BIM Use Definition Standard

Draft for NBIMS-US Project Committee and Public Review
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Foreword

BIM Uses provide a common language for communicating how BIM is applied during the life of project. The BIM Uses include both the BIM Use itself and the attributes of the BIM Use. A BIM Use is a method of applying BIM for a specific purpose. BIM Uses focus on the objectives being achieved through BIM rather than specific methods and outcomes. Methods utilized to implement a BIM Use vary from project to project or implementation to implementation. Additionally, the specific outcome(s) depends on phase, trade, and appointing party requirements. Both methods and outcomes should be defined during specific implementations a BIM Use. The provided list of BIM Uses outlined in this document does not attempt to be comprehensive; rather, the list of BIM Uses focuses on those BIM Uses that are more widely used throughout the industry. The BIM Use definitions provide a structure to define additional BIM Uses as these applications of BIM mature.

1 Introduction

This module identifies various BIM Uses project teams may leverage to implement BIM on a project along with example methods and outcomes to achieve the BIM Use. The BIM Uses provide consistent terminology for the purposes of applying BIM. When implementing a BIM Use, ensure that the specific method and outcomes are also identified. (Note that other publications refer to the combination of the BIM Use, a specific method, and a specific outcome as a BIM Use Case.) The BIM Uses were gathered from existing versions of NBIMS-US and other industry sources, then compiled through a consensus process as described below. In the end, the workgroup identified fifteen (15) primary BIM Uses with attributes that can be used to develop project BIM requirements, processes, and BIM deliverables.

The list of BIM Uses outlined in this document is a list of primary BIM Uses. The BIM Use Definition Workgroup fully recognizes that additional BIM Uses exist. However, the Workgroup felt those BIM Uses had not yet matured to a level of adoption and standardization to merit inclusion into the primary list of BIM Uses. The Workgroup’s aim is to develop a list of BIM Uses that apply across all construction sectors; market sector-specific BIM Uses were omitted, regardless of the level of maturity within that market sector. In the future, other BIM Uses may be balloted for inclusion in the primary list as the technology and process around BIM mature.

2 Scope

The BIM Uses module outlines what a BIM Use is, provides a list of primary BIM Uses and associated Attributes, the Definition for those BIM Uses and a protocol for referencing the BIM Uses in other resources. The module is not comprehensive of all potential BIM Uses, rather focused on those more widely implemented BIM Uses across the construction industry and provides a framework for identifying additional BIM Uses as they merit inclusion. The module does not include methodology for applying BIM Uses, nor a method of establishing BIM requirements.
3 Terms and Definitions

Building Information Management (BIM)
Functions of controlling the acquisition, analysis, retention, retrieval, and distribution of built asset information all within an information processing system

Note 1: Within the term, ‘building’ refers to the process of building a built asset, not a specific type of facility. BIM is a function that can be implemented across all types of built assets, including buildings, bridges, highways, tunnels, process plants, and other infrastructure and facility types.

Building Information Model
A shared digital representation of physical and functional characteristics of a facility and built asset.

Note 1: NBIMS-US Version 3 also included “As such it serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its life cycle from inception onwards.”

Note 2: Added the word ‘shared’ to the definition to be more consistent with ISO/TS 12911:2012(en) definition. The ISO definition uses the term ‘built object’ instead of ‘facility’ and adds facility types including ‘buildings, bridges, roads, process plant’. The NBIMS-US definition maintains the word ‘facility’ which implies the inclusion of various facility types.

Note 3: Added the words ‘and built assets’ to specify that a building information model can include representations of buildings, roads, bridges, plants, and other built assets.

Building Information Modeling
Generating and using a shared digital representation of a built asset to facilitate design, construction and operation processes to form a reliable basis for decisions.

BIM Use
The purpose for applying BIM.

Analyze Design
Examine and evaluate a facility design to assess its functionality, and compliance with various criteria and requirements.

Author Design
Develop a design using BIM authoring software with 3D and attribute information for a facility/site leveraging an object library of parametric elements.
Author Temporary Work
Generate the design of non-permanent elements in a model necessary to construct a project.

Capture Condition
Capture information about the existing site and assets to include in a model.

Compile Record Deliverables
Capture and document project and asset information for the purpose of communicating the status at the completion of the delivery phase.

Coordinate Design and Construction
Verify the overall design layout and spatial arrangement of systems by applying construction means and methods and additional spatial constraints (such as code requirements, maintenance access and clearances) to validate the constructability of the project.

Establish Project Requirements
Establish data-centric approach to capture and monitor key project aspects and scope such as area, spatial, functional, asset, deliverable, code, end user, organizational, and other stakeholder requirements.

Generate Estimate(s)
Use data-centric approach to extract project, site, and asset quantity information from model(s) to support the development of project and/or lifecycle cost estimates.

Generate Fabrication Detail
Generate the manufacturing and/or construction details in a model necessary to fabricate elements of a project.

Layout Construction Work
Use model information to support real-time positioning to layout features of work on a construction project.

Manage Assets
Track asset performance and ensure proper maintenance to ensure longevity and optimal functionality.

Manage Space
Allocate, organize, and optimize the use of the physical space of a facility.

Monitor Facility Performance
Assess and evaluate the performance of a facility to ensure it operates efficiently, effectively, and with performance standards.

Produce Construction Documentation
Generate documentation necessary to communicate design intent and construction details which may include plans, elevations, sections, renderings, data schedules, 3D diagrams, or specifications.

**Review Design**
Validate the design intent and constructability of the project based on meeting project requirements and stakeholder expectations, and regulatory compliance (such as validating design quality, 3D model quality, and data quality). Note, this BIM Use is not limited to the design phase.

**Visualize Construction Sequencing**
Use a model to graphically represent and communicate the timing and/or sequencing of construction activities.

### 4 Reference Documents for Use in BIM Use Definition
The content developed within the BIM Use Definitions is an extension of the BIM Project Execution Planning Guide available via Creative Commons. The following documents are referenced throughout the development of the BIM Use Definitions ballot:

- University, University Park, PA.

These reference documents may also be used as resources for developing additional BIM Uses.
5 The BIM Use Development Process

BIM Uses were developed through a consensus effort by a committee made up of BIM experts from multiple disciplines and market sectors. The committee worked to identify the unique reasons why BIM is implemented through the life of projects and facilities.

The development included gathering BIM Uses from existing versions of NBIMS and other sources. Each BIM Use was discussed within the BIM Use Definition Workgroup and evaluated for any necessary revisions to align with current industry practices. The workgroup included a standardized, structured approach to develop BIM Uses, which provides flexibility to create or document additional BIM Uses consistent with the national standard. While the BIM Use Definitions are not intended to describe means and methods, necessary components of the BIM Use have been identified (i.e., prerequisites, input, output, etc.).

