Transhipment Capacity Modeling

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Introduction

Export 10 Mtpa

- Port of Albany, Western Australia

- Cape vessels 300m LOA, 18m draft)

- New berth & expanded channel

Export 5 Mtpa

- Transhipment

- Load Cape vessels in King George Sound

- Reduce startup time & capital cost

BMT

Project

Objectives

- Is 5Mtpa by transhipment feasible?
- What equipment?
- Capex and Opex cost?

Overview

- 90km pipeline from mine to port
- Dewatering at Port
- Port stockpile
- Load transhipper vessel (TSV)
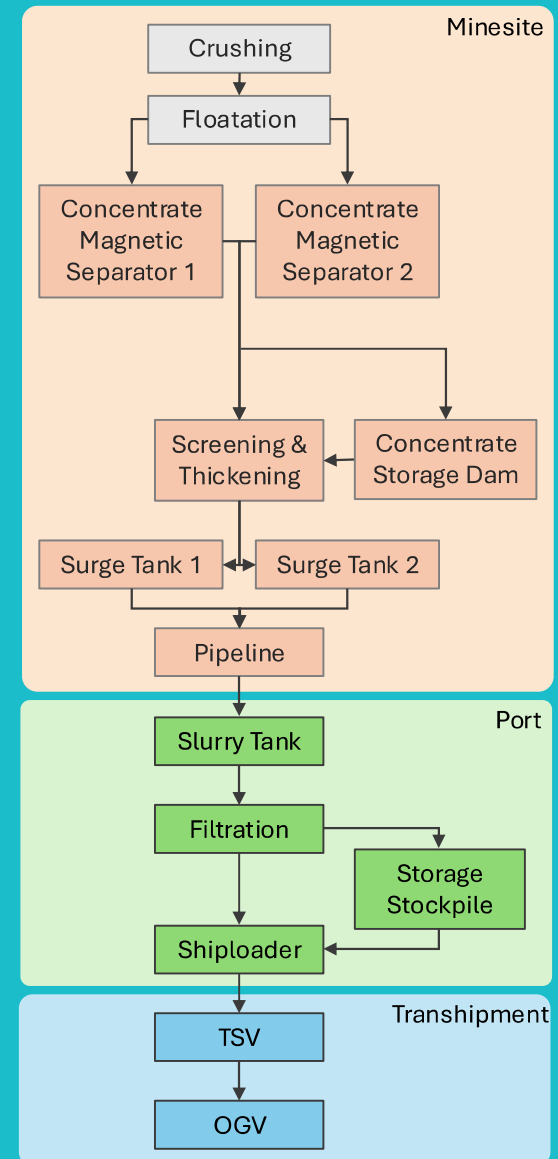- Load ocean-going-vessels (OGV) 2 stages
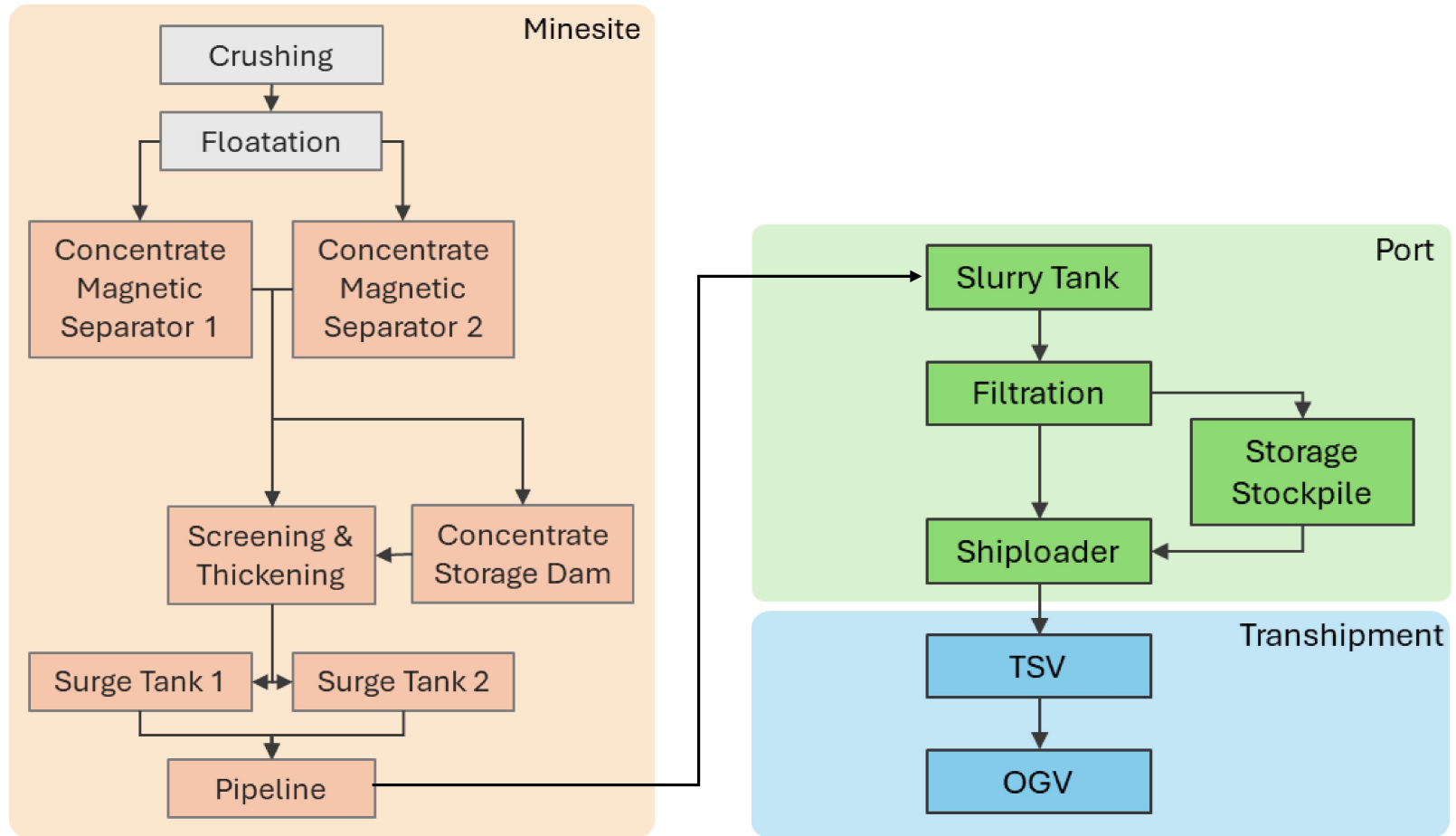

