NEW YORK CITY
DEPARTMENT OF DESIGN + CONSTRUCTION

July 2012

BIM Guidelines

Michael R. Bloomberg, Mayor
David J. Burney, FAIA, Commissioner
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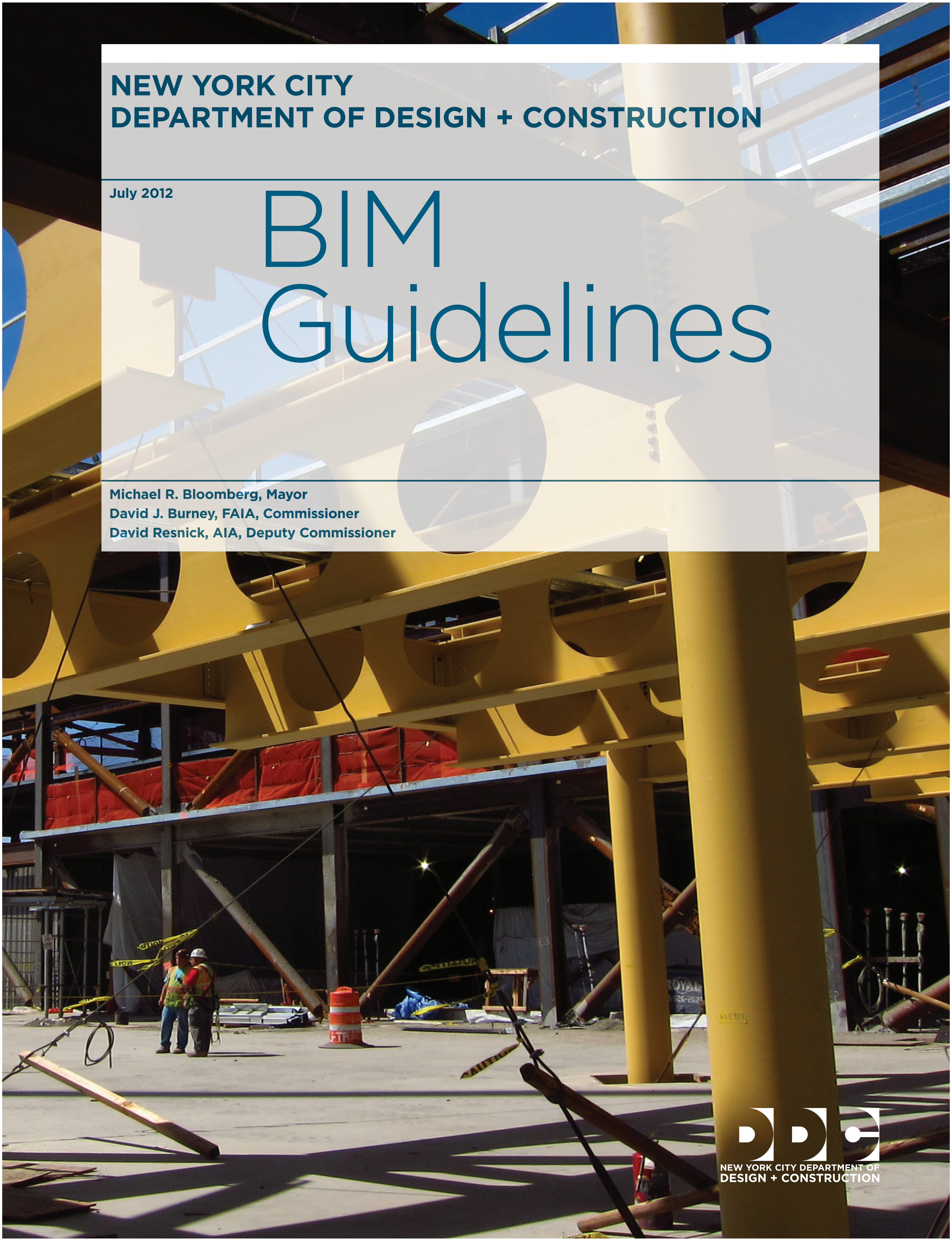


NEW YORK CITY DEPARTMENT OF
DESIGN + CONSTRUCTION

TABLE OF CONTENTS

Message From The Commissioner

Managing the design and construction for New York City's capital projects is an increasingly collaborative process. Our consultant design teams include many separate firms representing the various disciplines and specialties, whose work must be tightly coordinated. Our consultants must work closely with DDC and with our client agency representatives as well as with other city agencies involved in the design and construction of a civic building. Because of this, DDC continually looks for ways to improve the collaborative process. One way to do so is by using Building Information Modeling. BIM strengthens collaboration by allowing all members of the design team to accurately add to a shared database information about how a building looks and functions. Using this information, the BIM database creates a virtual model of a building at every stage – from design conception through construction and occupancy.

BIM is currently being used on major projects around the world and is quickly becoming an industry standard. It not only provides us with a virtual representation of our projects at all stages, but also tracks and analyzes design, construction, and operational information that are critical to the success of these projects. Shared access to this information creates valuable insight across the building lifecycle and can help improve project management performance.

We believe that the successful integration of civic building design, delivery, and operations through BIM will streamline the project management process, resulting in cost-savings and more on-time completion. We are committed to broadening and accelerating the adoption of BIM for City projects. We have been working closely with the A/E/C community and other public works agencies regionally on appropriate uses and optimizing the benefits from BIM, and we are pleased to introduce this Citywide BIM standard that will be used for DDC projects and may be adopted by other agencies and organizations.

Sincerely,

David J. Burney, FAIA

DDC Public Buildings Division

The Public Buildings Division manages the design and construction of buildings for more than 20 client agencies. The Division manages new buildings and substantial renovations for a wide range of building types including libraries, museums, police precincts, firehouses, emergency medical stations, transportation facilities, health centers, day care centers, senior centers, courts, and correctional facilities.

Building Information Modeling (BIM)

Building Information Modeling (BIM) refers to a digital collection of software applications designed to facilitate coordination and project collaboration. BIM can also be considered as a process for developing design and construction documentation by virtually constructing the building on the computer before actually building it.

BIM is a multidimensional model (3D, 4D [time], and 5D [cost]) in which a virtually unlimited range of visual and non-visual project and building related information is tagged or attached to each model element as a collection of attributes.

BIM is scalable not just in terms of project magnitude and complexity, but in the breadth and depth of its application and use on a project.

Using BIM tools, designs can be developed directly in 3D as a collection of model elements (similar to the lines, arcs and blocks in a 2D CAD drawing). As the project is developed, increasing amounts of intelligence are added to each model element, and this intelligence is captured in a database.

The benefits of using BIM are:

- Immediate 3D design visualization
- Enhanced coordination, as conflicts between systems are easily seen and addressed early in the process, before they become costly change orders
- The ability to model schedule scenarios and site logistics by time loading the elements of the model
- The ability to link the model elements to cost data for real-time estimating and to facilitate a transparent bid process
- Transition of the model to the users after construction for use in building operations and maintenance

The Purpose of This Guide

The DDC BIM Guide provides guidelines for the consistent development and use of BIM across multiple building types and for a wide range of municipal agencies. Furthermore, this guide will be useful for any agency or organization that may be interested in utilizing BIM for public projects in New York

City but do not have their own standards. The guide is intended to ensure uniformity in the use of BIM for all New York City Public Buildings projects.

The BIM guide considers the end-use of the model for multiple client agencies, allowing qualified and authorized client agency representatives to review the ways in which the BIM may facilitate their ongoing building operation and maintenance protocols, and tailor their agency requirements and standards to leverage the enhanced capabilities provided by BIM for building O&M. This BIM Guide will also support client agency design standards in support of each agency's mission.

BIM toolsets and uses continue to evolve, and the DDC BIM Guide will continue to be reviewed and updated to reflect advances in industry technology, methodology and trends, as deemed appropriate for municipal agency work in New York City.

Public Buildings Lifecycle Vision

DDC Division of Public Buildings considers that Building Information Modeling (BIM) as technology and process is superior to traditional non-BIM methods when properly scaled in its use. BIM as an enhanced digital delivery system represents a change in how the DDC, our end-users, and our Design Consultants interact and use information. DDC is committed to our internal growth as well as that of our clients and design consultants in the effective and efficient use of BIM in support of our Lean strategies and delivery methods.

The goal of the Division of Public Buildings is to improve the design, management, and construction of our projects and deliver superior public facilities to over 20 client agencies and the millions of people they serve. The information in BIM and the digitization of building data will improve and enhance buildings from design concept to operations and on to repurposing or demolition. The standardization of this data is important to our agency, our clients, and the City of New York as we begin to share more and more information across multiple agencies on multiple platforms and with our millions of citizens.

