# An Operators Approach to Terminal Automation

## SESSION VI: Elements of Container Terminal Planning and Design

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Long Beach, CA, 18th October 2011

# Agenda

**Introduction**

**Approach to Terminal Planning & Design**

**Upgrading of Terminal Facilities**

**Foresights of the Future Terminal Automation**

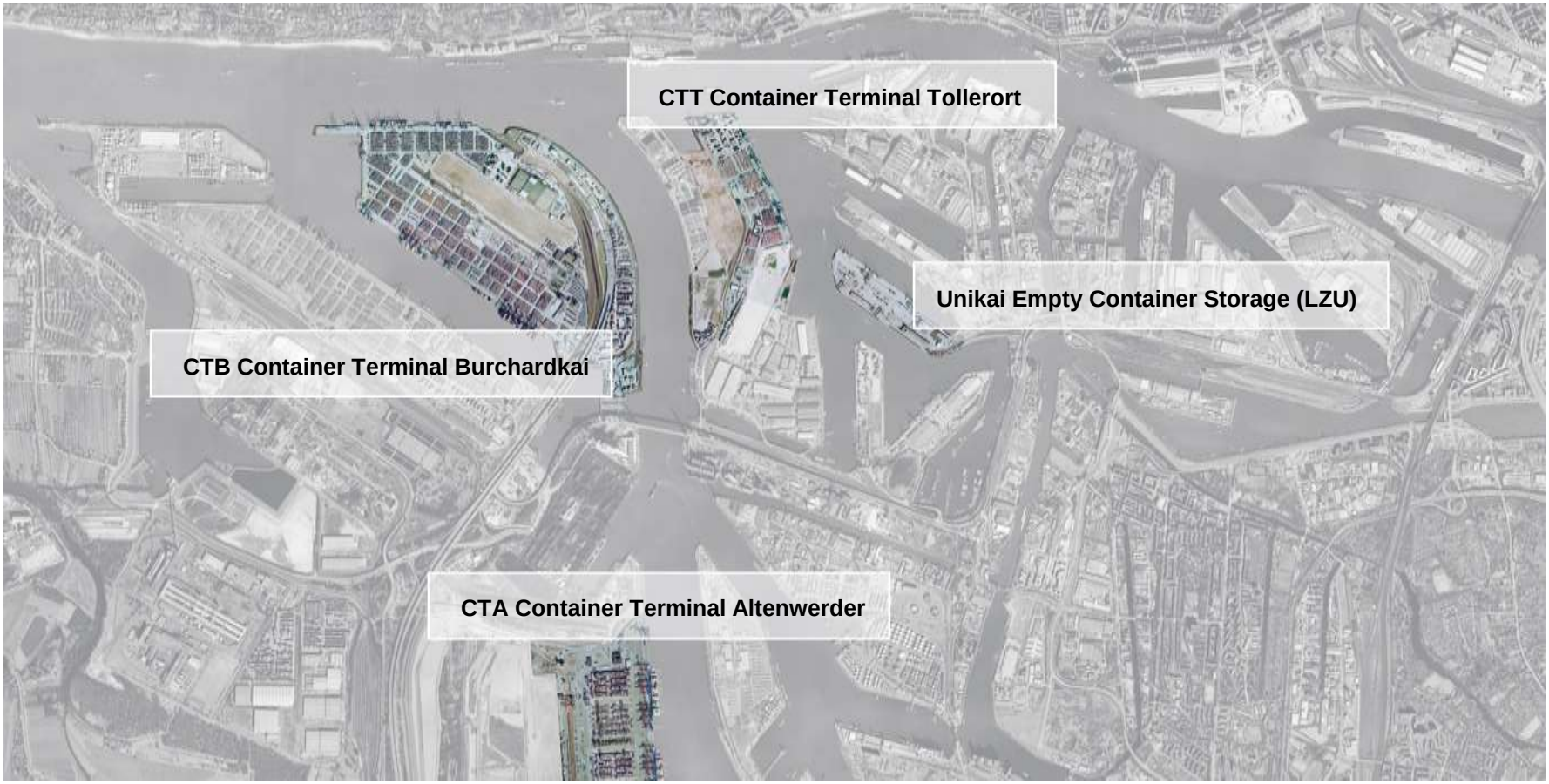
 

# HPC Hamburg Port Consulting GmbH

- Founded in 1976 as subsidiary of the HHLA Hamburger Hafen und Logistik AG
- Around 100 experts (incl. subsidiaries, w/o HPC Ukraine), annual turnover in 2010 approx. € 13 million
- Reputation as one of the world's leading consultants in the port sector
- Since 1976 port and transport related projects in more than 100 countries, private and public sector
- Approx. 1100 projects world-wide with extensive experience in container terminal planning
- Subsidiaries for port training & management (HPTI) and transport solutions (Uniconsult), HPC Ukraina as terminal operator in Odessa (Ukraine)

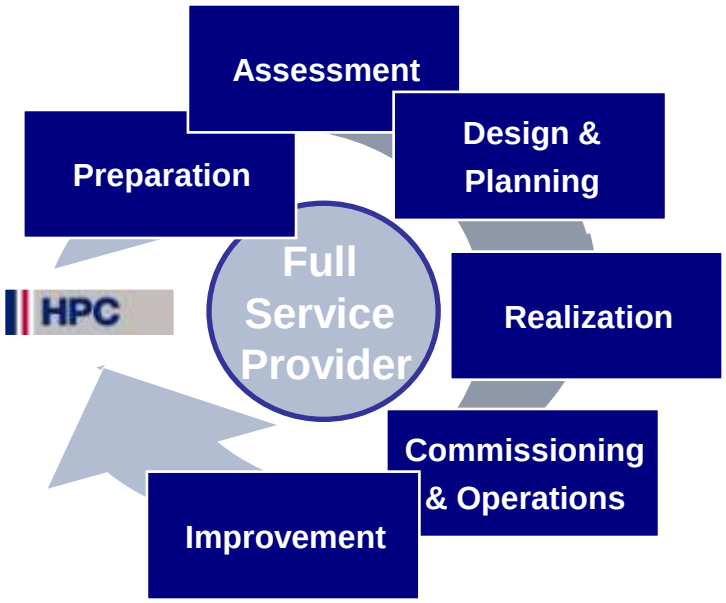
 

# HHLA Container Terminals in Hamburg



# HPC Services

## Container Terminal Automation Planning




**Automated Container Terminals**

**Conceptual planning** 1
- System selection
- System calibration

**Concept validation** 2
- Static assessments
- Dynamic simulations

**Equipment definition** 3
- Specification
- Tender Support
- Construction supervision

**IT + TOS selection** 4
- Business Process Definition (BPM)
- Specification
- Tender support

**Integration / Commissioning** 5
- IT + equipment integration support
- Commissioning support
- Operations Optimization

# Terminal Automation Planning

## Development Drivers & Goals

**External Drivers**

- Environmental concerns & fleet development
- Labour availability & reliability
- Economy & market development
- Increasing traffic vs. limited area sizes
- Equipment evolution & technology

