The Polder Terminal Concept

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The International Association of Ports & Harbors
www.iaphworldports.org
Innovative “Dutch” Initiative to Sustainable Terminal Design
Content

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Consultants, architects, planners, engineers
3,600 professionals
Established in the Netherlands in 1881
World-wide global experience delivered locally
Some 550 staff working in the ports and shipyards, engineering and consultancy sectors
“To create solutions for issues which concern the interaction between people and their maritime environment”
The ‘innovative’ approach

... maybe we should try to think out of the box?
A polder is a low-lying tract of land enclosed by embankments (barriers) known as *dikes*, that forms an artificial hydrological entity, meaning it has no connection with outside water other than through manually-operated devices.
The Netherlands - ‘polder’ country
Dutch History ‘Exported’

House within dike-ring - Vicksburg, Mississippi

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And applied ‘domestically’

Borssele Nuclear Power Plant
Two events in 2009:

• Interview question
  What goes wrong on a container terminal when it floods?

• Container terminal project
  To be located on a tidal mud in Asia
Suvarnabhumi Airport ready for floods?

Airport within 3.5m high and 37m wide earthen dike and sheet piles
• Suvarnabhumi International Airport (Bangkok)
• Cost of raising by 2.5m (32 km²)
• Settlement problems (20m soft clay)
• Polder plan (De Weger / Royal Haskoning, 1993)
Suvarnabhumi Airport not affected by flooding

BANGKOK, Nov 14 – In an attempt to restore sagging visitor arrivals, officials of Suvarnabhumi Airport are campaigning to tell prospective travelers around the world that the gateway to Thailand and almost all of Thailand's provinces is not affected by the current floods, according to airport management.

In visits to a number of countries and tourism-related organisations, Thai officials are spreading the word that travel to Thailand is unaffected by the current floods, and that Suvarnabhumi airport is safe from flooding.

The move follows a significant drop in the numbers of daily arrivals at Thailand's gateway airport where numbers have been cut 20,000 daily from a normal average of 130,000 persons every day.

Airports of Thailand (AOT) executive Srisakul Seesawasdee, in his capacity as Acting General Manager.
Port construction

- Few on-shore locations left
- Offshore development
- Land reclamation (MV2 +5m CD)
- Large volumes of good quality fill
- High dredging, transport and placing cost
- Environmental impact of dredging
- Soil settlement
- Soil improvement
• Container terminal
• Tidal mud flat along a river
• Tens of meters of soft mud
• Large volumes of fill required
• Extensive soil improvement required

Why not a polder terminal?
Local knowledge

Prawn Farms, Vietnam

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Terminal operations

Conventional terminal:
• Quay, apron and yard all at same level
• No problems with horizontal transport

Polder terminal:
• Quay on higher level than yard
• Operations - horizontal transport?
• Quay, apron dike combination?
• Dual Trolley Crane System
Terminal operations

First-generation automated container terminal
Second-generation automated container terminal
(Euromax and Altenwerder)
Terminal operations

Case #1
Conventional operation between crane legs

Case #2
Back reach operation with single trolley

Case #3
Back reach operation with dual trolley

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Crane efficiency is determined by the ship to derrick performance and not the terminal level.
Quay wall dike structure

- Conventional structures
- Land side wall is anchor wall
- Combi wall is seepage screen
Quay wall dike structure

Landside view
The concept
The concept
The concept

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Water management

Water discharge:

- Discharge sluice
- Electric pumping station
- Use only wind generated power
- Water level fluctuations allowed
Water management
Water management
Water management

Collection and storage:

• Polder water fresh or brackish
• Water collection and storage system
• Drains and gravel beds
• Drains and surface water (5%-10%)
• Water level fluctuation allowed (no agriculture, no historic buildings)
• Wetland development (nature compensation inside the port)
• Fish or algae farming
Water management

Water collection and storage

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Wind Energy for the pumps

Water discharge systems energy requirements
The psychological factor
The psychological factor (cont’d)
Conclusions

- Requires less fill
- Less environmental impact through dredging
- Nature may be included in terminal
- Has been done before (Bangkok)
- Less settlement of yard area
- Less visual impact of yard
- Compatible with modern container terminal layout
- Existing construction techniques
- Adaptable to unanticipated sea level rising