PORTZONE

A CONVERSATION ABOUT DRY BULK

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FAM
MEMBER OF BEUMERGROUP

WITH
LUKAS PAUL

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EPISODE 12: SELECTION STRATEGIES FOR DRY BULK HANDLING EQUIPMENT AT SEASIDE

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Port Zone

Selection Strategies for Dry Bulk Handling Equipment at Seaside

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Episode 12
29 November 2023

MADE DIFFERENT

Agenda

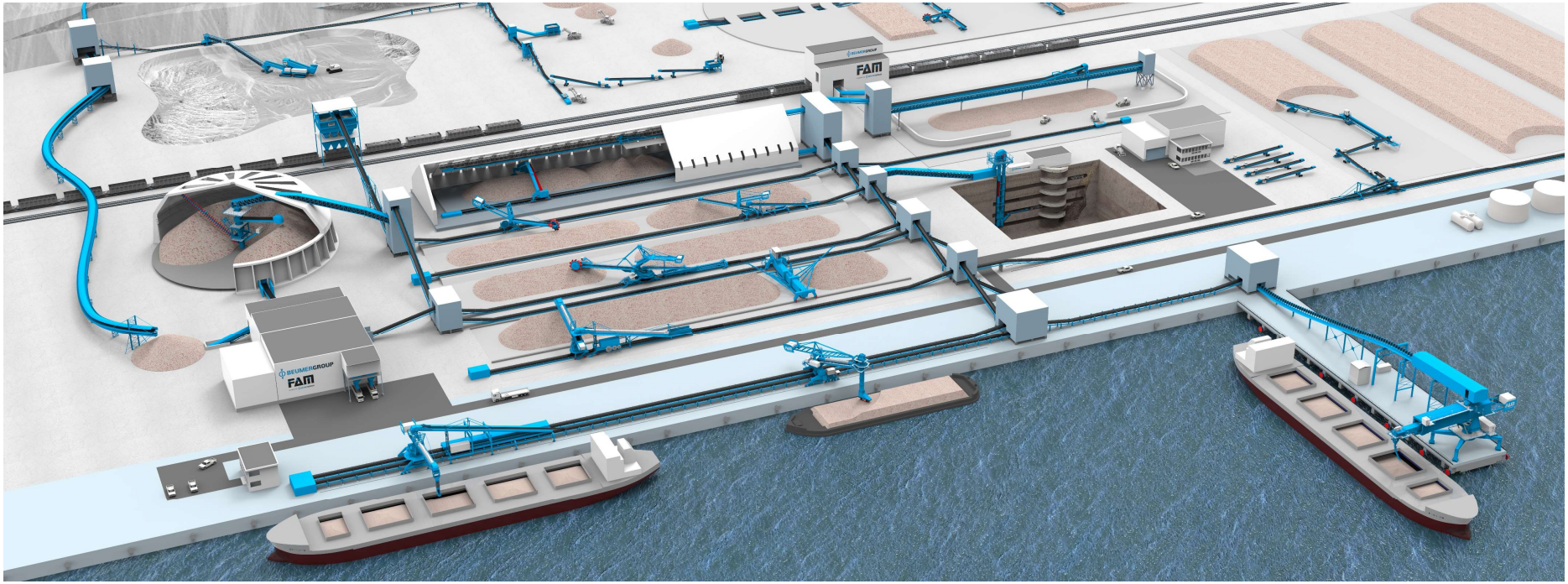
- Introduction
- Berth Occupancy & Commitment Concepts
- Ship handling operations
- Fleet Distribution
- Product properties
- Conclusions
- Q&A Session

Asean Buntulu Fertilizer, Urea ship loader 1.000 tph, ***Beumer Group***

Introduction

Motivation

- How to organize my seaside operations?
- How many berths to construct?
- What kind of material handling equipment to select (type, number, capacity)?



Introduction

Starting point

Selection strategy of seaside material handling facility
Major decisive aspects are reflected in PIANC*

- ***Product(-s)** (Properties, Mono/ Multi cargo)
- ***Throughputs** (for each product, direction, seasonality)
- ***Fleet Distribution** (Vessel DWT, dimensions, parcel)
- ***Terminal/ Port Particularities** (weather restrictions, channel & tidal conditions, etc.)

- **Greenfield / Brownfield** (expansion/ due diligence)
- **Land plot & space** available

**PIANC 184-218 Design principles for design bulk terminals, The World Association for Waterborne Transport Infrastructure*

