Innovative Intermodal Terminals
Future concepts

TRB
Newport Beach
California
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Gottwald Port Technology

GOTTWALD
port technology

Content

- Ojectives of innovative intermodal terminals
- Development of rail terminals
  (lessons learnt from sea terminals)
- Innovative intermodal concept - layout proposal
- Variety of different layout applications of the GPT cranes and the terminal systems concepts
- ASC crane movie
- Conclusions

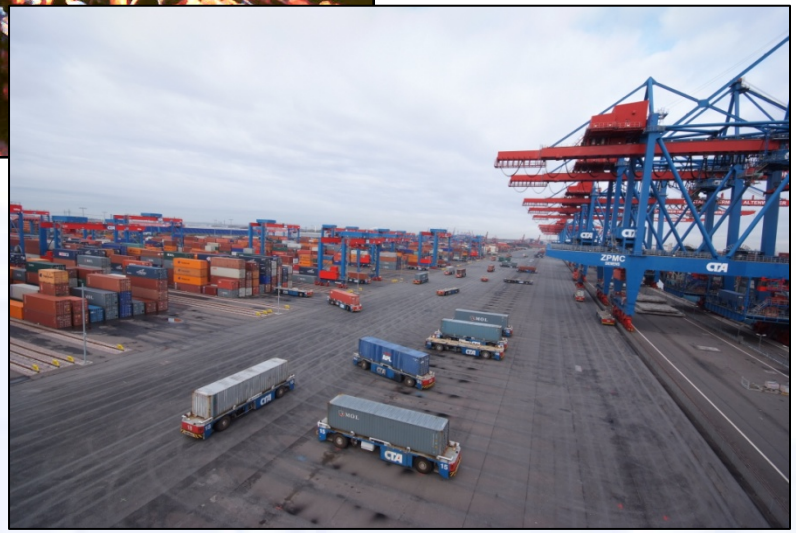
Objective for Innovative Intermodal Terminal Operation

- Improved service for connecting modalities (short train turn around times (≤ 3 hours)
- Scalability into different terminal scenarios
- High area utilization
- Capability to expand in line with volume development
- Flexible terminal layout design
- Low labor impact
- Economy of scales to reduce labor cost

Content

- Ojectives of innovative intermodal terminals
- **Development of rail terminals (lessons learnt from sea terminals)**

Development of the Sea Terminal



All Functionalities within one Type of Equipment (Crane)

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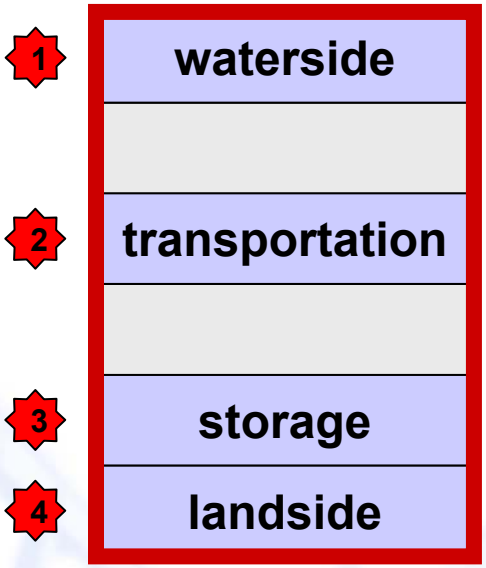
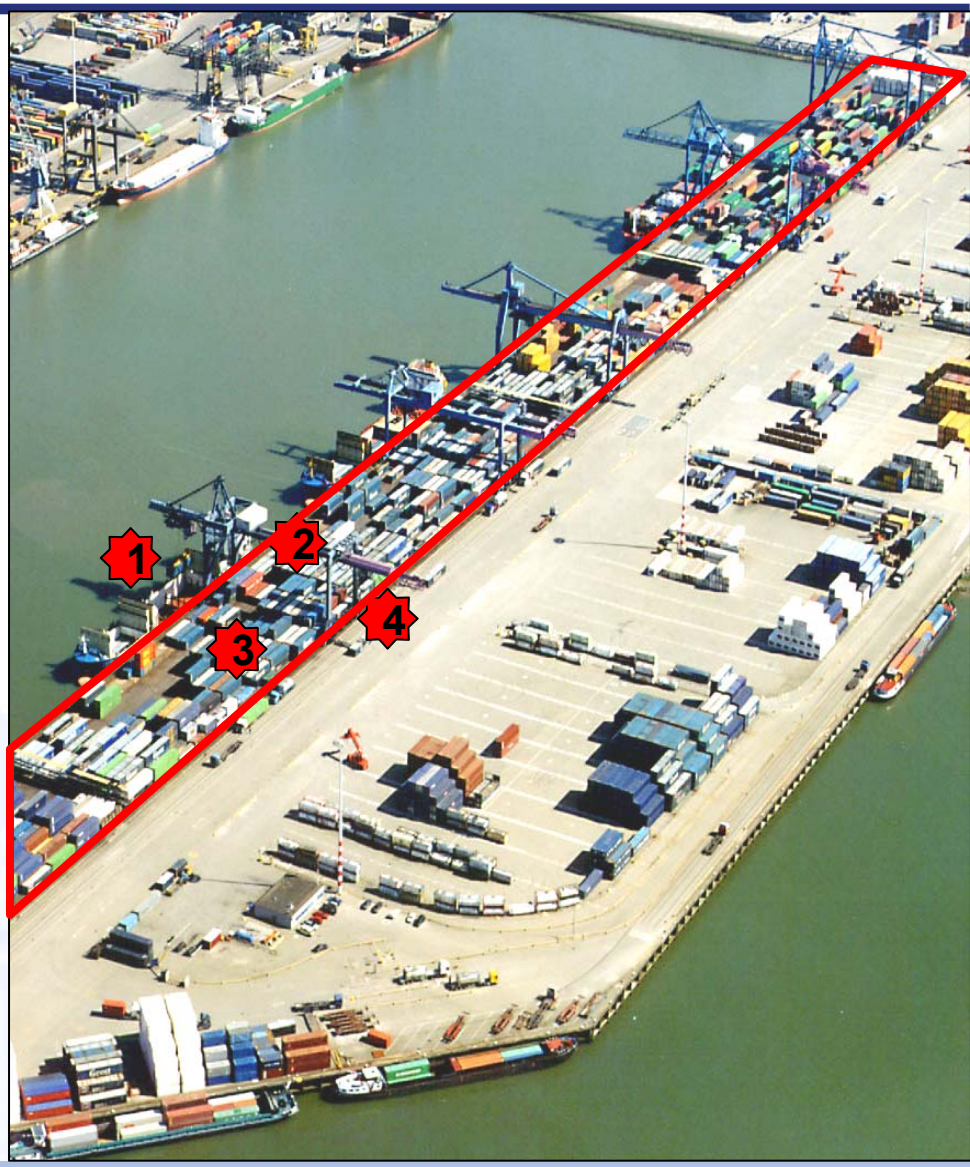
Type 1



1 system type (1 crane)



One Step Further: Quay Crane and Yard Operation have been Separated

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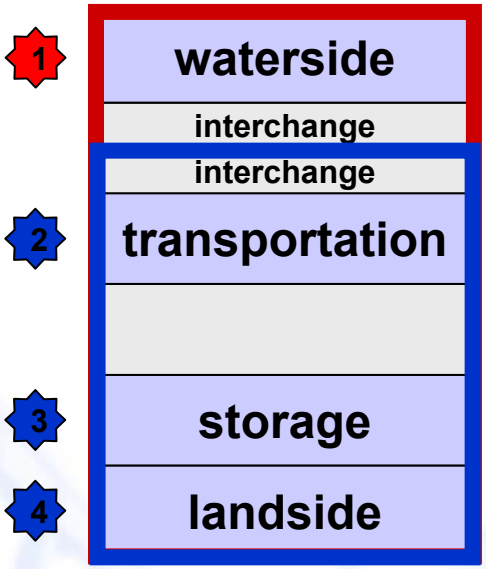
Type 2



2 system type

The Modern Approach: Specialization stands for Automation and Performance

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Type 3

1 waterside

interchange

interchange

2 transportation

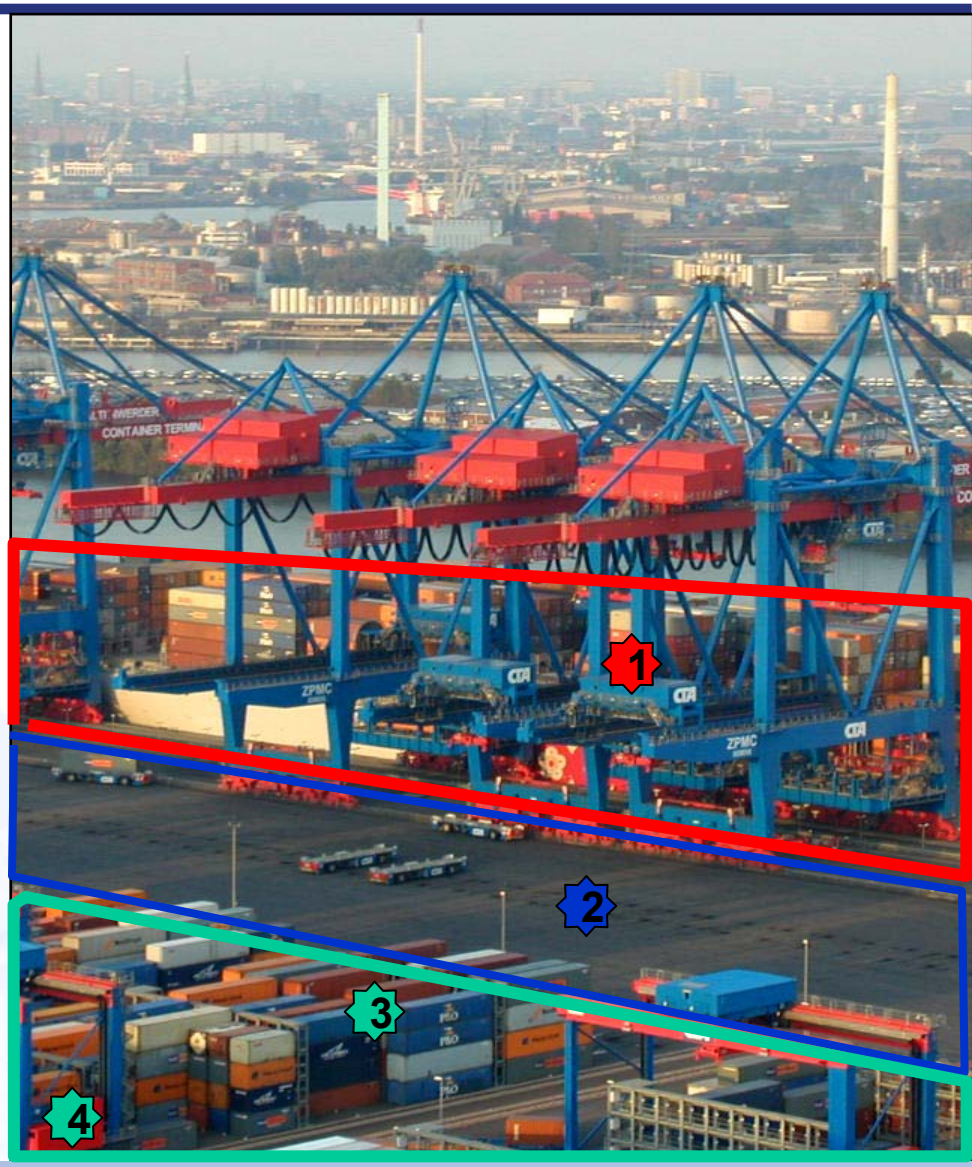
interchange

interchange

3 storage

4 landside

3 system type



Sea Terminals have specialized: Focus on Service and Productivity

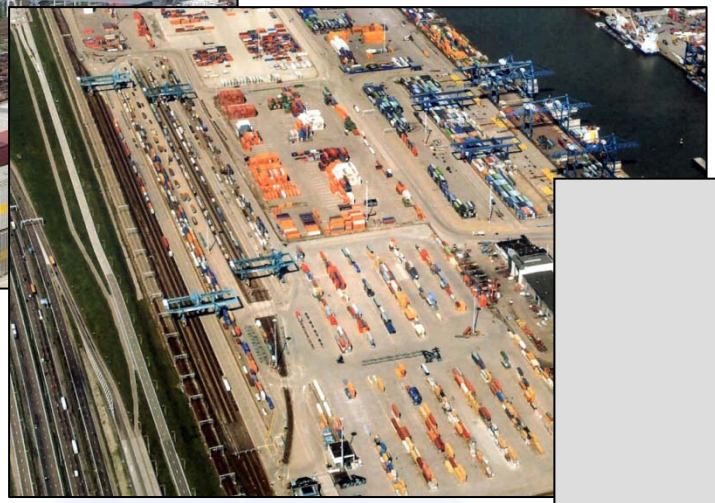
Service and productivity increase from dedicated functionalities

Type 1	Type 2	Type 3
waterside	waterside	waterside
	interchange	interchange
	interchange	interchange
transportation	transportation	transportation
		interchange
		interchange
storage	storage	storage
landside	landside	landside
1 system type	2 system type	3 system type

Development of the Intermodal Terminal

Type 1

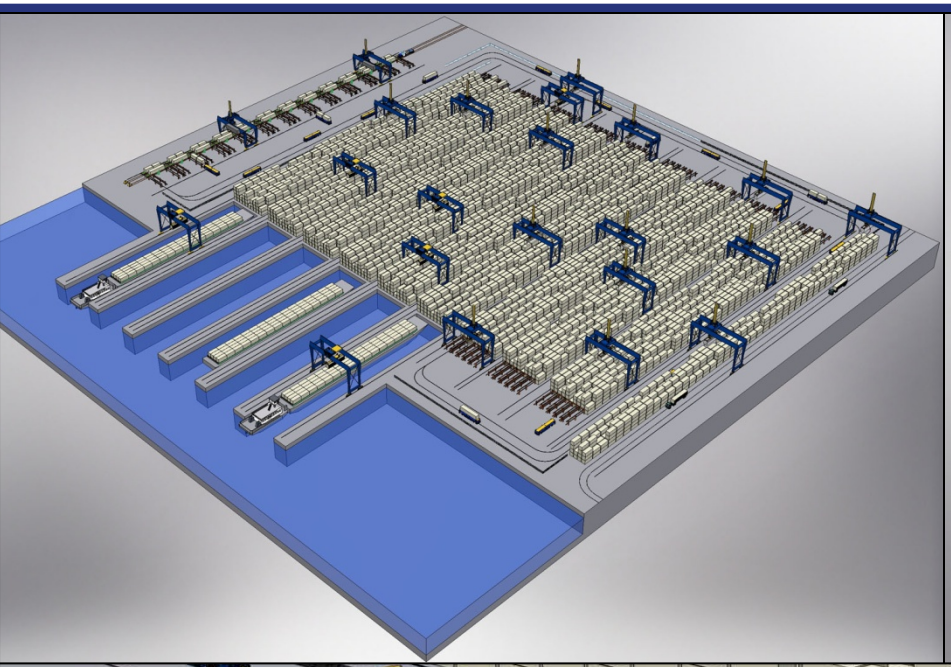
Type 2

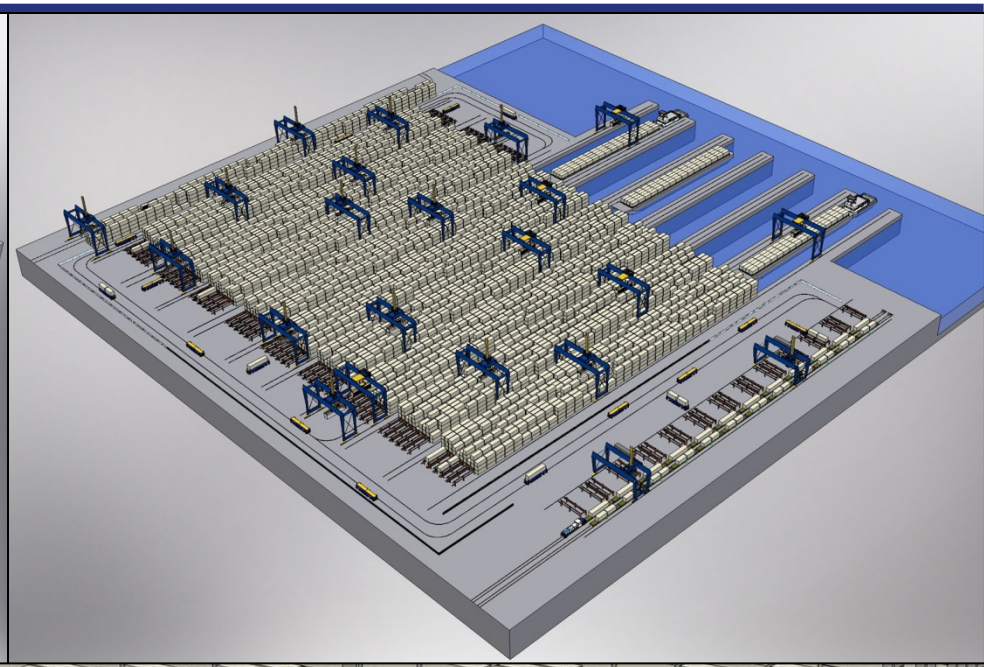


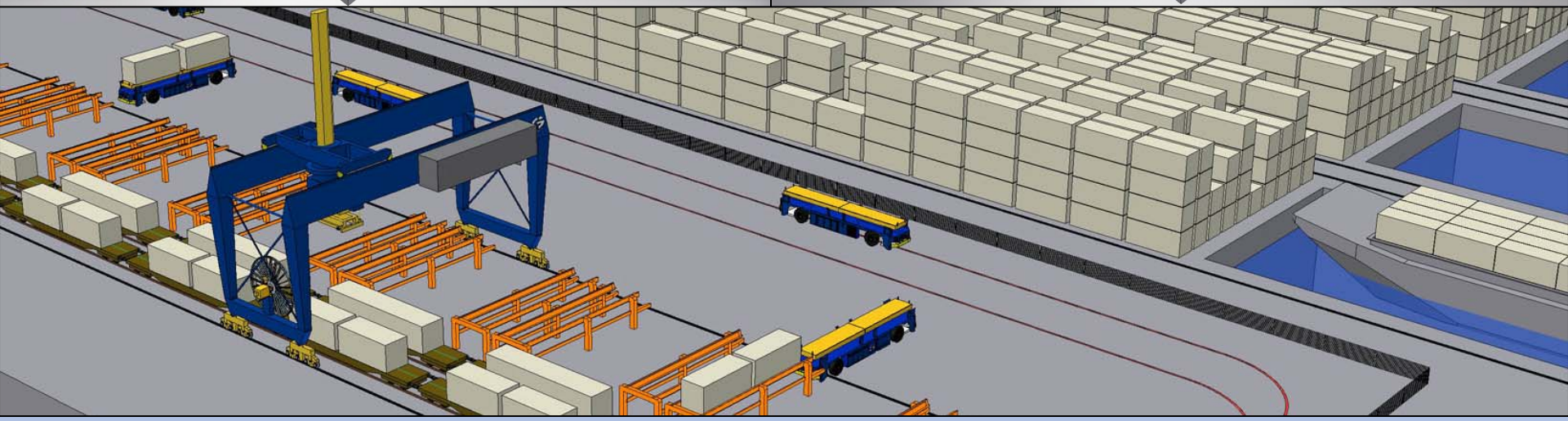
Type 3 ?

