OhioDAS
General Services Division

State Architect's Office
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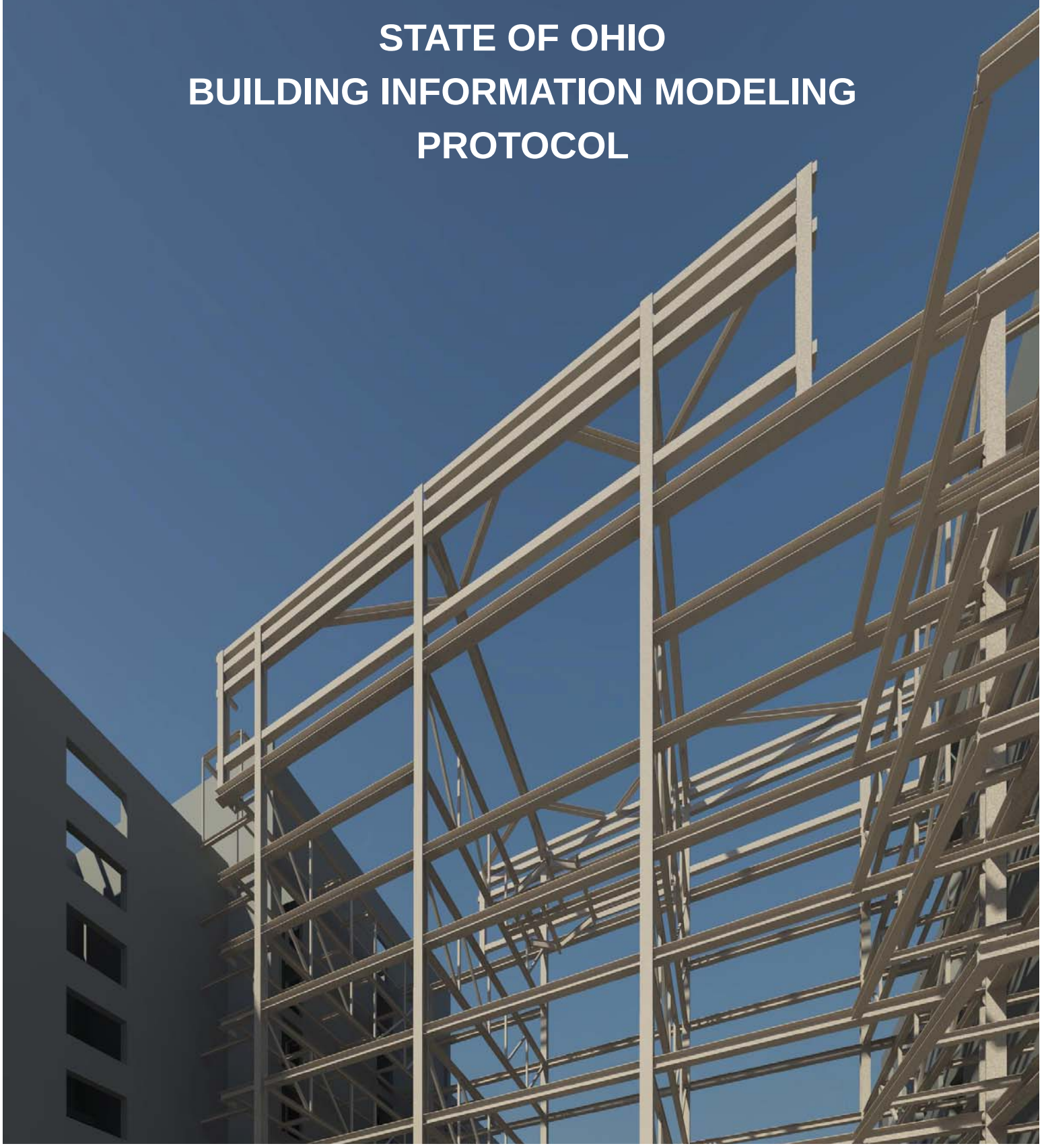
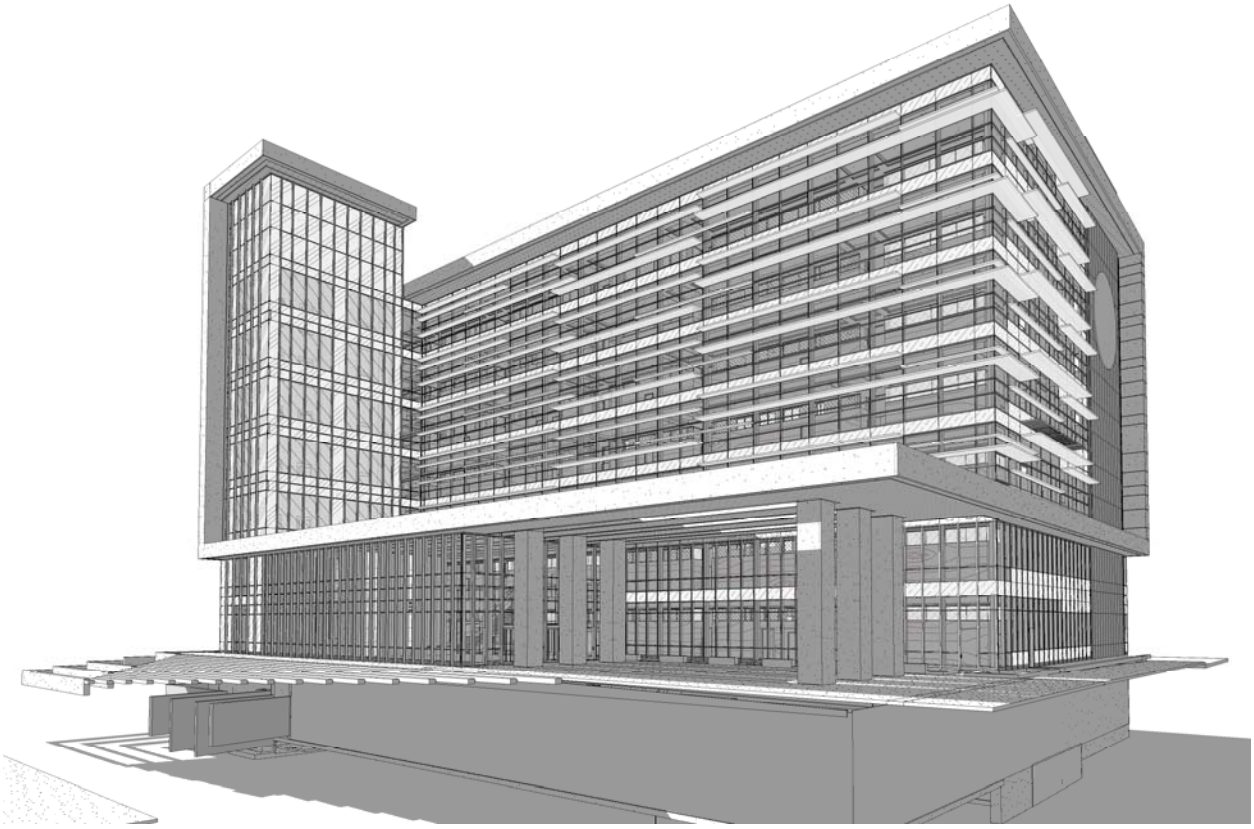
STATE OF OHIO
BUILDING INFORMATION MODELING
PROTOCOL



Front and Back Covers: The Ohio State University South High Rises Addition | Image provided by Shelley Metz Baumann Hawk, Inc. and Schooley Caldwell Associates



Franklin County Common Pleas Courthouse | Image courtesy of Arquitectonica and DesignGroup

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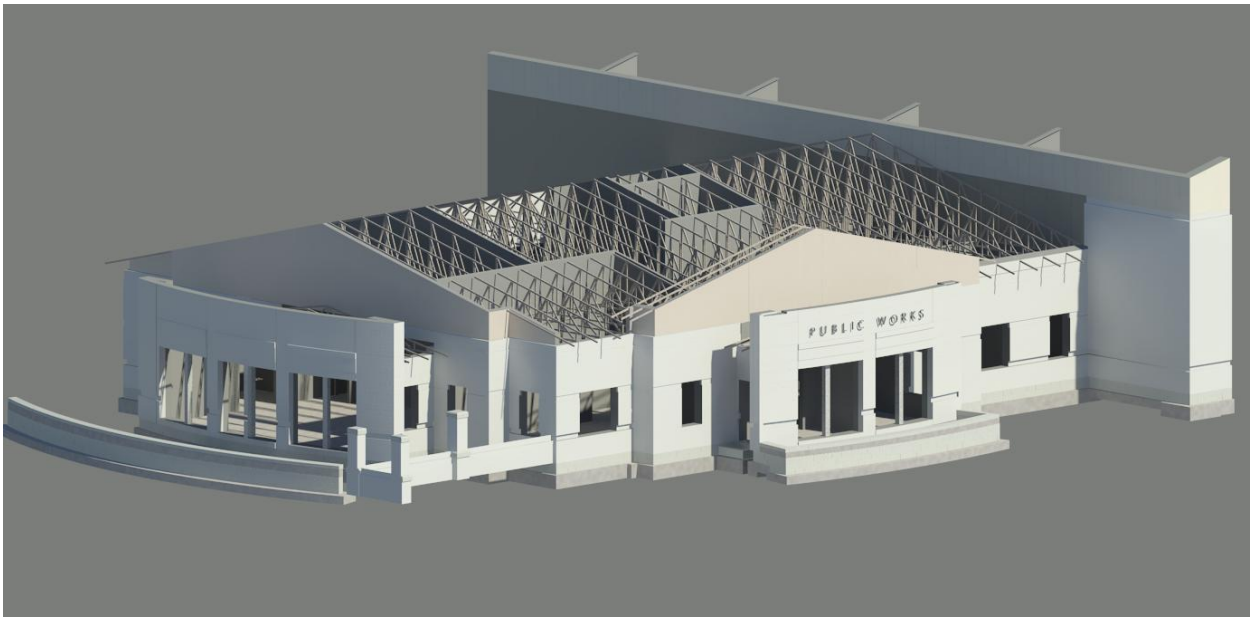
Franklin County Common Pleas Courthouse | Image courtesy of Arquitectonica and DesignGroup

