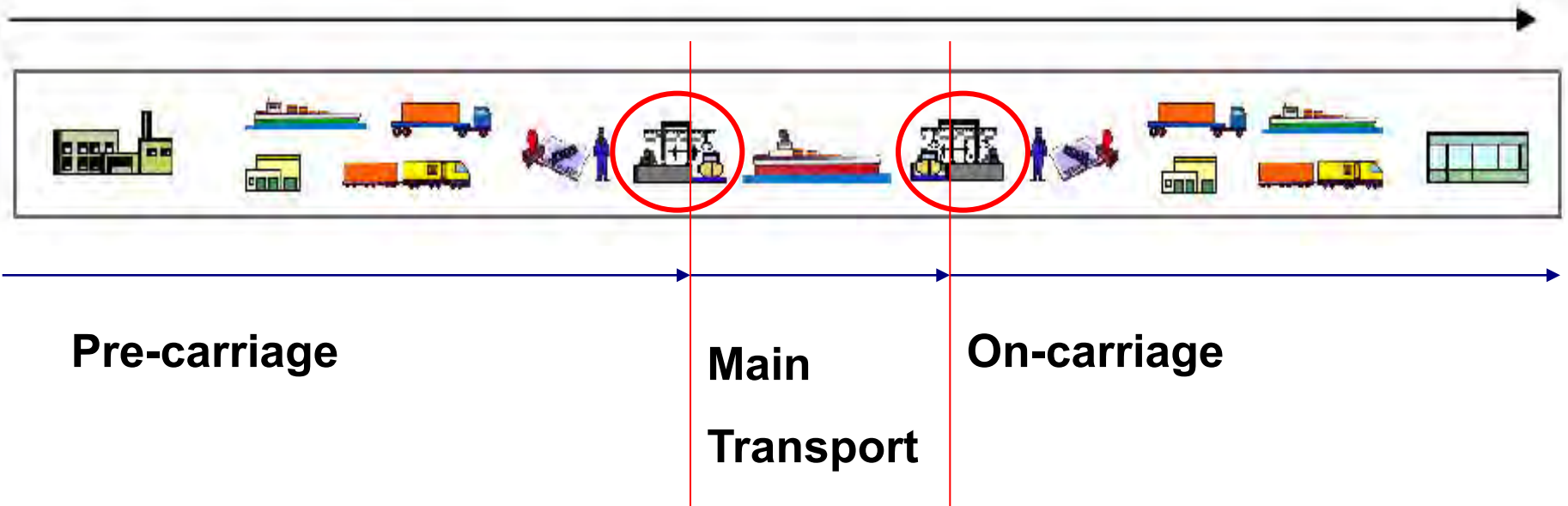
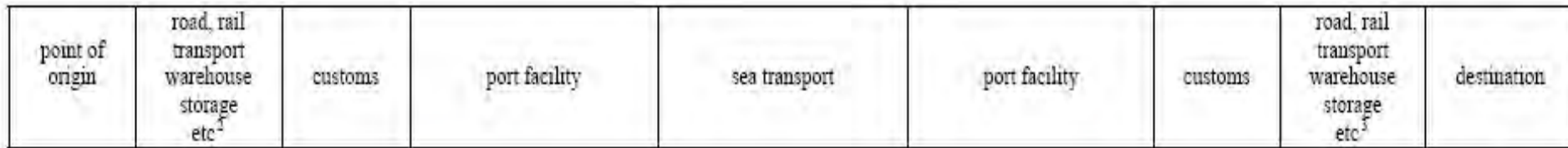


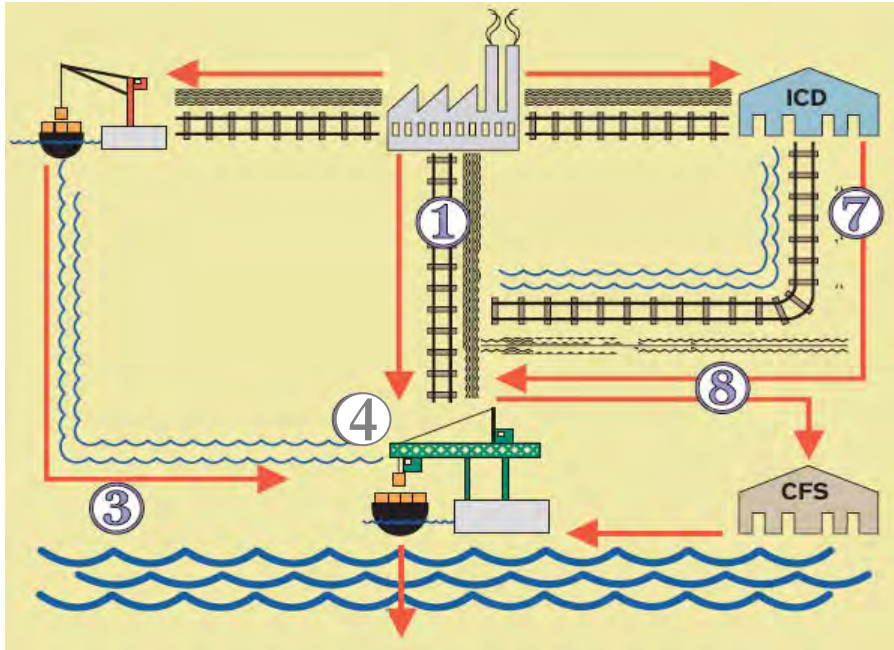
Introduction Container Terminals General

Intro Containerterminals General



Intro Containerterminals

General

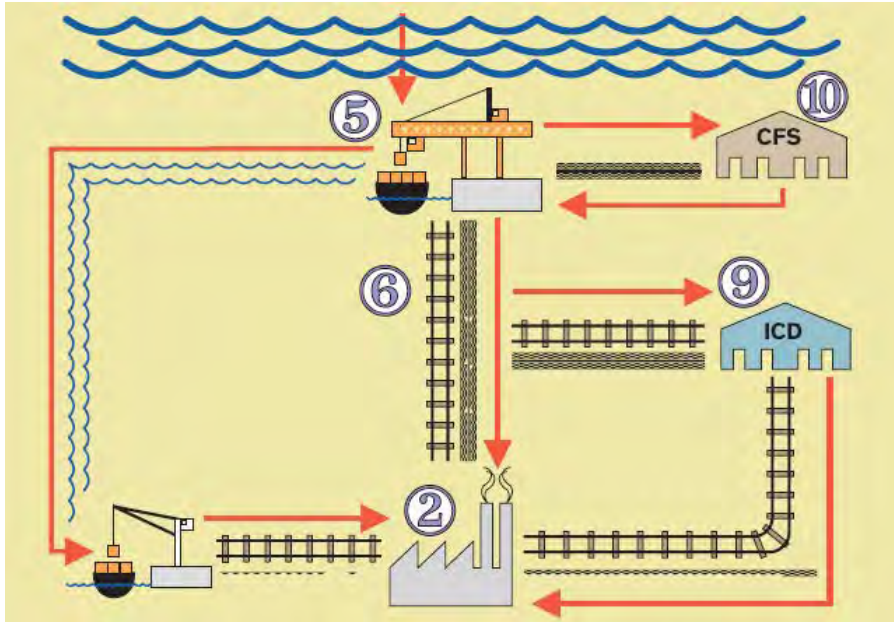


Logistic chain: Pre-carriage

1. Consignor or Seller
2. Consignee or Buyer
3. Inland transport
4. Port of export

Intro Containerterminals

General



Logistic chain: On-carriage

- 5. Port of import**
- 6. Inland transport**
- 7. Inland Clearance Depot (ICD)**
- 8. Inland transport**
- 9. Inland clearance depot**
- 10. Container Freight Station (CFS)**

Intro Container terminals

Subject

- FCL:
Full Container Load
One consignment, one consignee
- LCL:
Less than Container Load
Multiple consignments, multiple consignees

Stuffing and stripping of LCL at ICD or CFS

Intro Containerterminals

General



Modalities

- Deepsea vessel
- Feeder vessel
- Barge
- Train or Rail
- Truck



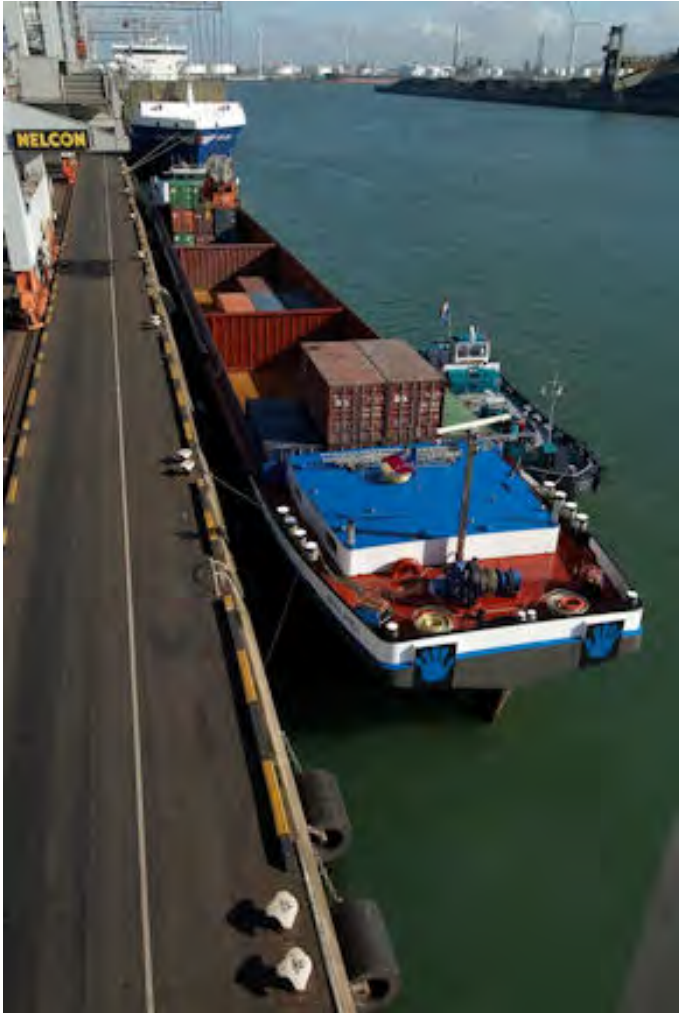
Deepsea vessel is for main transport

Feeder vessel is for pre- or on-carriage

Intro Containerterminals

General

Barge, train and truck are for pre- and on-carriage of goods.



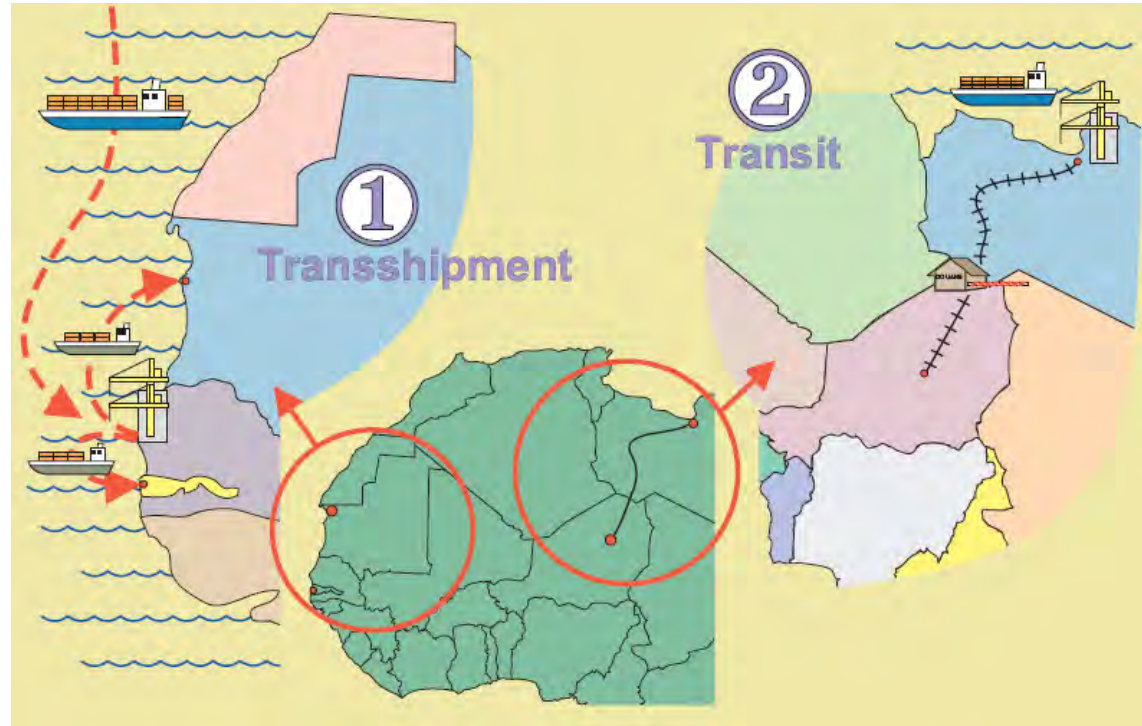
Introduction Container Terminals Transport routes

Intro Containerterminals

Transport routes

Transshipment:
Discharge from
vessel to load
on other vessel

Transit:
Discharge from
vessel for
oncarriage to
country inland
v.v.