Objectives

BIM authoring software shall be used throughout the project lifecycle for all DDC projects designated to be delivered using BIM. DDC recognizes the many intricacies of the design process throughout all its phases. The intended use of BIM and the application of the DDC BIM guidelines are to be coordinated with the general and specific project delivery guidelines laid out in the DDC Design Consultant Guide. Where applicable, and possible BIM's shall be created in support of all design criteria, Pre-Preliminary Design, Schematic Design, Design Development, Final Design, BID Award and Registration, Services during Construction, and Regulatory Approvals. In addition, BIM's shall be created in support of their intended uses and specified levels of development outlined in this document.

Software

DDC recognizes that many BIM applications exist, and in support of our diverse consultants and end-users the DDC does not require the use of any specific commercially available software. DDC also recognizes that of the commercially available BIM software there are applications that have a wider market share as well as larger user base amongst our consultants and end-users. To that end; throughout this document there may be references to specific tools or functions which are intended to be implicit in nature and shall be applied to your specific workflow or application where possible.

DDC encourages the use of software applications that foster collaboration throughout the design and construction process. Software applications produced by the same developer but specific to each discipline may help achieve this level of collaboration.

A parametric modeling application is required for the creation of any BIM. Plans, elevations, sections, details and schedules shall be created from the BIM where model geometry may be represented in 2D and any other non-geometric data shall be attached to those 2D elements.

The following table shows a list of current known and acceptable BIM applications for DDC Projects. This list does not preclude the utilization of other software for the prescribed uses.

Use	Software
Space Programing	Trelligence Afinnity Programming. Onuma System, dRofus Smart Planning
Architectural Design	Autodesk Revit Architecture, Bentley Architecture, Graphisoft ArchiCAD, Nemetschek Vectorworks Architect
MEP Design	Autodesk Revit MEP, Bentley Building Mechanical Systems, Graphisoft MEP Modeler
Structural Design	Autodesk Revit Structure, Tekla Structures, Bentley Structural Modeler
Inter-Disciplinary Coordination and Clash Detection	Navisworks Manage; Solibri Model Checker
Code Checking	Solibri Model Checker

Project Delivery Models (Design-Bid-Build; CM/Build; Design Assist)

Choice of delivery model will affect the way in which the BIM is created and built upon, and should be determined in the contract prior to project initiation. It is important to understand how the choice of Design-Bid-Build (DBB), Design Build (DB), or Design Assist (DA) to the extent permitted under state law will impact BIM. Knowing in advance will ensure that BIM is properly managed and maintained from project inception. Considerations shall be given to the number of BIM managers required where DB may only have one BIM manager and DBB will have a BIM manager for design and one for construction. Similarly, considerations shall be given to contractually defined risk where one combined design and construction model exist or multiple BIM's exist for design and construction. DDC has had success with an integrated project model that fosters collaboration and brings multiple stakeholders together early in the decision making process through combined and integrated project offices. Data interoperability is important to DDC and is in line with our life cycle vision. It is also important that nationally defined standards and protocols be used when developing BIM's so that data may be normalized for multiple uses. Standards such as the National BIM Standards, OmniClass, Uniformat, Masterformat, and GUID's should be used whenever possible.

Model Ownership

DDC holds ownership of the BIMs including all inventions, ideas, designs, and methods contained within the model. This includes, but is not limited to; the content submitted as part of the BIMs itself.

Outside resources, such as consultants and/or contractors, using the BIM are granted temporary use of it for the duration of the project. After project completion they are required to return all copies of the BIM to the DDC.

DDC holds ownership of all the contents within the models from project conception (pre-schematic design) all the way to completion (construction)

BIM Roles and Responsibilities

This section describes the BIM Roles and Responsibilities of the Team Members involved in DDC Projects. These Roles and Responsibilities may vary depending on the Project Delivery Model and specific project conditions. At a minimum these roles and responsibilities must be met on all DDC BIM projects, any further consideration or elaboration on these roles and responsibilities will be included in the BIM Execution Plan (BEP)

BIM Manager

A BIM manager shall serve as the key point of contact with the DDC for all BIM related activity on a project. Individuals in this role will have the necessary experience for the successful implementation of BIM in regards to the scope and complexity of any given project. In addition this individual shall have Intermediate knowledge and skills in the use of the proposed BIM authoring application as well as significant experience in the overall BIM process and ancillary tools.

In general, minimum responsibilities shall include the following:

- Assures development and compliance with DDC BEP
- Maintains and ensures adherence to the DDC - BIM Guidelines Manual
- Overall responsibility for the proper use, implementation, and creation of BIM during design or construction
- Manage and maintain the creation of all BIM content
- Coordinate and Manage BIM related meetings with lead BIM technicians
- Interface with IT managers to ensure proper hardware and software is in place and functioning properly
- Provides specifications for BIM coordination rooms including necessary hardware and software for proper use
- Facilitates use of correct models and assures the proper compilation of multiple models in support of necessary BIM uses
- Manages coordination process, provides reports with the identification and or resolution of hard and soft conflicts
- Facilitates the proper export and data extraction from the BIM as requested and in support of specific BIM uses
- Assures proper deliverables are met and provided in formats as specified
- Coordinates BIM training as required

Discipline Trade BIM Coordinators

A Discipline Trade BIM Coordinator shall serve as the lead BIM technician within their discipline or trade. Individuals in this role will have the necessary experience for the successful implementation of BIM specific to their profession or trade. In addition, this individual shall be responsible for coordinating his or her work with the rest of the design or construction team.

In general, minimum responsibilities shall include the following:

* Coordinates all technical discipline and trade specific BIM activity with BIM manager. Tools, Content, Standards, Requirements
* Manage other BIM Users within the Discipline
* Coordinate any BIM related issues with the rest of their Discipline Team
* Supports team in the use of BIM tools
* Create discipline specific BIM content
* Coordinate discipline specific clash detection and resolution activities
* Export the Model for Inter-Disciplinary Clash Detection.
* Coordinates BIM training as required.

BIM Execution Plan

The DDC requires a BIM Execution Plan (BEP) within 30 days of project award and registration. The BEP shall align with the specific project delivery model for the project.

The intent of the BIM Execution Plan is to provide a framework that will let all the parties involved use and take advantage of BIM technology, along with best practices and procedures aligned with the DDC BIM Guidelines, to ensure the project is complete on time and with minimum design and or coordination problems.

DESCRIPTION

The BIM Execution Plan (BEP) is a detailed plan that defines how the project will be executed, monitored and controlled with regard to BIM. It is required that a BEP be developed to provide a master information and data management plan and assignment of role and responsibilities for model creation and data integration at project initiation. The Plan shall incorporate requirements specified for a project and will be developed through a collaborative approach involving all stakeholders.

The BEP will outline the project procurement strategy and will align to suit the needs of DBB, DB, DA, and DDC's Integrated Delivery Strategy. Aspects of the BEP shall focus on Team Skills, Industry Capability, and improvements in technology. Through this collaborative process the team shall agree on how, when, why, and to what Level of Development (LOD) BIM shall be used in support of project outcomes and objectives. Depending on the procurement strategy, multiple BEP's may be needed. For example, in the case of Design-Bid-Build, one shall be provided during design and one during construction. For an Integrated Project, one BEP may be sufficient for the entire duration of the project.

BIM Uses

The nature of BIM technology allows different stakeholders to use the BIM in multiple ways depending on the specific needs they may have. As the project moves from phase to phase, the information contained within the BIM shall evolve in a progressive manner.

The following list of BIM uses are the most common applications of BIM on DDC projects. BIM uses shall be considered and aligned with project goals and selected based on added value. BIM use shall be assessed and recorded in the DDC BEP.

One single BIM may perform multiple BIM uses. Therefore, the DDC is not expecting one model per each use described below.

EXISTING CONDITIONS MODELING

A process in which a project team develops a 3D Model of the existing conditions of a facility. This model can be developed in multiple ways depending on what is desired and what is most efficient. Once the model is constructed, it can be queried for information, whether it is for new construction or a modernization project.

The value of Existing Conditions Modeling is:

- Document existing building for historical use
- Provide documentation of environment for future uses
- Enhance efficiency and accuracy of existing conditions documentation
- Provide location information
- Aids in future modeling and 3D design coordination
- Use for visualization purposes

LASER SCANNING

A process in which a laser beam is used to rapidly capture existing conditions of a building (interiors and/or exteriors) and/or natural environments (landscape) through equipment capable of measuring every point at a specific distance, speeding up the process of traditional data collection techniques and reducing errors and omissions.

Consultants using this technology will be responsible for processing this information and incorporating it back into the BIM as existing conditions. This process can be outlined in the BEP and will be reviewed by DDC's Site Engineering Laser Scanning group.

SITE ANALYSIS

A process in which BIM and or GIS tools are used to evaluate properties in a given area to determine the most optimal site location for a future project. The site data collected is used to first select the site and then position the building based on other criteria.

The value of Site Analysis is:

- Use calculated decision making to determine if potential sites meet the required criteria according to the project requirements, technical factors, and financial factors
- Decrease costs of utility demand and demolition
- Increase energy efficiency

* Minimize risk of hazardous material
* Maximize return on investment

PROGRAMMING

A process in which a spatial program is used to efficiently and accurately assess design performance in regard to spatial requirements. The developed BIM allows the project team to analyze space and understand the complexity of space standards and regulations. Critical decisions are made in this phase of design and bring the most value to the project when needs and options are discussed with the client and the best approach is analyzed.

