Twin hub

Intermodal rail freight Twin hub Network North West Europe

Twin hub network: an innovative concept to boost competitiveness of intermodal rail transport to the hinterland

Conference Ports, Terminals & Intermodal Transport 2013, 6 and 7 February, Amsterdam
Content of presentation

• General intermodal challenge
• The bundling challenge
• Twin hub concept
• Promising Twin hub networks
• Twin hub project
• The Rotterdam bundle challenge
Challenge (intermodal) transport
Intermodal rail transport is highly relevant

- High growth rates of freight transport (50% between 2000 and 2020)
- Impossible to accommodate growth mainly by truck transport (current share is about 75% in the EU)
- Rail transport is relatively sustainable (e.g. climate, pollution, noise, accidents, infrastructure, space)
- Societal aims: increase share intermodal rail and barge transport
  In Rotterdam the aim is to increase rail share from 11% to 20% in 2033. In Antwerp to 15% in 2020.
- Commercial aims: Intermodal rail transport is a growth market for the railway sector
Intermodal rail transport is only modestly competitive

- Growth share intermodal rail transport is hampering

- Good quality only (according to the European project IQ):
  - In corridors with large flows
  - From and to large nodes
  - In some well organized regions

- Rail is typically chosen because of low costs, but numerous railway companies / intermodal rail operators cannot cover their costs

- Capacity restrictions in rail network at large nodes, in large seaports in particular
Relevance of the performances

Intermodal rail terminals served from Rotterdam in its “own” hinterland.

LEGENDA:

- Existing terminals, of which:
- Served by different rail operators.

EK-OTB (2005)
Conclusion for intermodal transport: Operational improvements

Continuously in search for appropriate innovations:

- **Network** design (mainly services):
  - Bundling of rail flows
  - Train roundtrips
  - Pre- and post-haulage
  - Spatial organization (locations of terminals and customers)

- **Node** design (services and infrastructure)

- **Vehicle** design

- **Business and organisational** design
The bundling challenge
Many intermodal rail flows are too small for direct train services … … also from and to large nodes “Complex bundling” is required for many relations

**Basic bundling choices**

<table>
<thead>
<tr>
<th>Direct bundling</th>
<th>Complex bundling</th>
</tr>
</thead>
<tbody>
<tr>
<td>A — B</td>
<td>A — B</td>
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<tr>
<td>C — D</td>
<td>C — D</td>
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</table>

**Legend:**
- Partially loaded trains
- Fully loaded trains
- Begin-and-end-terminal

Kreutzberger, 1998

Detour and perhaps local rail transport
Transhipment or other type of exchange

Higher loading degree

More end terminals
Relevance of the performances

• Larger trainloads
  -> lower costs per load unit
  (most important for train costs)

• Higher frequencies -> lower costs of shipper:
  • E.g. interest costs for goods in circulation
  • Storage costs at the shippers’ locations

• Higher network connectivity -> shorter distances pre- and post-haulage
  -> lower door-to-door costs

• More efficient use of infrastructure -> less land use and lower infrastructure and hence transport costs per load unit
### Basic bundling choices

<table>
<thead>
<tr>
<th>Direct network  (= BE network)</th>
<th>Hub-and-spoke network  (= HS network)</th>
<th>Line network  (= L network)</th>
<th>Fork network  (= TCD network)</th>
<th>Trunk-feeder network  (= TF network)</th>
</tr>
</thead>
</table>

- Only trunk rail network (with full trainloads)
- Trunk rail and local rail network (with full and small trainloads)

Source: Kreutheger, 2008
The advantages of HS bundling

**HS network: larger trainloads** *

<table>
<thead>
<tr>
<th>Direct network</th>
<th>Hub-and-spoke network</th>
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<tbody>
<tr>
<td>Begin terminals</td>
<td>End terminals</td>
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<tr>
<td>Begin terminals</td>
<td>Hub</td>
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<td>End terminals</td>
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HS network: smaller transport network volumes required *

<table>
<thead>
<tr>
<th>Direct network</th>
<th>Hub-and-spoke network</th>
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HS network: higher transport frequencies *

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<tr>
<th>Direct network</th>
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<td>Hub</td>
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<tr>
<td>End terminals</td>
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</tbody>
</table>

* Than in direct network

Source: Kreutzberger, 2011
Physical choices within HS networks

Shunting of wagons (formerly including containers)

Crane transhipment of containers at a terminal

Megahub Antwerp

Source: Interferryboats, 2004
Physical choices for HS bundling

- Exchanging single wagons on gravity shunting yard is relative expensive and time consuming.

- Exchanging wagon groups on flat (or gravity) shunting yard is acceptable for costs and time, but only suitable for flows which are large enough to fill a wagon group.