Intro Container terminals

Transport routes

- Export:
Cargo originating from the country in which the terminal is located with destination another country
- Import:
Cargo originating from another country with destination the country in which the terminal is located

Outbound

Inbound

Transshipment

Intro Containerterminals

Transport routes

out / to:► in / from:▼	Deepsea	Feeder	Barge	Rail	Road
Deepsea	Tranship	Tranship	Inbound or Import	Inbound or Import	Inbound or Import
Feeder	Tranship	Tranship	Inbound or Import	Inbound or Import	Inbound or Import
Barge	Outbound or Export	Outbound or Export	Tranship	Tranship	Tranship
Rail	Outbound or Export	Outbound or Export	Tranship	Tranship	Tranship
Road	Outbound or Export	Outbound or Export	Tranship	Tranship	Tranship

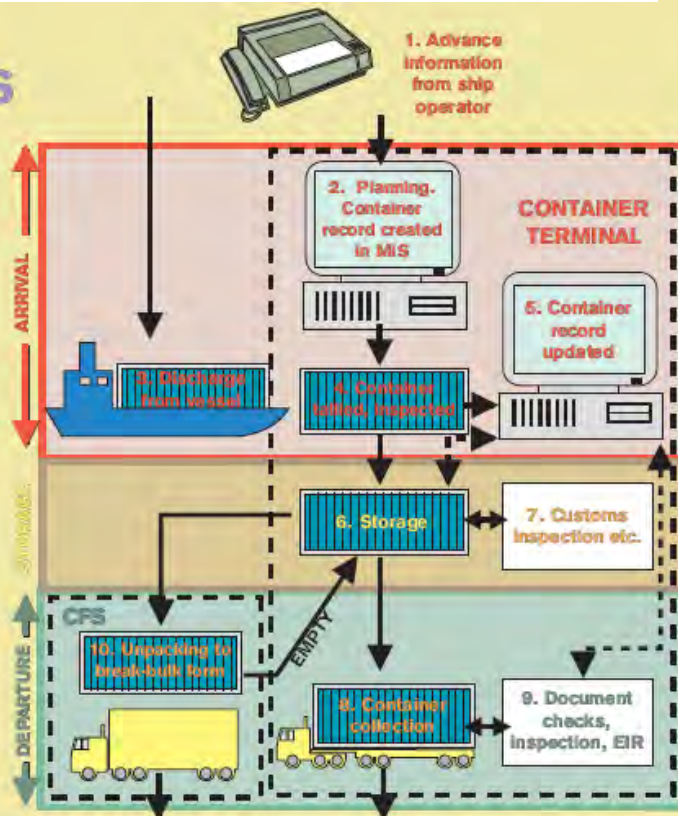
Introduction Container Terminals Activities

Intro Containerterminal Activities

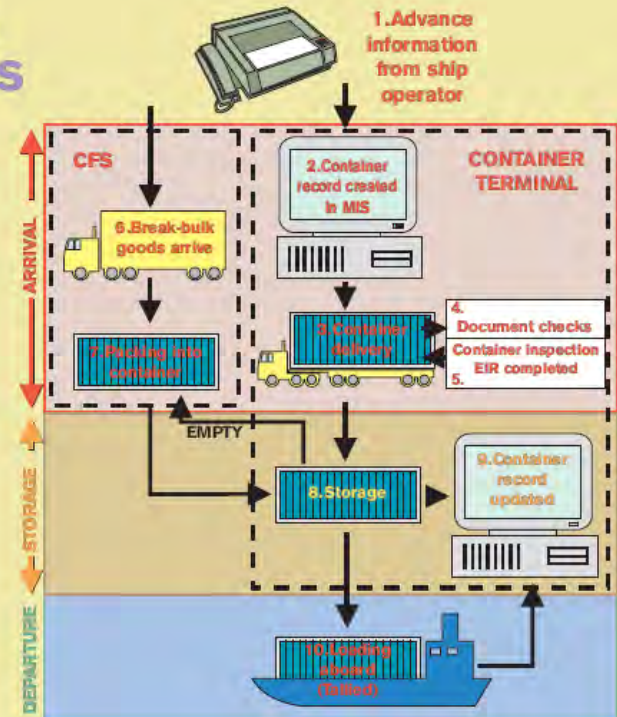
Three activities:

- Container arrival
- Container storage
- Container departure

INBOUND CONTAINERS



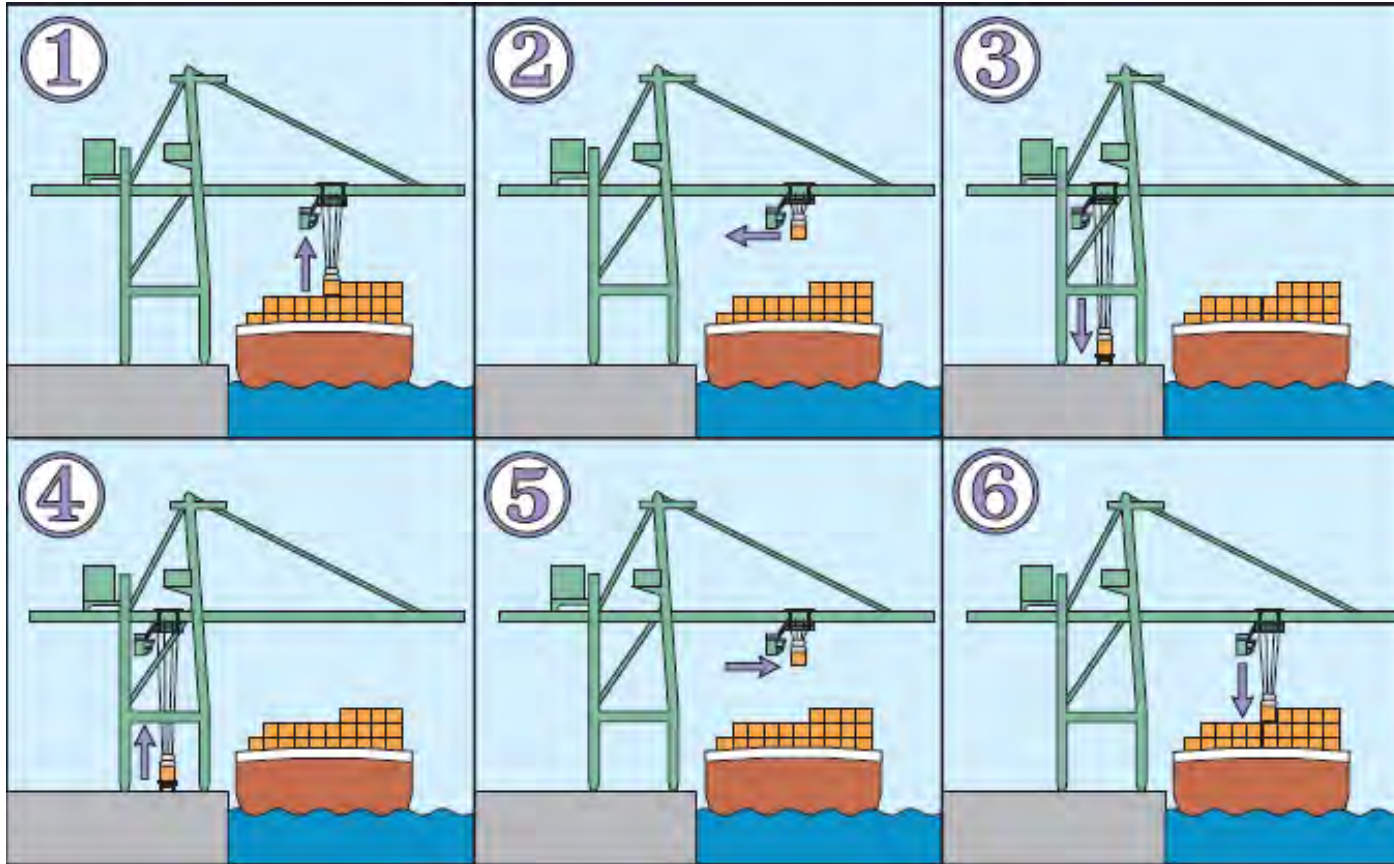
OUTBOUND CONTAINERS



Arrival: Via land or water side

Departure: Via land or water side

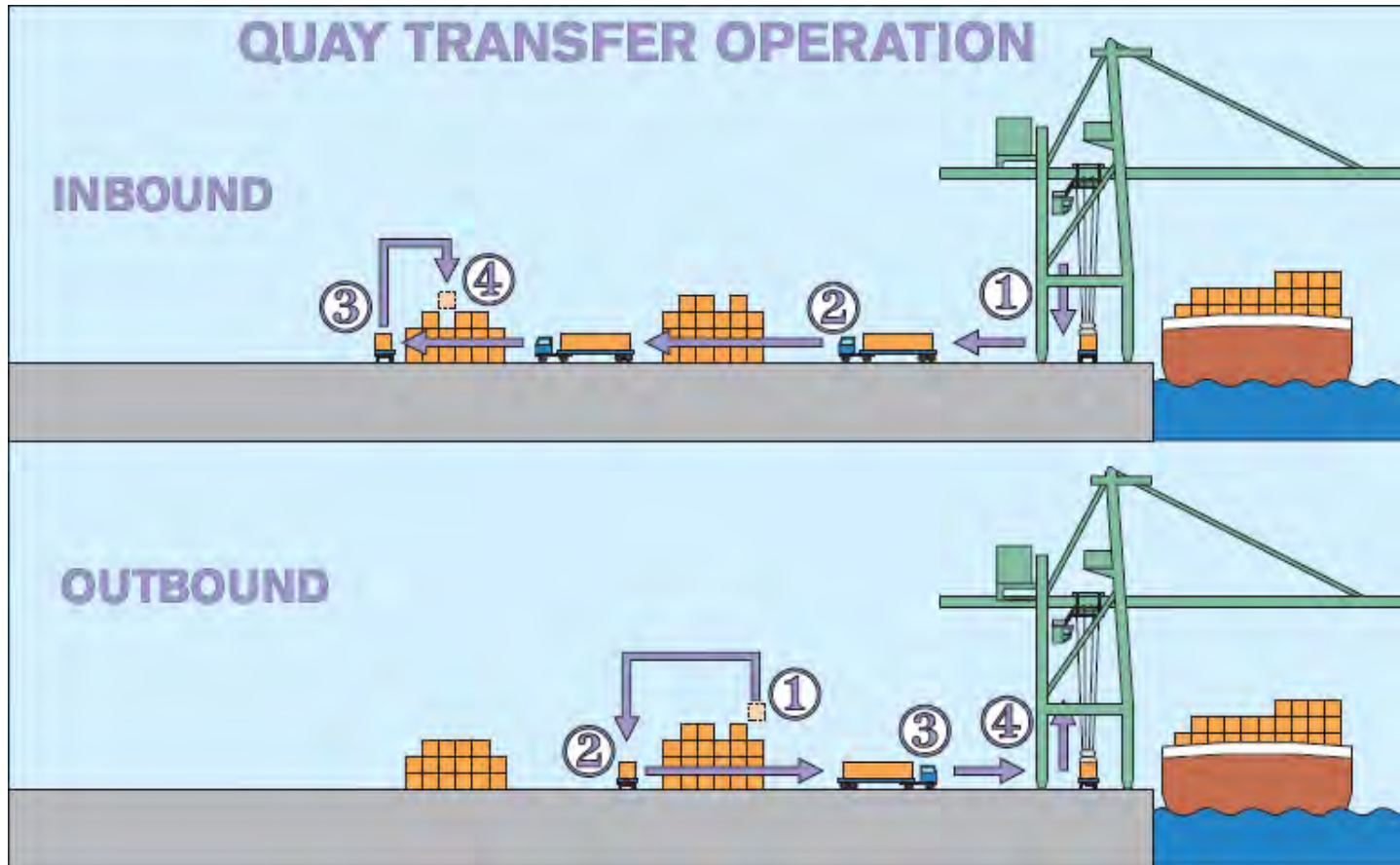
Intro Containerterminals Activities



Shipoperation

- Discharge move 1-3
- Load move 4-6

Intro Containerterminals Activities



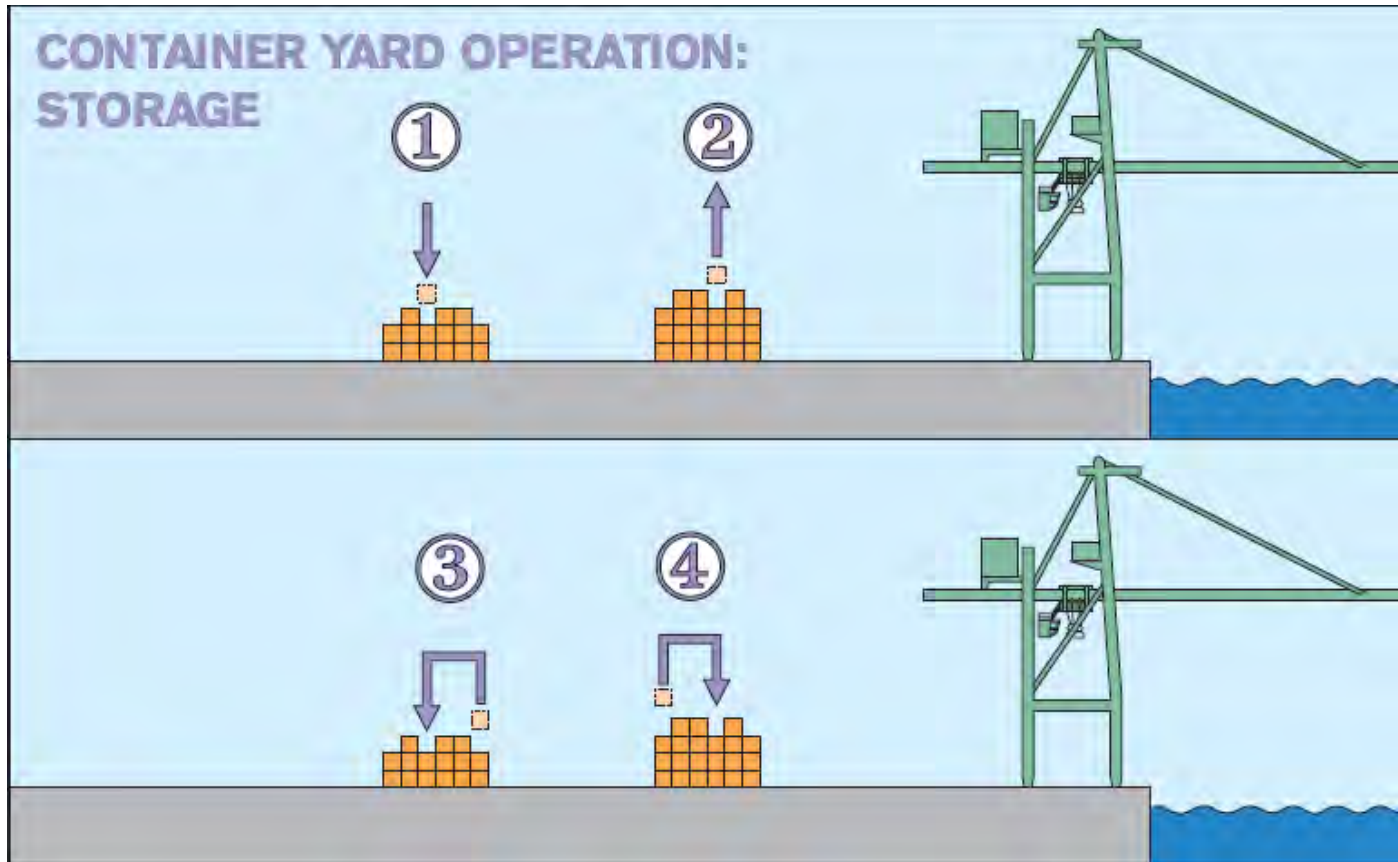
**Import to
container stack
near land-side**