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Pit to Ship Logistics

- Minesite

- Port

- Transhipment

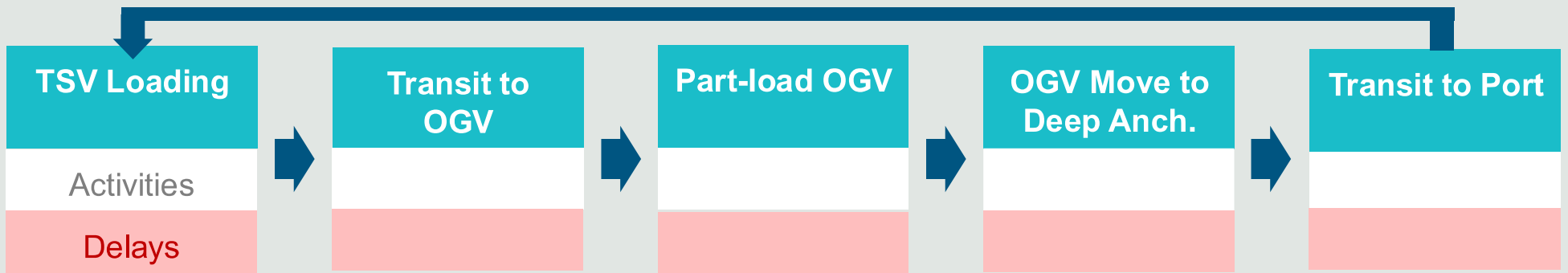- Response of the whole system difficult to predict