How is the situation in intermodal terminals ?

Idea of a Combined Mixed Hub for all three Modalities (road, rail, barge)

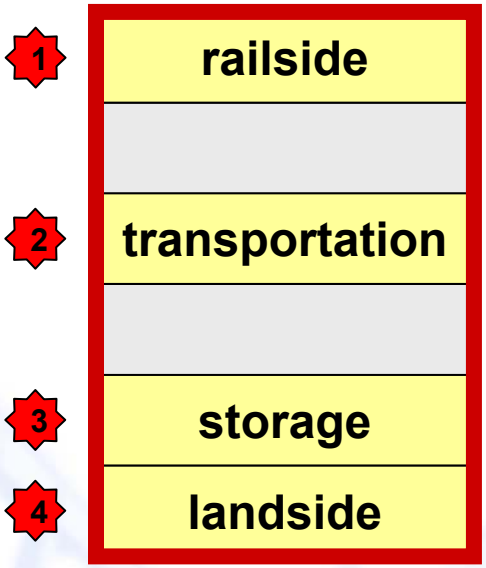




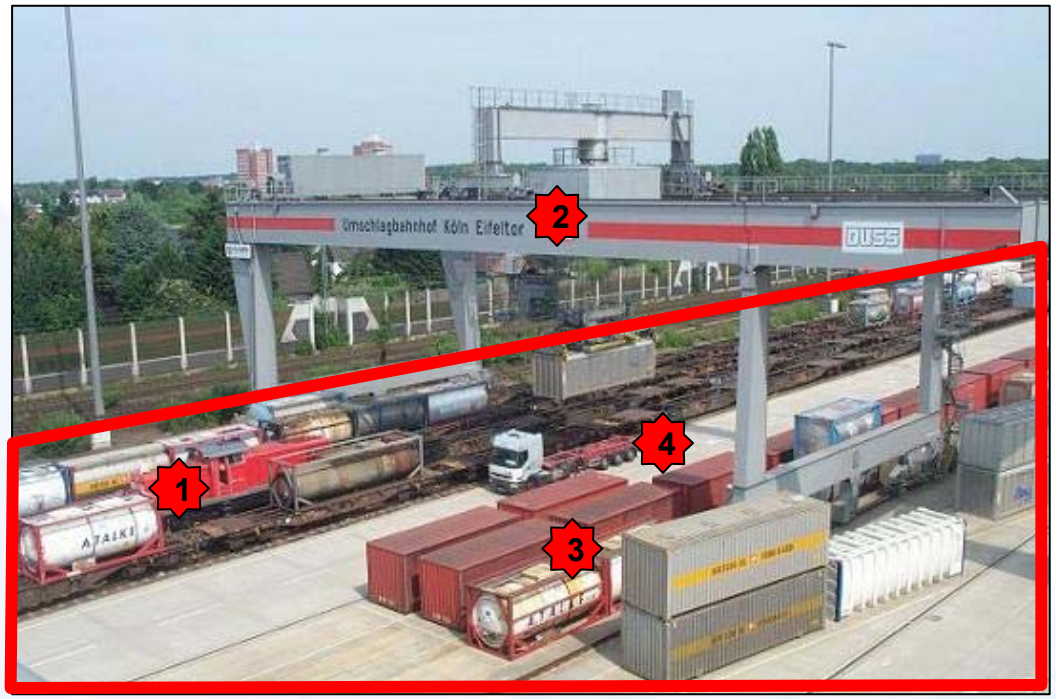


Existing Railroad Terminals compared with Type 1 of the Sea Terminals

Type 1

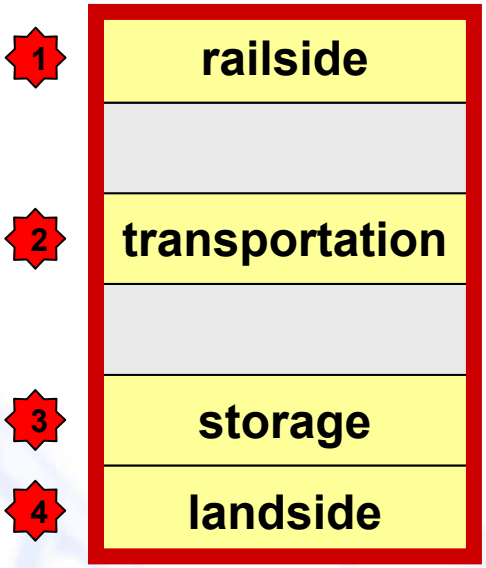


1 system type (1 crane)

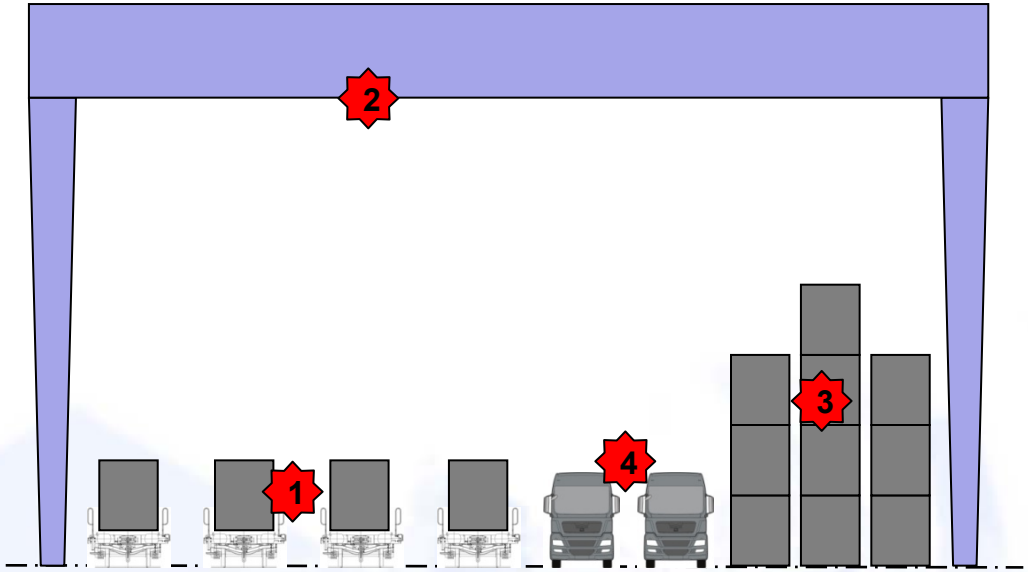


Cross Section Type 1 of an Intermodal Railroad Terminal

Type 1



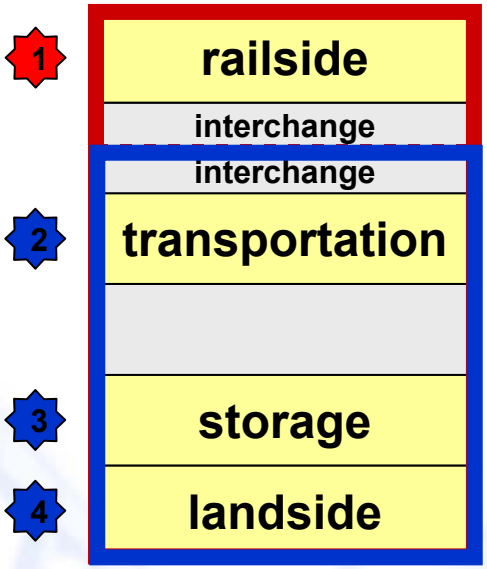
1 system type
(1 crane)



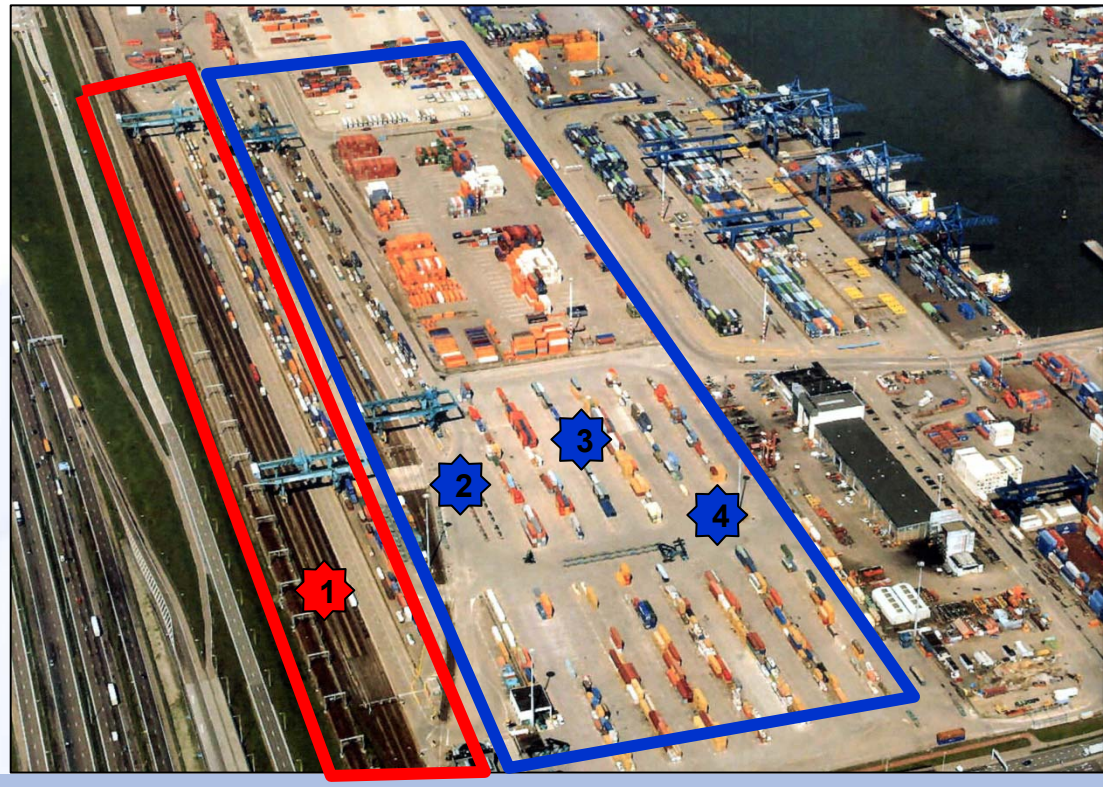
- The crane has to handle the trains
- The crane has to handle the trucks
- The crane has to handle the stack (buffer)