The value of Programming is:

* Efficient and accurate assessment of design performance in regard to spatial requirements by the owner

ENGINEERING ANALYSIS

A process in which intelligent modeling software uses the BIM to determine the most effective engineering method based on design specifications. Development of this information is the basis for what will be passed on to the owner and/or operator for use in the building's systems. These analysis tools and performance simulations can significantly improve the design of the facility and its energy consumption during its lifecycle in the future.

The value of Engineering Analysis is:

* Achieve optimum, energy-efficient design solution by applying various rigorous analyses
* Faster return on investment with applying audit and analysis tools for engineering analyses
* Improve the quality and reduce the cycle time of the design analyses

DESIGN AUTHORING

A process in which 3D software is used to develop a Building Information Model based on criteria that is important to the development of the building's design. Design authoring tools are a first step towards BIM and the key is connecting the 3D model with a powerful database of properties, quantities, means and methods, costs and schedules.

The value of Design Authoring is:

* Transparency of design for all stakeholders
* Better control and quality control of design, cost and schedule
* Powerful design visualization
* True collaboration between project stakeholders and BIM users
* Improved quality control and assurance

SUSTAINABILITY (LEED) EVALUATION

A process in which a project is evaluated based on LEED or other sustainable criteria. This can refer to materials, performance, or a process. Sustainability Evaluations can be applied across all four phases of a construction project, Planning, Design, Construction, and Operation. Sustainability evaluation is most effective when it is done in planning and design stages and then applied in the construction and operations phase. Model all sustainable aspects of a project throughout its life-cycle in order to obtain the desired LEED certification in the most efficient manner by condensing design analyses into a single database.

The value of Sustainability (LEED) Evaluation is:

* Accelerate design review and LEED certification process with efficient use of a single database with all the sustainable features present and archived
* Improved communication between project participants in order to achieve LEED credits and decreased redesign efforts as a result
* Align scheduling and material quantities tracking for more efficient material use and better cash flow analysis
* Optimize building performance by tracking energy use, indoor air quality and space planning for the adherence to LEED standards leading to integrated facility management using a BIM model

DESIGN REVIEW

A process in which a 3D model is used to evaluate meeting the program and set criteria such as layout, sightlines, lighting, security, ergonomics, acoustics, textures and colors. Virtual mock-ups can be done in high detail to quickly analyze design alternatives and solve design and constructability issues.

The value of Design Review is:

* Eliminate costly and timely traditional construction mock-ups
* Model different design options and alternatives in real-time during design review by end users or owner
* Create shorter and more efficient design reviews
* Resolve the conflicts that would otherwise only become apparent in a mock-up and model the potential fixes in real-time along with tolerances revised and RFI's answered
* Preview space aesthetics and layout during design review in a virtual environment
* Evaluate effectiveness of design in meeting building program criteria and owner's needs
* Easily communicate the design to the owner, construction team and end users. Get instant feedback on meeting program requirements, owner's needs and building or space aesthetics

CODE VALIDATION

A process in which code validation software is utilized to check the model parameters against project specific codes.

The value of Code Validation is:

* Validate that building design is in compliance with specific codes (IBC International Building Code, ADA Americans with Disabilities Act guidelines and other project related codes using the 3D BIM).
* Code validation done early in design reduces the chance of code design errors, omissions or oversights that would be time consuming and more expensive to correct later in design or construction
* Code validation done automatically while design progresses gives continuous feedback on code compliance

CLASH DETECTION

A process in which clash detection software is used during the coordination process to determine field conflicts by comparing 3D models of building systems. The goal of clash detection is to eliminate major system conflicts prior to installation.

The value of Clash Detection is:

* Reduce and eliminate field conflicts; which reduces RFI's significantly compared to other methods
* Visualize construction sequences, staging and logistics
* Reduced construction cost; potentially less cost growth (less change orders)
* Decrease construction time
* Increase productivity on site
* More accurate as built drawings

COST ESTIMATION

A process in which the BIM can be used to generate an accurate quantity take-off and cost estimate early in the design process and provide cost effects of additions and modifications with potential to save time and money and avoid budget overruns. This process also allows designers to see the cost effects of their changes in a timely manner which can help curb excessive budget overruns due to project modifications.

The value of Cost Estimation is:

* Precisely estimate material quantities and generate quick revisions if needed
* Stay within budget constraints while the design progresses
* Better visual representation of project and construction elements that need to be estimated
* Provide cost information to the owner during the early decision making phase of design
* Focus on more value adding activities in estimating (identifying construction assemblies, generating pricing and factoring risks) which are essential for high-quality estimates
* Exploring different design options and concepts within the owner's budget
* Saving estimator's time and allowing them to focus on more important issues in an estimate since take-offs can be automatically provided

CONSTRUCTION SYSTEM DESIGN

A process in which 3D system design software is used to design and analyze the construction of a complex building system (form work, glazing, tie-backs).

The value of Construction System Design is:

* Ensure constructability of a complex building system
* Increase construction productivity
* Increase safety awareness of a complex building system
* Increase Communication

PHASE PLANNING

A process in which BIM is utilized to effectively plan the phased occupancy in a renovation, retrofit, addition, or to show the construction sequence and space requirements on a building site. 4D modeling is a powerful visualization and communication tool that can give a project team, including the owner, a better understanding of project milestones and construction plans.

The value of Phase Planning is:

* Better understanding of the phasing schedule by the owner and project participants and showing the critical path of the project
* Dynamic phasing plans of occupancy offering multiple options and solutions to space conflicts
* Integrate planning of human, equipment and material resources with the BIM model to better schedule and cost estimate the project
* Space and workspace conflicts identified and resolved ahead of the construction process
* Marketing purposes and publicity
* Identification of schedule, sequencing or phasing issues
* More readily constructible, operable and maintainable project
* Monitor procurement status of project materials
* Increased productivity and decreased waste on job sites
* Conveying the spatial complexities of the project, planning information, and support conducting additional analyses

DIGITAL FABRICATION

A process that utilizes machine technology to prefabricate objects directly from a BIM. The Model is spooled into appropriate sections and input into fabrication equipment for production of system assemblies.

The value of Digital Fabrication is:

* Automate building component fabrication
* Minimize tolerances through machine fabrication
* Maximize fabrication productivity

RECORD MODELING

A process used to depict an accurate representation of the physical conditions, environment, and assets of a facility. The record model should, at a minimum, contain information relating to the main architectural and MEP elements. Additional information including equipment and space planning systems may be necessary if the owner intends to utilize the information for maintenance and operations.

With the continuous updating and improvement of the record model and the capability to store more information, the record model contains a true depiction of space with a link to information such as serial codes, warranties and maintenance history of all the components in the building. The record model also contains information linking pre-build specification to as-built specifications. This allows the owner to monitor the project relative to the specifications provided.

The value of Record Modeling is:

* Aid in future modeling and 3D design coordination for renovation
* Provide documentation of environment for future uses, e.g., renovation or historical documentation
* Dispute elimination (for example, a link to contract with historical data highlights expectations and comparisons drawn to final product.)
* Solid understanding of project sequencing by stakeholders leads to reduced project delivery times, risk, cost, and lawsuits

ASSET MANAGEMENT

A process in which an organized management system will efficiently aid in the maintenance and operation of a facility and its assets. These assets, consisting of the physical building, systems, surrounding environment, and equipment, must be maintained, operated, and upgraded at an efficiency which will satisfy both the owner and users at the lowest appropriate cost. It assists in financial decision making, as well as short-term and long-term planning. Asset Management utilizes the data contained in a record model to determine cost implications of changing or upgrading building assets, segregate costs of assets for financial tax purposes, and maintain a current comprehensive database that can produce the value of a company's assets.

The value of Asset Management is:

- Store operations, maintenance owner user manuals, and equipment specifications
- Perform and analyze facility and equipment condition assessments
- Maintain up-to-date facility and equipment data including, but not limited to, maintenance schedules, warranties, cost data, upgrades, replacements, damages/deterioration, maintenance records, manufacturer's data, equipment functionality, and others required by owner
- Provide one comprehensive source for tracking the use, performance, and maintenance of a building's assets for the owner, maintenance team, and financial department
- Produce accurate inventory of current company assets which aids in financial reporting, bidding, and estimating the future cost implications of upgrades or replacements of a particular asset
- Allow for future updates of record model to show current building asset information after upgrades, replacements, or maintenance by tracking changes
- Aid financial department in efficiently analyzing different types of assets through an increased level of visualization
- Increase the opportunity for measurement and verification of systems during building occupation

Parametric Modeling

To allow the different BIM Uses described in the BIM Uses section, Parametric Modeling is to be used on all DDC BIM Projects. Parametric Modeling is characterized by designing with objects having real-world behaviors and attributes, using parameters (numbers or characteristics) to determine the behavior of a graphical entity and define relationships between model components.