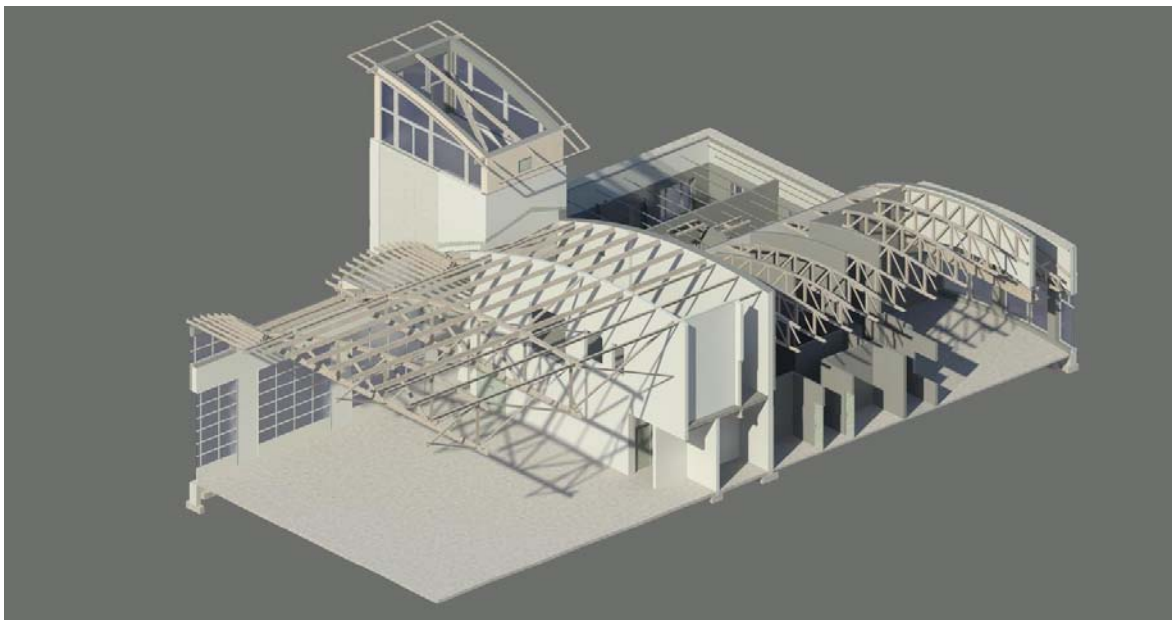


Miami Township Public Works Building | Image courtesy of THORSON BAKER & Associates, Inc., consulting engineers and CR architecture + design, Architects

Statement of Purpose

The Sections consist of the following:

- Necessity
- Fact Finding
- Results
- Goals



Miami Township Fire Station | Image courtesy of THORSON BAKER & Associates, Inc., consulting engineers and CR architecture + design, Architects

Necessity

The term building information modeling (BIM) has become a catch phrase within the design and construction community. An increasing number of architects, engineers, consultants and contractors are creating multi-dimensional drawings of buildings and components that are rich in details regarding materials and even fabrication and construction methods. Software developers and building component manufacturers are developing applications to develop and utilize building data. Building owners and operators are embracing the technology as a tool to manage the operation of the facility, monitoring building systems, scheduling and forecast maintenance and repairs, and to evaluate future facility options. The technology is offering the potential for the designer and building owner to design, construct, and even operate the facility without physical construction documentation.

This paradigm shift is similar to the developments in how we navigate our roadways. Early road travel was guided by paper maps of varying scales and levels of accuracy. No two maps of a given area would provide the same level of information. As surveying and mapping technology developed the accuracy of maps increased, creating a consistent product regardless of manufacturer and agency providing the information on a location. The advent of electronic mapping software further increased the accuracy to reach a destination and provided additional information on the location and resources available to the traveler in route. Today mapping technology fits into a box not much larger than a deck of cards that guides the traveler to the destination with verbal and visual directions. The additional data available can guide the user on all aspects of the trip, from fuel to lodging and entertainment.

The technological shift in construction documentation has been evolving rapidly. This can create obstacles to the implementation of BIM. While many owners of public construction are interested in being part of the BIM revolution, the levels of information available, types of software, and expertise of the professionals create confusion and result in unmet expectations at the conclusion of the project. They hire consultants to develop standards and guides to document their requirements without having a clear and compelling vision of what they want to accomplish.

The potential of this technology can also create an expectation that can exceed the user's current ability to gain benefit. Requiring BIM to be used on a project for the sole purpose of having electronic models limits the value of the product while increasing the effort on all parties involved with the project. It is crucial that the information be sufficient and formatted for the intended purpose. For the data to be useable, a protocol outlining how such data is to be created, embedded, and delivered is necessary to ensure the value desired by public owners is handed over by the teams they contract with.

The State of Ohio BIM Protocol does not establish a "standard" that requires specific software or hardware to be used by the state's vendors, but provides general guidance that ensures that building owners know what they should include in their requests for qualifications, agreements, bidding requirements, contracts, and other documents affected by this new medium and process.

Requiring open standards for data exchange is another goal. Integration of the project team through industry standard communication formats will ensure the digital data will remain available and accessible during continued development of the underlying technology, and provide building owners the opportunity to utilize the data developed through this technology after the building is completed.

Fact Finding

To gain an understanding of the current level of development of building information modeling (BIM), implementation within the design and construction industry and public owner's ability to utilize this tool, the State Architect's Office conducted four distinct but interrelated fact finding activities:

State and National BIM Standards and Guidelines Review: The State Architect's Office reviewed the guidelines and standards currently developed by other Federal, State and public agencies. The review focused on the entity's purpose for requiring BIM on their projects, the criteria for BIM implementation and the level of development of the models.

Design and Construction Industry Market Survey: Over 4,500 individuals, representing all professions of the design and construction industry, were contacted via email and requested to complete a survey on the use of BIM for design, construction and facilities management. The questions addressed awareness of BIM, perceived benefits of implementing BIM, level of participation and training on BIM authoring software, and any obstacles that impact the implementation of BIM software and processes. Over 600 responses were received, representing architects, engineers, consultants, contractors, suppliers, and owners.

State of Ohio Agency and Institutions of Higher Education Interviews: The State Architect's Office conducted interviews with 25 State of Ohio agencies and institutions of higher education. The State Architect's Office met with members of the planning and facilities staff and discussed the current level of familiarity with BIM and the processes used by those agencies and institutions for design and construction management of capital projects. The current process for facilities maintenance management and the type of system used to track facility issues (space utilization, maintenance and work orders, etc.) was discussed, focusing on the potential for electronic management should a computerized system not be in place or utilized.

Design and Construction Process Review: The State Architect's Office conducted an internal review of design and construction procedures to determine the impact and benefit of BIM implementation on the projects managed by its office. The focus of the reviews were based on coordination processes, construction administration, and the current level of document quality received from architects, consultants and other entities under contract with the State of Ohio.

Results

There is a general awareness of the concept of building information modeling (BIM) within Ohio's construction industry. Levels of awareness vary between market segments with architectural firms having the largest percentage of participation with BIM processes, and contractors and owners having the lowest degree of awareness of BIM and its benefits. The majority of the interviewees and survey respondents see BIM being most beneficial for the design process, with BIM data and technology for facilities management as a future development. Some of the conclusions of the groups are as follows:

Architects: Architectural firms have the largest percentage of participation with BIM processes, awareness of BIM benefits to their profession and business, and have the greatest ability to implement BIM on future projects. The interoperability of data transfer is a primary focus for firms considering the implementing BIM software and processes.

