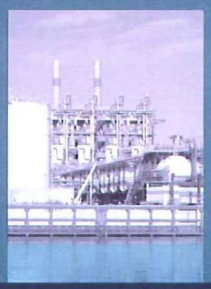
Report

Container terminal of the future

Brainstorm session



Rotterdam, 23 januari 2004

Port of Rotterdam

TU Delft

Brainstorm session on "The container terminal of the future"

23rd of January, 2004

World Port Centre, Rotterdam

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FOREWORD

The Port of Rotterdam and the Delft University are happy to present to you the full report of the brainstorm session on "The Container Terminal of the future", held at the Port of Rotterdam's office, 23rd of January 2004 in Rotterdam, the Netherlands.

This report contains the results of the three parallel thematic sessions on the topics, IT and security, the terminal in a network of inland terminals and the flexible terminal.
Besides the results of the workshop the 6 short state of the art presentations held by several company representatives have been included. The presentations will provide a view on future container handling worldwide.

Both company representatives, the Port of Rotterdam and the Delft University representatives look back on a pleasant and foremost fruitful afternoon and we would like to thank every delegate for their participation and their willingness to join this session.

The authors wish that the reported results of the brainstorm provide inspiration to the readers' innovative minds and will contribute to the realisation of the "Container Terminal of the Future".

Port of Rotterdam
Delft University of Technology

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INTRODUCTION

The project "The container terminal of the future" is part of a jointly set up program by the Port of Rotterdam and the Delft University of Technology aiming for new concepts for container handling in future. One part of that project is a brainstorm session with special representatives of major stakeholders with regard to the handling of containers.

The changing world of container handling

Today's world of container handling is changing faster and faster. Container terminal operators and port authorities are confronted with higher requirements and new developments in container logistics.

Due to the increasing container-vessel capacity and the demand of carriers to restrict the "in port time" to 24 hours, the productivity of the seaside handling should be improved. The state of the art terminal in the year 2020 should further have a higher area utilisation. To this effect the handling of the hinterland modalities also have to be improved.
As well as the higher operational demands, there is an increasing emphasis on sustainability and topics as energy saving, pollution and noise reduction. And last but not least, handling costs should go down.

Figure 1: Container handling in the port of Rotterdam

Apart from the expected growth of containers to be handled, in a world aiming for sustainability, business has to be done in another economical, social, political and technological environment. This is also expected to have its influence on container logistics in seaports and hinterland ports.
The increasing experience with IT and automation applications may lead to further enhancement of automated systems. The sudden emphasis on security after September the 11th put a further incentive to the use of IT. This may create new opportunities for better information-exchange in container transportation.
In the hinterland of the port of Rotterdam a network of inland terminals is developing in relation with the port. In future an information network is believed to be an indispensable link for improved container logistics. In that way a physical and IT network connects the port of Rotterdam and its hinterland. In summary, all these issues together will ask for new concepts.

Aims and objectives of the brainstorm

The aim of the workshop was to focus on concepts and integrated solutions form a vision-oriented view. The challenge is to change our role and image ourselves in the future.

The main objectives of the brainstorm for the Port of Rotterdam are:

- To identify requirements related to drastically improved container logistic concepts;
- To find and define drivers for change;
- To define functional requirements for future seaport facilities and the handling of containers;
- To get a feel on how the terminal of the future may look like.

PRESENTATIONS ON TOMORROW'S CONTAINER HANDLING

Some representatives have given short presentations on popular topics regarding tomorrow's container handling. In this section only summaries are given. The complete presentations are given in annex 2.

The Euromax terminal Rotterdam

by Joost Achterkamp, Euromax Terminal

The prospective Euromax Terminal in Rotterdam is a joint venture between ECT and P&O Nedlloyd. The terminal will be constructed in four phases on Maasvlakte 1 and a small part on Maasvlakte 2. In 2008 the first phase will be operational. Basics for the design of this high tech terminal are high performance for low costs, use of proven technology and flexibility regarding the modal split. The productivity of the terminal will be quite better in comparison with current terminals.
At the Euromax terminal, 12,500 TEU vessels can be handled. The new ship-to-shore cranes will realise a vessel productivity of 150 containers/hour and for a crane gang no more than two men are needed.
Stacking will be done by a new concept. Each stacking lane is equipped with a dedicated land side and water side automated RMG. The choice of terminal transport between the stack and the quay is still open. Automated straddle carriers or AGV's will be used.

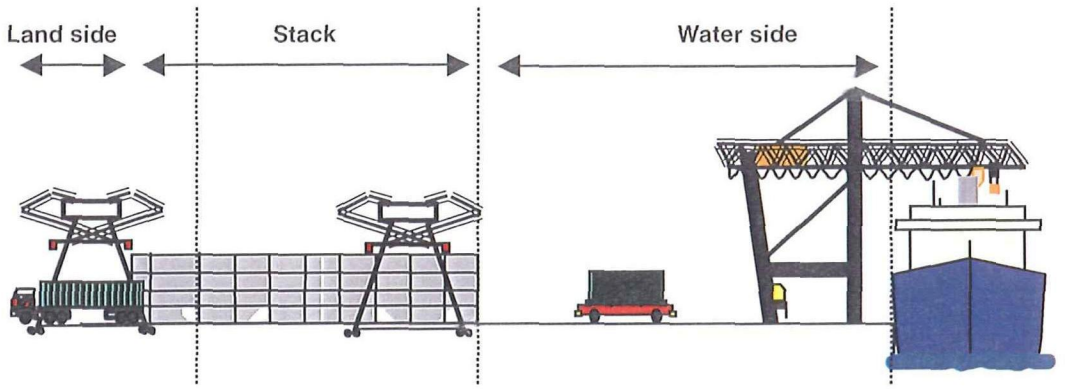

Figure 2: Terminal concept

Regarding the hinterland connections new concepts will also be applied. A dedicated RMG is available for truck handling on the land side. The container may be loaded on the truck by the trucker himself. The total visit of the truck shouldn't exceed half an hour. The expectation is that in future more containers will leave the terminal by barge and rail.
For barge and feeder handling, dedicated barge cranes will be used and for rail handling the terminal is equipped with an on dock rail terminal. The transport between the stack and the rail terminal may be automated in the future (see also annex 2).

Performance of terminal operations

by Kent Busk, APM

The terminal of the future is a cost-efficient system. This doesn't count only for new terminals but also for existing terminals. The future terminal operations may be automated, covering:

1. Advanced operational strategy. (requires advanced IT-systems)
2. Unmanned handling and transport equipment in interaction with advanced IT-systems.

The developments will focus on:

- Cost savings in existing terminals. Implementing more advanced IT-systems in existing RTG/TT- and SC-operations could potentially increase the labour- and equipment efficiency with 10 - 20%.

- Increase volume in existing terminals. Currently we are working on increasing terminal capacity by 15% by advanced operational strategies.

- New terminals. By implementing unmanned high performance equipment and advanced IT-systems, the labour efficiency has a potential saving for 30-40% compared with conventional RTG/TT-operations. (see also annex 2)

Taking current RTG/TT operation as a benchmark for cost and performance efficient terminal operation shows the importance of automation.

