Life Cycle Modelling and Design Knowledge Development in Virtual Environments

CRC Project 2001-02-B

CRC Construction Innovation
BUILDING OUR FUTURE

Industry Basis

- **Maintenance data not value adding**
- **Knowledge in maintenance database**
- **Designs should account for maintenance**

Project Team

University of Sydney

John S Gero	Project leader
Rabee M Reffat	Project Manager
Julio Rosenblatt	Research Fellow
Vladimir Kazakov	Research Fellow
Wei Peng	Research Assistant
PakSan Liew	Research Assistant

CSIRO

Lan Ding

QDPW

Teng Hee Tan
David Harrison

Woods Bagot

David Marchant

Project Aims

The purpose of this project is to improve the life cycle modelling of buildings through:

1. **Linking of a 3D model with maintenance data**

2. **Integration of data mining agents into the maintenance process in a virtual environment**

3. **Development of a demonstration computer system**

First Report: Preliminary Report on Scope of the Project

- Background
- Existing Life Cycle Models (LCM) of Building
- Existing Commercial Data Management Systems
- Survey of Available Industry Data
- Data Mining Approach for LCM in the AEC Industry
- Proposed Framework
- Conclusions and Future Milestones

III. Summary

- **Virtual environments provide an interactive interface to improve communications and enhancing predictable strategic planning**
- **IFC-compliant object oriented database in standardizing the data exchange and facilitating the manipulation, reusability of project information.**
- **The linkage of maintenance data to 3D CAD model provides the potential of future development of intelligent life cycle analysis**
- **However, no use of data mining of the hybrid and no performance-gaining life cycle analysis.**

Survey of Available Industry Data

- CAD data from Queensland Department of Public Works (QDPW)
- Maintenance data from QDPW
- CAD data from Central Sydney Area Health Service (CSAHS)
- Maintenance data from CSAHS
- CAD data from Woods Bagot

Second Report: Preliminary Analysis of Maintenance Data from CSAHS

Data Mining Approach Focusing:

- **Components that frequently need maintenance**
- **Historical consequences of maintenance decisions that may inform future decisions**
- **Components of buildings that significantly determine maintenance cost which may inform future building designs**

