

Development of an Intelligent Manufacturing Management Simulation Model: An Application to the Precast Concrete Industry



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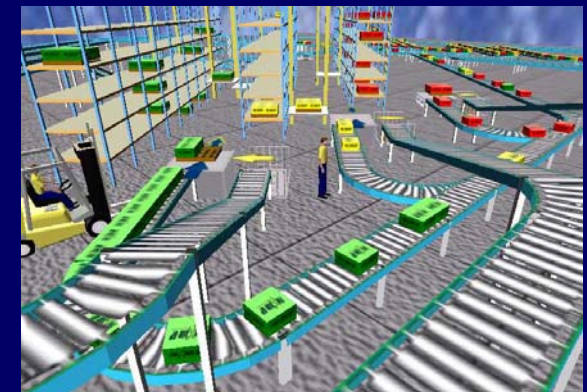
Research Aim

- Improve the performance of the precast concrete manufacturing system.
- Develop and test an evolutionary meta-heuristic approach embedded in simulation models



Research Objectives

- Design a process mapping
- Develop a simulation model
- Develop an optimisation engine embedded in the simulation model.



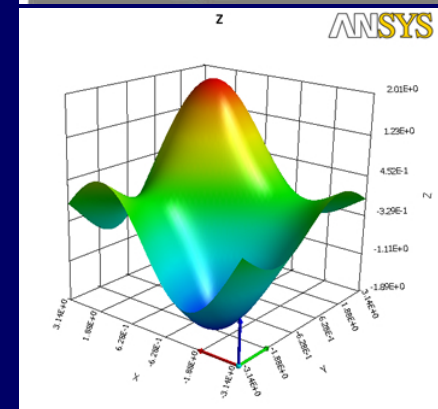
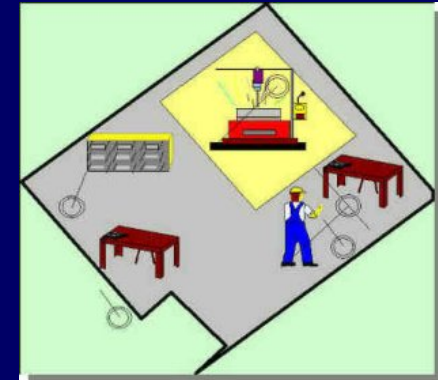
Research Methodology

- 1. Review state-of-art simulation applications in precast industry
- 2. Development of process mapping using visual modelling language (IDEF0)
- 3. Data Collection



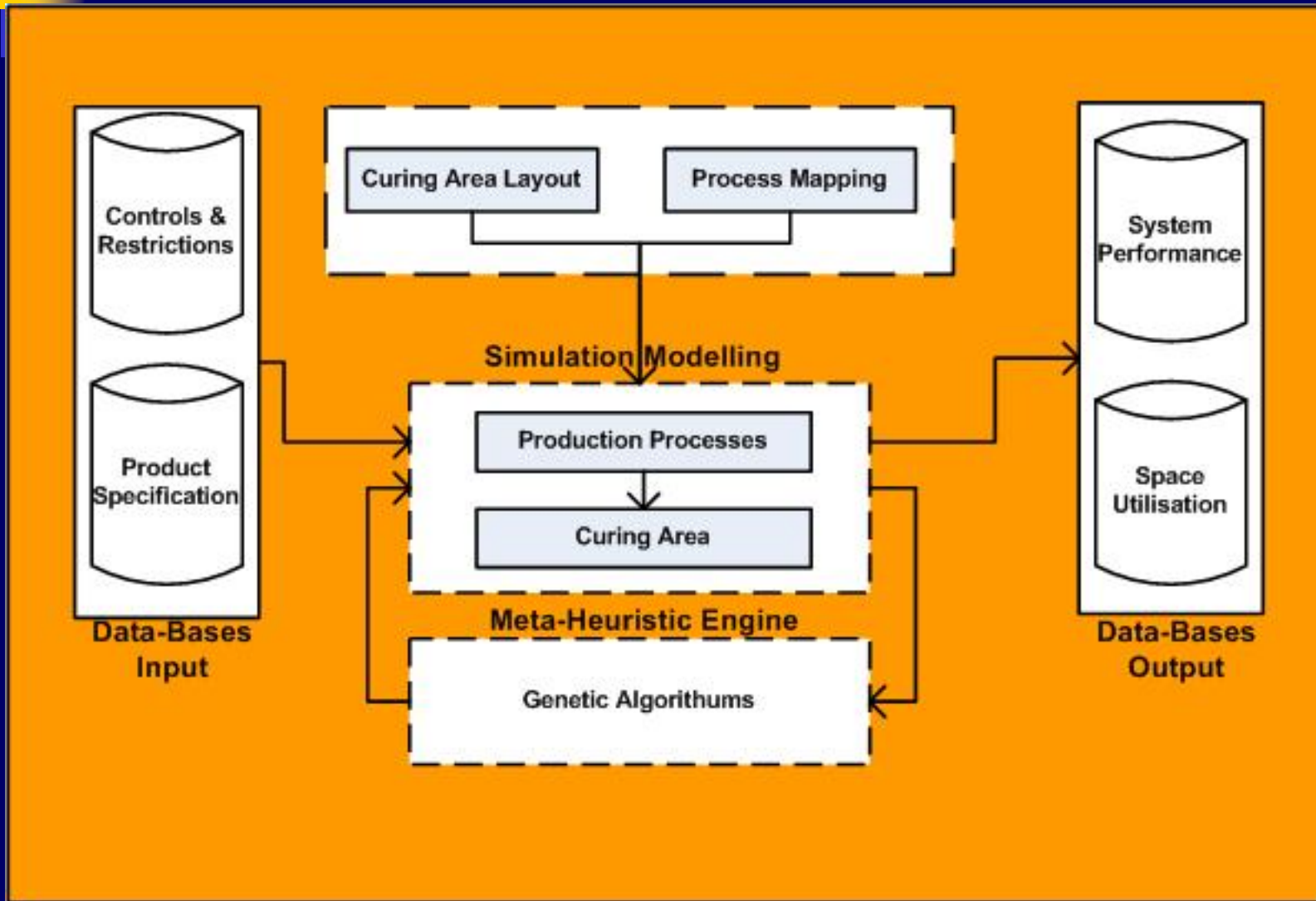
Research Methodology (Cont)