Index:	Existing RTG Terminal	Cost Savings in Existing Terminal	More Volume Through puth Same Terminal Area	New terminal Unmanned Operation
Labour Hours per Move	100	90	90	70
Equipment utilisation (moves/year)	100	110	110	-
Stack Capacity (TEU)	100	100	115	140
Required Initial Investments (equipment and paving)	100	100	105	140
Total Cost per Move	100	95	95	80

Table 1: Cost en performance efficient terminal operation

Use of information

by Thomas Koch, Hamburg Port Consulting

At the container terminal information plays a crucial role.
Use of information is required to:

- Maximise land utilisation
- Optimise logistics on the terminal
- Avoid unnecessary moves
- Minimise congestion at the terminal and in the hinterland
- Achieve maximum throughput
- Improve security measures

Information can not only ensure an economic operation of terminals in the future. For the terminal operator it is a necessary precondition to stay competitive and survive so: First, make better use of the available information, and second improve information and data quality.

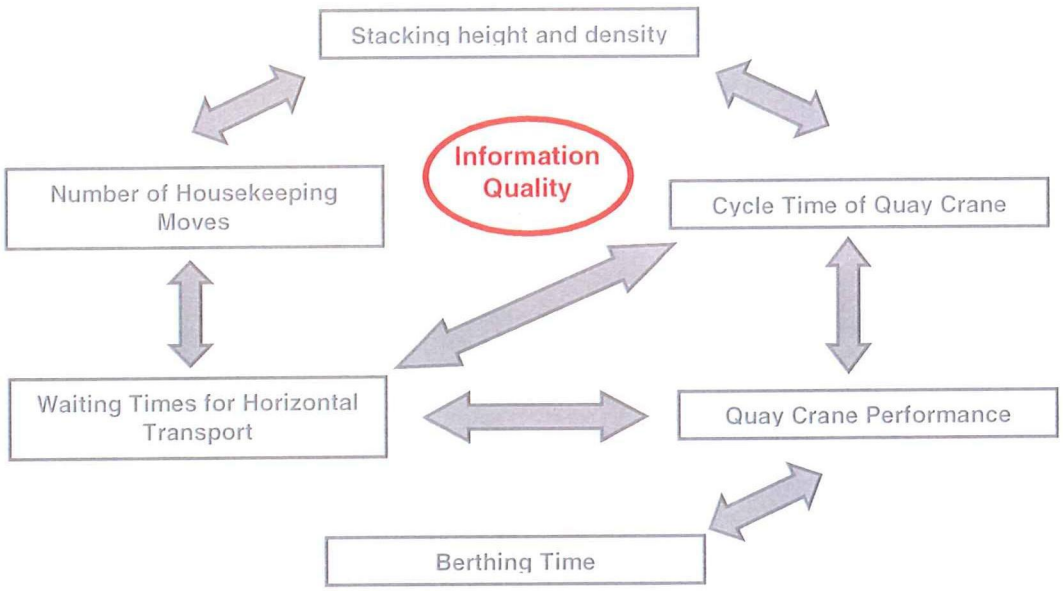

Figure 3: The crucial role of information in terminal operations

At present all terminals in Hamburg suffer from insufficient information, especially on hinterland traffic for import goods coming in from the waterside.
Missing information leads to re-shuffling in the stack because optimal stacking is directly related to information quality. An optimum stacking algorithm makes use of the information on the container's future disposition.
Optimum use of hinterland terminals requires a maximum of information on dwell time and disposition in order to decide which boxes to displace to these facilities.

Changing the container flow from a "push" to a "pull" system can optimise the truck dispatch. One idea is as follows: the line operator, who typically places transport orders to a truck company, instead places it at an Internet market. The transport order comprises a time frame for the transport and a maximum price for which the transport should be carried out. (see also annex 2)

Flexible terminal design

by Erik d' Hondt, MSC Belgium

Operators should remember the following statements

- One has to live with efficiency problems on container terminals;
- The terminal of the future is highly automated, to use as little labour as possible.
- Main criteria for liners to choose a terminal:
  1. Reliability
  2. Productivity
  3. Price

Future developments:

- Stacking height should increase. A straddle carrier is very flexible and has the opportunities for buffering, but is restricted in stacking height;
- Automated or semi-automated systems are necessary due to rising labour costs;
- Be the second who is implementing new technology. Being the first means high risks;
- Rail transport will stay the under-dog in future for Antwerp and Rotterdam;
- The expectations about barge transport is that 40 to 50% will be transported by barge;
- Expected vessel size: 12,000 TEU maybe 10,000 TEU, depending on the development of propulsion technology (two propellers not viable);
- High capacity vessels will only be handled on terminals with a yearly throughput of more than 1,000,000 TEU, because the smaller ones can go bankrupt because of over investments;
- Terminals will dictate the ship size, because there are only a few places in the world which have sufficient area available and enough water depth. This causes a power-change from the liners to the terminal operators.

Discussion

Should a vessel in future be handled within 24 or 48 hours and how will that be possible with the handling speeds of the Euromax and Altenwerder terminals?

- The development of the "In port Time" is uncertain: Liners will not tell us their changing strategy and maybe the handling time will lie between 24 and 48 hours
- Depending on he stowage plan handling speed on the Euromax terminal using 5 to 6 cranes will be 150 m/v/h;
- Altenwerder will handle high-capacity vessels with 100 m/v/h.
- The costs have to decrease while productivity has to increase.

Asian terminals in comparison with European

by Frank Kho, Hutchison Port Holding

- Automation does not always mean a higher performance;
- Define the customer needs;
- Liner and terminal operator have to adjust to each other;
- Most important is to develop a terminal witch is satisfying for the liner;
- Turbo Mode: offering a quick service for a limited time in case of a motor breakdown of the vessel or bad wetter conditions;
- Arrival outside the time window should be possible;
- Last minute service: late arrival and speed planning.

⇨ The terminal of the future doesn't exist out means but will anticipate on exceptional cases. (see also annex 2)

R&D by Delft University of Technology

by Joan Rijsenbrij and Han Ligteringen, Delft University of Technology

Over the last years several research studies were carried out:

- In the FAMAS research project concepts were developed for high capacity container handling. Terminals were developed with a high productivity, but costs were also rising.
- The idea of a big multi-user terminal is overgrown because of the fast increasing vessel size.

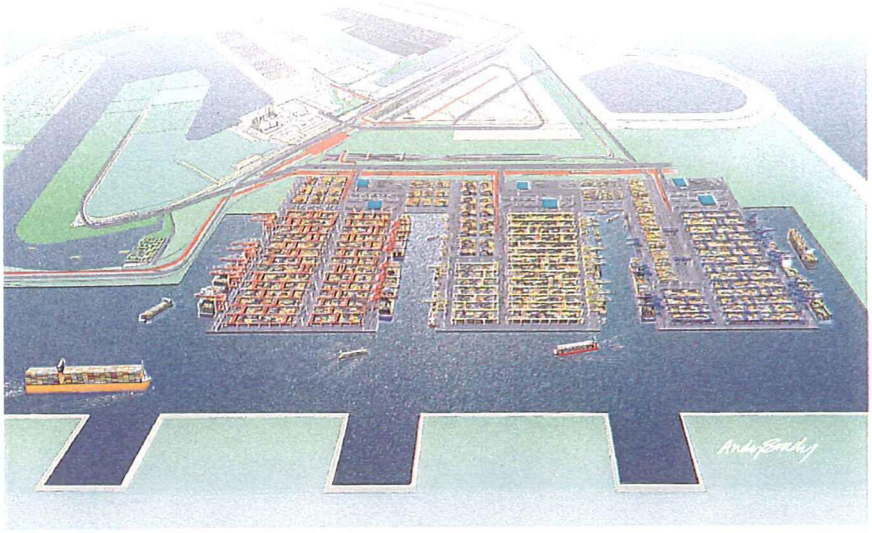

Figure 4: A possible layout for Maasvlakte 2

Innovative projects researched by the faculty of Civil Engineering of Delft University of Technology:

- Container warehouses: the cost efficiency needs further research.
- Underground storage of reefers: energetic advantage limited.
- Inland terminals.
- Floating Port concept (PhD-project).
- Flexibility in quay-walls.