Model Purpose

- Select equipment

- Identify bottlenecks

- Quantify throughput capacity

Pit to Ship Logistics

Transhipment Cycle
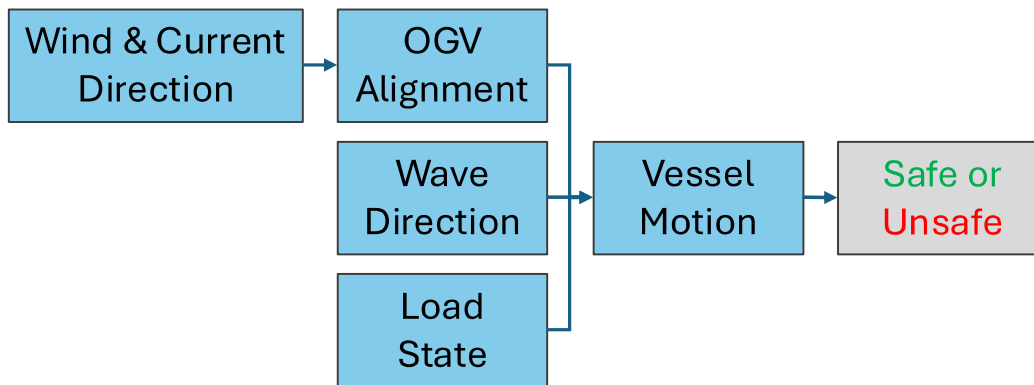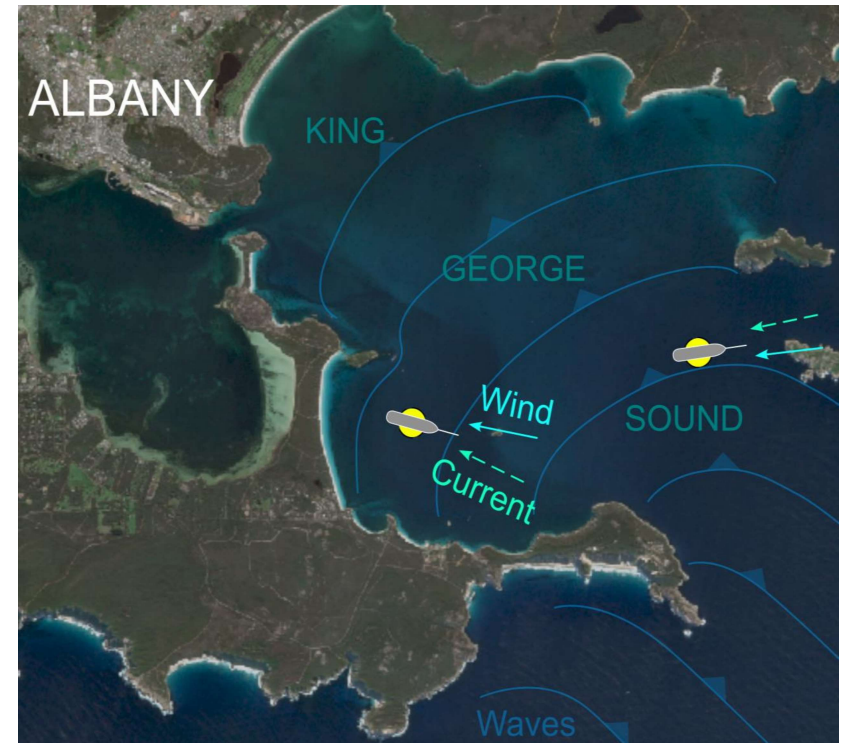

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TSV Loading		Transit to OGV		Part-load OGV		OGV Move to Deep Anch.		Transit to Port
Activities	→		→		→		→	
Delays								

