2013

High Performance (HP) Elementary School

2013 AEI Competition

The competition is a project involving the design and construction management of the engineered aspects of a high performance building including the structural systems, building envelope, mechanical systems and electrical systems.

The emphases of the competition are integration of the engineered systems for a high performance building, collaboration, competition, and peer review, all of which are important in the development of designs in the professional world. Students are encouraged to work together in multi-disciplinary teams and consider how the engineered systems work with or enhance the architecture of the building.

Matt Hoerner & Brian Blenner: Construction Manager
Kyle Houser & Keith McMullen: Lighting/Electrical Engineer
Devon Saunders & Eric Cook: Structural Engineer
Dan McGee & Brittany Notor: MEP Engineer

UNITUS
9/4/2013

BIM PROJECT EXECUTION PLAN
VERSION 9/4/2012
FOR
High Performance Elementary School
DEVELOPED BY
UNITUS

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Section A: BIM Project Execution Plan Overview

1. Reason For BIM Project Execution Plan:

To successfully implement Building Information Modeling (BIM) combined with Integrated Project Development (IPD) for the completion of the AEI Competition and Penn State AE senior Thesis. The BIM Project Execution Plan defines uses for BIM on the project along with a detailed design of the process for executing BIM throughout the project lifecycle. BIM Project Execution Plan defines our goals as well as our means and methods to get there.

2. Mission Statement For Company
"Building to Unite Us"

3. Mission Statement For Project
"To build a stronger sense of community"

4. Design Criteria

a. Quick Return on Investment
   i. Low facility costs
   ii. Low equipment and energy costs
b. Versatile Space (Community Building Emphasis
   i. Open Floor Plan
c. Exposed Educational Experiences of the Design and Construction
d. Transparency of Space
   i. Reduce bullying through design

Section B: Project Information

1. **Project Owner**: 2013 AEI Competition & AE Senior Thesis

2. **Project Name:** High Performance Elementary School

3. **Project Location and Address**: The corner of Thirteen Street and Park Ave. in Reading, PA

4. **Contract Type / Delivery Method:** Integrated Project Delivery

5. **Brief Project Description**: This elementary school will be located in an urban setting and is expected to be a high performance building which is sustainable, accessible, and secure. The focus of the school will need to be on life cycle cost savings and initial costs for the building when considering high performance features. The project needs to be accessible to the public because it will be a place used during the day and at night all year round. It will also need to be accessible because it will act as a shelter facility as part of the local Homeland Security department.

6. **Additional Project Information**:
   - Space needs to be adaptable to technology advances and future educational delivery methods
   - Needs LEED Certification
   - Strong consideration for a Green Roof or Community Garden
   - Possibly includes a 6 Lane 25 meter indoor pool with amenities

7. **Project Schedule / Phases / Milestones**: TBD

PROJECT PHASE / MILESTONE	ESTIMATED START DATE	ESTIMATED COMPLETION DATE	PROJECT STAKEHOLDERS INVOLVED
Presentation 1	8-27-12	9-14-12	ALL
Presentation 2	9-15-12	10-3-12	ALL
Presentation 3	10-4-12	10-24-12	ALL
Presentation 4	10-25-12	11-12-12	ALL
Final Paper	11-13-12	2-22-13	ALL

Section C: Key Project Contacts

Role	Contact Name	Location	E-Mail	Phone
Structural Engineer	Eric Cook	State College, PA	emc247@psu.edu	484-354-9968
	Devon Saunders	State College, PA	dws218@psu.edu	908-432-3375
Mechanical Engineer	Dan McGee	State College, PA	djm5287@psu.edu	860-748-9162
	Brittany Notor	State College, PA	bkn113@psu.edu	609-558-4593
Lighting / Electrical Engineer	Kyle Houser	State College, PA	keh5185@psu.edu	610-883-0869
	Keith McMullen	State College, PA	kdm5133@psu.edu	814-932-3984
Construction Engineer	Matt Hoerner	State College, PA	msh5140@psu.edu	717-805-9152
	Brian Blenner	State College, PA	bbb142@psu.edu	267-229-3464

Section D: Project Goals / BIM Uses

1. Major BIM Goals / Objectives:

PRIORITY (HIGH/ MED/ LOW)	GOAL DESCRIPTION	POTENTIAL BIM USES
High	Focus on the life-cycle cost, while not forgetting the initial cost	Mechanical, Electrical, Energy, Structural Analysis
High	Emphasize versatile spaces	Site Utilization Planning, Construction System Design
Med	Well Documented Project	Design Authoring, Design Review
Med	Coordinate with all trades when focusing on a discipline specific problem	3D Coordination, 4D Phasing, Cost Estimation
Med	Create a building to unite not only the students but the community as well	Design Review, Design Authoring
Med	Provide opportunities for giving back (or making revenue for the communities)	Design Reviews, Construction System Design

2. BIM Use Analysis Worksheet: Attachment 1

3. BIM Uses:

BIM Use Not Used In Design	BIM Use To Be Used In Design	BIM Use Not Used in Construction	Potential BIM Use in Construction & Operations

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
	PROGRAMMING	X	DESIGN AUTHORING	X	SITE UTILIZATION PLANNING		BUILDING MAINTENANCE SCHEDULING
	SITE ANALYSIS	X	DESIGN REVIEWS	X	CONSTRUCTION SYSTEM DESIGN		BUILDING SYSTEM ANALYSIS
		X	3D COORDINATION		3D COORDINATION		ASSET MANAGEMENT
		X	STRUCTURAL ANALYSIS		DIGITAL FABRICATION		SPACE MANAGEMENT / TRACKING
		X	LIGHTING ANALYSIS		3D CONTROL AND PLANNING		DISASTER PLANNING
		X	ENERGY ANALYSIS		RECORD MODELING		RECORD MODELING
		X	MECHANICAL ANALYSIS				
			OTHER ENG. ANALYSIS				
			SUSTAINABLITY (LEED) EVALUATION				
			CODE VALIDATION				
	PHASE PLANNING (4D MODELING)	X	PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)
	COST ESTIMATION	X	COST ESTIMATION		COST ESTIMATION		COST ESTIMATION
	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING

Section E: Organizational Roles / Staffing

1. **BIM Roles and Responsibilities:**

Role	Responsibilities
Structural	• Create and maintain Revit structures model • Design and model all structural components including sub and super structure • Tag elements in a concise manner for use with 4D scheduling and cost estimation • Collaborate with other disciplines to ensure systems conformity and integration
Mechanical	• Design a complete mechanical system that serves the heating, cooling, and ventilation loads of the school • Perform life cycle analysis for system options to maximize benefit to cost ratio of chosen mechanical systems • Spearhead innovation in energy savings / "Green Building" design • Integrate the mechanical system with all other building systems for efficient design and construction • Perform acoustical analysis of critical learning spaces • Organize visual materials (including presentations, poster boards, etc...) for consistency and visual appeal • Keep website updated • Ensure that our image in media materials matches and supports the team's goals.
Lighting / Electrical	• Enhance the building renderings using the focus of day lighting integration • Develop a lighting scheme and design that follows building theme, while creating designs for the switching, circuiting, and power of the building • Create a telecommunication, security, and fire alarm design for the building as well as any technology features that could enhance learning within the space=
Construction	• Assist with the constructability input of all designed building systems • Perform cost analysis's of potential systems to allow for a more informative decision when comparing building systems • Keep track of LEED points in the design and look for other opportunities for sustainability • Continual 3D Coordination of all systems to allow for a more integrated approach throughout • Develop process maps and schedules which will be synchronized with the model for a better understanding of the