**Meeting Point**

**Terminal Automation**

**Customer Satisfaction**

**Operator Internal Goals**

- Improve safety and labour conditions
- Lowering life cycle costs
- Reduce equipment damage
- Increase the level of service
- Increase stacking density

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# General Approach

## Automation as Philosophy

***Automation Technology to reach the Peak Efficiency Level at Required Flexibility***

**To automate**

- inputs/outputs to the process are perfectly understood
- inputs/outputs are stable and homogeneous
- inputs/outputs are in mass production
- the quality, productivity & utility to be increased (with a high level of service and specific capacity)
- the material handling to be decreased
- labour cost significantly high
- labour safety to be increased

**Not to automate**

- inputs/outputs to the process aren't understood
- inputs/outputs are volatile
- inputs/outputs have changing characteristics
- the performance is adaptable with the given equipment
- processes may have to involve human interference (physically or in decision making)
- Labour cost are very low even at high reliability

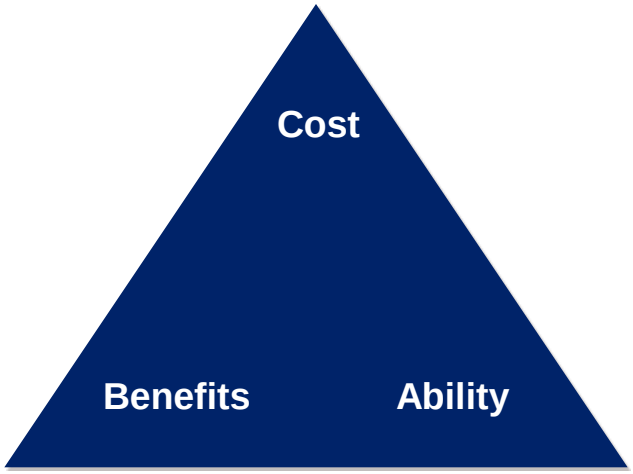
→ **Direct investment cost is only one block of total cost in automation, majority is related to set-up, integration and optimization!**

# General Approach

## Efficient Automation Level

- Equipment cost
- Training cost
- M&R cost
- Cost of operations breakdown
- Opportunity cost for reduced flexibility




- Productivity gains
- Quality improvement
- Process stabilisation and reliability
- Electrification and emission reduction
- Safety improvement
- Image gains

- Ability to integration
- Complexity management
- Usability
- Safety and regulatory frameworks

→ Level of automation is a trade-off to be thoroughly evaluated!