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Transshipment Operability

Metocean Conditions & Ship motions

```
Wind & Current    →    OGV
Direction              Alignment
                          │
                       Wave       →    Vessel    →    Safe or
                       Direction        Motion         Unsafe
                          │
                       Load
                       State
```
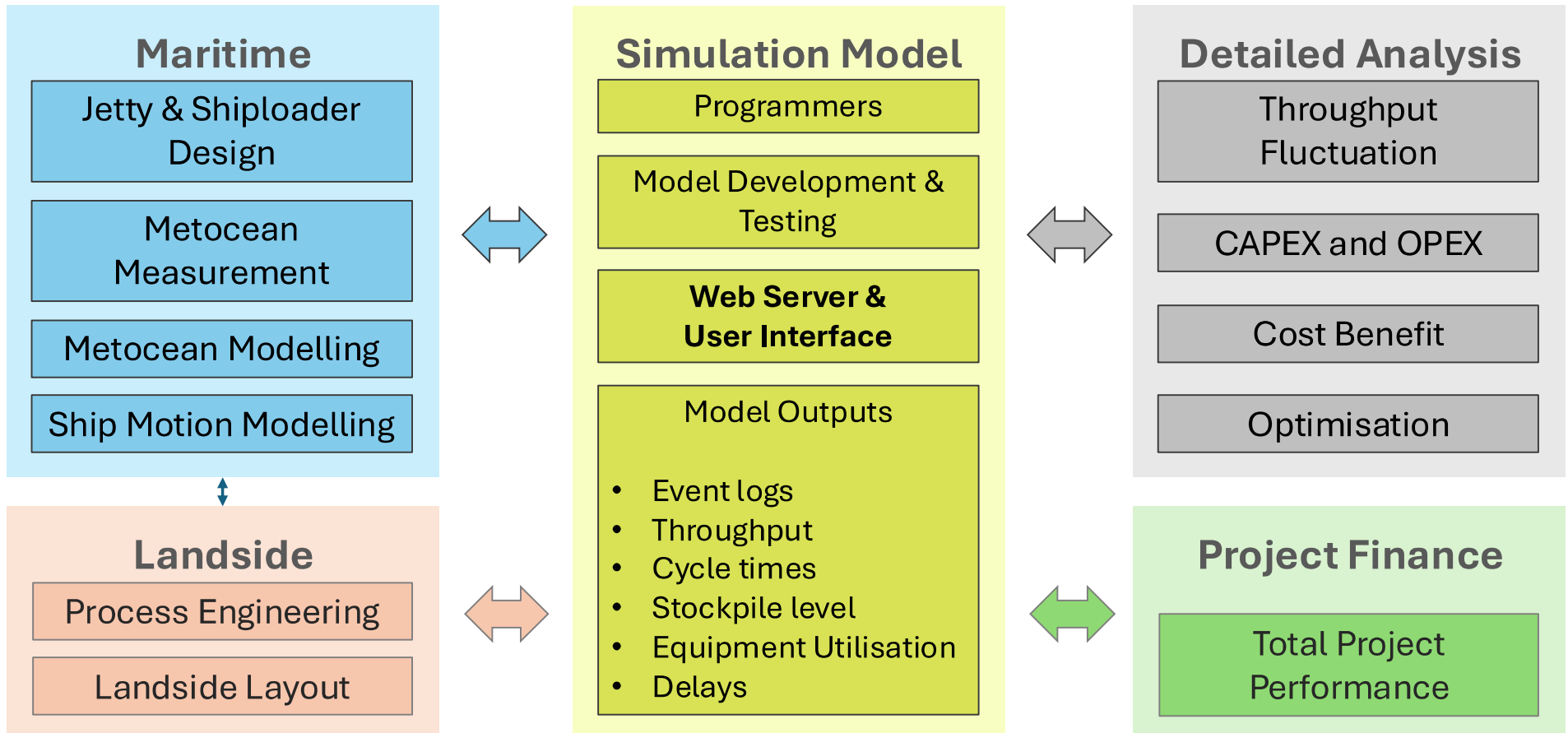
- Measured wind, waves & currents
- Calibrated numerical models
- 10 year hindcast of conditions at anchorages
- Conditions assessed at model run-time

Project Team

Maritime	Simulation Model	Detailed Analysis
Jetty & Shiploader Design	**Programmers**	**Throughput Fluctuation**
Metocean Measurement	**Model Development & Testing**	**CAPEX and OPEX**
Metocean Modelling	**Web Server & User Interface**	**Cost Benefit**
Ship Motion Modelling	**Model Outputs**	**Optimisation**

Model Outputs

- Event logs
- Throughput
- Cycle times
- Stockpile level
- Equipment Utilisation
- Delays

