RE Trans
Research & Education on Transport Logistics

Reader

Road Transport
Basics

Section:

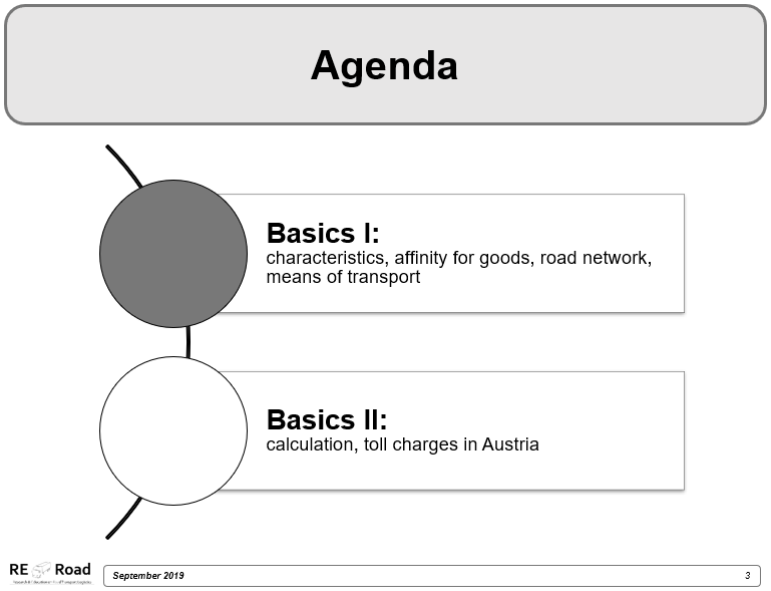
RE Road
Research & Education on Road Transport Logistics

This reader supplements the Power Point presentation on road transport basics 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

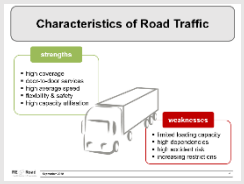
Overview

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



Basics I

Characteristics, affinity for goods, road network, means of transport



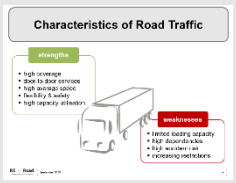
Characteristics of road traffic

According to Kummer, road transport is characterised by the following strengths and weaknesses:[1]

Strengths	Weaknesses
High degree of coverage: mainly achieved by high road network density. **Door-to-door traffic:** Direct connection to customers as well as an increase in the degree of individualisation of the service provision is made possible. The advantage over other modes of transport is that very few companies have direct access to a track,	**Limited loading capacity:** Compared to other modes of transport, road transport can only transport heavy objects or objects with a larger volume to a limited extent. As a rule, this requires special permits, which are relatively costly in terms of planning, implementation and costs. **High dependencies:** Road traffic is heavily dependent on existing road conditions (e.g. black

[1] Cf. Kummer (2010) p. 86 f.

waterway, airport or pipeline. The road is much more flexible. **High average speed:** Regardless of external factors (e.g. traffic jams), road transport/traffic has a high average speed not least due to the available road network and good coverage. **Flexibility and security:** Flexibility is mainly created above by door-to-door services options and quickly realisable operational readiness. The safety aspect lies on the one hand in transport safety devices and in the assumption of personal responsibility by the driver. **High occupancy rates:** High occupancy rates are created, among other things, by targeted planning agendas or measures in scheduling.	ice, rain) and the current traffic situation (e.g. traffic jams, bypasses). **Highly accident-prone:** The high risk of accidents results primarily from the fact that there is high traffic density on the road (characterised by short distances to cars following behind) and that some drivers do not comply with speed limits. **Increasing restrictions:** Increasing political regulations (e.g. extension of driving bans or subsidies for alternative vehicles) or social resistance are hampering the development of road traffic.



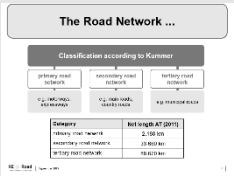
Road Transport & its Competitors ...