- 4. Developing a simulation model
- 5. Developing an optimisation engine.
- 6. Running of a case study



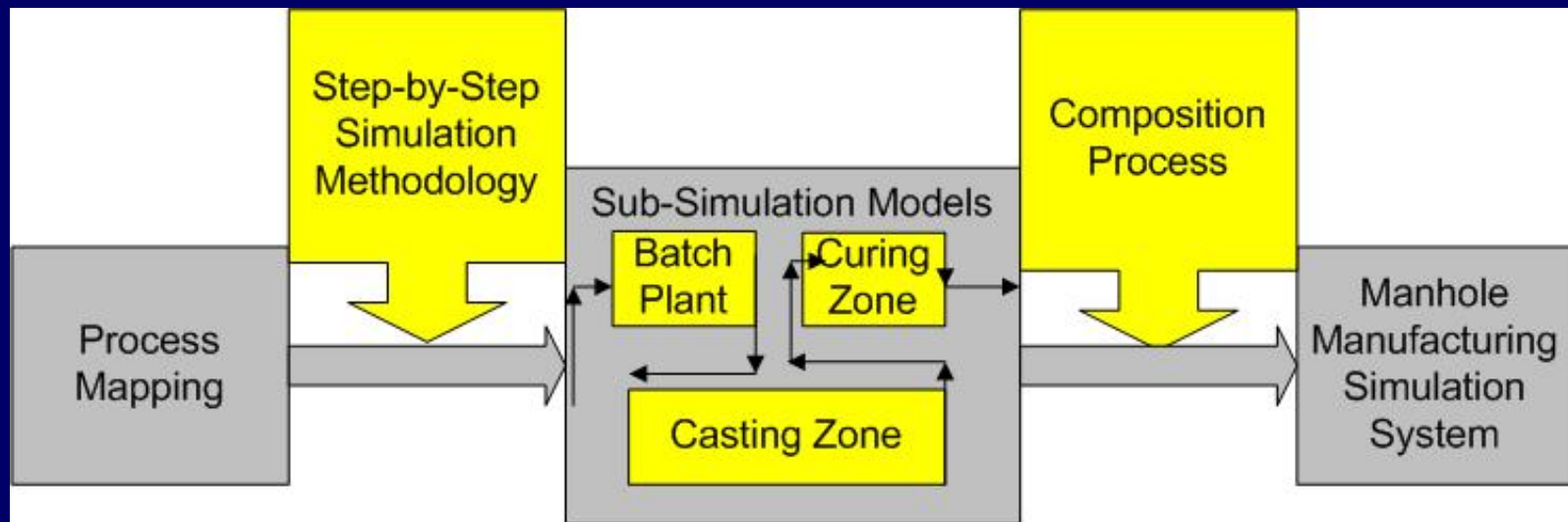
System Framework

Precast Industry

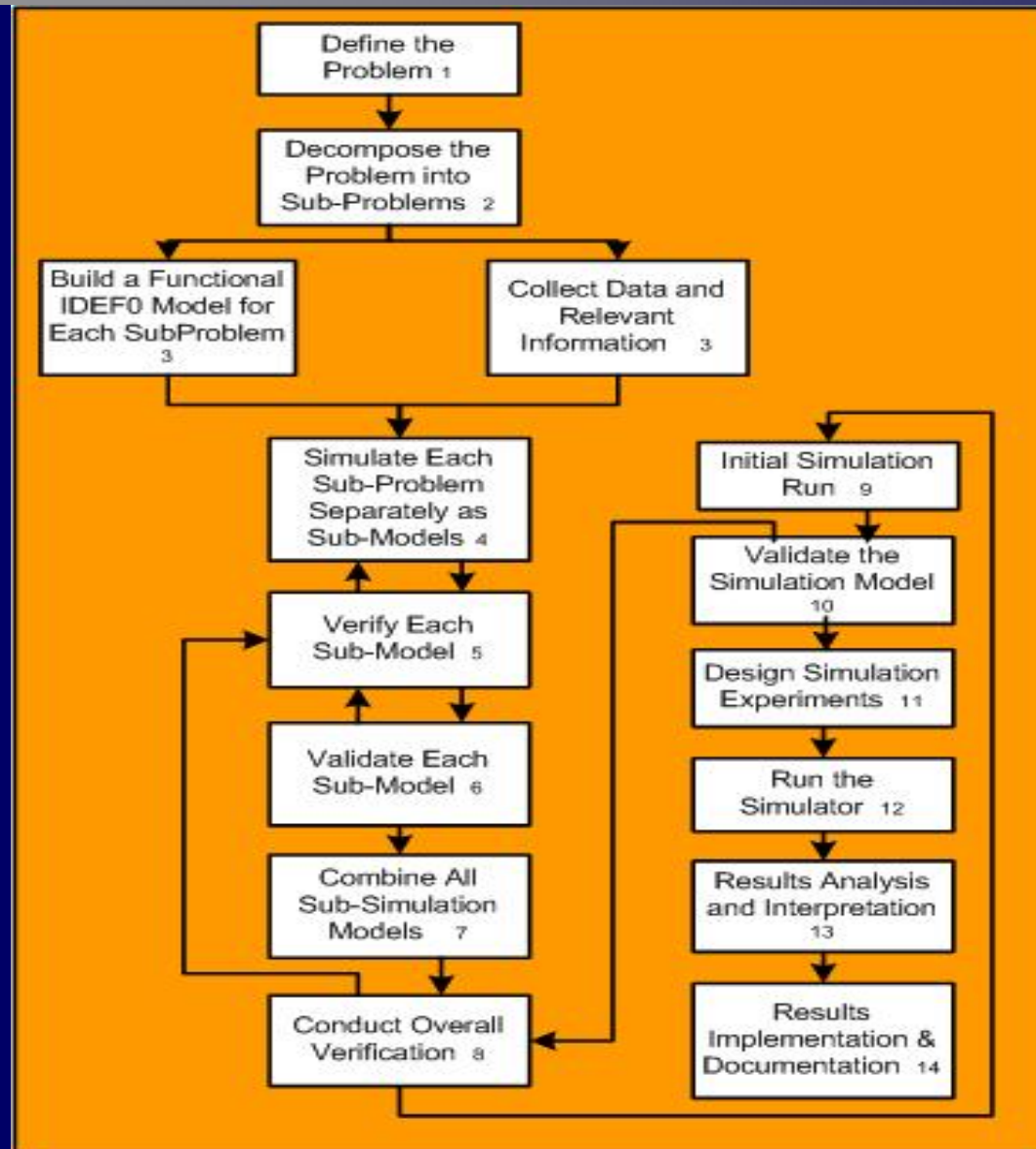


The Used Techniques

- Process Mapping Technique (IDEF0 Diagrams)
- Step by Step Simulation Methodology
