RiskLogik

Mitacs

SYSTEMATIC RISK MANAGEMENT APPROACH FOR BUILDINGS

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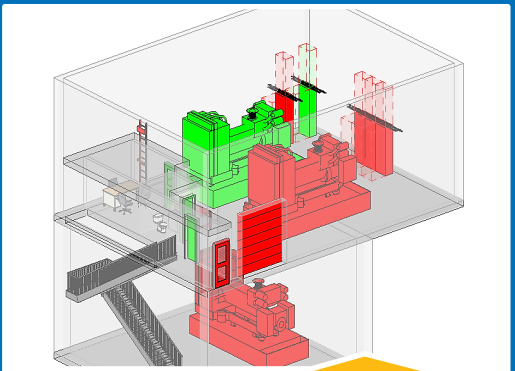
University of Victoria | Civil Engineering

cisl | The Cities & Infrastructure Systems Lab for Resilience & Sustainability

Outline

BIM

Current Practices



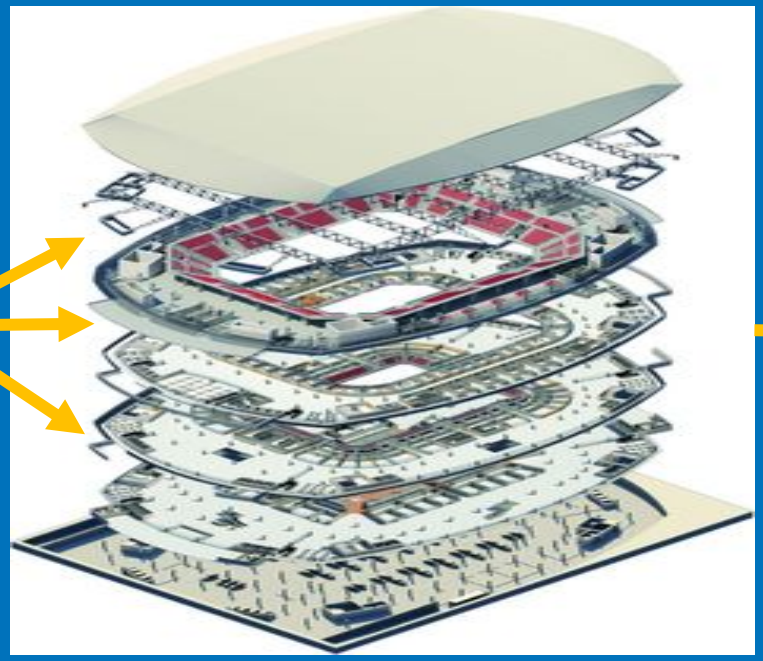
Risk and BIM

Methodology

Conclusion and Future Directions

BIM: Building Information Modeling

Building Systems



Architecture

Structural

Electrical

Plumbing

Mechanical

BIM

Geometric Data

Non-geometric Data

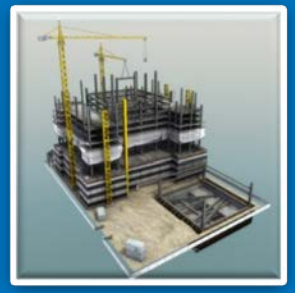
Displayed-Analyzed-Modified

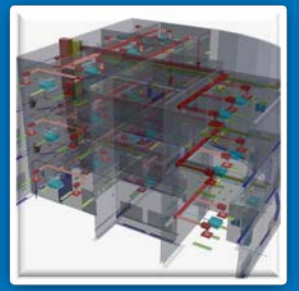
IFC

BIM: Norms and Benefits

Design

Construction



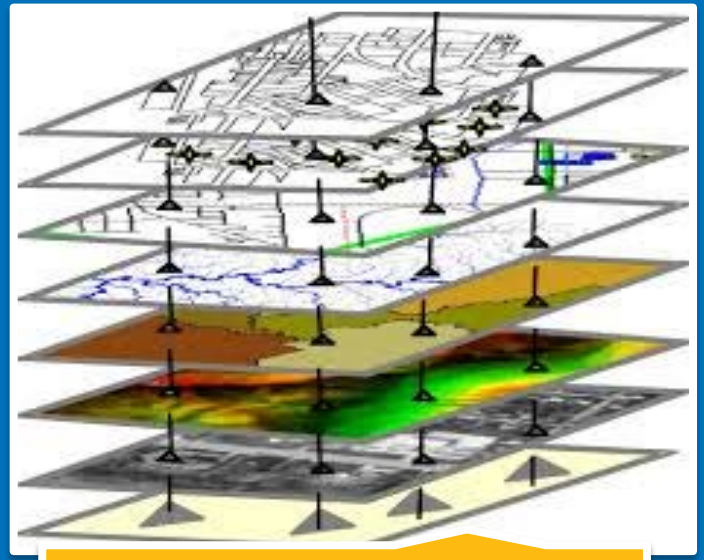


Operation and Maintenance

Current Practices: Challenges

Capital Intensive

- Aging Facilities
- Mounting Challenges



Integrated Management

- Absence
- Interdependency

Growing Demands

- Sustainability
- Service Level

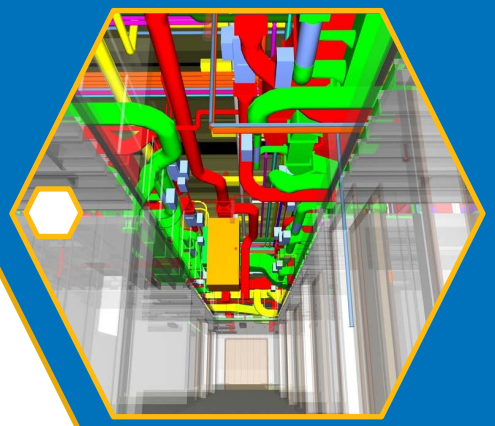
Current Practices: Challenges

Total	100,00
Budget Gap	38 billion /year
Need Repair	53%
Demand Increase	3%

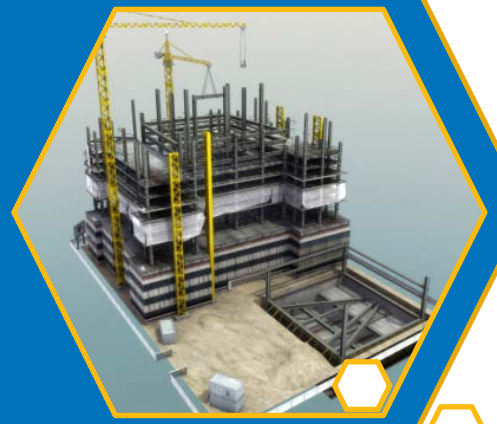
- Objectives
- Resources
- Service Level
- Risk

Total	926
Budget Gap	37 Billion /year
Economy	26%
Value	4.6 Trillion

Current Practices: BIM Now



Interdependency



Risk

Design and Construction

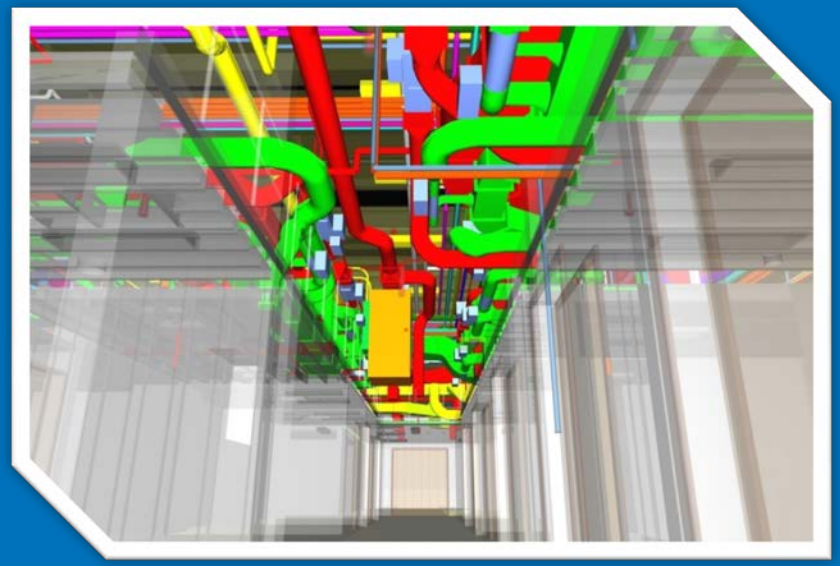
Law Suit: $1Billion.

