3. Using Megaswing rail wagons for efficient semi-trailers door-to-door transport

3.1 Summary

This case is based on a fictive domestic door-to-door transport solution of temperature controlled food from Bremervörde to Memmingen in Germany. The solution is based on the rail wagon Megaswing that enables intermodal transport of semi-trailers that cannot be lifted by cranes.

Initially the solution is based on a pure road transport solution. The first development step includes more traditional intermodal transport solutions through the large scale terminal. The second step involves two smaller terminals that reduces road transport distances and waiting times. Railway transport distances increases.

Baseline:
Using tractors with semi-trailers for road transport from Bremervörde to Memmingen

Step 1:
Using intermodal transport by road and rail using transshipment terminals with cranes

Step 2:
Using intermodal transport by road and rail using Megaswing wagons for transshipment

Transshipment of semi-trailer through cranes (Reach stacker) or the Megaswing wagon
Implementation

This technology and solution is in a very early phase of its market introduction and at present the willingness to adopt the solution by the commercial market is very low.

3.1.1 Results in brief

<table>
<thead>
<tr>
<th>NTMCalc Advanced</th>
<th>Overall results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis</td>
<td>Unit</td>
</tr>
<tr>
<td>Transport activity</td>
<td>Tonkm</td>
</tr>
<tr>
<td>Cost</td>
<td>EUR</td>
</tr>
<tr>
<td>Lead time</td>
<td>H</td>
</tr>
<tr>
<td>CO2 total</td>
<td>Kg</td>
</tr>
<tr>
<td>CO2 relative</td>
<td>g/tonkm</td>
</tr>
<tr>
<td>Energy</td>
<td>MJ</td>
</tr>
<tr>
<td>Energy relative</td>
<td>MJ/tonkm</td>
</tr>
</tbody>
</table>

Comments

Most indicators show substantial improvements but increase of lead time may be a major obstacle for intermodal in general. The question is if the lead times reductions by Megaswing wagon can enable more intermodal solutions.
3.2 Background
Door to door delivery of fresh (food) and fast moving goods by a combined rail and road transport system faces several fundamental structural barriers. The barriers have been identified through a number of years of practical large scale operations as well as a number of tests combined rail and road transport service.

3.2.1 Lack of reliability and credibility regarding on time delivery
The credibility of the railway system in general among shippers and transport service providers (forwarders etc) is very low through a history of insufficient service record regarding on-time delivery. In principle, the railway transport system should by its operational organization, based on thorough time schedules be able to deliver very accurate on time service. However, due to the interconnected railway system, small and large disturbances, from congestions, accidents and existing bottlenecks spreads out in the railway system which lower service levels. In addition to delivery delays, the railway system has not reported sufficiently on coming delays that would have enabled the shipper and transport service provider to carry out mitigating actions. In this context it should be noted that the railway operators have improved, but on the other hand overall traffic has increased which makes operational conditions more severe in this respect.

3.2.2 Lack of reliability of delivered cargo quality
A major reason for shippers of sensitive cargo to choose road transport service is how a driver can ensure and take measures in order to counteract various disturbances that threaten the cargo regarding temperature, fragility or theft of high value goods. The railway system has over the recent 30 years been bothered by various disturbances with diminished cargo quality delivery. When using the wagon load system the shunting procedures have often lead to cargo breaking shocks damaging cargo, stop in the railway system without sufficient redundancy on climate control systems has altogether lead to damaged goods. Moreover has high valu cargo been at risk in a slow or stands still railway transport chain that has increased the risk of theft.

3.2.3 Too high total costs of switching mode of transport
Transport logistics services meet severe competition with a very transparent market and low barriers of entry i.e. a high pressure on the price. For long term viability the transport operation thereby needs to operate cost efficiently. Combined rail and road system based cargo load units with transhipment by a large scale crane has not been able to compete at short distance due to high terminal handling costs. Moreover has the large scale cranes operation lead to handling bottlenecks that increases the time of terminal handling and further reduces the competition of the combined transport solution.

3.2.4 Lack of trailers that can be lifted on board a railway wagon
According to the European commission SAIL report, only 3% of today’s trailers within the European community can be lifted by a crane on to a railway wagon and thereby utilize combined rail and road services. Moreover, this means lacking compatibility which in turn increases transport logistics planning costs as only few trailers can operate freely in this respect.
3.2.5 Poor operational follow up systems for combined transport systems
A major service request from shippers and transport providers is deviation reports in order to counteract the effects that may occur at various disturbances. The railway operators has all the information needed for this type of service but have been weak in delivery. In combined solutions this is a more structural problem as there is a lack of combined road and rail production information at one provider delivering relevant deviation reports.