Higher Educational Institutions: State supported colleges and universities are the largest percentage of owners that are preparing to require BIM on future projects. Many are developing standards and guidelines for BIM implementation on their projects, and are considering requirements for receiving models as part of the Conformed Documents phase of work. Long term utilization of the model after construction is a future consideration that will be dependent on the facilities management processes and technology of the individual institution.

Agencies and other Owners: The majority of agency and facility owners interviewed and surveyed indicated that they have not received a model for their projects and are not currently requiring BIM implementation on their projects. These owners do see benefit of BIM for improving document quality through reduction of clashes and conflicts and for the 3-dimensional graphic properties of modeling to explain and review the project with building users. Most owners have a facilities management system in place; however few have plans for upgrading their system in the near term to incorporate the types of data developed through a model.

Small Firms: Across all construction market segments, small firms indicate the cost to set up BIM authoring software and training of staff is an obstacle to implementing BIM processes within their organizations. Small firms see the advantages of implementing BIM to be improved collaboration and communication.

Contractors and Construction Managers: Contractors responded with the lowest percentage of firms with knowledge of BIM, while those firms categorizing themselves as construction managers have knowledge or use of BIM, which is second only to architects. The majority of the contractors indicate that owner requirements will drive their need to implement BIM, although they do see a benefit through improved communication and collaboration. Construction managers share this vision of the benefits of BIM with additional benefits being a reduction of conflicts and added value; time for training staff is viewed as the largest obstacle to implementing BIM.

The largest single factor that is driving industry development and use of BIM in Ohio is the requirement by owners for BIM implementation on projects. The cost to purchase the necessary hardware and software combined with training and short-term productivity loss are immediate obstacles that may slow BIM implementation. Owners understand that there is a value for modeling their projects, but have varied understanding as to the types and levels of models to be implemented on their projects, and question the added benefits of BIM if implementation requires an increase in project costs.

1. The results of the survey and interviews indicate that the protocol should be:
2. A guide for the owner and professional on the use of BIM.
3. Focusing on end-use of the models.

Support clear communications between owner, professionals and contractors on the goals and work product for BIM implementation.

Goals

The research and review of established BIM standards by other parties, the data collection and analysis of an Ohio industry survey, and the interviews with public owners have led to the advancement of several important goals that will guide the current and future development of the State of Ohio BIM Protocol. These goals have been generally categorized into immediate, short term, midterm and long term milestones. The promulgation of this initial BIM Protocol is intended to achieve the immediate goals that are identified, while the remaining milestones will be realized over the next several years as the industry adoption and experience with BIM increases and the value of further detailed guidance becomes advantageous.

Immediate Goals:

- Immediate Goal 1: Establish a common methodology for communicating owner's expectations for the level of detail and types of data contained in a building information model. The methodology should be designed to adapt to future industry trends and integrate flexibility for owner defined requirements.
- Immediate Goal 2: Establish minimum building information modeling expectations that reflect current industry capabilities while incorporating processes that provide immediate value to owners.
- Immediate Goal 3: Encourage further industry adoption of building information modeling to allow owners to receive increased benefit from the technology.

Short Term Goals:

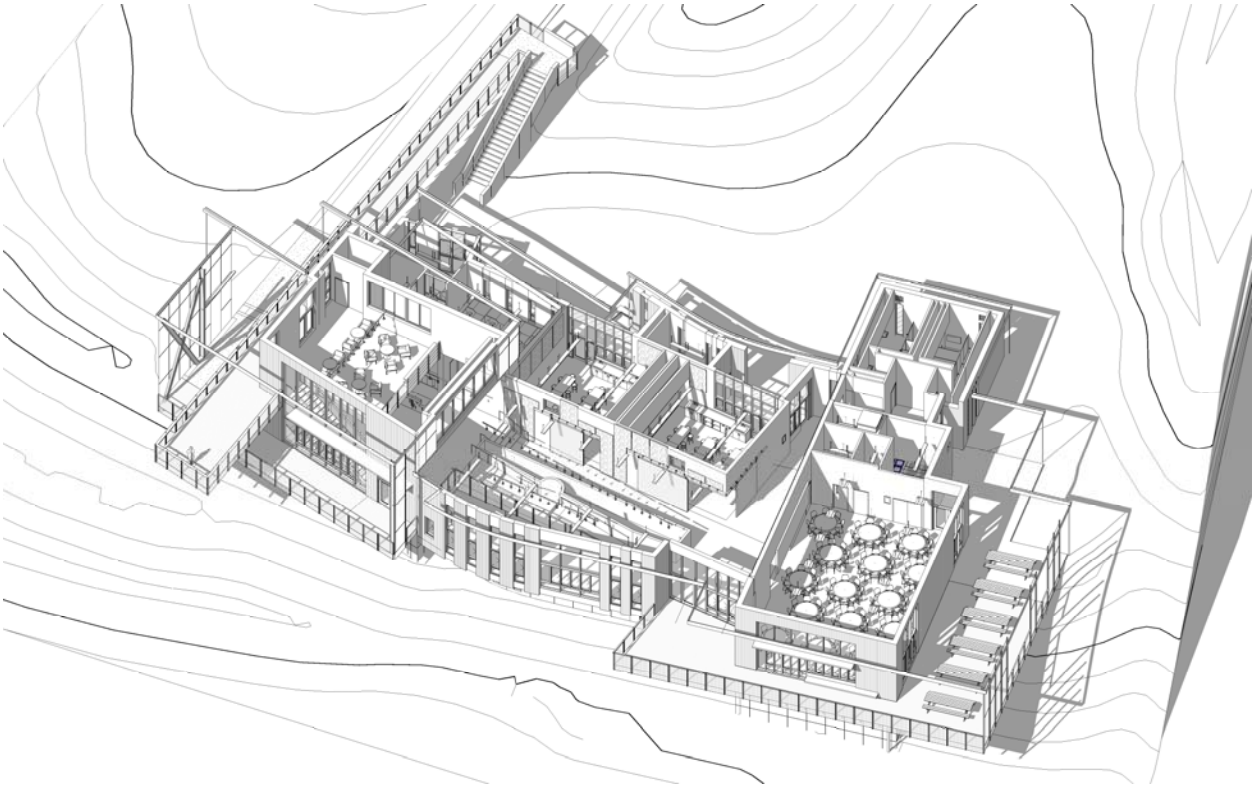
- Short Term Goal 1: Facilitate the refinement and standardization of specifying owner defined requirements for building information modeling.
- Short Term Goal 2: Explore options in the implementation of building information modeling to determine optimum practical strategy for public owners and the State of Ohio.
- Short Term Goal 3: Maximize integration of building information modeling with project delivery methods for the advantage of all project participants and stakeholders.

Midterm Goals:

- Midterm Goal 1: Increase minimum building information modeling requirements in relation to industry adoption trends.
- Midterm Goal 2: Increase the number of defined levels of detail groups used to describe owner's expectations for building information modeling in alignment with advances in technology and business needs.
- Midterm Goal 3: Increase the amount and types of relevant data associated with building information models as the number of connected business applications increase over time.

Long Term Goals:

- Long Term Goal 1: Maximize the value and benefit of building information modeling for public owners and the State of Ohio.