Reopen: 48 Hours

Public Image

Risk and BIM: Better Understanding

Risk Modeling

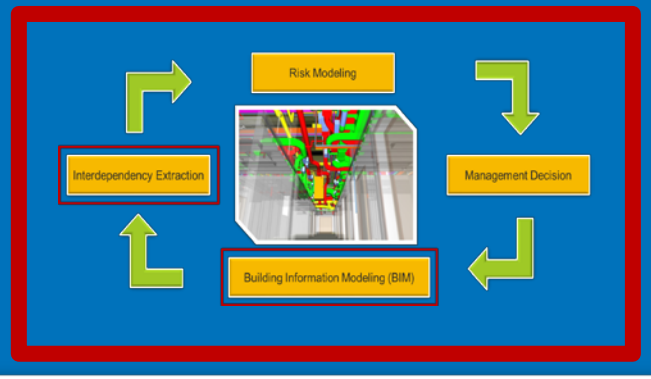


Management Decision

Building Information Modeling (BIM)

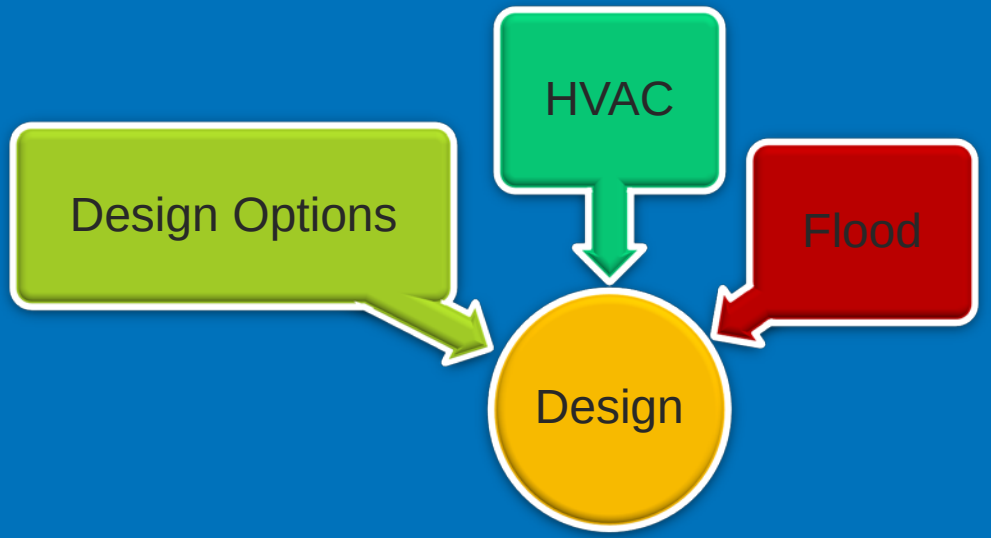
Interdependency Extraction

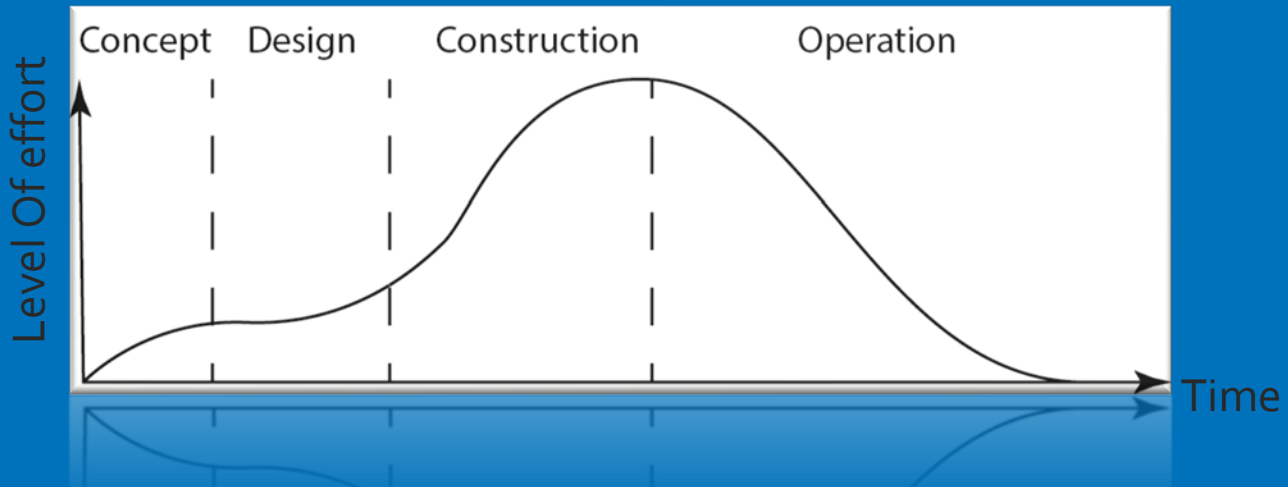
BIM and Risk: Objectives

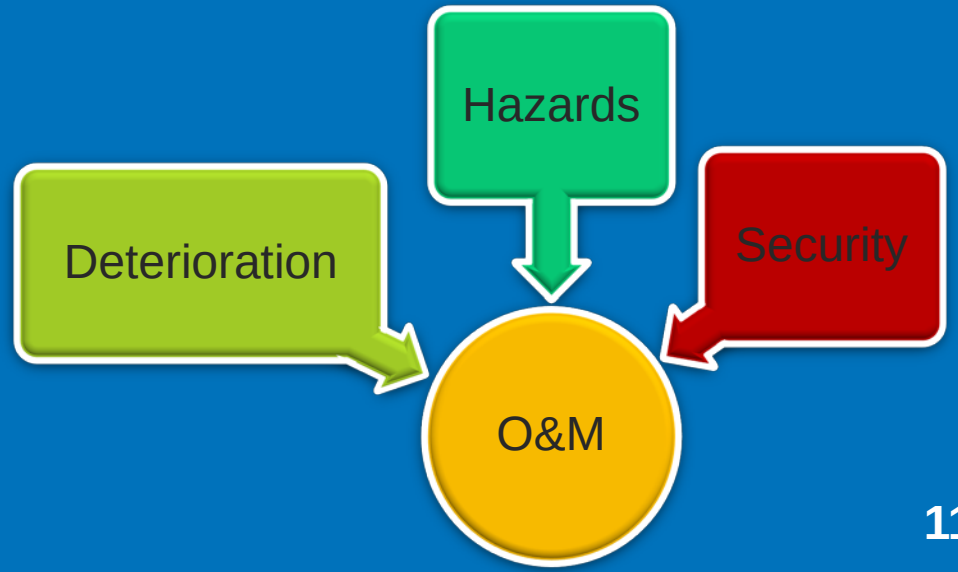


Optimized Decision Making Process

Risk Scenarios







Methodology: RiskLogik Framework

1 Mission Analysis

2 Operations Analysis

3 Risk Analysis

4 Options Analysis

Hazard → Risks → Mitigation Actions

Cost of Solution

- Action 1
- Action 2

Cost of Risk

- Risk 1
- Risk 2

Methodology Overview: RiskLogik Framework

1 Mission Analysis

2 Operations Analysis

3 Risk Analysis

4 Options Analysis

Calculation Plan

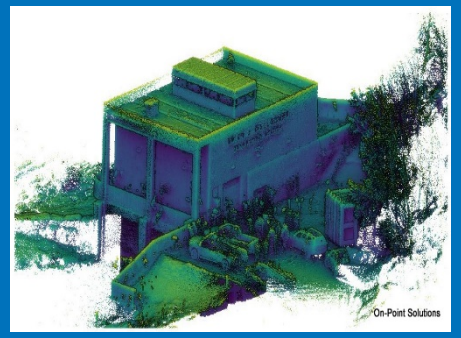
Hazard → Risks → Mitigation Actions

Cost of Solution
- Action 1
- Action 2

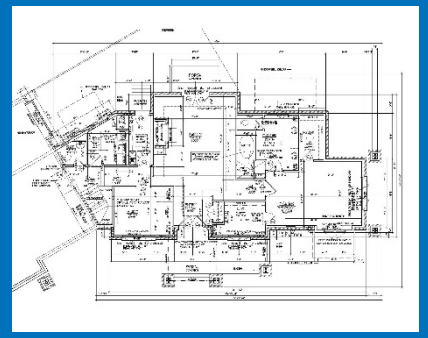
Cost of Risk
- Risk 1
- Risk 2

Concept Development Report

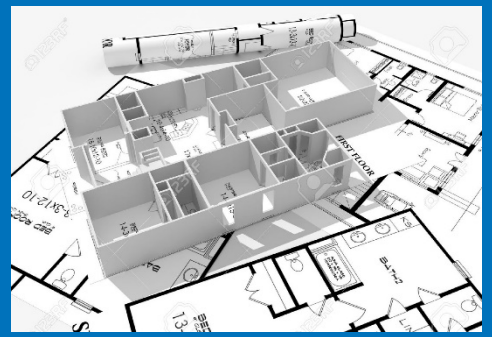
Methodology Overview: BIM and RiskLogik Integration