5. BIM Use Staffing:

BIM Use	Discipline Lead	Responsibilities
Design Authoring	All	• Continuously develop the detailed design model with the team to provide the most valuable design for the owner
Design Review	All	• Review and analyze outside party input to better the development of the designs feasibility
3D Coordination	Construction	• Work in constant coordination with the Mechanical, Electrical, and Structural Design. • Develop a plan to integrate all systems into the building
Structural Analysis	Structural	• Perform an analysis of the model to size the members of the steel to meet the building load requirements
Lighting Analysis	Lighting/Electrical	• Perform an analysis to compare multiple systems, layouts, and styles to provide the best visual and performance possible.
Energy Analysis	Lighting/Electrical	• Perform an analysis to compare different building orientations, and systems and make decisions based on the project goals
Mechanical Analysis	Mechanical	• Perform an analysis to determine the sizing and load requirements necessary to cool this addition
4D Modeling	Construction	• Create a model of the new construction that shows the development of the project that follows that of the schedule.
Cost Estimation	Construction	• Keep an up to date cost estimation of the project so that proper value engineering strategies can remain an effective way to problem solve design concerns

Section F: BIM Process Design

1. **Design Process Overview Map: Attachment 2**

2. **BIM Process Overview Map: Attachment**

3. **Detailed Design process Map: Attachment 4**

    a. Structural
    b. Lighting Electrical
    c. Mechanical
    d. Construction

4. **Detailed BIM Process Map: Attachment 5**

    a. Cost Estimation
    b. 4D Modeling
    c. Design Reviews
    d. Design Authoring
    e. Energy Analysis
    f. Structural Analysis
    g. Lighting Analysis
    h. 3D Coordination

Section G: BIM Information Exchanges

1. BIM Use Requirements

BIM Use	Requirements	Sender	Receiver
Design Authoring	•Model of each individual system within the building	Individual Disciplines	UNIFIED
Design Review	•Team analysis of the designed building system	UNIFIED	Individual Discipline
3D Coordination	•A design model consisting of all structural, mechanical, and electrical systems	Mechanical, Structural, L/E	Construction
Structural Analysis	• The architecture file to incorporate the structure into the building for further analysis	Structural	UNIFIED
Lighting Analysis	• The architecture file to incorporate the lighting into the building for further analysis	Lighting/Electrical	UNIFIED
Energy Analysis	• The architecture file to incorporate the energy specifications, orientation and the building requirements to be able to analyze	Lighting/Electrical	UNIFIED
Mechanical Analysis	• The architecture file to incorporate the mechanical into the building for further analysis	Mechanical	UNIFIED
4D Modeling	• The architecture and structural (and possibly mechanical) to be able to synchronize the building schedule with the building components	Construction	UNIFIED
Cost Estimation	• The central model to be able to perform take-off of the individual systems	Construction	UNIFIED

Section H: Collaboration Procedures

1. Collaboration Strategy

Our team plans to be at a minimum of 2 separate times during the week outside of class. We will be working on the design solutions until all parties feel comfortable with a decision that was made. We have many means of contacting the team to reach each member at any time. Our most popular means of communication will be through cell phones and email to set up meetings. We will be in constant contact with each other to increase the collaboration, and specific ideas for the design.

2. Team Decision Making Process:

- Try to make a decision in a smaller group
- If decision cannot be agreed upon by the smaller group and deemed important, bring to attention of the entire group
- Have the parties which cannot agree discuss the important details and technical aspects
    - Have all members given the opportunity to speak in the group setting about their opinion
        - Don't take opinions personally when speaking in a group
    - Create a list pros and cons
- Based on the Pros and Cons list, combined with the group's members opinions try to come to a compromise which is agreed to by everyone

- If Split Base the decision off of this criteria, in order, 1. Highest ROI, 2. Sustainability, 3. Versatility of Space

3. Meeting Procedures:

MEETING TYPE	PROJECT STAGE	FREQUENCY	PARTICIPANTS	LOCATION
Class Time	All	Three times a week	All Members	Willard
Team Meeting	All	Twice a week	All Members	Sackett
Additional Meeting	TBD	TBD		
Coordination Meeting	TBD	TBD		
Presentation Meeting	TBD	TBD		

4. Electronic Communication Procedures:

FILE LOCATION	FILE STRUCTURE / NAME			FILE TYPE	FILE MAINTAINER
Penn State Network	Z:			FOLDER	UNIFIED
	Analysis			FOLDER	UNIFIED
		Construction		FOLDER	Construction
		Lighting/Electrical		FOLDER	Lighting/Electrical
		Mechanical		FOLDER	Mechanical
		Structural		FOLDER	Structural
	Codes/Standards			FOLDER	Eric Cook
	Drawings			FOLDER	UNIFIED
		All Central Files		.RVT	UNIFIED
			All Recovery Files	.RVT	UNIFIED
	Images			.JPEG / .PNG	UNIFIED
	Meetings			FOLDER	Brian Blenner
		Meeting Documents		FOLDER	Brian Blenner
		Meeting Minutes		FOLDER	Brian Blenner
	Presentations			FOLDER	UNIFIED
	Research			FOLDER	UNIFIED
	Trash Bin			FOLDER	UNIFIED

5. Model Structure:

File Naming Structure:
The file names for each model type are determined first by the type of construction, followed by the project name abbreviation as well as the construction team abbreviation. Finally each time the project is saved, the date at the end will be adjusted accordingly to better keep track of the most up to date file.

FILE NAMES FOR MODELS SHOULD BE FORMATTED AS:	
CENTRAL MODEL FILE	Reading Elementary Central File_DO NOT TOUCH.RVT
ARCHITECTURAL MODEL	Reading Elementary Architectural File_DO NOT TOUCH.RVT
MECHANICAL MODEL	Reading Elementary Mechanical File_DO NOT TOUCH.RVT
ELECTRICAL MODEL	Reading Elementary Electrical File_DO NOT TOUCH.RVT
STRUCTURAL MODEL	Reading Elementary Structural File_DO NOT TOUCH.RVT

Model Structure:
The project is going to be one complete file due to small size

Measurement and Coordinate Systems:
TBD

Section I: Project Deliverables

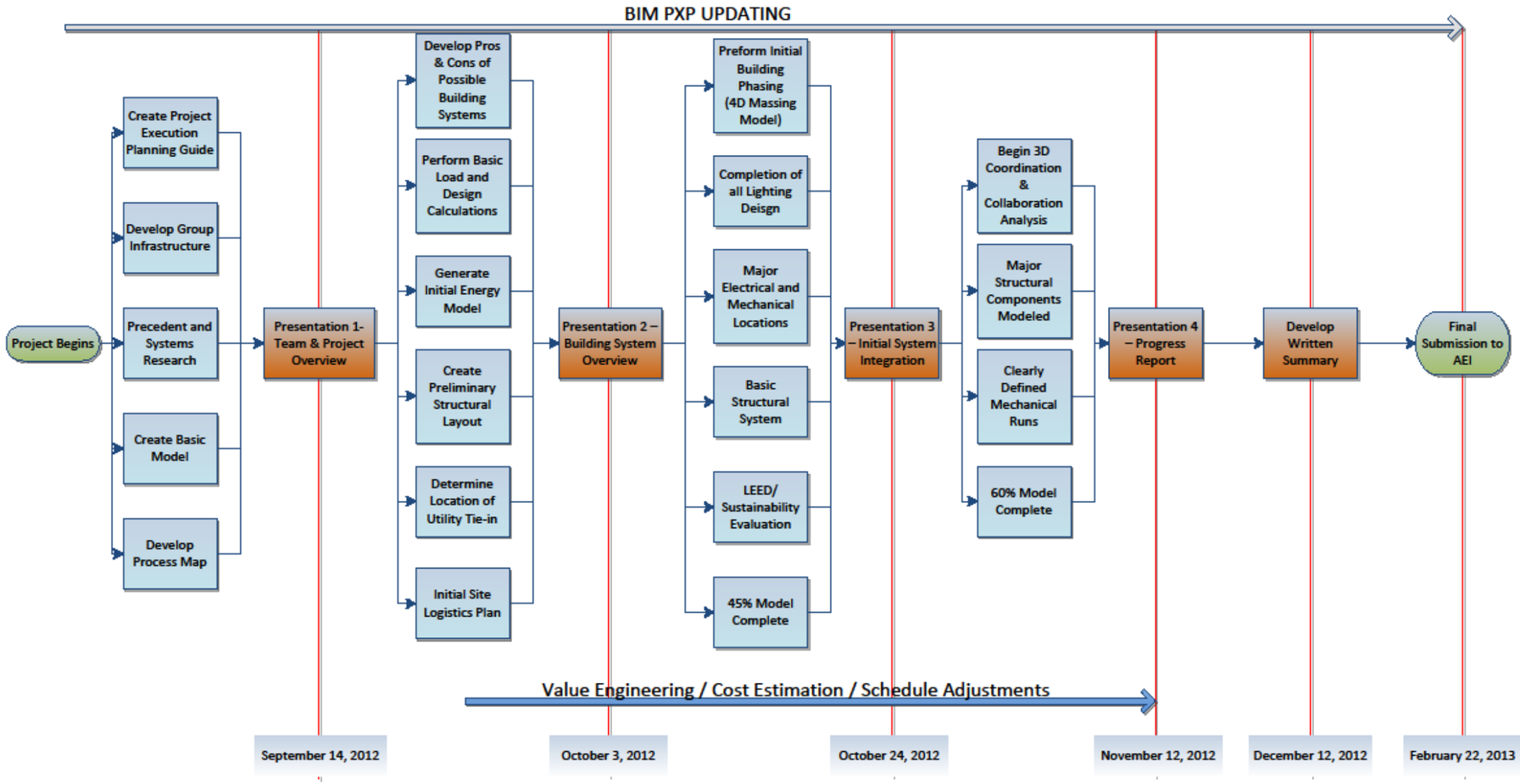
BIM SUBMITTAL ITEM	STAGE	Approximate Due Date	FORMAT	NOTES
Presentation 1	Planning	9-14-12	.PDF	Describing process for completing the project
Presentation 2	Design Concepts	10-3-12	.PDF	Proposing multiple system
Presentation 3	Planned Design	10-24-12	.PDF	Narrowing the proposed systems
Presentation 4	Proposed Design	11-12-12	.PDF	Propose the problem and the teams research solutions
Final Paper	Final Design	2-22-13	.PDF	Propose completed project

