A FRAMEWORK FOR REFURBISHMENT OF HEALTHCARE FACILITIES

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Author:  Mr. Amey Sheth  
email: A.Sheth@lboro.ac.uk

Co-authors: Professor A. D. F. Price and Dr. J. Glass

Department of Civil & Building Engineering
Loughborough University
Leicestershire
England
LE11 3TU. UK

HaCIRIC
Health and Care Infrastructure Research and Innovation Centre

UNIVERSITIES OF SALFORD and READING, IMPERIAL COLLEGE
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INTRODUCTION

- Explores facilities built in the **late 20th century** onwards with a **key focus** being the energy consumption of these facilities
- Increasing use of **BIM** and **simulation** tools for **speedy** and **improved delivery** of construction projects
- Importance to new construction and consideration to initial cost during refurbishment

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**REFURBISHMENT**

- Whole life-cycle cost
- Quality of the refurbishment project
- Economic efficiency
- Performance
- Environmental impact (sustainability)

*Building Information Modelling*
RESEARCH METHODS

- Aim to **integrate/interface** existing tools
- Literature review + a questionnaire **survey**, face-to-face **interviews** and site **visits** to various hospitals
- A **protocol** was developed with three key sections
- **Pilot study** followed by questionnaire survey
- 43 questionnaire responses and 11 face-to-face interviews
CONSIDERATION DURING REFURBISHMENT (Continue..)

- Communication
- BIM should not be dominating
- Consideration to location of patients’ rooms and users
- Inform (provide detail) users about construction
- No phasing plan is perfect and be ready for challenges
- Be prepared for unforeseen problems
- No scope of work is perfect

<table>
<thead>
<tr>
<th>For refurbishment</th>
<th>For existing buildings and users</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Communication between the design team, hospital staff, patients, and users is important</td>
<td>User is aware of at least the next 10 construction moves/activities.</td>
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<td>2. The use of BIM is suggested but should not be dominating.</td>
<td>It is difficult to locate mechanical services and utilities; be ready for surprises.</td>
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<td>3. Any planned construction activity away from and with consideration to patients’ rooms will help the smooth running of a project.</td>
<td>There might be harmful fumes, gases released (e.g., at roof level) from existing building in use, which can affect ongoing work.</td>
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<td>4. Provide details about where the construction team will be working.</td>
<td>Conduct a pre-investigation before starting any works.</td>
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<td>5. No phasing plan is perfect, and there might be challenges to execute planned activities.</td>
<td>Be prepared to have back-up equipment to support running of mechanical plant.</td>
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<td>6. Because of obstruction to existing users, be prepared to accept some unforeseen problems.</td>
<td>In some cases there may be a need to work with minimum available clear height, space, or time.</td>
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<td>7. No scope of work for refurbishment is perfect.</td>
<td>Always carry out an investigation on completion of work, irrespective of scale of work.</td>
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### CONSIDERATION TO EXISTING BUILDINGS AND USERS

- Difficult to locate mechanical services
- Release of harmful fumes/gases
- Constraints due to existing buildings (e.g. Height, space, time)
- Investigation before any work
- Back-up equipments to support operational parts of the facilities
- Investigation after any work

**Table 1: Points to be considered in regard to existing building and users**

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AIM, OBJECTIVES, GOALS

- Objectives related to design
- Objectives related construction

- Goals for existing buildings
  - Sustainability
  - Corporate commitment
  - Well planned programme

# PHASE-I-IV, MEASURES and SUMMARY

**Table 2: Phase I - ‘Proposal’ during refurbishment of healthcare facility**

<table>
<thead>
<tr>
<th>Measures</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Compliance with progressively tightening building regulations</td>
<td></td>
</tr>
<tr>
<td>2. Provision of Energy Performance certificate (EPC)</td>
<td></td>
</tr>
<tr>
<td>3. Better comfort, satisfaction, and productivity</td>
<td></td>
</tr>
</tbody>
</table>

