

Terminal Design and Planning for automated Facilities

– getting the Fundamentals right

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Preconditions

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

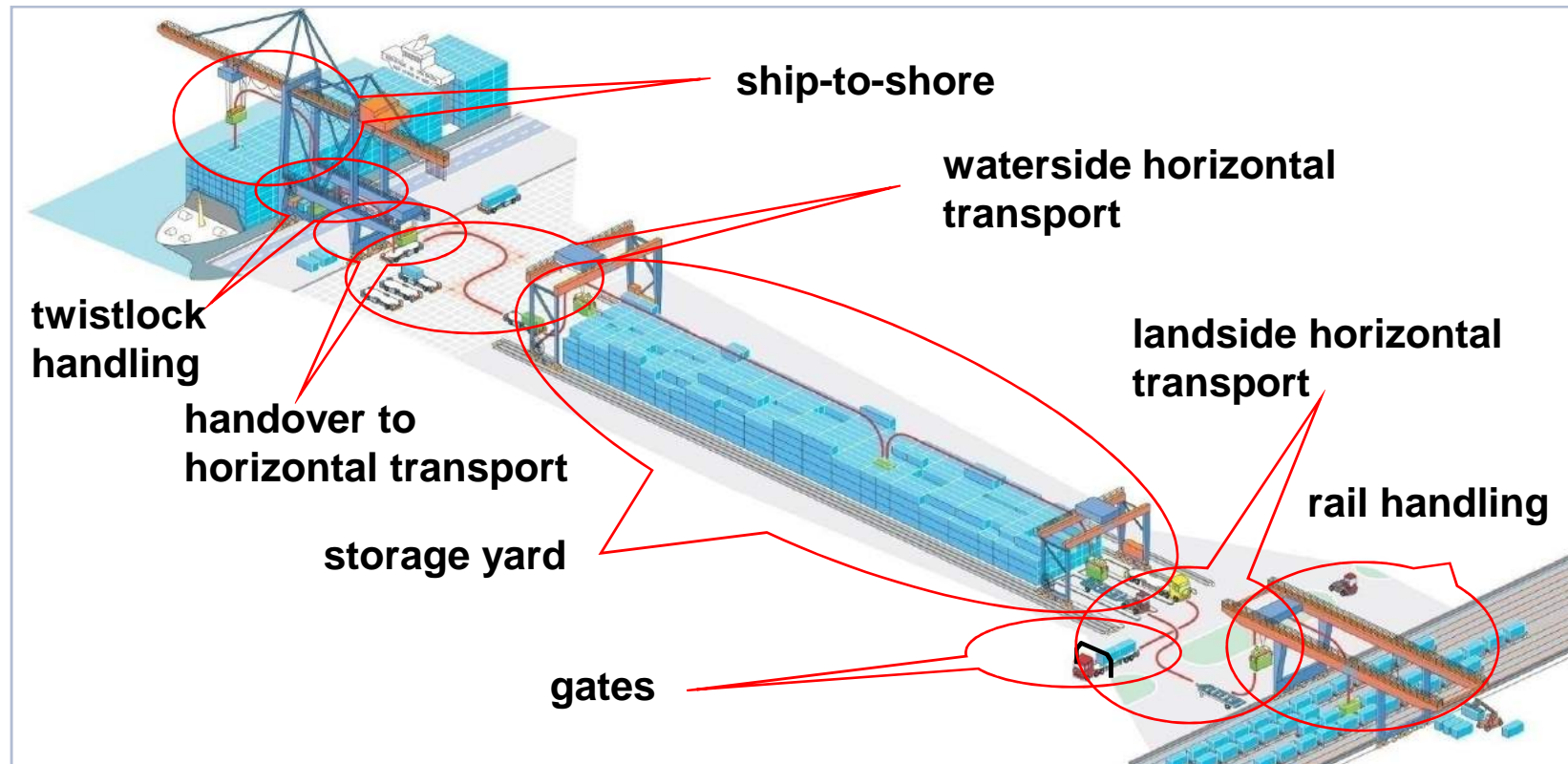


- Scope of automation and resulting process changes
- Adequate sequencing of conversion steps
- Proper phasing of conversion of capacities
- Acceptance within existing labour organisation

