European Commission

Case study analysis of the burden of taxation and charges on transport

Final report

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CONTENTS

LIST OF ABBREVIATIONS

ETS	European emission trading scheme
HGV	Heavy goods vehicle
HSL	High speed link
LCV	Light commercial vehicle (van)
LTO	Landing and take-off cycle
IC	Internal costs
IWT	Inland waterway transport
MC	Motorcycle
Pkm	Passenger kilometre
PLI	Price level indicator
PSO	Public service obligation
PTE	Personal transport equipment
T&C	Taxes and charges
TEN-T	Trans-European transport networks
TEU	Twenty foot equivalent unit
Tkm	Tonne-kilometres
VAT	Value added tax
Vkm	Vehicle-kilometre

SUMMARY

Background of the study

This study has been carried out in the context of the broader work on internalisation of external costs of transport. External costs are costs to society that, without policy intervention, are not reflected in the costs actually borne by transport users. Transport users are thus faced with incorrect incentives for transport supply and demand, leading to welfare losses for the society as a whole. Internalisation, which is often referred to as the 'user pays' and 'polluter pays' principle, means that these costs are made part of the decision making process of the users, usually by use of market based instruments. The principle is inter alia also crucial for any discussion on multi-modal transport and in a broader sense on the circular economy.

Many studies have been carried out on external costs, infrastructure costs, internalisation and transport pricing. A methodology for calculating external costs was provided in the 'Handbook on estimation of external costs in the transport sector' by CE Delft and INFRAS in 2008 which was updated by Ricardo in 2014. Total levels of external costs for the various transport modes have been calculated and assessed in detail in 'External Costs of Transport in Europe' in 2011 by CE Delft et al. The level and structure of transport taxes have been thoroughly investigated in the study 'An inventory of measures for internalising external costs in transport in 2012' by CE Delft et al.

The 2011 White Paper on Transport showed that the transport sector faces significant challenges. Internalisation of external costs is one of the leading principles of EU transport policy contributing to solving these challenges. Recently, the European Parliament has called for renewed efforts in internalisation and also the Commission Communication of 2016 on 'A European Strategy for Low-Emission Mobility' emphasizes the need for making steps forward in applying the 'polluter pays' and 'user pays' principles. In 2017 further steps have been taken by the adoption on 31 May of a proposal for a revised Eurovignette Directive as part of the Clean, competitive and connected mobility package. In addition, an extensive study has been launched by the Commission to support the next steps towards the internalisation of external costs of transport in the EU.

Objectives and limitations of the study

The main objective of the study is to provide information in the area of taxation and charging in the transport sector. The study should help analyse the burden of taxation and charges put on different modes of transport, with a view to better compare the framework conditions in which various transport modes operate. To the extent possible, given the data limitations, the study takes into account subsidies to transport operations or modes, which are important when comparing the framework conditions across modes.

This study provides data on the fiscal burden of both passenger and freight transport modes for twenty European corridors.[1] It therefore contributes important data for the

[1] Corridors in this context are defined as selected routes. They should not be confused with the trans-European transport network (TEN-T) corridors.

broader and more extensive study launched by the Commission in 2017 on internalisation measures, external costs and infrastructure spending. The present study exemplifies for concrete situations crucial elements for any discussion on the relative burden of different transport modes. This is done in a quantified way as much as possible, and qualitative conclusions are drawn when quantification is not possible.

For a proper assessment of the framework conditions of the various transport modes, the (variable) taxes and charges of each mode should be compared with the (marginal) external and infrastructure costs of the same mode. Differences between the cost coverage ratio of the various modes can be regarded as an indicator for the level playing field (as long as all relevant external and infrastructure costs, taxes, charges and subsidies are included). By definition this study provides only part of the information needed for estimating the cost coverage ratios. Only taxes, charges and subsidies are assessed, but external cost and infrastructure cost are out of scope. Building inter alia on the information collected by this study, the Commission has launched another extensive study which aims to give a comprehensive update of internalisation measures, external costs and infrastructure spending. This should enable a proper comparison of the framework conditions of the various transport modes.

In this study, the relevant taxes, charges and subsidies for specific (EU-average) reference vehicles are assessed and compared for each of the corridors, applying an end-user approach (travellers for passenger transport and transport operators for freight transport are considered the relevant end-users). For many taxes/charges, the rate applied depends on vehicle/vessel characteristics (e.g. weight, CO_2 emissions, noise class, etc.). Therefore, an important caveat is that the fiscal burden estimated for the various transport means depends heavily on the reference vehicles, as well as the load factor chosen.[2] For other vehicle types, the tax burden can be different.[3]

The scope of taxes/charges may (slightly) differ between transport modes, as for particular services the costs are covered by charges for one transport mode while for other modes these costs may be part of the internal costs.[4] This may, for example, be the case for ground-handling charges for cargo aviation, which cover the costs of ground-handling services on the airport. The costs of similar services in maritime ports may, however, be considered internal costs.[5]

Furthermore, it is also important to note that transport decisions of users are also affected by factors like the internal costs, average transport times, reliability and flexibility of transport modes, and for passengers also comfort and social aspects

2 For other load factors, the burden per tonne or passenger will be different (e.g. in the case of full load, it will be lower for each mode). The EU-average load factors are in line with those used by CE et al. (2011); however, load factors can differ largely per country or vehicles.

3 Often discounts are applicable for cleaner vehicles. Discounts can be given by lowering toll costs for cleaner vehicles, reducing port charges for cleaner vessels or lower LTO charges for airplanes with less noise production. The vehicles used in this study represent EU averages, and as a result are not subject to all possible environmental discounts.

4 Internal costs are costs other than taxes and charges. Internal costs include the cost of vehicle purchase or lease, use and maintenance, energy use, driver and organisational costs, and profit margin. See appendix E for a detailed discussion on internal costs considered in this study.

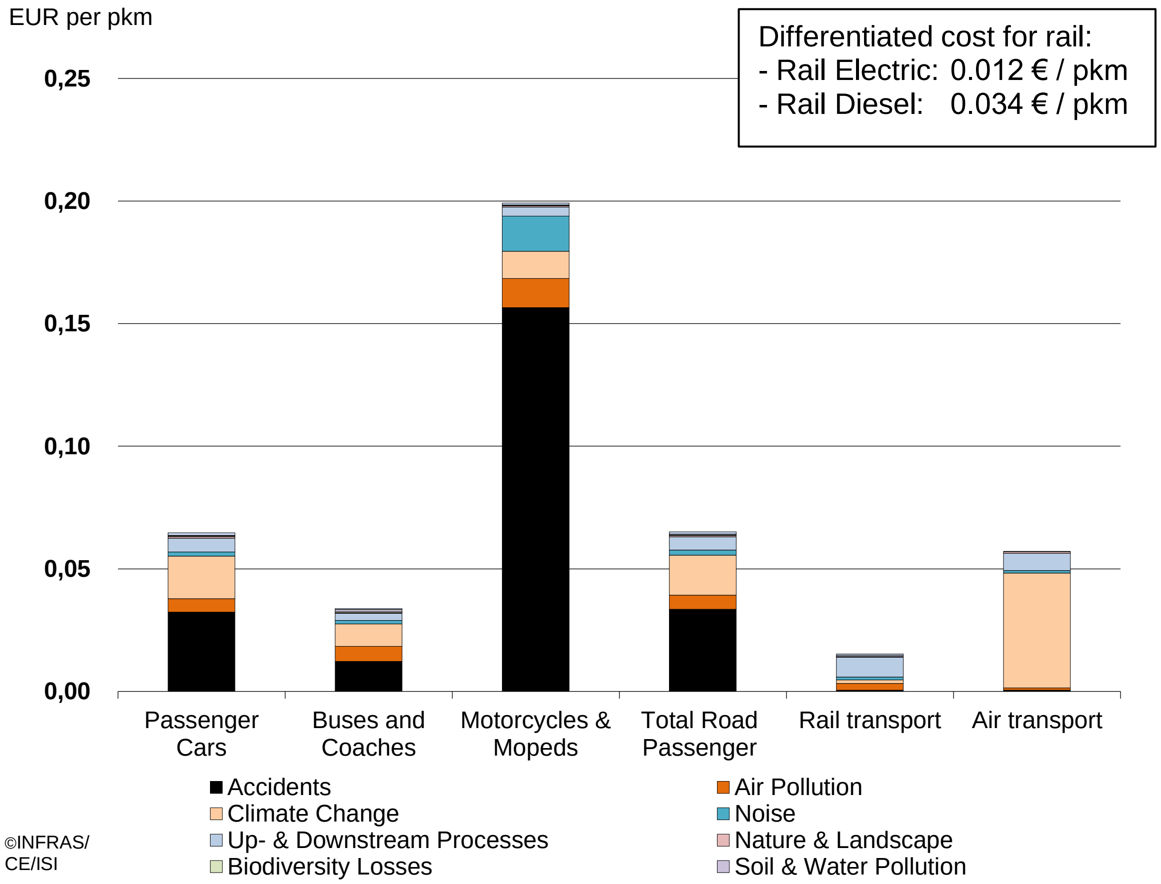
5 Ground-handling charges are considered by type of flight in this study and cover the costs of ground-handling services on the airport. For vessels it is less clear which facilities will be used, and therefore these are considered internal costs.

(such as changing mobility patterns, attitude towards car ownership etc.). All these factors can be partly seen as intrinsic characteristics of the transport modes, but they depend on some other factors as well. The most prominent of these factors are the availability and quality of transport infrastructure, differences in regulation (e.g. environmental regulation, operational regulation) and broader transport subsidy schemes (e.g. rail public service obligations, subsidies for rolling stock).

Previous findings on external costs

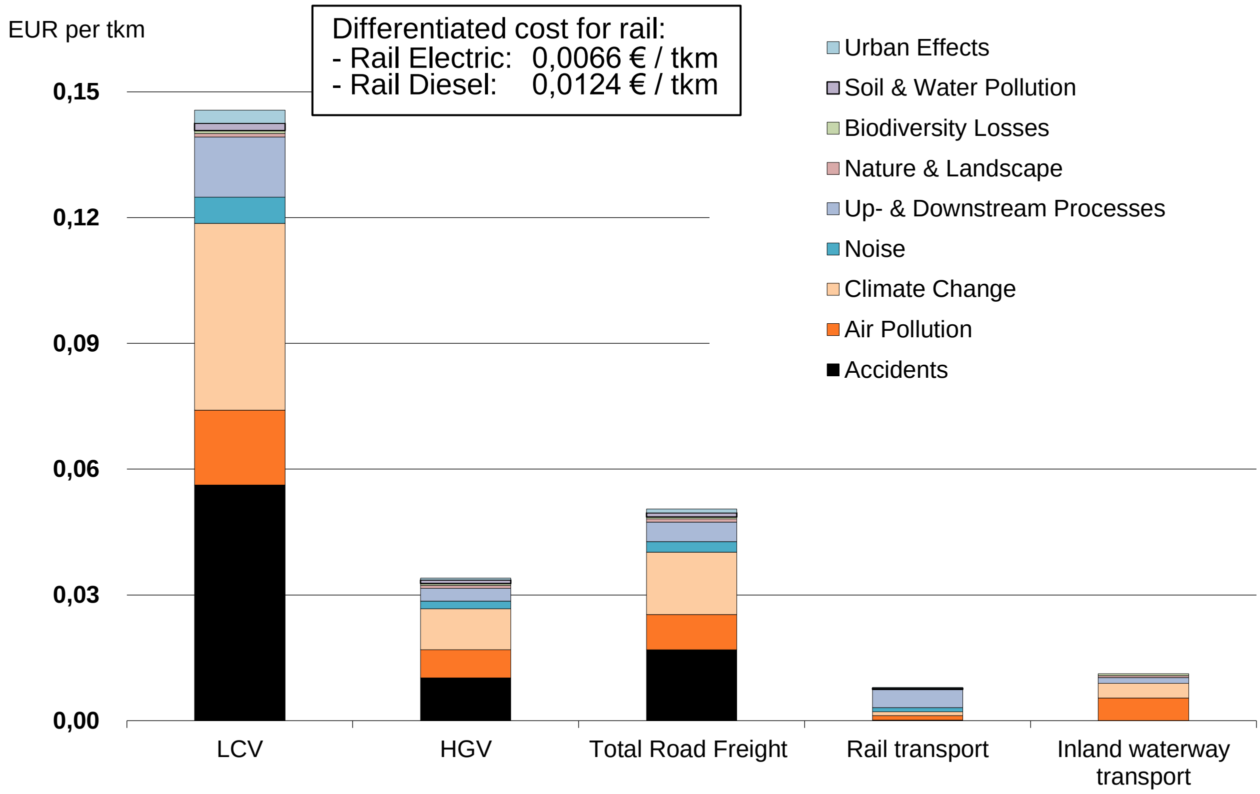
The 2011 study on external costs by CE Delft shows that in 2008, apart from motorcycles, the external costs per passenger-kilometre were highest for cars and aviation (on average about 6 €ct), while for coaches they were about 3 €ct and for rail transport about 1.5 €ct. These figures do not cover infrastructure costs. They are included here to provide some context for the tax burden values discussed below.

Figure 1 Average external costs of passenger transport modes in 2008 (CE Delft et al, 2011)



Also for freight transport, road transport shows considerably higher external costs (on average more than 5 €ct per tonne-kilometre in 2008), than those of rail freight transport (less than 1 €ct) and inland waterways (less than 1.2 €ct).

Figure 2 Average external costs of freight transport modes in 2008 (CE Delft et al, 2011)[6]



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Overview of the corridors

An overview of the corridors considered in this study is given in Table 1. These corridors provide a good geographical coverage; they cover all trans-European transport network (TEN-T) corridors, all main transport modes and different types of freight transport (container/general cargo and bulk) and all different types of taxes, charges and subsidies applied in Europe. Therefore, they provide a good reflection of the transport operations on the TEN-T network.

Table 1 Overview of the corridors

International corridors	National corridors
• Paris – Amsterdam • Paris – Madrid • Antwerp – Warsaw • Amsterdam – Frankfurt • Frankfurt – Budapest • Rome – Berlin • Hamburg – Prague • Helsinki – Gdansk • Lisbon – Antwerp • Stockholm – Hamburg • Genoa – Rotterdam • Budapest – Milan • Bucharest – Warsaw • Dublin – Amsterdam • Athens - Vienna	• Paris - Marseille • Hamburg - Munich • Gdansk – Katowice • Madrid - Barcelona • Milan – Naples

[6] LCV stands for Light Commercial Vehicle (van) and HGV for Heavy Goods Vehicle.

Taxes, charges and subsidies considered

An overview of the taxes and charges considered in the study is shown in Table 2 (passenger transport) and Table 3 (freight transport). These taxes and charges are not applied on all corridors. For example, urban road pricing schemes are only applied on the corridor Stockholm – Hamburg. On the other hand, fuel taxes are examples of taxes that are applied on all corridors. Value-added tax (VAT) is not shown for freight transport as it can be deducted by freight operators.

Next to these taxes and charges, relevant subsidy schemes are assessed as well. These include energy tax exemptions (e.g. for shipping and aviation), VAT exemptions (e.g. for international aviation) and exemptions from infrastructure charges (e.g. charges for using locks and bridges).

Table 2 Passenger transport taxes and charges

Passenger cars	Coaches	Rail transport	Aviation
• Fuel taxes • Ownership tax • Registration tax • Insurance tax • Distance-based road charges • Time-based road charges • Tolls on specific parts of the network • Urban road pricing schemes • VAT[7]	• Fuel taxes • Ownership tax • Registration tax • Insurance tax • Distance-based road charges • Time-based road charges • Tolls on specific parts of the network • Urban road pricing schemes • VAT	• Fuel taxes • Electricity taxes • Infrastructure charges • Charges for specific infrastructure • VAT	• Aviation taxes • Passenger related charges • LTO[8] / landing charges • Ground-handling / infrastructure related charges • Navigation charges • ETS[9] • VAT (only domestic flights)

Table 3 Freight transport taxes and charges

Heavy goods vehicles	Rail transport	Inland waterway transport	Maritime transport	Aviation
• Fuel taxes • Ownership tax • Registration tax • Insurance tax • Distance-based road charges • Time-based road charges • Tolls on specific parts of the network • Urban road pricing schemes	• Fuel taxes • Electricity taxes • Infrastructure charges • Charges for specific infrastructure	• Port charges • Fairway dues • Water pollution charges	• Port charges • Fairway dues • Piloting charges • Waste charges	• Aviation taxes • LTO / landing charges • Ground-handling / infrastructure related charges • Navigation charges • ETS

7 Value Added Tax

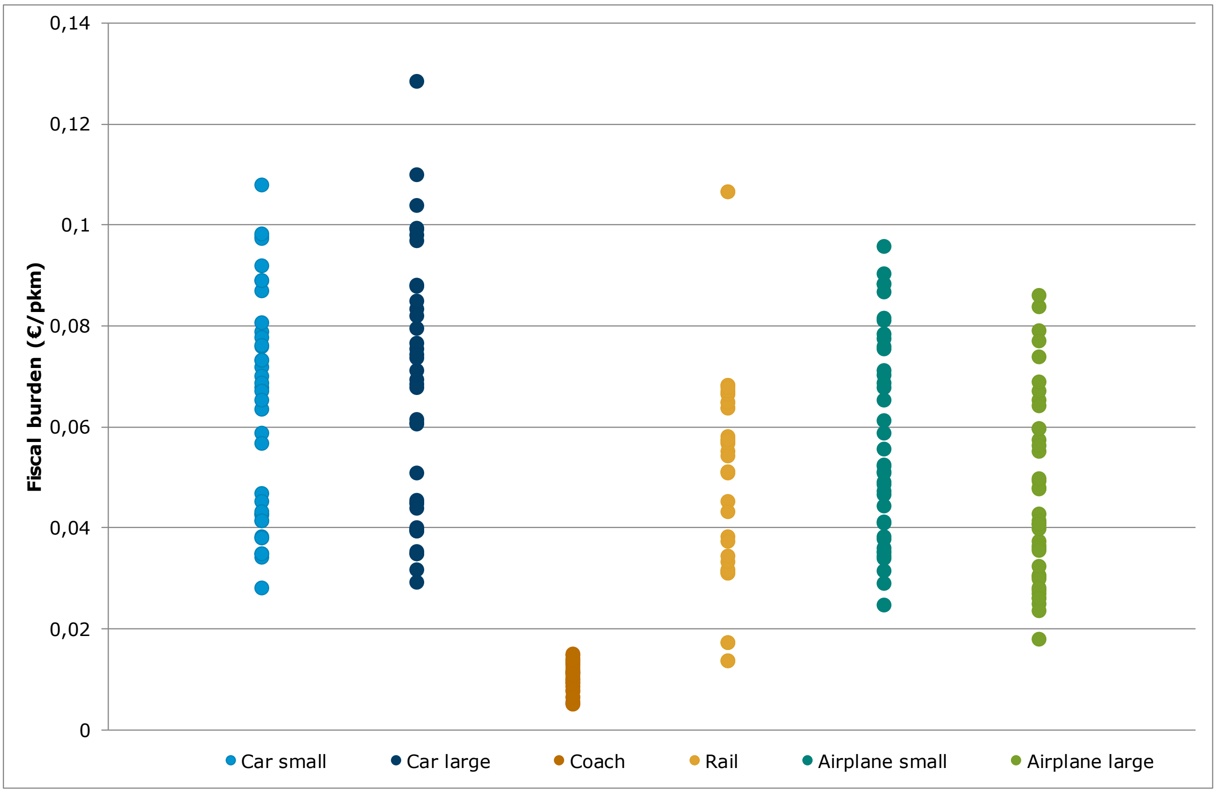
8 Landing and take-off charges cover both landing and take-off of airplanes.

9 Aviation is part of the European Emission trading Scheme (EU ETS), which is a trading system for greenhouse gas emissions.

Fiscal burden[10] for passenger transport modes

The overall fiscal burden (per passenger-kilometre) of the various reference vehicles on the twenty corridors is shown in Figure 3 (each dot represents the result for a reference vehicle on a specific corridor). Both the fiscal burden for outward and return trips are shown in Figure 3.

Figure 3 Overview of fiscal burden of passenger transport means in € per passenger-kilometre (pkm) in the different corridors



To convert all taxes and charges into distance-based concepts (such that they can be allocated to the trips on the corridors) several assumptions had to be made (e.g. on annual mileage and economic lifetime of the reference vehicles). These assumptions significantly affect the share of fixed taxes/charges that are allocated to the trips on the corridors. In addition, the fiscal burden per passenger or tonne-kilometre depends significantly on the average number of passengers or loads assumed for the reference vehicles. For vehicles with a higher or lower occupancy rate or load factor than average, average costs can deviate strongly from the values presented.

As shown in Figure 3, the fiscal burden for the various modes differ significantly between corridors, reflecting the specific characteristics of the different corridors. However, some general conclusions can be drawn.

In general, the transport means that generate the highest external cost, also show the highest tax burden.[11] This is especially true for freight, while for passenger transport

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10 Fiscal burden refers to both the taxes and the charges levied on the corridor.

11 With the exception of coaches, which are subject to a low level of tax burden while their external costs are higher than for instance rail. A further caveat to bear in mind is that very little information is available on infrastructure costs across the different modes and so they have not been taken into account.

the results show higher variation within a given mode. For example, highest charges apply to passenger car users on most of the twenty European corridors considered in this study. Per passenger-kilometre, the fiscal burden for these vehicles ranges from 3 €ct to 10 €ct. The burden is highest on corridors where distance-based road charges or tolls for specific parts of the network (bridges, tunnels) are applied. Next to these charges, fuel taxes and VAT contribute significantly to the burden on all corridors. Vehicle taxes (e.g. ownership tax, registration tax) play a less important role on most of the corridors, although there are some exceptions (e.g. corridors originating from the Netherlands and Greece, as in these countries high levels of ownership and/or registration taxes are levied on passenger cars).

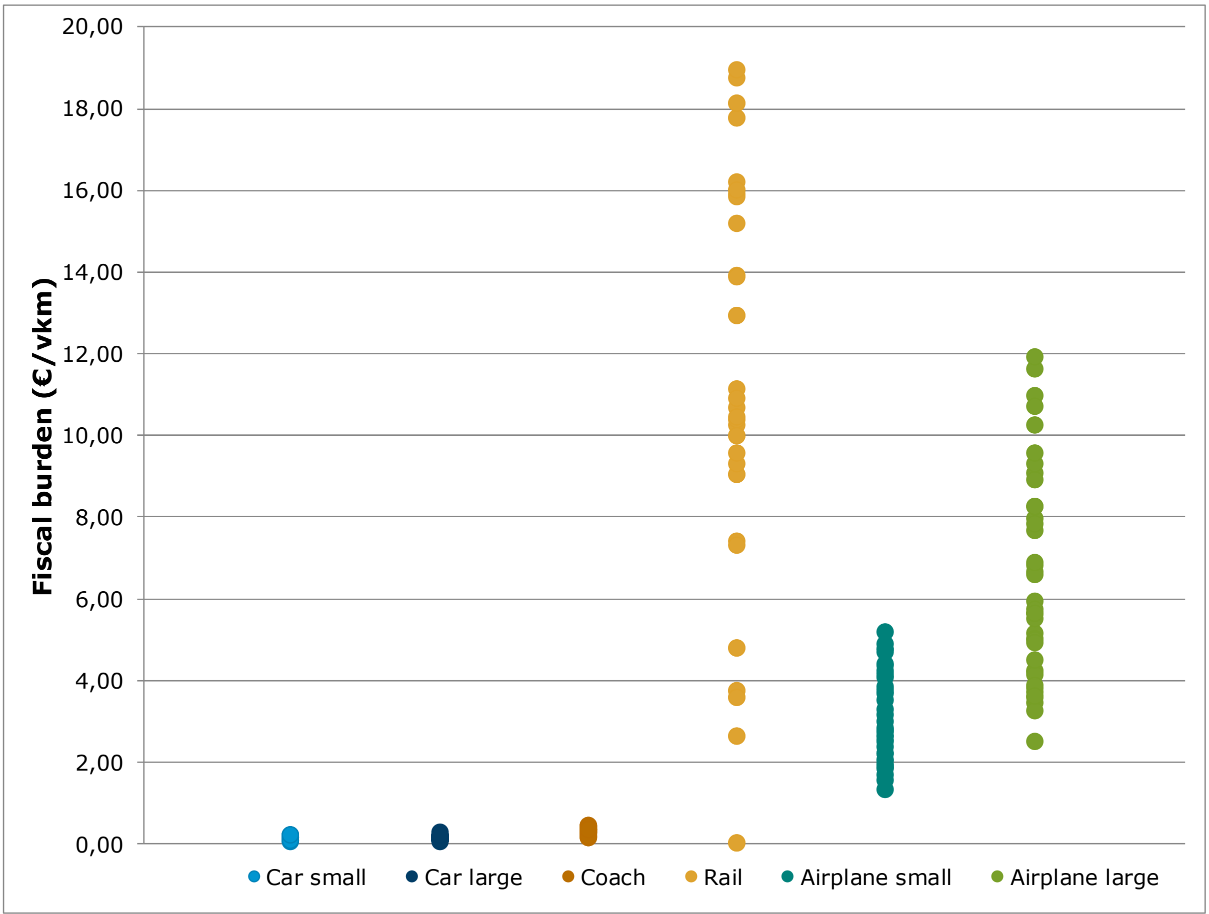
As airplanes are mainly charged with fixed fees (e.g. landing and taking off charges, passenger charges) whose level is independent of the trip length, the fiscal burden for this transport mean is significantly higher for medium-distance trips than for long-distance trips. On medium-distance corridors (e.g. Paris – Amsterdam, Amsterdam – Frankfurt and Hamburg – Prague) the fiscal burden may be up to 9 €ct per passenger-kilometre (being even higher than for passenger cars on those corridors), while on long-distance corridors (e.g. Lisbon – Antwerp) it may be as low as 2 €ct per passenger kilometre. In general, the burden on aviation is higher on national corridors than on international ones, as domestic flights are not exempted from VAT (as do international flights).

The fiscal burden for rail transport is generally in the range of 1 €ct to 7 €ct per passenger-kilometre. On most corridors this burden consist mainly of infrastructure charges and (to a lesser extent) VAT. However, on the corridors covering Germany (and Austria) electricity taxes are relevant as well.

Finally, the fiscal burden for coach transport is significantly lower than for the other passenger transport means (in the range of 0.5 €ct to 1 €ct per passenger-kilometre), reflecting the relatively low tax/charge levels applied for these vehicles. Corridors covering countries with relatively high VAT levels on coach transport (Germany) or relatively high distance-based road charges (e.g. France) provide the highest fiscal burden for coach transport.

When expressed in € per vehicle-kilometre as shown in Figure 4, the picture is rather different. Large and heavy transport means have much higher tax burden than smaller ones.

Figure 4 Overview of fiscal burden of passenger transport means in € per vehicle-kilometre in the different corridors



This highlights the challenges with finding a suitable common denominator across modes, which stems from the fact that different vehicles have very different capacities. Using passenger-kilometres and tonne-kilometres seems straightforward, but they naturally show a lower per unit burden for vehicles with large capacity as opposed to ones with small capacity. In contrast, expressing taxation per vehicle-kilometre shows a high burden for large vehicles. This makes a comparison across modes challenging and illustrates that it is not appropriate to compare only taxation across modes. Furthermore, there is a link between capacity and unit external costs, as higher capacity vehicles tend to have lower external costs per passenger and ton-kilometres. For a proper comparison, taxes and charges per passenger-kilometres and tonne-kilometres should be compared to external and infrastructure costs within modes. The different modes can then be compared as to how much they fulfil the 'user-pays and polluter-pays principles', and this is what the EU policy framework calls for.

Fiscal burden for container/general cargo transport

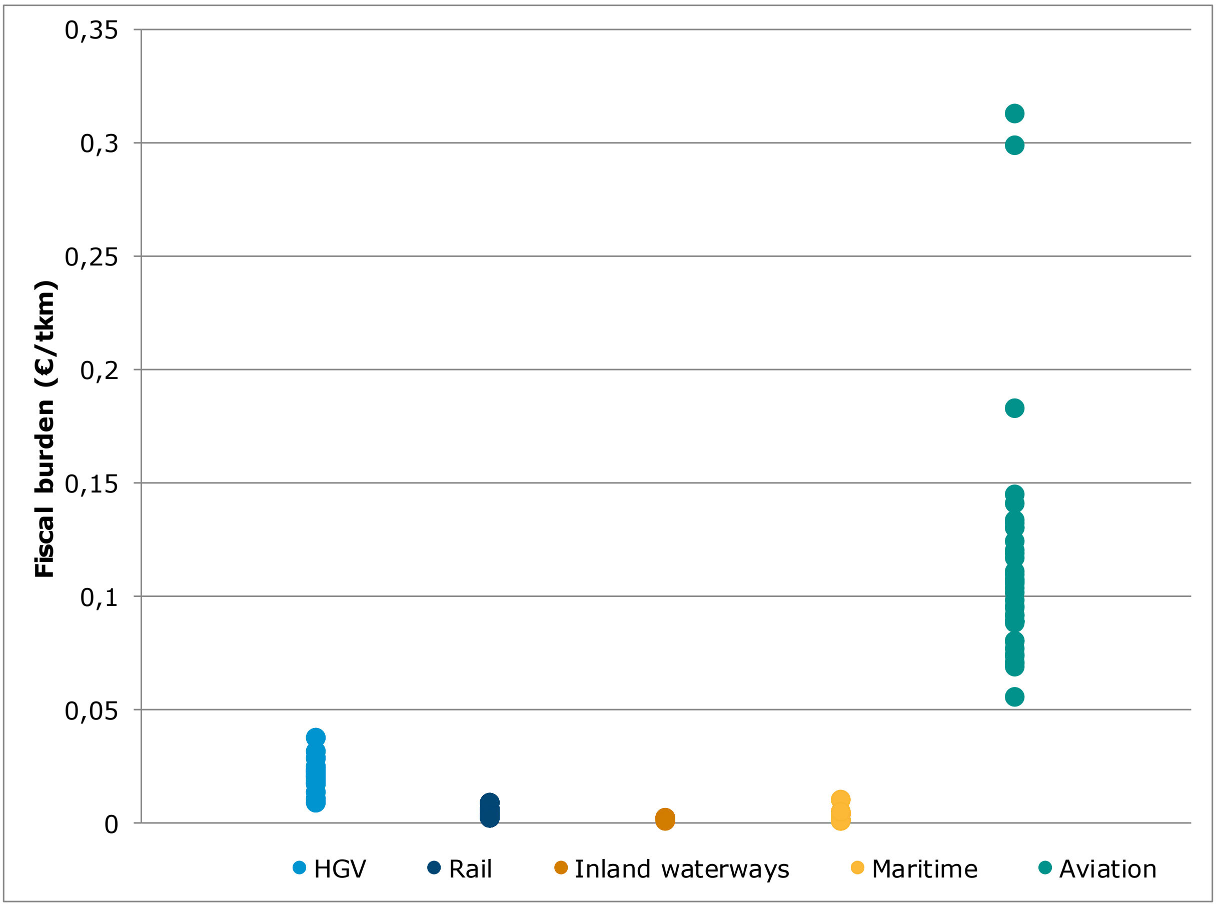
Figure 5 shows the range of total fiscal burden for various freight transport modes on the selected corridors. Like for passenger transport, also for freight transport the modes that generate the highest external costs (road and aviation) face the highest tax burden, while rail and waterborne modes display lower external costs and pay generally less taxes. However, this does not imply that the tax levels reflect well the external and infrastructure costs. For that, as is the case for passenger transport, a more in-depth study on both external costs and taxes and charges would be needed.

For container and bulk freight transport, the fiscal burden on road transport (heavy goods vehicles - HGVs) is considerably higher than for rail or shipping transport on all corridors. The burden for HGVs is in the range of 1 to 3.5 €ct per tonne-kilometre, while for rail freight transport it ranges from 0.2 to 0.8 €ct. For inland waterways and maritime shipping the fiscal burdens are in the order of 0.1 – 0.2 and 0.1 – 0.4 €ct per tonne-kilometre, respectively.

For all freight transport modes, infrastructure charges (e.g. road charges, rail access charges, port charges) are very relevant and hence significantly affect the differences in fiscal burden between corridors. For example, a relatively high fiscal burden exists for HGVs on the corridor Genoa – Rotterdam, mainly due to the road charges applied on the Swiss part of this corridor. For road and rail transport, energy taxes also significantly contribute to the overall fiscal burden. For rail, this is mainly the case for corridors covering Germany and/or Austria, as those countries levy higher electricity taxes on rail transport.

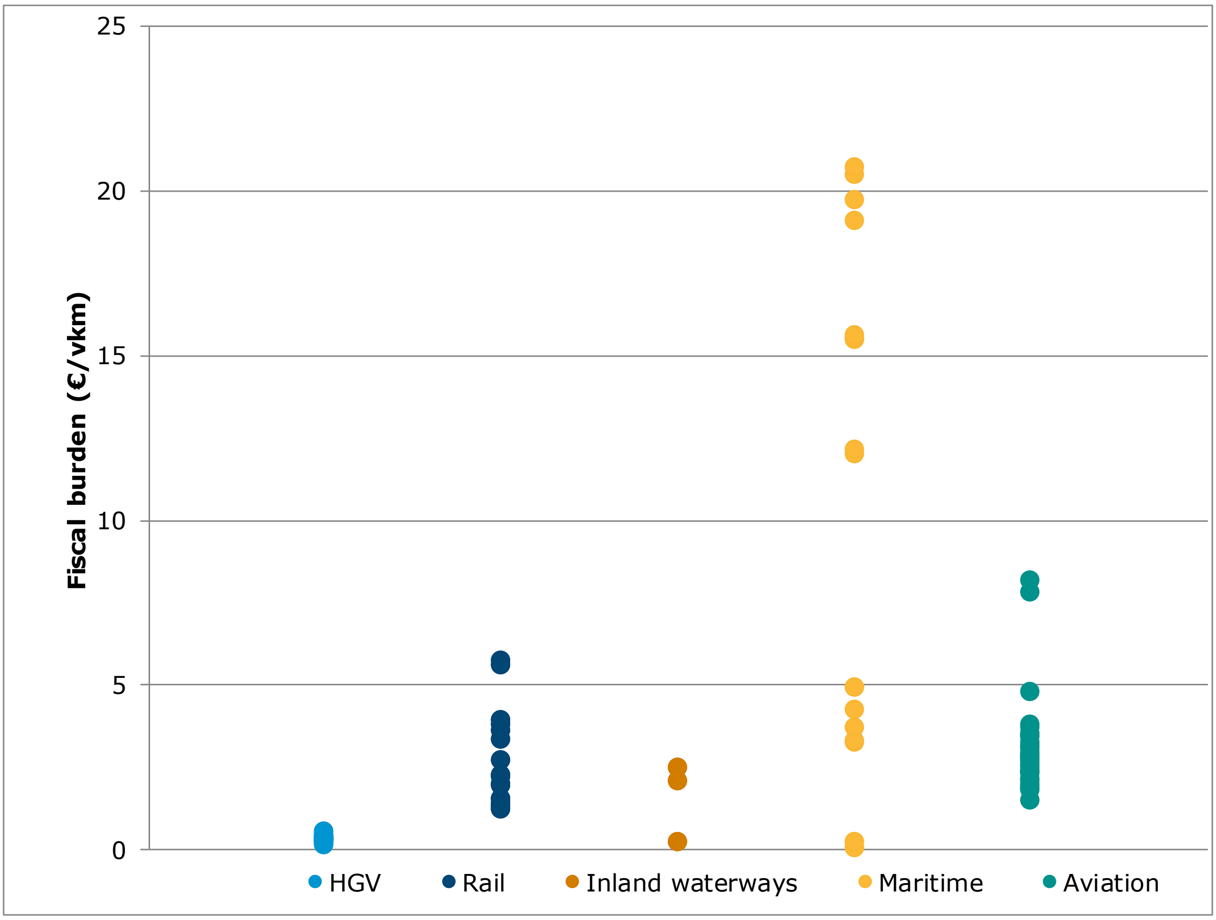
On all corridors, the fiscal burden of cargo airplanes largely exceeds the burden for other freight transport modes. This is related to the relatively low tonnage capacity of aircraft compared to the vehicle size and transport cost, which makes that also the internal costs per tonne-kilometre are relatively high, in comparison to other modes. As a result aviation only competes on specific sub-segments of the general cargo freight market (e.g. flowers, high valuable consumer goods). This complicates the direct comparison of aviation and other freight transport modes in terms of fiscal burden.

Figure 5 Overview of fiscal burden of container/general cargo transport in € per tonne-kilometre (tkm) in the different corridors



Like for passenger transport, when expressed in € per vehicle-kilometre as shown in Figure 6, the picture is rather different. Large and heavy transport means have much higher tax burden than smaller ones.

Figure 6 Overview of fiscal burdens of container/general cargo transport in € per vehicle-kilometre in the different corridors



Benchmarking fiscal burden on total internal costs

For each of the corridors, the fiscal burden of the various transport modes is benchmarked on the total internal transport costs (i.e. including taxes and charges). Although the share of taxes and charges in the total internal costs differ widely between corridors, some rough ranges can be defined for each transport mode (see Table 4).

Table 4 Rough indication of the share of taxes/charges in the total internal costs

Passenger transport means	Share of taxes/charges in total internal costs	Freight transport means	Share of taxes/charges in total internal costs
Passenger car	30% – 50%	**HGV**	15% - 30%
Coach	15% - 25%	**Freight train**	15% - 45%
Passenger train	30% - 70%	**Inland waterway transport**	5% – 20%
Passenger airplane	40% - 70%	**Maritime transport**	10% - 50%
		Cargo airplane	30% - 50%

For passenger transport the share is lowest for coach transport, while the share is higher for rail and aviation. For freight transport, the share is lowest for inland waterway transport and highest for cargo aircraft. The shares do not give an indication about the level of taxes and charges as they are also affected by the level of internal costs, which varies significantly between transport means. Moreover, these shares do not provide good indication about the cost coverage ratios; for this purpose, tax and charge levels should be compared to external costs which are outside the scope of this study.

Table 5 shows the total internal costs per passenger- or tonne-kilometre. Passenger cars have the highest total internal cost per passenger-kilometre. For the other transport means the internal costs are considerably lower because as collective transport means they make, in general, more efficient use of resources.

For freight transport internal costs are highest for road transport and cargo airplanes. Rail, inland waterway and maritime transport have lower internal costs per tonne-kilometre. Internal costs are influenced, among other things, by the load factors. Vehicles with higher load factors, for example trains and vessels in general have lower internal costs per tkm.

Table 5 Average internal costs for different vehicles in € per passenger-kilometre or tonne-kilometre

Passenger transport means	Internal cost in € per pkm	Freight transport means	Internal cost in € per tkm (container/bulk)
Passenger car (small/large)	0.13/0.15	**HGV**	0.08/0.12
Coach	0.04	**Freight train electric**	0.02/0.009
High speed train	0.04	**Freight train diesel**	0.02/0.012
Regular train (electric/diesel)	0.10/0.20	**Inland waterways small**	0.009/0.009
Passenger airplane (small/large)	0.06/0.03	**Inland waterways large**	0.011/0.010
		River sea vessel	0.010/0.09
		Short sea vessel	0.003/0.003
		Cargo airplane (general cargo)	0.12

RÉSUMÉ

Contexte de l'étude

Cette étude a été réalisée dans le cadre du travail plus général sur l'internalisation des coûts externes des transports. Les coûts externes sont des coûts pour la société qui, sans intervention gouvernementale, ne se reflètent pas dans les coûts effectivement supportés par les utilisateurs des transports. Les utilisateurs de transport sont donc confrontés à des incitations incorrectes pour l'offre et la demande de transport, ce qui entraîne des pertes de bien-être pour la société dans son ensemble. L'internalisation, souvent appelée le principe de l'utilisateur-payeur et du pollueur-payeur, signifie que ces coûts font partie du processus décisionnel des utilisateurs, généralement par l'utilisation d'instruments basés sur le marché. Le principe est notamment crucial pour toute discussion sur le transport multimodal et, dans un sens plus large, sur l'économie circulaire.

De nombreuses études ont été réalisées sur les coûts externes, les coûts d'infrastructure, l'internalisation et la tarification des transports. Une méthodologie pour calculer les coûts externes a été fournie dans le manuel sur l'estimation des coûts externes dans le secteur des transports par CE Delft et INFRAS en 2008. Le manuel a été mis à jour par Ricardo en 2014. Les niveaux totaux de coûts externes pour les différents modes de transport ont été calculés et évalués en détail dans «External Costs of Transport in Europe » en 2011 par CE Delft et al. Le niveau et la structure des taxes sur les transports ont fait l'objet d'une enquête approfondie dans l'étude «An inventory of measures for internalising external costs in transport in 2012» par CE Delft et al.

Le Livre Blanc 2011 sur les transports a montré que le secteur des transports est confronté à des défis importants. L'internalisation des coûts externes est l'un des principes importants de la politique de transport de l'UE contribuant à résoudre ces défis. Récemment, le Parlement européen a appelé à des efforts renouvelés en matière d'internalisation. La Communication de la Commission de 2016 sur « une stratégie européenne pour une mobilité à faible taux d'émissions» souligne la nécessité de faire des progrès dans l'application du principe de l'utilisateur-payeur et du pollueur-payeur. En 2017, des mesures supplémentaires ont été prises par l'adoption, le 31 mai, d'une proposition de directive *Eurovignette* révisée dans le cadre du programme de mobilité propre, compétitive et connectée. En outre, la Commission a lancé une étude approfondie pour soutenir les prochaines étapes vers l'internalisation des coûts externes des transports dans l'UE.

Objectifs et limites de l'étude

L'objectif principal de l'étude est de fournir des informations dans le domaine de la fiscalité et de la tarification dans le secteur des transports. L'étude devrait aider à analyser la charge de la fiscalité et des redevances sur différents moyens de transport, afin de mieux comparer les conditions-cadres dans lesquelles opèrent différents moyens de transport. Dans la mesure du possible, et compte tenu des limites liées aux données, l'étude prend en compte les subventions aux opérations ou aux moyens de transport, ce qui est important lorsque l'on compare les conditions-cadres entre ces moyens.

Cette étude fournit des données sur la charge fiscale des moyens de transport de passagers et de marchandises pour vingt corridors européens[12]. Il fournit donc des données importantes pour une étude plus large et plus approfondie lancée par la Commission en 2017 sur les mesures d'internalisation, les coûts externes et les dépenses d'infrastructure. La présente étude illustre, pour des situations concrètes, des éléments cruciaux pour toute discussion sur la charge relative des différents moyens de transport. Cela se fait de manière quantifiée autant que possible, et des conclusions qualitatives sont tirées lorsque la quantification n'est pas possible.

Pour une évaluation correcte des conditions-cadres des différents moyens de transport, les taxes (variables) et les charges de chaque mode doivent être comparées avec les coûts (marginaux) externes et d'infrastructure du même moyen. Les différences entre le ratio de couverture des coûts des divers moyens de transport peuvent être considérées comme un indicateur de l'égalité de traitement (tant que tous les coûts, taxes, charges et subventions externes et d'infrastructure concernés sont inclus). Par définition, cette étude ne fournit qu'une partie des informations nécessaires pour estimer les ratios de couverture des coûts. Seules les taxes, les charges et les subventions sont évaluées, mais les coûts externes et les coûts d'infrastructure sont en-dehors du champ de l'étude. En s'appuyant, entre autres, sur les informations recueillies par cette étude, la Commission a lancé une autre étude approfondie visant à fournir une mise à jour complète des mesures d'internalisation, des coûts externes et des dépenses d'infrastructure. Cela devrait permettre une comparaison appropriée des conditions des différents modes de transport.

Dans cette étude, les taxes, les redevances et les subventions applicables à un véhicule de référence spécifique (moyenne de l'UE) sont évalués et comparés pour chacun des corridors, en appliquant une approche axée sur l'utilisateur final (les voyageurs pour le transport de passagers et les opérateurs de transport pour le transport de marchandises sont considérés comme les utilisateurs finaux concernés). Pour de nombreuses taxes / charges, le taux appliqué dépend des caractéristiques du véhicule / navire (par exemple, poids, émissions de CO2, classe de bruit, etc.). Par conséquent, une réserve importante est que la charge fiscale estimé pour les différents modes de transport dépend fortement des véhicules de référence, ainsi que du facteur de charge choisi[13]. Pour les autres types de véhicules, la charge fiscale peut être différente[14].

L'étendue des taxes / charges peut (légèrement) différer entre les moyens de transport, car pour les services particuliers, les coûts sont couverts par des charges pour un moyen de transport, tandis que pour d'autres moyens, ces coûts peuvent faire

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[12] Les corridors dans ce contexte sont définis comme des itinéraires sélectionnés. Ils ne doivent pas être confondus avec les corridors du réseau de transport transeuropéen (TEN-T).

[13] Pour d'autres facteurs de charge, la charge par tonne ou passager sera différent (par exemple, dans le cas de la charge totale, il sera plus bas pour chaque moyen). Les facteurs de charge utilisés sont conformes aux moyennes de l'UE, comme par exemple utilisé par CE et al. (2011), cependant les facteurs de charge peuvent différer selon le pays ou les véhicules.

[14] Souvent, les réductions sont d'application applicables pour les véhicules plus propres. Ces réductions peuvent être apportées en réduisant les coûts de péage pour les véhicules plus propres, en réduisant les frais de port pour les navires plus propres ou les frais de LTO plus bas pour les avions avec moins de production de bruit. Les véhicules utilisés dans cette étude représentent les moyennes de l'UE et, par conséquent, n'ont pas reçu tous les réductions environnementaux possibles.

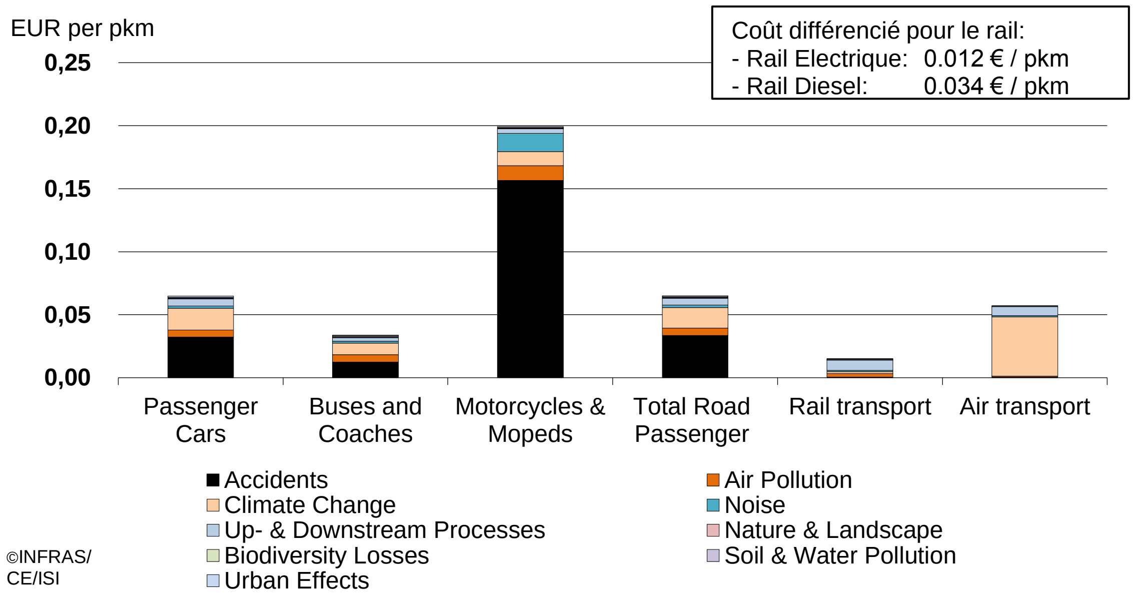
partie des coûts internes [15]. Cela peut, par exemple, être le cas pour les frais de manutention au sol pour les avions cargo, qui couvre les coûts des services de manutention au sol à l'aéroport. Toutefois, des coûts des services similaires dans les ports maritimes peuvent être considérés comme des coûts internes[16].

De plus, il est important de noter que les choix d'utilisation d'un moyen de transport par les utilisateurs sont également affectées par des facteurs tels que les coûts internes, les temps moyens de transport, la fiabilité et la flexibilité des moyens de transport, ainsi que le confort et les aspects sociaux (comme l'évolution des modèles de mobilité, l'attitude concernant la propriété de la voiture, etc.). Tous ces facteurs peuvent être considérés en partie comme des caractéristiques intrinsèques des modes de transport, mais ils dépendent également de certains autres facteurs. Les facteurs les plus importants sont la disponibilité et la qualité des infrastructures de transport, les différences de réglementation (par exemple, la réglementation environnementale, la réglementation opérationnelle) ainsi que des régimes plus larges de subventions de transport (par exemple, obligations de service public ferroviaire, subventions pour le matériel roulant).

Résultats antérieurs sur les coûts externes

L'étude de 2011 de CE Delft sur les coûts externes montre qu'en 2008, à l'exception des motos, les coûts externes par passager-kilomètre étaient les plus élevés pour les voitures et l'aviation (en moyenne environ 0,06 €), tandis que pour les autocars, ils étaient d'environ 0,03 € et pour le transport ferroviaire d'environ 0,015 €. Ces chiffres ne couvrent pas les coûts d'infrastructure. Ils sont inclus pour fournir un certain contexte pour les valeurs de charge fiscale décrites ci-dessous.

Figure 7 Coûts externes moyens des modes de transport passagers en 2008 (CE Delft et al, 2011)

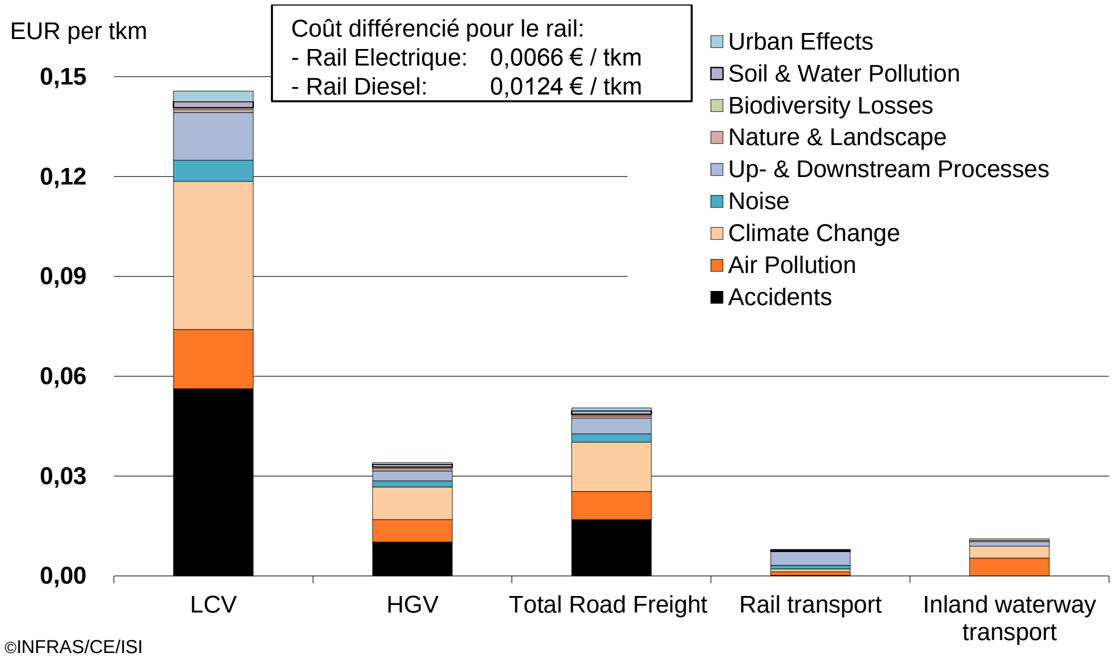


[15] Les coûts internes sont des coûts autres que les taxes et les frais. Les coûts internes comprennent le coût de l'achat ou de la location, l'utilisation et la maintenance du véhicule, la consommation d'énergie, les coûts du conducteur et d'organisation et la marge bénéficiaire. Voir l'annexe E pour une discussion détaillée sur les coûts internes considérés dans cette étude.

[16] Les frais de manutention au sol sont considérés comme une charge car ceux-ci sont utilisés par le type de vols considérés dans cette étude. Pour les navires, il est moins clair quelles installations seront utilisées et, par conséquent, elles sont considérées comme coûts internes.

Pour le transport de marchandises, le transport routier affiche des coûts externes considérablement plus élevés (en moyenne plus de 0,05 € par tonne-kilomètre en 2008) que ceux du transport ferroviaire de marchandises (moins de 0,01 €) et des voies navigables intérieures (moins de 0,012 €).

Figure 8 Coûts externes moyens des modes de transport de marchandises en 2008 (CE Delft et al, 2011)



Liste des corridors

Un aperçu des corridors dans cette étude est donné dans le Tableau 6. Ces corridors offrent une bonne couverture géographique. Ils couvrent tous les corridors de transport transeuropéen (TEN-T), tous les moyens de transport principaux et différents types de transport de marchandises (conteneurs / marchandises générales et vrac) et tous les différents types de taxes, redevances et subventions appliquées en Europe. Par conséquent, ils reflètent bien les opérations de transport sur le réseau TEN-T.

Tableau 6 Liste des corridors

Corridors internationaux	Corridors nationaux
• Paris – Amsterdam • Paris – Madrid • Antwerp – Warsaw • Amsterdam – Frankfurt • Frankfurt – Budapest • Rome – Berlin • Hamburg – Prague • Helsinki – Gdansk • Lisbon – Antwerp • Stockholm – Hamburg • Genoa – Rotterdam • Budapest – Milan • Bucharest – Warsaw • Dublin – Amsterdam • Athens - Vienna	• Paris - Marseille • Hamburg - Munich • Gdansk – Katowice • Madrid - Barcelona • Milan – Naples

Taxes, redevances et subventions prises en compte

Un aperçu des taxes et des charges prises en compte dans l'étude est présenté dans le Tableau 7 (transport de passagers) et dans le Tableau 8 (transport de marchandises). Ces taxes et frais ne sont pas appliqués sur tous les corridors. Par exemple, les programmes de tarification des routes urbaines ne sont appliqués qu'au corridor Stockholm-Hambourg. En revanche, les taxes sur les carburants sont des exemples de taxes appliquées sur tous les couloirs. La taxe sur la valeur ajoutée (TVA) n'est pas indiquée pour le transport de marchandises, car elle peut être déduite par les exploitants de marchandises.

Tableau 7 Taxes de transport de passagers et charges

Voitures	Autocars	Transport ferroviaire	Aviation
• Taxes de carburant • Taxes de circulation • Taxes d'immatriculation • Taxes d'assurance • Taxes routières basées sur la distance • Taxes routières basées sur le temps • Péages sur des parties spécifiques du réseau • Schémas de tarification de routes urbaines • TVA[17]	• Taxes de carburant • Taxes de circulation • Taxes d'immatriculation • Taxes d'assurance • Taxes routières basées sur la distance • Taxes routières basées sur le temps • Péages sur des parties spécifiques du réseau • Schémas de tarification de routes urbaines • TVA	• Taxes de carburant • Taxes d'électricité • Charges d'infrastructure • Charges d'infrastructure spécifique • TVA	• Taxes d'aviation • Charges relatives aux passagers • LTO[18] / charges d'atterrissage • Frais de manutention au sol / frais liés à l'infrastructure • Charges de navigation • ETS[19] • TVA (seulement vols intérieurs)

Tableau 8 Taxes et charges de transport de marchandises

Camions	Transport ferroviaire	Transport de navigation intérieur	Transport maritime	Aviation
• Taxes de carburant • Taxes de circulation • Taxes d'immatriculation • Taxes d'assurances • Taxes routières basées sur la distance • Taxes routières basées sur le temps • Péages sur des parties spécifiques du réseau • Schémas de tarification de routes urbaines	• Taxes de carburant • Taxes d'électricité • Charges d'infrastructure • Charges d'infrastructure spécifique	• Charges de port • Cotisations Fairway • Charges de pollution de l'eau	• Charges de port • Cotisations Fairway • Charges de pilotage • Charges des déchets	• Taxes d'aviation • Frais liés aux passagers • LTO / charges d'atterrissage • Frais de manutention au sol / frais liés à l'infrastructure • Charges de navigation • ETS

À côté de ces taxes et charges, les régimes de subvention pertinents sont également évalués. Il s'agit notamment des exonérations d'impôt sur l'énergie (par exemple pour la navigation et l'aviation), les exonérations de TVA (par exemple pour l'aviation

[17] Taxe sur la Valeur Ajoutée

[18] Charges d'atterrissage et de décollage couvrent aussi bien l'atterrissage que le décollage des avions.

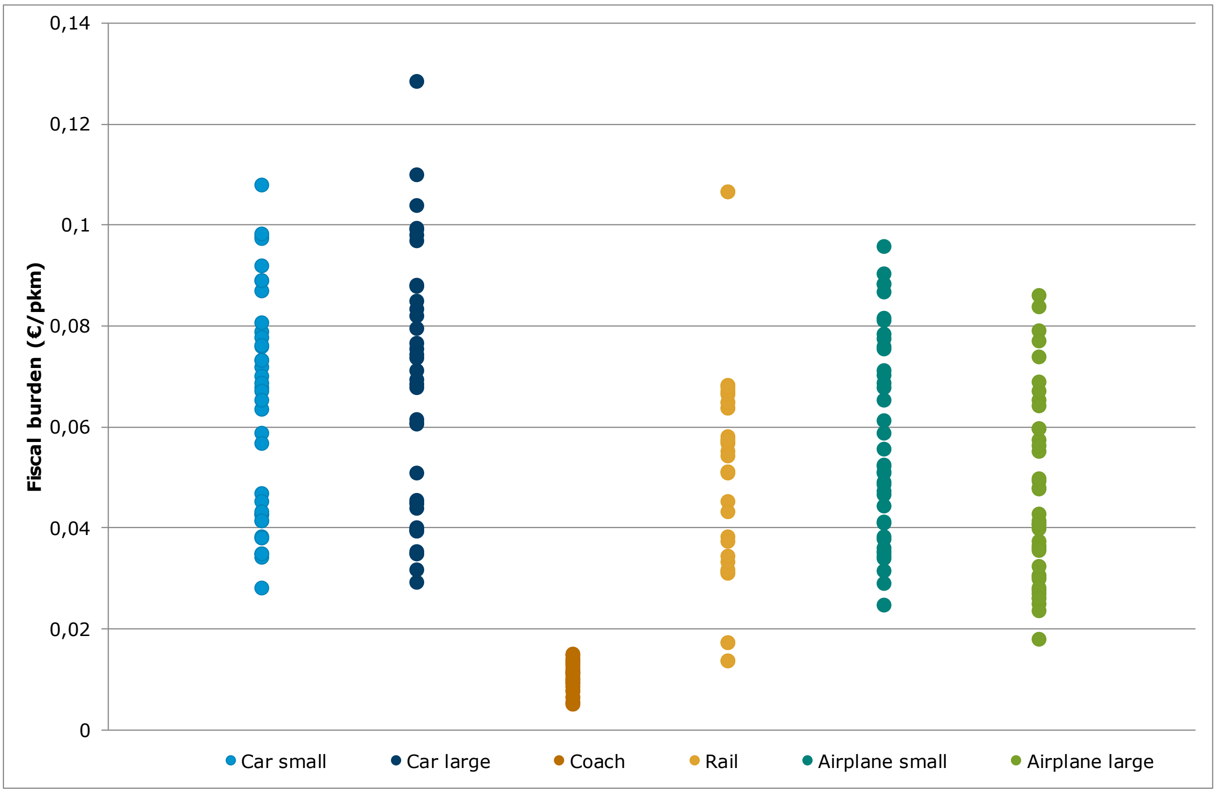
[19] L'aviation fait partie du Schéma Européen d'Émissions Commerciales, qui est un système commercial des émissions de dioxyde de carbone.

internationale) et les dérogations de frais d'infrastructure (par exemple, les frais d'utilisation des écluses et des ponts).

Charges fiscales [20] pour le transport de passagers

La charge fiscale globale (par passager-kilomètre) des différents véhicules de référence sur les vingt corridors est représentée dans la Figure 9 (chaque point représente le résultat d'un véhicule de référence sur un corridor spécifique). La charge fiscale pour les voyages aller-retour est présentée dans la Figure 9.

Figure 9 Aperçu de la charge fiscale du transport de passagers en € par passager-kilomètre (pkm) dans les différents corridors



Comme indiqué ci-dessus, pour convertir toutes les taxes et charges basés sur la distance (afin qu'ils puissent être attribués aux voyages sur les corridors), plusieurs hypothèses ont été faites (par exemple, sur le kilométrage annuel et la durée de vie économique des véhicules de référence). Ces hypothèses affectent de manière significative la part des taxes/charges fixes qui sont attribuées aux voyages dans les corridors. De plus, la charge fiscale par passager ou tonne-kilomètre dépend considérablement du nombre moyen de passagers ou de charges présumé pour les véhicules de référence. Pour les véhicules ayant un taux d'occupation ou un facteur de charge supérieur ou inférieur à la moyenne, les coûts moyens peuvent fortement s'écarter des valeurs présentées.

Comme le montre la Figure 9, la charge fiscale pour les différents modes diffère considérablement de corridor à corridor, reflétant les caractéristiques spécifiques des différents corridors. Cependant, certaines conclusions générales peuvent être tirées.

En général, le moyen de transport qui génère le coût externe le plus élevé, montre également la charge fiscale la plus élevée[21]. Ceci est particulièrement vrai pour la

[20] La charge fiscale se réfère aussi bien aux taxes qu'aux taxes prélevées sur le corridor.

cargaison, tandis que pour le transport de passagers, les résultats montrent une variation plus élevée pour un même moyen de transport. Par exemple, les frais les plus élevés s'appliquent aux usagers de voitures particulières sur la plupart des vingt corridors européens pris en compte dans cette étude. Par passager-kilomètre, la charge fiscale de ces véhicules varie de 0,03 € à 0,1 €. La charge est la plus élevée dans les corridors où des taxes routières basées sur la distance ou des péages pour des parties spécifiques du réseau (ponts, tunnels) sont d'application. À côté de ces charges, les taxes sur les carburants et la TVA contribuent de manière significative à la charge dans tous les corridors. Les taxes sur les véhicules (par exemple la taxe de circulation, la taxe d'immatriculation) jouent un rôle moins important dans la plupart des corridors, bien qu'il existe des exceptions (par exemple, les couloirs dans les Pays-Bas et la Grèce, car dans ces pays, des taxes élevés de propriété et/ou d'enregistrement sont prélevé sur les voitures particulières).

Comme les avions se voient principalement appliquer des frais fixes (par exemple, les frais d'atterrissage et de décollage, les frais de passagers) qui sont indépendants de la durée du trajet, la charge fiscale pour ce moyen de transport est significativement plus élevée pour les voyages de courte et moyenne distances que pour les voyages de longue distance. Sur les corridors de moyenne distance (par exemple, Paris - Amsterdam, Amsterdam - Francfort et Hambourg - Prague), la charge fiscale peut atteindre 0,09 € par passager-kilomètre (ce qui est plus élevé que pour les voitures particulières sur ces corridors). Dans les corridors de longue distance (par exemple, Lisbonne - Anvers), la charge peut être que 0,02 € par passager-kilomètre. En général, la charge de l'aviation est plus élevée sur les vols nationaux que sur les vols internationaux, car les vols intérieurs ne sont pas exemptés de TVA (ce qui est le cas des vols internationaux).

La charge fiscale du transport ferroviaire se situe généralement entre 0,01 € et 0,07 € par passager-kilomètre. Dans la plupart des corridors, cette charge consiste principalement en des redevances d'infrastructure et (dans une moindre mesure) la TVA. Cependant, dans les corridors traversant l'Allemagne (et l'Autriche), les taxes sur l'électricité sont également applicables.

Finalement, la charge fiscale pour le transport en autocar est nettement inférieure à celle des autres moyens de transport de passagers (dans une fourchette de 0,005 € à 0,01 € par passager-kilomètre), ce qui reflète les niveaux d'imposition/charge relativement bas appliqués à ces véhicules. Les corridors traversant des pays dont le taux de TVA est relativement élevé sur le transport en autocar (Allemagne) ou dont les péages sont relativement élevés (France) présentent la charge fiscale la plus élevée pour le transport en autocar.

Lorsqu'il est exprimé en € par véhicule-kilomètre, comme le montre la Figure 10, les résultats sont assez différents. Les moyens de transport larges et lourds ont une charge fiscale beaucoup plus élevé que les moyens de transport plus petits.

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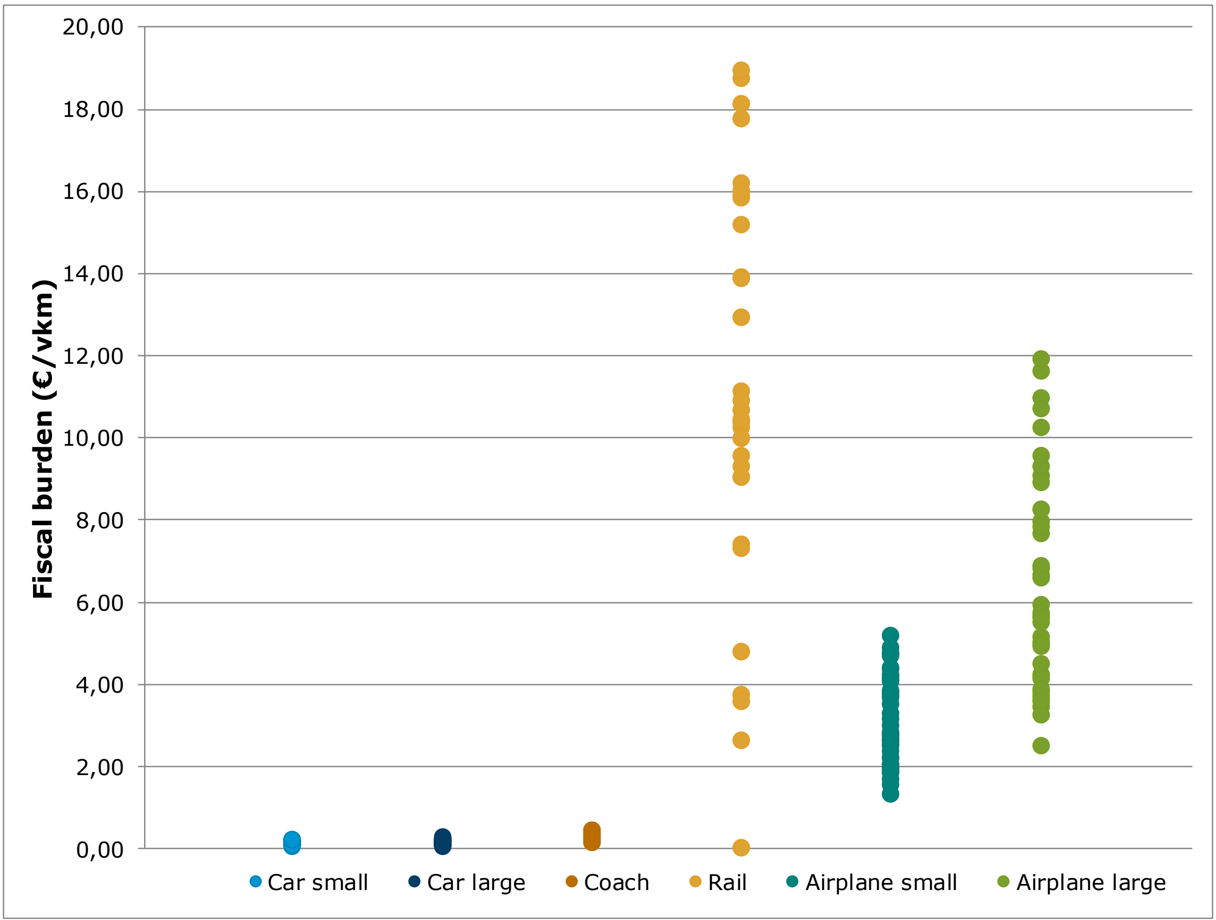
[21] A l'exception des autocars, qui sont sujet à un niveau plus bas de charge fiscale, alors que les coûts externes sont plus élevés que pour par exemple les chemins de feUne autre remarque à tenir à l'œil est que très peu d'informations sont disponibles sur les coûts d'infrastructure dans les différents moyens de transport et ne peuvent donc pas être prises en compte ici.

Figure 10 Aperçu de la charge fiscale du transport de passagers en € par véhicule-kilomètre dans les différents corridors



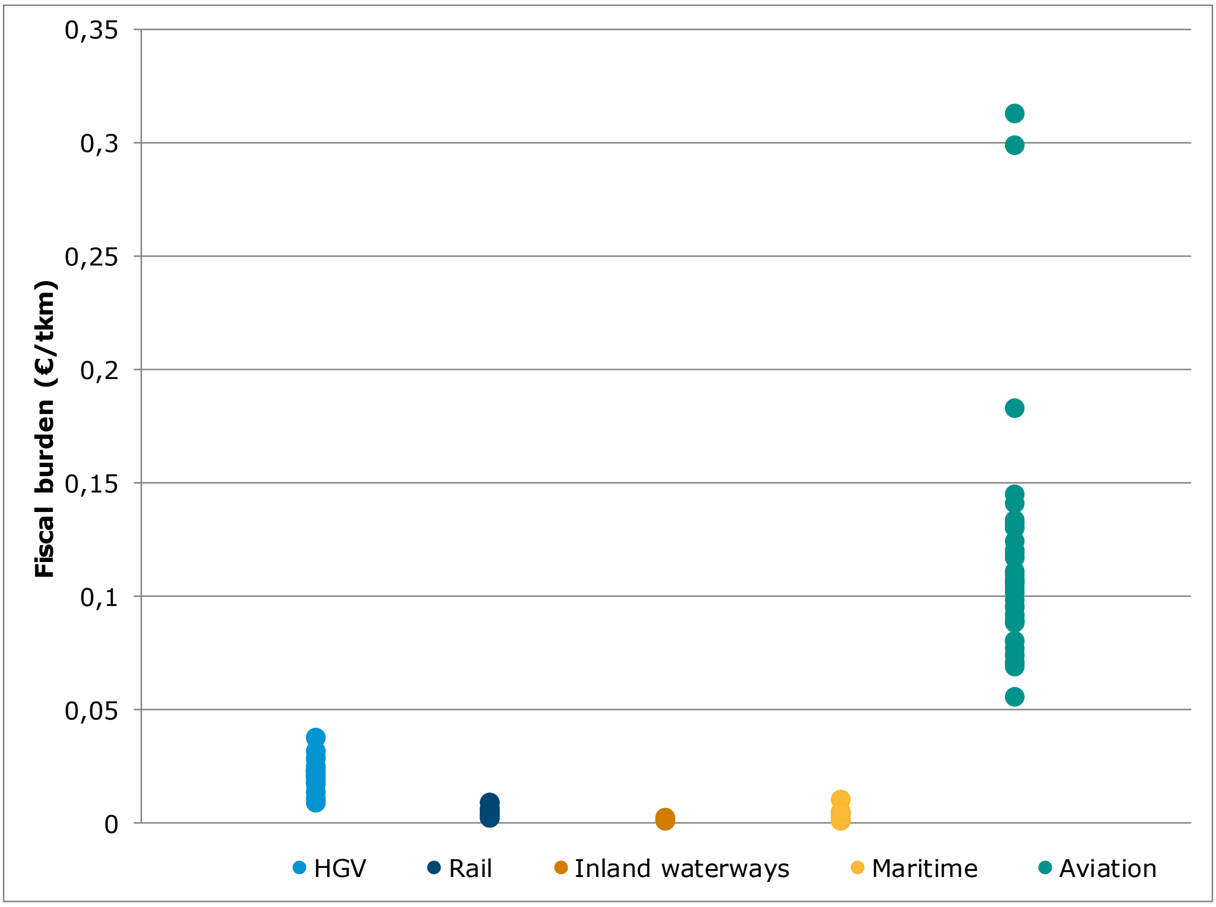
Cela souligne les défis liés à la recherche d'un dénominateur commun approprié dans tous les modes, qui découle du fait que les différents véhicules ont des capacités très différentes. L'utilisation des passagers-kilomètres et des tonnes-kilomètres semble simple, mais ils montrent une charge inférieure par unité pour les véhicules à grande capacité par opposition à ceux à faible capacité. En revanche, l'expression de la fiscalité par véhicule-kilomètre montre une charge élevée pour les gros véhicules. Cela rend difficile la comparaison entre les moyens de transport et cela montre qu'il n'est pas approprié de comparer uniquement la fiscalité entre les moyens. En outre, il existe un lien entre la capacité et les coûts externes unitaires, car les véhicules à capacité supérieure ont tendance à avoir des coûts externes plus faibles par passager et par tonne-kilomètre. Pour une comparaison appropriée, les taxes et les frais par passager-kilomètre et par tonne-kilomètre devraient être comparés aux coûts externes et aux coûts d'infrastructure pour chaque moyen de transport. Les différents moyens peuvent ensuite être comparés dans la façon dont ils remplissent le principe utilisateurs-payeurs et pollueurs-payeurs, ce que demande le cadre politique de l'UE.

Charge fiscale dur transport de conteneurs / transport général de marchandises

Figure 11 montre la portée de la charge fiscale totale pour différents moyens de transport de marchandises sur les corridors sélectionnés. Tout comme dans le cas du transport de passagers, les moyens de transport générant les coûts externes les plus élevés (route et aviation) ont la charge fiscale la plus élevée, alors que le transport ferroviaire et la navigation affichent des coûts externes plus bas et paient en général moins de charges fiscales. Cependant, cela n'implique pas que les niveaux d'imposition reflètent bien les coûts externes et les coûts d'infrastructure. Pour cela, comme pour le transport de passagers, une étude plus approfondie des coûts externes et des taxes et redevances serait nécessaire.

Pour le transport de marchandises en vrac ou en conteneurs, la charge fiscale sur le transport routier (poids lourds) est considérablement plus élevée que pour le transport ferroviaire ou maritime sur tous les corridors. La charge fiscale pour les poids lourds se situe entre 0,01 et 0,035 € par tonne-kilomètre, tandis que pour le transport ferroviaire de marchandises, il varie de 0,002 à 0,008 €. Pour les transports nationaux et les expéditions maritimes, les charges fiscales sont de l'ordre de 0,001 à 0,002 et de 0,001 à 0,004 € par tonne-kilomètre.

Figure 11 Aperçu des charges fiscales du transport de conteneurs / transport général de marchandises en € par tonne-kilomètre (tkm) dans les différents corridors

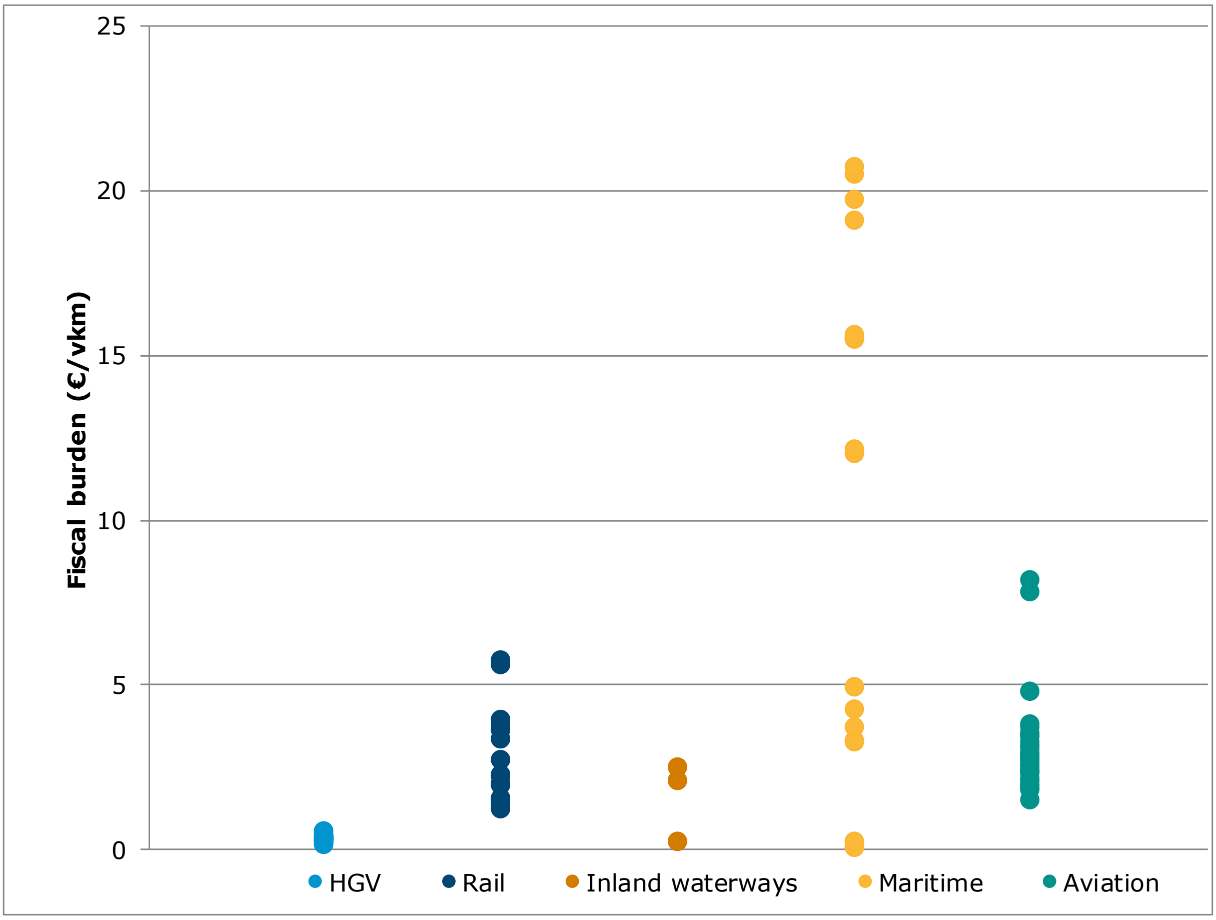


Pour tous les moyens de transport de marchandises, les frais d'infrastructure (par exemple, les frais routiers, les frais d'accès ferroviaire, les frais portuaires) sont très importants et affectent de manière significative les différences de charge fiscale entre les corridors. Par exemple, il existe une charge fiscale relativement élevée pour les poids lourds sur le corridor Gênes - Rotterdam, principalement en raison des redevances routières appliquées sur la partie Suisse de ce corridor. Pour le transport routier et ferroviaire, les taxes sur l'énergie contribuent également de manière significative à la charge fiscale globale. Pour les chemins de fer, c'est principalement le cas pour les couloirs traversant l'Allemagne et/ou l'Autriche, car ces pays imposent des taxes d'électricité plus élevées sur le transport ferroviaire.

Dans tous les corridors, la charge fiscale des avions cargos dépasse largement la charge fiscale des autres moyens de transport de marchandises. Ceci est lié à la capacité de fret relativement faible des avions par rapport à la taille de l'avion et au coût de transport, ce qui rend les coûts internes par tonne-kilomètre relativement élevés par rapport aux autres moyens de transport. L'aviation n'est en concurrence avec les autres modes que sur des sous-segments spécifiques du marché général du transport des marchandises (par exemple fleurs, biens de consommation à forte valeur ajoutée). Cela complique la comparaison directe entre l'aviation et d'autres moyens de transport de marchandises en termes de charge fiscale.

Comme pour le transport de passagers, les résultats sont assez différents lorsqu'ils sont exprimé en € par véhicule-kilomètre, comme le montre la Figure 12. Les moyens de transport larges et lourds présentent une charge fiscale beaucoup plus élevée que les plus petits.

Figure 12 Aperçu des charges fiscales du transport de conteneurs / transport général de marchandises en € par véhicule-kilomètre dans les différents corridors



Benchmarking de la charge fiscale sur les coûts internes totaux

Pour chacun des corridors, la charge fiscale des différents moyens de transport est comparée aux coûts totaux du transport interne. Bien que la part des taxes et des charges dans les coûts internes totaux varie considérablement entre les corridors, certains intervalles peuvent être définis pour chaque moyen de transport (voir Tableau 8).

Tableau 9 Indication approximative de la part des taxes / charges dans les coûts internes totaux

Transport de passagers	% des taxes/charges dans les coûts internes totaux	Transport de marchandises	% des taxes/charges dans les coûts internes totaux
Voiture	30% – 50%	**HGV**	15% - 30%
Autocar	15% - 25%	**Train de marchandise**	15% - 45%
Train à passagers	30% - 70%	**Transport fluvial**	5% – 20%
Avion à passagers	40% - 70%	**Transport maritime**	10% - 50%
		Avion-cargo	30% - 50%

Pour le transport de passagers, le pourcentage est le plus bas pour le transport en autocars, tandis que le pourcentage est le plus élevé pour les trains et l'aviation. Pour le transport de marchandises, le pourcentage est le plus bas pour le transport par voie navigable et le plus élevé pour les avions cargo. La répartition ne donne aucune indication au niveau des taxes et des charges car les pourcentages sont également affectés par le niveau des coûts internes, qui varie également de façon significative entre les moyens. De plus, les pourcentages ne disent rien sur les ratios de couverture des coûts en ce qui concerne les niveaux d'imposition et de charge et devraient être comparés aux coûts externes au lieu des coûts internes totaux.

Le Tableau 10 montre les coûts internes totaux par passager-kilomètre ou par tonne-kilomètre. Les voitures particulières ont le coût interne total le plus élevé par passager-kilomètre. Pour les autres moyens de transport, le coût interne total est considérablement inférieur. La raison principale est que tous ces autres moyens de transport sont des moyens de transport collectifs qui, en général, utilisent plus efficacement les ressources.

Pour le transport de marchandises, les coûts internes sont les plus élevés pour le transport routier et les avions cargos. Le transport ferroviaire, la navigation intérieure et le transport maritime ont des coûts internes inférieurs par tonne-kilomètre. Les coûts internes sont influencés, entre autres, par les facteurs de charge. Les véhicules ayant des facteurs de charge plus élevés, par exemple les trains et les navires en général, ont des coûts internes inférieurs par tonne-kilomètre.

Tableau 10 Coûts internes moyens pour les différents véhicules en € par passager-kilomètre ou tonne-kilomètre

Transport de passagers	Coût interne en €par pkm	Transport de marchandises	Coût interne en € par tkm (conteneur/vrac)
Voiture (petite/grande)	0.13/0.15	**HGV**	0.08/0.12
Autocar	0.04	**Train de marchandises électrique**	0.02/0.009
Train à grande vitesse	0.04	**Train de marchandises diesel**	0.02/0.012
Train régulier (electrique/diesel)	0.10/0.20	**Voies navigables intérieures petites**	0.009/0.009
Avion à passagers (petit/grand)	0.06/0.03	**Voies navigables intérieures grandes**	0.011/0.010
		Navire intérieure (rivières)	0.010/0.09
		Navire maritime distance courte	0.003/0.003
		Avion de fret (cargaison générale)	0.12

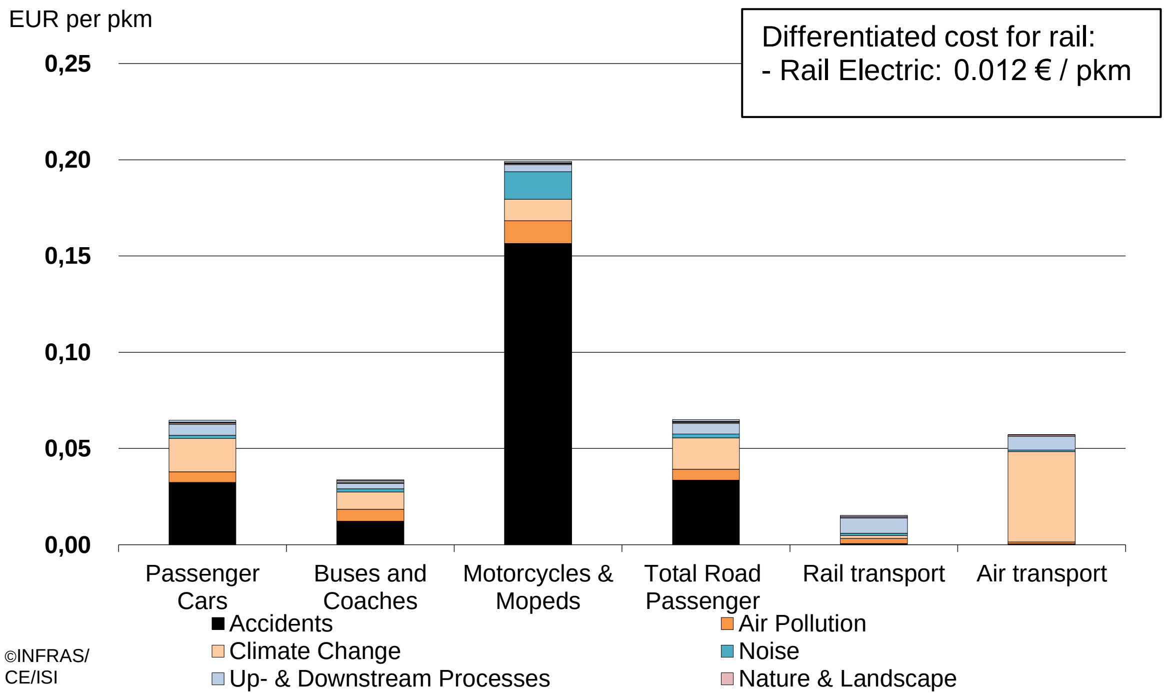
1 INTRODUCTION

1.1 Background to the study

This study has been carried out against the background of the internalisation of external costs. External costs are costs to society that, without policy intervention, are not taken into account by the transport users. Transport users are thus faced with incorrect incentives for transport supply and demand, leading to welfare losses. Internalisation, which is often referred to as the 'user pays' and 'polluter pays' principle, means that these costs are made part of the decision making process of the users, usually by introducing market based instruments. Internalisation of external costs of transport is a key policy principle for the EU transport policy.

Many studies have been carried out, on external costs, infrastructure costs, internalisation and transport pricing. A methodology for calculating external costs was provided in the 'Handbook on estimation of external costs in the transport sector' by CE Delft and INFRAS in 2008 (building in many EU research projects like UNITE and GRACE) which was updated by Ricardo in 2014. Total levels of external costs for the various transport modes have been calculated and assessed in detail in 'External Costs of Transport in Europe' in 2011 (CE Delft et al, 2011). This study shows (see Figure 13) that in 2008, the extern cost per passenger-kilometre were highest for cars and aviation (on average about 6 €ct), while for coaches they were about 3 €ct and rail transport about 1.5 €ct. These figures do not include infrastructure costs. They are included here to provide some context for the tax burden values mentioned below.

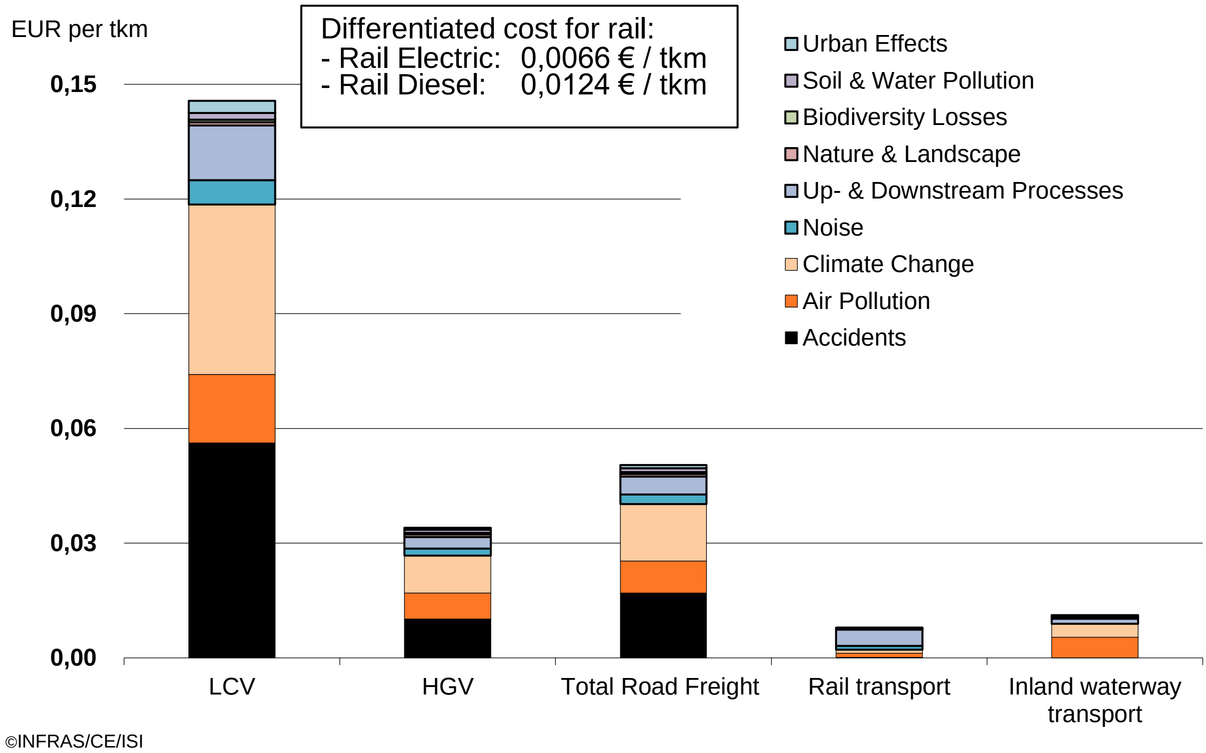
Figure 13 Average external costs of passenger transport modes in 2008 (CE Delft et al, 2011)



As can be seen in Figure 14, also in the freight market, road transport has considerably higher external costs (on average more than 5 €ct per tonne-km in

2008), than those of rail freight transport (less than 1 €ct) and inland waterways (less than 1.2 €ct).

Figure 14 Average external costs of freight transport modes in 2008 (CE Delft et al, 2011)[22]



The 2011 White Paper on Transport showed that the transport sector faces significant challenges (European Commission, 2011b). The internalisation of external costs is one of the leading principles in EUs transport policy, contributing to solving these challenges. Recently, the European Parliament has called for renewed efforts in internalisation and also the Commission Communication of 2016 on 'A European Strategy for Low-Emission Mobility' emphasized the need for making steps forward in applying the 'polluter pays' and 'user pays' principles. In 2017 further steps have been taken by the adoption on 31 May of a proposal for a revised Eurovignette Directive as part of the Clean, competitive and connected mobility package. In addition, the Commission has launched an extensive study to support the next steps towards the internalisation of external costs of transport in the EU.

One of the reasons of the unequal level playing field on the European transport market, are differences in taxation between transport modes due to unequal fiscal requirements that not reflect well the (differences in) external costs. From the side of the European Commission, there have been several initiatives to improve the effectiveness and fairness of transport taxation in Europe, among other things by promoting the 'user pays' and 'polluter pays' principles[23]. For example, the EU has

[22] LCV stands for Light Commercial Vehicle (vans)

[23] The 'user pays' principle means that transport users should pay for at least the maintenance costs of transport infrastructure, while the 'polluter pays' principle implies that transport users should also pay for the external costs caused by transport activities.

introduced the Eurovignette Directive[24], which provides a framework that aims to recover construction, maintenance and environmental costs of heavy goods transport. In addition, by adopting the Energy Tax Directive[25] the EU provides a common EU framework for taxing motor fuels, heating fuels and electricity. Over the last years, little progress in improving transport taxation has been made, due to disagreements on this issue between the Member States.