Additional considerations of the BIM Use Definition Workgroup Included:

- Conducting detailed review of BIM Uses from existing resources referenced above, engaged sound scholarly research and user interviews/surveys to identify additional BIM Uses that are candidates for inclusion.
- Evaluated the list of BIM Uses for inclusion in primary list of BIM Uses based on:
  o Is this BIM Use Widely Adopted?
  o Is this BIM Use Essential to successfully adopting BIM on a project?
  o Is this BIM Use a part of another BIM Use?
  o Has the technology and/or processes facilitating this BIM Use matured beyond the research and development or piloting phase?
  o Is this BIM Use representative of all phases and market sectors rather than only specific to one?
- Created a framework for BIM Uses including:
  o Identifying the necessary attributes of a BIM Use.
  o Creating a naming convention for a BIM Use beginning with a verb.
- Consolidated and expanded upon BIM Uses based on similar purposes which greatly reduced the number of BIM Uses because the traditional list included elements such as Phase, Level of Development, or Key Stakeholder.
  o Consolidating terms that use different technology to achieve the same purpose.
  o Consolidating terms that identified different LODs or project phases. While a BIM Use may apply to a single phase of a project, the goal of the BIM Use could also be achieved over multiple phases.
  o Consolidating terms that used different party or stakeholders.
- Reviewed preliminary by outside experts and industry practitioners.

6 BIM Uses Identified

The workgroup identified the most broadly adopted BIM Uses. Other BIM Uses exist outside of those identified and may be included in future version of this module as their maturity merits inclusion. The
BIM Use names are organized using verb noun format to highlight the objective being achieved by implementing the BIM Use. When referencing a BIM Use, the name of the BIM Use along with BIM Use Version should be included, i.e., Author Design (AuthorDesign- 4.0-1).

Table 1: Identified BIM Use Summary Table *(Details for each identified BIM Use can be found in Section 9)*

<table>
<thead>
<tr>
<th>Name</th>
<th>Definition</th>
<th>Related Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish Project Requirements</td>
<td>Establish data-centric approach to capture and monitor key project aspects and scope such as area, spatial, functional, asset, deliverable, code, end user, organizational, and other stakeholder requirements.</td>
<td>Scoping Requirements, Identify Project Characteristics, Programming Requirements, Spacing Planning, Design Criteria</td>
</tr>
<tr>
<td>Capture Conditions</td>
<td>Capture information about the existing site and assets to include in a model.</td>
<td>Existing Condition Modeling, Laser Scanning, Reality Capture, Integrated Surveying, Photogrammetry, Photo/Video Documentation</td>
</tr>
<tr>
<td>Author Design</td>
<td>Develop a design using BIM authoring software with 3D and attribute information for a facility/site leveraging an object library of parametric elements.</td>
<td>Design Authoring, Modeling, &quot;Discipline&quot; Modeling, Model Generation, Generative/Parametric Modeling, Generative Design, Federated Design Model</td>
</tr>
<tr>
<td>Analyze Design</td>
<td>Examine and evaluate a facility design to assess its functionality, and compliance with various criteria and requirements.</td>
<td>Design Analysis, Engineering Analysis, Structural Analysis, Energy Analysis, Lighting Analysis, emergency evacuation planning,</td>
</tr>
<tr>
<td>Visualize Construction Sequencing</td>
<td>Use a model to graphically represent and communicate the timing and/or sequencing of construction activities.</td>
<td>4D Modeling, Phase Planning, Constructability, Schedule Visualization, Sequencing, Site Utilization Planning, Construction Simulation, Construction Logistics</td>
</tr>
<tr>
<td>Coordinate Design and Construction</td>
<td>Verify the overall design layout and spatial arrangement of systems by applying construction means and methods and additional spatial constraints (such as code requirements, maintenance access and clearances) to validate the constructability of the project</td>
<td>3D Coordination, MEP Coordination, Clash Management, Interference management, Spatial coordination, Clash detection,</td>
</tr>
<tr>
<td>Review Design</td>
<td>Validate the design intent and constructability of the project based on meeting project requirements and stakeholder expectations, and regulatory compliance (such as validating design quality, 3D model quality, and data quality). Note, this BIM Use is not limited to the design phase.</td>
<td>Virtual Mock-up, Data validation, Validating Project Requirements, Design Review, Model Quality Review, Value Analysis / Engineering, Constructability, Sustainability, Maintainability</td>
</tr>
<tr>
<td>Name</td>
<td>Definition</td>
<td>Related Terms</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Produce Construction</td>
<td>Generate documentation necessary to communicate design intent and construction details which may include plans, elevations, sections, renderings, data schedules, 3D diagrams, or specifications.</td>
<td>PS&amp;Es, Produce Drawings, Working Drawings, Contract Documents, Contract Drawings, CDs</td>
</tr>
<tr>
<td>Documentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Generate Estimate(s)</td>
<td>Use data-centric approach to extract project, site, and asset quantity information from model(s) to support the development of project and/or lifecycle cost estimates.</td>
<td>5D, Quantity Takeoff, QTO, Cost Estimating, Engineers Estimate,</td>
</tr>
<tr>
<td>Generate Fabrication Details</td>
<td>Generate the manufacturing and/or construction details in a model necessary to fabricate elements of a project.</td>
<td>Shop Modeling, Fabrication Modeling, Construction Model, Federated Construction Model,</td>
</tr>
<tr>
<td>Author Temporary Work</td>
<td>Generate the design of non-permanent elements in a model necessary to construct a project.</td>
<td>Temporary Works Models</td>
</tr>
<tr>
<td>Layout Construction Work</td>
<td>Use model information to support real-time positioning to layout features of work on a construction project.</td>
<td>Digital Layout, Automated Machine Guidance, Digital Control, Machine Control</td>
</tr>
<tr>
<td>Compile Record Deliverables</td>
<td>Capture and document project and asset information for the purpose of communicating the status at the completion of the delivery phase.</td>
<td>Record Modeling, As-Built Modeling, As-Built Markup, Turnover Documents, Digital Markups, Project Record, electronic Operations Maintenance Support Information (eOMSI), Operations &amp; Maintenance Manuals</td>
</tr>
<tr>
<td>Manage Assets</td>
<td>Track asset performance and ensure proper maintenance to ensure longevity and optimal functionality.</td>
<td>Asset Management, Asset Planning, Capital Management, Maintenance Management</td>
</tr>
<tr>
<td>Manage Space</td>
<td>Allocate, organize, and optimize the use of the physical space of a facility.</td>
<td>Space Management, Space Utilization, Space Requirement Analysis, Space Inventory, Space Allocation, Traffic Flow and Circulation Planning,</td>
</tr>
<tr>
<td>Monitor Facility Performance</td>
<td>Assess and evaluate the performance of a facility to ensure it operates efficiently, effectively, and with performance standards.</td>
<td>Monitor System Performance, Performance tracking, Building System Analysis.</td>
</tr>
</tbody>
</table>

### 7 BIM Use Attributes

Attributes have been defined for each BIM Use to further explain, expand upon, and relate other BIM Uses as well as provide commentary and guidance on applying the BIM Use on a project or within an organization. The information for each attribute is not intended to be comprehensive but rather provide examples and general guidance.