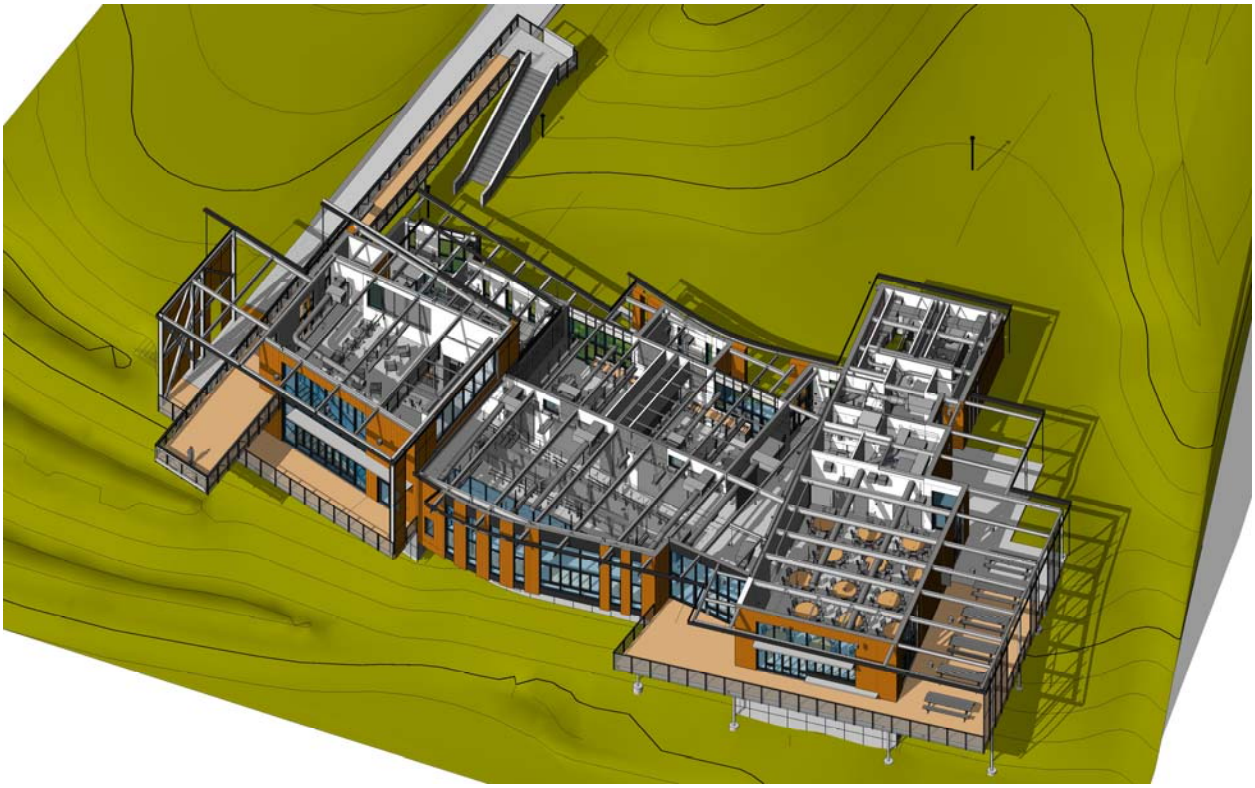


Battelle Darby Creek Nature Center | Image courtesy of DesignGroup

The Protocol

The Sections consist of the following:

- Protocol Framework
- Model Use
- Data Requirements
- Model Management
- Selection Process Factors
- Compensation Expectations



Battelle Darby Creek Nature Center | Image courtesy of DesignGroup

Protocol Framework

The State of Ohio BIM Protocol is designed to serve as a guide for consistent model development and management across state agencies and institutions of higher education, facilitating owners that may or may not have their own BIM standards in place and wish to have projects completed through BIM implementation.

The BIM protocol serves as the foundation for BIM use on a project, providing the structure for BIM implementation. Where owners have their own BIM guidelines and standards, the BIM protocol will support these standards. The owner's standard may focus on the specifics for documenting elements, families and data delivery at the end of the project. Additional BIM standards and requirements may be added by the professionals and contractors for their specific project needs. The architect may specify the responsibilities and data formats for the model, the consultants may include their individual model requirements, and the contractor may include model requirements necessary for scheduling and logistics planning. The model structure may even incorporate the individual manufacturer, who has model requirements necessary for fabrication of their specific building component.

The protocol considers the end use of the model, allowing owners to select the category of model use and levels of development for specific building components that support their particular building and facilities management needs after construction, as well as review approval needs during design.

The protocol encourages education for the owners and management team by requiring decisions regarding model use and levels of development to be made prior to requesting proposals from architects and consultants. This will result in clearer direction from the owner to the design professionals at the beginning of the project, with clearer expectations for document quality and building performance during design, and greater satisfaction by the owner for goals met at occupancy.

The State of Ohio BIM Protocol is a living document and will continually be reviewed for applicability with current methods and technology. The State Architect's Office will implement a feedback process, receiving information from owners, contractors, architects, consultants and internal staff regarding the performance of the BIM process on their projects, outcomes received versus expected, and areas for improvement or revision.

Modeling Use

The State of Ohio BIM Protocol supports agency and institution projects, and will be implemented on project administered through the State Architect's Office advertised for architect and consultant selection after July 1, 2011, with the following parameters:

All projects (new construction, additions, and alterations) with a total project value funded through state appropriations of $4 million or greater; or

All projects (new construction, additions, and alterations) funded through state appropriations where the total estimated value of plumbing, fire protection, HVAC, and electrical work within the project is greater than 40 percent of the value of construction.

These parameters may be adjusted to include any size project or waived by the state agency or institution of higher education for specific project requirements.

Implementation of the State of Ohio BIM Protocol is strongly recommended for Construction Manager at Risk and Design-Build project delivery.

Data Requirements

BIM authoring software: The design team is required to use parametric BIM authoring software for creation of models that include all geometry, physical characteristics and product data needed to describe the design and construction work to the level of detail required in the Implementation section of this protocol. While a specific BIM authoring software is not required by the protocol, all members of the design team shall provide models and data in the format necessary to support the model level of detail required for the project. A specific deliverable file format, if required for a specific project, will be described in the request for professional services and bidding documents for that project. Deliverable requirements are as specified in the SAO Manual and the Deliverables section of this protocol document.

Open architecture: The design team is encouraged to use software based on or using open standards for greatest interoperability between consultants, contracting authority, and owner facility maintenance and management systems.

IFC Compliance: BIM authoring software shall be compliant with the latest release of the Industry Foundation Classes (IFC) as certified by the buildingSMART alliance.

Project Collaboration: The design team shall provide the State Architect's Office and owner model reviewing tools (readers) that support the collaborative review environment for design and construction work.

Geo-reference: The design team is required to geo-reference building information models, site plans and associated construction drawings to provide projection and coordinate system information necessary to ensure interoperability with existing Geographic Information Systems (GIS). Final models, site plans and associated construction drawings shall be delivered in the respective Ohio State Plane Coordinate System (SPCS) and Zone within which the project is located ; shall utilize the North American Datum of 1983 (NAD83) and the North American Vertical Datum of 1988 (NAVD 88), and; shall employ measurement units appropriate to the project's scale and design (i.e. US Survey Feet or Meters). The State's GIS are maintained by the Ohio Geographically Referenced Information Program (OGRIP), which may be contacted by phone at 614.466.4747, or by visiting their website at http://ogrip.oit.ohio.gov/Home.aspx.

Project specific requirements: Additional requirements for data development and transmission may be required for the project. The design team is advised to thoroughly review the announcement developed for the project for additional requirements.

[1]Counties within the Ohio State Plane Coordinate System Zones: http://codes.ohio.gov/orc/157.01
[2]NAD83 Datum Requirement see: http://codes.ohio.gov/orc/157.11

Model Management

Model Manager: Unless noted otherwise in the agreement, or as subsequently amended; the architect will be responsible for management of the model throughout the design and construction phases of the project, and will coordinate all updates for the individual and specialized models and databases to insure completeness and accuracy of the overall project model. The Owner may consider other parties (e.g., Construction Manager) as the model manager at their discretion and as appropriate for the project.

BIM Execution Plan: The protocol has established a level of development for model elements and data requirements. The project participants are required to develop a BIM Execution Plan (e.g., Computer Integrated Construction Research Program's "BIM Project Execution Planning Guide") or similar tool (see page 23 for BIM Execution Plan Outline) to develop a detailed plan for development and management of the model throughout the design process and construction phase. The plan shall incorporate the requirements specified for the project, and be reviewed and approved by the contracting authority.

Ownership of the Model: BIM models and facility data developed for the project are the property of the project owner. The owner may make use of this data as allowed under the laws of the State of Ohio for electronic data and contract documents.

Selection Process Factors

BIM requirements for a project will be described through the request for qualification (RFQ), defining the roles and responsibilities of the design and construction professionals during the project. The following factors will be considered as professionals are selected for projects:

Determination of BIM requirements: For projects administered through the State Architect's Office, the owner and State Architect's Office will review the project requirements with the owner and assist them in determining whether BIM is appropriate for the project. For projects administered locally by the state agency or institution of higher education, the State Architect's Office encourages the owner to review BIM requirements prior to release of the RFQ for design services, and is available to provide support and guidance in this process.

Projects that do not require BIM: For projects that do not require BIM, the RFQ selection process is unchanged from that currently used by the State Architect's Office, state agencies and institutions of higher education. The evaluation will not consider BIM usage by firms proposing on these projects. Firms are encouraged to implement BIM where applicable to support the quality and coordination goals of the project.

Projects requiring BIM: When BIM is required for the project, the following factors will be implemented in the RFQ and selection process:

1. The RFQ will describe the specific BIM and owner defined requirements, level of development to be achieved within the models, deliverables, and owner's intended use of the model after construction.

2. Form F110-330, Statement of Qualifications, currently used by the State Architect's Office and state agencies and institutions of higher education for Architect/Engineer selection will not be altered to address BIM specifically; however, the RFQ will describe how the proposing firms should address their BIM expertise or processes in their submittal. The evaluation process will take BIM experience and/or proposed management and implementation of the BIM process into account in selecting the design team. The evaluation will focus on the proposing firm's ability to perform the work, management of quality construction documents, and clarity of responsibilities. Other sections of the rating form may consider BIM experience or proposed management as applicable to the specific project.

3. Firms are encouraged to address how they will implement BIM on the proposed project, experience and level of training of staff, incorporation of team partners that have previous BIM experience, and an understanding of the BIM process.

Future selection requirements: The value to both project and client through the use BIM processes and tools will continue to grow as technology and experience grow within the industry. The State Architect's Office recognizes the value of BIM as part of a quality design and construction process, and may include the design and consulting firm's BIM experience and expertise as part of the criteria in the consultant list selection process after January 2013.