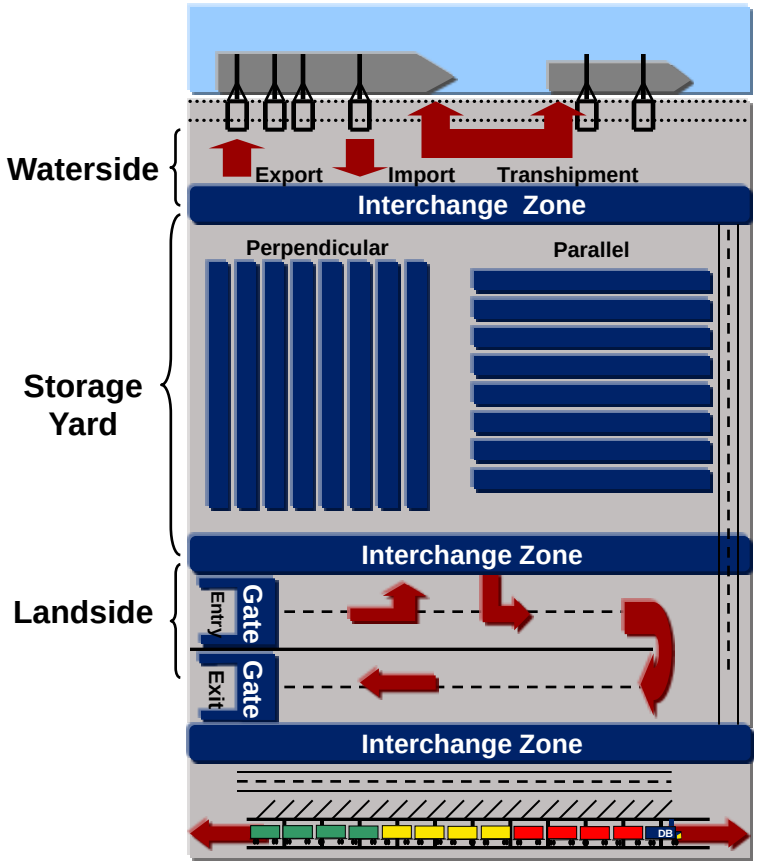
 

# General Approach

## Aspects to be considered

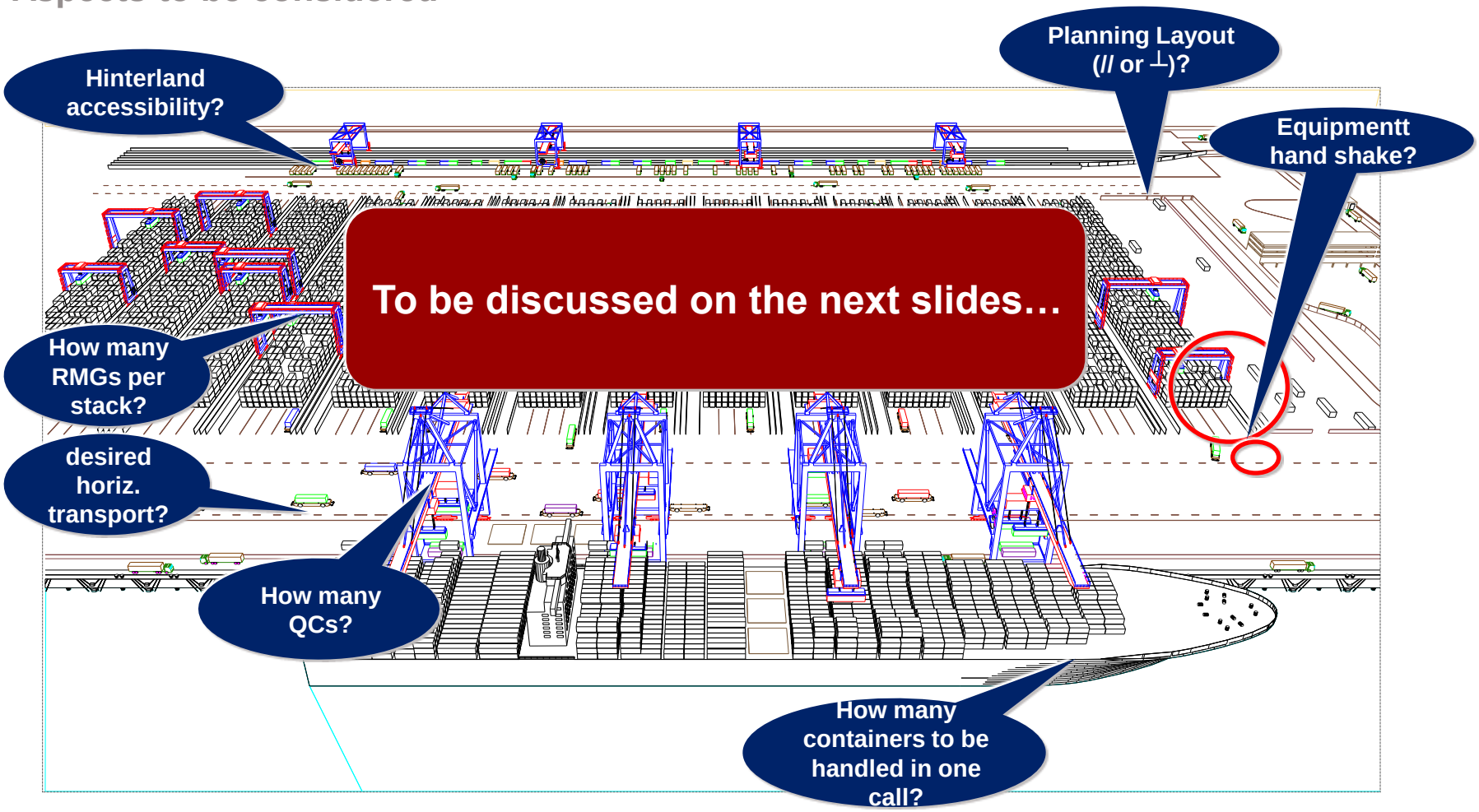
**Planning an automated terminal requires several aspects to be considered:**

- Geography and topography of the selected area
- Space availability (general footprint & depth of area)
- Land and water transport links with the hinterland
- Type and size of vessels per visit
- Terminal annual throughput goal per year
- Projected productivity and utilization level
- Service level
- Investment costs
- Yard Layout (⊥ or ∥)
- Peak factors (waterside, yard, landside)



