Level 2: Existing Conditions Modeling

Process:

Start Process

- Collect Current Site Conditions Data
  - Responsible Party

- Survey Existing Sites Conditions
  - Responsible Party

- Collect Data through Photographs
  - Responsible Party

- Laser Scan Existing Conditions
  - Responsible Party

- Compile Existing Conditions Information
  - Responsible Party

End Process

Reference Info:

- Geotechnical Report
- Historical Site/Facilities Information
- GIS Data

Info Exchange:

- Laser Scan Model
- Survey Model
- Existing Conditions Information Model
**Level 2: Cost Estimation**

**Project Title**

---

**REFERENCE INFO.**

- Cost Reports
- Analyze Method
- Cost Database

---

**PROCESS**

1. **Start Process**
   - Contractor

2. **Establish Cost Targets**
   - Contractor

3. **Adjust BIM for Takeoff**
   - Contractor
   - **Yes:** Export BIM for Analysis
   - **No:** No

4. **Export BIM for Analysis**
   - Contractor

5. **Develop Quantities Schedule**
   - Contractor

6. **Review Quantities**
   - Contractor
   - **Yes:** Evaluate Methods for Assembly Construction
   - **No:** No

7. **Evaluate Methods for Assembly Construction**
   - Contractor

8. **Organize Quantities to Cost Data**
   - Contractor

9. **Calculate Costs from Quantities**
   - Contractor

10. **Review Costs Results**
    - Contractor

11. **Incorporate Contingencies Overheads**
    - Contractor

12. **Evaluate Quantities and Cost Breakdown**
    - Contractor

13. **Results in Compliance with Cost Target?**
    - Contractor
    - **Yes:** End Process
    - **No:** No

---

**INFO EXCHANGE**

- 3D Model
- Quantity Takeoff for Assemblies
- Cost Estimate for Assemblies

---

Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team, [http://www.engr.psu.edu/ae/cic/bimex](http://www.engr.psu.edu/ae/cic/bimex).

Cost Estimation Model ready for QTO/Cost Analysis?

- Yes
- No

Results Acceptable?

- Yes
- No

Contractor Establish Cost Targets
Contractor Adjust BIM for Takeoff
Contractor Export BIM for Analysis
Contractor Develop Quantities Schedule
Contractor Review Quantities
Contractor Evaluate Methods for Assembly Construction
Contractor Organize Quantities to Cost Data
Contractor Calculate Costs from Quantities
Contractor Review Costs Results
Contractor Incorporate Contingencies Overheads
Contractor Evaluate Quantities and Cost Breakdown
Contractor Results in Compliance with Cost Target?

---

Cost Reports Analyze Method Cost Database

---

**End Process**
Level 2: 4D Modeling
Project Title

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http://www. engr/psu.edu/ ae/cic/bimex

REFERENCE INFO.

INFO. EXCHANGE

PRODUCTIVITY INFO.

LEAD TIMES

Producivity
Information

PROCESS

Start
Process

Set Construction
Sequencing and Flow
All disciplines

Prepare/Adjust
Schedule
All disciplines

Establish Information
Exchange Requirements
All Disciplines

Create New or Modify
Previous 3D Model
All disciplines

Link 3D Elements to
Activities
4D Modeler
All disciplines

Validate Accuracy of
4D Model
All disciplines

Model Correct?

Review 4D Model/
Schedule
All disciplines

Schedule Optimized?

End
Process

3D Model

Schedule (Draft)

4D Model (Draft)

4D Model

Schedule

End
Process
Level 2: Site Analysis

Project Title

Site Investigation Data

- Analyze Area Data
  - Responsible Party
- Select a Building Site Location
  - Responsible Party

  Is Site Acceptable and Available? (No)

  Analyze Project Site Data
  - Responsible Party

  Determine Building Location and Orientation
  - Responsible Party

  Is Building Location Acceptable (No)

End Process

Site Analysis Model

Site Analysis

Start Process

- Site Investigation Data

- Analyze Area Data
  - Responsible Party
- Select a Building Site Location
  - Responsible Party

  Is Site Acceptable and Available? (Yes)

  Generate Site Analysis Model
  - Responsible Party

  End Process
Level 2: Programming

**Project Title**

INFO

EXCHANGE

REFERENCE INFO.

