SIMULATION-INTEGRATED DESIGN OF TERMINALS

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2. Simulation (dis)advantages
3. Analysis of historical data
4. Tools
5. Examples
6. Conclusions
Introduction

- Exspecta was founded in May 2014.
- As a result of my PhD study at Delft University of Technology.
- Exspecta, a consultancy firm, aims to bring logistical models and simulation tools into the maritime industry.
- Especially for terminal operators and terminal designers.
- I wrote a PhD dissertation about my research.
- I defended this thesis successfully at January 13th 2015.
Introduction

• PhD research was entitled as “Simulation-integrated Design of Dry Bulk Terminals”

• Keywords:
  • Seaside modeling and design
  • Stockyard sizing
  • Stockyard machine selection
  • Design of belt conveyor networks
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Simulation (dis)advantages

- During daily operation at terminals stochastic processes occur.
- Stochastic: unpredictable due to the influence of a random variable.

Examples:
- Ships arrive later due to storms during sea-journey, speed losses, unavailability of pilots and tug boats, etc.
- (Un)loading or transportation equipment breaks down.
- Variation in amount of cargo per ship.
- Material is stored for different times at stockyards.
- ......

Simulation is a probate technique to take such stochastic influences into account.
Simulation (dis)advantages

• Many authors and companies already applied simulation techniques in maritime industry.
  • Especially,
    • for seaside modeling and design
    • for container terminals
  
• Significant less examples for dry bulk and liquid bulk terminals.
• Dedicated for specific terminals.

Disadvantages:
• Hardly software-on-the-shelf available
• Time consuming
• Garbage in = Garbage out
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Analysis of historical data

Essential for:
- Understanding the process
- Real-world data versus analytical, theoretical data.
- An example is the distribution of ships’ interarrival times

2 examples of measured interarrival time distributions
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Tools

- Using of a general programming language: Pascal (owned by Embarcadero’s Delphi XE) coupled with the open-source simulation package TOMAS.
- Advantages:
  - No limitation due to pre-defined simulation blocks
  - Basic programming, f.e. less attention to visual effects but high simulation speed
- Disadvantages:
  - Experienced developers are required.
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Example 1: Belt conveyor network design

- For a dry bulk terminal operator in Rotterdam.
- Assessment of several belt conveyor network designs
Example 1: Belt conveyor network design

- During simulation the ship’s port times (waiting + unloading time) and port times of landside transportation modalities (trains, barges and batches to power plants) were registered.

- Best design performs 10% better for ships and 20% better for landside modalities compared to the existing layout.

- Simulation results underpinned the investment proposal successfully.
Example 2: Maintenance of unloading jetty

- For a liquid bulk terminal operator in Rotterdam.
- Assessment of several scenario’s during major revision of unloading jetty.

Screen dump of the simulation model
Example 2: Maintenance of unloading jetty

- During simulation the crude oil tankers’ port times were measured.

- The simulation study quantified the impact on terminal performance of several renovation scenario’s.

- The results were used to select the best scenario.
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Conclusions

- Simulation proved to be a powerful tool during terminal design and operational optimization.
- Stochastic processes have to be taken into account and historical data must used as input for providing realistic outcomes.
- Using a general programming language and an open-source simulation package to realize maximum flexibility.
- Several projects were already performed in the maritime industry and proved to be succesfull and usefull for terminal operators.
END OF PRESENTATION

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