- General-Purpose Simulation Language (ARENA)



Step by Step Simulation Modelling



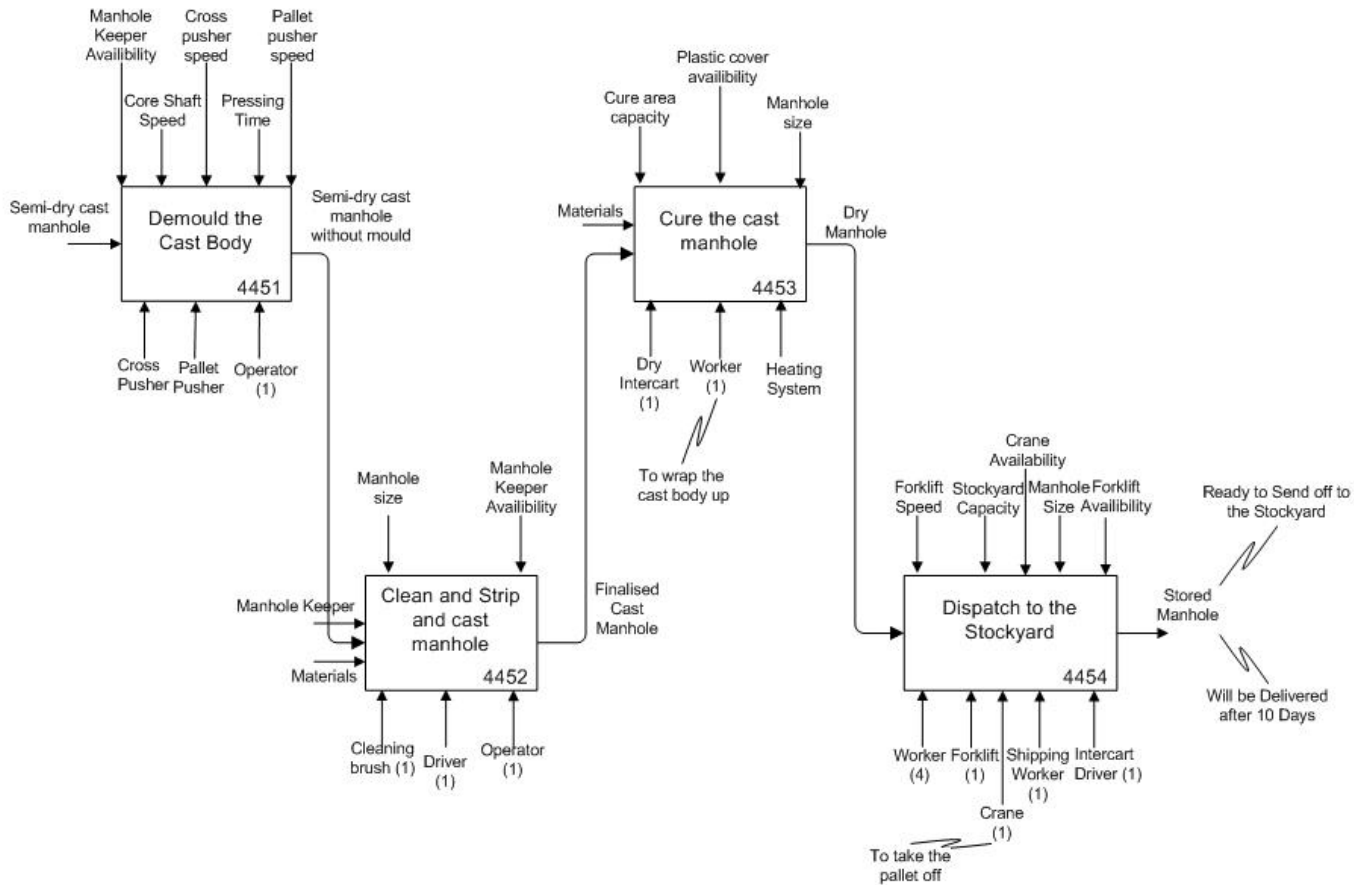
Case Study: The Precast Industry

- The case study we are going to present here is for one of the most specialised precast supplier companies in the UK.
- Manhole precast product is considered as one of the precast concrete product families.