A more Modern Approach is the Type 2 as implemented in Rotterdam

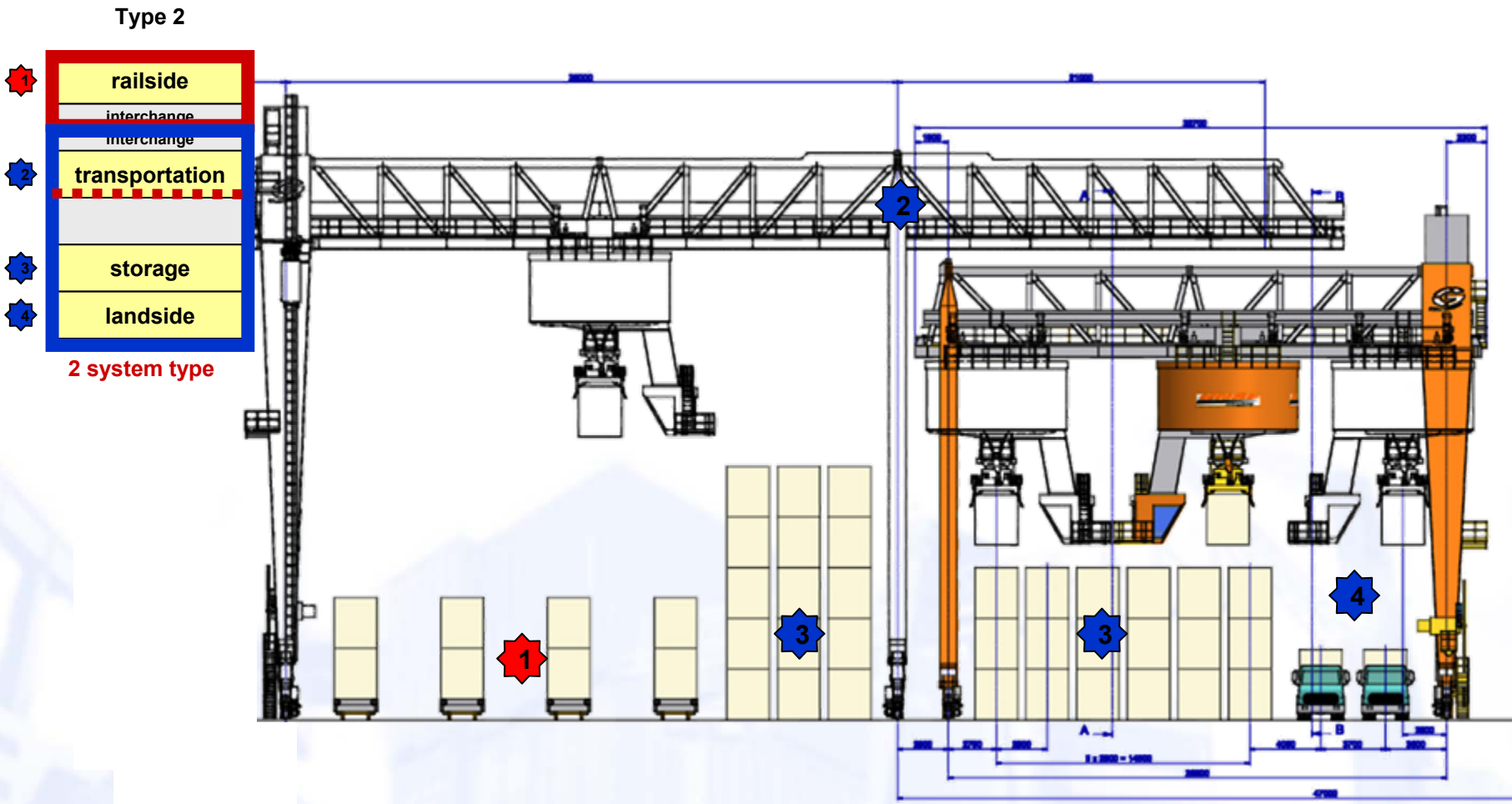
Type 2



2 system type

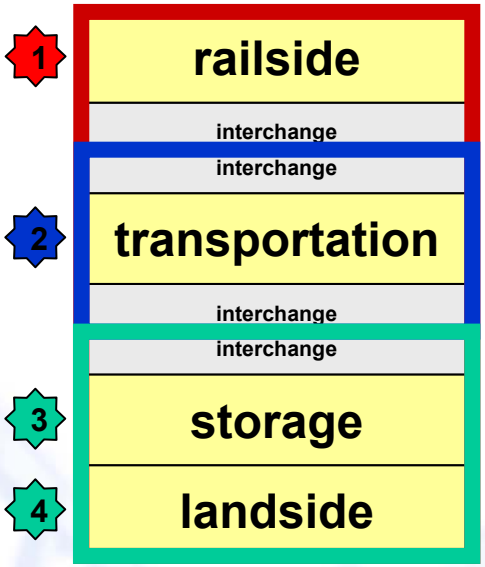


Cross Section Type 2 of an American Intermodal Terminal

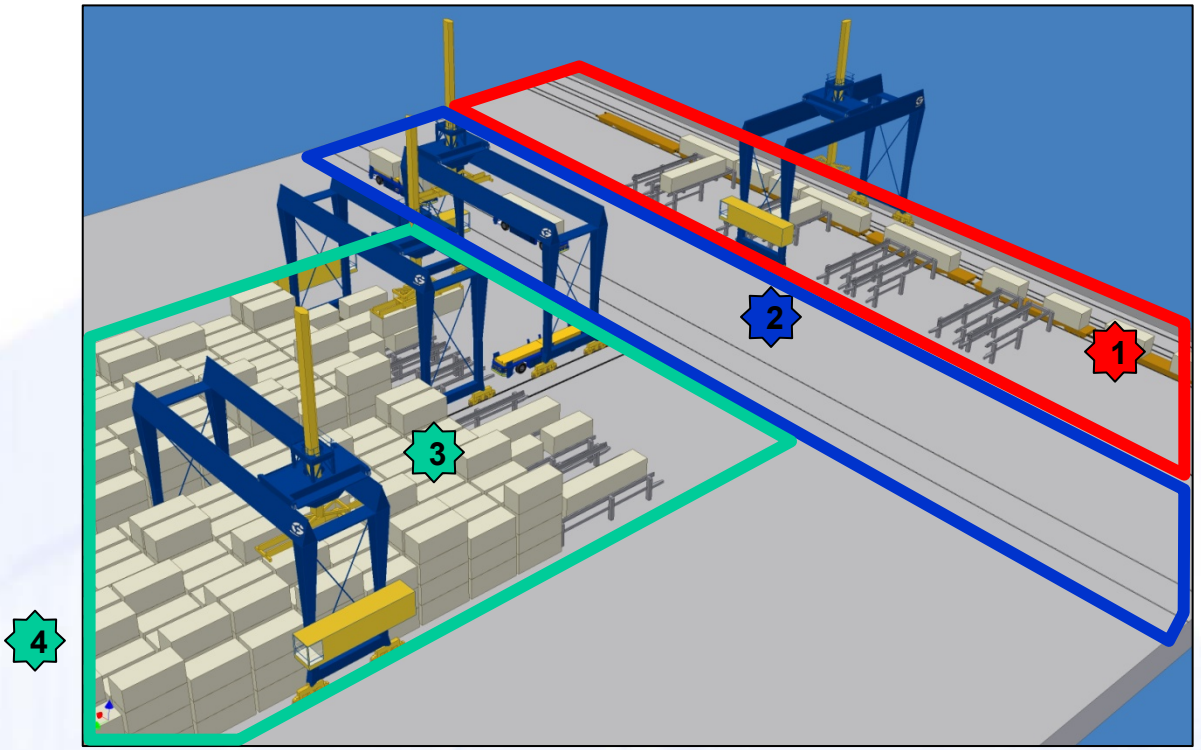


Creating a High Performance and fully Automated Terminal – Type 3 Concept

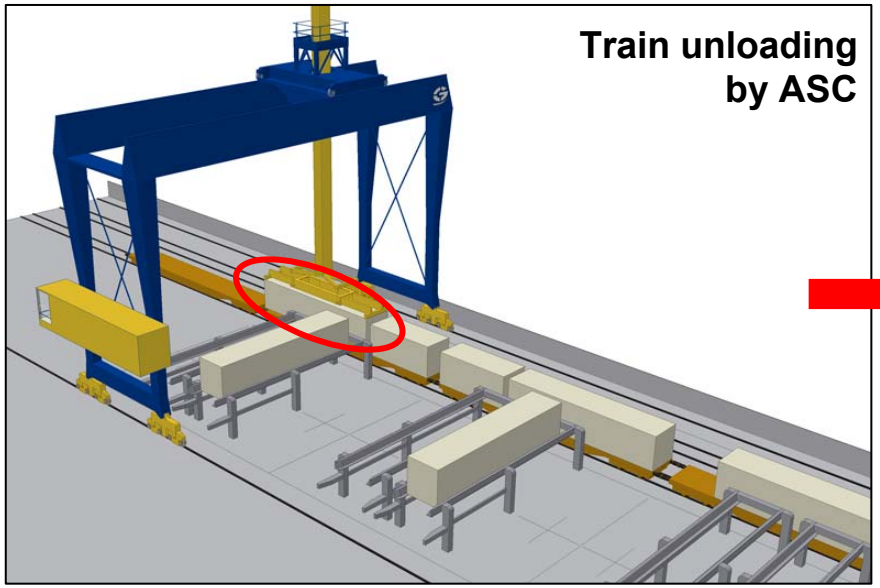
Type 3

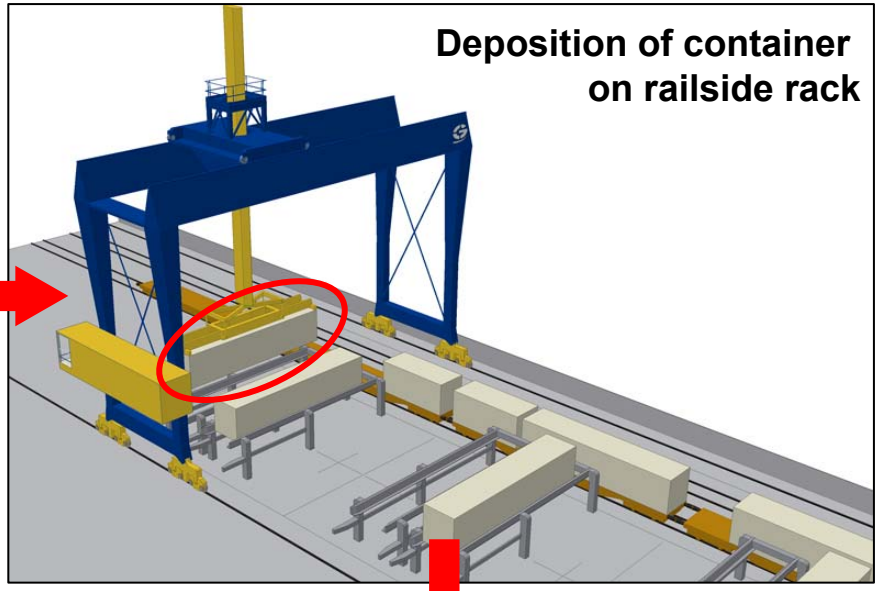


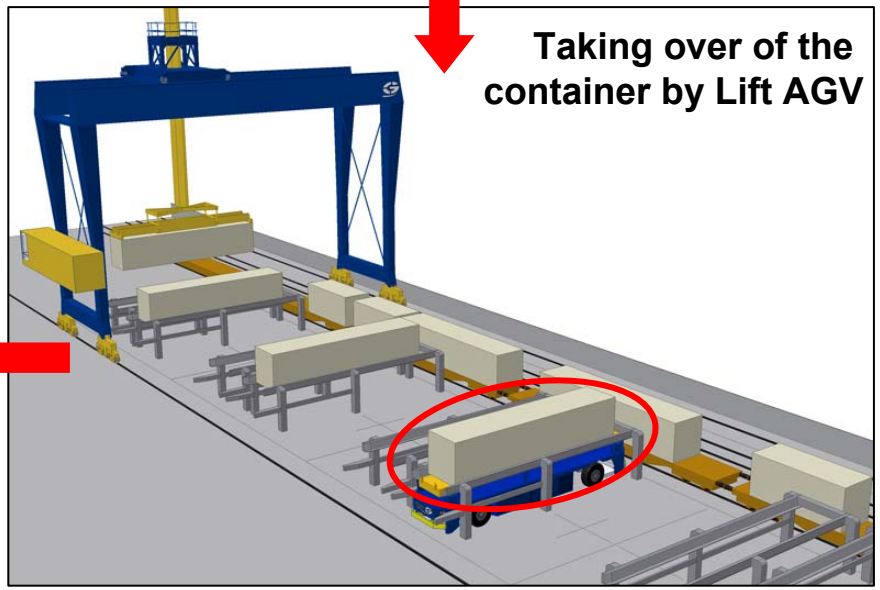
3 system type

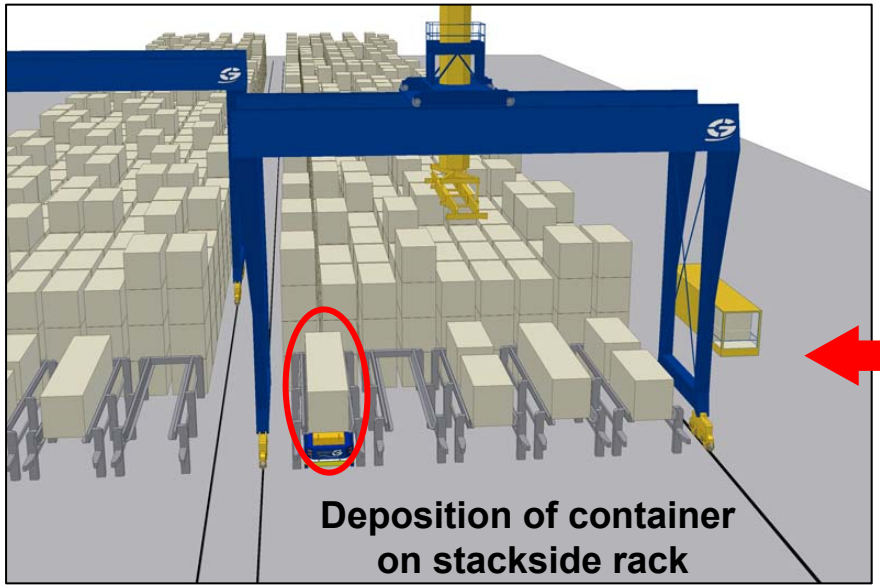


Exemplary Container Flow

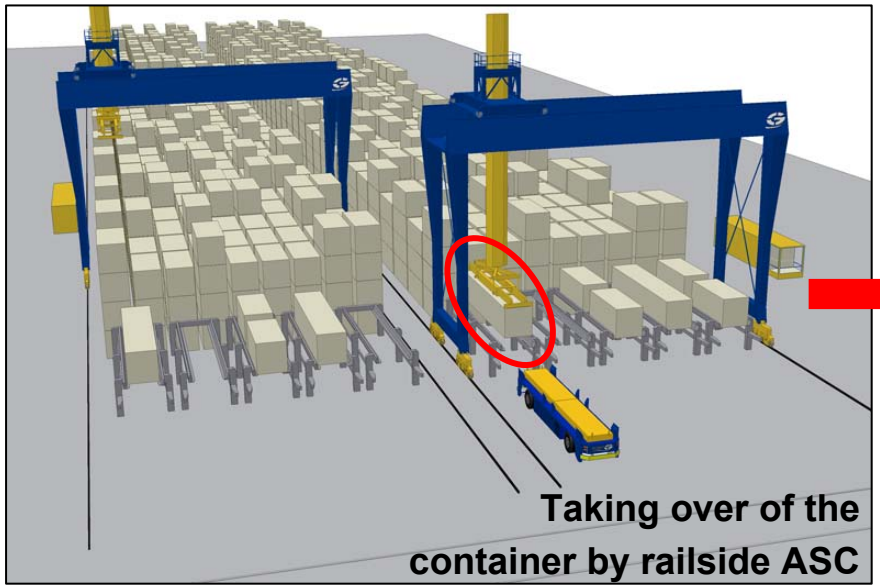


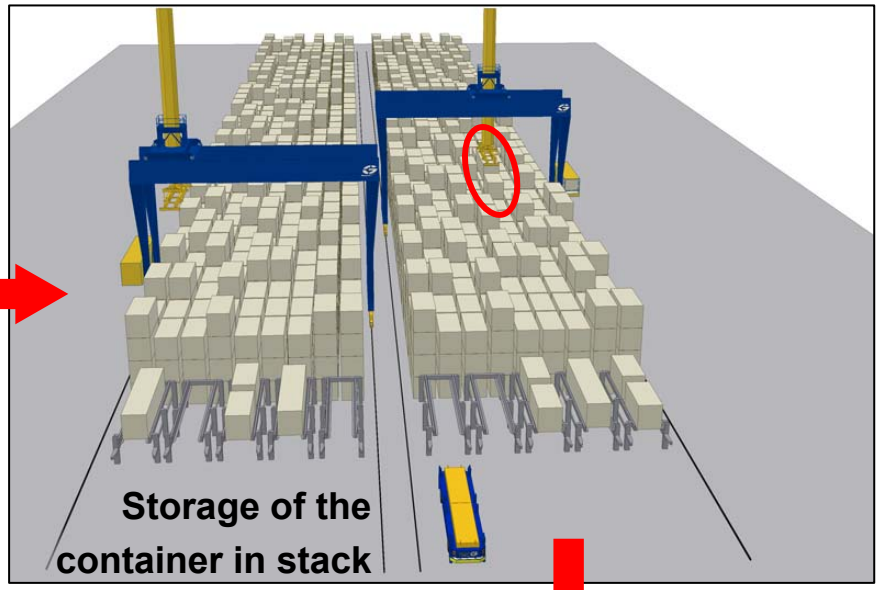


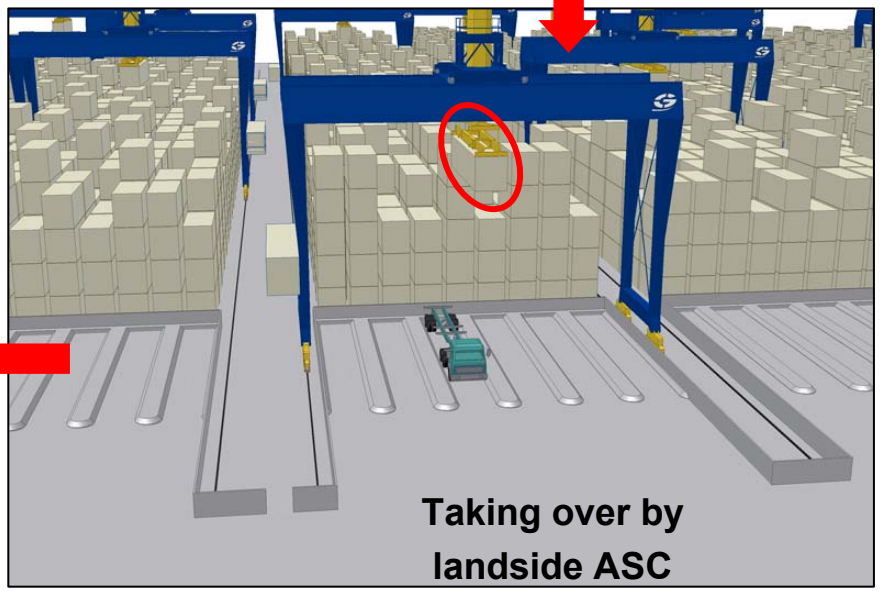


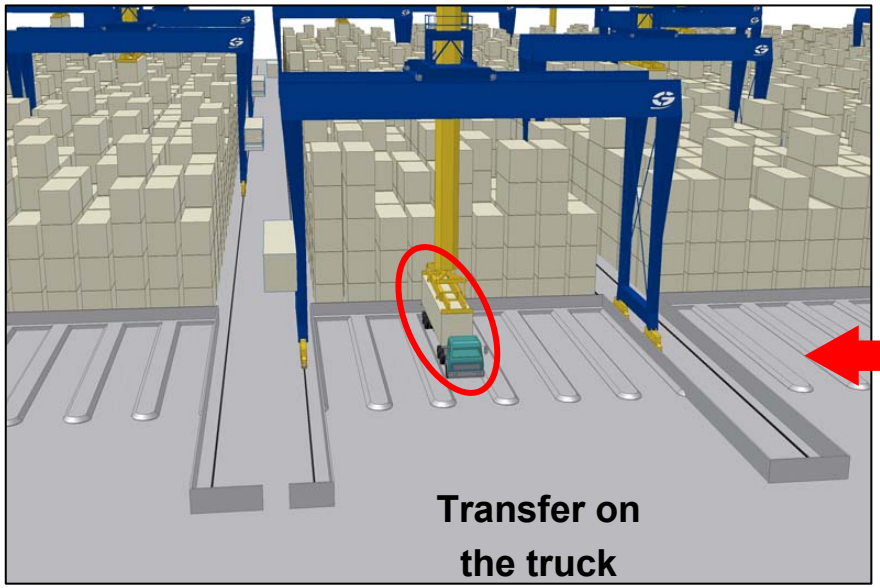


Exemplary Container Flow

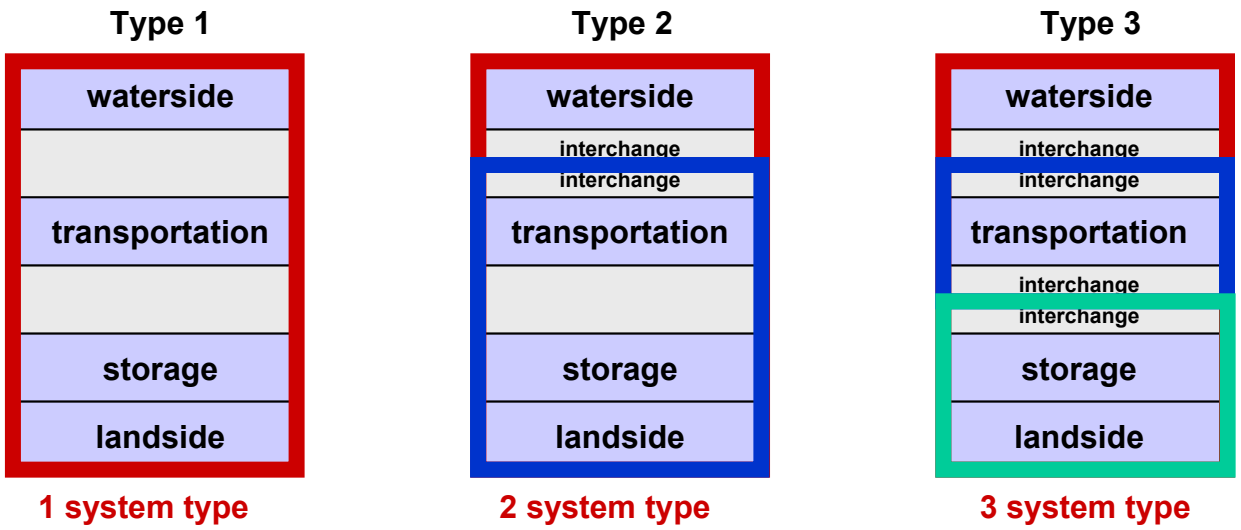




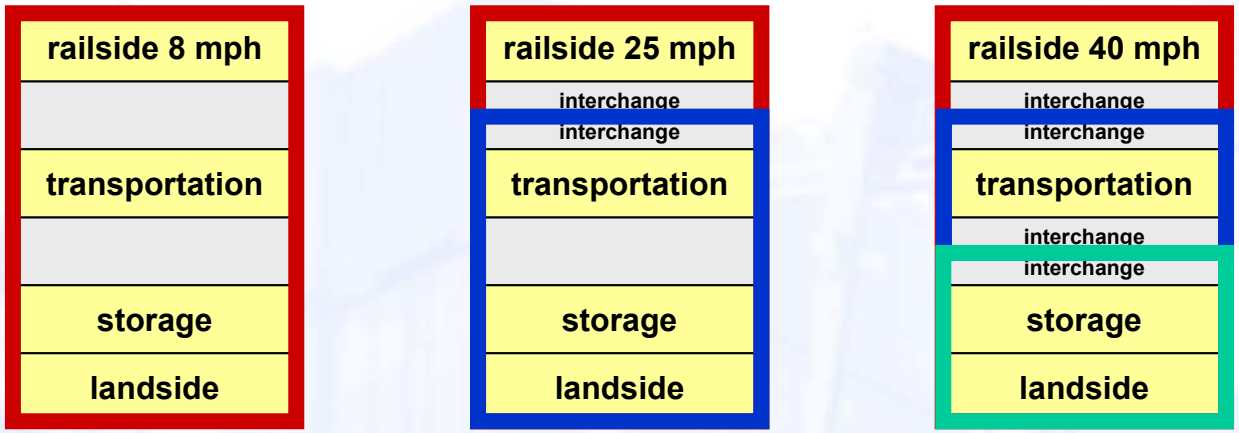




Intermodal Rail Terminals may follow Sea Terminals Developments



Productivity increase through specializing

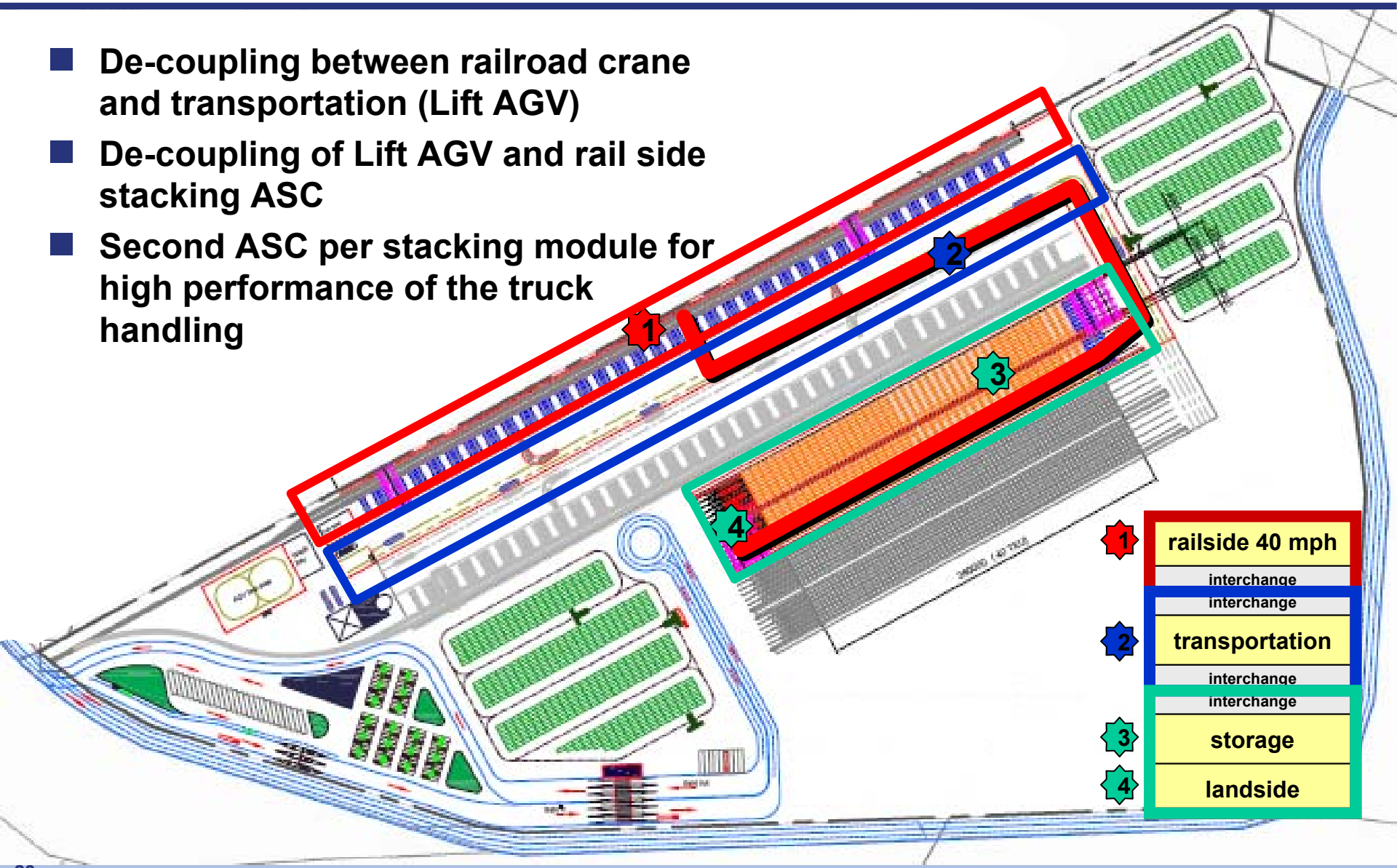


Content

- Ojectives of innovative intermodal terminals
- Development of rail terminals
  (lessons learnt from sea terminals)
- **Innovative intermodal concept - layout proposal**