Start Process

Site Information

PROCESS

- Identify Building Use/Type
  - Owner
- Identify Area Requirements
  - Owner
- Identify Cost Targets
  - Owner
- Create Program
  - Owner
- Start Design Programming
- Generate Conceptual Building Layout
  - Architect
- Identify Final List of Requirements
  - Owner
- Program Validation
  - Acceptable
  - Not Acceptable
- End Process

INFO EXCHANGE

- Site Analysis Model
- Existing Conditions Model
- Program Model

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http://www.engr.psu.edu/ae/cic/bimex
Level 2: Design Authoring

Start Process

1. Identify Models Required
   - All Disciplines
2. Identify Content for Model Creation
   - All Disciplines
3. Develop Initial Architecture Model
   - Architect
4. Create Schematic Design Architecture Model
   - Architect
5. Create Schematic Design Structural Model
   - Engineer
6. Create Schematic Design MEP Model
   - Engineer
7. Create Other Models (as needed)
   - All Disciplines
8. Does the model meet the requirements?
   - Yes
9. Create Design Development Architecture Model
   - Architect
10. Create Design Development Structural Model
    - Engineer
11. Create Design Development MEP Model
    - Engineer
12. Create Other Models (as needed)
    - All Disciplines
13. Does the model meet the requirements?
    - Yes
14. Create Schematic Design Architecture Model
    - Architect
15. Create Schematic Design Structural Model
    - Engineer
16. Create Schematic Design MEP Model
    - Engineer
17. Create Other Models (as needed)
    - All Disciplines
18. Design Authoring
    - Yes
19. Program Model
20. Preliminary Architecture Model
21. Schematic Design
    - Architectural Model
22. Structural Model
23. MEP Model
24. Other
25. Construction Documentation
   - MEP Model
26. Other
27. End Process

Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team,
http://www.engr.psu.edu/ae/cic/bimex
Level 2: Design Review

Project Title

INFO EXCHANGE

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http://www.engr.psu.edu/ae/cic/bimex

Start Process

Design Model

Design Review Information

INFO EXCHANGE

REFERENCE INFO.

PROCESS

Create Virtual Mockups
Architect

Perform End User Review
Architect/User

Compile Design Review Feedback
All Disciplines

Yes
End Process

No

Compile Info for O&M Review
All Disciplines

Perform O&M Review
Facility Manager

Yes
End Process

Perform Constructability Review
Contractor

Compile Model for Constructability Review
All disciplines

Return to Design Authoring
Level 2: Energy Analysis
Project Title

INFO EXCHANGE

Construction Type Library
Space Type Library
Mechanical System Library

REFERENCE INFO.

Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team.
http://www.engr.psu.edu/aec/cic/bimex

ENERGY ANALYSIS

Start Process

Adjust BIM for Energy Analysis
Responsible Party

Assign Construction Types to Building Elements
Contractor

Assign Outside Design Criteria and Energy Targets
Mechanical Engineer

Create and Assign Thermal Zones
Mechanical Contractor

Is model ready for simulation?

Export BIM for Analysis
Mechanical Engineer

Analyze Energy Demand and consumption
Mechanical Engineer

Review Energy Analysis Results
Mechanical Engineer

Prepare Report for Documentation
Mechanical Engineer

Results acceptable?

No

Yes

No

Yes

End Process

Space Type Library
Mechanical System Library

Energy Tariff
Analysis Method
Weather Data

Design Model
Energy Analysis Model

Construction Type
Library

Note: This map was developed from a review of the bSa/OGC AECOO-1 Testbed Project
Level 2: Structural Analysis

Project Title

Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team.

http://www.engan.psu.edu/ae/cic/bimex

Process

Start Process

Is Site Acceptable and Available?