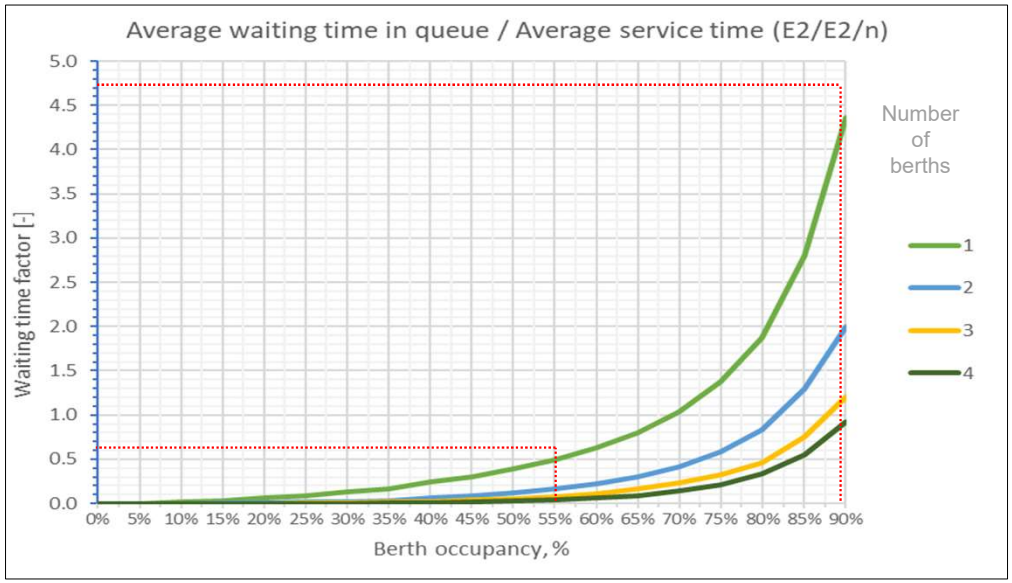
Project: First Terminal for Valemax-Ships in South East Asia, 26 Troughed belt conveyors, 5 km conveyors in total, Planning & Engineering Services, Supervision of erection & commissioning, ***Beumer Group***

Berth occupancy concept

Number of berths: relationship between berth occupancy and vessel waiting time

- **Berth Occupancy = Berth occupancy time/ Berth available time**
- With increase of berth occupancy, queueing time increases exponentially
- If berth occupancy is high, vessels start queuing > risk of demurrage > less attractive for ship owners

- **If berth occupancy is high, vessels start queuing > risk of demurrage**
- **Demurrage for bulkers:** 30.000~50.000 EUR per day
- **If no demurrage + high occupancy> less attractive terminal for ship owners**
- However, **higher occupancy is possible** > clockwork operations > risks are higher > could be during peak season



Average waiting time of vessels on anchorage for service (vessel arrival according to Erlang 2 distribution E2/E2/n) [UNCTAD Port Development, United Nations Conference on Trade and Development]

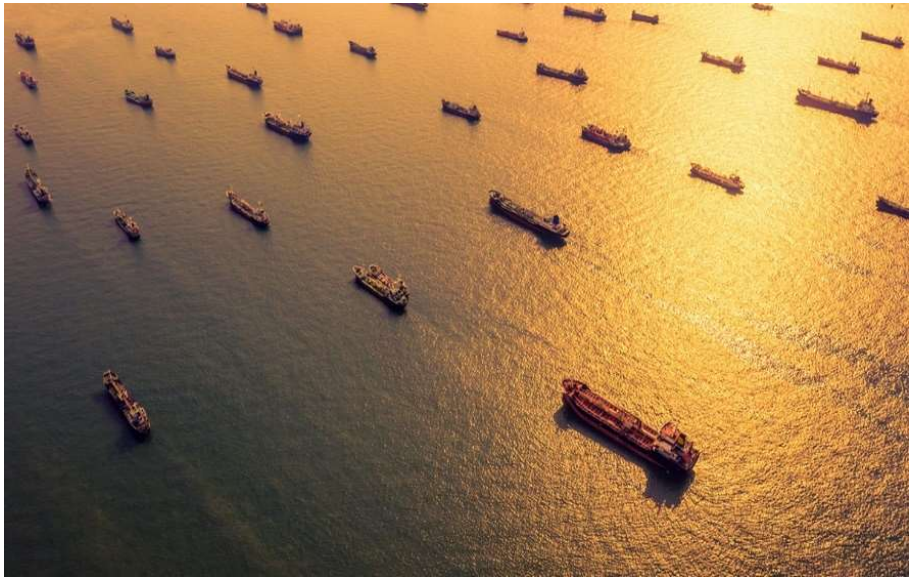


Figure from [www.crawfordnautical.com]