Process Mapping

Precast Industry



Some Flowcharts and Pictures

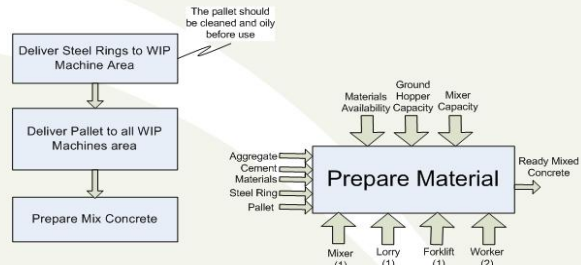


Figure (6): Materials preparation for the manholes manufacturing process with some details



Picture (1): Snapshot of the batch plant



Picture (2): The main silo with five partitions



Picture (3): Three pipes to pump the cements up to the silo



Picture (4): One stack of oily and cleaned pallets



Picture (5): Aggregate stored into the WIP area storage



Picture (6): The Ground hopper to receive gravel and sand

Prepare Material Process

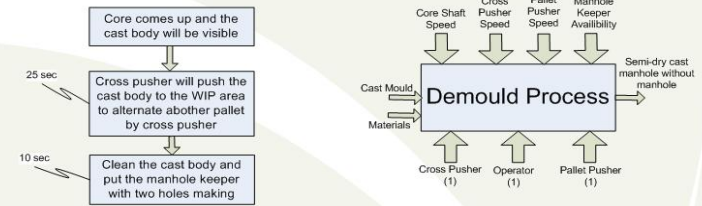


Figure (11): Demould process for the manholes manufacturing process with some details



Picture (20): The core comes up to make the manhole visible



Picture (21): The cross pusher is pushing the manhole off



Picture (22): The manhole is waiting the cross pusher



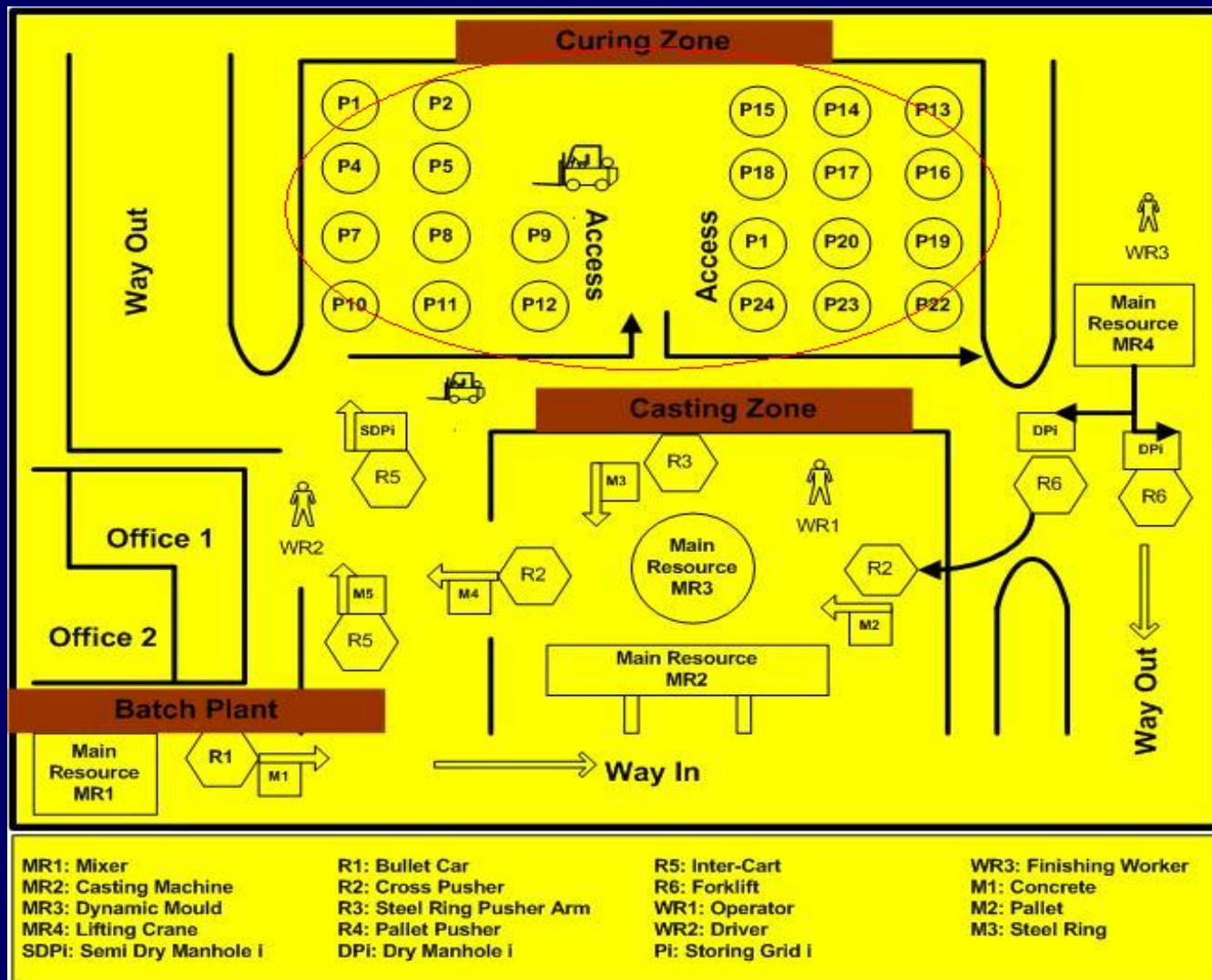
Picture (23): A manhole is pushed by the cross pusher