Figure 5: Underground storage of reefers

THE BRAINSTORM SESSIONS

The brainstorm took place in three smaller groups. All of the groups discussed a different topic:

- IT and security in container logistics and their impact on container terminals
- The deepsea terminal in a network of inland terminals
- The flexible container terminal

IT and security in container logistics and their impact on container terminals

Developments in IT and security will have their impact on the terminal. In this brainstorm a vision on the situation of IT and security in 2020 was asked.
Key question: how does the deepsea terminal look like taking into account the developments in IT and security.

Participants of this workshop
Mr. Joan Rijsenbrij *(chairman)*
Mr. Jan van Klinken *(reporter)*
Mr. Frank Kho
Mr. Thomas Koch
Mr. Joop Smits

➔ *Developments in IT and security*

Continuing increase of IT power

- self learning and self planning systems;
- real-time calculation in terminal operation e.g. AGV's at CTA (Hamburg);
- dynamic algorithm and forecasting e.g. calculating different scenarios for decision support;
- internet/wireless technology e.g. UMTS, mobile phones.

New trading/matching e-communities

- pick-up and delivery concepts for truck dispatch;
- empty box equipment;
- status/request information.

Security

- is a driver for change
- on-time & accurate information;
- 'tracking & tracing' of containers with tags (reality in the next 10 to 20 years)
- on the short term more inspections

Global container information system

- Integration next/previous port;
- Reality of a global container information system:

- Based on the experience in aviation with global booking systems, the reality of global container systems will be soon realised.
- The reliability of a global container system will be no problem in future (e.g. electronic banking).

➔ *The impact of IT and security on the terminal logistics and design*

Security technology is an enabler for (terminal) logistic improvements. For the terminal logistics and design this means:

- Security technology creates flexibility in physical process and lay-out (X-ray, inspection);
- Better security means less people;
- Integration of tags on containers in terminal systems (e.g. positioning);
- Integration of customs systems in terminal operating systems;
- 'Virtual road concepts' with electronic seals and "tracking and tracing" of containers. The inspection by the customs can be done everywhere.
- Higher stacking without extra reshuffling;
- Direct transfer of containers will be possible.

Discussion topics

Collaborations of parties in the logistic chain

- Reducing parties involved:
- Rotterdam: Truckers are often small companies;
- Hamburg: smaller trucking companies without EDI (e.g. Poland truckers);
- Hong Kong: everybody uses his mobile phone to make an appointment with the terminal;
- Giving incentives only will not work, giving penalties and refusing parties will produce the desired result.

Possible problem can be the delay of ships. What if a suspicious container is loaded at the bottom of a 10.000 TEU vessel and the customs want to inspect that container?

The deepsea terminal in a network of inland terminals

The idea of this concept is that a part of the container volume will be transported by barges or shuttles to inland terminals, were further handling will take place.
Key question: how does the deepsea terminal look like if we make optimal use of the inland terminals?

Participants of this workshop

Mr. Maurits van Schuylenbrug *(chairman)*
Mrs. Anneke van de Hulsbeek *(reporter)*
Mr. Joost Achterkamp
Mr. Jan van Beemen
Mr. Erik d' Hondt
Mr. Wilfred Molenaar

➔ *Important topics for the network terminal*

- Direct delivering of empty containers to the market via inland terminals;
- Using Rotterdam's best modality, barge or shuttle, for transport to the inland terminals;
- Reducing dwell time and the stack area on the deepsea terminal;
- Reliability will be more important

➔ *Interesting ideas for a deepsea terminal in a network*

- "Turntable terminal". The container goes directly through the inspection scan and afterwards the container goes automatically to the right dispatching point.
- "Floating crane" for direct deepsea transfer to barges. Advantages:
  - Applicable for all ship sizes
  - No containers over the quay
  - Very flexible

  A sketch of this concept can be found in annex 3.
- Network terminals in the old port e.g. ECT delta terminal versus ECT home more inland. Other terminal operators can help with loading a super vessel with their floating crane for extra handling capacity.
- Containers are transferred from deepsea vessels on one side to push-barges on the other side. A small part of the containers can be handled on land. (e.g. containers with incomplete forms)

➔ *Flexibility of a network*

Is a network of terminals flexible?

- During the transport process there are little possibilities to change the destination or modality.
- The quality of information is an important issue for the network, but fully information is not necessary.
- Decreasing the dwell time of containers at the deepsea terminal. Slow movers can stay at low-cost area's

➔ *Costs aspects*

The terminal as element in the hinterland network is a link in the supply chain. For a right comparison of the profits of these concepts the whole chain must be taken into account. Which part of the concept and which stakeholders will deliver the profits compensating the extra handling costs?

- In case of direct transfer an extra handling is eliminated.
- Use of cheaper area's (e.g. old terminals) compensates the extra handling costs.
- Create the need that the merchants collaborate and deliver extra information (e.g. incentives by prices or reliability)

Costs saving	Extra costs
direct transfer higher area utilisation less stacking area more transport by barges moving stock, lower stock-costs empty combined with distribution Reliability	extra handling extra information-systems Investments in inland terminals

Table 2: Costs aspects for a network terminal

➔ *Terminal design*

If we make use of the inland terminals, the deepsea terminal looks as follows:

- smaller gate area
- extra barge facilities
- floating cranes for extra peak capacity
- lean and mean stack
- "turntable function"

The flexible container-terminal

The flexible terminal should offer a solution to prevent the terminal from becoming obsolete before its depreciation.
Key question: how does the deepsea terminal look like in its lifecycle if we make optimal use of flexible solutions.

Participants of this workshop

Mr. Han Ligteringen *(chairman)*
Mr. Christian Paus *(reporter)*
Mr. Cees Buijs
Mr. Kent Busk
Mr. Anko Nagel
Mr. Ben Jaap Pielage
Mr. Johan Uggla

➔ *First round of ideas*

Return on investments

- Reduce investments;
- Lower initial costs or the same initial costs with a higher productivity;
- Reduce the risks on investments: minimum capital in pavement and infrastructure because you can't move them in case of lower throughput volumes;
- Reduce the depreciation time: "Disposable equipment";
- Return on investment should be guaranteed.

More flexibility in design

- Infrastructure and quay-walls should be flexible for all kind of ships;
- Flexibility on infrastructure like rail is impossible because it's difficult to remove;
- Standards for equipment, so the second hand value will be improved;
- When volume goes up, you need new strategies and implementation of these new technologies should be possible in the existing terminal;
- More flexible equipment: equipment which can easily be automated;
- Alliances comprising of port authority, liner and terminal operator will develop new technologies;
- Modular systems for lay-out, equipment and quay-walls;
- Floating quay: flexible and can be used on more terminals and in other ports when necessary. (see also annex 4)

➔ *Combinations and structuring of the ideas*

Short payback time

- Create a lower return on investment: decrease fixed costs and labour-costs;
- Shorten the payback time of your terminal: a straddle carrier for example has a short payback time;
- Lower initial costs.

Flexibility

- Short payback time for suprastructure. Port authority 's investments should keep their value for a long time in case of moving customers.
- It doesn't matter if you will build the quay wall for a short time or a long time: the initial costs are mainly depending on the water depth.
- Use different tactics for suprastructure and sub-structure: the last is difficult to sell or remove.
- Synchronise the payback time for equipment and the quay-wall, but it will be far too expensive.

