An Integrated Future

BIM and Knowledge based Risk Management System

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1. Research background
2. The problem to be solved
3. Research findings and future plan
One World Trade Center is the world’s fourth tallest building

The tallest buildings worldwide (in metres)

- Dubai: 828m (2010)
- Shanghai: 632m (2014)
- Makkah: 601m (2012)
- New York: 541m (2014)
- Taipei: 509m (2004)
- Shanghai: 492m (2005)
- Hong Kong: 484m (2010)

Source: http://www.statista.com/chart/2917/tallest-buildings/

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Risk Management is still a global challenge

Examples

- **503** bridges collapsed in US 1989-2000 [1];
- Over **26,000** workers died on construction sites in US 1989-2013 [2];
- Over **60,000** on-site fatal accidents happen very year globally [3];

...
Method of identifying current gaps

Traditional risk management in construction projects

BIM and BIM-related technologies based risk management

Literature Review

Interview

Experience

Findings

Findings

Research Gaps
General process of risk management

Concept of ‘Early risk identification and prevention’ required by UK CDM rules

Heavily reliant on multi-disciplinary knowledge and experience

Fragmented risk information management

Capture of ‘correct’ knowledge is challenging within limited time

Risk communication tends to be poor, incomplete and inconsistent

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BIM and BIM related digital technologies based risk management

**BIM**

is becoming a systematic tool for risk management in AEC projects

**Automated rule checking** [2]

**Knowledge based system**

**Reactive IT-based safety systems**

1) Database
2) Virtual Reality
3) 4D CAD
4) GIS

**Proactive IT-based safety systems**

based on sensing & tracking technologies (using real-time data)

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Identified Gaps

1) Lack of a multi-disciplinary system-thinking

2) No theory to support aligning BIM with traditional risk management methods to support the development process of a project;

3) Lack of a standard and colour scheme to support visualising risk in BIM

4) Lack of practical testing and implementation experience
To narrow these gaps?
BIM and KM based Risk Management System

BIM can be the primary data repository for shared knowledge; the visualisation capabilities of BIM could help technicians or decision makers to implement the concept of ‘early risk identification and prevention’.

KM can effectively extract and manage fragmented expert based knowledge and experience, and facilitate data stored in a proper structure, communicated and reused.

Building Information Modelling (BIM)

Traditional Risk Management

Knowledge Management (KM)
Research Objectives

1) Develop a knowledge based risk model that stores risk information and cases in a proper structure;

2) Develop a methodology that can establish the relation between a knowledge based risk model with BIM;

3) Develop a tool based on existing BIM software to implement and validate the proposed methodology through a selected case study.

Research Questions

1) How can a Risks Model for bridge projects be formalized?

2) How can the ‘link’ between Risks Model and Building Information Model (BIM) be formalized?

3) How can a BIM-based tool be developed to support the proposed methodology?
Framework of BKRMS
Development of risk database

- Academic Publications
- Industrial practices or reports
- Standards

Risks Mining

Knowledge based risk database

Risk Breakdown Structure (RBS)
Work Breakdown Structure (WBS)
Risk Breakdown Structure (RBS)

Work Breakdown Structure (WBS)

RBS-WBS Matrix
Case based reasoning library

- Construction Schedule
- 3D BIM
- 4D BIM
- Gaining new cases

BIM Module

- Knowledge based risk database
- SQL query

BIM and Knowledge based Risk Management System (BKRMS)

- “Condition Search” Engine
- Case-based Reasoning Library
- Risk Module

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A trial case study

Dunmow foot bridge on M60, Manchester

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manage and track risks

visualise risks

Microsoft Access

link

AUTODESK NAVISWORKS

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Tool development: technical solution

BIM Environment

User Interface

Risk Database

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Future work plan

1) Further refine risk database, RBS, WBS and CBRL.

2) Establish the theory to link risks with BIM.

3) Develop a tool with user interface based on Revit and Navisworks.

4) Conduct a case study to validate the proposed method and tool.
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THANK YOU
References