Landside

- Process Engineering
- Landside Layout

Project Finance

- Total Project Performance

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Analysis

Key Performance Metrics

- Export target of 5Mtpa achieved?
- Throughput variability
- Cycle times variability
- Equipment utilisation
- Quantified Delays
  - Concentrate availability
  - Metocean conditions at anchorage sites
  - Upstream supply interruptions
- Port stockpile levels – upstream impacts
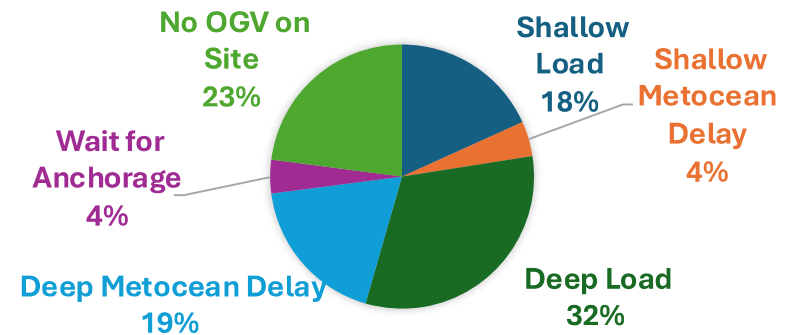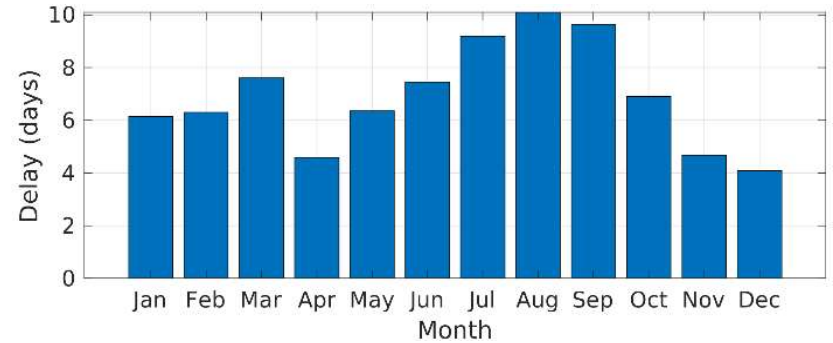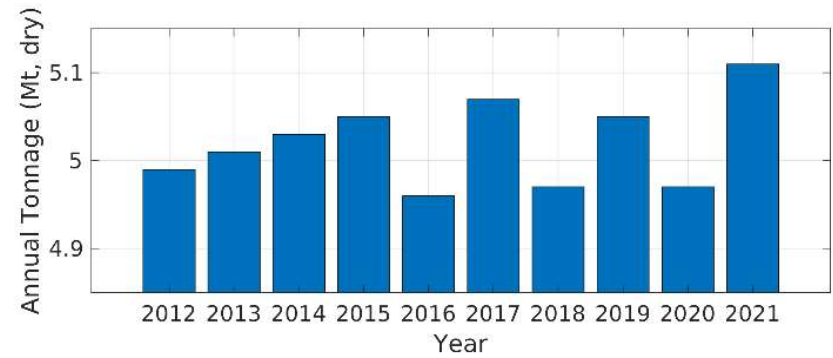
Questions Answered

Preferred Equipment

- TSV – capacity and material handling ✓
- OGV – capacity and arrival schedule ✓
- Stockpile – size & reclaim equipment ✓
- Shiploader – type and rate ✓
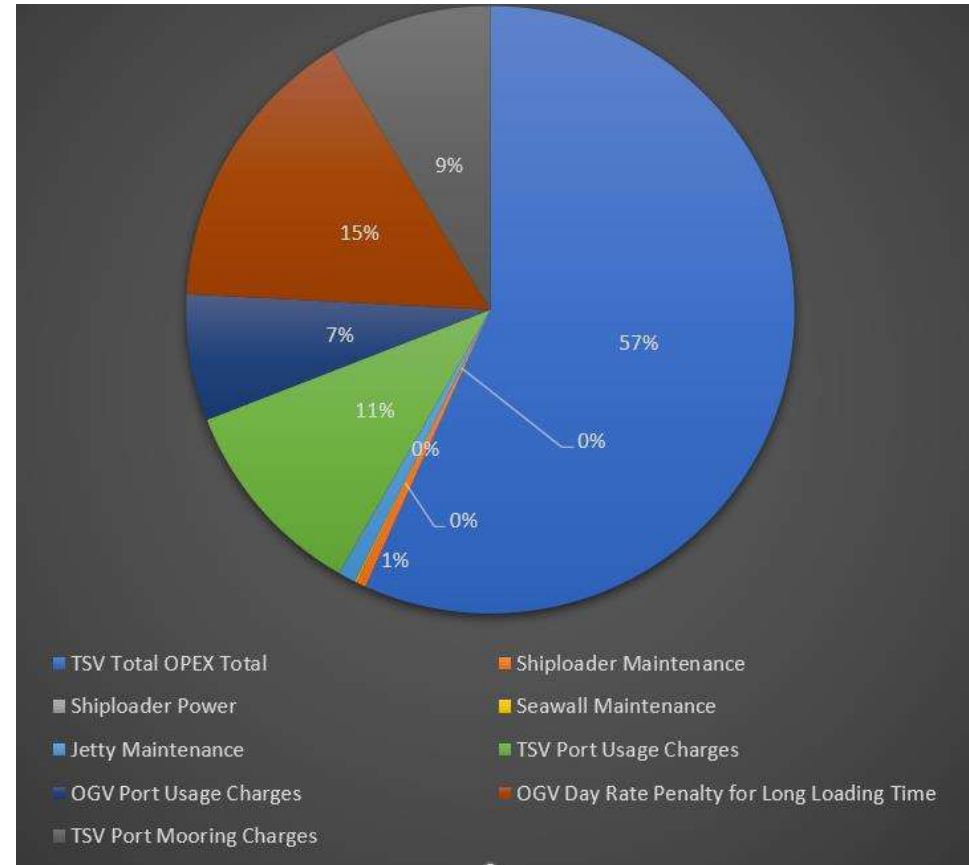- Landside process components ✓