Sub conclusions

- Synchronise payback time of infrastructure and equipment;
- Multifunctional long term investments.

➔ *Further elaboration on flexibility*

Operational flexibility

- High operational flexibility: it should be possible for the terminal operator to move equipment from one terminal to the other when necessary;
- People matter (Fun Port);
- Well-fare is an important design factor.

Capacity flexibility: (time range ~ 1 yr.)

- Standards in equipment.(on the long term this can be contra-productive while changing design is impossible)

➔ *Impact of flexibility on terminal design*

- Development of a terminal lay-out which can be used for all kind of terminals, in case of a moving customer;
- Try to think a step further: offices and buildings not on future stacking sites
- Floating cranes to increase the handling capacity;
- Modular systems to upgrade the terminal easily;
- More standards in equipment to improve the second hand market.

➔ *Overall conclusions*

- The Port Authority needs multifunctional long-term investments.
- The terminal operator should invest as little as possible.

SUMMARY, DISCUSSION AND CONCLUSION

Summary of the workshops

In this summary the workshops on IT & security, a network of inland terminals and flexibility will be brought together to one concept of a future terminal.
The increasing availability of information causes perspectives for future container handling concepts. The prediction is that in 10 to 20 years every container will be provided with a tag, to allow tracking and tracing and thus a global container information system will be reality. This means better information and so a more efficient container handling at the terminal. A better area utilisation is an example of more efficient container handling. Another opportunity, which could make partly use of direct transfer, is the deepsea port in a network of inland terminals.
The idea of this concept is that a part of the container volume will be transported by barges or shuttles to inland terminals or old port areas, were further handling will take place. This concept causes an extra handling and investments for the inland terminals. Advantages of this concept are a decreasing dwell-time, less stacking area, more transport by barges and shuttles and a higher reliability.
To anticipate on prospective developments both for terminal equipment and sub-structure, flexible solutions are preferable. One may think on more standardisation of equipment to improve the second hand market. Further developments could be modular systems or floating crane concepts.
The future container terminal will exist of a combination of all these developments. One can think on a terminal, which functions in a network of inland terminals. The pay back time of the terminal will be as short as possible and the pay back time needs a flexible grid to vary easily in size.
In case of ultra large container vessels capacity will be increased by use of a floating crane. Because of using a lot of barge transport, the number of truck gates will decrease and barge-handling facilities should be improved. Truck handling can be improved by using the "turntable function" which means that the terminal operator co-ordinates the truck transports. Inspections will be integrated in the container handling process.

Final discussion

- The starting point for designing the "Container terminal of the future" is a business case that investigates the feasibility of the results of the workshop for new terminal design. Organising a business case is difficult because nobody gets in detail.
- Discussions with stakeholders and a good business case will contribute to the success of a terminal
- Terminals will grow out of capacity in too short time. There is a need for new rules of thumb and a new set-up of requirements to design new terminals.

Conclusion

- All the ideas and remarks need further investigation
- From discussions the need became clear for a platform for pre-competitive knowledge exchange for companies involved in container handling.

ANNEX 1 DELEGATE LIST AND PROGRAMME

Delegate list

Name	Company
Mr. Joost Achterkamp	Euromax terminal
Mr. Jan van Beemen	Royal Haskoning
Mr. Cees Buijs (Chairman)	Public Works of the Municipality of Rotterdam
Mr. Kent Busk	APM
Mr. Johan Uggla	APM
Mr. Erik d' Hondt	MSC Belgium
Mr. Frank Kho	Hutchison Port Holdings
Mr. Thomas Koch	HPC
Mr. Han Ligteringen	Delft University of Technology
Mr. Wilfred Molenaar	Delft University of Technology
Mr. Anko Nagel	Legana
Mr. Ben Jaap Pielage	Delft University of Technology
Mr. Joan Rijsenbrij	Delft University of Technology
Mr. Maurits van Schuylenburg	Port of Rotterdam
Mr. Joop Smits	Port of Rotterdam

Programme

12.00u	Lunch
12.30u	Opening by Port of Rotterdam
12.35u	Aims and objectives of the brainstorm by Mr. Buijs
12.45u	Introduction of delegates
13.00u	Short presentations on: - hinterland connections - ship to shore operations - use of information - flexible terminal design - comparison with Asian terminals - R&D by Delft University of Technology
14.10u	Introduction to the brainstorm
14.30u	Start brainstorm
15.30u	Reflection on brainstorm
16.30u	Group discussion
17.00u	Finish with a drink

ANNEX 2 FULL PRESENTATIONS

Presentation "The Euromax terminal in Rotterdam"

Presentation "Performance of terminal operations"

Presentation "Use of information"

Presentation "Asian terminal in comparison with European"

Euromax Terminal Rotterdam

Presentation

Brainstorm "container terminal of the future"

23 January 2004

Contents

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- Location
- Phasing
- Design assumptions
- Hinterland connections
- Operational concept
- Barge/Feeder
- Rail
- Truck

Euromax Terminal Shareholders

50:50 joint venture

P&O Nedlloyd

Leading container line operator
US$ 4.6 billion turnover
Control terminals in key ports

ect

Hutchison Port Holdings
Leading container terminal operator
US$ 2 billion turnover

Port of Rotterdam

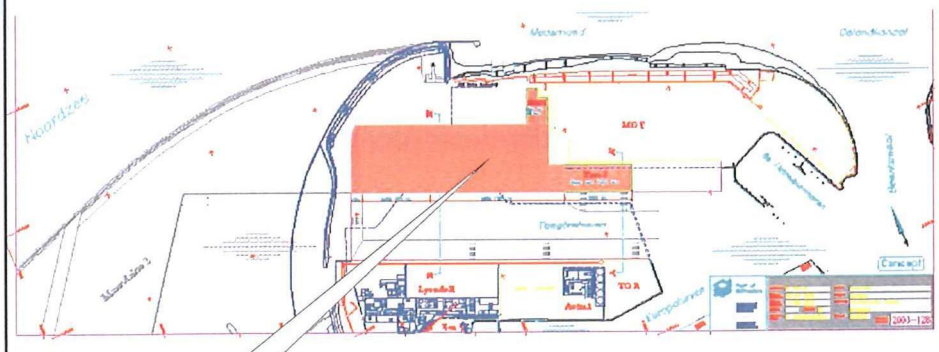
Euromax Terminal Customers

	2002 volumes
P&O Nedlloyd	250.000
Grand Alliance partners (Hapag Lloyd, OOCL, NYK, MISC)	480.000
Total	730.000 ds moves
Expected growth	6 % per year
Expected volume 2009	1.100.000 ds moves

Rotterdam Location (1)

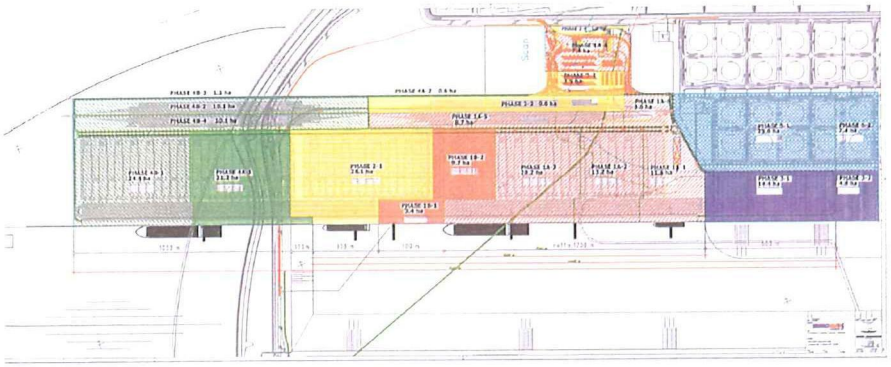
EUROMAXX TERMINAL

Rotterdam Location (2)