**Export from
container stack
near water-side**

Quay transfer operation

- Inbound move, from crane into stack
- Outbound move, from stack to crane

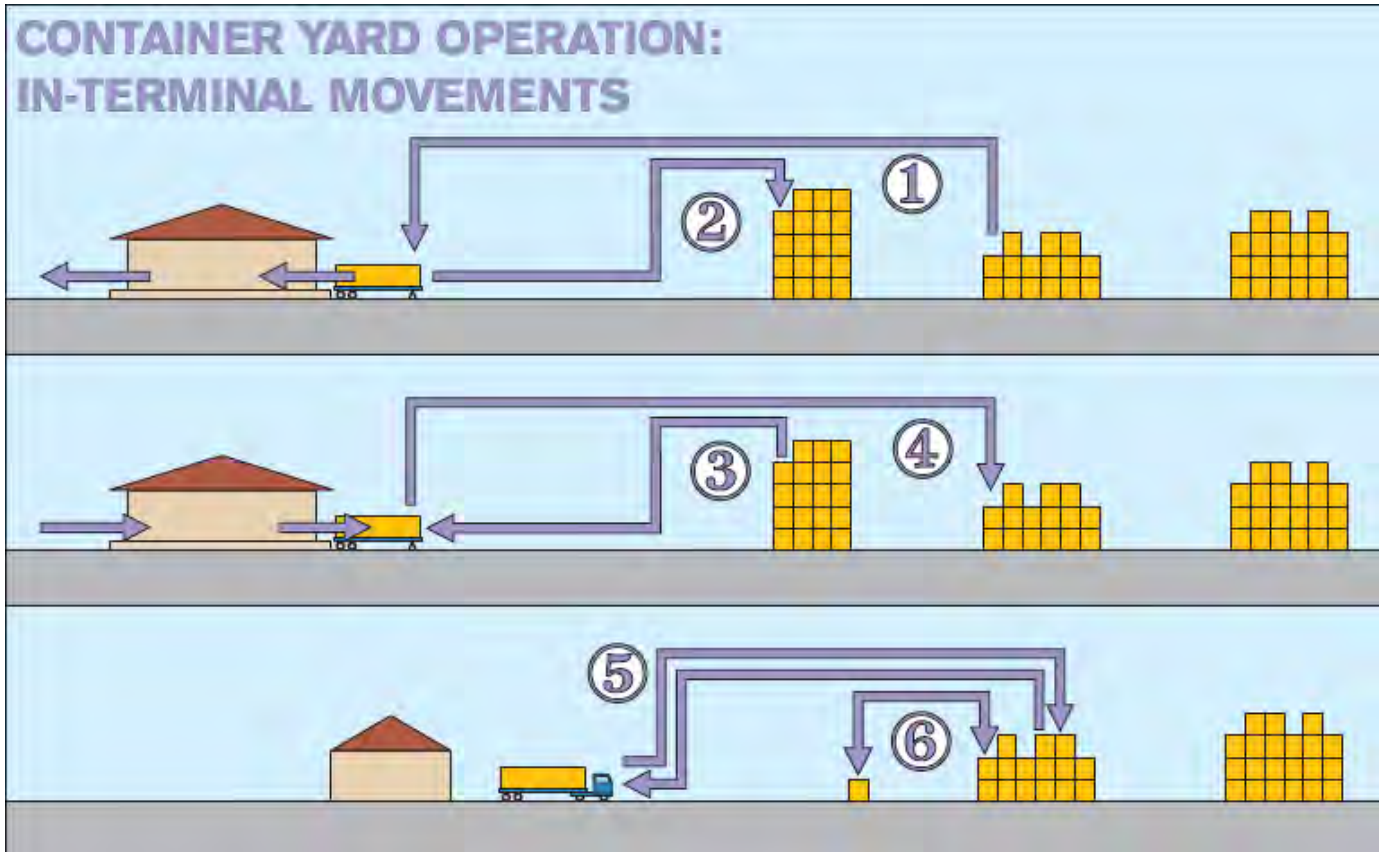
Intro Containerterminals Activities



Stack operation (storage)

- Lifting and landing containers
- Moving containers in the stack

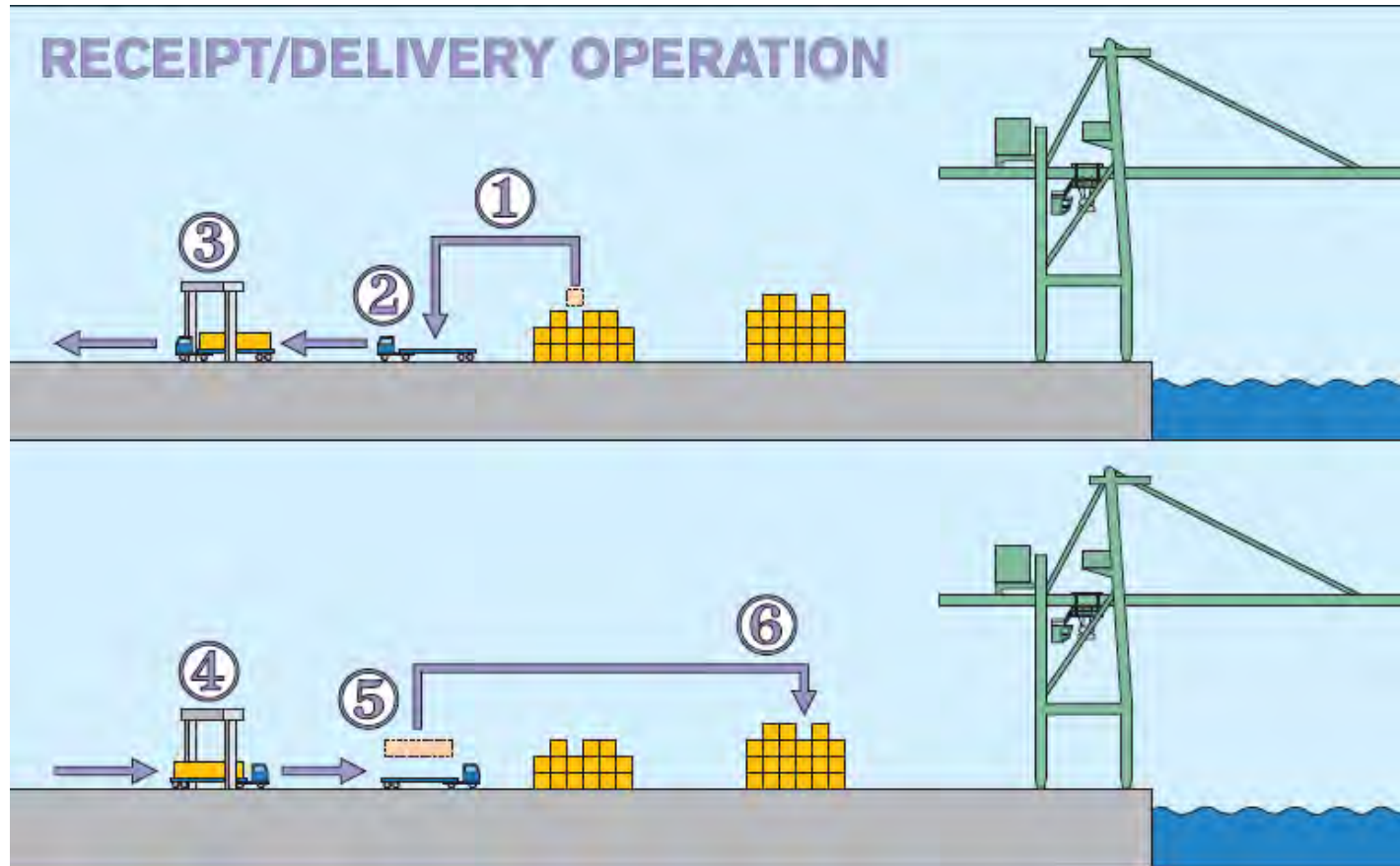
Intro Containerterminals Activities



Stack operation (internal movements)

- Import- and export movements via CFS
- Movements for inspections by customs etc.

Intro Containerterminals Activities



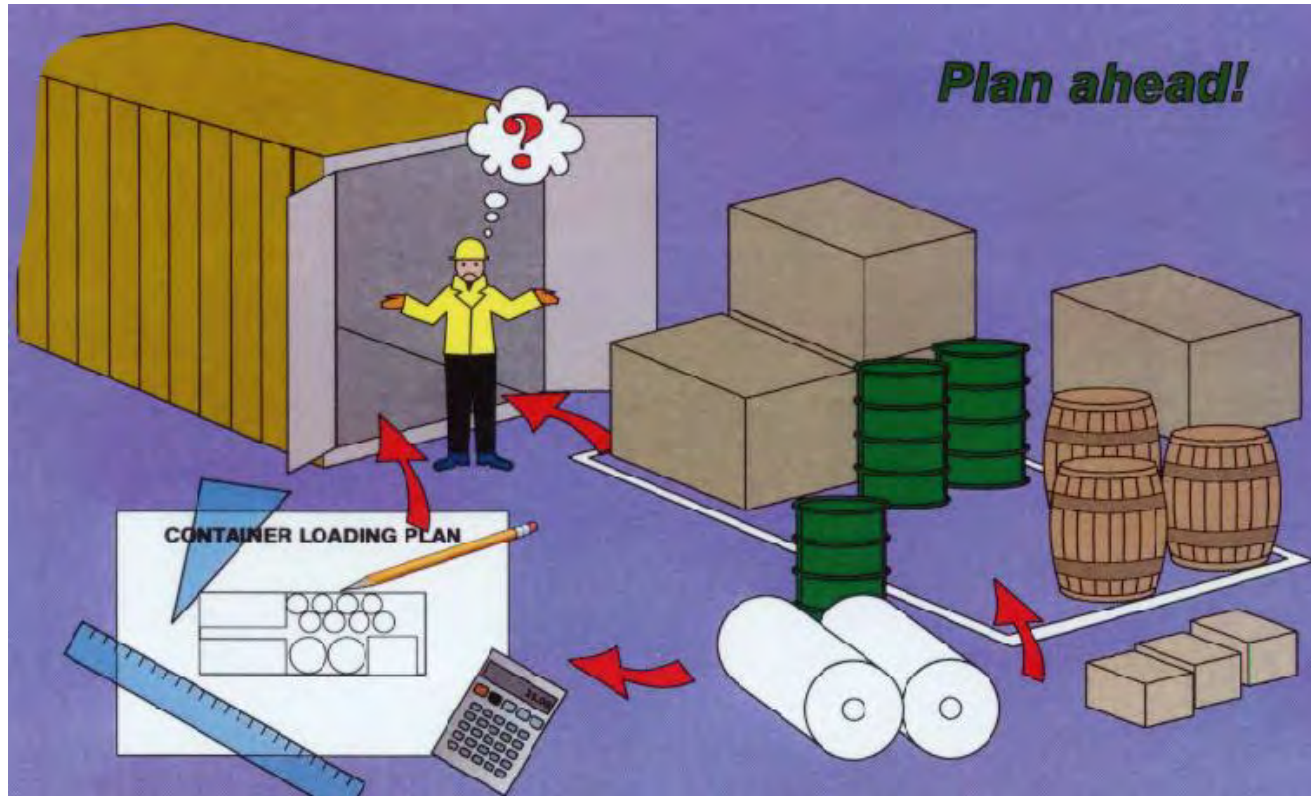
**Import
containers stack
near land-side**

**Export
containers stack
near water-side**

Receipt and delivery operation

- From stack to external modality for import
- From external modality to stack for export

