Design Change Management Using a BIM-based Visualization Model

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Outline

- Introduction
- Background
- Proposed Methodology
- Case Study
- Conclusion
What is change?

Leonard, Moselhi (1988), Antill et al. (1990), Ibbs C. W. et al. (1995), Mokbel et al. (2003), Ibbs, W. et al. (2005), Ming Sun a. X. et al. (2009)
The followings are the words of the estimator for the general contractor:

“we knew we had been clobbered, but we didn’t know what had hit us. It was like walking down a dark alley midnight and waking up the next day in a hospital bed. The police want to know who hit us. You don’t even know what happen.”…
“So, gentlemen, I think this pretty well concludes what I have to say on this subject. It’s a field that is grossly misunderstood and needs more study. It’s a tremendous problem, and much remains to be studied”
- Our models in late 80s
- B. Ibbs
- Others

• In US, cost of change could reach $50 billion per year with the additional spent on claims and legal disputes (Ibbs and Allen 1995)

• 50% of the surveyed projects were suffered from delays due to changes (Kumaraswamy et al. 1998)

• Changes caused 70% of the construction projects in Saudi Arabia faced with delay (Assaf et al. 2006)
• Owners request changes at any phase of a project to respond to new market demands

• Owners may not realize the consequences of their requested changes

• Changes Impact the project’s
  • Schedule
  • Cost
  • Project overall performance
Proposed Methodology

Data Acquisition Framework | Data Analysis Framework | Reporting Framework

Original BIM Model → Copy of BIM Model → Modified BIM Model

Owner’s Change Requests

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Proposed Methodology

Data Acquisition Framework

Data Analysis Framework

Reporting Framework

Micro Level WBS

Activity level (Floor)

Sub-activity level (Area)

Work package level (System)

Part level (Component)

- Architectural
- Structural
- Electrical
- Mechanical
- Plumbing & Piping
- HVAC

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Proposed Methodology

Component's Info.

ID

Cost

Location

- Room
- Floor

System

- Architectural
- Structural
- Electrical
- Mechanical

Schedule

- Duration
- Start Date
- Finish Date
Proposed Methodology

Data Acquisition Framework | Data Analysis Framework | Reporting Framework

- Component IDs
- Component IDs
- Original BIM Model
- Modified BIM Model

1. Change Ripple Effect Visualization Module
2. Change Time Impact Analysis Module
3. Change Cost Impact Analysis Module

Main Interface
Proposed Methodology

Data Acquisition Framework

Data Analysis Framework

Reporting Framework

Change Ripple Effect Visualization Module

Area Connections

Floor 3
Room A2-3

Floor 2
Room A3-2
Room A2-2
Room A1-2

Floor 1
Room A2-1

Vertical Surroundings
Horizontal Surroundings

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## Proposed Methodology

### Data Acquisition Framework

### Data Analysis Framework

### Reporting Framework

### Component ID/name/ Location

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<thead>
<tr>
<th>Component ID</th>
<th>Component name</th>
<th>Component location</th>
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### Original Model

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<th>Original Component Specification</th>
<th>Geometry</th>
<th>Volume</th>
<th>Material</th>
<th>Start date</th>
<th>Finish date</th>
<th>Activity Duration (days)</th>
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### Modified Model

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<th>Volume</th>
<th>Material</th>
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# Preliminary Implementation

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<th>Data Acquisition Framework</th>
<th>Data Analysis Framework</th>
<th>Reporting Framework</th>
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![Image of a computer screen displaying views of original and modified models.](Image)

*Original model before applying changes*

*Copy (with applied owner Changes)*
Preliminary Implementation

Data Acquisition Framework

Data Analysis Framework

Reporting Framework

Change Ripple Effect Visualization Module
Preliminary Implementation

Data Acquisition Framework

Data Analysis Framework

Reporting Framework

changed components are checked
✓ A change anywhere can lead to a change everywhere

✓ Every design change has a story that matters before owners make final decisions

✓ When the change gets visualized, it gets materialized
1. Overview of COs Impact

2. Design-change near-real-time ripple effect visualization

3. Development of a system for efficient management of COs
Thank You for Your Attention!

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