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

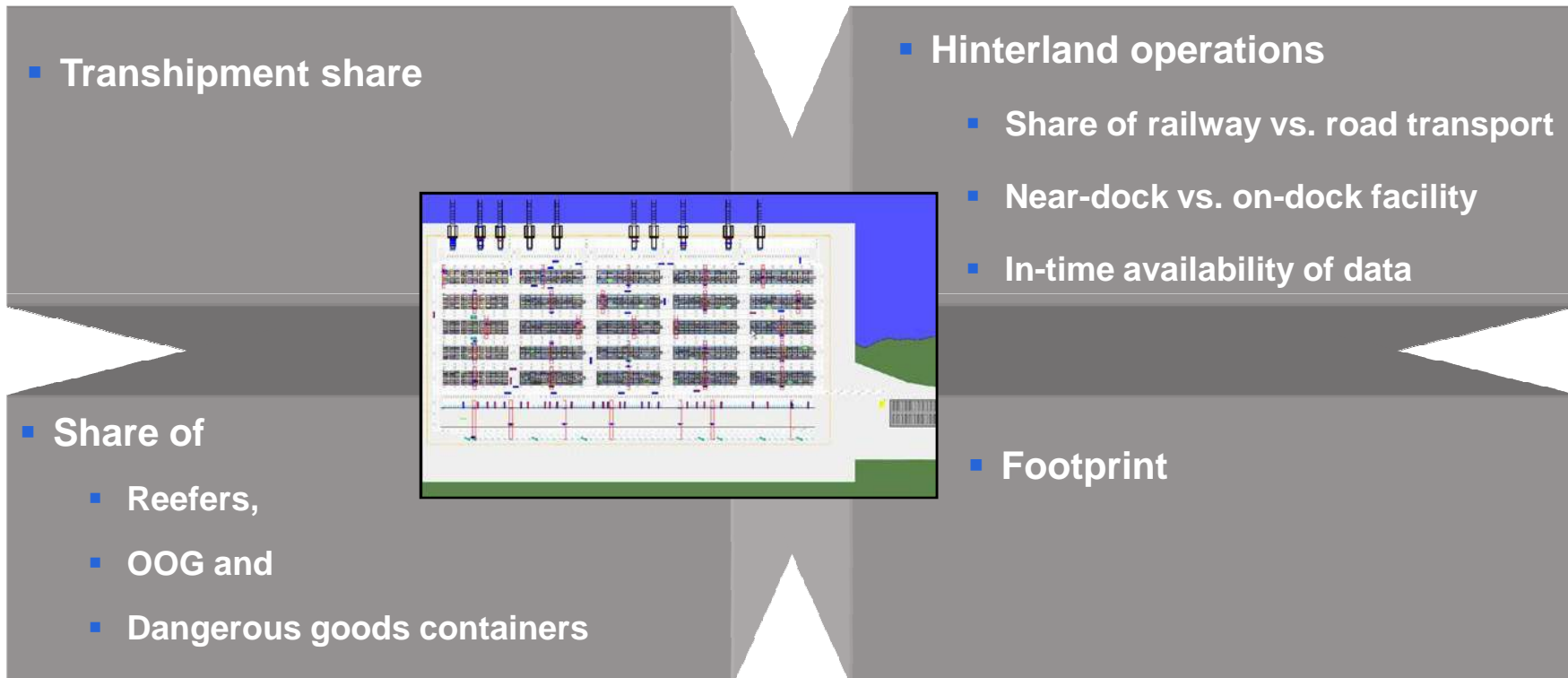
Preconditions determine Degree of Freedom in Design and Project Management Objectives

Scope of Automation



**Complexity of total System is not just the Sum of Complexity of its Components
→ Focus stepwise on most promising Processes and avoid Bing Bang Approach**