The BIM Use attributes defined by the workgroup include:
7.1 The Necessity to Define Methods and Outcomes

The BIM Uses themselves do not define specific methods and outcomes when implementing a BIM Use. As BIM continues to mature, the number of methods and outcomes continues to expand. With that said,
when determining how a project team will implement BIM, it is critical to identify the specific method (i.e., laser scanning) and the specific outcomes that are desired (i.e., a propriety model format).

When identifying the implementation of a BIM Use include the BIM Use, followed by the Method, followed by the Outcome (see Figure 1). For example:

- Capture Conditions using UAV with Photogrammetry Processing to Update Site Model.
- Capture Conditions using Laser Scanning with Point Cloud Registration to Update Site Model in IFC format.
- Capture Conditions using weather sensor devices to Identify Current Working Conditions.

![Figure 1: BIM Use Components](image-url)
8 BIM Uses with Attributes

Below is a list of each BIM Use with its associated attributes.

8.1 Establish Project Requirements

ID / Version: EstablishProjectRequirements-4.0-1

Author: BIM Use Definition Workgroup

Definition: Establish data-centric approach to capture and monitor key project aspects and scope such as area, spatial, functional, asset, deliverable, code, end user, organizational, and other stakeholder requirements.


Example Methods and Outcomes: Establish Project Requirements through:
- Establish space requirements using programmatic modeling.
- Create space model templates for use in authoring design(s).

Potential Benefits: Efficient and accurate assessment of design performance regarding spatial requirements by the appointing party.

Assess the DOR’s compliance with meeting program requirements, to include: space requirements - designed vs programmed, equipment requirements, maintenance accessibility, code requirements, etc.

Considerations / Commentary: Consider appointing party’s BIM Knowledge and understand current appointing party deliverable requirements. Should clearly identify format, data, and outcome requirements. This BIM Use is typically performed by appointing party / designer during the early phases of a project. If possible, review available national and international standards and borrow requirements from other similar organizations.

Inputs:
- Reference Database Export
- Subsurface Scanning (GPR and EM)
- Above Surface Scanning (LiDar)

Outputs:
- Program Requirements Documentation.

Predecessor BIM Use(s):
- Capture Conditions
- Compile Record Deliverables (Renovation)

Successor BIM Use(s):
- Capture Conditions
- Author Design

Methods / Tools:
- Programmatic modeling
- Generative Design

Competencies:
- Ability to manipulate, navigate, and review a 3D model.

Resources:
Guide: GSA BIM Guide 02 - Spatial Program Validation
Guide: GSA BIM Guide 06 - Circulation and Security Validation
8.2 Capture Conditions

**ID / Version**  
CaptureConditions-4.0-1  
**Author**  
BIM Use Definition Workgroup

**Definition**  
Capture current information about the site and assets to include in a model.

**Related Terms**  
Existing Condition Modeling, Laser Scanning, Reality Capture, Integrated Surveying, Photogrammetry, Photo/Video Documentation.

**Example Methods and Outcomes**  
Capture Conditions through:

- Using drones to create a photogrammetric model
- Using a laser scanner to create a point cloud
- Using total station to create a GIS dataset
- Using thermal camera to map energy leaks
- Using GPR to create a sub-surface model

**Potential Benefits**  
- Reduced risk of differing site / facility conditions
- Reduced reliance on field verification
- Increased accuracy of record documentation
- Reducing the potential exposure to unsafe conditions during data capture
- Ability to verify record information against as-built conditions.

**Considerations / Commentary**  
- What is the level of accuracy of the data supporting the conditions capture.
- Which systems (and what level of detail of those systems) is necessary to be captured to support future steps within the asset lifecycle.
- Verify tolerance and accuracy of data capture – different tool precision and accuracy varies with device type and site conditions.
- Data to be included within any record deliverable. Can be completed at any phase of the design, construction, and operations

**Inputs**  
- Record Data from appointing party such as drawings and models.
- Survey data

**Predecessor BIM Use(s)**  
- Establish Project Requirements

**Outputs**  
- Existing Conditions Model, Point Cloud Model, Asset schedules, Reports, Photos, Drawings, GIS Data

**Successor BIM Use(s)**  
- Author Design
- Establish Project Requirements
- Visualize Construction Sequencing
- Compile Record Deliverables

**Methods / Tools**  
- Field survey with manual model development
- Automated data capture with manual model development
- Automated data capture with automated model development

**Competencies**  
Experience in Surveying, GIS Data Management and Reality Capture.

**Resources**  
Guide: [GSA BIM Guide 03 – 3D Imaging](https://gsa.gov/3d imaging)


ASCE C-I 38-02; ASCE/UESI/CI 38-22; and ASCE 75-22

Map/LiDAR Standards-NMAS, ASPRS, NSSDA, ISO/TS 19159-2
8.3 Author Design

**ID / Version** AuthorDesign-4.0-1  
**Author** BIM Use Definition Workgroup  
**Definition** Create a model of an asset using authoring software leveraging parametric and data rich elements.

**Related Terms** Design Authoring, Modeling, "Discipline" Modeling, Model Generation, Generative/Parametric Modeling, Federated Design Model

**Example** Author Design through:
- Engineering the Structural Systems of a Bridge
- Configuring the Mechanical Systems of a Hospital

**Potential Benefits**
- Typically a prerequisite for other BIM Uses.
- Improved ability to make changes and have those changes reflect throughout all aspects of the design – Parametric modeling.
- Improve ability to communicate and visualize design intent.
- Improve collaboration between project stakeholders and BIM users.
- Improve control and quality control of design, cost and schedule.