Ship handling operations

Vessel service time

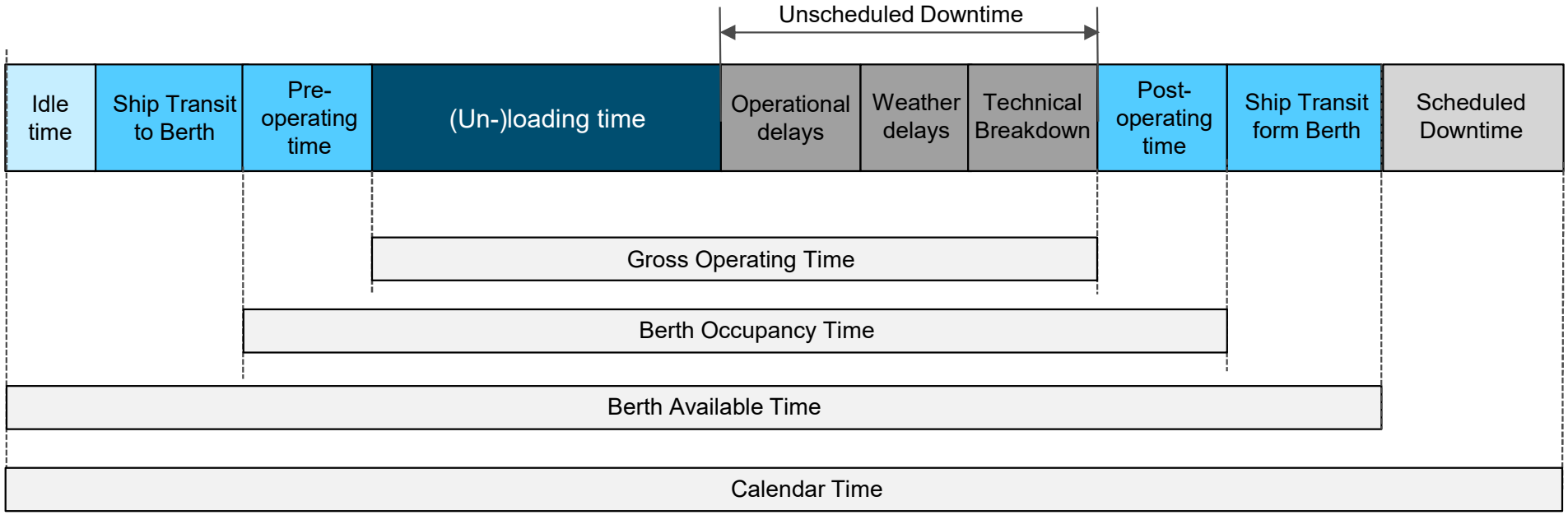
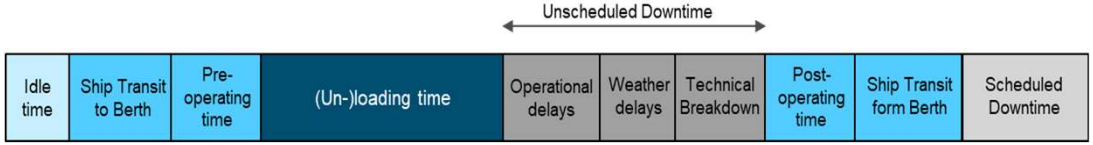


Figure modified from [PIANC 184-218 Design principles for design bulk terminals], The World Association for Waterborne Transport Infrastructure

Ship handling operations

Vessel service times

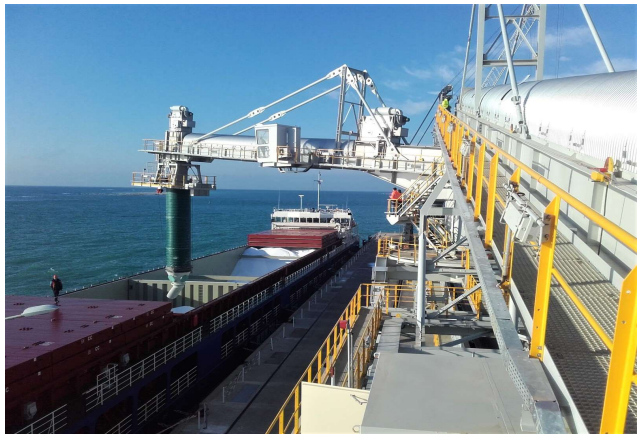
- **Auxiliary operations** (1~12)h, depend on Vessel size
  - **Pre:** Mooring, Draft survey, Setting-up gangway, Review of loading/ discharge plan, Customs, Formalities, Fumigation
  - **Post:** Final draft survey, formalities, waiting for pilotage, unmooring



- **Unscheduled downtime:** scattered over the vessel service time
- **Operational delays:**
  - **Parcel size, equipment cleaning & switch**
  - **Hatch change> important for ship loading operation & Ballast system, Vessel configuration**
  - **Redundancy** (1SL x 5000 tph or 2 x 2500 tph or 2 x 5000 tph), take into account loads on quay structure, system flexibility requirement

Figure: Lloyd

*Project: Onne Port, Nigeria SL 990 t/h for urea, **FAM Beumer Group***



*Project: GAP Insaat Dubai 1SL 1200 tph for urea, **FAM Beumer Group***

Vessel service time

Ship handling operations

Idle time	Ship Transit to Berth	Pre-operating time	(Un-)loading time	Operational delays	Weather delays	Technical Breakdown	Post-operating time	Ship Transit form Berth	Scheduled Downtime

- **Weather delays**:
  - geographical location, (non-)sheltered terminal,
  - multi-cargo (un-)hygroscopic properties > even can be regulated by different local standards > close hatches, parking SL, transfer to anchorage
- **Technical breakdown:**
  - depend on the equipment condition & maintenance
  - Technical availability of a transport consecutive line
- **Scheduled Downtime:** planned maintenance ('opportunity' management, between ship calls)

*Project: Puerto Ventanas, Chile, pipe conveyors supply by **Beumer Group** Figure: [www.mundomaritimo.cl]*

Sheltered terminal, the Netherlands, Figure [www.portofamsterdam.com]

*Project: LLC Riga Fertilizer, Terminal Riga, Latvia, twin SLs 1900 tph, urea, supplied by **FAM Beumer Group***

