Table 105: Use case 1 – standardisation calculation

Capacity comparison wagon / semi-trailer	Capacity
Loading capacity of a wagon (Hbbills-uy)	38 EPAL 1 pallets
Loading capacity of a semi-trailer	34 EPAL 1 pallets
Factor wagon/semi-trailer	1.118

Source: HaCon

4.2.3. Use case 2: Borlänge-München

Use case 2 represents a rail transport of printing paper (large rolls) between Borlänge (SE) and Munich (DE) over a distance of 2,080km. The train starts from the siding of a local paper mill in Borlänge and ends in the intermodal terminal Riem Ubf in Munich. End-haulage of the paper rolls is carried out by truck (5km) as the siding of the receiver is no longer in operation. The train parameters are specified in Table 101. Details on the rail transport chain are shown in Table 106 below.

Table 106: Use case 2 – rail transport supply chain

Rail Transport
SE: Siding operations (service provider): Train takeover, provision of the empty wagon sets at loading facility, loading of wagons by sender, Pick-up of loaded wagons, transfer to the handover track, train clearance (wagon master)
SE: Initial haul Rail transport Borlänge paper mill – Borlänge Rangerbangard (loco 185)
SE: Rail transport Borlänge Rangerbangard – Hallsbergs Rangerbangard – Mjölby – Malmö Godsbangard (single-system loco)
DK/DE: Rail transport Malmö Godsbangard – Padborg – Maschen (loco EG 3100 MS)
DE: Rail transport Maschen Rbf – München Nord Rbf – Public loading siding München-Riem Ubf I (loco 185-2)
DE: Rail-road transhipment
DE: Final haul Road transport München-Riem Ubf I – Printing company, München
DE: Unloading of trucks by recipient

Source: HaCon

The cost structure of the rail transport is shown in Table 107. The highest share on the total cost with 22.8% is assigned to track access costs while energy cost amounts cost to 17.9%. The share of these two cost positions differ compared to use case 1 due to the significantly higher transport distance. This fact and the possibility of a direct train entrance into the terminal München Riem I leads to a lower ratio of shunting with 15.6%. Personnel costs come to 9.7%. Costs for locomotives and wagons (sum of depreciation and financing costs and maintenance & repair) total to 8.5% and 9.0% respectively. Rail carrier’s overhead costs have a share of 12.8%, the margin amounts to 2.0%.

Table 107: Use case 2 – cost structure of the rail carrier

	Rail only
	Share
Depreciation cost of locomotives	3.3%
Depreciation cost of wagons	4.1%
Financing cost of locomotives	1.0%
Financing cost of wagons	0.9%
Maintenance & repair cost of locomotives	5.4%
Maintenance & repair cost of wagons	4.0%
Shunting and pushing services cost	15.6%
Track access cost	22.8%
Energy cost	17.9%
Personnel cost rail carrier	9.7%
Insurance cost	0.4%
Overhead rail carrier	12.8%
Rail carrier’s margin	2.0%
Total cost rail carrier	**100%**

Source: HaCon

The train is transporting 17 wagons of the type Sins of which are 14 are loaded (82.35%). The total cost structure of the rail transport per loaded wagon is shown in Table 108. This includes costs for the transhipment of the paper rolls in Munich from rail to road (1.8%), for the final haulage by truck to the receiver (8.6%) and for the forwarders personnel cost. Overhead costs amount to 4.6%, the margin to 2.9%.

Table 108: Use case 2 – cost structure of the rail forwarder per wagon

Type of cost	Rail forwarder
	Share
Average rail cost per shipment (wagon)	82.0%
Rail sidings: Rail <-> road transhipment (wagon)	1.8%
Rail sidings: Road haulage (wagon)	8.6%
Personnel cost per shipment (wagon)	0.2%
Overhead forwarder	4.6%
Forwarder's margin	2.9%
Total cost rail forwarder per wagon	**100%**

Source: HaCon

For the cost comparison, the loading of a wagon and a semi-trailer have to be standardised. As for this use case no pallets are needed, a standardisation was made based on tonnes:

Table 109: Use case 2 – standardisation calculation

Capacity comparison wagon / semi-trailer	Capacity
Loading capacity of a wagon (Sins)	61.5 tonnes
Loading capacity of a semi-trailer	24.0 tonnes
Factor wagon/semi-trailer	2.5625

Source: HaCon

4.2.4. Use case 3: Göteborg-Hannover

Use case 2, represents a rail transport of automotive parts between Göteborg (SE) and Hannover (DE) over 1,030km. The train starts from a rail logistics centre in Göteborg Marieholm and ends in siding of a car manufacturer in Hannover –Nordhafen. Pre-haulage of the freight between the store of the sender and the rail logistics centre is carried out by truck (6.5km). The train parameters are specified in Table 101. Details on the rail transport chain are shown in Table 110 below.

Table 110: Use case 3 – rail transport supply chain

Rail Transport
SE: Loading of trucks by sender
SE: Initial haul Road transport Automotive industry – Railport Göteborg Marieholm
SE: Road-rail transhipment
SE: Rail transport Göteborg Marieholm – Malmö Godsbangard (loco EG 3100 MS)
DK: Rail transport Peberholm – Taulov – Padborg (loco EG 3100 MS)
DE: Rail transport Padborg – Maschen Rbf – Hannover-Hainholz (loco EG 3100 MS)
DE: Final haul Rail transport Hannover-Hainholz – Hannover Nordhafen (diesel loco)
DE: Siding operations (service provider): Train takeover, provision of the loaded wagon sets at unloading facility, unloading of wagons by recipient, pick-up of unloaded wagons, transfer to the handover track, train clearance (wagon master)

Source: HaCon

The total cost structure of the rail transport sums is shown in Table 111. The highest share on the total cost with 31.6% is assigned to the first and last-mile shunting operations. Track access cost amounts to 17.9%, while costs for personnel and energy come to 7.2% and 12.5% respectively. Costs for locomotives and wagons (sum of depreciation and financing costs and maintenance & repair) total to 7.2% and 8.6%. Rail carrier's overhead costs amount to 12.8%, the margin has a share of 2.0%.