Intro Containerterminals Activities



- CFS activities
- Empty Depot activities
- Other activities

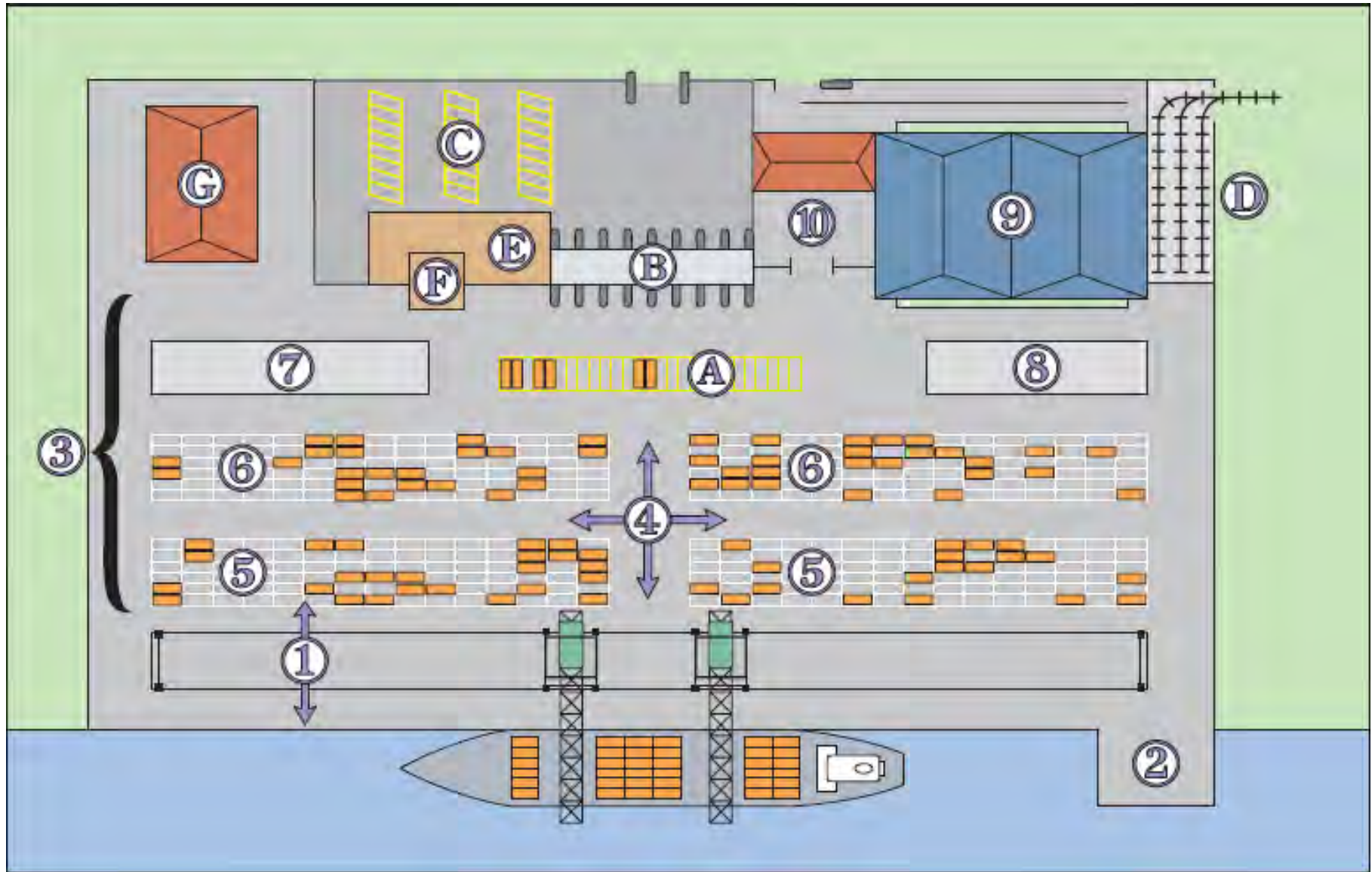
Introduction Container Terminals Layout

Intro Containerterminals Layout

- Chaos
- Disorder
- Mistakes
- Accidents
- ...



Intro Containerterminals Layout

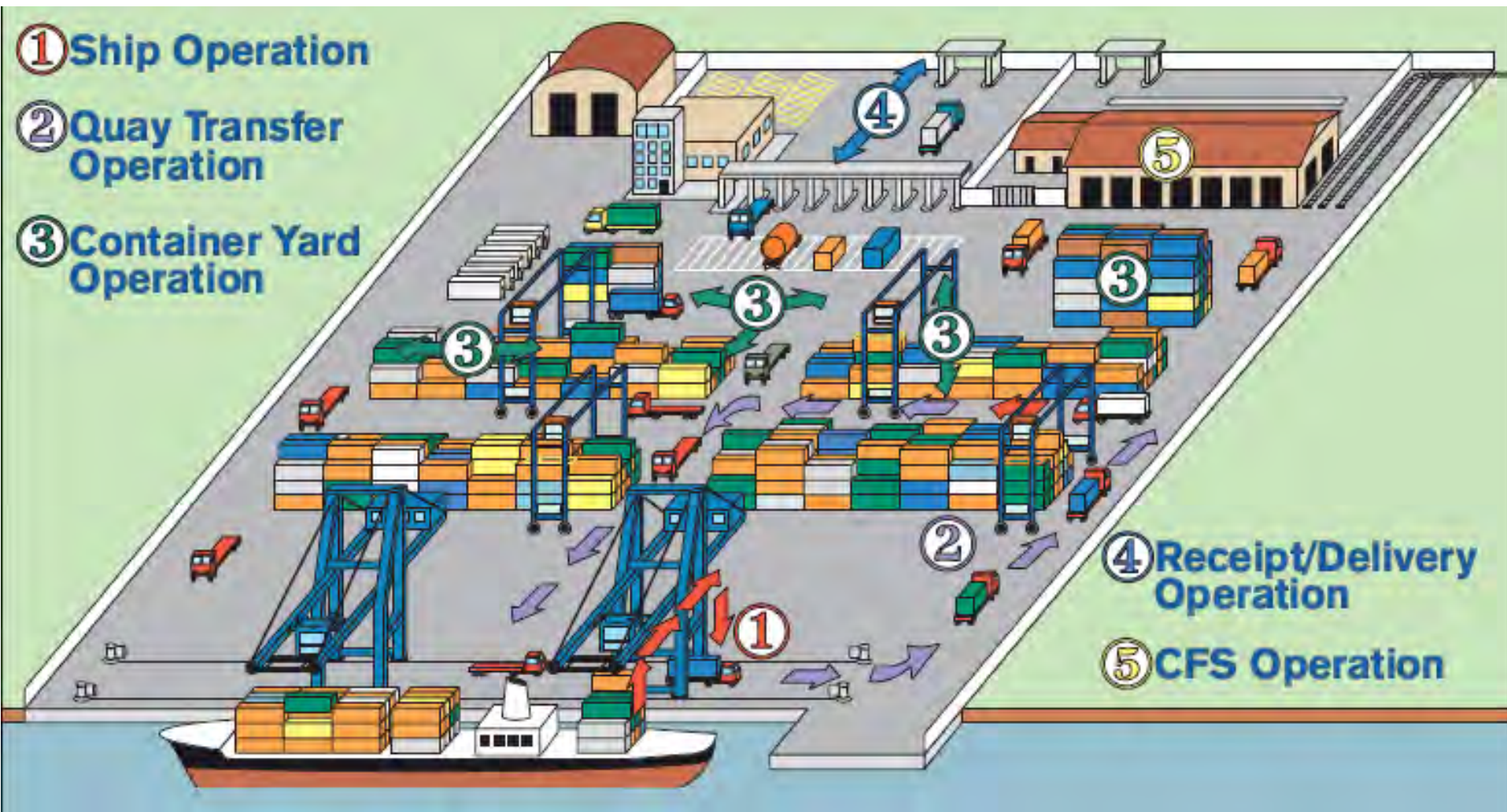


Intro Container terminals Layout

General layout container terminal:

1. Quay
 2. Roro ramp
 3. Container yard or stack
 4. Road- and isle ways
 5. (Export) Blocks or sub-stack
 6. (Import) Blocks or sub-stack
 7. Special stack
 8. Empty stack or depot
 9. CFS
 10. Inspection area
- a. Interchange area
 - b. Gate facility
 - c. Parking area's
 - d. Railhead or rail terminal
 - e. Administration offices
 - f. Control center
 - g. Maintenance building

Intro Containerterminals Layout



Intro Containerterminals IT

YARD ADDRESS SYSTEM

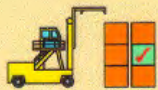
Ensures that :



1. The container is placed in its planned position.



2. The storage location is correctly communicated to the control room.



3. The correct container is moved.



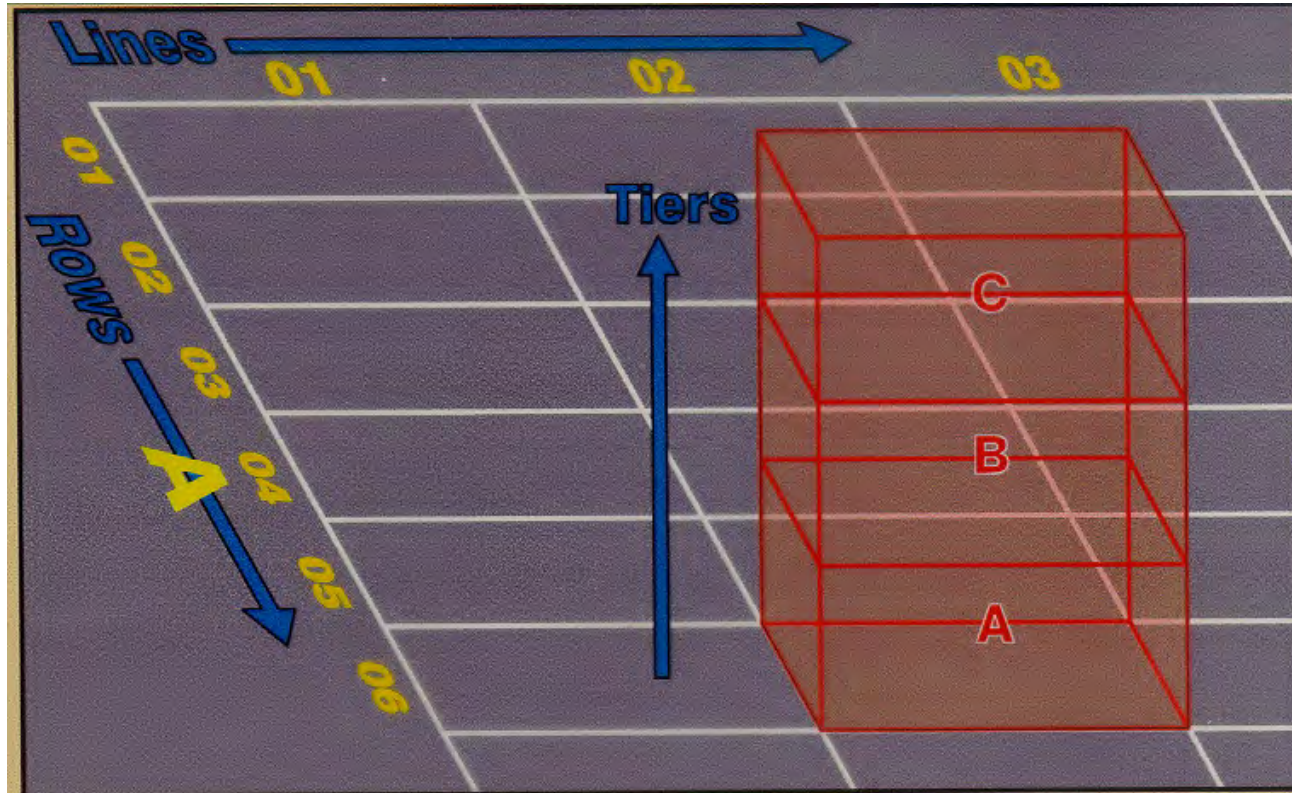
4. The container is quickly and accurately located.



5. The slots occupied and empty are always known.

To allow a proper track and trace, each position in the stack must have a unique code

Intro Containerterminals IT



Bock A
Row 06
Line 02
Tier A

Intro Containerterminals Layout

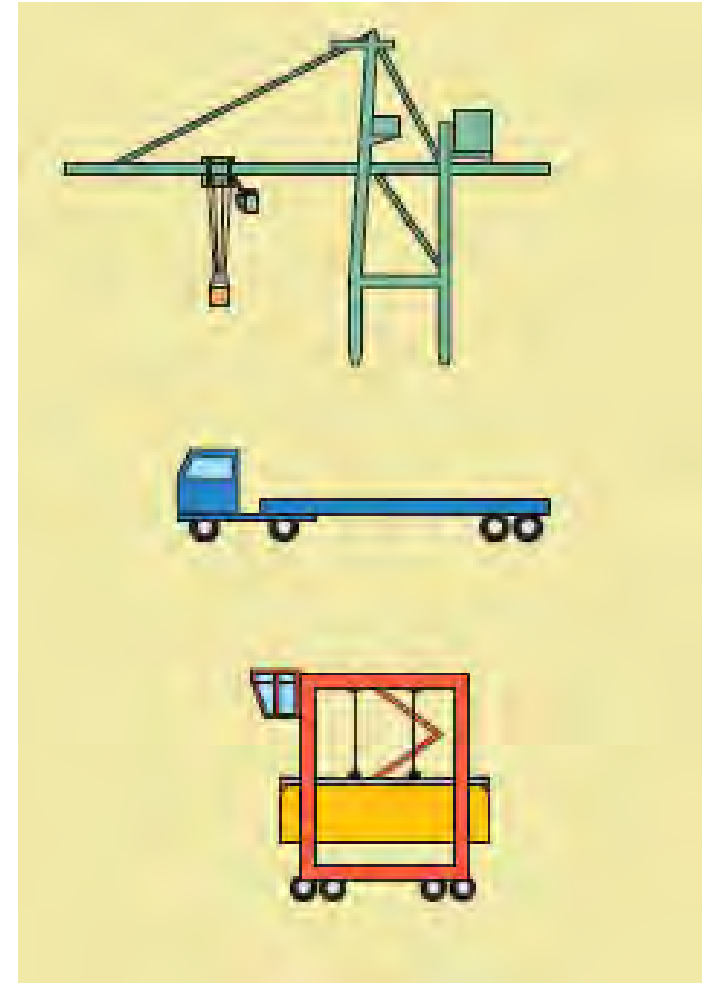
Dependency of the activities:

- Effects of delay in receipt/delivery operations
- Effects of shortage of equipment in stacking area
- Effects of shortage of equipment for quaytransport