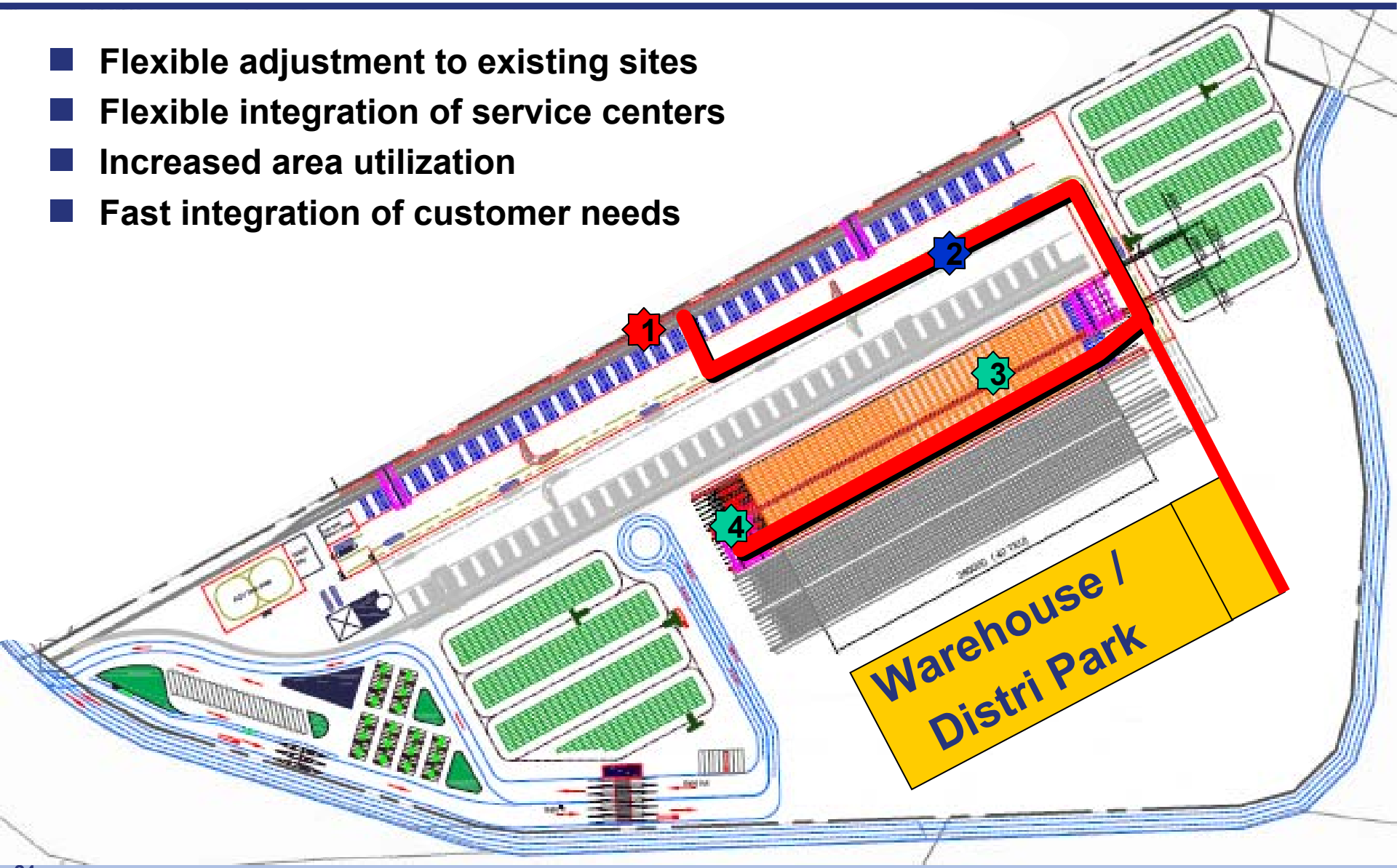
Projection of the Type 3 Concept on an Existing Site

- De-coupling between railroad crane and transportation (Lift AGV)
- De-coupling of Lift AGV and rail side stacking ASC
- Second ASC per stacking module for high performance of the truck handling



Terminal Functionality can be expanded with Value Added Services (Distri Park)

- Flexible adjustment to existing sites
- Flexible integration of service centers
- Increased area utilization
- Fast integration of customer needs

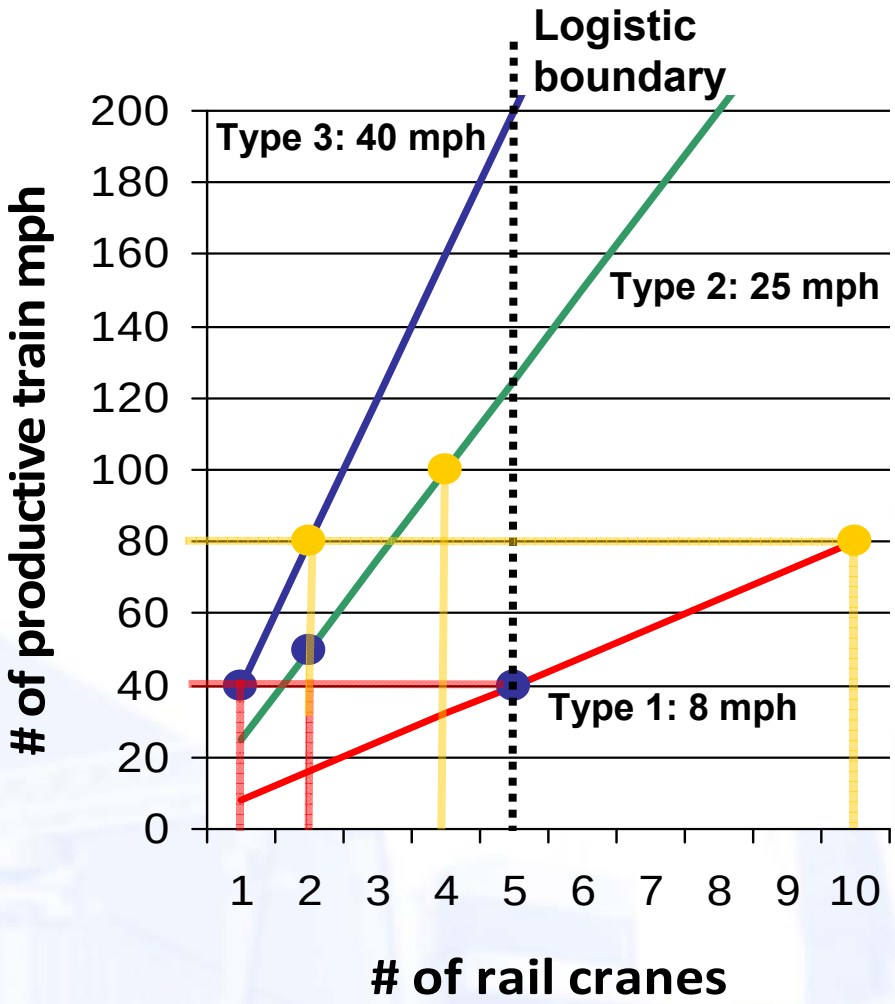


Comparison of Expansion Potential for the Three Terminal Types

Type	1	2	3
ASC			1 + 4
WSG	5	2	
AGV			4
RS		8	1

Equipment for 40 productive train moves, 200,000 TEU/year

For logistic reasons it is not recommended to have more than 5 cranes on one track bundle



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- Ojectives of innovative intermodal terminals
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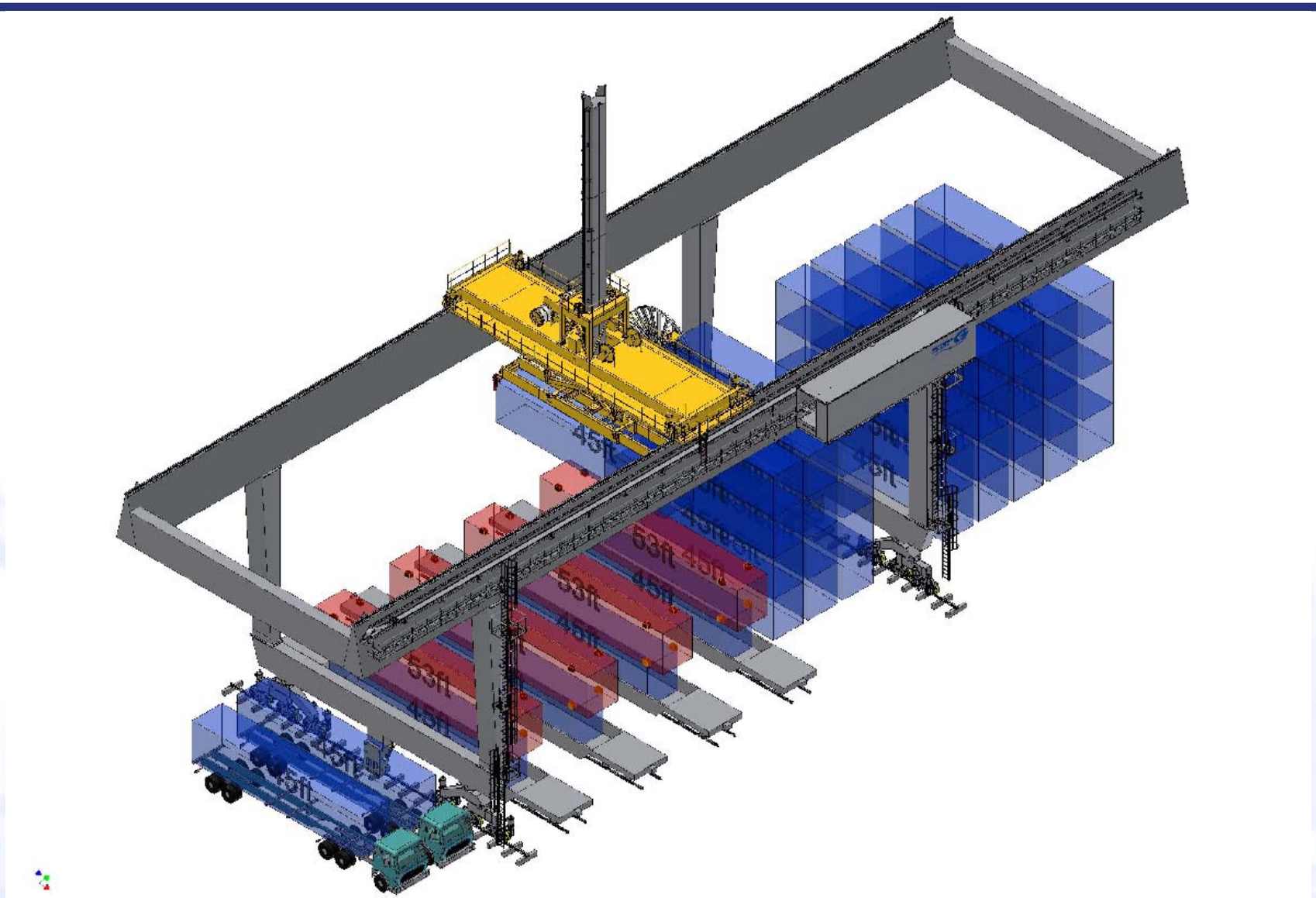
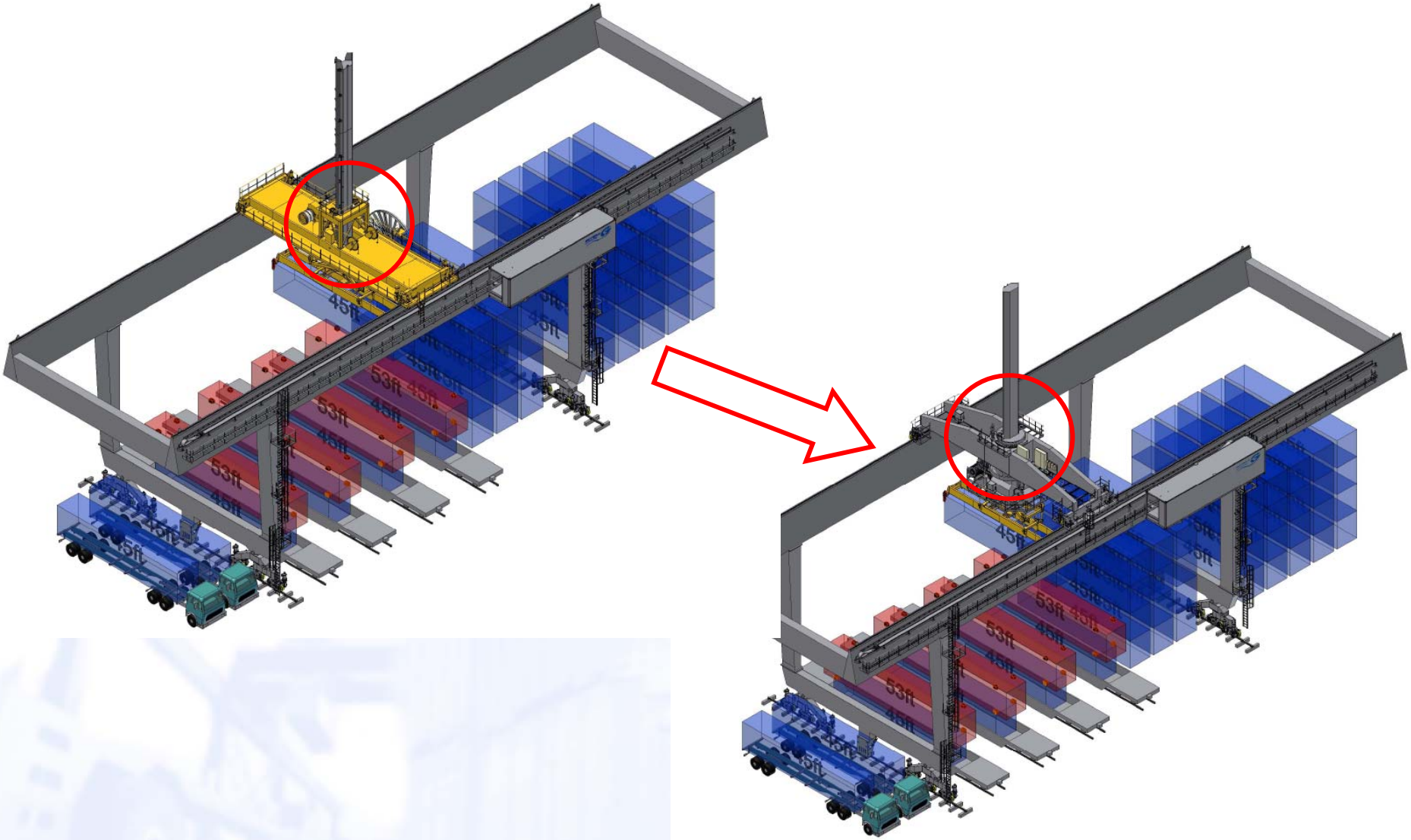
- **Variety of different layout applications of the cranes and the terminal systems**

Intermodal Crane based on ASC Crane Concept (Modular Design)