SECTION J: ATTACHMENTS

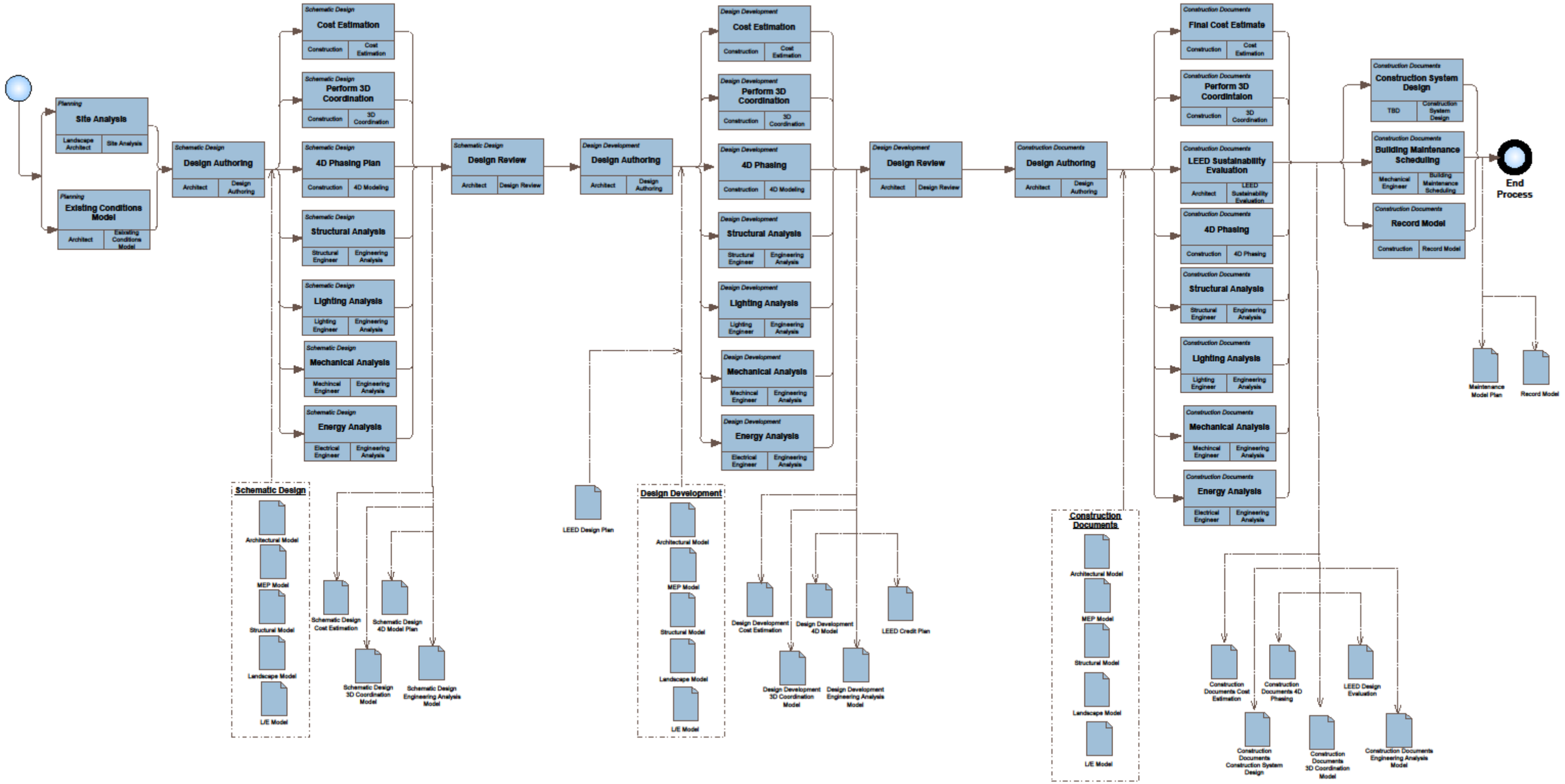
1. **ATTACHMENT 1**: **BIM USE SELECTION WORKSHEET** [FROM SECTION D]
2. **ATTACHMENT 2: DESIGN PROCESS OVERVIEW MAP** [FROM SECTION F]
3. **ATTACHMENT 3: BIM PROCESS OVERVIEW MAP** [FROM SECTION F]
4. **ATTACHMENT 4: DETAILED DESIGN PROCESS MAP** [FROM SECTION F]
5. **ATTACHMENT 5: DETAILED BIM PROCESS MAP** [FROM SECTION F]