A parametric modeling application is required for the creation of any BIM. Plans, elevations, sections, details, and schedules shall be created from the BIM where model geometry may be represented in 2D and any other non-geometric data shall be attached to those 2D elements.

NOTE:
The integrity of the Model should not be compromised to reflect the 2D representation of 3D elements contained within the BIM.

To ensure consistency, all models and parts of models designed though analysis, shop drawing or any other non-parametric application must be integrated back into the design or construction models at each submission.

Model Discrepancies

When conflicts exist between the contents of a BIM and the Contract Set of Drawings, the information contained within the Contract Set will prevail and will be considered as definitive. The BIM shall still contain accurate representations of the design condition regardless of what is displayed on the drawing set.

Uniformat Classification and Omniclass

DDC BIM Guidelines organizes all of its assets based on the Uniformat System (CSI Uniformat 2004 Classification) and with the OmniClass System (OmniClass Construction Classification System). These classification systems organize all the different building elements into specific groups.

The CSI Release 2010 Edition of UniFormat and the 2010 OmniClass Tables should be used as a reference when classifying Objects within the BIM.

Coordinate System

In an effort to organize, consolidate and standardize the information generated and consumed by all Design Disciplines within the DDC, BIM projects shall use NY State Plane NAD83(NA2011) Epoch 2010.00 Long Island zone unless otherwise dictated.

Model Continuity

DDC requires that all BIMs shall be developed using object-based elements only, such as Columns, Beams, Walls, Doors, Windows, etc. along with their associated parametric information. This will ensure continuity of the BIM process from Conceptual Design through Construction. As well, provide a foundation for the owner of the facility to expand the model for operations and maintenance.

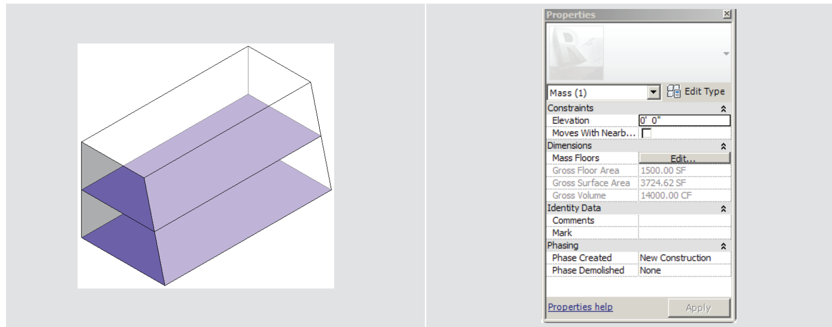
Model Level of Development

The Model Level of Development (LOD) describes the level of detail to which a Model is developed and its minimum requirements. The Level of Development is accumulative and should progress from LOD 100 at Conceptual Design through LOD 400 at completion of Construction.

The DDC Level of Development has been developed in alignment with the AIA – Exhibit E202 Document.

LOD 100

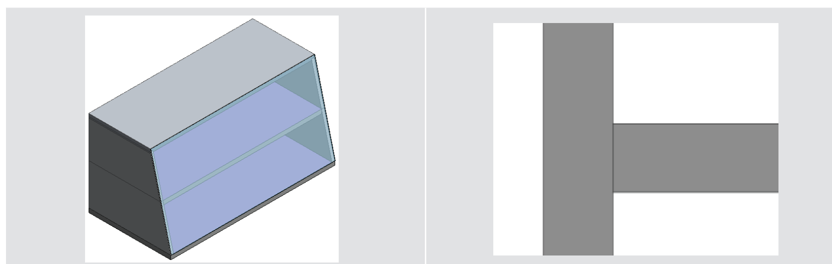
Level 100 Models include elements such as Masses and are used for preliminary studies, such as Conceptual Design and Overall Project Phasing. Analysis based on their Location and Orientation can be performed. Quantities based on Overall Area and Overall Volume can be obtained.



The images above show the Building Elements as Masses and its associated Area and Volume.

LOD 200

Level 200 Models include elements in which Masses have been replaced with Generic Components. Analysis based on Overall Systems can be performed. Quantities based on specific Elements can be obtained.

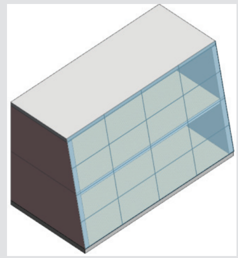


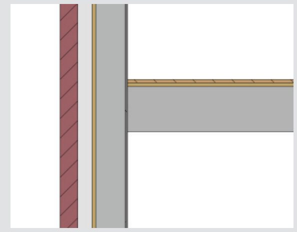
Wall Schedule (LoD-2)					
Family	Type	Width	Length	Area	Volume
Basic Wall	Generic - 8"	0' - 8"	39' - 0"	656 SF	437.51 CF
Basic Wall	Generic - 12"	1' - 0"	39' - 4"	759 SF	759.22 CF

The images above show the different Building Elements as Generic Components. The major characteristics of components are their thickness and width allowing quick takeoffs.

LOD 300

Level 300 Models include elements in which Generic Components have been replaced with fully defined Assemblies. Analysis based on Specific Systems can be performed. Quantities based on Materials can be obtained.





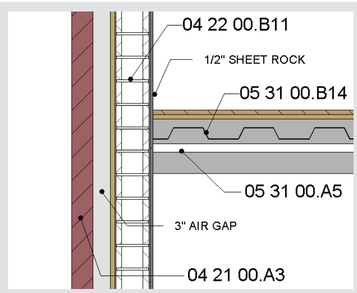
Wall Material Takeoff (LoD-3)	
Material: Name	Material: Volume
Gypsum Wall Board	58.66 CF
Masonry - Brick	425.26 CF
Metal - Stud Layer	703.87 CF
Misc. Air Layers - Air Space	351.94 CF
Wood - Sheathing - plywood	87.98 CF

The images above show the different Building Elements as fully defined Assemblies, where the different components have well-defined characteristics; therefore a more specific takeoff can be performed.

At LOD 300 the model can be leveraged for the generation of traditional Construction Documents and Shop Drawings. The model can be used for analysis such as: Energy Performance, Clash & Cost.

LOD 400

Level 400 Models include elements that are accurate in terms of size, shape, location, quantity and orientation with complete fabrication, assembly and detailing information. At this Level, the Model may also have non-geometric (3D) information such as text, dimensions, notes, 2D details, etc.



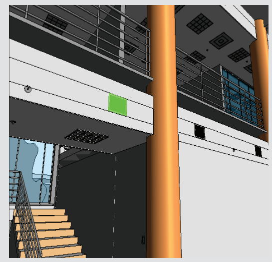
The image above shows a detail where 2D information has been placed on top of the 3D Model on a Section View.

At LOD 400 the model is a representation of the proposed elements. Analysis can be performed such as: Energy Performance, Clash Detection, and Sequencing & Cost.

LOD 500

Level 500 Models includes elements modeled as constructed. Elements are modeled to accurate size, shape, location and orientation. Non geometric or physical attributes are included as parameters to the geometric shape. At this level, model granularity is similar to LOD 400 with the exception that elements are as-constructed.

At LOD 500, the model is capable of being utilized for operations and maintenance.



element_ID	revit_ID	last_inspected	next_inspection_due_date	priority	condition
132457383	659832	6/2/2008	9/11/2011	medium	good
132426790	679334	6/2/2008	9/11/2011	medium	good
132447782	650023	6/2/2008	9/11/2011	medium	good
131276003	672363	4/20/2006	1/24/2011	high	fair
132786522	650933	6/2/2008	9/11/2011	medium	good
131028862	667681	6/2/2008	9/11/2011	medium	good
132290073	679911	6/2/2008	9/11/2011	medium	excellent
131189520	640087	6/2/2008	9/11/2011	medium	good

Model Granularity

BIM's shall be created providing an accurate representation of geometry needed to support specific BIM use. The level of detail needed will vary by object and by model, and the BIM itself may not represent the exact design intent of real live elements. As a rule of thumb, any object that fits within a 6"x6"x6" cube should not be modeled. Rather than modeling provide a generic node, or other graphic which contains appropriate parametric characteristics. Examples of this may be a telephone or a junction box which may only require a generic representation as a modeled element containing the correct parameters and properties, this same modeled element may be represented in typical views such as plan, elevation, and section with the standard technical symbol.

Submission Requirements

At each phase of the Design and Construction process the NYC DDC requires the delivery of the model, electronic versions of hardcopy submissions and other files that support the intent of the project.

In an effort to assist the consultants and contractors with the requirements of each phase, file types have been identified in the section entitled Deliverables. To further guide in the specifics of each deliverable, the section describes in further detail the requirements of each phase of a typical project.

The table provided on the next page describes the types of models and any analysis files expected at each submission. Depending on the project specifics, the Building Information Model may vary. It is anticipated that each file will be supplied at the incremental submissions during each phase as they are available.