Modular Design
ASC with Rotating Trolley



Modular Design
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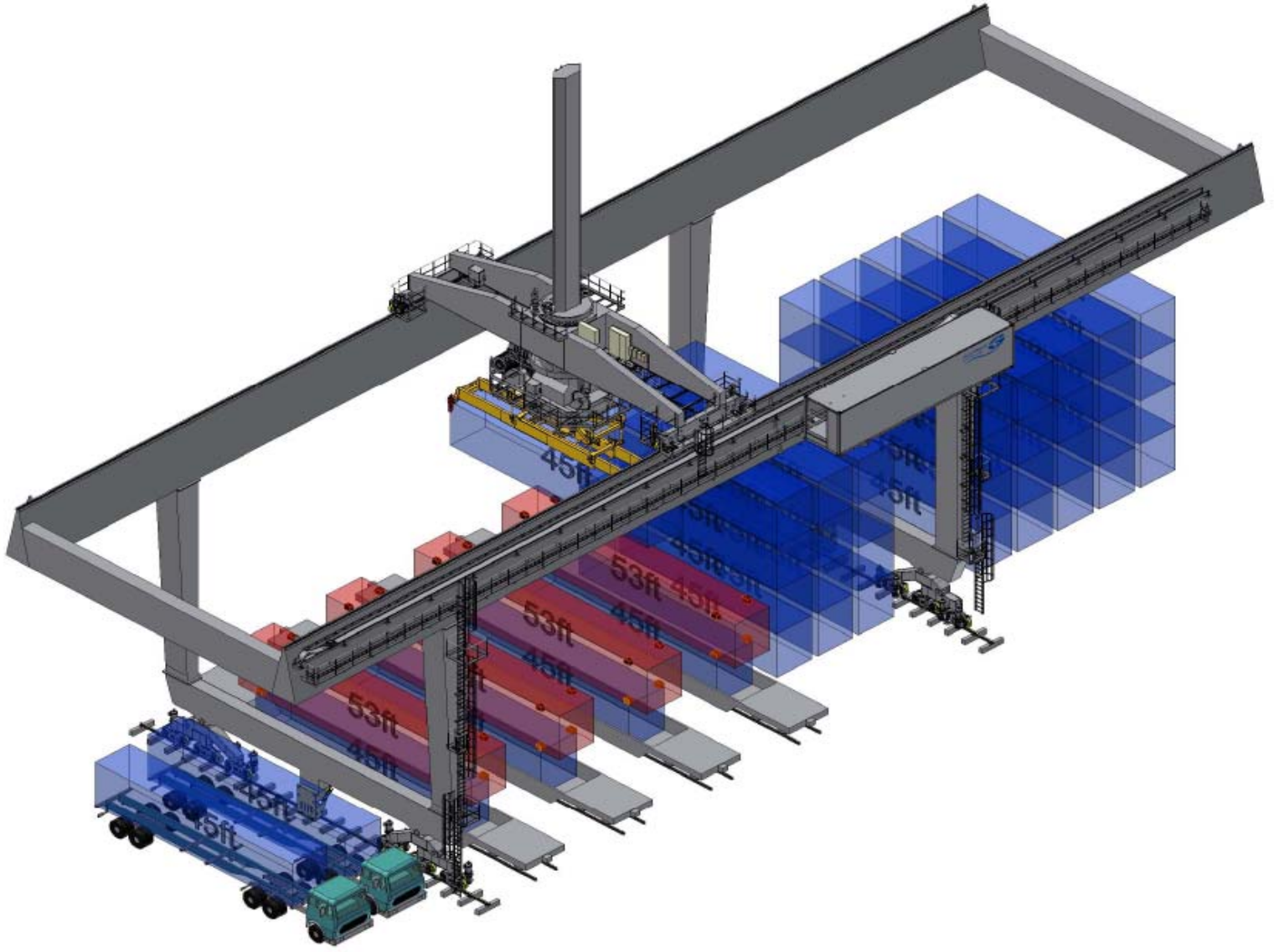
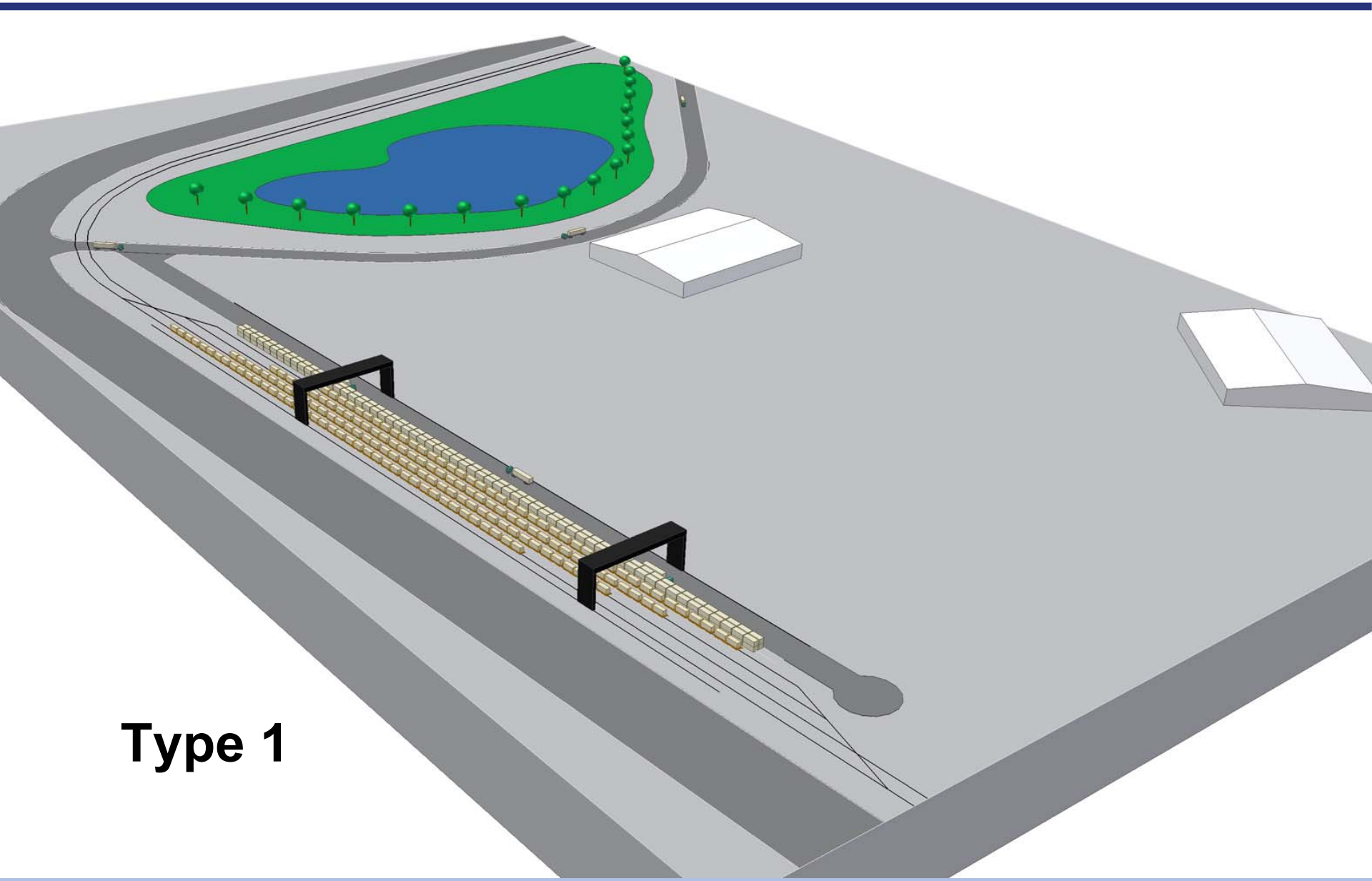


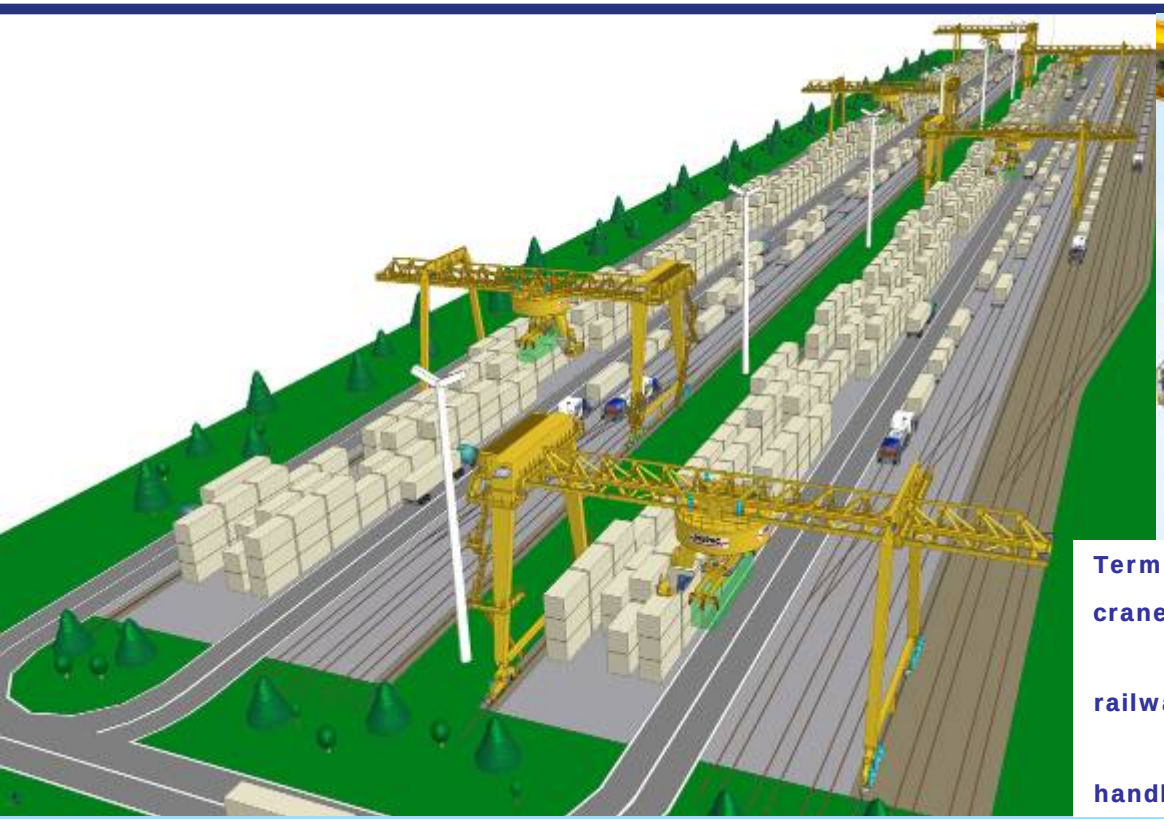
The Classical Intermodal Terminal Layout



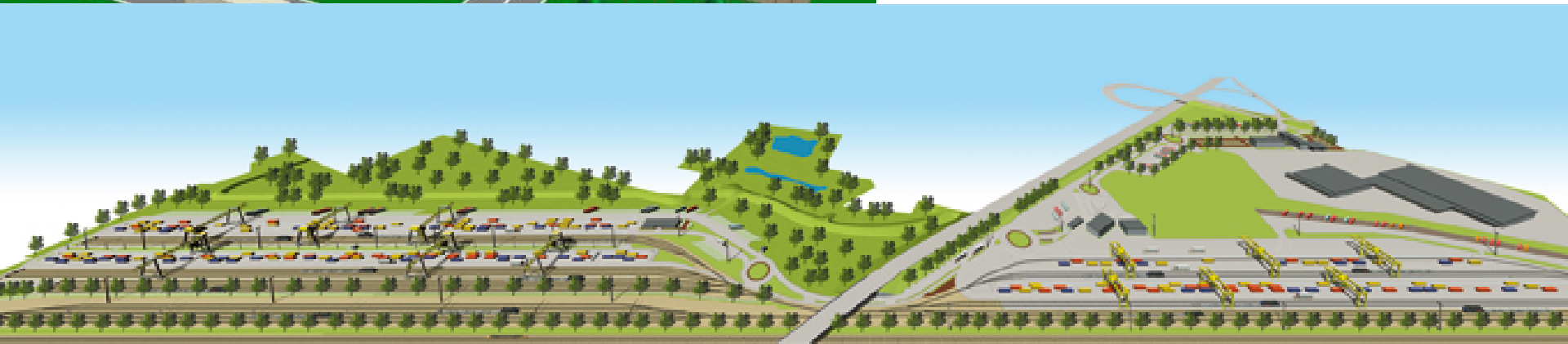
Type 1

Köln Eifeltor
330.000 Cont/Year, 6 RMGs, 8 + 1 Tracks

Type 1 Intermodal Rail Terminal
Gottwald WSG at HUPAC, Galarate, Italy



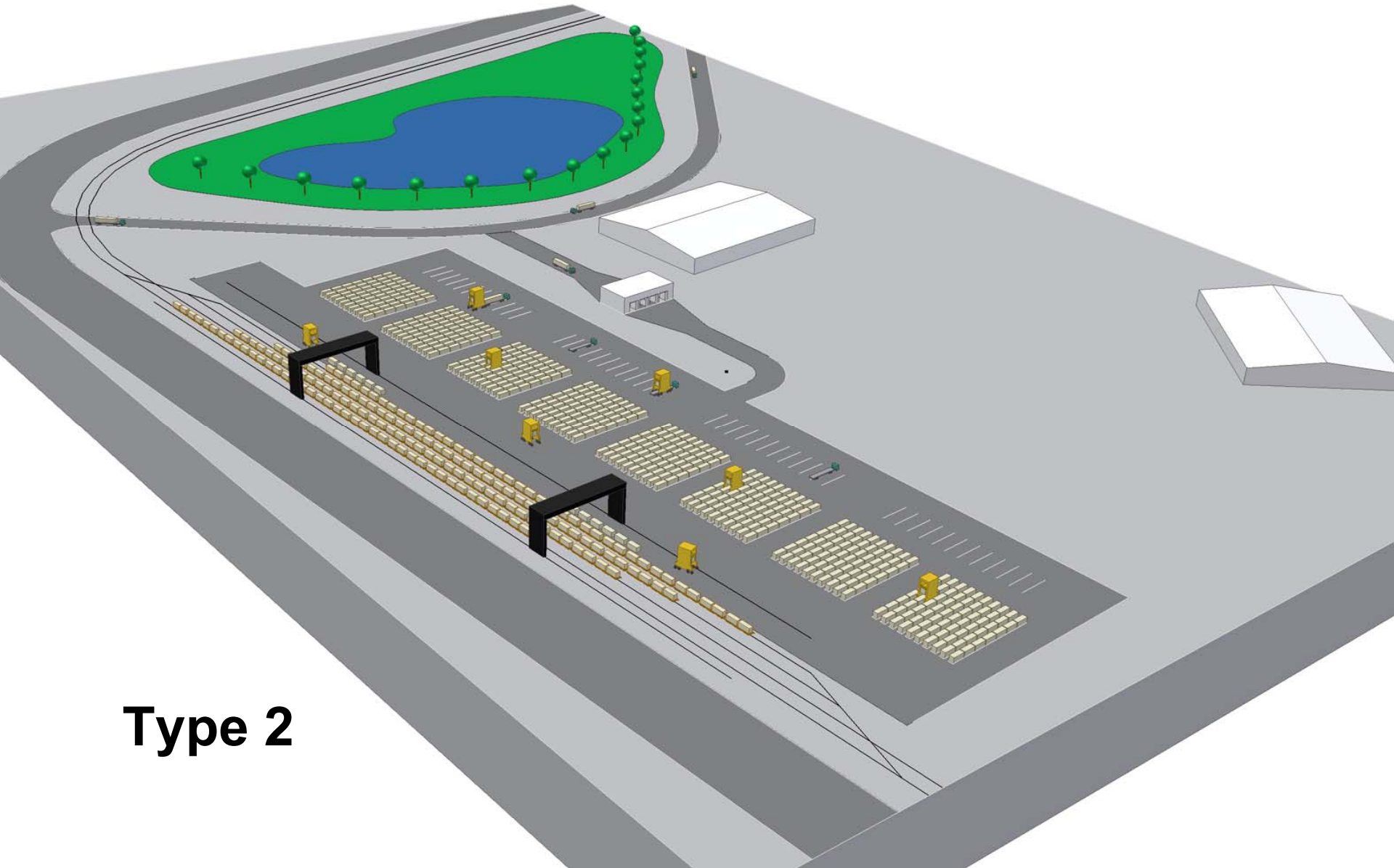
Terminal area	242800 sqm
cranes	11 portal cranes max. 41 t lifting capacity
railway tracks	3 tracks à 540 m useable length 2 tracks à 630 m useable length 3 tracks à 710 m useable length 3 tracks à 760 m useable length
handling capacity	about 550.000 boxes per year



Rail Terminals –
Terminals for Combined Traffic

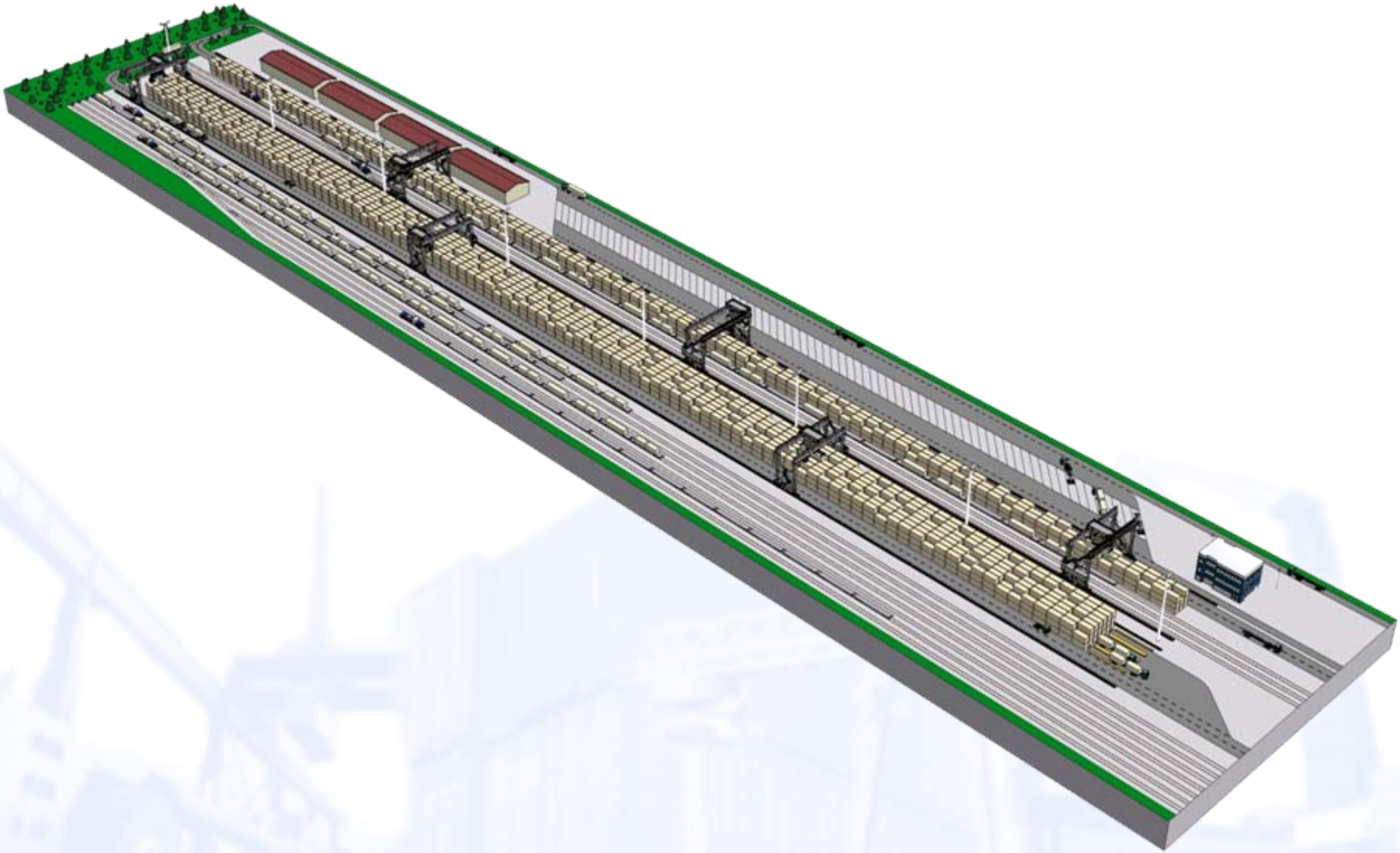
- Wide Span Gantry cranes
- HUPAC, Gallarate, Italy
- Semi-automated operation
- Transhipment of containers from road to rail and vice versa
- Handling rate per crane:
  30 loading units per hour