As the national and EU transport markets have opened up significantly over the last decade, competition between different modes has increased notably. As a consequence, businesses operating in freight and passenger transport have become more sensitive to differences in taxation across modes and across Member States. Although most of the taxation is the responsibility of the Member States, it is important to ensure the transparency and comparability of transport taxes, charges and subsidies at EU level. Better information on the types of taxes, charges and subsidies applied in the various EU Member States is also necessary for any (future) initiatives aiming at better internalisation of the external costs in transport.

The level and structure of transport taxes have been thoroughly investigated in the study 'An inventory of measures for internalising external costs in transport in 2012' (CE Delft et al., 2012). This study provides a complete overview of all transport taxes and charges levied on the various transport modes in all EU Member States. However, all the information provided by this study is on the country level, while modal competition is often happening on international corridors[26] with specific characteristics. Therefore, the impact of transport taxation /charging requires an in-depth analysis of transport activity on specific corridors. In this study, data for such an analysis has been provided for a number of representative EU transport corridors.

It should be emphasized that in this study only part of the information needed for concluding on the level playing field of transport modes is investigated. Only taxes, charges and subsidies are assessed, but external costs and infrastructure costs are out of scope. For a proper assessment on the level playing field of the various transport modes, the (variable) taxes and charges of each mode should be compared with the (marginal) external and infrastructure costs of the same modality. Differences between the cost coverage ratios of the various modes can be regarded as an indicator for the level playing field (as long as all relevant external and infrastructure costs, taxes, charges and subsidies are included). Building *inter alia* on the information collected by this study, the Commission has launched another extensive study which aims to give a comprehensive update of internalisation measures, external costs and infrastructure spending. This should enable a proper comparison of the framework conditions of the various transport modes.

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24 Directive 2011/76/EU of the European Parliament and of the Council of 27 September 2011 amending Directive 1999/62/EC on the charging of heavy goods vehicles for the use of certain infrastructures

25 Council Directive 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity

26 The word corridor refers to a belt connecting two areas. The term corridor in this study should not be mistaken with the European TEN-T corridors.

1.2 Objective

The objective of the study is to compare the total burden of taxation, charging and subsidisation on different transport means on twenty representative EU transport corridors.

More specifically, this study aims to:
- Identify and describe twenty EU transport corridors that well reflect the transport operations on the European TEN-T network.
- Identify relevant taxes, charges and subsidies that are levied on the various transport operations on these twenty corridors. For this purpose, the transport operations are considered in both directions meaning that the cities which define the corridor are treated both as an origin and a destination of a given journey.
- Collect data on the structure and size of these taxes, charges and subsidies.
- Compare the total burden of taxation, charging and subsidisation of different transport means on the selected corridors and between transport modes.

1.3 Scope

In this section we present the scope of the study. The following issues are discussed in this respect:
- the base year applied;
- the end-user perspective applied;
- the exclusion of external and infrastructure costs from the analyses;
- transport operations considered, including the reference vehicles defined.

1.3.1 Base year
The results of this study are presented for the year 2016[27]. Furthermore, all financial results are in euro price levels of 2016 (unless otherwise stated). Data from sources where price levels from other years were used were translated to price level 2016 by Consumer Price Indices (CPI) for the specific countries[28].

1.3.2 End-user perspective
In this study an end-user perspective is applied, implying that the taxes, charges, subsidies and internal[29] costs of transport operations are considered from the perspective of travellers (passenger transport) and transport operators (freight transport). In addition, for the collective passenger transport modes (bus, rail and aviation) we also present results for transport operators (see Annex H). These results may differ from the results for travellers, among other things because transport operators may reclaim their VAT payments. Furthermore, internal costs may differ between both groups due to the profit margin that transport operators add to their internal costs to calculate the transport prices to be paid by passengers.

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27 For some taxes, charges and subsidies, only information on 2017 levels was available. However, as the differences between 2016 and 2017 levels are in general very small, this does not significantly affect the results of the study.

28 No correction for differences in purchasing power (PPP correction) between the countries has been made. From the perspective of the international traveller /transport company it makes more sense to compare uncorrected tax/charge/subsidy figures.

29 Internal costs are costs other than taxes and charges. Internal costs include the cost of vehicle purchase or lease, use and maintenance, energy use, driver and organisational costs, and profit margin. See appendix E for a detailed discussion on internal costs considered in this study.

1.3.3 Exclusion of external and infrastructure costs from the analyses

The use of the end-user perspective also implies that broader social costs, such as external and infrastructure costs, are not considered in this study (as far as they are not internalised). As a consequence, this study does not aim to discuss the extent by which the various transport modes meet the user pays or polluter pays principles, or in broader terms, to what extent the current allocation of transport operations on the European transport market can be considered efficient from a social perspective. For such an analysis, it is necessary to include external and infrastructure costs in the assessment as well, particularly as these costs differ widely between the various modes (e.g. see CE Delft et al., 2011). Instead, this study aims to just provide insight in the taxes, charges and subsidies applied on twenty European corridors.

1.3.4 Transport operations

Transport operations are defined as carrying persons or cargo from one place to another. In this study, it is assumed that the transport operation starts at the moment of embarking or loading the vehicle at the origin and ends at the moment people leave the vehicle or cargo is unloaded at the destination. Furthermore, first- and last-mile transport is not considered as part of transport operation on the corridors. For freight, the transport operation considered is thus between different freight terminals (trucking terminals, rail terminals, ports, airports). In the case direct transport between the different freight terminals is not possible (e.g. transhipment between modes is necessary) combined transport is used. For the selected corridors combined transport is only applicable in combination with maritime transport. Direct rail transport is possible as rail freight terminals exist in all destinations; road-rail combined transport is therefore not included. None of the routes using combined transport apply a subsidy scheme related to it. Subsidies for combined transport are therefore not included.

The definitions of transport operations, as presented above, exclude storage and warehousing of transported goods at the origin or final destination. Possible storage of goods at transhipment locations (e.g. for multimodal transport) are part of the transport operations considered. By the same reasoning, waiting times at the origin (or destination) of a passenger trip are not considered in this study, while waiting times at a transfer are.

Important components of the transport operations are the type of transport considered and the type of vehicles involved. Both will be discussed in more detail below.

Types of transport

For freight transport, we distinguish between two different types of transport: container transport/general cargo[30] and bulk transport. They may differ with respect to the tax and/or charge levels, the amount of subsidy granted or the amount of internal costs. The assumptions made for these three types of transport are summarised in Table 11. In Chapters 4 and 5, we present the results for container

[30] For aviation, container transport is not relevant. As general cargo transport by aviation may compete with some (sub-segments) of road container transport, comparing aviation cargo transport with container transport makes most sense. However, when interpreting the final results of this study, it should be considered that aviation cargo transport only compete with a limited number of sub-segments of the container transport market.

transport / general cargo, while the results for bulk transport are presented in Annex G.

For passenger transport, no distinction between different types of transport (e.g. business vs. private transport) is made, as they do not differ significantly with respect to the taxes/charges levied and subsidies received.

Table 11 Assumptions made for the different types of freight transport

Type of freight transport	Assumptions
Container / general cargo transport	• Type of goods: Consumer goods • Type of containers assumed: 40 ft containers (2 TEU), weight 19t/TEU • Container transport is considered for road, rail, inland shipping and maritime shipping • For aviation, general cargo transport is considered.
Bulk transport	• Type of goods: metal ores. • Relevant transport modes: road, rail, inland shipping, maritime shipping

Reference vehicles

In this study we consider all transport modes, for both passenger and freight transport: road transport, rail transport, inland shipping, maritime shipping and aviation. For all these modes we consider EU average reference vehicles, in order to allow for a harmonised comparison between corridors. This implies that for the technical and operational characteristics of the vehicles EU average values are chosen. However, with respect to the acquisition and operational costs national values are applied, as they have to be directly comparable with national tax, charge and subsidy levels.

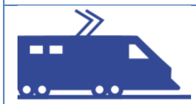
An overview of the reference vehicles (including a brief description) is given in Table 12 (passenger transport) and Table 13 (freight transport). More detailed information on the technical and operational characteristics of the reference vehicles can be found in Annex A. More information on the assumed acquisition and operational costs of the vehicles can be found in Annex E.

Table 12 Reference vehicles passenger transport

Transport means	Subclasses	Characteristics
	Small passenger car	A FIAT 500 (petrol, Euro 5) is considered as small car in this study. For this car an average occupancy rate of 2 persons on long distance trips is assumed.
	Large passenger car	A Volkswagen Passat (diesel, Euro 6) is assumed as large car in this study. For this car an average occupancy rate of 2 persons is assumed as well.
		Given the long distances on the corridors, a long distance coach (diesel, Euro 6) is assumed as reference bus. On average 30 persons are seated in the bus.
	Regular electric train	An average European intercity passenger train is considered as reference vehicle for regular electric passenger trains. For this study, 85 persons per train are assumed.
	High speed train	For the high speed connections, an average European high speed train is considered. For this train, 280 persons per train are assumed.
	Regular diesel train	An average European diesel intercity passenger train is considered as reference vehicle. The operational characteristics of this train are equal to the characteristics of the regular electric train.

Transport means	Subclasses	Characteristics
	Large airplane	The Airbus A320-232 is often used for intra-EU flights and is therefore chosen as reference international/large airplane. An average of 139 persons per flight is assumed for this airplane.
	Small airplane	A regional/smaller alternative for the Airbus A320 is the Embraer 170 STD. This smaller airplane carries on average 54 persons per flight.
		For some of the corridors, intermodal trips using ferries are considered in this study. For these corridors a RoPax vessel is assumed. This vessel is able to carry 1000 passengers (next to cargo).

Table 13 Reference vehicles freight transport

Transport means	Subclasses	Characteristics
		Given the long distances on the selected corridors, only large heavy goods vehicles (HGVs) are considered in this study. Therefore, a 40 tonne diesel truck (Euro 6) is taken as reference vehicle. The average load of this vehicle is assumed to be 1.4 TEU (container) or 12 tonnes (bulk).
		An average long electric freight train (600 metres) is considered as reference freight train in this study. This train carries an average load of 72 TEU (container) or 1250 tonnes (bulk). Furthermore, a full train load is assumed in this study for all freight rail operations.
		An average diesel freight train (600 metres) is considered as reference diesel freight train. The same operational parameters as for the long electric freight train are assumed.
	Large ship	A CEMT Va vessel is considered as reference inland ship for this study. This type of vessel, also known as Large Rhine, is commonly used on the deepest inland fairways. The average load assumed for this ship is 156 TEU (container) or 1,680 tonnes (bulk).
	Small ship	Not on all corridors a CEMT Va vessel can be used due to limited fairway depths. Therefore, a smaller reference inland ship (CEMT IV) has also been defined. This ship is commonly used on these fairways. The average load assumed for this ship is 72 TEU (container) or 840 tonnes (bulk).
	LoLo vessel	A Load on / Load off (LoLo) vessel is chosen as reference vessel for short sea shipping operations. The average load of this ship is 486 TEU (container) or 4,824 tonnes (bulk). This ship is common for shortsea operations in the European area.
	Small ship	For some of the corridors, a river sea vessel is assumed. This vessel can sail on both coastal and inland waters, such that inland ports can be reached. On average this vessel carries 168 TEU (container) or 2,010 tonnes (bulk). This ship is chosen as it is able to go to the port of Paris.
		The often used cargo airplane Boeing 757-200 is assumed as reference cargo plane. The average load of this airplane is 26 tonnes.

It is assumed in this study that vehicles are registered in the country of origin. For example, on the corridor Paris – Amsterdam all vehicles are assumed to be registered in France. However, as we consider the transport operations on all corridors from both directions, we will also assess the situation in which the vehicles are registered in the Netherlands.

The reference vehicles are chosen to reflect the most commonly used vehicles. In order to promote the internalisation of external cost many rebates or discounts are possible for environmental friendly vehicles. For example, many ports provide considerable discounts for environmental friendly vessels as shown by the recent study for the European Commission done by COGEA (2017). The share of environmental friendly vehicles in the total fleet is generally small, and environmental friendly vehicles are not representative for the whole fleet. Many of the discounts will therefore not (to their full extent) apply to the chosen reference vehicles, which are vehicles commonly used and sold.

Also the number of passengers per passenger vehicle and average loading factor for freight vehicles are based on averages. In specific cases these can deviate significantly (e.g. only 1 or even 5 passengers in a car), which significantly affects the tax burden per passenger-kilometre (tonne-kilometre in the case of freight).

1.4 Overview of the study

In Chapter 2, we present the twenty corridors for which the assessment in this study has been carried out. Furthermore, it is shown that these corridors provide a good reflection of the transport operations on the European TEN-T network. In Chapter 3, we identify the taxes, charges and subsidies that are relevant for the different transport modes on the corridors studied. The level of these taxes, charges and subsidies for the different transport modes is presented in Chapter 4. In this chapter we compare the (net) fiscal burden of the various transport modes per corridor. A comparison of the net fiscal burden between corridors is provided by Chapter 5. Finally, the main conclusions are presented in Chapter 6.

Complementary to this report a background document has been produced, presenting detailed information on the individual taxes, charges and subsidies applied on the various corridors.

2 OVERVIEW OF CORRIDORS

2.1 Introduction

In this chapter, we present the twenty transport corridors that are studied in this report. In total 15 international corridors are covered, while for five large EU countries also national corridors are investigated. An overview of the corridors is given in Table 14.

Table 14 Overview of corridors

International corridors	National corridors
• Paris – Amsterdam • Paris – Madrid • Antwerp – Warsaw • Amsterdam – Frankfurt • Frankfurt – Budapest • Rome – Berlin • Hamburg – Prague • Helsinki – Gdansk • Lisbon – Antwerp • Stockholm – Hamburg • Genoa – Rotterdam • Budapest – Milan • Bucharest – Warsaw • Dublin – Amsterdam • Athens - Vienna	• Paris - Marseille • Hamburg - Munich • Gdansk – Katowice • Madrid - Barcelona • Milan – Naples

In the remainder of this chapter, we first validate the selection of these twenty corridors by showing that they provide a good reflection of the transport operations on the European TEN-T network (Section 2.2). Subsequently, these twenty corridors are briefly introduced in Section 2.3 by discussing the transport means used, the routes, and the travel distances and times. More detailed information on the corridors is presented in Annex C.

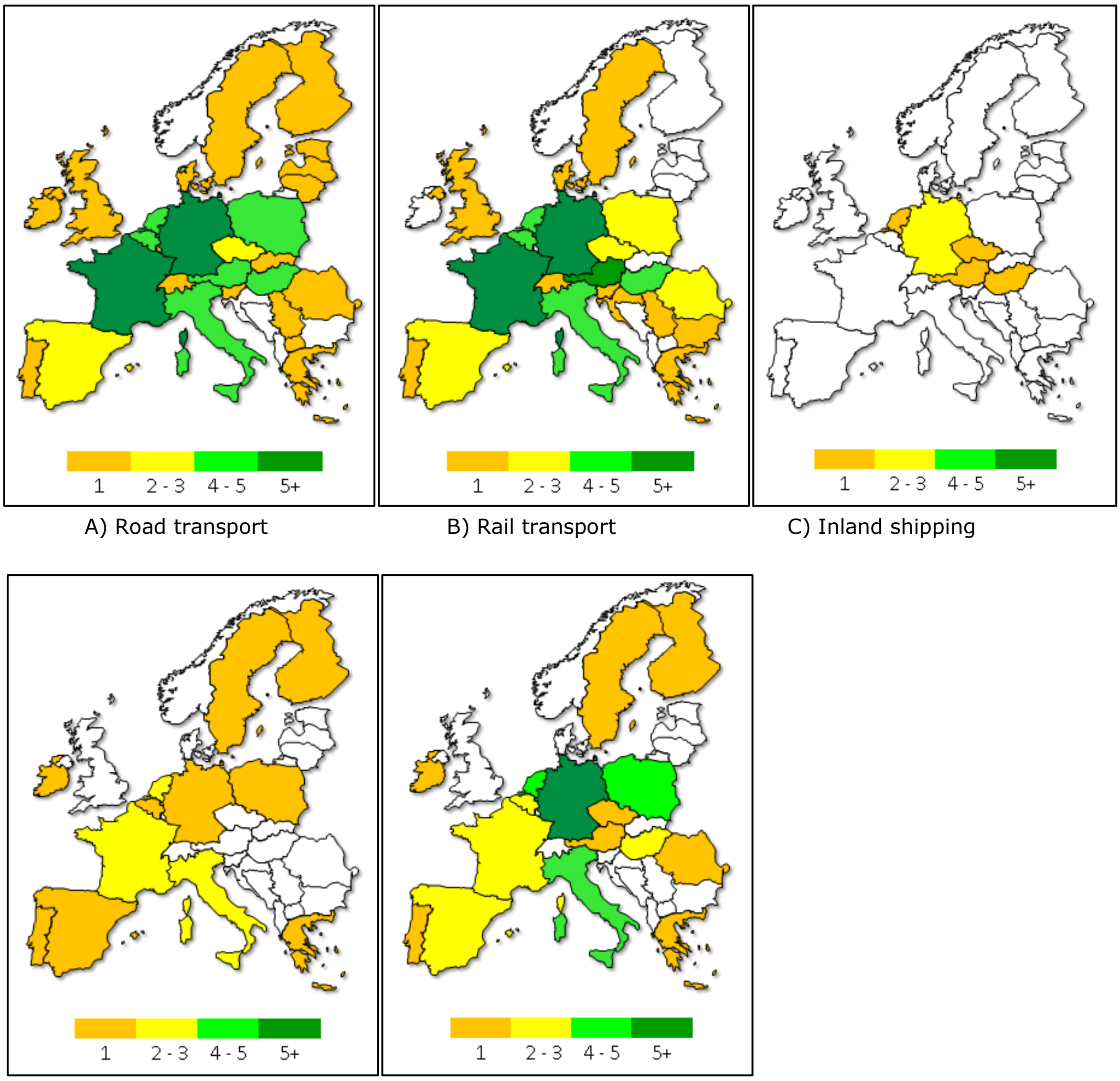
2.2 Validation of corridors

The twenty selected EU transport corridors provide a good reflection of the transport operations on the European TEN-T network in terms of geographical coverage, coverage of different types of transport operations and transport taxes and charges levied in Europe. This is discussed in more detail in the subsections below.

2.2.1 Good geographical coverage

The twenty corridors provide a good geographical coverage, as is shown in Figure 15. For road and rail transport, most EU Member States are covered by at least one corridor. For rail transport, particularly the Baltic countries are missing in the corridors selected. However, this is due to the missing international railway connections in these countries, complicating rail transport between these countries and the rest of Europe (Triniti et al., 2014). The geographical coverage provided by the corridors on which inland shipping is applied is more limited, but this is explained by the fact that inland shipping is only applied (on a significant scale in a few EU countries). The two most important countries with respect to inland shipping (Germany and the Netherlands) are, however, well covered by the corridors. Although for maritime transport and aviation no complete coverage of all EU Member States is provided by the corridors, all different regions are well covered.

Figure 15 Number of corridors in which each country is included per transport mode



A) Road transport B) Rail transport C) Inland shipping

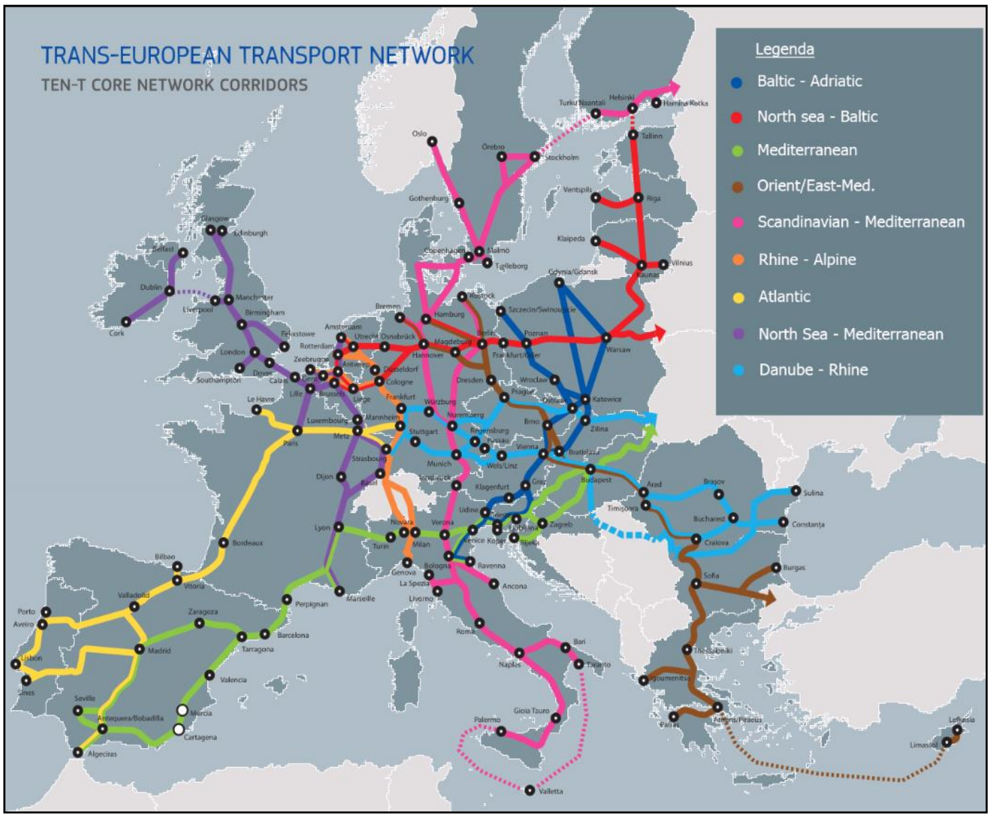
D) Maritime transport E) Aviation

2.2.2 Coverage of all TEN-T corridors

The EU transport infrastructure policy aims to close the gaps between Member States' transport networks, remove bottlenecks that hamper the smooth functioning of the internal market and overcome technical barriers (e.g. improve "interoperability" for rail transport). The main focus of this policy is on the core network corridors (see Figure 16), which represent the strategic heart of the trans-European network (TEN-T).

As shown in Table 15, the corridors investigated in this study provide a good coverage of the nine core TEN-T corridors. With the exception of the Baltic – Adriatic corridor, all TEN-T corridors are at least covered by two selected corridors. Moreover, the selected corridors often cover different parts of the core TEN-T corridors. As for the Baltic – Adriatic corridor, only the Northern part is directly covered in this study (by the corridor Katowice – Gdansk). However, the Southern part of the Baltic – Adriatic corridor overlaps with the Eastern part of the Mediterranean corridor, for which the corridor Budapest – Milan is included in the study.

Figure 16 TEN-T corridors



Source: TENtec information system

Table 15 Coverage of TEN-T corridors

TEN-T corridor	Corridor
Scandinavian – Mediterranean corridor	• Berlin – Rome • Stockholm – Hamburg • Hamburg – Munich • Milan – Naples
North Sea – Baltic corridor	• Antwerp – Warsaw • Helsinki – Gdansk (partly)
North Sea – Mediterranean corridor	• Amsterdam – Dublin • Paris – Amsterdam • Paris – Marseille
Baltic – Adriatic corridor	• Gdansk – Katowice
Orient/East-Med. corridor	• Hamburg – Prague • Athens – Vienna
Rhine – Alpine corridor	• Rotterdam – Genoa • Amsterdam – Frankfurt
Atlantic corridor	• Paris – Madrid • Lisbon - Antwerp (partly)
Rhine – Danube corridor	• Frankfurt – Budapest • Bucharest – Warsaw (partly)
Mediterranean corridor	• Budapest – Milan • Madrid - Barcelona

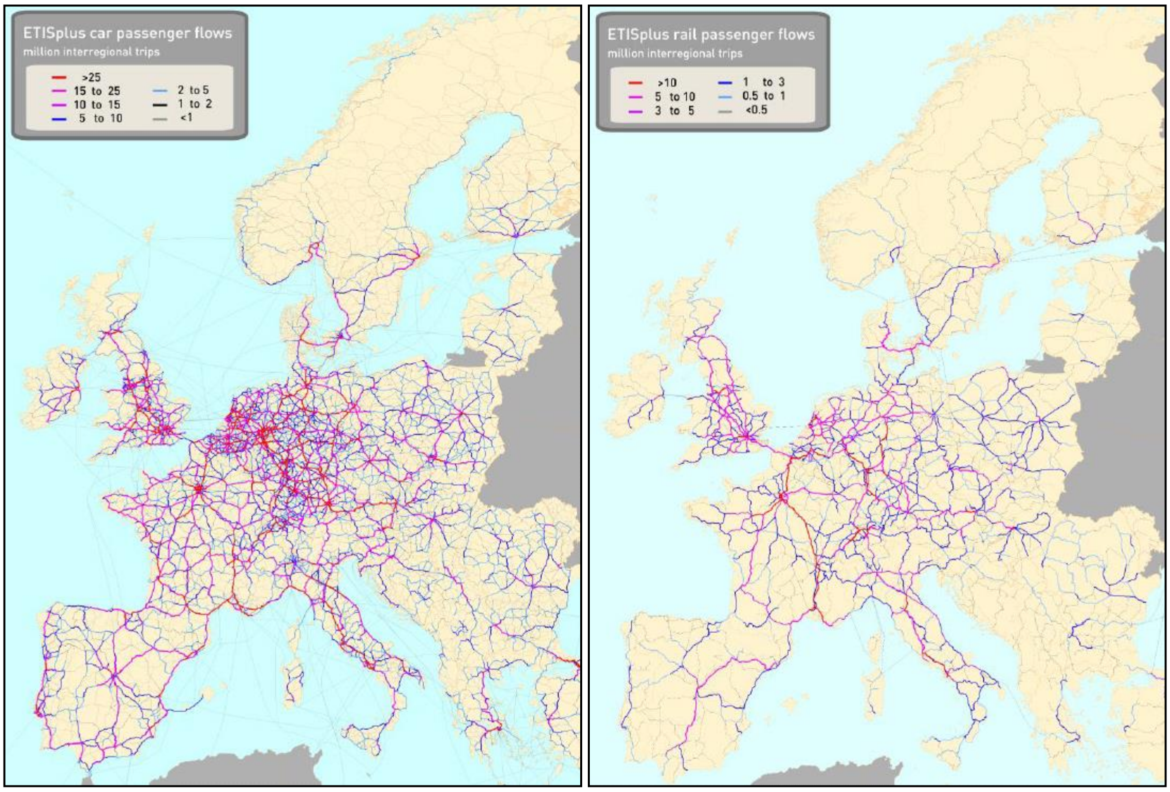
2.2.3 Coverage of the main transport flows

The main transport flows in Europe are well reflected by the selected corridors. For road and rail transport, the main international transport flows in Europe are shown in

Figure 17. The large road transport flows in North-Western Europe (in Germany, Belgium, Luxemburg, the Netherlands and Austria) are well covered by corridors like Amsterdam – Frankfurt, Antwerp – Warsaw, Paris – Amsterdam and Hamburg – Munich. Furthermore, also corridors like Frankfurt – Budapest, Milan – Naples and Madrid – Barcelona cover important passenger transport flows in Europe. For rail transport, significant passenger flows are covered by corridors like Amsterdam – Frankfurt, Hamburg – Munich, Paris – Amsterdam, Paris – Marseille and Milan – Naples.

Figure 17 Interregional passenger flows in 2010 (in million trips)

A) Road transport *B) Rail transport*



Source: ETISplus (2013)

The corridors also provide a good coverage of the main airports in Europe, as is shown in Table 16. From the ten most important EU airports (in terms of passengers carried) seven airports are included in one or more corridors (only London Heathrow, London Gatwick and Paris Orly are missing). From the top twenty, twelve airports are covered by the corridors selected for this study. Additionally, the four main Eastern European airports (Prague, Warsaw, Budapest and Bucharest) are included in one or more corridors as well.

Table 16 Top 20 EU airports (in terms of total number of passengers carried in 2015) covered by the corridors

Ranking	Airport	Corridors
2	Paris – Charles de Gaule	Paris – Amsterdam, Paris – Madrid, Paris – Marseille
3	Frankfurt am Main	Amsterdam - Frankfurt, Frankfurt – Budapest
4	Amsterdam - Schiphol	Paris – Amsterdam, Amsterdam – Frankfurt, Dublin – Amsterdam, Rotterdam – Genoa
5	Madrid Barajas	Paris – Madrid, Madrid – Barcelona
6	Munich	Hamburg – Munich
8	Roma - Flumicino	Berlin – Rome

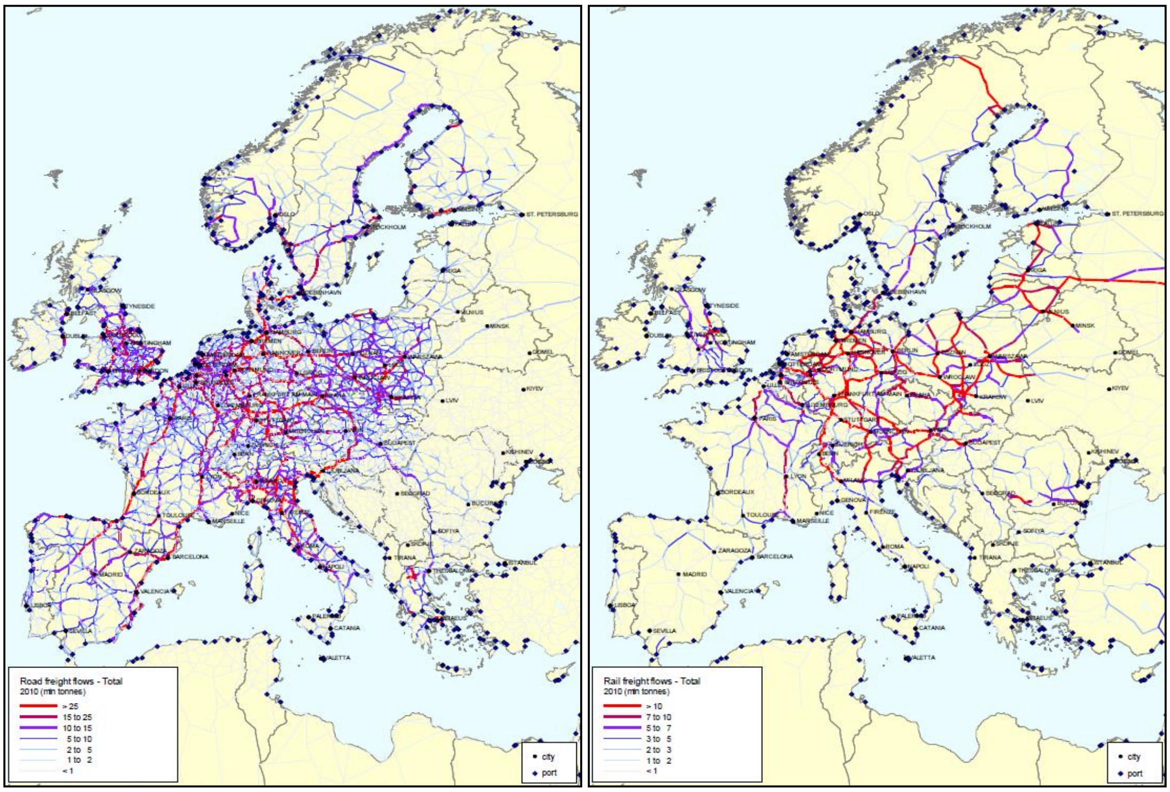
Ranking	Airport	Corridors
9	Barcelona – El Prat	Madrid – Barcelona
12	Dublin	Dublin – Amsterdam
14	Brussels	Antwerp – Warsaw, Lisbon - Antwerp
15	Stockholm – Arlanda	Stockholm – Hamburg
17	Wien – Schwechat	Athens – Vienna
20	Berlin Tegel	Berlin - Rome

Source: Eurostat (2017)

As for road and rail freight transport, the main transport flows in Europe are shown in red and purple in Figure 18. For road transport, important transport flows in North Western Europe (Belgium, Germany, the Netherlands) are well covered by corridors like Amsterdam – Frankfurt, Antwerp – Warsaw and Hamburg – Munich. Also important flows between Paris and Madrid, Stockholm and Hamburg, Budapest and Milan, and Hamburg and Prague are well covered by the selected corridors. As for rail freight transport, corridors like Rotterdam – Genoa, Hamburg – Prague, Amsterdam – Frankfurt and Frankfurt – Budapest cover a large share of the main rail routes in Europe.

Figure 18 Road and rail freight transport flows in 2010 (in million tons)

A) Road transport *B) Rail transport*



Source: ETISplus (2013)

For inland shipping, the main transport flows are heavily concentrated in a small part of Europe (the Netherlands, Germany). This is clearly shown in Figure 19. The corridor Frankfurt – Amsterdam well covers this region and the inland shipping flows over the Rhine. Next to the Rhine Delta, important inland waterways (IWT) flows are found on the Danube. These flows are well covered by the corridor Frankfurt – Budapest. Finally, the (limited) IWT flows on the Elbe are covered by the corridor Hamburg – Prague. Other significant European IWT flows are found on the Seine and the

Romanian part of the Danube, but as these routes are relatively short we do not cover them in this study.

Figure 19 Main inland shipping transport flows in 2010

Source: ETISplus (2013)

Finally, the selected corridors cover the five largest short sea shipping ports in Europe, as is shown in Table 17. From the top 10, six ports are represented in the corridors that are studied in this report. Furthermore, the second largest short sea shipping port in Eastern Europe (Gdansk) is covered in the study as well.

Table 17 Top 10 EU short sea shipping ports (in terms of goods handled in 2015) covered by the corridors

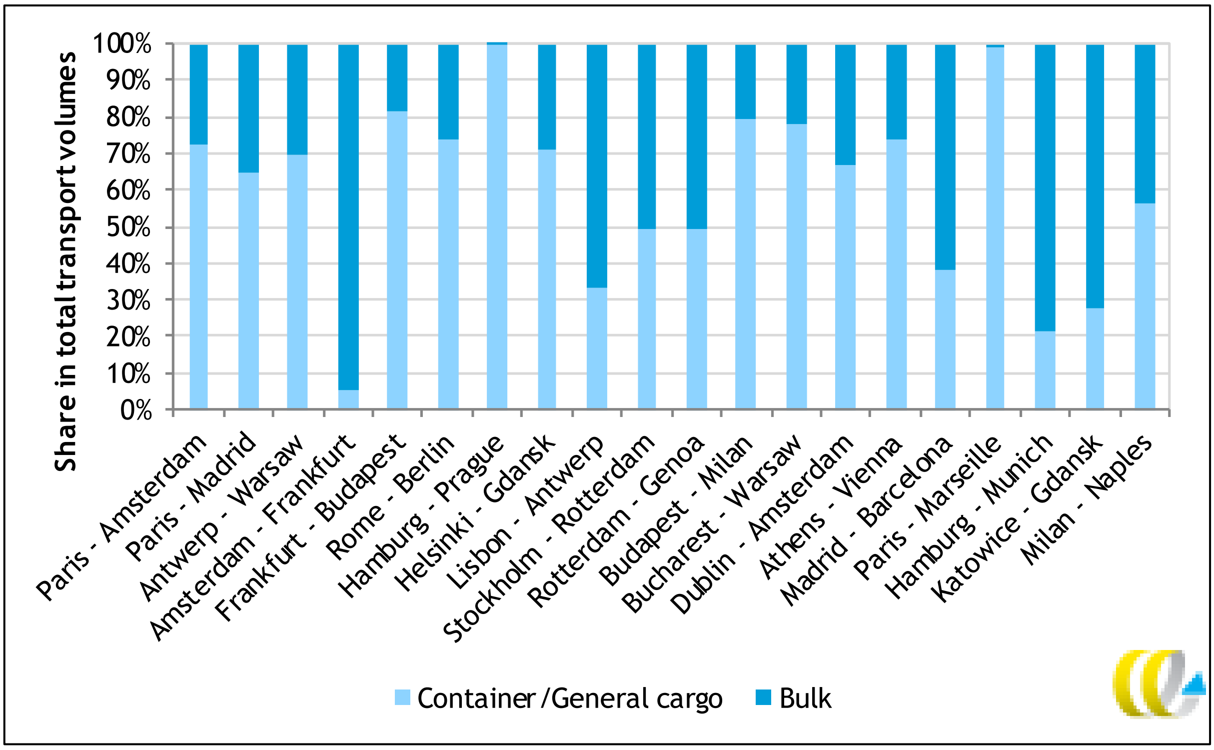
Ranking	Seaport	Corridors
1	Rotterdam	Rotterdam – Genoa
2	Antwerp	Lisbon - Antwerp
3	Hamburg	Stockholm - Hamburg
4	Amsterdam	Paris – Amsterdam, Dublin – Amsterdam
5	Marseille	Paris – Marseille
10	Genoa	Rotterdam - Genoa

Source: Eurostat, 2017

2.2.4 Coverage of the different types of freight transport

As explained in Section 1.3, we distinguish two types of freight transport in this report: container/general cargo and bulk transport. As is shown in Figure 20, both types of transport are well reflected on the twenty selected corridors. Whereas some of the corridors can be considered typical bulk routes (e.g. Amsterdam – Frankfurt, Hamburg – Munich, Katowice - Gdansk), others are dominated by container transport (e.g. Paris – Marseille, Hamburg – Prague).

Figure 20 Composition of freight transport volumes on the twenty corridors in 2010



Source: ETISplus, adapted by CE Delft[31]

2.2.5 Good coverage of different types of taxes and charges

As this study considers the level of taxation/charging and subsidisation of the various transport modes, it is important that the corridors reflect well the wide variety of taxes, charges and subsidies applied in the European countries. As is shown in Section 3.3, all important taxes and charges are covered by several of the corridors considered in the study.

2.3 Introducing the selected corridors

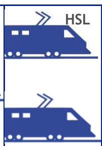
In this section we introduce the various corridors by discussing the transport means that are used on the corridors and the routes they take (by discussing travel distances and time per mode per corridor). A more detailed description per corridor can be found in Annex C. The methodology applied to determine the routes (including travel distances and time) on each of the corridors is explained in detail in Annex B.

2.3.1 Transport means used on the corridors

An overview of the passenger transport means that are considered on each of the corridors is given in Table 18.

[31] The ETISplus data used is on the NUTS3 level (large city agglomerations), which well reflects the transport flows on the selected corridors. The ETISplus data doesn't differentiate between bulk and container / general cargo transport, but instead 24 different categories of goods are distinguished. These categories of goods are designated to the three broader categories of freight transport by the researchers. In this way a rough estimation of the market shares of bulk, container and general cargo transport on the various corridors is provided.

Table 18 Reference vehicles that can be used for passenger transport on the various corridors

											
Paris – Amsterdam	✓	✓	✓			✓					
Paris - Madrid	✓	✓	✓			✓					
Antwerp - Warsaw	✓	✓			✓		✓				
Amsterdam - Frankfurt	✓	✓	✓			✓					
Frankfurt - Budapest	✓	✓	✓			✓					
Rome - Berlin	✓	✓			✓	✓					
Hamburg - Prague	✓	✓		✓		✓					
Helsinki - Gdansk						✓			✓	✓	
Lisbon - Antwerp	✓	✓			✓		✓				
Stockholm - Hamburg						✓			✓	✓	✓
Genoa – Rotterdam	✓	✓			✓		✓				
Budapest - Milan	✓	✓			✓	✓					
Bucharest - Warsaw	✓	✓		✓		✓					
Dublin – Amsterdam						✓			✓	✓	✓
Athens – Vienna	✓	✓			✓	✓					
Madrid – Barcelona	✓	✓	✓			✓					
Paris – Marseille	✓	✓	✓			✓					
Hamburg – Munich	✓	✓	✓			✓					
Katowice – Gdansk	✓	✓	✓					✓			
Milan – Naples	✓	✓	✓			✓					

Road passenger transport (by passenger car or coach) is possible on all corridors, although on three corridors (Helsinki – Gdansk, Stockholm – Hamburg and Dublin – Amsterdam) a ferry has to be taken.

Passenger rail transport is considered on 19 of the twenty corridors. Only on the corridor Helsinki – Gdansk passenger rail transport is not possible due interconnectivity issues between the different countries (among other things due to different gauges in the Baltic States and the other countries). A high speed connection (connecting Berlin with Tallinn) is currently under development (Rail Baltic), such that passenger rail transport will become possible on this corridor in 2030. On half of the corridors (10) high speed trains can be used, while on 7 other corridors part of the route can be travelled by high speed lines. Only on two corridors (Hamburg – Prague and Bucharest – Warsaw) the entire route is done by a regular (electric) intercity train. Finally, on 11 corridors no direct rail connection is available, but one or more transfers are required (see Table 19). Particularly, on the corridors Genoa – Rotterdam, Dublin - Amsterdam, Athens – Vienna and Antwerp - Warsaw a significant number of transfers are required.

Table 19 Rail transfers required on the corridors

Corridor	Number of transfers	Place(s) of transfer
Paris - Madrid	1	Barcelona
Antwerp – Warsaw	3	Brussels, Essen, Berlin
Frankfurt – Budapest	1	Vienna
Rome – Berlin	2	Milan, Basel
Lisbon - Antwerp	2	Irun, Paris
Stockholm – Hamburg	1	Copenhagen
Genoa – Rotterdam	3	Milan, Basel, Utrecht
Budapest – Milan	2	Innsbruck, Verona
Bucharest – Warsaw	1	Vienna
Dublin – Amsterdam	4	Holyhead, London, Paris, Brussels
Athens - Vienna	3	Thessaloniki, Belgrade, Budapest

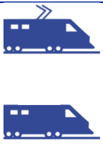
Aviation is possible on all corridors, although on four corridors no direct connection is available. On these corridors, aviation is part of an intermodal chain, most often in combination with a high-speed train. These and other intermodal chains are presented in more detail in Table 20.

Table 20 Detailed information intermodal passenger transport chains

Corridor	Intermodal chain	Explanation
Antwerp – Warsaw	• Airplane: Warsaw - Brussels • High speed train: Brussels - Antwerp	No direct connection by airplane between Antwerp and Warsaw.
Genoa – Rotterdam	• Airplane: Genoa-Amsterdam • High speed train: Amsterdam – Rotterdam	No direct connection by airplane between Genoa and Rotterdam
Helsinki – Gdansk	• Passenger car / bus • Ferry between Helsinki and Tallinn	Use of ferry is required to cross the Gulf of Finland
Lisbon - Antwerp	• Airplane: Lisbon – Brussels • High speed train: Brussels - Antwerp	No direct connection by airplane between Lisbon and Antwerp
Stockholm – Hamburg	• Passenger car / bus / high speed train • Ferry between Rodby and Puttgarden	Use of ferry is required to cross the Baltic sea
Dublin – Amsterdam	• Passenger car / bus / high speed train • Ferry between Dublin and Holyhead (road) or Liverpool (rail)	Use of ferry is required to cross the Irish see
Katowice - Gdansk	• Airplane: Gdansk – Krakow • Passenger car: Krakow - Katowice	No direct connection by airplane between Katowice and Gdansk

An overview of the freight transport means that are considered on each of the corridors is given in Table 21.

Table 21 Reference vehicles that can be used for freight transport on the various corridors

									
Paris – Amsterdam	✓	✓			✓	✓			
Paris - Madrid	✓	✓				✓			✓
Antwerp - Warsaw	✓	✓					✓		
Amsterdam - Frankfurt	✓	✓		✓		✓			
Frankfurt - Budapest	✓	✓		✓		✓			
Rome - Berlin	✓	✓				✓			
Hamburg - Prague	✓	✓		✓		✓			
Helsinki - Gdansk					✓	✓		✓	
Lisbon - Antwerp	✓		✓		✓		✓		
Stockholm - Hamburg		✓			✓	✓		✓	
Genoa – Rotterdam	✓	✓			✓		✓		
Budapest - Milan	✓	✓				✓			
Bucharest - Warsaw	✓	✓				✓			
Dublin – Amsterdam					✓	✓		✓	
Athens – Vienna	✓		✓			✓			✓
Madrid – Barcelona	✓	✓				✓			
Paris – Marseille	✓	✓			✓	✓			
Hamburg – Munich	✓	✓				✓			
Katowice – Gdansk	✓	✓					✓		
Milan - Naples	✓	✓				✓			✓

As for passenger transport, road transport is possible on all corridors whether or not in combination with a ferry (on the corridors Helsinki – Gdansk, Stockholm – Hamburg and Dublin – Amsterdam).

Rail freight transport is (theoretically) possible on most of the corridors, with the exception of Helsinki – Gdansk and Dublin – Amsterdam (as it cannot compete with maritime transport on this corridor). Although not on all of the corridors scheduled rail freight services are offered, it is assumed that they can be offered if requested by a shipper. However, since they are not offered on a regular basis, available data on specificities of these routes (e.g. number and place of transhipment) are scarce and hence some assumptions had to be made. As explained in Section 1.3.4, we assume full train load operations for each corridor, such that there is little need for transhipments. We assume only transhipment if they are required because of differences in rail infrastructure (e.g. gauges) or if they are explicitly mentioned by transport operators offering regular rail freight services. Based on these assumptions, we have identified three corridors where transhipment is needed (See Table 22). Finally, on most corridors electrified rail transport is possible; only on the corridors Athens – Vienna and Lisbon - Antwerp (small) parts of the route are done by diesel trains. For these corridors, transhipments are considered as well.

Table 22 Rail transhipments required on the corridors

Corridor	Number of transhipments	Place(s) of transhipment
Paris - Madrid	1	Irun/Hedaye
Lisbon - Antwerp	2	Irun/Hedaye, Paris
Athens – Vienna	1	Sopron

As for inland navigation, transport is possible on three corridors: Amsterdam – Frankfurt, Frankfurt – Budapest, and Hamburg – Prague. On the first two corridors a large reference ship can be used, while for the corridor Hamburg – Prague the smaller reference vessel is considered.

Maritime transport is possible on 10 corridors, although on three of them (Paris – Madrid, Athens – Vienna and Milan – Naples) in combination with road transport. For the corridors Paris – Amsterdam, Paris – Madrid and Paris – Marseille the smaller reference maritime ship is considered (because of the limited navigability for seagoing vessels of the Seine); while for the other corridors the large reference vessel is considered.

Aviation is possible on all corridors, although on four of the corridors only in combination with truck transport. This is because no direct air connection exist between the origin and destination city on these four corridors. These and other intermodal freight chains are presented in more detail in Table 23.

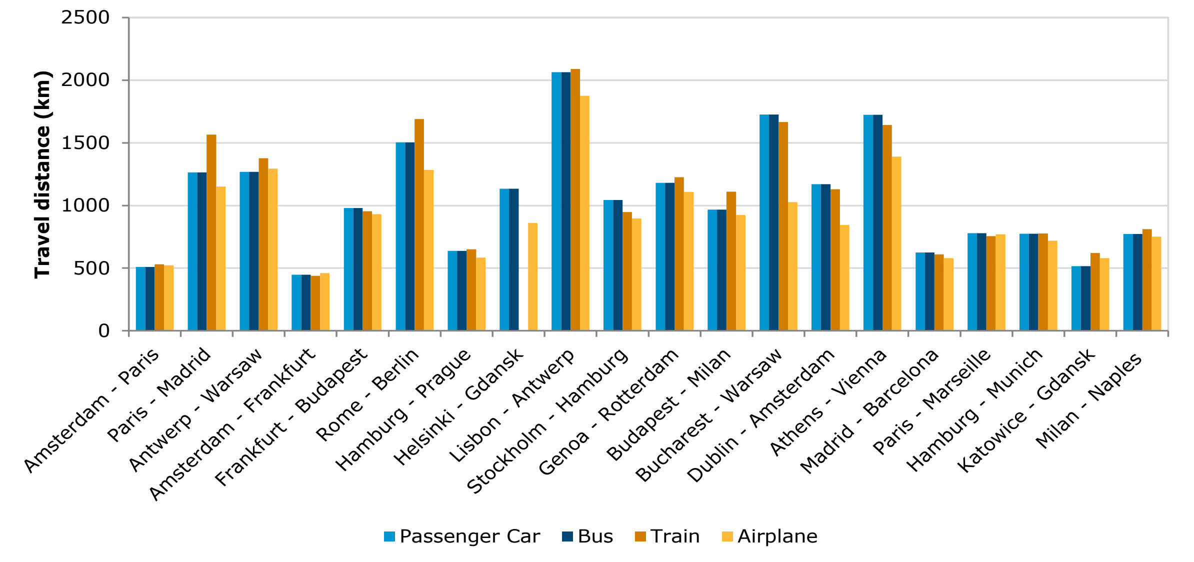
Table 23 Detailed information intermodal freight transport chains

Corridor	Intermodal chain	Explanation
Paris – Madrid	• Maritime ship: Paris – Bilbao • HGV: Bilbao – Madrid	Madrid has no maritime port; Bilbao is a viable (intermodal) maritime connection with Paris.
Antwerp - Warsaw	• Airplane: Warsaw - Brussels • HGV: Brussels - Antwerp	No direct connection by airplane between Antwerp and Warsaw.
Genoa – Rotterdam	• Airplane: Genoa – Amsterdam • HGV: Amsterdam – Rotterdam	No direct connection by airplane between Genoa and Rotterdam
Helsinki - Gdansk	• HGV • Ferry between Helsinki and Tallinn	Use of ferry is required to cross the Gulf of Finland
Lisbon – Antwerp	• Airplane: Lisbon – Brussels • HGV: Brussels - Antwerp	No direct connection by airplane between Lisbon and Antwerp
Stockholm - Hamburg	• HGV • Ferry between Rodby and Puttgarden	Use of ferry is required to cross the Baltic sea
Dublin - Amsterdam	• HGV • Ferry between Dublin and Holyhead	Use of ferry is required to cross the Irish see
Athens - Vienna	• HGV: Athens - Patras • Maritime ship: Patras – Trieste • HGV: Trieste - Vienna	Vienna has no maritime port, but via Trieste a viable (intermodal) maritime route to Greece is available.
Katowice - Gdansk	• Airplane: Gdansk – Krakow • HGV: Krakow - Katowice	No direct connection by airplane between Katowice and Gdansk
Milan - Naples	• Maritime ship: Naples - Genoa • HGV: Genoa - Milan	Milan has no maritime port, but via Genoa a viable (intermodal) maritime route is available.

2.3.2 Travel distances and times

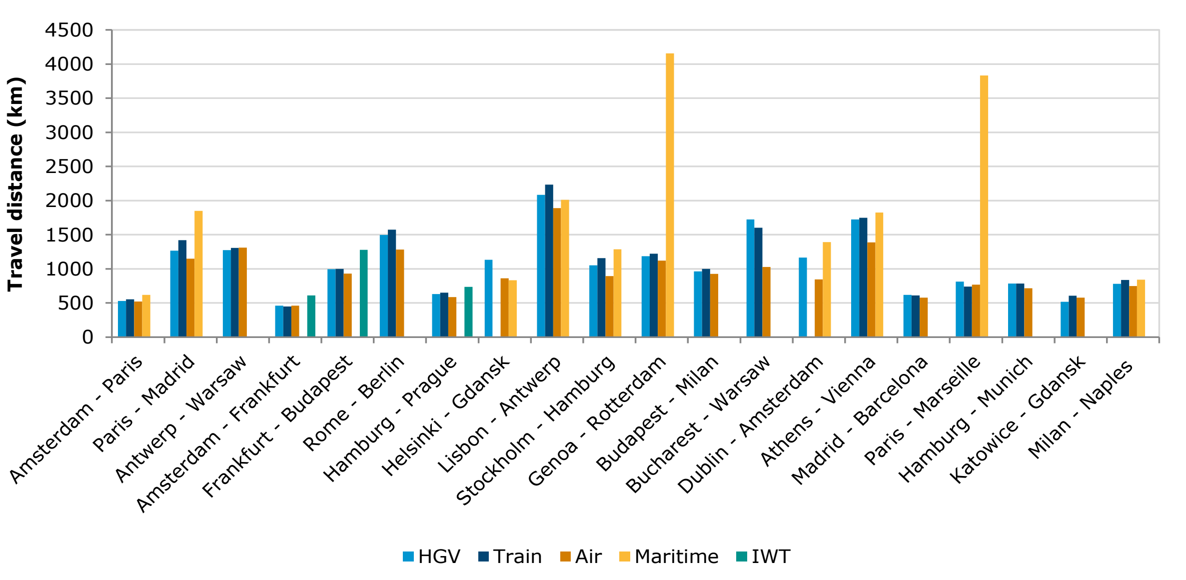
The travel distances of passenger transport means on the different corridors are presented in Figure 21. It shows that in this study we cover a broad range of corridors, ranging from about 500 kilometres (e.g. Amsterdam – Paris, Amsterdam – Frankfurt, Madrid – Barcelona) to about 2000 kilometres (Lisbon – Antwerp). As expected, distances do not differ much between the various transport means on most corridors. An exception is the corridor Bucharest – Warsaw, for which the trip length by airplane is significantly shorter than for road and rail transport. Due to the relatively low density of motorways and railways in the countries on this corridor, the transport distances for road and rail transport are relatively long.

Figure 21 Travel distances of passenger transport means on the twenty corridors



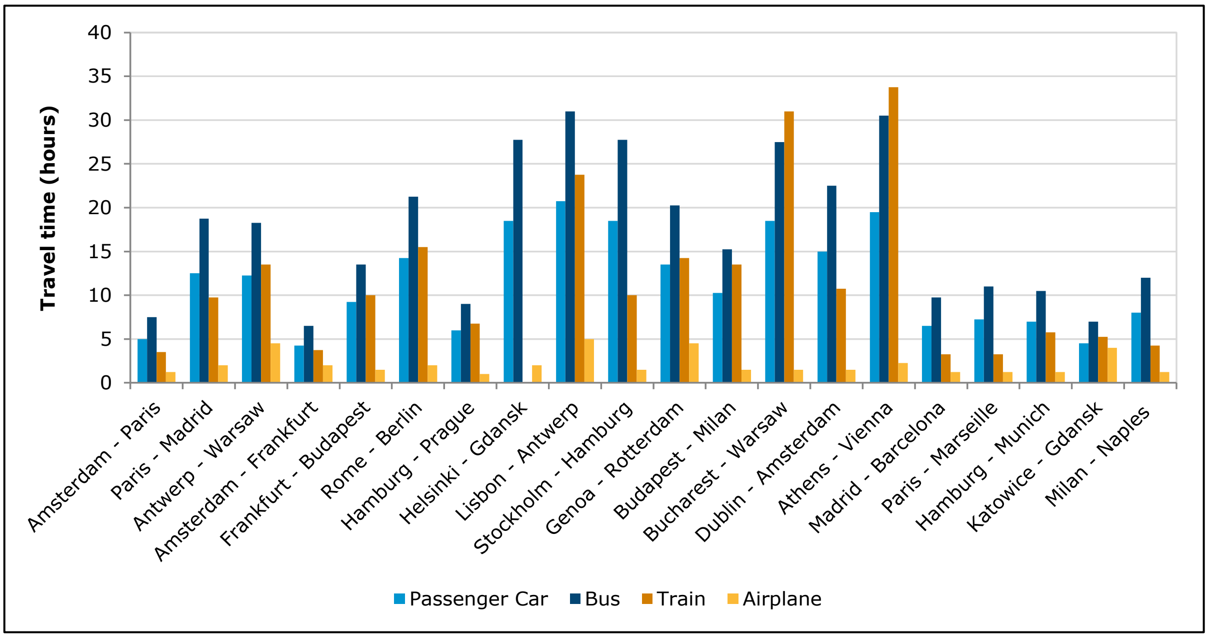
Transport distances for freight transport are shown in Figure 22. Compared to passenger transport, more significant differences in transport distances are found. On some of the corridors, maritime transport (and to a lesser extent IWT) results in much longer travel distances (particularly on the corridors Rotterdam – Genoa and Paris – Marseille).

Figure 22 Travel distances of freight transport means on the twenty corridors



The travel times[32] of passenger transport means are presented in Figure 23. As expected, aviation has by far the lowest travel times. Rail transport is often the second fastest mode, particularly on corridors with high speed rail connections and not too many transfers. Exceptions are the corridors Athens – Vienna and Bucharest – Warsaw, for which rail transport is by far the slowest transport mode due to the lack of direct connections and good transfer options.

Figure 23 Travel times of passenger transport means on the twenty corridors

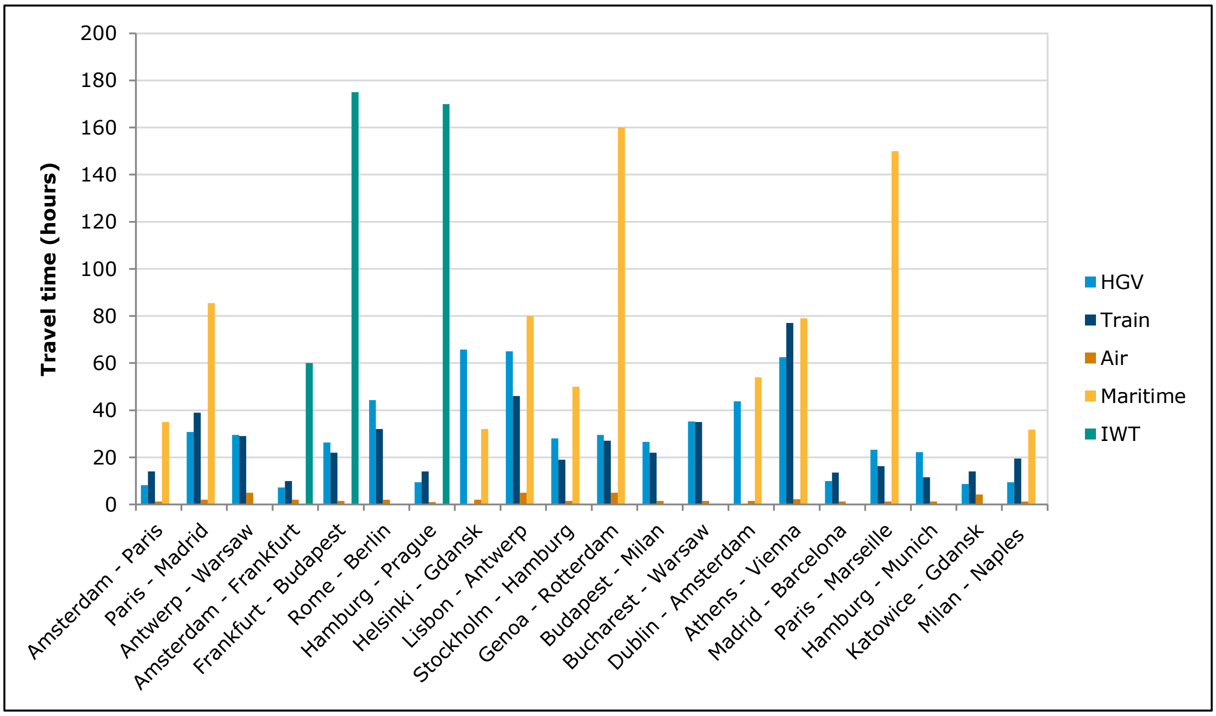


The travel times of freight transport means are shown in Figure 24. For IWT and maritime transport, transport times are often significantly longer as for road and rail transport. However, on long-distance corridors (e.g. Lisbon – Antwerp) the transport times of road transport may be significant as well, particularly due to the mandatory rest times of truck drivers.[33] As for passenger transport, aviation is by far the fastest mode on all corridors.

[32] The travel time is defined as the time between the moment the vehicle is leaving the origin and it arrives at the final destination. The time required for transfers or transshipments are included in the travel time figures, as well as the time for (mandatory) rest-breaks and border times.

[33] To estimate the transport times of road transport one driver per truck was assumed. On long-distance trips sometimes two drivers per truck are used, which significantly lowers the travel time (but also increases the internal costs).

Figure 24 Travel times of freight transport means on the twenty corridors



The travel times presented above do not include the time needed for embarking/disembarking and loading/unloading the vehicles/vessels at the origin and destination (the time these activities take at a transfer or transhipment is taken into account in the travel times). A rough estimation of EU average figures for (dis)embarking and (un)loading times is given in Table 24. For passenger transport, these are the recommended times (by transport operators) for check-in, while for freight transport these are estimates of the actual (un)loading times. Particularly the (un)loading times of shipping transport are uncertain, as this depends heavily on the type of goods considered (bulk transport) and the port facilities. Therefore, a range of times is presented that are considered to be relevant for the average European port.

Table 24 EU average (dis)embarking and (un)loading times

Transport means	(Dis)embarking and (un)loading times	Sources
Passenger transport		
Passenger car	Not relevant	
Bus	15 minutes	www.eurolines.co.uk; www.flixbus.com
Train	30 minutes	www.thalys.com; www.eurostar.com
Air plane	2 hours	www.klm.com; www.ba.com
Freight transport		
HGV	60 minutes	CEFIC et al. (2009), Parwani (2013)
Train	8 hours	DB Schenker (2009)
Small inland vessel	3 hours (container) 4 - 12 hours (bulk)	Panteia, input for NODUS transport model
Large inland vessel	4 hours (container) 4 - 15 hours (bulk)	Panteia, input for NODUS transport model
Small maritime vessel	4 hours (container) 4 - 15 hours (bulk)	The same (un)loading times as for a large inland ship are assumed.
Large maritime vessel	4 – 15 hours (container) 5 – 8 hours (bulk)	JOC Group (2014), TOI (2014), Slack and Comtois (2014)
Cargo airplane	2 hours	www.fedex.com (loading time is about 0.5 hours, but additional time for security check etc. is assumed)

3 IDENTIFICATION OF TAXES, CHARGES AND SUBSIDIES

3.1 Introduction

In this chapter, the taxes, charges and subsidies applied on the various corridors are identified. Therefore, we first discuss the different types of taxes, charges and subsidies that are covered in this study (see Section 3.2). Next, it is shown to what extent these taxes and charges (Section 3.3) and subsidies (Section 3.4) are present on the twenty corridors that are considered in this study.

Transport decisions are not only affected by taxes, charges and subsidies. In Section 3.5 we briefly discuss the other factors that may affect the transport decisions on the corridors, considering both direct and indirect factors. This discussion may contribute to a better understanding of the level playing between transport modes on the various corridors, providing a better basis to interpret the results of the next chapters.

3.2 Taxes, charges and subsidies covered

In this section we discuss the taxes, charges and subsidies covered by this study. We clearly define them and discuss their main characteristics.

3.2.1 Taxes and charges

Although taxes and charges are often used interchangeably, they are different concepts. Taxes are compulsory, unrequited payments to the general government (Eurostat, 2001). They are unrequited in the sense that benefits provided by government to taxpayers are not normally in proportion to their payments. The revenue of taxes normally goes to the general budget or is earmarked for specific purposes (Määttä, 2006). Charges, on the other hand, are compulsory, requited payments to either general government or to (semi-)private bodies. In other words, they can be seen as payments for a service delivered by the government or (semi-)private body. Finally, the term levy is often used to cover all kinds of compulsory payments, referring to both taxes and charges.

In this study, we consider a specific subset of taxes and charges, i.e. transport taxes and charges. There is no generally accepted definition of this type of taxes and charges. In this study we define them as all taxes and charges that are directly related to the ownership and use of transport vehicles, including the levies related to the use of transport infrastructure. This definition excludes taxes like profit taxes and wage taxes (e.g. for truck drivers), as they are only indirectly related to transport activities. As for transport charges, we consider all compulsory (non-administrative) payments to governments and infrastructure operators (e.g. road authorities, ports, airports, etc.). Payments for transport services delivered by other semi-private agents are considered internal costs.

An overview of the transport taxes covered by this study is given in Table 25.

Table 25 Overview of transport taxes

Taxes	Description	Transport specific or general tax	VAT, vehicle, energy, or infrastructure tax	Fixed or variable tax	Applicable to:
Road transport					
Fuel taxes	Consumption tax on transport fuel	Transport specific	Energy	Variable	User / transport company
Vehicle ownership or circulation tax	Periodic (e.g. annual) tax on the ownership of a vehicle	Transport specific	Vehicle	Fixed	Vehicle owner
Vehicle purchase or registration tax	One-off tax on the purchase or registration of a new vehicle	Transport specific	Vehicle	Fixed	Vehicle owner
Insurance tax	Indirect tax levied on general insurance premiums. For this study the tax on motor third-party liability (MTPL) premiums and vehicle damage premiums is considered.	General	Vehicle	Fixed	Vehicle owner
VAT	Indirect tax levied on transport operations and related purchases. Only relevant for passenger transport, as for freight transport VAT can be reclaimed by companies.	General	VAT	Fixed / variable	User / shipper
Rail transport					
Fuel tax (diesel)	Consumption tax on transport fuel	Transport specific	Energy	Variable	Railway operator
Electricity tax	Consumption tax on electricity	Transport specific	Energy	Variable	Railway operator
VAT	See 'VAT road transport'.	General	VAT	Variable	Passenger
Inland shipping					
Fuel tax	Consumption tax on transport fuel	Transport specific	Energy	Variable	Ship operator
Maritime transport					
Fuel tax	Consumption tax on transport fuel.	Transport specific	Energy	Variable	Ship operator
Aviation					
Fuel tax	Consumption tax on transport fuel	Transport specific	Energy	Variable	Airlines
Aviation taxes	Aviation taxes, including taxes levied on passengers and environmental taxes.	Transport specific	Infrastructure	Fixed	Passengers
VAT	See 'VAT road transport'	General	VAT	Variable	Shipper / passenger

Company car taxation is not included in Table 25, as this is regarded as income tax and not as transport tax. However, as the existence of company car taxation may affect transport decisions on the corridors, it is discussed briefly in Section 3.5.

In Table 25 it is indicated whether taxes should be considered transport specific or general taxes (e.g. VAT). Although this distinction is not necessary for the purpose of this study (as both types of taxes related to transport operations affect the level playing field between transport modes from the end-user perspective), it may be relevant as the results of this study are used for other analyses (e.g. assessing to what extent some transport mode meets the 'polluter-pays principle'). This is discussed in more detail in Annex J. In Table 25, it is also indicated whether the various taxes are levied on vehicles, the use of energy or the use of infrastructure. Additionally it is shown whether the tax can be regarded as fixed (independent of number of kilometres travelled) or variable (dependent on the number of kilometres travelled). For example, the purchase taxes for passenger cars can be considered fixed, as its level does not depend on the extent by which the car is used. On the other hand, fuel taxes are directly related to the usage of the vehicle and hence can be regarded as variable. Finally, it is shown who has to pay the various taxes.

An overview of the transport charges covered by this study is given in Table 26, again presenting some important characteristics of the various charges.

Table 26 Overview of transport charges

Charges	Description	Vehicle, energy or infrastructure charge	Fixed or variable charge	Applicable to:
Road transport				
Distance-based road charges (tolls)	Charge for the passage along the road network	Infrastructure	Variable	User / transport company
Time-based road charges (vignettes)	Charge for access to road network for a specific period	Infrastructure	Fixed	User / transport company
Tolls on specific parts of the (regional) network (e.g. bridges)	Charge for passing a specific part of the road network	Infrastructure	Variable	User / transport company
Urban road pricing schemes	Charge for using urban roads	Infrastructure	Variable	User / transport company
Rail transport				
Rail infrastructure access charges	Charges for the use of rail infrastructure. This charge includes: 1) track access charges, 2) charges for using stations and other rail infrastructure, 3) congestion charges, 4) environmental charges. As these different charges are often integrated in one overall charge, we will consider them together in this report.	Infrastructure	Variable	Railway company
Charges for specific infrastructure	Charges for using bridges or tunnels			
Inland shipping				
Port charges	Charge for the use of a port	Infrastructure	Fixed	Ship operator
Fairway dues	Charge for using a specific waterway / territorial water	Infrastructure	Variable	Ship operator
Dues for locks and bridges	Charge for using/passing a lock or bridge	Infrastructure	Fixed	Ship operator
Water pollution charges	Fuel surcharge to bear the costs for the collection and disposal of bilge water, waste oil, and other oily and greasy	Energy	Fixed	Ship operator

Charges	Description	Vehicle, energy or infrastructure charge	Fixed or variable charge	Applicable to:
	water.			
Maritime shipping				
Port charges	Charge for the use of a port	Infrastructure	Fixed	Ship operator
Fairway dues	Charge for using a specific waterway / territorial water	Infrastructure	Fixed	Ship operator
Dues for locks and bridges	Charge for the use of a port	Infrastructure	Fixed	Ship operator
Piloting charges	Fees for the services of a pilot, who assists the master of a ship in navigation when entering or leaving a port.	Infrastructure	Fixed	Ship operator
Waste charges	Charge to be paid by calling a port to bear the costs of ship waste	Infrastructure	Fixed	Ship operator
Aviation				
Passenger related charges	Charges to be paid by passengers for airport departure, airport services, security, PRM, etc.	Infrastructure	Fixed	Passenger
LTO / landing charges	Charge paid for landing and/or take-off at an airport (incl. environmental charges)	Infrastructure	Fixed	Airline
Ground-handling and infrastructure related charges	Charges for ground-handling services (e.g. air bridges, parking charges, fuelling charges, etc.)	Infrastructure	Fixed	Airline/passenger
Navigation charges	All charges related to air navigation (e.g. en-route navigation, terminal navigation charges)	Infrastructure	Fixed/variable	Airlines
ETS	European flights are covered by the EU Emission Trading Scheme	Energy	Variable	Airlines

Some of the charges presented in Table 25 do actually represent a set of different, but related charges. This is particularly the case for port charges for maritime transport (which often includes fees like quay charges and mooring charges) and the various charges for aviation (e.g. passenger related charges). For more detailed information on the composition of these charges on the various corridors, see the background report provided by this study.

Charges that are not included in Table 26 and hence are not covered in this study are:

- Car parking fees: As the transport operations in this study are defined to start when leaving the origin and to end when arriving at the final destination, car parking fees are out of the scope of the study.
- Towing charges for maritime shipping: these are the fees for the services of a towing vessel when entering or leaving a port. As we do not consider large maritime vessels in this study, we assume that towing charges are not relevant for the assessments carried out.

3.2.2 Subsidies

Definitions of the term 'subsidy' differ widely. On the one hand, a broad welfare economic approach defines transport subsidies as all transport costs that are not covered by users, including all kinds of externalities, infrastructure costs or different regulation. On the other hand, a fiscal policy approach defines subsidies as only those economic advantages that are granted from public budgets without a direct service in return (e.g. grants and tax deductions) (Ecologic et al., 2006). Since externalities and infrastructure costs of transport are out of the scope of this study we used the fiscal policy definition of subsidies.

In addition to subsidies, public service obligations (PSO) are considered in this study. PSOs are government payments to transport companies for which a direct service is expected in return. PSOs are, for example, often used to ensure a sufficient quality of public transport services. Although PSOs are technically not subsidies (according to the fiscal definition presented above), they will be taken into account in this study as well, as they may significantly affect the level playing field of several transport modes. The term 'subsidies' is used in this study for both 'actual' subsidies and PSOs.

A distinction between on-budget and off-budget subsidies can be made. On-budget subsidies can be defined as cash transfers paid directly to industrial producers or consumers that appear on national balance sheets as government expenditure. Off-budget subsidies are defined as transfers to producers and consumers that do not appear on national accounts as government expenditures (EEA, 2004). Examples of on-budget subsidies include direct government payments out of public funds, whereas tax exemptions would be off-budget subsidies. In this study we considered both on- and off-budget subsidies. However, it should be noted that many of the off-budget subsidies are already covered by the assessment of taxes and charges (e.g. the fuel tax exemption for international aviation is implicitly covered by this assessment) and hence the risk on double-counting should be carefully considered.

In this study we considered the subsidies that are directly related to transport operations, in line with the definition we use for transport taxes and charges. This implies, for example, that innovation subsidies for car manufacturers are not considered. Additionally, infrastructure subsidies are not considered as well, as this would require a complete assessment of infrastructure expenditures on the corridors. Such an assessment is very time consuming and hence out of the scope of this study. This implies that no subsidies to transport infrastructure managers are considered.

An overview of the subsidies investigated in this study is given in Table 27. For all modes tax breaks and exemptions, and direct subsidies are considered. Furthermore, PSOs are considered for rail transport (however, not found relevant for passenger rail transport in this study as explained below), inland shipping and maritime transport. As we consider (commercial) coaches instead of public transport busses in this study, PSOs are not relevant for road transport.

Table 27 Overview of subsidies considered

Mode	Description
Road transport	• Tax breaks and exemptions • Direct subsidies to coach operators
Rail transport	• Tax breaks and exemptions
Inland shipping	• Tax breaks and exemptions
Maritime transport	• Tax breaks and exemptions
Aviation	• Tax breaks and exemptions • Direct subsidies to airlines

In addition to the subsidies mentioned in Table 27, transport operators may be supported by the following direct or indirect subsidies as well:

- **Subsidies for purchasing vehicles/vessels** (e.g. for low emission or electric vehicles, European subsidies for purchasing rolling stock (e.g. for Poland, Czech Republic and Hungary), national investment subsidies for low-emission inland navigation vessels (e.g. in the Netherlands and Germany), subsidy schemes for low-emission maritime ships (e.g. in Finland, Spain));
- **Subsidies for vehicle adaptations or improvements** (e.g. for energy saving measures);
- **Under-taxation of company cars** (compared to private cars), as applied in all European countries (assessed by Copenhagen Economics (2010)).
- **Financing of recurrent losses of state-owned transport operators** (including recapitalisation and favourable depreciation regimes), e.g. to finance recurrent losses or restructuring programmes (e.g. recently the Polish government has provided financial aid to the Polish airline PLL Lot to implement a restructuring programme; in Hungary, state guarantees for loans as well as debt cancellation has been provided by the government to the state-owned rail operator);
- **Exemptions from non-transport taxes**; particularly for maritime transport, several exemptions from general taxation exist in European countries. A large number of European Member States (e.g. Belgium, Finland, Ireland, Germany, the Netherlands, Spain, and Sweden) apply a tonnage tax as an alternative scheme to traditional corporate tax. This tax is not based on shipping companies' profits (as is the case for the corporate tax), but on the size of the shipping company fleet. The tonnage tax rates are set at such a level that the tax liability of shipping operators is lower than it otherwise would have been, hence implicitly subsidising maritime transport (Roe and Selkou, 2005). Additionally, in various European countries (e.g. Ireland, the Netherlands, Portugal, Sweden) income tax exemptions exist for seafarers, while some countries apply VAT exemptions (e.g. Belgium, the Netherlands) and tax exemptions on wage costs for employers (e.g. Germany) as well (Panteia et al., 2015).
- **Public service obligations (PSO's)** are applied for rail passenger transport in (almost) all European countries (CER, 2011). In general, these PSOs are mainly applied for regional and local transport (particularly for unprofitable lines), although in some countries they may be applied for some international lines as well. As all corridors considered in this study reflect train routes with high traffic, PSOs are not relevant for (most) corridors considered in this study. Furthermore, the level of PSOs is often negotiated between national (or regional) governments and the rail transport providers for a whole region or network (CER, 2011) and hence it is often impossible to determine the actual PSO applied on a specific route. For these reasons, PSOs for rail passenger transport have not been considered in this study. Furthermore, our research identified no relevant PSOs for inland waterway and maritime transport.
- **(Partly) exemptions of non-transport taxes or subsidies for overhead costs** (e.g. exemptions for wage taxes or company taxes, subsidies for schooling).

All these subsidies are not considered in the quantitative analyses carried out in this study, although they may affect the level playing field between transport modes. However, it is not possible to develop a well-founded methodology to allocate these rather general subsidy schemes to the specific routes that are considered in this study.

3.3 Identification of taxes and charges per corridor

In this section we present for each corridor the taxes and charges that are levied on the various transport means. We do this separately for each of the different transport means.

The information on the various schemes has been collected by studying both EU-wide sources (e.g. the ACEA tax guide) and national sources (national ministries of Finance/Transport, infrastructure managers, national statistical agencies, national studies, etc.). For each of the instruments identified, a factsheet has been produced, summarising the main information for that instrument (e.g. transport means that are charged, tax base, tax level). All these factsheets can be found in the background report. Based on this information, a brief overview of the taxes and charges levied on the different corridors is given in this section.

3.3.1 Passenger car

An overview of the taxes and charges levied on passenger cars is given in Table 28. The taxes and charges actually levied on a corridor are indicated in green. Furthermore, it is mentioned in which countries on the corridor the taxes/charges are levied. For some of the taxes (e.g. ownership tax, registration tax, insurance tax, VAT), the taxing country is dependent on the country in which the vehicle/vessel is registered. As described in Section 1.3.4, it is assumed that a vehicle/vessel is registered in the country of origin (e.g. France on the corridor Paris – Amsterdam) and hence in Table 28 it is noted that the tax is levied in that country. However, as we consider transport operations on each of the corridors from both directions, also the 'other' origin country is indicated as taxing country for these taxes. This is done by using a forward slash (i.e. /), indicating that the taxing country depends on the direction of the transport operation that is considered.

As is shown in Table 28, on all corridors fuel taxes are levied on passenger cars. Ownership taxes are also levied on the majority of the corridors, except for the corridors with Poland as origin country. Registration taxes on passenger cars are not levied in Czech Republic, Germany and Sweden and hence the corridors where these countries are as origin are not covering these taxes. As for road infrastructure charges, most countries do cover either distance-based or time-based road charges. Only on the corridors Amsterdam – Frankfurt, Stockholm –Hamburg, Amsterdam – Dublin, Hamburg – Munich, and Madrid – Barcelona no road infrastructure charges are levied on passenger cars. As for the corridor Madrid – Barcelona it has been reported (2015) that many road users avoid toll roads on this route (see Annex B for a detailed analysis) and it has thus not been considered in this study. Also on parts of the corridors Paris – Madrid and Lisbon – Antwerp certain tolled sections are avoided; similarly, they have not been considered in the study. Finally, tolls for specific bridges or tunnels are only relevant for a few corridors, as do urban road pricing schemes (Stockholm congestion charge on the corridor Stockholm - Hamburg).

Table 28 Overview of taxes and charges for passenger cars per corridor

Corridor	Fuel taxes	Ownership tax	Registration tax	Insurance tax	Distance based road charges	Time-based road charges	Tolls on specific parts of network	Urban road pricing schemes	VAT
Paris - Amsterdam	All	FR/NL	FR/NL	FR/NL	FR	-	-	-	All
Paris – Madrid	All	FR/ES	FR/ES	FR/ES	FR	-	-	-	All
Antwerp - Warsaw	All	BE/-	BE/PO	BE/-	PL	-	-	-	All
Amsterdam - Frankfurt	All	NL/DE	NL/-	NL/DE	-	-	-	-	All
Frankfurt - Budapest	All	DE/HU	-/HU	DE/HU	-	AT,HU	-	-	All
Rome - Berlin	All	IT/DE	IT/-	IT/DE	IT	AT	AT	-	All
Hamburg - Prague	All	DE/CZ	-	DE/CZ	-	CZ	-	-	All
Helsinki - Gdansk	All	FI/-	FI/PL	FI/-	PL	-	-	-	All
Lisbon - Antwerp	All	PT/BE	PT/BE	PT/BE	FR, ES, PT	-		-	All
Stockholm - Hamburg	All	SE/DE	-	SE/DE	-	-	DK	SE	All
Genoa – Rotterdam	All	IT/NL	IT/NL	IT/NL	IT, FR	CH	-	-	All
Budapest - Milan	All	HU/IT	HU/IT	HU/IT	IT	HU, SI	-	-	All
Bucharest - Warsaw	All	RO/-	RO/PL	RO/-	-	RO,HU, SK,CZ	-	-	All
Dublin – Amsterdam	All	IE/NL	IE/NL	IE/NL	-	-	UK[a]	-	All
Athens – Vienna	All	EL/AT	EL/AT	EL/AT	EL,MK, RS	HU,AT	-	-	All
Madrid – Barcelona	ES	ES	ES	ES	-	-	-	-	ES
Paris – Marseille	FR	FR	FR	FR	FR	-	-	-	FR
Hamburg – Munich	DE	DE	-	DE	-	-	-	-	DE
Katowice – Gdansk	PL	-	PL	-	PL	-	-	-	PL
Milan - Naples	IT	IT	IT	IT	IT	-	-	-	IT

[a] Canal tunnel

3.3.2 Coach

An overview of the taxes and charges levied on busses on the various corridors is given in Table 29. Fuel taxes are levied on coaches in all countries on the corridors. Also ownership taxes are considered on all corridors, except for the corridors Helsinki – Gdansk (with Finland as origin country) and Athens – Vienna (with Austria as origin country). However, in contrast to passenger cars, registration taxes are only applied on a few corridors. From all countries considered, only France, Italy, Portugal and Romania levy a registration tax for coaches and hence only on the corridors with these countries as origin this tax is considered. The majority of the corridors cover distance-based road charges for coaches, except for Amsterdam – Frankfurt, Stockholm – Hamburg, Amsterdam – Dublin, Hamburg – Munich, and Madrid – Barcelona[34]. On these corridors no time-based road charges are levied. As for passenger cars specific tolls for bridges/tunnels and urban road user charges are relevant for only a few corridors. Finally, on most corridors the passengers travelling by coaches have to pay VAT on their fares (at least for some countries crossing). However, notice that the bus companies do not pay VAT, as they can reclaim all their VAT payments.

[34] As for passenger cars, it is assumed that busses avoid the toll roads on the corridor Madrid – Barcelona (see Annex B).

Table 29 Overview of taxes and charges for coaches per corridor

Corridor	Fuel taxes	Ownership tax	Registration tax	Insurance tax	Distance based road charges	Time-based road charges	Tolls on specific parts of network	Urban road pricing schemes	VAT
Paris - Amsterdam	All	FR/NL	FR/-	FR/NL	FR	-	BE	-	All
Paris – Madrid	All	FR/ES	FR/-	FR/ES	FR	-	-	-	All
Antwerp - Warsaw	All	BE/PL	-	BE/-	PL	-	-	-	All
Amsterdam - Frankfurt	All	NL/DE	-	NL/DE	-	-	-	-	All
Frankfurt - Budapest	All	DE/HU	-	DE/HU	AT	HU	-	-	DE, AT
Rome - Berlin	All	IT/DE	-	IT/DE	AT, IT	-	-	-	AT, DE
Hamburg - Prague	All	DE/CZ	-	DE/CZ	CZ	-	-	-	DE
Helsinki - Gdansk	All	-/PL	-	FI/-	PL	LT	-	-	PL
Lisbon - Antwerp	All	PT/BE	-	PT/BE	PT, ES, FR	-	-	-	ES, FR,BE
Stockholm - Hamburg	All	SE/DE	-	SE/DE	-	-	DK	SE	DK, DE
Genoa – Rotterdam	All	IT/NL	IT/-	IT/NL	IT, FR	CH	-	-	CH, DE, NL
Budapest - Milan	All	HU/IT	-/IT	HU/IT	IT, SI	HU	-	-	SI
Bucharest - Warsaw	All	RO/PL	RO/-	RO/-	SK,CZ, PL	RO	-	-	-
Dublin – Amsterdam	All	IE/NL	-	IE, NL	-	-	UK[a], BE	-	FR, BE, NL
Athens – Vienna	All	EL/-	-	EL/AT	EL,MK, RS, AT	-	-	-	EL, AT
Madrid – Barcelona	ES	ES	-	ES	-	-	-	-	ES
Paris – Marseille	FR	FR	FR	FR	FR	-	-	-	FR
Hamburg – Munich	DE	DE	-	DE	-	-	-	-	DE
Katowice – Gdansk	PL	PL	-	-	PL	-	-	-	-
Milan - Naples	IT	IT	IT	IT	IT	-	-	-	-

[a] Canal tunnel

3.3.3 Heavy goods vehicles

An overview of the taxes and charges levied on HGVs on the several corridors is given in Table 30. Fuel taxes are levied on HGVs in all countries on the corridors. In contrast to coaches and passenger cars, ownership taxes on HGVs are implemented on all corridors. However, registration taxes are only applied on a few corridors (the ones with France, Italy, Romania or Greece as origin country). With the exception of Poland, insurance taxes are levied on HGVs in all relevant countries and hence on almost all corridors. Additionally, distance based road charges are levied on almost all corridors as well; the only corridor where these charges are not relevant is Madrid – Barcelona, as a large proportion of HGVs do avoid the toll roads between Zaragoza and Barcelona (RACC 2015). Time-based road charges, on the other hand, are only applied on a few corridors. This is also the case for specific tolls for tunnels and bridges, while urban road pricing schemes are not relevant for HGVs at all (as the origin and destination of the freight trips are out of the city centre).

Table 30 Overview of taxes and charges for HGVs per corridor

Corridor	Fuel taxes	Ownership tax	Registration tax	Insurance tax	Distance based road charges	Time-based road charges	Tolls on specific parts of network	Urban road pricing schemes
Paris - Amsterdam	All	FR/NL	FR/-	FR/NL	FR,BE	NL	BE	-
Paris – Madrid	All	FR/ES	FR/-	FR/ES	FR	-	-	-
Antwerp - Warsaw	All	BE/PL	-	BE/-	BE,DE, PL	-	-	-
Amsterdam - Frankfurt	All	NL/DE	-	NL/DE	DE	NL	-	-
Frankfurt - Budapest	All	DE/HU	-	DE/HU	DE,AT, HU	-	-	-
Rome - Berlin	All	IT/DE	-	IT/DE	DE,AT, IT	-	-	-
Hamburg - Prague	All	DE/CZ	-	DE/CZ	DE, CZ	-	-	-
Helsinki - Gdansk	All	FI/PL	-	FI/-	PL	LT	-	-
Lisbon - Antwerp	All	PT/BE	-	PT/BE	PT,ES,FR,BE	-	BE	-
Stockholm - Hamburg	All	SE/DE	-	SE/DE	DE	DK,SE	DK	-
Genoa – Rotterdam	All	IT/NL	IT/-	IT/NL	IT,CH,FR,BE	LU, NL	-	-
Budapest - Milan	All	HU/IT	-/IT	HU/IT	HU,SI,IT	-	-	-
Bucharest - Warsaw	All	RO/PL	RO/-	RO/-	SK,CZ, PL, HU	RO	-	-
Dublin – Amsterdam	All	IE/NL	-	IE, NL	BE	NL	UK[a]	-
Athens – Vienna	All	EL/AT	EL/-	EL/AT	EL,MK, RS, AT		-	-
Madrid – Barcelona	ES	ES	-	ES	-	-	-	-
Paris – Marseille	FR	FR	FR	FR	FR	-	-	-
Hamburg – Munich	DE	DE	-	DE	DE	-	-	-
Katowice – Gdansk	PL	PL	-	-	PL	-	-	-
Milan - Naples	IT	IT	IT	IT	IT	-	-	-

[a] Canal tunnel

3.3.4 Passenger train

An overview of the taxes and charges for passenger rail is provided in Table 32. Electricity taxes are levied on passenger trains on all corridors except Milan – Naples, although not in all countries covered by these corridors. Fuel taxes are only relevant for the two corridors where diesel trains are used (on the Spanish part of the corridor Lisbon – Antwerp and on the Greek part of the corridor Athens – Vienna). Infrastructure charges are levied by all European countries. Additionally, on the corridor Stockholm – Hamburg and Dublin – Amsterdam charges for specific infrastructure (i.e. the Oresund bridge and the Canal tunnel) are implemented. Furthermore, for the electricity used by electric passenger trains on all corridors emission allowances on the European Emission Trading Scheme (ETS) have to be bought by the power generation sector. The allowances prices are expected to be passed through to the rail operators through the electricity prices. Since railway operators do not directly buy allowances we consider ETS part of the internal costs of rail operators. Finally, on most corridors the rail passengers have to pay VAT on their fares (at least for some country crossing). However, the rail operators do not pay VAT, as they can reclaim all their VAT payments.

Table 31 Overview of taxes and charges for passenger trains per corridor

Corridor	Fuel taxes	Electricity tax	Infrastructure charge	Charges for specific infrastructure	ETS	VAT
Paris - Amsterdam	n/a	FR, NL	All	-	All	BE, NL
Paris – Madrid	n/a	All	All	-	All	ES
Antwerp - Warsaw	n/a	DE, PL	All	-	All	BE, DE
Amsterdam - Frankfurt	n/a	All	All	-	All	NL, DE
Frankfurt - Budapest	n/a	All	All	-	All	DE
Rome - Berlin	n/a	AT, IT	All	-	All	CH, DE
Hamburg - Prague	n/a	DE	All	-	All	DE
Lisbon - Antwerp	ES	ES, FR	All	-	All	ES, BE
Stockholm - Hamburg	n/a	DE	All	SE	All	DE
Genoa – Rotterdam	n/a	DE, NL	All	-	All	CH, DE, NL
Budapest - Milan	n/a	HU, AT, DE	All	-	All	AT, DE
Bucharest - Warsaw	n/a	RO, HU, PL	All	-	All	AT
Dublin – Amsterdam	n/a	IE, FR, NL	All	UK	All	BE, NL
Athens – Vienna	EL	All	All	-	GR, HU, AT	EL, AT
Madrid – Barcelona	n/a	ES	All	-	All	ES
Paris – Marseille	n/a	FR	All	-	All	-
Hamburg – Munich	n/a	DE	All	-	All	DE
Katowice – Gdansk	n/a	PL	All	-	All	-
Milan - Naples	n/a	-	All	-	All	-

3.3.5 *Freight train*

An overview of the taxes and charges for rail freight is provided in Table 32. The taxes and charges applied for freight trains are mostly the same as for passenger trains, except for the fact that VAT is not relevant for freight transport by rail.

Table 32 Overview of taxes and charges for freight trains per corridor

Corridor	Fuel taxes	Electricity tax	Infrastructure charge	Charges for specific infrastructure	ETS
Paris - Amsterdam	n/a	FR, NL	All	-	All
Paris – Madrid	n/a	All	All	-	All
Antwerp - Warsaw	n/a	DE, PL	All	-	All
Amsterdam - Frankfurt	n/a	All	All	-	All
Frankfurt - Budapest	n/a	All	All	-	All
Rome - Berlin	n/a	AT, IT	All	-	All
Hamburg - Prague	n/a	DE	All	-	All
Lisbon - Antwerp	ES	ES, FR	All	-	All
Stockholm - Hamburg	n/a	DE	All	SE	All
Genoa – Rotterdam	n/a	DE, NL	All	-	All
Budapest - Milan	n/a	HU, AT, DE	All	-	All
Bucharest - Warsaw	n/a	RO, HU, PL	All	-	All
Athens – Vienna	EL	All	All	-	All
Madrid – Barcelona	n/a	ES	All	-	All
Paris – Marseille	n/a	FR	All	-	All
Hamburg – Munich	n/a	DE	All	-	All
Katowice – Gdansk	n/a	PL	All	-	All
Milan - Naples	n/a	-	All	-	All

3.3.6 Inland navigation

An overview of the taxes and charges for inland navigation is provided in Table 33.

Table 33 Overview of taxes and charges for IWT vessels per corridor

Corridor	Fuel taxes	Port charges	Fairway dues	Charges for locks and bridges	Water pollution charges
Amsterdam – Frankfurt	-	NL/DE	DE	-	NL/DE
Frankfurt – Budapest	-	DE/HU	DE	-	DE/-
Hamburg - Prague	-	DE/-	-	-	DE/-

As shown by Table 33, on all three corridors commercial (freight) inland navigation is exempted from fuel taxes. However, port charges are levied on IWT on all corridors, although the Port of Prague is free of charges. In Germany, fairway dues have to be paid on certain waterways (e.g. Main, Main-Danube canal), such that these charges have to be considered for the corridors Amsterdam – Frankfurt and Frankfurt – Budapest. For none of the corridors charges for locks and bridges are relevant. Water pollution charges are implemented in the Dutch and German ports, such that these charges are relevant for all three corridors.