ATTACHMENT 1: BIM USE SELECTION WORKSHEET

ATTACHMENT 2: DESIGN PROCESS OVERVIEW MAP

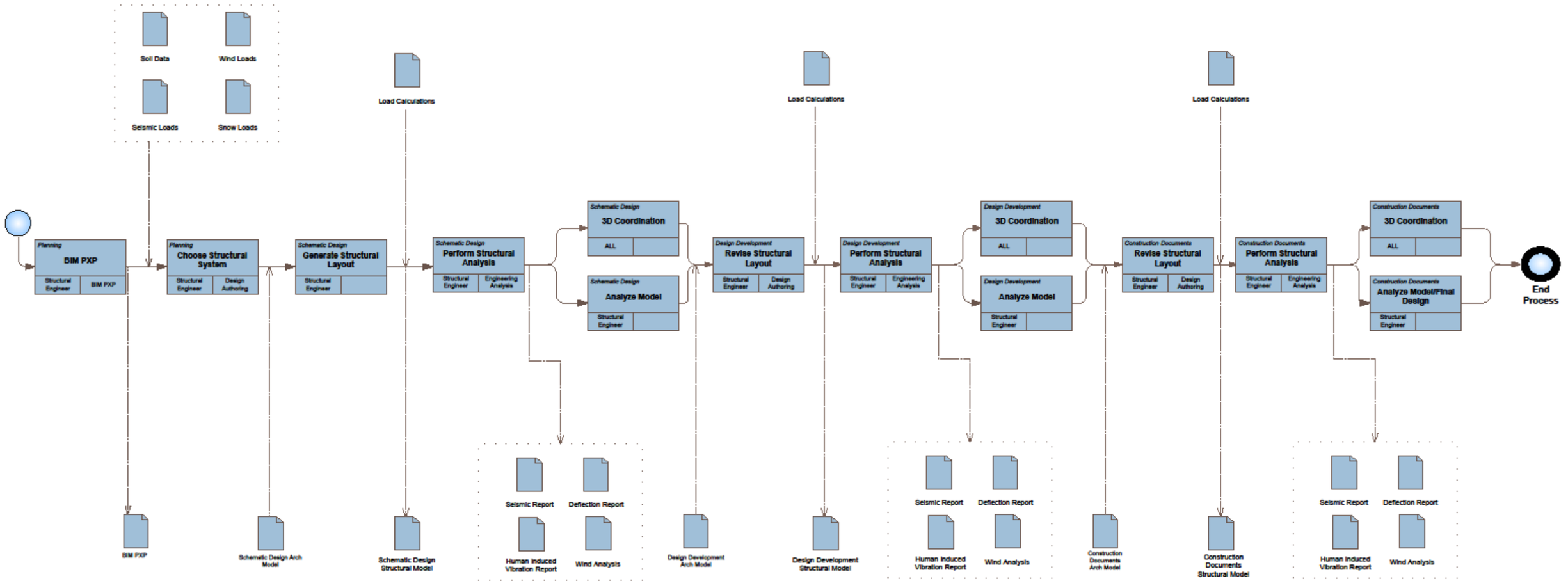


ATTACHMENT 3: BIM PROCESS OVERVIEW MAP

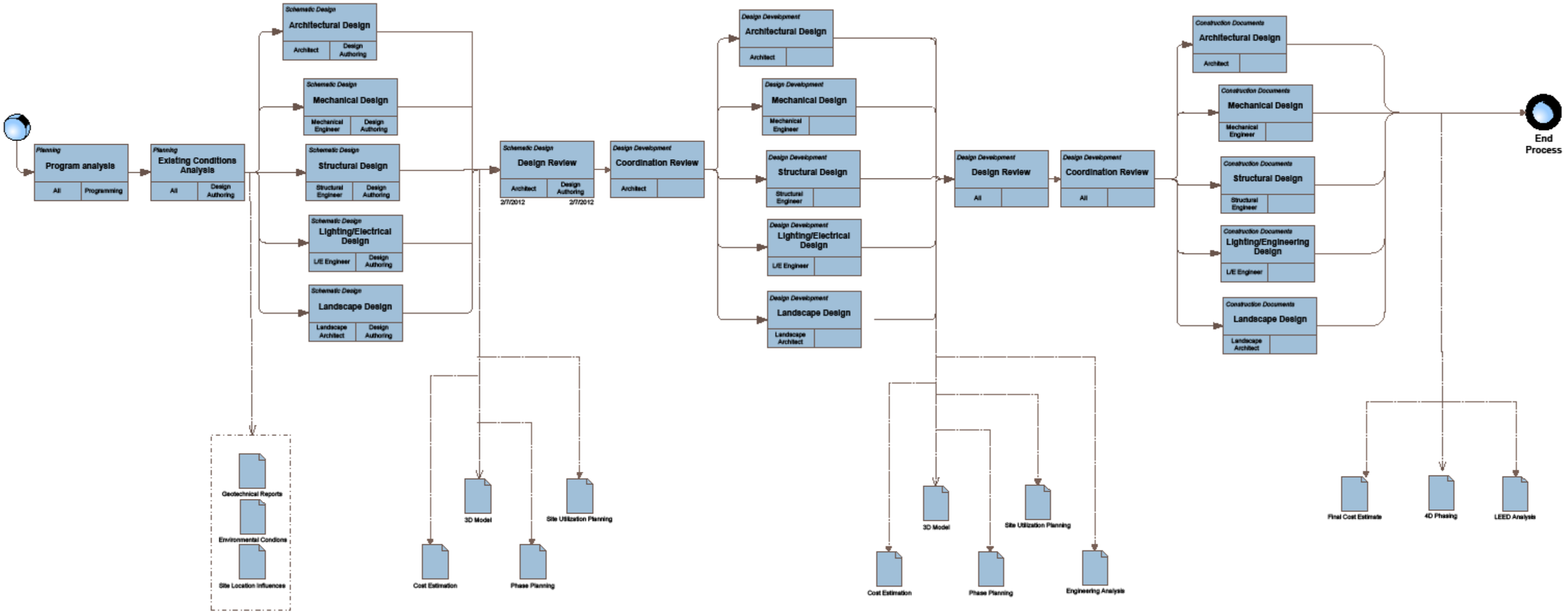