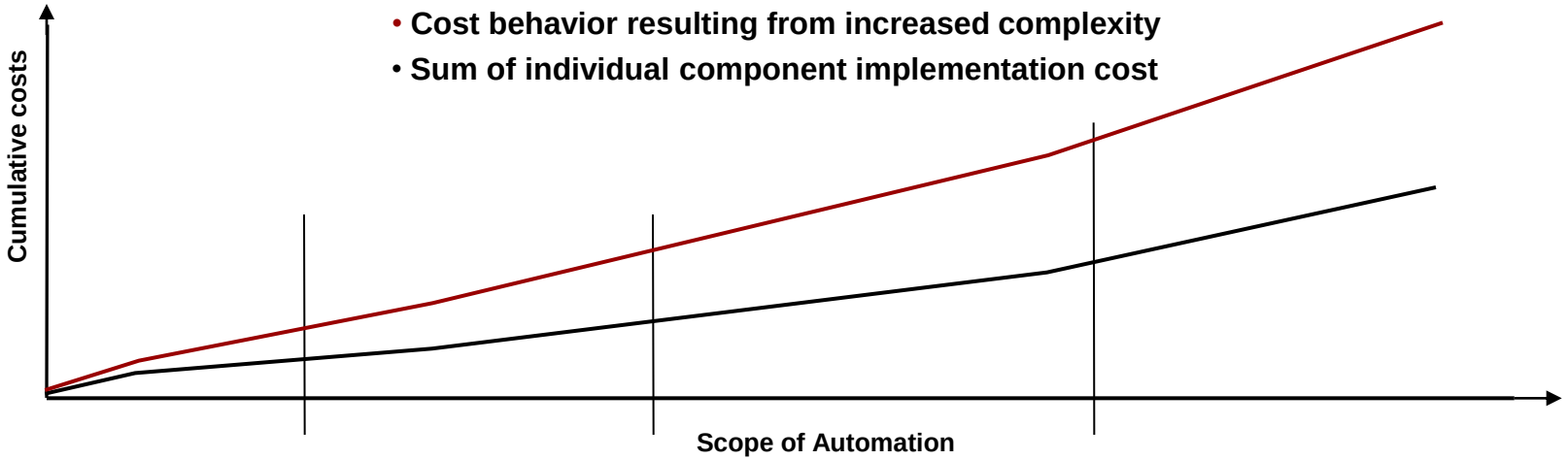
# Design & Handling Equipment

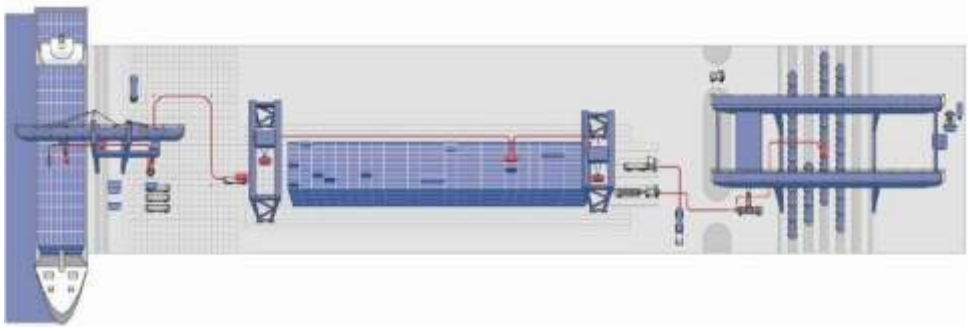
## Aspects to be considered



# Scope of Automation

## Terminal Automation Process Cost Factors



→ Complexity is THE automation cost driver
→ Bing Bang solution require very professional management!

# Off-the-Shelf Solution?

**Off-the-Shelf** **vs.** **Taylor Made**

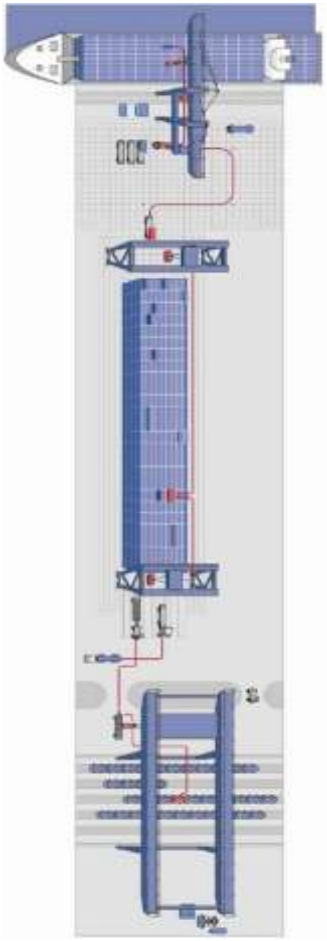
- Reduced complexity
- Faster implementation
- Reduced investment
- Responsibility/liability can be passed over to suppliers
- Integration MAY BE less costly and faster

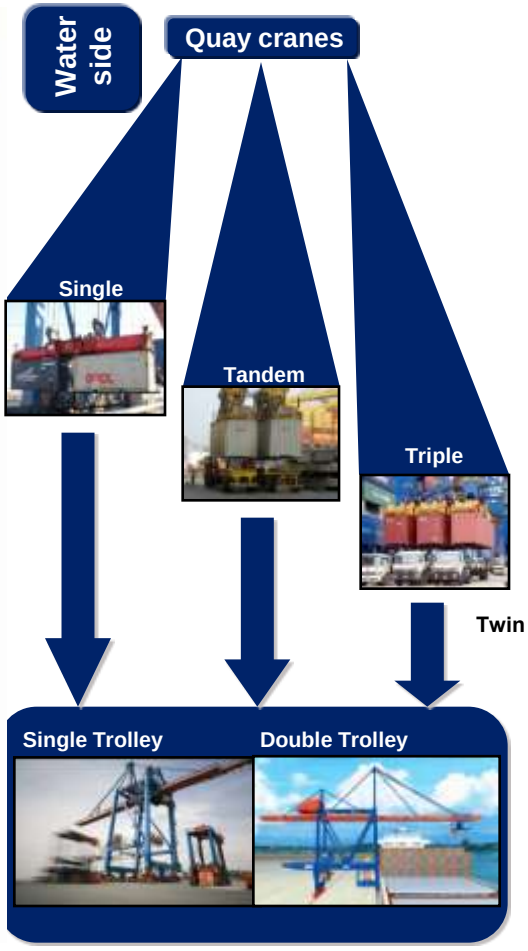
- If done right, terminal remains adaptable to market changes
- Due to higher involvement of operator, resources for continuous optimization are available inhouse
- Options remain with terminal operator to create a competitive advantage

→ **Every Terminal is a unique Terminal and requires a specific Solution!**

# Waterside

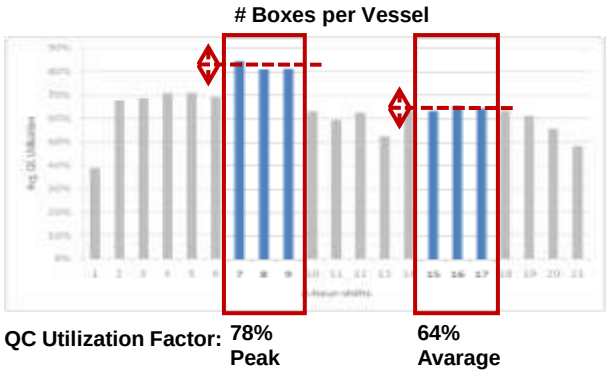
## Quay Cranes Consideration






Factors to be considered for selection

- Size & frequency of vessels
- No. of QC (mvs/h)
- QC performance (mvs/h)
- Height of the QC
- Length of the Berth
- Spreader type
- Utilization factor
- Investment costs
- TEU factor
- Peak factor

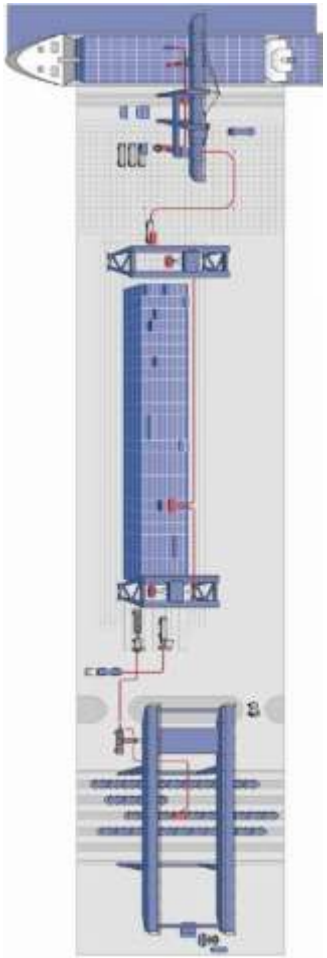



→ QC system decision difficult to change in automated environments!