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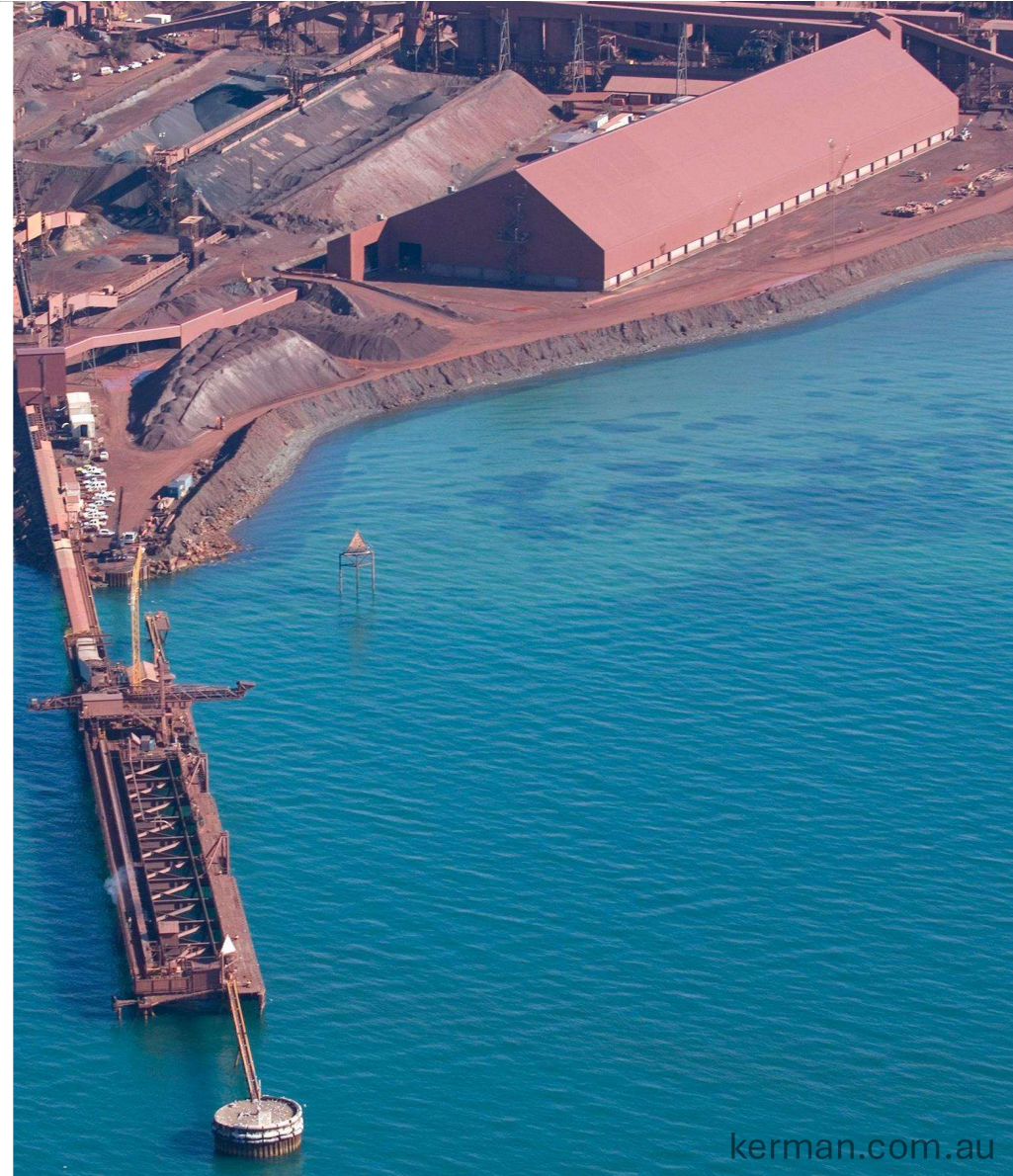
Cost Estimate

