Exploring Potentials for the Application of Simulation Methods in Construction Projects Delivery in New Zealand

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Rationale and Significance of the Study

1. Two Main priority area based on BBNZ (Building a Better New Zealand): 1-1/ Automation, Industrialization, and New Technology, 1-2/ Productivity

2. DBH (Department of Building and Housing) Taskforce Report on Construction Productivity


4. New Methods of Construction in Bridge Construction Projects: Twin Truss Gantry in Bridge Launching Construction

5. Inherent features of Construction Projects: Uniqueness, Uncertain, Repetitive, Complex Interactions among Projects’ activities

**Knowledge Gap**

- **KG1** • Lack of concept on the integration of modelling methods in construction planning/managing.

- **KG2** • Lack of interest on using new technology in complex and unique projects like construction operations.

- **KG3** • Insufficient knowledge on system behavior in specific operations comprising particular resources (machines like gantry crane).

- **KG4** • Low productivity due to inadequate planning in highly repetitive, dynamic, unique, and complex projects.

Research Questions

RQ1 • In which **aspects** are simulation modelling tools applicable in construction projects?

RQ2 • What is the link between a **project’s WBS** and **simulation modeling progress**?

RQ3 • Is a simulation tool **applicable for improving productivity in the New Zealand construction sector**?

RQ4 • How does **simulation facilitate Construction Scheduling Progress**?

To develop a simulation technique using Stroboscope engine that could be integrated into traditional planning tools such as MSProject, Primavera etc. with a view to facilitate planning and scheduling of bridge construction projects.

**Research Objectives**

**Obj.1**
- Determination of modelling techniques/methods/languages applicable to the construction industry.

**Obj.2**
- Creating a specific WBS/conceptual framework, and system specifications to align the case study project characteristics with the simulation technique/tool’s Standards.

**Obj.3**
- Modification and Development of the modelling method to make it more adaptable to NZ construction sector and specifically in Bridge Construction Works.

Simulation is a Powerful Tool to Support Decision Making

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Why Supporting DM?

- **Uniqueness**
- **Complexity**
- **Dynamic**
- **Uncertain**
- **Repetitive**

- Resource utilization
- Changing the structure of project in reality
- Wrong decision on the selection of the best strategies

Difficulties in Planning Process

** Model input parameters **

Amount of soil in m³ : 10000  
Number of trucks : 5  
Truck cost ($/hr) : 48  
Excavator cost ($/hr): 65  
Overhead cost ($/hr) : 75

** Calculated results after simulation **

Hrs needed to move material: 51.7635  
Production rate (m³/hr) : 193.283  
Unit cost ($/m³) : 1.96603

** Calculated results after simulation **

<table>
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<tr>
<th>Run</th>
<th>Hrs</th>
<th>ProdRate</th>
<th>UnitCst</th>
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<tbody>
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<td>5</td>
<td>52.1091735</td>
<td>192.000742</td>
<td>1.97915902</td>
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</tbody>
</table>

Average: 51.9029729  
Std Dev: 0.18656115  
Minimum: 51.7088068  
Maximum: 52.1091735

Simulation Procedure

- Defining the Nodes, Required Conditions, and Outputs.
- Identifying the types of link between Queue and Activity.
- Assigning the annotations to the link.
- Estimating the duration of each Activity.
- Parameterizing the models.
- Customizing Output.

# Implementing the simulation on the real construction project

Running the simulation model based on the data obtained from the first round of data collection

Analysing the different scenarios resulted from simulation and modelling module

Selection of the best resource combination

Reiteration of the modelling based on different simulation strategies

Selection of the best strategy

Updating the model within the second round of data collection when the construction of the next ramp will be in progress

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<table>
<thead>
<tr>
<th>Topic</th>
<th>Details</th>
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<tbody>
<tr>
<td>Sensitivity analysing using both simulation and SPSS</td>
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<tr>
<td>Measuring the impact factor and developing the simulation database</td>
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<tr>
<td>Comparison of the schedule resulted from simulation with the plan resulted from any scheduling tools which have already been applied in the case study</td>
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<td>Organizing a training workshops</td>
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References


Al-Ghtani, K. Application of Simulation in Construction Processes (Planning and Modeling of Construction). In E. C. King Saud University, Civil Engineering Department (Ed.)


Thanks for your attentions!

Any Questions???