Major Determinants for Planning and Design of Automated Terminals



**Not only Layout depends on Determinants
 → Scope of Automation and Design are heavily influenced**

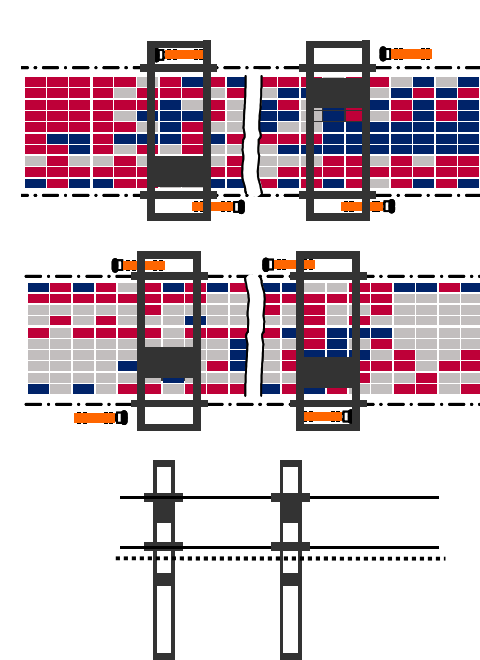
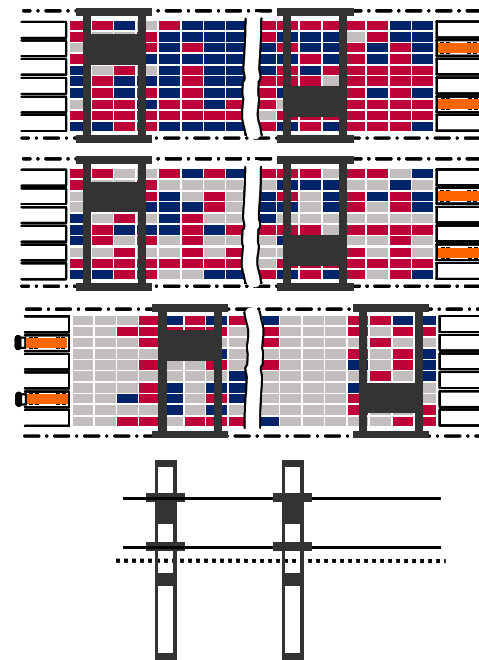
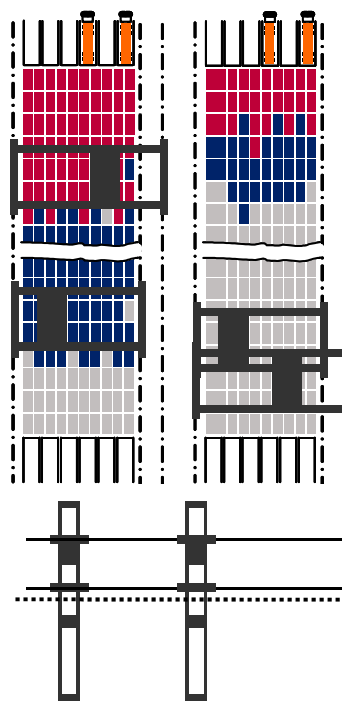
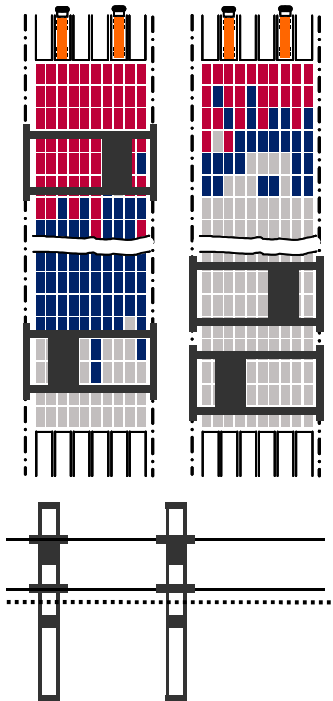
Transshipment Share

- Twin-RMG
(perpendicular)

- D-RMG
(perpendicular)

- Twin-RMG
(parallel)