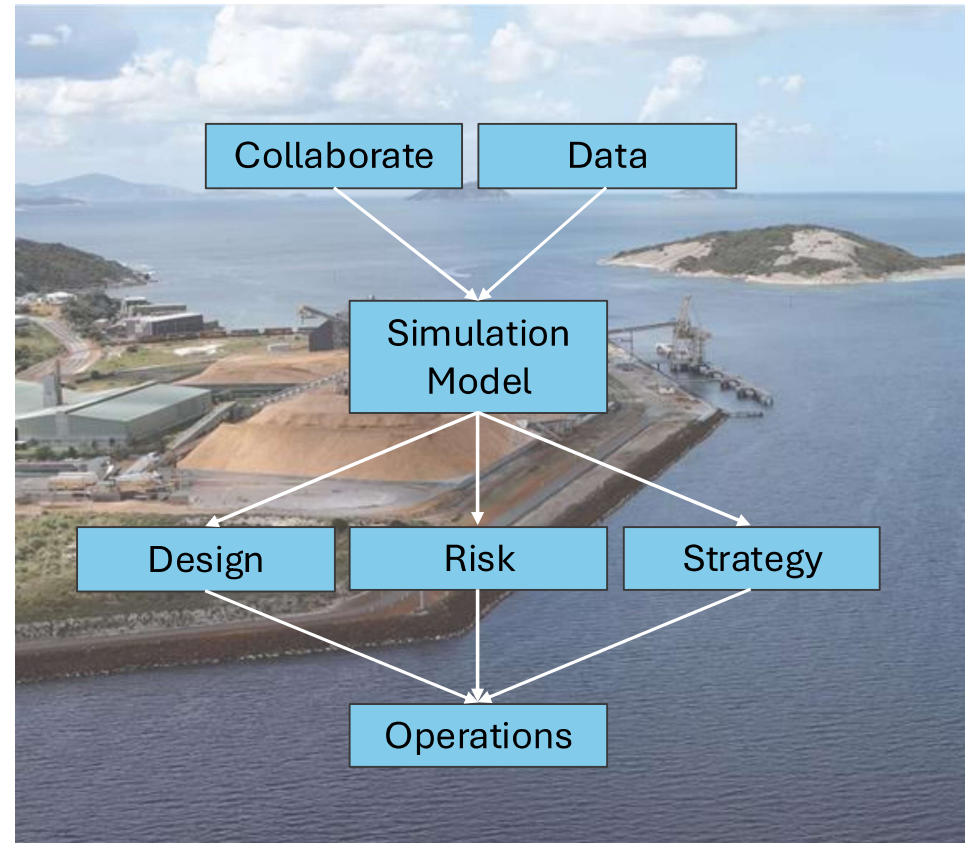Model reported:

- Time in every activity
- Equipment utilisation

Operating Costs

- TSV Fuel
- Personnel
- Ship loader power
- Port charges for TSV & OGV movements
- Penalties due to delays in OGV loading

Legend:
- TSV Total OPEX Total
- Shiploader Maintenance
- Shiploader Power
- Seawall Maintenance
- Jetty Maintenance
- TSV Port Usage Charges
- OGV Port Usage Charges
- OGV Day Rate Penalty for Long Loading Time
- TSV Port Mooring Charges

Pie chart values: 57%, 9%, 15%, 7%, 11%, 0%, 0%, 0%, 1%

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Summary

Transshipment Throughput Modelling

- Part of a supply chain

- Model simulates complex interactions

- Coordination & multi-disciplinary collaboration

- Requires good data

- High confidence in system capacity

- Informs design, risks & commercial strategy

- Forecast for operational management

Thank you