3.3.7 Maritime transport

An overview of the taxes and charges levied on maritime transport on the various corridors is given in Table 34. On some of the corridors mentioned in this table, maritime transport is part of a multimodal transport chain (i.e. on the corridors Paris – Madrid, Athens – Vienna and Milan – Naples). In this section we only consider the maritime part of this chain.

Table 34 Overview of taxes and charges for maritime transport per corridor

Corridor	Fuel taxes	Port charges	Charges for locks and bridges	Piloting charges	Waste charges	Fairway dues
Paris – Amsterdam	-	FR/NL	-	FR/NL	-/NL	-
Paris - Madrid	-	FR/ES	-	FRES	-/ES	-
Helsinki - Gdansk	-	FI/PL	-	FI/PL	FI/PL	FI/-
Lisbon – Antwerp	-	PT/BE	-	PT/BE	PT/BE	-
Stockholm - Hamburg	-	SE/DE	-	SE/DE	SE/DE	SE/-
Genoa – Rotterdam	-	IT/NL	-	IT/NL	IT/NL	-
Dublin – Amsterdam	-	IE/NL	-	IE/NL	IE/NL	-
Athens - Vienna	-	EL/IT	-	-/IT	EL/IT	-
Paris – Marseille	-	FR	-	FR	FR	-
Milan - Naples	-	IT	-	IT	IT	-

According to the Council Directive 2003/96/EC on the taxation of energy products and electricity (European Commission, 2003), Member States shall exempt from taxation energy products used as fuel for navigation within Community waters. As a consequence no fuel taxes are charged on any of the corridors. Port charges, waste charges and piloting charges are applied in (almost) all ports covered by the corridors, although the types of services covered by the port charges differ between ports (see the background report). No charges for locks and/or bridges are applied on the selected corridors. Finally, on the corridors Helsinki – Gdansk and Stockholm – Hamburg fairway dues are charged on all ships using the Finish or Swedish territorial waters.

3.3.8 Passenger airplane

An overview of the taxes and charges for passenger airplanes is provided in Table 35. On all corridors, aviation is fully exempted from fuel taxes and VAT is applied only for domestic flights. Aviation taxes are applied on some corridors, due to the tax schemes existing in France, Germany, Italy and Austria. Passenger related charges, LTO/landing charges and navigation charges are levied on all corridors, although there may be significant differences between airports with respect to the specific types of charges applied (see the background document for more information on the types of charges applied at the individual airports). Also ground-handling and infrastructure related charges are implemented at most airports, although there are some exceptions (e.g. Amsterdam, Dublin and Helsinki). Finally, air passenger trips considered in this study fall under the European ETS.

Table 35 Overview of taxes and charges for passenger airplanes per corridor

Corridor	Fuel taxes	Aviation taxes	Passenger related charges	LTO/ landing charges	Ground-handling and infrastructure related charges	Navigation charges	ETS	VAT
Paris - Amsterdam	-	FR/-	All	All	FR/-	All	All	-
Paris – Madrid	-	FR/-	All	All	FR/ES	All	All	-
Antwerp - Warsaw	-	-	All	All	BE/PL	All	All	-
Amsterdam - Frankfurt	-	-/DE	All	All	-/DE	All	All	-
Frankfurt - Budapest	-	DE/-	All	All	DE/HU	All	All	-
Rome - Berlin	-	IT/DE	All	All	IT/DE	All	All	-
Hamburg - Prague	-	DE/-	All	All	DE/CZ	All	All	-
Helsinki - Gdansk	-	-	All	All	-	All	All	-
Lisbon - Antwerp	-	-	All	All	PT/BE	All	All	-
Stockholm - Hamburg	-	-/DE	All	All	SE/DE	All	All	-
Genoa – Rotterdam	-	IT/-	All	All	IT/-	All	All	-
Budapest - Milan	-	-/IT	All	All	HU/IT	All	All	-
Bucharest - Warsaw	-	-	All	All	RO/PL	All	All	-
Dublin – Amsterdam	-	-	All	All	-	All	All	-
Athens – Vienna	-	-/AT	All	All	EL/AT	All	All	-
Madrid – Barcelona	-	-	All	All	ES	All	All	ES
Paris – Marseille	-	FR	All	All	FR	All	All	FR
Hamburg – Munich	-	DE	All	All	DE	All	All	DE
Katowice – Gdansk	-	-	All	All	PL	All	All	PL
Milan - Naples	-	IT	All	All	IT	All	All	IT

3.3.9 Cargo airplane

An overview of the taxes and charges for cargo airplanes is provided in Table 36. Similar to passenger airplanes, cargo airplanes are exempted from fuel taxes on the selected corridors. Aviation taxes are also not relevant for cargo airplanes on most corridors; only the French solidarité tax is levied on cargo airplanes. The different airport charges (LTO/landing charges, ground-handling and infrastructure related charges and navigation charges) are levied on cargo airplanes on almost all corridors, with a few exceptions. Finally, also cargo aviation trips included in this study are subject to the European ETS.

Table 36 Overview of taxes and charges for cargo airplanes per corridor

Corridor	Fuel taxes	Aviation taxes	LTO / landing charges	Ground-handling and infrastructure related charges	Navigation charges	ETS
Paris - Amsterdam	-	FR/-	All	FR/-	All	All
Paris – Madrid	-	FR/-	All	FR/ES	All	All
Antwerp - Warsaw	-	-	All	BE/PL	All	All
Amsterdam - Frankfurt	-	-	All	-/DE	All	All
Frankfurt - Budapest	-	-	All	DE/HU	All	All
Rome - Berlin	-	-	All	IT/DE	All	All
Hamburg - Prague	-	-	All	DE/CZ	All	All
Helsinki - Gdansk	-	-	All	-	All	All
Lisbon - Antwerp	-	-	All	PT/BE	All	All
Stockholm - Hamburg	-	-	All	-/DE	All	All
Genoa – Rotterdam	-	-	All	IT/-	All	All
Budapest - Milan	-	-	All	HU/IT	All	All
Bucharest - Warsaw	-	-	All	RO/PL	All	All
Dublin – Amsterdam	-	-	All	-	All	All
Athens – Vienna	-	-	All	EL/-	All	All
Madrid – Barcelona	-	-	All	ES	All	All
Paris – Marseille	-	FR	All	FR	All	All
Hamburg – Munich	-	-	All	DE	All	All
Katowice – Gdansk	-	-	All	PL	All	All
Milan - Naples	-	-	All	IT	All	All

3.4 Identification of subsidies per corridor

In this section we present the relevant subsidies that are granted to the various transport means on the twenty EU corridors. EU wide studies on transport are scarce and most data had been collected from national sources. Additionally, the state aid database of the European Commission has been consulted for this task.

3.4.1 Road transport

Both for coaches and HGVs, fuel tax reductions exist in European countries, i.e. Belgium France, Hungary, Italy, Slovenia, Spain and Romania. In these countries, transport operators can partly reclaim the diesel excise duty paid in accordance with the 'commercial gas oil' tax scheme. Additionally, reduced VAT rates (including zero rates) exist for coach transport services in almost all EU countries, except for Germany. The corridors for which these indirect subsidies are relevant are shown in Table 37.

Table 37 Relevant subsidies for road transport

Subsidy	Relevant transport means	Corridors for which the subsidy is relevant
Fuel tax exemptions	Coaches and HGVs	Paris – Amsterdam, Paris – Madrid, Antwerp – Warsaw, Frankfurt – Budapest, Rome – Berlin, Lisbon – Antwerp, Genoa – Rotterdam, Budapest – Milan, Bucharest – Warsaw, Madrid – Barcelona, Paris – Marseille, Milan - Naples
Reduced VAT rate	Coaches	All, except for Hamburg - Munich

No other relevant subsidies for road transport on the twenty corridors have been identified. In some European countries (e.g. Czech Republic, Slovakia, Germany), exemptions on ownership taxes exist for HGVs used in combined transport, which may be relevant for first/last mile transport on the corridors covering these countries. However, as mentioned in Section 1.3.4, we do not consider first/last mile transport and therefore these subsidies are not relevant for this study.

3.4.2 Rail transport

In several European countries electric rail transport is (partly) exempted from electricity taxes. This is the case for Belgium, Czech Republic, Denmark, France, Germany, Italy, Portugal, Slovakia, Sweden, Switzerland, and UK. As for coach transport, reduced VAT rates (including zero rates) exist for rail passenger services in all European countries (except Germany). An overview of the corridors for which these indirect subsidies are relevant is shown in Table 38.

Table 38 Relevant subsidies for rail transport

Subsidy	Relevant transport means	Corridors for which the subsidy is relevant
Electricity tax exemptions	Passenger and freight trains	All, except for Athens – Vienna, Madrid – Barcelona and Katowice - Gdansk
Reduced VAT rate	Passenger trains	All, except for Hamburg - Munich

For some European countries, direct subsidies to support intermodal (freight) rail transport have been identified. However, as shown in Table 39, these schemes are for several reasons not directly relevant for the transport operations on the corridors considered in this study.

Table 39 Overview of national intermodal freight rail subsidy schemes

Subsidy	Country	Explanation
Förderprogramm „Schienengüterverkehr neu"	Austria	All rail transport undertakings performing single wagon load transport, unaccompanied combined transport or accompanied transport may be granted by this scheme. The subsidy is based on the comparison of infrastructure use costs of road and rail and the difference in external costs of both modes. Differentiated subsidy levels are applied. As we do not consider combined transport or single wagon load transport for the corridors covering Austria, this subsidy scheme is not directly relevant for this study.
Aid to combined transport and single wagon load transport by rail	Belgium	This subsidy scheme is meant to support the shift of freight transport from the road to rail. Therefore domestic rail transport between terminals or between ports is supported (subsidy level is equal to €0.14 x ITU[35] + €28), as well as single wagon load transport by train departing or arriving in Belgium (subsidy level: € 0.57 per km per single wagon load). As the combined transport subsidy scheme only refer to domestic transport, it is not relevant for this study. The single wagon load subsidy is not relevant, as only full train services are considered in this study.
Subsidy scheme for rail freight	Denmark	The Danish government provides an environmental subsidy to rail freight transport operators in order to offset the effects of the rail infrastructure charges and promote a shift from road to rail transport, thus reducing the negative external costs related to road transport operations. Therefore, a subsidy of about € 0.0021 per tonne-kilometre is granted for domestic freight transport by rail as well as for combined transport through Denmark. As for transit traffic the subsidy is paid only where the transport would not have

[35] Intermodal transport Units

Subsidy	Country	Explanation
		been undertaken by ship or ferry. As we do not consider combined transport through Denmark, this subsidy is not relevant for this study. Furthermore, on the corridor Stockholm – Hamburg (covering rail transport through Denmark) transporting goods by ship is a viable alternative to rail transport, which is another reason this subsidy is not relevant for this study.
Ferrobonus	Italy	This subsidy scheme is meant to strengthen the intermodal transport chain in Italy and develop the modal shift of freight traffic from road to rail. Therefore subsidies are granted to companies using rail transport services which commissioned multimodal transport and/or transhipment services. The amount of the subsidy is € 2.50 per train-km. As we do not consider multimodal rail transport services on the corridors covering Italy, this subsidy scheme is not relevant for this study.
State aid scheme for Ro-La combined transport	Romania	This subsidy schemes supports the transportation of lorries by rail on low-loader wagons, whereby the lorries drive onto the wagon at the start and drive off it at the end of the rail journey. Objective of the scheme is to shift freight transport from road to rail. Up to 60% of the total costs of the railway part of the Ro-La combined transport journey is subsidised. As we do not consider Ro-La combined transport on the corridor covering Romania (Bucharest – Warsaw), this scheme is not relevant for this study.
Bundessubvention Schienengüterverkehr	Switzerland	Federal governmental subsidies for rail freight operations can be given to railway undertakings and third parties to cover governmental ordered combined transport and single wagon load performance that is not covered by market prices (no fixed subsidy levels). As we only consider full train services in this study, this subsidy scheme is not directly relevant for this study.

Source: European Commission State Aid database; national sources

As explained in section 3.2.2, public service obligations for rail passenger transport have not be found relevant for this study.

3.4.3 Inland navigation

Due to the Mannheim convention and the Belgrade convention, Member States are not allowed to levy charges on commercial IWT vessels using the Rhine, the Danube and their tributaries. In line with these conventions, many countries (including the Netherlands, Germany and Czech Republic) decided not to charge fuel taxes and lock/bridge fees on other inland waterways as well. As a consequence, inland navigation on the corridors Amsterdam – Frankfurt, Frankfurt – Budapest and Hamburg – Prague is fully exempted from fuel taxes and charges on locks and bridges (see Table 40). No relevant PSOs have been identified for the selected inland navigation routes.

Table 40 Relevant subsidies for inland navigation

Subsidy	Relevant transport means	Corridors for which the subsidy is relevant
Fuel tax exemptions	IWT	Amsterdam – Frankfurt, Frankfurt – Budapest, Hamburg - Prague
Exemptions from charges for locks and bridges	IWT	Amsterdam – Frankfurt, Frankfurt – Budapest, Hamburg - Prague

3.4.4 Maritime transport

As mentioned in Section 3.3.7, all maritime transport on the corridors considered is exempted from fuel taxes (see Table 41). Additionally, in some ports discounts on the port dues are provided to clean and safe ships. For example, several ports (e.g. Amsterdam, Hamburg, Lisbon, and Rotterdam) provide a discount on the port dues for ships possessing a green award. However, as we consider in this study EU average reference vessels, they do not meet the requirements for these (environmental) discounts on port dues. Our research has identified no relevant PSOs for the selected maritime routes.

Table 41 Relevant subsidies for maritime transport

Subsidy	Relevant transport means	Corridors for which the subsidy is relevant
Fuel tax exemptions	Maritime vessels	Paris – Amsterdam, Paris – Madrid, Helsinki – Gdansk, Lisbon – Antwerp, Stockholm – Hamburg, Genoa – Rotterdam, Dublin – Amsterdam, Athens – Vienna, Paris – Marseille, Milan - Naples

3.4.5 Aviation

The Chicago Convention and bilateral agreements do not allow to levy fuel taxes on airplanes used for international trips. Therefore, aviation on all international corridors is exempted from fuel taxes. Although taxation of kerosene is allowed for domestic flights, it does not apply for the national corridors considered in this study. Therefore, fuel tax exemptions are considered for aviation for all corridors. Furthermore, all international flights are fully exempted from VAT. On the national corridors, however, VAT is levied on air travel trips, but only for the corridor Hamburg – Munich the standard rates are applied.

Table 42 Relevant subsidies for aviation

Subsidy	Relevant transport means	Corridors for which the subsidy is relevant
Fuel tax exemptions	All airplanes	All corridors
VAT exemption	Passenger airplanes	On all international corridors, aviation is fully exempted from VAT. On the national corridors reduced VAT rates are charged, except for the corridor Hamburg – Munich; on this corridor aviation is charged the full VAT rates.

No other relevant aviation subsidies are identified for the corridors considered in this study, neither are public service obligations for air transport (European Commission, 2017a).

3.5 Other factors affecting transport decisions

Next to the taxes, charges and subsidies discussed in the previous sections, transport decisions taken by travellers and transport operators are affected by several other factors as well. The main factors are:

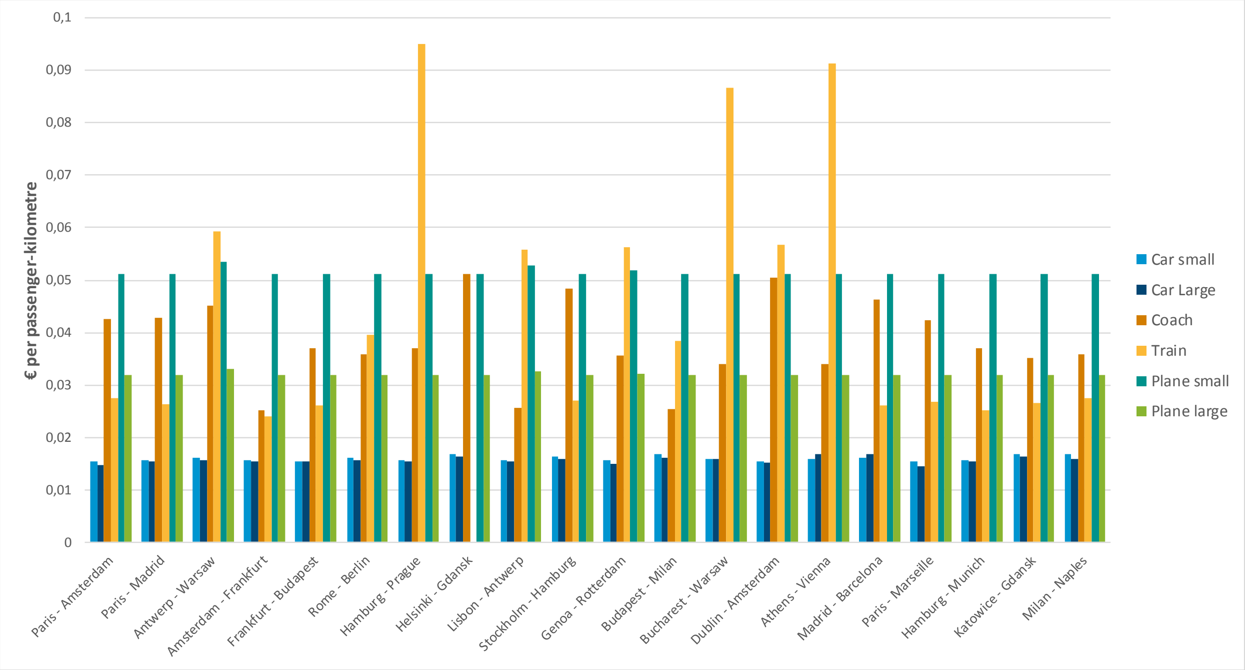
- Internal costs;
- Travel times;
- Reliability and flexibility;
- Infrastructure;
- Regulation;
- Comfort and social aspects.

In the remainder of this section, we first briefly discuss the main factors that affect the transport decisions of travellers and transport operators. For internal cost and travel times, a comparison of the corridors is included. For other factors, corridor-specific information can be found in Annex C.

3.5.1 Internal costs

Transport decisions are heavily influenced by the internal costs of the transport operation. Internal costs are costs other than taxes, charges and subsidies. These costs include cost for procurement, maintenance and wages. Also costs can be fixed (independent of kilometres driven) or variable (dependent on kilometres driven). For more details on the internal costs, see Annex E. An overview of the internal costs per transport mode on the twenty corridors is given in Figure 25 and Figure 26.

Figure 25 Internal costs (excl. taxes and charges) of the various passenger transport means per corridor



Note: In this graph, only the variable costs for passenger cars are considered

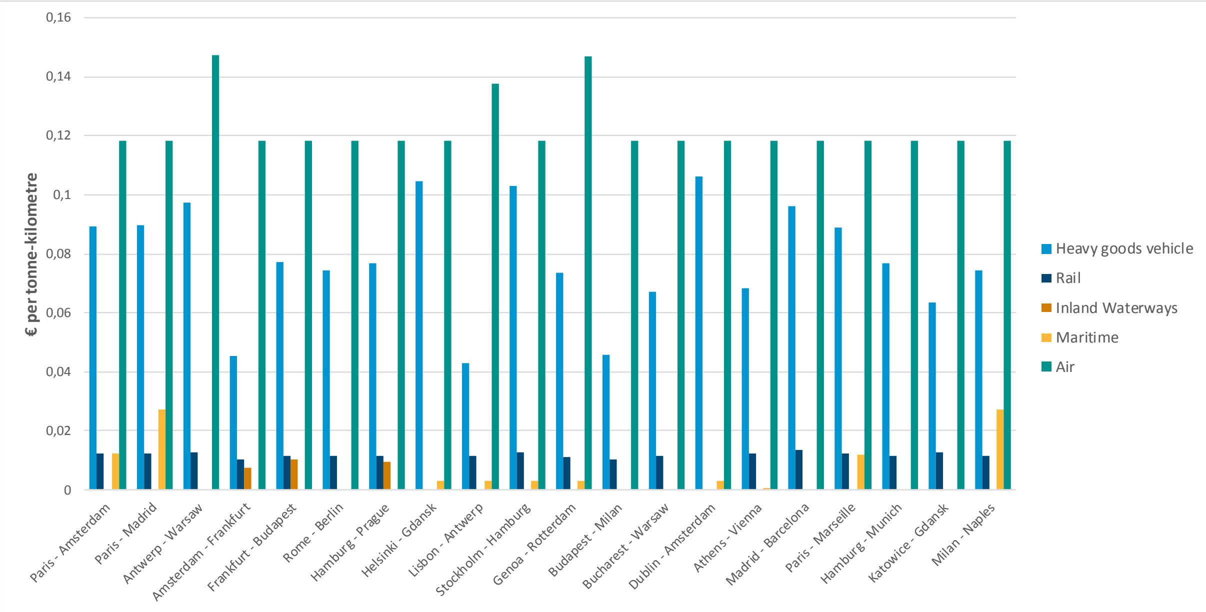
For passenger transport, the lowest internal costs per passenger kilometre are found for passenger cars. However, it should be noted that only the variable internal costs for passenger cars are shown, while for the other modes all internal costs (variable plus fixed) are considered. This is because people will only/mainly consider the variable costs of passenger cars in their transport decisions, while for the other modes they are confronted with both the fixed and variable costs (as both cost items are considered in the fare price)[36]. On most corridors the internal costs for small airplanes are among the highest, with the exception of the corridors Hamburg – Prague, Bucharest – Warsaw and Athens – Vienna. On these three corridors the internal costs of rail are highest, due to the fact that regular electric intercity trains with relatively low occupancy rates are assumed. The internal costs of high speed trains are, on the other hand, relatively low (per passenger kilometre) due to the high occupancy rates assumed (see Annex A). Routes that are partly travelled by high speed trains and

[36] In the study, unless explicitly stated otherwise, internal costs includes fixed and variable costs

partly by regular trains have internal costs comparable to small airplanes. Large airplanes have considerably less internal costs compared to small airplanes.

For freight transport, cargo airplanes have the highest costs per tonne-kilometre (see Figure 26). Differences in internal cost for air transport are a result of extra costs for routes where combined transport is required. For example the route Antwerp – Warsaw is partly done by heavy goods vehicles. The high internal costs for airplanes are due to the very low average loads they carry on a trip. The lowest internal costs are found for rail and particularly shipping transport, due to the high load capacities of these vehicles/vessels.

Figure 26 Internal costs (excl. taxes and charges) of the various container freight transport means per corridor



3.5.2 *Travel times*

Next to transport costs, (expected) travel times are relevant as well. The impact of travel time can be roughly illustrated by estimating the generalised costs of travel[37], i.e. taking both the internal and time costs into account (see Annex B for more information on generalised costs). For illustration purposes, this is done for passenger transport on the corridors Paris – Madrid and Bucharest - Warsaw, taking into account the time needed for embarking (see Table 43). In line with Figure 25 only variable costs are considered for passenger transport. The assessment shows that the relatively short travel time of airplanes makes this mode attractive for long-distance trips as is the case for high speed trains (on the corridor Paris – Madrid).

[37] To estimate the time costs, Value of Time (VoT) figures are used for long distance trips. The following VoT figures were used for the corridor Paris – Madrid (assuming a French traveller): € 14 per passenger per hour for car/rail; € 10 per passenger per hour for coaches; € 20 per passenger per hour for aviation. For the corridor Bucharest – Warsaw the following figures were used (assuming a Romanian traveller): € 3 per passenger per hour for car/rail; € 2 per passenger per hour for coaches; € 5 per passenger per hour for aviation (CE Delft et al, 2008 ; adapted by CE Delft. See Annex B for more details).

Table 43 Illustrative overview of generalised costs of passenger transport on the corridors Paris – Madrid and Bucharest - Warsaw (€/pkm)

Cost item	Passenger cars	Coaches	Rail transport	Aviation
Paris - Madrid				
Internal costs (excl. taxes and charges)	0.015	0.04	0.03	0.05
Time costs	0.13	0.15	0.09	0.07
Generalised costs	0.15	0.19	0.12	0.12
Bucharest - Warsaw				
Internal costs (excl. taxes and charges)	0.016	0.03	0.09	0.05
Time costs	0.04	0.04	0.06	0.02
Generalised costs	0.06	0.07	0.15	0.07

Note: The derived time costs are just rough estimates of the actual time costs, as the Value of Time (VoT) used for this assessment are marginal costs, not entirely suitable for this kind of assessments. Therefore, these results should be considered as illustrative.

Travel times are often even more important for freight transport than they are for passenger transport. Part of these time costs (wage costs of the driver) are covered by the internal costs estimated above. However, the opportunity costs of not being able to use the capital tied in a certain shipment in other productive use is not considered in internal cost figures[38]. Due to a lack of reliable figures it is not possible to easily estimate these costs.

3.5.3 Reliability and flexibility

Transport modes may also differ with respect to their performances in terms of reliability and flexibility (Ecorys, 2004; Samimi et al., 2011). For maritime transport and IWT particularly their flexibility is often criticised, while for rail freight transport reliability is often a matter of concern for shippers. These sometimes lower performances associated to non-road modes give rise to negative perception by shippers, even in case they actually perform well (Heljedal, 2013). Similar concerns are found for non-road passenger transport modes.

3.5.4 Infrastructure and traffic management

The travel costs, travel times, reliability and flexibility of the various transport modes are significantly influenced by factors related to transport infrastructure and traffic management. International rail transport in the EU is, for example, hampered by differences in gauge width, in electrification, and in signalling systems between EU Member States (European Commission, 2017b). Due to this low level of interoperability trains on some of the selected corridors are forced to make several stops when crossing borders between Member States, increasing the time and costs required to transport goods from origin to destination. This is particularly relevant for the international corridors covering Spain and Portugal, as a different gauge width is applied in these countries than in other EU countries. But also on other corridors, lack of rail interoperability may hinder international rail transport. Particularly rail transport and multi-modal transport could benefit from further harmonisation and improved coordination, in particular for cross-border connections.

Transport infrastructure capacity constraints and missing links may affect transport operations as well (by increasing travel times and costs and lowering reliability). For several corridors, motorways in urban areas are heavily congested (e.g. on the

[38] Note that these opportunity costs are covered in the market prices for freight transport.

corridor Amsterdam – Frankfurt or Paris – Madrid), while capacity problems at maritime ports and airports are identified for several corridors as well (e.g. capacity issues for aviation on the corridor Frankfurt – Budapest).

Poor connectivity of (air)ports to the rail network may hamper first/last mile transport for shipping and aviation transport on some of the corridors (e.g. Hamburg – Prague, Lisbon – Antwerp). In addition, IT facilities providing information on schedules, delays and available capacity is often missing (European Commission, 2011).

Large divergence in quality and availability of infrastructure between modes and corridors affect transport operations as well. Particularly Eastern European countries still have a motorway network of a limited size, few high speed rail line connections and their conventional railway lines are often in relatively poor condition.

Winter conditions in Northern and Eastern European countries as well as mountainous areas may affect transport modes to a different extent. Particularly maritime transport on the corridors Helsinki – Gdansk and Stockholm - Hamburg may be hampered significantly due to winter weather conditions.

Finally, the way transport infrastructure is funded can affect the user costs. Where road, rail and IWT infrastructure is mainly financed from public sources (although private finance is increasingly used for investments in road infrastructure), maritime ports and airports are frequently financed from private sources and the (air)port dues collected from the users of the (air)ports (ITF, 2013). As a consequence, a larger share of the infrastructure costs of maritime transport and aviation is internalised, resulting in higher internal costs for these modes. Infrastructure costs lie outside the scope of this study; so only the portion of infrastructure costs that are internalized for the different modes are included in internal costs.

3.5.5 Regulation

Differences in regulation between transport modes (and between countries) may affect the level playing field between these modes, as these differences can have an impact on transport costs or time. First, this is the case with environmental regulation. For example, more stringent regulation on air pollutant emissions for road transport compared to other modes has resulted in an (limited) increase in the relative costs of road transport.

Differences in operational requirements are relevant as well. For example, the European Commission has set maximum weights and dimensions of HGVs for international transport (European Commission, 2015). At the national level, restrictions on train length, axle loads and maximum speeds are set for some national rail network segments, hampering international rail transport (European Commission, 2016).

Social regulation may also affect the level playing field between transport modes. For example, there may be differences in required rest times between modes and countries. As for maritime shipping, Member States tend to have individual approaches to determine safe manning levels (number of deck and engineering officers), leading to different operating costs and distorting the level playing field between countries (but also between modes) (Panteia et al., 2015).

Finally, administrative procedures differ between transport modes in Europe as well. Particularly for maritime transport, moving goods around Europe can be complex due to the fact that once ships travel beyond the EU's territorial waters, they are considered to pass the EU borders (Mustilli & Pelkmans, 2013). Consequently, ships transporting goods between EU ports are often subject to the same administrative procedures (inspections, exchange of customs documents) as ships transporting goods to/from other parts of the world. This administrative burden increases delays and costs for short sea shipping, reducing its competitiveness. Currently, the Commission is working on several measures to minimise the administrative requirements with the aim to create a 'European Maritime Single Window environment', with simplified formalities for ships that travel between ports (European Commission, 2013).

3.5.6 Comfort and social aspects

For passenger transport comfort and social aspects affect the transport decision as well. The (perceived) comfort of passenger transport is affected by a wide range of factors such as air conditioning, seating, space, auxiliaries, noise, smell, ability to work or to communicate (live or by telephone or internet). Also, the (in)dependency on fixed time tables, the difficulty of navigating in (e.g. for example in cities) and the predictability of travel times all affect the level of comfort. Social aspects such as privacy or (perceived) safety or social status can play a role as well. For freight transport similar aspects can be identified, e.g. flexibility and reliability of transport, conditioning of goods, administrative complexity, etc.

4 COMPARATIVE ANALYSES PER CORRIDOR

4.1 Introduction

In this chapter we compare the total burden of taxation, charging and subsidisation of different transport means on the selected corridors. Although we do take the subsidies identified in Chapter 3 into account, they are not explicitly shown in the tables and graphs presented in this chapter. The reason for this is that we only consider tax/charge exemptions, such that the net taxes/charges are shown in all tables and graphs.

We first discuss the assessment framework (Section 4.2); the indicators used in the comparative analyses are defined and the approach to measure them is explained. In Section 4.3 we present the results per corridor.

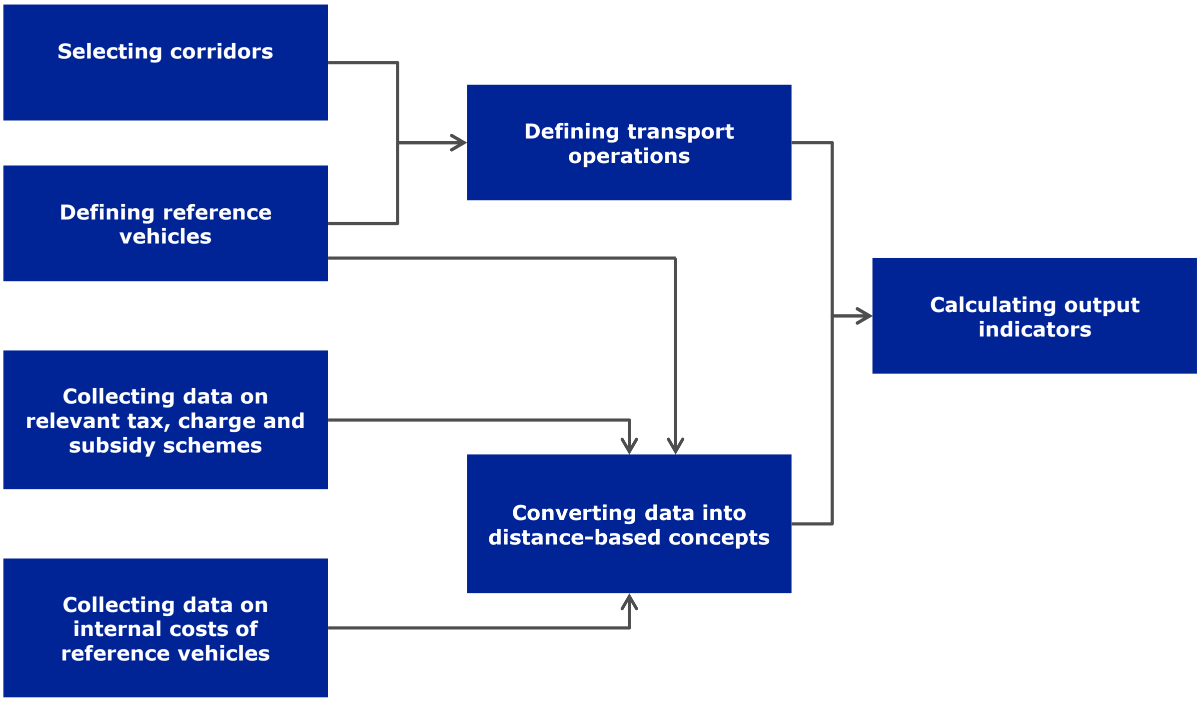
4.2 Assessment framework

The aim of this study is to compare the overall fiscal burden (including taxes, charges and subsidies) of different transport modes and means on twenty selected corridors. For this purpose, four output indicators have been developed that combine several taxes, charges and subsidies into one value:

- *Total fiscal burden,* including all relevant taxes, charges and subsidies that can be allocated to one trip on the corridor.
- *Fiscal burden per passenger or tonne-kilometre*, again including all relevant taxes, charges and subsidies that can be allocated to one trip on the corridor. By expressing the fiscal burden in terms of passenger or tonne-kilometres, fair comparisons between transport modes with different load capacity (e.g. truck and maritime vessel) can be made.
- *Share of taxes, charges and subsidies in the total internal costs* (i.e. including all relevant taxes, charges, subsidies) that can be allocated to one trip on the corridor. This indicator provides some insight in the contribution of taxes, charges and subsidies to the overall internal costs of the various transport modes.
- *Ratio of fiscal burden and internal costs* that can be allocated to one trip on the corridor. This indicator is complementary to the previous one.

In order to calculate these four indicators, an approach as shown in Figure 27 has been applied.

Figure 27 Approach to calculate the output indicators



Transport operations (in terms of routes, total travel distances, total travel time, etc.) have been defined for each of the relevant reference vehicles on each of the corridors. The results of this assessment have been presented in Chapter 2 (and in more detail in Annex C). Additionally, data on all relevant tax, charge and subsidy schemes on the selected corridors have been collected. The results of that assessment have been presented in Chapter 3 (and in more detail in the background document). Data on all internal costs (both fixed and variable) of the reference vehicles have been collected as well (see Annex E).

In order to make all taxes, charges, subsidies and internal costs comparable, they have been converted into distance-based concepts (€/vkm) using tailor-made methodologies. For example, one-off vehicle taxes (e.g. registration taxes) are divided by the expected lifetime mileage of the vehicle to derive the tax rate per vehicle kilometre. (Air)port charges are allocated: 50% to the arrival/landing and 50% to the departure. All conversion methodologies used are presented in Appendix D (for taxes, charges and subsidies) and Appendix E (for internal costs). Based on the distance-based concepts, the four different output indicators have been calculated.

4.3 Results per corridor

In this section we present the results of the comparative analyses carried out per corridor. Therefore, the four output indicators defined in Section 4.2 are discussed for each corridor, both for passenger and freight transport. For freight transport only the results for container/general cargo transport are presented in this chapter. The results for bulk transport can be found in Annex G.

Although the results for general cargo transport by airplanes is directly compared with container transport by the other freight modes, it should be mentioned that air cargo transport only competes with a limited number of sub-segments of the container transport market (e.g. certain high valuable consumer goods). This should be considered when interpreting the results.

As discussed in Section 1.2, the transport operations on all corridors are considered in both directions, meaning that the cities which define the corridor are treated both as an origin and a destination of a given journey. As some of the taxes/charges/subsidies depend on the country of origin, this implies that each corridor should be considered for both types of transport operations (i.e. from both directions). However, to limit the number of graphs/tables in this chapter, we only present the results of the comparative analyses for the transport operations starting in the city first mentioned in the corridor description (e.g. for Paris – Amsterdam, only the transport operations with Paris as origin are considered). The results for the other direction (return trip) are presented in Annex F.

Finally, for passenger transport the results from the perspective of the traveller are presented. The results from the perspective of transport companies (relevant for coaches, trains and airplanes) are presented in Annex H.

4.3.1 Paris – Amsterdam

Passenger transport

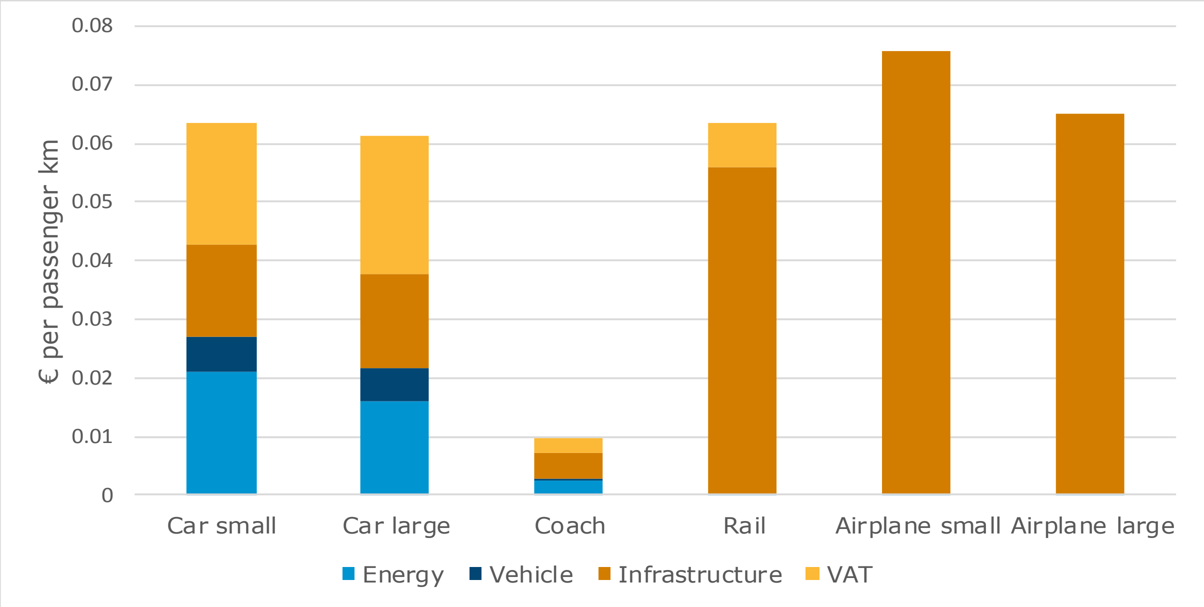
The total fiscal burden for all relevant passenger transport means on the corridor Paris – Amsterdam is shown in Table 44. The highest burden is found for the high speed train between Paris and Amsterdam due to the high infrastructure charges levied on this vehicle.

Table 44 Total fiscal burden for passenger transport means on the corridor Paris – Amsterdam (€/vehicle/trip)

	Small	Large		HSL	Small	Large
Energy taxes/charges	21	16	38	68	7	11
Vehicle taxes/charges	6	6	6	-	-	-
Infrastructure taxes/charges	16	16	65	9,075	2,250	4,987
VAT	21	24	39	1,218	-	-
Total fiscal burden	65	62	147	10,360	2,257	4,998

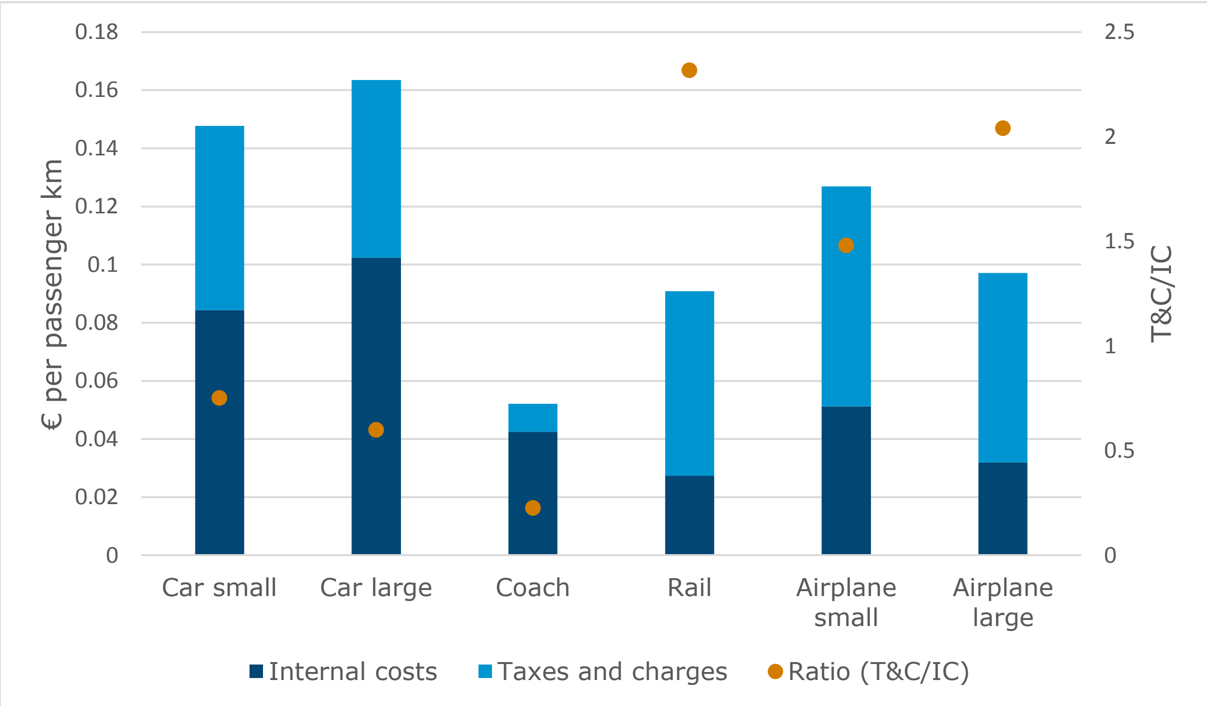
The comparison of the fiscal burden per passenger kilometre is shown in Figure 28. The highest burden is found for aviation, in the range of 6.5 to 7.5 €ct per passenger kilometre. This almost fully consists of (fixed) infrastructure charges (e.g. airport charges), only a small portion of the fiscal burden consists of allowances for the EU ETS. As the flight distance between Amsterdam and Paris is short, the burden per passenger kilometre is relatively high. The fiscal burden for rail transport is in the same range as the one for small airplanes, mainly due to the high infrastructure charges for high speed trains in the Netherlands and France. Also for passenger cars the fiscal burden is in the range of 6 to 6.5 €ct per passenger kilometre. Fuel taxes contribute about 30% to this burden, while infrastructure charges and vehicle taxes contribute respectively 25% and 10%. Finally, about 35% of the total fiscal burden is due to VAT payments. No large differences exist between small and large cars, except for the lower size of fuel taxes for large diesel cars compared to small petrol cars. Finally, the taxes and charges on coach transport is lowest, due to the relatively low tax/charge levels for these vehicles.

Figure 28 Comparison of fiscal burden per passenger kilometre on the corridor Paris - Amsterdam



The share of the taxes and charges in the internal costs of passenger transport on the corridor Paris – Amsterdam is shown in Figure 29. The ratio between the fiscal burden and internal costs is shown in this figure as well. The share of the taxes and charges in total internal costs is highest for rail (HSL), followed by aviation and passenger cars.

Figure 29 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Paris – Amsterdam



Freight transport

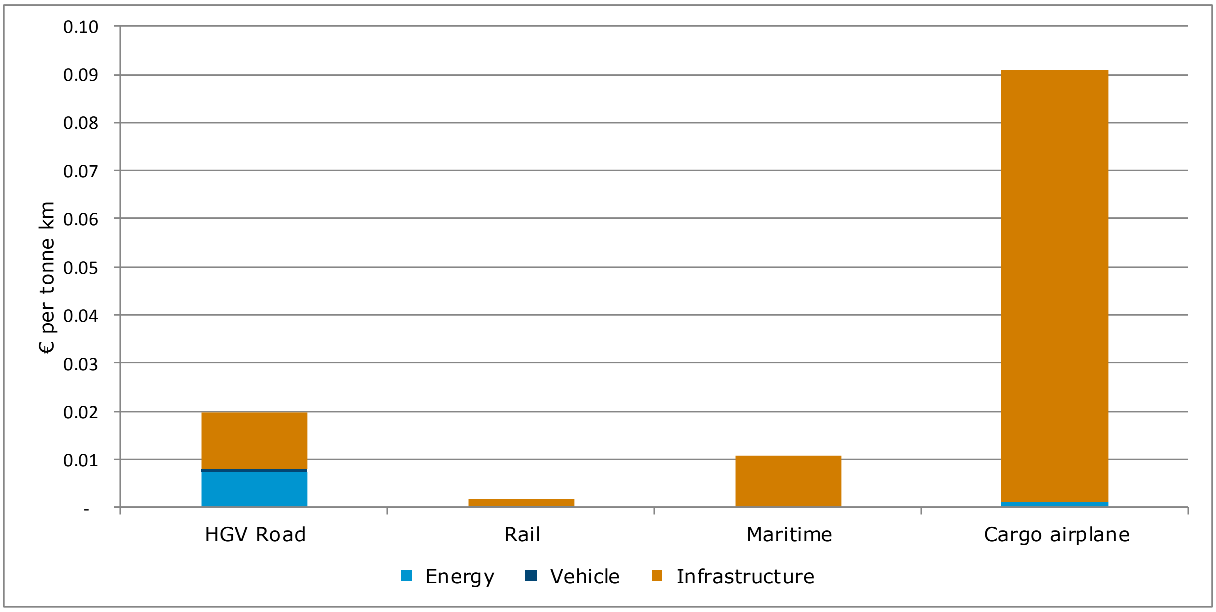
The total fiscal burden for freight transport means on the corridor Paris – Amsterdam is presented in Table 45. The highest burden per vehicle is found for maritime vessels, followed by cargo airplanes.

Table 45 Total fiscal burden for freight transport means on the corridor Paris – Amsterdam (€/vehicle/trip)

				
Energy taxes/charges	52	54	-	18
Vehicle taxes/charges	7	-	-	-
Infrastructure taxes/charges	83	1,167	12,575	1,287
Total fiscal burden	141	1,221	12,575	1,304

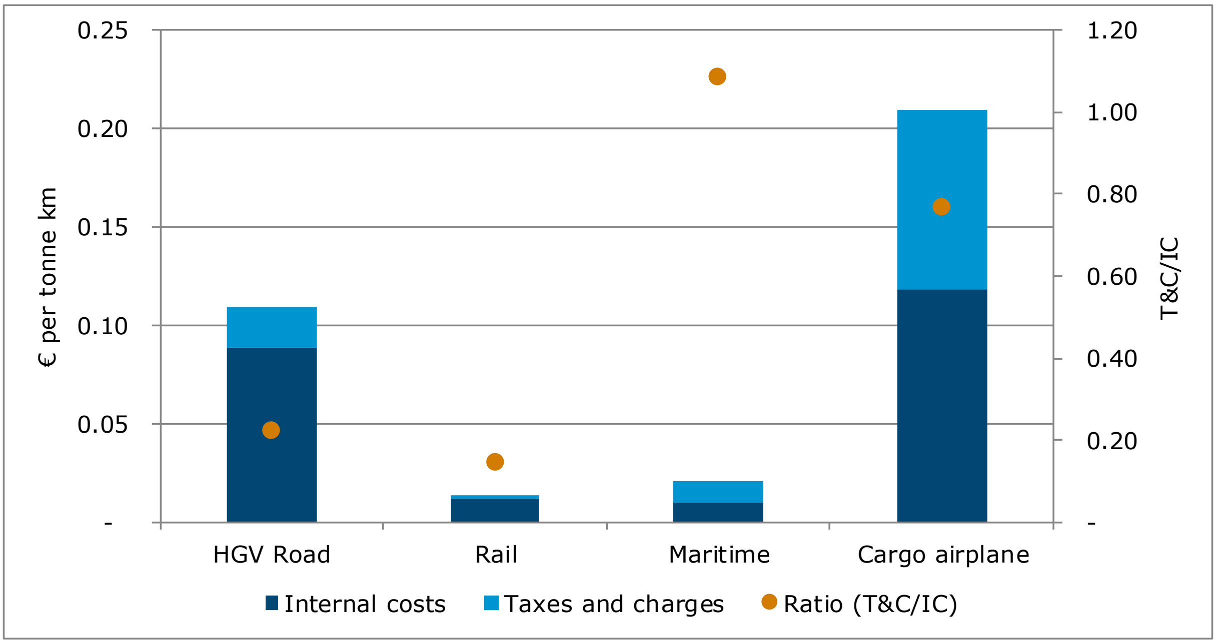
The fiscal burden per tonne-kilometre is shown in Figure 30. The burden is highest for aviation, which is mainly due to the relatively low average load of cargo airplanes. A small proportion of the fiscal burden is due to ETS allowances. For HGVs, infrastructure charges (mainly in Belgium and France) contribute most to the total fiscal burden (about 60%), followed by fuel taxes (about 37%). For maritime transport the charges mainly consist of port charges and piloting charges, both labelled infrastructure charges. Finally, the fiscal burden for rail freight transport is lowest (in €/tkm).

Figure 30 Comparison of fiscal burden for container freight per tonne-kilometre on the corridor Paris - Amsterdam



The share of the taxes and charges in the total internal costs and the ratio of internal costs and fiscal burden of freight transport on the corridor Paris – Amsterdam is shown in Figure 31.

Figure 31 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Paris – Amsterdam



Taxes and charges contribute most to the total internal costs of maritime vessels, followed by cargo airplanes, HGVs and rail freight transport.

4.3.2 Paris – Madrid

Passenger transport

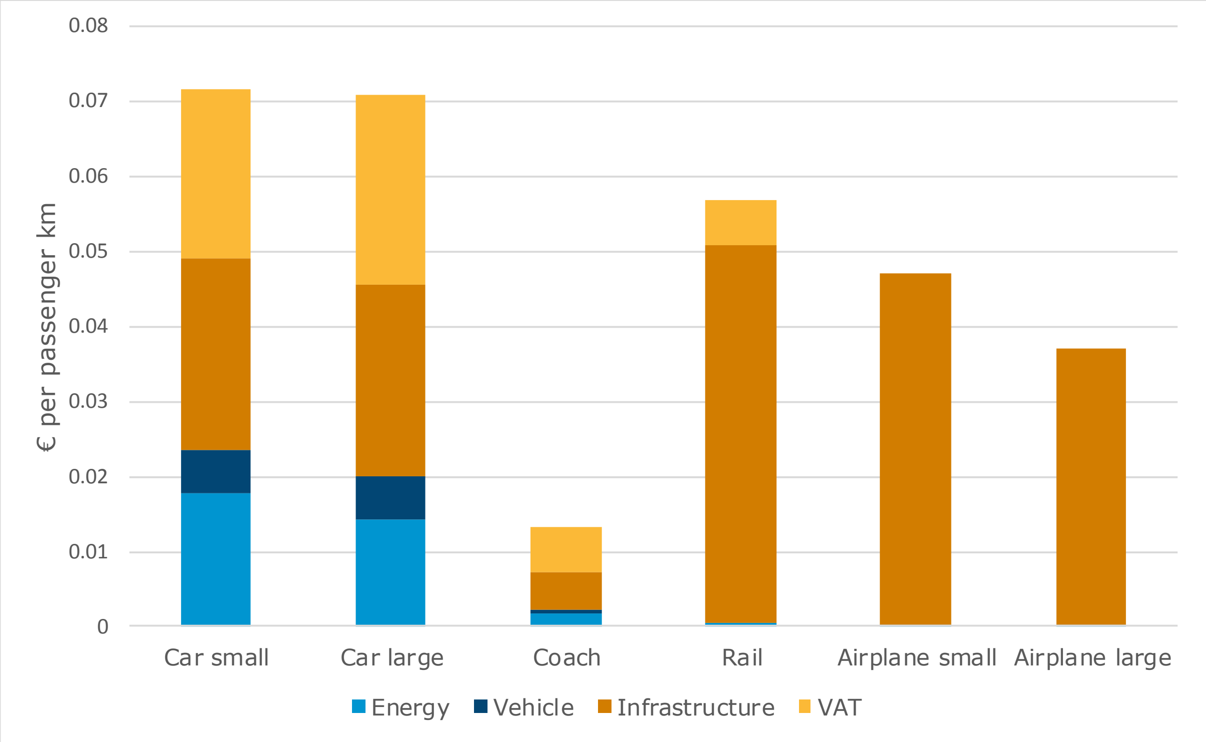
An overview of the total fiscal burden for passenger transport means on the corridor Paris – Madrid is shown in Table 46. The highest total burden per trip is levied on passenger trains, followed by airplanes.

Table 46 Total fiscal burden for passenger transport means on the corridor Paris – Madrid (€/vehicle/trip)

						
Energy taxes/charges	46	37	69	287	21	32
Vehicle taxes/charges	15	15	15	-	-	-
Infrastructure taxes/charges	64	64	187	24,175	2,901	5,896
VAT	57	64	229	2,924	-	-
Total fiscal burden	182	180	501	27,385	2,922	5,928

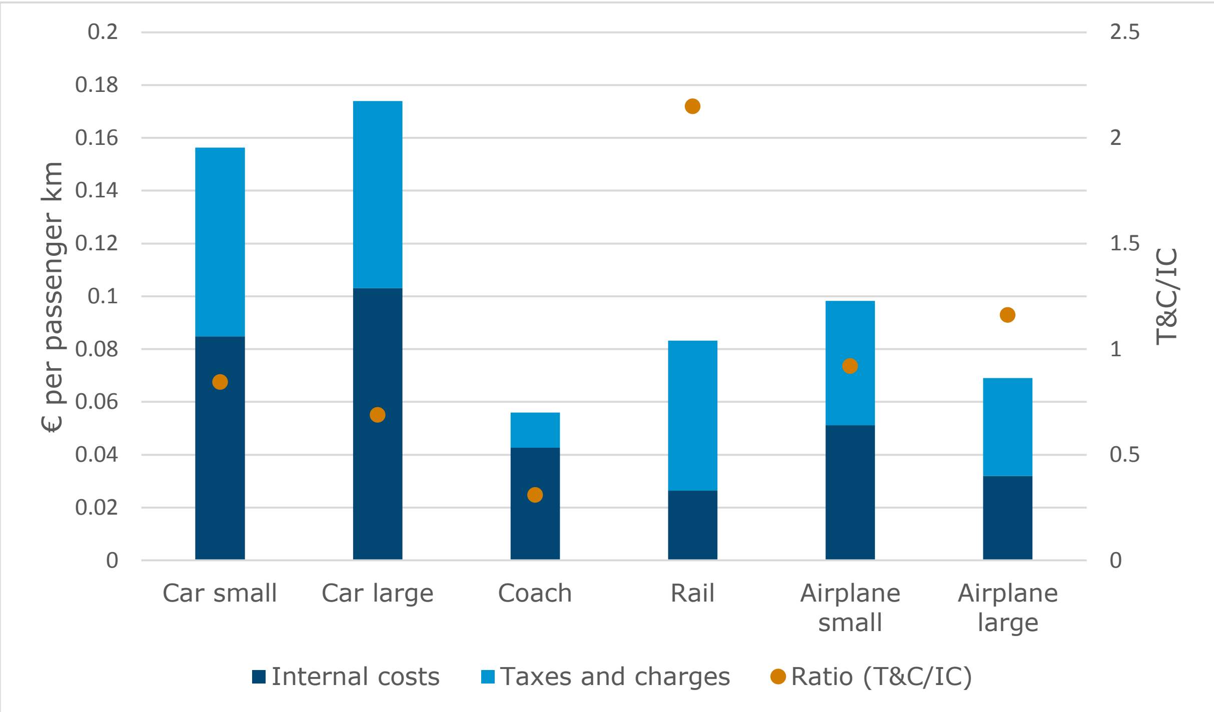
The fiscal burden per passenger kilometres for the various transport means is presented in Figure 32. The highest burden is levied on passenger cars (about 7 €ct per passenger kilometre). Infrastructure charges (distance-based road tolls) contribute most to this burden, even when considering that some French and Spanish toll roads are avoided (see Annex C.2). The fiscal burden on rail transport (HSL) is higher than for aviation, while the burden is lowest for coach transport (due to the relatively low tax/charge levels for these vehicles).

Figure 32 Comparison of fiscal burden per passenger kilometre on the corridor Paris - Madrid



The share of the fiscal burden in the total internal costs of passenger transport on the corridor Paris – Madrid is shown in Figure 33. In relative terms, taxes and charges contribute most to the total internal costs of rail transport, followed by aviation and passenger cars.

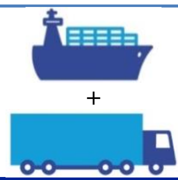
Figure 33 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Paris – Madrid



Freight transport

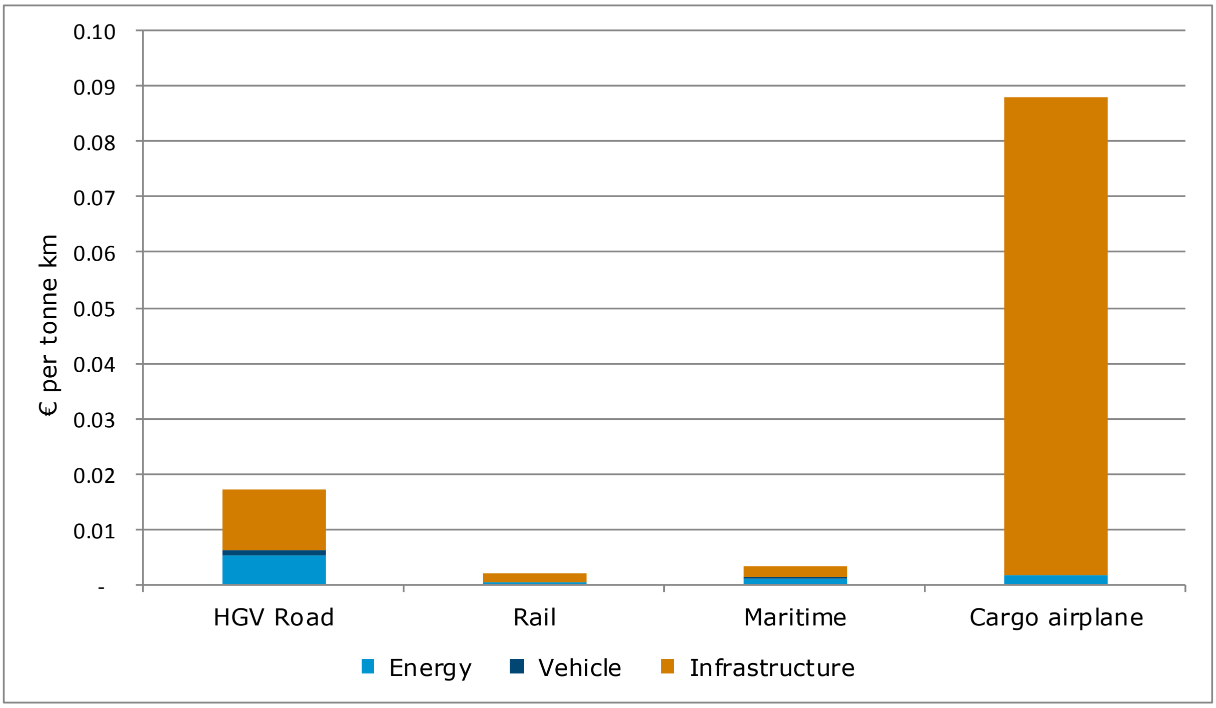
Table 47 presents the total fiscal burden for freight transport means on the corridor Paris – Madrid. The highest total burden is found for intermodal maritime transport (transhipment in Bilbao from vessel to truck), followed by train and airplane.

Table 47 Total fiscal burden for freight transport means on the corridor Paris – Madrid (€/vehicle/trip)

				
Energy taxes/charges	91	898	3,615	50
Vehicle taxes/charges	13	-	1,498	-
Infrastructure taxes/charges	185	2,436	7,303	2,586
Total fiscal burden	288	3,334	12,415	2,637

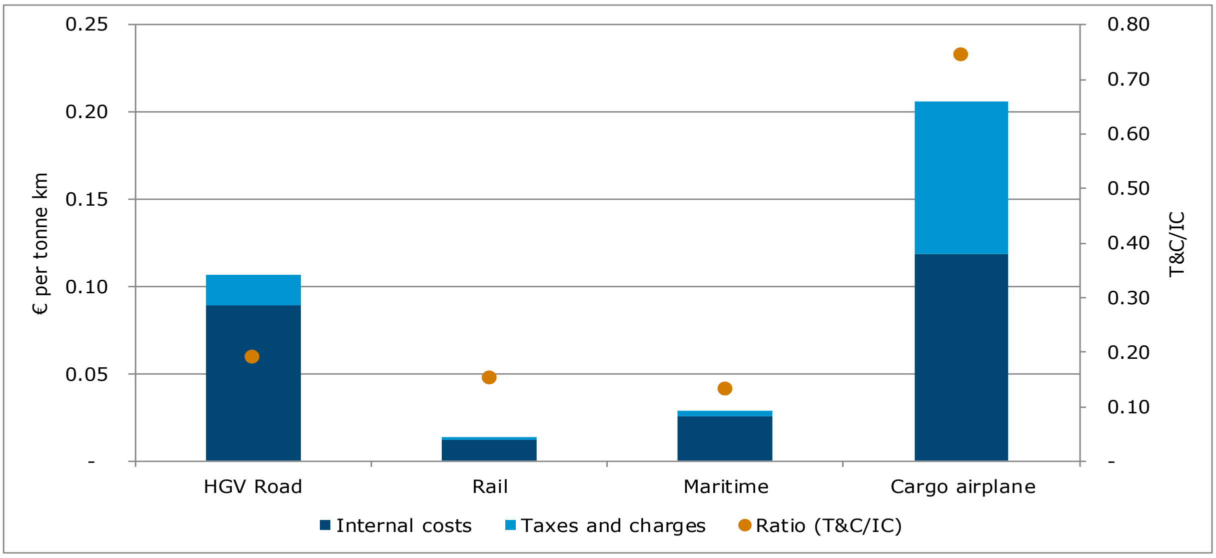
The fiscal burden per tonne-kilometre is shown in Figure 34. Due to the low average load of cargo airplanes, the fiscal burden per tonne-kilometre is relatively high for aviation. The fiscal burden for HGVs is higher than for maritime transport and rail transport. For HGVs, infrastructure charges (road tolls on French and Spanish motorways) contribute most to the total burden, followed by fuel taxes. Vehicle taxes only have a minor contribution to the total fiscal burden (about 4%). For the maritime transport operations, the road leg (between Bilbao and Madrid) significantly contributes to the total fiscal burden (e.g. energy taxes are fully related to road transport, as maritime transport is exempted from energy taxes on this corridor).

Figure 34 Comparison of fiscal burden per tonne-kilometre on the corridor Paris - Madrid



The share of the taxes and charges in the total internal costs and the ratio of internal costs and fiscal burden of freight transport on the corridor Paris – Madrid is shown in Figure 35. Taxes and charges contribute most to the total internal costs of aviation, followed by road, rail and maritime transport.

Figure 35 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Paris – Madrid

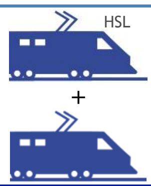
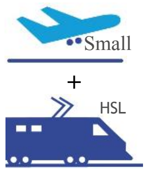
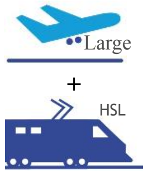


4.3.3 Antwerp - Warsaw

Passenger transport

An overview of the total fiscal burden for passenger transport means on the corridor Antwerp – Warsaw is provided by Table 48. The highest fiscal burden is identified for rail transport, followed by aviation (intermodal trip with passenger train between Antwerp and Brussels).

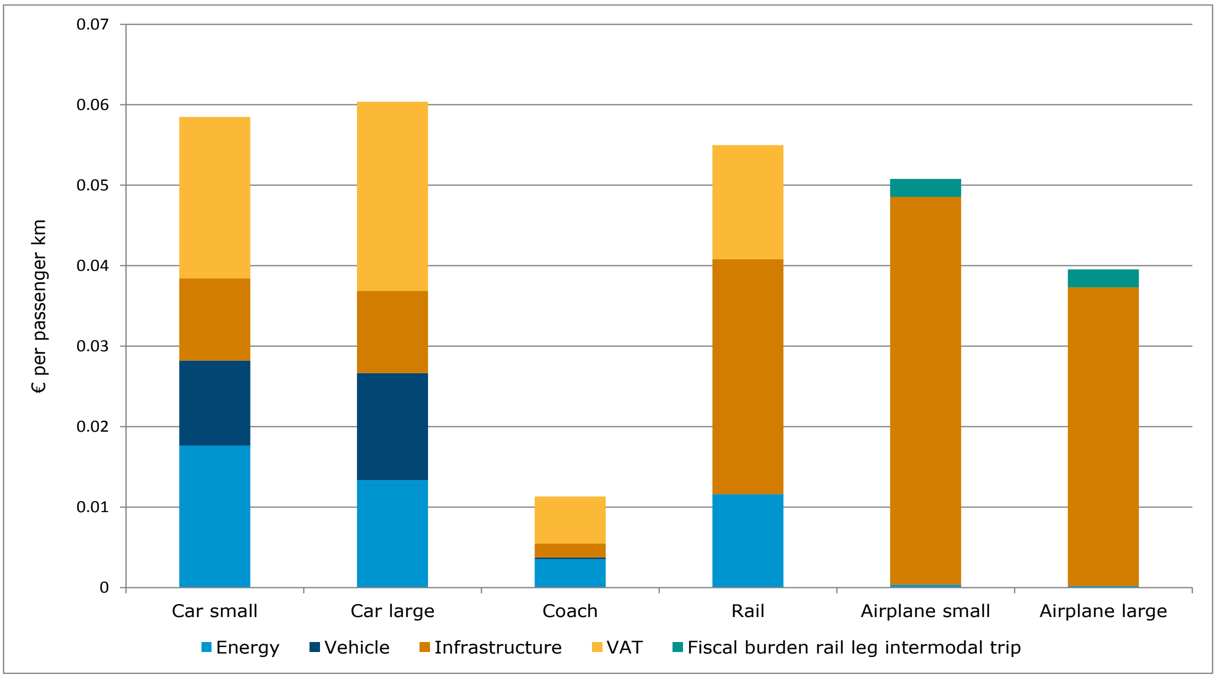
Table 48 Total fiscal burden for passenger transport means on the corridor Antwerp - Warsaw (€/vehicle/trip)

	 Small	 Large		 HSL + HSL	 Small + HSL	 Large + HSL
Energy taxes/charges	44	33	132	1,855	23	35
Vehicle taxes/charges	27	33	9	-	-	-
Infrastructure taxes/charges	26	26	64	4,702	3,255	6,447
VAT	50	59	221	3,614	-	-
Fiscal burden rail leg intermodal trip by aviation	-	-	-	-	151	388
Total fiscal burden	147	152	426	10,171	3,429	6,870

The fiscal burden per passenger kilometre for the various passenger transport means is shown in Figure 36. The burden is highest for passenger cars, followed by rail transport and aviation. For passenger cars, fuel taxes contribute about 23% to 30% to the fiscal burden, while vehicle and infrastructure charges (distance-based road charges in Poland) contribute both about 18% to 22%. Finally, VAT has a share of about 34% up to 40% in the total fiscal burden for passenger cars. For rail transport, the main part of the fiscal burden is related to infrastructure charges, although VAT and energy taxes (due to the relatively high electricity taxes for rail transport in

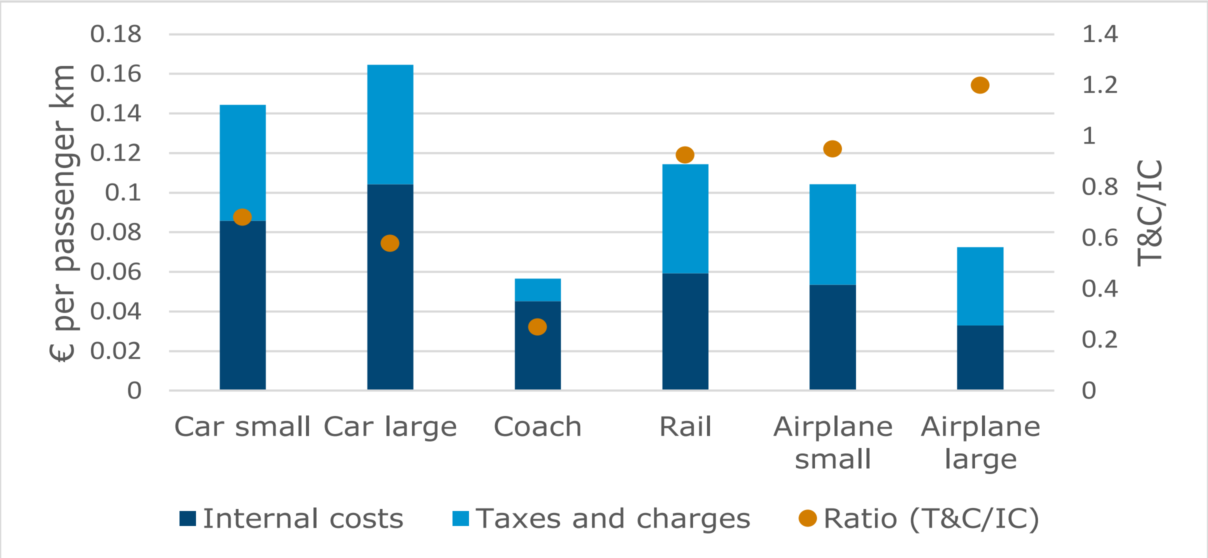
Germany) have a significant share as well. For aviation, the main part of the fiscal burden consists of infrastructure charges related to the use of airport (facilities). A small part of the fiscal burden of this trip is related to the rail transport between Antwerp and Brussels airport (separately shown in Figure 36). Finally, coach transport has the lowest fiscal burden. This burden mainly consists of VAT and fuel taxes.

Figure 36 Comparison of fiscal burden per passenger kilometre on the corridor Antwerp - Warsaw



The share of the fiscal burden in the total internal costs of passenger transport on the corridor Antwerp - Warsaw is shown in Figure 37. In relative terms, taxes and charges contribute most to the total internal costs of aviation and rail transport, followed by passenger cars and coach transport.

Figure 37 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Antwerp - Warsaw



Freight transport

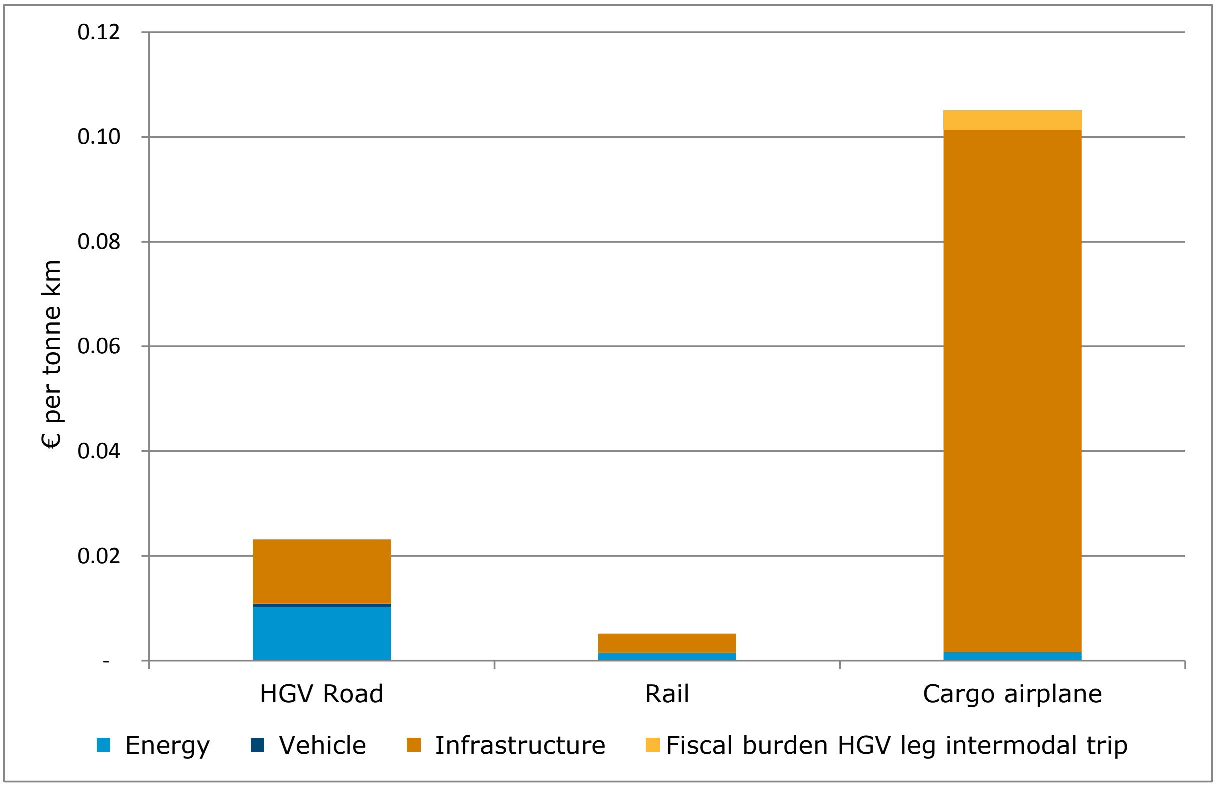
An overview of the total fiscal burden for freight transport means on the corridor Antwerp – Warsaw is given in Table 49. The highest total burden is found for rail transport, followed by aviation (intermodal trip, as transport between Antwerp and Brussels airport is done by HGV).

Table 49 Total fiscal burden for freight transport means on the corridor Antwerp - Warsaw (€/vehicle/trip)

			
Energy taxes/charges	174	2,509	54
Vehicle taxes/charges	10	-	-
Infrastructure taxes/charges	209	6,006	3,240
Fiscal burden HGV leg intermodal trip by aviation	-	-	118
Total fiscal burden	393	8,515	3,412

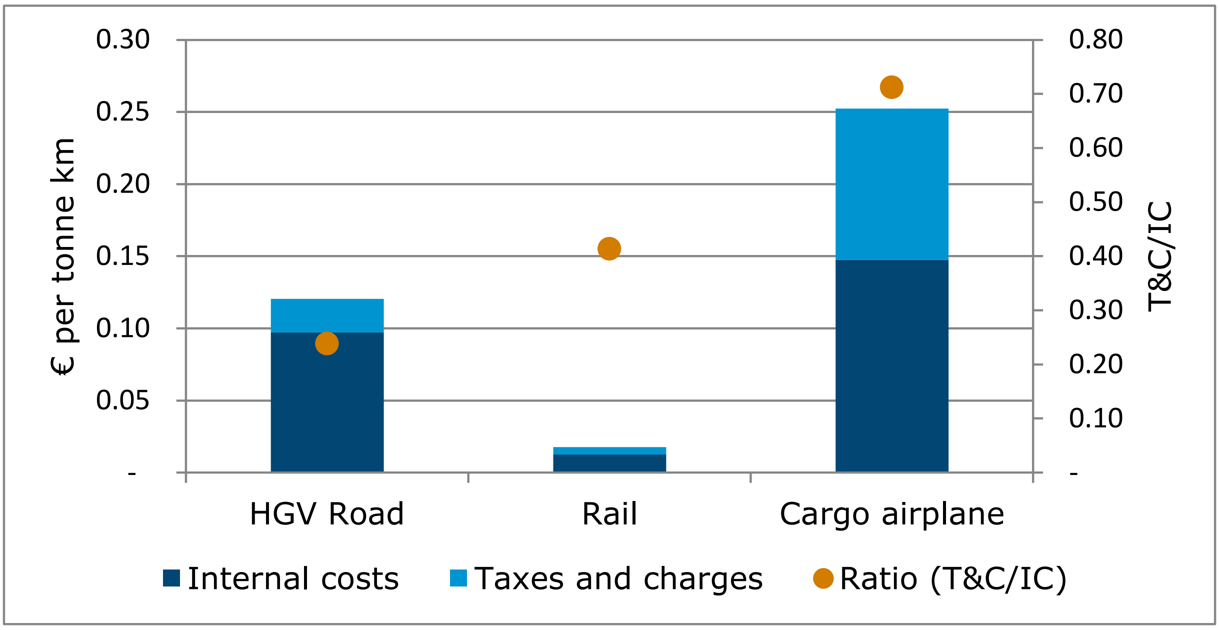
The fiscal burden per tonne-kilometre is shown in Figure 38. Aviation has the highest burden, mainly due to the relatively low average load of cargo planes. The taxes/charges related to the rail leg of the intermodal trip by air are shown separately. For trucks, both infrastructure charges (e.g. distance-based road charges in Belgium, Germany and Poland) and fuel taxes contribute significantly to the total burden (53% and 44%, respectively), while vehicle taxes only have a very limited share (about 3%). Finally, for rail transport the fiscal burden consist of infrastructure charges and electricity taxes; their contribution in the total burden is 71% and 29% respectively.

Figure 38 Comparison of fiscal burden per tonne-kilometre on the corridor Antwerp - Warsaw



The share of the fiscal burden in the total internal costs of freight transport on the corridor Antwerp - Warsaw is shown in Figure 39. In relative terms, taxes and charges contribute most to the total internal costs of aviation, followed by rail transport and HGVs.

Figure 39 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Antwerp - Warsaw



4.3.4 Amsterdam - Frankfurt

Passenger transport

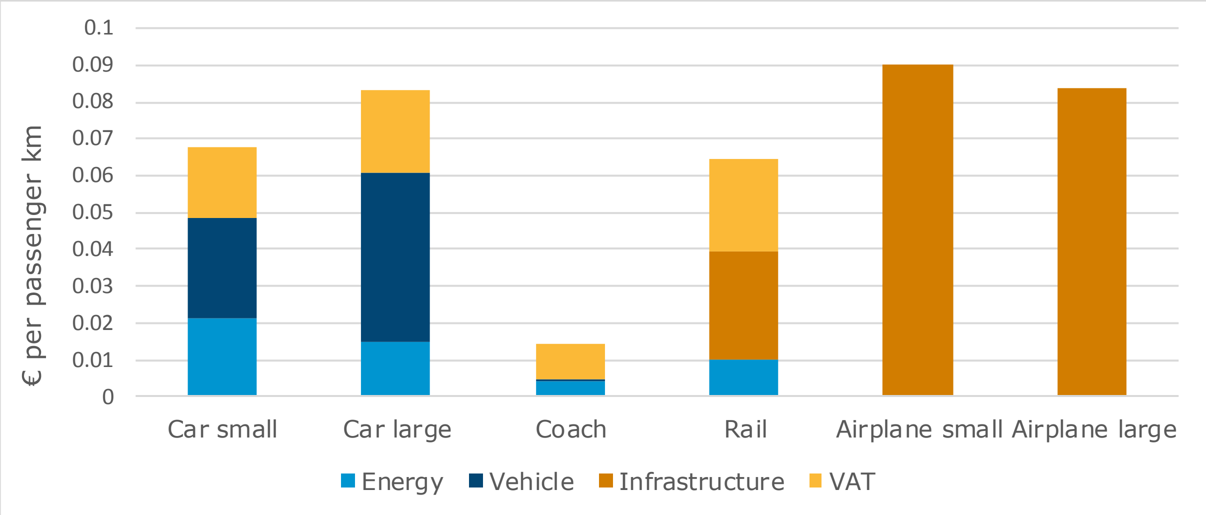
Table 50 presents the total fiscal burden for passenger transport means on the corridor Amsterdam – Frankfurt. The highest total burden is found for rail transport, followed by aviation and coach transport.

Table 50 Total fiscal burden for passenger transport means on the corridor Amsterdam - Frankfurt (€/vehicle/trip)

	Small	Large		HSL	Small	Large
Energy taxes/charges	19	13	53	1,373	7	10
Vehicle taxes/charges	24	41	10	-	-	-
Infrastructure taxes/charges	-	-	-	3,986	2,233	5,336
VAT	17	20	132	3,407	-	-
Total fiscal burden	60	74	195	8,766	2,240	5,347

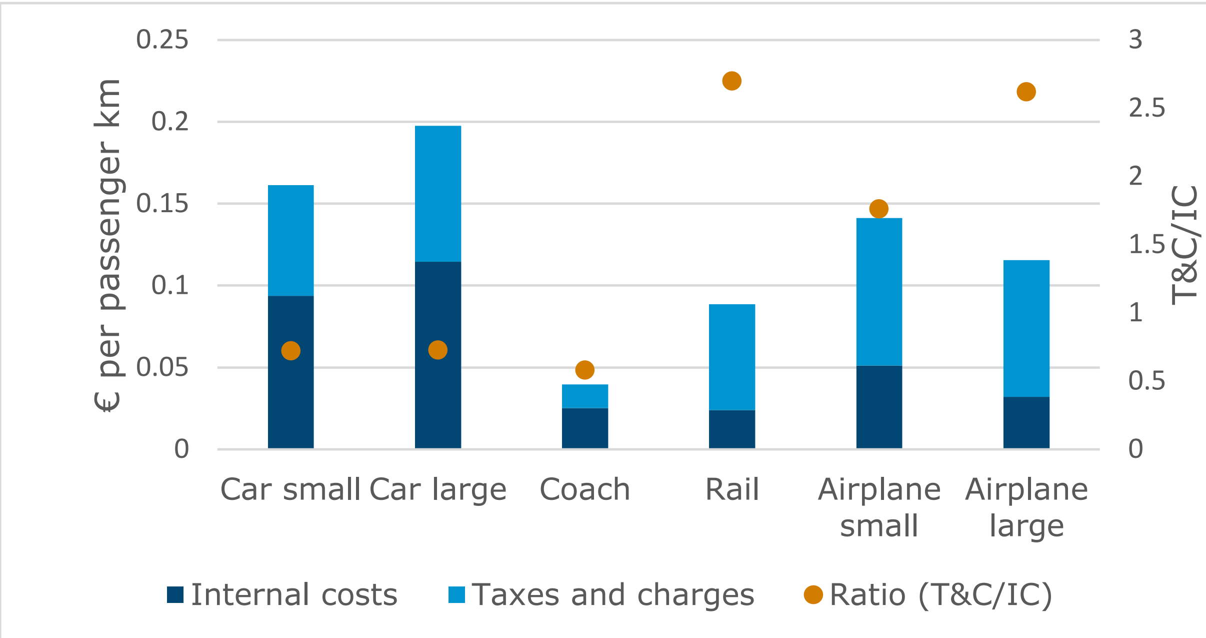
The fiscal burden per passenger kilometre on the corridor Amsterdam – Frankfurt is shown in Figure 40. Aviation displays the highest burden per passenger kilometre, which is partly explained by the fact that the fixed infrastructure charges (e.g. LTO charges) are allocated to a limited number of kilometres as the flight distance between Amsterdam and Frankfurt is relatively short. For passenger cars, the main part of the fiscal burden consists of vehicle taxes (particularly, ownership and registration taxes), which are relatively high in the Netherlands (CE Delft, 2016). Particularly the vehicle taxes for the large (diesel) car is high, which can be explained by the malus for diesel cars in the Dutch ownership and registration tax. With respect to rail transport, the main share of the fiscal burden consists of infrastructure charges, although VAT and electricity taxes (particularly for the German part of the corridor) significantly contribute to the total burden. Finally, the fiscal burden for coaches mainly consists of VAT and fuel taxes.

Figure 40 Comparison of fiscal burden per passenger kilometre on the corridor Amsterdam - Frankfurt



The share of the fiscal burden in the total internal costs of passenger transport is shown in Figure 41. In relative terms, taxes and charges contribute most to the total internal costs of rail transport, followed by aviation and passenger cars.

Figure 41 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Amsterdam - Frankfurt



Freight transport

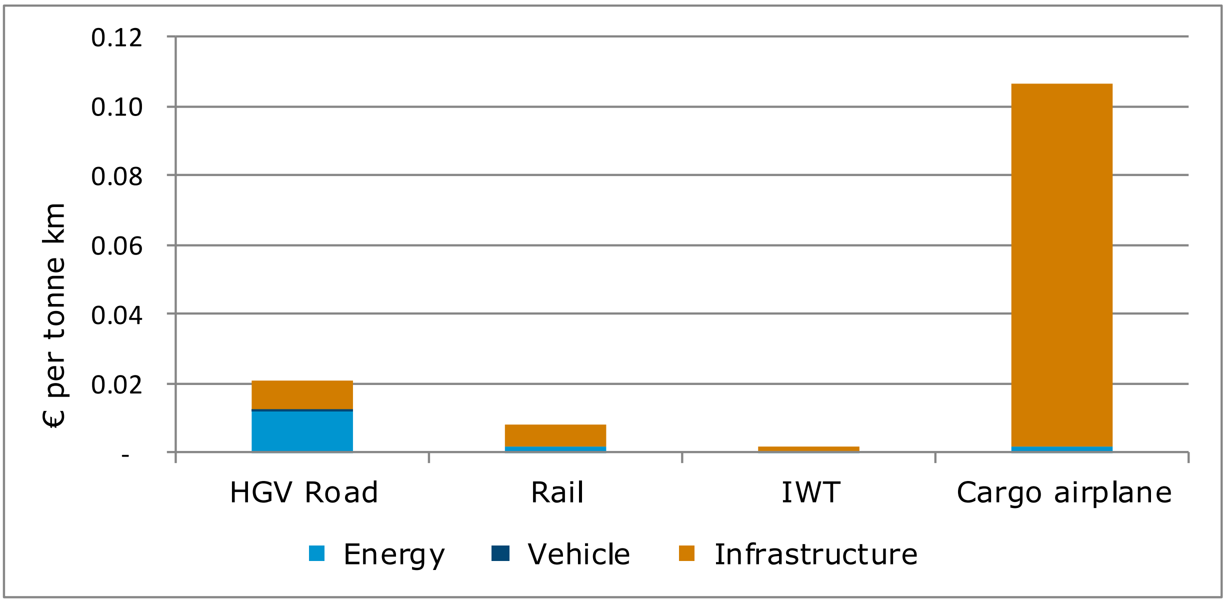
An overview of the total fiscal burden for freight transport means on the corridor Amsterdam – Frankfurt is given in Table 51. Rail freight transport has the highest total burden, followed by aviation and inland shipping.

Table 51 Total fiscal burden for freight transport means on the corridor Amsterdam - Frankfurt (€/vehicle/trip)

				
Energy taxes/charges	71	968	61	16
Vehicle taxes/charges	6	-	-	-
Infrastructure taxes/charges	50	3,692	1,181	1,258
Total fiscal burden	127	4,659	1,242	1,274

The fiscal burden per tonne-kilometre is shown in Figure 42. As for the previous corridors, the highest burden is identified for aviation (due to the low average load of cargo airplanes). For HGVs, the main part of the fiscal burden consists of fuel taxes (56%), complemented by infrastructure charges[39] (39%) and vehicle taxes (5%). The taxes/charges levied on rail freight transport on the corridor Amsterdam – Frankfurt consist of infrastructure charges (79%) and electricity taxes (21%). Finally, the taxes/charges for IWT consist for 95% of infrastructure charges (port charges, fairway dues), while 5% are related to water pollution charges (which are included in the energy charges category in this study).

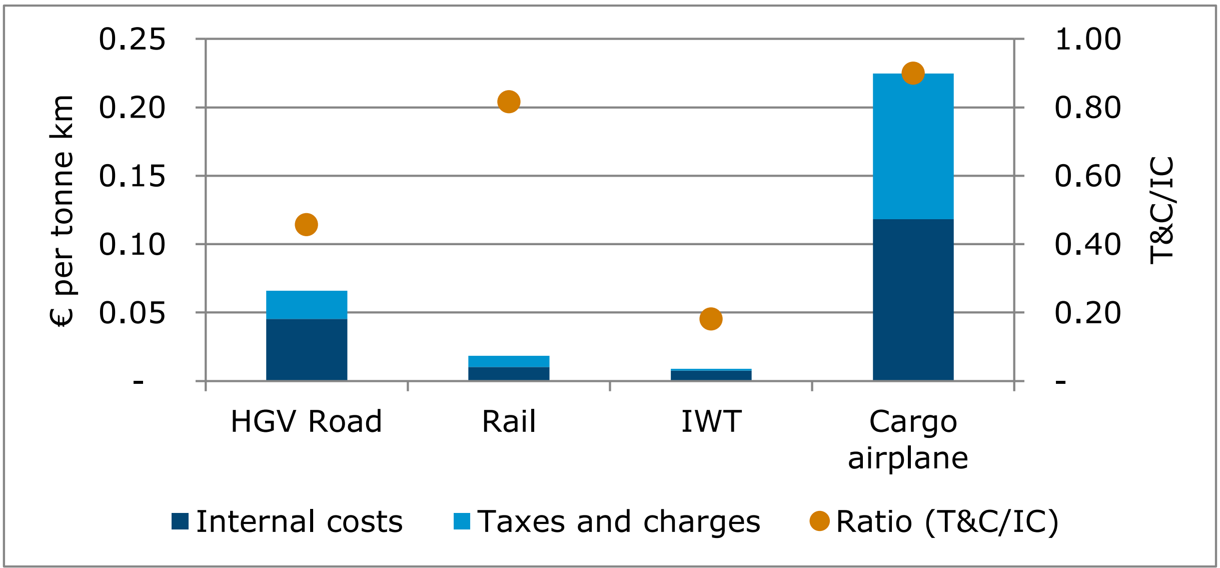
Figure 42 Comparison of fiscal burden per tonne-kilometre on the corridor Amsterdam - Frankfurt



The share of the fiscal burden in the total internal costs of freight transport on the corridor Amsterdam – Frankfurt is shown in Figure 43. Taxes and charges contribute most to the total internal costs (in relative terms) of rail freight transport, followed by cargo airplanes, HGVs and inland shipping.