Vessel service time

Ship handling operations : vessel statements review

DATE	DAY	TIME	OPERATION NOTICES
		0154	VESSEL ARRIVED AT PIVDENNIY PILOT STATION. NOR TENDERED.
		0154-0645	RIVER PILOT ON BOARD. PROCEEDING TO PORT ROADS.
24.06.2021	THU	0645-0700	PORT PILOT ON BOARD. MANEUVERING.
		0700	VESSEL ARRIVED AND ANCHORED AT PORT ROADS.
		0700-2400	AWAITING BERTHING IN LINE AFT
25.06.2021	FRI	0000-2400	AWAITING BERTHING IN LINE AFTER M
26.06.2021	SAT	0000-2400	AWAITING BERTHING IN LINE AFTER M
27.06.2021	SUN	0000-2400	AWAITING BERTHING IN LINE AFTER M
		0000-2042	AWAITING BERTHING IN LINE AFTER M/V
		1900-2042	PORT PILOT ON BOARD. BERTHING.
		2042	ALL FAST AT BERTH #5.
		2042-2100	GANGWAY INSTALLATION.
		2100-2120	INWARD CLEARANCE.
28.06.2021	MON	2120	F.P.G. WRITTEN FORM OF NOR HANDED OVER TO AGENT.
		2120-2320	INITIAL DRAFT SURVEY.
		2220-2320	CARGO HOLDS INSPECTION BY SURVEYORS.
		2320	CARGO HOLDS ACCEPTED.
		2320	LOADING COMMENCED.
		2320-2400	LOADING IN PROGRESS.
29.06.2021	TUE	0000-2400	LOADING IN PROGRESS.
		0000-0340	LOADING IN PROGRESS.
		0340-0440	*NO LOADING DUE TO RAIN.*
		0440-2010	LOADING IN PROGRESS.
30.06.2021	WED	*2010-2100*	*NO LOADING DUE TO RAIN.*
		2100-2240	LOADING IN PROGRESS.
		2240-2330	*NO LOADING DUE TO RAIN.*
		2330-2400	LOADING IN PROGRESS.
		0000-1130	LOADING IN PROGRESS.
		1130	LOADING COMPLETED. NO MORE CARGO REQUESTED FOR LOADING BY MASTER.
		1130-1330	FINAL DRAFT SURVEY.
		1330	CARGO DOCUMENTS ON BOARD. SIGNED.
		1330-1400	CARGO DOCUMENTS VERIFIED BY CUSTOMS.
01.07.2021	THU	1330-1400	OUTWARD CLEARANCE.
		1400-1500	PILOTS ON BOARD, UNBERTHING.
		1500	VESSEL SAILED.

Example fragment of a vessel statement

*Project: Baffinland Iron Ore Corporation Milne Inlet - Nunavut Canada 2 x SL 3500 tph iron ore, supplied by **FAM Beumer Group***

Vessel service time

Ship (un-)loading time

Idle time	Ship Transit to Berth	Pre-operating time	(Un-)loading time	Operational delays	Weather delays	Technical Breakdown	Post-operating time	Ship Transit form Berth	Scheduled Downtime

- **Ship loading operations**
  - Intake equipment capacity: preference for decoupled in/ out take operations (e.g., grain export terminal Truck-Vessel or Truck-Storage-Vessel)
  - Vessel size limits the ship loading capacity (ballast system)
- **Ship unloading operations**
  - Ballast system is not limiting
  - Consider through-ship capacity, efficiency losses extends unloading time

Vale vessel is loaded with 2 quadrant SLs [Figure: www.gcaptain.com]

Barges are loaded with mobile equipment from trucks [Figure: Telestack]

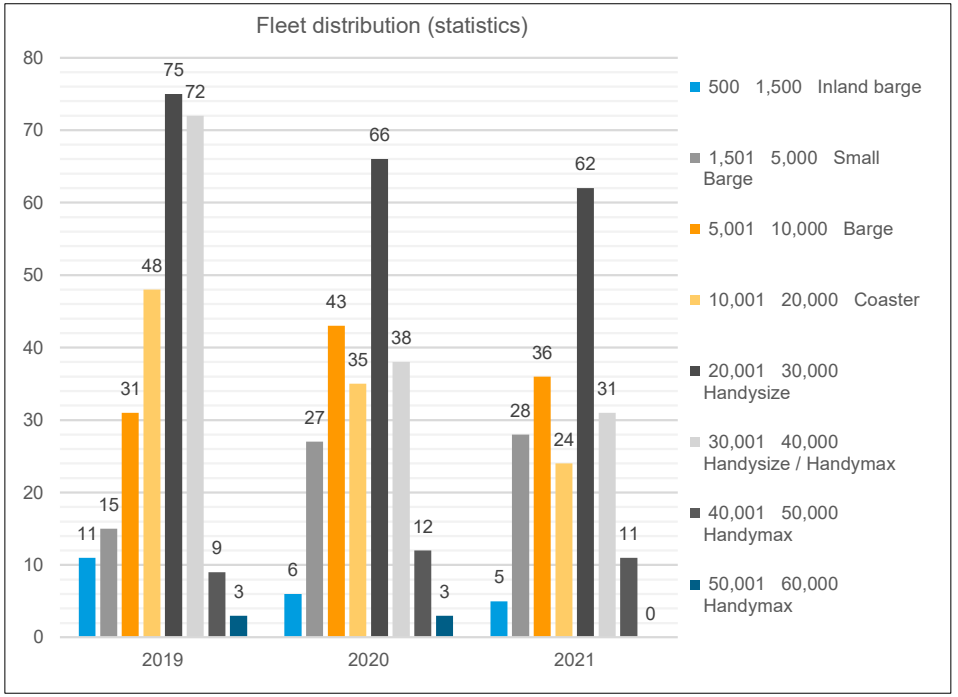
Example of cleaning hold with mobile equipment [Figure Wikimedia commons]