As previously stated, one single BIM may perform multiple uses and, depending on the project specifics, not all Design Phases may require all Building Information Model instances described in the table below.

Continuing through the remainder of the section, each Building Information Model is described in further detail.

Through each Building Information Model, description references to terminology and processes are made to both BIM Uses and Model Requirements already defined in previous sections of this document.

An appendix to this document entitled “Object Requirements” contains a list of objects with tables outlining object parameters required at each phase of the project. Specifically, parameters are defined by Level of Development to better align with industry standards. Each parameter will support the anticipated analysis performed on the model at each phase. While the appendix contains a significant group of objects it is not intended to be all inclusive. As objects are created not identified, the tables are to be used as a guide to the development of objects and elements throughout the project.

Design Phase	Building Information Model
Pre-Schematic (LOD 100)	Existing Condition Model
	Site Analysis
	Space Program
	Design Authoring - Volumetric Model
	Zoning and Orientation
Schematic (LOD 200)	Design Authoring - Preliminary Model
	Sustainability (LEED) Evaluation
	Programing
	Phase Planning
	Preliminary Cost Estimate (Square Footage)
	Design Review
	Preliminary 3D Coordination
Design Development (LOD 300)	Design Authoring - Model
	Sustainability (LEED) Analysis
	Detailed Energy Analysis
	System Cost Estimates
	3D Coordination Reporting
	Program Validation
Construction Documents (LOD 400)	Design Authoring - Final Model
	3D Coordination Validation
	Cost Estimation
	Sustainability (LEED) Reporting
Services During Construction (LOD 500)	Construction System Design
	Phase Planning
	Digital Fabrication
	Record Modeling
	Asset Management

PRE-SCHEMATIC DESIGN

Pre-Schematic Design should align with the First Level of Development (LOD 100) as described in this Manual, and the Pre-Schematic Design section of the DDC Design Consultant Guide

EXISTING CONDITIONS MODEL

The consultant shall provide a parametric model of all exiting conditions that may affect their scope of work. Understanding the capabilities of BIM and the ability to capture multiple BIM uses in a single model, objects and model elements designated as Existing Conditions shall be consistently defined as such and clearly managed and differentiated from new construction or proposed future work.

SITE ANALYSIS

Surveys shall be provided as 3D topographic information within the Model. Using best BIM practices survey points using comma separated values in

.txt format or points available in other CAD applications shall be imported and used as the basis to develop topography.

Additional information might be provided as 2D elements as long as they are not required for the project specifics or they are used as a reference only.

SPACE PROGRAM

Where the consultant is developing a space program for the project, the space program shall be able too seamlessly integrate with the BIM application in use during the schematic design phase, as well as be imported and further developed in any DDC approved space programming application.

DESIGN AUTHORING - VOLUMETRIC MODEL

The Volumetric Model shall be defined as masses based on the information gathered from the Site and should define the building footprint. This model should be the basis of what will be developed in future phases.

As the Model evolves, the Design Authoring – Volumetric Model should include:

- Building function and occupancy
- Building location
- Building HVAC equipment information (EER, COP, MBH, kW, tons, etc.)
- Building envelope construction components including U-values, SHGC, absorptivity, SRI value, color, thickness, etc.

ZONING & ORIENTATION

The Volumetric Model shall be used in support of an early decision making process for building location and orientation within the property line.

The purpose of these simulations is to inform early design decisions with reference to building envelope, lighting, domestic water, and HVAC systems. Multiple energy simulation iterations shall be performed by changing one component at a time and comparing those results to the results of other iterations in a “percent better” or “percent worse” scenario.

Design components that present “percent better” that are in line with the project energy goals will then be developed further in the schematic (criteria) design phase.

SCHEMATIC DESIGN

Schematic Design must align with the Second Level of Development (LOD 200) as described in this Manual and the Schematic Design Section of the DDC Design Consultant Guide.

DESIGN AUTHORING - PRELIMINARY MODEL

The Preliminary Model shall at least include the following generic elements to ensure the appropriate effort within this phase. Refer to Object Requirements in the appendix for a detailed description of each of these Objects.

- Site Model
    - Existing Conditions
    - Topography
- Architecture
    - Interior and Exterior Walls
    - Doors and Windows
    - Stair and Ramps
    - Ceilings
    - Roofs
    - Bounded Rooms with Names and Numbers
- Structure
- Foundations

* Columns
* Beams
* Bracing
* Floors
* Mechanical
* Equipment
* Main Duct Lines
* Fire Protection
* Equipment
* Main Pipe Lines Plumbing
* Equipment and Fixtures
* Main Pipe Lines Electrical
* Panels and Fixtures
* Main Conduit Lines Electronics
* Panels and Fixtures
* Main Conduit Lines

SUSTAINABILITY (LEED) EVALUATION

All aspects of sustainability should be considered at this stage in order to evaluate the LEED criteria of materials, performance, and processes. Building performance should be optimized by tracking energy use, indoor air quality and space planning for the adherence to LEED standards. LEED goals should be established at this stage and strategies for evaluating, tracking, and documenting LEED within the BIM shall be implemented.

PROGRAMMING

During this phase a space program is expected to be incorporated into the BIM. The creation of this data can support the design team in program validation, program reporting and tracking. A space programming application may be used to achieve this requirement where customized reports may be produced. All program data in support of the space program regardless of where it derived shall be updated and maintained in the BIM.

The following shall be derived automatically from the BIM:

* Program Function
* Room Name
* Room Number
* Assignable Areas measured to inside face of wall objects and designated boundaries of areas
* Gross Area measured to the outside face of wall objects

PHASE PLANNING

Design phases should be defined at this stage and shall be consistent throughout all the different project models for proper coordination. Design phases shall be implemented using a tool or a parameter to define or categorize all elements contained within the BIM.

PRELIMINARY COST ESTIMATE (SQUARE FOOTAGE)

Extract square foot information directly from the BIM integrated tools to support comparative costs analysis of options studied. Outputs shall be converted to spreadsheets and submitted as part of the design solution justification at end of this phase.

A summary of construction cost per trade is expected at this stage

DESIGN REVIEW

A detailed Design Review is critical at this stage since the Model will be developed further once it’s moved to the next stage. Program evaluation and layout design, lighting, acoustics, textures and colors should be considered as part of the review.

PRELIMINARY CLASH DETECTION

Preliminary coordination at this stage should, at a minimum, be performed within the major systems on these pairs of elements:

- Architectural Systems vs. Structural Systems
- Architectural Systems vs. Mechanical Systems
- Architectural Systems vs. Electrical Systems
- Structural Systems vs. Mechanical Systems
- Structural Systems vs. Electrical Systems
- Mechanical Systems vs. Electrical Systems

DESIGN DEVELOPMENT

Design Development must align with the Third Level of Development (LOD 300) as described in this Manual, and the Design Development section of the DDC Design Consultant Guide.

All systems shall be defined at this stage with the appropriate shapes and sizes along with the proper documentation to support the analysis. Listed below are defined systems with the most common elements defined for each. The list is not intended to be all inclusive, but rather a foundation to build upon.

DESIGN AUTHORING – MODELS

The Model will evolve from the previous phase and shall include better defined elements to ensure the appropriate effort within this phase. Refer to the Object Requirements in the appendix for a detailed description of each of these Objects.

Additional elements and objects may need to be added from the previous stage Design Authoring - Preliminary Model to represent new features of the project.

SUSTAINABILITY (LEED) ANALYSIS

This model shall be detailed and finalized enough to use as an indicator of approximate building energy use after occupancy. This model shall also serve as a baseline for future comparisons.

Custom parameters may be created to associate LEED information to the different elements within the BIM.

This model shall be used as a tool to facilitate post-occupancy commissioning should discrepancies between modeled and actual energy use arise.

COST ESTIMATION

All elements or objects included within the Model should be automatically extracted and quantified for estimating purposes.

CLASH DETECTION

Coordination at this stage should be performed within the major and minor systems based on these pair of elements:

- Architectural Systems vs. Structural Systems
- Architectural Systems vs. HVAC Systems
- Architectural Systems vs. Plumbing Systems
- Architectural Systems vs. Fire Protection Systems
- Architectural Systems vs. Electrical Systems
- Architectural Systems vs. Electronics Systems
- Structural Systems vs. HVAC Systems
- Structural Systems vs. Plumbing Systems
- Structural Systems vs. Fire Protection Systems
- Structural Systems vs. Electrical Systems
- Structural Systems vs. Electronics Systems
- HVAC Systems vs. Plumbing Systems

* HVAC Systems vs. Fire Protection Systems
* HVAC Systems vs. Electrical Systems
* HVAC Systems vs. Electronics Systems
* Plumbing Systems vs. Fire Protection Systems
* Plumbing Systems vs. Electrical Systems
* Plumbing Systems vs. Electronics Systems
* Fire Protection Systems vs. Electrical Systems
* Fire Protection Systems vs. Electronics Systems

PROGRAM VALIDATION

Program requirements should be compared and validated with the actual design solution through reports and charts generated automatically from the BIM.