In this presentation, the focus of the competition analysis was on rail transport and inland waterway transport due to the project objectives. In comparison to road transport, rail has a higher mass efficiency (thus a corresponding suitability for heavy or voluminous transport objects) not least due to its larger dimensions, as well as higher requirements in connection with safety agendas. Road transport, on the other hand, scores with its door-to-door service for its customers. Like inland navigation, rail transport can only offer terminal-to-terminal transport. Only very few customers have a direct rail or waterway connection. This in turn necessitates the use of road traffic to overcome the first and last mile and means less flexibility for the customer and the operator of the respective means of transport. One of the topics often discussed in connection with inland navigation is transport time. Many companies do not generally rely on inland navigation due to the longer running time or transport time and the higher packaging requirements. The high demands placed on packaging particularly, are of great importance for the protection of the transport object due to current weather conditions.[2]

[2] Cf. Kummer (2010) p. 86 ff.

Affinity for Goods in Road Transport

Media reports and public discussions usually focus their attention on the importance and significance of road transport for society. There is agreement among Austrian transporters that without road transport many products of daily use would no longer be available or would only be available to a limited extent. Above all, perishable goods, such as fruit or vegetables, goods with special requirements, such as milk or eggs which need to be refrigerated, or the daily available newspaper depend on road services. Wider analysis also shows that road plays a dominant role in parcel collection, the parcel distribution sector and in the waste transport sector, which is already taken for granted. Without these, many products or services (e.g. also in medicine) would not be possible. The consequences of complete non-use of the road are not to be underestimated. Many companies or other modes of transport are dependent on road transport and could no longer carry out most of their activities if road transport was completely forgone or banned. The consequences would be production bottlenecks, empty shelves in supermarkets, unemployment or declining economic output. Of course, it should be noted in this context that heavy goods vehicles cannot be the "panacea" of road transport and that alternative options, depending on their design (e.g. cargo bicycles or electric drive), may also have future potential. The choice always depends on various factors, such as urgency, convenience or consignment size. Depending on these requirements, this must be weighed accordingly.[3]



Road Traffic Network

Following classification according to Kummer, a road network can be divided into three categories. On the one hand, a distinction is made between the primary road network, which primarily serves "supra-regional transport and national and international long-distance transport"[4] with several lanes in one direction. Motorways or expressways belong in this category. On the other hand, according to Kummer, a further distinction is made between secondary and tertiary road networks. Secondary road networks include "all other roads of supra-regional importance"[5], serve regional traffic and as a connection to the primary road network. Examples in this context include main and state roads. The

[3] Cf. Die Transporteure (2010) online; Cf. Kummer (2010) p. 86 f, 123.
[4] Kummer (2010) p. 175.
[5] Kummer (2010) p. 175.

function of the tertiary road network lies mainly in the establishment of land closures and the implementation of local movements. Municipal roads are usually cited as a typical example of tertiary road networks.[6]

The overall transport plan published by the Federal Ministry of Transport, Innovation and Technology covers a road network in Austria of around 124,510 km. Of these, around 1.7 % concern the primary road network (in absolute figures: 2,180 km), around 27 % the secondary network (in absolute figures: 33,660 km) and around 71.3 % the tertiary road network (in absolute figures: 88,670 km).[7]

The following two maps illustrate the structure and distribution of Austrian and European road networks in more detail. Closer analysis of the higher-level road network shows that in Austria alone, mainly good connections between the large cities in the provinces and sufficient options for "fine distribution" through secondary road networks (e.g. main or regional roads) exist. To meet the growing challenges of the future, ASFINAG has published plans for further investments in the road network in 2016. Figure 1 provides an overview of the existing high-level road network and the investment projects planned for 2016 in Austria:

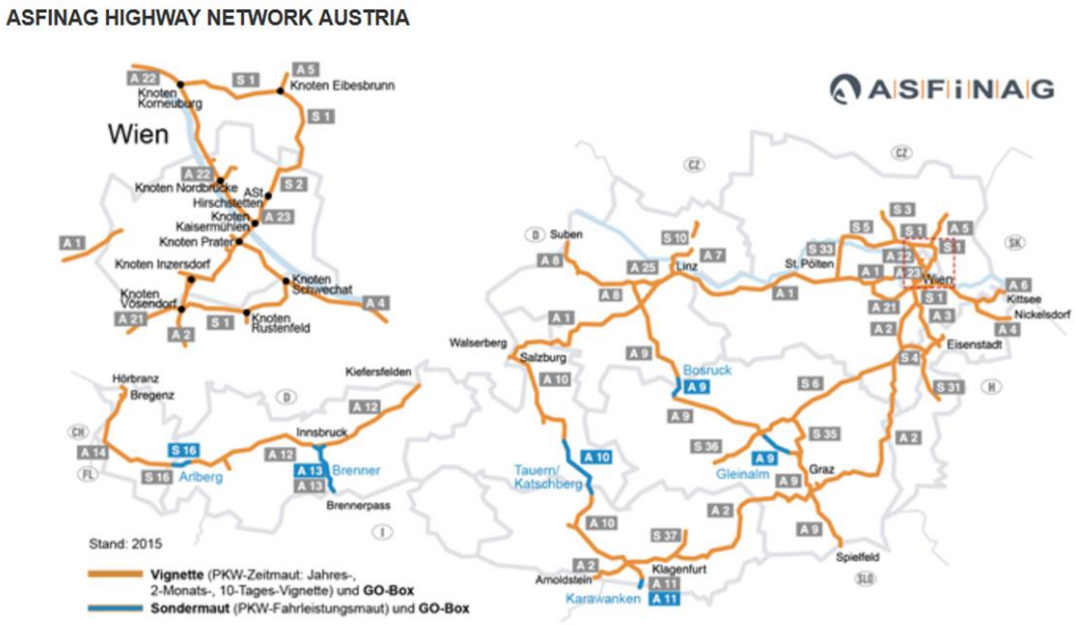


Figure 1: High-level road network in Austria (including investment projects)[8]

Figure 2 shows that the European road network as such has - combined with area-related higher levels - predominantly good coverage.

[6] Cf. Kummer (2010) p. 175.
[7] See BMVIT (2012) p. 1.
[8] ASFINAG (2019) online.

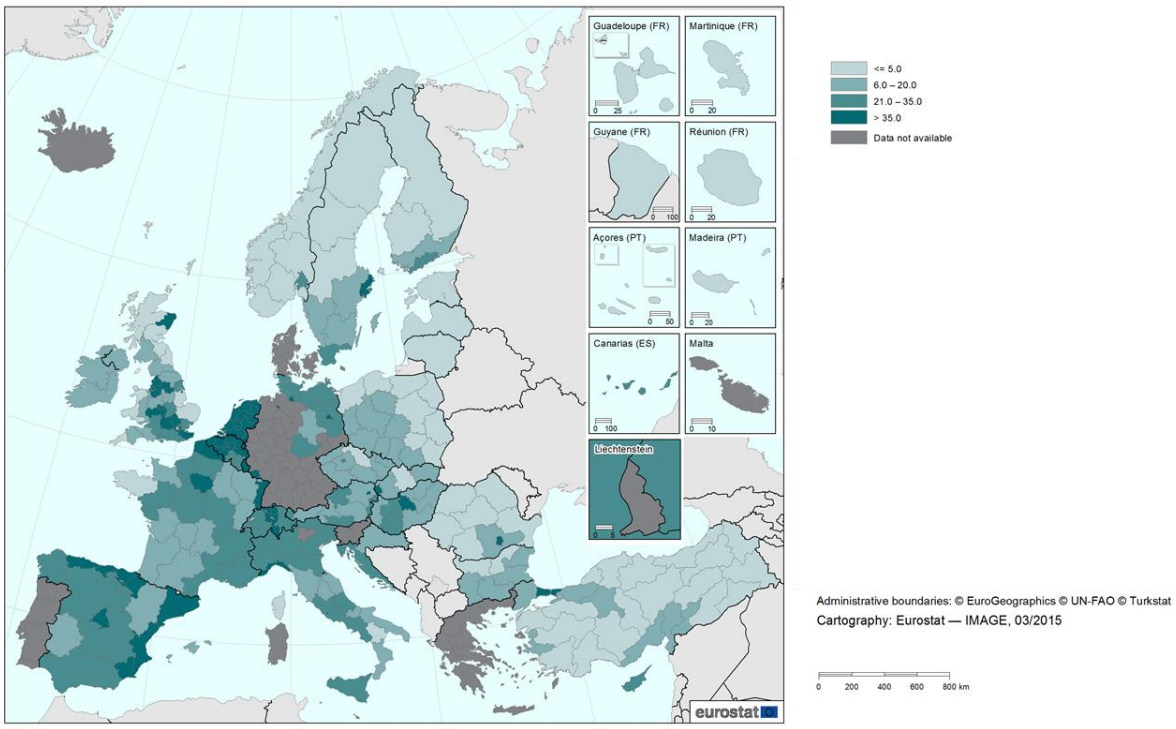
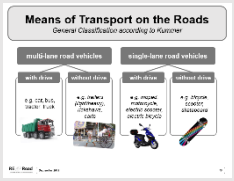