Impact of fleet distribution

Trade-off study

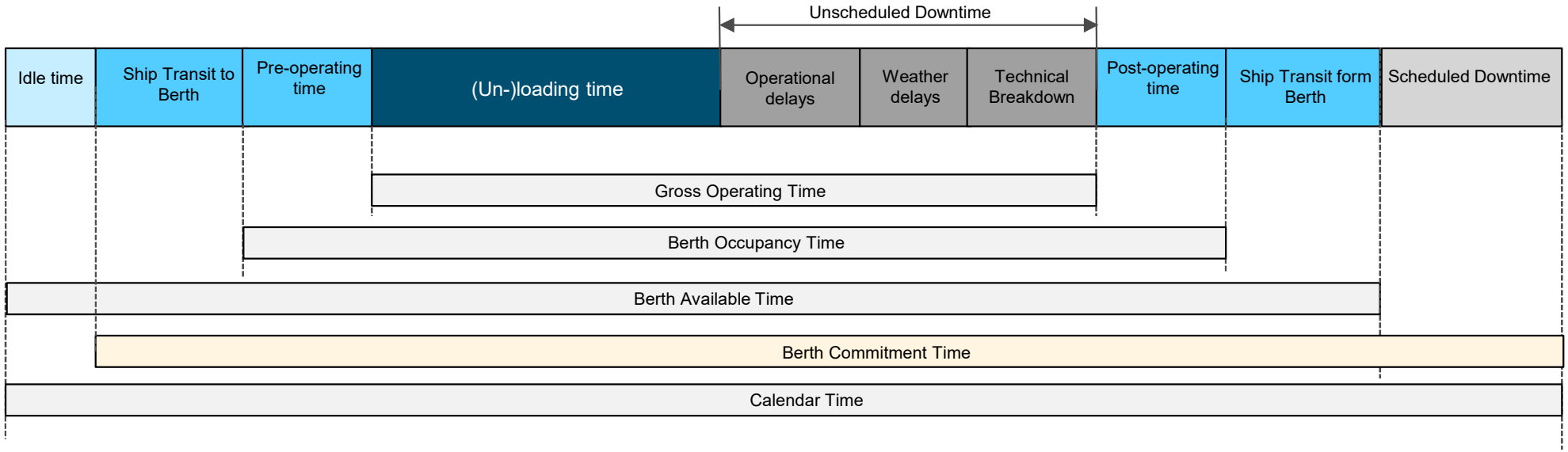
How do we divide our throughput?

- **Impact of fleet distribution**
  - Large vessels are more effective higher SL capacity + efficient use of time > more time on actual (un-) loading> less time is wasted on non-(un-) loading operations
  - Depend on contractual obligations



Example of fleet distribution of an existing grain terminal of a multi-cargo port

Berth Commitment concept



[PIANC 184-218 Design principles for design bulk terminals], The World Association for Waterborne Transport Infrastructure

Food for thought

- **Berth occupancy strategy:**
  - recommendations are based on queueing theory
  - seem more conservative, higher occupancies are observed
- **Berth commitment strategy:**
  - recommendations are limited for case options
  - relevant when ship transit is important (e.g., channel access)

Which one do you use?

Impact of product, equipment selection

Product governs the type of SL or CSU

- **Type of equipment and (Un-)loading capacity is also limited by product properties**
  - Mineral fertilizers > particle breakage > needed for crop growing (not evenly distributed at fields) > product quality damage > 2000-4000 tph
  - Ship unloading equipment: Coarse material > high volume, coal, iron ore (grab crane, CSU: vertical screw, bucket elevator)
  - Continuous ship unloading equipment: fine powder & low density > pneumatic

*Project: East Europe, 3 x ship loaders 1500 tph, 60.000 DWT, potassium chloride, supplied by **FAM Beumer Group***

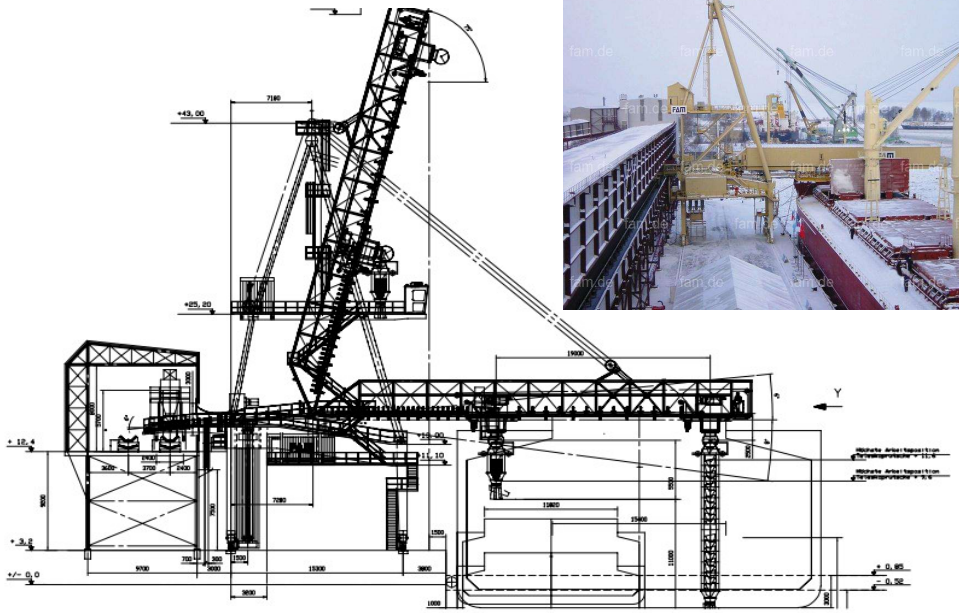
*Project: 2 x CSUs 850 tph, coal, Power station Song Hau 1, Vietnam, supplied by **FAM Beumer Group***