- Transshipping load units at true hub terminal is acceptable for costs and time and also suitable for smaller flow sizes than required in wagon group trains.
Twin hub concept
Twin hub concept

- Bundle rail flows of Rotterdam and Antwerp and of smaller seaports
  - Transport Dutch load units in Antwerp trains wherever they have or could have a strong market position
  - Transport Belgian load units in Rotterdam trains wherever they have or could have a strong market position
  - Complementary corridors in acknowledgement of seaport competition
  - Move load units between inland terminals and different (“west”) seaports in the same train

- Organize such bundling by means of hub-and-spoke- (= HS-) networks

- Two hubs, in regions Antwerp and Rotterdam (= gravity points of flows)

- The Twin hub concept enlarges the service area of each hub increasing the advantages of HS bundling
Twin hub concept

LEGEND
- = terminal
- = hub terminal Antwerp
- = hub terminal Rotterdam
- = services via hub Antwerp
- = services via hub Rotterdam
- = services beyond NWE
Twin hub concept

Train services via hub Rotterdam

Train services via hub Antwerp

LEGEND = train services to/from European inland terminals
**Twin hub concept**

Avoid inefficient types of operations. Therefore:

- Each train and load unit only visits 1 hub
- No exchange of single wagons. Instead:
  - Rail-rail transshipment of load units between trains
  - Exchange of wagon groups between trains
- No local trains with relative small trainloads
Twin hub concept

Twin hub:
• Cooperation between competitors
  • seaports
  • countries
  • rail operators

Currently: Intermodal hub-and-spoke bundling by train is typically restricted to:
• seaports within 1 country
• 1 rail firm or ”family” of rail firms

Twin hub: open to new actors to participate
Twin hub project
Twin hub project

Lasts almost 4 years

Budget more than 5,5 million Euros

Partners:
- 4 universities
- 4 rail operators
- 2 seaports
- 3 consultants

Advisory group

Four work packages:
1) Identification of promising Twin hub networks
2) Business plan pilot, pilot, monitoring pilot, innovative booking system
3) Twin hub infrastructure on the long term
4) Societal benefits
Identification of Twin hub networks
Approaches to identify promising Twin hub networks

1. On the basis of flows (combination of flows) (TU Delft)

2. On the basis of a new bundling tool (cost minimization) (TU Delft)

3. On the basis of the Euro Terminal model (VUB, Brussels)

4. Modal shift analysis for (1) and (2)
Bundling of flows in the terminal-terminal matrix

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<tr>
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</table>

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“Day A/B” is to say that the train arrives at the end terminal on the day after departure.

**Bundling in 1 seaport** (e.g. HS bundling)
(in case of only 2 rail also L bundling is possible, as in current operations)
Bundling of flows in the terminal-terminal matrix

<table>
<thead>
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</table>

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“Day A/B” is to say that the train arrives at the end terminal on the day after departure.

Twin hub bundling:
Of flows of several seaports
plus UK (not shown here)
Concrete identification of promising Twin hub networks

Criterion:

• 3 departures per week and direction

• 600m train length

• 20,000 TEU or more per year in two directions, of which at least 6,500 TEU in the minor direction

• To be achieved by e.g. loading degrees of 90% in one and 60% in the other direction
Regions that can be served by Twin hub services (in 1,000 TEU) between seaports Rotterdam / Antwerp and Germany / Czech republic / Poland, 2010

Legend
Rotterdam & Antwerp only
Sum of Fields
140,000
RDAM
ANTW
Potential
TOTAL
<20K TEU
>20K TEU

Bron: Konings e.a., 2012
Regions that can be served by Twin hub services (in 1,000 TEU) between seaports Rotterdam / Antwerp / Greater London and Germany / Czech republic / Poland, 2010

Data source: GSCO - Euregat (European Commission)
Administratieplakettes (AWK) © Eurochildhuis, VU/AoA, Tops Talpa

Legend
UKI
Sum of Fields
150,000
RDAM
ANYW
REGIO
Potential
TOTAL
<20K TEU
>=20K TEU

Bron: Konings e.a., 2012
Conclusions

Twin hub network:

• First steps to identify promising Twin hub networks seem to confirm:
  
  • Twin hub networks allows to access more inland-terminals by bundling Rotterdam en Antwerp flows, which otherwise will go by road (increase of network connectivity)
  
  • Twin hub network increases size of trainloads
  
  • Twin hub network increases service frequency
  
  • All to be confirmed by cost optimization models and to be proven in the project pilot
The Rotterdam bundle challenge
Bundling challenge in seaports

**Rotterdam**
- Increasing number of rail terminals (within and outside of MV 2)
- L bundling not sufficient to integrate flows to trainloads
- Solutions: barge, feeder train, hub-and-spoke bundling (= HS)
- HS is very promising, especially based on hub terminal
- But Rotterdam has no hub terminal

**Antwerp**
- Missing rail links to reach the seaport

**Smaller seaports**
- Get attached to the train services of the large seaports
- By barge and by rail (multi-destination trains to the hub terminals of the large seaports)
Potential locations hub terminal for Rotterdam flows

- **MAASVLAKTE**
  - Corridor neutral hub, periphery

- **VALBURG**
  - Corridor specific hub

- **KI J FHOEK**
  - Corridor neutral hub, centre

- **MOERDIJK**
  - Corridor neutral hub, periphery

- **ANTWERP**
  - Corridor specific hub

- **DUISBURG**
  - Corridor specific hub
Criteria to analyse potential hub locations

- **Corridor neutral:**
  - bundling easier than corridor specific
  - outplacement of port functions easier than corridor specific
  - useful for other seaports, contrary to corridor specific

- **Periphery (e.g. Moerdijk):**
  - less optimal than centre

- **Periphery (Mvt):**
  - only suitable for bundling of Mvt flows
  - (= future maybe 80% of all Rotterdam flows), contrary to centre
Questions ?