39 Particularly the German MAUT

Figure 43 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Amsterdam - Frankfurt



4.3.5 Frankfurt - Budapest

Passenger transport

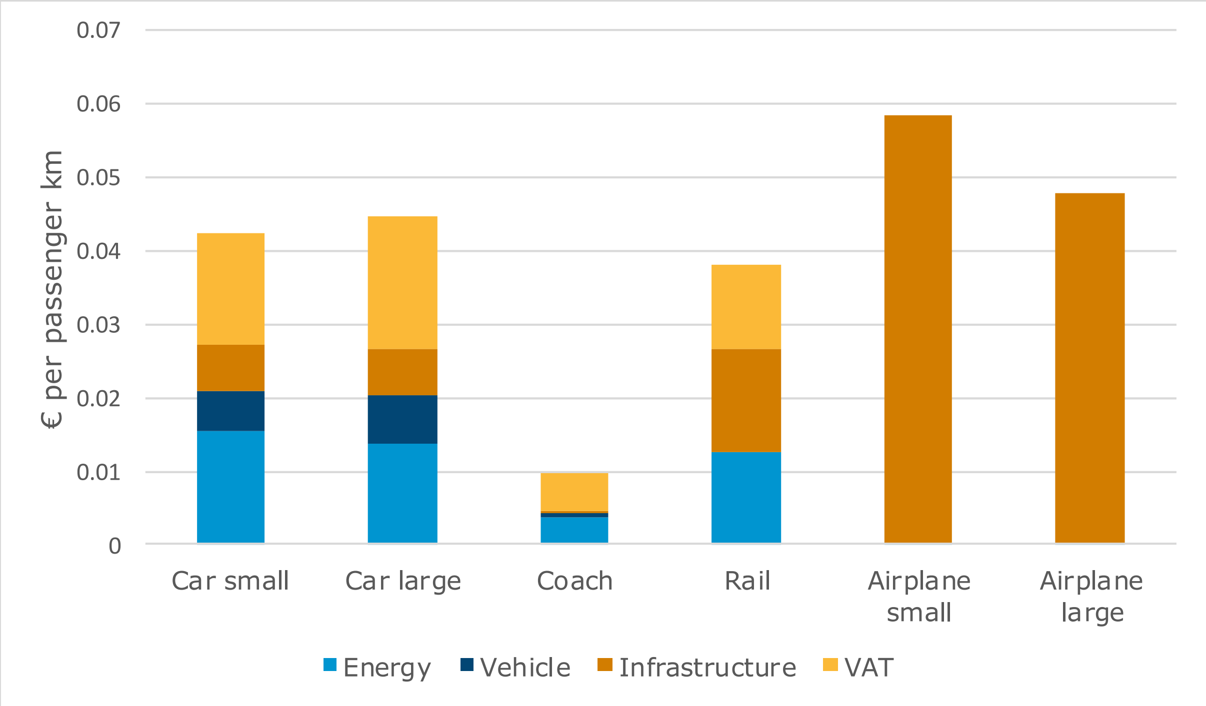
Table 52 presents an overview of the total fiscal burden for passenger transport means on the corridor Frankfurt – Budapest. Rail transport has the highest fiscal burden, followed by aviation and coach transport.

Table 52 Total fiscal burden for passenger transport means on the corridor Frankfurt – Budapest (€/vehicle/trip)

	Small	Large		HSL	Small	Large
Energy taxes/charges	31	27	107	3,726	16	25
Vehicle taxes/charges	10	13	17	-	-	-
Infrastructure taxes/charges	12	12	11	4,089	2,925	6,149
VAT	30	36	152	3,400	-	-
Total fiscal burden	83	88	287	11,215	2,941	6,174

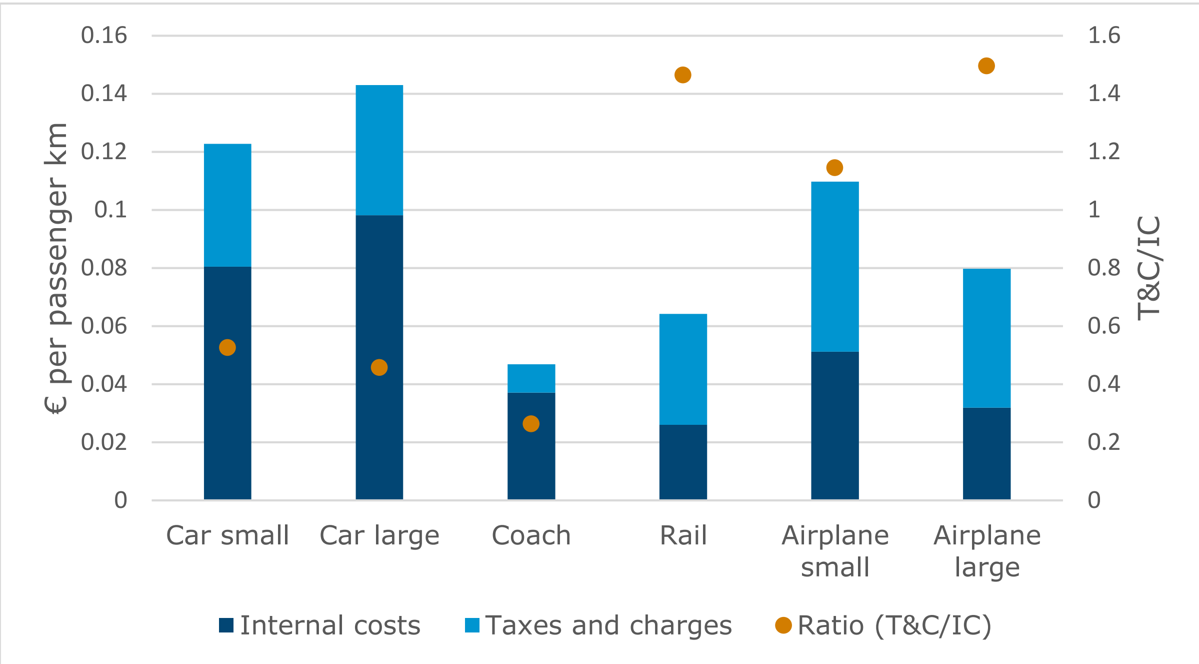
The fiscal burden per passenger kilometre on the corridor Frankfurt – Budapest is shown in Figure 44. The highest burden is found for aviation (mostly infrastructure charges), followed by passenger cars. Fuel taxes are responsible for a significant part of the total fiscal burden for passenger cars (32% - 37%), while infrastructure charges and vehicle taxes represent around 15% each of the total burden. Finally, VAT represents about 36% to 43% of the total fiscal burden. For rail transport, infrastructure charges, electricity taxes (both on the German and Austrian part of the corridor) and VAT (particularly on the German part of the corridor) contribute significantly to the total burden. Finally, for coach transport particularly VAT and fuel taxes contribute to the total fiscal burden.

Figure 44 Comparison of fiscal burden per passenger kilometre on the corridor Frankfurt - Budapest



As shown in Figure 45, the highest share of the fiscal burden in the internal costs is found for passenger rail transport and aviation, followed by passenger cars and coach transport.

Figure 45 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Frankfurt - Budapest



Freight transport

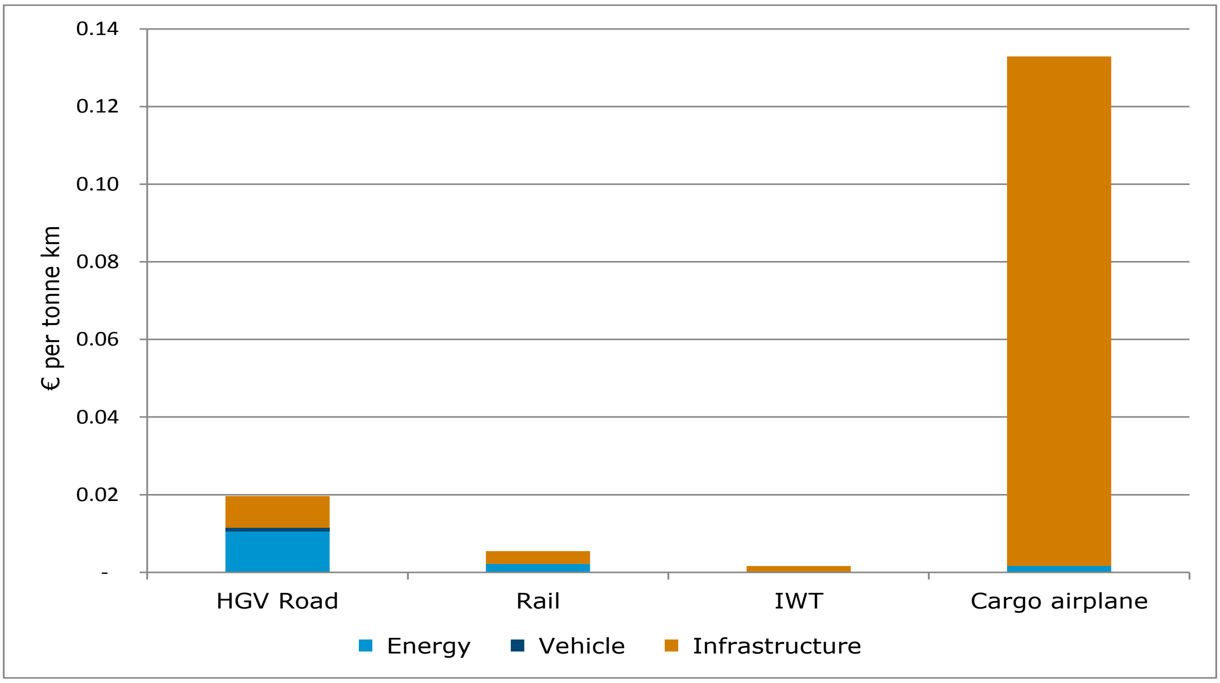
An overview of the total fiscal burden for freight transport means on the corridor Frankfurt - Budapest is given in Table 53. Rail freight transport has the highest total burden, followed by aviation and inland shipping.

Table 53 Total fiscal burden for freight transport means on the corridor Frankfurt - Budapest

				
Energy taxes/charges	141	2,745	-	39
Vehicle taxes/charges	12	-	-	-
Infrastructure taxes/charges	109	4,103	2,674	3,175
Total fiscal burden	262	6,848	2,674	3,214

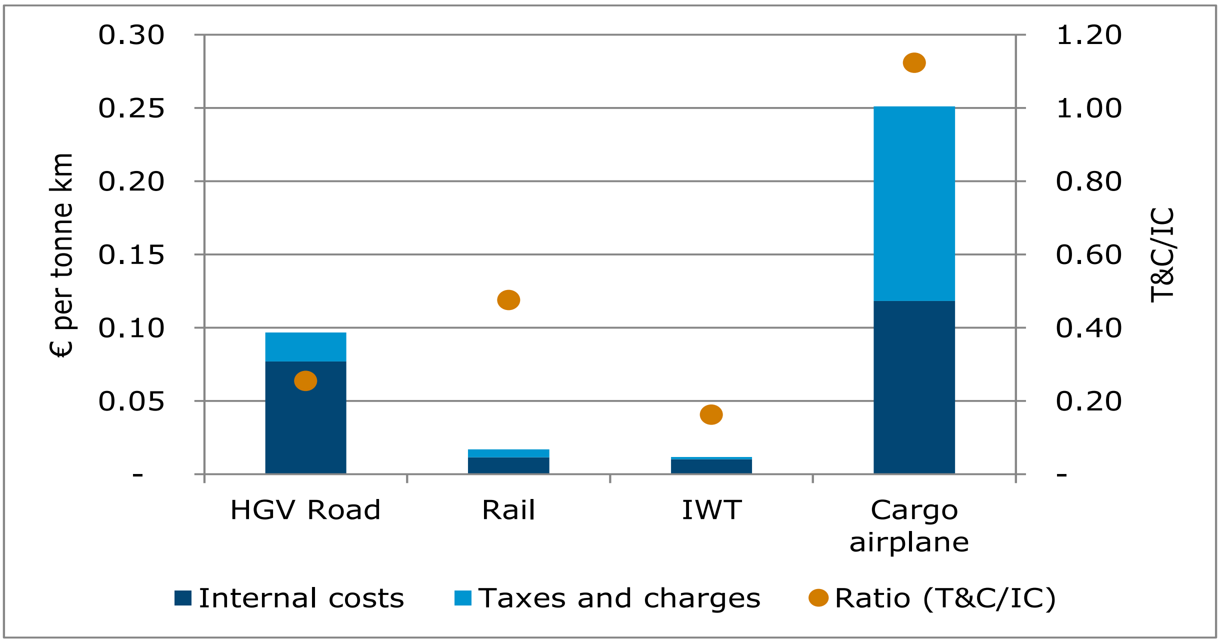
The fiscal burden per tonne-kilometre is shown in Figure 46. As for the previous corridors, the highest fiscal burden per tonne-kilometre is found for aviation followed by road freight transport. For HGVs, about 54% of the fiscal burden is due to fuel taxes, while infrastructure charges contribute about 42%. For rail transport, both electricity taxes and infrastructure charges contribute significantly to the total burden (40% and 60%, respectively). Finally, for IWT only infrastructure charges (e.g. port charges, fairway dues) are applied on this corridor.

Figure 46 Comparison of fiscal burden per tonne-kilometre on the corridor Frankfurt - Budapest



As shown in Figure 47, taxes and charges contribute most to the total internal costs of aviation, followed by freight rail transport, HGVs and IWT.

Figure 47 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Frankfurt - Budapest



4.3.6 Rome - Berlin

Passenger transport

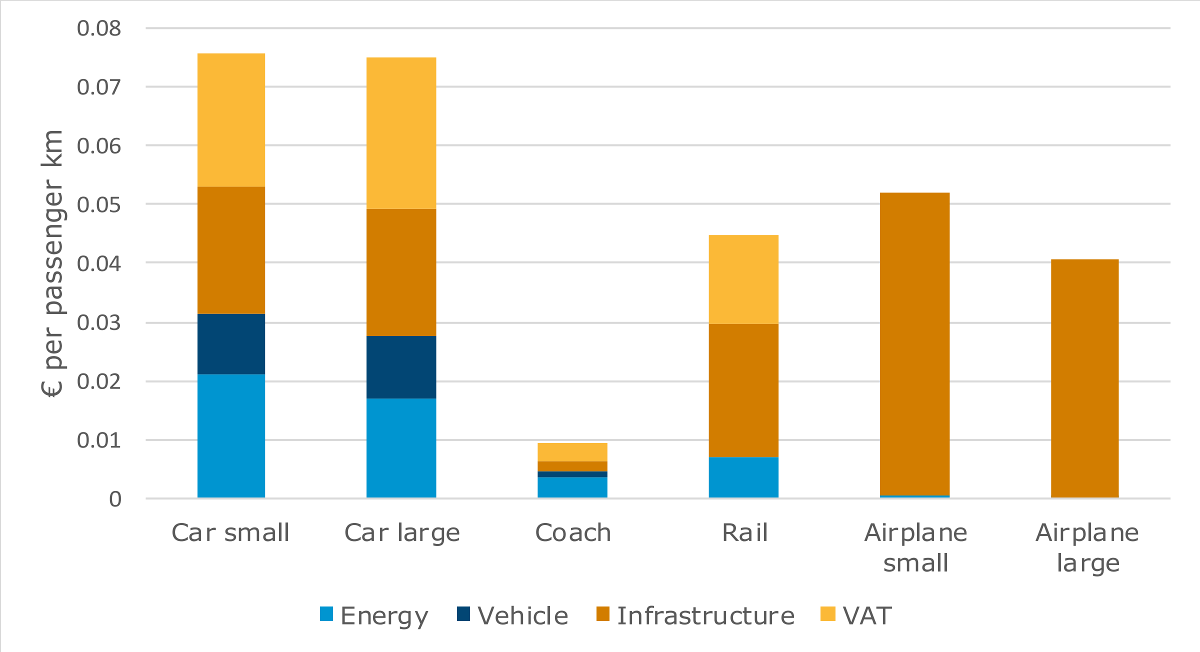
An overview of the total fiscal burden for passenger transport means on the corridor Rome – Berlin is given in Table 54. The highest burden is found for passenger rail transport, followed by aviation.

Table 54 Total fiscal burden for passenger transport means on the corridor Rome - Berlin (€/vehicle/trip)

	Small	Large		HSL +	Small	Large
Energy taxes/charges	63	51	165	2,909	24	36
Vehicle taxes/charges	32	33	45	-	-	-
Infrastructure taxes/charges	65	65	71	8.522	3,564	7,173
VAT	68	78	149	6,438	-	-
Total fiscal burden	228	226	430	17,869	3,588	7,210

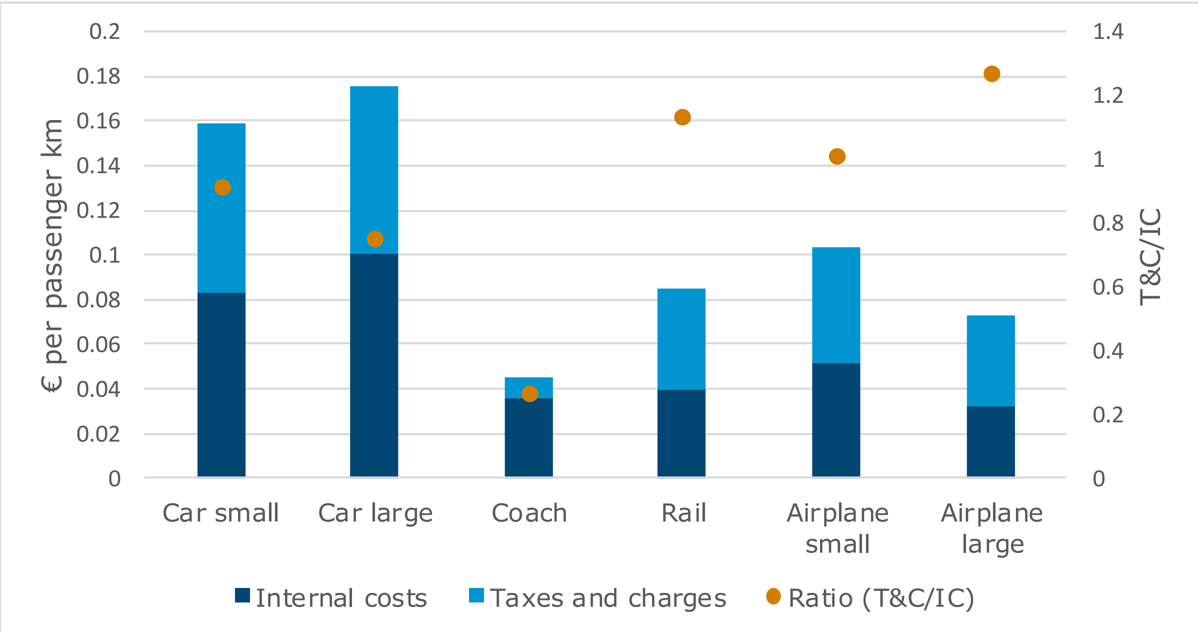
The fiscal burden per passenger kilometre for passenger transport means on the corridor Rome – Berlin is shown in Figure 48. Passenger cars have the highest burden, consisting of fuel taxes (22% to 28%), infrastructure charges (about 29%), vehicle taxes (about 15%) and VAT (30% to 34%). For aviation, the fiscal burden consists almost completely of infrastructure charges (e.g. LTO charges), while for rail transport infrastructure charges, VAT and electricity taxes (on the German and Austrian part of the corridor) are relevant. Finally, the fiscal burden is smallest for coach transport.

Figure 48 Comparison of fiscal burden per passenger kilometre on the corridor Rome - Berlin



The share of taxes and charges in the total internal costs of passenger transport means is shown in Figure 49. Taxes and charges contribute most to the internal costs of airplanes and rail transport, although the differences with passenger cars are small.

Figure 49 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Rome - Berlin



Freight transport

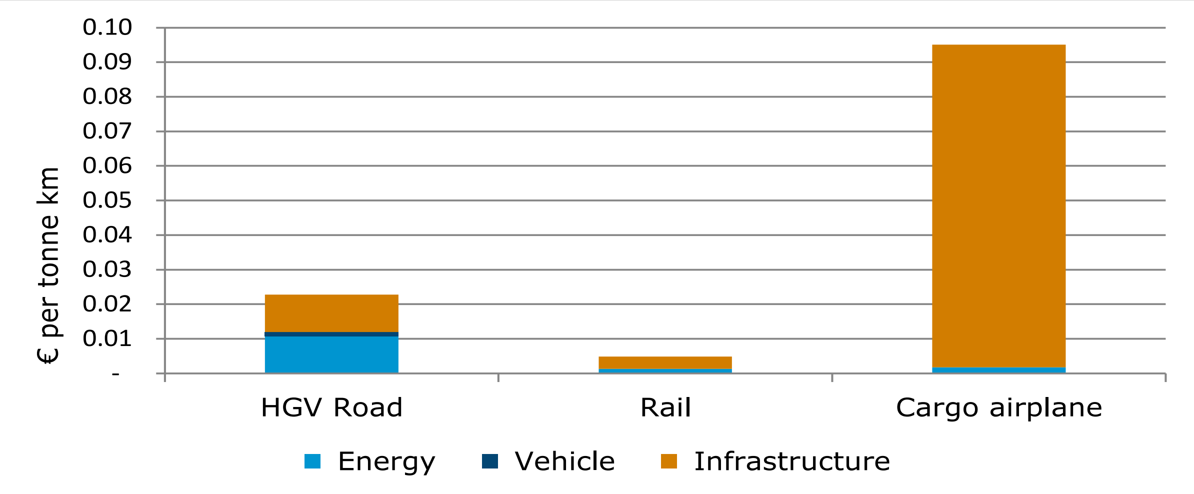
The total fiscal burden for freight transport means on the corridor Rome – Berlin is provided by Table 55. The highest burden is found for rail freight transport.

Table 55 Total fiscal burden for freight transport means on the corridor Rome - Berlin (€/vehicle/trip)

			
Energy taxes/charges	214	2,590	57
Vehicle taxes/charges	24	-	-
Infrastructure taxes/charges	216	6,899	3,108
Total fiscal burden	453	9,488	3,165

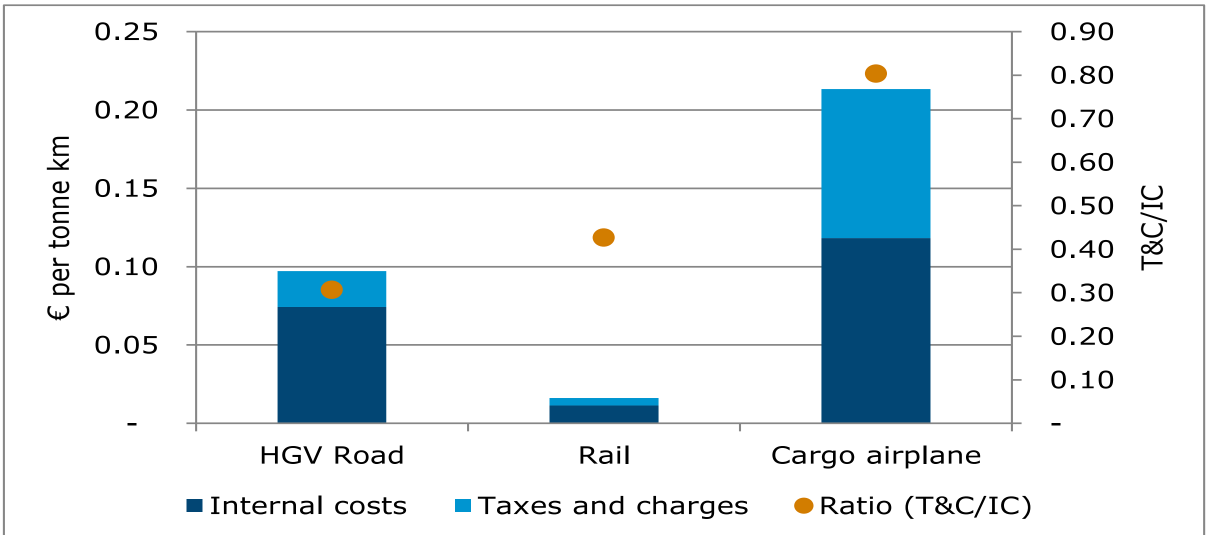
Figure 50 shows that the cargo airplanes have the highest fiscal burden per tonne kilometre on the corridor Rome – Berlin (due to the limited average load of airplanes), followed by HGVs and rail transport. For HGVs, the fiscal burden mainly consists of fuel taxes and infrastructure charges (47% and 48%, respectively). For rail transport, infrastructure charges contribute most to the total burden (about 73%), while electricity taxes (on the German and Austrian part of the corridor) contribute about 27%.

Figure 50 Comparison of fiscal burden per tonne-kilometre on the corridor Rome - Berlin



As shown in Figure 51, taxes and charges contribute most to the total internal costs of cargo airplanes, followed by rail freight transport and trucks.

Figure 51 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Rome - Berlin



4.3.7 Hamburg - Prague

Passenger transport

An overview of the total fiscal burden for passenger transport means on the corridor Hamburg – Prague is given in Table 56. Passenger trains have the highest burden, followed by aviation and coaches.

Table 56 Total fiscal burden for passenger transport means on the corridor Hamburg - Prague (€/vehicle/trip)

	Small	Large			Small	Large
Energy taxes/charges	25	18	73	1,166	9	14
Vehicle taxes/charges	7	9	11	-	-	-
Infrastructure taxes/charges	6	6	2	3,934	2,155	4,459
VAT	20	23	127	776	-	-
Total fiscal burden	57	56	214	5,876	2,164	4,473

The fiscal burden per passenger kilometres for passenger modes is shown in Figure 52. The highest burden is found for passenger trains (more than 10 €ct per passenger kilometre). As regular intercity trains are assumed on the entire route between Hamburg and Prague, which have lower occupancy rates than HSL trains, the fiscal burden per passenger kilometre is relatively high for trains on this corridor. The fiscal burden for aviation is about 6 €ct per passenger kilometre, while for passenger cars this is about 4 €ct. The latter mainly consist of fuel taxes and VAT. This is also the case for the fiscal burden of coaches.

Figure 52 Comparison of fiscal burden per passenger kilometre on the corridor Hamburg - Prague

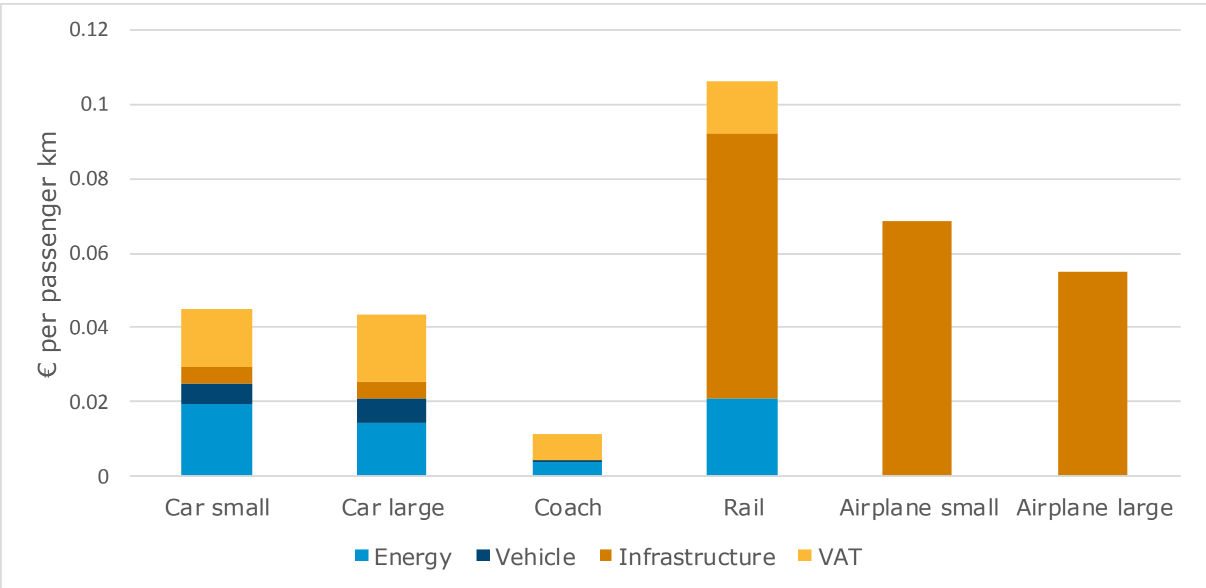
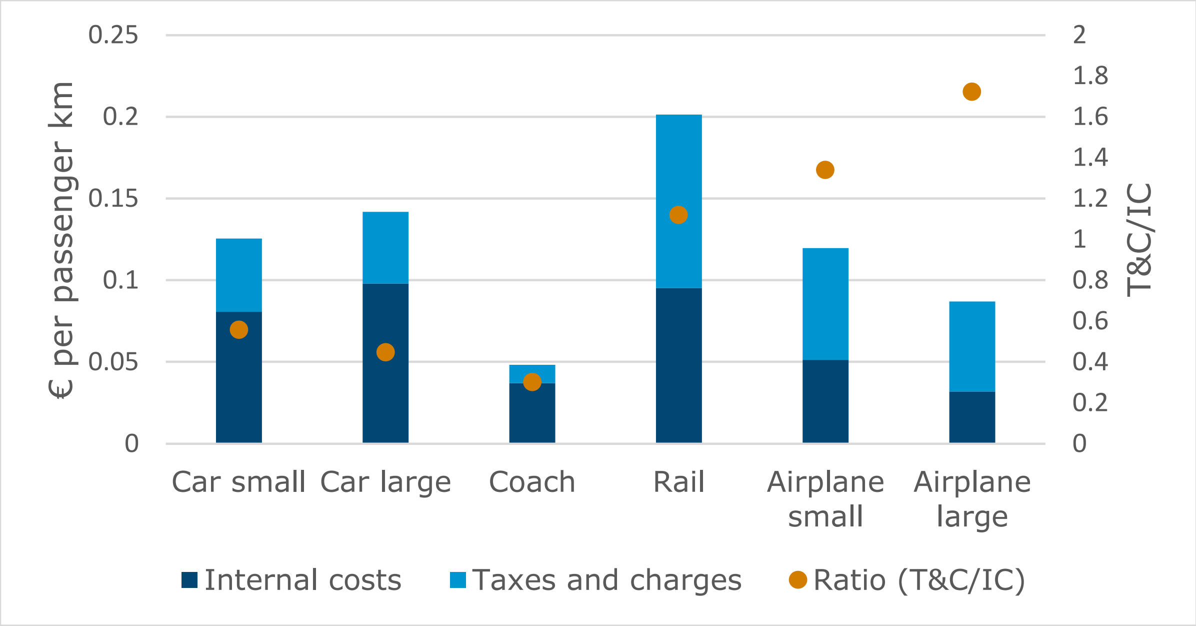


Figure 53 shows that taxes/charges contribute most to the total internal costs of aviation, followed by rail transport.

Figure 53 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Hamburg - Prague



Freight transport

Table 57 presents the total fiscal burden for freight transport means on the corridor Hamburg – Prague. The highest fiscal burden is identified for rail transport.

Table 57 Total fiscal burden for freight transport means on the corridor Hamburg - Prague (€/vehicle/trip)

				
Energy taxes/charges	95	1,584	40	22
Vehicle taxes/charges	8	-	-	-
Infrastructure taxes/charges	82	3,064	97	2,747
Total fiscal burden	185	4,648	137	2,769

The fiscal burden per tonne-kilometre for cargo airplanes is relatively high on the corridor Hamburg – Prague, which is partly due to the relatively short flight distance between these cities (see Figure 54). For HGVs, the fiscal burden is about 2 €ct per tonne-kilometre. Fuel taxes contribute most to this burden (about 50%), followed by infrastructure charges (44%). The fiscal burden for rail transport is about 1 €ct, of which 66% is due to infrastructure charges and 33% electricity taxes (on the German part of the corridor). Finally, the fiscal burden for IWT is very low (about 0.03 €ct per tonne-kilometre), among other things due to low port charges in Hamburg and lack of port charges in Prague.

Figure 54 Comparison of fiscal burden per tonne-kilometre on the corridor Hamburg - Prague

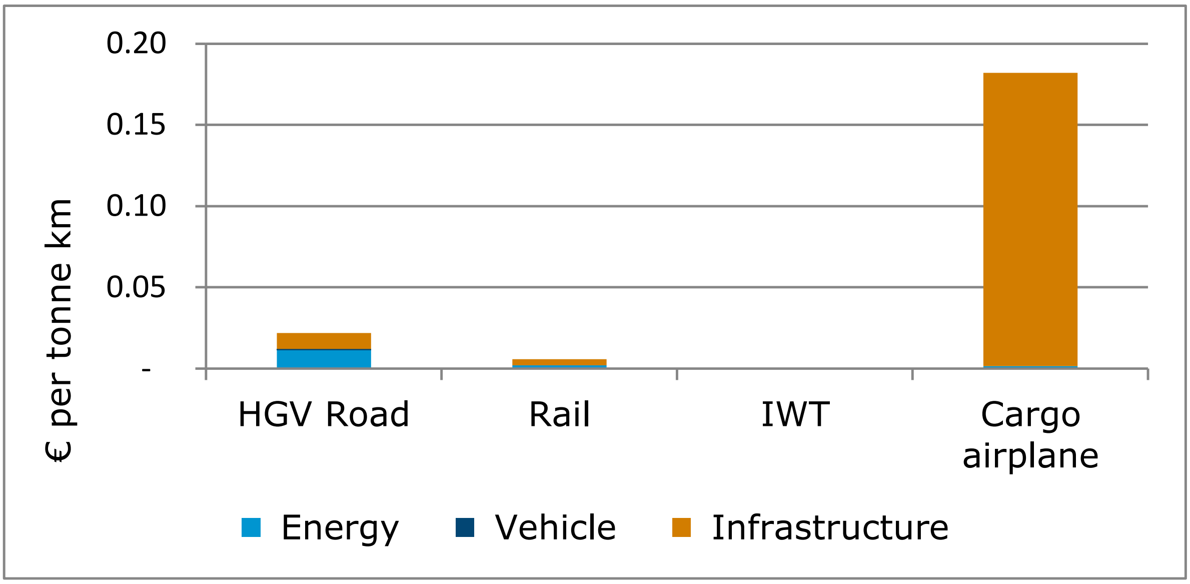
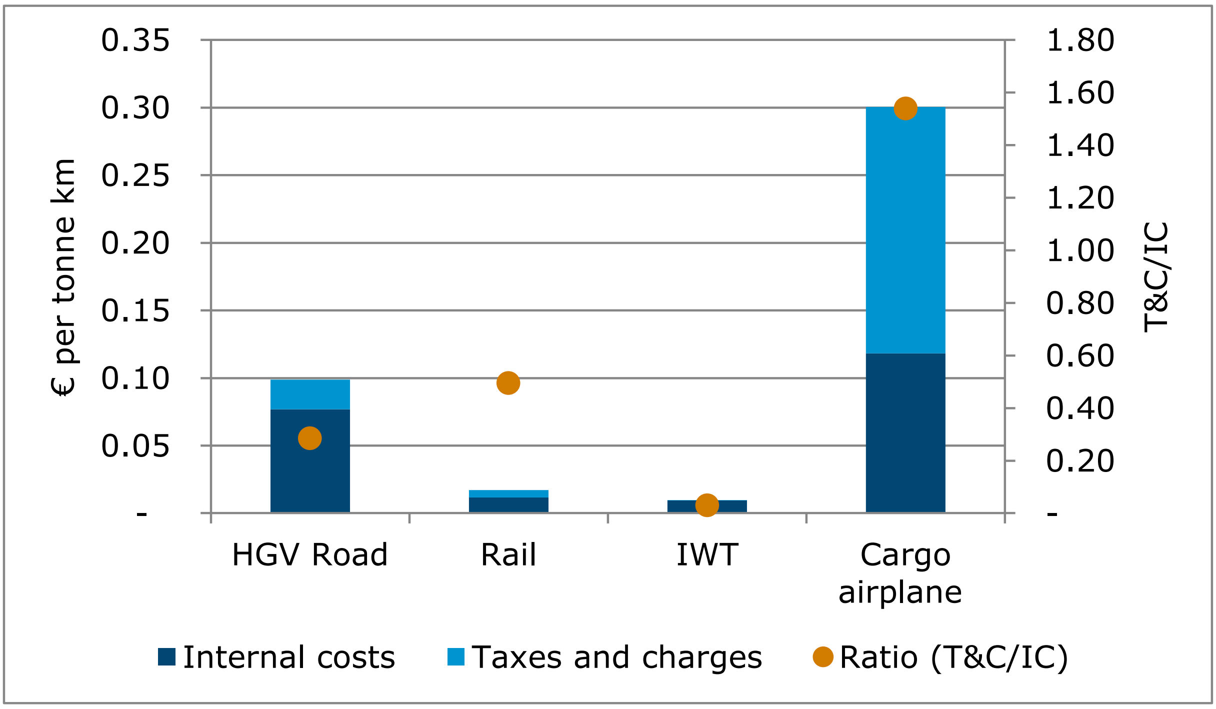


Figure 55 shows the share of taxes and charges in the total internal costs of the various freight transport modes. Taxes and charges contribute most to the internal costs of cargo airplanes, followed by rail transport and trucks.

Figure 55 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Hamburg - Prague



4.3.8 Helsinki - Gdansk

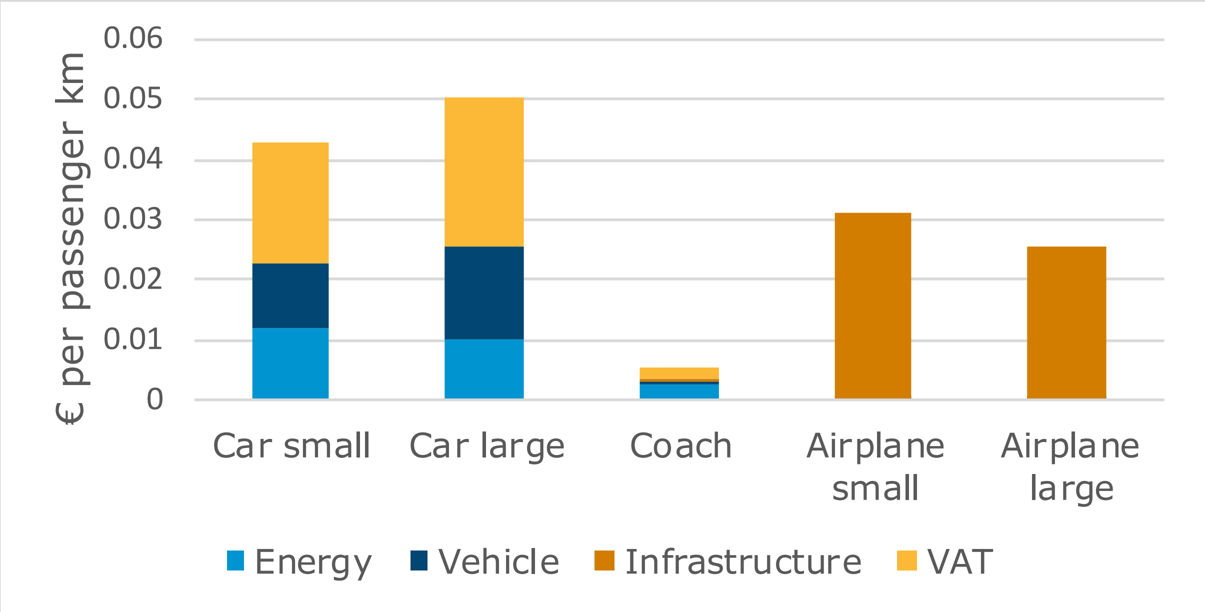
Passenger transport
An overview of the total fiscal burden for passenger transport means on the corridor Helsinki – Gdansk is given in Table 58. Aviation has the highest fiscal burden.

Table 58 Total fiscal burden for passenger transport means on the corridor Helsinki - Gdansk (€/vehicle/trip)

	Small	Large		Small	Large
Energy taxes/charges	27	23	91	16	24
Vehicle taxes/charges	24	35	9	0	0
Infrastructure taxes/charges	-	-	20	1,438	3,057
VAT	46	57	64	0	0
Total fiscal burden	97	115	184	1,454	3,081

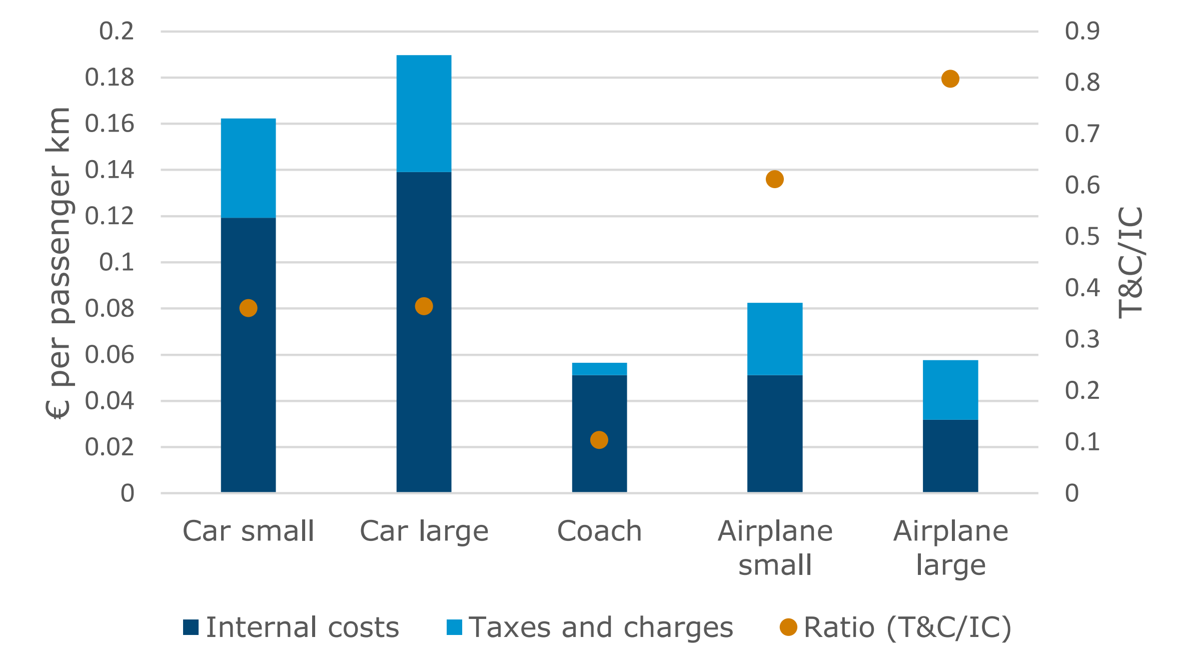
As shown in Figure 56, the highest fiscal burden per passenger kilometre exists for passenger cars. For these vehicles mainly VAT, fuel taxes and vehicle taxes are relevant, while infrastructure charges are not relevant on this corridor. The fiscal burden for aviation is in the range of 2.5 to 3 €ct per passenger kilometre (almost completely infrastructure charges), while the fiscal burden for coaches is about 0.5 €ct per passenger kilometre.

Figure 56 Comparison of fiscal burden per passenger kilometre on the corridor Helsinki - Gdansk



The share of taxes and charges in the total internal cost of the various passenger transport means on the corridor Helsinki – Gdansk is shown in Figure 57. The highest share exists for aviation, followed by passenger cars and coaches.

Figure 57 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Helsinki - Gdansk



Freight transport

The total fiscal burden for freight transport means on the corridor Helsinki – Gdansk is presented in Table 59. The highest burden is identified for maritime transport, followed by aviation and trucks.

Table 59 Total fiscal burden for freight transport means on the corridor Helsinki - Gdansk (€/vehicle/trip)

			
Energy taxes/charges	118	-	38
Vehicle taxes/charges	14	-	-
Infrastructure taxes/charges	18	18,332	1,746
Total fiscal burden	150	18,332	1,783

Figure 58 shows the fiscal burden per tonne-kilometre for freight transport modes on the corridor Helsinki – Gdansk. The highest burden is shown for cargo airplanes, which is due to the relatively low average load transported by these vehicles. For HGVs, the fiscal burden is relatively low (about 1 €ct per tonne-kilometre), mainly due to the fact that distance-based infrastructure charges are not in place for HGVs on the main part of this corridor (only in Poland a small road toll segment on the corridor exists). As also vehicle taxes on HGVs are limited on this corridor (mainly Finish ownership tax), the main part of the fiscal burden consist of fuel taxes. For maritime transport, on the other hand, infrastructure charges (port charges, fairway dues and piloting charges) make up most of the fiscal burden on the corridor Helsinki – Gdansk.

Figure 58 Comparison of fiscal burden for freight transport per tonne-kilometre on the corridor Helsinki - Gdansk

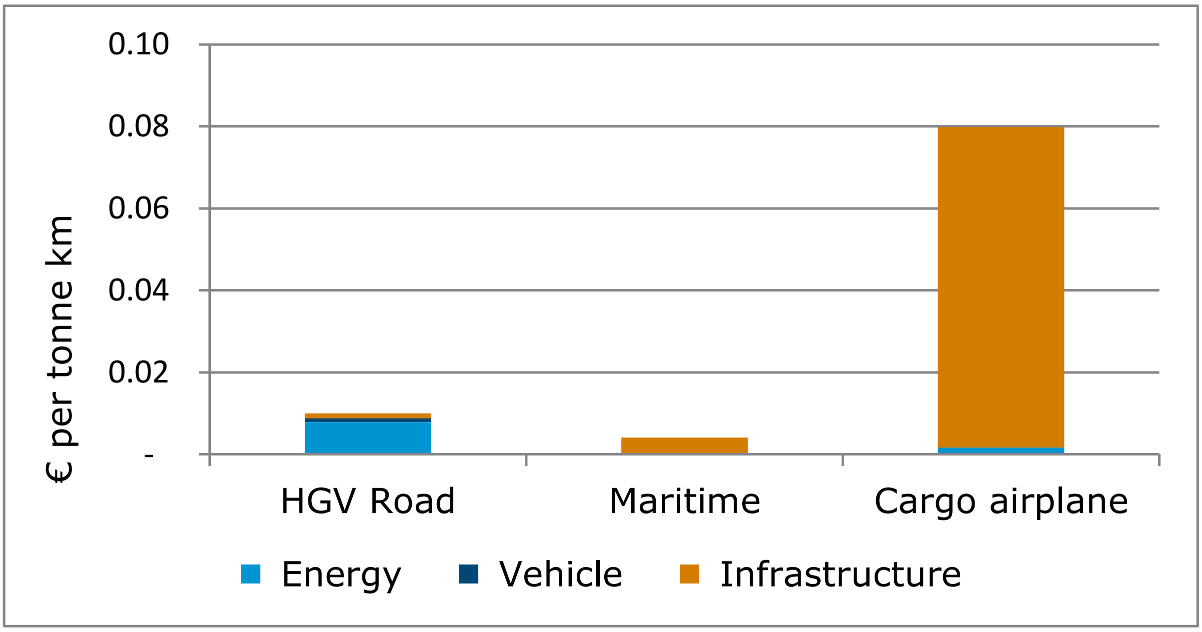
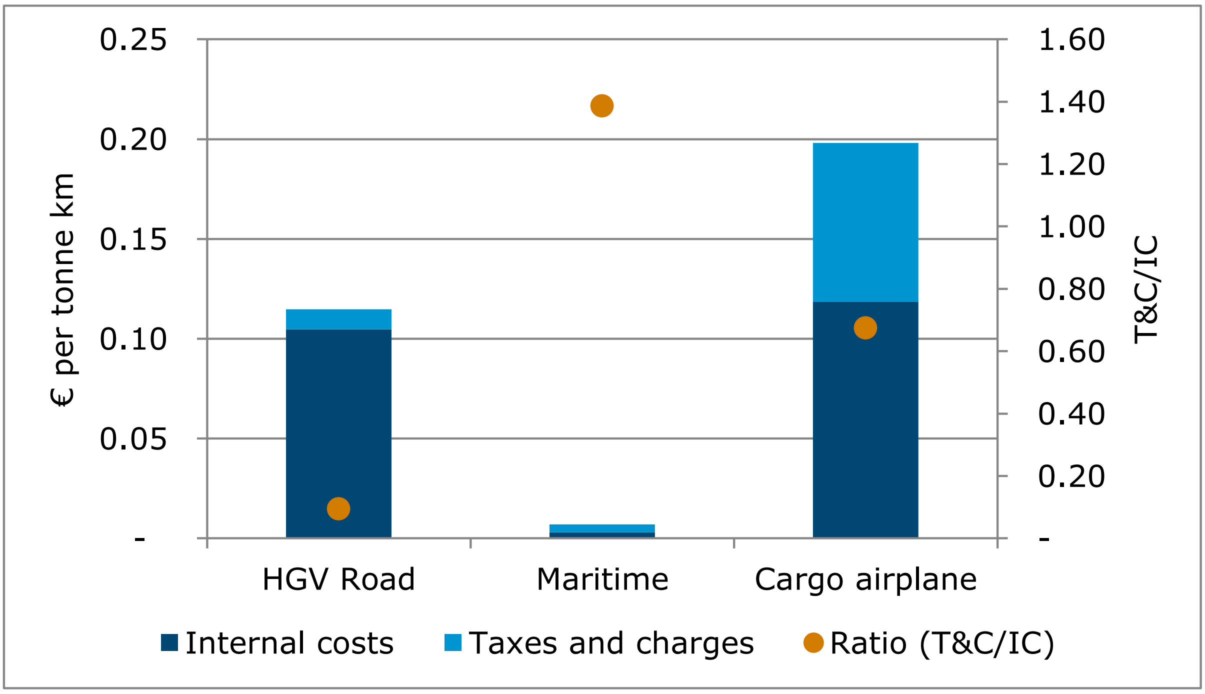


Figure 59 shows that taxes/charges contribute most to the total internal costs of maritime transport on the corridor Helsinki – Gdansk, followed by cargo airplanes and trucks.

Figure 59 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Helsinki - Gdansk



4.3.9 Lisbon - Antwerp

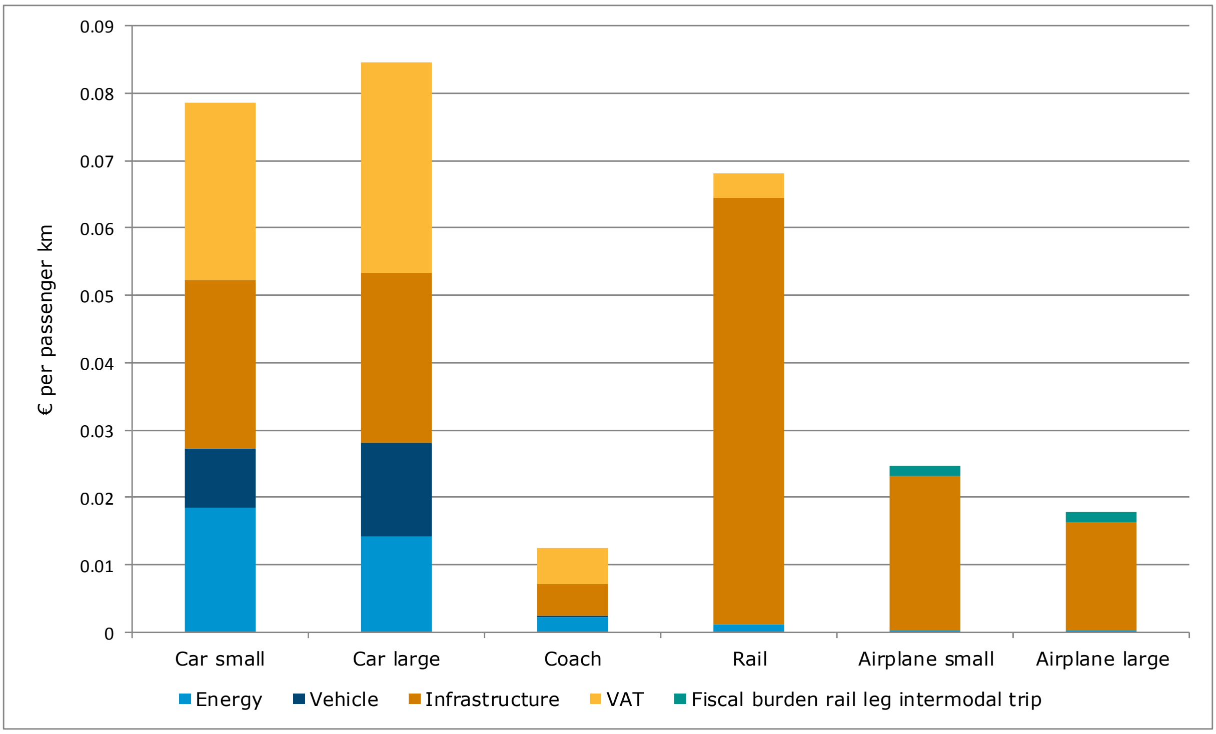
Passenger transport
Table 60 presents an overview of the total fiscal burden for passenger transport means on the corridor Lisbon – Antwerp. Rail transport has the highest fiscal burden of all passenger transport means.

Table 60 Total fiscal burden for passenger transport means on the corridor Lisbon - Antwerp (€/vehicle/trip)

	Small	Large		HSL +	Small + HSL	Large + HSL
Energy taxes/charges	78	61	137	120	35	52
Vehicle taxes/charges	36	57	17	-	-	-
Infrastructure taxes/charges	104	104	286	10,883	2,303	4,206
VAT	108	130	338	1,232	-	-
Fiscal burden rail leg intermodal trip by aviation	-	-	-	-	151	388
Total fiscal burden	326	351	777	12,236	2,488	4,646

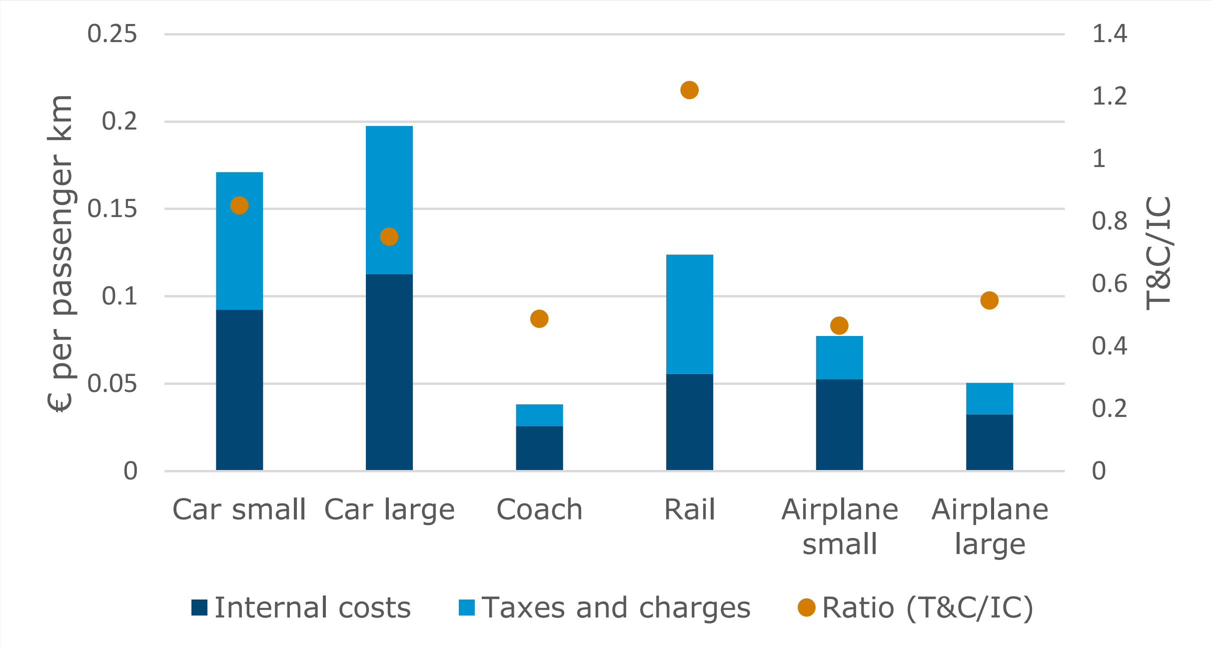
The fiscal burden per passenger kilometres is presented in Figure 60. This figure shows that passenger cars are highest taxed/charged (about 8 €ct per passenger kilometre), mainly due to distance-based road charges (in Portugal, Spain and France) and VAT. For rail transport, the main part of the fiscal burden consists of infrastructure charges; this is also the case for aviation. The fiscal burden per passenger kilometre is relatively low for aviation, as the fixed infrastructure charges can be allocated to a relatively large flight distance. Finally, for coaches, VAT, infrastructure charges and fuel taxes make up the main part of the total fiscal burden.

Figure 60 Comparison of fiscal burden per passenger kilometre on the corridor Lisbon - Antwerp



As shown in Figure 61, taxes/charges contribute most to the total internal costs of rail transport, followed by passenger cars. For aviation, charges contribute relatively little to the total internal costs (compared to other corridors), which is due to the low level of aviation charges per passenger kilometre on the corridor Lisbon – Antwerp.

Figure 61 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Lisbon - Antwerp



Freight transport

An overview of the total fiscal burden for freight transport means on the corridor Lisbon – Antwerp is given in Table 61. The highest burden is shown for rail freight transport and maritime transport.

Table 61 Total fiscal burden for freight transport means on the corridor Lisbon - Antwerp (€/vehicle/trip)

				
Energy taxes/charges	181	744	-	82
Vehicle taxes/charges	23	-	-	-
Infrastructure taxes/charges	301	5,790	6,508	2,474
Fiscal burden HGV leg intermodal trip by aviation	-	-	-	118
Total fiscal burden	505	6,534	6,508	2,675

Figure 62 shows the fiscal burden per tonne-kilometre for the freight transport modes on the corridor Lisbon – Antwerp. Cargo airplanes have the highest burden (due to their relatively low average loads), followed by HGVs. For HGVs, the main part of the fiscal burden consists of infrastructure charges (distance-based charges on all countries on the corridor) and fuel taxes. For rail transport, the main part of the fiscal burden consists of infrastructure charges (about 85%). Finally, the fiscal burden per tonne-kilometre for maritime transport is relatively small (compared to some other corridors); this is due to the fact that the fixed infrastructure charges (port charges, piloting charges) are divided by a relatively large distance between Lisbon and Antwerp.

Figure 62 Comparison of fiscal burden for freight transport per tonne-kilometre on the corridor Lisbon - Antwerp

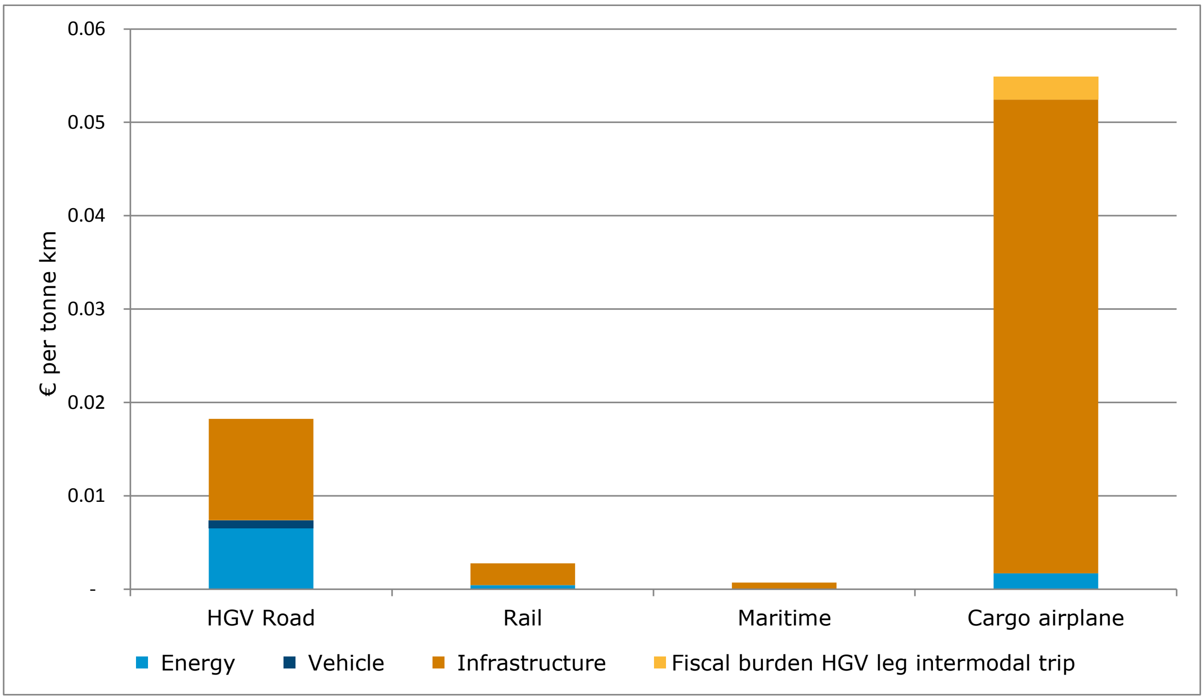
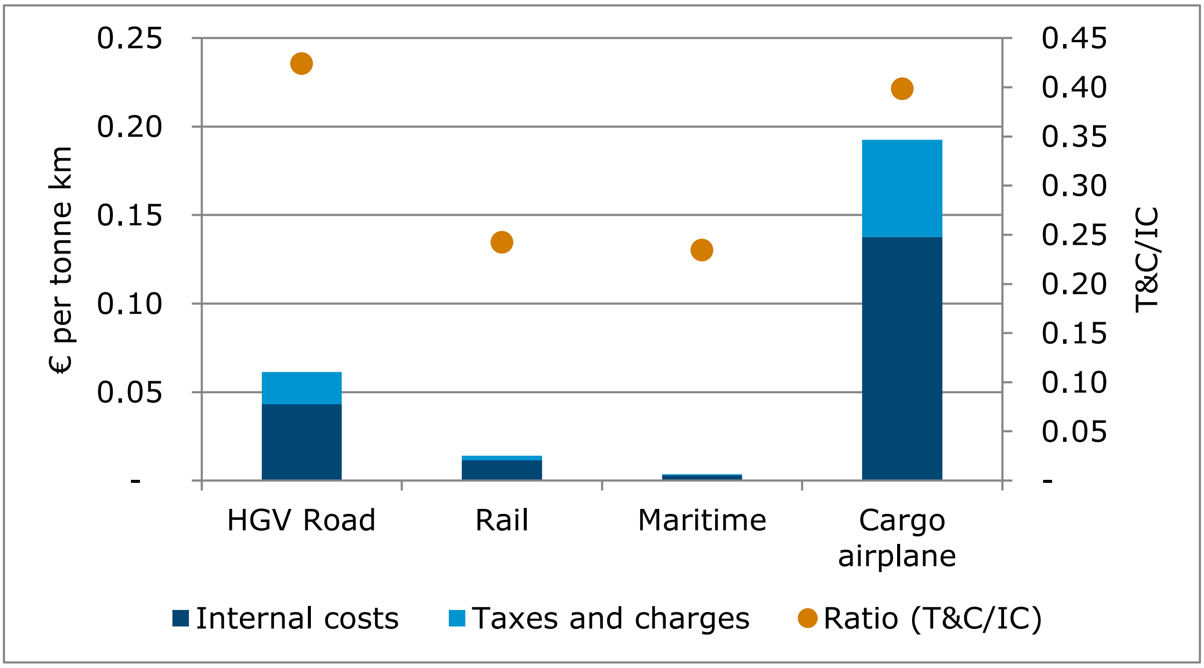


Figure 63 shows that taxes and charges contribute most to the total internal costs of HGVs and cargo airplanes. Particularly for airplanes, the share of charges in total internal costs is relatively low (compared to other corridors), which is due to the relatively low fiscal burden per tonne-kilometre for airplanes on the corridor Lisbon – Antwerp.

Figure 63 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Lisbon - Antwerp



4.3.10 Stockholm - Hamburg

Passenger transport

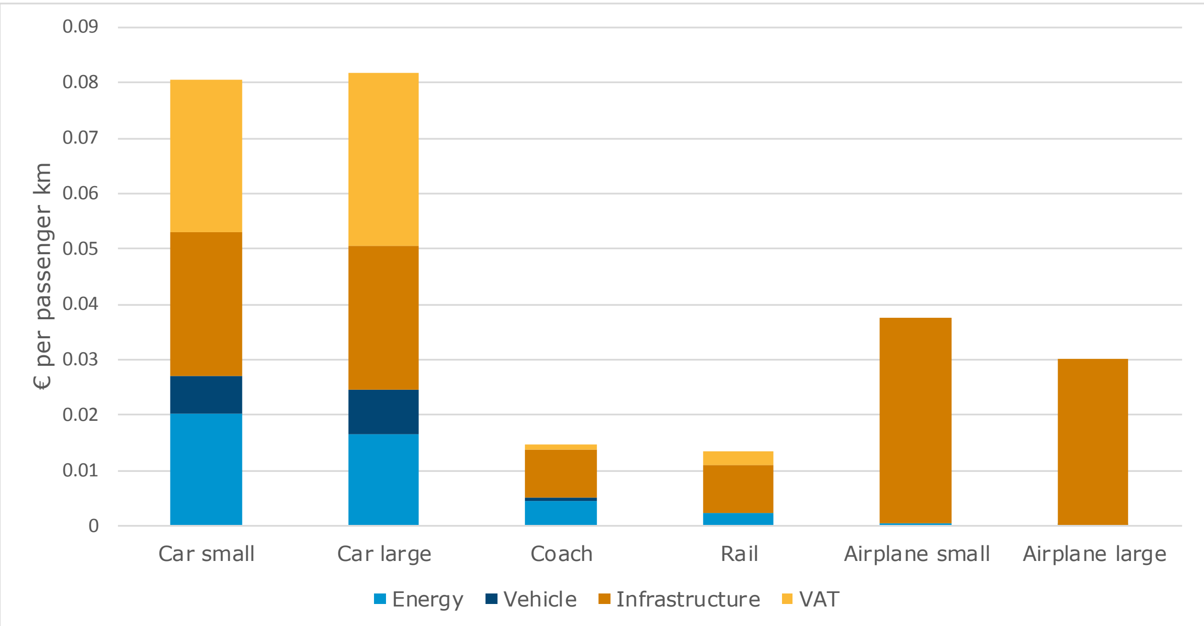
The total fiscal burden for passenger transport means on the corridor Stockholm – Hamburg is given in Table 62. The highest burden is identified for rail transport and aviation.

Table 62 Total fiscal burden for passenger transport means on the corridor Stockholm - Hamburg (€/vehicle/trip)

	Small	Large		HSL	Small	Large
Energy taxes/charges	42	34	138	622	16	25
Vehicle taxes/charges	14	17	21	-	-	-
Infrastructure taxes/charges	54	54	272	2,600	1,804	3,723
VAT	57	65	32	667	-	-
Total fiscal burden	168	171	462	3,889	1,820	3,747

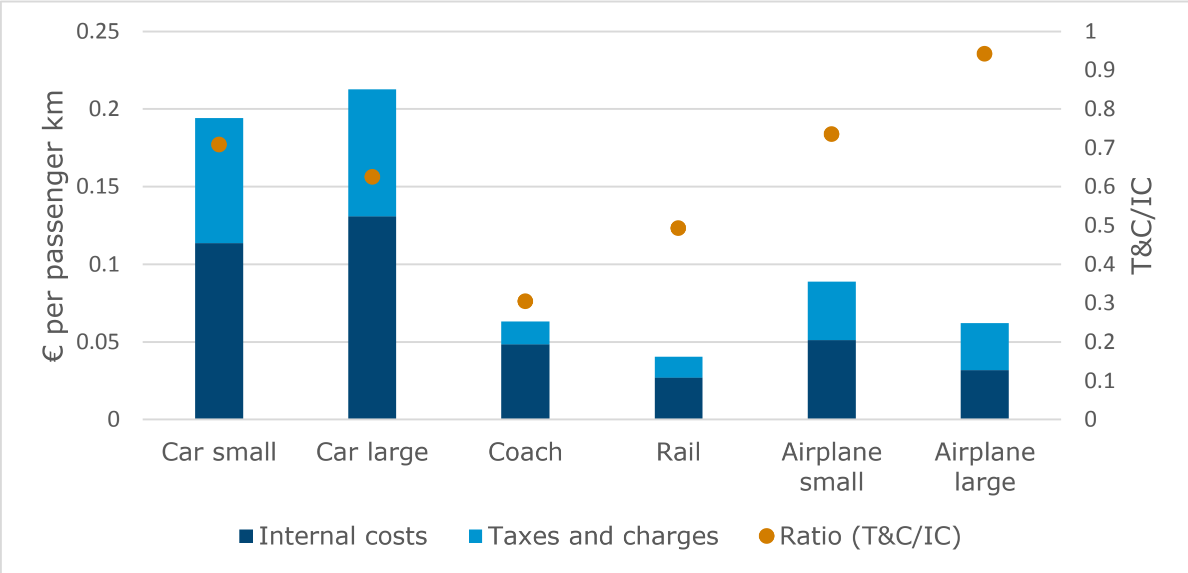
As shown in Figure 64, the highest burden per passenger kilometre on the corridor Stockholm – Hamburg is calculated for passenger cars. An important contribution to this fiscal burden is provided by the toll on the Oresund Bridge, connecting Sweden and Denmark. Furthermore, VAT and fuel taxes significantly contribute to the fiscal burden for passenger cars. Also for coaches, the toll on the Oresund Bridge significantly contributes to the fiscal burden on this corridor. The fiscal burden of rail transport on this corridor is relatively small (even smaller than for coaches), which is due to the low infrastructure charges in Sweden and Denmark and the exemption of rail transport for electricity taxes in these two countries.

Figure 64 Comparison of fiscal burden per passenger kilometre on the corridor Stockholm - Hamburg



The shares of taxes and charges in the total internal costs of passenger transport modes on the corridor Stockholm – Hamburg are shown in Figure 65. The largest shares are found for aviation and passenger cars, while the lowest shares are identified for coaches.

Figure 65 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Stockholm - Hamburg



Freight transport

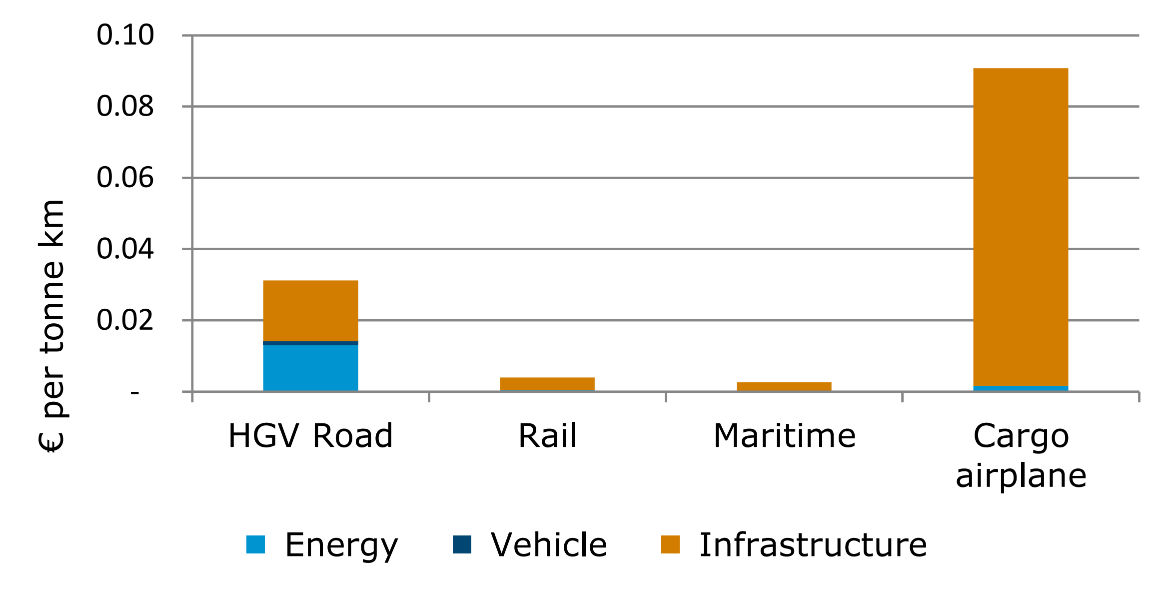
Table 63 provides an overview of the total fiscal burden for freight transport on the corridor Stockholm – Hamburg. The highest burden exists for maritime transport.

Table 63 Total fiscal burden for freight transport means on the corridor Stockholm - Hamburg (€/vehicle/trip)

				
Energy taxes/charges	181	593	-	39
Vehicle taxes/charges	16	-	-	-
Infrastructure taxes/charges	236	5,032	12,951	2,077
Total fiscal burden	433	5,625	12,951	2,115

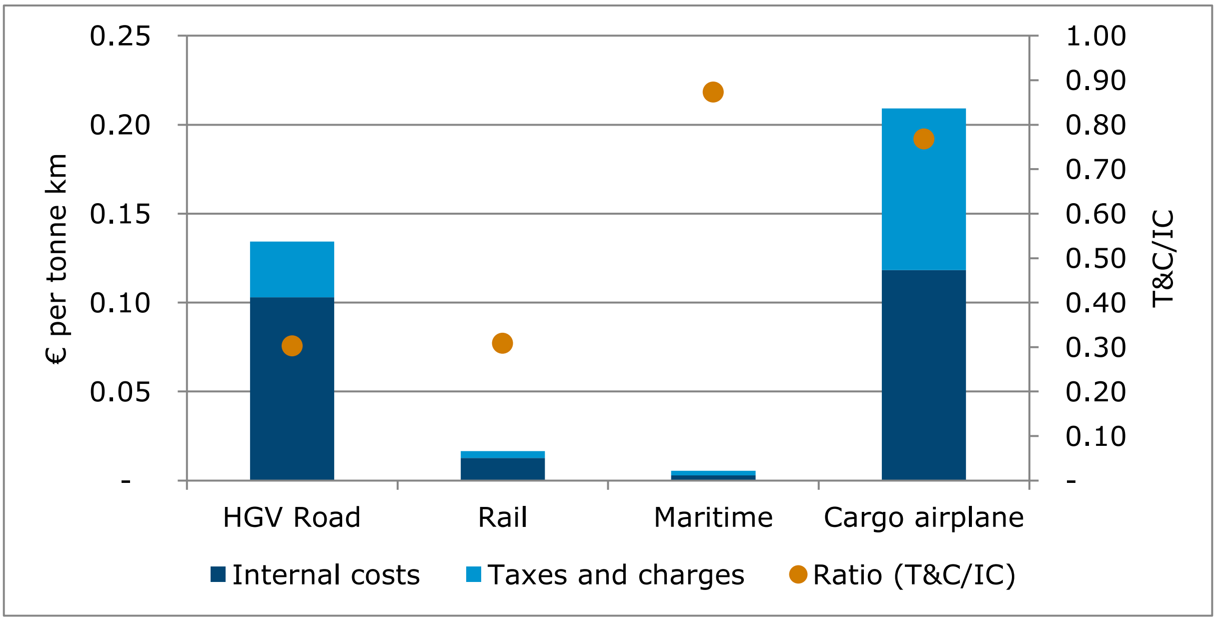
The fiscal burden per tonne-kilometre is presented in Figure 66, showing that the burden is highest for cargo airplanes followed by HGVs and rail. As for passenger transport, the toll on the Oresund bridge significantly contributes to the fiscal burden of HGVs.

Figure 66 Comparison of fiscal burden per tonne-kilometre on the corridor Stockholm - Hamburg



Finally, Figure 67 shows the shares taxes/charges have in the total internal costs of the various freight transport modes. This share is highest for maritime transport, followed by aviation.

Figure 67 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Stockholm - Hamburg



4.3.11 Genoa - Rotterdam

Passenger transport

An overview of the total fiscal burden for passenger transport means on the corridor Genoa – Rotterdam is given in Table 64. The highest fiscal burden exists for rail passenger transport, followed by aviation (including the taxes on the rail leg of the intermodal trip by aviation).

Table 64 Total fiscal burden for passenger transport means on the corridor Genoa - Rotterdam (€/vehicle/trip)

	Small	Large		HSL + HSL	Small + HSL	Large + HSL
Energy taxes/charges	55	47	138	1,469	18	28
Vehicle taxes/charges	25	26	35	-	-	-
Infrastructure taxes/charges	47	47	123	3,796	2,107	4,291
VAT	45	53	99	3,419	-	-
Fiscal burden rail leg intermodal trip by aviation	-	-	-	-	371	956
Total fiscal burden	172	173	396	8,683	2,497	5,274

The fiscal burden per passenger kilometre is shown in Figure 68. The highest burden exists for passenger cars, mainly due to fuel taxes, infrastructure charges and VAT. For rail transport, infrastructure charges contribute most to the total fiscal burden, but also VAT and electricity taxes (mainly on the German part of the corridor) provide significant shares of the total fiscal burden. For aviation, the fiscal burden mainly consists of infrastructure charges, although also the taxes/charges on rail transport between Rotterdam and Schiphol Amsterdam significantly contribute to the fiscal burden for this intermodal trip.

Figure 68 Comparison of fiscal burden per passenger kilometre on the corridor Genoa - Rotterdam

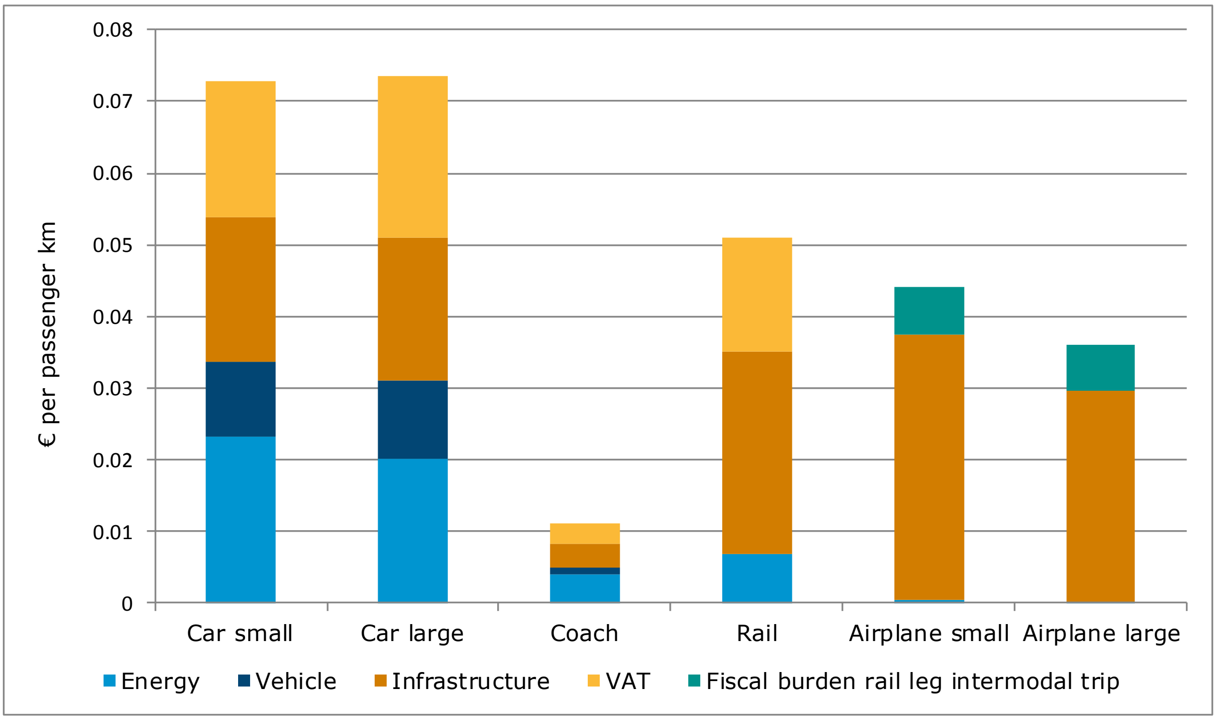
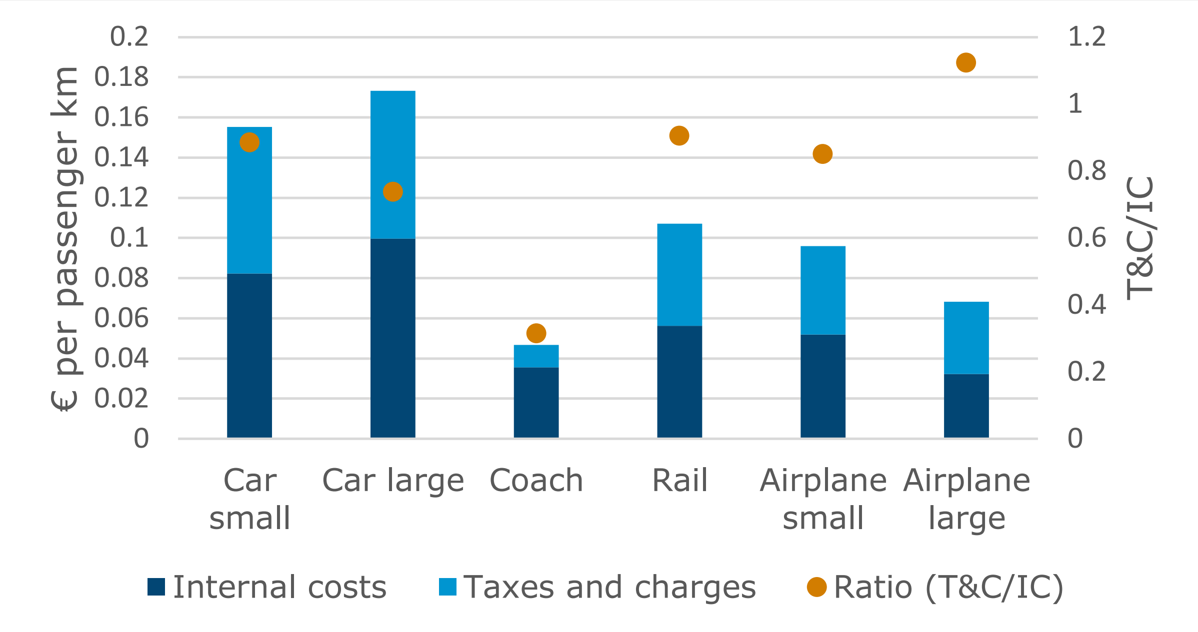


Figure 69 shows the contribution that taxes and charges have in the total internal costs of passenger transport on the corridor Genoa – Rotterdam. The highest share is estimated for large airplanes.

Figure 69 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Genoa - Rotterdam



Freight transport

Table 65 shows an overview of the total fiscal burden for freight transport means on the corridor Genoa – Rotterdam. The highest burden is estimated for maritime transport.

Table 65 Total fiscal burden for freight transport means on the corridor Genoa - Rotterdam (€/vehicle/trip)

				
Energy taxes/charges	181	61	-	43
Vehicle taxes/charges	19	-	-	-
Infrastructure taxes/charges	386	3,267	15,037	3,409
Fiscal burden HGV leg intermodal trip by aviation	-	-	-	91
Total fiscal burden	585	3,328	15,037	3,544

The fiscal burden per tonne-kilometre is presented in Figure 70, showing that the burden is highest for cargo airplanes followed by HGVs and rail. For HGVs, distance-based road charges (in Italy, Switzerland, France and Belgium) significantly contribute to the total fiscal burden (next to fuel taxes). For rail transport, the fiscal burden consists almost completely of infrastructure charges (as rail transport is exempted from electricity taxes in many countries on this corridor). Also for maritime transport, the fiscal burden consists mainly of infrastructure charges (port charges, piloting charges).

Figure 70 Comparison of fiscal burden per tonne-kilometre on the corridor Genoa - Rotterdam

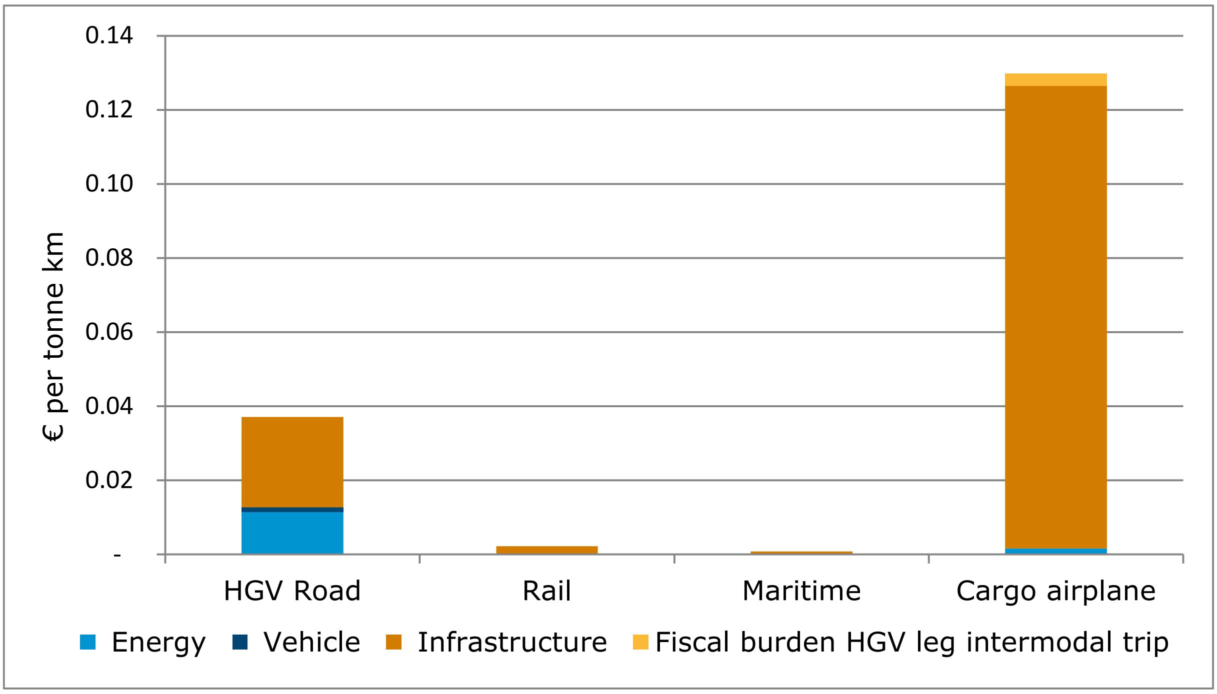
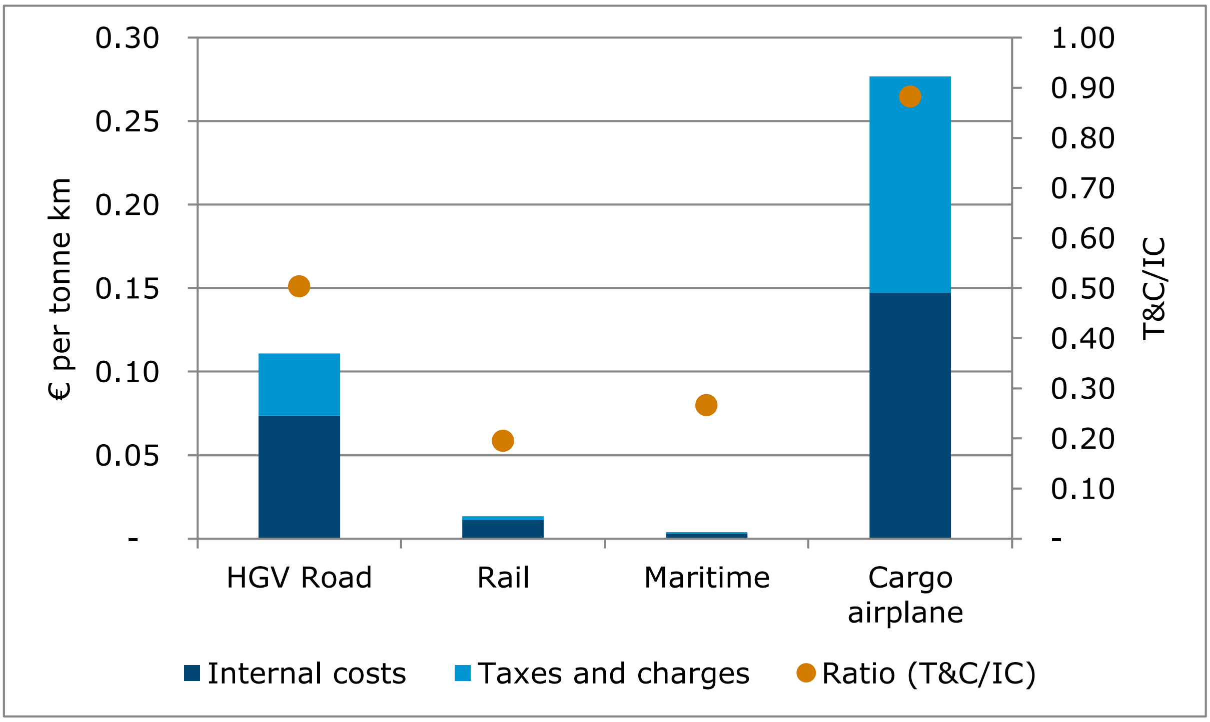


Figure 71 presents the share of taxes/charges in the total internal costs of freight transport modes on the corridor Genoa – Rotterdam. The highest shares are estimated for cargo airplanes, followed by HGVs and maritime transport.

Figure 71 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Genoa - Rotterdam



4.3.12 Budapest - Milan

Passenger transport

An overview of the total fiscal burden for passenger transport modes on the corridor Budapest – Milan is shown in Table 66. Rail transport shows the highest burden, followed by aviation.

Table 66 Total fiscal burden for passenger transport means on the corridor Budapest - Milan (€/vehicle/trip)

	Small	Large		HSL +	Small	Large
Energy taxes/charges	34	29	86	2,204	16	25
Vehicle taxes/charges	12	12	17	-	-	-
Infrastructure taxes/charges	40	38	95	2,924	2,511	5,446
VAT	44	51	51	1,649	-	-
Total fiscal burden	129	131	249	6,777	2,527	5,471

The fiscal burden per passenger kilometre for the various passenger transport modes on the corridor Budapest – Milan is shown in Figure 72. Passenger cars have the highest burden (about 6.5 €ct), consisting of fuel taxes (about 22% to 26%), infrastructure charges (about 30%), vehicle taxes (about 9%) and VAT (34% to 39%). The fiscal burden for aviation ranges from 4 to 5 €ct; it mainly consists of infrastructure charges. For rail transport, infrastructure charges contribute most to the total fiscal burden; but also electricity taxes (mainly on the Austrian part of the corridor) significantly contribute to this burden. Finally, fuel taxes, infrastructure charges and VAT contribute to the fiscal burden for coaches.