CONSTRUCTION DOCUMENTS

Construction Documents should align with the Fourth Level of Development (LOD 400) as described in this Manual. This model should include the current design models from each phase through the end of Design Development.

DESIGN AUTHORING - FINAL MODEL

The Model will keep evolving from the previous phase and shall include construction specifications along with constructions details including text, dimensions, tags, notes, materials, colors and any other description or characteristic required for construction.

As previously stated, the integrity of the Model should not be compromised to reflect the 2D representation of 3D elements contained within the BIM.

3D COORDINATION VALIDATION

3D coordination validation should evolve from the previous phase. All conflicts previously found should be resolved at the end of this phase by running a final Clash Detection Report to validate the absence of Conflicts.

COST ESTIMATION

Quantity takeoffs should be automatically extracted from the model. Cost should be validated by integrating applications with Quantity tools or exported as spreadsheets for traditional methods.

SUSTAINABILITY (LEED) REPORTING

All LEED documentation and reports should be completed at this stage and should be ready to be submitted as part of the project deliverables.

These documents and reports will use the previously defined custom parameters in which LEED information have been associated to the different elements within the BIM.

BID, AWARD AND REGISTRATION

Services during BID, Award and Registeration should align with the Fourth Level of Development (LOD 400) as described in this manual, and the BID Award and Registration section of the DDC Design Consultant Guide. After completion and approval of the 100% construction document phase, design intent BIM's shall be archived and provided to the DDC. (see deliverables section of this guide) All deliverables including Archived BIM's, hardcopies, dwf's and pdf's derived from such BIM's shall be indentical to the desired design conditions at the time bids are received.

During the Bidding phases through Award and Registration the model may be provided for informational purposes. Refer to the project specific RFP and the DDC BEP for BIM use and model availablility.

SERVICES DURING CONSTRUCTION

Services during Construction should align with the Fifth Level of Development (LOD 500) as described in this Manual, and the Services during construction section of the DDC Design Consultant Guide. The design BIM will be provided by the owner in its native authored format along with an assembled BIM in a format appropriate for collaboration (Navisworks or equal see deliverables section of this guide). The Construction manager or the general construction contractor shall use the Design BIM as a basis for creating a construction model to achieve the desired BIM uses outlined in this section.

CONSTRUCTION SYSTEM DESIGN

The BIM shall be used to better understand how complex element or elements of the project can get built on the site. These virtual mock-ups can be used to replace the on-site mock-ups and facilitate or expedite construction through tools that will allow linking the BIM sequencing, take offs, etc.

These virtual mock-ups will enable the trial of alternate options before construction begins allowing the contractor to select the best one that fits the project needs.

PHASE PLANNING

Phases during Construction should be defined after the Design phase is completed and before the project is handed over for construction. Construction phases shall be implemented to improve constructability through the use of tools that will allow linking the BIM to a construction scheduling appllcation, such as Primavera and/or Microsoft Projects.

The BIM shall be used to analyze and perform construction sequencing to avoid conflicts once construction starts and therefore improve the constructability process.

SCHEDULING

During construction the BIM shall be utilized to facilitate activity scheduling. Prior to construction the BIM shall be linked to the schedule by the CM and or GC for the purpose of 4d scheduling. Using applicable tools and applications elements or parts of the BIM shall be linked to the specific task in the schedule for the purpose of informing critical planning decisions and construction methods, site space utilization, resource allocation, activity sequencing, visualization and communication. Primary elements of the model listed below shall be linked to the schedule to achieve desired results.

- Structural system—structural framing components including foundations, grade beams, columns, load bearing walls, floor and roof decks and support.
- Exterior building envelope—stud wall, exterior panels and assemblies, curtain walls, openings, and glazing.
- Interior partitions—main interior walls, plumbing walls, and wall assemblies.
- Mechanical systems—main ductwork and equipment, separated by floors.
- Roof systems—roof assemblies, major equipment, and openings.
- Site work—excavation work, footings, foundations, and slabs on grade.
- Plumbing systems—main connection lines from site and main plumbing lines.

Additional considerations shall be made to specific construction activities and task where detailed construction planning is required such as virtual test installations and logistics planning. Linking the model to the schedule in these instances shall improve coordination and parallel activity workflows reducing conflicts and delays by location and resource unavailability.

3D COORDINATION

3D coordination is an on-going process which should start at the early stages of the Design phase and evolve and muture as the project progresses.

3D coordination will also happen during construction to assist and to support the creation of the “as built” model once construction is completed so a conflict-free model can be provided for the operations and maintenance of the building.

DIGITAL FABRICATION

The BIM can be used to extract information directly from it to streamline the pre-fabrication and/or fabrication of elements such as pipes, ducts, structural members, etc. A list of intended objects that will be part of this effort shall be defined at the Construction phase so they can be modeled using the characteristic defined within their construction specifications.

RECORD MODELING

As construction progresses, the BIM shall be updated if changes occur on site due to conflicts and/or chagnes on scope, this way at the completion of the project the BIM becomes the “as built” and can be leveraged beyond construction.

ASSET MANAGEMENT

The “as built” BIM shall be leveraged to manage and operate the building once construction is completed, to that extent, the BIM shall include fields (parameters) to support this effort.

These fields may vary from project to project and may be different depending on the type of project as well, therefore, they should be defined and incorporated within the BIM at the Construction phase with the input of the people responsible for maintenance and operations.

Submissions & Deliverables

NOMENCLATURE

This section establishes the basic naming conventions and standards required to be used when developing a project using BIM technology for DDC.

DISCIPLINE CODES

All model files, content and support files shall be prefixed with the appropriate discipline code. Discipline codes in use by the DDC are represented in the table below.

Discipline Name	Designator Code
Architectural	A
Civil	C
Electrical	E
Fire Protection	FP
Landscape	L

Mechanical	M
Plumbing	P
Structural	S

PROJECT IDENTIFICATION NUMBER

Each project within the DDC is assigned a unique FMS Project identifier. At the inception of all projects the FMS Project Identifier should be obtained to support the proper naming of model files, content and other support files.

FILE NAMING

All electronic project information should be named following the DDC-BIM guidelines naming conventions described within this section. This will ensure that projects can be accurately maintained during production, archived as a single project at each milestone and retrieved for future use.

MODEL FILES

Model Files should be named beginning with the FMS Project Identification Number followed by a dash, and a Discipline Code.

The filename should take the form of:
FMSID-D.format

Item	Description
FMSID	FMS Project Identification Number
D	Discipline Code

As an example, an Architecture Model File would be named as follows:
LQ471BNA-A.format

NOTE
If a model needs to be broken down further more based on the project specifics or complexity, a dash and a 2 letter designation will need to be appended at the end of the file name.

PLOTSHEET FILES (DWFX/PDF)

Plotsheet files should be generated out of the Models in DWFX and/or PDF format and should be named beginning with the FMS/Project Identification Number, a dash, a Discipline Code, a dash, the Discipline Designation Code (if applicable) followed by the Sheet Number range, a dash, and a two-digit Revision Decimal Number.

The filename should take the form of:
FMSID–D-DC001_###-RN.dwfx
FMSID–D-DC001_###-RN.pdf

Item	Description
FMSID	FMS Project Identification Number
D	Discipline Code
DC	Discipline Designation Code (if applicable)
001_ ###	First Sheet Number to Last Sheet Number (Three-digit Number)
RN	Revision Number (Two-digit Number)

DISCIPLINE DESIGNATOR CODES

Discipline Name	Designator Code
Architectural	A
General	G
Title/Coversheet	T
Antenna	ANT
Hazardous Materials	H
Landscape	L
Civil	C
Mechanical	M
Electrical	E
Plumbing	P
Borings/Geotechnical	B
Builders Pavement Plan	BBP
Curb Cut	CC
Demolition	DM
Energy Code Compliance	EN
Construction Related Equipment	EQ
Fire Suppression Systems	F
Fire Alarms	FA
Foundations	FO
Fire Protection	FP
Structural	S
Stand Pipe	SD
Signs	SG
Excavation	SOE
Sprinkler	SP
Sprinkler & Standpipe	SP/SD
Site Safety	SSP
Other Disciplines	X
Zoning	Z

As an example, an Inter-Disciplinary Coordination File is being created for a Plumbing project with Project identification Number of LQ471BNA for its revision 7. The file should be named as follows:
LQ471BNA -P-07.nwd

SHEET NUMBER

The Sheet Number refers to the three-digit number that appears right after the Discipline Designator Code.

REVISION DECIMAL NUMBER

The Revision Decimal Number refers to the two-digit number that appears right after the Sheet Number.

REVISIONS

When creating Plotsheet in DWFX or PDF format containing revisions, only consecutive sheets can be grouped together within the electronic files.