Compensation Expectations

Historically, new processes and technology have start up costs but result in a savings to the user through improved efficiency and a reduction in errors and rework. Architects and consulting firms have an initial cost for the authoring software and training, and may experience a short-term loss of productivity while adapting to the new processes. However, current experience by long-term users is suggesting that productivity is enhanced, as there are fewer drawing revisions due to conflict and coordination issues, and fewer change orders during construction.

The use of BIM on a project should not result in increased fees, and BIM deliverables at the minimum levels of development shall be included in the basic fee as negotiated. There are items that should be reviewed by the owner prior to issuance of the request for qualification and bid document for the potential cost impact that may be associated with unique modeling and/or data requirements. Requests for additional embedded data in a model may result in additional service fees to compensate for the level of effort required. BIM deliverables at a higher level of developed required by the owner shall be identified in the schedule of additional services.

There is an earlier expenditure of design production hours with a BIM process, and the SAO Manual provides a payment schedule specific to BIM implemented projects. This schedule is already available and in use on current BIM projects, and is illustrated below:

Project Stage	% Payment (Non-BIM)	% Payment (BIM)
Predesign	5%	5%
Schematic Design	15%	20%
Design Development	15%	20%
Construction Documents	30%	20%
Bid and Award	5%	5%
Conformed Documents	2%	2%
Construction Administration	25%	25%
Contract Closeout	3%	3%

The cost for purchasing BIM authoring software and training will not be compensated by the owner for the project requiring BIM implementation. If the owner or contracting authority requires software license(s) for their use, the costs will be included as a reimbursable expense.

Additional service fees may be considered for further model development and enhancement during the construction phase, but not for typical as-built or post construction documentation requirements. Specific management or coordination requirements of contractor models may be negotiated as necessary through specific project requirements.

Construction manager requirements for BIM management and participation will be described in the request for qualifications, and will be incorporated into the construction manager's fee proposal. Contractor modeling requirements will be described within the bid documents, and will be included in the contractor's bid.

Bowling Green State University South Central Residence Hall | Image courtesy of DesignGroup

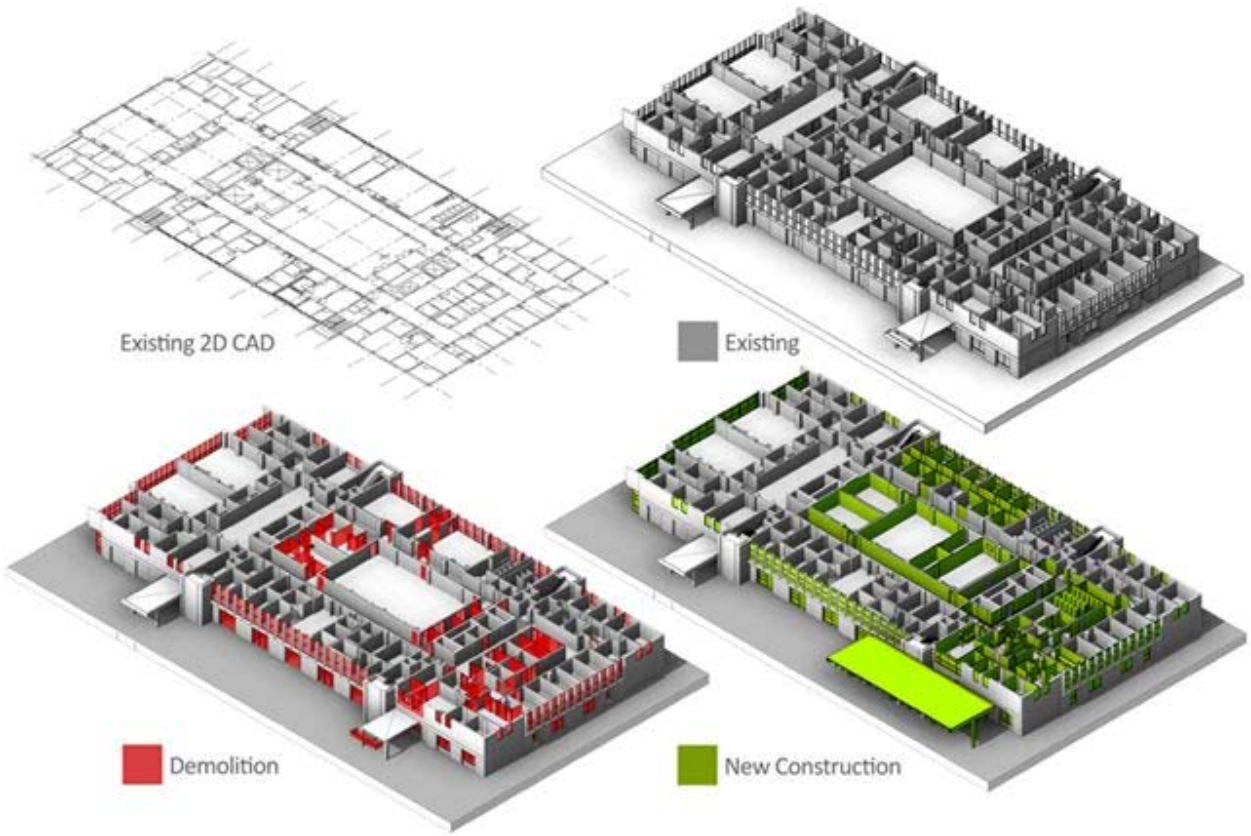
Implementation

The Sections consist of the following:

Implementation

Deliverables

Contractural Provisions



The Ohio State University McCampbell Hall - Ambulatory Modifications | Image courtesy of DesignGroup

Implementation

Determination of the BIM requirements for a project is based on a three part approach to select the type of model development and level of development required for models. Each part of this selection focuses on a specific element of model development: owner defined requirements for model use; categories of modeling development; and level of development for each model component.

Owner defined requirements: These requirements describe how the model(s) will be used by the owner during and after construction. Owner defined requirements are split into two categories: requirements for model use during design and construction, and requirements for model use by the owner after project completion. Models shall be of a level of development sufficient to support an integrated design process that coordinates critical systems for proper building function and performance.

Requirements for model use during design and construction: These requirements are consistent for BIM implemented projects, and include the following:

Programming: Models support and confirm the program of requirements for the project.

Energy modeling: Models shall be of a minimum level of development to support energy modeling requirements for the State of Ohio and requirements for LEED certification, if required for the project.

Visualization: Models shall be of a level of development to support a three dimensional illustration of the organizational and spatial relationship of the occupied spaces.

Coordination: Models shall be able to support the review of conflicts, clearances and “clashes” through evaluation software utilized by the design team and/or construction manager, or as selected by the owner.

Fabrication: Models shall be able to support fabrication of building elements.

Requirements for model use by the Owner (Post Construction): These requirements will vary depending on the specific needs of the owner and project. Several examples of owner use requirements include:

Capital planning support: The model may be required to support owner planning activities for capital project development. The model will be of sufficient development to assist the owner in reviewing renovation and systems requirements for future projects.

Integration into energy management systems: The owner may require the model to provide a level of development to support electronic management systems or other monitoring and control systems.

Facilities management: The owner may require elements of the model to provide levels of development to support a facilities management system or process.

Owner defined requirements should be developed at project initiation, and will be included in the announcement and selection process of architects and design professionals.

Model Development Categories: The State of Ohio has developed four initial categories of model development. The category of model development required for a specific project will be described in the request for professional services, and will be incorporated into the A/E agreement. The selected model development level may be adjusted to accommodate a specific project or owner need. The design team is strongly encouraged to review the specific modeling development requirements described with the announcement for the project. The four categories of model development are described as follows:

I: This model will support project planning through space and volume illustration, adjacencies, and site positioning.

II: This model will include a sufficient level of development to support document and system review, clash detection and coordination, and support an as-built format for Owner use after completion. This is the standard model category for Ohio projects.

III: This model will include all the benefits and requirements of the early model categories, and will provide sufficient detail to support a detailed model development of systems supporting building occupancy and facility management.

IV: This model will include the benefits and requirements of the earlier model categories, and support highly detailed logistical, scheduling, and estimating efforts.

As the technology and expertise of model development expands, additional model development categories will be added. The next likely category will be a level of model development necessary to support post construction facility management.

Level of development for model components: The level of development for each model component is based on the model content criteria established by AIA Document E202, Building Information Modeling Protocol Exhibit. The content for each level of development is described as follows:

Level 100: Overall building massing indicative of area, height, volume, location and orientation.

Level 200: Generalized systems or assemblies with approximate quantities, size, shape, location and orientation.

Level 300: Specific assemblies accurate in terms of quantity, size, shape, location and orientation.

Level 400: Specific assemblies accurate in terms of quantity, size, shape, location and orientation with complete fabrication, assembly and detailing information.

Level 500: Constructed assemblies that are actual and accurate in terms of size, shape, location, quantity and orientation.