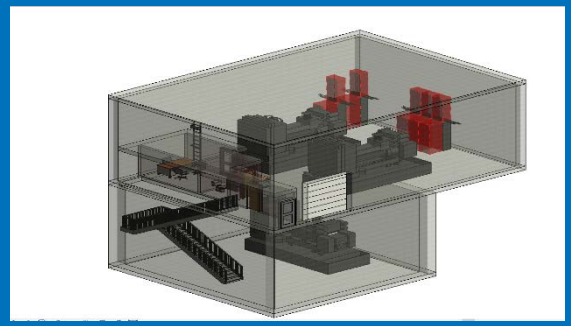
1 Scanning



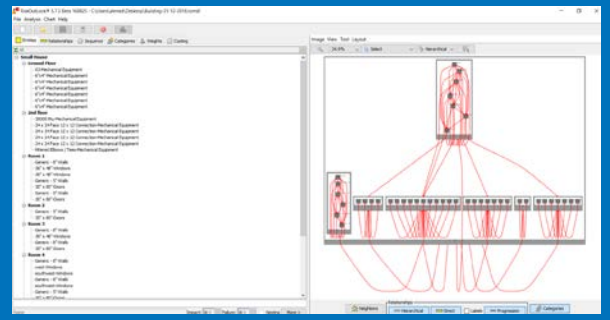
2 CAD



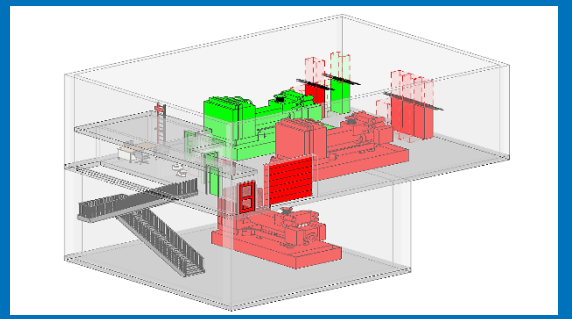
3 Revit Model



4 Interdependency Extraction



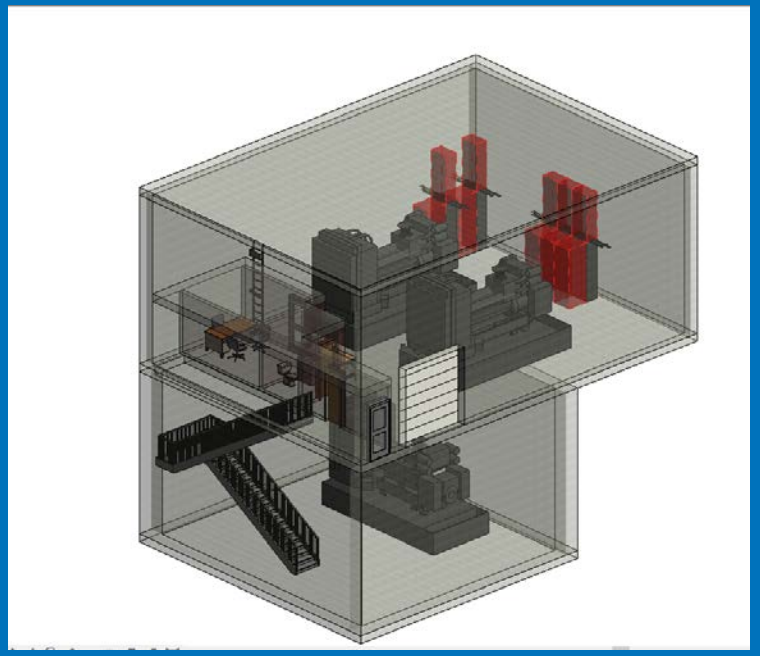
5 Risk Analysis



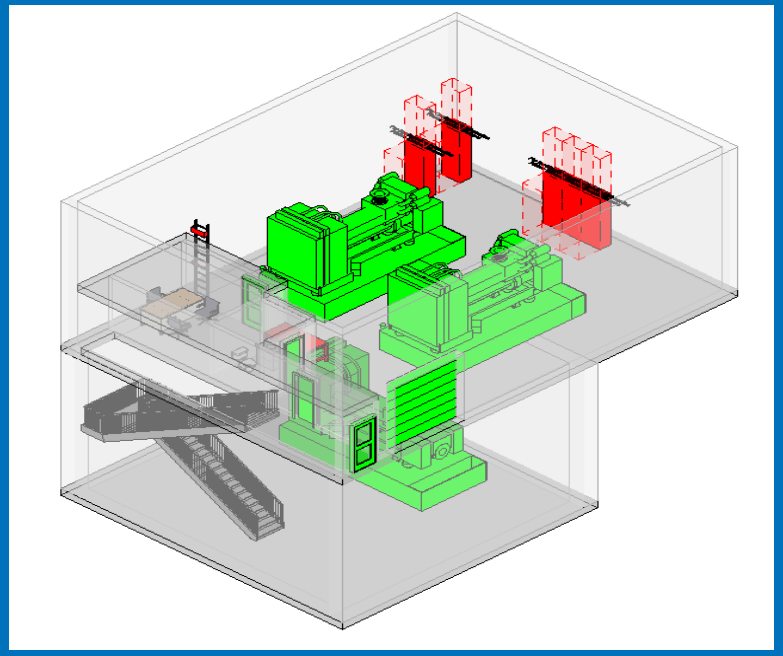
6 Visualization

Methodology Overview: Value Added

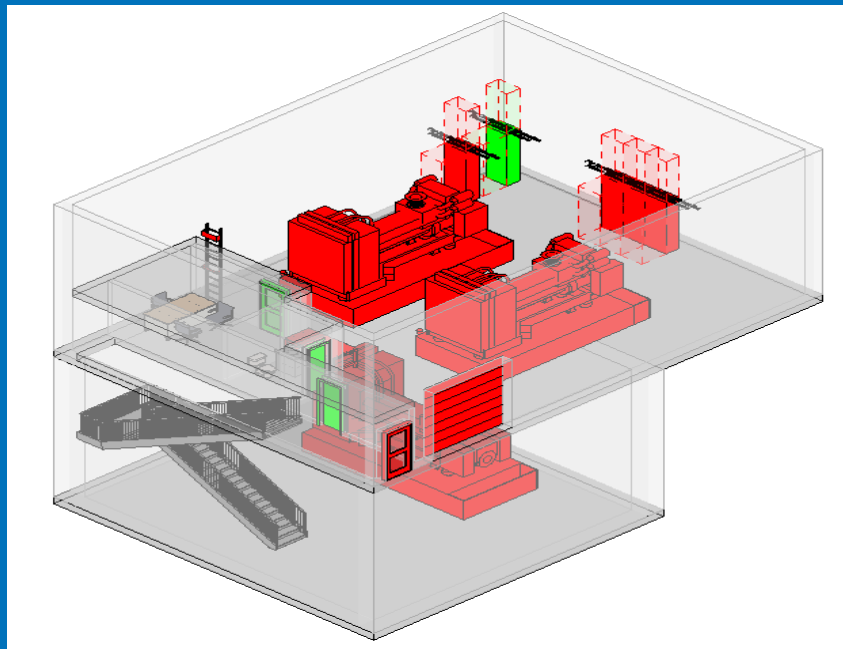
BIM Model



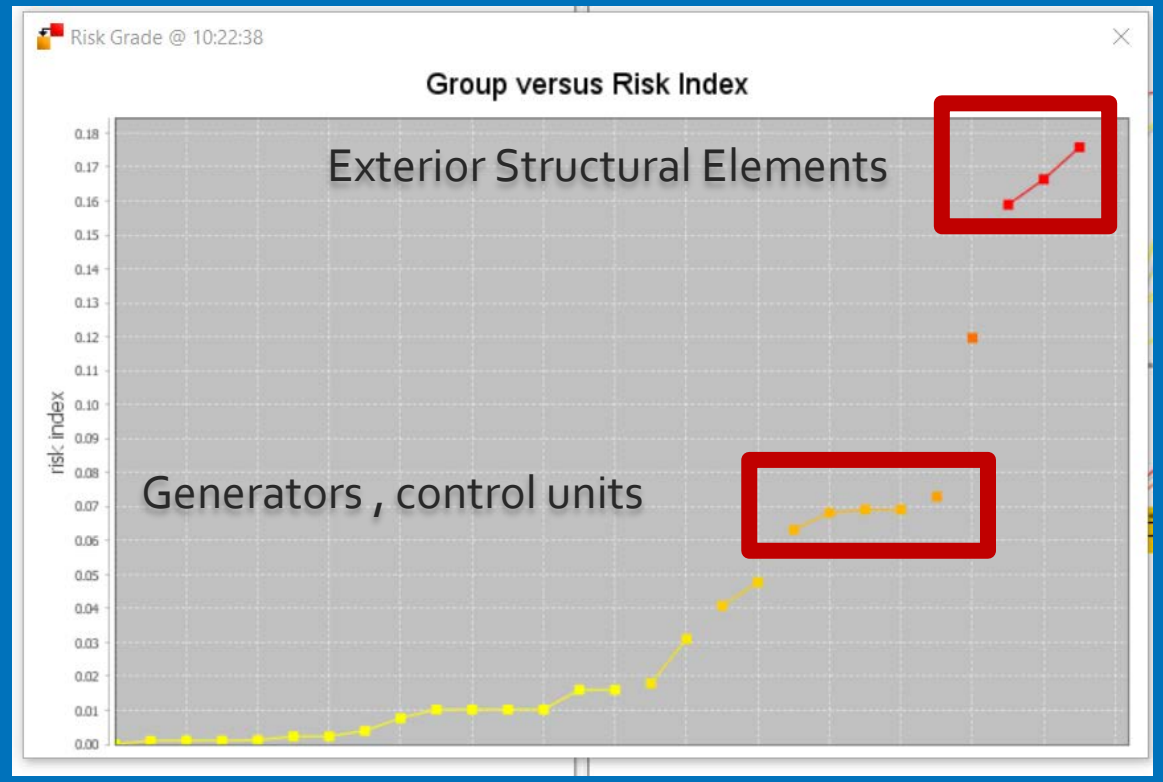
Normal Operation

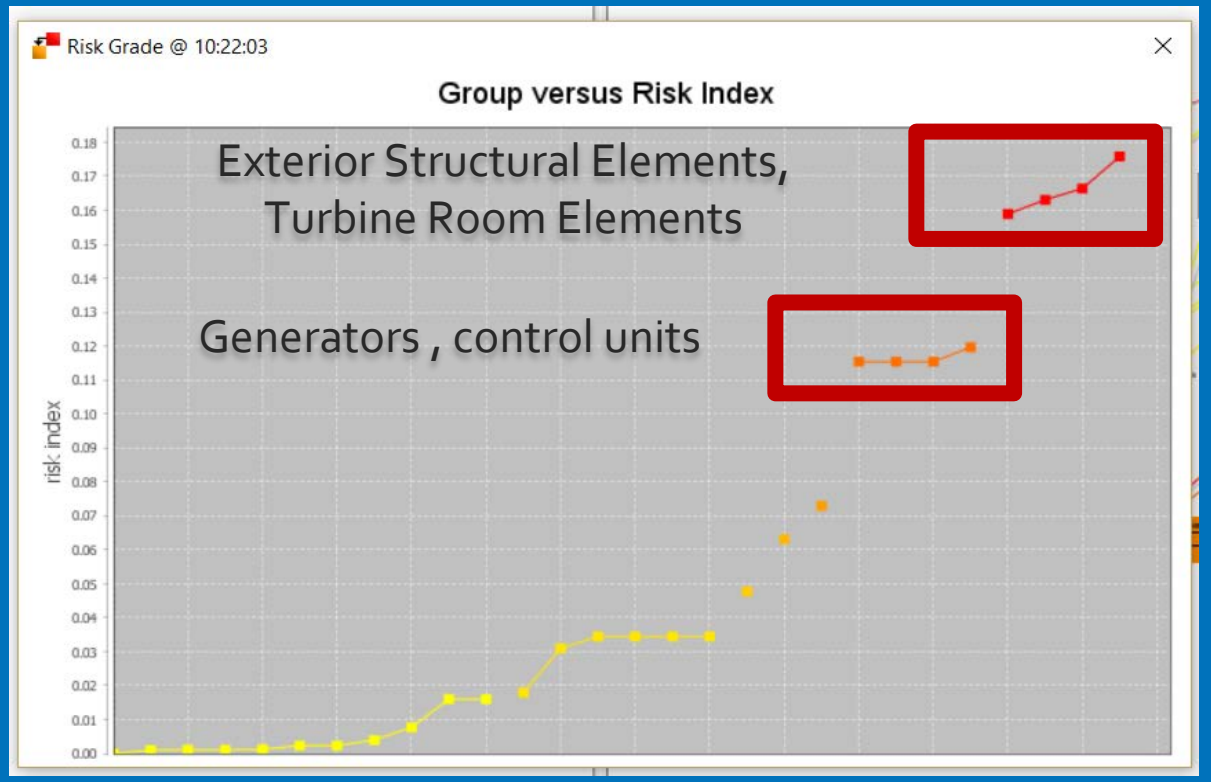


Flood Hazard



Case Study: Grade Risk Profile





Normal Operation

Flood Hazard

Cost

Impact

Conclusion and Future Work

Problem

- Backlogs of aging buildings.
- Changing hazards.
- Increasing risks and demands.