Figure 2: Road network density in Europe[9]



Means of Transport on the Roads

Just as a reminder, according to Kummer, means of transport are "technical or natural facilities for transport and transhipment of transport objects (goods, persons or messages)".[10] This term should not be confused with the term "mode of transport" which includes all means of transport using "the same type of transport infrastructure".[11] To provide a better overview Kummer has drawn up a general classification of the various road-related means of transport. In a first step, a distinction is made between multi-lane and single-lane (depending on the design) road vehicles. For the sake of clarity and better classification of the individual means of transport on the road, Kummer once again subdivides between those means of transport on the road that function with or without drive. The classic cars of passenger transport, buses (e.g. in public transport or tourism), tractors and classic trucks in freight transport form multi-lane road vehicles with propulsion. Without propulsion, multi-lane vehicles include trailers (depending on weight as light or heavy trailers), carts or the rickshaw (a basic idea of locomotion from India, which today is often used in the context of bicycle rickshaws for daily tourism in many cities of the world). In addition to the multi-lane means of road transport, a distinction is

[9] Eurostat (2015) online.
[10] Kummer (2010) p. 39.
[11] Kummer (2010) p. 40.

also made between single-lane options. Single-track road vehicles with drive systems include the well-known moped, motorcycle or scooter with electronic drive. Examples of single-track vehicles on the road that do not require a drive include the classic bicycle, scooter and skateboard.[12]

In the case of motor vehicles used for road freight transport, a distinction can be made between light, medium and heavy vehicles according to the different weight categories according to Kummer. Light goods vehicles are particularly important for the distribution of parcels, for express and courier services (= conditions where fast delivery or direct delivery to a transport object is necessary), for everyday activities in the craft sector (e.g. a carpenter delivers and assembles the furniture to the Mayer family) and also in the private sector (e.g. for the transport of furniture during a move or when moving into a new home). The maximum legal total weight for light goods vehicles is 3.5 tonnes. In addition to light vehicles, our everyday life would be inconceivable without medium-weight goods vehicles. Cargo road vehicles with a maximum legal weight of between 3.5 and 12 tonnes are assigned to this category. Medium-duty goods vehicles are used, for example, to supply construction sites with the necessary resources for further construction progress, to collect waste or to distribute general cargo (e.g. parcels). In everyday life, residents must predominantly put up with heavy goods vehicles, which are often used for urban and interurban deliveries due to their higher load-bearing capacity. For this type of goods vehicle, the maximum legal total weight is between 36 and 60 tonnes (e.g. in Asia or Europe) or between 36 and 125 tonnes (e.g. in Australia, the USA or Canada). In this context, it should be noted that in Austria the maximum legal total weight is 40 tonnes, which may not be exceeded by heavy goods vehicles (except with a corresponding special permit and associated restrictions or requirements). Heavy goods vehicles are particularly suitable for improving the connection between larger hubs in a network (e.g. Post AG's day-to-day business: parcels and mail are taken from regional post offices to mail centres responsible for different Austrian provinces, transhipped between the large hubs and finally distributed at regional level) and, due to the larger dimensions, for transporting heavy or overlong goods (e.g. transport of a fuselage section of an aircraft on the motorway) with the corresponding special permit.[13]

In everyday road transport, the term "articulated lorry" comes up. A semitrailer truck is the combination of a semitrailer tractor (= drive area of the semitrailer truck) and a trailer or semi-trailer (= loading area of the semitrailer truck). A truck of this type has an external length of around 16.5 m and a cargo hold of around 90 m3 (corresponding to a cargo floor of around 34 Euro pallets). The articulated train is longer than the articulated lorry. A link train is a combination of swap bodies (usually with a corresponding motor vehicle)