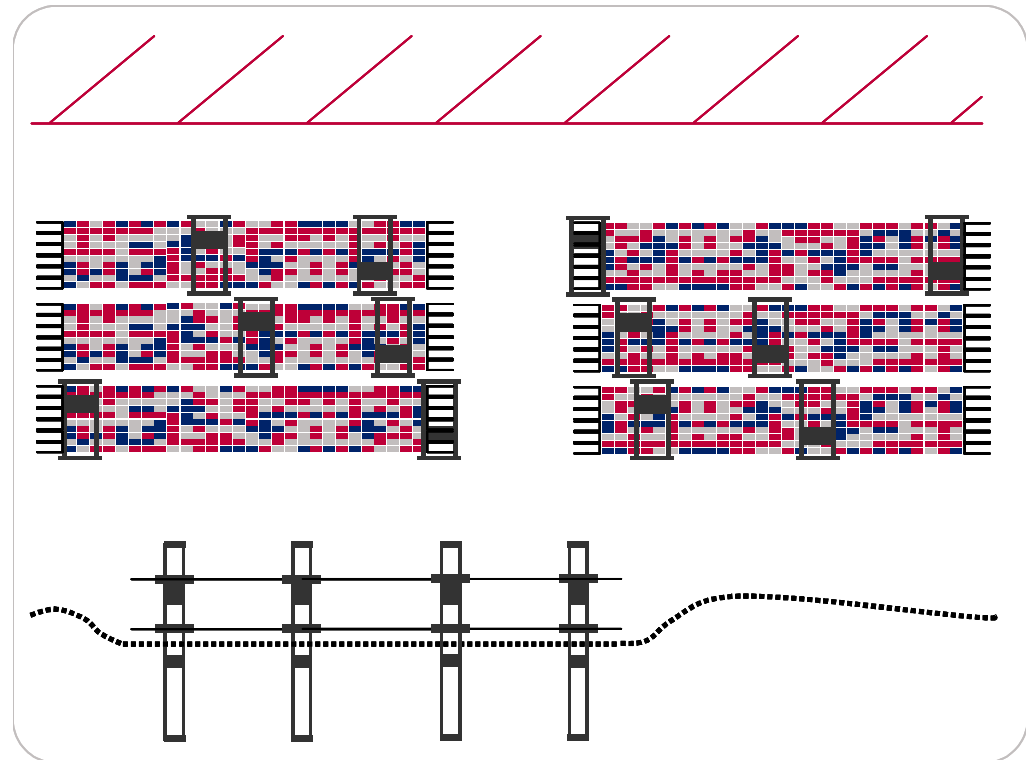
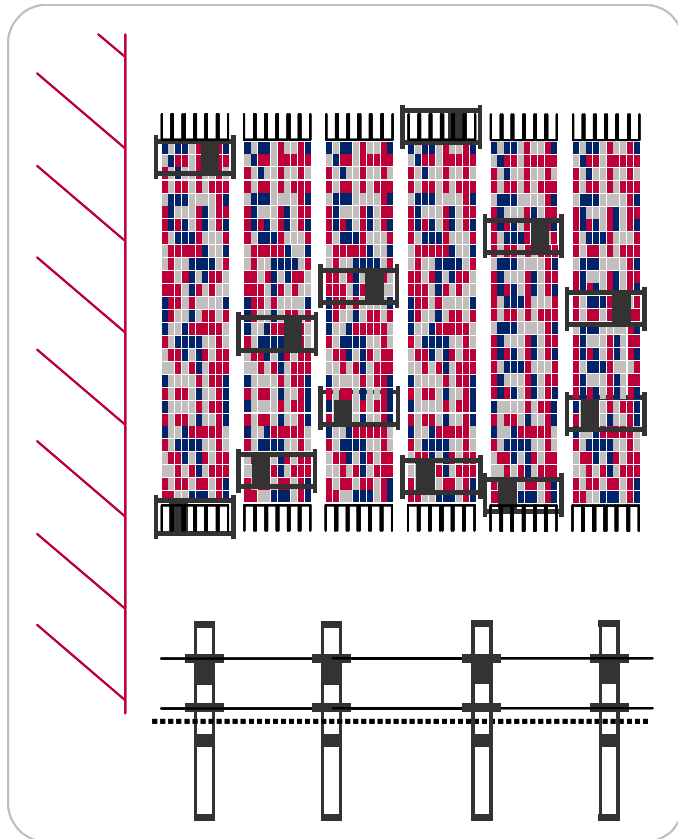
- C-RMG
(parallel)