Figure 72 Comparison of fiscal burden per passenger kilometre on the corridor Budapest - Milan

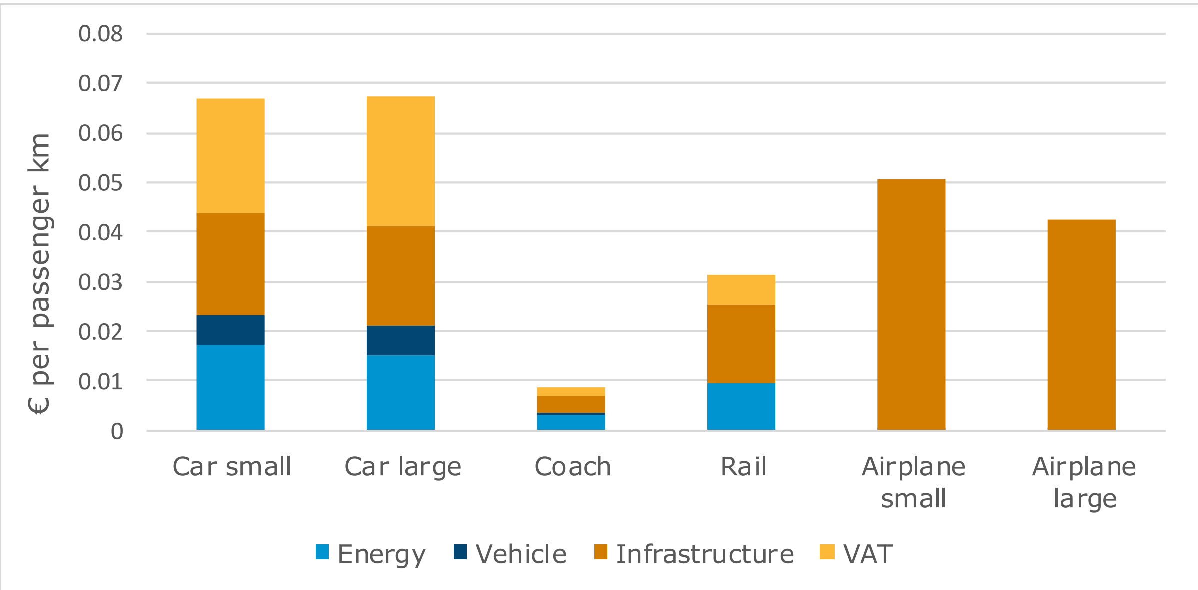
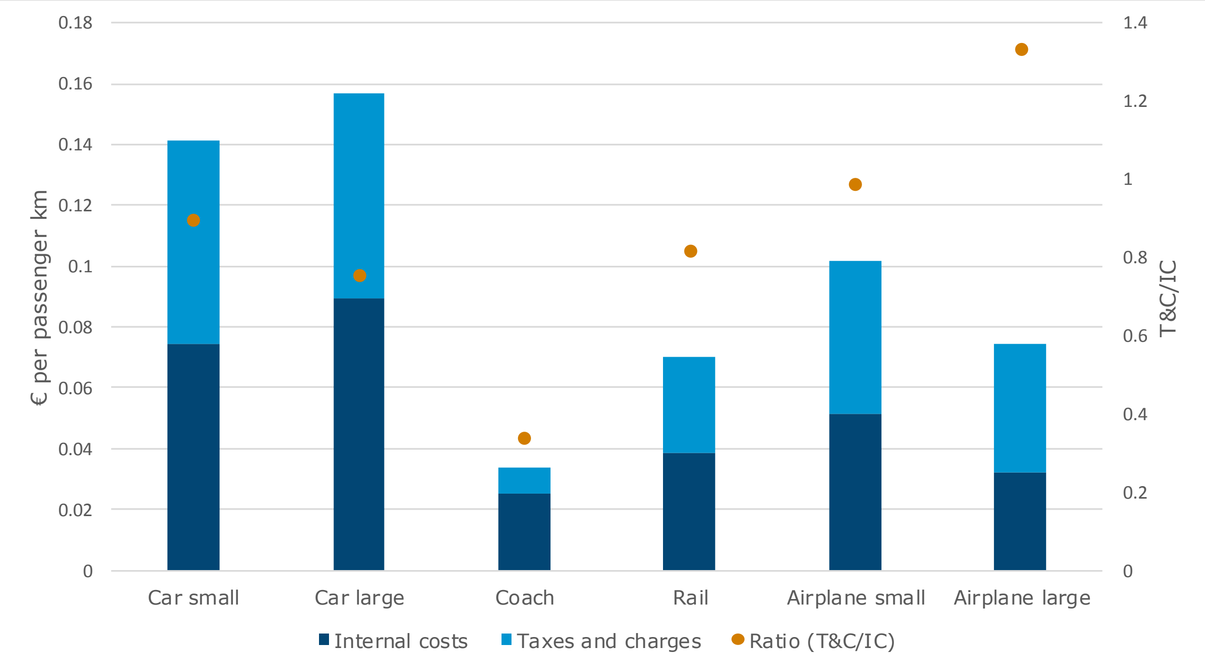


Figure 73 shows that taxes and charges contribute most to the total internal costs of aviation, followed by passenger cars and rail transport.

Figure 73 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Budapest - Milan



Freight transport

The total fiscal burden for freight transport means on the corridor Budapest – Milan is shown in Table 67. The highest burden is estimated for rail transport and aviation.

Table 67 Total fiscal burden for freight transport means on the corridor Budapest - Milan (€/vehicle/trip)

Energy taxes/charges	111	174	39
Vehicle taxes/charges	11	-	-
Infrastructure taxes/charges	235	2,558	2,578
Total fiscal burden	357	2,732	2,617

Figure 74 shows the fiscal burden per tonne-kilometre for freight transport modes on the corridor Budapest – Milan. The highest burden exists for cargo airplanes (due to relatively low average loads of airplanes), followed by HGVs. For HGVs, the fiscal burden mainly consists of infrastructure charges (e.g. distance-based road charges in Italy and Slovenia) and fuel taxes. Finally, the fiscal burden for rail transport consists almost completely of infrastructure charges (about 95%).

Figure 74 Comparison of fiscal burden per tonne-kilometre on the corridor Budapest - Milan

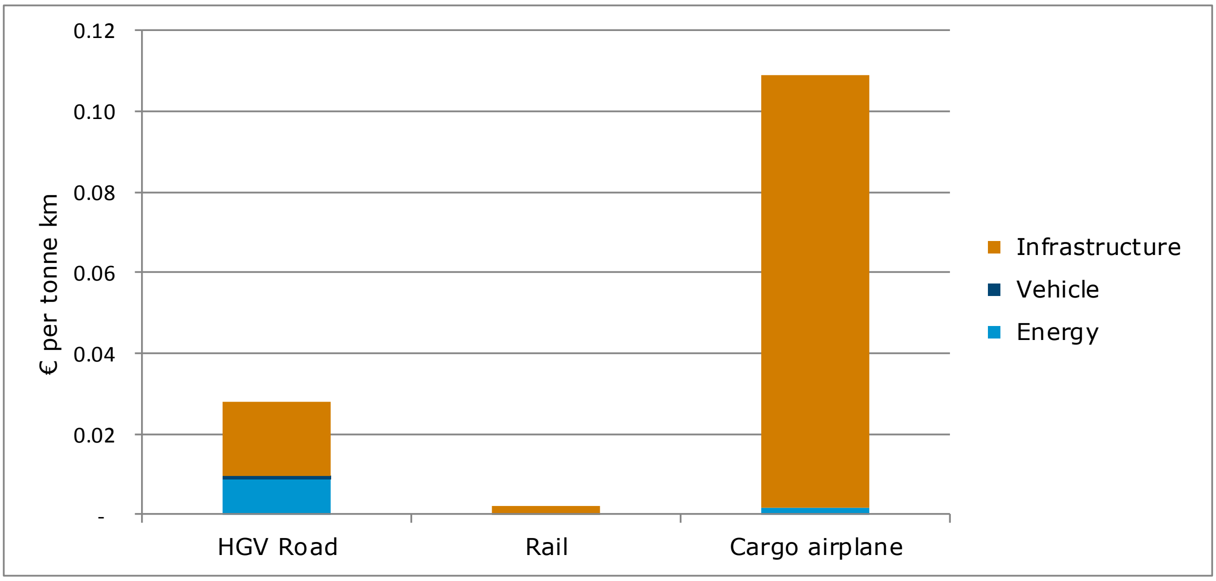
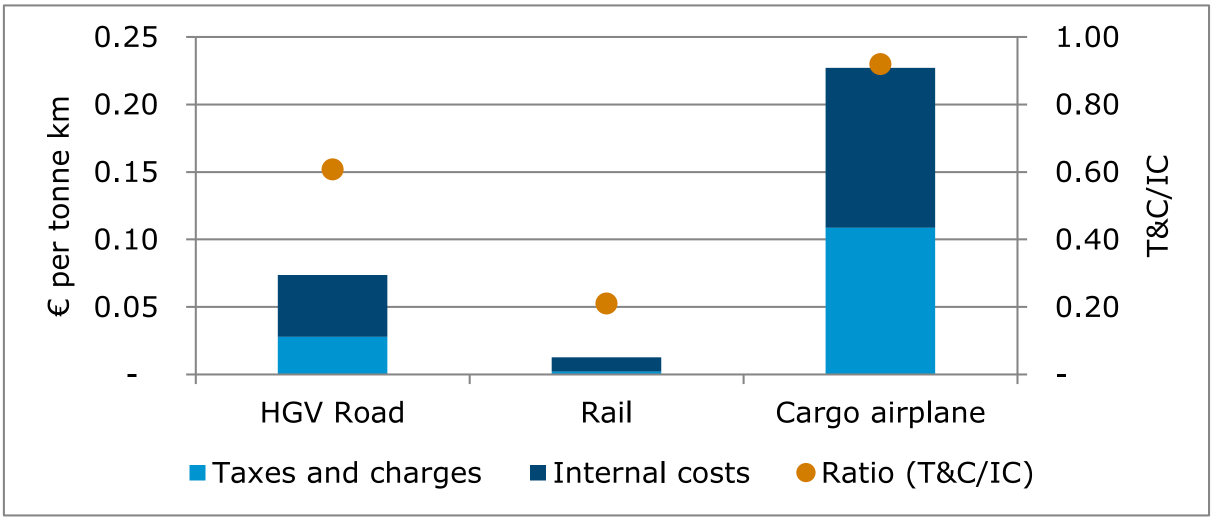


Figure 75 shows the share of taxes and charges in the total internal costs. This share is highest for cargo airplanes on the corridor Budapest - Milan.

Figure 75 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Budapest – Milan



4.3.13 Bucharest - Warsaw

Passenger transport

An overview of the total fiscal burden for passenger transport means on the corridor Bucharest – Warsaw is given in Table 68. The highest total burden is estimated for rail transport and aviation.

Table 68 Total fiscal burden for passenger transport means on the corridor Bucharest - Warsaw (€/vehicle/trip)

	 Small	 Large			 Small	 Large
Energy taxes/charges	42	36	143	1,092	20	30
Vehicle taxes/charges	4	4	13	-	-	-
Infrastructure taxes/charges	20	19	62	3,205	2,552	5,077
VAT	52	62	38	59	-	-
Total fiscal burden	118	121	255	4,357	2,572	5,107

The fiscal burden per passenger kilometre is shown in Figure 76. The highest burden exists for aviation (due to infrastructure charges), followed by passenger cars and rail transport. For passenger cars, VAT and fuel taxes makes up most of the fiscal burden, while infrastructure charges (time-based road charges in Romania, Hungary, Slovakia and Czech Republic) provide a significant contribution as well. For rail transport, the main part of the burden consists of infrastructure charges, while also electricity taxes (particularly in Austria, Poland and Romania) are relevant. Finally, the fiscal burden of coach transport mainly consists of fuel taxes; this is because of low VAT rates and the lack of distance-based charges for bus transport on this corridor.

Figure 76 Comparison of fiscal burden per passenger kilometre on the corridor Bucharest - Warsaw

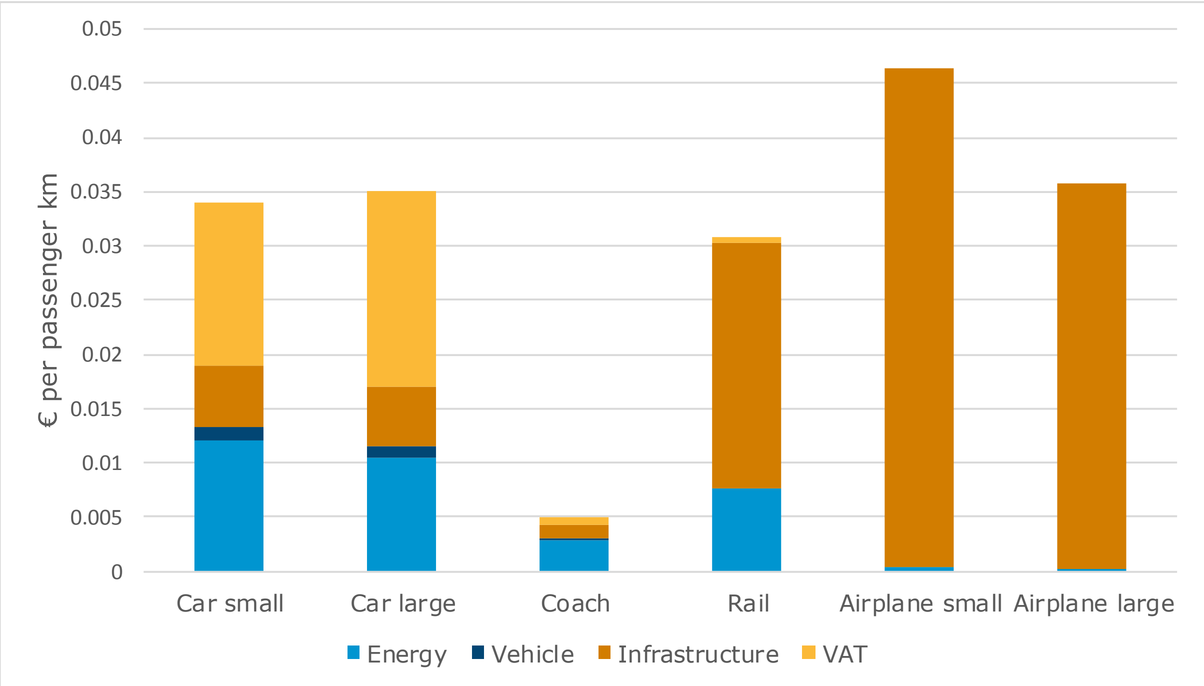
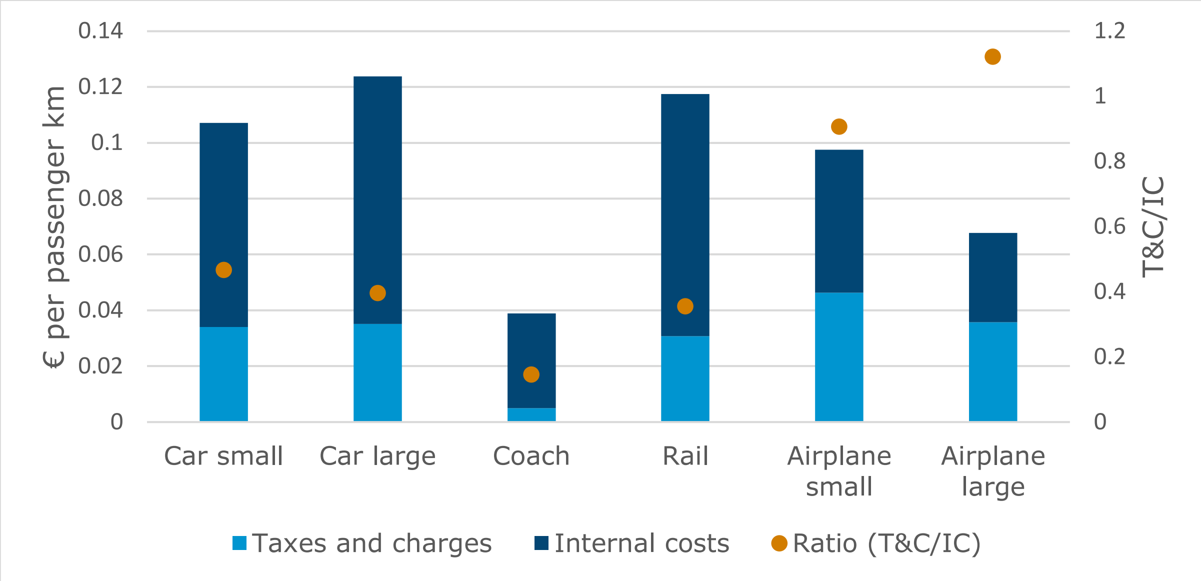


Figure 77 shows the share of taxes and charges in the total internal costs of passenger transport modes on the corridor Bucharest – Warsaw. The highest share is estimated for aviation, followed by passenger cars and rail transport.

Figure 77 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Bucharest - Warsaw



Freight transport

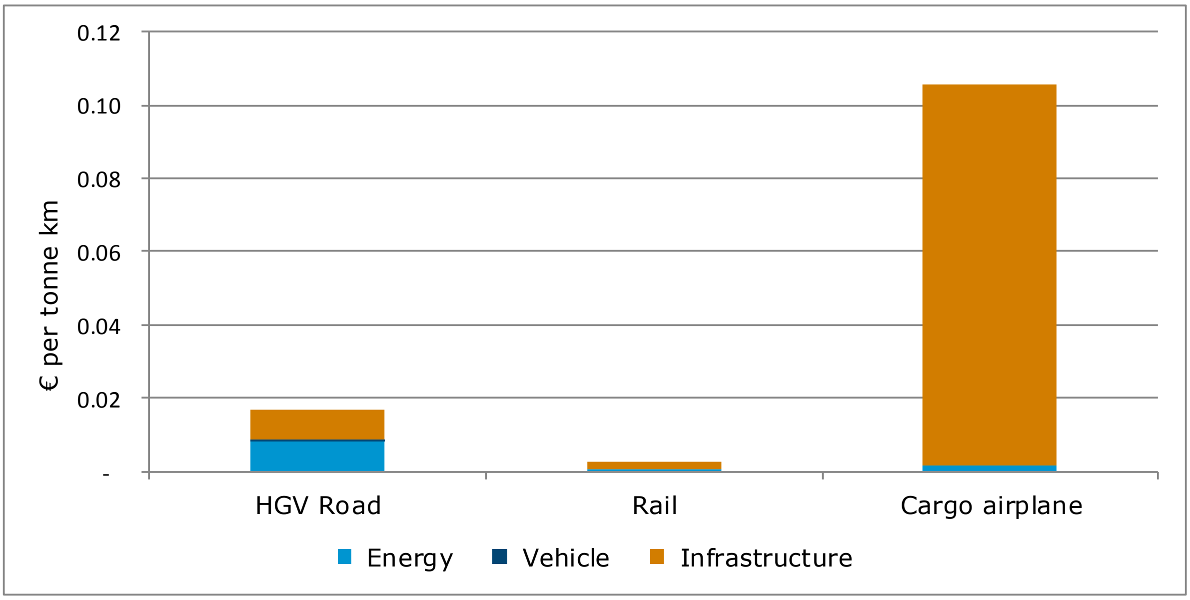
Table 69 provides an overview of the total fiscal burden for freight transport means on the corridor Bucharest – Warsaw. The highest burden is estimated for rail transport.

Table 69 Total fiscal burden for freight transport means on the corridor Bucharest - Warsaw (€/vehicle/trip)

			
Energy taxes/charges	186	890	47
Vehicle taxes/charges	10	-	-
Infrastructure taxes/charges	192	4,739	2,775
Total fiscal burden	388	5,629	2,821

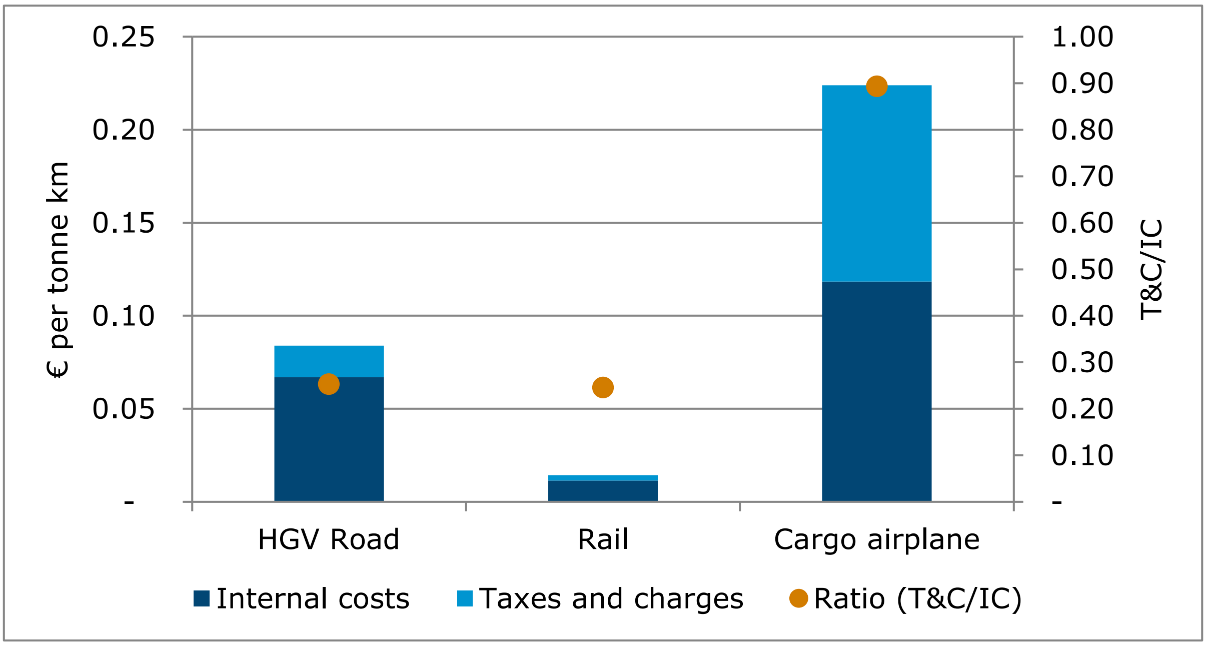
Figure 78 shows the fiscal burden per tonne-kilometre. This burden is highest for cargo airplanes (due to the relatively low average load of airplanes), followed by HGVs. For HGVs, the main part of the fiscal burden consists of fuel taxes, although the various distance-based road charges applied on this corridor contribute significantly as well.

Figure 78 Comparison of fiscal burden per tonne-kilometre on the corridor Bucharest - Warsaw



Finally, the contribution of the taxes and charges in the total internal costs of freight transport modes on the corridor Bucharest – Warsaw is shown in Figure 79. The highest share is estimated for cargo airplanes, while the share for HGVs and rail transport is comparable.

Figure 79 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Bucharest - Warsaw



4.3.14 Dublin – Amsterdam

Passenger transport

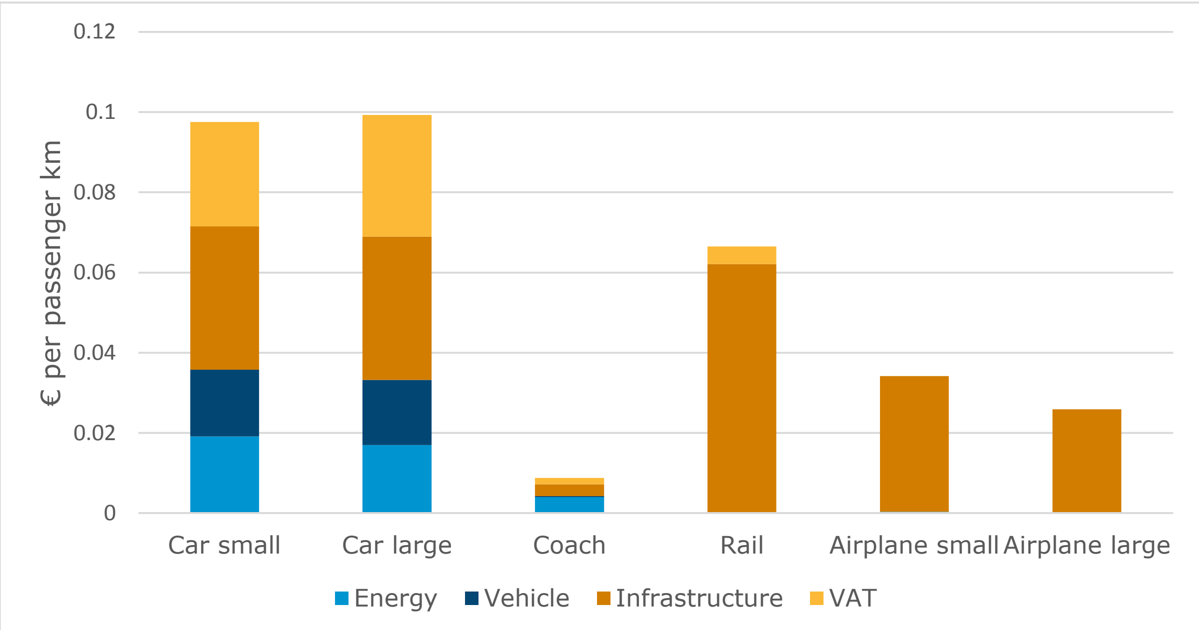
An overview of the total fiscal burden for passenger transport means on the corridor Dublin – Amsterdam is presented in Table 70. The highest burden is estimated for rail transport.

Table 70 Total fiscal burden for passenger transport means on the corridor Dublin – Amsterdam (€/vehicle/trip)

	Small	Large		HSL +	Small	Large
Energy taxes/charges	45	40	140	38	15	22
Vehicle taxes/charges	39	38	10	-	-	-
Infrastructure taxes/charges	84	84	101	12,288	1,545	3,023
VAT	61	71	58	971	-	-
Total fiscal burden	228	232	309	13,297	1,559	3,045

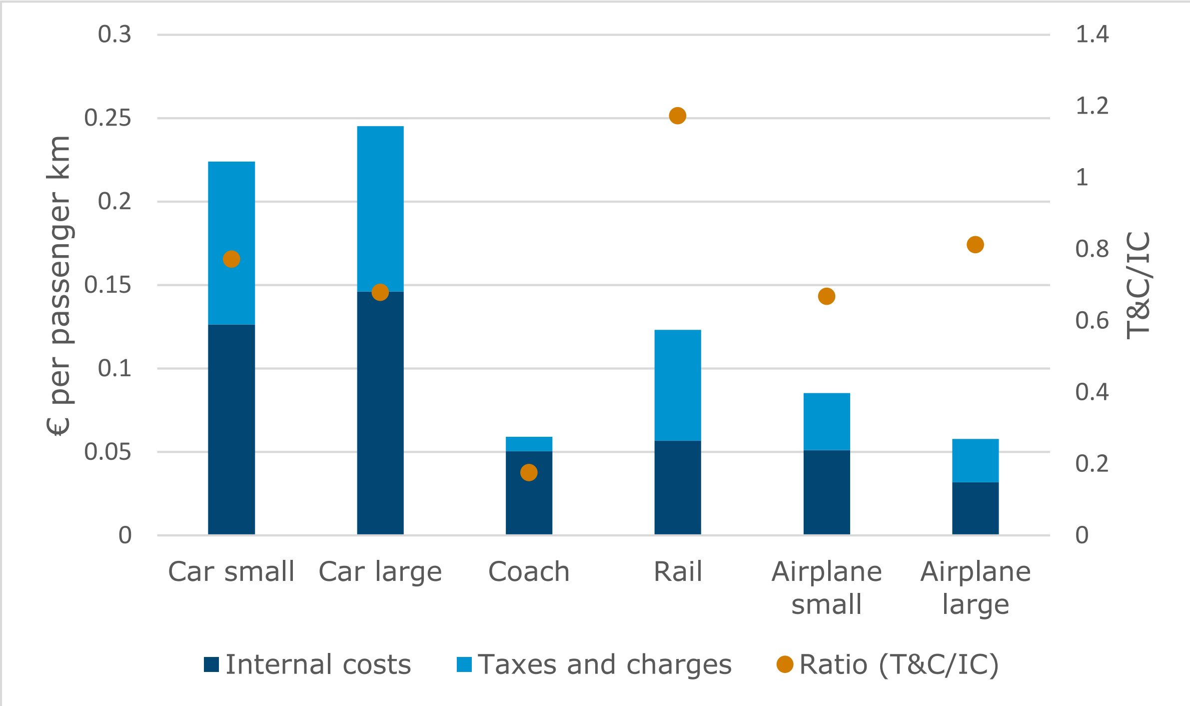
The fiscal burden per passenger kilometre for passenger transport modes on the corridor Dublin – Amsterdam is shown in Figure 80. The highest burden is estimated for passenger cars (about 10 €ct per passenger kilometre), followed by rail transport and aviation. For passenger cars (and coaches) the Eurotunnel charge is the only relevant infrastructure charge, which significantly contributes to the overall fiscal burden. Also for rail transport, the infrastructure charge levied on the Eurostar train between Brussels and London (passing the Eurotunnel) contributes significantly to the total fiscal burden, resulting in a relatively high average burden for rail transport on this corridor.

Figure 80 Comparison of fiscal burden per passenger kilometre on the corridor Dublin - Amsterdam



The share of taxes and charges in the total internal costs of passenger transport modes on the corridor Dublin – Amsterdam is presented in Figure 81. The highest share is estimated for rail transport, followed by aviation and passenger cars.

Figure 81 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Dublin - Amsterdam



Freight transport

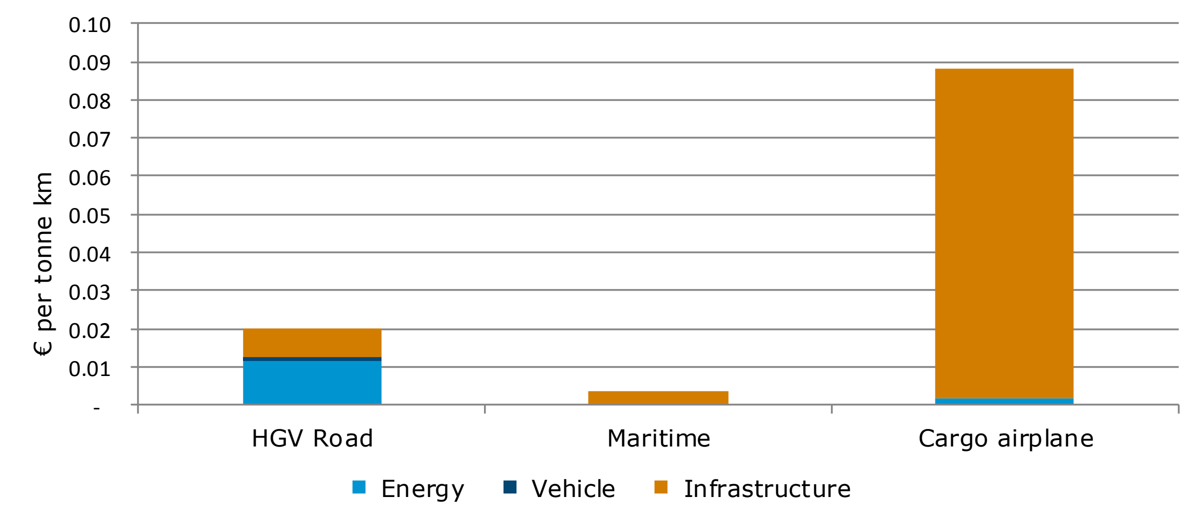
The total fiscal burden for freight transport means on the corridor Dublin – Amsterdam is given in Table 71. The highest burden is estimated for maritime transport.

Table 71 Total fiscal burden for freight transport means on the corridor Dublin – Amsterdam (€/vehicle/trip)

			
Energy taxes/charges	181	-	35
Vehicle taxes/charges	12	-	-
Infrastructure taxes/charges	112	24,969	1,903
Total fiscal burden	305	24,969	1,938

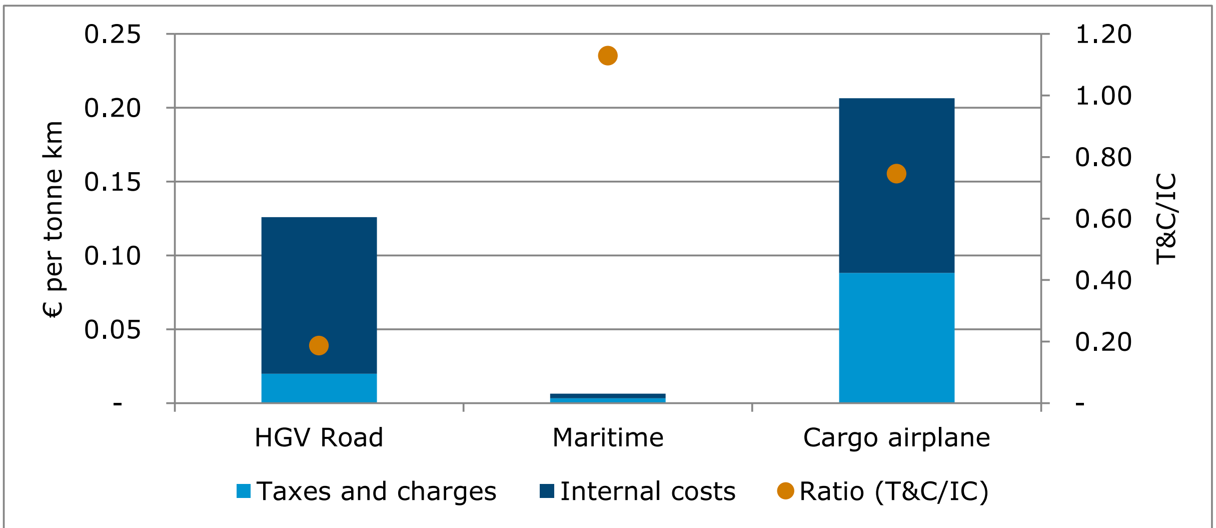
As shown in Figure 82, the fiscal burden per tonne-kilometre is, as for the other corridors, highest for cargo airplanes. For HGVs, the fiscal burden is estimated at 2 €ct per tonne-kilometre, of which about 60% is due to fuel taxes. The infrastructure charges for trucks mainly consist of the specific toll for the Eurotunnel and the distance-based road charges in Belgium.

Figure 82 Comparison of fiscal burden per tonne-kilometre on the corridor Dublin - Amsterdam



Finally, the share of taxes and charges in the total internal costs of freight transport on the corridor Dublin – Amsterdam is presented in Figure 83. The highest share is estimated for maritime transport, followed by aviation.

Figure 83 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Dublin - Amsterdam



4.3.15 Athens - Vienna

Passenger transport

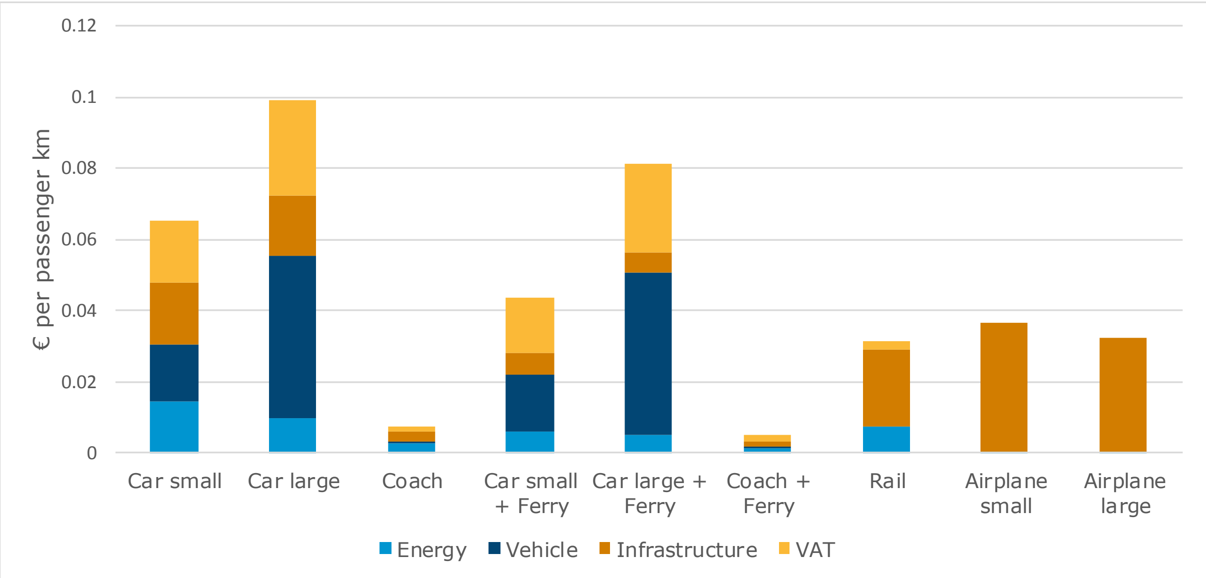
Table 72 provides an overview of the total fiscal burden for passenger transport modes on the corridor Athens – Vienna. The highest total burden is estimated for aviation, followed by rail transport.

Table 72 Total fiscal burden for passenger transport means on the corridor Athens - Vienna (€/vehicle/trip)

	Small	Large		+ Small	+ Large	+		Small	Large
Energy taxes/charges	50	33	131	20	17	66	715	26	39
Vehicle taxes/charges	56	157	27	56	157	27	-	-	-
Infrastructure taxes/charges	59	59	143	20	20	73	2,097	2,721	6,179
VAT	59	91	79	53	85	79	277	-	-
Total fiscal burden	224	341	380	141	271	235	3,089	2,747	6,217

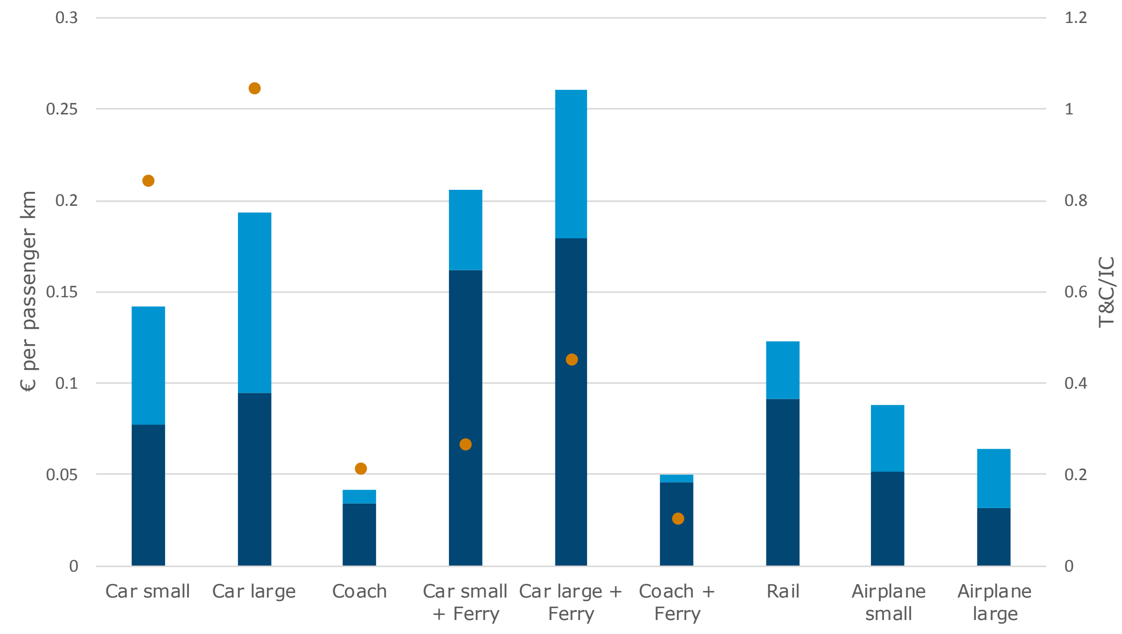
The fiscal burden per passenger kilometre for the various passenger transport modes on the corridor Athens – Vienna is shown in Figure 84. The highest burden is estimated for passenger cars, which is particularly due to the relatively high vehicle taxes levied on passenger cars in Greece. For the large reference car, not only an ownership and registration tax applies, but also an one-off luxury tax of 30% of the car value. The routes that take the ferry connection between Patras and Trieste have a lower fiscal burden, due to the lower road distance driven. For aviation and rail transport, infrastructure charges contribute most to the overall fiscal burden, although electricity taxes (in Austria, Macedonia and Serbia) also contribute significantly to the total fiscal burden of rail transport. Finally, the fiscal burden for coach transport is mainly made up of fuel taxes, infrastructure charges and VAT.

Figure 84 Comparison of fiscal burden per passenger kilometre on the corridor Athens – Vienna



The share of taxes and charges in the total internal costs of passenger transport modes is shown in Figure 85. The highest share is found for passenger cars and aviation, followed by rail transport. The internal costs for the options using the ferry are higher than the routes by land. This is a result of the costs of the ferry fare, which are included in the internal costs. The ferry fare contains the taxes and charges the ferry operator faces. These costs are passed on to the passengers through the fare. Passengers often do not observe these directly, and the fare costs are thus considered internal costs.

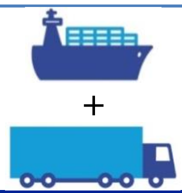
Figure 85 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Athens - Vienna



Freight transport

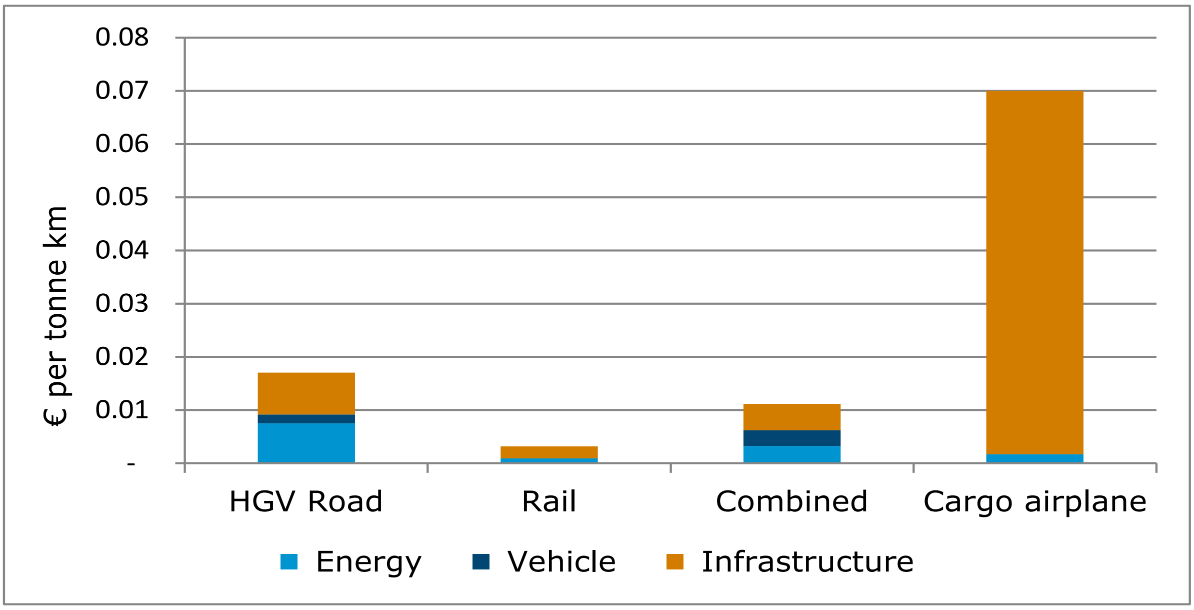
An overview of the total fiscal burden for freight transport means on the corridor Athens – Vienna is given in Table 73. The highest burden is found for rail transport. The maritime transport option actually reflects a combined transport operation in which a truck is transported by a RoPax vessel from Patras (Greece) to Trieste (Italy). As the charges for the RoPax vessel are considered internal costs for the truck operator, the total fiscal burden for this 'maritime' transport operation is made up of the taxes/charges levied on HGVs and hence is relatively small (compared to maritime transport operations on other corridors).

Table 73 Total fiscal burden for freight transport means on the corridor Athens - Vienna (€/vehicle/trip)

				
Energy taxes/charges	171	1,400	120	61
Vehicle taxes/charges	40	-	85	-
Infrastructure taxes/charges	181	4,255	184	2,468
Total fiscal burden	391	5,655	389	2,529

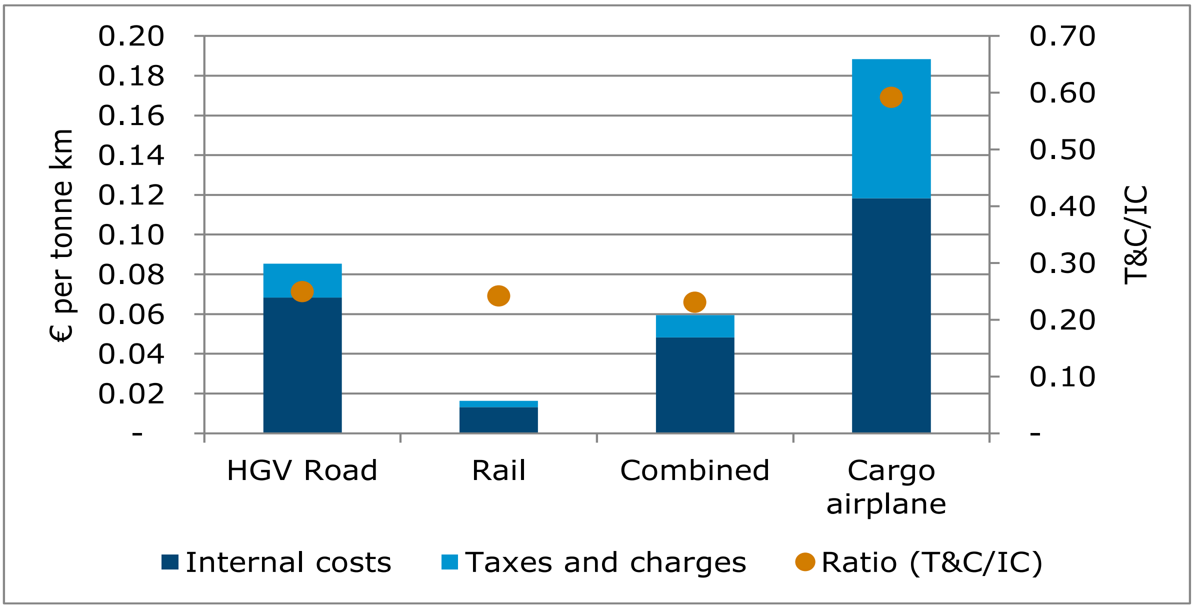
The fiscal burden per tonne-kilometre on the corridor Athens – Vienna is shown in Figure 86. As for all other corridors, the highest burden is estimated for cargo airplanes. The burden for HGVs and the combined transport operation (taking the RoPax vessel between Patras and Trieste) is comparable, as they both reflect the taxes and charges levied on trucks. The burden for HGVs is slightly higher, mainly because they have to pay fuel taxes and infrastructure charges over the entire length of the corridor, while trucks used in the combined transport operation do not have to pay these taxes/charges for the maritime leg of their trip.

Figure 86 Comparison of fiscal burden per tonne-kilometre on the corridor Athens - Vienna



The share of the taxes and charges in the total internal costs of freight transport on the corridor Athens – Vienna is presented in Figure 87, showing that this share is highest for cargo airplanes. For all other modes, these shares are (almost) similar (in relative terms).

Figure 87 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Athens - Vienna



4.3.16 Madrid - Barcelona

Passenger transport

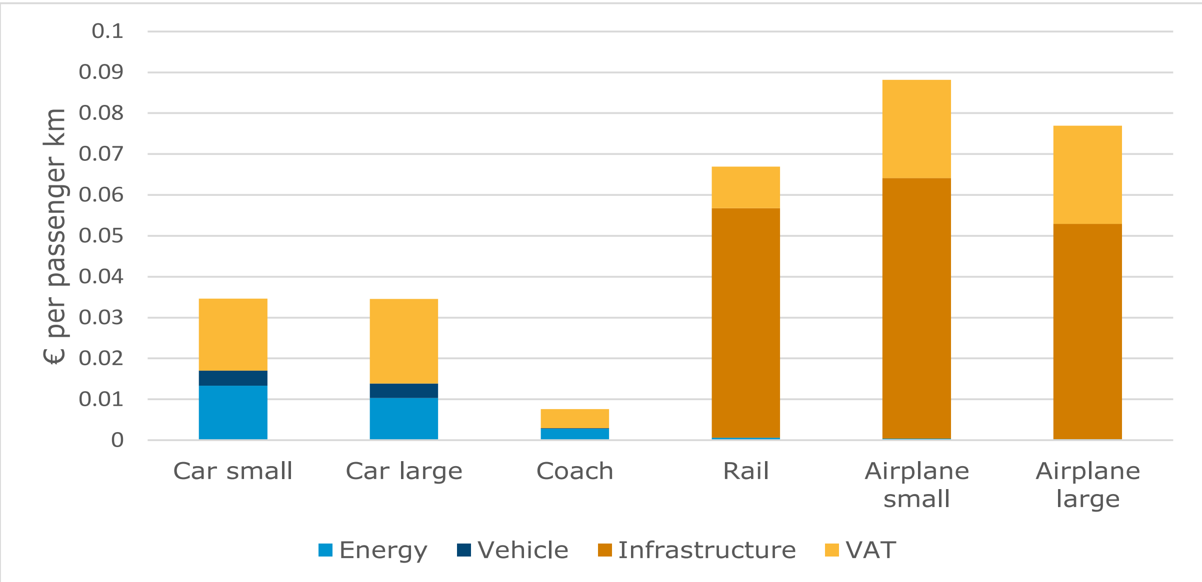
Table 74 provides an overview of the total fiscal burden for passenger transport means on the corridor Madrid – Barcelona. The highest burden is found for rail transport, followed by aviation. For road transport, no infrastructure charges are assumed on this corridor, although distance-based road charges are applied on the motorway between Zaragoza and Barcelona. However, as explained in Annex C, it is assumed that road users avoid this toll road as the financial savings outweigh the (limited) time losses.

Table 74 Total fiscal burden for passenger transport means on the corridor Madrid - Barcelona (€/vehicle/trip)

	Small	Large		HSL	Small	Large
Energy taxes/charges	18	14	52	113	12	18
Vehicle taxes/charges	5	4	4	-	-	-
Infrastructure taxes/charges	-	-	-	10,558	1,998	4,249
VAT	22	26	87	1,909	751	1,933
Total fiscal burden	45	45	143	12,580	2,761	6,200

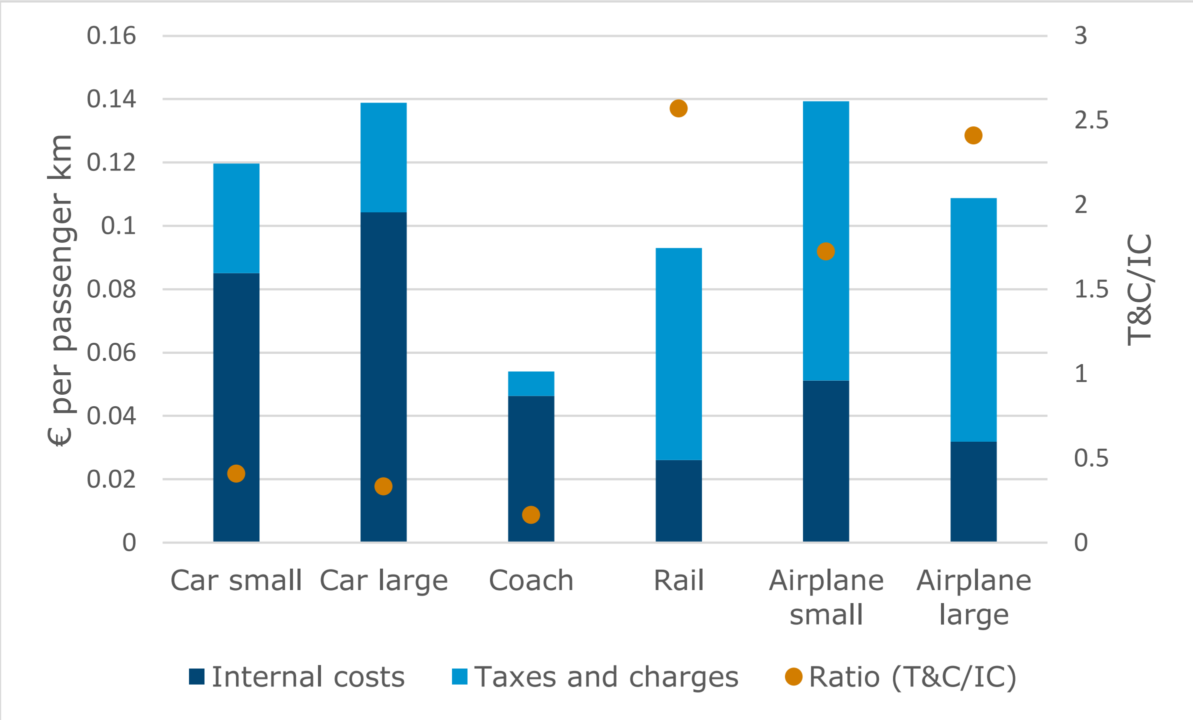
The fiscal burden per passenger kilometres for the various passenger transport modes on the corridor Madrid – Barcelona is shown in Figure 88. The highest burden is estimated for aviation, ranging from 7.5 to 9 €ct per passenger kilometre. In contrast to the international corridors, VAT is levied on aviation on this corridor (VAT on domestic flights is allowed, while international flights are exempted from VAT). For rail transport, the main part of the fiscal burden consists of infrastructure charges, supplemented by some VAT payments. For passenger cars, the fiscal burden is mainly made up of fuel taxes and VAT (as infrastructure charges are assumed not to apply as explained above), which is the same for coach transport.

Figure 88 Comparison of fiscal burden per passenger kilometre on the corridor Madrid - Barcelona



The share of taxes and charges in the total internal costs of passenger transport is shown in Figure 89. The highest share is estimated for rail transport, followed by aviation.

Figure 89 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Madrid - Barcelona



Freight transport

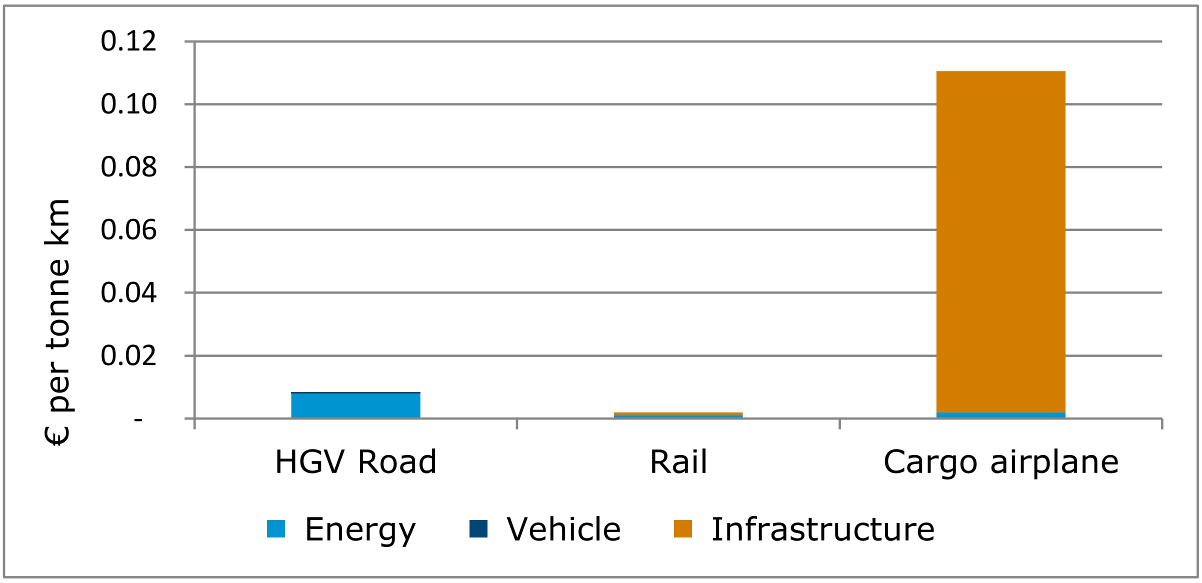
The total fiscal burden for freight transport means on the corridor Madrid – Barcelona is shown in Table 75. As for passenger transport, it is assumed that trucks avoid the toll roads between Zaragoza and Barcelona, resulting in no infrastructure charges for this mode.

Table 75 Total fiscal burden for freight transport means on the corridor Madrid - Barcelona (€/vehicle/trip)

			
Energy taxes/charges	66	798	29
Vehicle taxes/charges	3	-	-
Infrastructure taxes/charges	-	697	1,639
Total fiscal burden	69	1,495	1,667

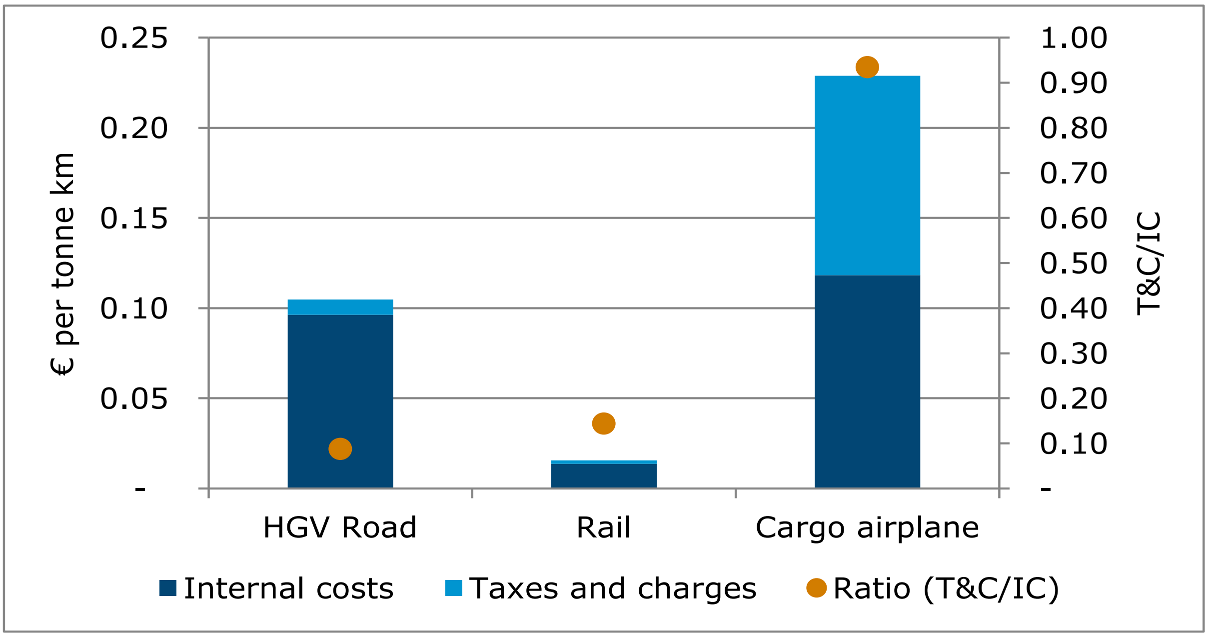
Figure 90 presents the fiscal burden per tonne-kilometre for freight transport modes on the corridor Madrid – Barcelona. As expected, the highest burden is estimated for aviation (due to the relatively low average loads of cargo planes). For HGVs, a fiscal burden of about 1 €ct is estimated, which almost completely consists of fuel taxes (due to the avoidance of infrastructure charges by trucks). For rail freight transport, the burden per tonne-kilometre is about 0.2 €ct per tonne-kilometre. The contribution of electricity taxes and infrastructure charges in this total burden is 53% and 47%, respectively.

Figure 90 Comparison of fiscal burden per tonne-kilometre on the corridor Madrid - Barcelona



Finally, the share of taxes and charges in the total internal costs of freight transport on the corridor Madrid – Barcelona is presented in Figure 91, showing that this share is highest for cargo airplanes.

Figure 91 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Madrid - Barcelona



4.3.17 Paris – Marseille

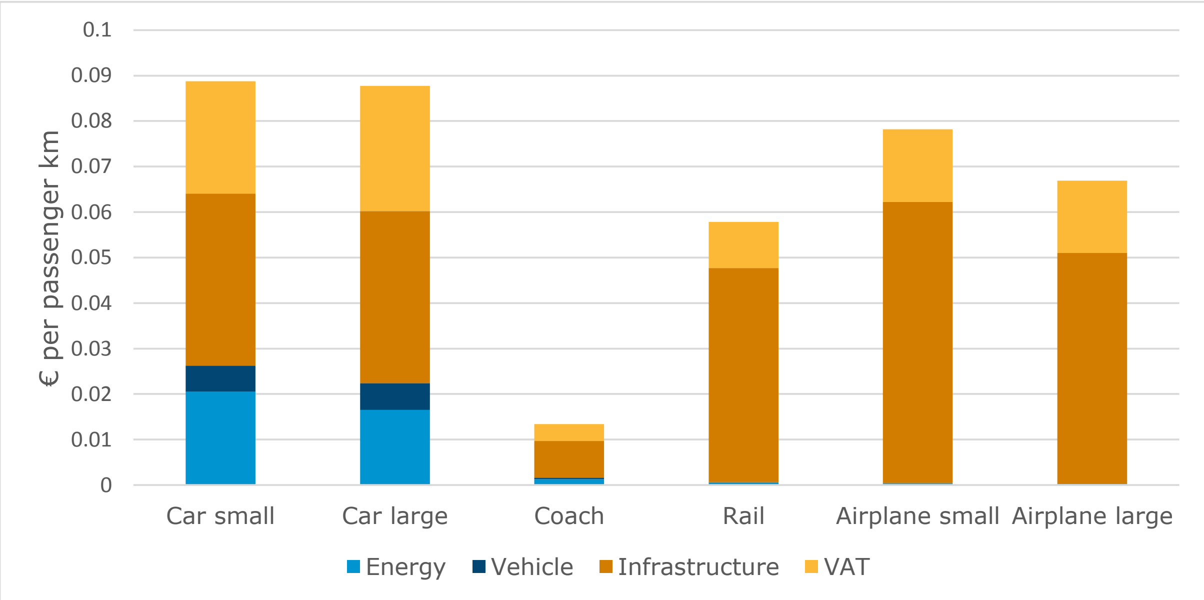
Passenger transport
An overview of the total fiscal burden for passenger transport modes on the corridor Paris – Marseille is given in Table 76. The highest total burden is estimated for rail transport, followed by aviation.

Table 76 Total fiscal burden for passenger transport means on the corridor Paris – Marseille (€/vehicle/trip)

	Small	Large		HSL	Small	Large
Energy taxes/charges	32	26	29	137	16	24
Vehicle taxes/charges	9	9	9	-	-	-
Infrastructure taxes/charges	59	59	187	10,962	2,572	5,431
VAT	38	43	87	2,367	663	1,706
Total fiscal burden	138	137	312	13,466	3,251	7,161

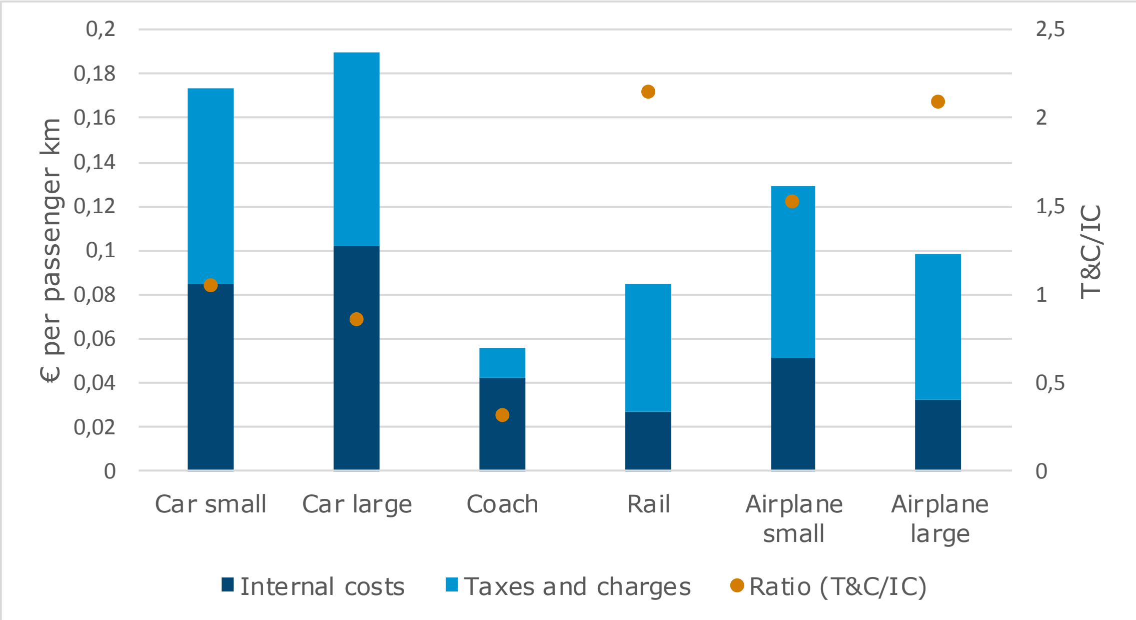
Figure 92 shows the fiscal burden per passenger kilometre on the corridor Paris – Marseille. The highest burden is estimated for passenger cars (about 9 €ct per passenger kilometre), with significant contribution of the distance-based road tolls applied on French motorways. For aviation and rail transport, infrastructure charges are responsible for the main part of the fiscal burden, although for both modes VAT is relevant as well. Finally, the fiscal burden for coach transport consists mainly of infrastructure charges. Fuel taxes on coach transport on this corridor are low, as they can be (partly) reclaimed by the coach operators.

Figure 92 Comparison of fiscal burden per passenger kilometre on the corridor Paris - Marseille



An overview of the share of taxes and charges in the total internal costs of passenger transport modes on the corridor Paris – Marseille is given in Figure 93. The highest shares are estimated for rail transport and aviation, followed by passenger cars and coaches.

Figure 93 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Paris – Marseille



Freight transport

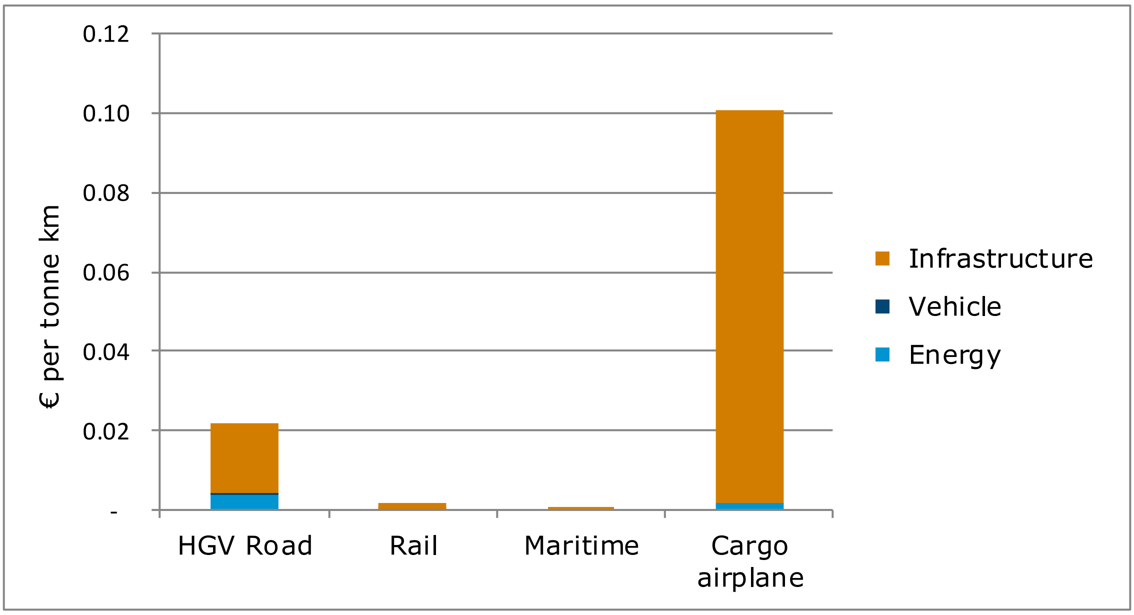
Table 77 shows an overview of the total fiscal burden for freight transport means on the corridor Paris – Marseille.

Table 77 Total fiscal burden for freight transport means on the corridor Paris – Marseille (€/vehicle/trip)

				
Energy taxes/charges	40	95	-	38
Vehicle taxes/charges	8	-	-	-
Infrastructure taxes/charges	187	1,480	3,446	1,981
Total fiscal burden	235	1,575	3,446	2,019

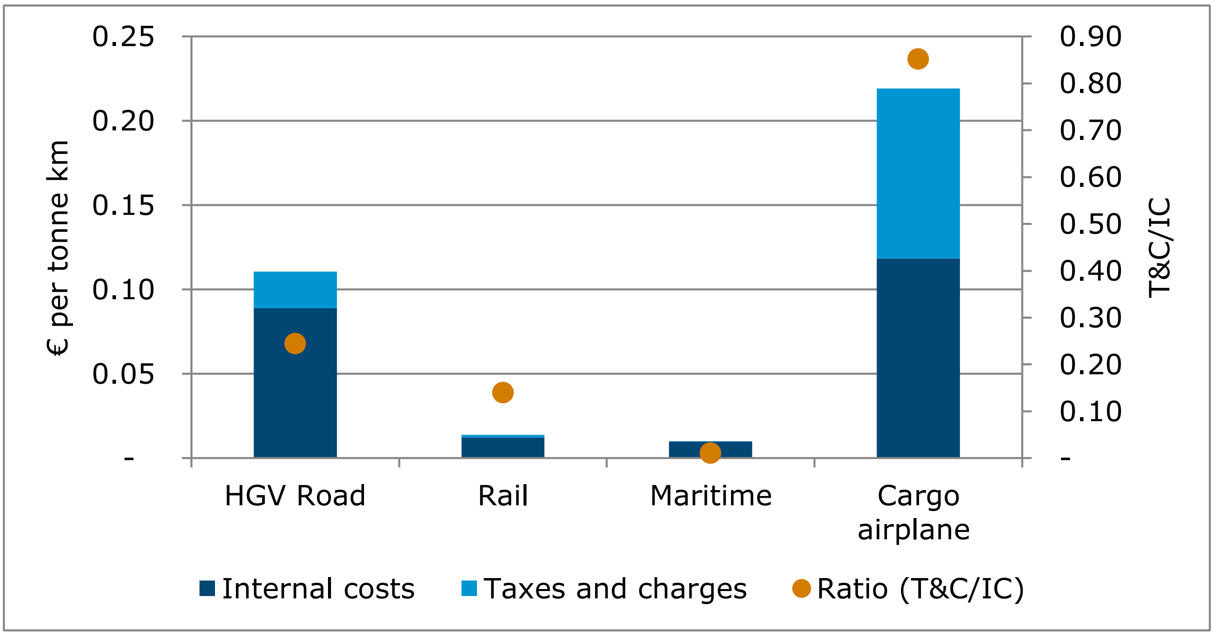
Figure 94 shows that, as for all other corridors, the fiscal burden per tonne-kilometre is highest for cargo airplanes (ca. 10 €ct). For HGVs, this burden is about 2 €ct, mainly consisting of distance-based road charges (fuel taxes can be partly reclaimed by transport operators). The fiscal burden for rail freight transport and maritime transport is estimated at less than 1 €ct per tonne-kilometre.

Figure 94 Comparison of fiscal burden per tonne-kilometre on the corridor Paris - Marseille



In Figure 95 the share of taxes and charges in the total internal costs of freight transport modes is presented, showing that this share is highest for cargo airplanes.

Figure 95 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Paris – Marseille



4.3.18 Hamburg - Munich

Passenger transport

An overview of the total fiscal burden for passenger transport means on the corridor Hamburg – Munich is presented in Table 78. The highest burden is found for rail transport, followed by aviation.

Table 78 Total fiscal burden for passenger transport means on the corridor Hamburg - Munich (€/vehicle/trip)

	Small	Large		HSL	Small	Large
Energy taxes/charges	31	23	91	3,221	15	22
Vehicle taxes/charges	8	10	13	-	-	-
Infrastructure taxes/charges	-	-	-	6,163	1,926	4,135
VAT	24	28	216	4,292	1,052	2,708
Total fiscal burden	64	61	320	13,676	2,993	6,865

The fiscal burden per passenger kilometre is shown for all passenger modes in Figure 96. The highest burden is estimated for aviation and rail transport. As no reduced VAT rates are applied for these types of transport (neither for coach transport) in Germany, the contribution of VAT in the total fiscal burden of these modes is significant (35% - 40% and 31%, respectively). For passenger cars, the fiscal burden mainly consists of fuel taxes and VAT, as no infrastructure charges are applied for passenger cars in Germany and vehicle taxes are relatively low (CE Delft, 2016a). Finally, for coach transport, VAT is the main contributor to the fiscal burden.

Figure 96 Comparison of fiscal burden per passenger kilometre on the corridor Hamburg - Munich

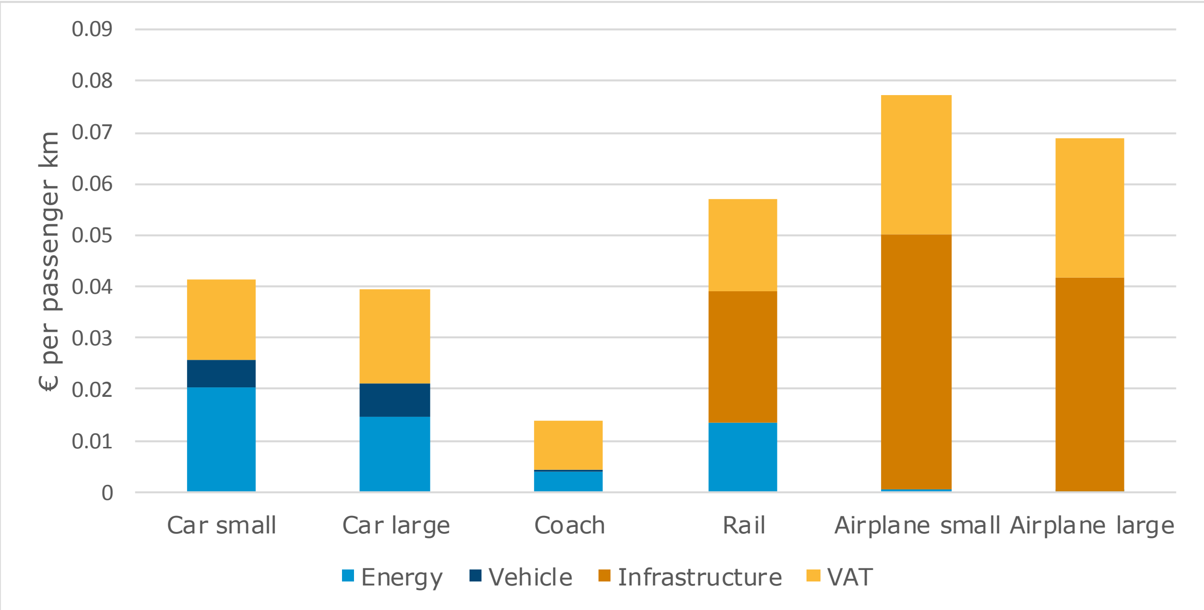
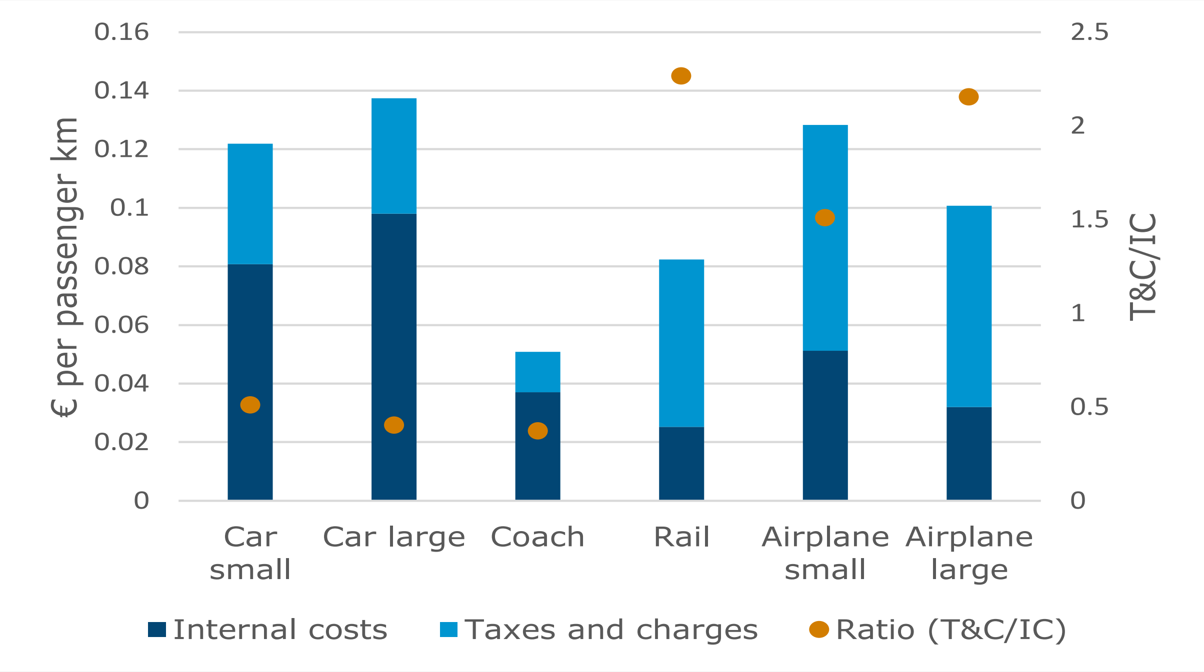


Figure 97 shows that taxes and charges have the highest shares in the internal costs of rail transport and aviation.

Figure 97 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Hamburg - Munich



Freight transport

Table 79 presents the total fiscal burden for freight transport means on the corridor Hamburg – Munich. The highest burden is estimated for rail transport, followed by aviation.

Table 79 Total fiscal burden for freight transport means on the corridor Hamburg - Munich (€/vehicle/trip)

			
Energy taxes/charges	120	2,294	35
Vehicle taxes/charges	9	-	-
Infrastructure taxes/charges	100	5,661	2,198
Total fiscal burden	230	7,954	2,233

As shown in Figure 98, the fiscal burden per tonne-kilometre is highest for cargo airplanes (due to their relatively low average load). As for HGVs, the fiscal burden mainly consists of fuel taxes (about 52%) and infrastructure charges (about 43%). Finally, for rail transport infrastructure charges contribute 71% of the total burden, while electricity taxes are responsible for 29% of this burden.

Figure 98 Comparison of fiscal burden per tonne-kilometre on the corridor Hamburg - Munich

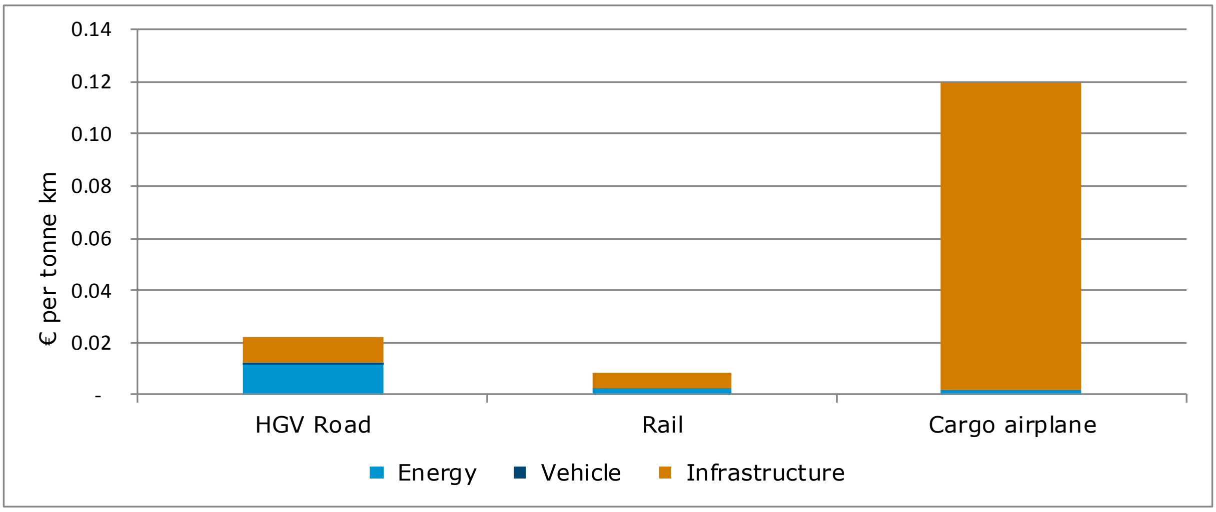
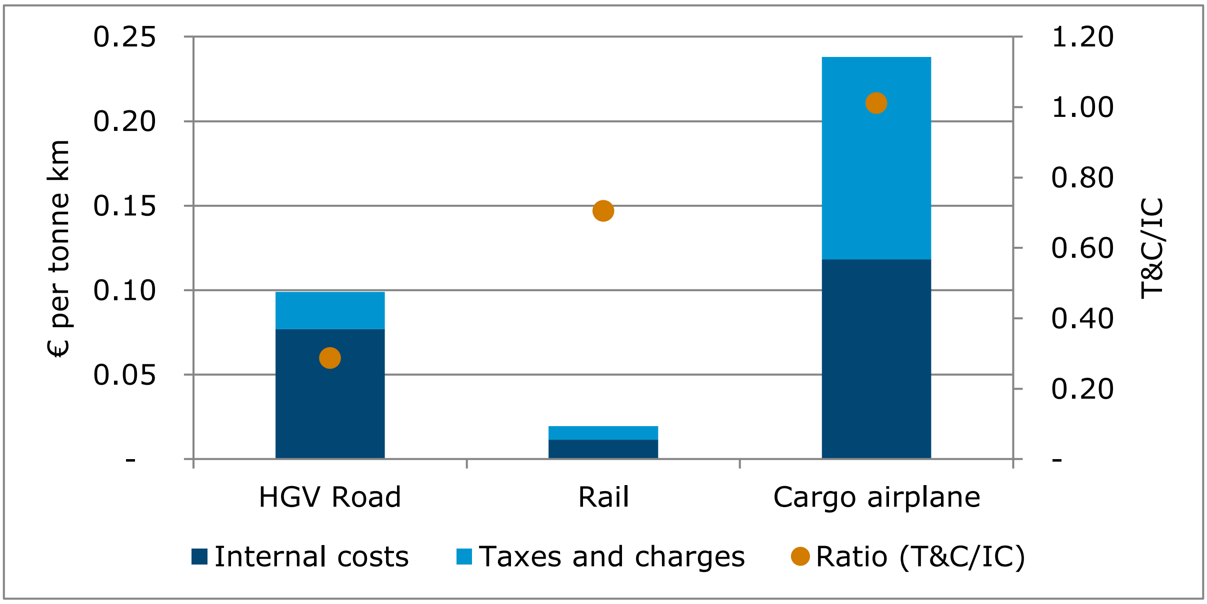


Figure 99 shows that the taxes and charges have the highest share in the total internal costs of cargo airplanes, followed by rail transport.

Figure 99 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Hamburg - Munich



4.3.19 Katowice - Gdansk

Passenger transport

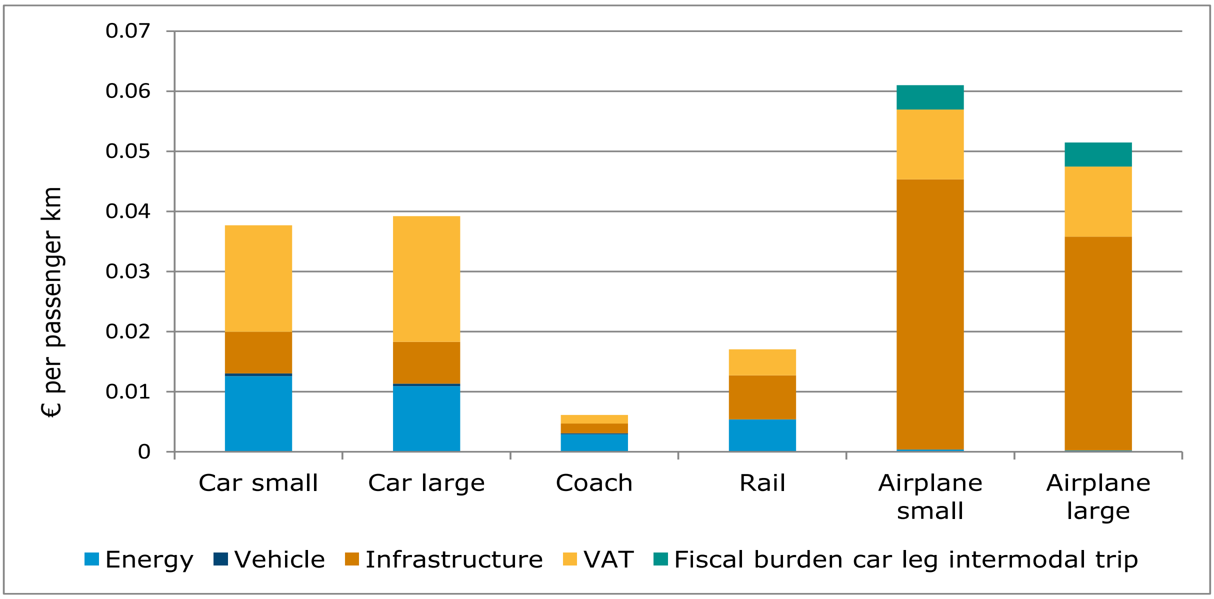
An overview of the total fiscal burden for passenger transport means on the corridor Katowice – Gdansk is presented in Table 80. The highest burden is estimated for rail transport and aviation.

Table 80 Total fiscal burden for passenger transport means on the corridor Katowice - Gdansk (€/vehicle/trip)

	Small	Large		HSL	Small + Small	Large + Small
Energy taxes/charges	13	11	45	1,026	12	18
Vehicle taxes/charges	0	0	2	-	-	-
Infrastructure taxes/charges	7	7	25	1,402	1,407	2,869
VAT	18	22	22	830	364	937
Fiscal burden car leg intermodal trip by aviation	-	-	-	-	126	325
Total fiscal burden	39	41	95	3,258	1,783	3,824

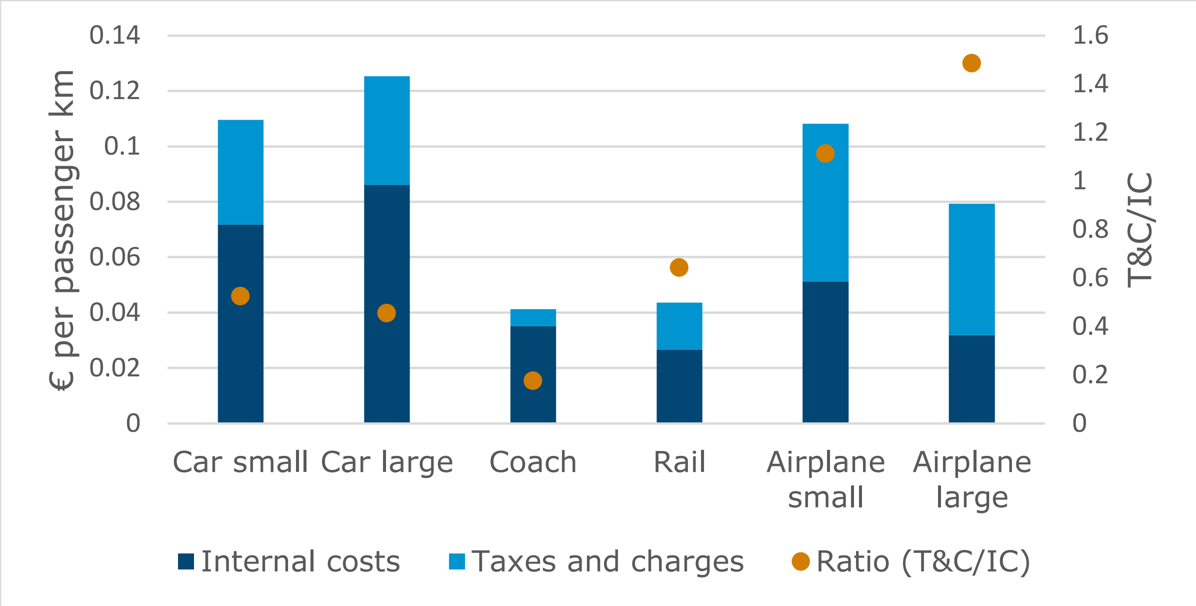
The fiscal burden per passenger kilometre is shown in Table 97. The highest burden is estimated for aviation, mainly consisting of infrastructure charges. However, also the VAT on domestic flights in Poland and the taxes/charges levied on passenger cars used to travel from Katowice to Krakow airport are significant. For passenger cars, VAT and fuel taxes are responsible for the main part of the fiscal burden. Additionally, distance-based road charges significantly contribute to the total fiscal burden. Vehicle taxes only have a very minor role, mainly due to the fact that no purchase taxes and insurance taxes are levied on passenger cars in Poland. For rail transport, infrastructure charges, electricity taxes and VAT all contribute significantly to the overall fiscal burden. Finally, for coach transport fuel taxes are the main component of the total burden, followed by infrastructure charges and VAT.

Figure 100 Comparison of fiscal burden per passenger kilometre on the corridor Katowice - Gdansk



The share of taxes and charges in the total internal costs of passenger transport modes on the corridor Katowice – Gdansk is shown in Figure 101. The highest share is estimated for aviation, while the shares of passenger cars and rail transport are in the same range.

Figure 101 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Katowice - Gdansk



Freight transport

In Table 81 an overview of the total fiscal burden for freight transport means on the corridor Katowice – Gdansk is shown.

Table 81 Total fiscal burden for freight transport means on the corridor Katowice - Gdansk (€/vehicle/trip)

			
Energy taxes/charges	59	708	29
Vehicle taxes/charges	3	-	-
Infrastructure taxes/charges	28	1,744	1,393
Fiscal burden HGV leg intermodal trip by aviation	-	-	21
Total fiscal burden	91	2,452	1,421

The fiscal burden per tonne-kilometre is shown for all relevant freight transport modes in Figure 102. The highest burden is estimated for cargo airplanes, mainly consisting of infrastructure charges. Payments for ETS allowances and taxes/charges related to the use of HGVs to transport goods from Katowice to Krakow airport both have a limited share in the total fiscal burden for cargo planes. For HGVs, the main part of the fiscal burden consists of fuel taxes (65%) and distance-based infrastructure charges (31%). Finally, for rail transport the main part (about 70%) of the fiscal burden consists of infrastructure charges.