EUROMAXX TERMINAL

Euromax Phasing (1)



Euromax Phasing (2)

Phasing	Start	1	1+2	1+2+3
	Mv1	Mv1	Mv1	Mv1
Operation				
DeepSea Berths	1	3	4	5
FeederBarge Berth	1	3	4	5
Start operation	2008	2009	2011	??
Capacity (milj DS boxes)	0.4	1.3	1.8	2.0
Equipment				
Quay cranes	5	12	14	16
Barge / feeder cranes	1	4	5	6
Stacking cranes (RMG-10)	20	58	92	102
Rail cranes	1	2	4	4
Infrastructure				
Quay rail & pavement (m)	600	1500	1800	2400
Area (ha)	*32*	78	118	132
Stack lanes (#)	10	29	46	51
Reefer plugs (#)	708	1.888	2.832	3.186
Rail tracks (750 m)	6	6	12	12

Euromax design (1)

Deep Sea Vessels	7.500 TEU	10.000 TEU	12.500 TEU
Length overall in m.	320	375	382
Breadth overall in m.	42,8	48,4	57
Breadth in containers	17	19	23
Normal draught in m.	14,5	15,5	17
Overall height*	46,1	48,6	51,5

* From keel to top of highest container

Stacking	
Dwell time	4,5 days
TEU – ratio	1,60
Yard density	70%
Workable yard density	85%
Peak factor	1,25

Modal split	2003	2010	2020
Sea to sea as % of Deep-sea			
DS-Relay	6,70%	6,70%	6,70%
DS-Feeder*	13,30%	13,30%	13,30%
Total sea to sea	20%	20%	20%
Waterside vs Landside			
Total Landside as % of DS	80%	80%	80%
Modal split as % of LS:			
Barge	43%	40%	40%
Road	45%	40%	30%
Rail	12%	20%	30%

Euromax design (2)

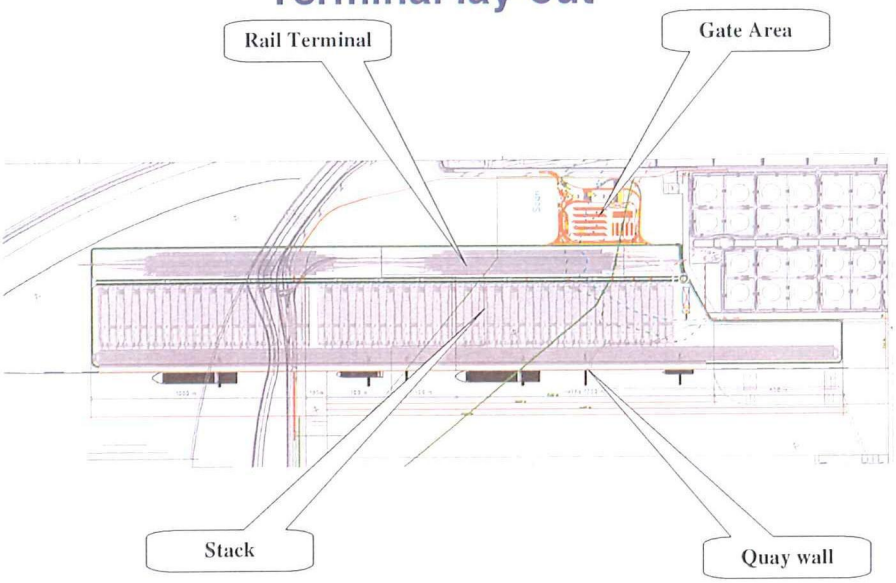
Basic design assumptions:

- High performance
- Low Cost
- Proven technology
- Flexible regarding modal split

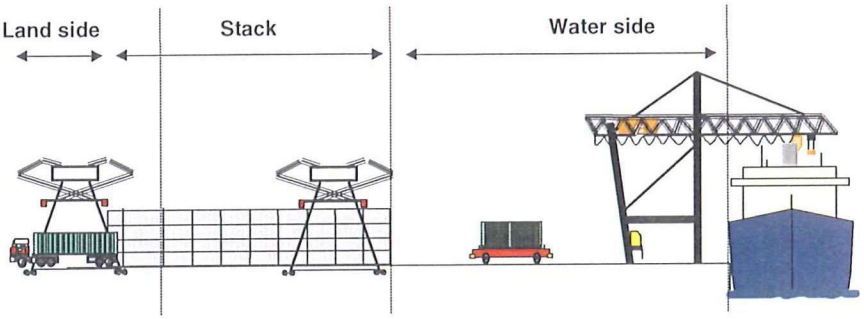
Key performance indicators:

KPI	2008		2015
DSF TEU/ m quay/ year	1350		1850
DSF TEU/ ha/ year	17.500		30.000
Moves / QC / year	110.000		140.000
Berth productivity / hour	100		150
QC productivity / hour	25		35

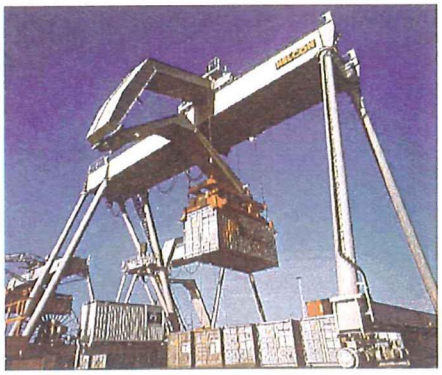
Terminal lay-out



Terminal concept



Stack



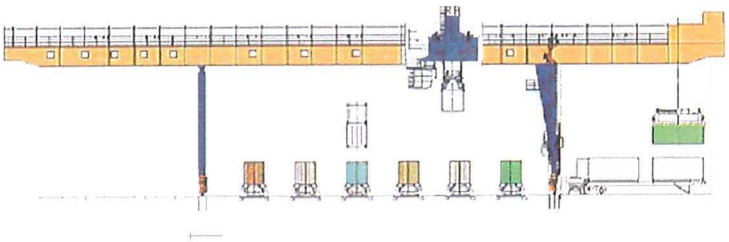
Rail mounted gantries
(automated)

Characteristics
•10 wide
•1 over 4 high
•2 on 1 rail track
•Semi-automated on LS

Barge/Feeders

- Barges and feeders handled at same quay as deep sea vessels
- Dedicated barge/feeder cranes with limited height at the outer sides of the quay to optimize productivity
- Crane gang exists of only 2 persons
- Close connection possible with deep sea vessels
- If Maasvlakte 2 is not ready in time the barge/feeder volume will move to a dedicated quay of 600 m