[12] Cf. Kummer (2010) p. 194.
[13] Cf. Kummer (2010) p. 195.

connected like links on a chain (e.g. a necklace) and together form a "train". The total length of this truck type is around 18.75 m, with a total cargo area of around 36 Euro pallets (equivalent to a cargo hold of around 94 m3).[14]

The formation of load and transport units plus the use of securing means (e.g. belts, trend walls) are as important as the transport operation. For a good to be carried from starting point (= source) to destination (= sink) a carrier or freight forwarder requires at least one load and a corresponding means of transport. However, not every load can be loaded immediately onto an appropriate means of transport (such as a semitrailer truck for road transport). As a rule, loads require "aids" which, according to Kummer, can be subdivided into loading devices, carriers and transport equipment. It should be noted, however, that not every load must use every "aid". The choice depends on individual requirements and must be applied accordingly.[15]

The following examples illustrate this point:[16]

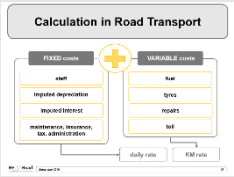
- Let's assume, for example, winter is approaching and OMV, carrying out placed orders, is transporting heating oil from its refinery to households in the Vienna area. The oil is pumped directly from the silo (= storage facility) into the tank truck (= means of transport). Due to the nature of the means of transport no additional loading aids (e.g. packaging), load carriers (e.g. pallet) or other transport equipment (e.g. container) are required here.
- From a different perspective, would there be any changes if the oil were carried by train? Let us assume that OMV transports a large amount of oil by rail from Schwechat to Linz to a branch office for further distribution. Due to the nature of the means of transport, direct loading of the oil is not possible. Smaller cartons or boxes make no sense for easier loading of the oil. Nobody wants to pour the oil from e.g. a cardboard box into a silo at its destination. The nature of the load it necessitates the next transport unit, a transport aid. In this case a tank container facilitates loading onto a train without major requirements. With additional support the means of transport can thus meet the requirements.
- The ideas pointed out so far can be applied to another example. This time, a larger number of glasses of a certain type are delivered (= cargo) from the central warehouse of a furniture store to its individual branches in the Vienna area. Reasonably, a semitrailer truck (= means of transport) is deployed for this purpose. If the employee of the central warehouse placed each glass individually on the articulated lorry, it would take days, if not weeks, for the glasses to be delivered. Further, this would also significantly increase the risk of damage. So,

[14] Cf. Kummer (2010) p. 194 f.
[15] Cf. Kummer (2010) p. 203 ff.
[16] Kummer (2010) p. 203 ff and in cooperation with Mario Dobrovnik, MSc. (University of Economics and Business Administration Vienna, Institute of Transport Economics and Logistics)

to make loading faster and safer, several glasses are packed together, e.g. in a carton (= loading aid). Loading individual cartons would be much better compared to the previous approach but is still not satisfactory or efficient. For faster and safer loading, several cartons are now placed on one pallet (= load carrier) and secured accordingly. With the help of the pallets now formed, the loading space in the semi-trailer is filled. The semi-trailer as a transport aid enables the furniture store to transport the goods in the first place. The tractor alone would not be able to deliver the full array of goods. It does not even have a corresponding storage area.

- This process of creating "transportable" units can also be seen in the daily deliveries to grocery stores. Hygiene articles, such as shampoo or fragrances, are also combined in cartons (= loading aids). Then several cartons are grouped together on a roller container (= load carrier), which is usually consolidated for a specific store. This is vital as it keeps the driver's stay at the delivery location - the store - as short as possible. In this example, a motor vehicle is used as the means of transport. No further transport aid is necessary for this, as the motor vehicle has - in combination with the drive - its own transport space.