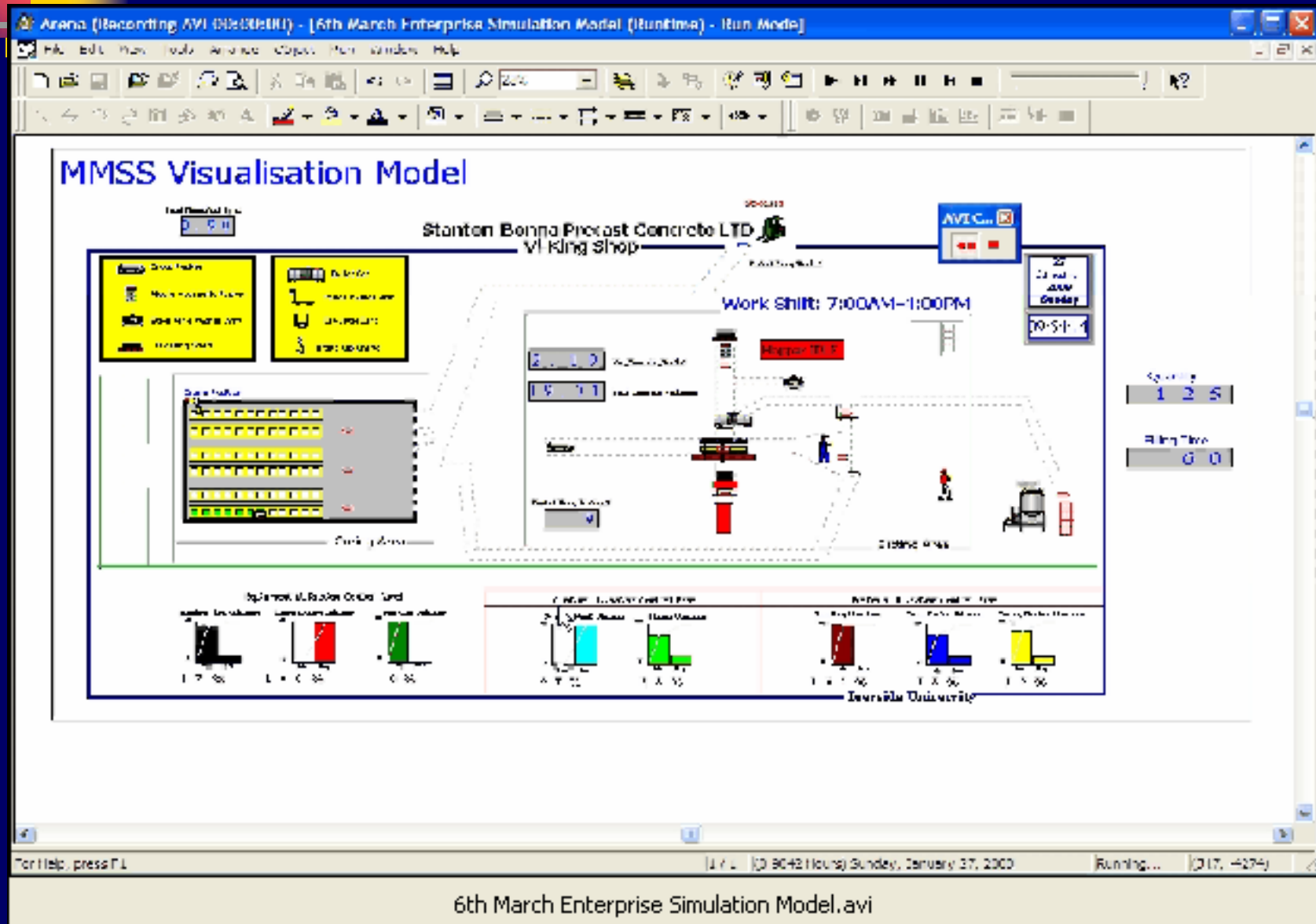
Picture (24): Short length manhole waiting in the WIP area for some finishing works