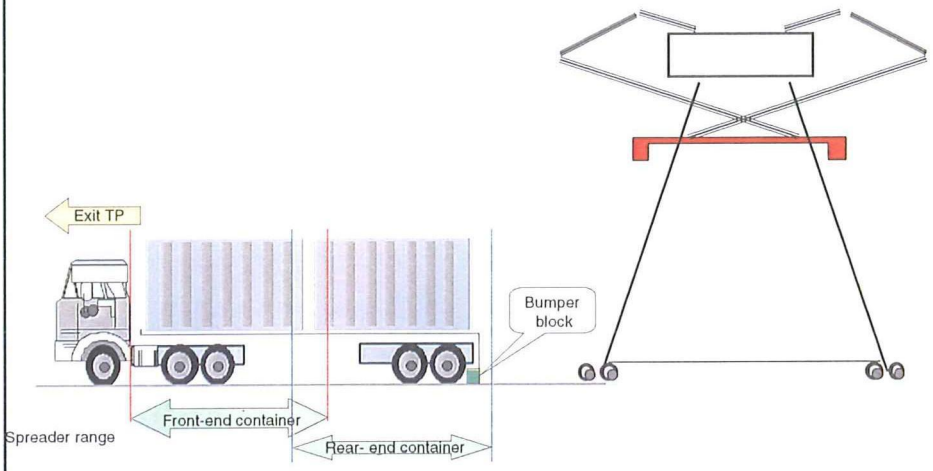
Rail terminal



Rail terminal

- On dock rail terminal with double track connection
- Expected growth in rail volume from 15 to 30 % of the landside volume due to “Betuwelijn” effect
- Phase 2 with second rail bundle at Maasvlakte 1
- Further growth possible at MV2 with 3rd an 4th bundle
- Transport rail-stack with manned TT
- Possibility of automated rail-stack transport is kept open in future with AGV’s coming from waterside

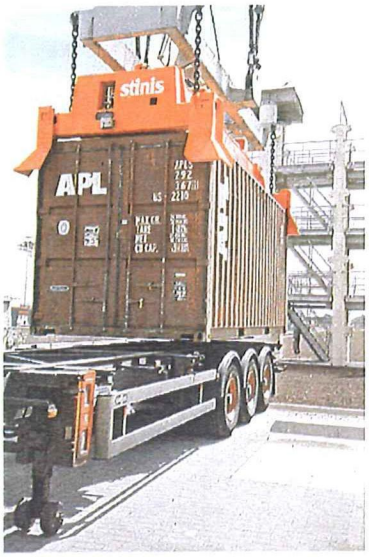
Stack landside



Truck handling

- One stop gate if truck is pre-announced.
- One direction gate for in/out coming trucks.
- Terminal visit time < 30 min.
- Direct handling with ASC's.
- Fast handling with dedicated landside ASC.
- Self handling by truck driver (if authorized).
- Expected decrease in % truck due to shift to rail volume.

Stack landside



What is "Future Terminal Operations"?

Automation is the future Terminal Operations:

- Advanced operational strategy (requires advanced IT-systems).

2) Unmanned handling and transportations equipment in interplay with advanced IT-systems.

Cost savings in existing terminals

Implementing more advanced IT-systems in existing RTG/TT- and SC-operations, could potentially increase the labour and equipment efficiency with 10 - 20%.

Increase volume in existing terminals

Currently we are working on increasing the terminal capacity by 15% by advanced operational strategies.

New Terminals

By implementing unmanned high performance equipment and advanced IT-systems, the labour efficiency has a potential for 30-40% with compared with conventional RTG/TT-operations.

Why Automate Terminal Operation?

Taking current RTG/TT operation as benchmark for a cost and performance efficient terminal operation:

Index:	Existing RTG Terminal	Cost Savings in Existing Terminal	More Volume Through the Same Terminal Area	New terminal Unmanned Operation
Labour Hours per Move	100	90	90	70
Equipment utilisation (moves/year)	100	110	110	-
Stack Capacity (TEU)	100	100	115	140
Required Initial Investments (equipment and paving)	100	100	105	140
Total Cost per Move	100	95	95	80

Automated Terminals

Terminals	landside Loading Container to Trucks from Automated Yard	Yard Storage Equipment	Waterside Loading Container to Vehicles from Automated Yard	Waterside Transportation Vehicle
WAN-HAI	Operator in Crane	AUTOMATED RMGS	Operator in Crane	MANNED
HIT	Operator in Crane	AUTOMATED RMGs	Operator in Crane	MANNED
Pasir Panjang	Remote Operator in Building	AUTOMATED RMGs And AUTOMATED OBCs	Remote Operator in Building	MANNED
THAMESPORT	Remote Operator standing at pedestal Outside	AUTOMATED RMGS	Remote Operation by Tractor Driver	MANNED
ECT	By Manned SC	AUTOMATED RMGS	AUTOMATED	AUTOMATED AGVS
CTA	Remote Operator in Building	AUTOMATED RMGS	AUTOMATED	AUTOMATED AGVs

APM TERMINALS
www.apmterminals.com

Semi Automated Terminal

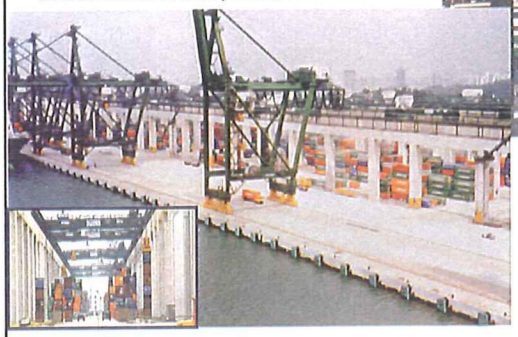
Thames Port
Manned Trucks and automated RMGs with automatic crane and trolley movements

Wan-Hai Line, Tokyo
Manned Trucks and automated cantilever RMGs with automated crane and trolley movements

APM TERMINALS
www.apmterminals.com

Semi Automated Terminal

PSA
Manned Trucks and automated Over Head Bridge Cranes
with automated crane and trolley movements

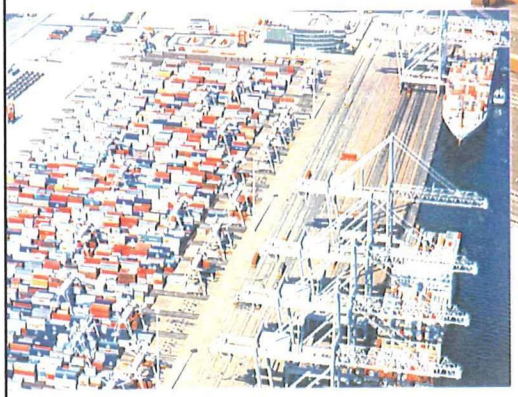


HIT (terminal 6&7), Hong Kong
Manned Trucks and automated cantilever RMGs
with automated crane and trolley movements

APM TERMINALS
www.apmterminals.com

Fully Automated Terminal

ECT
AGVs and unmanned RMGs



CTA
AGVs and unmanned RMGs

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Hamburg Port Consulting GmbH

Brainstorming Session "The Container Terminal of the Future"

Dr. Thomas Koch
23.01.2004

Development Tendencies

- The growing figures of international container handling call for new terminal structures in the future:
  - Double-digit growth rates in international traffic drive ship sizes towards an expected maximum of up to 12.500 TEU capacity.
  - Consequently, ships tend to call at fewer hub ports in future, expecting maximum performance and highest service speed.
  - This may lead to new developments in the field of handling equipment in order to maximize productivity and to minimize berthing times. Container handling on the terminal as well as in the hinterland will have to cope with this growing handling speed, avoiding congestion to the best possible extent.
  - Terminal design and definition of operating procedures have to follow these developments.