→ Transshipment Share determines RMG System AND Layout

Footprint

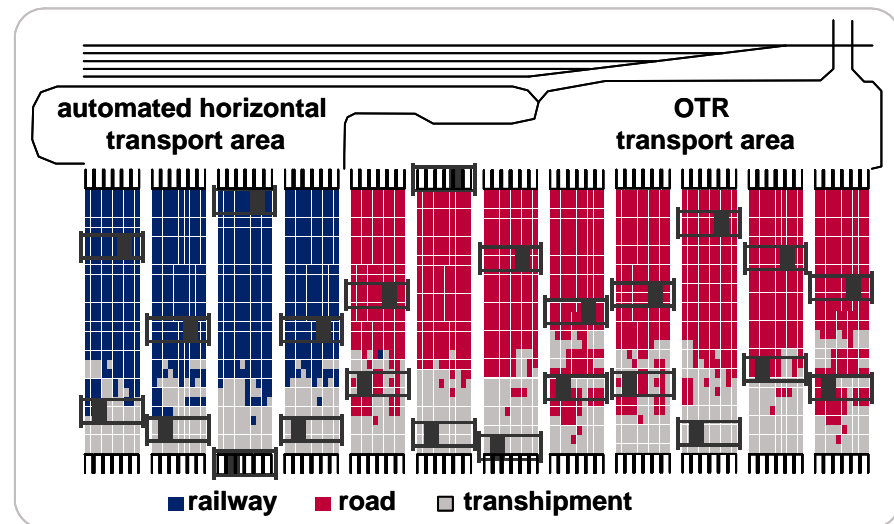
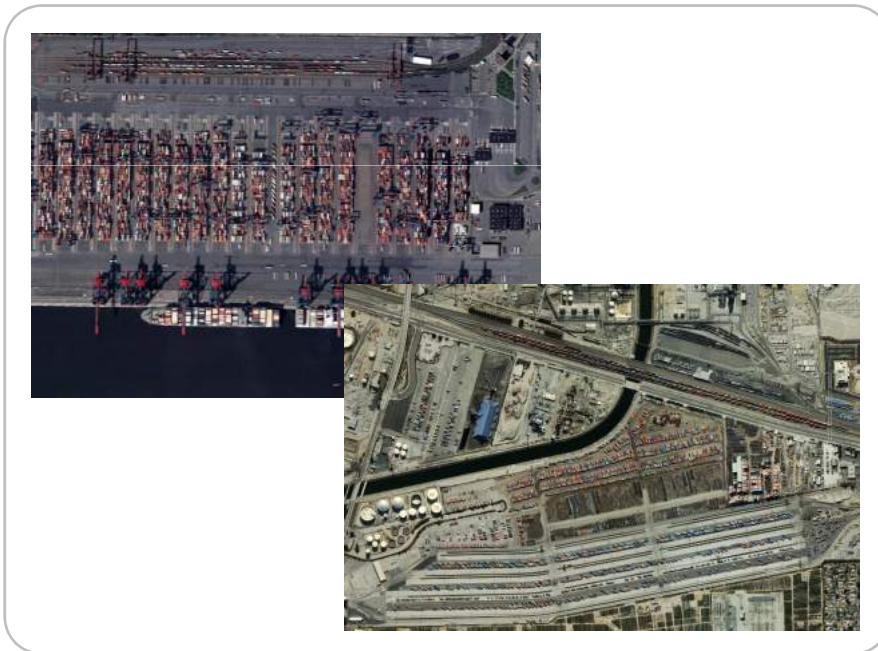
- Rectangular shape
- Depth to length ratio



