Prevention of Berthing Pains:
Flexibility in the Design of a Marine Dock for Bulk Liquid Chemicals Loading

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Background

- Bulk marine shipping is the primary mode of transport
- Marine dock idle capacity and over capacity both carry large cost penalties
- Design can be componentized for adding flexibility

Image Source: [http://upload.wikimedia.org/wikipedia/commons/0/07/Loading_Arm_KLE.jpg](http://upload.wikimedia.org/wikipedia/commons/0/07/Loading_Arm_KLE.jpg)
Approach

- Four design scenarios
- Monte-Carlo simulation and decision rules
- Based on Master’s thesis project with sponsor company
- Mix of stochastic and deterministic variables

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<th>Stochastic Variables</th>
<th>Deterministic Variables</th>
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Simulation Results

Inflexible, Low Capacity

Inflexible, High Capacity
Simulation Results

Flexible, Single Stage

Flexible, Multiple Stages

Comparison
**Additional Analysis**

- Flexible scenarios yield highest NPV and lowest PV Capital Expenditure
- Significant Capital Expenditure is delayed to later years with flexibility
- A hybrid of the multi-stage and single-stage models should be investigated

**Conclusions**

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