**Considerations / Commentary**
- Appointing party's BIM Requirements
- Model element breakdown and model progression specification
- Model organization and element naming conventions to support subsequent BIM Uses

**Inputs**
- Owner Project Requirements
- Existing Historical Drawings

**Outputs**
- Model(s)
- Structured Data (Files, Database(s), etc.)

**Predecessor BIM Use(s)**
- Capture Conditions
- Establish Project Requirements

**Successor BIM Use(s)**
- Review Design
- Coordinate Design and Construction
- Create Construction Documents
- Author Estimate
- Visualize Construction Sequencing
- Author Fabrication Details
- Author Temporary Works
- Compile Record Deliverables

**Methods / Tools**
- 3D Modeling Software
- Generative Design

**Competencies**
- Knowledge of Modeling Software
- Ability to create intelligent models with associated facility data/attribute data.
- Knowledge to design and construction requirements
- Knowledge of construction means and methods

**Resources**
8.4 Analyze Design

**ID / Version**: AnalyzeDesign-4.0-1  
**Author**: BIM Use Definition Workgroup

**Definition**: Examine and evaluate a facility design to assess its functionality, and compliance with various criteria and requirements.

**Related Terms**: Design Analysis, Engineering Analysis, Structural Analysis, Energy Analysis, Lighting Analysis, emergency evacuation planning.

**Example Methods and Outcomes**: Analyze Design using:
- Energy Analysis and Simulation tools to optimize facility performance.
- Structural Analysis and Design tools to validate structural design.
- Daylighting and Lighting Analysis Tools to understand facility lighting.
- Sustainability Assessment Tools to report on overall sustainability scoring.
- Code Compliance and Regulatory Analysis Tools to validate compliance.

**Potential Benefits**: Using Building Information Modeling (BIM) for design analysis facilitates performance optimization by analyzing energy efficiency, daylighting, and structural integrity. BIM enables designers to optimize energy performance, assess natural light levels, and evaluate structural integrity, leading to more efficient and sustainable designs. BIM-based design analysis empowers stakeholders to make informed decisions, identify design improvements, resolve conflicts, and ensure compliance with project objectives and requirements.

**Considerations / Commentary**: When using BIM for design analysis, it is important to consider factors such as data accuracy and quality, appropriate level of detail in the BIM model, selection of suitable analysis tools and software, integration and interoperability among different platforms, expertise and training of team members, clear definition of scope and objectives, an iterative and collaborative approach to analysis, and recognition of limitations and uncertainties inherent in the analysis process. By considering these aspects, project teams can ensure accurate and reliable analysis outcomes, leading to optimized design decisions and improved project outcomes.

**Inputs**
- BIM Models include model Geometry
- Material Properties
- Component specifications
- Design Constraints and requirements
- Project Site Information

**Outputs**
- Visualizations and Simulations
- Studies and Reports such as daylighting, energy, sustainability, overall performance.
- Facility Engineering Analysis
- Code analysis

**Predecessor BIM Use(s)**
- Author Design

**Successor BIM Use(s)**
- Author Design
• Capture Conditions
• Establish Project Requirements
• Visualize Construction Sequencing
• Review Design

Methods/Tools
• Design Authoring tools with enhanced analysis functionality.
• Energy Analysis and Simulation tools
• Structural Analysis and Design tools
• Daylighting and Lighting Analysis Tools
• Sustainability Assessment Tools
• Code Compliance and Regulatory Analysis Tools

Competencies
Using BIM-based design analysis effectively requires competencies such as a solid understanding of BIM principles and methodologies, proficiency in relevant software tools, data analysis and interpretation skills, domain expertise in the specific analysis discipline, effective collaboration and communication abilities, strong problem-solving skills, a mindset of continuous learning, and knowledge of applicable codes and regulations. These competencies enable professionals to navigate and manipulate BIM models, interpret analysis outputs, make informed design decisions, collaborate with multidisciplinary teams, and stay updated with industry trends.

Resources
8.5 Visualize Construction Sequencing

**ID / Version** VisualizeConstructionSequencing- 4.0-1

**Author** BIM Use Definition Workgroup

**Definition** Using a model to graphically represent and communicate the timing and/or sequencing of construction activities.

**Related Terms** 4D Modeling, Phase Planning, Constructability, Schedule Visualization, Sequencing, Site Utilization Planning, Construction Simulation, Construction Logistics, 4D Scheduling, 4D BIM

**Example Methods and Outcomes**
- Visualize Construction Sequencing to:
  - Creating site logistics plans to sequence trades work throughout a project
  - Create an animation to review the order in which elements of a project need to be installed
  - Visualize order of operations to relocate site utilities.
  - Visualize temporary lane closures for a bridge replacement.
  - Visualize construction sequence for prefabricated building systems and coordinate with on-site construction to minimize conflict.
  - Enhance construction waste recycling and planning sequences.
  - Use model to assess construction risks during the design phase.
  - Coordinate with temporary works model for safety and hazard analysis.
  - Visualize construction sequence for prefabricated building systems and coordinate with on-site construction to minimize conflict.
  - Enhance construction waste recycling and planning sequences.
  - Use model to assess construction risks during the design phase.
  - Coordinate with temporary works model for safety and hazard analysis.

**Potential Benefits**
- Enable 4D Modeling/ 4D Scheduling/4D simulations (VDC) possibilities, optimized schedules.
- Visualize schedule for trades to validate.
- Constructability Analysis
- Forecast construction plan.
- Provides a more efficient means for visualizing and communicating the project schedule and critical path to all stakeholders.
- Provides a more efficient means to create dynamic occupancy plans for evaluating swing space and potential conflicts.
- Integrate planning of human, equipment, and material resources with the model to improve scheduling and cost estimating functions.
- Identify and resolve spatial and sequencing conflicts ahead of the construction process.
- Use model for marketing purposes
- Use model for bidding on projects

**Considerations / Commentary** Additional information incorporated into the model can include labor resources, materials and associated deliveries, and equipment location. Because the 3D model components are directly linked to the schedule, site management functions such as visualized planning, short-term re-planning, and resources can be analyzed over different spatial and temporal data.
Visualizing Construction Sequencing is a useful tool for planning the phased occupancy of a building during renovation, retrofitting, or addition projects. It can also be used to visualize the construction sequence and space requirements on a building site. By incorporating the element of time, Visualizing Construction Sequencing provides a powerful visualization and communication tool that helps the project team, including the appointing party, to gain a better understanding of the project milestones and construction plans.