Demoulding Process

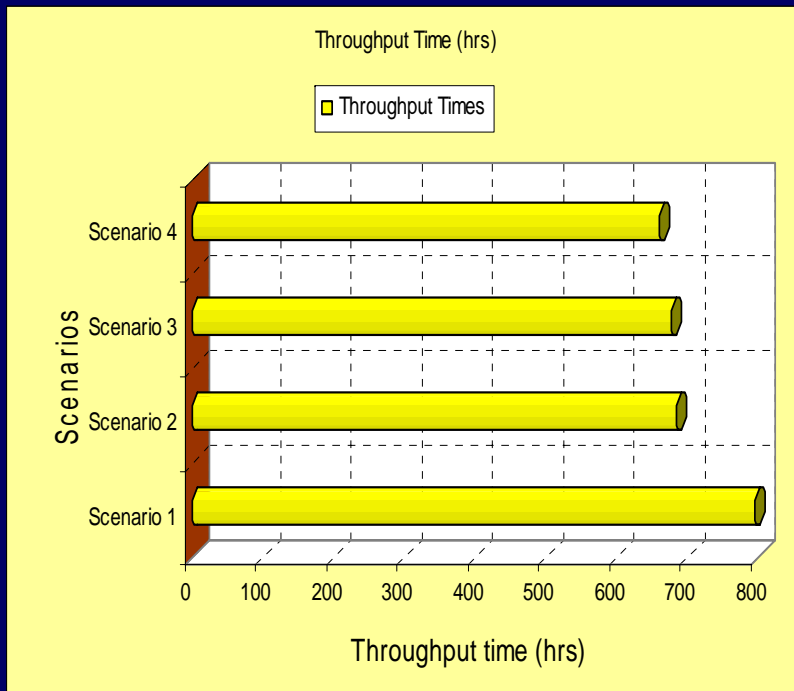
Conceptual Model



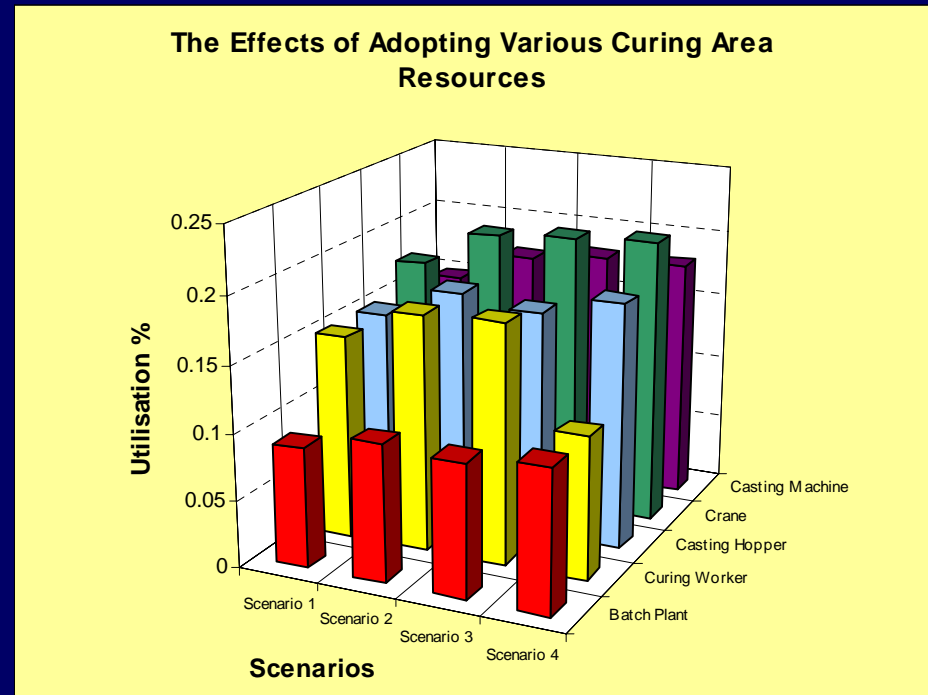
Visualisation of the Simulation Model



Initial Experimentation

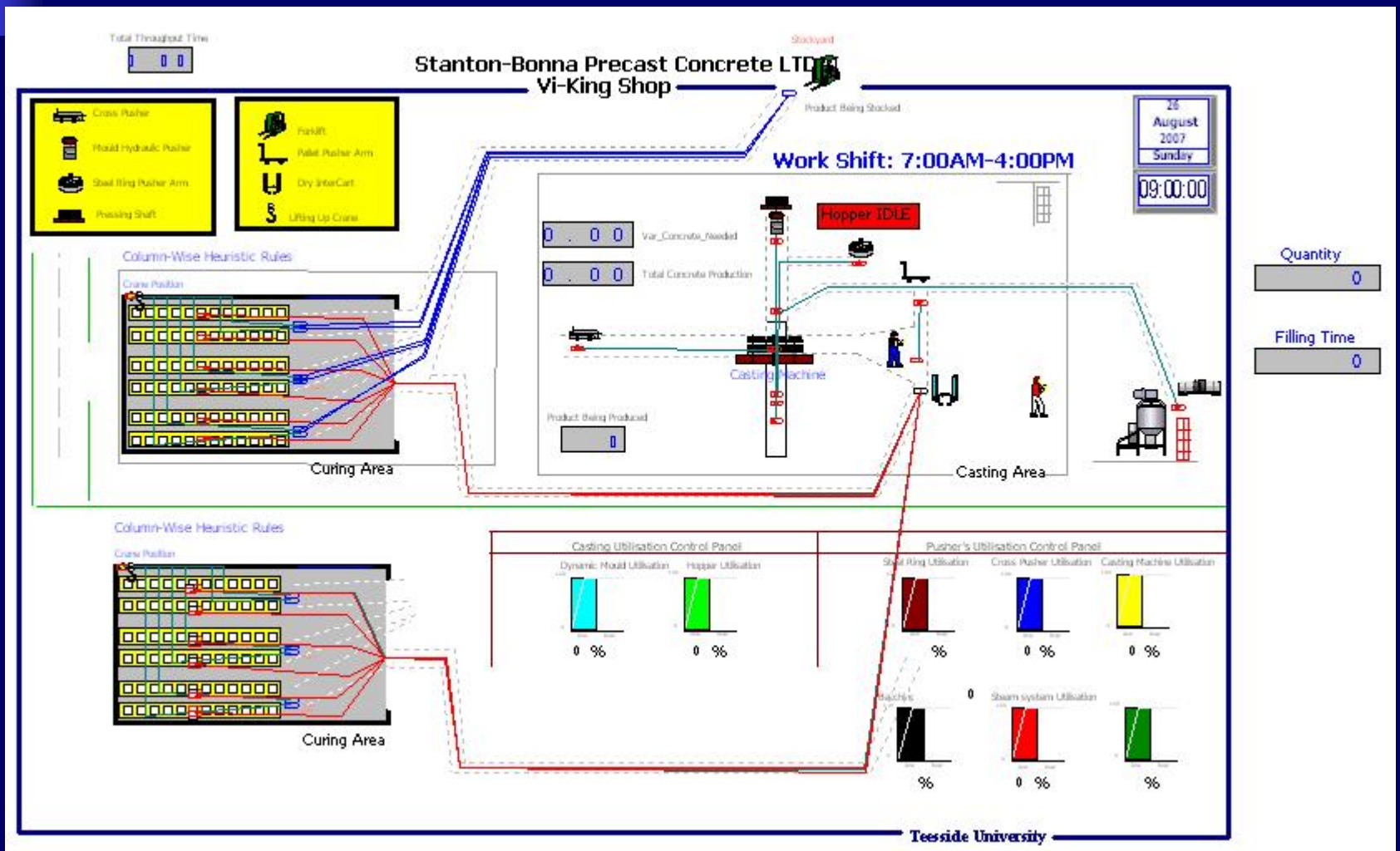


Throughput Time



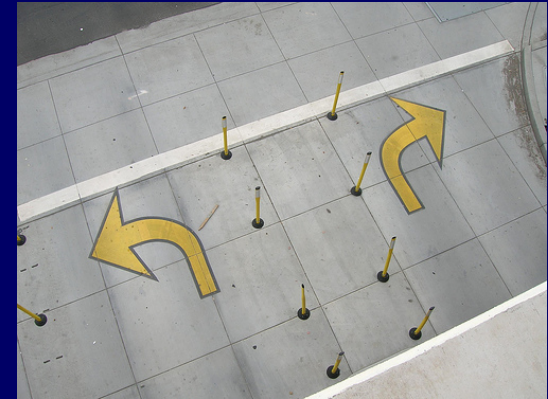
Resource Utilisation

Development of the Curing Area