# Storage Yard-1

## Layout & Handling Equipment Consideration



**Water side**

Quay cranes

**Waterside Transport**

Shuttle Carrier
Straddle Carrier
AGV
Lift AGV
Cassette AGV

**Storage Yard**

Yard Layout
Parallel | Perpendicular
Size (L, W, H)
Shuttle Carrier
RTG
RMG

**Factors to be considered for selection**

**Layout fit to footprint**

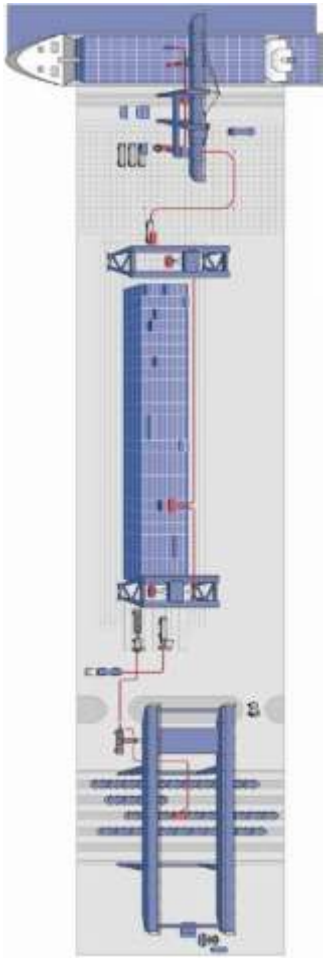
- Primary yard area (50-75 %)
- (Container Freight Station (15-30%) for stuffing & stripping etc. )
- Empty container (M&R, 10-20%)
- Entrance facilities – customs & buildings, parking (5-15%)

→ **Footprint determines RMG System AND Layout!**

# Storage Yard-2

## Layout & Handling Equipment Consideration



**Water side**

Quay cranes

**Waterside Transport**

Shuttle Carrier
Straddle Carrier
AGV
Lift AGV
Cassette AGV

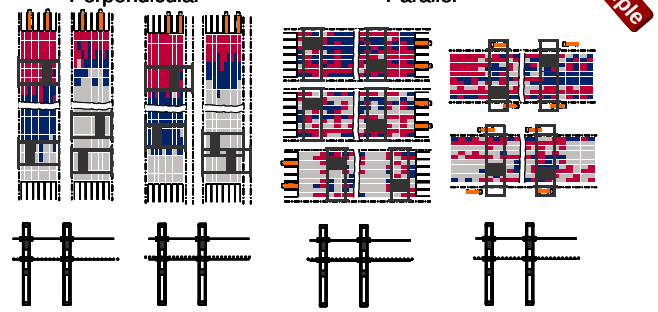
**Storage Yard**

Yard Layout
Parallel | Perpendicular
Size (L, W, H)
Double
Twin
Cantilever …
Carrier
RTG
RMG

**Factors to be considered for selection**

- Waterside input/output
- Landside input/output
- Annual yard capacity
- Nr. of blocks
- Block lengt, width & height
- Nr. of ground slots
- Nr. of total slots
- Yard Layout (⊥ or ⫽)
- Equipment performance
- Equipment compatibility
- Productivity factor
- Utilization factor
- TEU factor
- Dwell time
- Peak factor