Consider how tasks that are not associated with model geometry will be tracked/represented in the model. (i.e. permits, submittals, etc.). Consider Level of Development (LOD). Are you only developing the visualization to the LOD defined by the designer or breaking down modeled objects to a higher LOD to correlate to the tasks in the project schedule. (e.g. the designers design intent model will show a slab modeled as one pour however, the appointed party may choose to break up the model into multiple pours to align with the sequence of work/schedule).
Understand the goals of schedule visualization on a project. Understand the ROI and if and a appointed party uses it throughout a project lifecycle. For example, if an Appointing party pays for monthly updates to the visualization, what is the value if the appointed party isn't really using it to drive efficiencies on the project?

| Inputs | • 3D Model | Outputs | • Schedule Draft/ final |
| Predecessor BIM Use(s) | • Author Design | • 4D Model Draft/ Final |
| Predecessor BIM Use(s) | • Author Fabrication Details | Successor BIM Use(s) | • Coordinate Design and Construction Review Design |
| Methods/Tools | • Capture Conditions | | |
| Methods/Tools | • Author Temporary Works | | |
| Methods/Tools | • Design Authoring Software | | |
| Methods/Tools | • Scheduling Software | | |
| Methods/Tools | • 4D Modeling Software | | |
| Competencies | • Knowledge of construction scheduling and general construction processes | | |
| Competencies | • Ability to manipulate, navigate, and review a 3D model | | |
| Competencies | • Knowledge of 4D software: import geometry, create and manage links to schedule activities, produce and control animations, etc. | | |
Resources

- GSA BIM Guide 04 - 4D Phasing
8.6 Coordinate Design and Construction

**ID / Version** CoordinateDesignAndConstruction-4.0-1

**Author** BIM Use Definition

**Workgroup**

**Definition** Verify spatial arrangement and layout of design with the application of construction means and methods and additional spatial constraints (such as code requirements, maintenance access and clearances).

**Related Terms** 3D Coordination, MEPFP Coordination, Clash Management, interference management, spatial coordination, clash detection, BIM coordination

**Example Methods and Outcomes**
- Identify interferences in MEPFP systems prior to prefabrication
- Align structural and architectural elements during design development
- Understand potential installation concerns between existing and new facility systems

**Benefits** Reduced design errors and omission. Reduced defects in construction phases, below ground and above ground assets/services. (Note: rarely will models be completely clash free, rather critical items will be resolved).
- Better production planning with all appointed parties.
- Project checking rules leading to better design quality.
- Automatically identifying interferences within design and construction elements

**Considerations / Commentary**
- Level of Development of models being coordinated.
- Expectation of responsible coordination to be documented within the BEP. i.e. what is acceptable to leave as coordination concern.
- Uncertainty in source data including existing conditions model
- Ensuring that coordination efforts are properly aligned with design and construction schedules
- Ensure that appropriate decision makers are a part of coordination efforts
- Consider asynchronous coordination methodology and the order in which coordination concerns are able to be resolved.
- Coordination includes elements beyond clash detection such as clearances, accessibility, and constructability.

**Inputs**
- Design Model
- Construction / Fabrication Model
- 4D Model / Construction Schedule
- Existing Conditions Model

**Outputs**
- Coordinated Model
- Coordinated shop drawings
- Updates to design model(s)
- List of Coordination Concerns to be addressed including RFIs

**Predecessor BIM Use(s)**
- Author Design
- Author Fabrication Details
- Capture Conditions

**Successor BIM Use(s)**
- Visualize Construction Sequence
• Author Temporary Works

Methods/Tools
• Model aggregation software
• Model collaboration software
• Issue management software

Competencies
• Ability to navigate a model.
• Knowledge construction process and procedures
• Understanding of constructability of project elements

Resources
• Elements to consider in 3D BIM coordination | BIMCommunity
• USACE Interference Management Guidelines
• ASCE 38-20 Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data
• Mechanical, Electrical, Plumbing, And Fire Protection Systems (MEP) Spatial Coordination: Requirements for Construction Installation Models and Deliverables – Revised May 2012 NBIMS Version 3
8.7 Review Design

ID / Version          ReviewDesign-4.0-1      Author  BIM Use Definition Workgroup
Definition            Validate the design intent and construction details based on the project requirements and stakeholder expectations (such as validating project design quality, and model/data quality). Note, this BIM Use is not limited to the design phase.
Related Terms         Data Validation, Validate Compliance with LOD Requirements, Design Review, Model Quality Review, Virtual Mock-up
Example               Review design through:
Methods and Outcomes  • Using a checklist to validate a COBie output against the owner’s spatial requirements.
                        • Using a matrix to identify the minimum LOD required, and using that matrix to check the models against during the review process
                        • Using excel to automatically validate a spatial report provided by an Architect against the appointing party’s spatial requirements
                        • Using the Revit Model Checker to identify errors
                        • Using a cloud software to compare basis of design parameters against submitted parameters (e.g. - a pump’s design flow capacity vs. flow capacity of equipment being submitted for procurement)
Benefits               • Reduced RFIs
                        • Reduced Change Orders
                        • Reduced changes to schedule during construction
                        • Overall Cost Savings
Considerations / Commentary This BIM Use has many levels of maturity - all process based - that range from developing a PDF checklist to utilizing software to produce automated reports on design validity based on specific inputs.
Inputs                • BIM Execution Plans
                        • Digital Practice Plans
                        • Data requirements Matrix
                        • Scopes of Work
                        • Spatial Data Files
                        • Energy Data Files
                        • Design Intent Models
                        • Owner Project Requirements
Outputs               • Report of Review Comments
                        • Error Reports
                        • Data Validation Reports
                        • Deviation Reports
Predecessor BIM Use(s)  • Establish Program Requirements
                        • Author Design
                        • Create Construction Documents
Successor BIM Use(s)   • Author Design
Methods/Tools
- Design review software (model review and document review)
- Model Checkers
- Automated Tabular Review Template
- Task Tracking Software
- Coordination Software

Competencies
Understanding of design requirements and standards.
Understanding Model Quality Control and Quality Assurance processes.
Understanding project construction processes.
Understanding of asset operational processes.

Resources
GSA Model Checkers
8.8 Create Construction Documents

ID / Version     CreateConstructionDocuments-4.0-1  Author       BIM Use Definition Workgroup

Definition     Generate documentation necessary to communicate design intent and construction details which may include plans, elevations, sections, renderings, data schedules, 3D diagrams, or specifications.

Related Terms     PS&Es, Produce Drawings, Product Drawings, Working Drawings, Contract Documents, Contract Drawings, Construction Drawings (CDs)

Example     Create Construction Documents through:

Methods and Outcomes

• Using a design authoring tool to produce construction drawings
• Using a detailing tool create shop drawings and spool drawings

Benefits     Simplifying the annotation process through compiling elements such as notes, table of contents and schedules
Reducing time to make updates / revisions because of the parametric nature of the drawings.
Drawings are contained in the discipline models which reduces the files to submit
More accurate detailing and sections cut from model which are less error prone/avoid miss interpreting line styles and projections.