ATTACHMENT 4: DETAILED DESIGN PROCESS MAP

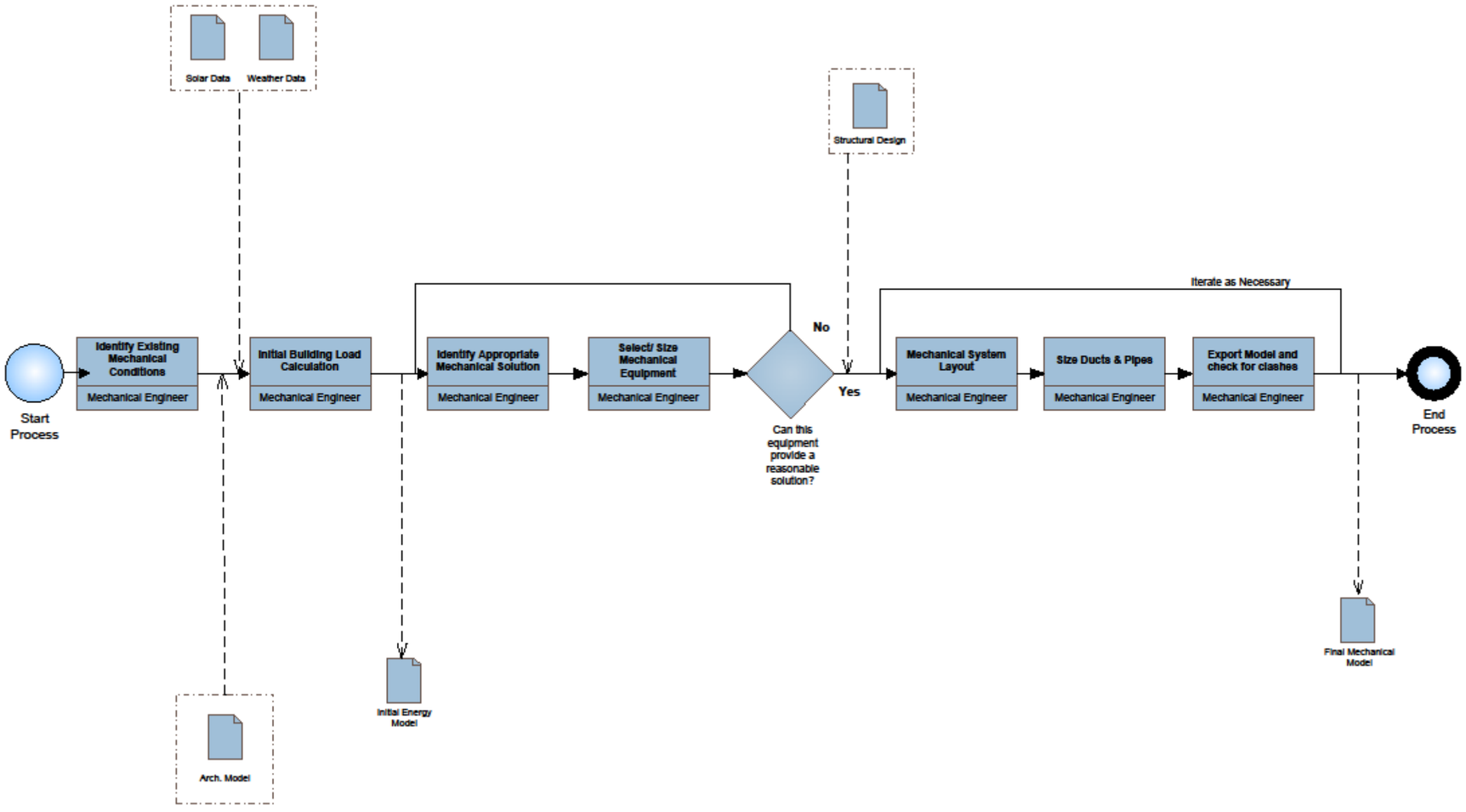
Structural Engineer Process Map



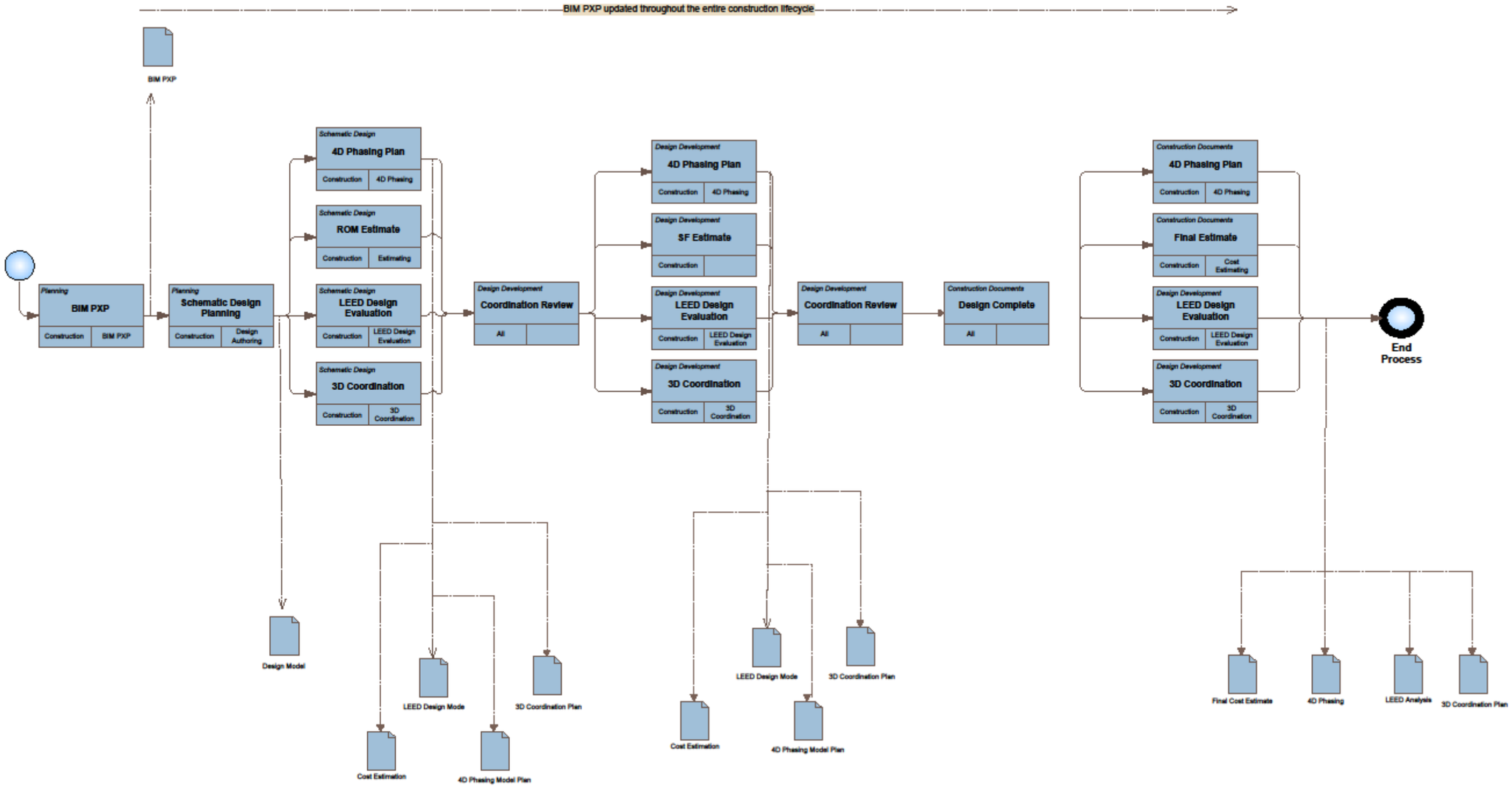
Lighting/Electrical Engineer Process Map