The role of Information

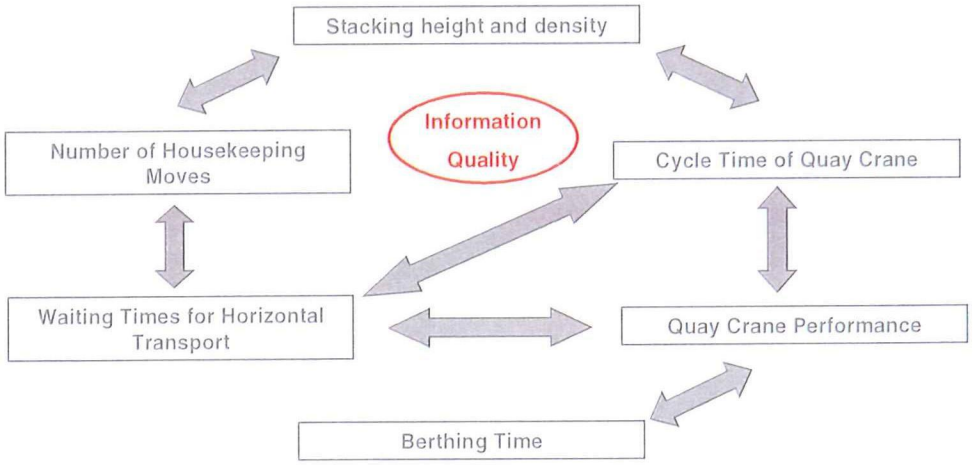
- Information on the container is the crucial issue in order to
  - Maximize land utilisation
  - Optimize logistics on the terminal
  - Avoid unnecessary moves
  - Minimize congestion at the terminal and in the hinterland
  - Achieve maximum throughput
  - Improve security measures

In brief:

Information not only can ensure an economic operation of terminals in the future.
For the terminal operator it is a necessary precondition to stay competitive and survive, so:

First, make better use of the available information !
Second, improve information and data quality !

Information Quality – The crucial Issue



The present Situation – Example: Hamburg

- At present, all terminals in Hamburg suffer from insufficient information especially on hinterland traffic for import goods coming in from waterside:

  At the time of stacking it is not clear whether how and when a box will be picked up by truck or rail. Trucks just show up without any appointment, rail is advised about 1 hour in advance.

  Advanced dispatch of boxes, optimization of stacking boxes, fast service for trucks and/or rail thus often is hindered – re-shuffling of boxes occurs with waiting times resulting.

  As there are no possibilities to control truck arrival, congestions at peak hours occur most frequently.

  Terminals are forced to grant maximum flexibility in order to cope with the unknown – that means high cost for staff and equipment.

How can "total information" influence terminal development?

- Land utilisation and stacking algorithms

  Maximizing land utilisation means increasing stacking density of containers in the yard, as traffic areas are to some extent restricted due to the physical dimensions of vehicles, strads etc. Increasing stacking density is related to higher stacks – for crane yards, stacking heights of 1 over 8 have been realised.

  => Stacking height is directly related to information quality.

  An optimum stacking algorithm makes use of the (total ?) information on the container's future disposition:

  - For transhipment boxes, it would build towers close to the waterside that can be re-loaded top down.
  - Truck or rail boxes should step by step be moved towards the landside end of the yard.

How can "total information" avoid congestion?

- As shown before, insufficient information on the container's disposition leads to unnecessary crane moves resulting from re-shuffeling.
- Consequently, the overall performance of the stack in terms of "productive moves" to the outside of the system goes down.
- This leads to waiting times for terminal equipment as well as for trucks and rail operation => congestion on the terminal, performance sinks.
- An automated stack optimization would make use of information on disposition and pick-up time and reorganize the stack consequently in times of low workload, thus avoiding unnecessary moves.
- Hinterland boxes would thus show up on top of a stack close to the landside shortly before their dispatch.

"Total information" and Hinterland terminals

- As a consequence of a possibly lesser number of calls (due to ship sizes) dwell time of boxes may rise again. This calls for higher stacking capacities.
- The scarce land resources in the seaports together with the increasing service speed and the need for comfortable internal traffic areas are contrary to the demand for additional stacking capacities.
- Hinterland terminals, in the case of Rotterdam linked by barges, can be a solution to cope with this discrepance.
- Optimum use of Hinterland terminals requires a maximum on information on dwell time and disposition in order to decide, which boxes to displace to these facilities.

An idea to optimize truck dispatch (1)

- To equalize truck traffic on the terminal as well as in the surroundings of Rotterdam, new concepts for truck dispatch will have to be developed:
- At least for Hamburg, at present we have a "Push" system – trucks show up as they like. Terminals have no possibility of influencing truck dispatch in order to come to an even workload over the whole day.
- It should be investigated, whether and how terminals might "Pull" trucks – thus having them show up according to the terminals needs (appointing system).
- Today, at least in Hamburg many transports are carried out by medium and small companies without EDI connection to the terminal. Most of the truck traffic goes to the nearer surroundings of Hamburg port.
- A practicable solution should therefore make use of mobile phone technology and Internet / WAP / UMTS structures.

An idea to optimize truck dispatch (2)

- In order to at least partially control truck traffic in the port area, why not putting at least some of the truck transport orders in an internet stock exchange?
- The idea: The line operator, who typically places transport orders to a truck company instead places it at an internet bourse. The transport order comprises a time frame for the transport and a maximum price for which the transport should be carried out.
- Truckers (by means of UMTS mobiles) or dispatchers of trucking companies can "bid" on the orders offered, taking in to account the possibility of double cycles (delivering an export box and picking up an import box on the same trip).
- The terminal decides on when to finish the auction in order to equalize truck traffic.

HPH

Europe vs. Asia
Terminals of the Future

Frank Kho

WPC Rotterdam, 23 January 2004

Purpose

HPH

- See what is already possible
- Pick the best and learn
- Figures could be objective, but be careful

Record performances

HPH

Hongkong China				
EVER REACH	EMPRESS SEA	ARTHUR MAERSK	SITC Tokyo	NYK PEGASUS
Dec	Dec	Dec	Dec	-
216	213	281	109	132

Europe			
-	EVER REPUTE	Maersk Constantia	MOL Progress
-	Dec	Dec	Dec
-	82	68	91

Asia						
CMA Slene (CMA)	CMA Mercure	DNHE	NAJR05	Iran Kerman	SEALAND MARINER	HHHW-10
Dec	Dec	Dec	Dec	Dec	Dec	Dec
81	160	46	88	122	74	101

America's						
MSC Matilde	Rotterdam 0352	Seaboard Victory	LT Trieste	LYKES AMBASSADOR	APL HONDURAS	LEGEND OF THE SEAS
07-Dec	Dec	Dec	Dec	Dec	Dec	Dec
85	37	33	64	110	61	-

Quay side performance

HPH

	Hongkong - China					Asia					
Gross QC Rate (mph)	32	31	30	26	24	24	21	28	24	19	32
Vessel Operating Rate (mph)	84	94	107	43	65	24	41	41	43	28	65
Berth Productivity (mph)	64	77	88	37	45	19	37	36	37	20	57

	Europe			America's						
Gross QC Rate (mph)	19	21	25	20	32	19	25	30	28	
Vessel Operating Rate (mph)	43	46	38	40	63	17	53	75	50	
Berth Productivity (mph)	34	43	27	34	43	8	29	63	33	

Resource Utilisation

HPH

2002 figures

	Hongkong China				Europe			
TEU / Ha	59	24	33	9	28	11	15	15
TEU / berth	545	577	270	170	361	240	220	400
TEU/ QC	156	160	135	85	149	80	110	129

	Asia					America's				
TEU / Ha	35	32	34	8	21	19	2	10	12	15
TEU / berth	234	405	512	164	233	176	214	113	246	45
TEU/ QC	117	147	128	82	175	101	143	57	99	23

Gate

HPH

Gate	HKG China					Europe				Asia
Gate Moves ('000 moves)	209	38	273	191	31	75	19	23	64	82
Tractor Moves ('000 tractors)	179	36	242	-	29	52	11	17	47	-
External Tractor Turntime (mins)	40	30	35	35	29	39	45	37	28	93

Automated: To Be or Not To Be

HPH

- Will continue.
- Not a goal by itself
- Different drivers per region
- Automation -> Lower Costs: Yes in Europe
- Automation -> Higher Performance: Not Always
- But first of all:
  - Define the customer needs.