Considerations / Commentary     What drawings need to be produced to construct a facility
How detailed the model needs to be to communicate design intent - often models are over detailed with little value provided for fabrication
When to transition from a design model to a fabrication
Best practices for modeling, such as model breakdown, responsibilities, and level of development.
What needs to be modeled vs drafting details, which templates to use, which disciplines will be in which models, where will general sheets be included, how will keynotes and sheet notes be developed, understand that model authoring tools will never produce a 1:1 match of traditional CAD standards but will get close - which needs to be expressed to appointing parties and CAD managers, etc.

Inputs     • Design and fabrication models

Outputs     • PDF set of Plans

• Design Model with sheet views.
• Model views and details to be imported into collaboration tools

Predecessor BIM Use(s)     • Author Design

Successor BIM Use(s)     • Author Fabrication Details

• Author Temporary Works

Methods/Tools     • Model Authoring software
• Drafting software
Competencies

- Design and/or fabrication detailing experience
- Understanding that model elements contain data which also needs to be accurately represented
- Expertise in the model authoring / detailing tools

Resources

- National CAD Standard
- A/E/C Graphic Standards
- GSA Drawings Standards
- ASHRAE Standards and Guidelines
8.9 Author Estimate

<table>
<thead>
<tr>
<th>ID / Version</th>
<th>AuthorEstimate-4.0-1</th>
<th>Author</th>
<th>BIM Use Definition Workgroup</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Use data-centric approach to calculate project, site and asset quantity information and establish project and/or lifecycle cost estimates.</td>
<td></td>
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<tr>
<td>Related Terms</td>
<td>5D, Quantity Takeoff, QTO, Cost Estimating, Engineers Estimate</td>
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<tr>
<td>Example</td>
<td>Author Estimate through:</td>
<td></td>
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<tr>
<td>Methods and</td>
<td>• Extracting quantities from a model to support cost estimating</td>
<td></td>
<td></td>
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<tr>
<td>Outcomes</td>
<td>• Mapping elements to a cost accounting solution to support updating cost estimates as the design develops</td>
<td></td>
<td></td>
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<tr>
<td>Benefits</td>
<td>Reducing the time to takeoff a project.</td>
<td></td>
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<tr>
<td></td>
<td>Increasing the accuracy of takeoffs, especially counts</td>
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<tr>
<td></td>
<td>Better visualization of quantities</td>
<td></td>
<td></td>
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<tr>
<td>Considerations/Commentary</td>
<td>BIM can and should be used to support the estimating process, however accuracy and maturity of the model must be considered just as with drawing development. Models may not also be developed in a manner suitable for QTO. Cost Estimator will want to work with designer to establish requirements and expectations to support their workflow. Level of development of the model, not all elements will be present yet. Data accuracy within the model - Often model elements are not properly labeled within a model or an element could be used to represent something else. i.e., a floor element could be used as a ceiling.</td>
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<tr>
<td>Inputs</td>
<td>• Design Model</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>• Construction / Fabrication Model</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Historical Cost Data Sets / RS Means</td>
<td></td>
<td></td>
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<tr>
<td>Outputs</td>
<td>• Excel file with counts and quantities</td>
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<tr>
<td></td>
<td>• Construction Estimate / Budget built upon data from a model</td>
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<tr>
<td></td>
<td>• A Bill of Materials to be purchase for the install</td>
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<tr>
<td>Predecessor</td>
<td>• Author Design</td>
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<tr>
<td>BIM Use(s)</td>
<td>• Author Fabrication Details</td>
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<tr>
<td>Successor</td>
<td>Author Design</td>
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<tr>
<td>BIM Use(s)</td>
<td></td>
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<tr>
<td>Methods/Tools</td>
<td>• Design authoring tools</td>
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<td></td>
<td>• Model review tools</td>
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<tr>
<td></td>
<td>• BIM enable cost estimating tools</td>
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<tr>
<td>Competencies</td>
<td>• Ability to understand and manipulate element data/attributes within the model</td>
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<tr>
<td></td>
<td>• Background in cost estimation fundamentals and best practices</td>
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8.10 Author Fabrication Details

ID / Version AuthorFabricationDetails-4.0-1  Author BIM Use Definition Workgroup

Definition Generate the manufacturing and/or construction details in a model necessary to fabricate elements of a project.

Related Terms Shop Modeling, Fabrication Modeling, Construction Model, Federated Construction Model

Example Methods and Outcomes Author Fabrication Details through:

• Detailing fabrication details on a priority CAD solution to drive a CNC machine
• Using an authoring tool to create installation details and requirements for an installation team

Potential Benefits
• Reduce fabrication time.
• Increased accuracy of fabricated elements.
• Reduce installation time.
• Reduce rework during installation.
• Reduced material waste.

Considerations / Commentary Do fabricators have the ability to use the fabrication details, assess downstream workflows, formats most suitable, and information that may be needed by the installers.

Inputs
• Product Catalog
• Design Model
• Construction Documents

Outputs
• Fabrication Model
• Product Specs/Data
• Fabrication/Shop Drawings
• Installation / Assembly instructions

Predecessor BIM Use(s)
• Author Design
• Create Construction Documents

Successor BIM Use(s)
• Coordinate Design and Construction
• Compile Record Deliverables
• Layout Construction Work

Methods/Tools
• Model Authoring software
• Drafting software.
• Specialized fabrication software (i.e. metal, steel, HVAC, plumbing, manufacturing, etc.)

Competencies
• Ability to manipulate, navigate, and review 3D model
• Ability to make appropriate construction decisions using 3D Design Software
• Knowledge of typical and appropriate construction practices for each component

Resources
8.11 Author Temporary Work

ID / Version: AuthorTemporaryWork-4.0-1

Author: Workgroup

BIM Use Definition

Definition: Generate the design of non-permanent elements in a model necessary to construct a project.

Related Terms: Temporary Works Models

Example: Author Temporary Work through:

Methods and Outcomes:
- These temporary systems can include Concrete formwork, Scaffolding, Support of excavation systems, Temporary shoring, Temporary heating and cooling, Temporary lighting, On-site temporary facilities, and other engineered temporary construction systems.

Benefits: By having a model for temporary work, components and installation sequences can be visualized, coordinated with the design model and construction sequence, and analyzed in detail. This leads to increased safety, productivity, and constructability. Workers benefit from improved communication and a better understanding of complex building systems. Collaboration between multiple disciplines is enabled, along with the automation of work package development. Additionally, the model can help identify modularization, preassembly, and prefabrication opportunities, as well as record asset information to prevent incidents and identify useful life for structures used and reused on multiple projects.