Each of the model categories has an established minimum level of model development for each building system. The level of development for each building system may be adjusted to reflect the owner requirements. Refer to the following matrix for the specific building system levels of development for each model category:

Building System	Model Category/Level of Development			
	I	II	III	IV
Substructure	0	300	300	400
Structure	100	300	300	400
Enclosure*	100	300	300	400
Interior*	100	300	300	400
Conveying Systems	100	200	300	400
Plumbing	100	200	300	400
HVAC	100	200	300	400
Fire Protection	100	200	300	400
Electrical	100	200	300	400
Equipment and Furnishings*	100	200	300	400
Special Construction	100	200	300	300
Site work	0	100	100	200
Site Improvements*	100	200	200	300
Site Utilities	100	200	300	300

** Additional level of development descriptions are provided for these building systems.*

Several building systems are composed of elements that may require separate levels of component development as described below:

Building System Component	Model Category/Level of Development			
	I	II	III	IV
Enclosure	**100**	**300**	**300**	**400**
Exterior Walls	100	300	300	400
Exterior Windows	100	200	300	400
Exterior Doors	100	300	300	400
Roof Coverings	100	200	300	400
Roof Openings	100	300	300	400
Interior	**100**	**300**	**300**	**400**
Interior Partitions	100	300	300	400
Interior Doors	100	300	300	400
Interior Specialties	0	200	300	400
Stair Construction	100	300	300	400
Wall Finishes	0	200	200	300
Ceiling Finishes	0	200	200	300
Windows	100	200	300	400
Floor/Ceiling Construction	100	300	300	400
Equipment and Furnishings	**100**	**200**	**300**	**400**
Fixed Equipment	100	200	300	400
Moveable Furnishings	100	100	200	300
Special Equipment	100	200	300	400
Fixed Furnishings	100	200	300	400
Site Improvements	**100**	**200**	**200**	**300**
Roadways	100	200	200	300
Parking	100	200	200	300
Pavements	100	200	200	300
Landscaping	0	100	100	200
Irrigation	0	100	200	200

The model categories should be reviewed together with the owner-defined requirements, adjusting the specific levels of development for building components to support the end-user requirements. For example: The owner may select a category II model for the project, but desires detailed equipment data for the HVAC system to support future expansion and systems management. The category II model would remain as stated, with the exception of the HVAC system components which may be set at a higher level of developments.

Deliverables

The requirement for BIM deliverables will not replace the current deliverables specified within the SAO Manual. The BIM deliverables indicated below are required to be submitted with the standard phase deliverables for each design phase. The BIM Execution Plan should establish primary and secondary responsibility for each deliverable. The level of development for each BIM deliverable should be sufficient to produce traditional two-dimensional deliverables required for that stage. Exact deliverable requirements and party responsible for each deliverable will be determined by the model category selected and described through the RFQ process, contract agreements for design, consulting, and contracting services, and verified through the execution plan process.

Pre-Design (*The SAO Manual*, Section 210)

- BIM Execution Plan (within 30 days after contract execution)
- Feasibility Models
- Data Base of Programs/Spaces
- Massing/Volume/Area
- Relationships/Functions
- Responsibility Matrix
- Data Organization Outline
- Restatement of Owner Requirements
- AIA E202 Refinements

Schematic Design (*The SAO Manual*, Section 220)

- BIM Execution Plan Update
- Preliminary Energy Model Values*
- Concept Model- 3 scheme concept
- Architectural Model- Based on approved concept model.
- Preliminary Systems Model - Structural, MEP, Civil or other systems required by the project.
- Clash Detection Report

Design Development (*The SAO Manual*, Section 230)

- Energy Model Values*
- Architectural Model
- Structural Model
- MEP Model
- Site/Civil Model
- Other Systems Models as required
- Detailed Clash/Collision Report
- Code Review Model if available

Construction Documents (*The SAO Manual*, Section 240)

- Energy Model Values*
- Architectural Model
- Structural Model
- MEP Model
- Site/Civil Model
- Other Systems Models as required
- Detailed Clash/Collision Report - Showing issues and resolutions.
- Code Review Model if available
- Quantity Reports as required

Construction (*The SAO Manual*, Section 300)

- Coordination
- MEP Model
- Architectural Model
- Structural Model

As Built (*The SAO Manual*, Section 320)

- Record Models - Updated with field changes and as-built conditions.
- Architectural Model
- Structural Model
- MEP Model
- Site/Civil Model
- Other Systems Models as required
- Code Review Model if available
- Quantity Reports as required
- No energy model or clash report

**Current Energy models may be outside of existing BIM software and applications*.

Contractual Provisions

The State Architect's Office makes an effort to stay current with trends in the design and construction industry to benefit the projects we oversee, and BIM is no exception.

Recently, the discussion and work of the Ohio Construction Reform Panel included a recommendation to leverage use of BIM on state construction projects.

As a result, the current agreements and contracts have some language that allows and facilitates the use of BIM for current projects. However, more work will be necessary as we move into full implementation of the BIM Protocol. The following provisions have been, or will be included, in the suite of legal documents that frame the contractual framework for each project.

Introductory language will be included in each agreement and contract conditions will require the project participants to develop consensus on BIM implementation for the specific project:

2.1.4 Building Information Modeling ("BIM")

.1 The Owner, the Contracting Authority, the CM if applicable, and the A/E intend to use BIM in connection with design, engineering, coordination, and construction of the Project, with all design and engineering of the Project being provided in one or more integrated BIM models. Within 30 days after the effective date of this Agreement, the Owner, Contracting Authority, A/E, and CM shall meet to agree upon the BIM standards, protocols, and formats to be used by all Project participants, including Contractors, Subcontractors and Consultants, and such agreement shall be memorialized by the parties through the execution of a BIM Execution Plan approved by the Contracting Authority.

The A/E is currently required to hand over electronic files to contractors, on request, to facilitate development of models used for coordination between trades and Subcontractors, as well as Submittals:

2.6.10 Conformed Documents

.5 The A/E shall provide Electronic Files to each requesting Contractor for the Contractors' convenience for the purpose of preparing its submittals, including, but not limited to, Shop Drawings and Coordination Drawings. The A/E shall provide such Electronic Files at no additional cost to the Contractor or the Owner.

State Law currently stipulates that the project Owner holds title to the Contract Documents. With changes in technology, SAO interpreted this to include digital data as early as the April 2007 Standard Requirements. However, we recognize the distinction between the concepts of "instruments of service" and "intellectual property of the design," and identify additional compensation if the project becomes a prototype constructed on multiple sites. Current A/E and CM agreements include the following:

9.2 Document Ownership and Use

9.2.1 Property of State

.1 Drawings, Specifications, and other documents prepared by, or with the cooperation of, the A/E or any Consultant pursuant to this Agreement, including the Electronic Files used to create them, are, from the moment of creation, the property of the Owner, whether or not the Project for which they are prepared is commenced or completed, and the Owner alone owns every right, title, and interest therein.

.2 The A/E or Consultant, as applicable, may retain copies, including reproducible copies of such Drawings, Specifications and other docu¬ments for information and reference.

.3 Such Drawings, Specifications, or other documents, including the Electronic Files used to create them, may be used by the Contracting Authority, the Owner or others employed by the Contracting Authority or Owner for reference in any completion, correction, remodeling, renovation, reconstruc¬tion, alteration, modification of, or addition to, the Project, without prior approval of, or compensation to, the A/E or its Consultants.

.4 Unless the Project is a prototype, such Drawings, Specifications or other documents, including the Electronic Files used to create them, shall not be used by the Contracting Authority or the Owner, or be given or sold by the Contracting Authority or the Owner to be used by others, on other projects, except by prior written agreement with, including mutually acceptable compensation to, the A/E or Consultant, as applicable.

.5 If an event occurs, for which the A/E or its Consultant may be liable, the Contracting Authority shall notify the A/E or Consultant of such event as soon as practical after such event and shall provide access to the Project to the A/E or Consultant and their representatives.

.6 This subparagraph 9.2.1 shall survive ter¬mination of this Agreement.

9.2.2 A/E's Intellectual Property

.1 All inventions, patents, design patents, and computer programs acquired, or developed by, the A/E in connection with, or in relation to, the Project shall remain the property of the A/E, and shall be protected by the Contracting Authority and the Owner from use by others, except by prior written agreement with, including mutually acceptable compensation to, the A/E.

We recognize the need of the Owner to have a license to potentially access and use models developed for coordination by the contractors, Subcontractors, and Material Suppliers for facility operation and maintenance. To facilitate such access, we may develop language that asserts ownership of these deliverables as well. It is again our intent to respect the potential intellectual property, and trade secrets, of these parties, and language will be developed in coordination with the Attorney General's Office.