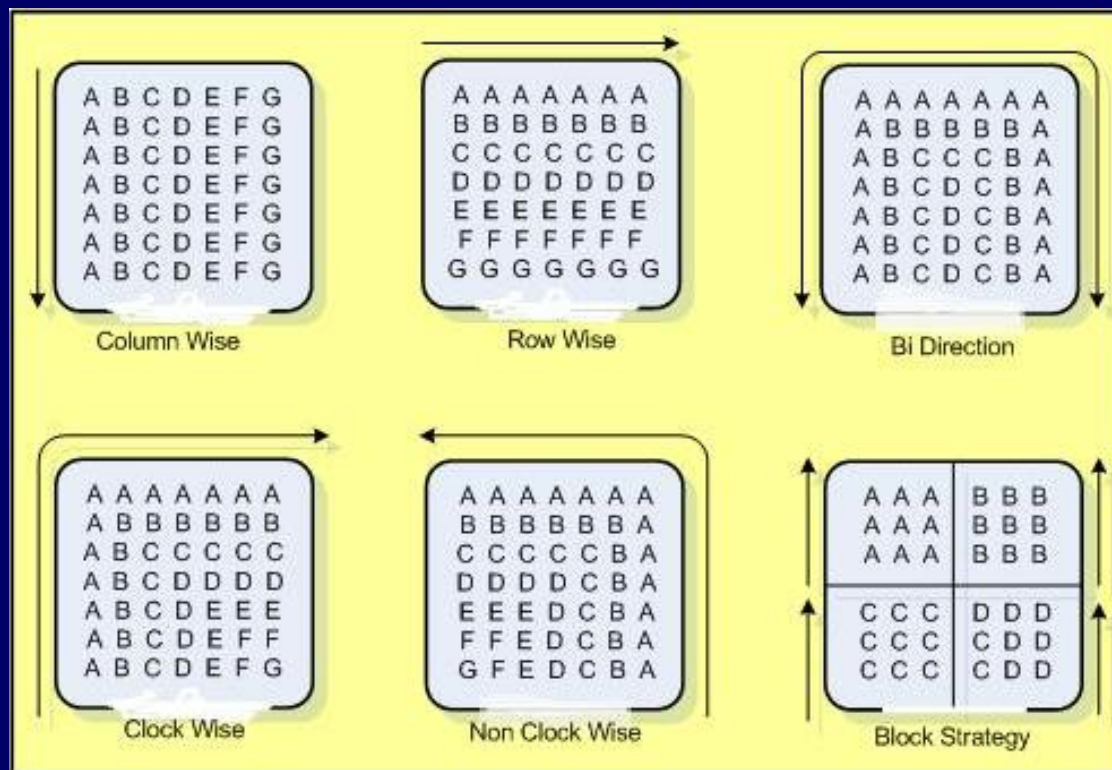
Scenarios of Development

- Develop different Heuristic rules to accommodate products.
- Curing area layout
- Available type of resources (speed, capacity)
- Change the type of production rate pattern (low, medium and high)
- Shift patterns (8 hrs, 24 hrs)
- Double the heating system capacity (4 hrs instead of 8)