Considerations / Commentary:
- The temporary work model needs to be vetted with the design model and the sequence of the temporary installation with the construction sequence to minimize conflict between all model components.
- The structural components of the temporary structures need to be coordinated with the project’s structural components for clash detection and elimination.

Inputs:
- Open libraries
- Existing conditions
- Construction schedule
- Site logistics utilization plan/inventory storage layout
- Supply chain/material delivery schedule
- Design model
- Prefabrication details
- MEP layout
- Heavy equipment information
- Existing conditions model

Outputs:
- Temporary works model and, if applicable:
- Clash-detection reports/information
- Revised construction sequence
- Revised supply chain
- Revised site logistics/utilization
- Revised prefabrication information
- Project (out-of-service) timeline information
- Revised space utilization layout/information
• Author Design
• Create Construction Documents

Successor BIM Use(s)
• Coordinate Design and Construction
• Layout Construction Work

Methods/Tools
• Model Authoring software
• Drafting software

Competencies
• Ability to manipulate, navigate, and review 3D model
• Ability to make appropriate construction decisions using a 3D Design Software
• Knowledge of typical and appropriate construction practices for each component
• Ability to analyze the impact of introduced model components on potential benefits such as safety, productivity, and sequencing of work.

Resources
8.12 Layout Construction Work

ID / Version LayoutConstructionWork-4.0-1  Author BIM Use Definition Workgroup

Definition Using model information to layout features of work on a construction project

Related Terms Digital Layout, Automated Machine Guidance, Digital Control, Machine Control

Example Method and Layout Construction Work through:

- Load model information on a survey instrument to place reference markers, check reference markers, or layout work in real-time with machine control systems.

Outcomes

Benefits

- Decrease layout errors.
- Increase efficiency and productivity by decreasing time spent preparing survey data for the field.
- Reduce rework since control points are received directly from the model.

Considerations / Commentary

Construction layout uses survey tools and methods but is not a licensed practice. Nevertheless, the person performing layout or preparing the data for the machine control systems needs to have a thorough understanding of survey principles.

Inputs

- Survey metadata describing the project coordinates.
- Control monuments
- GPS localization
- Design models

Outputs

- Grade checking spreadsheet
- Graded surface
- Reference markers
- Reference stakes

Predecessor BIM Use(s)

- Author Design
- Create Construction Documents
- Author Fabrication Details
- Author Temporary Works

Successor BIM Use(s)

- Compile Record Deliverables

Methods/Tools

Data preparation to create a file to load onto real-time positioning system, e.g., survey rover or machine control system.

- Real-time positioning equipment with the required accuracy for the construction tolerance.
- Machine control systems
- Digital layout equipment
- Survey/field data preparation software

Competencies

Thorough understanding of survey principles related to construction layout.

Ability to create, manipulate, navigate, and review 3D models.

Thorough understanding of machine control systems.

Resources


### 8.13 Compile Record Deliverables

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<thead>
<tr>
<th>ID / Version</th>
<th>CompileRecordDeliverables-4.0-1</th>
<th>Author</th>
<th>BIM Use Definition Workgroup</th>
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</thead>
</table>

**Definition**
Capture and document project and asset information for the purpose of communicating the status at the completion of the delivery phase.

**Related Terms**

**Example Methods and Outcomes**
Compile Record Deliverables through:
- Asset Information exchange for use in facility information management systems
- Documenting precise As-built conditions in an updated fabrication model
- Reusable updated design intent model reflecting as installed information.
- Market the facility features
- Perform space planning/management.
- Monitor energy performance and other maintenance needs.
- Use model for personnel training.

**Benefits**
Provide a reference toward modeling of future renovations.
Create historical documentation/record of the facility.
Populate facility information management systems.
Provide the appointing party with a model of the building, equipment, and spaces within a building to create possible synergies with other BIM Uses
Minimize physical documentation required for building turnover information
Enable integration of information with appointing party facility management systems
Unlocking additional BIM Uses
Aid in the permitting process (e.g., continuous change vs. specified code.)
Minimize facility turnover dispute (e.g., link to contract with historical data highlights expectations and comparisons drawn to the final product.)
 Accommodate the appointing party’s needs and wants to help foster a stronger relationship and promote repeat business.
Assess appointing party requirement data such as room areas or environmental performance to as-designed, as-built, or as-performing data

**Considerations / Commentary**
Record deliverables can be compiled through all stages in the project, i.e., design, construction, and operation. Therefore, the model fidelity varies depending on which phase it is being developed (Dossick et al., 2017).
These types of models are a more cost-effective solution for facility management purposes as they can be created with a single software package, making the model easy to use and modify throughout a facility’s lifecycle. Owners can also use Design-Intent Record Models for commissioning (Messner et al., 2013).
Design-Intent Record Models can also be used to map and track recently updated commissioning data (Massachusetts Port Authority, 2017)

**Predecessor BIM Use(s)**
- Author Design
- Create Construction Documents

**Successor BIM Use(s)**
- Establish Project Requirements
- Capture Conditions
• Author Fabrication Details
• Author Temporary Works
• Layout Construction
• Coordinate Design and Construction

Inputs
• Equipment Information, Project Submittal Information, COBIE Requirements,
• Design Model,
• Coordination Model,
• 4D model

Outputs
• Record Model
• O&M Manuals

Competencies
Ability to manipulate, navigate, and review 3D model.
Ability to use BIM modeling application for building updates.
Ability to thoroughly understand facility operations processes to ensure correct input of information.
Ability to effectively communicate between the design, construction, and facilities management teams

Methods/Tools
RFID Tagging to locate fixed and movable assets
3D model viewing software

Resources
8.14 Manage Assets

ID / Version: ManageAssets-4.0-1

Definition: Track asset performance and ensure proper maintenance to ensure longevity and optimal functionality.


Example Methods and Outcomes:
- Manage Assets:
  - Using Asset information to create a central repository of asset data.
  - Using BIM Data to schedule and optimize maintenance activities.
  - Using Mobile BIM Solution to locate and update asset data on-site.
  - Using Digital Twins to provide real-time data for better decision making.

Potential Benefits:
Using BIM to aid in managing assets offers benefits to organizations such as improved asset performance, cost savings, compliance, informed decision-making, extended asset lifespans, efficient inventory management, safety and risk management, and stakeholder satisfaction. By utilizing BIM technology, organizations can enhance asset management practices by incorporating 3D models, data integration, and collaborative workflows. BIM enables organizations to create a digital representation of assets, facilitating better planning, maintenance, and utilization throughout the asset lifecycle. With BIM’s comprehensive information and visualization capabilities, organizations can make more accurate decisions, optimize resource allocation, and streamline asset management processes, resulting in increased efficiency and improved outcomes.