Classical Layout with internal Buffer Extension



Type 2

Type 2 Intermodal Terminal with Gottwald‘s MSC-Crane



Type 2 Intermodal Terminal with Gottwald‘s MSC-Crane

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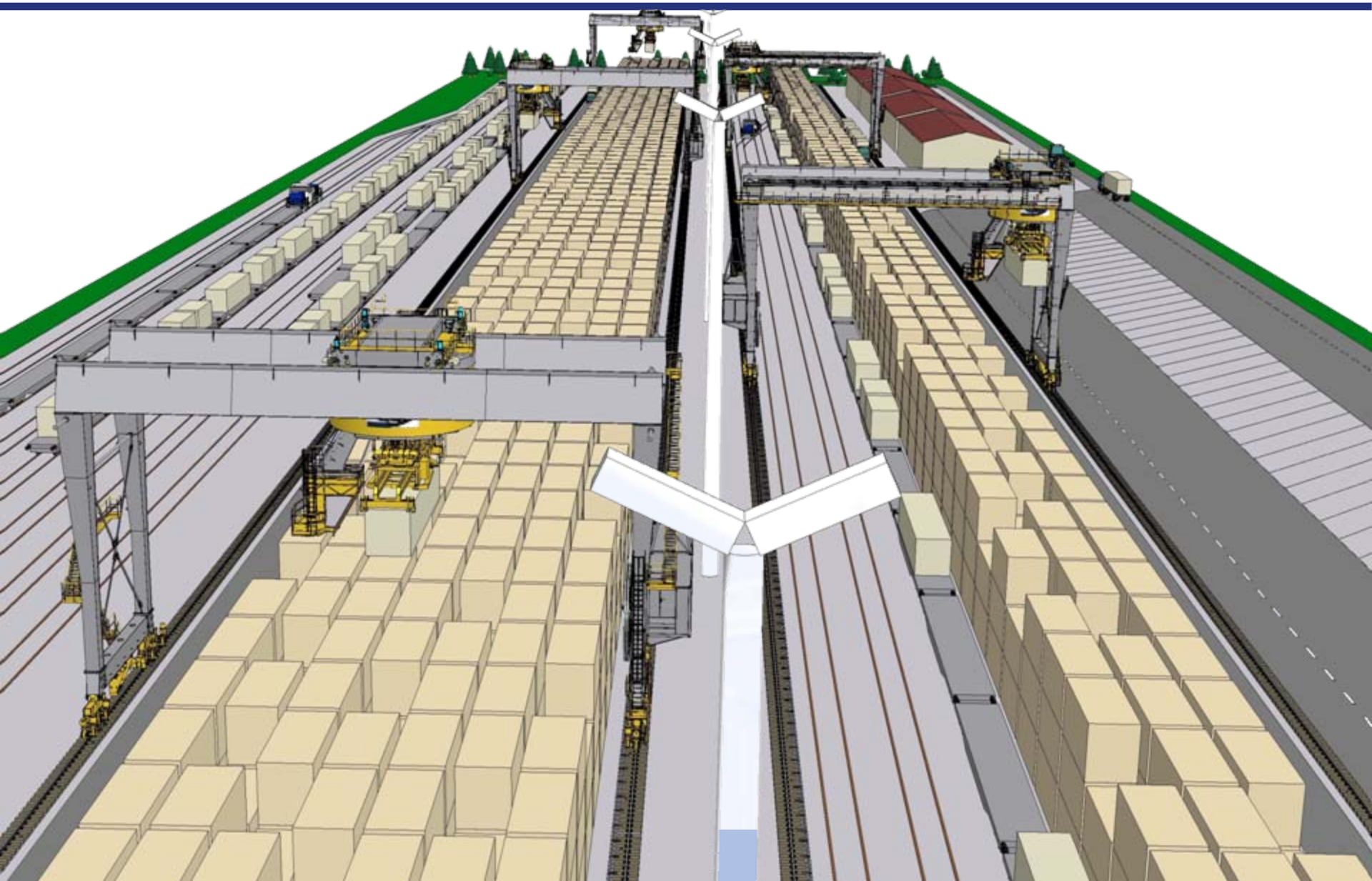
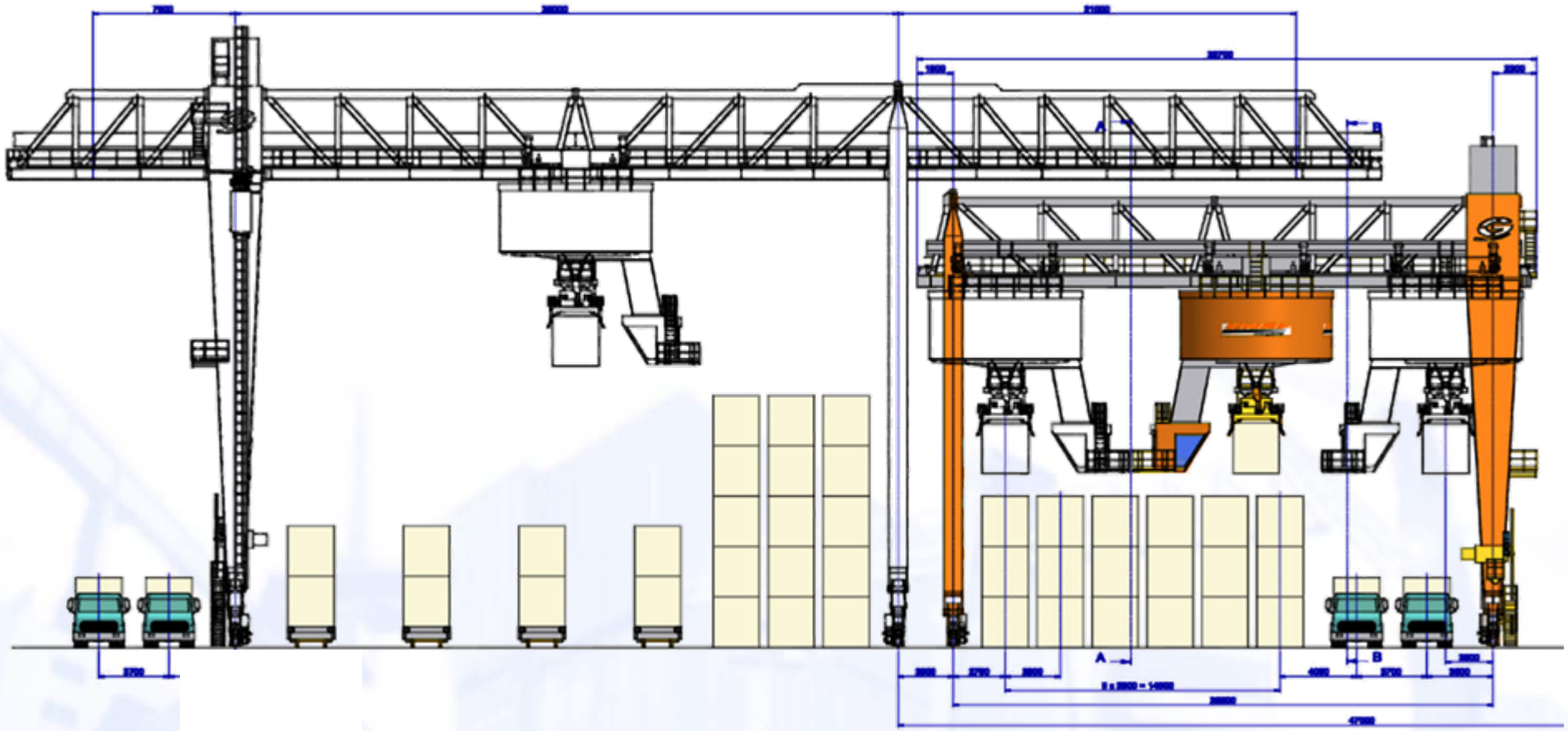
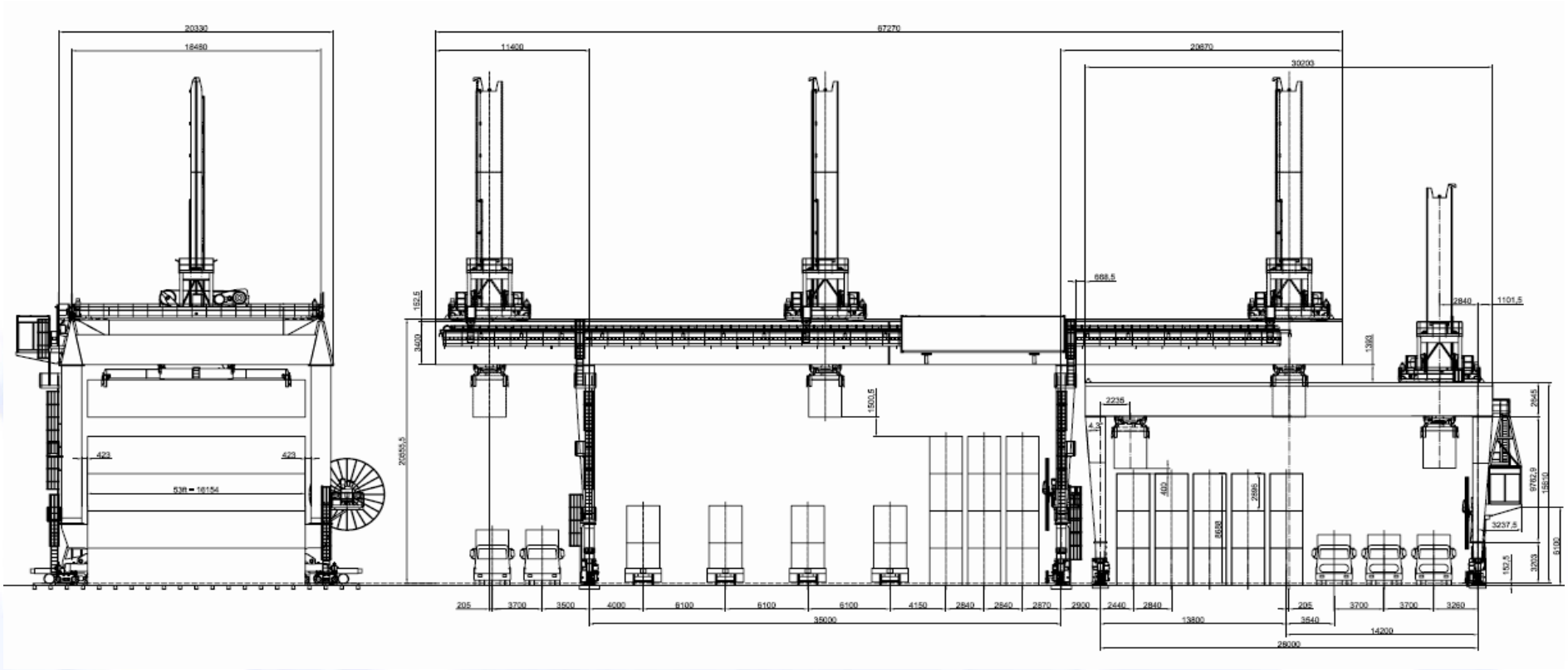


Type 2 - Layout for Intermodal Terminal (Gottwald 2005 for BNSF)



Type 2 - Layout for Intermodal Terminal based on ASC Modular Design



Automated Intermodal Terminal Layout with AGVs and ASC Stack Extension

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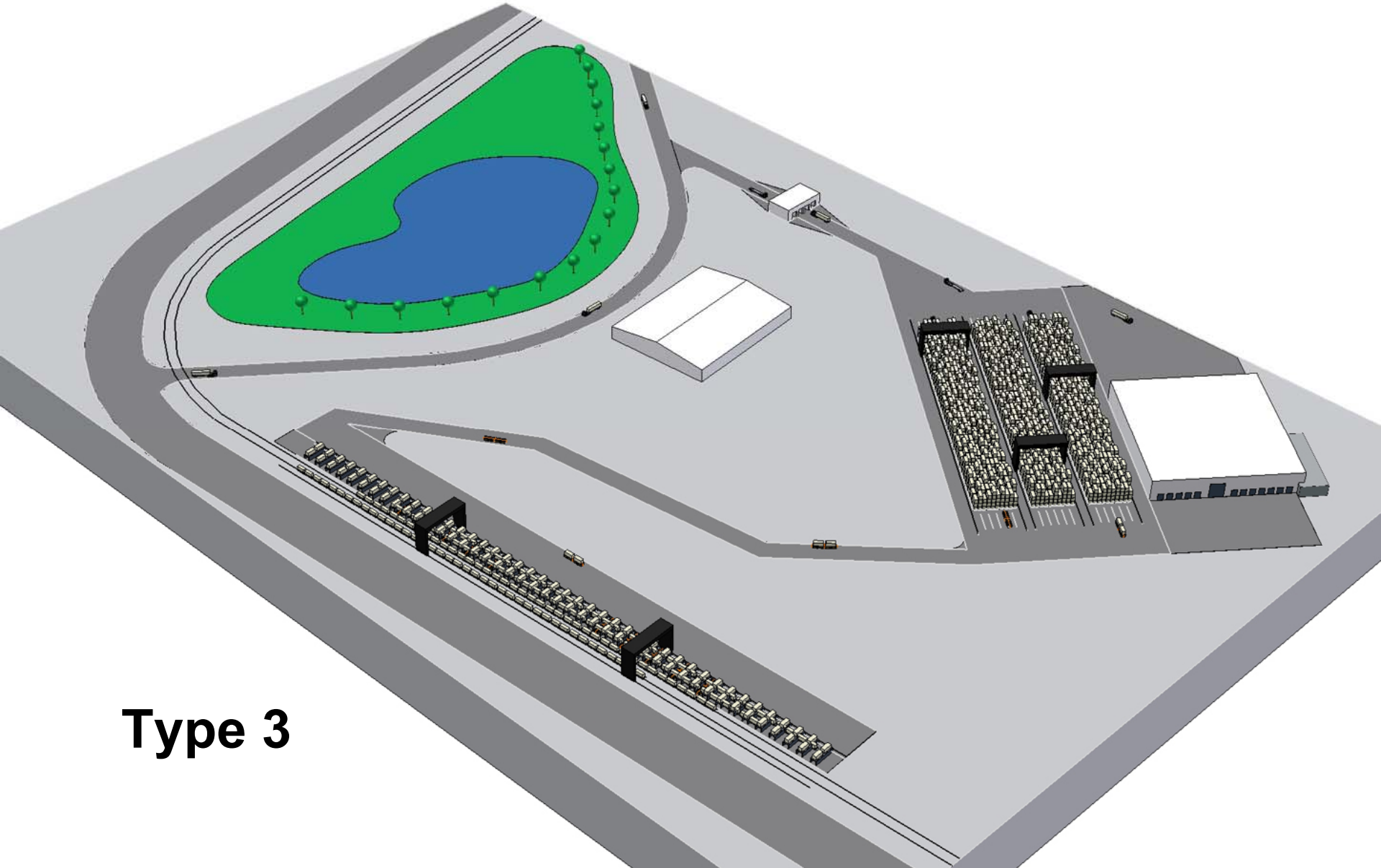