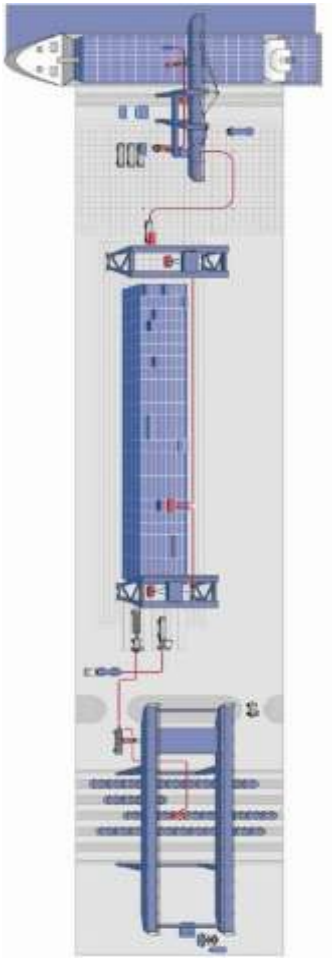
Example

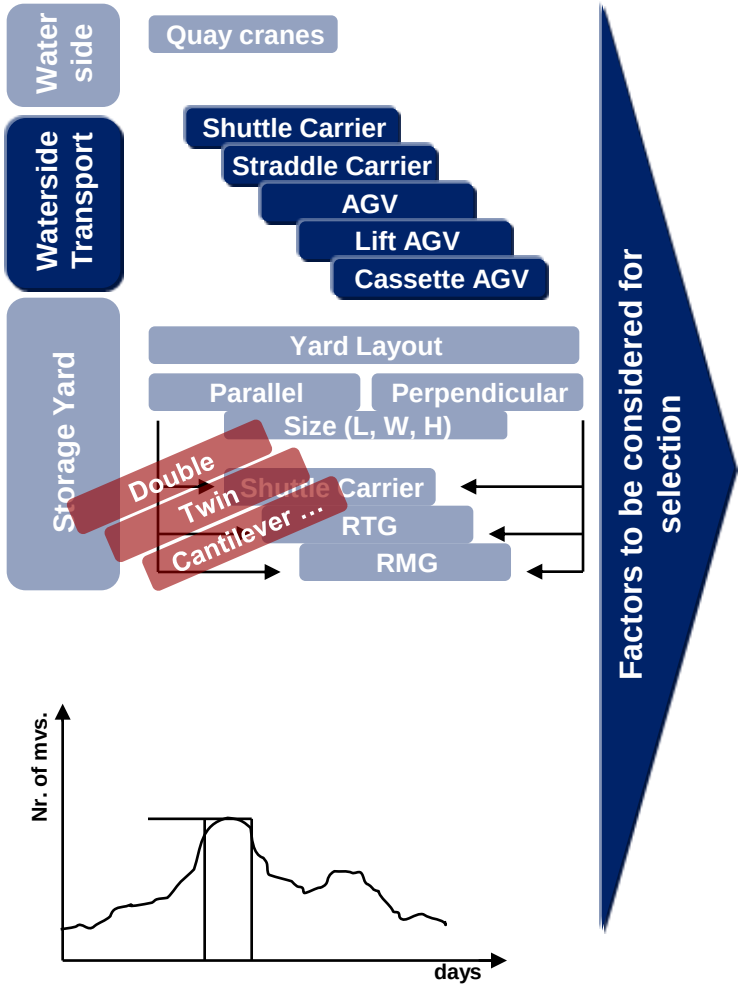



→ **Transshipment Share determines RMG System AND Layout!**

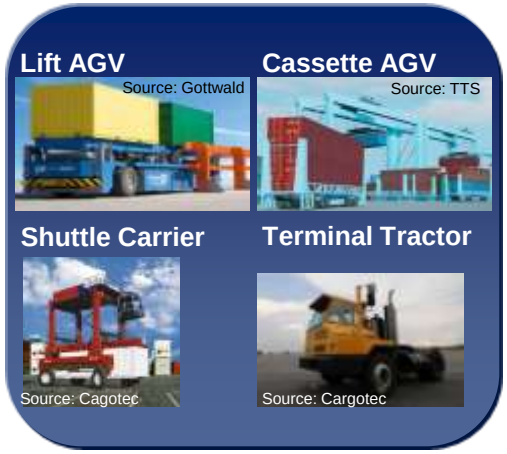
# Waterside

## Horizontal Transport Consideration






- Equipment compatibility
- Equipment performance
- Utilization factor
- TEU factor
- Peak factor

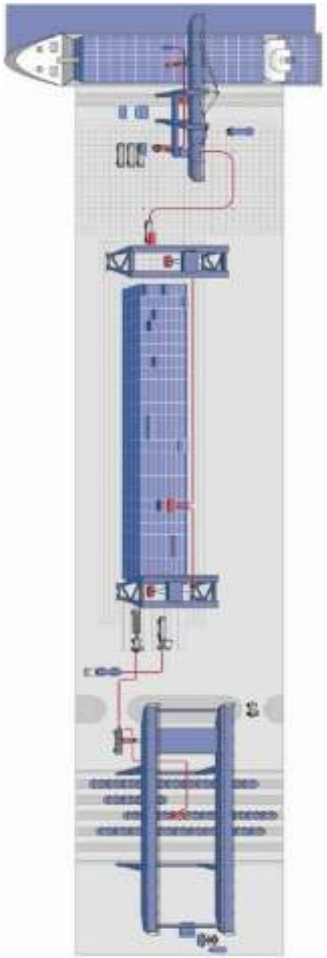



→ **Waterside Horizontal Transport is not an isolated Decision!**

# Landside

## Horizontal Transport Consideration



**Water side**

- Quay cranes

**Waterside Transport**

- Shuttle Carrier
- Straddle Carrier
- AGV
- Lift AGV
- Cassette AGV

**Storage Yard**

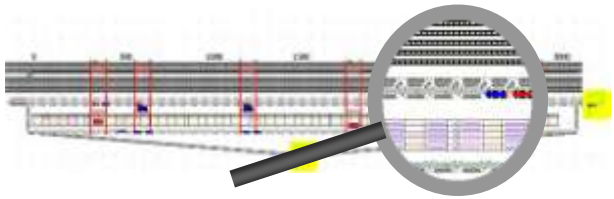
- Yard Layout
- Parallel
- Perpendicular
- Size (L, W, H)
- Shuttle Carrier
- RTG
- RMG

**Landside Transport**

- RMG
- Reach Stacker
- AGV
- Lift AGV
- Cassette AGV
- Shuttle Carrier
- Gate
- Rail

**Factors to be considered for selection**

- Number of external trucks (gate input/output)
- closed or open trucking community
- Railway accessibility
- Buffer-Zone railway layout
- Peak factor

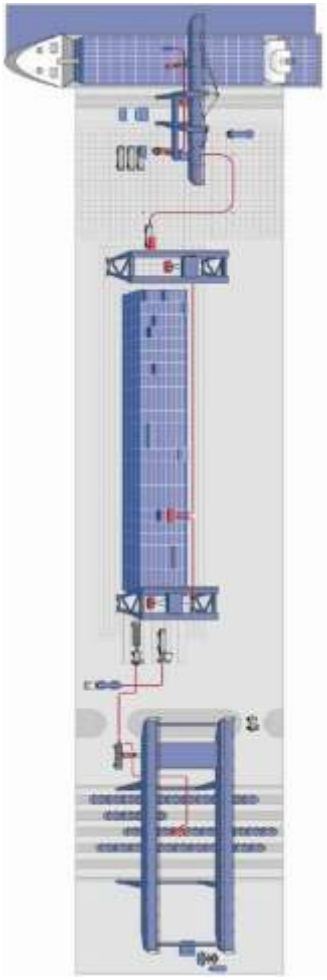


→ **Interaction with Hinterland Transportation Characteristics determines Decision!**

# Landside – Gate

## Horizontal Transport Consideration



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- Shuttle Carrier
- Gate
- Rail

**Factors to be considered for selection**

✓ **Identification**
Automation possible
→ OCR

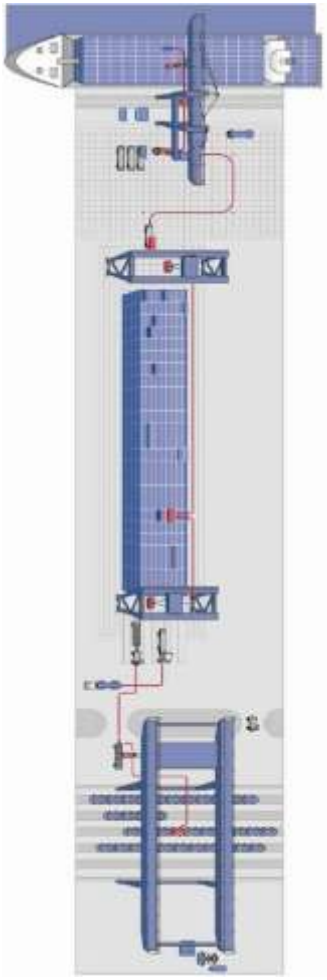
✓ **Auto-Checking**
Automated check and Remote check
→ Cameras