- Complexity of buildings.

Solution

- Integrated risk assessment practices.
- Integrated design provides a path forward.
- Scaling BIM with surrounding infrastructure.
- Improved data collection.

RiskLogik

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Thank You

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University of Victoria | Civil Engineering

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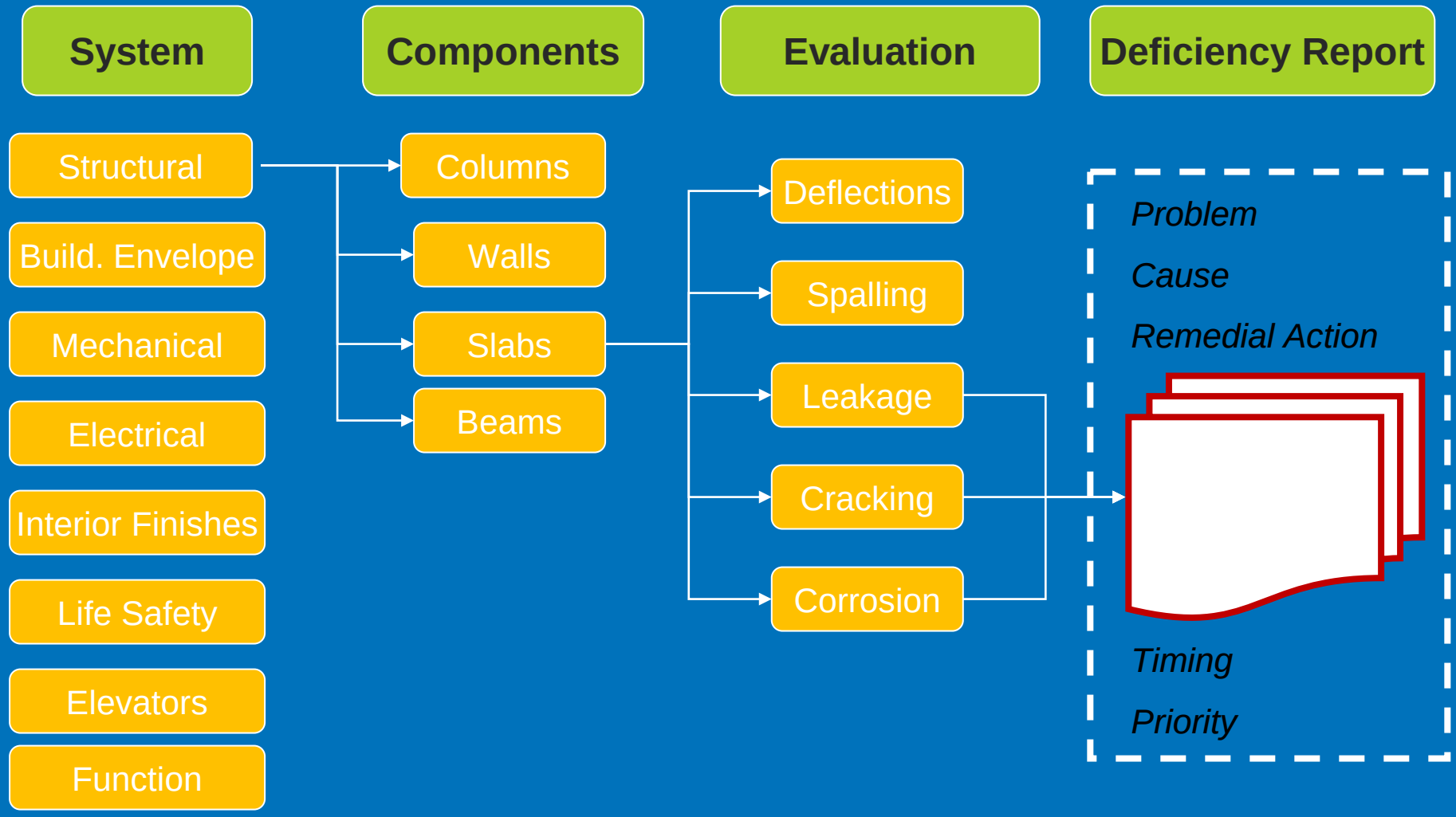
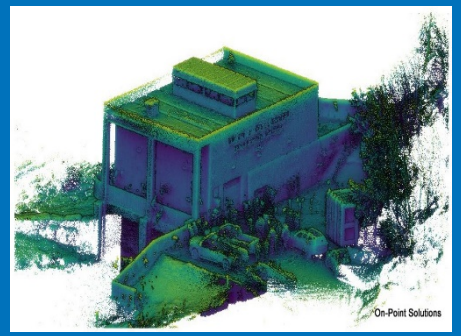
Backup Slides

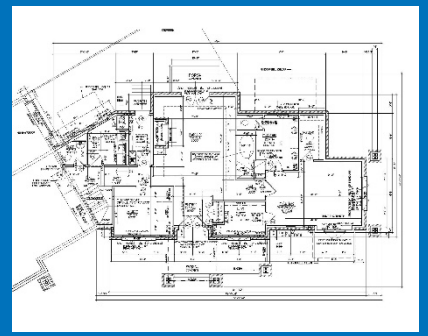
Condition Assessment: Building Inspection



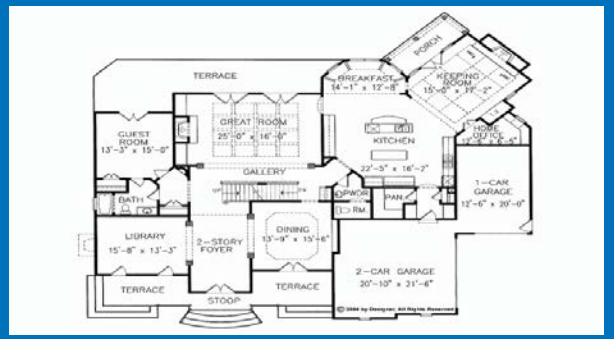
Methodology Overview: BIM and RiskLogik Integration



