4.1.2. Use case 1: Oslo-Soltau

The first use case relates to the transport of frozen fish from a distribution centre in Alnabru (NO) to a warehouse in Soltau (DE). To carry out CT operations the forwarder will deploy a craneable, refrigerated semi-trailer. The initial road leg to the CT terminal Alnabru is very short (approx. 3 km) whilst the final road leg from Hamburg-Billwerder, the nearest possible CT terminal, to Soltau amounts to about 75 km. The initial road leg comprises of the following processes: delivery of empty semi-trailer to the distribution centre, loading of cargo, transport of loaded semi-trailer to CT terminal. The final road leg includes the pick-up of the semi-trailer at the CT terminal, the delivery to the final destination and the unloading of the unit.

As concerns the main haul between Alnabru and Hamburg, there are two principal routing options. First of all, the trade lane can fully be covered by rail resulting in a CT rail-road service. The route runs from Alnabru via Sweden and the fixed link through Denmark, entering Germany south of Padborg and continues to Hamburg. The CT rail-sea-road service "breaks" the rail journey into two segments. The first part is between Alnabru and a south Swedish ferry port, Trelleborg or Malmö. Here, the intermodal load units are transferred from the train to a ferry and shipped over the Baltic Sea to the port of Lübeck. This ferry port is the starting point for the second rail leg to Hamburg. The full CT supply chains are presented in Table 71.

Table 71: Use case 1 – CT supply chains

Combined transport rail-road	Combined transport rail-sea-road
Initial road leg Oslo area	Initial road leg Oslo area
Road/rail transhipment at CT terminal Alnabru	Road/rail transhipment at CT terminal Alnabru
Rail transport Alnabru-Kornsjö border (single-system Loco NO + pushing loco Halden)	Rail transport Alnabru-Kornsjö border (single-system Loco NO + pushing loco Halden)
Rail transport Kornsjö-Malmö (single-system Loco SE)	Rail transport Kornsjö-Trelleborg (single-system Loco SE)
Rail transport Malmö-Hamburg (multi-system locomotive)	Rail/ferry transhipment at port of Trelleborg
Rail/road transhipment at CT terminal Hamburg-Billwerder	Ferry transport Trelleborg-Lübeck
Final road leg Hamburg-Soltau	Ferry/rail transhipment load unit at port of Lübeck
	Rail transport Lübeck-Hamburg (single-system Loco DE)
	Rail/road transhipment at CT terminal Hamburg-Billwerder
	Final road leg Hamburg-Soltau

Source: KombiConsult

The total costs of the rail carrier for a CT rail-road operation is about 50% higher than for a CT rail-sea-road operation. Track access and energy cost account for the largest shares in CT rail-road journeys with 20.4% and 18.0%, respectively. More than 10% of the rail carrier's total cost are made up by the cost for staff and shunting and pushing services. The latter reach a share of nearly 18% in CT rail-sea-road operations due to the additional shunting of intermodal trains at the ferry ports. Energy costs

are at a similar level like in CT rail-road while the share of track access costs drops to 11.1%. This is owing to two factors. Firstly, the rail distance is considerably shorter and, secondly, the combination of rail and ferry avoids the fixed link via Denmark, which incurs comparatively high infrastructure charges. The detailed breakdown by cost types for the two routing options is displayed in Table 72.

In the case of a CT rail-road supply chain, rail transport and road legs clearly are the biggest cost factors accounting for about 40.8% and 42%, respectively, of total cost. In CT rail-sea-road operations, the proportion of the road costs remains nearly at the same level (39.6%) but the ferry services "replace" a major part of the cost of rail operations. The detailed breakdown by cost types is provided in Table 72.

Table 72: Use case 1 – cost structure of the rail carrier in CT operations

Type of cost	CT rail-road	CT rail-sea-road
	Share	Share
Depreciation cost of locomotives	4.2%	4.0%
Depreciation cost of wagons	5.1%	5.8%
Financing cost of locomotives	1.3%	1.2%
Financing cost of wagons	1.2%	1.3%
Maintenance & repair cost of locomotives	5.9%	5.4%
Maintenance & repair cost of wagons	5.6%	6.3%
Shunting and pushing services cost	10.8%	17.9%
Track access cost	20.4%	11.1%
Energy cost	18.0%	17.0%
Personnel cost rail carrier	12.2%	14.7%
Insurance cost	0.6%	0.5%
Overhead rail carrier	12.8%	12.8%
Rail carrier's margin	2.0%	2.0%
Total cost rail carrier	**100%**	**100%**

Source: KombiConsult

Table 73: Use case 1 – cost structure of the forwarder in CT operations

Type of cost	CT rail-road	CT rail-sea-road
	Share	Share
Average rail cost	40.8%	25.7%
Terminal handling cost	4.9%	8.6%
Initial and final haulage costs	42.0%	39.6%
Cost of ferry transport	0.0%	13.9%
Equipment cost (depreciation/leasing)	4.5%	4.3%
Personnel cost forwarder	0.3%	0.3%

Type of cost	CT rail-road	CT rail-sea-road
	Share	Share
Overhead forwarder	4.6%	4.6%
Forwarder's margin	2.9%	2.9%
Total cost forwarder	**100%**	**100%**

Source: KombiConsult

4.1.3. Use case 2: Borlänge-München

This use case refers to the transport of paper rolls between a paper mill in Borlänge (SE) and the warehouse of a printing house in München (DE). The transport is being conducted by a craneable curtainside-type of semi-trailer. Both road legs are short; the distance is about 8 km between the paper mill and the CT terminal and approximately 7 km from the CT terminal München-Riem to the warehouse. Like for use case 1, CT service providers in cooperation with railway undertakings have two basic routes for the main haul – a through-rail transport or a combination with a ferry. The characteristics of both supply chains are shown in Table 74.

Table 74: Use case 2 – CT supply chains

Combined transport rail-road	Combined transport rail-sea-road
Initial road leg Borlänge	Initial road leg Borlänge
Road/rail transhipment at CT terminal Borlänge	Road/rail transhipment at CT terminal Borlänge
Rail transport Borlänge-Malmö (single-system Loco SE)	Rail transport Borlänge-Trelleborg (single-system Loco SE)
Rail transport Malmö-Hamburg (multi-system locomotive)	Rail/ferry transhipment at port of Trelleborg
Rail transport Hamburg-München (single-system Loco DE)	Ferry transport Trelleborg-Lübeck
Rail/road transhipment at CT terminal München-Riem	Ferry/rail transhipment at port of Lübeck
Final road leg München area	Rail transport Lübeck-München (single-system Loco DE)
	Rail/road transhipment at CT terminal München-Riem
	Final road leg München area

Source: KombiConsult

The total costs of the rail carrier for a CT rail-road operation is about 29.3 higher than for a CT rail-sea-road operation. Unlike use case 1, the distribution among cost types is almost equal in both variants. Track access and energy costs account for approx. 50% in CT rail-road and more than 44% in CT rail-sea-road. The personnel costs are in the range of 11-13%. The proportion of shunting costs drops