Figure 102 Comparison of fiscal burden per tonne-kilometre on the corridor Katowice - Gdansk

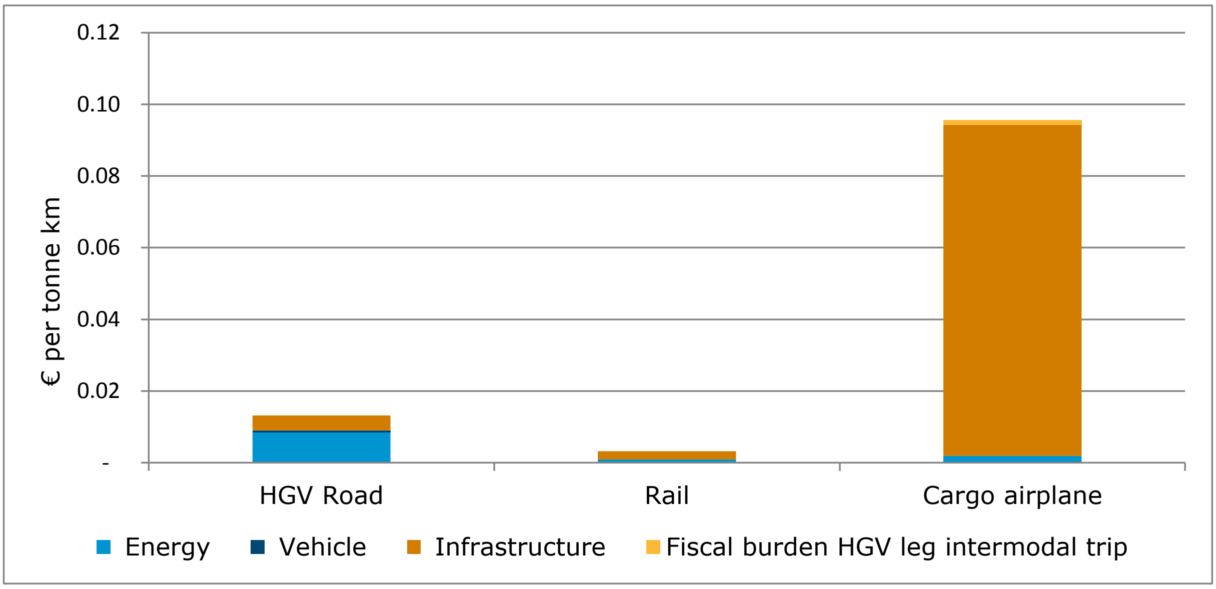
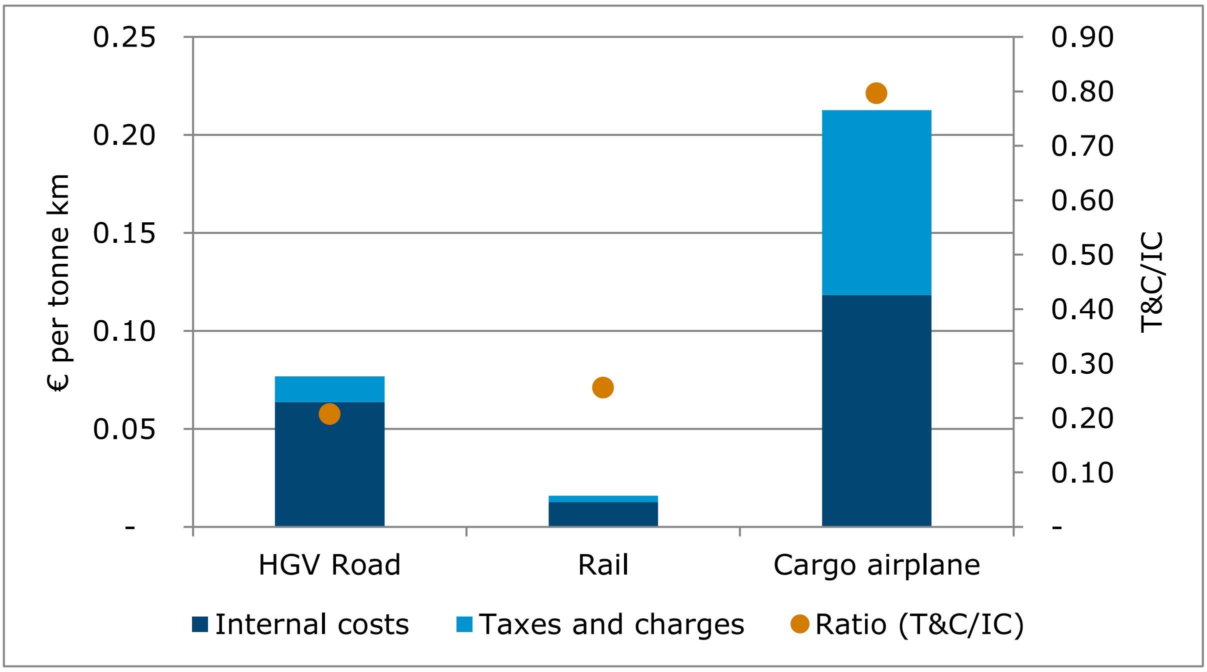


Figure 103 shown the share of the taxes/charges in the total internal costs of the various freight transport modes. This share is highest for cargo airplanes, followed by rail transport and HGVs.

Figure 103 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Katowice - Gdansk



4.3.20 Milan - Naples

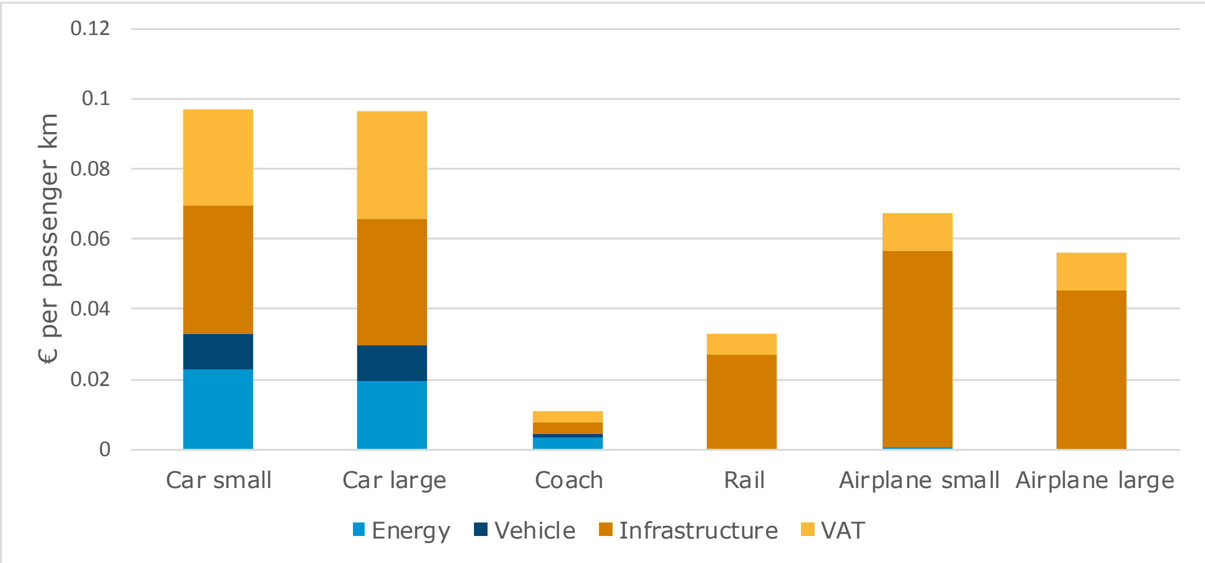
Passenger transport
Table 82 presents an overview of the total fiscal burden for passenger transport means on the corridor Milan – Naples. This total burden is highest for rail transport, followed by aviation.

Table 82 Total fiscal burden for passenger transport means on the corridor Milan -Naples (€/vehicle/trip)

	Small	Large		HSL	Small	Large
Energy taxes/charges	35	30	78	-	15	23
Vehicle taxes/charges	16	16	22	-	-	-
Infrastructure taxes/charges	56	56	77	6,764	2,284	4,692
VAT	43	47	79	1,527	442	1,137
Total fiscal burden	129	155	798	8,291	1,993	3,201

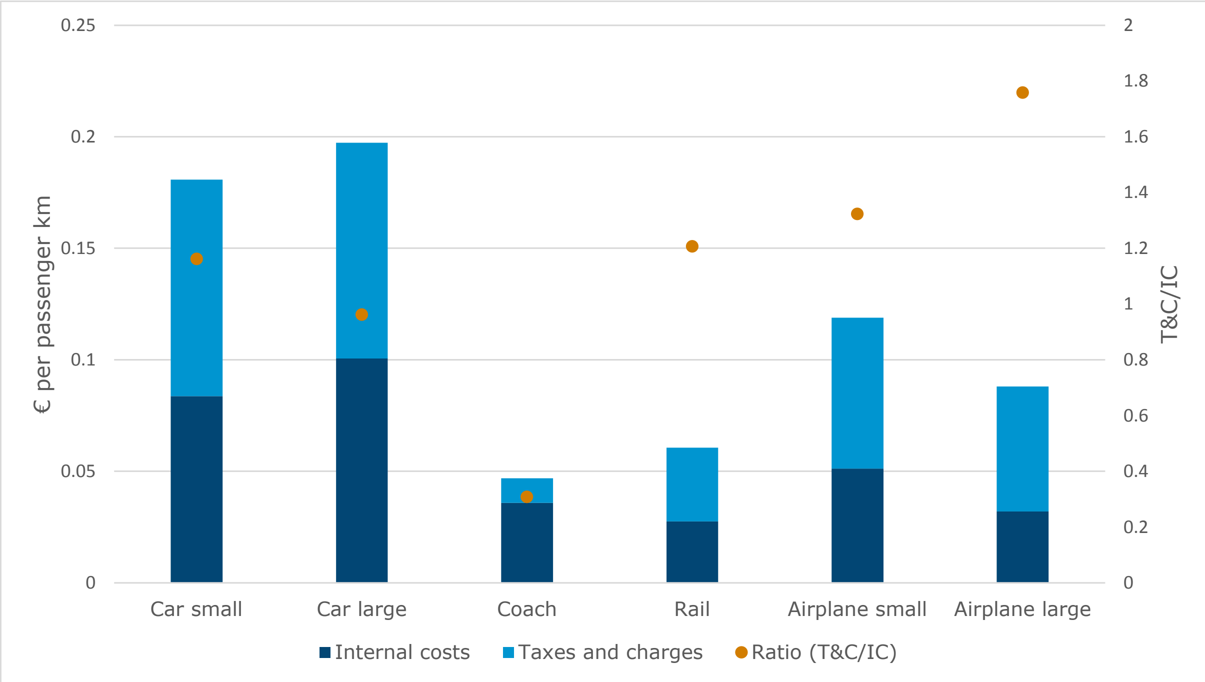
The fiscal burden per passenger kilometre for the various passenger transport modes on the corridor Milan – Naples is shown in Figure 104. The highest burden is estimated for passenger cars, mainly due to significant infrastructure charges (distance-based road charges on Italian motorways) applied. Fuel taxes and VAT have significant shares in the total fiscal burden as well. For aviation and rail transport, infrastructure charges are the most important component, although for both modes VAT also contributes significantly. Finally, for coaches, fuel taxes, infrastructure charges and VAT have equal shares in the total fiscal burden.

Figure 104 Comparison of fiscal burden per passenger kilometre on the corridor Milan - Naples



The share of taxes and charges in the total internal costs of passenger transport modes on the corridor Milan – Naples is shown in Figure 105. The highest share is estimated for aviation, followed by rail transport and passenger cars.

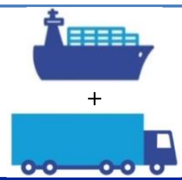
Figure 105 Ratio of fiscal burden and internal costs for passenger transport modes on the corridor Milan - Naples



Freight transport

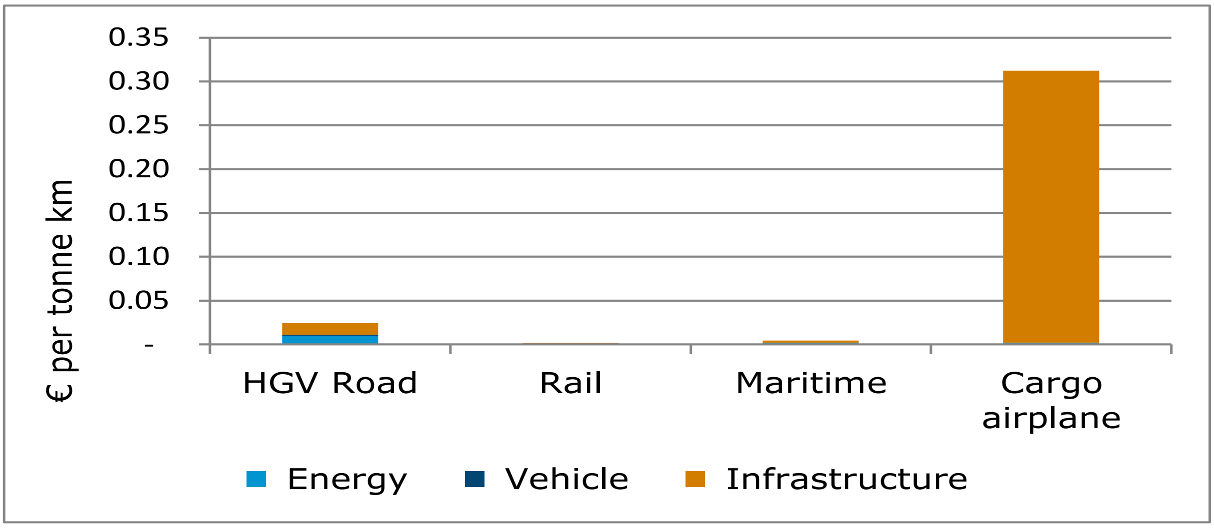
An overview of the total fiscal burden for freight transport means on the corridor Milan – Naples is given in Table 83. The highest burden is found for maritime transport, whereas the taxes/charges levied on the HGVs used to transport the containers from Milan to Genoa are taken into account as well. All energy and vehicle taxes are related to these HGVs.

Table 83 Total fiscal burden for freight transport means on the corridor Milan - Naples (€/vehicle/trip)

				
Energy taxes/charges	102	-	7,574	37
Vehicle taxes/charges	12	-	1,784	-
Infrastructure taxes/charges	136	1,836	10,624	6,054
Total fiscal burden	250	1,836	19,982	6,091

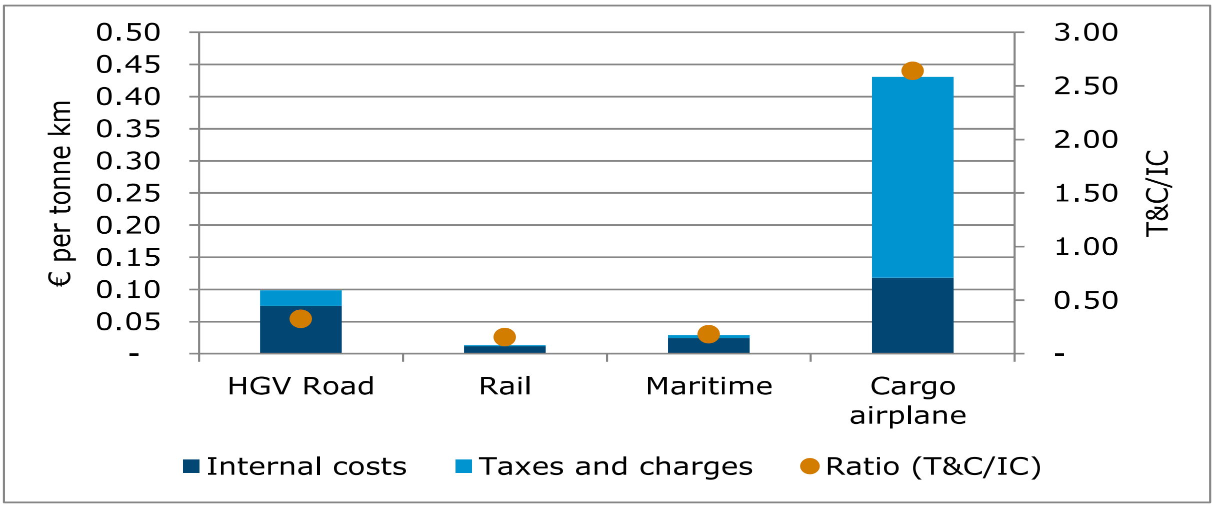
The fiscal burden per tonne-kilometre is shown in Figure 106. The highest burden is estimated for cargo airplanes (due to their relatively low average load). For HGVs, the burden is about 2 €ct per tonne-kilometre, of which 54% consisting of infrastructure charges (distance-based charges on Italian motorways) and 41% of fuel taxes. For rail freight transport and maritime transport, the fiscal burden is limited: 0.2 and 0.4 €ct per tonne-kilometre respectively.

Figure 106 Comparison of fiscal burden per tonne-kilometre on the corridor Milan - Naples



Finally, the share of taxes and charges in the total internal costs of freight transport modes is shown in Figure 107. The highest share is estimated for cargo aviation, while for the other modes the shares are significantly lower.

Figure 107 Ratio of fiscal burden and internal costs for freight transport modes on the corridor Milan - Naples



5 COMPARATIVE ANALYSES PER MODE

5.1 Introduction

In this chapter we provide some comparative analyses per mode. The aim is to compare the fiscal burden per transport mode between the different corridors. We do this by assessing the fiscal burden per passenger kilometre or tonne-kilometre.

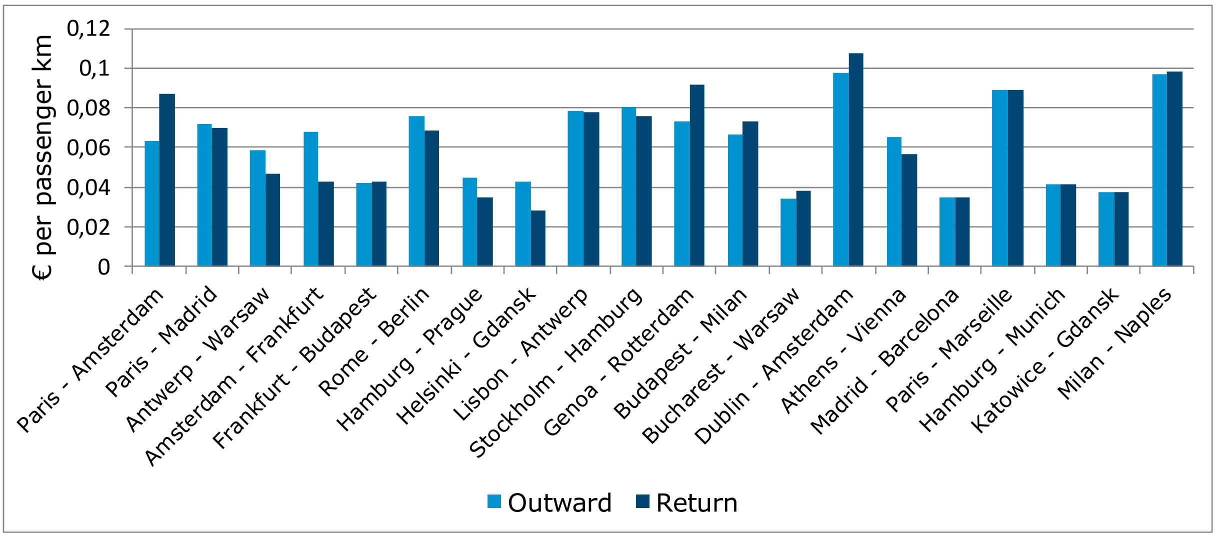
The results of the comparative analyses for the passenger transport means are presented in Section 5.2, while the results for the freight transport means are shown in Section 5.3. We present both the result for the outward and return trip.

5.2 Passenger transport

5.2.1 Passenger car

A comparison of the fiscal burden of small passenger cars on the twenty corridors is shown in Figure 108.

Figure 108. Fiscal burden for small passenger cars on the twenty corridors[40]



There is large variation in fiscal burden for small passenger cars between the various corridors (from 2.5 €ct on the corridor Helsinki – Gdansk to more than 10 €ct per pkm on the corridor Dublin – Amsterdam. This wide range reflects the large differences in transport taxes applied for passenger cars in Europe (CE Delft, 2016a). One general pattern that can be identified is that on corridors without distance-based road charges (e.g. Hamburg – Prague, Helsinki – Gdansk, Madrid – Barcelona[41], Hamburg – Munich) fiscal burden is low. Corridors where distance-based charges are applied on a major part of the route show, on the other hand, relatively high fiscal burden. This is, for example, the case for Paris – Marseille, Genoa – Rotterdam and Milan – Naples. The high fiscal burden on the corridors Stockholm – Hamburg and Dublin – Amsterdam is

40 The route shown between Athens and Vienna is fully done by road, this is in line with the other routes

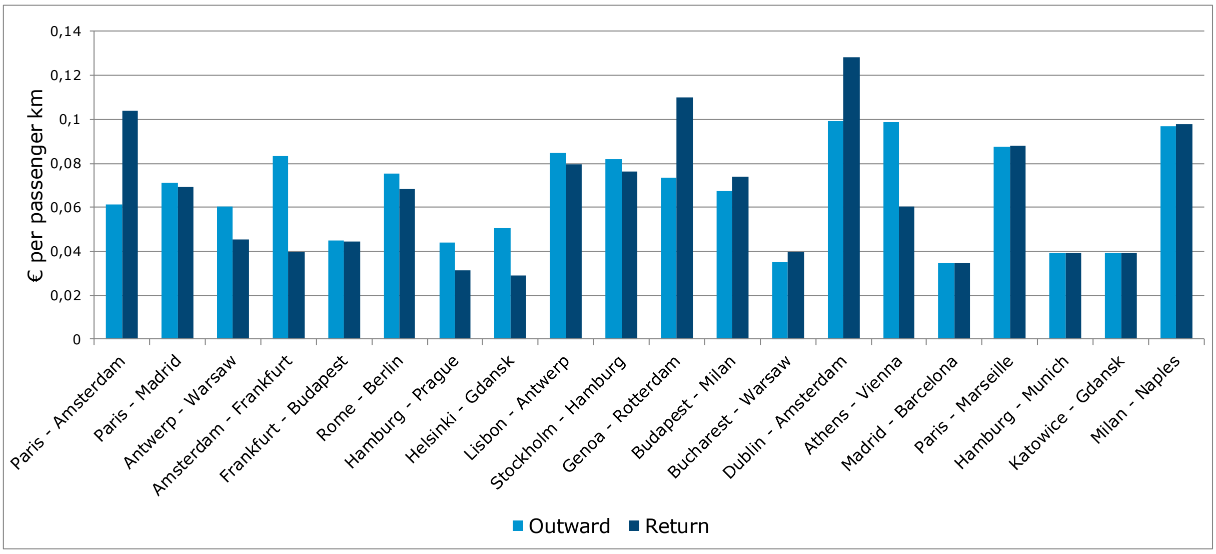
41 For road transport, no infrastructure charges are assumed on this corridor, although distance-based road charges are applied on the motorway between Zaragoza and Barcelona. However, as explained in Annex C, it is assumed that road users avoid this toll road as the financial savings outweigh the (limited) time losses.

explained by the tolls that exist for specific segments of the infrastructure on these corridors (i.e. the Oresund bridge and the Eurotunnel).

On many corridors, the fiscal burden for outward and return trip are comparable. However, there are some exceptions. First, the corridors with the Netherlands as origin or destination (Paris – Amsterdam, Amsterdam – Frankfurt, Genoa – Rotterdam and Dublin – Amsterdam) show on average larger differences in the fiscal burden of outward and return trips, which is due to the relatively high vehicle taxes in the Netherlands (CE Delft, 2016). Because of the relatively high vehicle taxes in Greece, the same pattern is visible for the corridor Athens – Vienna. Also on the corridor Antwerp – Warsaw significant differences exist between the outward and return trips, which is due to the higher vehicle taxes in Belgium than in Poland (no insurance and ownership tax is in place in Poland). Relatively low vehicle taxes in Poland and Czech Republic explain also the gap in fiscal burden between outward and return trips on the corridors Helsinki – Gdansk and Hamburg – Prague.

The fiscal burden for large passenger cars on the twenty European corridors is compared in Figure 109. In general, the same pattern as for small passenger cars is found. The main difference with the results for small passenger cars is the larger gap between outward and return trips for the corridors originating or ending in the Netherlands. This can be explained by the fact that both the purchase and ownership tax in the Netherlands contain (progressive) surcharges for diesel cars, resulting in significantly higher tax levels for the large reference car than for the small one.

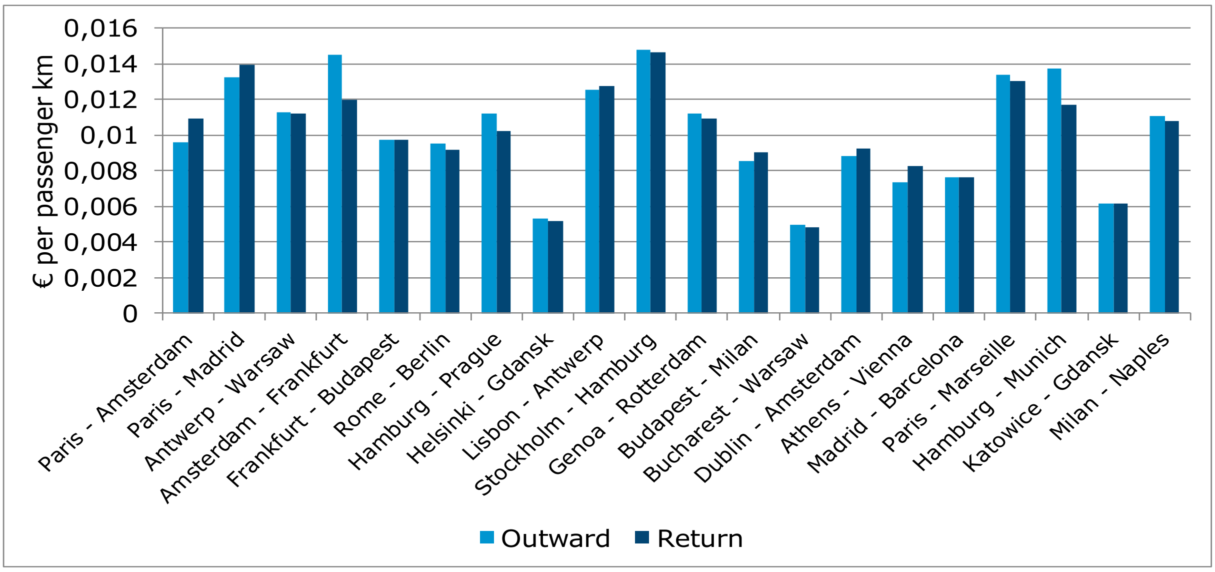
Figure 109 Fiscal burden for large passenger cars on the twenty corridors



5.2.2 Coach

Figure 110 shows the comparison of the fiscal burden for coaches on the twenty corridors.

Figure 110 Fiscal burden for coaches on the twenty corridors



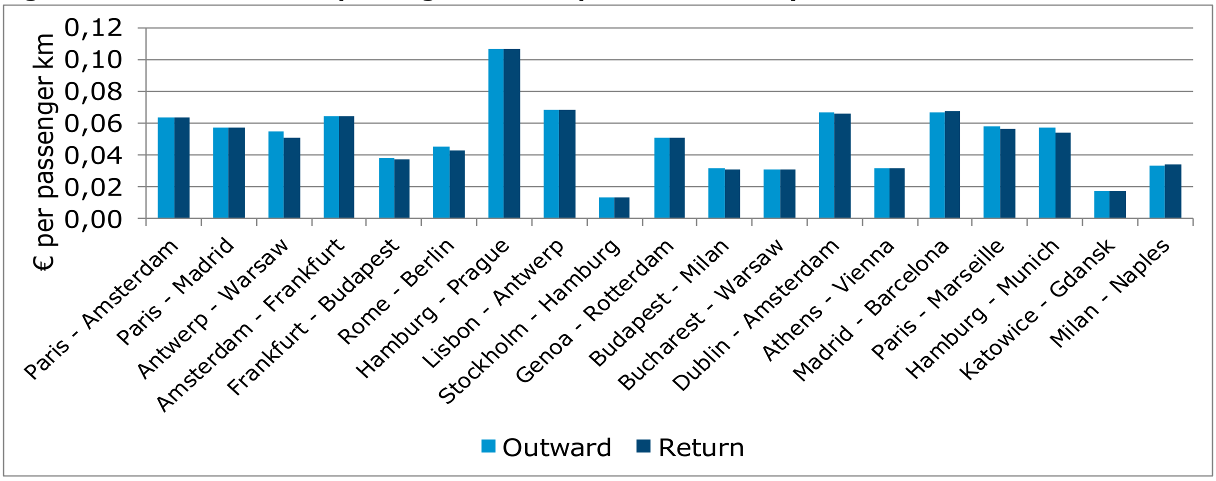
As already discussed in Chapter 4, the fiscal burden for coach transport is relatively low, ranging from 0.4 to 1.4 €ct per passenger kilometre. The fiscal burden mainly consists of fuel taxes, distance-based road charges and VAT on coach tickets. As Germany is the only European country that does not apply reduced VAT levels for coach transport, the VAT and hence the total fiscal burden is relatively high on corridors covering Germany (e.g. Hamburg – Munich and Amsterdam – Frankfurt). High French distance-based road charges explain the relatively high fiscal burdens for coaches on the corridors Paris – Madrid, Lisbon – Antwerp and Paris – Marseille. The high fiscal burden on the corridor Stockholm – Hamburg can be explained by the toll for the Oresund bridge and the relatively high fuel taxes in Sweden and Denmark.

Differences in fiscal burden between outward and return trips (e.g. for the corridor Amsterdam – Frankfurt or Hamburg – Munich) are mainly explained by differences in ticket prices for both trips, resulting in different VAT figures.

5.2.3 Rail transport

Figure 111 shows the comparison of fiscal burden of passenger rail transport on the twenty European corridors.

Figure 111 Fiscal burden of passenger rail transport on the twenty corridors



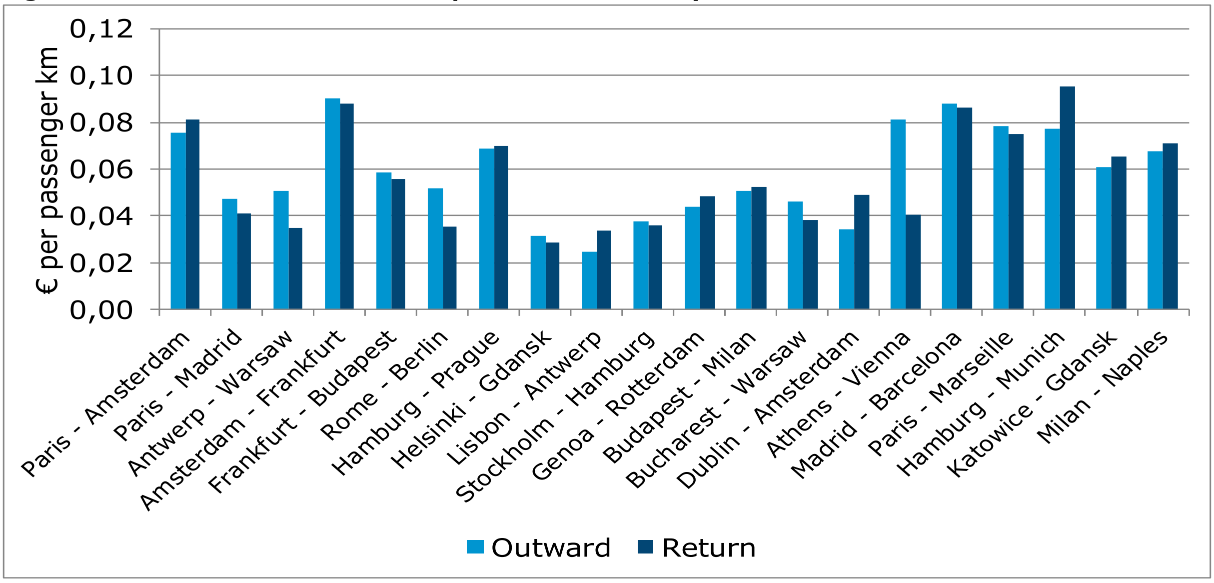
In general, the fiscal burden for rail transport ranges from 3 to 6 €ct per passenger kilometre. However, there are a few exceptions. First, on the corridor Hamburg – Prague the fiscal burden is about 10 €ct per passenger kilometre. On this corridor, a regular intercity train is assumed, which transports a lower number of passengers than high speed trains used on most of the other corridors, resulting in higher tax/charge figures per passenger kilometre. Furthermore, in Germany relatively high infrastructure charges and electricity taxes (no reduction for rail transport) are applied. On the corridors Stockholm – Hamburg and Katowice – Gdansk, on the other hand, relatively low fiscal burdens are estimated for rail transport, which is mainly due to relatively low infrastructure charges in Poland, Sweden and Denmark. Furthermore, on the corridor Stockholm – Hamburg electricity taxes are low, as rail transport is fully exempted from electricity taxes in both Sweden and Denmark.

The relatively small differences in fiscal burdens between outward and return trips on some of the corridors are fully explained by differences in ticket prices for the trips, resulting in different VAT figures.

5.2.4 Aviation

A comparison of the fiscal burden of small airplanes on the various corridors is provided by Figure 112.

Figure 112 Fiscal burden for small airplanes on the twenty corridors



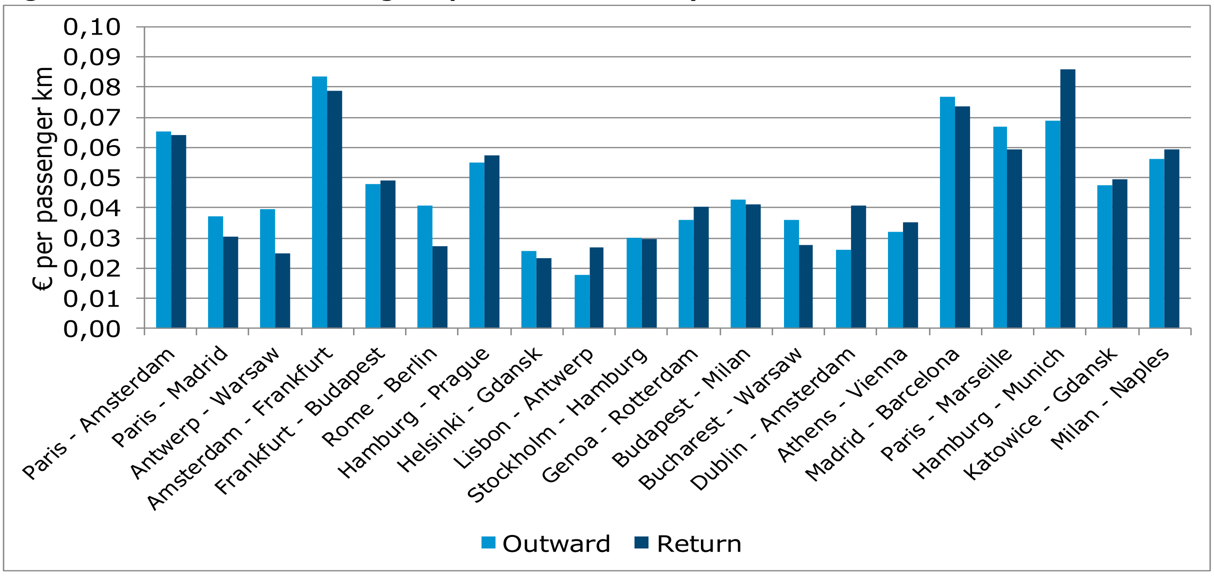
On the international corridors, the fiscal burden is mainly between 0.02 and 0.05 €ct per passenger kilometre. However, there are three exceptions: Paris – Amsterdam, Amsterdam – Frankfurt and Hamburg – Prague. These are the three international corridors with the shortest flight distances, resulting in relatively high fiscal burdens per passenger kilometre. Also on national corridors, fiscal burdens are, on average, higher than on international corridors. The main explanation for this finding is that aviation on national corridors is not exempted from VAT, while on international corridors it is. Furthermore, flight distances on national corridors are, on average, shorter than on international corridors.

For some of the corridors significant differences exist in the fiscal burden for outward and return trips. This is, for example, the case for Antwerp – Warsaw, Dublin –

Amsterdam and Hamburg – Munich. The reason for these differences is the charges levied on departing passengers at the airports of origin.

A comparison of fiscal burdens for large airplanes is given in Figure 113.

Figure 113 Fiscal burden for large airplanes on the twenty corridors



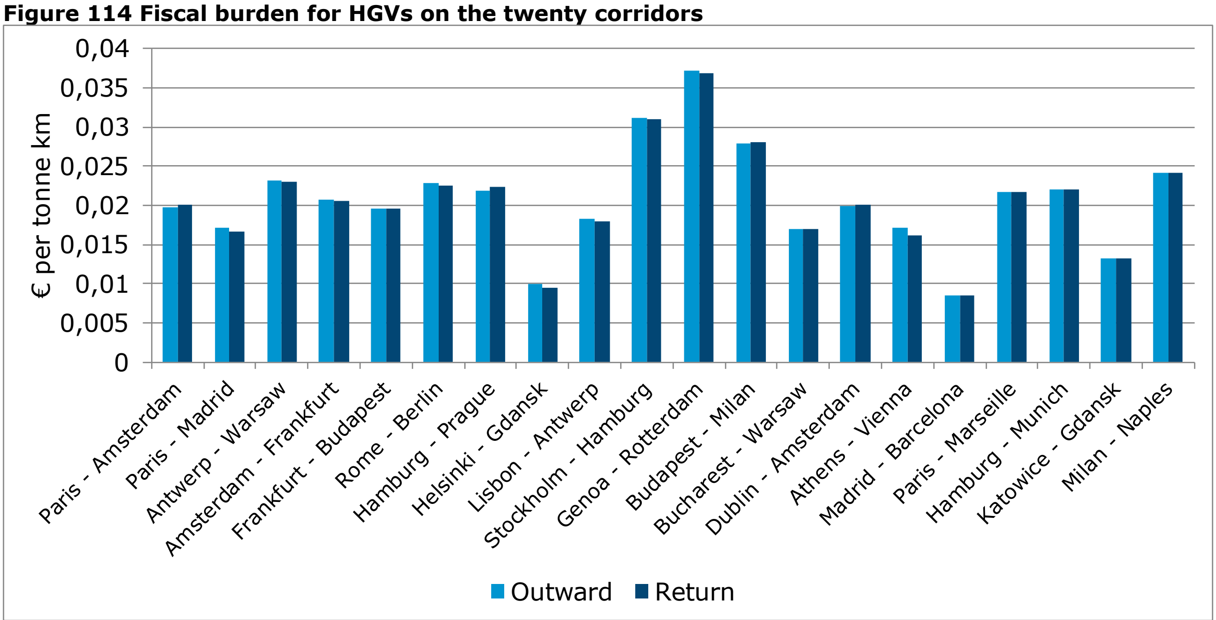
In general, the fiscal burden for large airplanes is lower than for the small reference aircraft, particularly because LTO/landing, ground-handling and navigation charges are divided over a larger number of passengers (and the higher charge levels for larger airplanes do not compensate for that). Furthermore, the same conclusions as for the small airplanes can be drawn.

5.3 Freight transport

5.3.1 HGV

A comparison of the fiscal burden for HGVs on the various corridors is shown in Figure 114.

Figure 114 Fiscal burden for HGVs on the twenty corridors

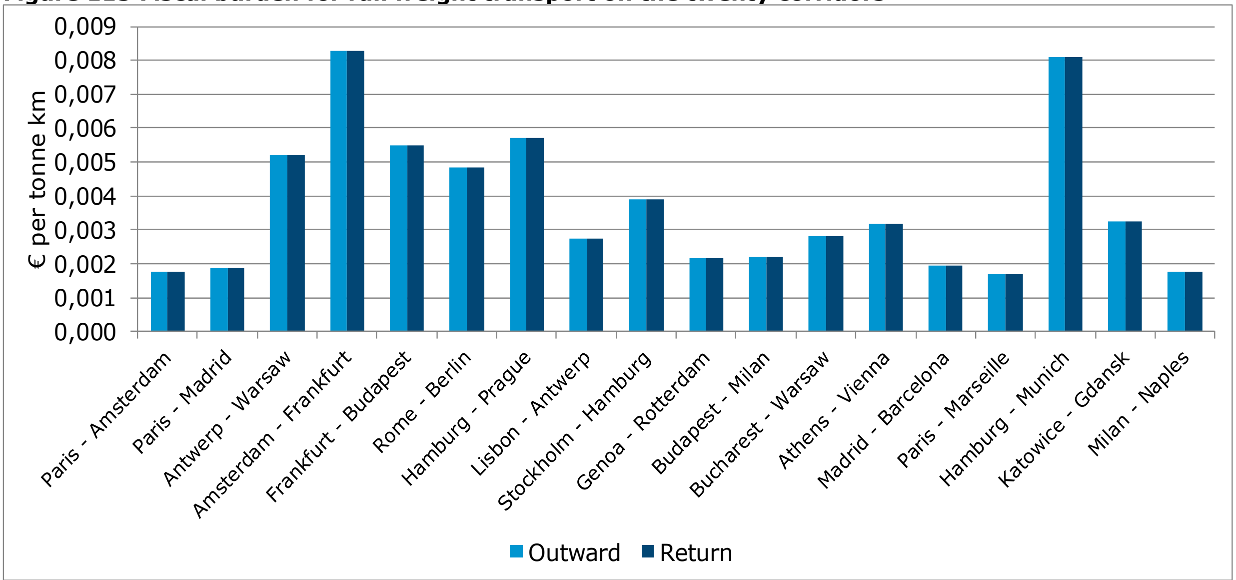


In general, the fiscal burden for HGVs is in the range of 1.5 to 2 €ct per tonne-kilometre. There are, however, some exceptions. On the corridor Genoa – Rotterdam the fiscal burden for HGVs lies significantly above average, which is mainly due to the high distance-based road charges in Switzerland. The high fiscal burden on the corridor Stockholm – Hamburg is mainly explained by the high toll for the Oresund bridge, while on the corridor Budapest – Milan high (distance-based) road charges are levied in Hungary and Slovenia. On the other hand, the fiscal burdens on the corridors Helsinki – Gdansk and Madrid – Barcelona are relatively low, as distance-based charges are only scarcely applied (Helsinki – Gdansk) or avoided (Madrid – Barcelona[42]). Finally, the differences in fiscal burden between outward and return trips are very low, which is due to the fact that vehicle taxes for HGVs are low in all European countries.

5.3.2 Rail transport

Figure 115 provides a comparison of the fiscal burden for freight rail transport on the twenty European corridors. The results in this figure can be mainly explained by the high electricity tax for rail transport in Germany, resulting in high fiscal burden on all corridors covering Germany. On these corridors the fiscal burden is in the range of 0.4 to 0.8 €ct per tonne-kilometre. On the other corridors, the fiscal burden ranges from 0.2 to 0.3 €ct per tonne-kilometre.

Figure 115 Fiscal burden for rail freight transport on the twenty corridors

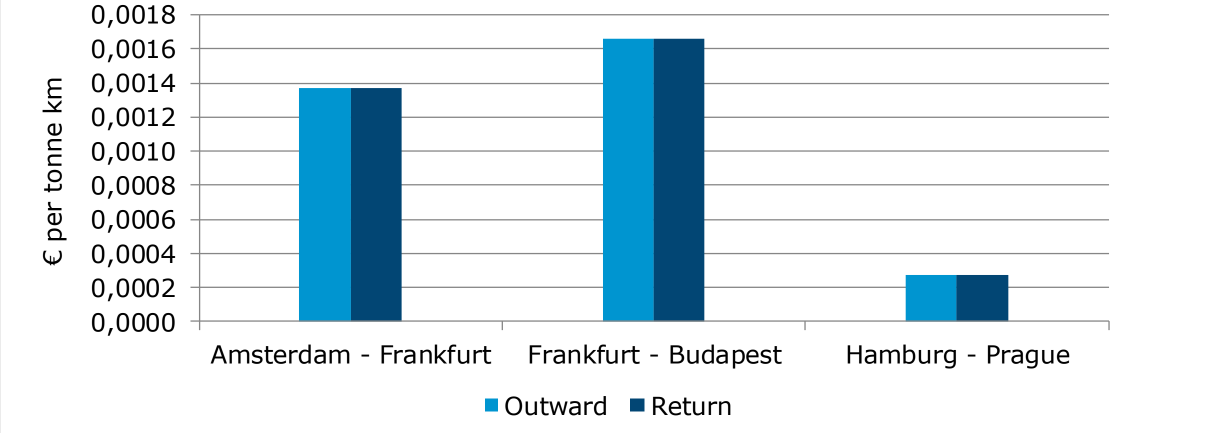


5.3.3 Inland navigation

A comparison of the fiscal burden for IWT on the European corridors is provided by Figure 116.

[42] For road transport, no infrastructure charges are assumed on this corridor, although distance-based road charges are applied on the motorway between Zaragoza and Barcelona. However, as explained in Annex C, it is assumed that road users avoid this toll road as the financial savings outweigh the (limited) time losses.

Figure 116 Fiscal burden for IWT on the twenty corridors

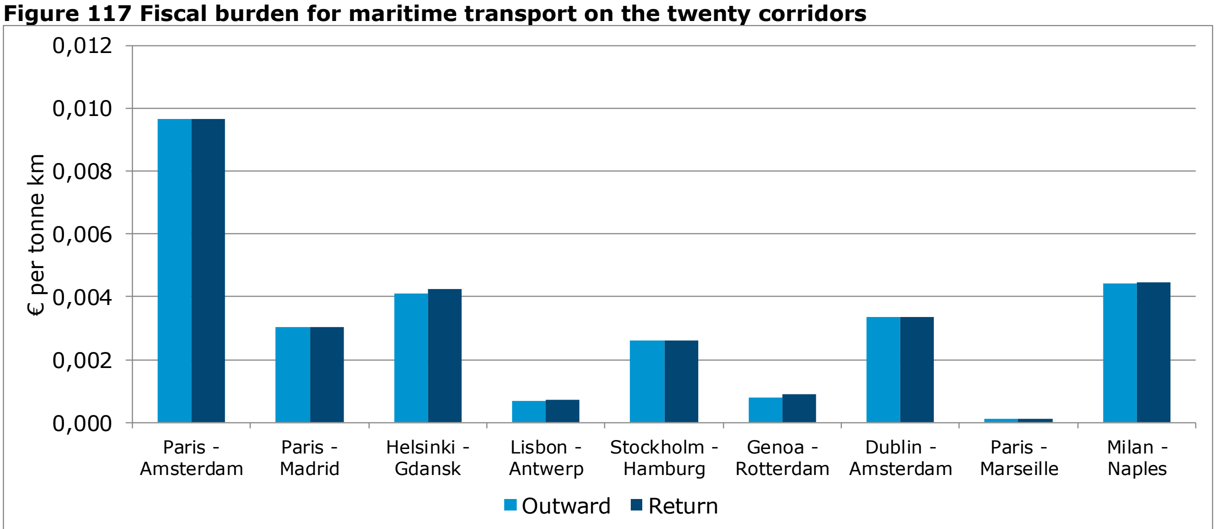


The fiscal burden on the corridors Amsterdam – Frankfurt and Frankfurt – Budapest are in the same range (about 0.14 to 0.16 €ct per tonne-kilometre). On both corridors port charges and fairway dues are applied. On the corridor Hamburg – Prague, the fiscal burden mainly consists of (relatively low) port charges in Hamburg, resulting in a low fiscal burden on this corridor. Most port charges are levied for the duration of the stay in the port. Therefore the charges of one port are divided over the outward and return route, resulting in similar fiscal burdens for outward and return routes.

5.3.4 Maritime transport

Figure 117 provides an overview of the fiscal burdens of maritime transport on the various European corridors. On average, the fiscal burden lies in the range of 0.2 to 0.4 €ct per tonne-kilometre. However, there are some exceptions. First, the fiscal burden on the corridor Paris – Amsterdam is considerably higher (almost 1 €ct per tonne-kilometre), mainly due to the high fixed piloting charges that are levied on the small reference ship in Amsterdam. On the other hand, the fiscal burden on the corridors Lisbon – Antwerp and Genoa – Rotterdam are relatively low, which is due to the long distances between the ports on these corridors (resulting in lower fiscal burden per tonne-kilometre). Finally, the fiscal burden for the corridor Paris – Marseille is underestimated, as no information was available on the level of piloting charges in Paris and Marseille.

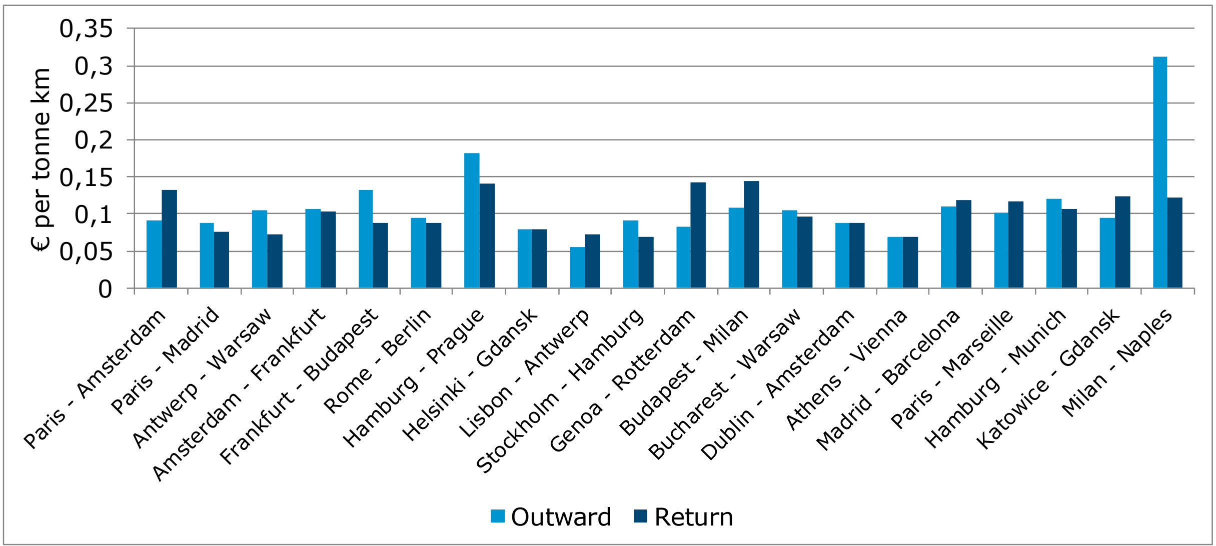
Figure 117 Fiscal burden for maritime transport on the twenty corridors



5.3.5 *Aviation*

A comparison of the fiscal burden of cargo airplanes on the various European corridors is provided by Figure 118. The fiscal burden differs widely over the corridors, reflecting the differences in airport charges for cargo aviation. Particularly on the corridor Milan – Naples the fiscal burden is very high (in case Milan is the origin), which is due to the very high unloading charge applied in Naples.

Figure 118 Fiscal burden for cargo airplanes on the twenty corridors



6 CONCLUSIONS

6.1 Previous findings on external costs

Previous studies on external costs have shown that in 2008, apart from motorcycles, the external costs per passenger-kilometre were highest for cars and aviation (on average about 6 €ct), while for coaches they were about 3 €ct and for rail transport about 1.5 €ct. It should be noted that these figures do not cover infrastructure costs. They are included here to provide some context for the tax burden values discussed below.

Also for freight transport, road transport shows considerably higher external costs (on average more than 5 €ct per tonne-kilometre in 2008), more than four times higher than those of rail and inland waterways freight transport.

6.2 Passenger transport

In general, the transport means that generate the highest external cost, also show the highest tax burden[43], although for passenger transport the results show a relatively high variation within a given mode. For example, highest charges apply to passenger car users on most of the twenty European corridors considered in this study. Per passenger-kilometre, the fiscal burden for the reference vehicles ranges from 3 €ct to 10 €ct. The burden is highest on corridors where distance-based road charges or tolls for specific parts of the network (bridges, tunnels) are applied. Next to these charges, fuel taxes and VAT contribute significantly to the burden on all corridors. Vehicle taxes (e.g. ownership tax, registration tax) play a less important role on most of the corridors, although there are some exceptions (e.g. corridors originating from the Netherlands and Greece, as in these countries high levels of ownership and/or registration taxes are levied on passenger cars).

As airplanes are mainly charged with fixed fees (e.g. landing and taking off charges, passenger charges) whose level is independent of the trip length, the fiscal burden for this transport mean is significantly higher for medium-distance trips than for long-distance trips. On medium-distance corridors (e.g. Paris – Amsterdam, Amsterdam – Frankfurt and Hamburg – Prague) the fiscal burden may be up to 9 €ct per passenger-kilometre (being even higher than for passenger cars on those corridors), while on long-distance corridors (e.g. Lisbon – Antwerp) it may be as low as 2 €ct per passenger-kilometre. In general, the burden on aviation is higher on national corridors than on international ones, as domestic flights are not exempted from VAT (as do international flights).

The fiscal burden for rail transport is generally in the range of 1 €ct to 7 €ct per passenger-kilometre. On most corridors this burden consist mainly of infrastructure charges and (to less extent) VAT. However, on the corridors covering Germany (and Austria) electricity taxes are relevant as well.

43 With the exception of coaches, which are subject to a low level of tax burden while their external costs are higher than for instance rail.

Finally, the fiscal burden for coach transport is significantly lower as for the other passenger transport means (in the range of 0.5 €ct to 1 €ct per passenger-kilometre), reflecting the relatively low tax/charge levels applied for these vehicles in comparison to the external costs related to this transport mode. Corridors covering countries with relatively high VAT levels on coach transport (Germany) or distance-based road charges (e.g. France) provide the highest fiscal burdens for coach transport.

To convert all taxes and charges into distance-based concepts (such that they can be allocated to the trips on the corridors) several assumptions had to be made (e.g. on annual mileage and economic lifetime of the reference vehicles). These assumptions significantly affect the share of fixed taxes/charges that are allocated to the trips on the corridors. In addition, the fiscal burden per passenger or tonne-kilometre depends significantly on the average number of passengers or loads assumed for the reference vehicles. For vehicles with a higher or lower occupancy rate or load factor than average, average costs can deviate strongly from the values presented.

When expressed in € per vehicle-kilometre, the picture is rather different. Large and heavy transport means have much higher tax burden than smaller ones.

This highlights the challenges with finding a suitable common denominator across modes, which stems from the fact that different vehicles have very different capacities. Using passenger-kilometres and tonne-kilometres seems straightforward, but they naturally show a lower per unit burden for vehicles with large capacity as opposed to ones with small capacity. In contrast, expressing taxation per vehicle-kilometre shows high burden for large vehicles. This makes comparison across modes challenging and illustrates that it is not appropriate to compare only taxation across modes. For a proper comparison, taxes and charges per passenger-kilometres and tonne-kilometres should be compared to external costs within modes. The different modes can then be compared as to how much they fulfil the 'user-pays and polluter-pays principles', and this is what the EU policy framework calls for.

6.3 Container/bulk transport

Like for passenger transport, also for freight transport the modes that generate the highest external cost (road and aviation) face the highest tax burden, while rail and transport waterborne modes display lower external costs and pay generally less taxes. However, this does not imply that the tax levels reflect well the external and infrastructure costs. For that, as is the case of passenger transport, a more in depth study on both external costs, and taxes and charges would be needed.

For container and bulk freight transport, the fiscal burden on road transport (heavy goods vehicles - HGVs) is considerably higher than for rail or shipping transport on all corridors. The burden for HGVs is in the range of 1 to 3.5 €ct per tonne-kilometre, while for rail freight transport it ranges from 0.2 to 0.8 €ct. For inland shipping and maritime shipping the fiscal burdens are in the order of 0.1 – 0.2 and 0.1 – 0.4 €ct per tonne-kilometre, respectively.

For all freight transport modes, infrastructure charges (e.g. road charges, rail access charges, port charges) are very relevant and hence significantly affect the differences in fiscal burden between corridors. For example, a relatively high fiscal burden exists for HGVs on the corridor Genoa – Rotterdam, mainly due to the road charges applied on the Swiss part of this corridor. For road and rail transport, energy taxes also significantly contribute to the overall fiscal burden. For rail, this is mainly the case for corridors covering Germany and/or Austria, as those countries levy higher electricity taxes on rail transport.

On all corridors, the fiscal burden of cargo airplanes largely exceeds the burden for other freight transport modes. However, it should be noted that aviation only competes on specific sub-segments of the general cargo freight market (e.g. flowers, high valuable consumer goods), on which only HGVs are active as well (but probably with different average loads relative to those assumed in this study). This complicates the direct comparison of aviation and other freight transport modes in terms of fiscal burden.

Like for passenger transport, when expressed in € per vehicle-kilometre the picture is rather different. Large and heavy transport means have much higher tax burden than smaller ones.

6.4 Benchmarking fiscal burden on total internal costs

For each of the corridors, the fiscal burden of the various transport modes is benchmarked on the total internal transport costs (i.e. including taxes and charges). Although the share of taxes and charges in the total internal costs differ widely between corridors, some rough ranges can be defined for each transport mode (see Table 84).

Table 84 Rough indication of the share of taxes/charges in the total internal costs

Passenger transport means	Share of taxes/charges in total internal costs	Freight transport means	Share of taxes/charges in total internal costs
Passenger car	30% – 50%	**HGV**	15% - 30%
Coach	15% - 25%	**Freight train**	15% - 45%
Passenger train	30% - 70%	**IWT**	5% – 20%
Passenger airplane	40% - 70%	**Maritime transport**	10% - 50%
		Cargo airplane	30% - 50%

For passenger transport the share is lowest for coach transport, while the share is higher for rail and aviation. For freight transport, the share is lowest for inland waterway transport and highest for cargo aircraft. The shares do not give an indication about the level of taxes and charges as the percentages are also affected by the level of internal costs, which varies significantly between transport means. Moreover, the shares do not provide indications about the cost coverage ratios; for this purpose, tax and charge levels should be compared to external costs, which are outside the scope of this study.

Table 85shows the total internal costs per passenger- or tonne-kilometre. Passenger cars have the highest total internal cost per passenger-kilometre. For the other transport means the internal costs are considerably lower because as collective transport means they make, in general, more efficient use of resources.

For freight transport internal costs are highest for road transport and cargo airplanes. Rail, inland waterway and maritime transport have lower internal costs per tonne-kilometre. Internal costs are influenced, among other things, by the load factors. Vehicles with higher load factors, for example trains and vessels in general have lower internal costs per tonne-kilometre.

Table 85 Average internal costs per passenger- or tonne-kilometre

Passenger transport means	Internal cost in € per pkm	Freight transport means	Internal cost in € per tkm (container/bulk)
Passenger car (small/large)	0.13/0.15	**HGV**	0.08/0.12
Coach	0.04	**Freight train electric**	0.02/0.009
High speed train	0.04	**Freight train diesel**	0.02/0.012
Regular train (electric/diesel)	0.10/0.20	**Inland waterways small**	0.009/0.009
Passenger airplane (small/large)	0.06/0.03	**Inland waterways large**	0.011/0.010
		River sea vessel	0.010/0.09
		Short sea vessel	0.003/0.003
		Cargo airplane (general cargo)	0.12

6.5 The role of other factors

Furthermore, it is also important to note that transport decisions of users are also affected by factors like the internal costs, average transport times, reliability and flexibility of transport modes and for passengers also comfort and social aspects (such as changing mobility patterns, attitude towards car ownership including social status, etc.). All these factors can be partly seen as intrinsic characteristics of the transport modes, but they depend on some other factors as well. The most prominent of these factors are the availability and quality of transport infrastructure, differences in regulation (e.g. environmental regulation, operational regulation) and broader transport subsidy schemes (e.g. rail public service obligations, subsidies for rolling stock).

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ANNEX A: DETAILED INFORMATION REFERENCE VEHICLES

A.1 Passenger transport

In this section we discuss the technical and operational characteristics of the passenger transport reference vehicles.

Passenger cars

Different types of passenger cars are used for trips on the selected corridors. In order to provide some insight on the impact of the type of passenger car on the tax burden experienced, we will consider two different types of cars, based on engine size (small: <1600cc and large>=1600cc).

The large passenger car will be a Euro 6 diesel fuelled vehicle with an engine size above 1600cc - with the highest sales in 2015 in Europe (Volkswagen Passat). The small passenger car will be a petrol fuelled car with an engine size below 1600cc, from a different brand than the large passenger car - with the highest sales in 2013 in the EU (FIAT 500).

An overview of the technical and operational characteristics of both passenger cars is given in Table 86.

Table 86 Technical and operational characteristics of the reference passenger cars

Characteristics	Large passenger car	Small passenger car	Sources
Brand / model	 Volkswagen Passat	 Fiat 500	
Fuel type	Diesel	Petrol	Assumption
Engine size (cc)	1968	1242	EEA (2016a)
Engine power (kW)	110	51	EEA (2016a)
Euro class	Euro 6	Euro 5	Assumption
CO_2 emissions (g/km)	119	119	EEA (2016a)
Fuel consumption (l / 100km)	4.5	5.11	EEA (2016a)
Occupancy rate (persons/car)	2	2	EEA (2016b)
Number of seats	5	5	EEA (2016a)
Annual mileage (km)	18,800	8,800	Emisia et al. (2013)
Lifetime mileage (km)	335,000	155,000	Lifetime mileage is estimated by multiplying annual mileage by 15 (average economic lifetime)
Weight (kg)	1451	940	EEA (2016a)
Maximum allowable weight (tonne)	3.5	3.5	European Commission (2001)

Bus/coach

As the selected routes are all over 500 km in distance, we will assume that only long distances coaches are used. The main technical and operational characteristics of this bus are shown Table 87.

Table 87 Technical and operational characteristics of the reference bus

Characteristics	Bus/coach	Sources
Type of bus	 Long distance coach	
Fuel type	Diesel	Assumption
Engine size (cc)	10,677	Assumption
Engine power (kW)	315	Assumption
Euro class	Euro 6	Assumption
Fuel consumption (l/100 km)	25	TML (2016)
Occupancy rate (persons/vehicle)	30	Steer Davies Gleave (2009)
Operational life (years)	14	TML (2016)
Annual mileage	57,900	Emisia et al. (2013)
Lifetime mileage	810,600	Lifetime mileage is estimated by multiplying annual mileage by 14 (average economic lifetime).
Axles	3	Assumption
Number of seats	50	Assumption
Weight (kg)	13,500	Assumption

As for the occupancy rate of busses, different values are presented by Emisia et al. (2013) and Steer Davies Gleave (2009). The former study presents a EU28 average of 19.6 passengers per vehicle, while the latter study presents a higher estimate (about 30 passengers per vehicle). This number was generally confirmed in a 2016 update of the study, albeit only through case studies (Steer Davies Gleave, 2016). As we are considering long-distance transport by coach, which often shows an above average occupancy rate, we used the figures from Steer Davies Gleave in this study.

High speed train

In the various EU Member States different types of high speed trains are used. For this study we have composed an 'average' high speed train, for which the technical and operational characteristics are presented in Table 88.

Table 88 Technical and operational characteristics of the reference high speed train

Characteristics	High speed train	Sources
Energy consumption (kWh / 100 km)	36.3	TML (2016)
Seat capacity	440	Estimated average seat capacity of European high speed trains.
Occupancy rate (%)	70	Estimate by researchers based on several sources, see text below the table.
Number of passengers per train	280	Calculated based on the information in the two rows above.
Operational life (years)	30	TML (2016)
Annual mileage (km)	425.000	Estimated average annual mileage of European high speed trains
Lifetime mileage (km)	12,750,000	Lifetime mileage is estimated by multiplying annual mileage by 30 (average economic lifetime).
Weight (ton)	380	SNCF
Maximum axle weight (ton)	17.7	UIC
Maximum speed (km/h)	300	SNCF
Length (m)	200	UIC

With respect to the seat capacity and the annual mileage, we have made use of figures of Rus et al. (2009) on the different types of high speed trains in France, Germany, Italy and Spain (see Table 89). For both parameters we have calculated the unweighted average of the values for the different types of trains and used those figures for the EU 'average' high speed train.

Table 89 Parameters for different types of high speed trains

Country	Type of train	Seat capacity	Average annual mileage
France	TGV Réseau	377	495,000
	TGV Duplex	510	525,000
	Thalys	377	445,000
Germany	ICE-1	627	500,000
	ICE-2	368	400,000
	ICE-3	415	420,000
	ICE 3 Polyc.	404	420,000
	ICE-T	357	360,000
Italy	ETR 500	590	360,000
	ETR 480	480	288,000
Spain	AVE	329	470,000
EU average		**440**	**425,000**

Source: Rus et al. (2009)

As for the occupancy rates of high speed rail, several figures were found in the literature. UIC (2013) present an occupancy rate of 73.8% for the Thalys, while Ortega (2013) finds an average occupancy rate for Spanish high speed trains of 74.3% in 2013. The EEA (2016b) quotes an 80% occupancy rate for the TGV Paris – Lyon, but only 50% for German ICE trains. Finally, Doomernik (2014) and Dinu (2016) present EU average occupancy rates of 57% and maximum 70%, respectively. Based on this evidence, we used a 70% occupancy rate for all high speed trains.

Regular passenger train

Although high speed trains are on many corridors the preferred rail option, conventional intercity passenger trains are used on some of the corridors as well. While the energy source (diesel or electricity) is relevant to determine the applicable taxes and charges, the choice generally is not based on a user or operator preference but on the suitability of the infrastructure (i.e. whether the network is electrified or not). As such, we will assume that all operational parameters (capacity, occupancy rate) are identical for both propulsion types. Technical parameters do, off course, differ between both types of trains.

A complete overview of the technical and operational characteristics of regular passenger trains is given in Table 90.

Table 90 Technical and operational characteristics reference intercity passenger trains

Characteristics	Electric passenger train	Diesel passenger train	Sources
Type of train	Passenger intercity	Passenger intercity	
Energy type	Electricity	Diesel	
Energy consumption	19.9 kWh / 100 km	2601 l/100 km	TML (2016)
Seat capacity	320	320	Eurostat (2017) presents figures for a selected number of countries. Based on these figures, the researchers estimated an EU average value.

Characteristics	Electric passenger train	Diesel passenger train	Sources
Number of passenger per train	85	85	Same approach as for seat capacity.
Operational life (years)	30	25	TML (2016)
Annual mileage (km)	107,900	45,250	TML (2016)
Lifetime mileage (km)	3,237,000	1,131,250	Calculated based on information in the two rows above.
Axle load (tonne)	21.5	21.5	Assumption
Maximum speed (km/h)	180	180	Assumption
Train length (metres	200[a]	200	Assumption
Train weight (tonne)	415[a]	415	Assumption

[a] A train with 7 wagons of 26 metres and 47 tonne is assumed. For the locomotive, a length of 18 metres and a weight of 86 tonnes are assumed.

Airplane

For aviation, we distinguish between two different airplanes: the Airbus A320-232 and the Embraer 170 STD. According to Eurostat statistics, the Airbus A320 was one of the most used airplanes for intra EU flights in 2015, while the Embraer 170 was one of the most often used regional airplanes in the EU in 2015 (Eurostat, 2017). Detailed technical and operational characteristics of both airplanes can be found in Table 91.

Table 91 Technical and operational characteristics of the reference passenger airplanes

Characteristics	International (medium distance) airplane	Regional airplane	Sources
Aircraft type	 Airbus A320-232	 Embraer 170 STD	
Engine type	V2527-A5	CF34-8E5	CE Delft et al. (2012)
Number of engines	2	2	CE Delft et al. (2012)
Fuel consumption	3.18 kg/km	2.11 kg/km	CE Delft et al. (2012)
CO_2 emissions	10kg/km	6.6kg/km	CE Delft et al. (2012)
MTOW (kg)	73,500	37,500	CE Delft et al. (2012)
Number of seats	179	70	CE Delft et al. (2012)
Passenger Load Factor	77.5%	77.5%	Based on average passenger load factor for European network airlines in 2011 (from AEA)
Number of passengers	139	54	Calculated based on the information in the two rows above.
Scheduled ground time (minutes)	120	120	Jetzky (2009)

Ferry

For some of the corridors, multimodal transport chains are considered including the ferry. As we do not consider cruise ships as part of this exercise, vessels in the context of the present study are generally of the RoPax type (accommodating for both rolling cargo, i.e. heavy duty freight vehicles, and passengers). Given the nature of the corridors on which a ferry is used (Dublin – Amsterdam, Helsinki – Gdansk, Stockholm – Hamburg), we assume that a relatively large ferry is used. The technical and operational characteristics of these vessels are presented in Table 92.

Table 92 Technical and operational characteristics of the reference ferry

Characteristics	Ferry	Sources
Type of vessel	RoPax	
Fuel consumption (ton HFO / km)	0.312	Delhaye et al. (2010)
Dead weight tonnage (tons)	12,000	Delhaye et al. (2010)
Length (m)	180	Assumption
Full Cargo weight	7,250	Delhaye et al. (2010)
Size (number of trailers)	290	Delhaye et al. (2010)
Number of passengers per vessel	1,000	Delhaye et al. (2010)
Operational life (years)	50	Delhaye et al. (2010)
Annual mileage (km)	62,350	Delhaye et al. (2010)
Lifetime mileage (km)	3,117,500	Delhaye et al. (2010)

A.2 Freight transport

In this section we discuss the technical and operational characteristics of the freight transport reference vehicles.

Heavy goods vehicle (HGV)

Given the distance of the itineraries on the various corridors, it seems unlikely that small HGVs would represent a significant share of the road freight market. Therefore, we only consider large HGVs. The reference vehicle selected for these long haul trips is a truck with a maximum permissible laden weight of 40 tonnes. Technical and operational characteristics of this HGV are shown in Table 93. For some of these characteristics (e.g. capacity, load factor and actual cargo weight) a differentiation between a bulk and container truck is made.

Table 93 Technical and operational characteristics of the reference HGV

Characteristics	HGV	Sources
Fuel type	Diesel	
Engine size (cc)	6000	Assumption
Engine power (kW / HP)	298 / 400	Assumption
Euro class	6	Assumption
Fuel consumption (l / 100km)	32.5	TML (2015)
Axle configuration	2 (truck) + 3 (semi-trailer)	Assumption
Presence of air suspension	Yes	Assumption
Load capacity bulk truck (tonne)	25.3	CE Delft (2016b)
Load capacity container truck (TEU)	40 ft container (2 TEU)	CE Delft (2016b)
Loading factor bulk truck[a]	48%	CE Delft (2016b)
Loading factor container truck	70%	CE Delft (2016b)
Actual bulk cargo weight (tonne)	12	Calculation based on capacity and loading factor
Actual container cargo weight (tonne/TEU)	13.3 / 1.4 TEU average	An average weight per 2 TEU container of 19 tonne is assumed (CE Delft, 2016). Combined with the loading factor presented above the actual container cargo weight is estimated.
Annual mileage (km)	103,000	Emisia et al. (2013)
Lifetime mileage (km)	1.5 million	Emisia et al. (2013)

Characteristics	HGV	Sources
Weight (kg)	15,000	Assumption
Maximum weight/axle load	40t. Driving axle 11.5 t, non-driving axle 10 t	Based on European Commission (2001)
Dead weight trailer (kg)	6,500	Based on European Commission (2001)
Maximum weight trailer (kg)	24 ton	Based on European Commission (2001)

[a] This is the average loading factor, taking into account the kilometres a truck is driving empty.

Freight train

Freight trains can be split by the origin of their cargo: directly from a single shipper (full train load), directly from several shippers (single wagon load) or as part of a combined transport operation. The relevant application will partly depend on the commodity type (i.e. general cargo, bulk, container) selected for each corridor. As a general rule, we propose to use full train load operation as default.

As for passenger transport, the propulsion type (electric or diesel) of the freight train selected for each route will depend on the characteristics of that route. However, we assume that the propulsion type will not affect the operational characteristics of the train, but only the technical ones. Both types of characteristics are presented in Table 94.

Table 94 Technical and operational characteristics of the reference freight trains

Characteristics	Electric freight train	Diesel freight train	Sources
Energy type	Electricity	Diesel	
Energy consumption Bulk train	38.360 kWh/100km	880.5 l/100km	TML (2016)
Energy consumption container train	25.586 kWh/100km	580l /100 km	Based on CE Delft, 2016)
Train length (metres)	600	600	TML (2016)
Axle load (tonne)	21.5	21.5	Calculated based on train weight and number of axles.
Number of wagons	30	30	TML (2016)
Capacity bulk train (tonne)	2500	2500	CE Delft (2016b)
Capacity container train (TEU)	90	90	TML (2016)/CE Delft (2016b)
Loading factor container train	70%	70%	CE Delft (2016b)
Loading factor bulk train[a]	50%	50%	CE Delft (2016b)
Actual weight container train (tonne/TEU)	685 /72	685 /72	An average weight of 19 tonne per 2 TEU container is assumed (CE Delft). Combined with the loading factor and capacity of the train, the actual weight of the train can be calculated.
Total weight container train (tonne)	1,370	1,370	Calculation based on CE Delft (2016b)
Actual bulk weight (tonne)	1,250	1,250	Calculation based capacity and loading factor
Total bulk train weight (tonne)	2,035	2,035	Calculation based on CE Delft (2016b)
Operational life (years)	30	25	TML (2016)
Annual mileage (km)	400,000	400,000	TML (2016)
Lifetime mileage (km)	12,000,000	10,000,000	Calculated based on information in the two rows above.

Characteristics	Electric freight train	Diesel freight train	Sources
Maximum speed (km/h)	150	150	Assumption

[a] This is the average loading factor, taking into account the kilometres a train is driving empty.

Inland ship

The type of inland ship that can be used depends heavily on the configuration of the waterways that are part of the route (CEMT class). For two out of the three corridors that cover inland shipping in this study (Amsterdam – Frankfurt and Frankfurt – Budapest), a CEMT Va ship is the largest ship that can be used. On the third corridor (Hamburg – Prague) a smaller CEMT IV ship has be used. The technical and operational characteristics of these ships are given in Table 95.

Table 95 Technical and operational characteristics of the reference inland ships

Characteristics	Large inland ship	Small inland ship	Sources
Ship type	CEMT Va	CEMT IV	
Energy type	Diesel	Diesel	
Energy consumption (kg/100 km)	1,109	607	EMMOSS
Length (m)	110	85	RWS (2011)
Breadth (m)	11.40	9.50	RWS (2011)
Load capacity bulk vessel[a]	3,000	1,500	CE Delft (2016b)
Load capacity container vessel (ton / TEU)	1,980 / 208	915 / 96	CE Delft (2016b)
Loading factor bulk vessel	56%	56%	CE Delft (2016b)
Loading factor container vessel	75%	75%	CE Delft (2016b)
Cargo weight bulk (tonne)	1,680	840	Calculated based on capacity and loading factor
Cargo weight container (tonne/TEU)	1480/156	680/ 72	Calculated based on capacity and loading factor)
Actual draught (m) bulk/container vessels	4.6/4.1	2.8/2.6	CE Delft (2016b)
Operational lifetime	50	50	TML (2016)
Annual mileage (km)	25,200	32,667	TML (2016)
Lifetime mileage (km)	1,260,000	1,633,333	TML (2016)

[a] This is the average loading factor, taking into account the kilometres a vessel is sailing empty as well as the loading factor of a container itself.

Short sea vessel

As reference short sea vessel we consider a LoLo vessel (load-on / load-off), that is used over medium to longer distances for freight transport (it should be noted that deep sea ships can be considerably larger). The technical and operational characteristics for this vessel can be found in Table 96. For some of the corridors river sea vessels are used, which are capable of sailing on both coastal and inland waters. This vessel is defined as small short sea vessel. As for the transport of HGVs on multimodal chains, we assume that RoPax vessels are used on the relevant corridors (see section A.1 for a description of the reference RoPax vessel used in this study).

Table 96 Technical and operational characteristics of the reference short sea vessel

Characteristics	Small short sea vessel	Large short sea vessel	Sources
Type of ship	River Sea vessel	LoLo vessel	
Fuel consumption (ton HFO / km)	0.0083 t/ km	0.163	Delhaye et al. (2010)
Sludge production	2% of fuel consumption	2% of fuel consumption	CE Delft (2017)
Length (m)	88	140	Shortsea centre Holland (2016), Delhaye et al. (2010)
Breadth (m)	13	23	Shortsea centre Holland (2016), Delhaye et al. (2010)
Dead weight tonnage	3.700	11,000	Shortsea centre Holland (2016), Delhaye et al. (2010)
Load capacity bulk vessel (ton)	3,000	7,200	Shortsea centre Holland (2016), Delhaye et al. (2010)
Load capacity container vessel (tonne/TEU)	1,980/208	5700 / 600	Shortsea centre Holland (2016), Delhaye et al. (2010)
Loading factor bulk vessel[a]	81%	81%	CE Delft (2016b)
Loading factor container vessel	67,5%	67,5%	CE Delft (2016b)
Bulk weight (tonne)	2010	4824	Calculated based on capacity and loading factor)
Container weight/TEU (tonne)	1600 /168	4620 /486	Calculated based on capacity and loading factor)
Operational life (years)	50	50	Delhaye et al. (2010)
Annual mileage (km)	25,200	56,800	Delhaye et al. (2010)
Lifetime mileage (km)	1,260,000	2,840,000	Delhaye et al. (2010)
Actual draught, bulk/container	4.7/4.5	7.6/7.5	Fleet monitoring
Gross Tonnage	2500	9980	Fleet monitoring
Netto Tonnage	1250	4500	Assumption

[a] This is the average loading factor, taking into account the kilometres a vessel is sailing empty as well as the loading factor of a container itself.

Cargo plane

As the reference cargo plane, the Boeing 757-200 is chosen, which is among the most commonly used cargo planes for short to medium distances. The technical and operational characteristics for this airplane are given in Table 97.

Table 97 Technical and operational characteristics of the reference cargo airplane

Characteristics	Cargo airplane	Sources
Aircraft type	 Boeing 757-200	
Engine type	Rolls Royce RB211-535C	CE Delft et al. (2012)
Number of engines	2	CE Delft et al. (2012)
Fuel consumption	5 kg/km	Own calculation based on Boeing website
CO_2 production	15.7 kg/km	
MTOW (kg)	115,600	Boeing website
Maximum cargo capacity (tonne)	33	Boeing website
Load factor	80%	TML (2016)
Actual amount of cargo (tonne)	26	Calculated based on information in the

Characteristics	Cargo airplane	Sources
		two rows above.

ANNEX B: METHODOLOGY TO DETERMINE ROUTES ON THE CORRIDORS

To determine the routes (including travel distances and travel times) of the various transport means on each corridor we have applied a three step approach:
1. Define origin and destination locations;
2. Determine the fastest routes between origin and destination location;
3. Determine the optimal routes by assessing whether alternative routes provide a more viable option.

In the remainder of this annex, we discuss these three steps in more detail.

1) Define origin and destination locations

The exact locations used as origin/destination of the corridors are presented in Table 98. For passenger transport, the main train station is used for road and rail transport, while for aviation the main airport is used[44]. With respect to road/rail freight transport, a main road/rail freight terminal is chosen as start/end. In order to get a uniform approach, a freight terminal located in the main ports (or if terminal locations do not have any port, near the main airport) is chosen. For inland and maritime transport the main port is chosen as origin/destination location, while for cargo planes the main airport is used.

Table 98 Origin / destination locations applied for the various transport means

Transport means	Origin / Destination location
Passenger transport	
Passenger car	Main train station
Bus	Main train station
Passenger train	Main train station
Passenger airplane	Main airport
Freight transport	
Heavy duty truck	Main road freight terminal (in the port or near the main airport)
Freight train	Main rail freight train terminal (in the port or near the main airport)
Inland ship	Main (inland) port
Maritime ship	Main (sea) port
Cargo airplane	Main airport

By choosing the origin/destination locations presented in Table 98, first-/last-mile transport is excluded from the assessments. This is in line with the scope of the study, as presented in Section 1.3.

2) Determine the fastest routes between origin and destination location

To determine the routes taken by the various transport means on the corridors, the fastest itineraries between origin and destination are determined by using route planners. As there was no single route planner available that provides reliable routes for all transport means, we have made use of several, transport mean specific route planners. These are presented in Table 99. For some of the transport means, the itineraries provided by the route planners are crosschecked with other route planners

[44] The origin/destination of aviation trips differs from those of the other modes, slightly affecting the comparisons of these modes in terms of internal costs and the burden of taxation. However, as we only consider long-distance trips these deviations will be minimal and hence will not affect the conclusions of this study.

(e.g. passenger rail transport). Furthermore, there have been discussions with the various European/national transport organisations (IRU, CER, EBU, and KVNR) in order to double check the routes. Based on these discussions, also some of the routes are excluded from this report, as they are considered as non-viable transport alternatives on a specific corridor (e.g. rail freight transport between Dublin and Amsterdam).

Table 99 Route planners used

Transport means	Route planner
Passenger car	Google Maps (Michelin route planner is used to estimate length of tolled road segments).
Bus	Google Maps (Michelin route planner is used to estimate length of tolled road segments)
Heavy duty truck	PTV Map & Guide
Passenger train	Google Map (verified by Rail Europe route planner)
Freight train	Eco Transit
Inland ship	Marine Voyager
Maritime ship	Marine Voyager
Passenger airplane	Google maps
Cargo airplane	Google maps (verified by OAG cargo flights)
Intermodal routes	Google maps, intermodalrouteplanner.com

For one of the corridors, Athens – Vienna, the fastest routes by road and rail pass through Macedonia and Serbia. As these are both no Schengen countries, border times (not included in the travel times provided by Google Maps) may be substantial on this route. Therefore, we have assessed an alternative route via Bulgaria and Romania in order to check whether this route is faster taking into account border times. However, as both Bulgaria and Romania are not Schengen countries as well, border times for these countries are substantial as well and therefore we found that this alternative route is not a more viable option. For more information, see Annex C.15.

For each of the routes determined, the travel distances (in kilometres) were presented by the route planners used as well. This was, however, not always the case for travel times. Travel times are defined as the time between the moment the vehicle is leaving the origin and it arrives at the final destination. This implies that the time required for transfers or transhipment are included in the travel time figures, as well as the time for (mandatory) rest-breaks and border times. In addition to the information available from the route planners the following assessments have been carried out:

- The route planners for passenger cars do not consider rest-breaks. Therefore, we have added 15 minutes to each two hours travel time presented by the route planners. With respect to border times, we have assumed that these are negligible for all border crossings between Schengen countries. For border crossings with non-Schengen countries (relevant for the corridors Dublin – Amsterdam and Athens – Vienna) additional assessments are carried out. See Annex C for more information.
- For bus transport, no total travel times were presented by the route planners used. However, for some of the corridors scheduled coach services are offered (e.g. by Flixbus) and hence for these corridors travel times can be found. Based on this information, the ratio of travel time by passenger car (including rest-breaks) and by coach was estimated. On average this ratio is 1.5, implying that the travel time of coaches (including rest-breaks) is 1.5 times longer than that of passenger cars. We have used this ratio to estimate the travel times of coaches on all corridors.
- For freight trains, a comparable, but slightly different approach as for coaches has been used to estimate the travel times, as these are not available from a route planner. For some of the corridors scheduled rail freight transport services are

available and for these services information on the travel times has been collected. Based on this information and information on the travel distances, the average speed of freight trains was estimated. Based on this figure, the travel times of freight trains on the different corridors were estimated.
- For maritime transport, no travel times were provided by the route planner (Marine Voyager) for small short sea vessels. For these vessels, the travel times were estimated by assuming an average speed of 18 km/h (Wijnne & Barends, 2017).

As indicated in Section 1.3.4, it is assumed that transport operations on the corridors start at the moment of embarking or loading the vehicle at the origin and end at the moment people leave the vehicle or cargo is unloaded at the destination. This implies that the total transport time includes the time of loading and unloading (or embarking and disembarking) in addition to travel times. Based on desk study, we have roughly estimated the EU average loading/unloading and (dis)embarking times for the various reference vehicles. The results of this assessment are shown in Section 2.3.2.

3) Determine the optimal routes

For road transport, distance-based and time-based road charges that are applied on some of the corridors may affect the route choice (and hence travel distances and times). Instead of choosing the fastest route, as was assumed in step 2, travellers may choose an alternative route which takes some more time but saves them paying (some) road tolls. In this third step we have checked for all corridors whether the fastest routes are also the optimal ones in case road charges are taken into account.

In the route planner used for road freight transport (i.e. PTV Map & Guide) road charges (and other economic costs such as fuel costs) are taken into account in calculating the preferred route. In other words, the route with the lowest economic costs (considering both direct costs, such as fuel costs and road charges, and the costs of travel time) are determined. In this so-called generalised travel cost approach, a trade-off is made between the cost of additional travel time by avoiding toll roads and the savings on road tolls by taking an alternative route.

For road passenger transport no route planner was available that provides the option to determine the route with the lowest generalised costs. Therefore, we have applied a generalised cost approach ourselves in order to check whether for some corridors avoiding (some) toll roads by road passenger transport may be a viable option. We have done this for passenger cars and assumed that coaches will take the same routes as passenger cars. For distance-based road charges this approach consisted of the following steps:

- Determine the corridors on which distance-based road tolls are applied. In total there are 13 corridors, listed in Table 101.
- For each of these corridors an alternative route is determined (by using Google Maps) where toll roads are completely avoided. For these routes the additional travel time and travel distance compared to the fastest route have been determined.
- Based on the recommended Value of Time (VoT) values in the Handbook on the estimation of External costs in the transport sector (CE Delft et al., 2008), we have estimated the economic costs of the additional time needed in case toll roads are

avoided[45]. More information on the VoT figures used can be found in the text box below. Furthermore, the additional fuel costs are estimated for taking the detour[46]. Together, these two cost items are considered as the additional (generalised) travel costs of avoiding the toll roads. See Table 101 for the results.

Value of time

The value of (travel) time (VoT) is an exchange rate between time and money: it is the rate at which a traveller is indifferent between marginal changes in travel time and travel cost (University of Leeds, 2012). This indicator can be used to convert travel time savings or delays into monetary units in order to make them directly comparable to financial travel costs (e.g. road tolls).

VoT values differ between countries, transport modes, travel motives and journey length (University of Leeds, 2012; HEATCO, 2005). First, as the VoT varies across the population with income (because the VoT is directly related to the marginal utility of income), it also varies between countries with different average income levels. Second, it is usually assumed that the VoT depends on the transport mode considered as well, e.g. because there are differences in the productivity of time spent in different modes. Third, differences in the VoT between travel motives may reflect the variance in scheduling constraints (the need to undertake activities at certain times) in conjunctions with penalties for being late and the inconvenience of arriving early. Finally, the dependency of VoT on journey length reflects the increasing discomfort of longer distance journeys and the larger opportunity costs of time spent travelling.

In this study we take all these effects into account by using national VoT values for long-distance, social journeys by passenger car. The VoT presented by HEATCO (2005) – recommended by CE Delft et al. (2008) and used by TRT (2016) as well – was used as basis to calculate the national figures. HEATCO (2005) presents an EU average VoT value for long distance, social journeys by passenger car of € 9.13 per person per hour (price level 2002). We converted this figure to price level 2016 by applying an EU average consumer price index. Next, the VoT per passenger car was estimated by multiplying the value per person with the average number of persons per car (2). Finally, the EU average values were converted to national values by correcting for differences in GDP/capita. The resulting VoT values are shown in Table 100.

Table 100 Value of time social trips per passenger car

Country	Value of time (€$_{2016}$/hour)	Country	Value of time (€$_{2016}$/hour)
Austria	32	Hungary	9
Belgium	30	Italy	22
Czech Republic	13	The Netherlands	33
Germany	31	Poland	9
Greece	13	Portugal	14
Finland	32	Romania	7
France	27	Spain	19

- The additional generalised travel costs are compared with the toll charges that have to be paid in case toll roads are not avoided. Based on this comparison, it has been decided that for three corridors (Paris – Madrid, Lisbon – Antwerp and Madrid – Barcelona) avoiding toll roads may be a viable option, as the amount of saved tolls is larger or (almost) comparable to the additional generalised travel times.
- In a final step, we have studied these three corridors in more detail, looking for possible attractive detours to avoid tolls. For the corridors Paris – Madrid and Antwerp – Lisbon, alternative routes were identified for two segments: Poitiers - Bordeaux and San Sebastian – Burgos. For these segments, avoiding tolls was a

45 In this calculation we used national VoT. As discussed in Section 1.3.4, we assume that the driver has the nationality of the country of departure and hence the corresponding national VoT figures were used. However, as we consider both the outward and retour trip on the corridors (see Section 1.2) two different nationalities (and hence two different VoT figures) have to be considered for each of the corridors. In order to provide consistent conclusions for each of the corridors, we have averaged the additional travel time costs of the outward and retour trip.

46 Using national fuel prices.

viable option. We discussed these segments with French and Spanish road transport associations (ACA and RACC). For the segment Poitiers – Bordeaux the 'Route National 10' provides a viable option saving €20 of toll, while the additional generalised costs are only €2 (see Table 101). On the segment San Sebastian – Burgos, the A1 provides a viable alternative for the AP1 between San Sebastian and Vitoria-Gasteiz, while a parallel road to the tolled motorway provides an interesting untolled alternative route between Vitoria-Gasteiz and Burgos. This was also confirmed by the RACC, who pointed out that a significant share of the road travellers makes use of this alternation route (RACC, 2015). Finally, on the corridor Madrid – Barcelona, an alternative, untolled route between Zaragoza and Barcelona was identified. Both the generalised cost calculation and RACC (2015) confirmed that a parallel road to the motorway AP2 can be considered a viable option on this segment. Based on these results, it was decided to consider the alternative, untolled routes for passenger road transport on these segments on the three corridors.

Table 101 Comparison of additional generalised costs of avoiding toll roads and the amount of tolls that is levied on a passenger car

Corridor	Additional travel time	Costs of additional travel time (€)	Cost of additional fuel use (€)	Additional generalised costs (€)	Amount of toll (€)
Entire corridor					
Paris-Amsterdam	1h20	40	2.0	42	16
Paris-Madrid	3h10	74	0.3	74	97
Antwerp - Warsaw	1h10	23	5.0	28	18
Rome - Berlin	5h10	137	1.6	139	52
Helsinki - Gdansk	4h10	84	0.8	85	1
Lisbon - Antwerp	5h15	125	6.5	131	130
Genoa-Rotterdam	4.30	125	10.1	135	25
Budapest-Milan	6h40	98	1.3	99	30
Athens-Vienna	5h30	125	1.5	126	34
Madrid-Barcelona	0h30	10	0.3	10	32
Paris-Marseille	3h30	95	6.8	101	59
Katowice-Gdansk	1h30	13	0.0	13	7
Milan - Naples	4h50	108	5.9	114	56
Specific segments					
Poitiers – Bordeaux	0h08	3	-1.2	2	20
San Sebastian – Burgos	0h31	12	0.7	13	25
Zaragoza – Barcelona	0h30	10	0.3	10	32

For time-based road charges a comparable, but slightly different approach has been applied:

- Determine the corridors on which time-based road charges are applied. In total, there are 6 corridors concerned (see Table 102).
- For each of these corridors an alternative route is determined (by using Google Maps), avoiding roads for which a vignette is required. This assessment has been carried out per relevant country on the corridor. Per country, the additional travel time and distance compared to the fastest routes are determined.
- The additional generalised costs per trip are estimated (per country) by applying the same approach as for distance-based road charges. As it is assumed that the vignettes can be used for both the outward and return trip, the generalised costs

per trip are multiplied by the factor 2. The resulting additional generalised costs are shown in Table 102.

- The additional generalised costs are compared with the vignette prices for the various countries. For each country a 10 days vignette is assumed, except for Hungary (monthly), Slovenia (monthly) and Switzerland (annual) as for these countries no 10 days vignette was available. Based on this comparison, it can be concluded that for none of the corridors avoiding roads with time-based road charges is a viable option.

Table 102 Comparison of additional generalised costs of avoiding roads for which a vignette is required and the price of the vignette for a passenger car

Corridor	Country for which vignette is required	Additional travel time	Costs of additional travel time (€)	Cost of additional fuel use (€)	Additional generalised costs (€)	Vignette price (€)
Frankfurt – Budapest	AT	2h45	110	-0.3	110	9
	HU	1h20	53	1.0	54	15
Rome – Berlin	AT	1h15	66	0.0	66	9
Hamburg –Prague	CZ	0h30	22	0.1	22	12
Genoa – Rotterdam	CH	4h30	250	7.0	257	38.50
Budapest – Milan	HU	2h05	66	3.9	70	15
	SI	2h45	87	2.9	90	30
Bucharest – Warsaw	HU	2h45	43	0.6	43	15
	SK	0h45	12	0.1	12	10
	CZ	1h30	23	-4.2	19	17

ANNEX C: DESCRIPTION OF CORRIDORS

In this Annex we provide detailed descriptions of the twenty corridors considered in this study. For each of the corridors, first information is provided on the transport means that are used, the routes of these means on the corridor (including required transfers/transhipments), and travel distances and travel times (more information on how these data are determined/estimated can be found in Annex B). As explained in Annex B, times for (un)loading and (dis)embarking of vehicles/vessels are not considered in the travel times, but instead EU average values were estimated separately. The results of that assessment can be found in 2.3.2.

For each of the corridors, we also present an overview of the relevant taxes, charges and subsidies for the reference vehicles defined in Annex A. Additionally, we present the total amount of taxes, charges and subsidies levied on each reference vehicle, considering both an outward trip (the city first mentioned in the corridor description is considered as origin) and return trip (the city last mentioned in the corridor description is considered as origin). By applying this differentiation, differences in fixed vehicle taxes (e.g. registration taxes) between both countries can be taken into account[47]. More detailed information on the individual taxes, charges and/or subsidies can be found in the background report.

