RE Trans
Research & Education on Transport Logistics

Reader

Combined Transport

Section:

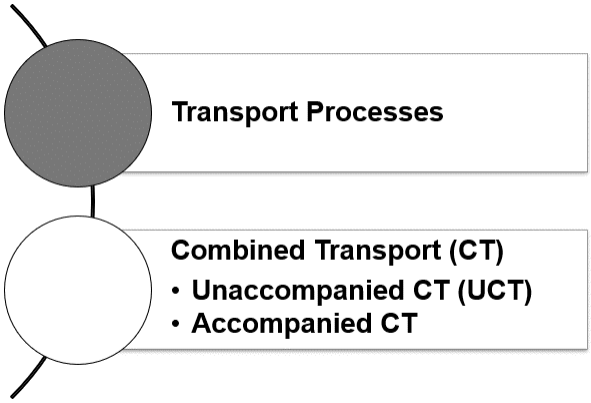
RE Rail
Research & Education on Rail Cargo Logistics

This reader supplements the Power Point presentation on combined transport doubling as a script.

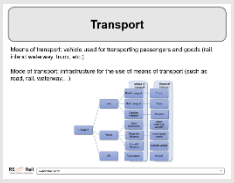
a project in cooperation with the University of Applied Sciences BFI Vienna, Logistikum Steyr, the SCHIG mbH and the Austrian Federal Ministry of Transport, Innovation and Technology

Overview

This reader on combined transport and the slide set it is based on are structured as follows:



Transport Processes



Traffic & Transport

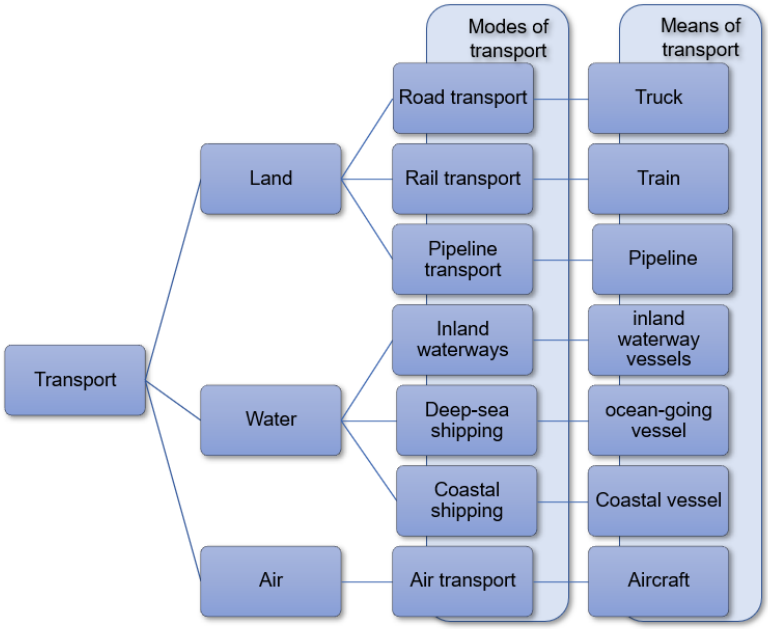
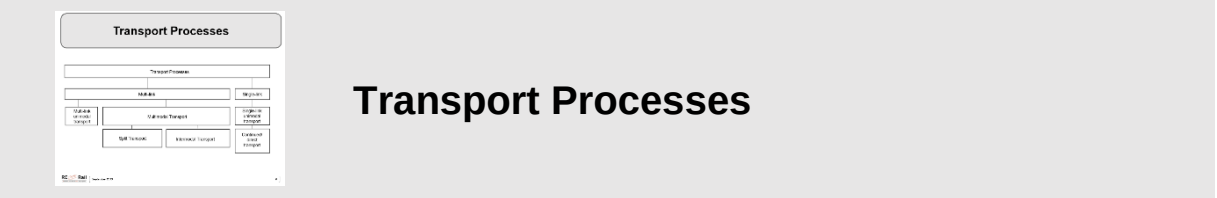


Figure 1: Transport media, modes of transport, means of transport[1]

[1] See Kummer (2010), p. 56 ff. Dolinsek et al., 2013, p. 174f.