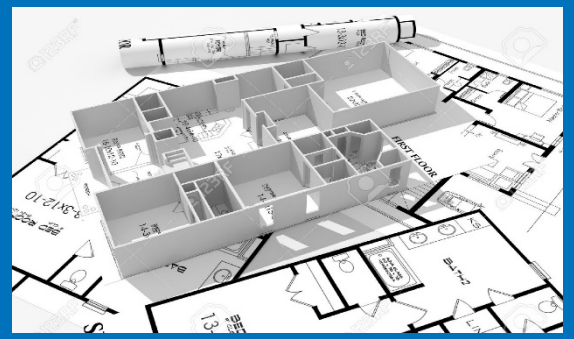
1 Scanning



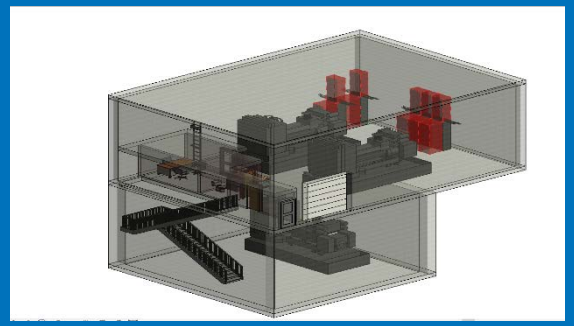
2 Design



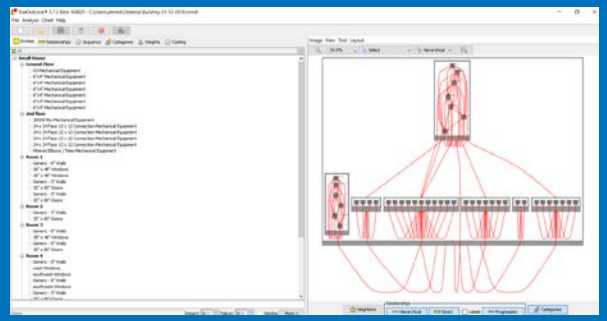
3 As Built



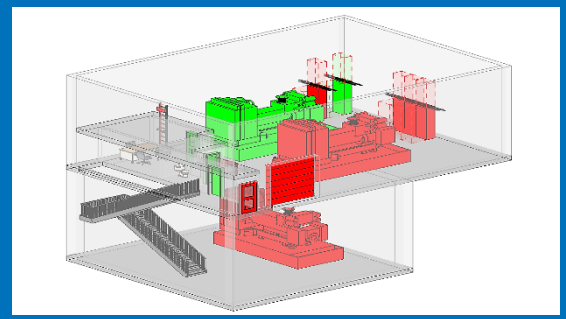
4 Revit Model



5 Interdependency Extraction



6 Risk Analysis



7 Visualization

Workflow: RiskLogik and BIM

Data Collection

- Scanning and image processing
- CAD Drawings

Building Modeling

- Revit Models