Finally, as explained in Section 3.5 various external factors (in addition to taxes, charges and subsidies) may affect travel costs, times, reliability and flexibility, and hence the level playing field between transport modes. Some of these external factors are quite general and apply to (almost) all corridors, while others are more corridor-specific. More information on the latter type of factors is presented in this Annex.

C.1 Paris – Amsterdam

The Paris – Amsterdam corridor is one of the most important (passenger) transport axes in the EU in terms of transport volumes. It connects two main business hubs and the capitals of France and the Netherlands.

Passenger Transport

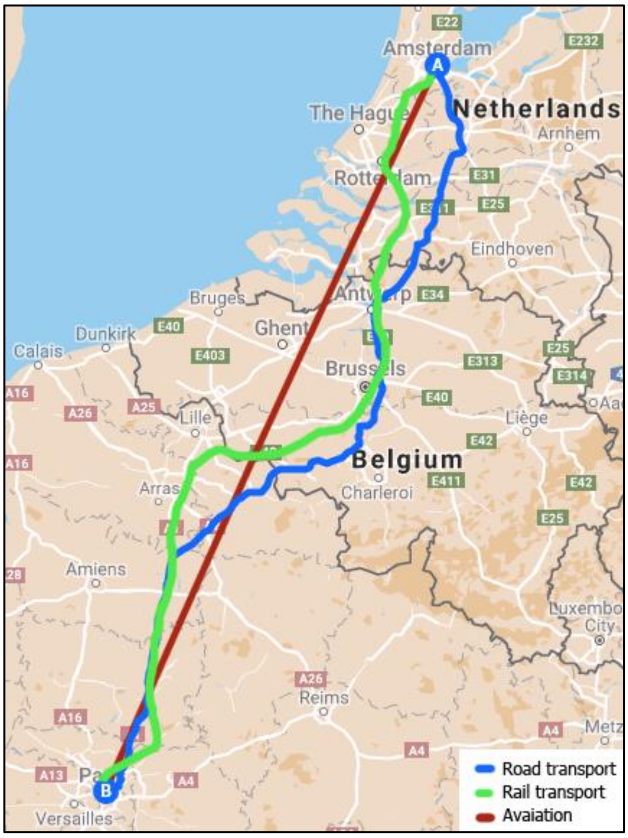
Passenger transport between Paris and Amsterdam can be done by car, bus, (high speed) rail and plane (all direct connections). Specificities on the routes of these transport means on the corridor Paris – Amsterdam are presented in Table 103. The routes themselves are presented in Figure 119. The rail connection between Paris and Amsterdam is done by the Thalys, a high speed line connecting France, Belgium and the Netherlands.

[47] As mentioned in Section 1.3.4, it is assumed that the owners of the reference vehicles have the nationality of the country of departure and hence the fixed vehicle taxes from this country are levied on the vehicle/vessel.

Table 103 Overview of passenger transport modes on the route Paris - Amsterdam

			HSL	
Origin & Destination	• Paris Gare du Nord • Amsterdam Central Rail Station	• Paris Gare du Nord • Amsterdam Central Rail Station	• Paris Gare du Nord • Amsterdam Central Rail Station	• Charles de Gaulle airport • Schiphol airport
Distances (km)	• Total: 510 • FR untolled: 92 • FR tolled: 129 • BE untolled: 169 • NL untolled : 120	• Total: 510 • FR untolled: 92 • FR tolled: 129 • BE untolled: 169 • NL untolled : 120	• Total: 530 • HSL FR: 236 • HSL BE: 162 • HSL NL: 132	• Total: 522
Travel time	5h05	7h30	3h25	1h15

Figure 119 Routes of the various passenger transport modes on the corridor Paris - Amsterdam



An overview of the taxes and charges levied on the various passenger transport modes is given in Table 104. For each of them the total amount levied for an outward and return trip on the corridor is presented. For some of the taxes and charges, the transport modes are (partly) exempted on the corridor Paris – Amsterdam. For coaches discounts of the fuel taxes exist in Belgium and France (by reclaiming part of the diesel tax), while reduced VAT rates are levied on coach fares in all countries on the corridor. Reduced VAT rates also apply to the train fares. Additionally, discounts on the Belgian and French electricity taxes exist for rail transport. Finally, aviation is fully exempted from fuel taxes and VAT.

Table 104 Taxes and charges for passenger transport means on the corridor Paris – Amsterdam (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	21/16	21/16
	Ownership tax		11/27
	Registration tax	1/1	13/16
	Insurance tax	5/5	4/4
	Distance-based road charges	16/16	16/16
	VAT	20/24	22/27
	Fuel tax	38	38
	Ownership tax	1	7
	Registration tax	1	-
	Insurance tax	4	4
	Distance-based road charges	65	65
	VAT	39	54
	Electricity tax	96	96
	Infrastructure charges	9,075	9,075
	VAT	1,218	1,218
	Aviation tax	303/780	-
	Passenger related charges	1,176/3,026	1,271/3.271
	LTO/landing charges	158/212	522/661
	Ground-handling and infrastructure related charges	84/164	84/164
	Navigation charges	529/805	529/805
	ETS	7/11	7/11

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

Next to taxes, charges and subsidies, other factors affect the level playing field of the different passenger modes on the corridor Paris – Amsterdam. An important factor in this respect is:

- The high levels of congestion on main parts of the road network (e.g. in the Amsterdam, Antwerp, Brussels and Paris areas), affecting the (reliability of) travel time of both passenger cars and coaches (Panteia et al., 2014).

Freight transport

The larger agglomeration of Paris and Amsterdam contain important industrial areas including the Port of Amsterdam, Port of Gennevilliers, Schiphol airport, Charles de Gaulle airport, and Orly airport. Therefore, considerable levels of freight transport on these corridors can be found. Direct connections are possible by road, rail, maritime transport (by a small maritime vessel) and aviation. Detailed information on the routes of the various transport modes can be found in Table 105 and Figure 120.

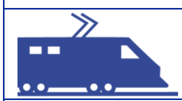
Table 105 Overview of freight transport modes on the route Paris - Amsterdam

				
Origin & Destination	• Paris Genevilliers • Amsterdam Westhaven	• Paris Valenton • Amsterdam Westhaven USA terminal	• Paris Valenton Port of Amsterdam	• Charles de Gaulle airport • Schiphol airport
Distances (km)	• Total: 531 • FR untolled: 83 • FR tolled: 159 • BE untolled: 15 • BE tolled: 118 • NL: 156	• Total: 553 • FR: 256 • BE: 152 • NL: 145	Total: 620	• Total: 522
Travel time	8h15	14 h	35 hours	1h15

Figure 120 Routes of the various freight transport modes on the corridor Paris - Amsterdam

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trip) is given in Table 106. For HGVs, discounts on the fuel taxes exist in France and Belgium (part of the diesel tax can be reclaimed). Freight trains are (partly) exempted from the electricity tax on the Belgian and French parts of the corridor, while maritime transport and aviation is fully exempted from fuel taxes.

Table 106 Taxes and charges for freight transport means on the corridor Paris – Amsterdam (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	52 / 52	52 / 52
	Ownership tax	3 / 3	4 / 4
	Registration tax	0 / 0	0 / 0
	Insurance tax	3 / 2	4 / 3
	Distance-based road charges	76 / 76	76 / 76
	Time-based road charges	6/6	6/6
	Electricity tax	54 / 80	54 / 80
	Infrastructure charges	1167 / 1241	1167 / 1241
	Port charges	518 / 1370	518 / 1370
	Piloting charges	12,057 / 12,057	12,057 / 12,057
	Aviation tax	35	
	LTO/landing charges	164	787
	Ground-handling and infrastructure related charges	16	16
	Navigation charges	1,072	1,072
	ETS	18	18

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

Finally, the level playing field of the different freight modes on the corridor Paris – Amsterdam is affected by several other (non tax/charge and subsidy related) factors (Panteia et al., 2014), including:

- Main parts of the road network are often heavily congested (e.g. in the Amsterdam, Antwerp, Brussels and Paris areas), affecting the (reliability of) travel time of trucks.
- Road haulage regulations differ between the various countries of the corridor, in terms of the hours when vehicles can use the network. This situation leads to parking areas congestion and saturation at the borders.
- No periodic (e.g. weekly) rail freight service is currently applied by a transport operator on this corridor.
- The countries use different communication systems for train transport, requiring trains that are compatible with different systems.
- Parts of the Belgium part of the corridor set a maximum train length of under 750m (European standard) during daytime, for instance on the segment Essen (BE) – Antwerp (BE).

C.2 Paris – Madrid

The Paris – Madrid corridor is a very important passenger transport axis in the EU in terms of transport volumes (ETISplus, 2017). At the same time, as Paris and Madrid are service oriented cities, freight volumes between both cities are relatively low.

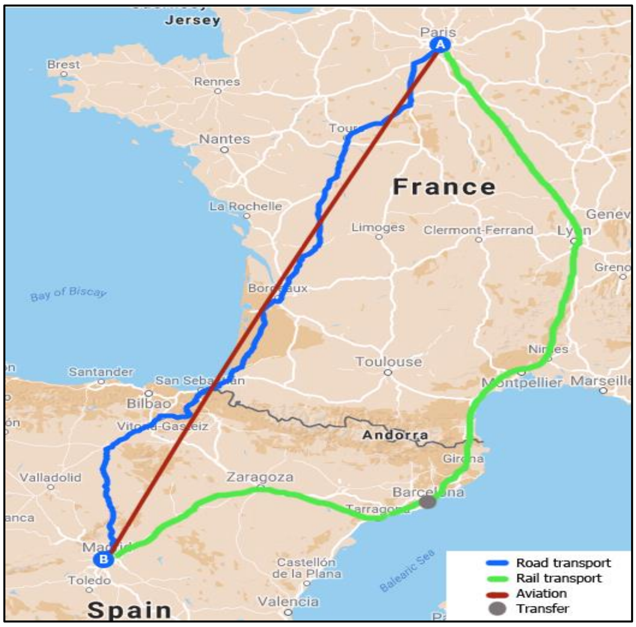
Passenger Transport

Passenger transport between Paris and Madrid can be done by car, bus, (high speed) rail and plane. Specificities of the routes of these transport means are presented in Table 107 and Figure 121. For road transport, part of the route contains toll roads, although they are partly avoided. Between Poitiers and Bordeaux and between San Sebastian and Burgos it is economically profitable to avoid the toll roads by taking a detour (see Annex B for more information). As a consequence, no Spanish toll roads are used. The additional travel time due to avoiding toll roads is about 25 minutes. The train connection is served by two high speed trains. Due to the differences in gauges between the Iberian rail network and European rail network a transfer is required in Barcelona.

Table 107 Overview of passenger transport modes on the route Paris - Madrid

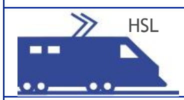
				
Origin & Destination	• Paris Gare du Nord • Madrid Atocha Train Station	• Paris Gare du Nord • Madrid Atocha Train Station	• Paris Gare Lyon • Madrid Atocha Train Station	• Charles de Gaulle airport • Madrid Barajas airport
Distances (km)	• Total: 1263 • FR untolled: 373 • FR tolled: 407 • ES untolled 483	• Total: 1263 • FR untolled: 373 • FR tolled: 407ES untolled: 483	• Total: 1565 • HSL FR: 850 • HSL ES: 715	• Total: 1,150
Travel time	12h30	18h45	9h40	1h55

Figure 121 Routes of the various passenger transport modes on the corridor Paris - Madrid



An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 108. Coach transport on this corridor is partly exempted from fuel taxes (i.e. diesel taxes in France can be partly reclaimed) and VAT (reduced rates in both France and Spain). Also rail transport is partly exempted from energy taxes (reduced tax rates in France) and VAT (reduced rate in both France and Spain). Finally, aviation is fully exempted from fuel taxes and VAT.

Table 108 Taxes and charges for passenger transport means on the corridor Paris – Madrid (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	46/37	46/37
	Ownership tax	-	6/6
	Registration tax	2/2	1/0.5
	Insurance tax	13/13	3/3
	Distance-based road charges	64/64	64/64
	VAT	57/64	48/66
	Fuel tax	69	69
	Ownership tax	3	5
	Registration tax	2	0.5
	Insurance tax	10	4
	Distance-based road charges	187	187
	VAT	229	265
 HSL	Electricity tax	287	287
	Infrastructure charges	24,175	24,175
	VAT	2,924	2,924
	Aviation tax	303/780	-
	Passenger related charges	1,176/3,026	1,081/2,783
	LTO/landing charges	438/640	436/493
	Ground-handling and infrastructure related charges	167/265	189/362
	Navigation charges	818/1,185	818/1,185
	ETS	21/32	21/32

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non-tax/charge and subsidy related) factors, including:

- the fact that Madrid airport is not connected to rail (only suburban rail and metro) may hamper the last-mile transport of aviation trips (TIS.pt et al., 2014).
- the fact that for the rail trip a transfer in Barcelona is required.

Freight transport

Freight transport between Paris and Madrid is possible via road, rail, maritime transport (intermodal) and air. As for road passenger transport, part of the toll roads are avoided as the additional travel time is compensated by the savings on toll charges. Due to differences in railways between Spain and France a stop of almost 8 hours is required for rail transport in order to change the bogies or transhipment. Maritime transport between Paris and Bilbao is possible, from where the goods can be transport by truck to Madrid (again, toll roads are avoided on this route). More information on the routes of freight transport can be found in Table 109 and Figure 122.

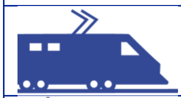
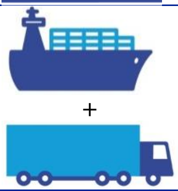
Table 109 Overview of freight transport modes on the route Paris - Madrid

				
Origin & Destination	• Paris Genevilliers • Madrid Barajas airport	• Paris Genevilliers • Madrid Barajas airport	• Paris Genevilliers • Madrid Barajas airport	• Charles de Gaulle airport • Madrid Barajas
Distances (km)	• Total: 1268 • FR untolled: 373 • FR tolled: 407 • ES untolled: 485	• Total 1422 • FR: 815 • ES: 607	• Total: 1850 • 1450 ship • ES untolled: 266 • ES tolled: 134	• Total: : 1,150
Travel time	29h40	39h	80h ship + 5h30 truck	1h55

Figure 122 Routes of the various freight transport modes on the corridor Paris - Madrid

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trip) is given in Table 110. Discounts on fuel taxes are applied for HGVs on the French part of the corridor (i.e. by reclaiming part of the diesel taxes), while freight trains are partly exempted from the French electricity tax. Maritime transport and aviation are fully exempted from fuel taxes.

Table 110 Taxes and charges for freight transport means on the corridor Paris – Madrid (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	91 / 91	91 / 91
	Ownership tax	6 / 6	3 / 3
	Registration tax	1 / 1	0.1 / 0.1
	Insurance tax	7 / 5	3 / 3
	Distance-based road charges	185 / 185	185 / 185
	Electricity tax	898 / 1,347	898 / 1,347
	Infrastructure charges	2,436 / 2,436	2,436 / 2,436
	Port charges	1,827 / 2,079	1,827 / 2,079
	Piloting charges	1,764 / 1,764	1,764 / 1,764
+	Fuel tax (HGV)	43/43	43/43
	Ownership tax (HGV)	38/38	38/38
	Insurance tax (HGV)	3/3	2/2
	Aviation tax	35	-
	LTO/landing charges	951	635
	Ground-handling and infrastructure related charges	73	73
	Navigation charges	1,528	1,528
	ETS	50	50

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of the different freight modes on the corridor Paris – Madrid is affected by several other (non-tax/charge and subsidy related) factors (TIS.pt et al. 2014), including:

- Track gauge differences between Spain (1668mm) and France (1435mm). France has 100% UIC track gauge, Spain only 25% (for Madrid-Valladoid and HS line Madrid-Antequera). This requires either axel change or transfer of load and hence makes rail transport for freight cargo less desirable.
- Simultaneously, the main border crossing between Irun (ES) and Hendaye (FR) is single track.
- There seems to be no transport operator offering the direct train service between Paris and Madrid on a structural basis.
- With respect to aviation, Madrid airport is not connected to the main rail network, hampering last-mile transport of aviation cargo transport.

C.3 Antwerp - Warsaw

The corridor Antwerp – Warsaw is one of the most important routes between Eastern and Western Europe. Furthermore, it reflects an important hinterland connection of one of the main sea ports of Europe (Antwerp).

Passenger Transport

Transport possibilities for passengers on this corridor are car, bus, train and aviation. The connection by rail takes three transfers, in Brussels, Essen and Berlin (three high speed trains, one regular electric train between Warsaw and Berlin). As for aviation, no direct flights are available between Antwerp and Warsaw, but between Brussels and Warsaw there are direct flights. As the rail connection from Antwerp Central to Brussels Airport is good (taking 30 minutes), we will consider this multimodal connection between Antwerp and Warsaw in this study. More information on the routes of passenger transport can be found in Table 111 and Figure 123.

Table 111 Overview of passenger transport modes on the route Antwerp - Warsaw

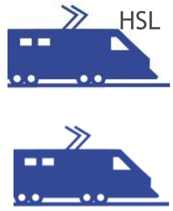
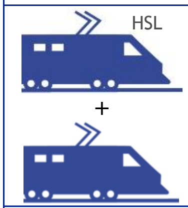
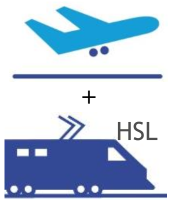
				
Origin & Destination	• Antwerp central station • Warsaw central Train Station	• Antwerp central station • Warsaw central Train Station	• Antwerp central station • Warsaw central Train Station	• Antwerp Central to Brussels Zaventem • Warsaw Airport
Distances (km)	• Total: 1256 • BE untolled: 59 • NL untolled: 77 • DE untolled: 650 • PL untolled: 219 • PL tolled: 351	• Total: 1256 • BE untolled: 59 • NL untolled: 77 • DE untolled: 650 • PL untolled: 219 • PL tolled: 351	• Total 1378 • HSL BE: 183 • HSL DE: 645 • Regular DE: 90 • Regular PL: 460	• Total 1293 • Flight:1253 • HSL BE: 40
Travel time	12h15	18h20	13h30	4h00 aviation + 30 min train

Figure 123 Routes of the various passenger transport modes on the corridor Antwerp - Warsaw

An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 112. Coach transport on this corridor is partly exempted from fuel taxes (on the Belgian part of the corridor) and VAT (reduced rates in Belgium and Poland). Rail transport is partly exempted from electricity tax in Belgium and Germany, while a (partly) exemption from VAT exist in Belgium and Poland. Finally, aviation is fully exempted from fuel taxes and VAT.

Table 112 Taxes and charges for passenger transport means on the corridor Antwerp - Warsaw (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	44/33	44/33
	Ownership tax	15/20	-
	Registration tax	2/3	1/1
	Insurance tax	10/10	-
	Distance-based road charges	26/26	26/26
	VAT	50/59	46/54
	Fuel tax	132	132
	Ownership tax	2	6
	Insurance tax	7	-
	Distance-based road charges	64	64
	VAT	221	221
	Electricity tax	3,296	3,296
	Infrastructure charges	8,344	8,344
	VAT	6,015	4,194
	Passenger related charges	1,469/3,782	781/2,010
	LTO/landing charges	442/867	50/79
	Ground-handling and infrastructure related charges	436/465	436/465
	Navigation charges	908/1,332	908/1,332
	ETS (aviation)	23/35	23/35
	Taxes charges rail leg intermodal trip by aviation	151/388	151/388

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non-tax/charge and subsidy related) factors, including:

- High road congestion levels on some urban parts of the corridor (e.g. Antwerp region).

Freight Transport

Freight transport between Antwerp and Warsaw is possible via road, rail and air. For road and rail transport, direct connections are available. However, no direct cargo flights exist between Antwerp and Warsaw (OAG cargo flights, 2017). Therefore an intermodal trip via Brussels airport is assumed (using a truck for the transport between Antwerp and Brussels). More information on the routes of freight transport can be found in Table 113 and Figure 124.

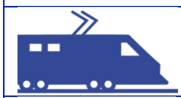
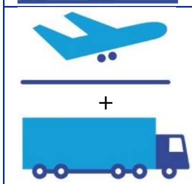
Table 113 Overview of freight transport modes on the route Antwerp - Warsaw

			
Origin & Destination	• Antwerp Westhaven • Warsaw	• Antwerp Westhaven • Warsaw	• Antwerp Westhaven • Warsaw
Distances (km)	• Total: 1272 • BE untolled: 4 • BE tolled: 66 • NL untolled: 75 • DE tolled: 650 • PL untolled: 10 • PL tolled: 467	• Total: 1309 • BE: 30 • NL: 145 • DE: 664 • PL: 470	• Total: 1310 • Total flight: 1253 • BE truck: 57
Travel time	28h40	29 h	4h00 aviation + 1h truck

Figure 124 Routes of the various freight transport modes on the corridor Antwerp - Warsaw

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trip) is given in Table 114. Discounts on fuel taxes are applied for HGVs on the Belgian part of the corridor (i.e. by reclaiming part of the diesel taxes), while freight trains are partly exempted from the Belgian and German electricity taxes. Finally, aviation is fully exempted from fuel taxes.

Table 114 Taxes and charges for freight transport means on the corridor Antwerp - Warsaw (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	174 / 174	174 / 174
	Ownership tax	6 / 6	8 / 8
	Insurance tax	6 / 4	-
	Distance-based road charges	193 / 193	193 / 193
	Time-based road charges	15/15	15/15
	Electricity tax	2509 / 3762	2509 / 3762
	Infrastructure charges	6006 / 6685	6002 / 6681
	LTO/landing charges	1,156	126
	Ground-handling and infrastructure related charges	354	354
	Navigation charges	1,730	1,730
	ETS	54	54
	Taxes/charges HGV leg intermodal trip by aviation	118	118

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of the different freight modes on the corridor Antwerp – Warsaw is affected by several (non-tax/charge and subsidy related) factors (Trinity et al., 2014), including:

- Between Poznan and Warsaw there are restraints to the maximum axle load for HGVs.
- ERTMS is not operational on the majority of the route, thus requiring trains that are compatible with multiple signalling systems.
- The length of trains is constrained to 650m between Poznan and KuNowice. Between the German-Polish border and KuNowice the length is restricted to 600m. Also Belgium has issued constrains on train length during day times because of traffic of passenger trains.

C.4 Amsterdam – Frankfurt

Amsterdam and Frankfurt have both large business sectors. Combined with their close distance, passenger volumes between the two cities are considerable (ETISplus, 2017). At the same time, the corridor Amsterdam – Frankfurt provides a reflection of the important freight traffic flows between the Netherlands and Germany.

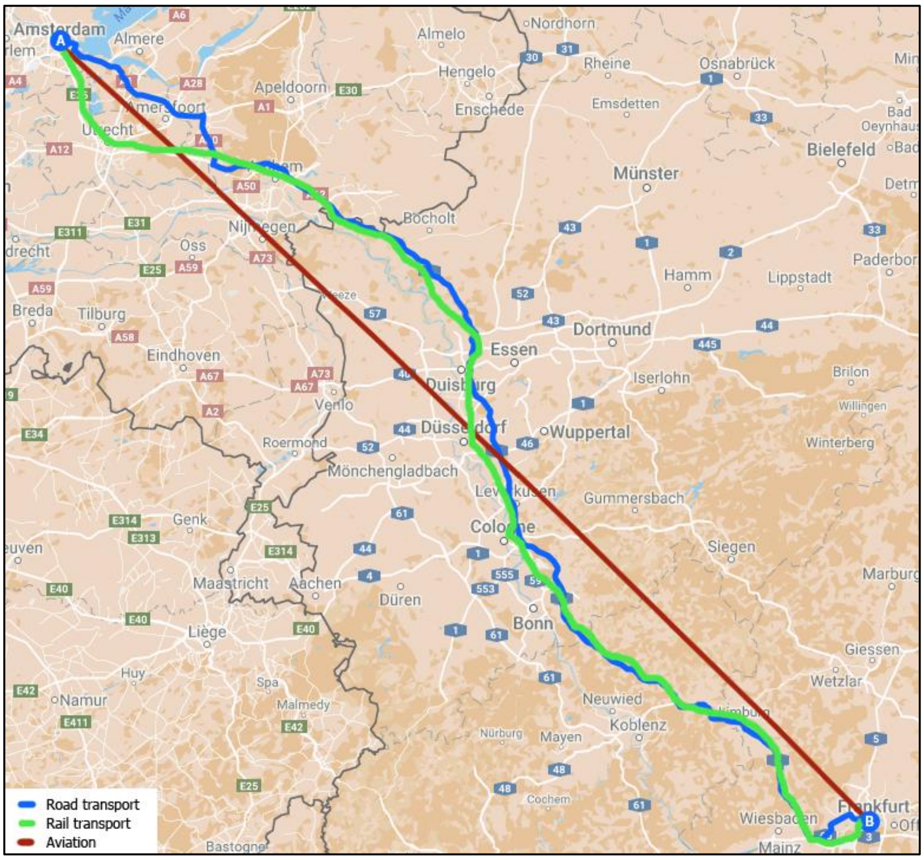
Passenger Transport

Passenger transport on this corridor is possible via car, bus, high speed train and air (all direct connections). More information on the specific routes of the various transport modes can be found in Table 115 and Figure 125.

Table 115 Overview of passenger transport modes on the route Amsterdam - Frankfurt

				
Origin & Destination	• Amsterdam Central Station • Frankfurt Hauptbahnhof	• Amsterdam Central Station • Frankfurt Hauptbahnhof	• Amsterdam Central Station • Frankfurt Hauptbahnhof	• Schiphol airport • Frankfurt am Main airport
Distances (km)	• Total: 447 • NL untolled: 124 • DE untolled: 323	• Total: 447 • NL untolled: 124 • DE untolled: 323	• Total: 440 • HSL NL: 114 • HSL DE: 326	• Total: 461
Travel time	4h10	6h30	3h39	1h55

Figure 125 Routes of the various passenger transport modes on the corridor Amsterdam - Frankfurt



An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 116. Both coach transport and rail transport are partly exempted from VAT on the Dutch part of the corridor. Furthermore, rail transport is partly exempted from electricity on the German part of the corridor. Finally, aviation is fully exempted from fuel taxes and VAT.

Table 116 Taxes and charges for passenger transport means on the corridor Amsterdam - Frankfurt (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	19/13	19/13
	Ownership tax	10/24	2/4
	Registration tax	12/14	-
	Insurance tax	3/3	2/2
	VAT	17/20	14/17
	Fuel tax	53	53
	Ownership tax	6	4
	Insurance tax	3	3
	VAT	132	100
HSL	Electricity tax	1,373	1,373
	Infrastructure charges	3,986	3,986
	VAT	3,407	3,407
	Aviation tax	-	405/1042.5
	Passenger related charges	1,271/3,271	1,117/2,874.5
	LTO/landing charges	201/429	201/429
	Ground-handling and infrastructure related charges	305/950	-
	Navigation charges	457/687	457/687
	ETS	7/10	7/10

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non-tax/charge and subsidy related) factors (HaCon et al., 2014), including:

- Congestion of roads around the main urban areas.
- Capacity problems at Frankfurt airport.

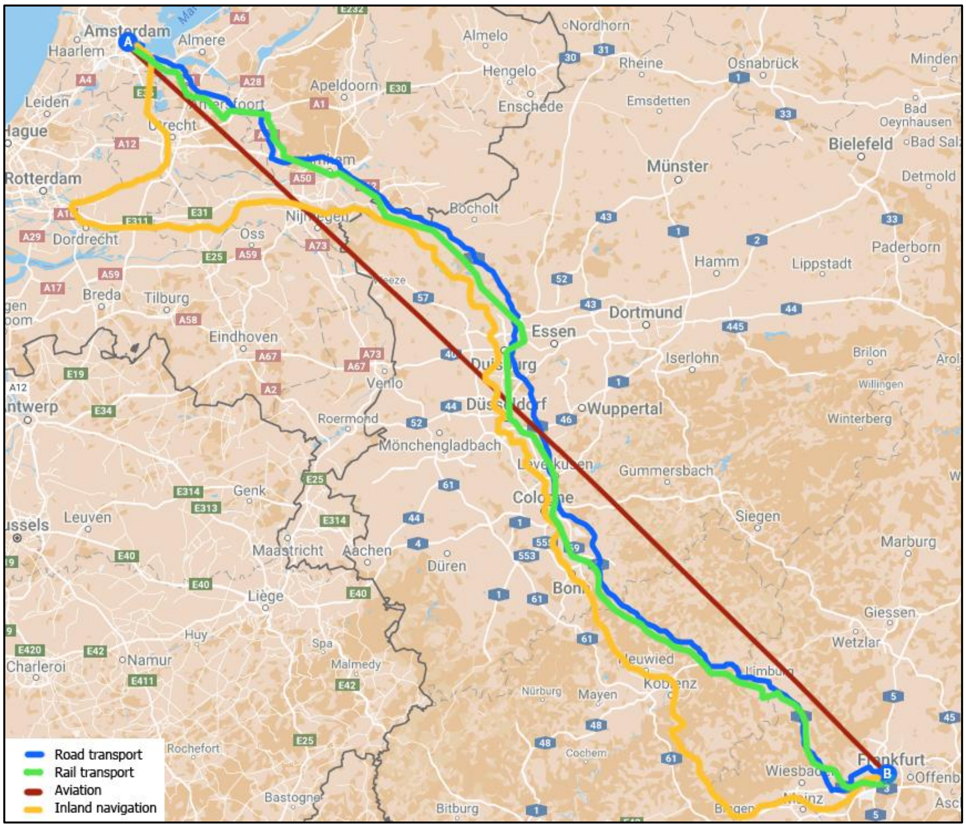
Freight Transport

Freight transport between Amsterdam and Frankfurt is possible via road, rail, water and air (all direct connections). For inland navigation a large vessel (CEMT Va) is considered. The Rhine is the main fairway connecting both cities, providing the opportunity of freight transport by the large reference inland ship. More information on the routes of freight transport can be found in Table 117 and Figure 126.

Table 117 Overview of freight transport modes on the route Amsterdam - Frankfurt

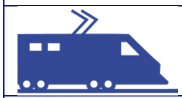
Origin & Destination	• Amsterdam Westhaven • Frankfurt Eastern Port	• Amsterdam Westhaven • Frankfurt Eastern Port	• Amsterdam Westhaven • Frankfurt Eastern Port	• Amsterdam Schiphol airport • Frankfurt airport
Distances (km)	• Total: 462 • NL untolled: 134 • DE untolled: 2 • DE tolled: 326	• Total: 450 • NL: 125 • DE: 325	• 611 • NL untolled: 219 • DE untolled: 357 • DE tolled 35	• Total: 461
Travel time	7h15	10h00	60h00	1h55

Figure 126 Routes of the various freight transport modes on the corridor Amsterdam - Frankfurt



An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 118. Rail transport is partly exempted from electricity taxes on the German part of the corridor, while IWT is fully exempted from fuel taxes and charges for locks and bridges on the entire corridor. Finally, aviation is fully exempted from fuel taxes.

Table 118 Taxes and charges for freight transport means on the corridor Amsterdam - Frankfurt (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	71 / 71	71 / 71
	Ownership tax	4 / 4	4 / 4
	Insurance tax	3 / 2	3 / 2
	Distance-based road charges	44 / 44	44 / 44
	Time-based road charges	6/6	6/6
	Electricity tax	968 / 1451	968 / 1451
	Infrastructure charges	3692 / 3739	3692 / 3739
	Port charges	1043 / 921	1043 / 921
	Fairway dues	138 / 435	138 / 435
	Water pollution charges	61 / 61	61 / 61
	LTO/landing charges	307	307
	Ground-handling and infrastructure related charges	43	-
	Navigation charges	908	908
	ETS	16	16

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of the different freight modes on the corridor Amsterdam – Frankfurt may be affected by several external (non tax/charge/subsidy related) factors (HaCon et al., 2014), including:

- ERTMS is not operational on the majority of the route, thus requiring trains that are compatible with multiple signalling systems
- Some sections of the German Rhine do (sometimes) have limited depths of fairways (Lobith – Krefeld: 2.8 m; Krefeld – Koblenz: 2.5m) which may hamper IWT by (very) large vessels.
- Frankfurt airport has capacity problems.

C.5 Frankfurt – Budapest

The corridor Frankfurt – Budapest is an important transport route in central Europe, connecting Western and Eastern Europe.

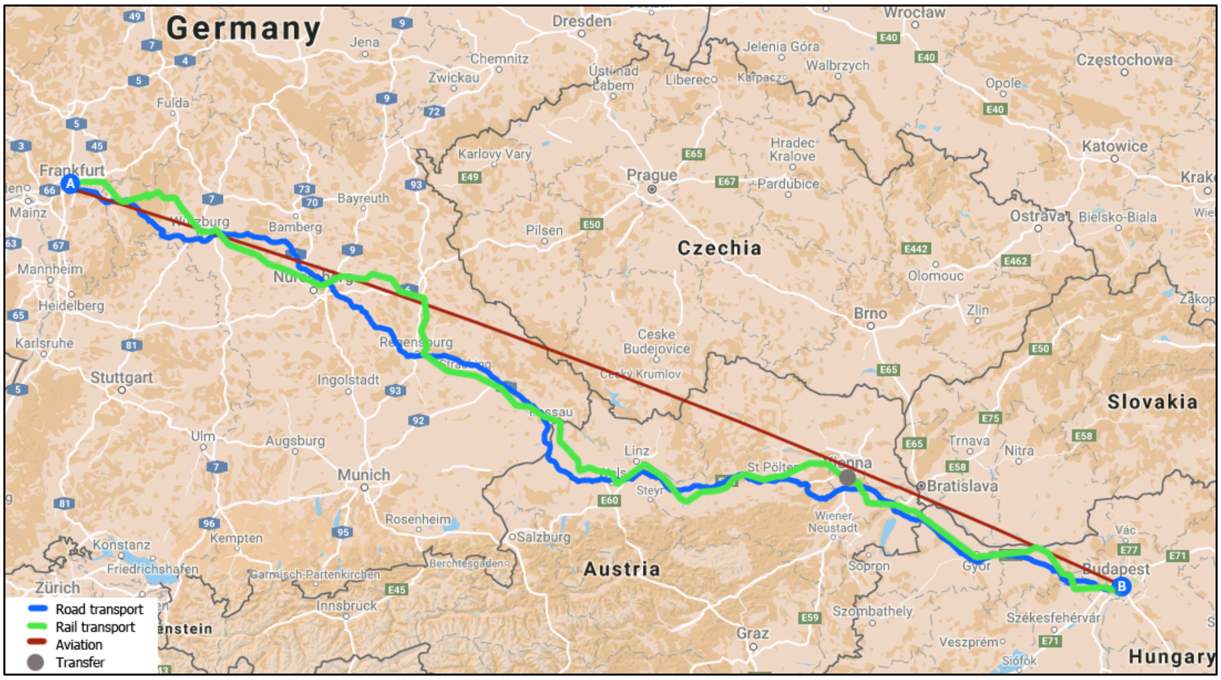
Passenger Transport

Passenger transport between Frankfurt and Budapest is possible via road, (high-speed) rail and air. For rail transport one transfer is required is Vienna. From Frankfurt to Vienna use is made of the ICE high speed train, while between Vienna and Budapest the high speed train Jet is used. More information on the routes of passenger transport can be found in Table 119 and Figure 127.

Table 119 Overview of passenger transport modes on the route Frankfurt - Budapest

			 HSL	
Origin & Destination	• Frankfurt Hauptbahnhof • Budapest Keleti	• Frankfurt Hauptbahnhof • Budapest Keleti	• Frankfurt Hauptbahnhof • Budapest Keleti	• Frankfurt am Main airport • Budapest airport
Distances (km)	• Total: 980 • DE: 459 • AT: 344 • HU: 177	• Total: 980 • DE: 459 • AT: 344 • HU: 177	• Total: 955 • HSL DE: 450 • HSL AT: 330 • HSL HU: 175	• Total: 930
Travel time	9h10	13h30	10h00	1h30m

Figure 127 Routes of the various passenger transport modes on the corridor Frankfurt - Budapest



An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 120. Coach transport is partly exempted from fuel taxes (in Hungary) and VAT (in Austria and Hungary). Also rail transport is partly exempted from electricity taxes (on the German part of the corridor) and VAT (on the Austrian and Hungarian part of the corridor). Finally, aviation is fully exempted from fuel taxes and VAT.

Table 120 Taxes and charges for passenger transport means on the corridor Frankfurt - Budapest (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	31/27	31/27
	Ownership tax	5/8	4/4
	Registration tax	-	1/1
	Insurance tax	5/5	7.5/7.5
	Time-based road charges	12/12	6/5

Transport mode	Tax/charge	Outward trip	Return trip
	VAT	30/36	35/43
	Fuel tax	107	107
	Ownership tax	9	4
	Insurance tax	8	1
	Distance-based road charges	11	11
	Time-based road charges	11	11
	VAT	152	152
	Electricity tax	3,726	3,726
	Infrastructure charges	4,089	4,089
	VAT	3,400	3,400
	Aviation tax	405/1043	-
	Passenger related charges	1,117/2,874	1,498/3,856
	LTO/landing charges	553/982	118/263
	Ground-handling and infrastructure related charges	40/49	345/999
	Navigation charges	810/1,201	810/1,201
	ETS	16/25	16/25

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of the different passenger modes on the corridor Frankfurt – Budapest may be affected by several (non tax/charge/subsidy related) factors, including congestion for road transport at the larger urban areas (Hacon et al., 2014)

Freight transport

Freight transport between Frankfurt and Budapest is possible via road, rail, inland navigation and aviation. For all modes, a direct connection is possible. For IWT the large reference vessel (CEMT Va) is assumed for this corridor. More information on the routes of freight transport can be found in Table 121 and Figure 128.

Table 121 Overview of freight transport modes on the route Frankfurt - Budapest

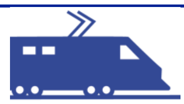
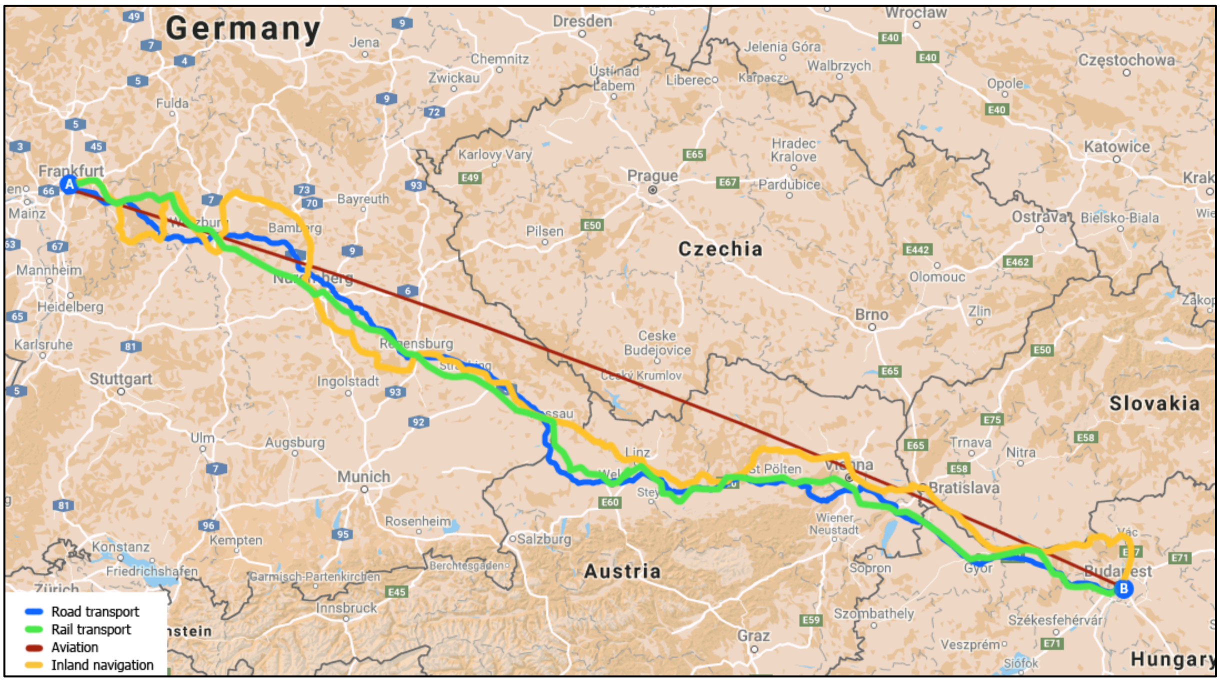
				
Origin & Destination	• Frankfurt Eastern Port • Budapest Port	• Frankfurt eastern port • Budapest Bilk container terminal	• Frankfurt Eastern Port • Container terminal Budapest	• Frankfurt am Main airport • Budapest airport
Distances (km)	• Total: 996 • DE untolled: 2 • DE tolled:452 • AT tolled: 338 • HU untolled: 40 • HU tolled: 164	• Total: 1000 • DE: 450 • AT: 360 • HU: 190	• Total: 1277 • DE untolled: 171 • DE tolled:420 • AT untolled: 326 • HU untolled: 225	• Total: 930
Travel time	24h50	22h00	7d 7h18	1h30

Figure 128 Routes of the various freight transport modes on the corridor Frankfurt - Budapest



An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 122. HGVs are partly exempted from fuel taxes (on the Hungarian part of the corridor), while rail transport is partly exempted from the German electricity tax. IWT is fully exempted from fuel taxes and charges for locks and bridges on the entire corridor. Finally, aviation is fully exempted from fuel taxes.

Table 122 Taxes and charges for freight transport means on the corridor Frankfurt - Budapest (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	141 / 141	141 / 141
	Ownership tax	8 / 8	4 / 4
	Insurance tax	6 / 4	9 / 7
	Distance-based road charges	109 / 109	109 / 109
	Electricity tax	2745 / 4116	2745 / 4116
	Infrastructure charges	4103 / 4407	4103 / 4407
	Port charges	1036 / 914	1036 / 914
	Fairway dues	1638 / 2760	1638 / 2760
	Water pollution charges	60 / 60	60 / 60
	LTO/landing charges	1,284	158
	Ground-handling and infrastructure related charges	317	360
	Navigation charges	1,573	1,573
	ETS	39	39

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of the different freight modes on the corridor Frankfurt – Budapest is affected by several (non tax/charge/subsidy related) factors (Hacon et al., 2014), including:

- There seems to be no transport operator offering the direct train service between Frankfurt and Budapest on a structural basis.
- Budapest airport is not connected to rail, making the hinterland connection difficult.

- The depth of the fairway is often not sufficient on the entire route, especially during low water conditions.
- Waterway infrastructure on the route is underdeveloped, leading to a low utilisation of container transport on the corridor.
- Frankfurt airport has capacity problems.

C.6 Rome – Berlin

This corridor connects the capitals of Italy and Germany, two of the largest European countries. Furthermore, this corridor is a connection between central and southern Europe.

Passenger transport

Transport between Rome and Berlin is possible by car, bus, train and aviation. For the train route, two transfers are required (in Milan and Basel). The main part of the route is done by high speed trains; only part of the route in Italy and Switzerland (between Milan and Basel) is done by a regular electric train. More information on the routes of passenger transport can be found in Table 123 and Figure 129.

Table 123 Overview of passenger transport modes on the route Rome - Berlin

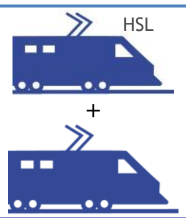
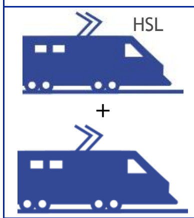
				
Origin & Destination	• Roma Termini • Berlin Hauptbahnhof	• Roma Termini • Berlin Hauptbahnhof	• Roma Termini • Berlin Hauptbahnhof	• Roma Fiumicino • Berlin Airport
Distances (km)	• Total: 1504 • IT untolled: 33 • IT tolled: 671 • AT untolled: 110 • AT tolled: 11 • DE untolled: 679	• Total: 1504 • IT untolled: 33 • IT tolled: 671 • AT untolled: 110 • AT tolled: 11 • DE untolled: 679	• Total: 1690 • HSL IT: 490 • Regular IT: 135 • Regular CH: 192 • HSL CH: 3 • HSL DE: 870	• Total: 1283
Travel time	14h15	21h20	15h30	2h00

Figure 129 Routes of the various passenger transport modes on the corridor Rome - Berlin

An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 124. Coach transport is (partly) exempted from fuel taxes (on the Italian part of the corridor) and VAT (on the Austrian and Italian part of the corridor), while rail transport is partly exempted from electricity taxes (on entire corridor) and VAT (on the Swiss and Italian part of the corridor). Finally, aviation is fully exempted from fuel taxes and VAT.

Table 124 Taxes and charges for passenger transport means on the corridor Rome - Berlin (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	63/51	63/51
	Ownership tax	16/17	8/12
	Registration tax	3/3	-
	Insurance tax	12/12	8/8
	Distance-based road charges	52/52	52/52
	Time-based road charges	4/4	4/4
	Tolls on specific parts of the road network	9/9	9/9
	VAT	68/78	52/60
	Fuel tax	165	165
	Ownership tax	26	14
	Insurance tax	17	12
	Distance-based road charges	71	71
	VAT	149	152
	Electricity tax	3,607	3,607
	Infrastructure charges	8,522	8,522
	VAT	6,985	6,985
	Aviation tax	131/336	405/1043
	Passenger related charges	1,714/4,412	738/1,898
	LTO/landing charges	161/320	161/320
	Ground-handling and infrastructure related charges	524/604	69/69
	Navigation charges	1,035/1,502	1,035/1,502
	ETS	24/36	24/36

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of the different passenger modes on the corridor Rome – Berlin is affected by several other (non tax/charge/subsidy related) factors (Kombiconsult et al., 2014), including congestion on parts of the road network (e.g. Milan area, Berlin area).

Freight transport

Freight transport between Rome and Berlin is possible via road, rail, and air, all by direct connections. More information on the routes of freight transport can be found in Table 125 and Figure 130.

Table 125 Overview of freight transport modes on the route Rome - Berlin

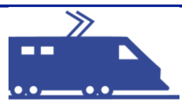
			
Origin & Destination	• Rome via del Omo • Berlin Westhaven	• Rome Urbe rail terminal • Berlin Westhaven rail terminal	• Roma Fiumicino • Berlin Airport
Distances (km)	• Total: 1496 • IT untolled: 12 • IT tolled: 691 • AT tolled: 121 • DE untolled: 1 • DE tolled: 671	• Total: 1574 • IT: 710 • AT: 71 • DE: 793	• Total: 1283
Travel time	44h	32h00	2h00

Figure 130 Routes of the various freight transport modes on the corridor Rome - Berlin

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 126. HGVs are partly exempted from fuel taxes (on the Italian part of the corridor), while rail transport is partly exempted from electricity tax on the entire corridor. Finally, aviation is fully exempted from fuel taxes.

Table 126 Taxes and charges for freight transport means on the corridor Rome - Berlin (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	214 / 214	214 / 214
	Ownership tax	13 / 13	12 / 12
	Purchase tax	2 / 2	-
	Insurance tax	13 / 10	214 / 214
	Distance-based road charges	216 / 216	12 / 12
	Electricity tax	2590 / 3882	2590 / 3882
	Infrastructure charges	6899 / 6996	6899 / 6996
	LTO/landing charges	497	497
	Ground-handling and infrastructure related charges	674	420
	Navigation charges	1,937	1,937
	ETS	57	57

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of the different freight modes on the corridor Rome – Berlin is affected by several other (non tax/charge/subsidy related) factors (Kombiconsult et al., 2014), including:

- Germany and Italy have both no ERMTS installed on train sections.
- For trains the Brenner pass is slow and has length and weight restrictions (under construction).
- Cross border transfers by multi-system locomotives is needed as no ERMTS is available.
- In Italy there are restrictions to the maximum train length, which is often below 740 meters. Furthermore, the maximum axle load is also below European standards.

C.7 Hamburg – Prague

The corridor Hamburg – Prague reflects an important hinterland connection of one of the main sea ports of Europe (Hamburg). But at the same time, it is a significant passenger transport connection between the North of Germany and Central Europe.

Passenger transport

Passengers travelling on the corridor Hamburg – Prague can make use of passenger cars, coaches, trains or planes. Specificities of the routes of these transport means are presented in Table 127, while the routes themselves are presented in Figure 131. Although it is possible to make (partly) use of a high speed train (between Hamburg and Berlin), a regular rail connection is considered in this study. As both options require comparable travel times, the regular rail connection is assumed to be preferred due to lower costs. Furthermore, it is a direct connection, while the high speed rail option requires a transfer in Berlin. For aviation, a direct connection between Hamburg and Prague is available.

Table 127 Overview of passenger transport modes on the route Hamburg - Prague

	Car	Coach	Rail	Aviation
Origin & Destination	• Hamburg Hauptbahnhof • Prague Central Station	• Hamburg Hauptbahnhof • Prague Central Station	• Hamburg Hauptbahnhof • Prague Central Station	• Hamburg international airport • Vaclav Havel international airport Prague
Distances (km)	• Total: 637 • DE untolled: 531 • CZ untolled: 106	• Total: 637 • DE untolled: 531 • CZ untolled: 106	• Total: 650 • Regular DE: 513 • Regular CZ: 137	• Total: 585
Travel time	6h00	9h00	6h40	1h05

Figure 131 Routes of the various passenger transport modes on the corridor Hamburg - Prague

An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 128. Both coach and rail transport is fully exempted from VAT on the Czech part of the corridor. Furthermore, rail transport is exempted from the Czech electricity tax. Finally, aviation is fully exempted from fuel taxes and VAT.

Table 128 Taxes and charges for passenger transport means on the corridor Hamburg - Prague (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
Car	Fuel tax	25/18	25/18
	Ownership tax	3/5	-
	Insurance tax	3/3	1/1
	Time-based road charges	6/6	0.43/0.20
	VAT	19/24	18/21
Coach	Fuel tax	73	73
	Ownership tax	6	4
	Insurance tax	5	1

Transport mode	Tax/charge	Outward trip	Return trip
	Distance-based road charges	2	2
	VAT	127	115
	Electricity tax	1,166	1,166
	Infrastructure charges	3,934	3,934
	VAT	776	776
	Aviation tax	405/1043	-
	Passenger related charges	536/1380	1,172/3,016
	LTO/landing charges	477/958	186/429
	Ground-handling and infrastructure related charges	68/68	174/183
	Navigation charges	669/1,010	669/1,010
	ETS	9/14	9/14

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non-tax related) factors, including:

- Only for part of the corridor (Berlin – Hamburg) a high speed rail connection is available, resulting in longer travel times for rail passengers.
- The lack of rail connection of the Vaclav Havel international airport in Prague, reducing the travel options to and from the airport (iC Consulenten et al., 2014).

Freight transport

The corridor Hamburg – Prague is an important European axis for freight transport, particularly for container and general cargo transport (ETISplus, 2017). Four different freight transport options are considered for the corridor Hamburg – Prague: truck, rail (electric), inland shipping and plane (all direct connections). For inland navigation a small reference ship (CEMT IV) is considered. More information on the routes of these transport means can be found in Table 129 and Figure 132.

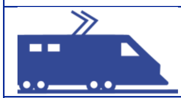
Table 129 Overview of freight transport modes on the route Hamburg - Prague

Origin & Destination	• Port of Hamburg • Port of Prague	• Hamburg Nette DB • Prague Uhrineves	• Port of Hamburg • Port of Prague	• Hamburg international airport • Vaclav Havel international airport Prague
Distances (km)	• Total: 633 • DE untolled: 7 • DE tolled: 521 • CZ untolled: 26 • CZ tolled: 79	• Total: 653 • DE: 542 • CZ: 111	• Total: 736 • DE: 585 • CZ: 151	• Total: 585
Travel time	20h50	14 h	± 7 days	1h05

Figure 132 Routes of the various freight transport modes on the corridor Hamburg – Prague

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 130. Rail transport is exempted from electricity tax on the Czech part of the corridor, while aviation is fully exempted from fuel taxes.

Table 130 Taxes and charges for freight transport means on the corridor Hamburg - Prague (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	95 / 95	95 / 95
	Ownership tax	5 / 5	10 / 10
	Insurance tax	4 / 3	1 / 1
	Distance-based road charges	82 / 82	82 / 82
	Electricity tax	1584 / 2374	1584 / 2374
	Infrastructure charges	3064 / 3247	3064 / 3247
	Port charges	97/97	97/97
	Water pollution charges	40/40	40/40
	LTO/landing charges	1,330	575
	Ground-handling and infrastructure related charges	80	203
	Navigation charges	1,338	1,338
	ETS	22	22

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

Some (non tax/charge/subsidy related) factors affecting the level playing field of the freight transport modes on the corridor Hamburg – Prague are:

- Capacity issues for rail freight transport on the Czech part of the route (iC Consulenten et al., 2014). The expected grow of rail traffic volumes may also result in capacity issues on the (German part of the) Dresden – Prague line in the (near) future.

- The maximum allowed train length in the Czech Republic is lower than in Germany, hampering large-scale rail freight transport on this corridor (iC Consulenten et al., 2014).
- Poor navigability of the Elbe and Vltava waterway due to unstable water levels (as they are subject to natural fluctuations) and low heights under bridges. Extremely low fairway depths of 1.4 m on German sections and 0.9 – 2.0 meter on Czech sections are occurring especially during dry seasons (iC Consulenten et al., 2014; FLAVIA, 2013). Commercial shipping is therefore not possible all year and hence current transport flows by inland shipping on the corridor are rather low. However, as future improvements for this route are considered, it is still interesting to include inland shipping in the analysis of this corridor.

C.8 Helsinki – Gdansk

The Helsinki – Gdansk corridor connects Scandinavia with Eastern and Central Europe, both for passenger and freight transport.

Passenger transport

Passenger transport is possible via road and aviation. Road transport requires the use of a ferry between Helsinki and Tallinn and hence should be considered an intermodal trip. Train transport is not possible on this corridor due to very bad interconnectivity between the different countries (among other things due to different gauges in the Baltic States and the other countries). Currently a high speed connection (connecting Berlin with Tallinn) is under development known as Rail Baltic. Construction is planned to start in 2019 with complete connection in 2030. More information on the routes of passenger transport can be found in Table 131 and Figure 133.

Table 131 Overview of passenger transport modes on the route Helsinki - Gdansk

			
Origin & Destination	• Helsinki central station • Gdansk Glowny	• Helsinki central station • Gdansk Glowny	• Helsinki international airport • Gdansk international airport
Distances (km)	• Total: 1133 • FI untolled: 4 • Ferry: 82 • EE untolled: 193 • LV untolled: 206 • LT untolled: 277 • PL untolled: 347 • PL tolled: 24	• Total: 1133 • FI untolled: 4 • Ferry: 82 • EE untolled: 193 • LV untolled: 206 • LT untolled: 277 • Pl untolled: 347 • PL tolled: 24	• Total: 860
Travel time	18h30m	27h45	2h00

Figure 133 Routes of the various passenger transport modes on the corridor Helsinki - Gdansk

An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 132. Although the road modes have to take the ferry between Helsinki and Tallinn, the charges levied on ferries are not considered as part of the total taxes and charges. Instead, they are assumed to be part of the internal costs of the road transport modes. Coach transport is (partly) exempted from VAT on the entire corridor, while aviation is fully exempted from fuel taxes and VAT.

Table 132 Taxes and charges for passenger transport means on the corridor Helsinki - Gdansk (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	27/23	27/23
	Ownership tax	9/18	-
	Registration tax	6/8	1/1
	Insurance tax	9/9	-
	Distance-based road charges	-	-
	VAT	47/57	36/32
	Fuel tax	91	91
	Ownership tax	-	5
	Insurance tax	9	1
	Distance-based road charges	1	1
	Time-based road charges	15	15
	VAT	64	64
	Passenger related charges	735/1,893	619/1,595
	LTO/landing charges	194/400	194/400
	Navigation charges	508/764	508/764
	ETS	16/24	16/24

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non-tax related) factors, including:

- The road conditions in Baltic countries and Poland are not optimal.

- No good rail connections exist between the Baltic countries and between Lithuania and Poland.

Freight transport

Freight transport between Helsinki and Gdansk is possible via road (intermodal), sea and air. Rail transport is not a viable option due to the bad connection between the countries. Both Helsinki and Gdansk are situated at the Baltic Sea, maritime transport is thus a viable option on this corridor. More information on the routes of freight transport can be found in Table 133 and Figure 134.

Table 133 Overview of freight transport modes on the route Helsinki - Gdansk

			
Origin & Destination	• Port of Helsinki • Port of Gdansk	• Port of Helsinki • Port of Gdansk	• Helsinki international airport • Gdansk international airport
Distances (km)	• Total 1133 • FI untolled: 3 • Ferry: 82 • EE untolled: 193 • LV untolled: 206 • LT untolled: 277 • Pl untolled: 347 • PL tolled: 24	• Total: 833	• Total: 860
Travel time	47h30	32h00	2h00

Figure 134 Routes of the various freight transport modes on the corridor Helsinki - Gdansk

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 134. Again, charges on the ferry used by HGVs are not taken into account as charges, but as part of the internal costs of HGVs. As for aviation, it is fully exempted from fuel taxes.

Table 134 Taxes and charges for freight transport means on the corridor Helsinki - Gdansk (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	118 / 118	118 / 118
	Ownership tax	6 / 6	7 / 7
	Insurance tax	11 / 8	-
	Distance-based road charges	2 / 2	2 / 2
	Time-based road charges	16/16	16 / 16
	Port charges	8582 / 6804	8582 / 6804
	Fairway dues	7886 / 7886	7886 / 7886
	Piloting charges	1864 / 1864	1864 / 1864
	LTO/landing charges	736	736
	Navigation charges	1,009	1,009
	ETS	38	38

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non-tax related) factors (Trinity et al, 2014), including:

- The road conditions in Baltic countries and Poland are not optimal.
- Ice could be an issue for maritime transport during winter season
- The Port of Helsinki needs better nautical accessibility to match the demand.

C.9 Lisbon – Antwerp

Lisbon – Antwerp is particularly a freight transport corridor, thanks to the maritime connection between both cities. Passenger transport on the corridor is relatively limited.

Passenger transport

The route between Lisbon and Antwerp is possible via road, rail and air. The rail trip between both cities requires two transfers: in Irun and Paris. Between Lisbon and Irun a regular (electric) intercity train is used, while between Irun and Paris and between Paris and Antwerp use can be made of high speed rail connections. The connection by airplane is intermodal, as there are no direct flights between Lisbon and Antwerp. Therefore a flight between Brussels and Lisbon is considered, while a high speed train is taken between Brussels and Antwerp More information on the routes of passenger transport can be found in Table 135 and Figure 135.

Table 135 Overview of passenger transport modes on the route Lisbon - Antwerp

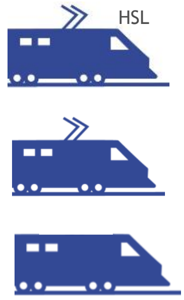
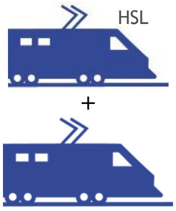
				
Origin & Destination	• Lisbon Oriente • Antwerp Central	• Lisbon Oriente • Antwerp Central	• Lisbon Oriente • Antwerp Central	• Lisbon Airport • Antwerp Central via Brussels Airport
Distances (km)	• Total: 2064 • PT untolled: 58 • PT tolled: 288 • ES untolled: 441 • ES tolled: 144 • FR untolled: 572 • FR tolled: 460 • BE untolled: 111	• Total: 2064 • PT untolled: 58 • PT tolled: 288 • ES untolled: 441 • ES tolled: 144 • FR untolled: 572 • FR tolled: 460 • BE untolled: 111	• Total: 2088 • Regular PT: 418 • RegularES:424 • ES diesel: 126 • HSL FR: 990 • HSL BE: 130	• Total: 1875 • Aviation: 1835 • HSL BE: 40
Travel time	20h40	31h00	23h50	4h30 + 30 min train

Figure 135 Routes of the various passenger transport modes on the corridor Lisbon – Antwerp

An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 136. Coach transport is (partly) exempted from fuel taxes (on the Belgian and French part of the corridor) and VAT (on the entire corridor), while rail transport is (partly exempted from electricity tax (on the Portuguese, French and Belgian part of the corridor) and VAT (on the entire corridor).

Table 136 Taxes and charges for passenger transport means on the corridor Lisbon - Antwerp (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	78/61	78/61
	Ownership tax	15/14	24/33
	Registration tax	11/33	3/5
	Insurance tax	10/10	17/17
	Distance-based road charges	104/104	104/104
	VAT	109/130	97/120
	Fuel tax	137	137
	Ownership tax	7	3
	Insurance tax	10	12
	Distance-based road charges	286	286
	VAT	338	353
	Fuel tax	108	108
	Electricity tax	223	223
	Infrastructure charge	22,354	22,354
	VAT	2,297	2,297
	Passenger related charges	804/2,069	2,273/5,851
	LTO/landing charges	50/79	381/759
	Ground-handling and infrastructure related charges	248/319	488/622
	Navigation charges	1,201/1,739	2,403/3,479
	ETS (aviation)	35/52	69/105
	Fiscal burden intermodal rail leg	151/388	302/777

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non-tax related) factors (TIS.pt et al., 2014; Panteia et al., 2014), including:

- Difference in rail gauges requires a transfer between Spain and France
- High levels of congestion on main parts of the road network (e.g. in the Rotterdam, Brussels and Pairs area), affecting the (reliability of) travel time of road transport).
- The itinerary includes a night train from Irun to Lisbon
- Lisbon airport is not connected by rail, only urban rail (metro), which may hamper last-/first-mile transport.

Freight transport

Freight transport on the corridor Antwerp and Lisbon is possible by road, rail, short sea shipping and aviation. For rail transport, 2 transfers are required, one in Irun (ES) and one in Paris. As for passenger transport, the connection by airplane is intermodal. There is a flight between Brussels and Lisbon, while Brussels – Antwerp is done by truck. More information on the routes of freight transport can be found in Table 137 and Figure 136.

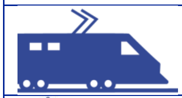
Table 137 Overview of freight transport modes on the route Antwerp - Lisbon

				
Origin & Destination	• Port of Lisbon • Port of Antwerp Westhaven	• Port of Lisbon • Port of Antwerp Westhaven	• Port of Lisbon • Port of Antwerp Westhaven	• Lisbon Airport • Antwerp via Brussels Airport
Distances (km)	• Total 2085 • PT untolled: 110 • PT tolled: 262 • ES untolled: 441 • ES tolled: 144 • FR untolled: 572 • FR tolled: 460 • BE untolled: 11 • BE tolled: 95	• Total: 2.236 • PT: 435 • ES electric: 490 • ES diesel: 126 • FR: 1058 • BE: 127	• Total: 2010	• Total:1890 • Flight: 1835 • Drive: 55
Travel time	63h45	46h00	80h00	4h30 + 45 min drive

Figure 136 Routes of the various freight transport modes on the corridor Lisbon - Antwerp

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 138. HGVs are partly exempted from fuel taxes (on the Belgian and French part of the corridor), while rail transport is partly exempted from electricity taxes (on the Portuguese, French and Belgian part of the corridor). Both maritime transport and aviation are fully exempted from fuel taxes.

Table 138 Taxes and charges for freight transport means on the corridor Lisbon - Antwerp (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	181 / 181	181 / 181
	Ownership tax	15 / 15	10 / 10
	Insurance tax	12 / 8	9 / 7
	Distance-based road charges	301 / 301	301 / 301
	Fuel tax	242/367	242/367
	Electricity tax	776 / 1164	776 / 1164
	Infrastructure charge	6146 / 6162	6146 / 6162
	Port charges	1981 / 2105	1981 / 2105
	Piloting charges	4527 / 4639	4527 / 4639
	Waste charges	-	81 / 81
	LTO/landing charges	126	1,006
	Ground-handling and infrastructure related charges	108	108
+	Navigation charges	2,240	2,240
	ETS	82	82
	fiscal burden intermodal HGV leg	118	118

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (TIS.pt et al, 2014; Panteia et al., 2014), including:

- Main parts of the road network are often heavily congested (e.g. in the Rotterdam, Antwerp and Paris areas), affecting the (reliability of) travel time of trucks.
- Road haulage regulations differ between the various countries of the corridor, in terms of the hours when vehicles can use the networks. This situation leads to parking areas congestion and saturation at the borders.
- Part of train route in Spain is not electrified
- Track gauge differences Spain (1668mm) – France (1435mm). France has 100% UIC track gauge, Spain only 25% (for Madrid-Valladoid and HS line Madrid-Antequera). This requires either axel change or transfer of load.
- Single track for border crossing Irun (ES) – Hendaye (FR), which is a major bottleneck for rail transport on this segment.

C.10 Stockholm – Hamburg

The corridor Stockholm – Hamburg incorporates the most important route to travel between the Scandinavian countries and the rest of Europe.

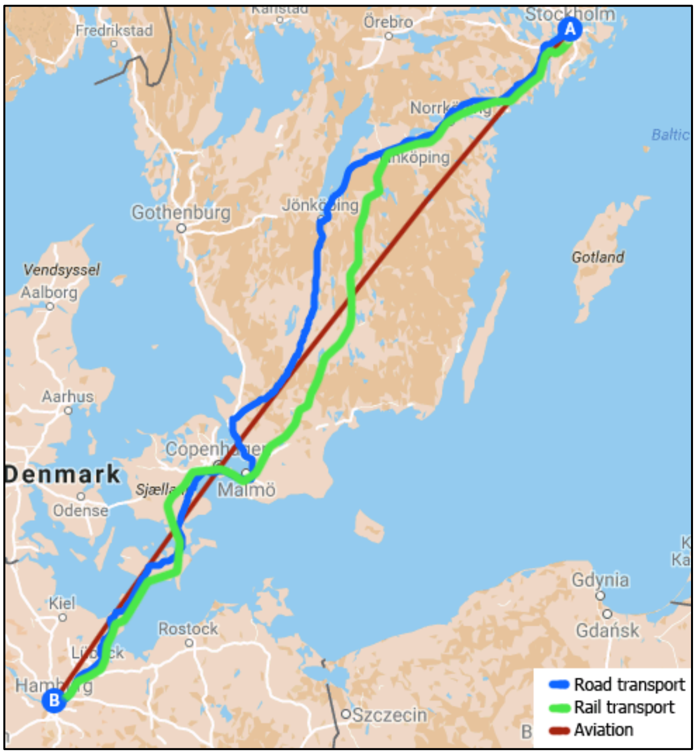
Passenger transport

Passenger transport on this corridor is possible by road, rail and air. The connection between Sweden and Denmark goes via the Oresund toll bridge. The connection of Denmark and Germany is by ferry, making the routes by car and bus intermodal. As for rail transport, one transfer has to be made in Copenhagen. This trip is served intermodal as well, as the high speed train from Copenhagen to Hamburg is transported by ferry to cross the Baltic Sea. More information on the routes of passenger transport can be found in Table 139 and Figure 137.

Table 139 Overview of passenger transport modes on the route Stockholm - Hamburg

			HSL	
Origin & Destination	• Stockholm central station • Hamburg Hauptbahnhof	• Stockholm central station • Hamburg Hauptbahnhof	• Stockholm central station • Hamburg Hauptbahnhof	• Stockholm international airport • Hamburg international airport
Distances (km)	• Total: 1044 • SE untolled: 653 • SE tolled: 8 • DK: 214 • Ferry:19 • DE untolled: 150	• Total: 1044 • SE untolled: 653 • SE tolled: 8 • DK: 214 • Ferry:19 • DE untolled: 150	• Total: 947 • HSL SE : 598 • HSL DK: 180 • Ferry 19 • HSL DE: 150	• Total: 896
Travel time	11h30	17	10h00	1h30

Figure 137 Routes of the various passenger transport modes on the corridor Stockholm - Hamburg



An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 140. As for the corridor Helsinki – Gdansk, the charges on the ferry are considered to be part of the internal costs of road and rail transport. Furthermore, coach transport is exempted from VAT (on the Swedish part of the corridor), while rail transport is (partly) exempted from both electricity taxes (on the entire corridor) and VAT (on the Swedish and Danish part of the corridor). Finally, aviation is fully exempted from fuel taxes and VAT.

Table 140 Taxes and charges for passenger transport means on the corridor Stockholm - Hamburg (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	42/34	42/34
	Ownership tax	5/7	6/8
	Insurance tax	9/9	6/6
	Tolls on specific parts of the road network	52/52	52/52
	Urban road pricing schemes	2	2
	VAT	58/66	51/57
	Fuel tax	138	138
	Ownership tax	8	10
	Insurance tax	13	8
	Tolls on specific parts of the road network	270	270
	Urban road pricing schemes	2	2
	VAT	32	32
	Electricity tax	622	622
	Infrastructure charge	2,313	2,313
	Charges for specific infrastructure	667	667
	VAT	622	622
	Aviation tax	-	405/1043
	Passenger related charges	866/2,228	536/1380
	LTO/landing charges	210/465	155/323
	Ground-handling and infrastructure related charges	122/147	16/32
	Navigation charges	606/883	606/883
	ETS	16/25	16/25

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (Kombiconsult et al., 2014), including congestion on roads around major cities and tunnels/bridges.

Freight transport

Freight transport between Stockholm and Hamburg is possible by road, rail, short sea shipping and aviation. The route via road is intermodal as part of the route is done by ferry connecting Denmark and Germany. The rail connection for freight traffic is direct. More information on the routes of freight transport can be found in Table 141 and Figure 138.

Table 141 Overview of freight transport modes on the route Stockholm - Hamburg

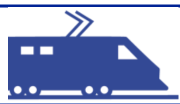
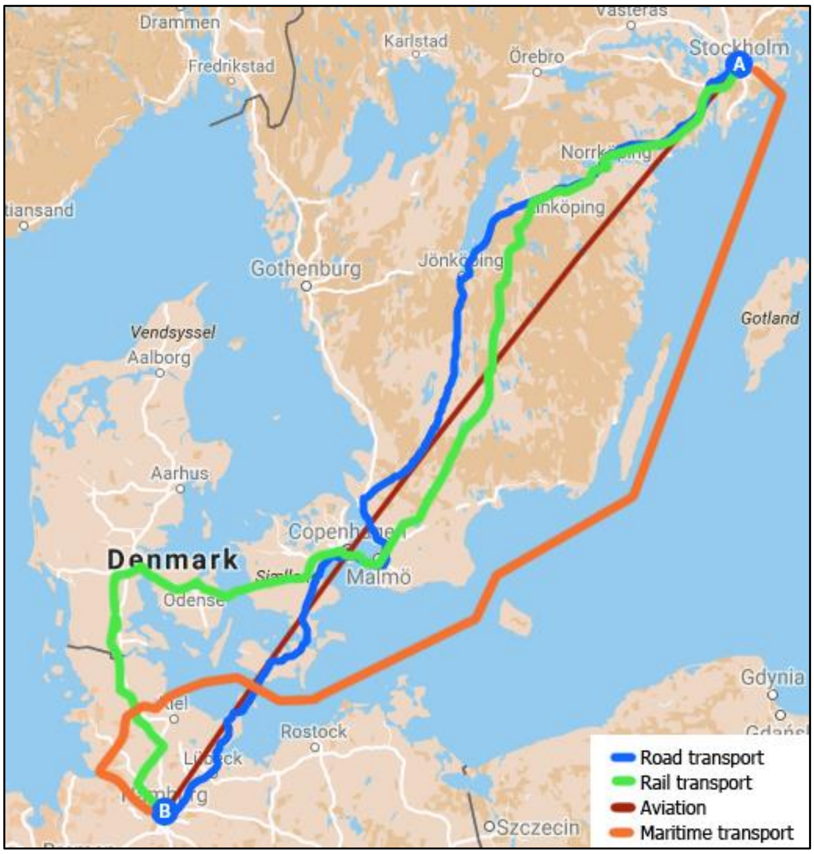
				
Origin & Destination	• Port of Stockholm • Port of Hamburg	• Stockholm Årsta rail terminal • Port of Hamburg Eurogate	• Port of Stockholm • Port of Hamburg	• Stockholm international airport • Hamburg international airport
Distances (km)	• Total 1052 • SE untolled: 688 SE tolled: 4 • DK untolled: 174 • Oresundbrug toll: 8 • Ferry: 19 • DE untolled:28 • DE tolled: 132	• Total: 1156 • SE: 611 • DK 342 • DE: 203	• Total: 1288	• Total: 896
Travel time	27h45	19h00	50h00	1h30

Figure 138 Routes of the various freight transport modes on the corridor Stockholm - Hamburg



An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 142. Rail transport is partly exempted from electricity taxes (on the entire corridor), while both maritime transport and aviation are fully exempted from fuel taxes. Finally, the charges on the ferry (for the road option) are considered internal costs of HGVs.

Table 142 Taxes and charges for freight transport means on the corridor Stockholm - Hamburg (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	181 / 181	181 / 181
	Ownership tax	6 / 6	8 / 8
	Insurance tax	13 / 9	6 / 5
	Distance-based road charges	18 / 18	18 / 18
	Time-based road charges	26 / 26	26 / 26
	Tolls on specific parts of the road network	193 / 193	193 / 193
	Electricity tax	593 / 889	593 / 889
	Infrastructure charge	3836 / 4857	3836 / 4857
	Charges for specific infrastructure	1196 / 1196	1196 / 1196
	Port charges	3178 / 8148	3178 / 8148
	Fairway dues	5643 / 3840	5643 / 3840
	Piloting charges	3734 / 3734	3734 / 3734
	Waste charges	396 / 396	396 / 396
	LTO/landing charges	812	448
	Ground-handling and infrastructure related charges	123	-
	Navigation charges	1,142	1,142
	ETS	39	39

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (Kombiconsult et al. 2014), including:

- Congestion on the road network around major cities and tunnels/bridges
- Stockholm – Malmo has maximum train length restrictions of 630 m
- The rail freight terminal of Hamburg has capacity issues
- The port of Stockholm requires ice breaking during the winter
- The Port of Hamburg has capacity issues.

C.11 Genoa – Rotterdam

The corridor Genoa – Rotterdam connects two important European maritime ports. Therefore, this corridor is particularly considered a freight transport corridor.

Passenger transport

Passenger transport between Genoa and Rotterdam is possible via road, rail and aviation. The rail connection has three transfers (in Milan, Basel and Utrecht). The connection between Milan and Utrecht is done by one high speed train (Utrecht – Basel), while the connections Utrecht – Rotterdam, Milan – Basel and Genoa - Milan are done by a regular (electric) intercity train. As for aviation, there are no direct flights between the airports of Rotterdam and Genoa. The most convenient route is to flight between Genoa and Amsterdam, and take the high speed train between Amsterdam and Rotterdam. More information on the routes of passenger transport can be found in Table 143 and Figure 139.

Table 143 Overview of passenger transport modes on the route Genoa - Rotterdam

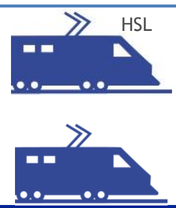
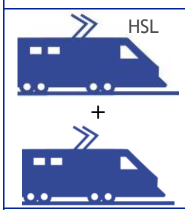
				
Origin & Destination	• Genoa Brignole • Rotterdam Centraal	• Genoa Brignole • Rotterdam Centraal	• Genoa Brignole • Rotterdam Centraal	• Genoa Critoforo Colombolo • Rotterdam centraal station via Schiphol
Distances (km)	• Total: 1180 • IT untolled: 29 • IT tolled: 166 • CH untolled: 290 • FR untolled: 198 • FR Tolled: 136 • LU untolled: 33 • BE untolled: 265 • NL untolled: 63	• Total: 1180 • IT untolled: 29 • IT tolled: 166 • CH untolled: 290 • FR untolled: 198 • FR Tolled: 136 • LU untolled: 33 • BE untolled: 265 • NL untolled: 63	• Total 1225 • Regular IT: 284 • Regular CH: 192 • HSL CH: 3 • HSL DE: 618 • HSL NL: 78 • Regular NL: 50	• Total: 1109 • Aviation: 1050 • HSL NL: 59
Travel time	13h30	20h15	14h10	4h00 + 30 min HSL

Figure 139 Routes of the various passenger transport modes on the corridor Genoa - Rotterdam

An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 144. Coach transport is (partly) exempted from fuel taxes (on the Belgian and French part of the corridor) and VAT (on the entire corridor), while rail transport is (partly) exempted from electricity taxes (on the Belgian, French, Swiss and Italian part of the corridor) and VAT (on the entire corridor except for the German part). Finally, aviation is fully exempted from fuel taxes and VAT.

Table 144 Taxes and charges for passenger transport means on the corridor Genoa - Rotterdam (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	55/47	55/47
	Ownership tax	13/13	28/63
	Registration tax	3/3	31/36
	Insurance tax	10/10	8/8
	Distance-based road charges	28/28	28/28
	Time-based road charges	19/19	19/19
	VAT	46/53	48/57
	Fuel tax	138	138
	Ownership tax	21	17
	Registration tax	1	
	Insurance tax	13	9
	Distance-based road charges	61	61
	Time-based road charges	62	62
	VAT	99	99
	Electricity tax	2,582	2,582
	Infrastructure charge	7,005	7,005
	VAT	6,006	6,006
	Aviation tax	131/336	-
	Passenger related charges	688/2,504	1,271/3,271
	LTO/landing charges	128/259	128/259
	Ground-handling and infrastructure related charges	24/24	24/24
	Navigation charges	931/1,371	931/1,371
	ETS	18/28	18/28
	Fiscal burden of intermodal train leg	371/956	371/956

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (HaCon et al. 2014; Panteia et al., 2014), including:

- High levels of congestion on main parts of the road network (e.g. in Rotterdam and Milan areas)
- Night driving bans for busses in Switzerland.
- Genoa airport has no rail connection, hampering first-/last-mile transport.

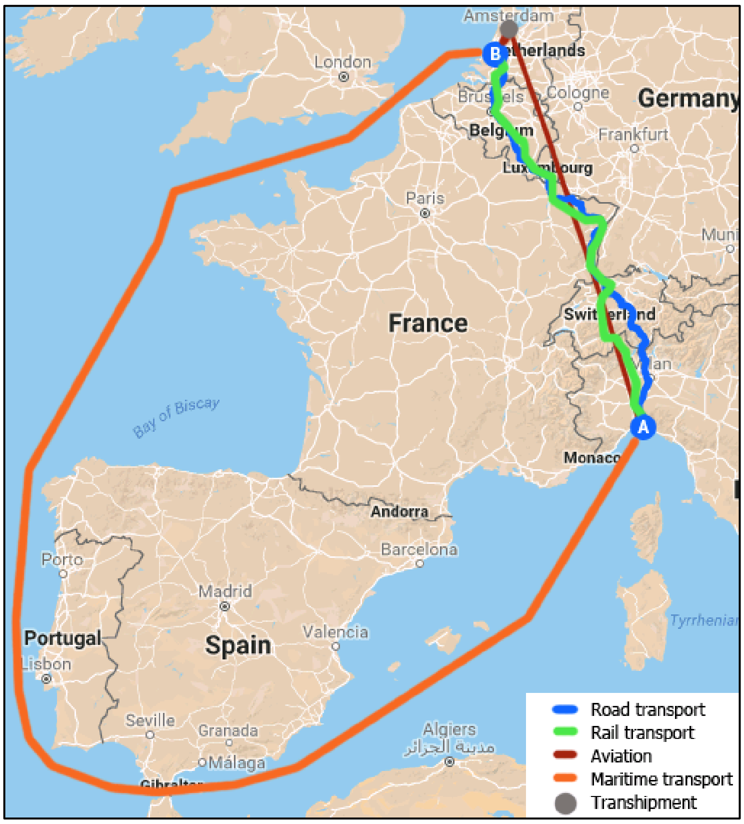
Freight transport

Freight transport between Genoa and Rotterdam is possible by road, rail, maritime transport and aviation. As for passenger transport, the aviation trip is intermodal: between Rotterdam and Amsterdam transport is carried out by truck. For the other modes, direct connections are assumed. More information on the routes of freight transport can be found in Table 145 and Figure 140.

Table 145 Overview of freight transport modes on the route Rotterdam - Genoa

				
Origin & Destination	• Port of Genoa • Port of Rotterdam	• Port of Genoa, Voltri terminal • Port of Rotterdam, Maasvlakte	• Port of Rotterdam • Port of Genoa	• Genoa Critoforo Colombolo • Port of Rotterdam via Amsterdam Schiphol airport
Distances (km)	• Total: 1185 • IT untolled: 41 • IT tolled: 143 • CH tolled: 290 • FR untolled:198 • FR tolled:136 • LU untolled: 33 km • BE tolled: 258 • NL untolled: 86 km	• Total: 1221 • IT: 260 • CH: 222 • FR 334 • LU: 34 • BE: 275 • NL: 96	• 4158 km	• Total: 1120 • Aviation: 1050 • Road: 70
Travel time	29h10	27h00	160h00	4h00 + 65 min HGV

Figure 140 Routes of the various freight transport modes on the corridor Genoa - Rotterdam



An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 146. HGVs are partly exempted from fuel taxes (on the Italian, French and Belgian part of the corridor), while rail transport is (partly) exempted from electricity taxes (on the Italian, Swiss, French and Belgian part of the corridor). Both maritime transport and aviation are fully exempted from fuel taxes.

Table 146 Taxes and charges for freight transport means on the corridor Genoa - Rotterdam (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	181 / 181	181 / 181
	Ownership tax	10 / 10	9 / 9
	Registration tax	1 / 1	
	Insurance tax	10 / 8	8 / 6
	Distance-based road charges	357 / 357	357 / 357
	Time-based road charges	29 / 29	29 / 29
	Electricity tax	61 / 91	61 / 91
	Infrastructure charge	3267 / 3814	3267 / 3814
	Port charges	4270 / 5099	4270 / 5099
	Piloting charges	10767 / 10767	13017 / 13017
	Waste charges		210 / 210
+	LTO/landing charges	300	300
	Ground-handling and infrastructure related charges	1,322	1,322
	Navigation charges	1,787	1,787
	ETS	43	43
	Fiscal burden intermodal HGV leg	91	300

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (HaCon et al., 2014), including:

- At the Swiss-German border there is a night time driving ban for heavy vehicles in Switzerland which poses a capacity challenge on sections leading from Italy and Germany into Switzerland, for parking facilities and border crossings. The night time driving ban in Switzerland is in effect between 22:00 and 5:00. The ban requires trucks to stop before the border. While this is considered in planning of transports, unexpected events and delays can require additional stops in cross-border areas requiring more parking facilities than on other road sections.
- Road haulage regulations differ between the various countries of the corridor, in terms of the hours when vehicles can use the networks. This situation leads to parking areas congestion and saturation at the borders.
- In 2001 Switzerland introduced a truck dosing system for the Gotthard tunnel which limits the possible truck passages per hour to 60 - 150 trucks, depending on car traffic. In case of higher volumes, trucks are stopped in dedicated waiting areas along the motorway.
- Switzerland has a maximum train length of 600 meters, while also Italy has maximum train lengths below the European standard.
- Genoa airport has no rail connection, hampering first-/last-mile transport.

C.12 Budapest – Milan

The corridor Budapest – Milan covers the transport flows between two important European cities in central Europe, both for passenger and freight transport.

Passenger transport

Passenger transport between Budapest and Milan is possible via road, rail and air. The train connection is partially by high-speed trains (Milan – Verona) and (Innsbruck – Budapest) and partially by an international intercity connection (Verona – Innsbruck). More information on the routes of passenger transport can be found in Table 147 and Figure 141.

Table 147 Overview of passenger transport modes on the route Budapest - Milan

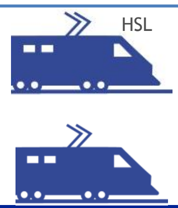
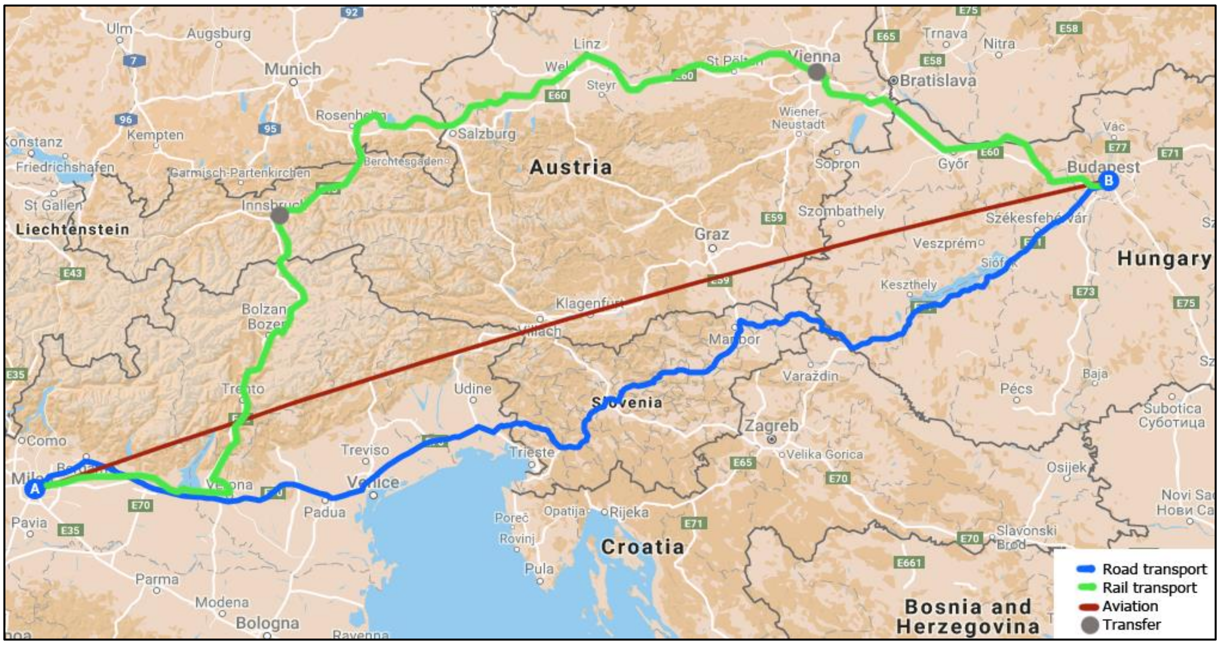
				
Origin & Destination	• Budapest Keleti • Milano Centrale	• Budapest Keleti • Milano Centrale	• Budapest Keleti • Milano Centrale	• Budapest international airport • Milan Malpensa international airport
Distances (km)	• Total: 967 • HU untolled 259 • SI untolled 316 • IT untolled: 33 • IT tolled: 359	• Total: 967 • HU untolled 259 • SI untolled 316 • IT untolled: 33 • IT tolled: 359	• Total 1110 • HSL HU: 175 • HSL AT: 435 • HSL DE: 100 • Regular AT: 35 • Regular IT: 225 • HSL IT: 140	• Total: 925
Travel time	10h10	15h15	13h30	1h35

Figure 141 Routes of the various passenger transport modes on the corridor Budapest - Milan



An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 148. Coach transport is (partly) exempted from fuel taxes (on the Hungarian and Slovenian part of the corridor) and VAT (on the entire corridor), while rail transport is (partly) exempted from electricity taxes (on the Italian and Slovenian part of the corridor) and VAT (on the entire corridor). Finally, aviation is fully exempted from fuel taxes and VAT.

Table 148 Taxes and charges for passenger transport means on the corridor Budapest - Milan (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	34/29	34/29
	Ownership tax	4/4	9/10
	Registration tax	1/1	2/2
	Insurance tax	7/7	8/8
	Distance-based road charges	30/30	30/30
	Time-based road charges	10/9	15/15
	VAT	45/52	44/50
	Fuel tax	86	86
	Ownership tax	4	15
	Registration tax	1	1
	Insurance tax	11	11
	Distance-based road charges	85	85
	Time-based road charges	11	11
	VAT	51	54
HSL +	Electricity tax	2,951	2,951
	Infrastructure charge	3,672	3,672
	VAT	2,153	2,153
	Aviation tax	-	131/337
	Passenger related charges	1,498/3,856	1,016/2,615
	LTO/landing charges	85/155	520/874
	Ground-handling and infrastructure related charges	40/107	40/107
	Navigation charges	888/1,327	888/1,327
	ETS	15/25	16/25

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (PwC et al., 2014), including:

- Congestion on the road network around Milan, Ljubljana and Budapest
- There is no motorway connection between Hungary and Slovenia
- The overall condition of the rail network in Hungary is in poor condition.
- Lack of interoperability and integration between transport modes
- Budapest airport is not connected to rail, hampering first-/last-mile transport.
- Milan Malpensa is not connected to rail, hampering first-/last-mile transport.

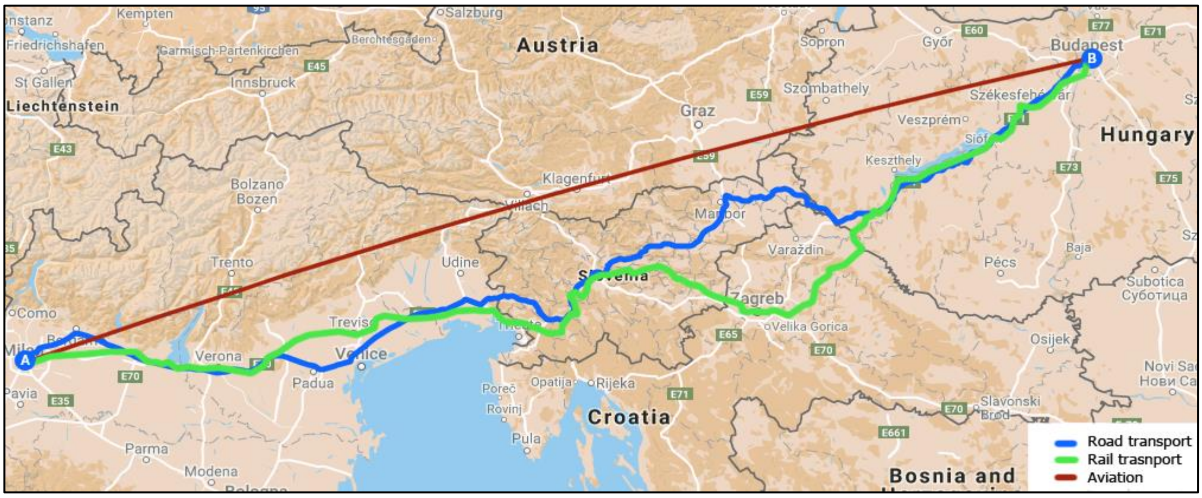
Freight transport

Freight transport is possible via road, rail and aviation (all direct connections). Information on the routes of freight transport can be found in Table 149 and Figure 142.

Table 149 Overview of freight transport modes on the route Budapest - Milan

			
Origin & Destination	• Port of Budapest • Milan Melzo	• Blik Container terminal Budapest • Milan Melzo terminal	• Budapest international airport • Milan Malpensa international airport
Distances (km)	• Total: 965 • HU untolled: 35 • HU tolled: 244 • SI tolled: 316 • IT untolled: 54 • IT tolled: 316	• Total: 1001 • HU: 262 • HR: 125 • SI: 231 • IT: 383	• Total: 925
Travel time	26h20	22h00	1h35

Figure 142 Routes of the various freight transport modes on the corridor Budapest - Milan



An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 150. HGVs are partly exempted from fuel taxes (on the entire corridor), while rail transport is (partly) exempted from electricity taxes (on the Italian and Slovenian part of the corridor). Aviation is fully exempted from fuel taxes.