The term transport refers to all activities that deal with the relocation of people, goods and communications.[2]

The transport of goods, messages or persons by means of transport is carried out using modes of transport. There are different types of modes and means of transport. A mode of transport offers the infrastructure that must be available for the use of a certain means of transport. Means of transport are vehicles and equipment for transporting people and goods, such as inland waterway vessels, trucks or trains. No transport is possible without this infrastructure. The modes of transport can be on land, on water and in the air. Land, water and air are the so-called transport media. Land transport includes road, rail and pipeline transport, for example. In air transport, for example, aircraft are used as means of transport, while inland waterways, deep-sea shipping and coastal shipping are included in water transport.[3]



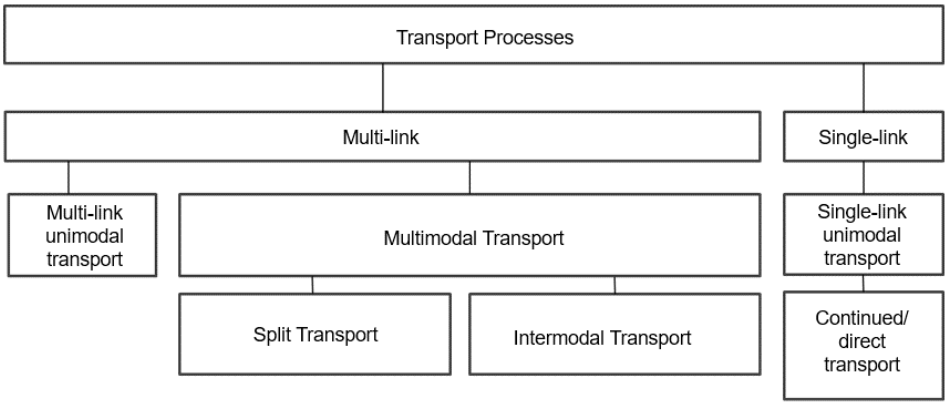


Figure 2: Transport Processes[4]

In the figure a distinction is made between multi-link and single-link transport processes in the first step. While goods are transhipped in multi-carriage transport, no transhipment takes place in single-carriage transport. Direct transport (single-link transport chain) takes place directly from the delivery point to the receiving point, which is why it is also referred to as door-to-door transport. No change of means of transport (e.g. truck, train,

[2] See Kummer (2010), p. 33ff.
[3] See Kummer (2010), p. 56 ff. Dolinsek et al., 2013, p. 174f.
[4] Cf. Dolinsek et al., 2013, p. 175f.

ship) or mode of transport (e.g. rail or inland waterway) is made. Therefore, direct transport is always unimodal (goods are transported by one means of transport from source to destination). Examples of this are port-port transport by inland waterway (e.g. transport of mineral oil from warehouse A to warehouse B).[5]

In multimodal transport, goods are transported using two or more different modes of transport (e.g. switching from water to rail). The goods are transferred from one means of transport to another. The positive properties of the respective carrier can be used, and the most cost-effective and environmentally friendly combination can be selected. Multimodal transport tends to be used for longer and less time-sensitive transports, as time is lost with each transhipment and additional costs incur.[6]