As an example, the Structural discipline is creating a revision 7 of sheets 001 through 007 and sheets 011 and 013. Three files should be named as follows:
LQ471BNA-S-001_007-07
LQ471BNA-S-011-07
LQ471BNA-S-013-07

INTER-DISCIPLINARY COORDINATION FILES (NWD)

Inter-Disciplinary Coordination Files should be generated out of the Models and saved as NavisWorks files (NWD). Similar to model files, coordination files should be named beginning with the FMS/Project Identification Number, a dash, a Discipline Code and a two-digit Revision Decimal Number.

The filename should take the form of:
FMSID–D- RN.nwd

Item	Description
FMSID	FMS/Project Identification Number
D	Discipline Code
RN	Revision Number (Two-digit Number)

As an example, an Inter-Disciplinary Coordination File is being created for a Plumbing project with Project identification Number of LQ471BNA for its revision 7. The file should be named as follows:

LQ471BNA -P-07.nwd

OBJECT NAMING

Objects within the Model should be named beginning with the Object Category, a space, a dash, a space, the Type, a space, a dash, a space, a Subtype, a space, a dash, a space, the Manufacturer Name, a space, a dash, a space and an optional User Description.

<Object Category>-<Type>-<Subtype>-<Manufacturer>-<Description>. format
The Type, Subtype and Manufacturer fields should be used as needed.

The following is a list of five examples:

* Window - Double Hung - Andersen - 400 Series - Arch Top
* Plumbing Fixtures - Sink - Oval - Generic - Under Counter
* Mechanical Equipment - Air Handling Unit - Vertical Packaged - Sierra - Roof Top
* Structural Framing - Wood - Lumber
* Structural Foundation - Concrete - Rectangular

NOTE:
A list of Objects is provided in the Appendix. Object Requirements should match the Object category field.

TYPES WITHIN OBJECTS

TYPES WITHIN OBJECTS

Types within the Objects should indicate the key differences or variations between the different options and their names might take one of the following forms:

<Model> or <Series Number>
<Value> or <Capacity>
<Width> x <Depth> x <Height>

The following is a list of five examples of the types within the Objects described above:

* ∗ Window - Double Hung - Andersen - 400 Series - Archtop
  * Model 430
  * Model 470

* ∗ Plumbing Fixtures - Sink - Oval - Generic - Undercounter
  * 10”
  * 12”

* ∗ Mechanical Equipment - Air Handling Unit - Vertical Packaged - Sierra - Roof Top
  * 2400 CFM
  * 3000 CFM
  * 4000 CFM

* ∗ Structural Framing - Wood - Lumber
  * 6” x 8”
  * 6” x 10”
  * 6” x 12”

* ∗ Structural Foundation - Concrete - Rectangular
  * 16” x 32” x 8”
  * 20” x 36” x 10”
  * 24” x 40” x 12”

DELIVERABLES

At each submission, native electronic copies and static versions of the model will be required. This is in addition to necessary hardcopy submissions to support legacy processes.

ELECTRONIC

The electronic version of the BIM is required for each milestone from Pre-Schematic Design Model through Services During Construction, and should be provided in their Native Format. In addition to that, below is a description of additional required file formats:

3D MODEL FILES REQUIRED:

* ∗ NWD: Autodesk NavisWorks Master files (containing all Model geometry)
* ∗ 3D DWF: Autodesk 3D Design WEB Format files

2D MODEL FILES REQUIRED:

* ∗ 2D DWF: Autodesk 2D Design WEB Format files
* ∗ PDF: Adobe Acrobat files

HARDCOPY

Final hard copies of drawings in full size, shall be 24”X36” unless otherwise approved and must be submitted on reproducible mylar plots using the DDC Title Sheets and Contract Borders as identified in the DDC Design Consultant Guide.

Refer to DDC – Design Consultant Guide for Submission Criteria.

Definitions

3D MODEL

A three-dimensional representation of a building or structure generated out of a CAD or BIM application

BEP

BIM Execution Plan (BEP) is an organized, documented approach to providing a strategy for all parties involved in contributing to model, information, analysis or consumption of a project utilizing the BIM process.

BIM

Building Information Modeling (BIM) is a process for managing a facility through its life-cycle. This extends from design to demolition. Typically, BIM starts with a three dimensional model with increasing levels of detail as to the functions it supports.

BUILDING INFORMATION MODEL

A Building Information Model (BIM) is a digital representation of the physical and functional characteristics of a building or structure

CAD/BIM MANAGER

The System Administrator for all CAD & BIM projects responsible for the management of all CAD & BIM data and processes.

DWF

A highly compressed non-editable vector file format created out of CAD/BIM applications. A DWF file can represent sheets for plotting purposes (2D DWF) or the entire 3D Model (3D DWF) for visualization or estimating purposes. DWF is short for Design Web Format, created by Autodesk.

DWG

DWG (Drawing) is a binary file system licensed by Autodesk for the purpose of storing two and three dimensional data and metadata. DWG is a native file format for AutoCAD.

IPD

Integrated Project Delivery (IPD) is a collaboration of all parties, systems and practices to optimize and maximize project success. Defined by the American Institute of Architects (AIA), IPD is typically applied to design and construction projects.

NOTE:
True IPD employs various constructs certain of which the city is precluded from using by state law and city rules. (such as the use of multi-party contracts, and profit sharing) DDC's integrated delivery approach leverages many aspects of IPD that are allowed by law. (such as co-location and BIM)

LEED

Leadership in Energy and Environmental Design (LEED) is a rating system for the design, construction and operation of buildings or facilities. Developed by the U.S. Green Building Council (USGBC), LEED provides owners and operators a guide for practical measures for sustainable practices.

LOD

Level of Development (LOD) describes, through five categories, the completeness of elements in a Building Information Model. Completeness will range from geometric detail to element information.

NAD

The North American Datum (NAD) is the official horizontal datum used for the primary geodetic network in North America. The latest published network is NAD83; however, the prior version NAD27 is still widely used. Each system is based on a separate set of measurements but is still geodetic reference systems.

NWD

An NWD file is a NavisWorks format that contains all model geometry-specific data. You can think of an NWD file as a snapshot of the current state of the model. NWD files are very small, as they compress the data by up to 80% of the original size.

PDF

An open standard for document exchange independent of authoring software, PDF is short for Portable Document Format, created by Adobe Systems.

VDC

Virtual Design and Construction (VDC) is the use of design models, and project information to apply construction processes in a virtual environment to reduce time, cost and ensure design intent.

DDC BIM Execution Plan (BEP) Template

This section identifies key members on the project as well as defines the master plan and project specific objectives, its phases and sequence along with the communication and interaction among the different disciplines involved and their projects.

KEY MEMBERS

This section identifies the contact person responsible for BIM coordination purposes only.

Discipline/ Trade	Consultant	Contact Person

FILE SHARING

Define within this section the methods for distribution of project information.

Project Site Location:	
Administrator	

MODEL COORDINATION

Define the origin point and coordinate system to be used

Model Origin Point	
Model Coordinate System	

PROJECT PHASES & SEQUENCE

This section identifies the project phases & sequence to understand when each project starts and its impact to other projects and the overall master plan.

Milestone	Percent	Start	End
Pre-Schematic			
Schematic			
Design Development			
Construction Documents			

PROJECT MILESTONES

Within this section define the project milestones, deliverables, format and naming

Milestone	Deliverable	Format	Name
Pre-Schematic			
Schematic			
Design Development			
Construction Documents			

PROJECT OBJECTIVES

This section identifies the primary objectives of the overall plan along with the project specific objectives.

Objective	Description

Object Requirements

AIR TERMINALS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
System Classification	N/A	*	*	*
System Type	N/A	*	*	*
System Name	N/A	*	*	*
Pressure Drop	N/A		*	*
Flow	N/A		*	*
Material	N/A			*
Mark	N/A			*
Phase Created	N/A			*
Phase Demolished	N/A			

CABLE TRAYS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Service Type	N/A		*	*
Material	N/A			*
Mark	N/A			*
Phase Created	N/A			*
Phase Demolished	N/A			*

CASEWORK

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Material	N/A		*	*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

CEILINGS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Height Offset from Level	N/A		*	*
Room Bounding	N/A		*	*
Material	N/A		*	*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

COLUMNS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Base Level	*	*	*	*
Base Offset	*	*	*	*
Top Level	*	*	*	*
Top Offset	*	*	*	*
Room Bounding		*	*	*
Material			*	*
Mark			*	*
Phase Created				*
Phase Demolished				*

COMMUNICATION DEVICES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Elevation	N/A	*	*	*
Panel	N/A		*	*
Circuit Number	N/A		*	*
Electrical Data	N/A		*	*
Material	N/A		*	*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

CONDUITS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Diameter	*	*	*	*
Trade Size		*	*	*
Service Type				*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

CURTAIN WALLS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Base Constraint	*	*	*	*
Base Offset	*	*	*	*
Top Constraint	*	*	*	*
Top Offset	*	*	*	*
Height		*	*	*
Room Bounding		*	*	*
Structural			*	*
Structural Usage			*	*
Material			*	*
Mark			*	*
Phase Created				*
Phase Demolished				*