3.2.6 Lack of redundancy in the railway system
Today’s technology implies that combined rail and road operation is based on large scale cranes i.e. high capital costs. A consequence is therefore that the number of terminals is kept at a minimum. With respect to transport operations cost and service levels the distance to consignee and delivery should be kept at a minimum. Furthermore do few available terminals lead to weak redundancy of the railway system if one terminal is blocked by technical or organizational cause. Thus, large scale railway terminals operation implies reduction of redundancy.
3.3 The solution

The new solution that is described is based on a two-step implementation process. Initially the solution is based on a pure road transport solution. The first development step includes more traditional intermodal transport solutions through the large scale terminal. The second step involves two smaller terminals that reduces road transport distances and waiting times. Railway transport distances increases.

Baseline:
Tractor with semi-trailer for road transport from Bremervörde to Memmingen

Step 1:
Intermodal transport by road and rail where transshipment terminals in Maschen and Munich are included equipped with cranes for the transshipment.

Step 2:
Intermodal transport by road and rail using Megaswing wagons for transshipment. Transshipment is carried out in two smaller terminals, Elsdorf and outside Memmingen closer to point of origin and final destination.

*Transshipment of semi-trailer through cranes (Reach stacker) or the Megaswing wagon*
Baseline solution

Step 2

Step 3
### 3.4 Results


#### Step 1: Baseline

<table>
<thead>
<tr>
<th>Tonnage</th>
<th>Weight</th>
<th>Trips</th>
<th>Tonne km</th>
<th>Cost €</th>
<th>Lead time h</th>
<th>CO2 total [kg]</th>
<th>CO2 fossil [kg]</th>
<th>CO2 biogen [kg]</th>
<th>CO2 equivalent [kg]</th>
<th>SO2 [g]</th>
<th>Diesel B5 - EU [l]</th>
<th>Electricity [kWh]</th>
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#### Step 2: To be added

#### Step 3: Additional

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<th>Tonnage</th>
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<th>Electricity [kWh]</th>
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</table>

#### Grand totals (relative)

<table>
<thead>
<tr>
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</table>

#### Comments

To be added
Assumptions

Baseline

Truck with trailer 34-40 t
Calculation model Shipment transport (weight)
Fuel Diesel B5 - EU
Road type Motorway
EuroClass Euro 4
Road gradient ±2%
Shipment weight 13 tonne
Distance 741.38 km
Cargo load factor (weight) 50 %
Cargo carrier capacity (weight) 26 tonne
Fuel consumption 0.328 l/km

Step 1

Truck with trailer 34-40 t
Calculation model Shipment transport (weight)
Fuel Diesel B5 - EU
Road type Rural Road
EuroClass Euro 4
Road gradient ±2%
Shipment weight 13 tonne
Distance 85.50 km
Cargo load factor (weight) 50 %
Cargo carrier capacity (weight) 26 tonne
Fuel consumption 0.343 l/km

Electric train
Calculation model Shipment transport (weight)
Cargo type Average
Train size Medium
Topography Hilly
Electricity source EU 27 mix
Shipment weight 13 tonne
Distance 872.96 km
Cargo load factor (weight) 60 %
Empty positioning factor 0.50
Max payload:Gross weight ratio 73 %
Train weight 1000 tonne
Transmission losses 0.15
Brake regeneration 0.00

Truck with trailer 34-40 t
Calculation model Shipment transport (weight)
Fuel Diesel B5 - EU
Road type Rural Road
EuroClass Euro 4
Road gradient ±2%
Shipment weight 13 tonne
Distance 115.23 km
Cargo load factor (weight) 50 %
Cargo carrier capacity (weight) 26 tonne
Fuel consumption 0.343 l/km

Step 2

Truck with trailer 34-40 t
Calculation model Shipment transport (weight)
Fuel Diesel B5 - EU
Road type Rural Road
EuroClass Euro 4
Road gradient ±2%
Shipment weight 13 tonne
Distance 65.94 km
Cargo load factor (weight) 50 %
Cargo carrier capacity (weight) 26 tonne
Fuel consumption 0.343 l/km

Electric train
Calculation model Shipment transport (weight)
Cargo type Average
Train size Medium
Topography Hilly
Electricity source EU 27 mix
Shipment weight 13 tonne
Distance 813.35 km
Cargo load factor (weight) 60 %
Empty positioning factor 0.50
Max payload:Gross weight ratio 73 %
Train weight 1000 tonne
Transmission losses 0.15
Brake regeneration 0.00

Truck with trailer 34-40 t
Calculation model Shipment transport (weight)
Fuel Diesel B5 - EU
Road type Urban Road
EuroClass Euro 4
Road gradient ±2%
Shipment weight 13 tonne
Distance 5.15 km
Cargo load factor (weight) 50 %weight
Cargo carrier capacity (weight) 26 tonne
Fuel consumption 0.445 l/km