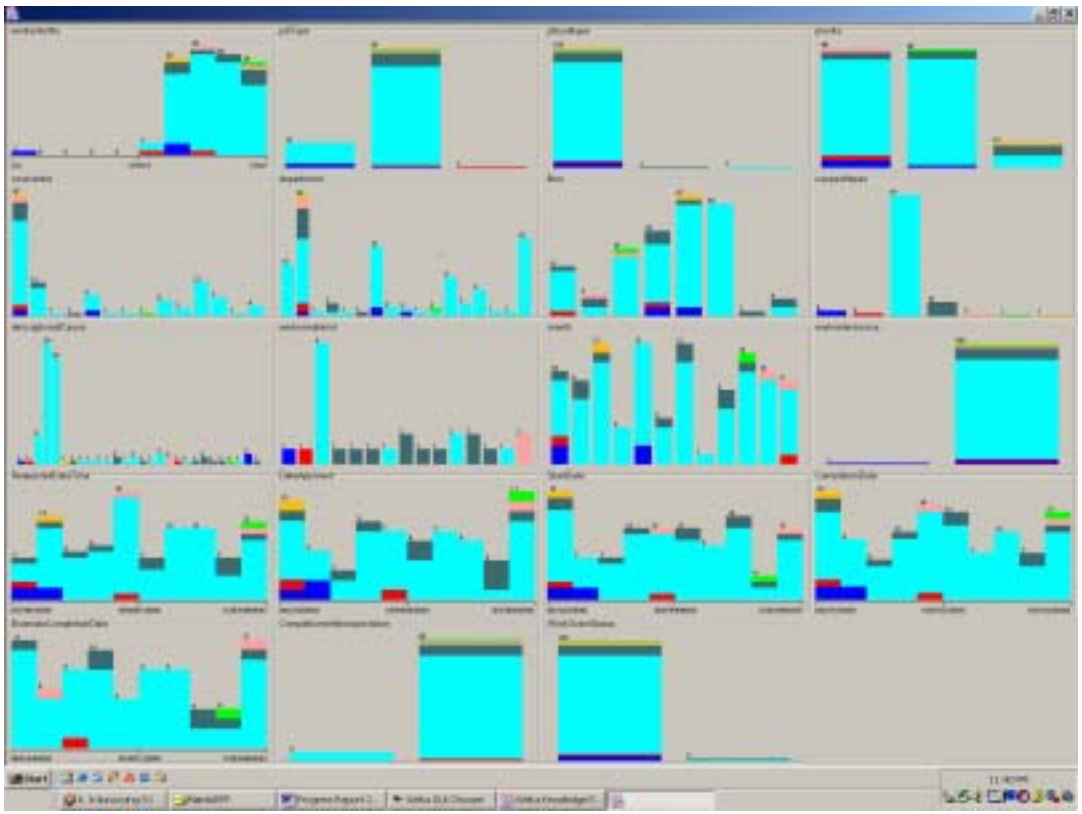
Preliminary Data Mining Results

The percentage of work orders completed (or cancelled) within a certain number of days is shown in Figure

Figure. Percentage of work orders completed (or cancelled) by the number of days indicated. The duration is measured from the time the work order was requested.