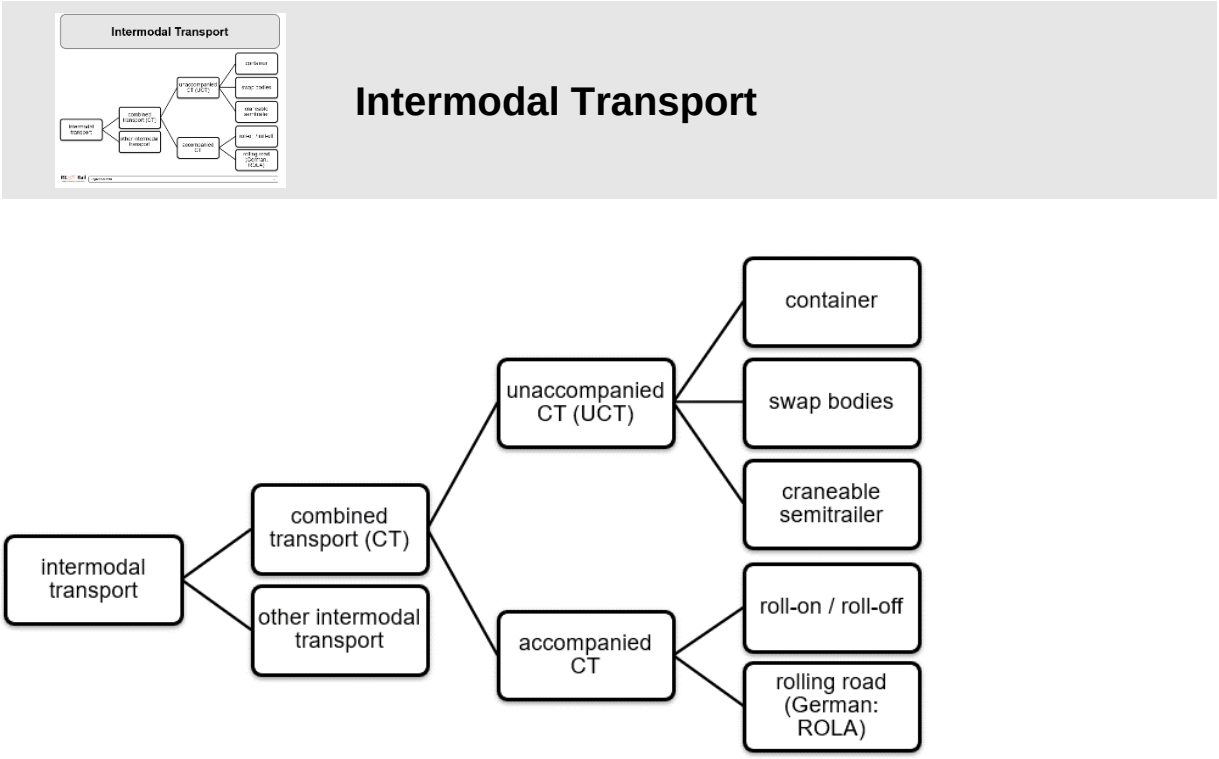


Figure 3: Intermodal transport[7]

Intermodal transport refers to the "transport of goods in one and the same loading unit or road vehicle by two or more modes of transport, with a change of loading unit but no transhipment of the transported goods themselves".[8]

In intermodal transport, loading units are transported from various sources to the transhipment point where the main leg starts. This process represents the pre-carriage. All delivered loading units are transhipped at the terminal onto the corresponding main

[5] See Kummer (2010), p. 40 ff. Dolinsek et al., 2013, p. 175f.
[6] See Kummer (2010), p. 40 ff. Dolinsek et al., 2013, p. 175f.
[7] Own presentation based on Kummer (2010), p. 40 ff. Dolinsek et al., 2013, p. 175f.
[8] UN/ECE (2011), P.17

leg carrier (transhipment process). In most cases this is rail or inland waterway. This mode of transport takes over the major part of the transport route to another terminal (main run). Here again a transhipment takes place for the transport to the destination (on-carriage). The main advantage of intermodal transport is the concentration of traffic flows on a more environmentally friendly mode of transport.[9]

Combined Transport

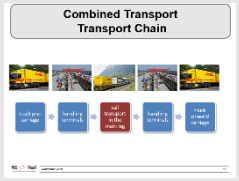
Combined Transport

Combined transport is defined as "intermodal transport in which the major part of the distance travelled in Europe is covered by rail, inland waterway or sea, and the pre- and on-carriage distances by road are kept as short as possible".[10]

Combined transport is thus characterised by transport chains in which standardised loading units, such as containers, swap bodies, trucks or their trailers, are transported successively on different modes of transport. When changing modes of transport in terminals, only the loading units are handled, i.e. the goods remain in the same transport container during the entire transport.

The loading units (e.g. containers, swap bodies) are usually transported individually between the place of dispatch and the point of transhipment (pre-carriage) or point of transhipment and point of receipt (post-carriage). The main leg is the distance between the transhipment points (e.g. transhipment terminal).

Another characteristic of combined transport is that the main leg is covered by an environmentally friendly means of transport, e.g. by rail, but also by inland waterway or sea, while pre- and post-carriage by road is kept as short as possible.[11]



Combined Transport Chain

[9] Cf. Gronalt et al (2010), p. 19
[10] UN/ECE (2011), P.18
[11] Cf. Kummer (2010), p. 57; Becker (2014), p. 39f; Forschungsinformationssystem (2016), online

Figure 4: Transport chain in combined transport[12]

By means of combined transport, truck transports over long distances are shifted from road to rail, i.e. the truck pre-carriage or truck onward carriage usually only takes place over short distances.