Pneumatic continuous ship unloader [Figure: Vigan]

Equipment selection

Trade-off study

- **Design vessels (Largest/ smallest, high/ low tide, laden/ empty)**
- No clashing, more flexibility and functionalities (luffing, slewing, retracting)
- CAPEX investment



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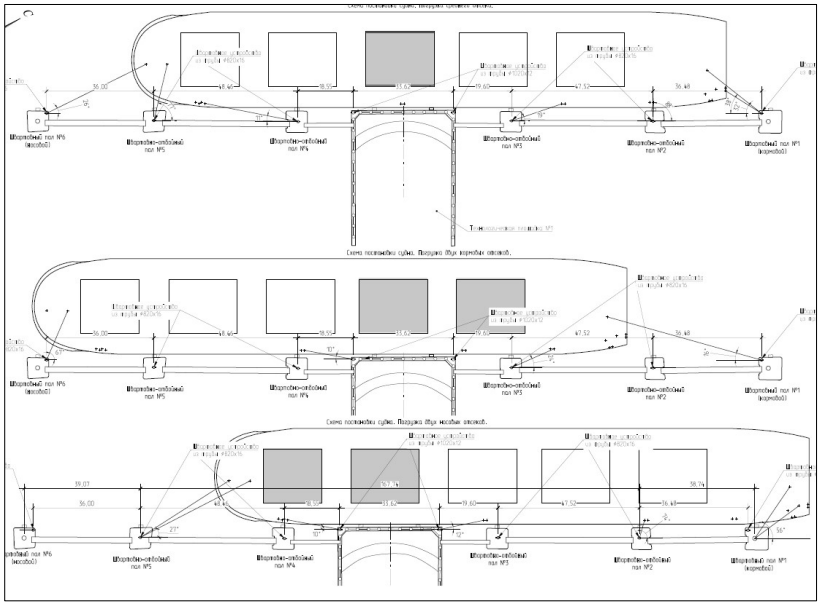
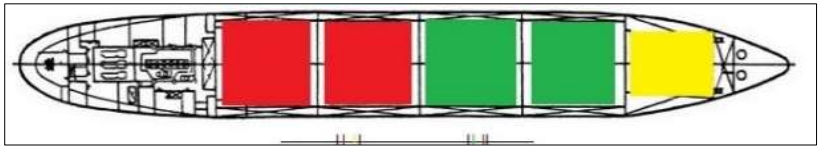




Example sketch: due diligence project, working corridor of existing SLs do not cover hatches of design vessels

Equipment selection

Trade-off study: Functionality & CAPEX investment

- Larger vessels are more effective for using available time, but:
- **Marine and civil works:** e.g., Quadrant SL (LOA, Beam, Draught) > dredging & marine structures, distance to achieve Vessel draught

*Project: Carbones del Cerrejon Ltd., Port Puerto Bolivar, 2 Quadrant SLs 6600 tph, supplied by **FAM Beumer Group***

- **Brownfield/ Greenfield:** selection of static SL, replacement of an old SL, integration to existing facilities

*Project: Taiheiyo Engineering Corporation, Port Bohol, Limestone 1x SL 1200 tph, Philippines supplied by **FAM Beumer Group***

Impact of product, equipment selection

Product properties

- Moisture, stickiness, abrasiveness
- Dustiness, flowability
- Ability to build-up, bridging and arching
- Self-heating, combustibility

Cascade chute to eliminate kernel breakage from falling

[Figure Cleveland Cascade]