Considerations / Commentary:
Considerations for using BIM in asset management include data integration, standardization, lifecycle perspective, collaboration, maintenance planning, training, security, and scalability. These factors ensure seamless information exchange, consistent data structures, effective maintenance planning, secure data management, and adaptability to future needs.

Predecessor BIM Use(s): Compile Record Deliverables

Successor BIM Use(s): Establish Project Requirements
- Capture Conditions
- Author Design

Inputs:
- Asset inventory data sets such as COBie and drawing equipment schedules
- Project cost data
- Design and construction data
- Commissioning and Maintenance reports

Outputs:
- Asset performance reports and corrections
- Maintenance and repair schedules
- Lifecycle Management reports
- Financial Reports
- Compliance Documentation
- Optimization recommendations
Competencies

Utilizing Building Information Modeling (BIM) for asset management requires competencies in BIM knowledge, asset management principles, data management and analysis, proficiency in relevant BIM software, collaboration and communication skills, asset performance analysis, standards and compliance knowledge, and a mindset of continuous learning. These competencies enable professionals to effectively work with BIM tools, manage asset data, analyze performance metrics, collaborate with stakeholders, ensure compliance, and stay updated with industry advancements.

Tools

Computerized Maintenance Management System, Enterprise Asset Management, Preventive Maintenance Management System (PPMS), Computer-Aided Facility Management (CAFM), Maintenance Management System (MMS), Asset Performance Management (APM), Field Service Management (FSM).

Resources


ISO 19650
8.15 Manage Space

**ID / Version** ManageSpace-4.0-1  
**Author** BIM Use Definition Workgroup

**Definition** Allocate, organize, and optimize the use of the physical space of a facility.

**Related Terms** Space Management, Space Utilization, Space Requirement Analysis, Space Inventory, Space Allocation, Traffic Flow and Circulation Planning.

**Example Methods and Outcomes** Compile Record Deliverables through:
- Methods

**Benefits** It improves space utilization by identifying underutilized areas and optimizing space allocation. BIM enhances design and planning by providing 3D visualization and simulation capabilities, aiding in informed decision-making. BIM fosters collaboration and communication among stakeholders involved in space management, reducing space conflicts. It leads to cost and time savings, better cost estimation, and supports future modifications and renovations. BIM also improves the occupant experience by designing spaces to meet their specific needs and preferences. Overall, BIM for space management optimizes space utilization, enhances efficiency, reduces costs, and improves occupant satisfaction.

**Considerations / Commentary** ensuring data accuracy and quality, establishing standardization and consistency in naming and classification, fostering collaborative processes and communication among stakeholders, providing training and skill development, integrating BIM with existing systems, implementing robust security measures and data management practices, and designing the BIM model to be scalable and flexible for future modifications. By addressing these considerations, organizations can maximize the benefits of BIM technology in space management, including accurate data, efficient collaboration, and adaptability to changing needs.

**Predecessor BIM Use(s)**
- Compile Record Deliverables

**Successor BIM Use(s)**
- Establish Project Requirements
- Capture Conditions
- Author Design

**Inputs**
- Design Models
- Facility Program Models
- Room Data Sheets
- Sensor Data
- Utilization Reports

**Outputs**
- Spatial Visualizations
- 2D and 3D floor Plans
- Space Allocations and Utilization reports
- Move Management Plans

**Competencies** proficiency in BIM software tools, understanding spatial planning and design principles, data management and organization skills, effective collaboration and communication abilities, problem-solving and critical thinking aptitude, continuous learning and adaptability, knowledge of building regulations and standards, project management proficiency, data analysis and visualization capabilities, and understanding of facility management principles. Developing these competencies through education, training, experience, and self-improvement enables individuals and teams to effectively leverage BIM for space management tasks.
8.16 Monitor Facility Performance

**ID / Version**: MonitorFacilityPerformance-4.0-1  
**Author**: BIM Use Definition Workgroup

**Definition**: Assess and evaluate the performance of a facility to ensure it operates efficiently, effectively, and with performance standards.

**Related Terms**: Monitor System Performance, Performance tracking, Building System Analysis.

**Example Methods and Outcomes**: Monitor Facility Performance using:
- Sensor Data and Building Automations systems to create performance dashboards
- IoT devices to forecast and adjust energy data.

**Benefits**: Improves operational efficiency by identifying inefficiencies and optimizing workflows, enhances sustainability through environmental impact assessment and green practices, enables proactive maintenance to prevent breakdowns and optimize schedules, ensures compliance with standards and regulations, facilitates data-driven decision-making for optimized resource allocation, fosters collaboration and communication among stakeholders, and supports lifecycle optimization for long-term benefits. Ultimately, these advantages lead to cost savings, improved occupant comfort, and a more sustainable and efficient facility overall.

**Considerations / Commentary**: ensuring data accuracy and integration from various sources, standardizing data formats and interoperability between software platforms, providing adequate training and skill development for personnel, implementing robust privacy and data security measures, designing the BIM model to be scalable and flexible for future changes, and fostering stakeholder engagement and collaboration.

**Predecessor BIM Use(s)**: Compile Record Deliverables

**Successor BIM Use(s)**: Establish Project Requirements

**Inputs**: 
- Facility Design and Construction Data
- Equipment and Systems Data
- Performance Metrics and Standards

**Outputs**: 
- Performance dashboards and reports
- Alerts and Notifications

---

**Tools**: Design Authoring tools, Integrated Workplace Management Systems (IWMS), Computer-Aided Facility Management (CAFM) System, Space Visualization and Modeling Tools, Space Analytics and Reporting Tools:

**Resources**: 
• Sensor Data and Building Automation System (BAS) Data
• Maintenance and Asset Management Data
• Predictive Analytics and Forecasting
• Maintenance and Performance Recommendations

Competencies
Effectively using BIM to monitor facility performance requires competencies in BIM software proficiency, data management and analysis, understanding performance metrics and standards, facility systems knowledge, technical understanding of energy efficiency and maintenance procedures, analytical and problem-solving skills, strong communication and collaboration abilities, and a mindset of continuous learning and adaptability.

Tools
Model Authoring Tools,
Performance Analysis Software
Building Automation Systems
Data analytics and Visualization
Sensor and IoT Technology

Resources
BIM for Building Owners and Developers: Making a Business Case for Implementing BIM on Capital Projects
BIM for Facility Managers