Yes

Export Model to Structural Design Application

Structural Engineer

Update Structural Design Model

Structural Engineer

End Process

No

Export Model to Structural Design Application

Structural Engineer

Update Structural Design Model

Structural Engineer

Soil Data

Wind Loads

Seismic Loads

Snow Loads

Structural Engineer

Generate Structural Layout

Structural Engineer

Generate Structural Design Model

Structural Engineer

Export Model to Structural Analysis Application

Structural Engineer

Analyze Model

Structural Engineer

Structural Analysis Model

Structural Engineer

Structural Design Model

(Draft)

Arch. Model

Structural Design Model
Level 2: Lighting Analysis

Project Title

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REFERENCE INFO:

Solar Data
Weather Data

INFO - EXCHANGE:

Arch. Model
Other Applicable Models
Struct. Model

Lighting Design Model (Draft)

Lighting Analysis Model

Lighting Design Model

---

PROCESS:

Start Process

1. Identify Lighting Criteria
   - Lighting Engineer

2. Generate Lighting Layout
   - Lighting Engineer

3. Generate Basic Lighting Model
   - Lighting Engineer

4. Export Model to Lighting Analysis Application
   - Lighting Engineer

5. Export Model to Lighting Design Application
   - Lighting Engineer

6. Update Lighting Model
   - Lighting Engineer

Is Building Lighting Acceptable?

- Yes:
  - Export Model to Lighting Design Application
  - Lighting Engineer

- No:
  - Modify Model for Analysis
    - Lighting Engineer
  - Analyze Model for Daylighting
    - Lighting Engineer
  - Analyze Model for Lighting Levels
    - Lighting Engineer
  - Analyze Model for Density Levels
    - Lighting Engineer

End Process
Level 2: Site Utilization Planning

Project Title

Referenced INFO.

REFERENCE INFO.

PROJECT

Start Process

Identify Construction Phases

Contractor

Determine Temporary Facilities

Contractor

Add Construction Equipment

Contractor

Insert Phased Staging Areas

Contractor

Are All Phases Analyzed? (Occurs for each Phase)

No

Yes

Analyze Site Layout for Phase Transition

Contractor

Analyze Site Layout for Space and Time Conflict

Contractor

Is Plan Acceptable?

No

Yes

Distribute Plan to Various Parties

Contractor

End Process

INFO. EXCHANGE

Design Model

Existing Site Conditions Model

Site Utilization Plan

Schedule

Construction Equipment Libraries

Design Model

Existing Site Conditions Model

Site Utilization Plan

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http://www. engr .psu .edu/ ae/ cic/ bimex
Level 2: 3D Control and Planning

Process:
- Start Process
- Determine Scope of Work to be Analyzed
  - Contractor
- Identify Alternative Construction Methods
  - Contractor
- Model Alternative Methods
  - Contractor
- Analyze Various Methods
  - Contractor
- Is Model Acceptable?
  - Contractor
- Compare and Select Options
  - Contractor
- Coordinate Construction Sequences
  - Contractor
- Is Construction Sequence Acceptable?
  - Contractor
- Generate Construction Plans
  - Contractor
- End Process

Reference Info:
- Design Specifications and Intent
- Schedule, Cost and Labor Info
- Construction Families and Libraries
- 3D Controls Report

Info Exchange:
- Design Model
- MSites Utilization Model
- Construction Model

Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team.
http://www.engr.psu.edu/aie/1bimex
Level 2: Maintenance Scheduling

Project Title

INFO EXCHANGE

REFERENCE INFO.

Sensor Information
CMMS Information
Warranty and Specification Information
Productivity Information

PROCESS

Start Process

Collect Building System Data
Facility Manager

Interpret Data for Maintenance Needs
Facility Manager

Prepare/Adjust Schedule
Facility Manager

Perform Maintenance
Responsible Party

Validate Equipment Performance
Responsible Party

Regenerate Maintenance Data
Facility Manager

Correct?
Yes

Warranty and Specification Information
Facility Manager

Production Information

INFO EXCHANGE

Record Model

Schedule
Level 2: Building System Analysis

Project Title

INFO.

REFERENCE INFO.

Sensor Data

Other Performance Data

Performance Targets

Performance Cost

Weather Data

PROCESS

Start Process

Adjust BIM for Performance Analysis

Responsible Party

Facility Manager

Assign Performance Targets

Facility Manager

Collect Sensor and Building Performance Data

Facility Manager

Is Model Ready For Simulation?

Yes

Export BIM for Analysis

Responsible Party

Facility Manager

Analyze Performance Demand and Consumption

Responsible Party

Facility Manager

Review Building Performance Analysis Results

Facility Manager

Prepare Performance Analysis Reports

Facility Manager

No

Results Acceptable?

Yes

End Process

No

Acceptable?

Yes

Energy Analysis Model

Record Model

Building Performance Analysis Model

Building Performance Analysis Output

INFO. EXCHANGE