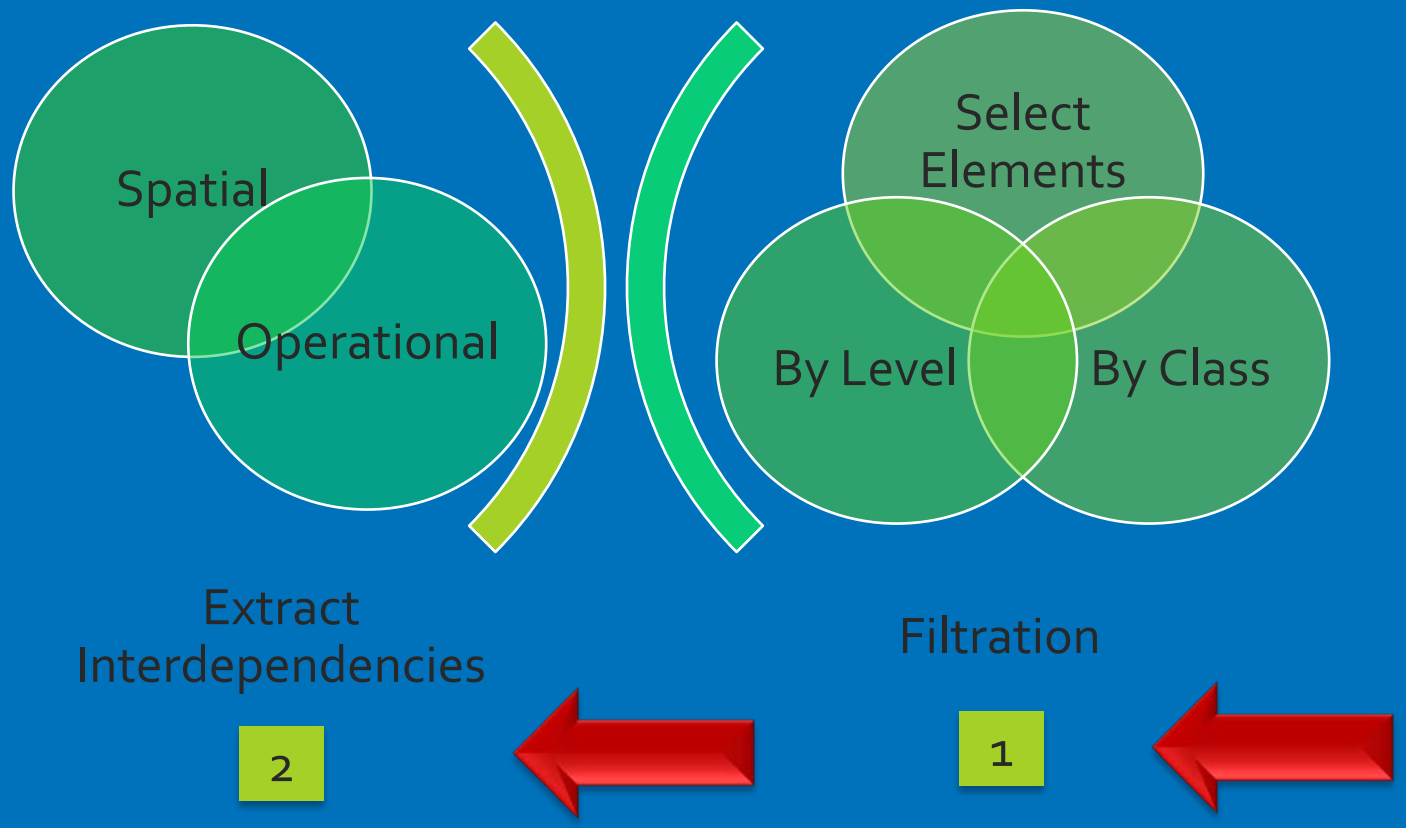
Risk Assessment

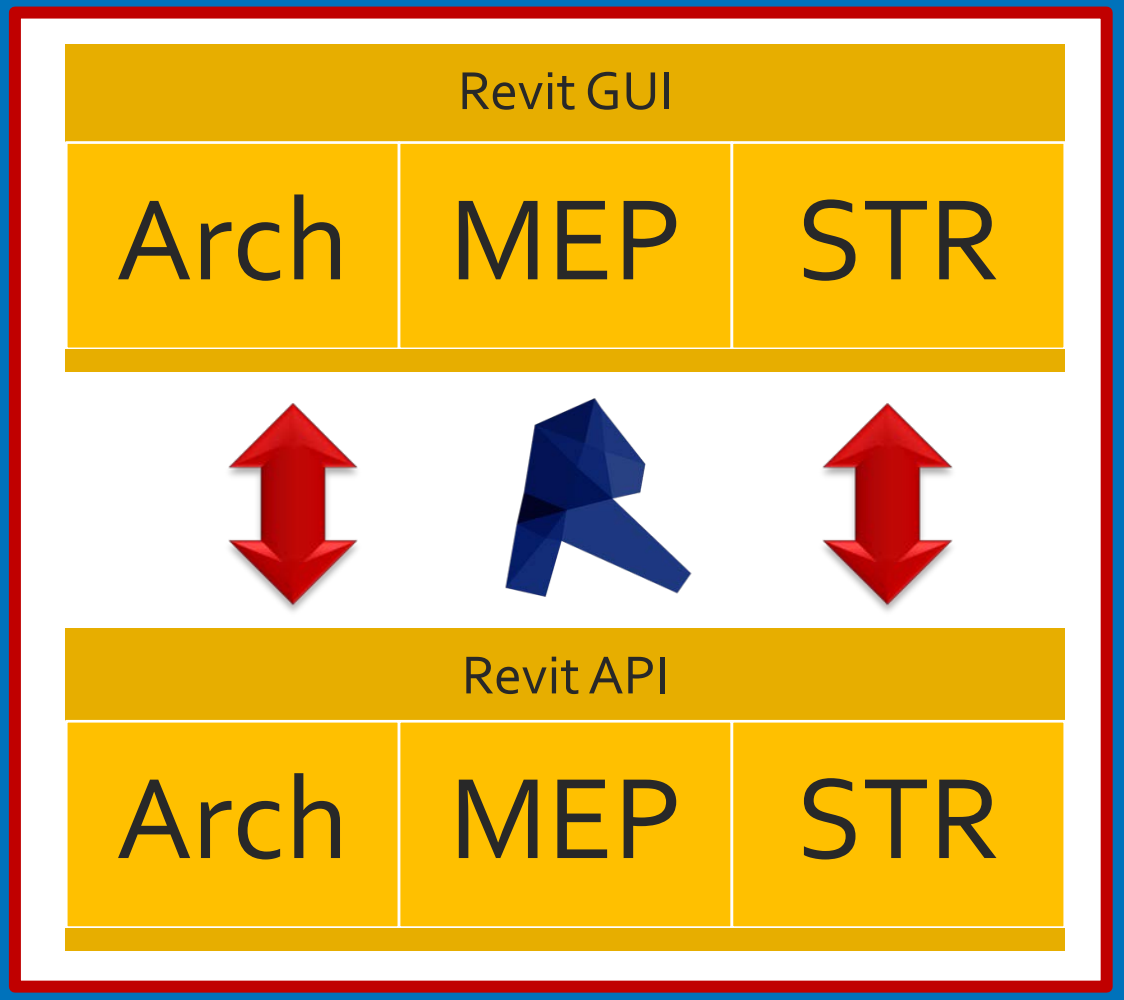
- Operational
- Structural

Concept Development Report

Calculation Plan

Interdependency Analysis: Revit API

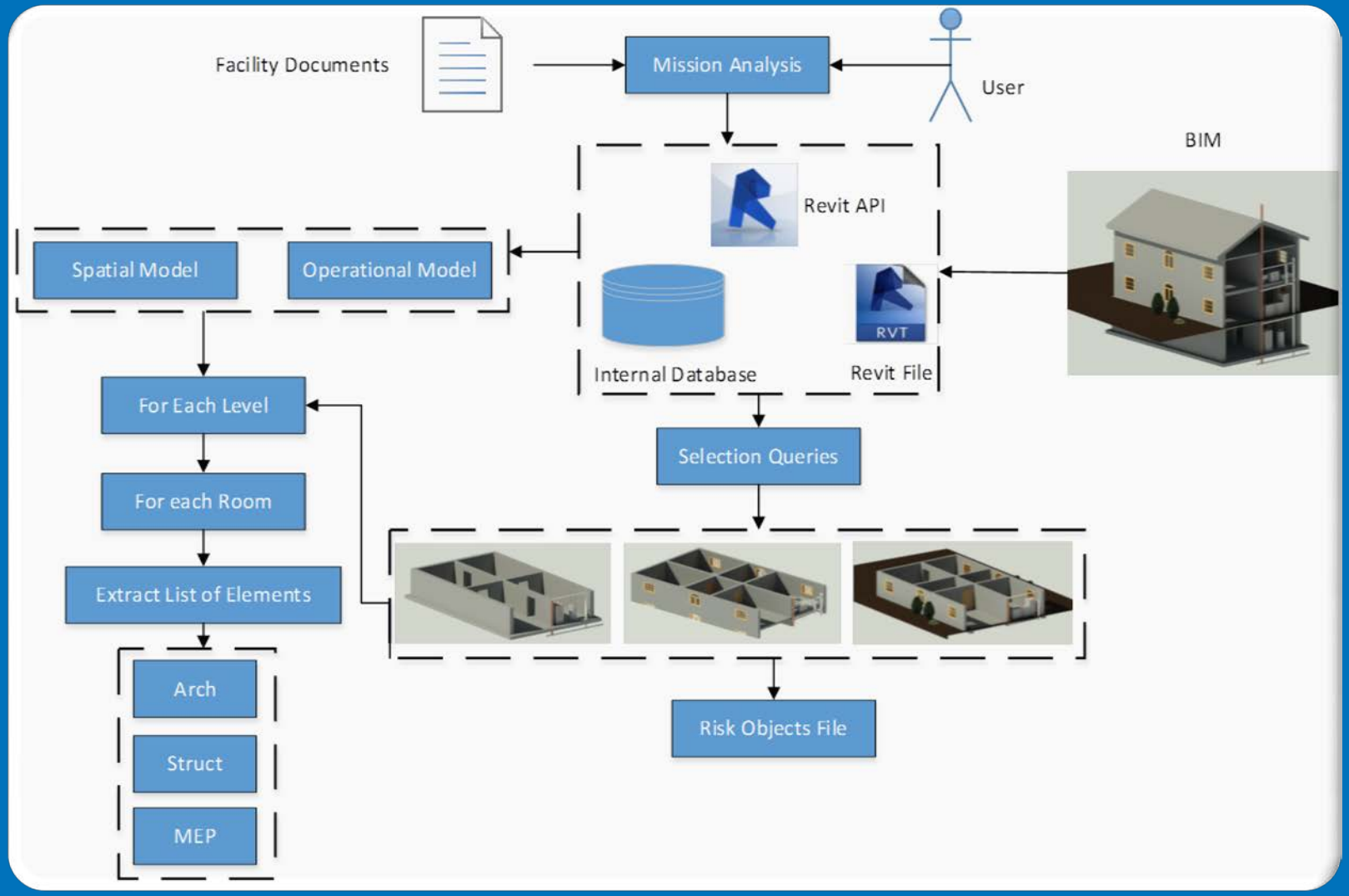




Interdependency Analysis: Revit Workflow

Step - 1

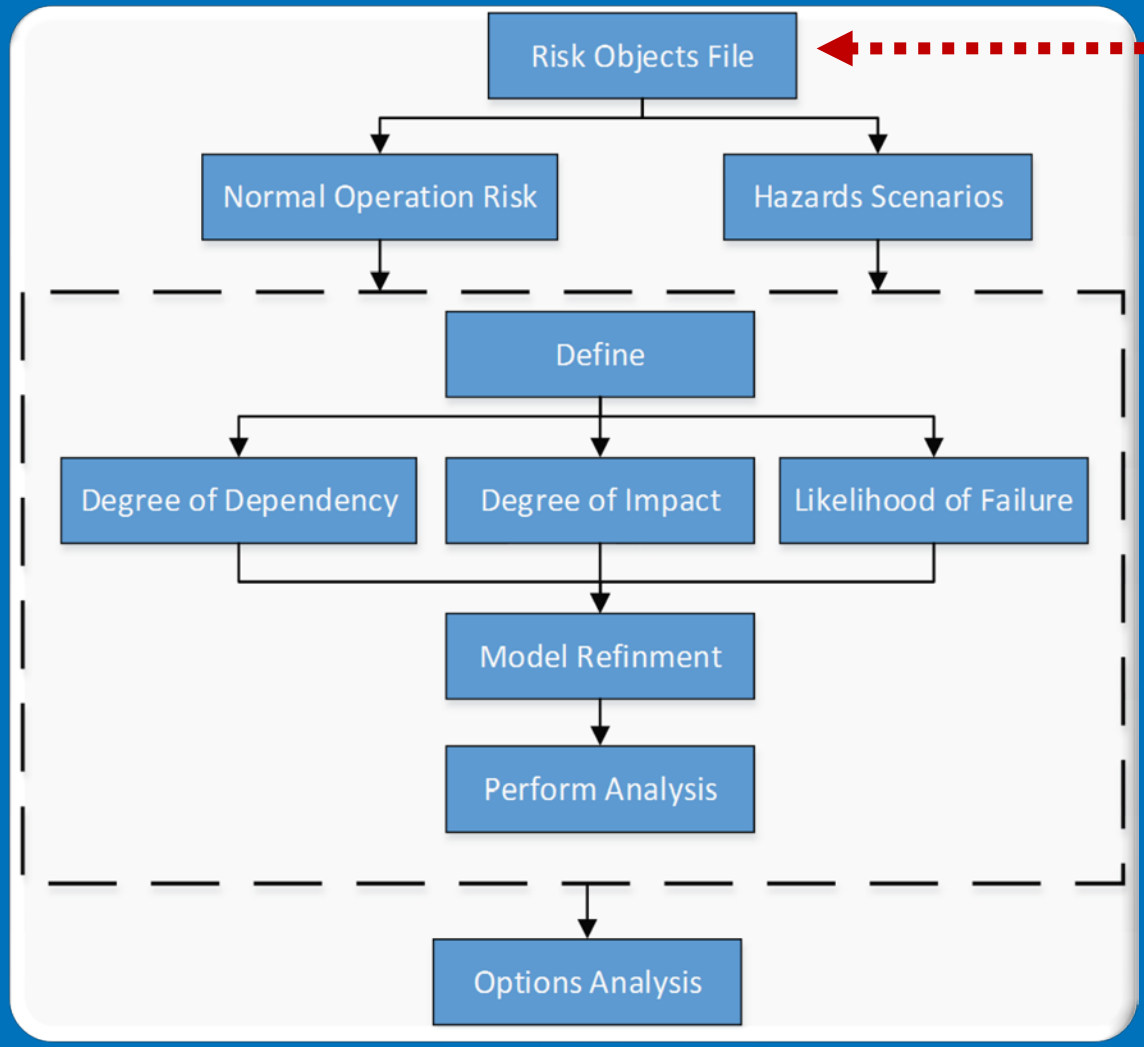
Interdependencies Extraction



Interdependency Analysis: RiskLogik Workflow

Step - 2