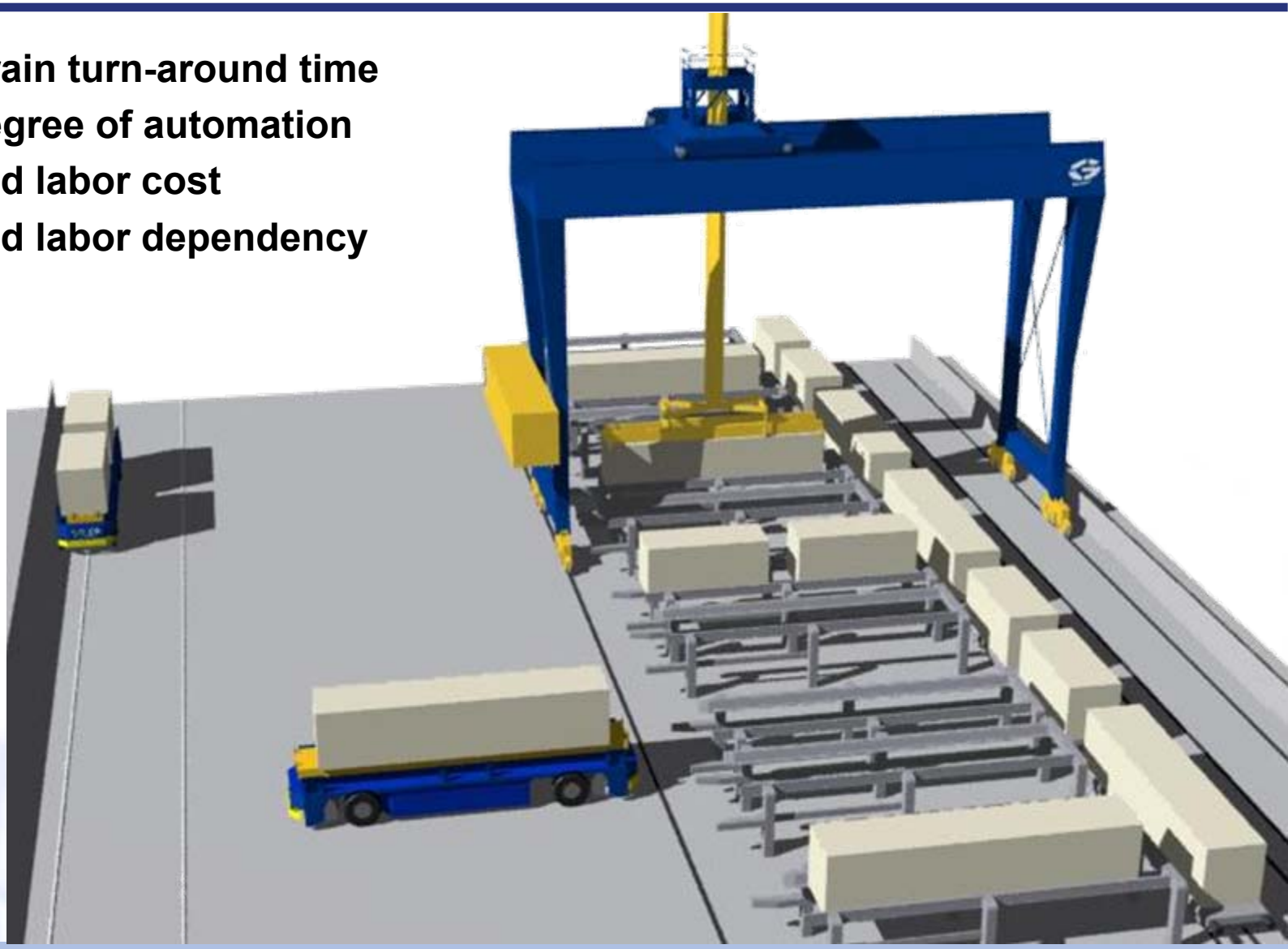
Type 3

Intermodal Rail Terminal
Gottwald´s WSG and ASC

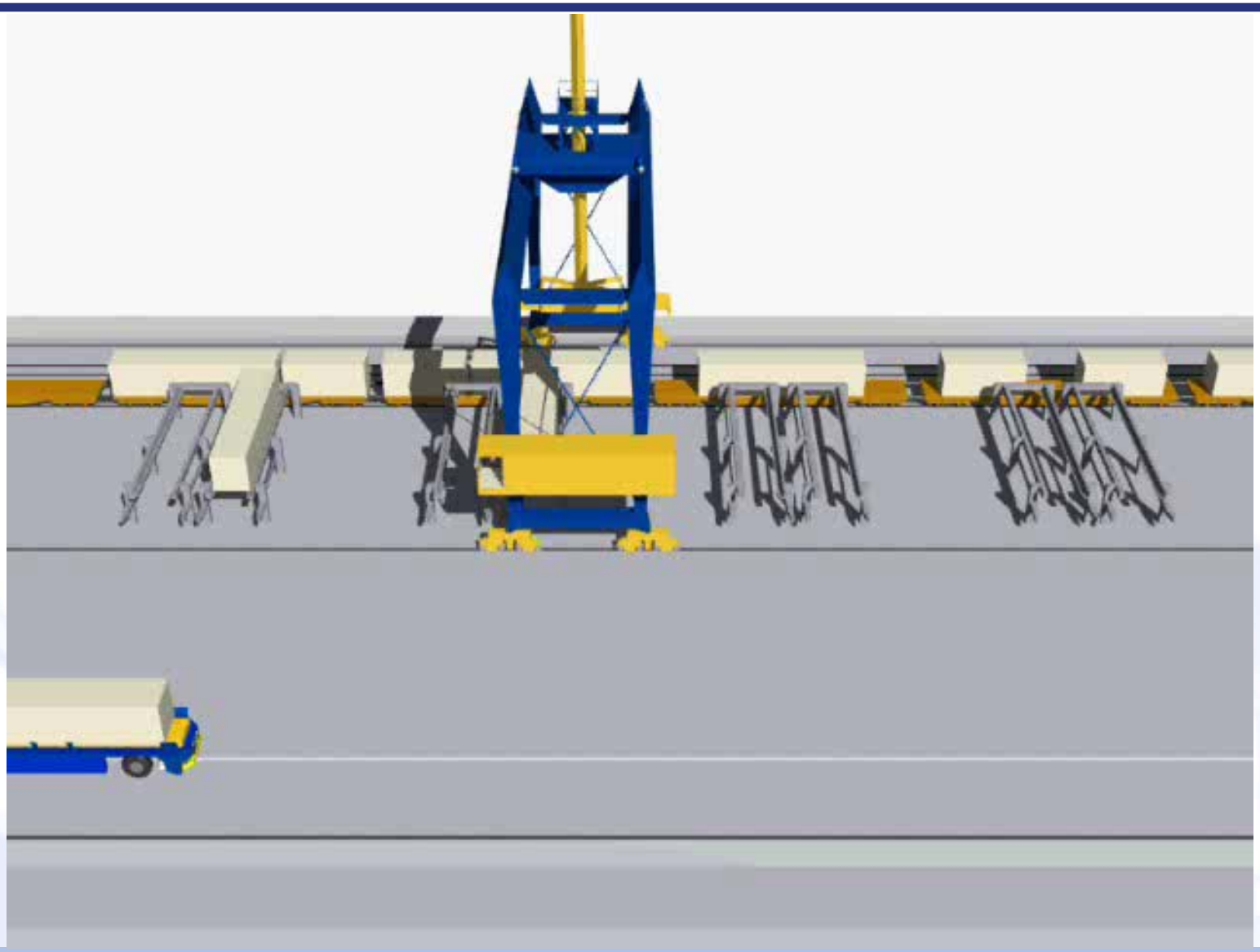
Intermodal Rail Terminal
Gottwald´s WSG and ASC

Type 3
Automation in Intermodal Terminals

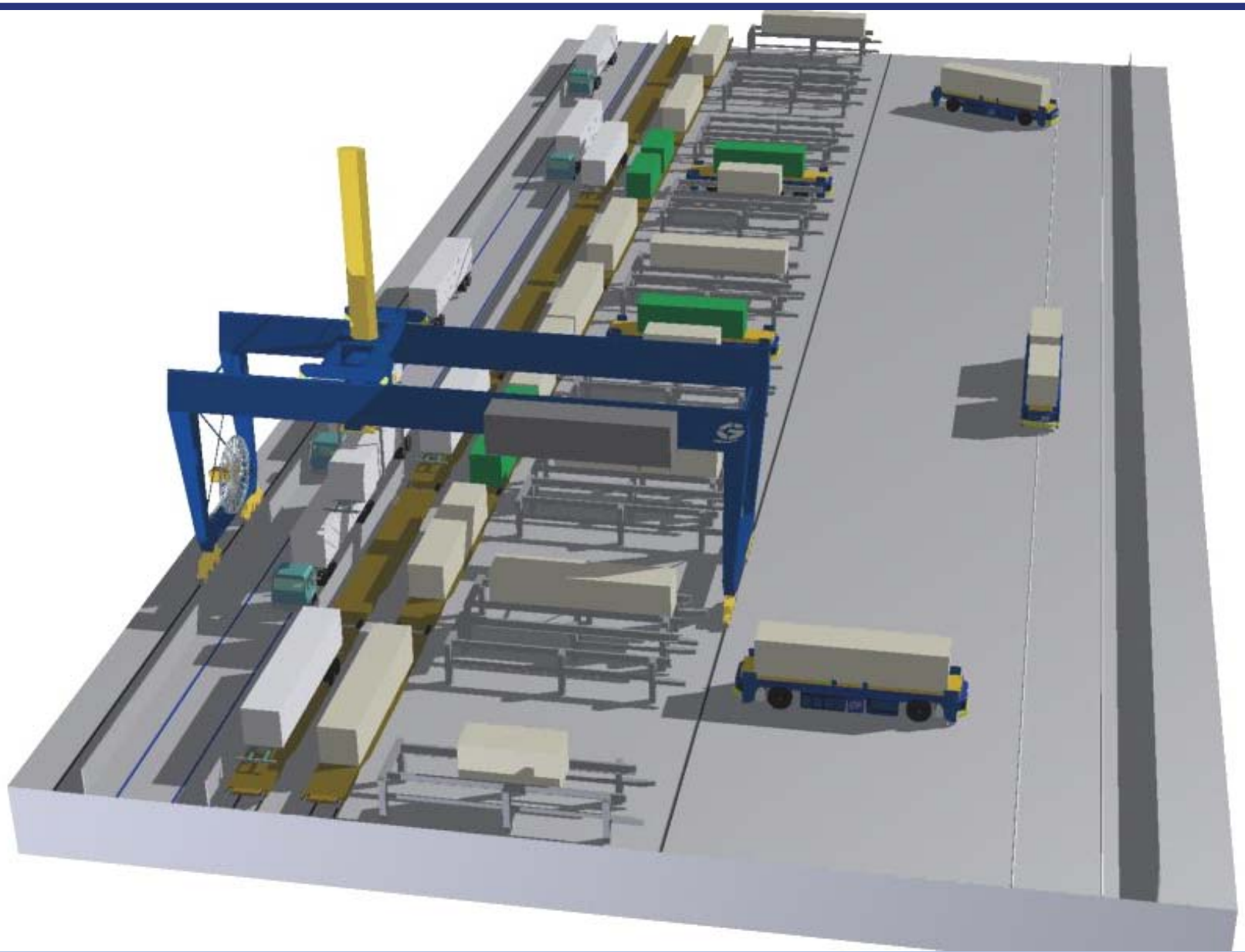
- Short train turn-around time
- High degree of automation
- Reduced labor cost
- Reduced labor dependency



Innovative Intermodal Terminal – Type 3



RSC - Konzepte für verschiedene Ladeeinheiten



Railsprinter Concept
Beispiel Applikationen

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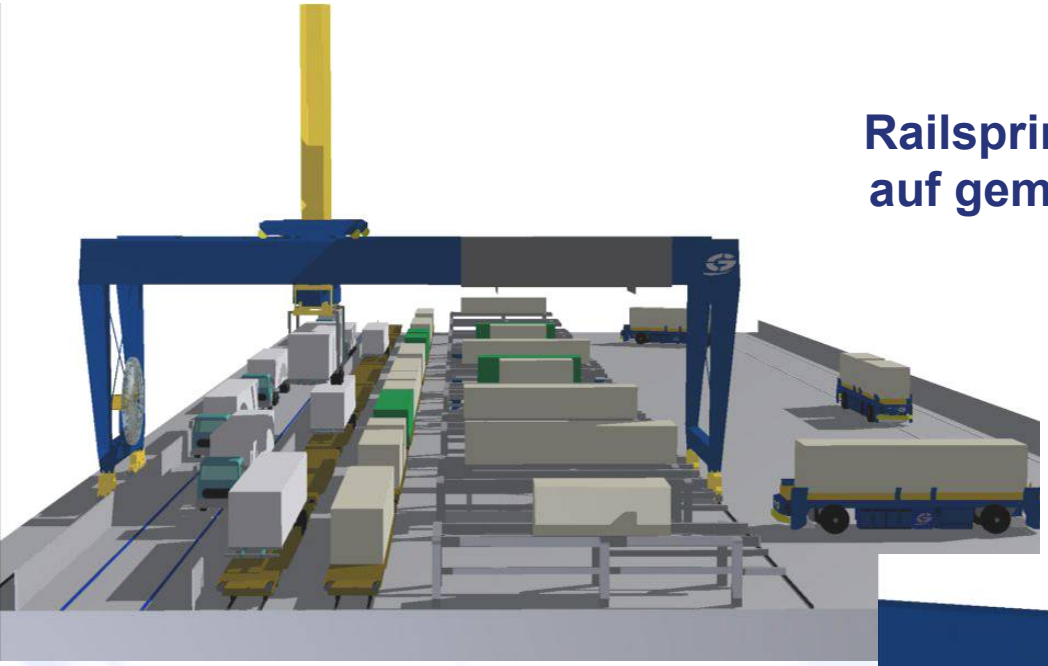
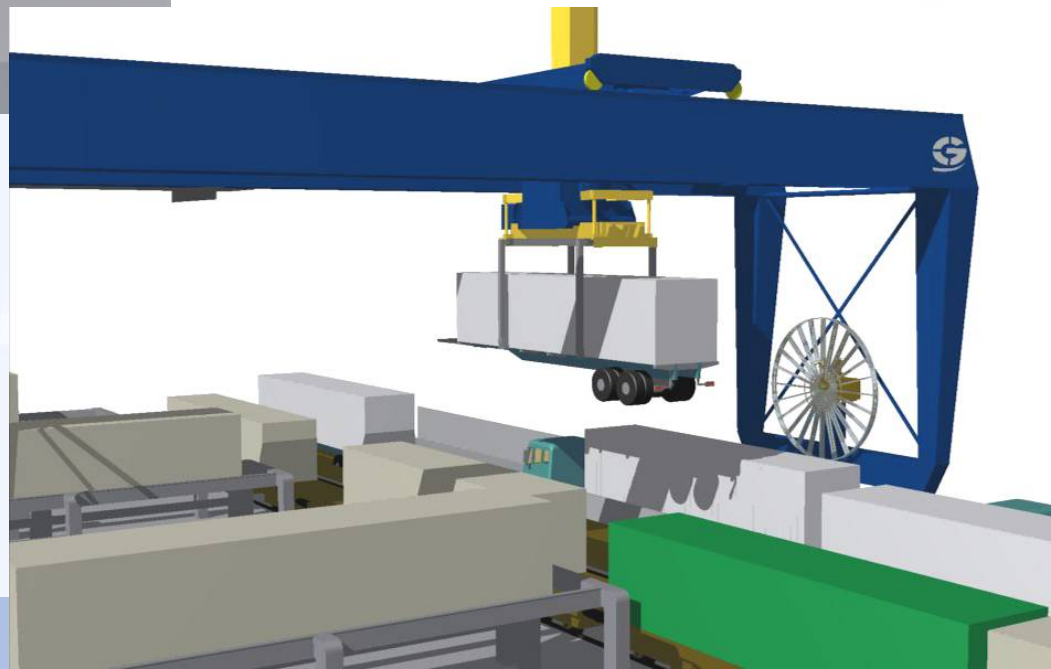


Railsprinter Concept kann auch auf gemischten Betrieb angewendet werden,

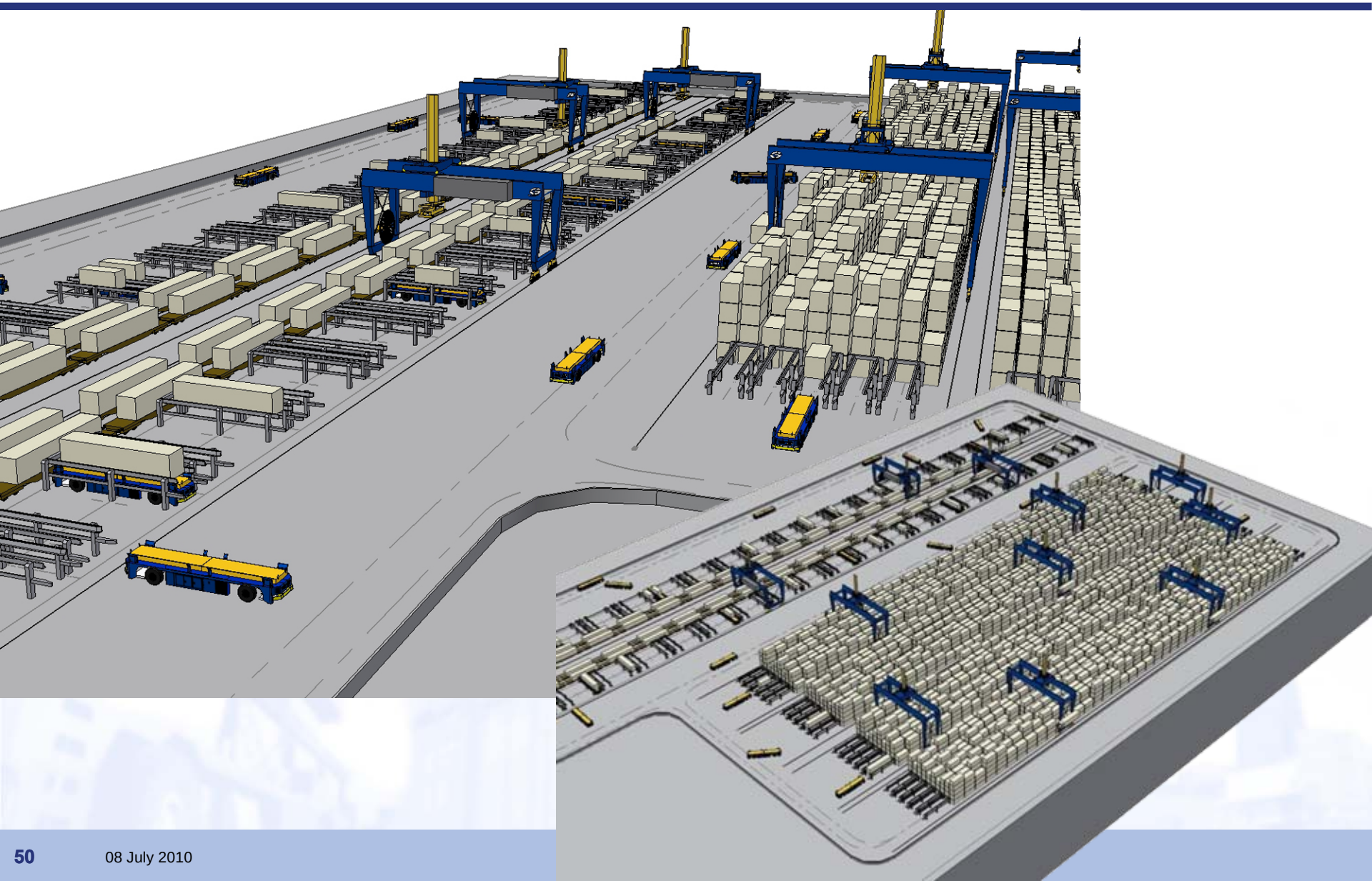
wobei der Automatisierungsgrad angepasst werden muss.