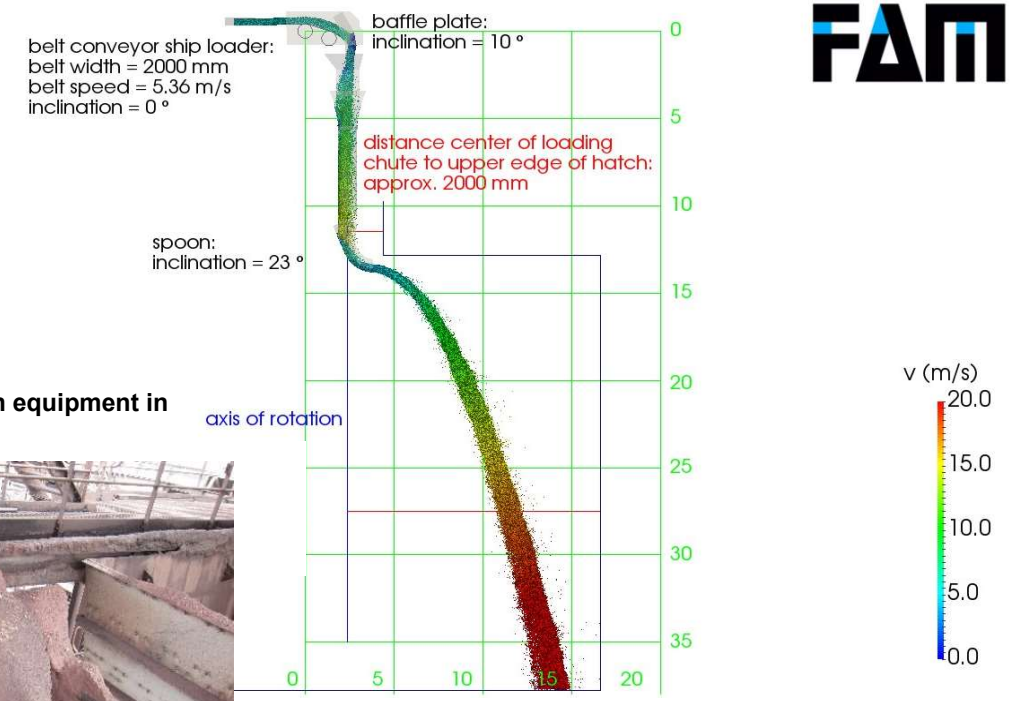
CSU tip equipped with a bucket wheel

FAM Beumer Group

Iron ore building up on equipment in a transfer

[Figure courtesy Jan Hiltermann]

Product trimming (outreach under coamings)

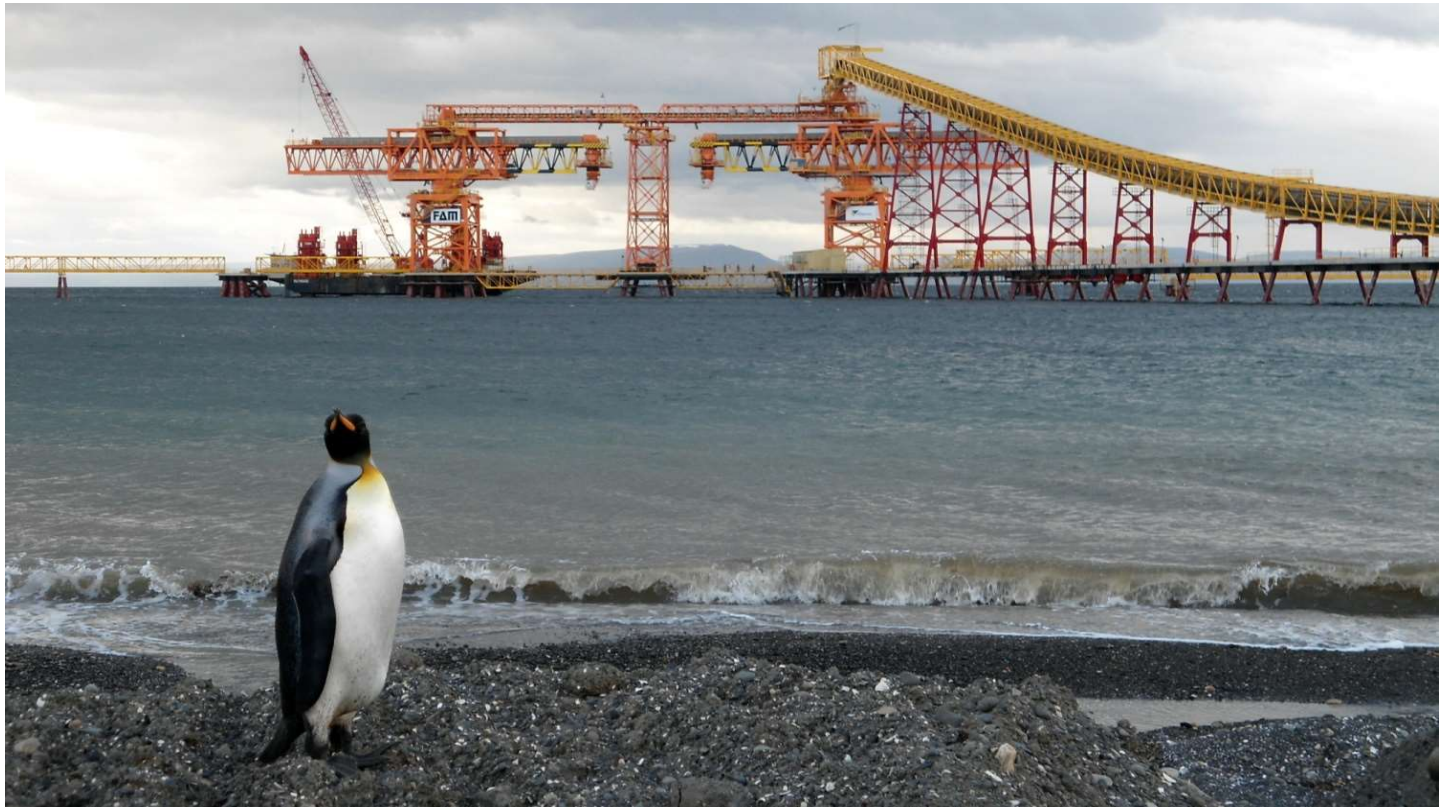


Hood-and-Spoon technology DEM simulation
FAM Beumer Group

Impact of product, equipment selection

Environmental protection

- Environmental protection: strict requirements for spillage-free and no dust emission operations