Between handling terminals, transport containers are carried by rail in the main leg, which usually corresponds to a longer distance.

One challenge for combined transport is the increased logistical effort, which is reflected in the costs for truck pre-carriage and truck post-carriage, as well as in the transhipment processes and loss of time due to transhipment processes.[13]

Unaccompanied Combined Transport (UCT)

In unaccompanied combined transport (UCT), only the loading units are transferred from one mode of transport to another and onward transported. Driver and vehicle do not accompany the transport and are available for other tasks. At the destination of the main leg, e.g. at a transhipment terminal, suitable trucks and drivers must therefore be available for onward transport.[14]

[12] Sources pictures: DVZ (2017), online; vehicle pictures (2017), online; Verkehrsrundschau (2015), online
[13] Cf. Becker (2014), p. 40
[14] See Gronalt et al (2010), p. 20 f.

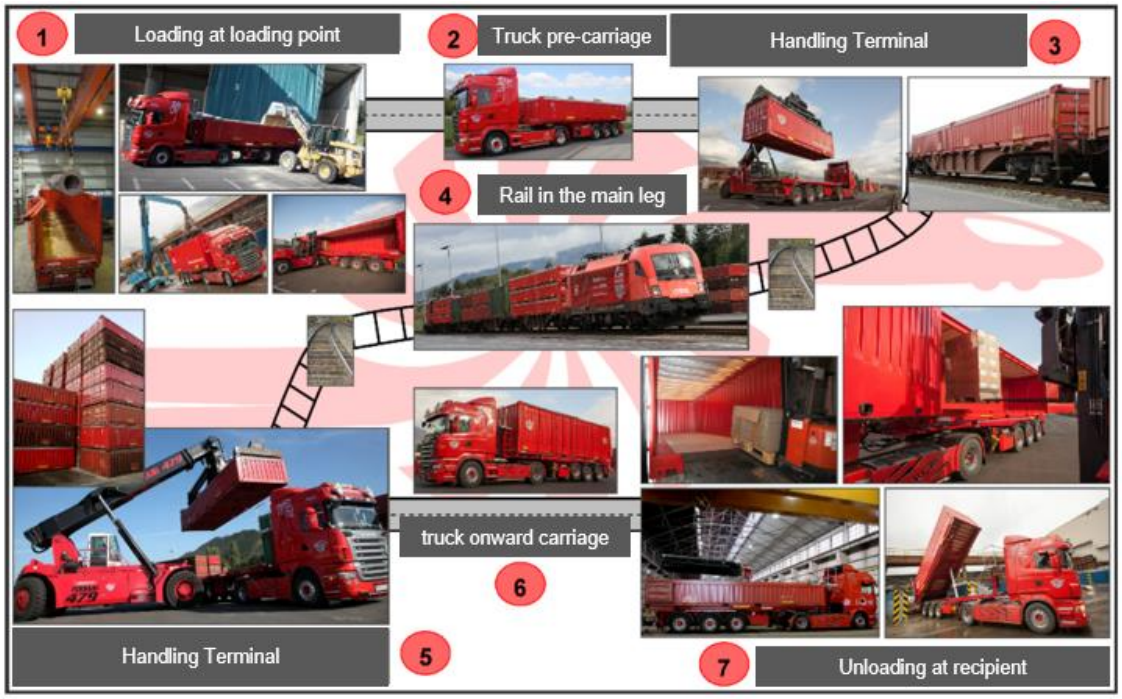
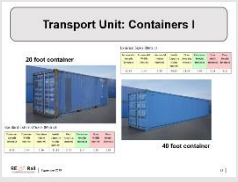


Figure 5: Unaccompanied combined transport (UCT)[15]

The figure above shows the process flow in UCT.[16]

The most important transport units used in UCT are:[17]

- containers
- swap bodies and
- craneable semitrailers



Transport Unit: Containers

The container first gained importance at the beginning of the 1950s. Until today the American origin is reflected in the measurements in foot (´). Advantages of the container are its standardization, robustness and resulting stackability. Its primary disadvantage is the lack of compatibility with Euro pallets, but also the fact that the container can only be parked on the ground, making it often difficult to load or unload.

[15] Montansped (2017), online
[16] Montansped (2017), online
[17] See Gronalt et al (2010), p. 20 f.