Shipping Line – Terminal

HPH

- Next area of huge improvement
- Waste of resources/performance, due to mis-match
- Co-operative design and improvement
- Better matching/synchronising Line and Terminal info/process
- Still an area of huge opportunities
- CoV/CoD, Planning, Slot Integrity
  - High impact on transparency, performance, utilisation of assets (-> costs)

Customer Needs

HPH

- Customer = Shipping line
- Speed ?
- Reliability ?
- Flexibility ?
  - Turbo-mode
  - Out of Window
  - Last minute service
    - Late arrival
    - Speed Planning

HPH

Our Mission

To be the global market leader in port development, operations and logistics services

ANNEX 3 THE FLOATING CONTAINER CRANE

One of the delegates, Mr. Jan van Beemen presented the idea of the floating crane. The floating crane is already in use for bulk handling in the Port of Rotterdam.

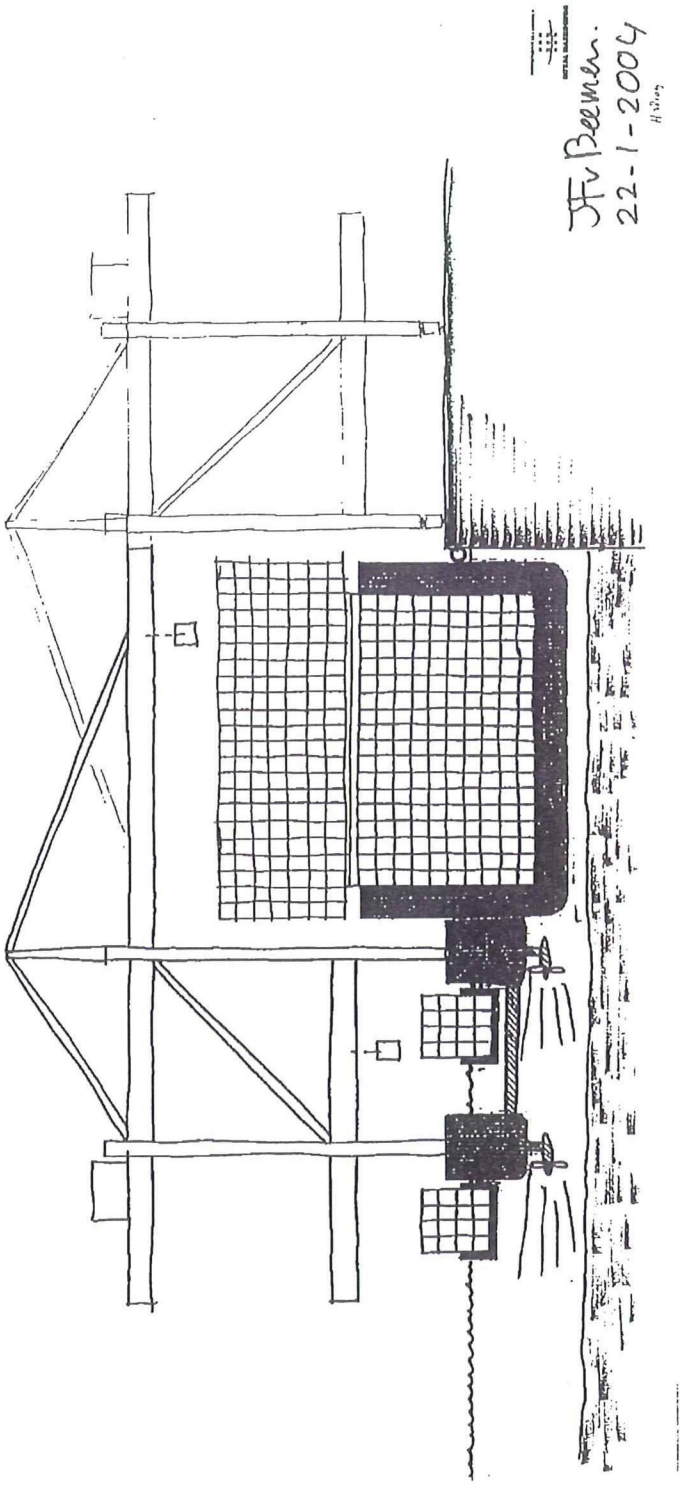


Figure 6: The floating crane

ANNEX 4 THE FLOATING QUAY

Mr. Han Ligteringen sketched an idea for a new terminal, the floating quay.

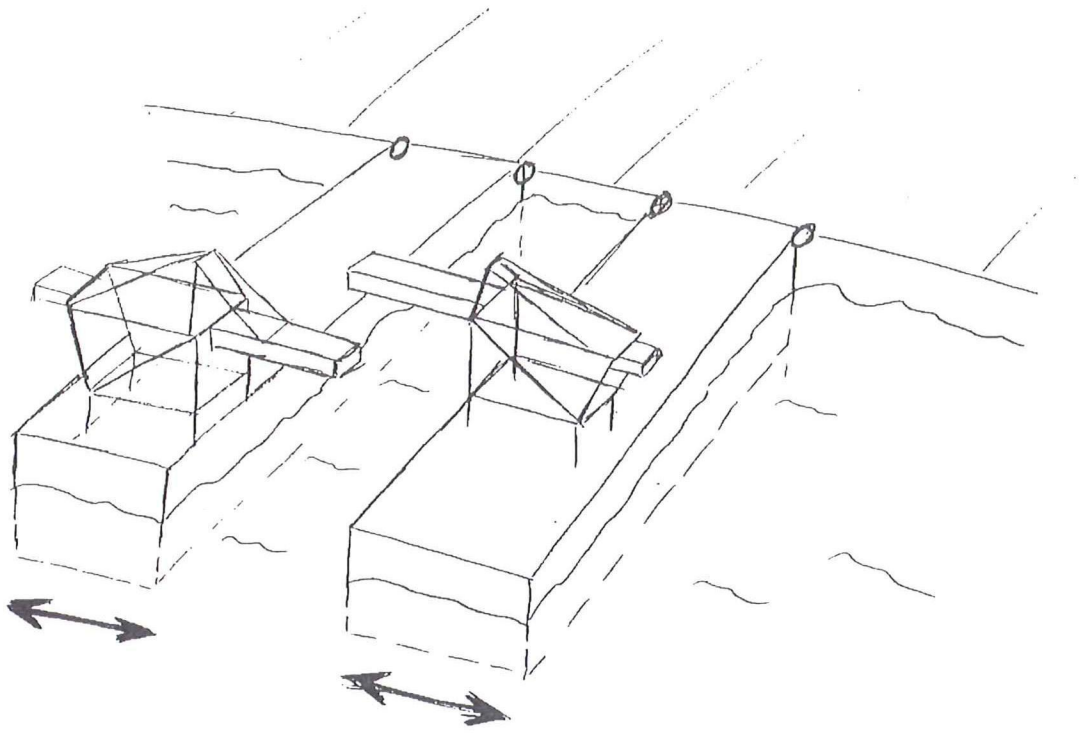


Figure 7: The floating quay