In order to facilitate collaboration with regard to the use of electronic files, each project participant is currently required indemnify the others. This is intended to eliminate objections to handing over digital data, due to the use of different software by the participants and issues related to data exchange. The user of the data becomes responsible for verifying the accuracy of the digital representations and that their software did not corrupt the information during the transfer process:

11.7 Indemnification for Use of Electronic Files

11.7.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Indemnified Parties from and against all claims, damages, losses, and expenses (including, but not limited to, the fees and charges of engineers, architects, attorneys, and other professionals) arising out of, or related to the Contractor's, or any other Person's use of electronic files, including, but not limited to, Computer-Aided Design ("CAD") or Building Information Modeling ("BIM") files (collectively "Electronic Files").

.1 These Electronic Files are provided solely for the Contractor's convenience and use related to the Project. Any use of the Electronic Files shall be at the sole risk of the Contractor.

.2 The Owner alone owns the Electronic Files and every right, title, and interest therein from the moment of creation.

.3 The Electronic Files are not products.

.4 The Contractor shall not use the Electronic Files for any purpose other than as a convenience for preparing Shop Drawings, Coordination Drawings, Record Drawings, or fabrication data for components, systems, and assemblies intended solely for use on the Project.

.5 The State and the A/E make no warranties, either express or implied, of the merchantability or fitness of the Electronic Files for any particular purpose.

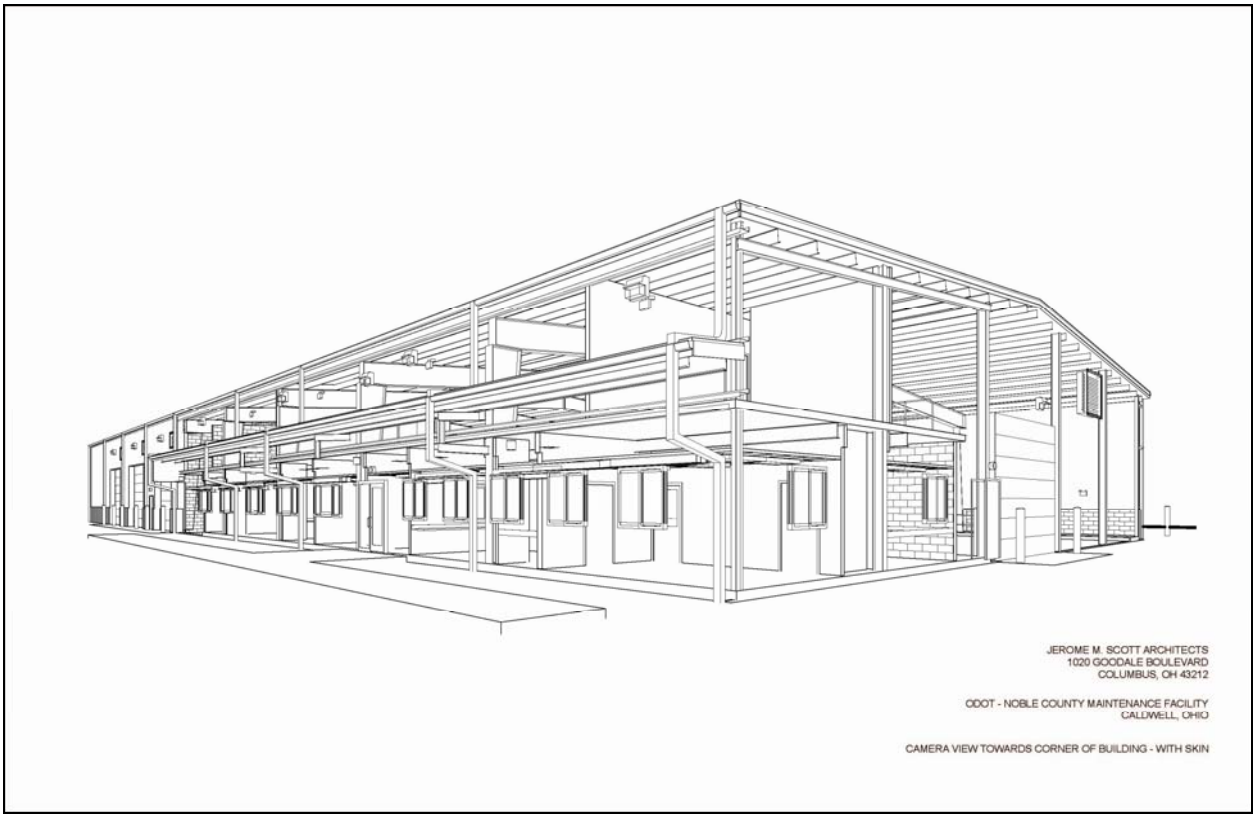
.6 The Contractor understands and accepts that the Electronic Files may deteriorate or be inadvertently or otherwise modified without authorization of the State or the A/E.

.7 The State and the A/E make no representations as to compatibility, usability, or readability of the Electronic Files resulting from the use of software, application packages, operating systems, or computer hardware differing from those used to create the Electronic Files.

.8 In the event of a conflict between the Contract Documents and the Electronic Files, the Contract Documents shall control, take precedence over, and govern the Electronic Files.

.9 The Contractor alone is responsible to check, verify, and otherwise confirm the accuracy of data on the Electronic Files.

.10 The Contractor shall not make any claims and hereby waives, to the fullest extent permitted by law, any claims or causes of action of any nature against the Indemnified Parties, which may arise out of, or in connection with, the use of the Electronic Files.

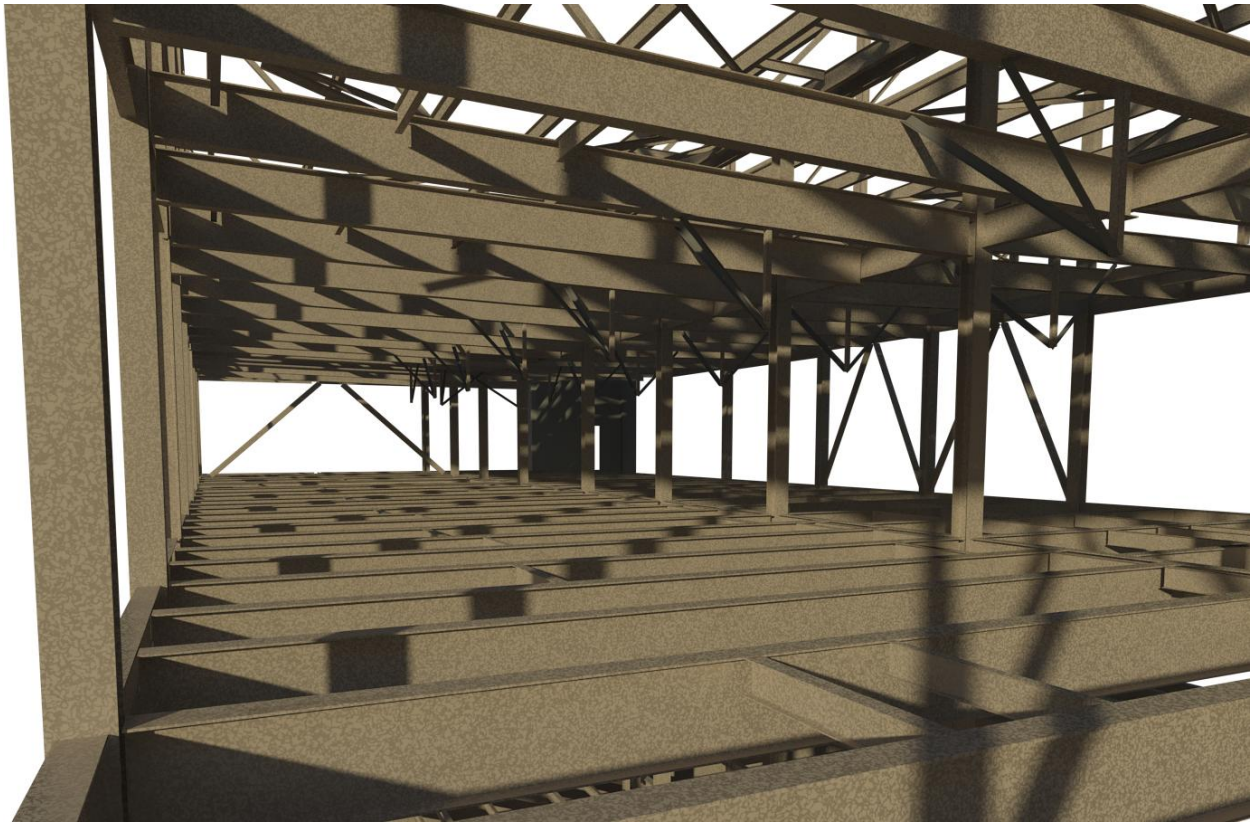


Ohio Department of Transportation Noble County Maintenance Facility | Image courtesy of Jerome M. Scott Archtiects

Appendix

The Sections consist of the following:

- Definitions
- References
- BIM Execution Plan Outline
- BIM Execution Plan Form



The Ohio State University South Campus Central Chiller Plant | Image courtesy of Shelley Metz Baumann Hawk, Inc.