According to ISO-Norma the container (International Standardisation Organisation) is the best-known loading unit, with the vast majority of containers having a length of 20 or 40 feet. Their dimensions are primarily oriented towards seagoing vessels.[18]

Figure 6: 20 foot container[19]

Standard External Sizes (Metric)

Container Length (metres)	Container Width (metres)	Container Height (metres)	Inside Capacity (cubic metres)	Floor Area (sq metres)	Container Weight (tonnes)	Door Width (metres)	Door Height (metres)
6.06	2.44	2.59	32.85	13.93	2.44	2.28	2.26

Figure 7: Dimensions 20 foot container[20]

Figure 8: 40 foot-container[21]

[18] See Gronalt et al (2010), p. 51ff.
[19] Carucontainers (2017), online
[20] Shippingcontainers (2017), online
[21] Carucontainers (2017), online.

External Sizes (Metric)

Intermodal Length (metres)	Intermodal Width (metres)	Intermodal Height (metres)	Inside Capacity (cubic metres)	Floor Area (sq metres)	Container Weight (tonnes)	Door Width (metres)	Door Height (metres)
12.19	2.44	2.59	66.83	28.33	4.06	2.28	2.26

Figure 9: Dimensions 40-foot container[22]

The internal dimensions of ISO containers do not permit optimum use of cargo space with Euro pallets widely used in Europe (use of the internal surface area for 20-foot containers: 78%, for 40-foot containers: 85%).

An inland container (according to UIC standard) is a container which has been adapted to European dimensions. With a width of up to 2.55 metres, they correspond to the maximum legal width of road vehicles and the clearance gauge of the railways. Thus, they adapt better to the conditions of European infrastructure and are much more suitable for loading Euro pallets than sea containers with an internal width of 2,420 to 2,440 millimetres.[23]

Figure 10: Flat container[24]

Flat containers are suitable for particularly heavy goods, available in a variety of designs, e.g. with fixed or foldable end walls, with floors of different heights, etc.[25]

[22] Shippingcontainers (2017), online
[23] See Gronalt et al (2010), p. 51ff.
[24] Shippingcontainers (2017), online
[25] See Gronalt et al (2010), p. 53ff.

Figure 11: Open Top Container[26]

Open Top Containers are open at the top and are therefore suitable for transporting goods that are insensitive to weather conditions. They can be covered with nets or tarpaulins.[27]

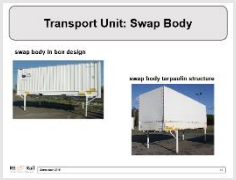
Figure 12: High Cube Container[28]

High Cube containers are suitable for specifically light but voluminous goods, whose structure resembles standard containers, but which are built slightly higher.[29]

[26] Shippingcontainers (2017), online
[27] See Gronalt et al (2010), p. 53ff.
[28] Shippingcontainers (2017), online
[29] See Gronalt et al (2010), p. 53ff.

Figure 13: Refrigerated container[30]

Refrigerated containers ("reefers") are equipped with their own electrical unit, thus enabling transport of temperature-controlled goods.[31]



Transport Unit: Swap Body

A swap body is an exchangeable load carrier which can be separated from the carrier vehicle, e.g. truck. Their development was influenced by the European road haulage industry. Therefore, Euro pallets are usually fully operational. Other designations for swap bodies are: swap body, swap trailer, demount body.

A basic distinction can be made between "box bodies" (made of wood or metal) and tarpaulin bodies, whereby the tarpaulins are usually kept in shape by so-called "hoops" made of wood or light metal.[32]

[30] Shippingcontainers (2017), online
[31] See Gronalt et al (2010), p. 53ff.
[32] Cf. Gronalt et al (2010), p. 56

Figure 14: Swap body in box design[33]

Illustration 15: Swap Body Tarpaulin Structure[34]

For use in combined transport, the swap body is equipped with gripping edges located on the underside, enabling transhipment by rail. For this purpose, cranes at the container terminals have special grab arms to enclose and lift swap bodies laterally.