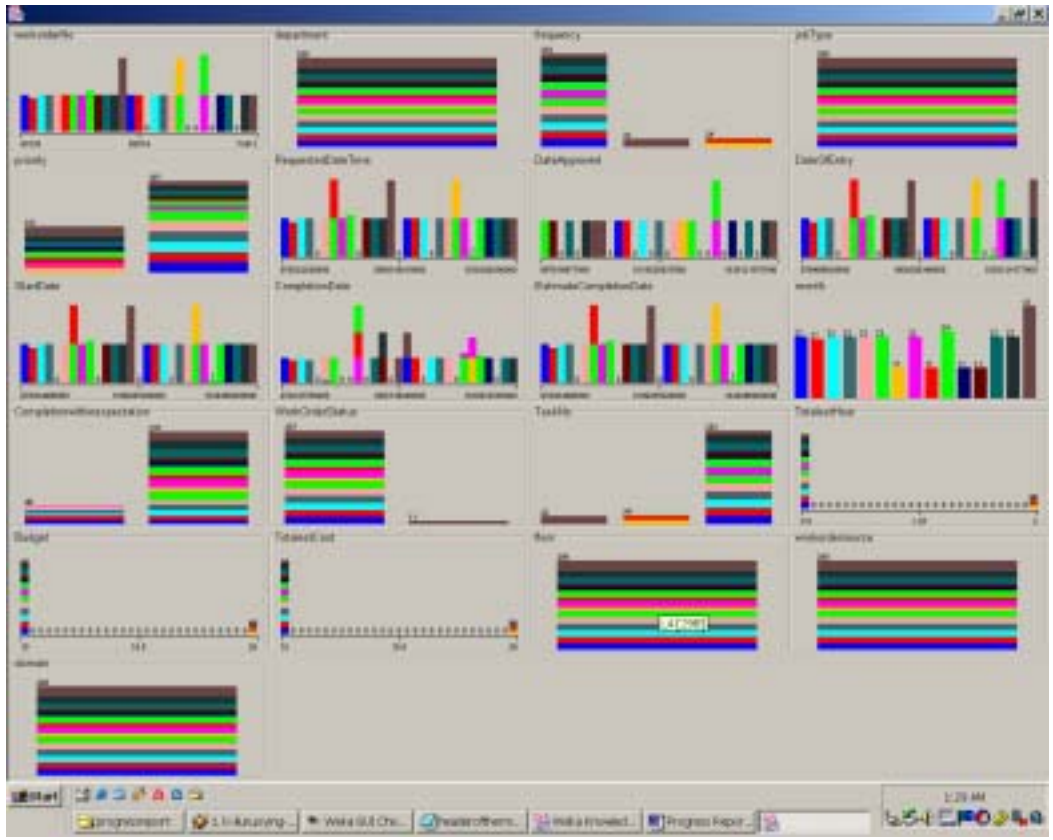
Preliminary Data Mining Results

Histogram of cause of repair

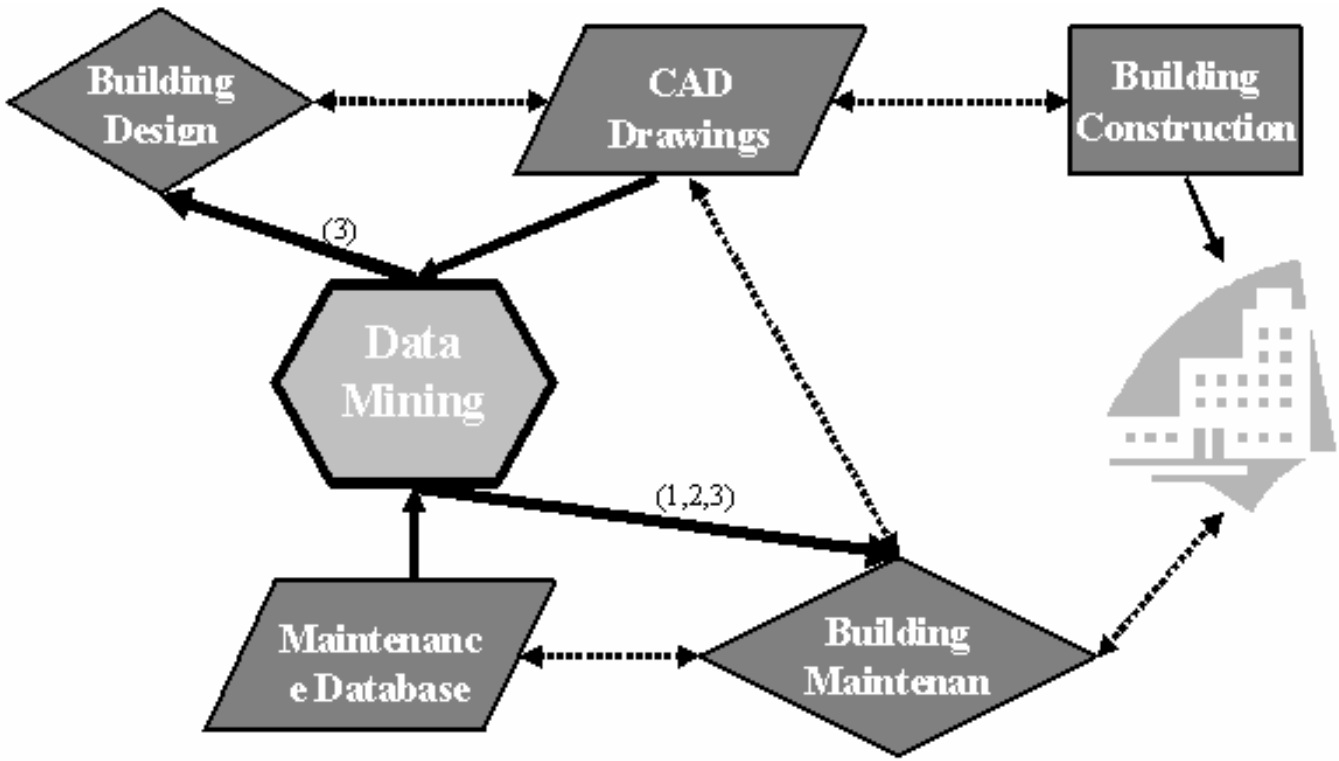


Preliminary Data Mining Results

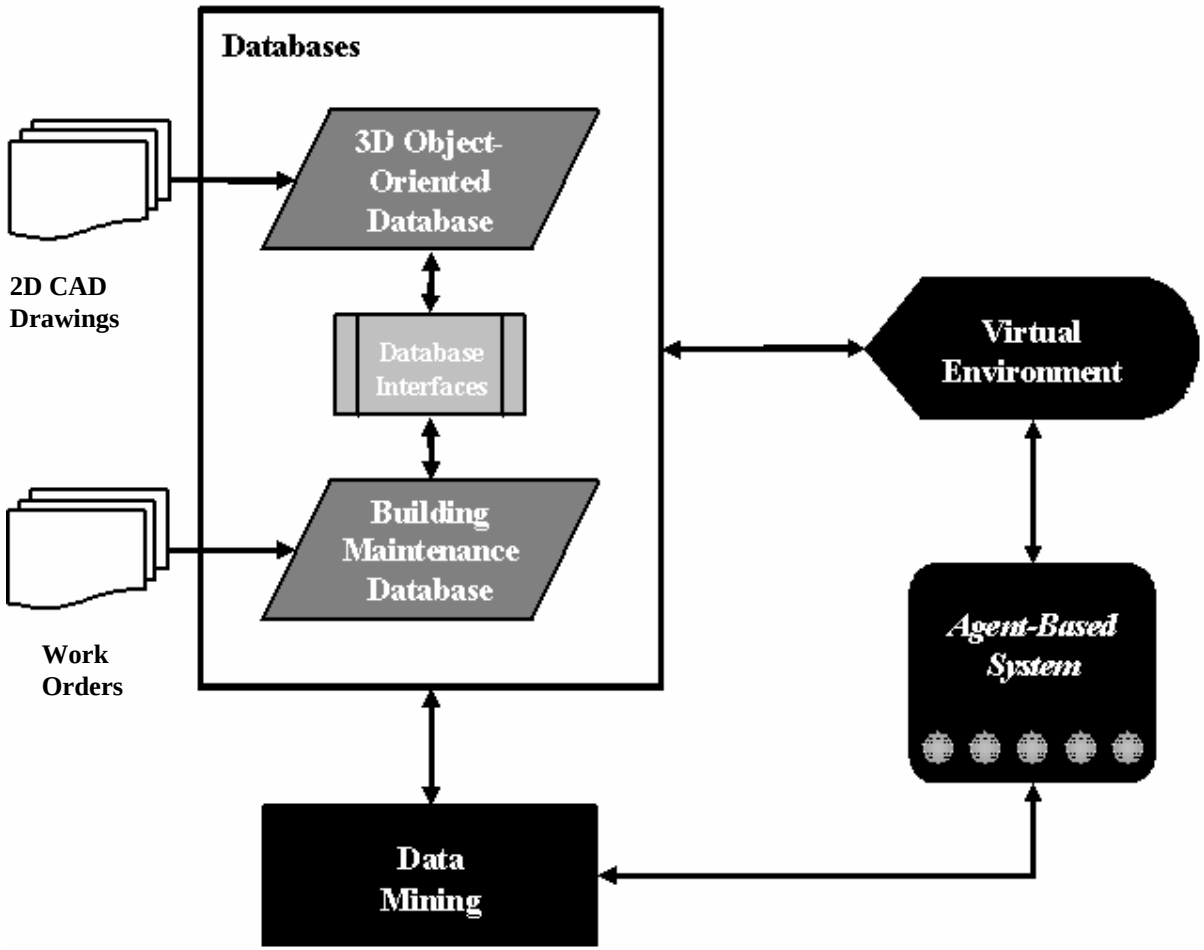
Histogram of month of repair



Data Mining Approach for LCM in AEC



Proposed Framework of LCM in Virtual Environments



Potential Further Development

- **Estimate reliability of maintainable systems from components**
- **Estimate maintainability in early design stages**