Risk Analysis

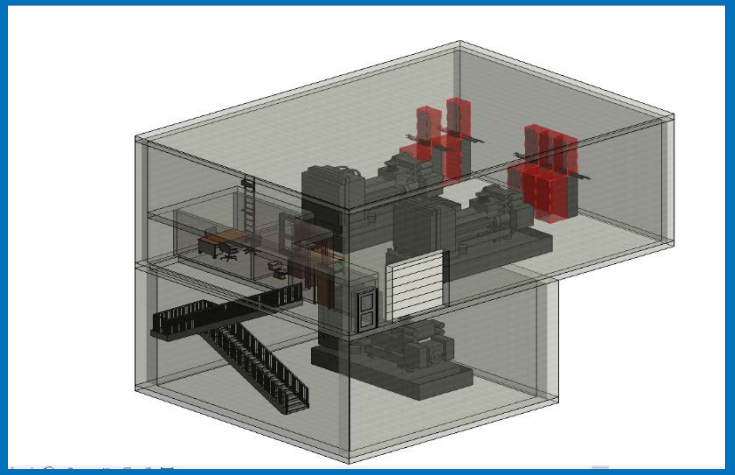


romdl file

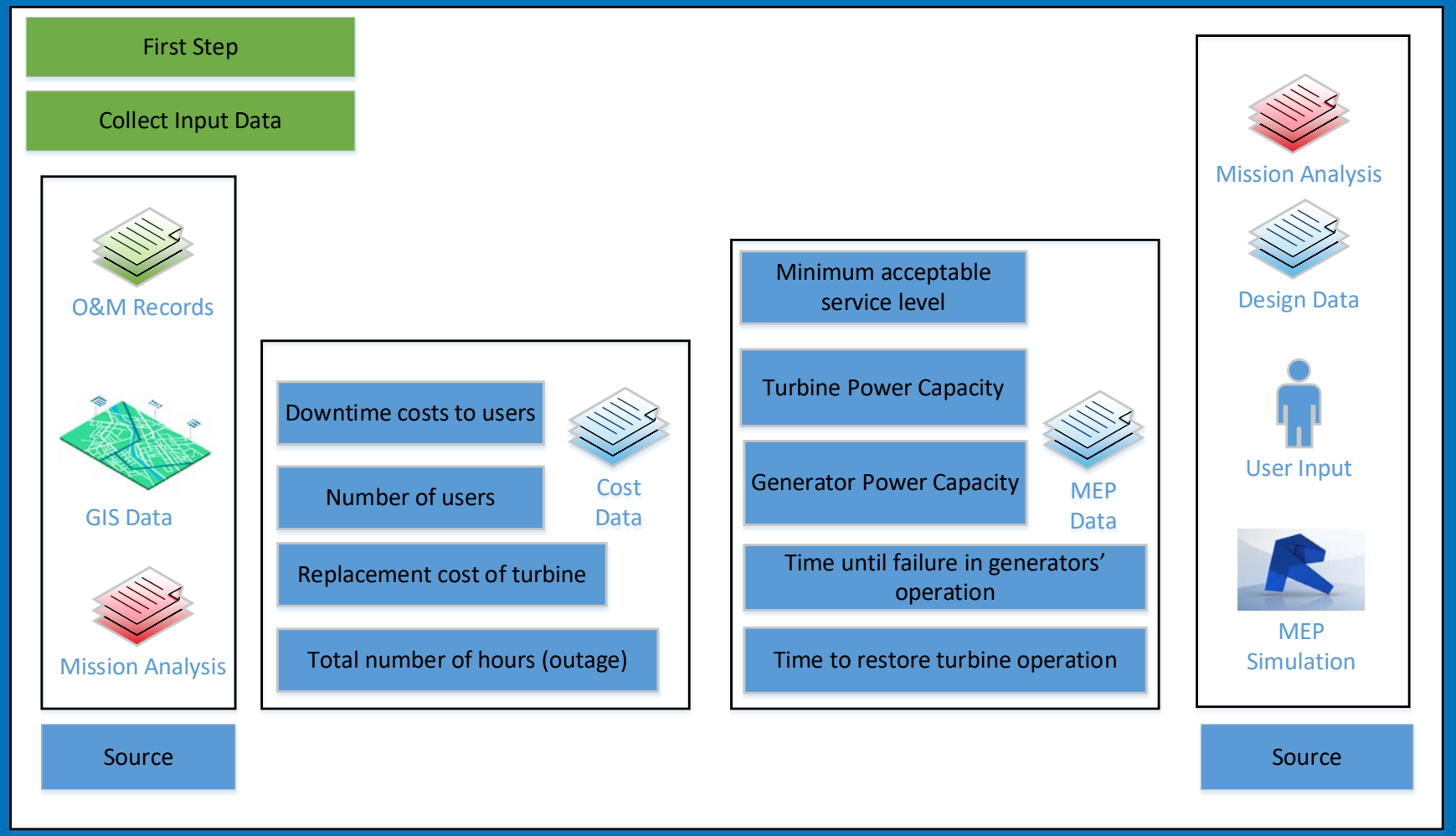
Visualization

Case Study: Almonte Power Plant

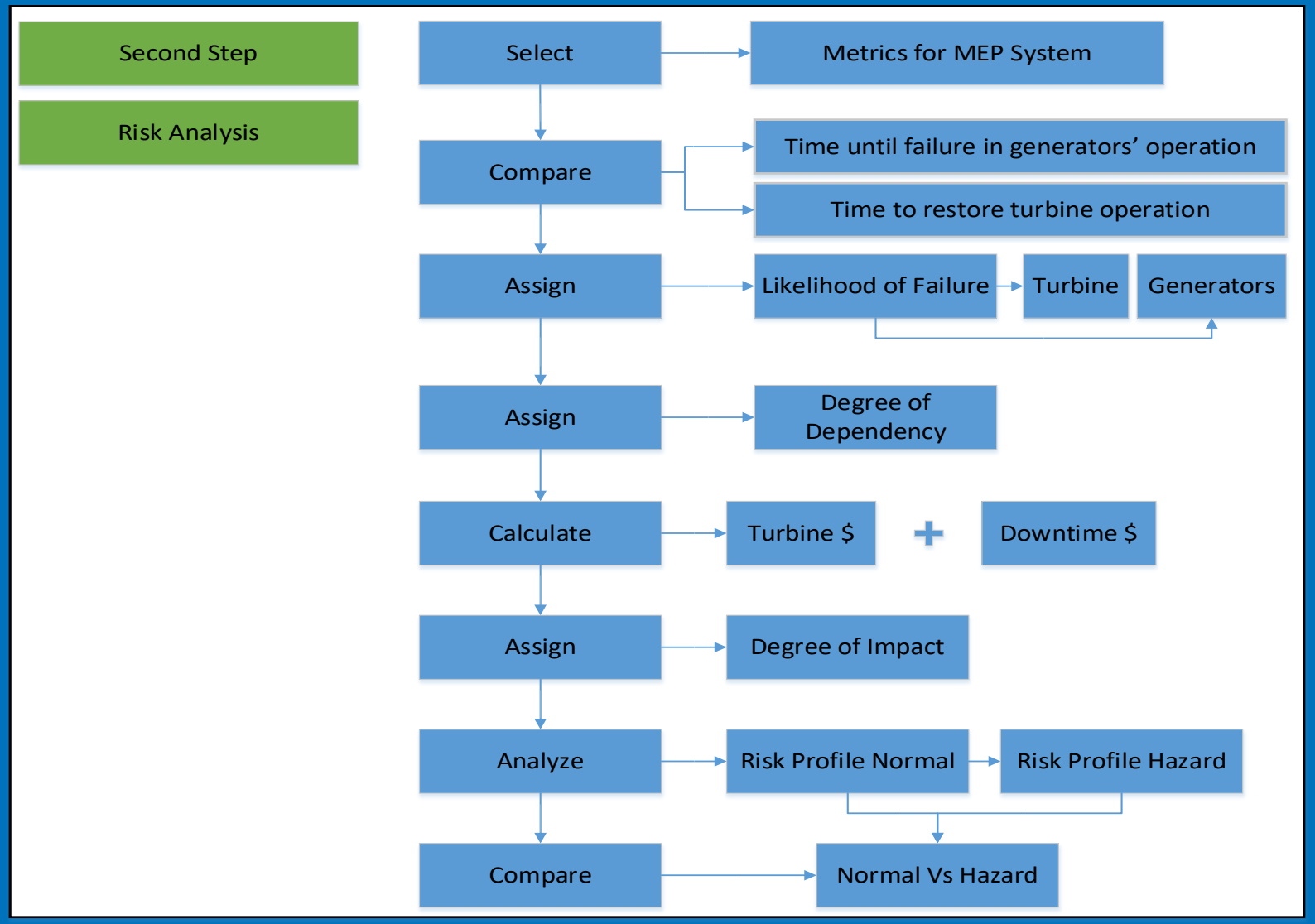
- Testbed for development
- Constructed using point cloud images and blue prints
- Interdependencies are extracted to RiskLogik
- Risk Scenario**: Flood the basement**
- Results imported back to Revit for Visualization