Footprint may require a certain general Layout Option – parallel vs. vertical

Hinterland Operations

- Multimodal landside operations or road only
- On-dock vs. near dock facility

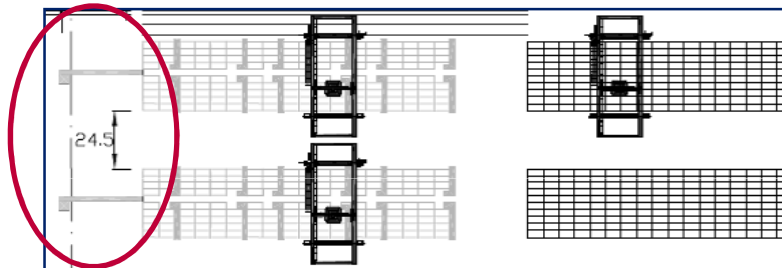


- on-time availability of data on hinterland transport

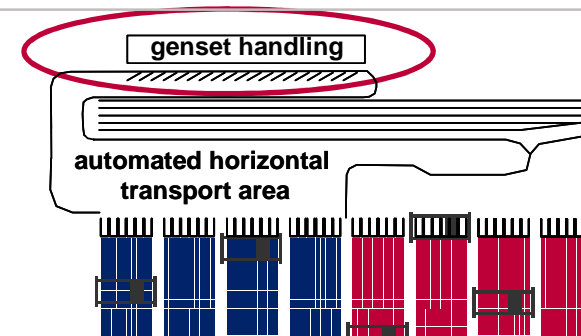
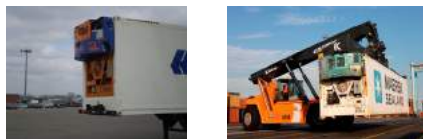
Rail Terminal Solution influences Automation of horizontal Transport

Share of Reefers, OOG and dangerous Goods Containers

- **Accessibility of reefers in perpendicular vs. parallel blocks**



- **Genset handling/mounting in automated horizontal transport environment**

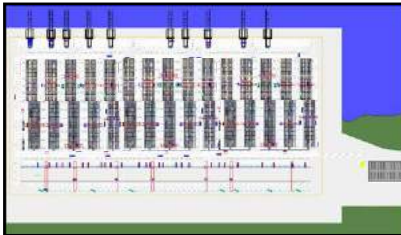


- **Shuttle carrier**
- vs.
- **Lift-AGV**

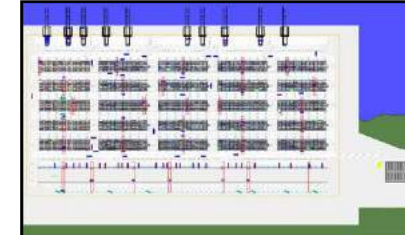
→ **Automation focuses on Standard Processes, Exception Solutions must be individually found outside Automation Approach**

Validation of selected Design Alternatives

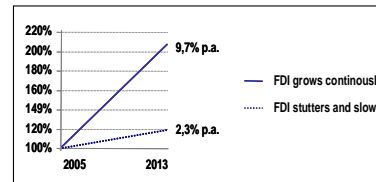
Alternative A



Alternative B



- Simulation, sensitivity analysis in
 - Alternative market scenarios
 - Alternative operating scenarios



- Bottleneck analyses
- Adaptation
- Optimisation

- Cost-benefit-analysis and
- Selection of most promising terminal design

	Weighting	RTG/PM	par. RMG/PM	par. RMG/ShC	perp. RMG/ShC
Quantitative Criteria					
Capital Cost	15.0%	0.15	0.17	0.22	0.2
Operating Cost	35.0%	0.35	0.4	0.4	0.38
Land Utilization	10.0%	0.1	0.08	0.11	0.097
Quay crane productivity	10.0%	0.1	0.12	0.093	0.113
Qualitative Criteria					
Operational flexibility	7.5%	0.075	0.052	0.068	0.045
Ease of maintenance	5.0%	0.05	0.035	0.04	0.022
Safety	2.5%	0.025	0.028	0.025	0.035
Automation potential	5.0%	0.05	0.075	0.08	0.027
Integration with existing terminals	10.0%	0.1	0.1	0.051	0.075
Sum	1	1.0000	1.0600	1.0870	0.9940

→ Validated Terminal Design Selection by Simulation and Sensitivity Analysis

THANK YOU !



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