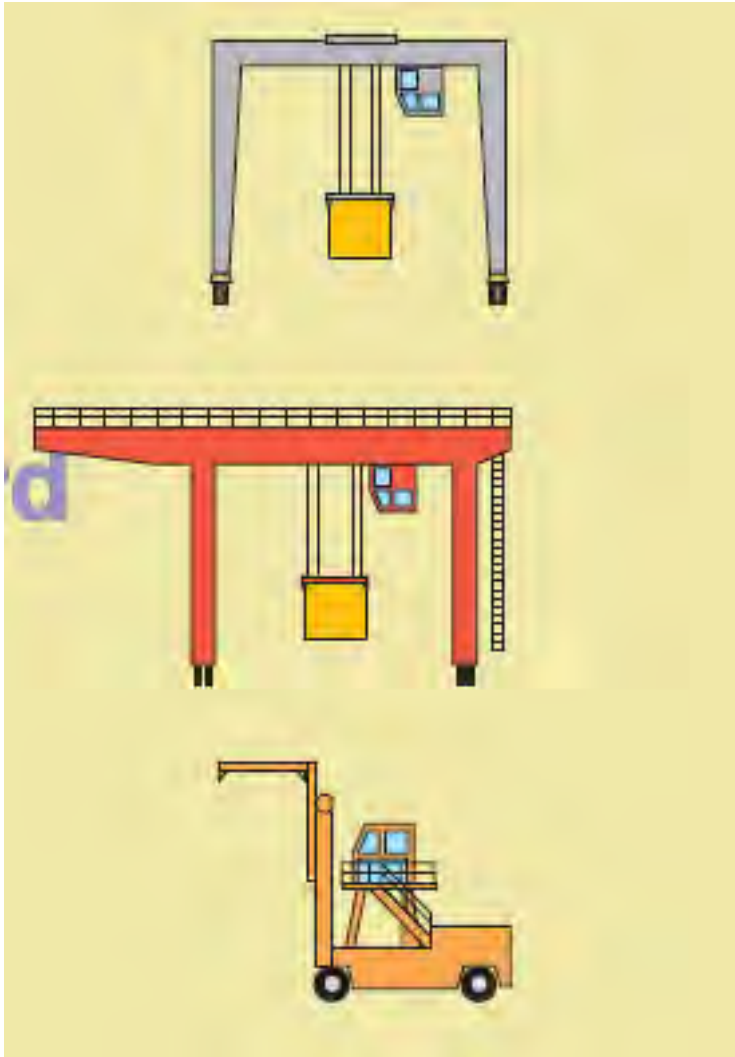
Introduction Container Terminals Equipment

Intro Containerterminals Equipment

- Ship To Shore Cranes or Quay Cranes:
For load- and discharge operations waterside
- Terminal Truck/Chassis:
For quay-stack transport, chassis also for stackstorage
- Straddle Carrier
For quay-stack transport, stackoperations and delivery/acceptance operations



Intro Containerterminals Equipment



- Rubber Tired Gantry Crane (RTG):
For stack operations
- Rail Mounted Gantry Crane (RMG):
For stack operations
- Top Lifter or Reach Stacker:
For delivery/acceptance
and stack operations

Intro Containerterminals Equipment



- a) Railspace
- b) Outreach
- c) Backreach
- d) Portal height
- e) Lifting height

Intro Containerterminals Equipment



Intro Containerterminals Equipment



Straddling one container

1-over-1 (sprinter)

1-over-2 or-3

Intro Containerterminals Equipment

Straddling 3-6 containers
wide

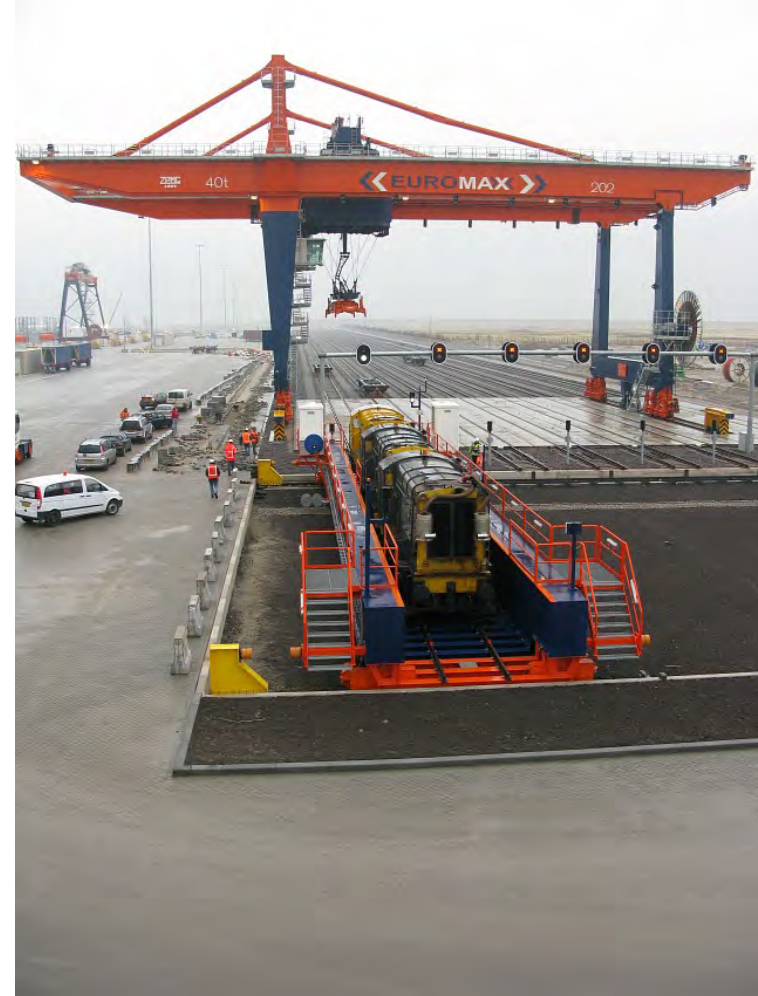
1-over-5 up to 8 high



Intro Containerterminals Equipment



- 6-10 containers wide
- 1-over-5 or 6



Intro Containerterminals Equipment



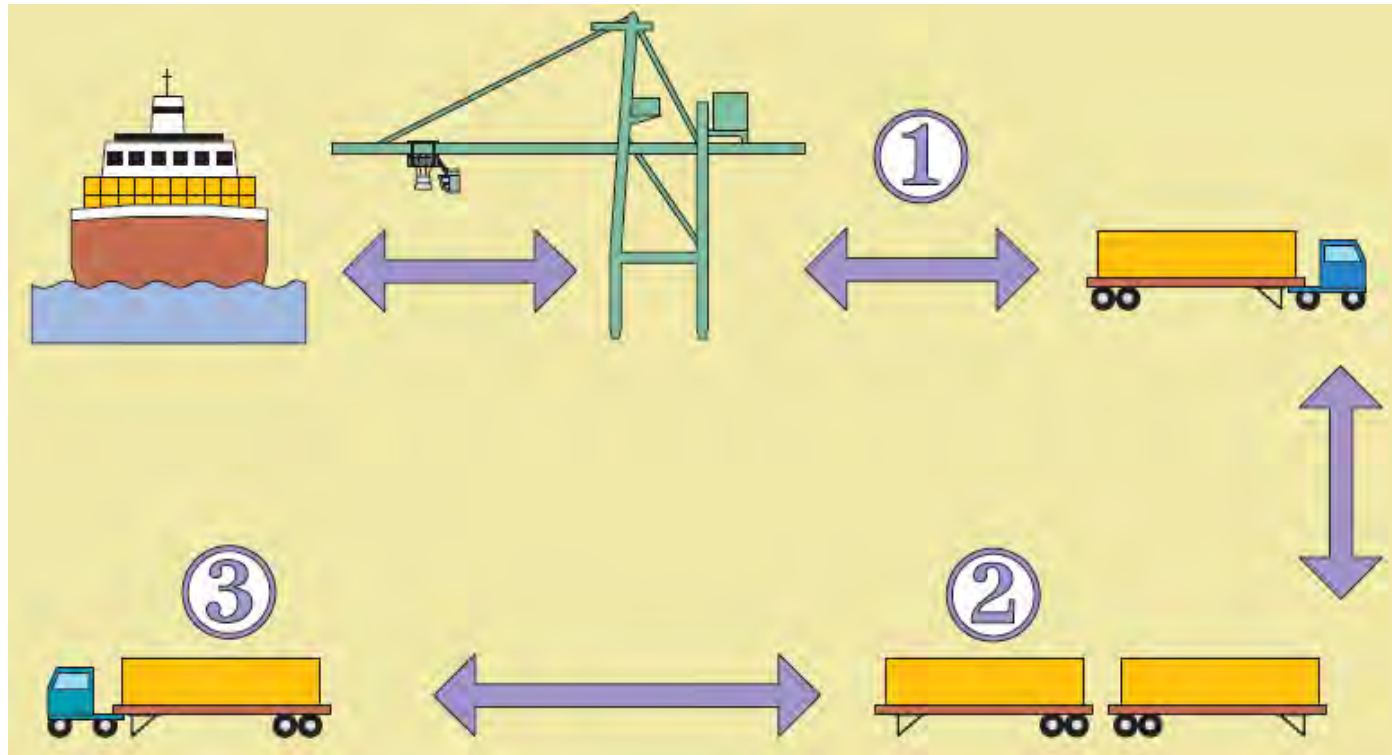
Introduction Container Terminals Systems

Intro Containerterminals Systems

Combining the various equipment types to a system:

- Chassis system
- Forklift or reach stacker system
- SC system
- Lifttruck system
- Combination systems
 - Straddlecarrier relay system
 - TT/TC-RTG (RMG) system

Intro Containerterminals Systems



1. Quay transfer
2. Stack
3. delivery

Chassis system

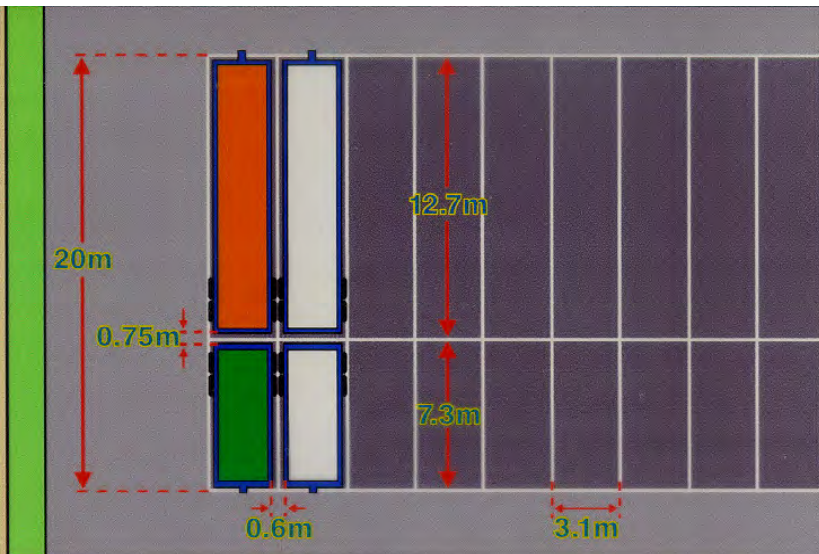
Intro Containerterminals Systems

Pro's

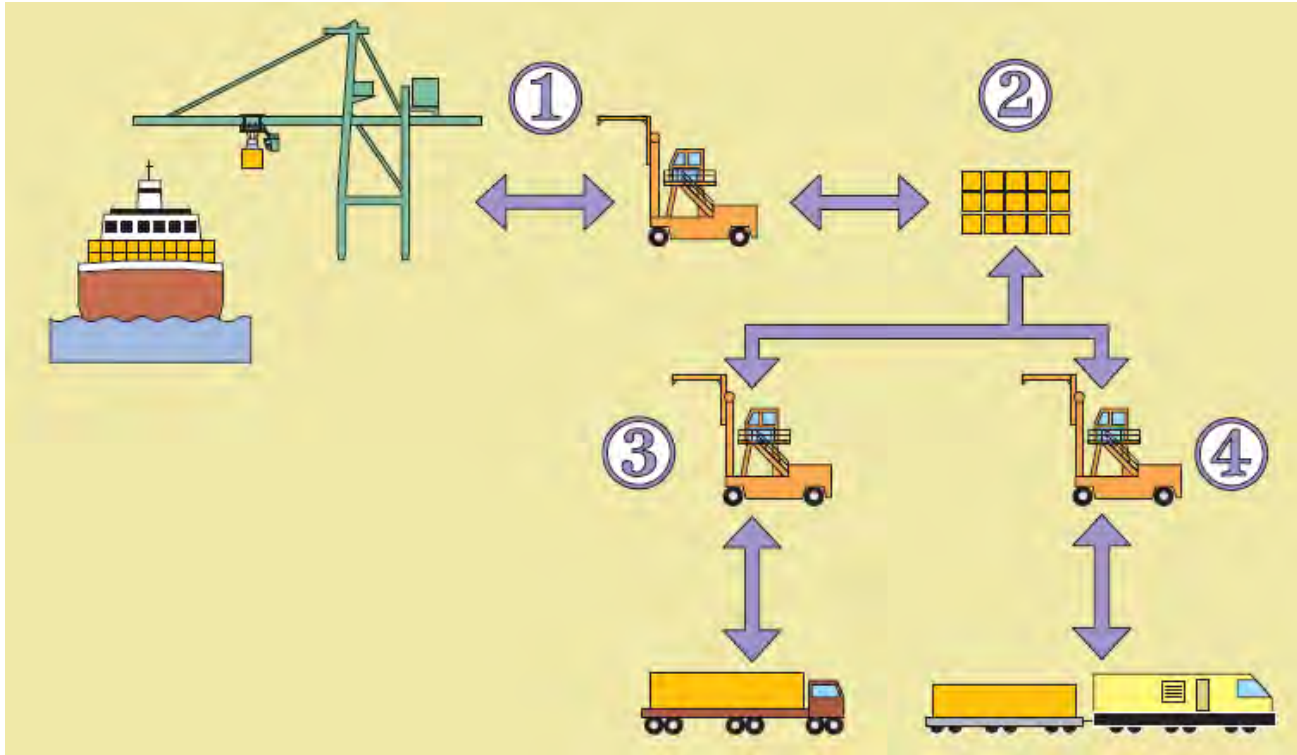
- + No additional equipment required
- + Easy access for truckers
- + flexibility of road chassis