DATA DEVICES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Elevation	N/A	*	*	*
Panel	N/A		*	*
Circuit Number	N/A		*	*
Electrical Data	N/A		*	*
Material	N/A		*	*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

DOORS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Sill Height	N/A	*	*	*
Material	N/A		*	*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

DUCTS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Offset		*	*	*
Start Offset		*	*	*
End Offset		*	*	*
System Classification			*	*
System Type			*	*
System Name			*	*
System Abbreviation			*	*
Material			*	*
Mark			*	*
Phase Created				*
Phase Demolished				*

ELECTRICAL EQUIPMENT

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Elevation		*	*	*
Panel Name		*	*	*
Mounting		*	*	*
Enclosure		*	*	*
Breakers		*	*	*
Mains		*	*	*
Circuit Naming			*	*
Circuit Prefix Separator			*	*
Circuit Prefix			*	*
Short Circuit Rating			*	*
Distribution System			*	*
Feed			*	*
Material			*	*
Mark			*	*
Phase Created				*
Phase Demolished				*

ELECTRICAL FIXTURES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Elevation	N/A	*	*	*
Switch ID	N/A		*	*
Panel	N/A		*	*
Circuit Number	N/A		*	*
Material	N/A			*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

FIRE ALARM DEVICES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Elevation	N/A	*	*	*
Panel	N/A		*	*
Circuit Number	N/A		*	*
Electrical Data	N/A		*	*
Material	N/A			*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

FLEX DUCTS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Offset		*	*	*
Start Offset		*	*	*
End Offset		*	*	*
System Classification			*	*
System Type			*	*
System Name			*	*
System Abbreviation			*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

FLEX PIPES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Offset		*	*	*
Start Offset		*	*	*
End Offset		*	*	*
System Classification			*	*
System Type			*	*
System Name			*	*
System Abbreviation			*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

FLOORS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Height Offset from Level	*	*	*	*
Room Bounding	*	*	*	*
Structural		*	*	*
Material			*	*
Mark			*	*
Phase Created				*
Phase Demolished				*

FURNITURE

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Material	N/A		*	*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

FURNITURE SYSTEMS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Material	N/A		*	*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

LIGHTING DEVICES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Elevation	N/A	*	*	*
Switch Voltage	N/A		*	*
Switch ID	N/A		*	*
Panel	N/A		*	*
Circuit Number	N/A		*	*
Material	N/A			*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

LIGHTING FIXTURES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Elevation	N/A	*	*	*
Switch ID	N/A		*	*
Panel	N/A		*	*
Circuit Number	N/A		*	*
Material	N/A			*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

MECHANICAL EQUIPMENT

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Panel		*	*	*
Circuit Number		*	*	*
Air Flow				*
Drain Flow		*	*	*
Air Pressure Drop			*	*
System Classification	N/A		*	*
System Name	N/A		*	*
Material	N/A			*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

PIPES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Start Offset		*	*	*
End Offset		*	*	*
Slope		*	*	*
System Classification			*	*
System Type			*	*
System Name			*	*
System Abbreviation			*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

PLUMBING FIXTURES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Flow Pressure		*	*	*
System Classification			*	*
System Type			*	*
System Name			*	*
System Abbreviation			*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

RAILINGS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Base Level	N/A	*	*	*
Base Offset	N/A	*	*	*
Material	N/A			*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

RAMPS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Base Level	*	*	*	*
Base Offset	*	*	*	*
Top Level	*	*	*	*
Top Offset	*	*	*	*
Width	*	*	*	*
Material			*	*
Mark			*	*
Phase Created				*
Phase Demolished				*

ROOFS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Base Level	*	*	*	*
Base Offset from Level	*	*	*	*
Room Bounding	*	*	*	*
Slope		*	*	*
Thickness		*	*	*
Material			*	*
Mark			*	*
Phase Created				*
Phase Demolished				*

ROOMS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Level	*	*	*	*
Upper Limit	*	*	*	*
Limit Offset	*	*	*	*
Base Offset	*	*	*	*
Number	*	*	*	*
Name	*	*	*	*
Occupancy		*	*	*
Department		*	*	*
Base Finish		*	*	*
Ceiling Finish		*	*	*
Wall Finish		*	*	*
Floor Finish		*	*	*
Occupant		*	*	*
Material				*
Mark				*
Phase Created				*
Phase Demolished				*

SECURITY DEVICES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Panel	N/A		*	*
Circuit Number	N/A		*	*
Electrical Data	N/A		*	*
Material	N/A			*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

SPACES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Level	*	*	*	*
Upper Limit	*	*	*	*
Limit Offset	*	*	*	*
Base Offset	*	*	*	*
Number	*	*	*	*
Name	*	*	*	*
Unbounded High	*	*	*	*
Lighting Calculation	*	*	*	*
Ceiling Reflectance	*	*	*	*
Wall Reflectance	*	*	*	*
Floor Reflectance	*	*	*	*
Design HVAC Loads	*	*	*	*
Design Other Loads	*	*	*	*
Supply Air Flow	*	*	*	*
Return Air Flow	*	*	*	*
Exhaust Air Flow	*	*	*	*
Zone	*	*	*	*
Plenum	*	*	*	*
Design Heating Loads	*	*	*	*
Design Cooling Loads	*	*	*	*
Electrical Loads		*	*	*
Occupancy		*	*	*
Condition Type		*	*	*
Space Type		*	*	*
Construction Type		*	*	*
People		*	*	*
Mark				*
Phase Created				*
Phase Demolished				*

SPRINKLERS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Elevation	N/A	*	*	*
System Classification	N/A		*	*
System Type	N/A		*	*
System Name	N/A		*	*
System Abbreviation	N/A		*	*
Edited by	N/A		*	*
Pressure Drop	N/A		*	*
Flow	N/A		*	*
Material	N/A		*	*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

STAIRS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Base Level	*	*	*	*
Base Offset	*	*	*	*
Top Level	*	*	*	*
Top Offset	*	*	*	*
Width	*	*	*	*
Number of Risers	*	*	*	*
Riser Height	*	*	*	*
Tread Depth	*	*	*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

STRUCTURAL BEAM SYSTEMS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Layout Rule	*	*	*	*
Fixed Spacing		*	*	*
Centerline Spacing		*	*	*
Justification		*	*	*
Beam Type		*	*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

STRUCTURAL COLUMNS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Base Level	*	*	*	*
Base Offset	*	*	*	*
Top Level	*	*	*	*
Top Offset	*	*	*	*
Room Bounding		*	*	*
Style		*	*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

STRUCTURAL FOUNDATIONS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

STRUCTURAL FRAMING

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Start Level Offset	*	*	*	*
End Level Offset	*	*	*	*
Lateral Justification		*	*	*
Cross Section Rotation		*	*	*
Structural Usage		*	*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

STRUCTURAL STIFFENERS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Offset	N/A	*	*	*
Material	N/A			*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

STRUCTURAL TRUSSES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Level	*	*	*	*
Start Level Offset	*	*	*	*
End Level Offset	*	*	*	*
Top Chord		*	*	*
Bottom Chord		*	*	*
Bearing Chord		*	*	*
Rotation Angle		*	*	*
Bearing Vertical Justification		*	*	*
Truss Height		*	*	*
Non-bearing Offset		*	*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

TELEPHONE DEVICES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Elevation	N/A	*	*	*
Material	N/A			*
Mark	N/A			*
Phase Created	N/A			*
Phase Demolished	N/A			*

WALLS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	*	*	*	*
Base Constraint	*	*	*	*
Base Offset	*	*	*	*
Top Constraint	*	*	*	*
Top Offset	*	*	*	*
Height	*	*	*	*
Room Bounding	*	*	*	*
Structural		*	*	*
Structural Usage		*	*	*
Material				*
Mark			*	*
Phase Created				*
Phase Demolished				*

WINDOWS

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Type/Dimensions	N/A	*	*	*
Level	N/A	*	*	*
Sill Height	N/A	*	*	*
Material	N/A		*	*
Mark	N/A		*	*
Phase Created	N/A			*
Phase Demolished	N/A			*

ZONES

Requirements	LOD 100	LOD 200	LOD 300	LOD 400
Level	*	*	*	*
Service Type	*	*	*	*
Coil Bypass	*	*	*	*
Cooling Information	*	*	*	*
Heating Information	*	*	*	*
Outdoor Air Information	*	*	*	*

Updates and Revisions

The dynamic nature of BIM technology dictates that this document will change over time. Changes to this document will be made as needed for the successful implementation of BIM on DDC projects as determined by the DDC BIM manager.

Changes may be made based on errors and omissions, as well as to enhance or update the guidelines based on changes in the BIM process. This document will evolve and continue to be reviewed. Revisions and updates to these guidelines may be submitted in writing to the DDC BIM manager.

Contact Information

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