An Operators Approach to Terminal Automation

SESSION VI: Elements of Container Terminal Planning and Design

Dr. -Ing. Felix Kasiske, Partner, Head of Terminal Development & Design
An Operators Approach to Terminal Automation

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

Introduction

Preparation

Assessment

Full Service Provider

Design & Planning

Realization

Commissioning & Operations

Improvement

Conceptual planning
- System selection
- System calibration

Concept validation
- Static assessments
- Dynamic simulations

Equipment definition
- Specification
- Tender Support
- Construction supervision

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

Integration / Commissioning
- 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

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

Meeting Point
Terminal Automation
Customer Satisfaction
An Operators Approach to Terminal Automation

Agenda

- Introduction
- Approach to Terminal Planning & Design
- Upgrading of Terminal Facilities
- Foresights of the Future Terminal Automation
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

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

- Hinterland accessibility?
- How many RMGs per stack?
- Desired horizontal transport?
- How many QCs?
- Equipment hand shake?
- Planning Layout (|| or \(\perp\))?
- How many containers to be handled in one call?

To be discussed on the next slides…
Scope of Automation

Terminal Automation Process Cost Factors

• Cost behavior resulting from increased complexity
• Sum of individual component implementation cost

→ 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

Waterside Transport
Water side

Storage Yard

Factors to be considered for selection

Yard Layout
Parallel
Perpendicular

Size (L, W, H)

Shuttle Carrier
Straddle Carrier
AGV
Lift AGV
Cassette AGV

Factors to be considered for selection

• 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

Factors to be considered for selection
- Waterside input/output
- Landside input/output
- Annual yard capacity
- Nr. of blocks
- Block length, 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

→ Transshipment Share determines RMG System AND Layout!
Waterside Horizontal Transport Consideration

Factors to be considered for selection:
- Equipment compatibility
- Equipment performance
- Utilization factor
- TEU factor
- Peak factor

Waterside Horizontal Transport is not an isolated Decision!
Landside
Horizontal Transport Consideration

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

Waterside Transport
- Quay cranes
- Shuttle Carrier
- Straddle Carrier
- AGV
- Lift AGV
- Cassette AGV

Storage Yard
- Yard Layout
- Parallel
- Perpendicular
- Size (L, W, H)

Landside Transport
- Shuttle Carrier
- RTG
- RMG
- Reach Stacker
- AGV
- Lift AGV
- Cassette AGV
- Shuttle Carrier

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

Approach to Terminal Planning & Design
Selection & Decision Making
Complexity of taking a Decision

Waterside Transport
- Quay cranes
- 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

Simulation/Emulation & Evaluation

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

Decision

Approach to Terminal Planning & Design

© HPC Hamburg Port Consulting GmbH
Development of the Terminal Layout
Simulation & Emulation

→ Terminal Automation requires a Team of experienced Professionals
Agenda

Introduction

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

Phase 1

Phase 2
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)

Phase 3
“Open-heart operation” with mixed operations models
CTB’s Terminal Development

Past

Future

CTB New Terminal Design

Quayside Transfer Area RMG Block
Agenda

Introduction

Approach to Terminal Planning & Design

Upgrading of Terminal Facilities

Foresights of the Future Terminal Automation
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 …
HPC HAMBURG PORT CONSULTING GMBH
CONTACT ADDRESS

HPC Hamburg Port Consulting GmbH
Dr.-Ing. Felix Kasiske
Container-Terminal Altenwerder
Am Ballinkai 1
D-21129 Hamburg
Germany

Phone: +49 40 74008 132
Fax: +49 40 74008 133
f.kasiske@hpc-hamburg.de