Swap bodies cannot be used in overseas traffic as they are neither centrally standardised nor registered. They are rarely stackable and do not have the required strength for the torsional forces during sea transport. On the other hand, they are usually equipped with adjustable feet so that they are positioned at ramp height, making loading and unloading easier than ISO containers.[35]

[33] Conzept (2017), online
[34] Conzept (2017), online
[35] Cf. Gronalt et al (2010), p. 56

Transport Unit: Semitrailer

Semi-trailers are special truck trailers that are not attached to the towing vehicle with a drawbar but are hooked into a recess in the chassis of the truck towing vehicle using "kingpins".[36]

Figure 16: Semi-trailer

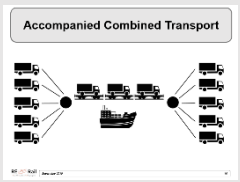
Figure 17: King pin

Figure 18: Side-open semi-trailer with sliding tarpaulin

[36] See Gronalt et al (2010), p. 58 ff.

Figure 19: Craneable semi-trailer[37]

Craneable semi-trailers can be used in both accompanied and unaccompanied combined transport, non-craneable semi-trailers, with a few exceptions, can only be used in accompanied combined transport (rolling road).[38]



Accompanied Combined Transport

In accompanied CT, trucks with trailers or articulated vehicles (articulated lorries and semi-trailers) are mainly loaded onto low-floor wagons at the terminals provided for this purpose in rail transport. Accompanied road - ship combined transport may also be possible, although road - ship combined transport is usually unaccompanied.[39]

Rolling Road (German: ROLA – Rollende Landstraße)

If a truck with tractor unit and semi-trailer or trailer is completely carried by rail (on low-floor or pocket wagons) and the truck driver drives in the couchette rail car, this is referred to as the "Rolling Road/Highway". For all other CT transports, transport is by rail without staff assistance.[40]

[37] LKW Walter (2017), online
[38] See Gronalt et al (2010), p. 58 ff.
[39] Cf. Gronalt et al (2010), p. 22
[40] Cf. Becker (2014), p. 14

Advantages of the rolling road:

Figure 20: Rolling Road (ROLA)[41]

If efficiency of CT is to be assessed, the relationship between payload and deadload must be considered. While, for example, the weight of the tractor and trailer of the rolling road is very high in relation to the transported weight of goods, this ratio is relatively favourable for swap bodies.[42]

Roll-on / Roll-off

Roll-on-Roll-off (RoRo) means the loading and unloading of a motor vehicle or railway wagon onto or from a ship, using its own wheels or wheels which have been placed under cover for this purpose. In most cases this constitutes unaccompanied combined transport.[43]

[41] Eurotransport (2017), online
[42] Cf. Becker (2014), p. 14
[43] See Gronalt et al (2010), p. 21f.

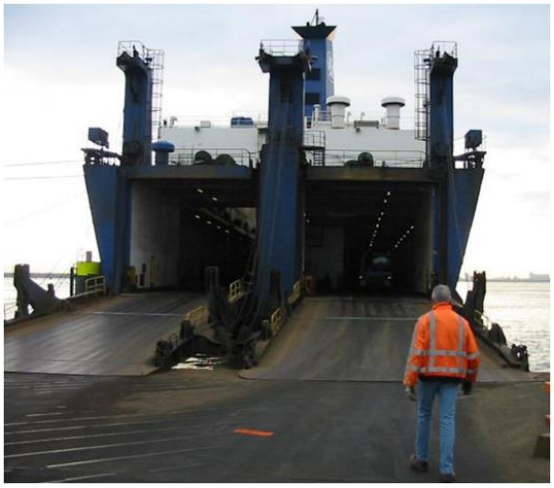


Figure 21: RoRo ship

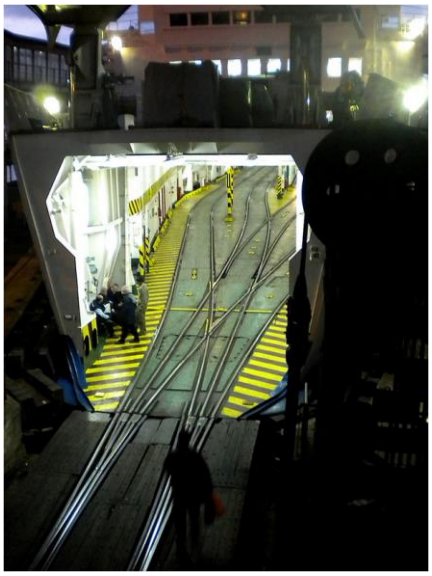


Figure 22: railway ferry

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