Mechanical Engineer Process Map

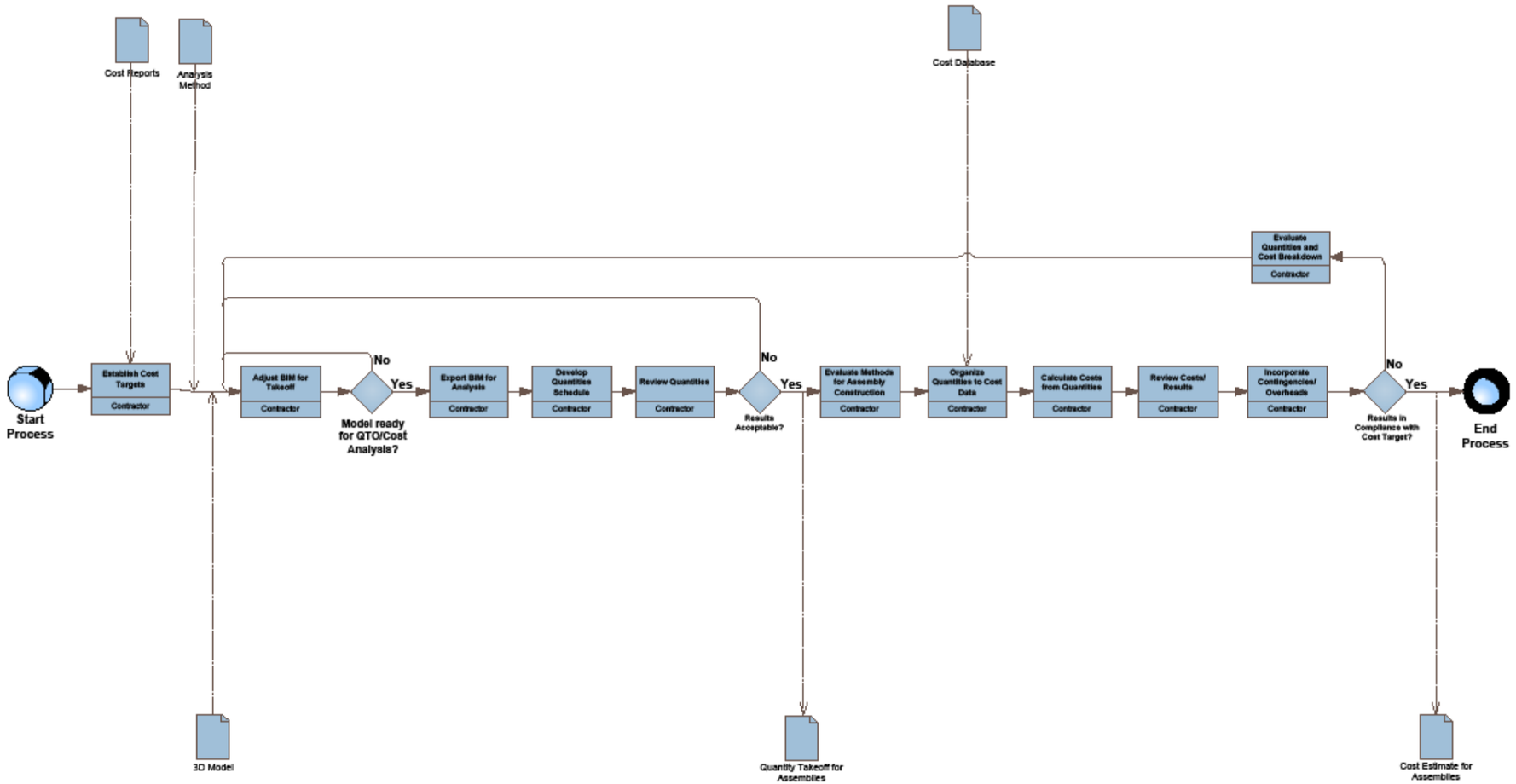


Construction Engineer Process Map

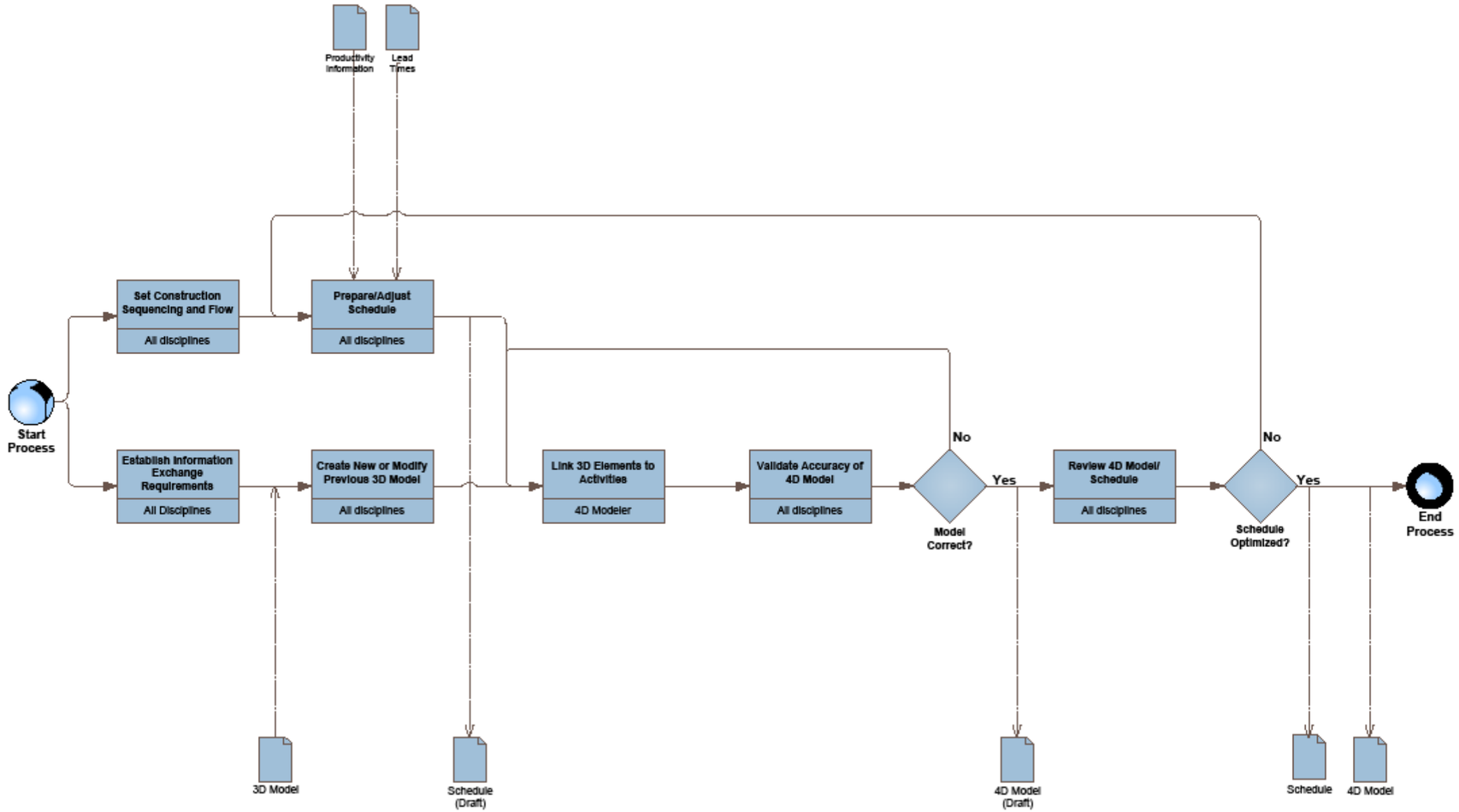


ATTACHMENT 5: DETAILED BIM PROCESS MAP

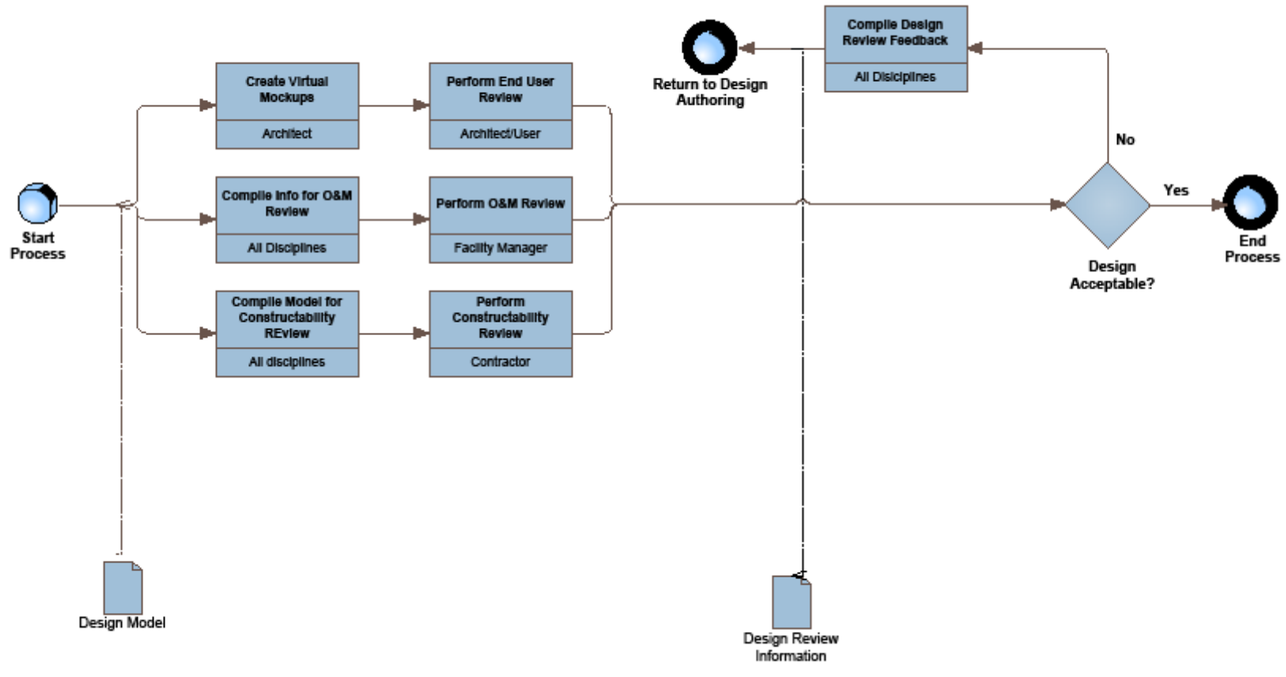
Cost Estimation



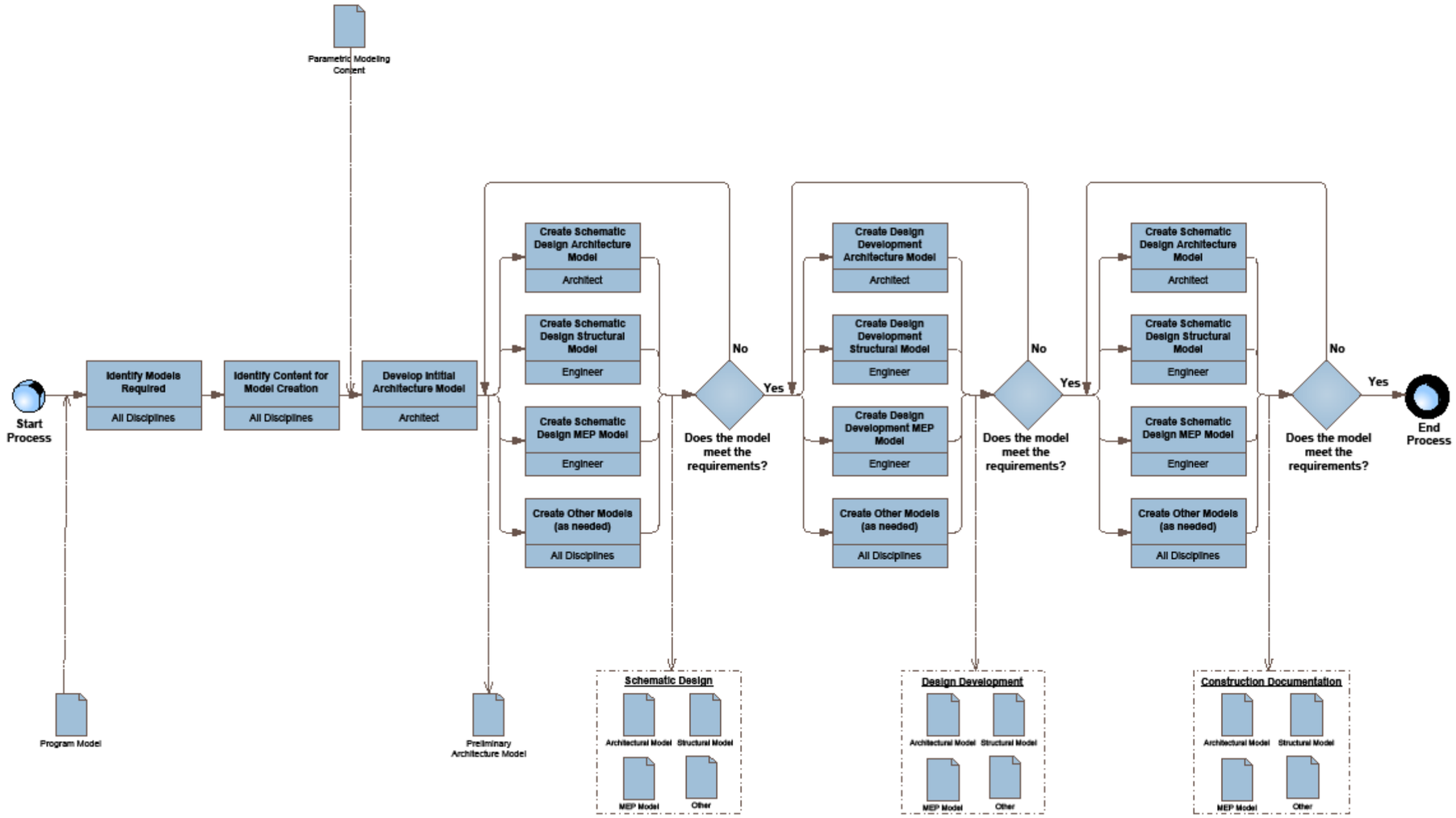
4D Modeling


Productivity Information
Lead Times
Set Construction Sequencing and Flow
All disciplines
Prepare/Adjust Schedule
All disciplines
Start Process
Establish Information Exchange Requirements
All Disciplines
Create New or Modify Previous 3D Model
All disciplines
Link 3D Elements to Activities
4D Modeler
Validate Accuracy of 4D Model
All disciplines
No
Model Correct?
Yes
Review 4D Model/ Schedule
All disciplines
No
Schedule Optimized?
Yes
End Process
3D Model
Schedule (Draft)
4D Model (Draft)
Schedule
4D Model