Definitions

Building Information Model/Modeling/Management (BIM)

A digital representation of the physical and functional characteristics of a facility; a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its life-cycle, which is defined as existing from earliest conception to demolition. The term BIM may be used as a noun to describe a single model or multiple models used in the aggregate. The term BIM may also be used as a verb in the context of Building Information Modeling or Management, the process of creating, maintaining, and querying the model.

OAKS Capital Improvements (OAKS CI)

The State's Web-based capital program and project management information system, based on Unifier software licensed to the State by Skire, Inc., hosted on State servers. OAKS is the State's Enterprise Resource Planning system, known as the Ohio Administrative Knowledge System, and CI is one of several modules of the total system.

Those portions of the Contract Documents consisting of detailed written administrative, procedural, and technical requirements, included in Divisions 01 through 49, for the construction of the Work, whether physically on the Drawings or bound in separate volumes, including identification of acceptable materials, methods, equipment, quality, and workmanship.

The SAO Manual

A publication that outlines the procedures, which the State Architect's Office (SAO) uses to manage capital projects. It also details standard office procedures associated with the day-to-day operation of SAO. Each section of the Manual describes the current practices and procedures required to undertake and successfully complete capital projects for Ohio agencies and institutions of higher education.

Additional definitions are available in the SAO Manual.

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BIM Execution Plan Outline

Project Information

- Identify project name, number, location (address & Geo-Reference)
- Identify owner (department/institution)
- Identify effective date or revision date of plan

Project Goals and Objectives

- Identify owner's intended goal or end use of the model
- Identify project stakeholder objectives of modeling during the project

Roles and Responsibilities

- Briefly identify primary role (objective) of model during each phase of project
- Briefly describe each organization's primary responsibility during each phase of project
- Identify role of model manager and model coordinators during each phase of project

Collaboration Plan

- Briefly identify document management plan that describes how and when the model will be updated and shared with stakeholders during each phase of project
- Describe quality assurance and quality control measures to be implemented
- Describe concurrent as-built modeling plan and responsible parties

Planned Models

- Identify model name, content, and phase of delivery
- Identify authoring company and model coordinator(s)
- Identify authoring tool(s) and file format required

Model Components

- Identify file naming structure
- Specify the level of detail for each building component/system by phase
- Briefly identify component/object properties that will be included in model
- Briefly describe level of precision and dimensioning (exclusions from model)

Model Analysis Plan

- Identify types of analysis that will be performed, the analysis tool(s), model, analyzing company, phase of delivery, and file format required
- Describe clash detection process and verification

Project Deliverables

- Identify electronic models, drawings, renderings, analyses and reports to be delivered

BIM Execution Plan

Ohio Department of Administrative Services
General Services Division
State Architect's Office ▪ 4200 Surface Road ▪ Columbus, Ohio 43228-1395

http://ohio.gov/sao
StateArchOff@das.state.oh.us
Phone 614.466.4761

Date _____

Project Information			
Project Name		Project Number	
Project Address		Project Geo-reference	
City, State ZIP		Effective Date of Plan	
Owner (Agency/Institution)		Revision Date of Plan	

Project Goals and Objectives
Identify Owner's intended goal or end use of the model
Identify project stakeholder objectives of modeling during the project

Roles and Responsibilities
Briefly identify primary role (objective) of model during each phase of project
Briefly describe each organization's primary responsibility during each phase of project Identify role of model manager and model coordinators during each phase of project

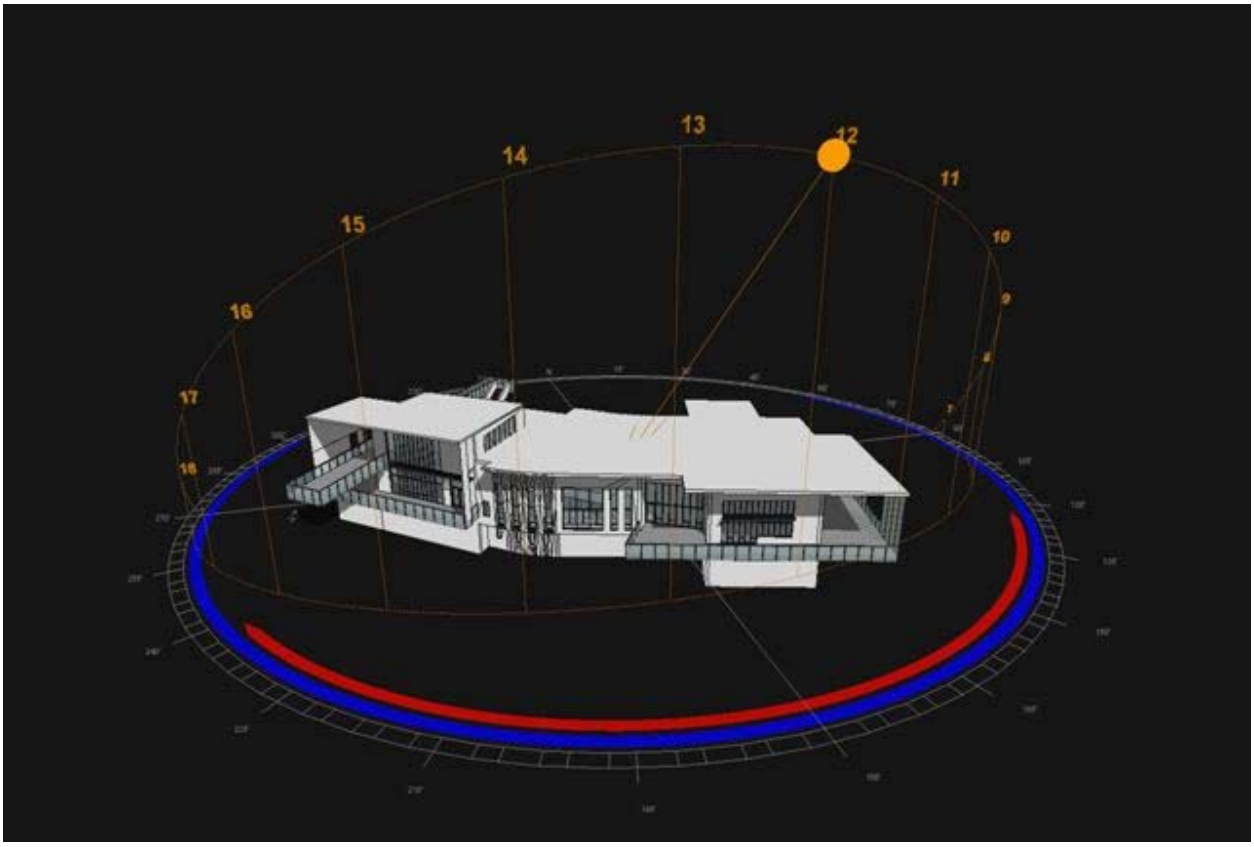
Collaboration Plan
Briefly identify document management plan that describes how and when the model will be updated and shared with stakeholders during each phase of project
Describe quality assurance and quality control measures to be implemented Describe concurrent As-Built modeling plan and responsible parties

Planned Models			
Model Name		Authoring Company	
Model Content		Authoring Tool(s)	
Model Coordinator(s)			
Phase of Delivery		File Format Required	

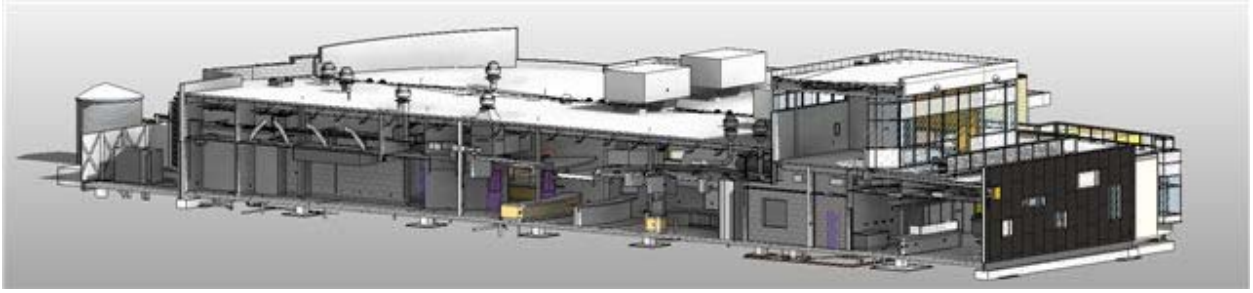
Model Components	
Identify file naming structure	
Specify the level of detail for each building component/system by phase Briefly identify component/object properties that will be included in model Briefly describe level of precision and dimensioning (exclusions from model)	

Model Analysis Plan			
Types of analysis performed			
Analysis Tool(s)			
Model		Analyzing Company	
Phase of Delivery		File Format Required	
Describe clash detection process and verification			

Project Deliverables
Identify electronic models, drawings, renderings, analyses and reports to be delivered



Battelle Darby Creek Nature Center | Image courtesy of DesignGroup



Bowling Green State University Dining Commons | Image courtesy of DesignGroup

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