**Table 3: Phase II - ‘Design’ during refurbishment of healthcare facility**

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<th>Summary</th>
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<td>1. Passive measures (day-lighting to reduce need for artificial light)</td>
<td>1. Keep the low carbon theme up front</td>
</tr>
<tr>
<td>2. Upgrading of building fabric (insulation, windows) to improve ‘Construction’ and ‘Use’</td>
<td>2. Develop an integrated low carbon design and whole life costing</td>
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</table>

**Table 4: Phase III and IV summary- ‘Construction’ and ‘Use’**

<table>
<thead>
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<th>Phase III Construction</th>
<th>Phase IV Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Selection of appropriate contractor and subcontractor</td>
<td>1. To make sure operator and occupants understand the building</td>
</tr>
<tr>
<td>2. Ensure effective project management</td>
<td>2. To conduct post-occupancy evaluation</td>
</tr>
<tr>
<td>3. Get buy-in from site works</td>
<td>3. To make changes depending on energy use and comfort conditions</td>
</tr>
<tr>
<td>4. Monitor site progress against objectives</td>
<td>4. Make the most of the low carbon building</td>
</tr>
<tr>
<td>5. Energy monitoring</td>
<td>5. Meet building regulations</td>
</tr>
<tr>
<td>6. Satisfaction of aim, objectives, and goals</td>
<td>6. Improved energy performance after refurbishment</td>
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- Proposal
- Design
- Construction
- Use
DISCUSSION OF INVESTIGATION

INPUTS

- Do nothing
- Refurbished
- New facility

Consideration to infection control
Detailed survey
Preserve existing character
Quality of indoor environment
Occupancy evolution

KEY STAGES

DEVELOP BUSINESS CASE
COMPARE POSSIBLE SOLUTION
MASTER PLANNING & PHASING
OVERALL ASSESSMENT
PROJECT PLAN
BIM MODEL
ENERGY MODELLING & SIMULATION

OUTPUTS

Possible solution
Quality of indoor & outdoor environment
Scope of work, advance planning
Facility performance
Estimated project cost
Energy usage
PROPOSED CONCEPTUAL FRAMEWORK

Pre-refurbishment Phases:
1. Business case
2. Define aim, objectives, goals
3. Master planning
4. Targets

Post-refurbishment Phases:
1. Detailed survey
2. Options for energy & carbon reduction
3. Monitor progress
4. Inform users

Construction Phases:
1. Maximum recycle
2. Safe disposal of waste
3. Notes for facility managers, etc.
4. Satisfy regulations

Tools/process:

Purpose:
- Think
- Propose
- Develop
- Integrate
- Implement
- Verify
- Validate

Support system:
- A. Pre-project survey
- B. Lessons from other projects
- C. Healing environment
- D. Evidence based design

Support:
- A. Modelling
- B. Energy targets
- C. Carbon targets
- D. Comparative studies

Pre & post Refurbishment evaluation and feedback to design team, etc:
- A. Modelling
- B. Energy targets
- C. Carbon targets
- D. Comparative studies

A. Simulation
B. Solar studies
C. Visualisation
D. Testing & validation

A. User feedback
B. Project learning
C. Virtual model for future
D. Project evaluation

A. Pre-project survey
B. Lessons from other projects
C. Healing environment
D. Evidence based design

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DISCUSSION & CONCLUSION

- Refurbishment is **neglected** area

- **Age** is important factor but refurbishment cannot be predicted only on the basis of age

- Limited or no consideration to **re-designing** and **re-planning** resulting in no significant improvement in building performance, post-refurbishment

- **Lack of frameworks** to implement BIM with refurbishment projects

- Possible to achieve significant energy saving with **sophisticated planning** & **mechanical system**

- Integration of **BIM** and **simulation** during refurbishment

- Energy saving should be achieved without comprising patient comfort.

- Framework is for designers, facility managers, client
FURTHER READING


THE ROYAL VICTORIA HOSPITAL, BELFAST, N. IRELAND

Recently completed refurbishment

Ongoing refurbishment + extension project
THANK YOU

Author: Mr. Amey Sheth

email: A.Sheth@lboro.ac.uk

www.haciric.org  www.lboro.ac.uk