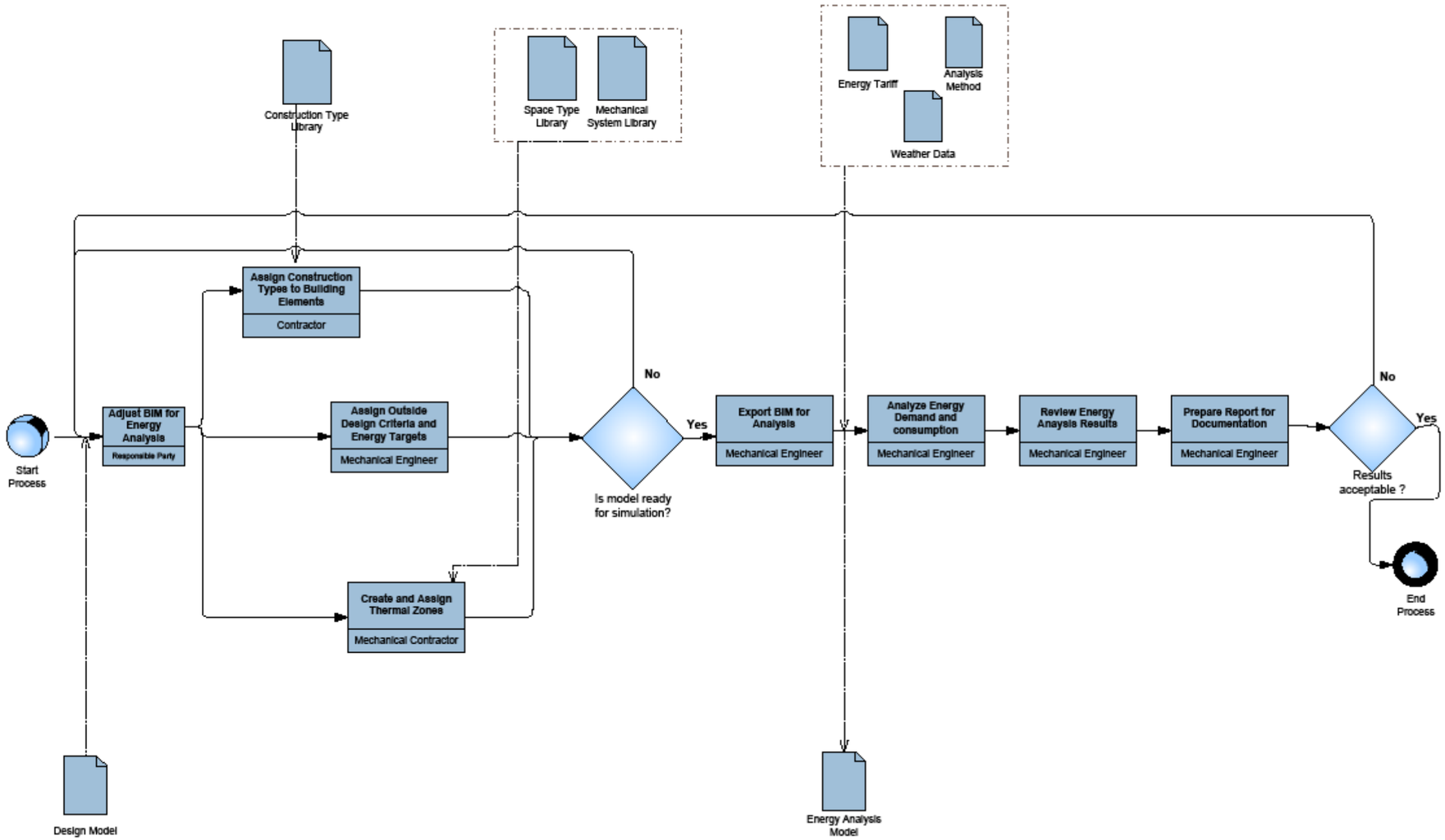
Design Review



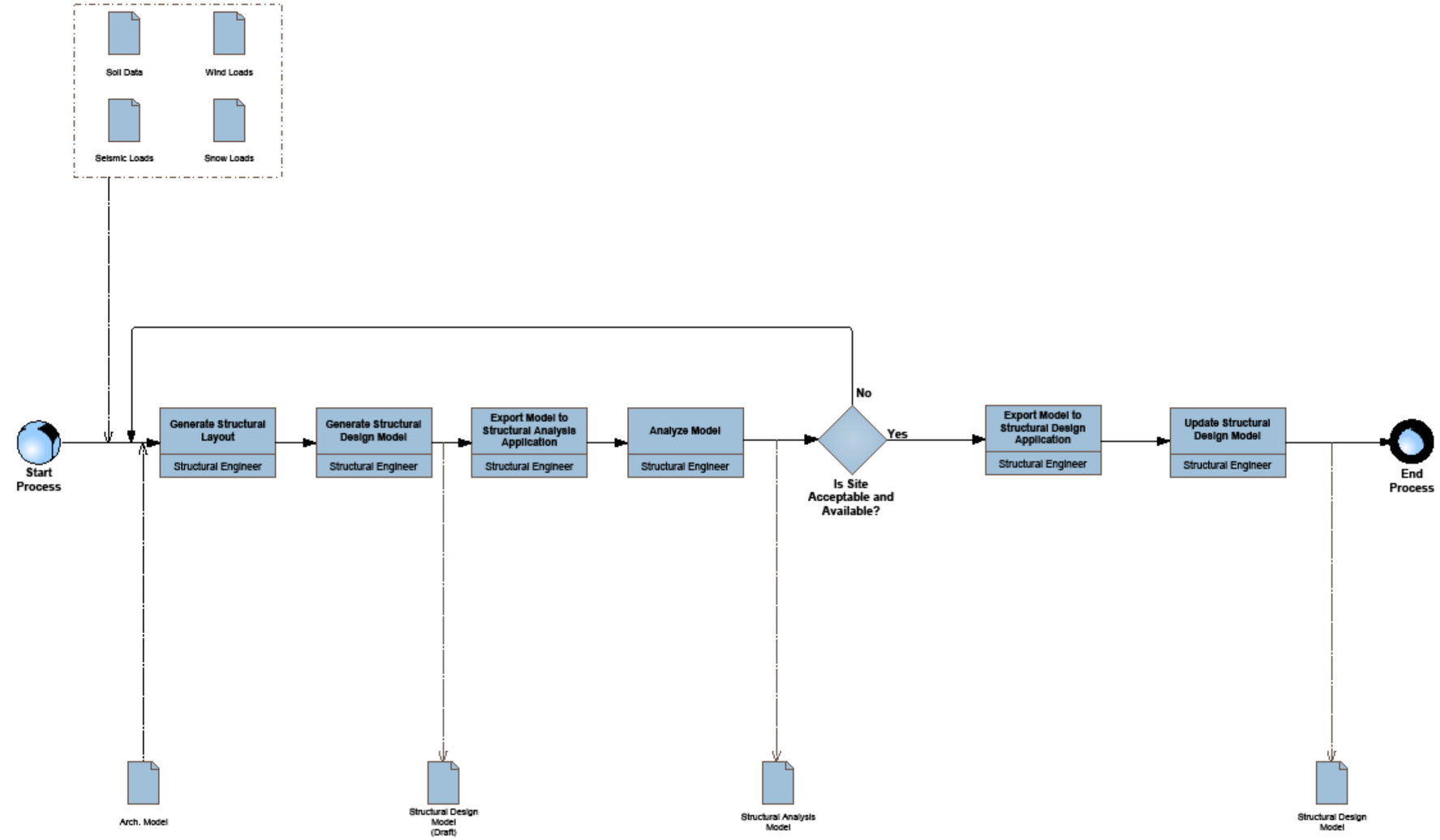
Design Authoring



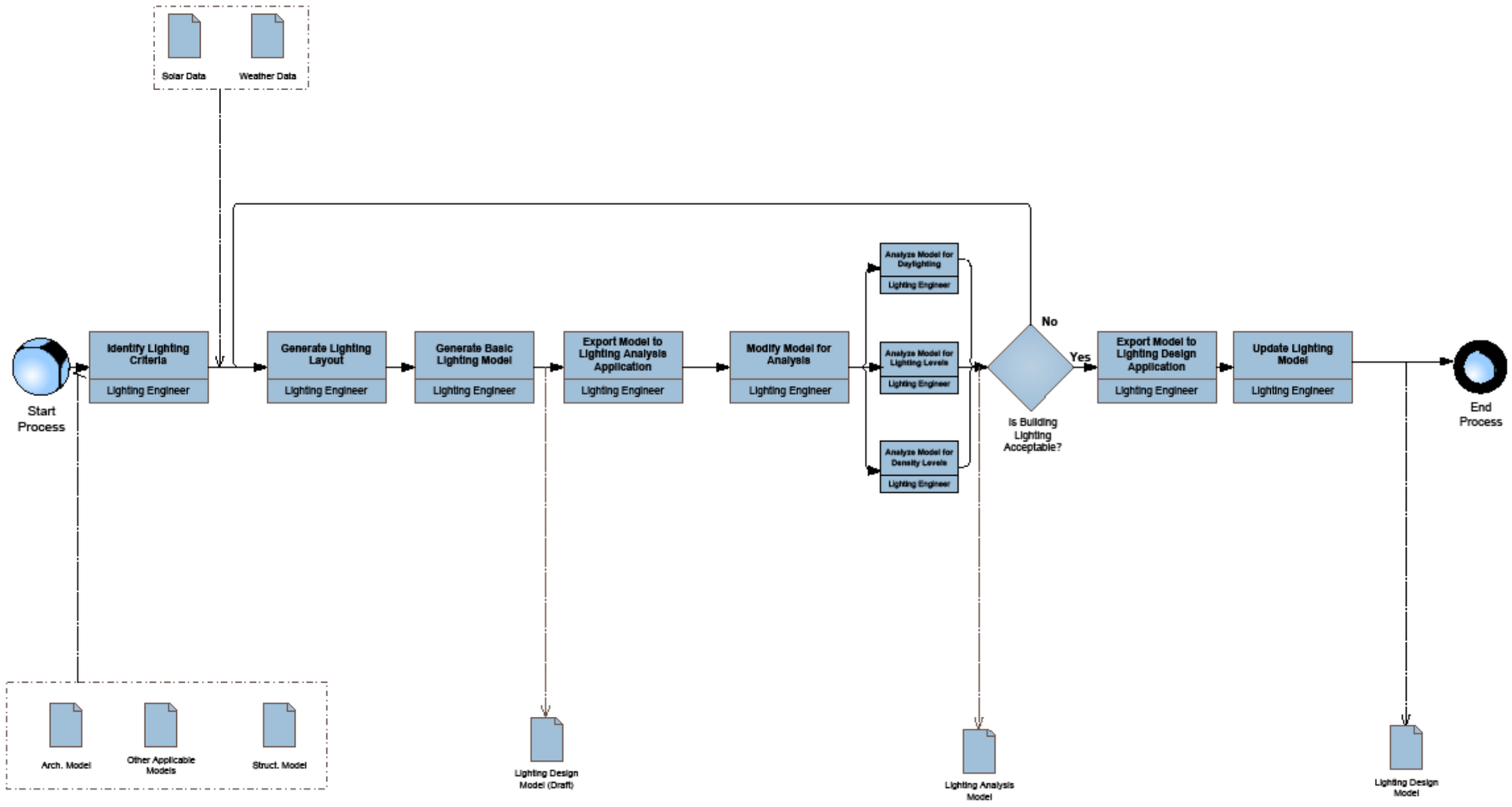
Energy Analysis



Structural Analysis



Lighting Analysis



3D Coordination