*Antarctic Project: Isla Riesco, most southern installation Twin bridge type 2SL 3000 tph, supplied by **FAM Beumer Group***

Impact of product, equipment selection

Trade-off study

- High congestive environment, from pit-to-port solutions
- Environmental protection: strict requirements for spillage-free and no dust emission operations

Project: Iron ore transport in China, Port of Rizhao, conveying systems 5500 tph, 2 x PCs, ø 500mm, total length 6,6 km, supplied by ***Beumer Group,*** *planning, engineering, supervision of erection & commissioning*

Other aspects

- **Channel access, port rules** **(think over berth commitment concept!)**
- **Shared adjacent berth** (e.g., space needed for unmooring is not suffceint for two largest vessels, depending on the fleet distribution, can occupy adjacent berth)
- Simulation study (Discrete Event Simulation)
- Seasonality (peak season period can be with higher berth occupancy, but need time slack to recover)

Evergreen vessel blocking Suez channel in 2021 [photo The Sun]

Conclusions

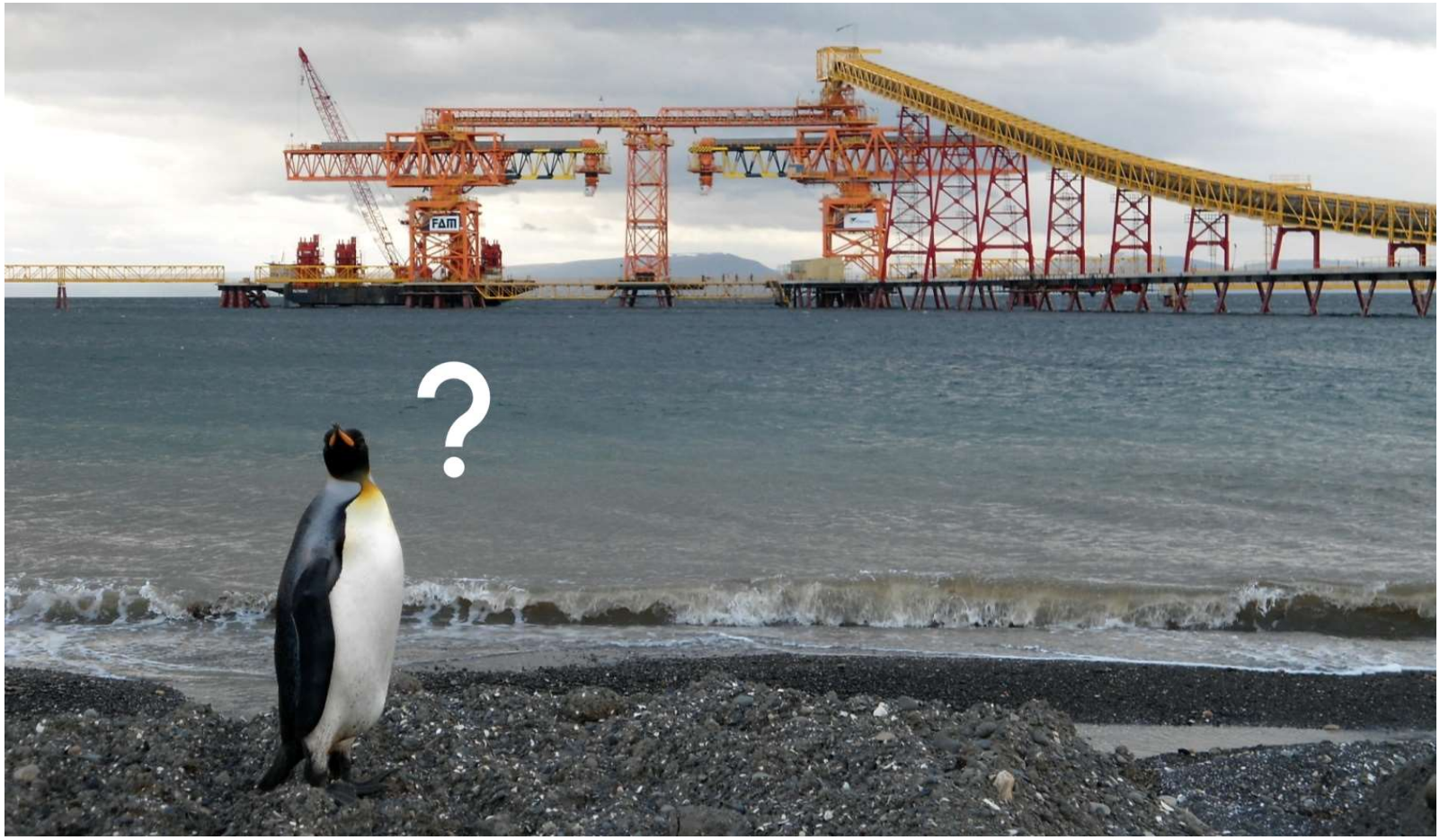
Strategies for Dry Bulk Handling Equipment for Seaside

The following need to be taken into account:

- Berth occupancy & berth commitment limitations
- Impact of fleet distribution and vessel service time
- Impact of product properties on equipment selection
- Impact of terminal particularities (space, weather, operations, channel, etc.)

- **Is always customized solution**

Any questions?



*Antarctic Project: Isla Riesco, most southern installation Twin bridge type 2SL 3000 tph, supplied by **FAM Beumer Group***