Basics II
Calculation, toll in Austria



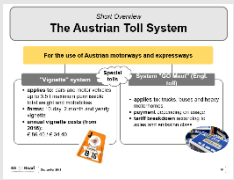
Calculation in Road Freight Transport

Like in any other company, road haulage operators have to calculate their costs in order to sell their services to different customers at a good price. According to cost accounting, both fixed (i.e. activity-independent) and variable (i.e. activity-dependent) costs are part of road transport calculation. The long-term goal is to cover all costs to guarantee further liquidity of the company.[17]

In road freight transport, the following costs, among others, may be incurred by a carrier or a freight forwarder with its own operations:[18]

fixed costs	variable costs
▪ staff ▪ imputed depreciation ▪ imputed interest ▪ maintenance, insurance, tax, administration	▪ fuel ▪ tyres (tyre wear) ▪ repairs ▪ toll

Individual costs are taken into account as kilometre rates (to cover variable costs based on annual average mileage) and daily rates (to cover the pro rata fixed costs broken down by operating days) as part of road transport calculation.[19]



The Austrian Toll System

Despite growing discussion about the introduction of a comprehensive toll system, only use of motorways and expressways is currently subject to the Austrian toll system. A general distinction is made between the "Vignette" system and the "GO Maut" system, the use of which is primarily dependent on the maximum permissible total weight of vehicles. Tolls and user charges are collected by ASFINAG (Autobahnen- und Schnellstraßen-Finanzierungs-Aktiengesellschaft). The "Vignette" system applies to cars and motor vehicles up to a maximum permissible total weight of 3.5 tonnes and to motorcycles. Owners of vehicles covered by this scheme must purchase a vignette for

[17] Cf. Kummer (2010) p. 88, 345 ff.
[18] Cf. Kummer (2010) p. 88, 345 ff.
[19] Cf. Kummer (2010) p. 88, 345 ff.

the use of Austrian motorways and expressways and affix it to the windscreen at the points provided for that purpose. Vignettes come as 10-day, 2-month or annual versions for which a one-off payment is made, allowing road network use without restriction during this period. In comparison, the "GO Box" system is characterised by the opposite principle. It applies to lorries, buses and heavy motor caravans which exceed the maximum permissible weight limit specified in the vignette system. In the "GO Maut" (Engl. toll) system, toll fees depend on the distance travelled. High-level road network use (= primary road network), incurs a corresponding fee. This means that each distance travelled is calculated separately or anew and no one-off amount is charged, as with the "Vignette" system. Individual tariffs depend on the number of axles and the respective emission class. The following applies: the better the emission class, the lower the applied tariff. The distance travelled by the vehicle is recorded by a mobile device, the "GO Box", which must be placed inside the vehicle on the windscreen. The "GO Box" employs microwave technology, a form of data transmission, to communicate with a toll portal (= a kind of thin steel bridge stretched across the road), which forms the basis for toll calculation. The advantage of the Austrian toll system is that the toll debit is not influenced by the lane used or the selected speed. This principle is also known in science as the "Multilane-Free-Flow" system.[20]

[20] See ASFINAG (2016b) online; see ASFINAG (2016c) online; see Kummer (2010) p. 272 ff.

Here is an overview of current tariffs:

GO toll rates 2019

The overall toll rates for 2019 with "external costs"

Distance-related toll

including surcharges for air and noise pollution

for motor vehicles with a maximum permissible weight of over 3.5 tonnes

from 1 January 2019

EURO emission class/drive type	Category 2 2 axles		Category 3 3 axles		Category 4+ 4 axles and more	
	Day	Night*	Day	Night*	Day	Night*
Drive type E/H2	0,18550	0,18590	0,26033	0,26125	0,39011	0,39127
EURO emission class EURO VI	0,18820	0,18860	0,26411	0,26503	0,39443	0,39559
EURO emission classes EURO V and EEV	0,20240	0,20280	0,28399	0,28491	0,41875	0,41991
EURO emission class EURO IV	0,20870	0,20910	0,29281	0,29373	0,42883	0,42999
EURO emission classes EURO 0 to III	0,22870	0,22910	0,32081	0,32173	0,46083	0,46199

Rates in EUR per km, excl. 20 % VAT

Figure 3: Current tariffs for the "GO Maut" system[21]

It should be noted that special fares apply on certain routes in Austria (e.g. Pyhrn or Tauern motorways), added to the tolls already paid under the "Vignette" or "GO Maut" system.[22]

[21] ASFINAG (2019b) online.
[22] See ASFINAG (2016d) online.

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