Con's

- Space consuming
- Easy access for truckers
- Shortage of equipment



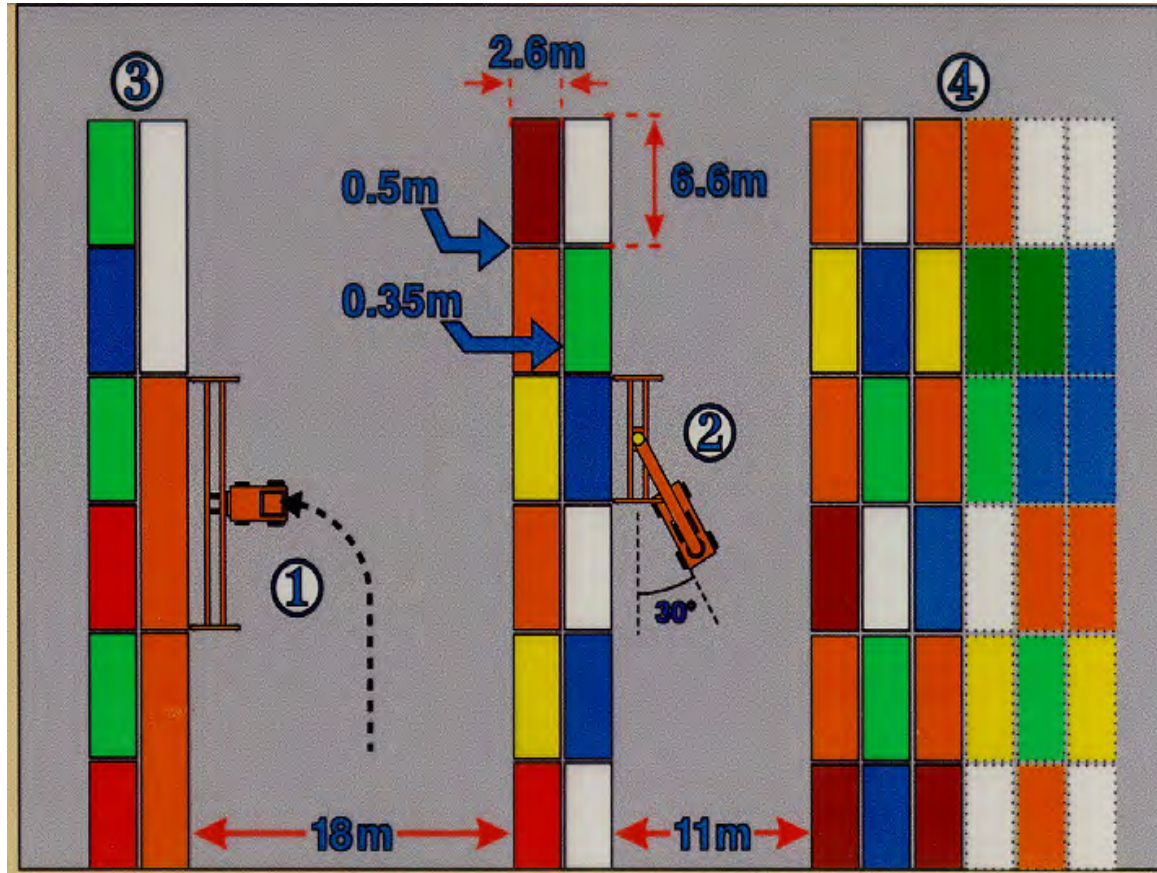
Intro Containerterminals Systems



1. Quay transfer
2. Stack
3. Delivery
4. Delivery to rail terminal

Lift truck system

Intro Containerterminal Systems



1. Forklift system
2. Reach stacker system
3. Maximum stack width forklift system
4. Maximum stackwidth reach stacker system

Pro's:

- + Flexible
- + Equipment invest

Con's:

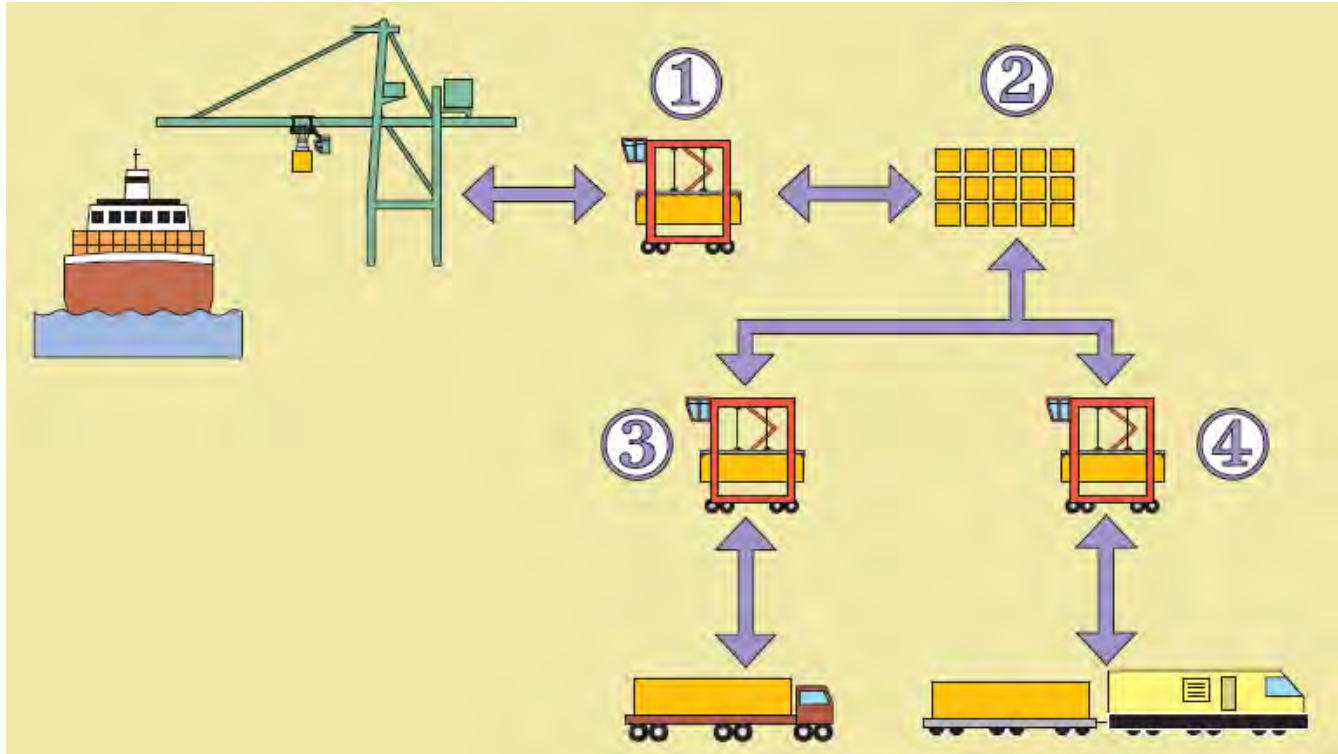
- Spaceconsuming

Forklift/reach stacker system

Intro Containerterminals Systems



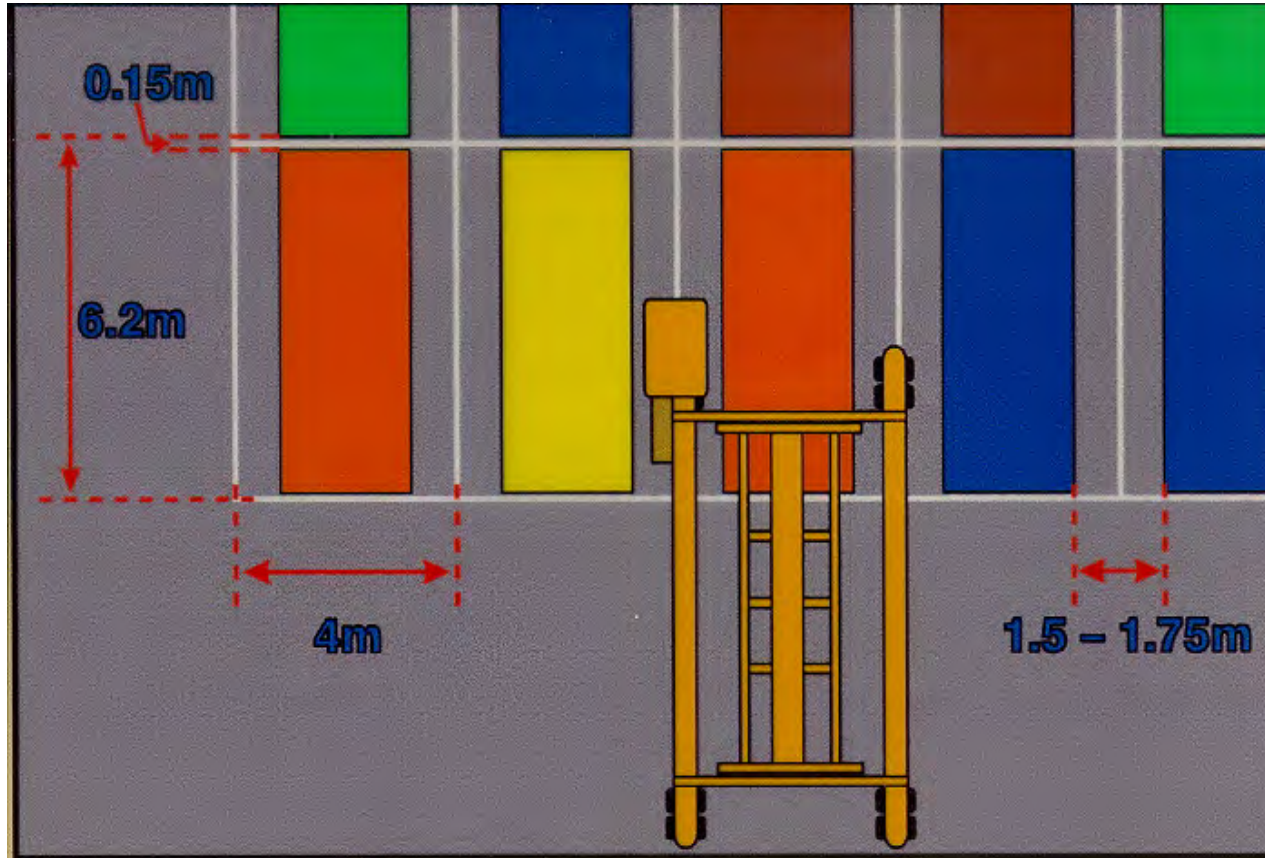
Intro Containerterminals Systems



1. Quay transfer
2. Stack
3. Delivery
4. Delivery to rail terminal

Straddle carrier direct system

Intro Containerterminals Systems



Pro's:

+ Flexible system

Con's:

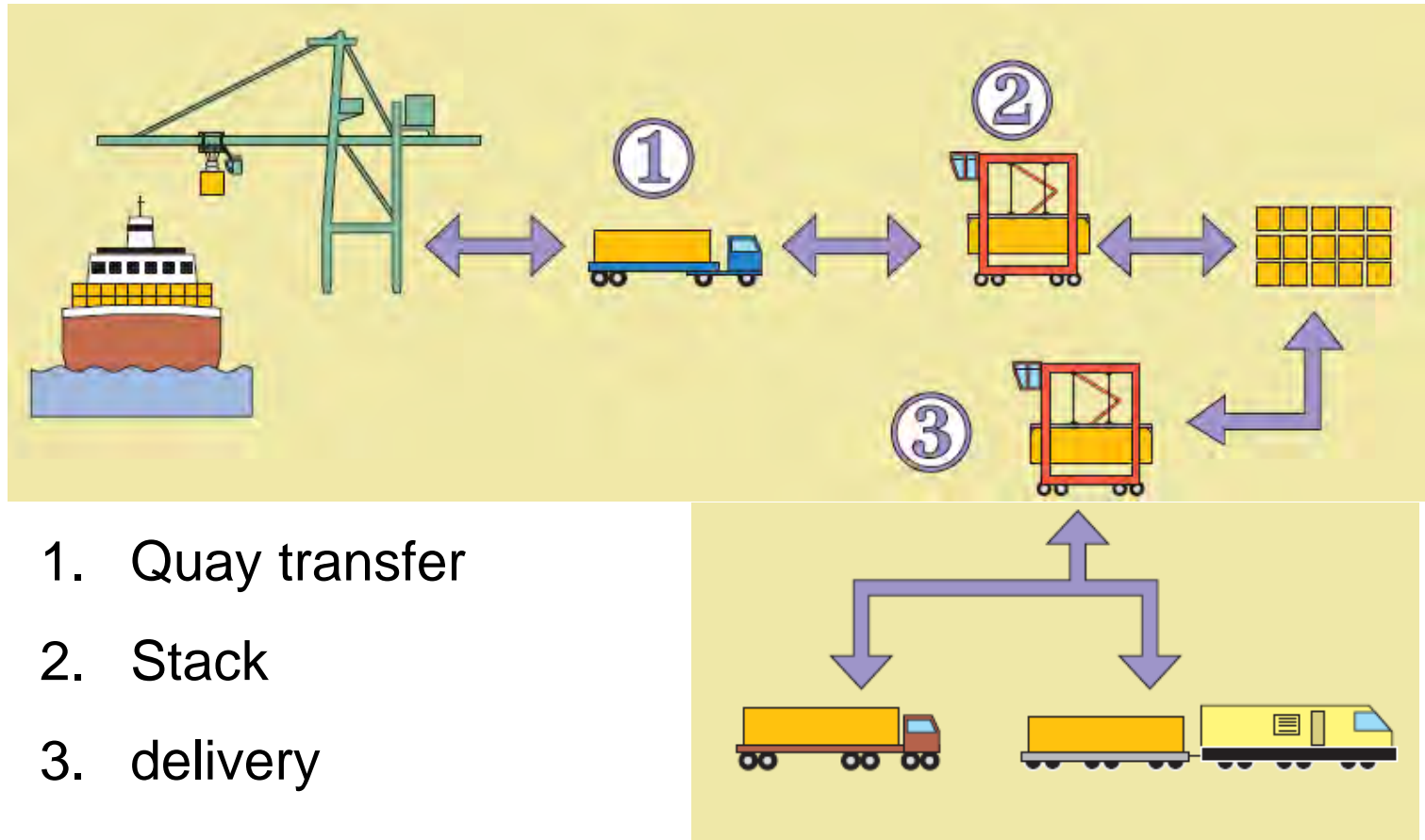
- Space consuming

- Travel distance

Intro Containerterminals Systems



Intro Containerterminals Systems



Straddle carrier relay system

Intro Containerterminals Systems



Pro's:

+ Flexible

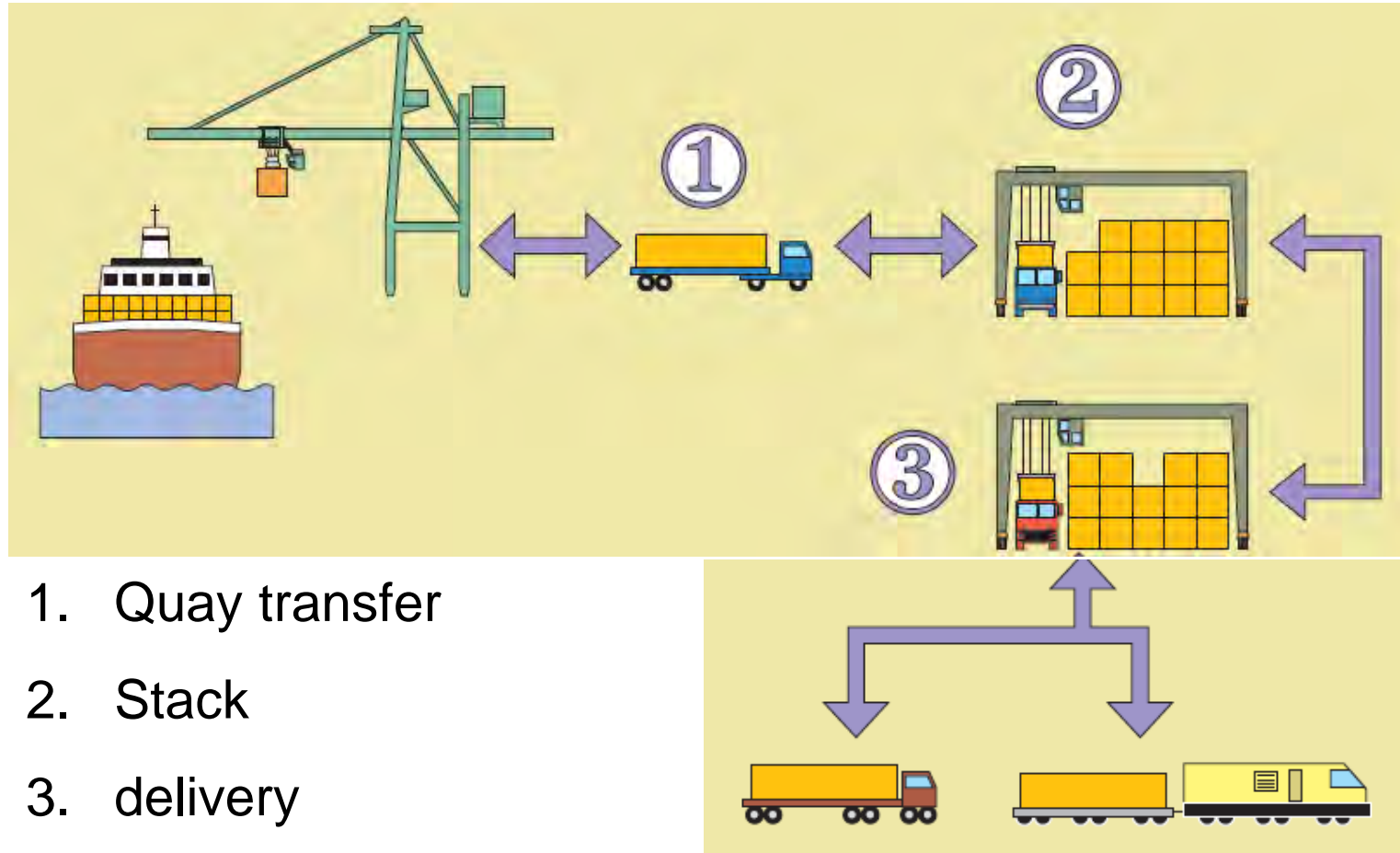
+ Fast

Con's:

- Space required

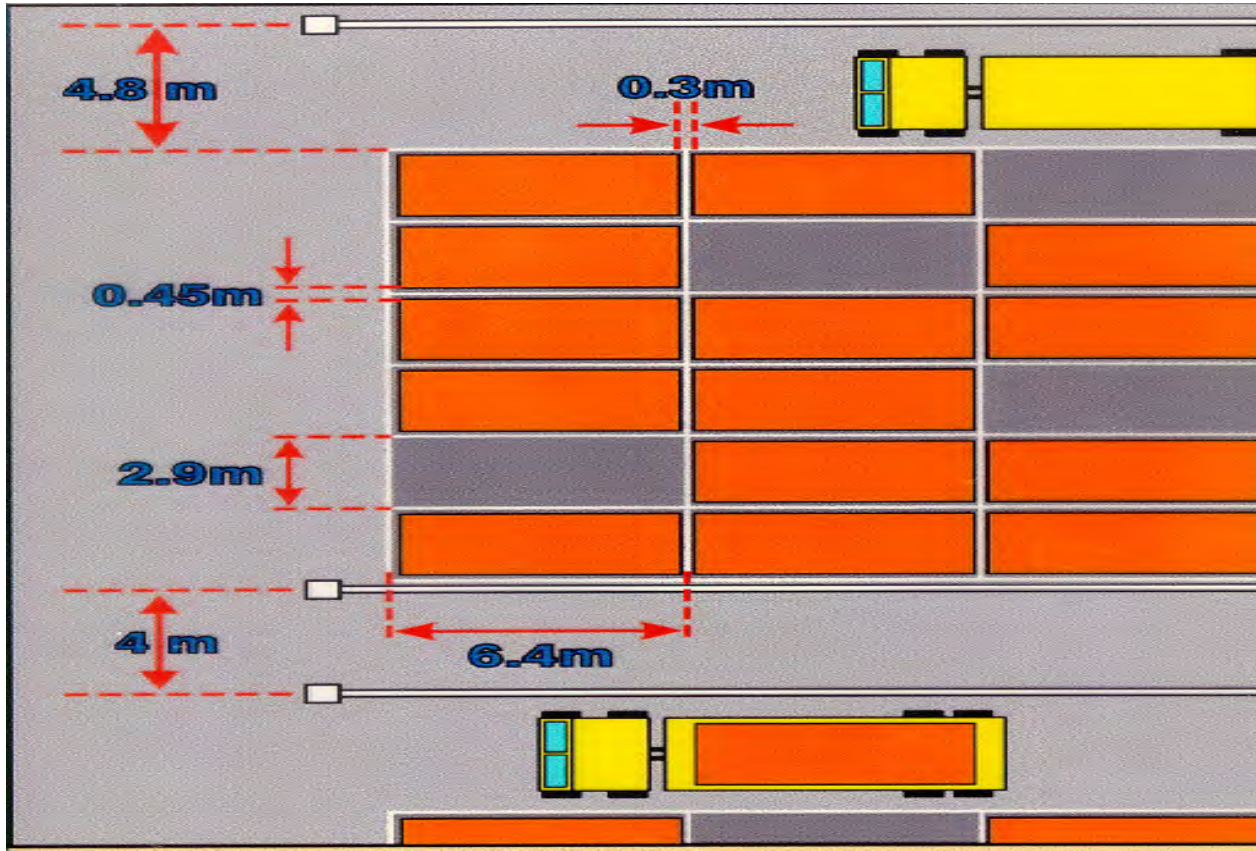
- Maximum 3 high stack

Intro Containerterminal Systems



TT/TC-Yard systems

Intro Containerterminal Systems



Pro's:

- + Dense stack
- + Automation

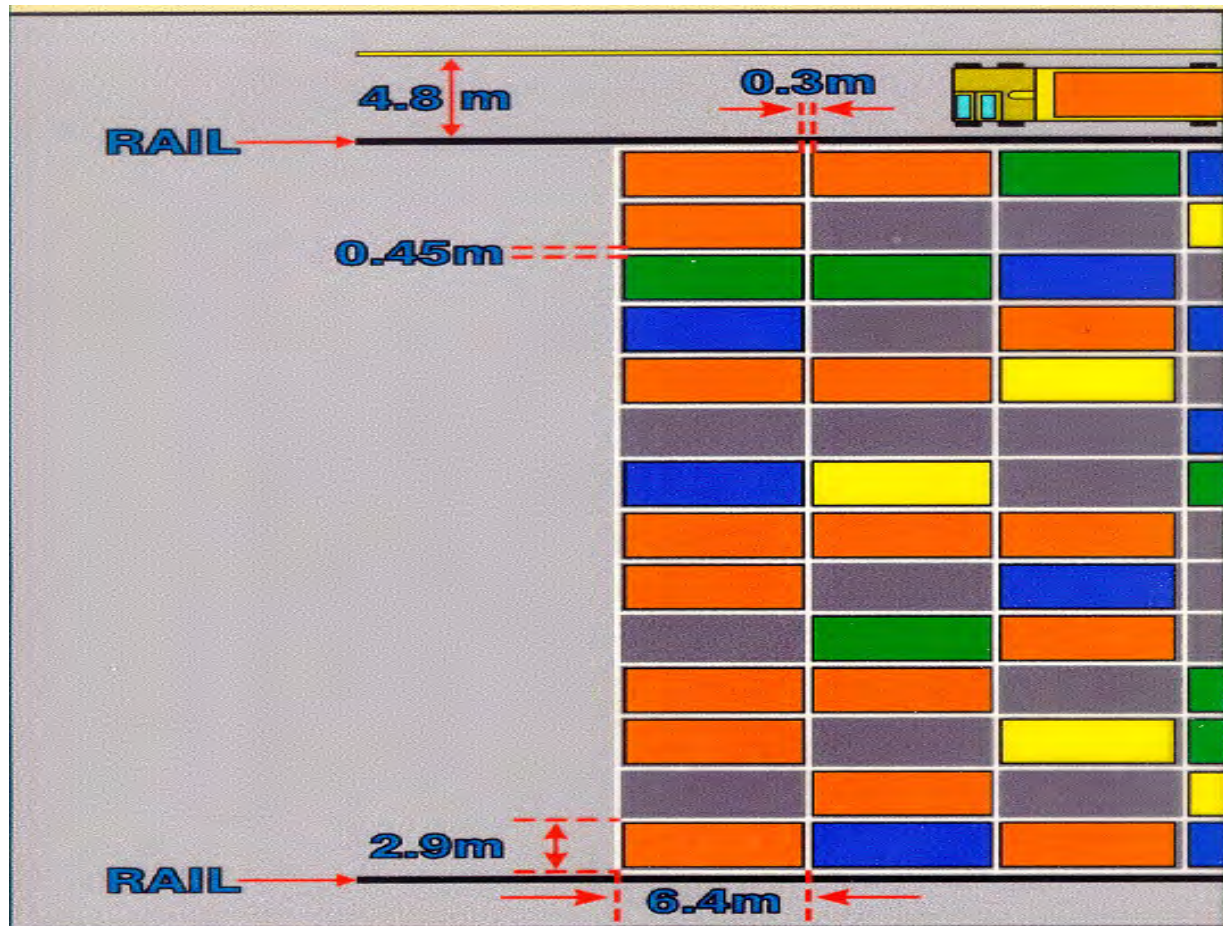
Con's

- Wheel loads
- More \$ required

Intro Containerterminals Systems



Intro Containerterminals Systems



Pro's:

- + Dense stack
- + Automation

Con's:

- Higher cost for infrastructure
- More \$ required

Intro Containerterminals Systems



Intro Containerterminals Systems



Automated Terminals:

- Automated quaytransport
 - Automated Guided Vehicle
 - Shuttle carrier



Intro Containerterminals Systems



Automated Terminals:

- Automated stack
 - RMG



Intro Containerterminals Systems



Automated terminals in:
Virginia (APMT)
Hamburg (CTA)
Rotterdam (ETC and Euromax)

Intro Containerterminals

Capacity

Operating system	Transport quay – stack	Stack	Stack delivery landside *	m ² per TEU
Chassis system	Terminal Truck	On chassis	Road truck	45 m ²
Lift truck system	Fork Lift truck Reach Stacker	Fork Lift truck Reach Stacker	Fork Lift truck Reach Stacker	FLT: 25 m ² RS: 15 m ²
Straddle carrier system	Straddle Carrier	Straddle Carrier	Straddle Carrier	16 m ²
Straddle carrier relay system	Terminal Truck and Chassis	Straddle Carrier	Straddle Carrier	16 m ²
Yard gantry system	Terminal Truck and Chassis	RTG RMG	Road truck	RTG: 12 m ² RMG: 8 m ²
Automated system	AGV or Automated SC	Automated RMG	Automated RMG	8 m ²
* Stack delivery landside	If indicated Road truck, a public road truck will enter the stack area to deliver or receive the container directly from the equipment operating the stack. If indicated otherwise, the public road truck will deliver or receive a container from the mentioned stack operating equipment at a dedicated interchange area.			