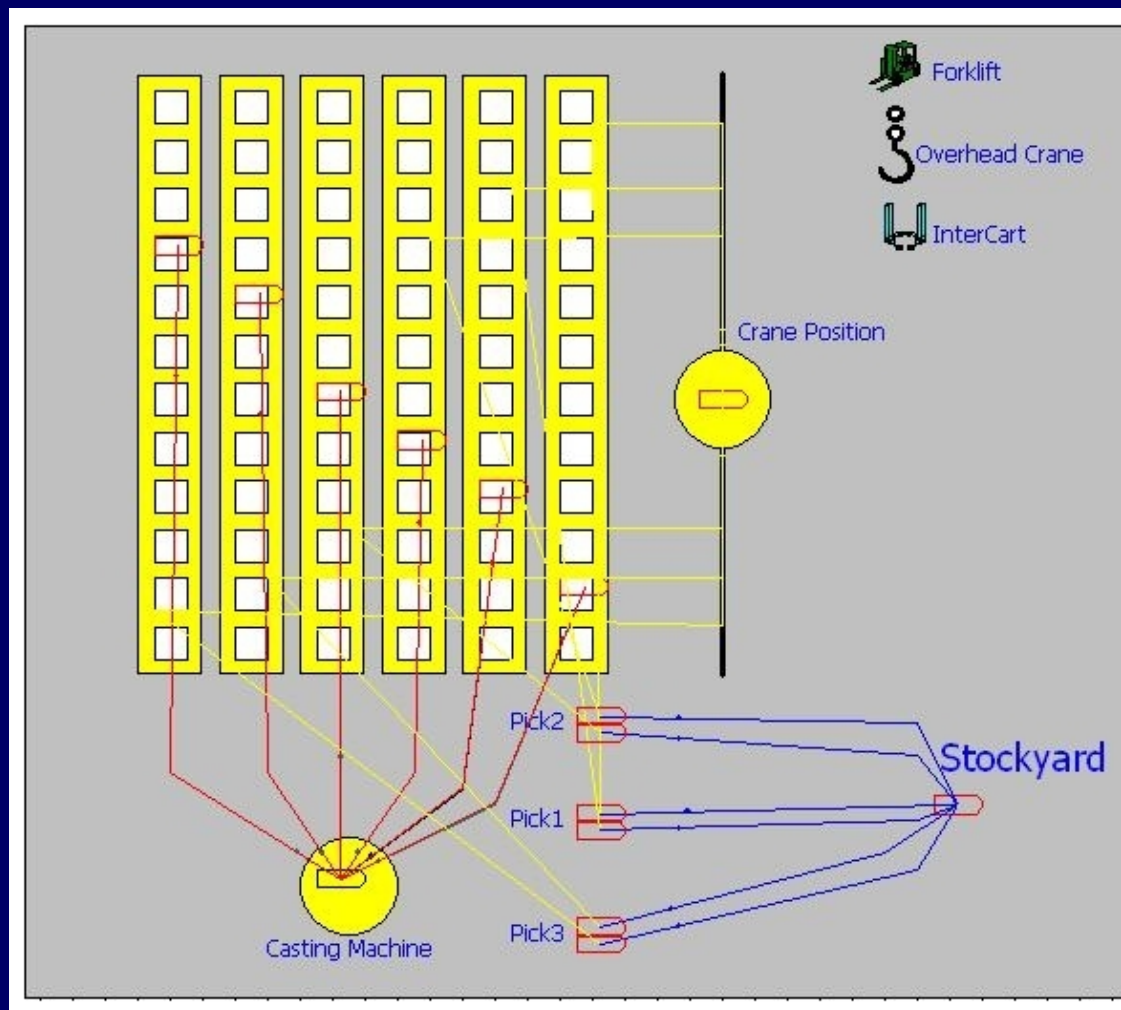


Method of Accommodating Products

- Several heuristic rules will be developed as:



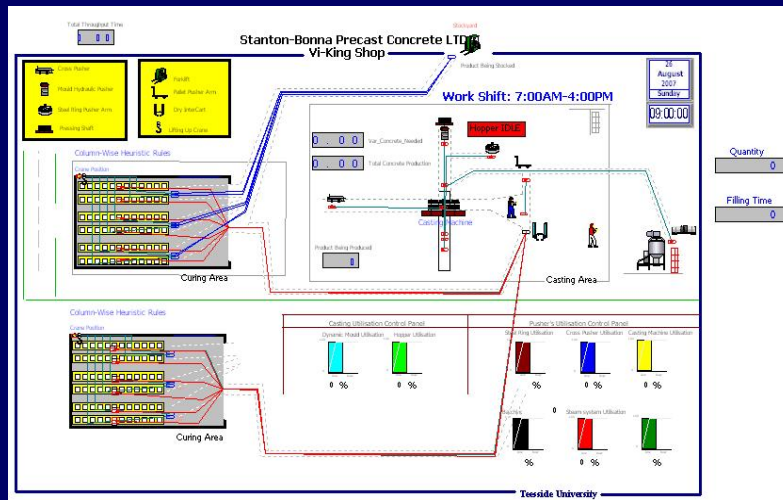
Curing Area Modelling- Heuristic Rule 1



Looking a Head

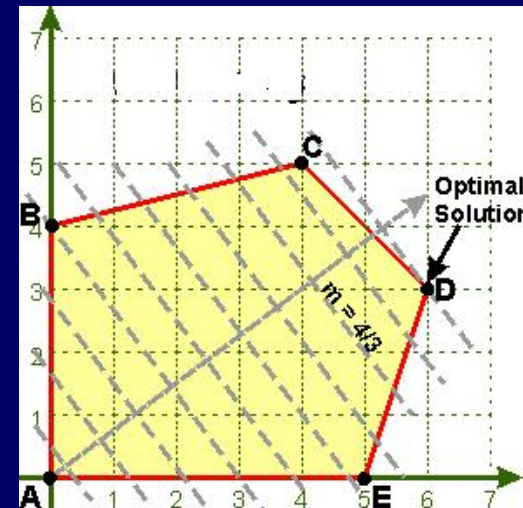


Future Developments

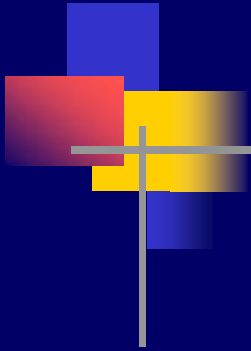


Simulation Model

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Optimisation Engine



Thank you

Any Questions ?