✗ **Auto-Handling**
Rail safety regulations require human supervision and control

✓ **Auto-Planning**
Appointment systems w. sufficient participation

# Selection & Decision Making

## Complexity of taking a Decision



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- Rail

**Simulation/ Emulation & Evaluation**

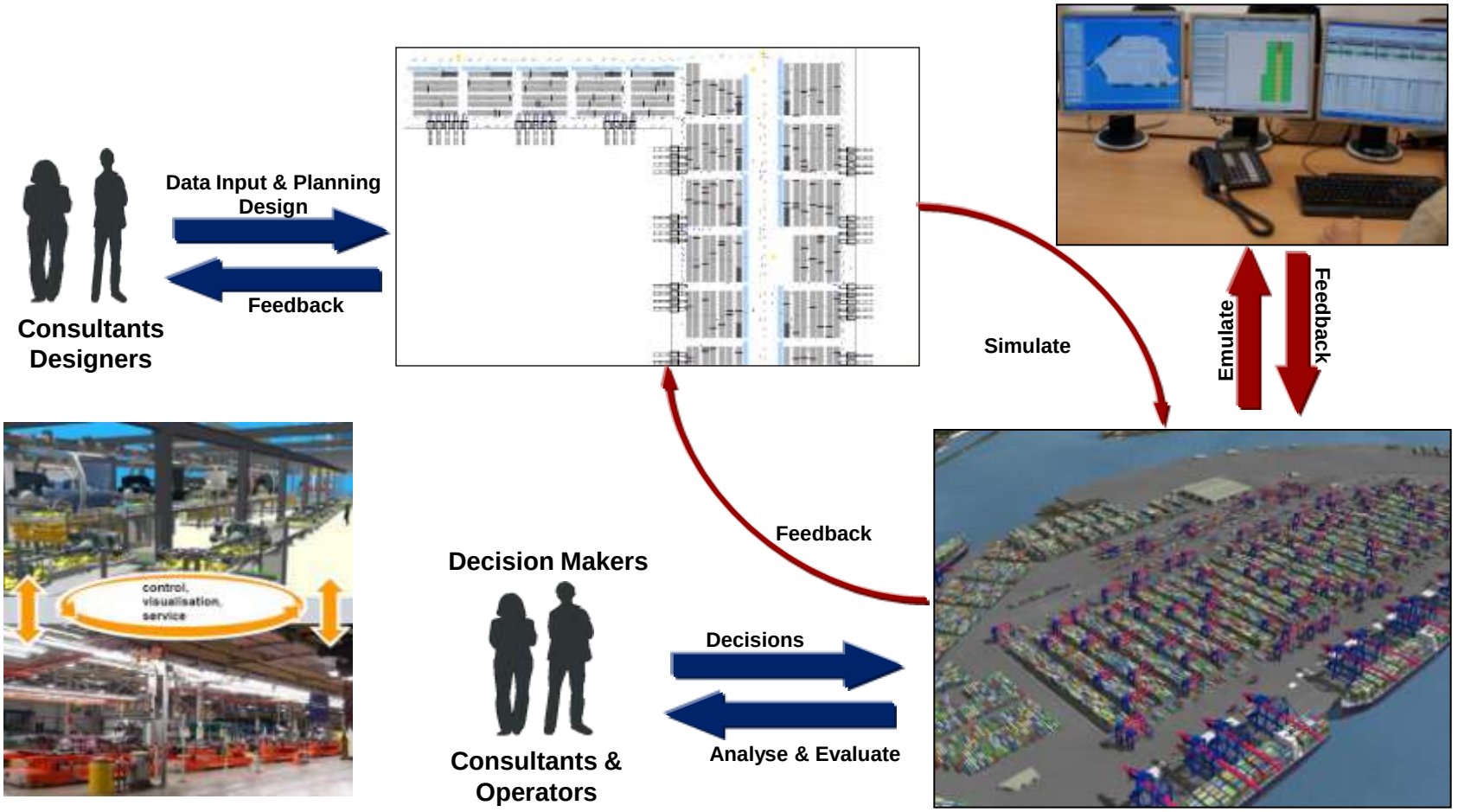
**Objectives**

- Key Performance Indicators & Analysis
- Operational & Engineering Aspects
- Financial Indicators & Cost Estimation
- Regulations, Environment, Safety & Labour

**Decision**

# Development of the Terminal Layout

## Simulation & Emulation




→ **Terminal Automation requires a Team of experienced Professionals**

# Agenda

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**Approach to Terminal Planning & Design**

**Upgrading of Terminal Facilities**

**Foresights of the Future Terminal Automation**

# Initial Situation for Automation Path

## Greenfield Project

- Political framework conditions and set timelines
- Interferences with general infrastructure project challenges
- Upgrading of external infrastructure
- Commercial performance expectations

→ **Key focus: Commencement date and stakeholder expectations**

## Conversion Project

- Scope of automation and resulting process changes
- Adequate sequencing of conversion steps
- Proper phasing of conversion of capacities
- Acceptance within existing labour organisation

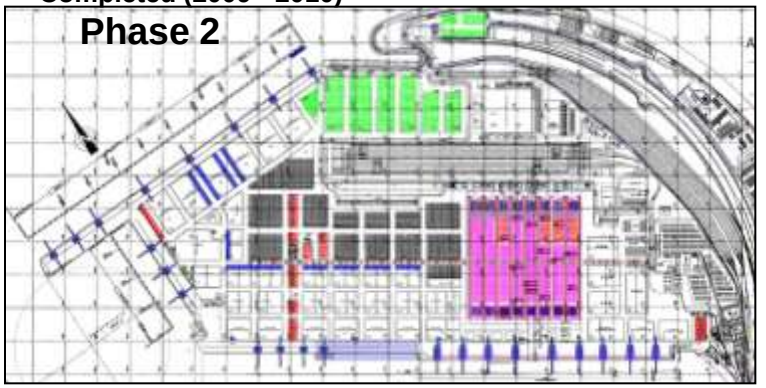
→ **Key focus: Least disruption of existing processes and smooth transition**