Intro Container terminals

Capacity

Relation between TEU and Container

- TEU = Twenty feet Equivalent Unit
- $1 \times 20' = 1 \text{ TEU}$
- $1 \times 45'' = 2.25 \text{ TEU}$
- Ratio = TEU factor
- Containers \times TEU factor = TEU
- TEU factor varies per trade

Intro Container terminals

Capacity

Factors influencing the capacity:

- Resources
 - Space
 - Equipment
 - Staff
- Dwell time
- Peak factor

Intro Container terminals Capacity

Assumptions:

- 350,000 containers per year
- TEU factor 1.4
- Dwell time 8 days
- RTG equipment for the stack
- Maximum yard occupancy is 70%
- Peak factor 1.2
- Stack area is 65% of terminal area

Intro Containerterminals Capacity

- 350,000 containers * 1,4 = 490,000 TEU
- 10,740 TEU in stock per day (dwell time).
- 128,877 m² for RTG system
- 184,110 m² 70% occupancy
- 220,932m² 1,2 peakfactor
- 339,895m² storage area
- 34 hectares.

Introduction Container Terminals

IT

Intro Containerterminals IT

Small terminal:

- Card system



Intro Containerterminals IT



- Large terminal:
- IT system

Intro Containerterminals IT



Typical structure of Terminal systems:

- Central D-base
- Plug-in modules:
 - o Berth planning
 - o Vessel planning
 - o Management
 - o Operating system

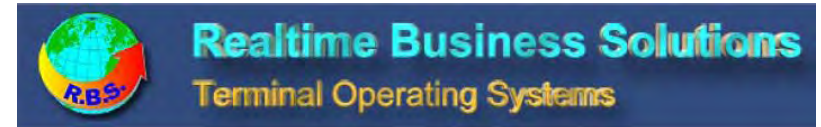
Intro Containerterminals IT

Container terminal
operations without system
support is unthinkable.



Suppliers:

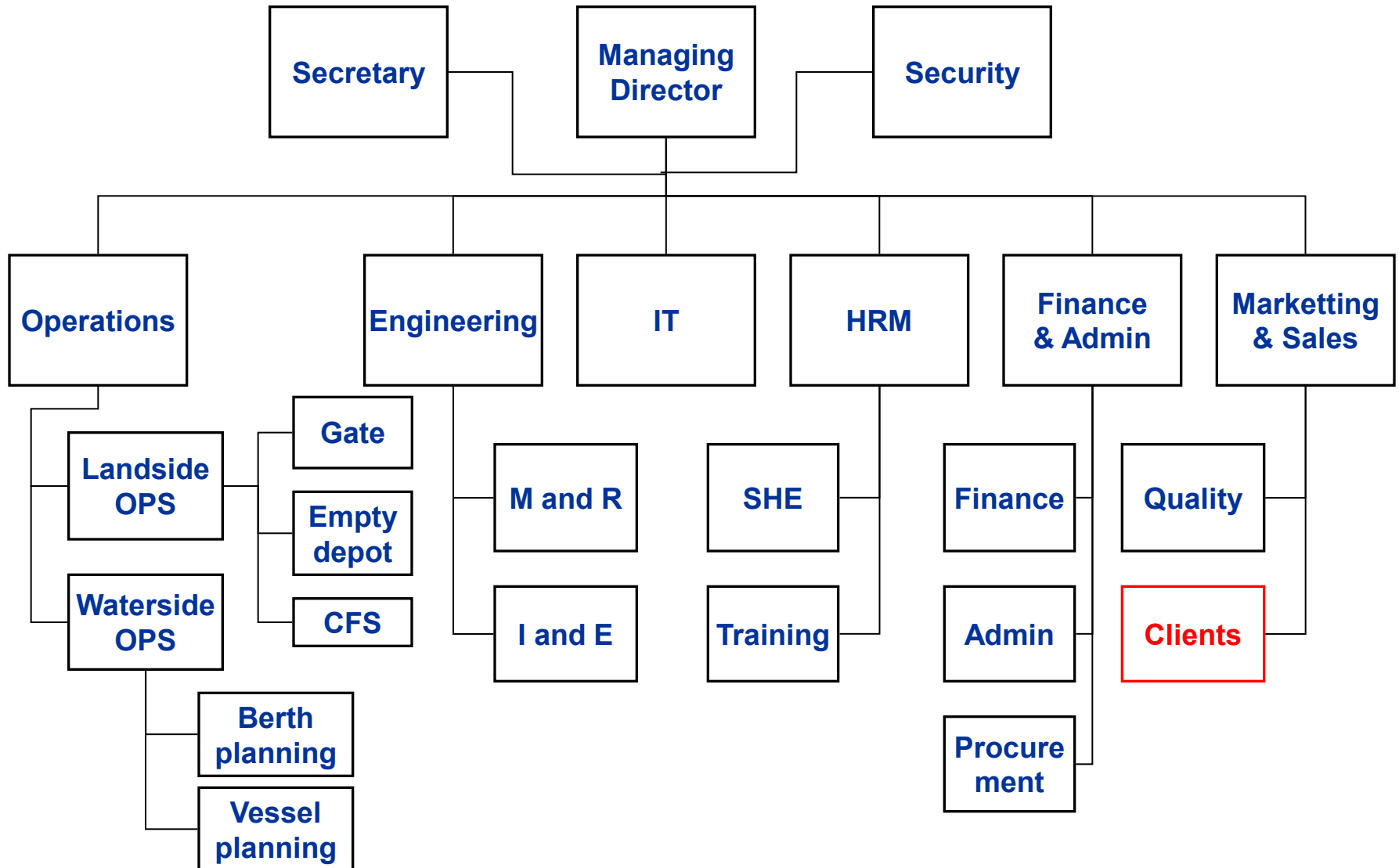
- Tideworks – Mainsail
- TSB – CATOS
- Zebra – NAVIS
- RBS – TOPX
- CMC – MACH



Inhouse development

Introduction Container Terminals Organisation

Intro Containerterminals Organisation



Intro Containerterminals Organisation

Operations department:

- Order process
- Planning process
- CFS management and operations
- Empty depot management and operations

Intro Containerterminals Organisation

Engineering department:

- Maintenance and repair
 - Infra
 - Equipment
 - Sparepart management
- Innovation and engineering
 - Improvement projects
 - Maintenance engineering

Intro Containerterminals Organisation

IT department:

- Software
 - TOS
 - ERP
 - IT Maintenance
 - EDI
- Hardware
- Communications

Intro Containerterminals Organisation

HRM:

- Staffing
- Training
- Assessments
- Trade union liason

Intro Containerterminals Organisation

Finance and Admin:

- Invoicing process
- Accounts
- Banking
- Treasury

Intro Containerterminals Organisation

Marketing and sales:

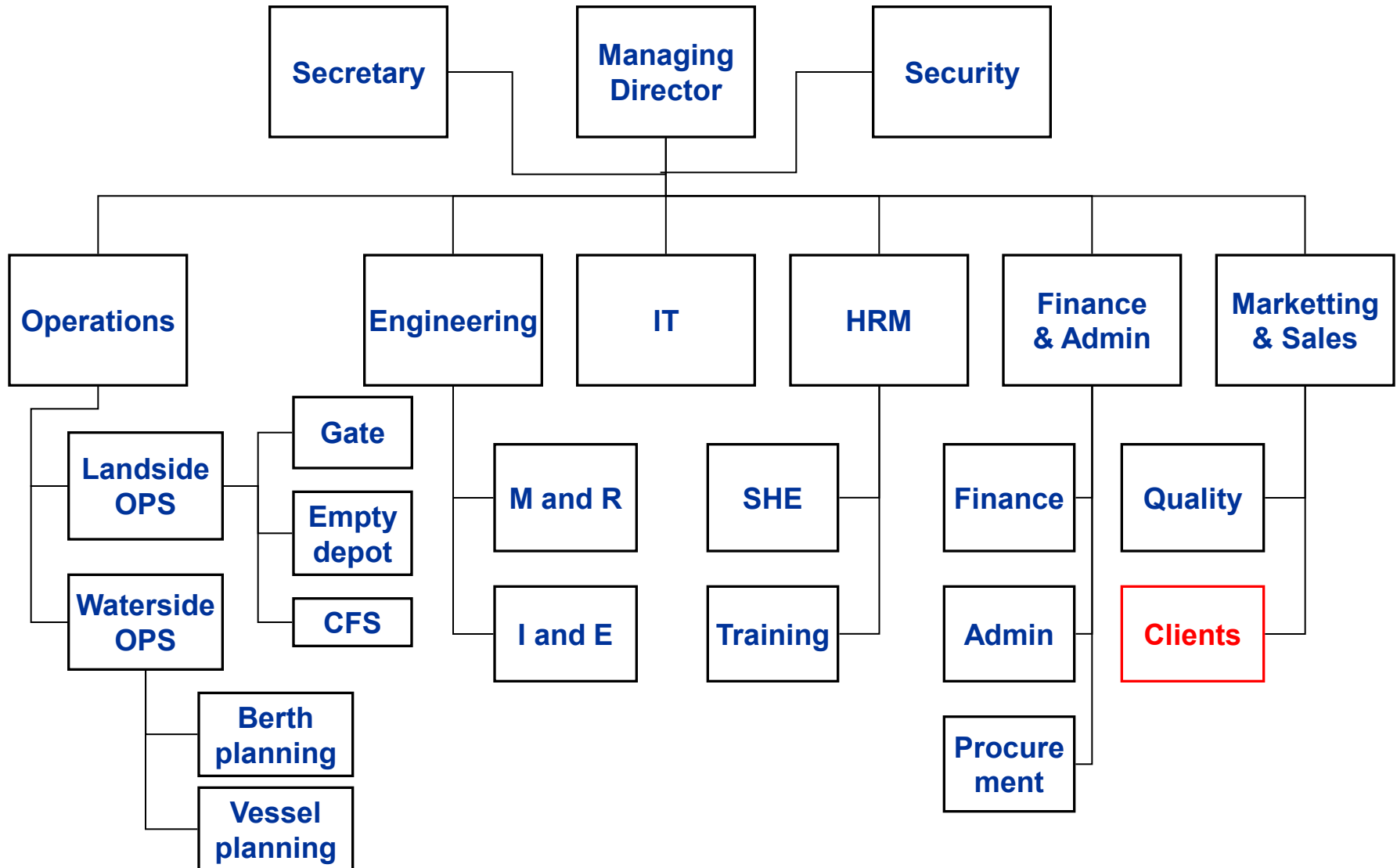
- Customer contact
- Customer contracts
- Quality

Intro Containerterminals Organisation

Security:

- Access control
- ISPS

Intro Containerterminals Organisation



Intro Container terminals

Finance

Cost

	Direct	Indirect
Variable	Lashing labor	Power
Fixed	Crane	Office

Intro Containerterminals Finance

Cost factors (1):

- Labor
 - Operational staff
 - Overhead
- Equipment
 - Investment
 - Interest or depreviation
 - Maintenance
 - Insurance

Intro Containerterminals Finance

Cost factors (2):

- Terminal area
 - Rental
 - Maintenance
- Terminal infrastructure
 - Rental
 - Maintenance
 - Depreciation
- General overhead

Intro Containerterminals Finance

Container handling rate:

- Direct cost per crane team per shift.
 - Equipment cost
 - Labor cost
 - Area cost
- Indirect cost.
 - Overhead
- Profit
- Productivity
- Rate

Intro Containerterminals

Finance

Equipment cost	STS Crane	RTG Crane	T. Truck	T. Chassis
Investment (I) \$	\$ 8.000.000,-	\$ 1.200.000,-	\$ 120.000,-	\$ 18.000,-
Annual direct costs:				
Depreciation yrs	25	12	12	6
Depr. Annual	\$ 320.000,-	\$ 100.000,-	\$ 10.000,-	\$ 3.000,-
Cost of interest 10%	\$ 416.000,-	\$ 65.000,-	\$ 6.000,-	\$ 1050,-
Maintenance %	2,5% * I	2,5% * I	5% * I	10% * I
Maintenance \$	\$ 200.000,-	\$ 30.000,-	\$ 6.000,-	\$ 1.800,-
Insurance %	2% * I	5% * I	5% * I	2% * I
Insurance \$	\$ 160.000,-	\$ 60.000,-	\$ 6.000,-	\$ 360,-
Power/Fuel kWh/lph	50 kWh	20 lph	10 lph	0
Fuel/Power	\$ 80.000,-	\$ 80.000,-	\$ 6.000,-	\$ 0,-
Total Annual costs	\$ 1.176.000,-	\$ 335.000,-	\$ 34.000,-	\$ 6.210,-
Operational hours per year	4000	4000	4000	4000
Costs per hour	\$ 294,00	\$ 83,75	\$ 17,62	\$ 1,55
Required units per gang	1	1	5	5
Cost per gang per hour	\$ 294,00	\$ 83,75	\$ 88,10	\$ 7,76

Intro Containerterminals

Finance

Labor cost	#	Weekly rate	Total \$ per week
Foreman	1	\$ 600,00	\$ 600,00
Crane driver	1	\$ 480,00	\$ 480,00
RTG driver	1	\$ 480,00	\$ 480,00
T Truck driver	5	\$ 400,00	\$ 2.000,00
Checker	2	\$ 400,00	\$ 800,00
Lasher	3	\$ 400,00	\$ 1.200,00
Total per week			\$ 5.560,00
Cost per gang per hour	40		\$ 139,00

Intro Containerterminals

Finance

Area cost	#	\$/m²day	Total \$ per week
Terminal area	340.000 m ²	\$ 0,05	\$ 120.000,00
Cranes	4		
Per crane per week	168 hour		\$ 30.000,00
Cost per crane per hour			\$ 178,60

Intro Containerterminals

Finance

Direct cost	Equipment cost	\$ 473,61	
	Labor cost	\$ 139,00	
	Area cost	\$ 178,60	
Subtotal			\$ 792,21
Indirect cost	Overhead 30%	\$ 221,31	
Per crane per hour			\$ 1012,52
Per crane per shift	8 hours per shift		\$ 8100,18
Productivity gross	Per crane per shift	250	
Lost labor	20%	50	
Productivity nett	Per crane per shift	200	
Handling rate	Per move		\$ 40,50
Profit and risk	20%		\$ 8,10
Handling rate	Per move	(inclusive profit)	\$ 48,60

Intro Container terminals Finance

Other costs to be included:

- Acceptance
- Delivery
- Storage
- Non core activities