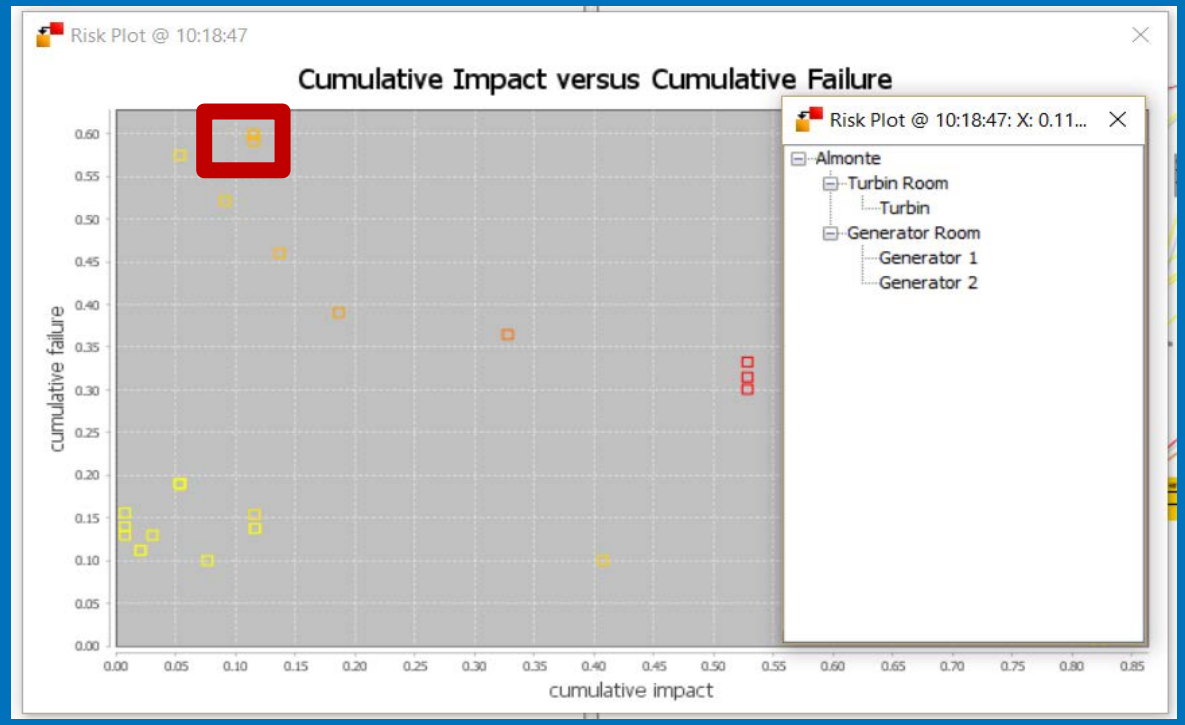
Case Study: Inputs



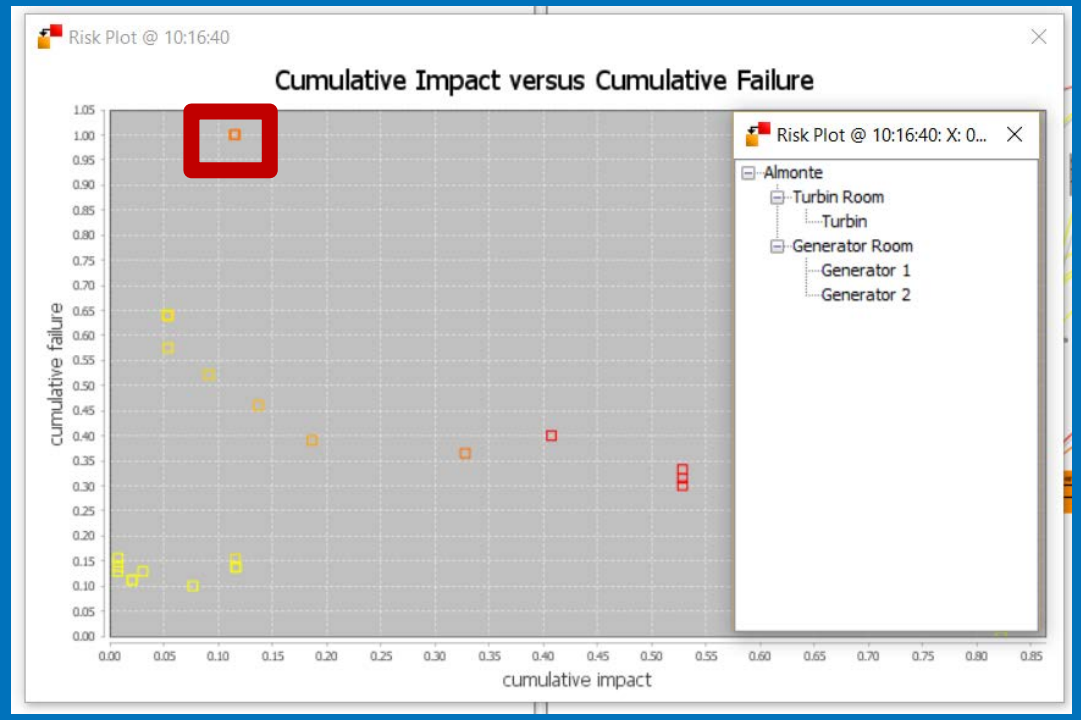
Case Study: Analysis Steps



Case Study: Cumulative Risk profile

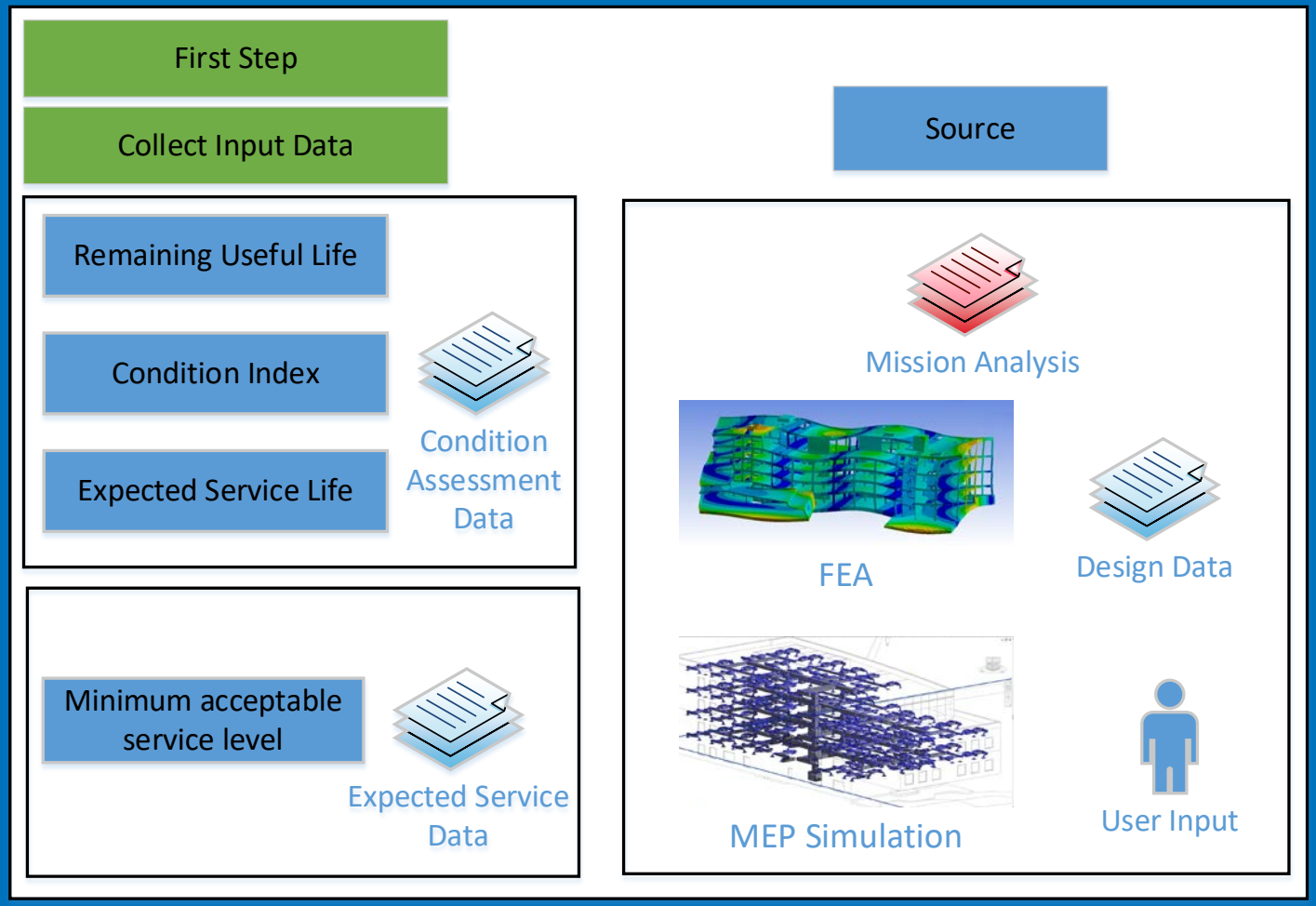


Normal Operation

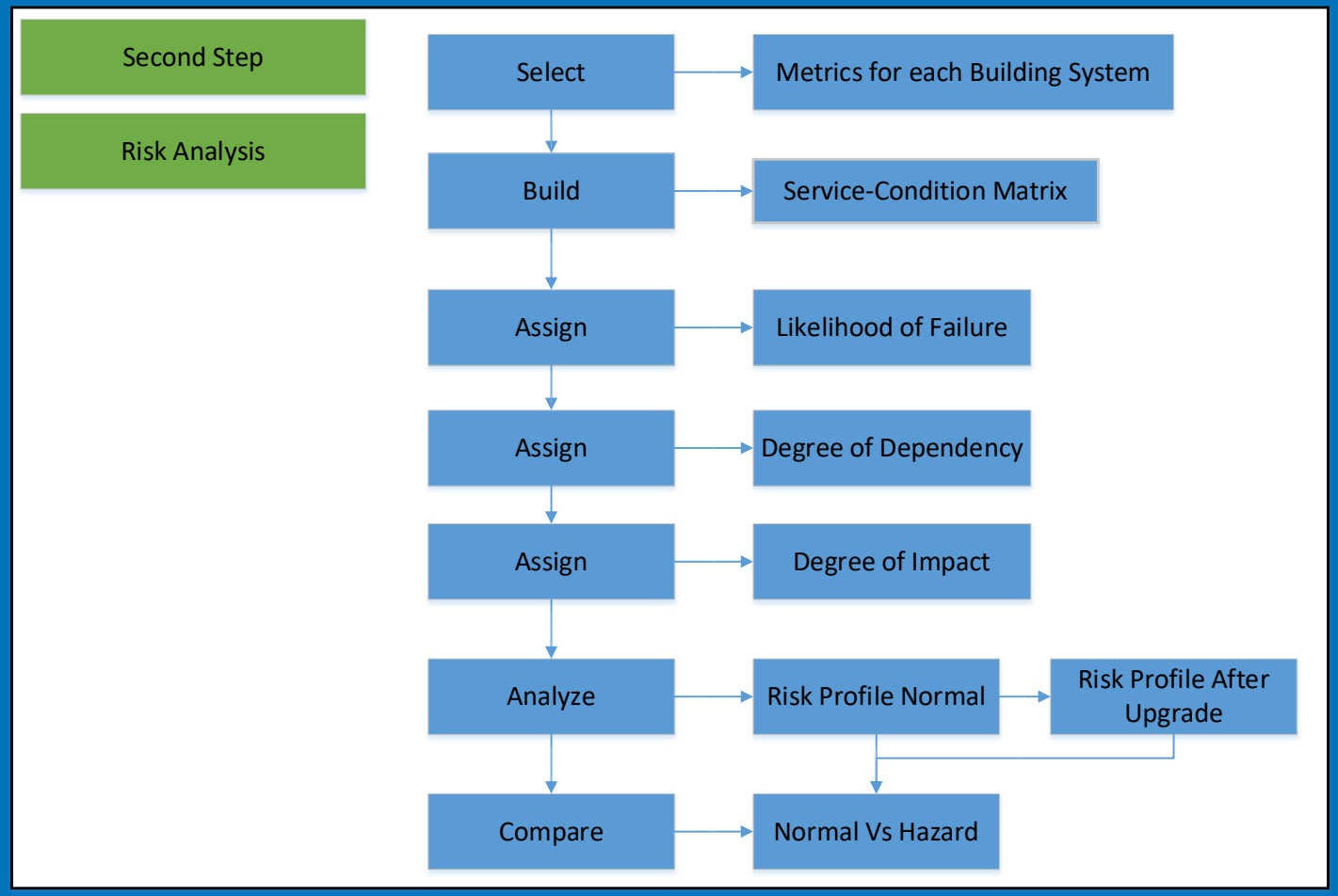


Flood Hazard

Case Study - 2: Inputs



Case Study - 2: Analysis Steps



Service – Condition Matrix: MEP System

	MEP element			
Condition	Remaining Service Life	Expected Service Level	MASL	Likelihood of Failure
1	1000 hours	Up to 5 hours	Up to 3 hours	1
2	700 hours	Up to 3 hours		3
3	500 hours	Up to 2 hours		6
4	300 hours	Up to 1 hours		7
5	Less than 100 hours	Up to 15 min		10

Service – Condition Matrix: Arch. & Struct. Systems

	Architecture and structural elements			
Condition	Remaining Service life	Expected Service Level from FEA	MASL	Likelihood of Failure
1	50 years	Up to 30 hours	Up to 15 hours	1
2	30 years	Up to 25 hours		3
3	20 years	Up to 15 hours		6
4	10 years	Up to 6 hours		7
5	Less than 5 years	Less than 2 hours		10