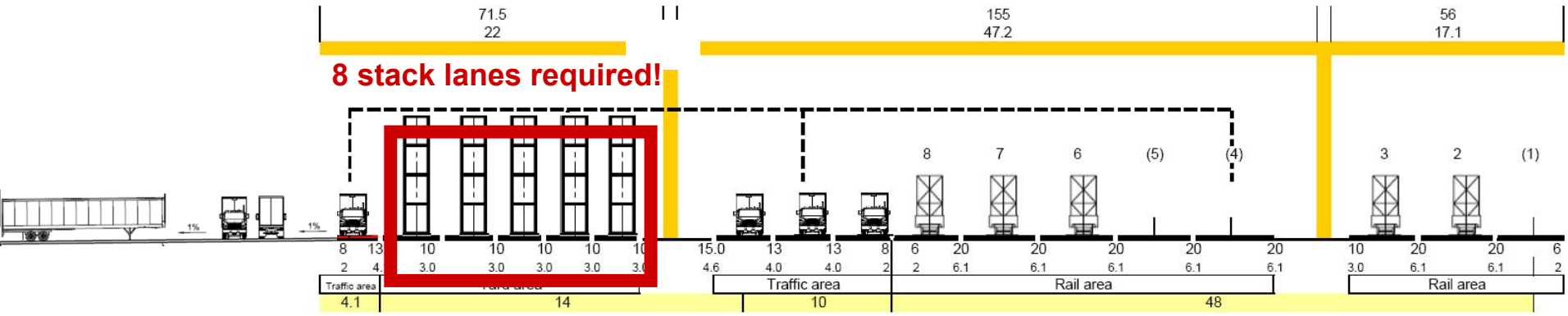
Railsprinter Concept
Beispiel Applikationen

- Skalierbarkeit der geplanten Gesamtanlage
- Hier Layout für eine Anlage mit Bedarf an Speicherkapazität und kurzen Zugstandzeiten (separates horizontales Transportsystem)

Applications: 3D-Rail Terminal for 1,800,000 TEU/Year, Buffer Capacity up to 8,000 TEU



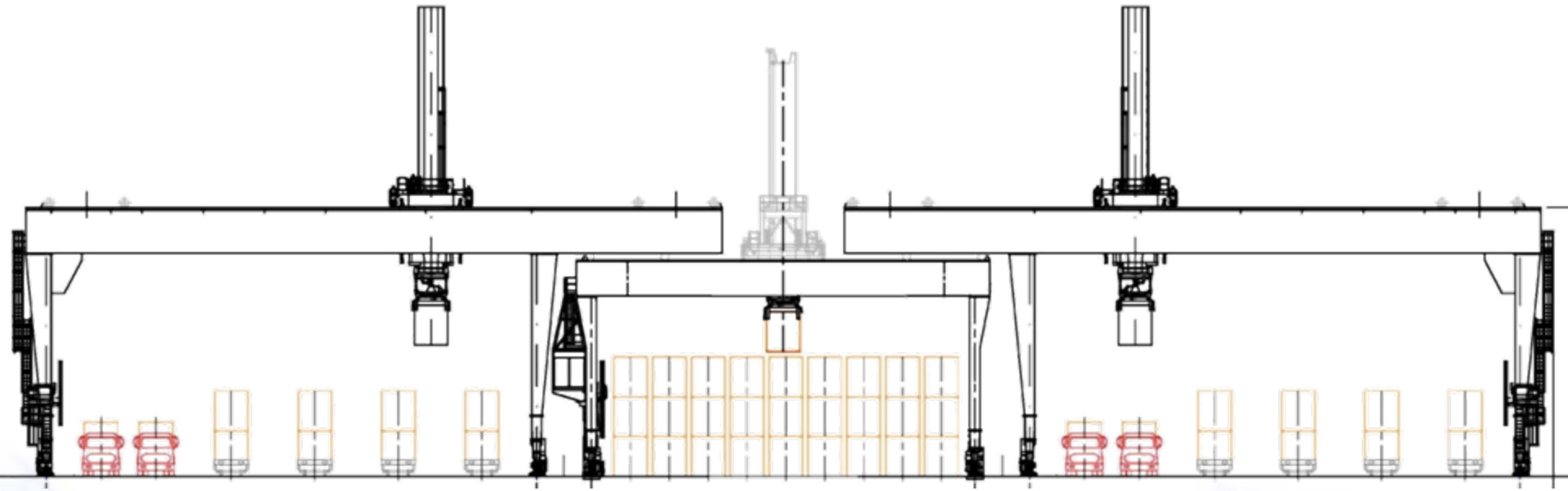
Present Day Concept
RMGs + TT for housekeeping and int. transport



- **Stack capacity:** simulated with 8[1] stack lanes (3000feet long), 6 x (1 over 4)
- **Crane speeds:** gantry travel 120m/min
  trolley travel 120m/min
  hoisting 36 … 72m/min (load dependant)
- **Housekeeping:** 6 tractors for housekeeping/internal transport
- **Gate operation:** 3 tractors for road trailer handling

[1] simulation results showed that 8 stack lanes are required, see next slide

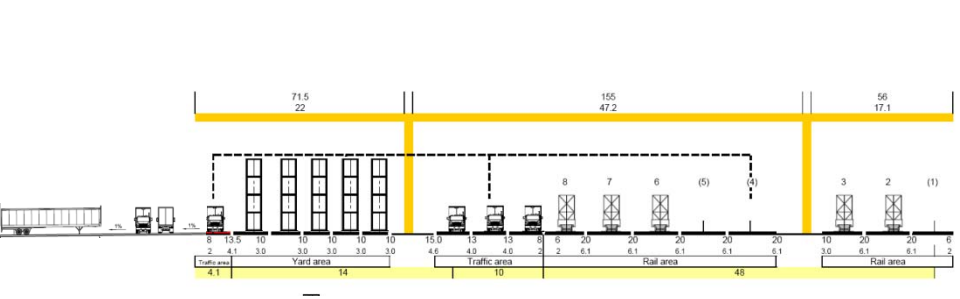
Rail Sprinter Concept (RSC)
RSCs + ASCs for housekeeping and int. transport

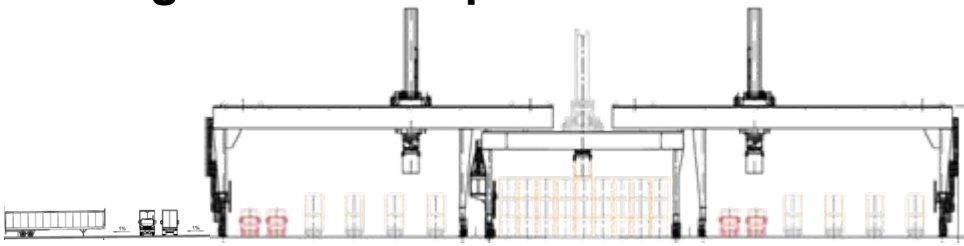


- **Stack capacity:** 9 stack lanes (3000feet long), 9 x (1 over 3)
- **Crane speeds:** gantry travel 240m/min
  trolley travel 60m/min
  hoisting 36 … 72m/min (load dependant)
- **Housekeeping:** 2 ASCs for housekeeping/internal transport
- **Gate operation:** 3 tractors for road trailer handling

Concept Comparison Results
Stack Capacity

Stack demand in 2010: **average 715 boxes/peak 1300 boxes**





Operational workable stack capacity:

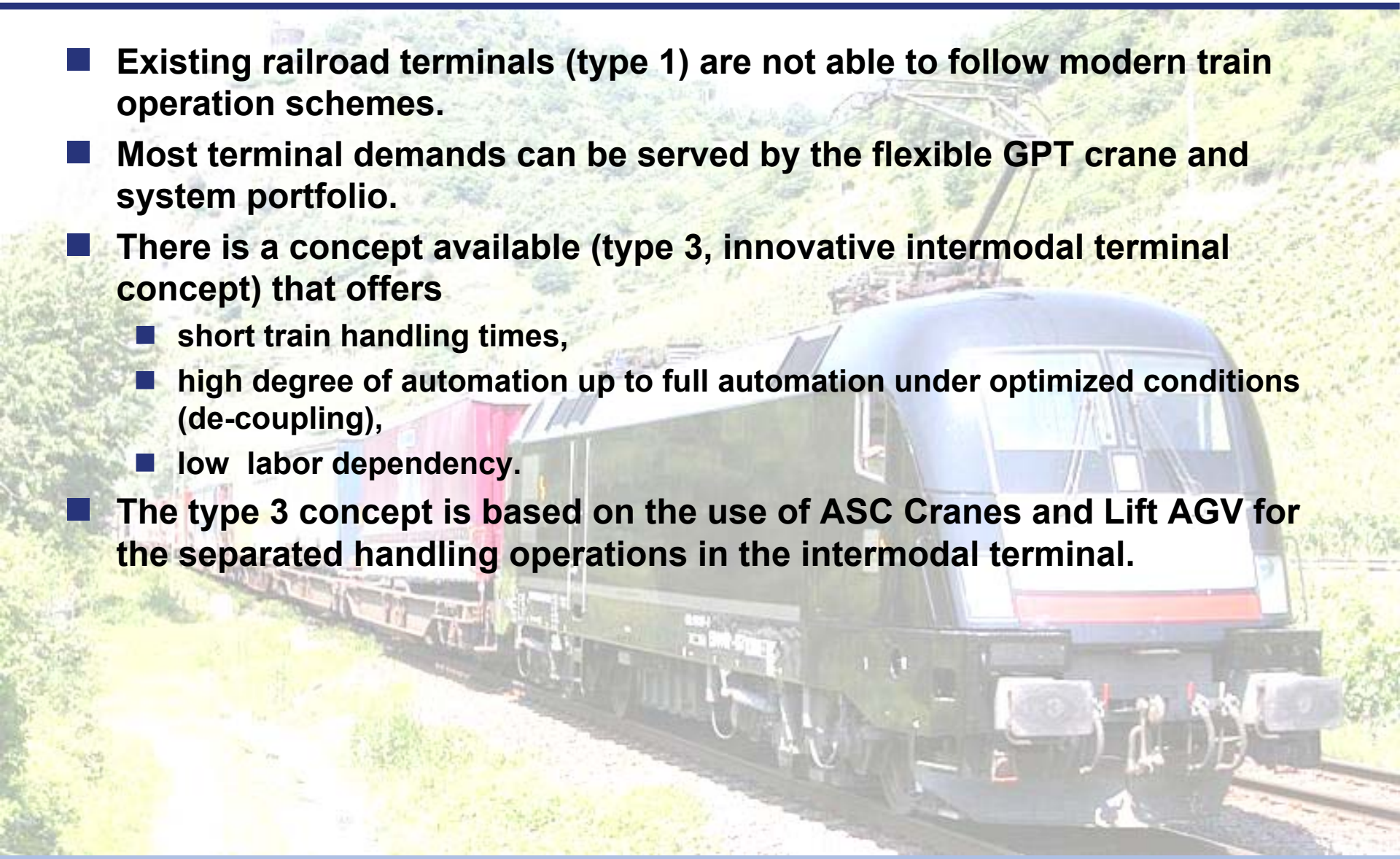
- **Present day concept (1 over 4, 6 lanes) 75% utilization** — **1080 boxes (50’ slots)**
- **RSC concept (1 over 3, 9 lanes) 85% utilization** — **1377 boxes (50’ slots)**

Conclusions:

- **In RSC concept 27.5% more operational stack capacity available**
- **Already in 2010 the present day concept layout must be lengthened in order to accommodate the peak stack capacity demands**

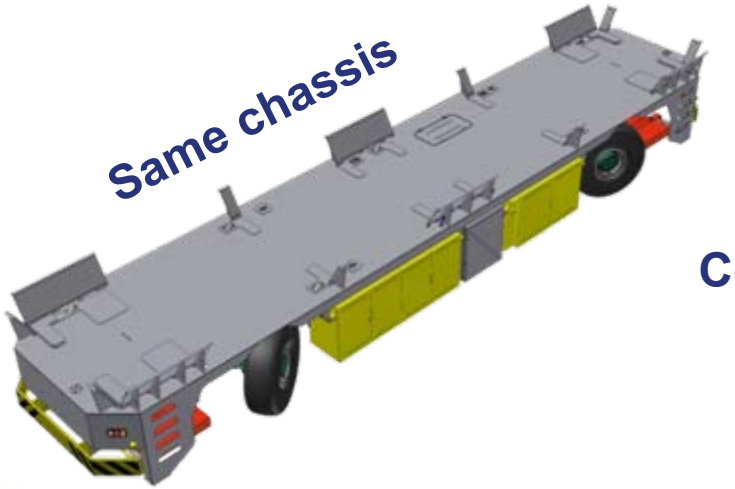
Conclusions

- Existing railroad terminals (type 1) are not able to follow modern train operation schemes.
- Most terminal demands can be served by the flexible GPT crane and system portfolio.
- There is a concept available (type 3, innovative intermodal terminal concept) that offers
  - short train handling times,
  - high degree of automation up to full automation under optimized conditions (de-coupling),
  - low labor dependency.
- The type 3 concept is based on the use of ASC Cranes and Lift AGV for the separated handling operations in the intermodal terminal.

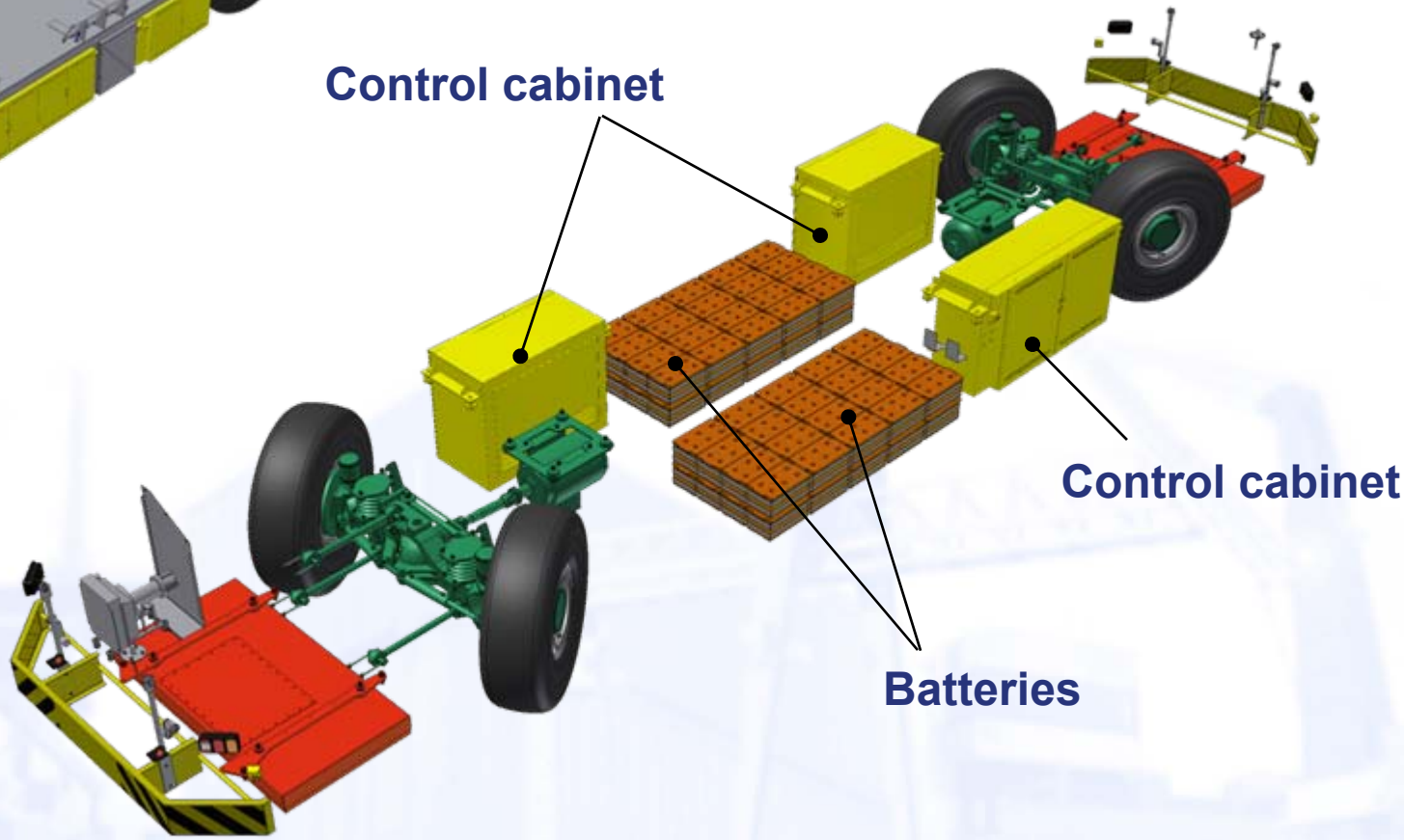


New AGV Drive Concepts

Battery-AGV (Prototype planned for 2009)



Same chassis

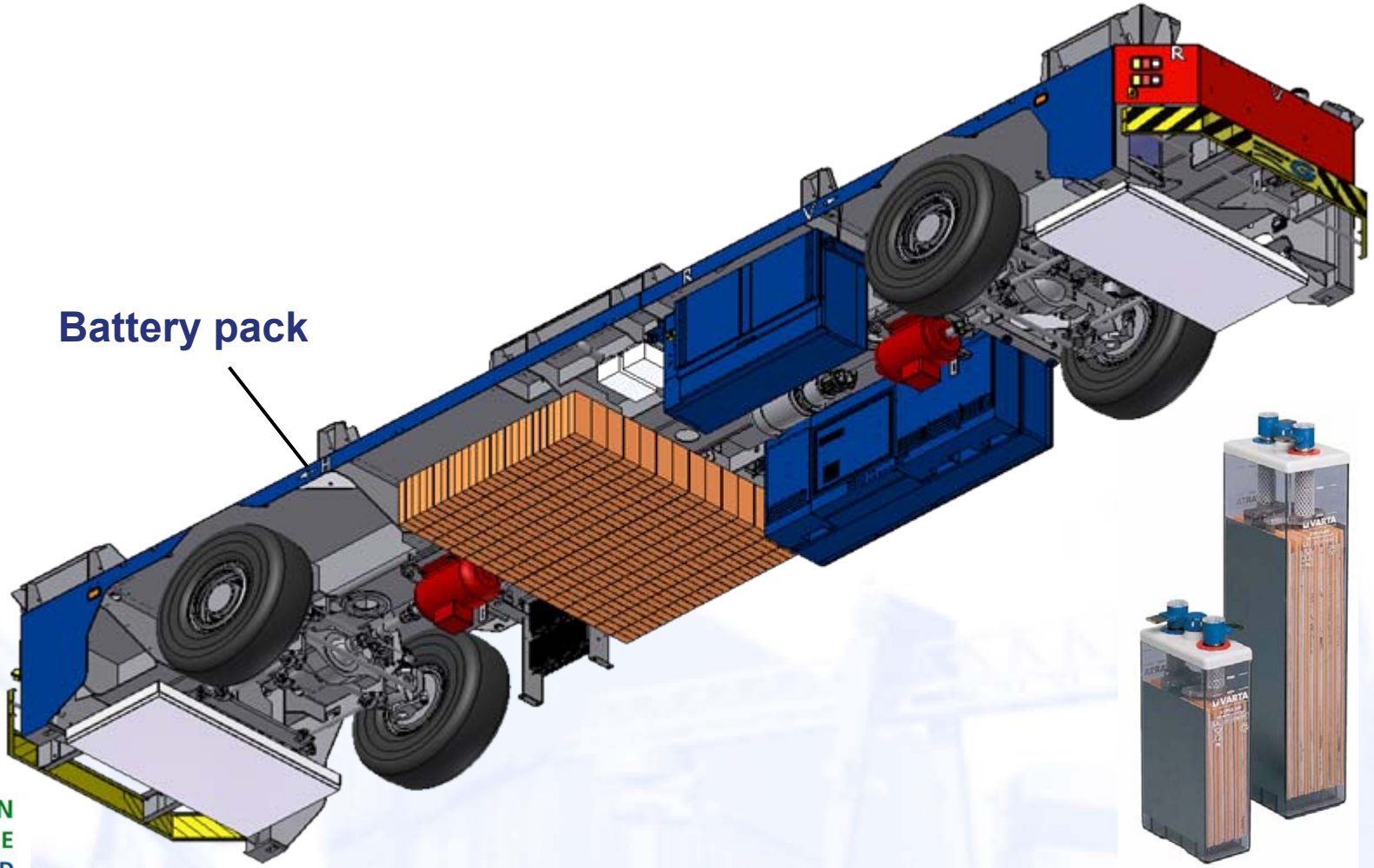


Control cabinet

Control cabinet

Batteries

Vehicle Design
Lead-Acid Battery



2V-cells