→ **Preconditions determine Degree of Freedom in Design and Project Management Objectives**

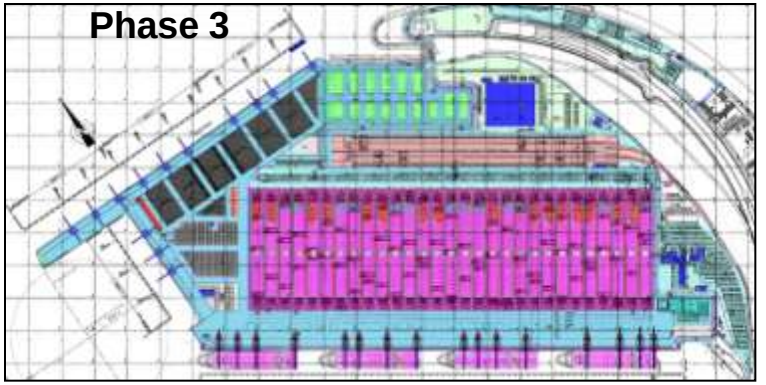
# CTB's Terminal Development

**New Railhead Completed, Extended Storage under SC, RMG Construction Commenced (2007 - 2008)**


**Berth No. 2 Consolidated & First 8 RMG Blocks Completed (2009 - 2010)**



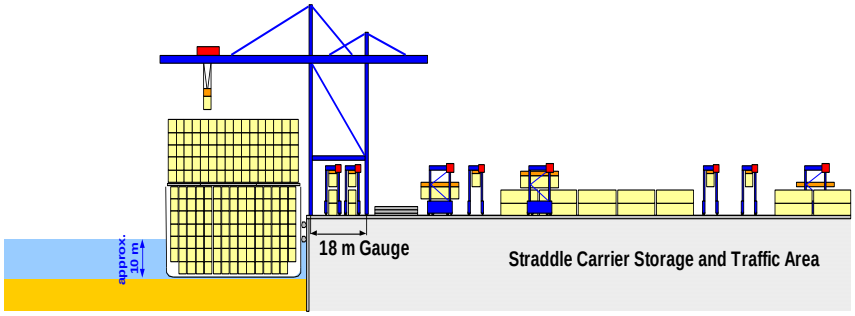

**Including Implementation of High Density Full Container Storage under RMG (Final Terminal Layout, 5.2 Mio TEU)**



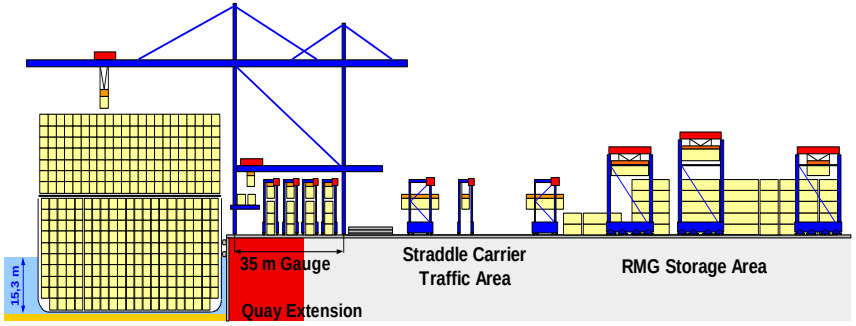

**"Open-heart operation"**
**with mixed operations models**

# CTB's Terminal Development

## Past




## Future




## CTB New Terminal Design

## Quayside Transfer Area RMG Block

# Agenda

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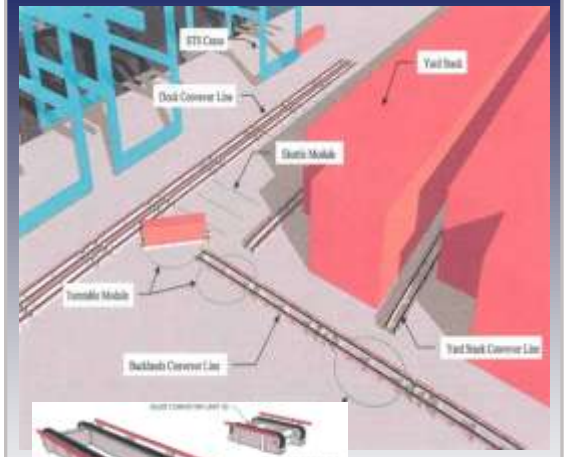
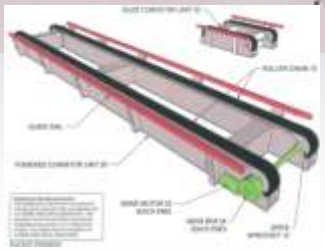
# Foresights

## New Innovative Developments

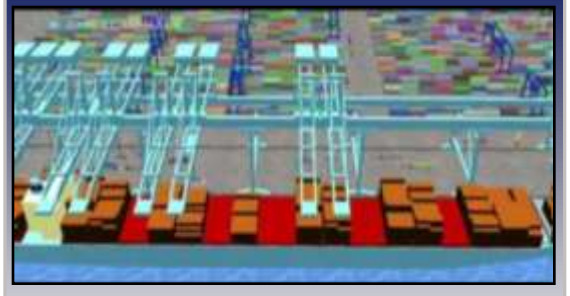
- **Technologies could be like ZPMC development**

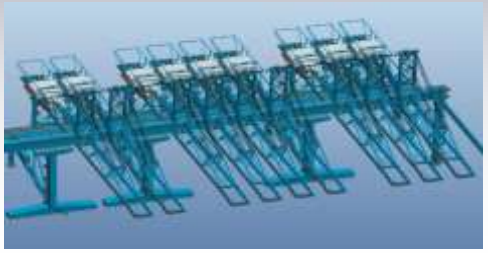

- **or like Caspar, Phillips & Associates**





- **or FastNet Concept by APM Terminals**





**→ No Limits for new innovative ideas …**

- **or …**

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