Table 150 Taxes and charges for freight transport means on the corridor Budapest - Milan (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	111 / 111	111 / 111
	Ownership tax	4 / 4	7 / 7
	Registration tax	1 / 1	1 / 1
	Insurance tax	9 / 6	8 / 6
	Distance-based road charges	235 / 235	235 / 235
	Electricity tax	174 / 260	174 / 260
	Infrastructure charge	2558 / 3173	2558 / 3173
	LTO/landing charges	514	1,363
	Ground-handling and infrastructure related charges	317	317
	Navigation charges	1,747	1,747
	ETS	39	39

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (PwC et al., 2014), including:

- Congestion on the road network around Milan, Ljubljana and Budapest.
- There is no motorway connection between Hungary and Slovenia.
- Milan rail/road terminal has capacity issues.
- Rail tracks in Slovenia are not ERTMS equipped, maximum length is below 740m and are overall not EU compatible. Furthermore, there are speed and axle restrictions for rail freight transport in Slovenia.
- The overall condition of the rail network in Hungary is in poor condition.
- Lack of interoperability and integration between transport modes and railways in Hungary
- Budapest airport is not connected to rail, hampering first-/last-mile transport.
- Milan Malpensa is not connected to rail, hampering first-/last-mile transport.

C.13 Bucharest – Warsaw

This corridor reflects an important transport connection in Eastern Europe, connecting the capitals of Romania and Poland.

Passenger transport

Passenger transport between Bucharest and Warsaw is possible via road, rail and aviation. For rail transport, one transfer is required in Vienna. All rail transport is carried out by regular (electric) intercity passenger trains. More information on the routes of passenger transport can be found in Table 151 and Figure 143.

Table 151 Overview of passenger transport modes on the route Bucharest - Warsaw

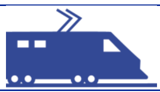
				
Origin & Destination	• Bucharest Gara de Nord • Warsaw Central station	• Bucharest Gara de Nord • Warsaw Central station	• Bucharest Gara de Nord • Warsaw Central station	• Bucharest international airport • Warsaw international airport
Distances (km)	• Total: 1726 • RO untolled: 620 • HU untolled: 390 • SK untolled: 81 • CZ untolled: 242 • PL untolled: 393	• Total: 1726 • RO untolled: 620 • HU untolled: 390 • SK untolled: 81 • CZ untolled: 242 • PL untolled: 393	• Total: 1665 • Regular RO: 555 • Regular HU: 405 • Regular AT: 145 • Regular CZ: 210 • Regular PL: 350	• Total: 1027
Travel time	18h30	27h30	31h00 (45h00 for Warsaw – Bucharest)	1h35

Figure 143 Routes of the various passenger transport modes on the corridor Bucharest - Warsaw

An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 152. Coach transport is (partly) exempted from fuel taxes (on the Hungarian part of the corridor) and VAT (on the entire corridor), while rail transport is (partly) exempted from electricity taxes (on the Slovakian and Czech part of the corridor) and VAT (on the entire corridor). Finally, aviation is fully exempted from fuel taxes and VAT.

Table 152 Taxes and charges for passenger transport means on the corridor Bucharest - Warsaw (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	42/36	42/36
	Ownership tax	2/1	-
	Registration tax	-	1/2

Transport mode	Tax/charge	Outward trip	Return trip
	Insurance tax	2/2	-
	Time-based road charges	20/19	32/32
	VAT	52/62	55/67
	Fuel tax	143	143
	Ownership tax	9	8
	Registration tax	-	0.13
	Insurance tax	4	-
	Distance-based road charges	26	26
	Time-based road charges	36	36
	VAT	38	38
	Electricity tax	1,092	1,092
	Charges for specific infrastructure	3,205	3,205
	VAT	59	59
	Passenger related charges	1,151/2,963	781/2,010
	LTO/landing charges	359/703	263/515
	Ground-handling and infrastructure related charges	456/497	456/497
	Navigation charges	587/914	587/914
	ETS	20/30	20/30

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (Hacon et al., 2014), including:

- The Czech Highway D1 that connects Vienna with Brno is in bad condition, making the route longer and uncomfortable.
- Long transit for rail passenger transport of 6 hours takes place in Vienna. Furthermore, a night train has to be used between Bucharest and Vienna.
- Bucharest airport is not connected by rail, hampering first-/last-mile transport.

Freight transport

Freight transport between Bucharest and Warsaw is possible via road, rail and aviation. Rail transport is done by electric trains, only the last mile in Romania is done by diesel train (but is not considered in this study). More information on the routes of freight transport can be found in Table 153 and Figure 144.

Table 153 Overview of freight transport modes on the route Bucharest - Warsaw

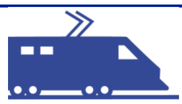
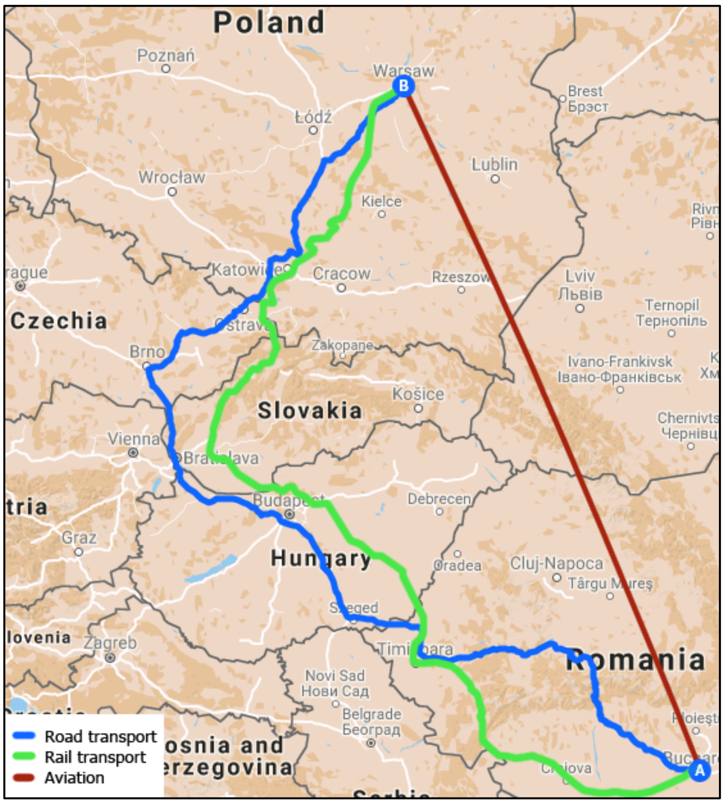
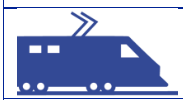
			
Origin & Destination	• Bucharest Chiajna • Port of Warsaw	• Bucharest Europolis logistic park • Warsaw Glowna terminal	• Bucharest international airport • Warsaw international airport
Distances (km)	• Total 1725 • RO untolled: 615 • HU untolled: 30 • HU tolled: 360 • SK untolled: 10 • SK tolled: 71 • CZ untolled: 7 • CZ tolled: 235 • PL untolled: 130 • PL tolled: 267	• Total: 1603 • RO: 600 • HU: 271 • SK: 305 • CZ: 34 • PL: 393	• Total: 1027
Travel time	49h00	35h00	1h35

Figure 144 Routes of the various freight transport modes on the corridor Bucharest - Warsaw



An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 154Table 116. HGVs are partly exempted from fuel taxes on the Hungarian part of the corridor. Furthermore, on the Slovakian and Czech part of the corridor rail transport is fully exempted from electricity taxes.

Table 154 Taxes and charges for freight transport means on the corridor Bucharest - Warsaw (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	186 / 186	186 / 186
	Ownership tax	8 / 8	11 / 11
	Insurance tax	3 / 2	-
	Distance-based road charges	172 / 172	172 / 172
	Time-based road charges	20 / 20	20 / 20
	Electricity tax	890 / 1335	890 / 1335
	Infrastructure charge	4739 / 5680	4739 / 5680
	LTO/landing charges	1,031	809
	Ground-handling and infrastructure related charges	485	485
	Navigation charges	1,259	1,259
	ETS	47	47

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors, including:

- The Czech Highway D1 that connects Vienna with Brno is in bad condition;
- Restrictions for train length to 540 meters in Romania .
- Restrictions of train length in Romania, Slovakia and Czech republic.
- Bucharest airport is not connected by rail, hampering first-/last-mile transport.

C.14 Dublin – Amsterdam

The corridor Dublin – Amsterdam reflects the transport connection between Ireland/UK and continental Europe.

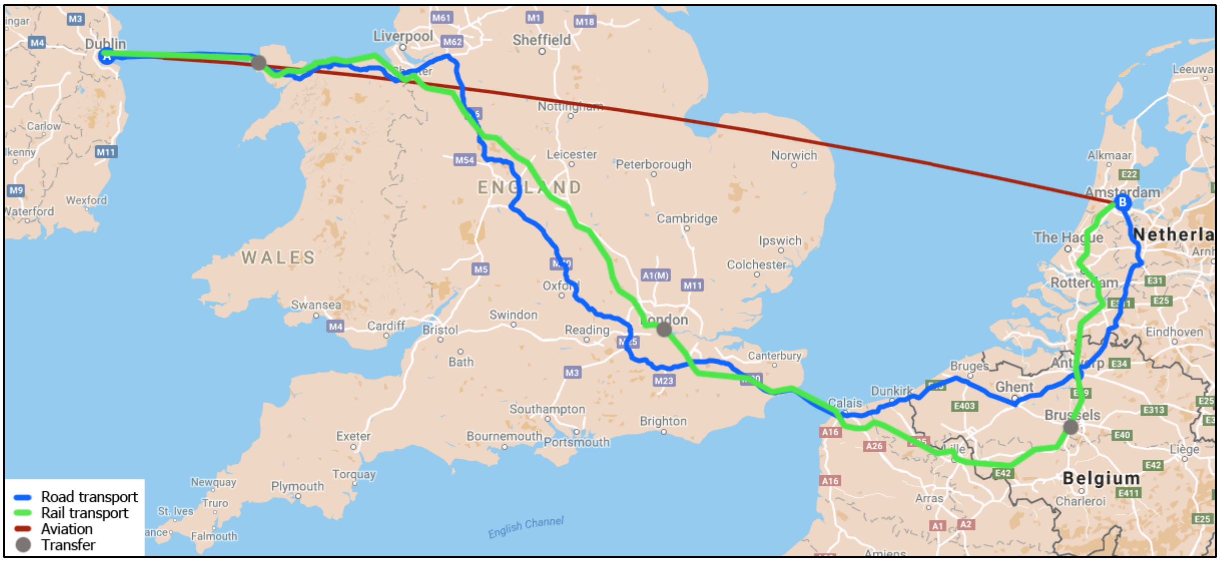
Passenger transport

Passenger transport between Dublin and Amsterdam is possible via road, rail and aviation. Both the road and rail connections are intermodal. The ferry transports passengers from Ireland to England (ferry between Dublin and Holyhead), while the crossing of the Channel is done via the Channel tunnel (by rail). In total, 4 transits are required for rail transport in order to travel the route. Part of the train route is served by high-speed trains. More information on the routes of passenger transport can be found in Table 155 and Figure 145.

Table 155 Overview of passenger transport modes on the route Dublin - Amsterdam

			HSL	
Origin & Destination	• Connolly station Dublin • Amsterdam Centraal	• Connolly station Dublin • Amsterdam Centraal	• Connolly station Dublin • Amsterdam Centraal	• Dublin international airport • Amsterdam Schiphol
Distances (km)	• Total: 1169 • IR Untolled: 6 • Ferry: 112 • UK untolled: 604 • Channel tunnel: 57 • FR untolled: 66 • BE untolled: 193 • NL untolled: 131	• Total: 1169 • IR Untolled: 6 • Ferry: 112 • UK untolled: 604 • Channel tunnel: 57 • FR untolled: 66 • BE untolled: 193 • NL untolled: 131	• Total: 1129 • Ferry: 112 • Regular UK: 410 • HSL UK: 120 • Tunnel 57 • HSL FR: 130 • HSL BE: 165 • HSL NL 135	• Total: 845
Travel time	15h00	22h30	8h45 train + 2h ferry	1h30

Figure 145 Routes of the various passenger transport modes on the corridor Dublin – Amsterdam



An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 156. Coach transport is (partly) exempted from fuel taxes (on the Irish part of the corridor) and VAT (on the entire corridor). The same is the case for rail transport, which is partly exempted from electricity tax (on the UK, French and Belgian part of the corridor) and VAT (on the entire corridor). Aviation is fully exempted from both fuel taxes and VAT. Finally, the charges on the ferry between Dublin and Holyhead are not taken into account as charges but as internal costs of the road or rail transport modes.

Table 156 Taxes and charges for passenger transport means on the corridor Dublin - Amsterdam (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	45/40	45/40
	Ownership tax	17/8	25/63
	Registration tax	20/28	31/36
	Insurance tax	2/2	8/8
	Tolls on specific parts of the road network	84/84	84/84
	VAT	61/71	60/69
	Fuel tax	140	140
	Ownership tax	8	16
	Insurance tax	2	8
	Distance based road pricing	18	18
	Tolls on specific parts of the road network	84	84
	VAT	58	57
	Electricity tax	60	60
	Infrastructure charge	13,927	13,927
	Charges for specific infrastructure	5,685	5,685
	VAT	1,524	1,524
	Passenger related charges	601/1,547	1,271/3,271
	LTO/landing charges	178/349	178/349
	Ground-handling and infrastructure related charges	-	-
	Navigation charges	766/1,127	766/1,127
	ETS	15/22	15/22

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (tax/charge/subsidy related) factors (Panteia et al., 2014), including:

- Congestion issues around major cities: Dublin, London, Antwerp, Brussels, Rotterdam, Amsterdam
- Dublin airport has no rail connection, hampering first-/last-mile transport.

Freight transport

Freight transport between Dublin and Amsterdam is possible via road, maritime transport and aviation. As for passenger transport, road transport is intermodal (ferry and rail in Channel tunnel). Rail transport is not a viable option, as the required use of water transport makes short sea shipping the preferred mode. More information on the routes of freight transport can be found in Table 157 and Figure 146.

Table 157 Overview of freight transport modes on the route Dublin - Amsterdam

Origin & Destination	• Port of Dublin • Port of Amsterdam	• Port of Dublin • Port of Amsterdam	• Airport of Dublin • Schiphol airport Amsterdam
Distances (km)	• Total: 1167 • IR Untolled: 3 • Ferry: 112 • UK untolled: 604 • Channel tunnel: 57 • FR untolled: 66 • BE untolled: 12 • BE tolled 160 • NL untolled: 153	• Total: 1391	• Total: 845
Travel time	43h30	54h00	1h30

Figure 146 Routes of the various freight transport modes on the corridor Dublin – Amsterdam

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trips) is given in Table 158. As for road transport, the charges levied on the ferry are considered internal costs of HGVs. Furthermore, HGVs are partly exempted from the fuel tax in Ireland, France and Belgium, while freight trains are (partly) exempted from the electricity tax in the UK, France and Belgium. Finally, both aviation and maritime transport are fully exempted from fuel taxes.

Table 158 Taxes and charges for freight transport means on the corridor Dublin - Amsterdam (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	181 / 181	181 / 181
	Ownership tax	10 / 10	9 / 9
	Insurance tax	2 / 1	8 / 6
	Distance-based road charges	35 / 35	35 / 35
	Time-based road charges	14 / 14	14 / 14
	Tolls on specific parts of the road network	63 / 63	63 / 63
	Port charges	13021 / 10552	13021 / 10552
	Piloting charges	11948 / 11948	11948 / 11948
	Waste charges	-	100 / 100

Transport mode	Tax/charge	Outward trip	Return trip
	LTO/landing charges	435	435
	Ground-handling and infrastructure related charges	-	-
	Navigation charges	1,468	1,468
	ETS	35	35

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (Panteia et al., 2014), including:

- Congestion issues on the road network around major cities: Dublin, London, Antwerp, Brussels, Rotterdam, and Amsterdam.
- Dublin airport has no rail connection, hampering first-/last-mile transport.

C.15 Athens – Vienna

The corridor Athens – Vienna covers important transport flows in Southeast Europe, connecting two capitals with economic and touristic importance.

Passenger transport

Passenger transport is possible via road, rail and aviation. The connection via road and rail passes through Serbia and Macedonia, which are not EU (and Schengen) countries. However, as shown in the textbox below, an alternative route via Bulgaria and Romania is not a viable option. Therefore, the route via Serbia and Macedonia is considered for all road transport means in this study. As for the estimation of the travel times, the minimal values of the border times are taken into account (i.e. 1 hour for passenger cars, 3 hours for busses and 2 hours for HGVs).

Border times on the corridor Athens – Vienna

The fastest route (excluding border times) by road between Athens and Vienna goes via Macedonia and Serbia. As both countries are no Schengen countries, border times may be substantial on this route and hence an alternative route avoiding these countries may be preferable. Therefore, we have assessed whether an alternative route (via Bulgaria and Romania is faster as also border times are taken into account. It should be noticed, however, that also Bulgaria and Romania are not Schengen countries and hence that border procedures in these countries take significant time as well.

Based on the results of the ACROSSEE project (AUHT, 2014), the border times for both the route via Serbia/Macedonia and Bulgaria/Romania are estimated, taking into account both waiting times and times for controls. Furthermore, the additional travel times (excluding border times) by taking the Bulgaria/Romania route is estimated by using Google Maps. The results of this analysis are shown in .

Table 159 Comparison of travel times between both routes

Route	Travel time (in min)	Passenger car	Bus	Truck
Via Macedonia and Serbia	Border time	55 to 805	160 to 888	107 to 1020
Via Bulgaria and Romania	Border time	68 to 300	95 to 534	94 to 2104
Difference between both routes (additional time for route via Macedonia and Serbia)	Border time	-13 to 505	65 to 354	-1804 to 13
	Travel time (excl. border time)	-315	-475	-475
	Total travel time	-328 to 190	-410 to -121	-2279 to - 462

As shown in the table, the border times may vary significantly for both routes. For passenger cars and busses, the border times are on average longer on the route via Macedonia and Serbia, while for trucks the average border times are longer on the route via Bulgaria and Romania (mainly due to potentially long border times between Romania and Bulgaria). The travel time (excl. border time) is significantly longer on the route via Bulgaria and Romania for all transport means. Total travel times (taking into account border times) are considerably longer on the route via Bulgaria and Romania for busses and trucks. For passenger cars it is not completely clear on which route travel times are longer, although the probability on longer travel times on the route via Bulgaria and Romania is significantly bigger. Therefore, we decided to consider for all road transport means the route via Macedonia and Serbia in this study.

As for passenger rail transport on the corridor Athens – Vienna, three transfers are required (in Thessaloniki, Belgrade and Budapest). More information on the routes of passenger transport can be found in Table 160 and Figure 147. The purple route represents the option using the ferry connection between Patras and Trieste. The route by land is the default option.

Table 160 Overview of passenger transport modes on the route Athens - Vienna

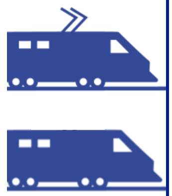
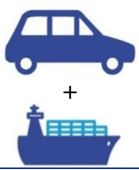
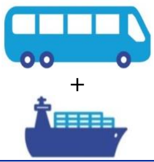
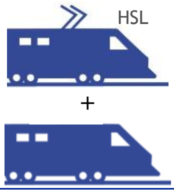
						
Origin & Destination	• Athens railway station • Vienna Hauftbahnhof	• Athens railway station • Vienna Hauftbahnhof	• Athens railway station • Vienna Hauftbahnhof	• Athens railway station • Vienna Hauftbahnhof	• Athens railway station • Vienna Hauftbahnhof	• Athens Eleftherios Venizelos international airport • Vienna international airport
Distances (km)	• Total: 1723 • EL untolled: 182 • EL Tolled: 365 • MK untolled: 132 • MK tolled: 59 • RS untolled: 256 • RS tolled 307 • HU untolled: 351 • AT untolled: 71	• Total: 1723 • EL untolled: 182 • EL Tolled: 365 • MK untolled: 132 • MK tolled: 59 • RS untolled: 256 • RS tolled 307 • HU untolled: 351 AT untolled: 71	• 222+ 479 + 1400 • EL untolled: 20 • El Tolled: 202 • IT untolled: 13 • SL untolled: 254 • AT untolled: 212 • Ferry	• Total: 2101 • EL untolled: 20 • El Tolled: 202 • IT untolled: 13 • SL untolled: 254 • AT untolled: 212 • Ferry	• Total: 1642 • Regular EL: 450 • Diesel EL: 98 • Regular MK: 160 • Regular RS:524 • Regular HU: 170 • HSL HU: 175 • HSL AT: 65	• Total: 1390
Travel time	19h30	30h30	40h	46h	33h40	2h10

Figure 147 Routes of the various passenger transport modes on the corridor Athens - Vienna

An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 161. A discount on fuel taxes exist for coaches on the Hungarian part of the corridor. Additionally, these vehicles are (partly) exempted from VAT on the entire corridor. Also rail passenger trains are (partly) exempted from VAT in all countries on the corridor. Finally, aviation is fully exempted from both fuel taxes and VAT.

Table 161 Taxes and charges for passenger transport means on the corridor Athens - Vienna (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	50/33	50/33
	Ownership tax	15/32	25/38
	Registration tax	31/115	6/11
	Insurance tax	10/10	6/6
	Distance-based road charges	47.4/47.4	47.4/47.4
	Time-based road charges	12/12	8/8
	VAT	59/91	52/66
	Fuel tax	131	131
	Ownership tax	12	-
	Registration tax	1	-
	Insurance tax	14	8
	Distance-based road charges	124	124
	Time-based road charges	19	19
	VAT	79	145
	Fuel tax	20/17	20/17
	Ownership tax	15/32	26/38
	Registration tax	31/115	6/11
	Insurance tax	10/10	6/6
	Distance-based road charges	9/9	9/9
	Time-based road charges	12/12	29/29
	VAT	53/85	46/60

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	66	66
	Ownership tax	12	-
	Registration tax	1	-
	Insurance tax	14	8
	Distance-based road charges	54.5	54.5
	Time-based road charges	19	19
	VAT	79	145
	Fuel tax	105	105
	Electricity tax	1,234	1,234
	Infrastructure charge	4,044	4,044
	VAT	349	349
	Aviation tax	-	378/937
	Passenger related charges	1,614/4,155	1,496/3,836
	LTO/landing charges	222/660	281/605
	Ground-handling and infrastructure related charges	180/321	171/304
	Navigation charges	706/1,042	706/1,042
	ETS	26/39	26/39

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (iC consulenten et al, 2014), including:

- Border crossing with non-EU countries of Macedonia and Serbia for road transport. This may result in longer travel times.
- Train transport is possible, but 3 transfers are required.
- The rail connection in Greece is not fully electrified. The connection between Athens and Sopron is done by diesel train, while the remaining part of the route is done by electric train.

Freight transport

Freight transport between Athens and Vienna is possible via road, rail and aviation. For rail transport, a transhipment in Sopron is necessary. The connection between Athens and Sopron is done by diesel train, while the remaining part of the route is done by electric trains. Direct connection via maritime transport is not possible, but there is an intermodal option via Trieste (road transport from Athens to Patras, maritime transport between Patras and Trieste, and finally road transport from Trieste to Vienna). For the maritime leg of this trip a RoRo ship is used (see Annex A). More information on the routes of freight transport can be found in Table 162 and Figure 148.

Table 162 Overview of freight transport modes on the route Athens - Vienna

Origin & Destination	• Port of Athens • Port of Vienna	• Port of Athens, Pireaus • Port of Vienna	• Port of Athens • Port of Vienna (via Trieste by truck)	• Athens international airport • Vienna international airport
Distances (km)	• Total: 1726 • GR untolled: 182 • GR Tolled: 367 • MK untolled: 132 • MK tolled: 59 • RS untolled: 256 • RS tolled 307 • HU untolled: 44 • HU tolled: 308 • AT untolled: 9 • AT tolled 62	• Total: 1748 • GR diesel: 98 • GR electric: 476 • MK: 202 • RS: 560 • HU: 340 • AT: 72	• Total: 1826 • Ship: 1137 • HGV EL untolled:27 • HGV EL tolled: 185 • HGV IT untolled: 10 • HGV SI tolled: 227 • HGV AT untolled: 9 • HGV AT tolled: 231	• Total: 1390
Travel time	50h00	77h00	32h ship + 9h00 HGV	2h10

Figure 148 Routes of the various freight transport modes on the corridor Athens - Vienna

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trip) is given in Table 163. For the maritime/intermodal option only the taxes/charges for HGVs are considered, as the costs of crossing the Adriatic Sea by the RoRo vessel can be seen as internal costs for the HGV (analogue to the ferry costs on the corridors Helsinki – Gdansk, Stockholm – Hamburg and Dublin – Amsterdam).

As for the fuel taxes, HGVs are partly exempted on the Hungarian part of the corridor. Furthermore, aviation is fully exempted from fuel taxes and VAT.

Table 163 Taxes and charges for freight transport means on the corridor Athens - Vienna (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	171 / 171	171 / 171
	Ownership tax	25 / 25	15 / 15
	Registration tax	6 / 6	-
	Insurance tax	12 / 9	7 / 5
	Distance-based road charges	181 / 181	181 / 181
 + 	Fuel tax	234/355	234/355
	Electricity tax	1474 / 2209	1474 / 2209
	Infrastructure charge	4255 / 4316	4255 / 4316
 + 	Fuel tax (HGV)	120/120	120/120
	Ownership tax (HGV)	15/15	11/11
	Registration tax (HGV)	4/4	-
	Insurance tax (HGV)	8/6	5/4
	Distance-based road charges (HGV)	184/184	184/184
	LTO/landing charges	1,009	953
	Ground-handling and infrastructure related charges	98	98
	Navigation charges	1,361	1,361
	ETS	61	61

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (iC Consulenten et al., 2014), including:

- Border crossing with non-EU countries of Macedonia and Serbia;
- Interoperability issues for the rail section from Athens to Békéscsaba (EL, BG, RO, HU) leading to longer travel times;
- Restrictions for axle load on parts of railways in Greece and Hungary.
- Parts of the rail network in Greece is not electrified;

C.16 Madrid – Barcelona

This national corridor connects the two main cities in Spain, covering both significant amounts of passenger and freight transport.

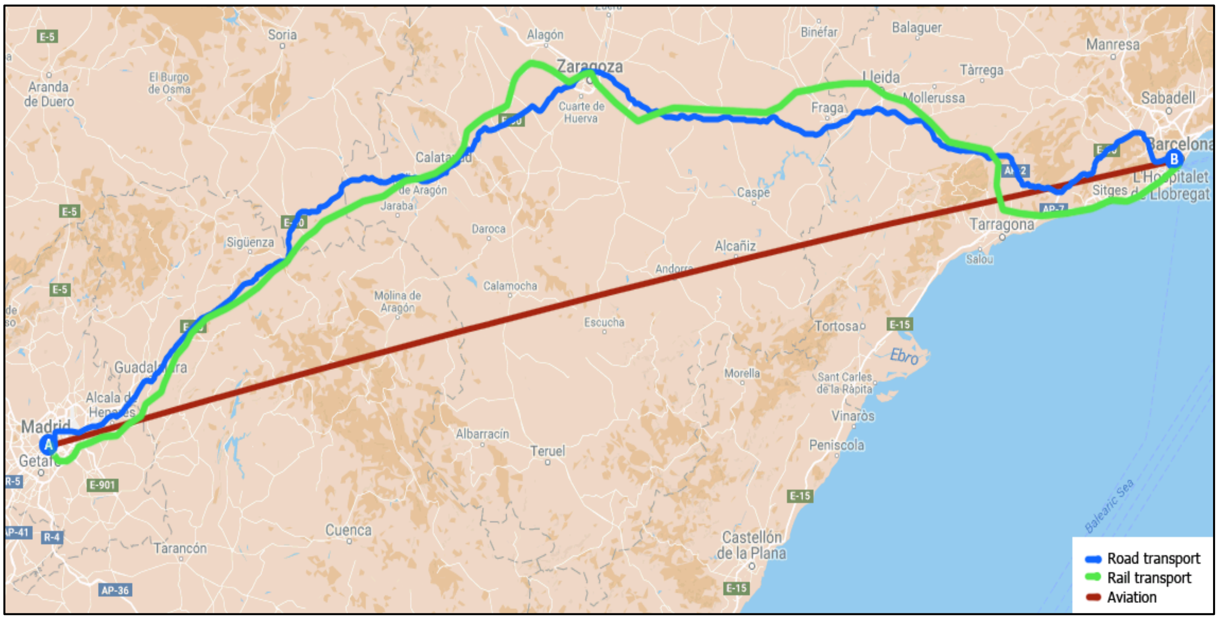
Passenger transport

Passenger transport between Madrid and Barcelona is possible via road, rail and aviation. For road transport an untolled route is assumed, although the tolled route will save 30 minutes of travel time. However, as we showed in Annex B, the time savings are not sufficient to incentivize travellers to choose for the tolled motorways (confirmed by RACC, 2015). As for rail transport, a direct high speed train connect the two cities. More information on the routes of passenger transport can be found in Table 164 and Figure 149.

Table 164 Overview of passenger transport modes on the route Madrid - Barcelona

				
Origin & Destination	• Madrid Atocha • Barcelona Sants	• Madrid Atocha • Barcelona Sants	• Madrid Atocha • Barcelona Sants	• Madrid Barajas • Barcelona el Prat
Distances (km)	• Total: 624 • Untolled: 624	• Total: 624 • Untolled: 624	• Total: 610 • HSL: 610	• Total: 580
Travel time	6h30	9h45	3h15	1h15

Figure 149 Routes of the various passenger transport modes on the corridor Madrid - Barcelona



An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 165. As toll roads are avoided by passenger cars and coaches, no distance-based road charges are considered for this corridor. Furthermore, VAT discounts for coaches and rail transport are taken into account, as well as aviation's full exemption from fuel taxes and reduced VAT levels.

Table 165 Taxes and charges for passenger transport means on the corridor Madrid - Barcelona (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	18/15	18/15
	Ownership tax	3/3	3/3
	Registration tax	0.38/0.21	0.38/0.21
	Insurance tax	1/1	1/1
	VAT	22/26	22/26
	Fuel tax	52	52
	Ownership tax	2	2
	Insurance tax	0.07	0.07
	Distance-based road charges	2	2
	VAT	87	87

Transport mode	Tax/charge	Outward trip	Return trip
	Electricity tax	113	113
	Infrastructure charge	10,558	10,558
	VAT	1,909	1,909
	Passenger related charges	1,081/2,783	1,024/2,636
	LTO/landing charges	322/526	365/597
	Ground-handling and infrastructure related charges	204/387	159/194
	Navigation charges	391/553	391/553
	ETS	12/18	12/18
	VAT	751/1,933	756/1,946

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (Panteia et al., 2014), including the fact that both Madrid and Barcelona airports have no railway connection, which hampers first-/last-mile transport.

Freight transport

For freight transport between Madrid and Barcelona road, rail and aviation can be used. For all three options direct connections are available. As for passenger road transport, the untolled route is assumed for HGVs. More information on the routes of freight transport can be found in Table 166 and Figure 150.

Table 166 Overview of freight transport modes on the route Madrid - Barcelona

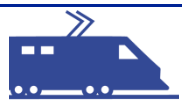
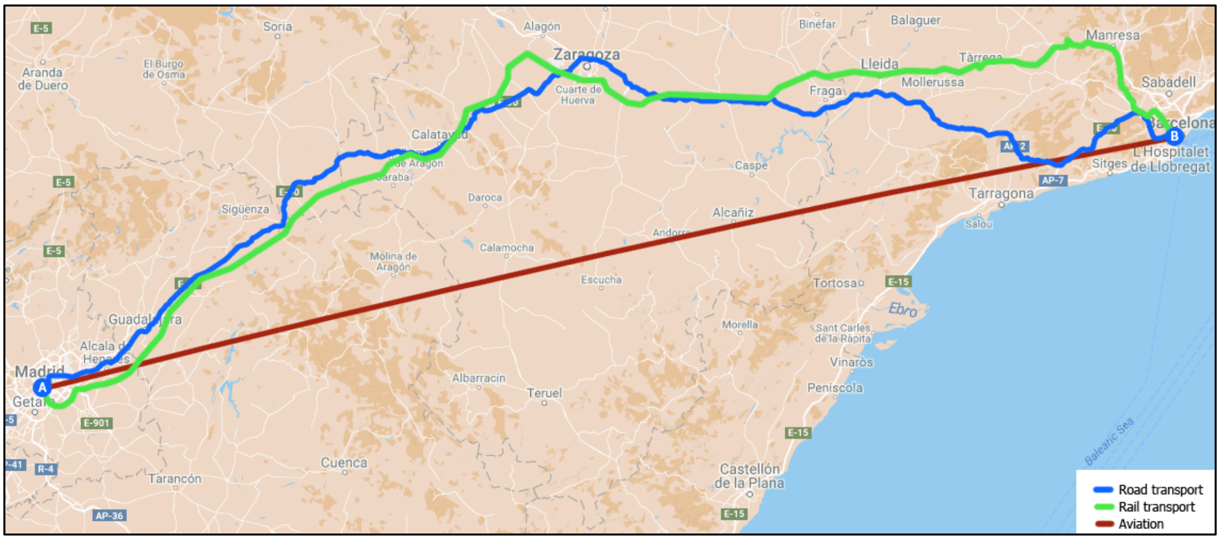
			
Origin & Destination	• Barajas Airport • Port of Barcelona	• Madrid Abronigal • Port of Barcelona	• Madrid Barajas • Barcelona el Prat
Distances (km)	• Total: 618 • Untolled: 618	• Total: 610	• Total: 580
Travel time	10h00	13h40	1h15

Figure 150 Routes of the various freight transport modes on the corridor Madrid - Barcelona



An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trip) is given in Table 167. No distance-based road charges are considered for HGVs as toll roads are avoided by these vehicles on this corridor. With respect to aviation, full exemptions on fuel taxes are taken into account.

Table 167 Taxes and charges for freight transport means on the corridor Madrid - Barcelona (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	66 / 66	66 / 66
	Ownership tax	2 / 2	2 / 2
	Insurance tax	2 / 1	2 / 1
	Electricity tax	798 / 1196	798 / 1196
	Infrastructure charge	697 / 697	697 / 697
	LTO/landing charges	827	938
	Ground-handling and infrastructure related charges	112	112
	Navigation charges	700	700
	ETS	29	29

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (Panteia at al., 2014; PwC et al., 2014; TIS.pt et al., 2014), including:

- Train length is a limitation for rail freight transport in Spain (550 to 600 metres maximum length).
- Lack of capacity of the rail network due to high use of passenger trains.
- Both Madrid and Barcelona airports have no railway connection, hampering first-/last-mile transport.

C.17 Paris – Marseille

This national corridor connects the two largest cities in France and hence significant passenger and freight transport flows.

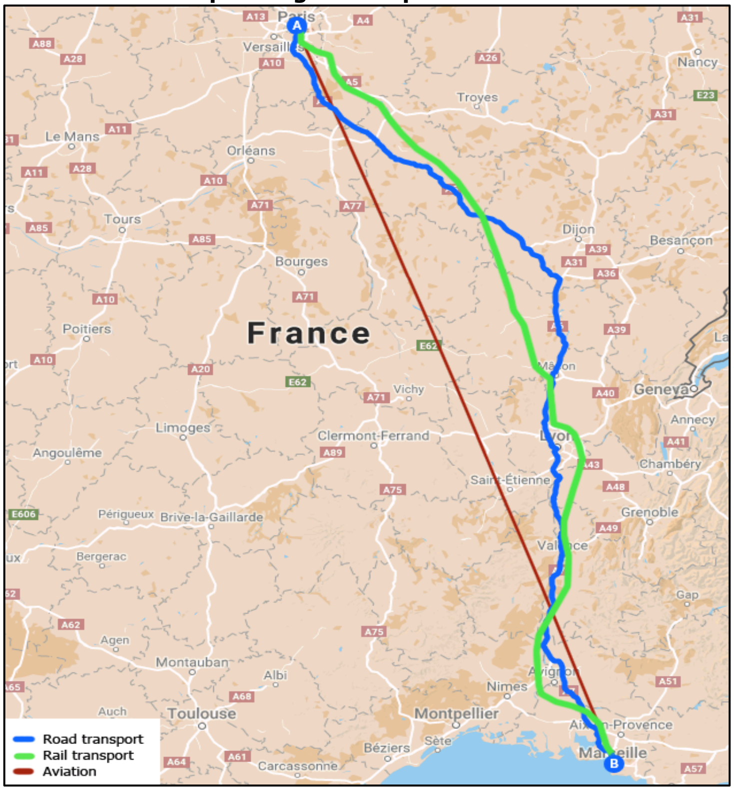
Passenger transport

Passengers travelling on this corridor can make use of the passenger car, coach, (high speed) train and airplane. For all transport means a direct connection between both cities is available. More information on the routes of passenger transport can be found in Table 168 and Figure 151.

Table 168 Overview of passenger transport modes on the route Paris - Marseille

				
Origin & Destination	• Paris Gare du Nord • Marseille Gare Saint-Charles	• Paris Gare du Nord • Marseille Gare Saint-Charles	• Paris Gare du Nord • Marseille Gare Saint-Charles	• Paris Charles de Gaule • Marseille Provence airport
Distances (km)	• Total: 778 • FR untolled: 176 • FR tolled: 602	• Total: 778 • FR untolled: 176 • Tolled: 602	Total HSL: 756	• Total:770
Travel time	7h15	11h00	3h20	1h20

Figure 151 Routes of the various passenger transport modes on the corridor Paris - Marseille



An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 169. Coaches are partly exempted from both fuel taxes and VAT. Also rail passenger transport is partly exempted from energy taxes and VAT. Finally, aviation is fully exempted from fuel taxes, while reduced VAT levels are applied for (domestic) aviation.

Table 169 Taxes and charges for passenger transport means on the corridor Paris - Marseille (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	32/26	32/26
	Ownership tax	-	-
	Registration tax	1/1	1/1
	Insurance tax	8/8	8/8
	Distance-based road charges	59/59	59/59
	VAT	39/43	39/43
	Fuel tax	29	29
	Ownership tax	2	2
	Registration tax	1	1
	Insurance tax	6	6
	Distance-based road charges	187	187
	VAT	87	79
HSL	Electricity tax	137	137
	Infrastructure charge	10,962	10,962
	VAT	2,367	2,367
	Aviation tax	303/780	303/780
	Passenger related charges	1,176/3,026	1,176/3,026
	LTO/landing charges	141/184	141/184
	Ground-handling and infrastructure related charges	120/201	120/201
	Navigation charges	832/1,241	832/1,241
	ETS	16/24	16/24
	VAT	663/1,706	663/1,706

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (Panteia et al., 2014), including:

- Congestion on the road networks around the major urban areas (e.g. Paris, Marseille).
- Marseille airport is not connected to the rail network, hampering first-/last-mile transport.

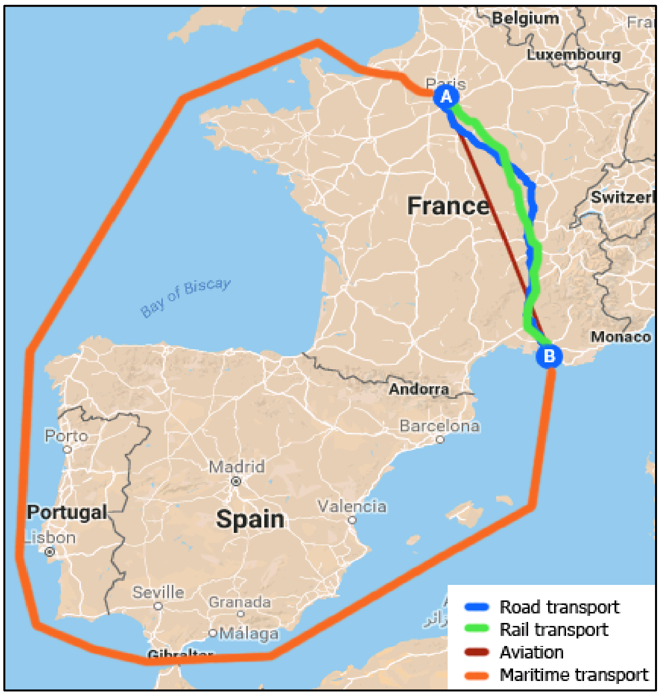
Freight transport

Freight transport between Paris and Marseille is possible via road, rail, maritime transport and aviation. For all modes, direct connections are available. Short sea shipping transport is possible using so called River Sea ships (the small reference vessel). More information on the routes of freight transport can be found in Table 170 and Figure 152.

Table 170 Overview of freight transport modes on the route Paris – Marseille

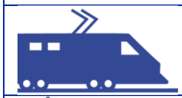
Origin & Destination	• Port of Paris • Port of Marseille (fos sur mer)	• Paris Valenton • Port of Marseille (fos sur mer)	• Port of Paris • Port of Marseille (fos sur mer)	• Paris Charles de Gaule • Marseille Provence airport
Distances (km)	• Total: 812 • FR untolled: 167 • FR tolled: 645	• Total: 740	Total: 3832	• Total:770
Travel time	22h30	16h20	150h00	1h20

Figure 152 Routes of the various freight transport modes on the corridor Paris - Marseille



An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trip) is given in Table 171 For HGVs, the discount on fuel taxes are taken into account, while the reduced electricity tax levels are considered for rail transport. Finally, both maritime and aviation are fully exempted from fuel taxes.

Table 171 Taxes and charges for freight transport means on the corridor Paris – Marseille (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	40 / 40	40 / 40
	Ownership tax	4 / 4	4 / 4
	Registration tax	1 / 1	1 / 1
	Insurance tax	5 / 3	5 / 3
	Distance-based road charges	187 / 187	187 / 187
	Electricity tax	95 / 142	95 / 142
	Infrastructure charge	1,480 / 1,480	1,480 / 1,480
	Port charges	1,633 / 1,653	1,633 / 1,653
	Piloting charges	1,814/1,814	1,814/1,814
	Waste charges	-	-
	Aviation tax	35	35
	LTO/landing charges	300	613
	Ground-handling and infrastructure related charges	16	16
	Navigation charges	1,630	1,630
	ETS	38	38

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (Panteia et al., 2014), including:

- The rail connection between Miramas and Marseille uses a GB-C45 loading gauge
- Only the western part of the Port of Marseille is connected to the rail network, hampering first-/last-mile transport.
- Marseille airport is not connected to the rail network, hampering first-/last-mile transport.

C.18 Hamburg – Munich

Hamburg and Munich are respectively the second and third largest cities in Germany. The corridor covers the main transport flows from the North to the South of Germany.

Passenger transport

Passenger transport between Hamburg and Munich is possible via road, rail and aviation, all with direct connections. As for rail transport, a high speed train connects the two cities. More information on the routes of passenger transport can be found in Table 172 and Figure 153.

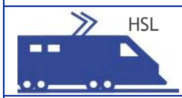
Table 172 Overview of passenger transport modes on the route Hamburg - Munich

				
Origin & Destination	• Hamburg Hauptbahnhof • Munich Hauptbahnhof	• Hamburg Hauptbahnhof • Munich Hauptbahnhof	• Hamburg Hauptbahnhof • Munich Hauptbahnhof	• Hamburg international airport • Munich international airport
Distances (km)	• Total: 775 • DE untolled: 775	• Total: 775 • DE untolled: 775	• HSL: 777	• Total: 718
Travel time	7h00	10h30	5h40	1h15

Figure 153 Routes of the various passenger transport modes on the corridor Hamburg - Munich

An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 173. For rail transport the partly exemption from the electricity tax is taken into account, while for aviation the full exemption from the fuel taxes is considered.

Table 173 Taxes and charges for passenger transport means on the corridor Hamburg - Munich (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	31/23	31/23
	Ownership tax	4/6	4/6
	Insurance tax	4/4	4/4
	VAT	24/28	24/28
	Fuel tax	91	91
	Ownership tax	7	7
	Insurance tax	6	6
	VAT	216	168
	Electricity tax	3,221	3,221
	Infrastructure charge	6,163	6,163
	VAT	4,292	4,292
	Aviation tax	405/1043	405/1043
	Passenger related charges	536/1380	1,119/2,880
	LTO/landing charges	158/421	158/421
	Ground-handling and infrastructure related charges	99/231	106/115
	Navigation charges	728/1,060	728/1,060
	ETS	15/22	15/22
	VAT	1,052/2,708	1,173/3,018

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (Kombiconsult et al., 2014), including congestion on the road network on parts of the corridor (e.g. Munich, Hamburg areas).

Freight transport

Freight transport between Hamburg and Munich can be carried out by HGVs, freight trains and aviation. For all transport means, direct connections are available. More information on the routes of freight transport can be found in Table 174 and Figure 154.

Table 174 Overview of passenger transport modes on the route Hamburg - Munich

			
Origin & Destination	• Port of Hamburg • Munich Riem rail terminal	• Port of Hamburg • Munich Riem	• Hamburg international airport • Munich international airport
Distances (km)	• Total: 783 • DE untolled: 9 • DE tolled: 774 (€105)	• Total: 785 • DE electric: 785	• Total: 718
Travel time	22h15	11h30	1h15

Figure 154 Routes of the various freight transport modes on the corridor Hamburg - Munich

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trip) is given in Table 175. For rail transport the partly exemption from the electricity tax is taken into account, while for aviation the full exemption from the fuel taxes is considered.

Table 175 Taxes and charges for freight transport means on the corridor Hamburg - Munich (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	120 / 120	120 / 120
	Ownership tax	6 / 6	6 / 6
	Insurance tax	5 / 3	5 / 3
	Distance-based road charges	100 / 100	100 / 100
	Electricity tax	2294 / 3439	2294 / 3439
	Infrastructure charge	5661 / 5661	5661 / 5661
	LTO/landing charges	471	471
	Ground-handling and infrastructure related charges	355	123
	Navigation charges	1,372	1,372
	ETS	35	35

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (Kombiconsult et al., 2014), including congestion on the road network on parts of the corridor (e.g. Munich, Hamburg areas).

C.19 Katowice – Gdansk

This corridor connects Gdansk, the city with the main Polish sea port, with Katowice, an important economic centre in Poland. This results in significant transport flows, both for passenger and freight transport.

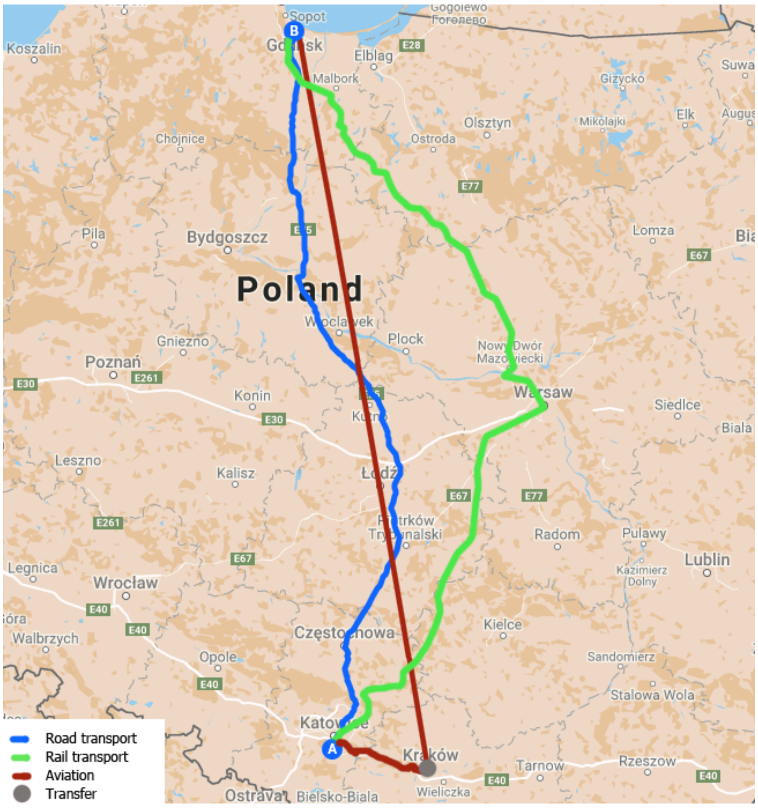
Passenger transport

Passenger transport is possible via road, rail and aviation (multimodal). A high speed train connects Gdansk with Katowice. No direct flights depart from Katowice airport, however direct flight are possible from Krakow airport, which is 40 minutes' drive away from Katowice. Therefore, we consider the multimodal connection aviation + passenger car for this corridor as well. More information on the routes of passenger transport can be found in Table 176 and Figure 155.

Table 176 Overview of passenger transport modes on the route Katowice - Gdansk

Origin & Destination	• Katowice central railway station • Gdansk Glowny	• Katowice central railway station • Gdansk Glowny	• Katowice central railway station • Gdansk Glowny	• Katowice central railway station via Krakow airport • Gdansk Airport
Distances (km)	• Total: 517 • PL untolled: 373 • PL tolled: 144	• Total: 517 • PL untolled: 373 • PL tolled: 144	• HSL: 620	• Aviation: 580 • Road untolled: 7 • Road tolled: 60
Travel time	4h30	7h00	5h20	3h15 + 40 min car (small)

Figure 155 Routes of the various passenger transport modes on the corridor Katowice - Gdansk



An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 177. For coaches, rail and aviation the reduced VAT levels are taken into account. Furthermore, the full exemption from fuel taxes for aviation is considered.

Table 177 Taxes and charges for passenger transport means on the corridor Katowice - Gdansk (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	13/11	13/11
	Registration tax	0.44/0.45	0.44/0.45
	Distance-based road charges	7/7	7/7
	VAT	18/22	18/22
	Fuel tax	45	45
	Ownership tax	2	2
	Purchase tax	0.04	0.04
	Distance-based road charges	25	25
	VAT	22	22
HSL	Electricity tax	1,026	1,026
	Infrastructure charge	1,402	1,402
	VAT	830	830
+	Passenger related charges	702/1,808	619/1,595
	LTO/landing charges	122/230	413/796
	Ground-handling and infrastructure related charges	113/114	108/109
	Navigation charges	469/718	469/718
	ETS	12/18	12/18
	VAT	364/937	292/752
	Fiscal burden intermodal car leg	126/325	126/325

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors, including the fact that Gdansk airport has no rail connection, which hampers first-/last-mile transport.

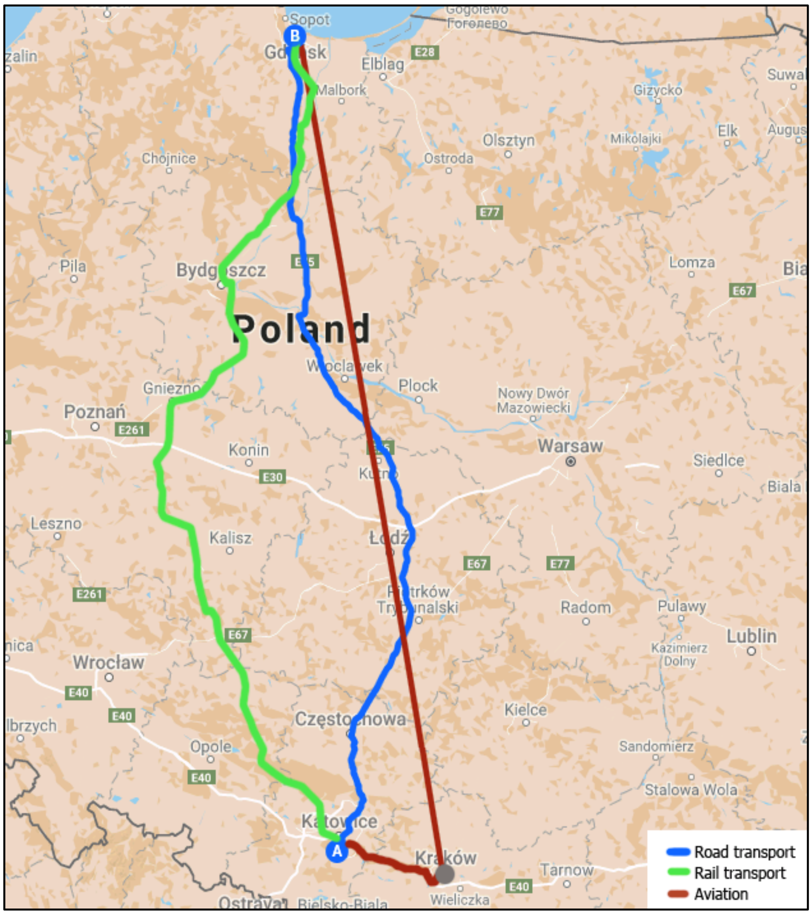
Freight transport

Road, rail and air transport are viable options on this corridor. As for passenger transport, freight transport by airplane requires a multimodal solution (truck between Katowice and Krakow). More information on the routes can be found in Table 178 and Figure 156.

Table 178 Overview of freight transport modes on the route Katowice - Gdansk

			
Origin & Destination	• Katowice Wlosienica • Port of Gdansk	• Katowice Euroterminal Slawkow • Port of Gdansk, DCT	• Katowice Wlosienica via Krakow airport • Gdansk Airport
Distances (km)	• Total: 517 • PL untolled: 155 • PL tolled: 362	• Total: 607 • PL electric: 607	• Aviation: 580 • Road untolled: 5 • Road tolled: 55
Travel time	8h44	14h00	3h15 + 60 min HGV

Figure 156 Routes of the various freight transport modes on the corridor Katowice - Gdansk



An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trip) is given in Table 179. For aviation the full exemption from the fuel taxes is considered.

Table 179 Taxes and charges for freight transport means on the corridor Katowice - Gdansk (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	59 / 59	59 / 59
	Ownership tax	3 / 3	3 / 3
	Distance-based road charges	28 / 28	28 / 28
	Electricity tax	708 / 1062	708 / 1062
	Infrastructure charge	1744 / 2367	1744 / 2367
 + 	LTO/landing charges	356	799
	Ground-handling and infrastructure related charges	79	79
	Navigation charges	958	958
	ETS	29	29
	Fiscal burden intermodal HGV leg	21	21

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors, including:

- The rail network around the port of Gdansk requires modernisation
- The maximum train length is below European standards.
- Gdansk airport has no rail connection, hampering first-/last-mile transport.

C.20 Milan – Naples

This corridor connects the second and third largest cities in Italy, covering main passenger and freight connections between North and South Italy.

Passenger transport

Passenger transport between Milan and Naples is possible via road, rail and aviation, all by direct connections. More information on the routes of passenger transport can be found in Table 180 and Figure 157.

Table 180 Overview of passenger transport modes on the route Milan - Naples

				
Origin & Destination	• Milano Centrale • Napoli Centrale	• Milano Centrale • Napoli Centrale	• Milano Centrale • Napoli Centrale	• Milan Malpensa • Naples Airport
Distances (km)	• Total: 772 • Untolled: 45 • Tolled: 727	• Total: 772 • Untolled: 45 • Tolled: 727	• Total: 812	• Total: 750
Travel time	8h00	12h00	4h20	1h10

Figure 157 Routes of the various passenger transport modes on the corridor Milan - Naples

An overview of the taxes and charges levied on the various passenger transport modes (both for outward and return trips) is given in Table 181. Coaches are partly exempted from fuel taxes and VAT, while passenger transport is (partly) exempted from the electricity tax and VAT. Also aviation is partly exempted from VAT, while this mode is fully exempted from fuel taxes.

Table 181 Taxes and charges for passenger transport means on the corridor Milan - Naples (€ per trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	35/30	35/30
	Ownership tax	8/8	9/9
	Registration tax	2/2	2/2
	Insurance tax	6/6	6/6
	Distance-based road charges	56/56	56/56
	VAT	42/47	42/47
	Fuel tax	78	78
	Ownership tax	12	15
	Registration tax	1	1
	Insurance tax	9	9
	Distance-based road charges	77	77
	VAT	79	71
HSL	Infrastructure charge	6,763	6,763
	VAT	1,527	1,527
	Aviation tax	131/336	131/336
	Passenger related charges	1,016/2,616	970 /2,497
	LTO/landing charges	143/286	143/286
	Ground-handling and infrastructure related charges	69/79	69/79
	Navigation charges	925/1,375	925/1,375
	ETS	15/23	15/23
	VAT	442/1,137	619/1,592

Note: for passenger cars and aviation, the first figure refers to the small reference vehicle, while the second figure refers to the large vehicle.

The level playing field of passenger transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (HaCon et al., 2014), including the fact that both Milan Malpensa and Naples airports are not connected to rail, which hampers first-/last-mile transport.

Freight transport

Freight transport between Milan and Naples is possible via road, rail and aviation, all by direct connections. An intermodal option including short sea shipping is possible as well. Genoa and Naples are connected via short sea shipping, while the section Genoa - Milan can be covered by road transport. More information on the routes can be found in Table 182 and Figure 158.

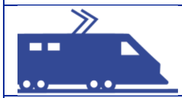
Table 182 Overview of freight transport modes on the route Milan - Naples

				
Origin & Destination	• Milan Melzo • Port of Naples	• Milan Melzo • Naples Nola terminal	• Milan Melzo via port of Genoa • Port of Naples	• Milan Malpensa • Naples Airport
Distances (km)	• Total: 780 • IT untolled: 29 • IT tolled: 751	• Total 837	• Total: 840 • Road untolled: 31 • Road tolled: 129 • Ship: 680	• Total: 750
Travel time	22h40	19h30	30h00 ship and 1h45 HGV	1h10

Figure 158 Routes of the various freight transport modes on the corridor Milan - Naples

An overview of the taxes and charges levied on the various freight transport modes (both for outward and return trip) is given in Table 183. For rail transport and aviation the (partly) exemption from electricity/fuel taxes is considered.

Table 183 Taxes and charges for freight transport means on the corridor Milan - Naples (€/trip)

Transport mode	Tax/charge	Outward trip	Return trip
	Fuel tax	102 / 102	102 / 102
	Ownership tax	6 / 6	7 / 7
	Registration tax	1 / 1	1 / 1
	Insurance tax	7 / 5	7 / 5
	Distance-based road charges	136 / 136	136 / 136
	Infrastructure charge	1836 / 1836	1836 / 1836
 + 	Port charges	4488 / 4619	4488 / 4619
	Piloting charges	567 / 567	567 / 567
	Waste charges	-	-
	Fuel tax (HGV)	7573/6241	7573/6241
	Ownership tax (HGV)	318/263	318/263
	Registration tax (HGV)	39/32	39/32
	Insurance tax (HGV)	1426/1620	1426/1620
	Distance-based road charges (HGV)	5569/4589	5569/4589
	LTO/landing charges	729	451
	Ground-handling and infrastructure related charges	3,523	3,523
	Navigation charges	1,803	1,803
	ETS	37	37

Note: for all transport modes (except aviation) two figures are presented per cell. The first figure refers to container transport, while the second refers to bulk transport.

The level playing field of freight transport modes on this corridor is affected by several (non tax/charge/subsidy related) factors (HaCon et al., 2014), including:

- Low maximum axle loads of rail transport between Rome and Naples.
- Milan Malpensa and Naples airports are both not connected to rail, hampering first-/last-mile transport.

ANNEX D: ACCOUNTING FRAMEWORK FOR TAXES, CHARGES AND SUBSIDIES

D.1 Introduction

In this section we discuss in more detail the accounting framework for taxes and charges, mainly by explaining the approach used to convert all taxes and charges in comparable concepts.

D.2 Attribution of taxes and charges to transport operations

In order to make all tax and charge levels comparable and suitable for the corridor analyses, we have converted them all into distance-based concepts (€/vkm). Tailor-made methodologies have been developed for each individual tax/charge based on their structure. An overview of the allocation methods applied for the various taxes/charges is given in Table 184.

Table 184 General allocation methods for taxes and charges

Type of tax / charge	Relevant taxes/charges	Allocation method
Distance-based taxes/charges	• Distance-based road charges (road) • Track access charges (rail)	No conversion of data is required.
One-off vehicle tax	• Vehicle purchase or registration tax (road)	Dividing the tax (€/vehicle) by the expected lifetime mileage of the vehicle
Periodic vehicle tax	• Vehicle ownership or circulation tax (road) • Insurance tax (road)	Dividing the tax (e.g. € per year) by the expected mileage for that period (e.g. annual mileage)
Market-based instruments, including energy taxes and environmental levies	• Fuel tax (all modes) • Electricity tax (rail) • Water pollution charge (inland shipping) • ETS	Multiplying the tax rate (in €/litre or €/kWh) with fuel/energy consumption figures of the specific vehicles. For each corridor and each mode we estimated weighted average fuel/energy tax rates for this assessment, based on the number of kilometres driven in the various countries on the corridor.
Time-based infrastructure charges	• Time-based road charges (road) • Potentially urban road charges (road) • Congestion charge (rail)	Dividing the tax (€/time period) by the expected mileage in the charged area in that period. For time-based road charges it is assumed that for domestic passenger cars an annual vignette is bought, while for foreign passenger cars a 10-days (or if not available monthly and in the case of Switzerland annually) vignette is bought. For all coaches and HGVs an annual vignette is assumed. Furthermore, it is assumed that foreign passenger cars travel twice through the charged area (outward and return trip), while foreign busses and HGVs makes the (return) trip 50 times a year. The resulting kilometres in the charged area is used to estimate the vignette costs per vkm. For domestic vehicles, the kilometres in the charged area were set equal to the total annual mileage.
One-off infrastructure	• Tolls on specific parts of the	The tax (€/passage, €/call, €/movement, etc.)

Type of tax / charge	Relevant taxes/charges	Allocation method
charges	(regional) network (road) • Urban road charges (road) • Charges for using stations and other rail infrastructure (rail) • Port charges (inland and maritime shipping) • Fairway dues (inland shipping) • Dues for locks and bridges (inland and maritime shipping) • Waste charges (maritime transport) • LTO charges (aviation) • Charges for ground-handling services (aviation) • Air navigation service charges (aviation)	is divided by the trip length (km). For port charges and LTO charges, it is assumed that 50% of the charges can be allocated to the outward trip and 50% to the return trip. In some cases, these charges are only levied on arriving/departing vehicles/vessels. In that case the charges are fully allocated to the relevant trip (outward or return).
Tax/charge per passenger	• Taxes collected per passenger (aviation) • Passenger-related charges (aviation) • Persons with reduced mobility charge (aviation) • Security charges (aviation)	Dividing the tax (€/person) by the trip length (km). Subsequently, the figure is multiplied by the number of passengers in the vehicle to estimate €/vkm.
Value added tax (only for passenger transport)	• Value added tax on fares (only national transport, by coach, train and aviation) • Value added tax on vehicle (passenger cars) • Value added tax on fuel (passenger cars) • Value added tax on infrastructure charges (passenger cars)	Multiplying the weighted tax rate with the total fare costs for the route Multiplying the national VAT rate with fixed costs where VAT is levied over (e.g. purchase price, maintenance costs) Multiplying VAT rate with the charge where VAT is levied over (fuel, toll)

ANNEX E: INTERNAL COSTS

E.1 Introduction

In this study the taxes, charges and subsidies are benchmarked to the internal costs of transport. These are those monetary costs incurred by transport users that are not taxes, charges or subsidies. In this Annex, we first list and define all relevant categories of internal costs. Then, an overview of the internal costs for the various modes is given, followed by a more detailed assessment of these costs. Finally, for each category the methodology to attribute the internal costs to transport operations is presented.

E.2 Overview of internal costs

Table 185 reflects the full list of internal costs which are considered in the context of this study. An important distinction is the notion of fixed or variable costs. Fixed costs are those costs that are incurred regardless of the amount of usage, whereas the level of variable costs for a trip depends on the work done by the vehicle (distance and operational conditions).

Table 185 Internal costs of transport

Cost type	Variable/fixed	Description	Modes	Comment
Procurement	Fixed	The cost to acquire the vehicle – purchase cost in case of ownership or lease cost in case of leasing	All	Leasing can be both distance and time based.
Maintenance	Fixed	The cost to keep the vehicle in good working order	All	Fixed/variable distinction is somewhat artificial: maintenance costs partly depend on the amount of use, but a certain fixed amount of maintenance is generally recommended regardless of usage.
Insurance	Fixed	The cost of the insurance premium that is received by the insurance company.	All	
Vehicle inspection	Fixed	The cost for mandatory periodic inspection of the vehicle	Road vehicles	
Energy: Fuel	Variable	The net cost of fuel (petrol, diesel, kerosene, fuel oil,…)	All non-electric modes	
Energy: Electricity	Variable	The cost of electricity needed to propel the vehicle	Electric rail, high speed rail	
Wages	Fixed	The wage of the driver for the duration of the trip	All	This includes the costs of waiting at the border
Administration and overhead	Fixed	Costs to fulfil administrative requirements such as professional certification, obtaining licences, etc.	All except passenger cars	
Loading, unloading and transhipment	Fixed	The cost of loading, unloading and transhipping the cargo of a freight vehicle	Freight	
Profit margin	Variable	A certain percentage on total costs	All except passenger cars	Based on assumptions

E.3 Overview internal cost figures applied in this study

An overview of the internal costs figures used for the passenger and freight transport modes in this study is given in Table 186 and Table 187. These are EU average figures, which have been transferred to national figures by using relevant correction factors (see Annex E.4).

Table 186 Overview of internal costs for passenger modes (EU average figures per vkm)

	Procurement	Maintenance	Insurance	Inspection	Energy	Wages	Administration and overhead	Total private cost
Small car	0.08	0.10	0.05	0.003	0.03	N/A	N/A	0.25
Large car	0.09	0.12	0.05	0.002	0.03	N/A	N/A	0.29
Coach	0.39	0.11	0.04	0.004	0.13	0.39	0.19	1.24
HST	1.57	2.94	0.71	N/A	2.03	0.77	2.23	10.24
regular electric train	1.54	2.90	0.70	N/A	1.11	1.73	0.42	8.40
regular diesel train	4.42	6.91	1.66	N/A	1.32	2.08	0.42	16.81
Small plane	0.21	0.80	0.03	N/A	0.87	0.65	0.59	3.15
Large plane	0.52	0.80	0.08	N/A	1.31	0.97	0.59	4.27

Table 187 Overview of internal costs for freight modes (EU average figures per vkm)

Mode	Cargo type	fixed cost	variable cost	personnel cost	specific cost	other cost	Total cost
Road	Bulk	0.28	0.50	0.51	0.01	0.17	1.47
Road	Container	0.21	0.21	0.47	0.01	0.08	0.98
Rail electric	Bulk	6.67	2.15	1.06	0.00	1.93	11.81
Rail diesel	Bulk	6.67	4.48	1.06	0.00	2.39	14.60
Rail electric	Container	7.46	2.15	1.06	0.00	2.10	12.76
Rail diesel	Container	7.46	4.48	1.06	0.00	2.56	15.56
Small IWT	Bulk	3.73	2.56	1.06	0.00	0.41	7.76
Small IWT	Container	2.41	2.59	1.06	0.00	0.34	6.41
Large IWT	Bulk	7.30	4.26	4.82	0.00	0.92	17.30
Large IWT	Container	4.96	4.32	6.18	0.00	0.87	16.32
SSS	Bulk	3.56	6.28	3.76	0.00	0.74	14.33
Sea river	Bulk	7.30	4.26	4.82	0.00	0.92	17.30
SSS	Container	3.56	6.28	3.76	0.00	0.74	14.33
Sea river	Container	4.96	4.32	6.18	0.00	0.87	16.32
Air	General	0.52	2.11	0.31	0.00	0.14	3.08

Since loading factors differ per vehicle it is to be expected that internal costs differ. Larger vehicles will require more labour and use more fuel among others. Table 188 and Table 189 show the internal costs per passenger and tonne kilometre. The loading factors that are used can be found in Annex A. Internal costs per passenger-kilometre are highest for cars, while the high speed train and airplanes have the lowest internal costs. For freight transport internal costs for bulk transport are in general lower than for container transport. Air and road transport have the highest internal costs for freight transport.

Table 188 Overview of internal costs for passenger modes (EU average figures per pkm)

	Procurement	Maintenance	Insurance	Inspection	Energy	Wages	Administration and overhead	Total private cost
Small car	0,0400	0,0500	0,0250	0,0015	0,0150	N/A	N/A	0,1250
Large car	0,0450	0,0600	0,0250	0,0010	0,0150	N/A	N/A	0,1450
Coach	0,0130	0,0037	0,0013	0,0001	0,0043	0,0130	0,0063	0,0413
HST	0,0056	0,0105	0,0025	N/A	0,0073	0,0028	0,0080	0,0366
regular electric train	0,0181	0,0341	0,0082	N/A	0,0131	0,0204	0,0049	0,0988
regular diesel train	0,0520	0,0813	0,0195	N/A	0,0155	0,0245	0,0049	0,1978
Small plane	0,0039	0,0148	0,0006	N/A	0,0161	0,0120	0,0109	0,0583
Large plane	0,0037	0,0058	0,0006	N/A	0,0094	0,0070	0,0042	0,0307

Table 189 Overview of internal costs for freight modes (EU average figures per tkm)

Mode	Cargo type	fixed cost	variable cost	personnel cost	specific cost	other cost	Total cost
Road	Bulk	0,0233	0,0417	0,0425	0,0008	0,0142	0,1225
Road	Container	0,0158	0,0158	0,0353	0,0008	0,0060	0,0737
Rail electric	Bulk	0,0053	0,0017	0,0008	0,0000	0,0015	0,0094
Rail diesel	Bulk	0,0053	0,0036	0,0008	0,0000	0,0019	0,0117
Rail electric	Container	0,0109	0,0031	0,0015	0,0000	0,0031	0,0186
Rail diesel	Container	0,0109	0,0065	0,0015	0,0000	0,0037	0,0227
Small IWT	Bulk	0,0044	0,0030	0,0013	0,0000	0,0005	0,0092
Small IWT	Container	0,0035	0,0038	0,0016	0,0000	0,0005	0,0094
Large IWT	Bulk	0,0043	0,0025	0,0029	0,0000	0,0005	0,0103
Large IWT	Container	0,0034	0,0029	0,0042	0,0000	0,0006	0,0110
SSS	Bulk	0,0007	0,0013	0,0008	0,0000	0,0002	0,0030
Sea river	Bulk	0,0036	0,0021	0,0024	0,0000	0,0005	0,0086
SSS	Container	0,0008	0,0014	0,0008	0,0000	0,0002	0,0031
Sea river	Container	0,0031	0,0027	0,0039	0,0000	0,0005	0,0102
Air	General	0,0200	0,0812	0,0119	0,0000	0,0054	0,1185

The internal costs figures presented above do not reflect the profit margin on transport operations. However, to be able to estimate the internal costs for users of passenger transport modes profit margins are relevant, as they reflect the difference between the costs for the operator and the costs for the end-user. While operators in different market segments and transport modes may experience large differences in consumer response to pricing and thus in profit margin, we assume a constant relative profit margin per mode. Indeed, in addition to general and specific economic performance, profit margins are impacted by market structure: sectors with many (small) service providers, such as road transport, tend to have lower margins than sectors dominated by a few large operators, like maritime transport. The fact that this study covers only longer distance transport also has an effect on profit margins, which tend to be higher than on cheaper short distance connections.

No recent, uniform public data on transport sector profit margins was found. Only for aviation in Europe a profit margin of 4.3% was found[48]. Due to the lack of sufficiently robust figures to reveal a clear trend in profit margins, we set the following margins as an expert guess: 4% (coach), 4% (rail), 4% (aviation). It should be clearly noted that these estimates have little impact on the outcome of the study.

E.4 Detailed assessment internal cost figures

In this section, we provide the more detailed assessment of internal cost figures, which resulted in the figures presented in Section E.3. The main data source for this section is the 2016 TML study MIRA (TML, 2016), which calculated both internal and external costs of different transport modes in Flanders (Belgium). To put those regional numbers in a European context (when needed), data from Eurostat (mainly cost and price level) is used. A third important source is the "Kostenbarometer" (Panteia, 2016), mainly for freight costs. As a fall-back option, data from the TREMOVE model were also used, but only for relative values (i.e. secondary costs as a fraction of e.g. vehicle purchase cost). Corrections were applied where needed.

Passenger car

Procurement costs
For the passenger car reference vehicles, baseline procurement costs are set as the purchase cost in the home country of the manufacturer:

- VW Passat: €33,725 (Germany), which is €28,340 excl. VAT
- Fiat 500: €13,850 (Italy), which is €11,352 excl. VAT

A correction for national differences is applied, based on the Personal Transport equipment (PTE) price level indicator for 2015 (see Eurostat table *prc_ppp_ind*). The correction factors for passenger car purchase costs are shown in Table 190.

Table 190 Price level indicator for Personal Transport Equipment

GEO/TIME	PTE PLI (2015)	GEO/TIME	PTE PLI (2015)
EU28	100.0	**Lithuania**	85.8
Belgium	101.4	**Luxembourg**	93.5
Bulgaria	80.1	**Hungary**	83.9
Czech Republic	73.6	**Malta**	99.0
Denmark	143.9	**Netherlands**	113.5
Germany	94.6	**Austria**	99.4
Estonia	83.2	**Poland**	79.9
Ireland	106.7	**Portugal**	111.5
Greece	88.9	**Romania**	83.3
Spain	100.2	**Slovenia**	83.4
France	100.4	**Slovakia**	82.8
Croatia	85.4	**Finland**	109.1

[48] http://www.iata.org/pressroom/pr/Pages/2015-12-10-01.aspx

GEO/TIME	PTE PLI (2015)	GEO/TIME	PTE PLI (2015)
Italy	97.0	**Sweden**	95.0
Cyprus	86.2	**United Kingdom**	110.6
Latvia	81.9		

Source: Eurostat

Maintenance costs
Maintenance costs are assumed to be a fixed percentage of purchase costs (i.e. 3.5%), based on MIRA.

As a cross-check, we looked at Eurostat data on mean consumption expenditure per household with expenditures greater than zero (hbs_exp_t123) on "Maintenance and repair of personal transport equipment". While this parameter only partially overlaps with maintenance costs (the type, age and number of vehicles per household is not further detailed in the Eurostat dataset), we find that for the majority of countries (20/28), the Eurostat figure is up to 50% higher than the values for the reference vehicles as calculated with the MIRA based method. Given the relatively low age of the reference vehicles, the result is considered to be reasonable.

Insurance costs
Annual insurance costs are assumed to be a fixed percentage of purchase costs, i.e. proportional with the value of the vehicle. For the small petrol powered reference vehicle (Fiat 500), the EU average found in TREMOVE is 3.4% of purchase costs. For the diesel reference vehicle (VW Passat), insurance cost is 2.9% of purchase cost. They represent average household spending on vehicle insurance, as collected by COWI to serve as input to the TREMOVE model. A similar check with Eurostat household expenditure on "insurance connected with transport" was performed, producing similar results: 15/28 countries are in the TREMOVE calculated range, another 9/28 are within 50%. With the scope of the Eurostat parameter even broader (as this may also include insurance for air or rail travel), we conclude that the match is good enough to be applied in this study.

Vehicle inspection costs
Vehicle inspection costs for passenger cars in the MIRA study (for Belgium) are €30.6. The same correction factor as for vehicle procurement cost is applied to estimate national figures.

Energy costs
Passenger car fuel costs depend on fuel consumption and fuel prices. Reference fuel consumption for the Fiat 500 is 5.1l petrol/100km; for the VW Passat it is 4.5l diesel/100km (see Annex A). A correction for real world driving is however in order. Spritmonitor.de is a website that allows users to upload and compare real world fuel consumption. The average real world fuel consumption for the VW Passat is assumed at 6.23 l/100km. For the Fiat 500, it is assumed at 6.29 l/100km.

Fuel prices are provided by the EC in the Weekly Oil Bulletin (European Commission, 2017c).

Table 191 Fuel prices without taxes

€/1000L	Petrol	Diesel
Austria	459.97	502.86
Belgium	469.23	473.67
Bulgaria	499.67	518.20
Croatia	483.80	517.13
Cyprus	538.70	563.21
Czech Republic	464.79	515.87
Denmark	559.92	561.80
Estonia	545.56	565.41
Finland	527.87	577.34
France	484.00	474.47
Germany	489.20	503.55
Greece	512.09	609.80
Hungary	495.19	530.90
Ireland	489.03	508.32
Italy	527.44	519.74
Latvia	522.09	535.23
Lithuania	514.17	514.66
Luxembourg	501.16	507.74
Malta	560.79	527.60
Netherlands	480.12	503.60
Poland	481.63	504.89
Portugal	525.73	536.08
Romania	492.32	521.04
Slovakia	480.66	531.45
Slovenia	469.32	465.03
Spain	540.87	538.79
Sweden	504.70	549.07
United Kingdom	467.66	497.07
Weighted average	**494.76**	**509.25**

Source: European Commission (2017c)

That puts the average ex-tax fuel cost for the Fiat 500 at €3.112/100 km. For the VW Passat, the cost is €3.173/100 km.

Coach

For bus/coach transport, both the fares and operator costs are assessed. The fares are used to estimate the VAT on coach transport.

Procurement costs
The purchase cost for a coach in Belgium is set at €330,000, based on MIRA. This does not include VAT. A correction for other countries is applied based on Eurostat's Price Level Indicator for Transport Equipment (TE) for 2015 (see Table 192).

Table 192 Price level indicator for Transport Equipment

GEO/TIME	TE PLI (2015)	GEO/TIME	TE PLI (2015)
EU28	100.0	**Lithuania**	89.0
Belgium	105.0	**Luxembourg**	97.8
Bulgaria	86.9	**Hungary**	88.2

GEO/TIME	TE PLI (2015)	GEO/TIME	TE PLI (2015)
Czech Republic	89.2	**Malta**	95.8
Denmark	130.1	**Netherlands**	99.4
Germany	96.0	**Austria**	108.3
Estonia	87.1	**Poland**	87.2
Ireland	100.8	**Portugal**	116.8
Greece	97.1	**Romania**	98.3
Spain	101.4	**Slovenia**	87.3
France	105.5	**Slovakia**	90.1
Croatia	88.9	**Finland**	119.7
Italy	92.9	**Sweden**	117.8
Cyprus	88.7	**United Kingdom**	103.1
Latvia	91.3		

Source: Eurostat

Maintenance costs

Annual maintenance costs for coaches are set at 2% of purchase cost, based on TREMOVE (which itself is based on internal data collection from various sources[49]).

Insurance costs

Annual insurance costs for coaches are set at €2,350 for Belgium, based on MIRA. The same Transport Equipment price level correction factor as for procurement cost is applied to generate the values for other countries.

Vehicle inspection costs

Annual inspection costs for coaches are set at €218 for Belgium, based on MIRA. Corrections for other countries are applied.

Energy costs

Fuel consumption for buses is set at 25 l/100 km (see Annex A). Combined with the information in Table 191, that puts the EU average cost at €12.73/100 km. Costs for individual countries are calculated according to national fuel prices.

Wage costs

Wage costs differ significantly over countries and even cities, with cost of living playing an important role. Eurostat's data on labour costs is used as the primary data source. For NACE sector "Transportation and storage", table *lc_lci_lev* presents hourly labour costs (see Table 193). As further detail is not available, we take this as a proxy for coach driver wage costs.

Table 193 Labour costs for "Transportation and storage" staff in €/hour for 2015 (unless otherwise noted)

	Labour cost/hour	***Wages***	***Employer's social contributions***
Belgium	36.6	*26.6*	*10.0*
Bulgaria	4.0	*3.5*	*0.5*
Czech Republic	9.2	*6.6*	*2.6*
Denmark	38.8	*34.0*	*4.8*
Germany	25.6	*19.9*	*5.7*

[49] Sources include ACEA Tax Guides, national taxation and household spending surveys, COWI (2002)

	Labour cost/hour	*Wages*	*Employer's social contributions*
Estonia	11.1	*8.2*	*2.9*
Ireland	28.3	*24.1*	*4.3*
Greece (2014)	19.3	*14.1*	*5.2*
Spain	21.3	*15.8*	*5.6*
France	32.3	*22.5*	*9.8*
Croatia	9.8	*8.2*	*1.6*
Italy	24.2	*17.7*	*6.5*
Cyprus (2012)	19.1	*16.1*	*3*
Latvia	7.7	*6.1*	*1.6*
Lithuania	7.4	*4.5*	*2.9*
Luxembourg	33.0	*28.1*	*4.9*
Hungary	7.4	*5.7*	*1.7*
Netherlands (2014)	29.5	*22.1*	*7.4*
Austria	30.0	*21.6*	*8.4*
Poland	7.7	*6.2*	*1.5*
Portugal (2012)	15	*11.7*	*3.4*
Romania	5.2	*4.0*	*1.2*
Slovenia	15.1	*12.7*	*2.5*
Slovakia	8.3	*6.0*	*2.3*
Finland	30.6	*24.6*	*6.0*
Sweden	34.0	*23.4*	*10.6*
United Kingdom	29.0	*23.8*	*5.2*

Source: Eurostat

As a reference specifically for bus driver wages, we can use the Swiss financial service provider UBS, which publishes data on bus driver earnings for 71 cities, including 30 EU cities. The average gross bus driver wage (i.e. excluding social contributions from employers) for those 30 cities is €24,705 per year, which equals to €13.3 per hour (based on 231 working days/year of 8 hours) – around 14% lower than the Eurostat values. Wages for local bus drivers are likely lower than for long distance coach drivers due to the fact that the latter spend more time away from home. As such, we've made the assumption that the wages in Table 193 are a good approximation of long distance coach drivers.

To convert hourly wage costs to costs per km, we assume an average speed of 60 km/h. These data match well with other sources of labour costs, including MIRA and Panteia's "Kostenbarometer".

Administration and overhead
Data sources for overhead costs are scarce. Panteia's "Kostenbarometer" estimates that overhead costs represent 8-12% of total transport cost for road freight transport. Hossain (2009) estimates administrative cost for road freight at 8%. Due to the lack of data for coach transport, we assume a similar cost share for coach transport and set it at 10%.

Fares
For fares, we consulted the websites www.GoEuro.com and www.Rome2Rio.com. The following bus fares were found for the selected corridors (see Table 194). They relate to costs paid by end users, including VAT, taxes and charges. Outward and return legs

of the trip are considered separately. For a return journey, we assume costs are equal to the sum of the individual legs.

Table 194 Coach fares for selected corridors

Origin	Destination	Away leg	Return leg	Site
Paris	Madrid	84	97	GoEuro
Paris	Amsterdam	18	25	GoEuro
Antwerp	Warsaw	62	62	GoEuro
Amsterdam	Frankfurt	33	25	GoEuro
Frankfurt	Budapest	46	46	GoEuro
Rome	Berlin	58	59	GoEuro
Hamburg	Prague	31	28	GoEuro
Helsinki	Gdansk	78	78	Rome2Rio
Antwerp	Lisbon	157	150	GoEuro
Stockholm	Hamburg	39	39	GoEuro
Genoa	Rotterdam	77		GoEuro
Budapest	Milan	56	60	GoEuro
Bucharest	Warsaw	70	70	Rome2Rio
Dublin	Amsterdam	66	65	Rome2Rio
Athens	Vienna	54	100	Rome2Rio
Madrid	Barcelona	32	32	GoEuro
Paris	Marseille	32	29	GoEuro
Hamburg	Munich	45	35	GoEuro
Katowice	Gdansk	10	10	GoEuro
Milan	Naples	29	26	GoEuro

Source: www.GoEuro.com for travel on Monday 22/05/2017, or www.Rome2Rio.com for a non-specified travel date, consulted 19/05/2017[50]

Rail

For rail transport, both the fares and operator costs are assessed. Again, the data on fares are mainly used to estimate the VAT on rail transport. A distinction is made between high speed rail and regular rail, where relevant.

Procurement costs

Purchase cost for high speed trains are estimated at around €20 million for single deck trains, and up to €35 million for double deck trains.[51]

Regular passenger trains cost around €5 million, according to MIRA. As the market for passenger trains is likely international, with relatively few buyers and sellers, no correction factor is applied.

50 GoEuro allows for the selection of specific travel dates, whereas Rome2Rio displays an array of prices for a certain connection for an unspecified travel date. Where GoEuro did not display a specific fare, Rome2Rio fares are shown in the table. The search option "Smartest route", which accounts for both time and cost, was selected.

51 http://www.journaldunet.com/economie/magazine/enquete/argent-public-combien-coute-a-l-etat/combien-coute-une-rame-de-tgv-34-5-millions.shtml, https://www.challenges.fr/entreprise/la-sncf-commande-40-tgv-pour-1-2-milliard-d-euros-a-alstom_11607

Maintenance costs
Annual maintenance costs are estimated at 6.25% of purchase cost, based on a TML (2009) social cost-benefit analysis for the Iron Rhine.

Insurance costs
Annual insurance costs are estimated at 1.5% of purchase cost, also based on TML (2009).

Vehicle inspection costs
These are covered under maintenance costs.

Energy costs
Electricity consumption for regular electric trains is estimated at 19.9 kWh/km. For HST, energy consumption is estimated at 36.3 kWh/km. The EU28 average electricity price for the second half of 2016 was €0.0560 per kWh (source: Eurostat table *nrg_pc_205*). The cost per km is thus estimated at €1.11 for regular electric trains. For HST, it is estimated at €2.03 per km. For diesel trains, fuel consumption is 2.6 l/km. Costs per km are calculated based on the fuel costs of Table 191.

Wage costs
Wage costs in rail transport are considerably higher than in coach transport. In addition, rail transport requires more staff per train (driver + one or more conductors). As a benchmark, MIRA's wage costs for regular (€147.0 per hour) and high speed (€284.2 per hour) rail are compared to general labour costs in transport, as shown in Table 193. The results are presented in Table 195.

Table 195: Labour costs for passenger rail transport in €/hour

	Regular rail	HST
Belgium	147.0	284.2
Bulgaria	16.1	27.2
Czech Republic	37.0	51.3
Denmark	155.8	264.1
Germany	102.8	154.5
Estonia	44.6	63.7
Ireland	113.7	187.2
Greece	77.5	109.5
Spain	85.6	122.7
France	129.7	174.7
Croatia	39.4	63.7
Italy	97.2	137.5
Cyprus	76.7	125.0
Latvia	30.9	47.4
Lithuania	29.7	34.9
Luxembourg	132.6	218.2
Hungary	29.7	44.3
Netherlands	118.5	171.6
Austria	120.5	167.8
Poland	30.9	48.2
Portugal	60.3	90.9
Romania	20.9	31.1
Slovenia	60.7	98.6

Slovakia	33.3	46.6
Finland	122.9	191.0
Sweden	136.6	181.7
United Kingdom	116.5	184.8

Source: own calculation based on MIRA and Eurostat

These are then converted to costs per km using average speed (HST: 200km/h, regular electric: 60 km/h, regular diesel: 50 km/h – source: MIRA).

Administration and overhead
Overhead in rail freight transport is between 12-14% (based on Panteia's "Kostenbarometer"). We assume 13% for rail passenger transport in this study.

Fares
As for coaches, fares for rail transport were collected from the websites www.GoEuro.com and www.Rome2Rio.com, or national rail operators. As a general rule, the "smartest" connection was taken, accounting for both total travel time and cost. If only a single option for rail was presented, and it included a section using HST, the fare is shown in the HST column.

Table 196: Rail fares for selected corridors

Origin	Destination	Rail regular Away	Rail regular Return	Rail HST Away	Rail HST Return	Source regular	Source HST
Paris	Madrid			239	252		GoEuro
Paris	Amsterdam			135	135		GoEuro
Antwerp	Warsaw			218	152		B-Europe
Amsterdam	Frankfurt			90	90		GoEuro
Frankfurt	Budapest			110	100		GoEuro
Rome	Berlin			320	280		B-Europe
Hamburg	Prague	70	70			GoEuro	
Helsinki	Gdansk						
Antwerp	Lisbon			281	281		SNCF
Stockholm	Hamburg			80	80		DB
Genoa	Rotterdam			232	232		Rome2Rio
Budapest	Milan			137	128		Rome2Rio
Bucharest	Warsaw	81	81			Rome2Rio	
Dublin	Amsterdam			313	292		Rome2Rio
Athens	Vienna						
Madrid	Barcelona			75	80		GoEuro
Paris	Marseille			93	81		GoEuro
Hamburg	Munich			96	80		GoEuro
Katowice	Gdansk			40	40		PKP
Milan	Naples			60	70		GoEuro

Source: www.GoEuro.com for travel on Monday 22/05/2017, or www.Rome2Rio.com for a non-specified travel date, consulted 19/05/2017[52]

As for coach fares, average VAT rates were calculated for each corridor.

Airplane

Operator costs are based on the sources used in the MIRA project.

Procurement costs
Procurement and ownership costs are set at €51.7/100 km (source: TML calculations based on annual reports of EasyJet and Ryanair for MIRA) - roughly 5-10% of total operating costs (including taxes and charges). This average represents costs of full purchase, dry lease or wet lease, with the majority of planes (65-80%) in full ownership. The reference airplane in MIRA was a Boeing 737-400, which has a similar new purchase cost as the A320 (around €100 million) (source: Airbus website). Purchase cost for the smaller Embraer 170 is around €40 million (source: Embraer website). As we assume that both planes are used on the same flights, procurement costs for the Embraer would then be €20.68/100km.

The annual reports used as data sources represent costs per ASK (Air Seat Kilometre) or total cost with an indication of total ASK. These were converted to costs per 100 km. Annual costs per plane are not provided.

[52] GoEuro allows for the selection of specific travel dates, whereas Rome2Rio displays an array of prices for a certain connection for an unspecified travel date. Where GoEuro did not display a specific fare, Rome2Rio fares are shown in the table.

Maintenance costs
Maintenance costs for full service operators as considered in this study are estimated at €80.35/100km (source: own calculations based on IATA (2014)). This represents around 7% (full service) of total operating costs. No distinction can be made between small and large planes based on available data.

Insurance costs
No information is available in MIRA, as insurance costs were not directly reflected in annual reports. For wet lease contracts, insurance is already covered in the lease costs. For other ownership models, insurance represents around 0.9% of total operating costs (ICAO, 2001).

Vehicle inspection costs
These are covered under maintenance costs.

Energy costs
Kerosene prices tend to fluctuate significantly. The price for February 2017 was 1.435USD/gallon, which equates to €0.337 per litre. Fuel costs for the A320 would thus amount to €130.8/100km. For the Embraer, the cost would be €86.8/100km.

Wage costs
Labour costs on the A320 are set at €97.44/100km (based on EasyJet and Ryanair annual reports, including a correction for the amount of on board staff between low cost and full service operators and including labour taxes). For the Embraer, we assume that 1/3 fewer staff is needed, with a proportionally lower cost: €64.96/100 km. This includes pilots, cabin crew, technical support staff on the ground and corporate staff. Given that it cannot be predetermined for a given connection what the nationality of the crew is, no distinction is made between countries.

Administration and overhead
Costs for sales, marketing, HR, etc. are estimated at 5% of total costs, based on EasyJet and Ryanair annual reports. The same rate is assumed for full service operators. This equates to €58.66/100km (TML, 2016).

Fares
Fares were collected from the website www.GoEuro.com (for travel on Monday 22/05/17). Where available, costs for both low cost and full service airlines are provided, though this study in principle only covers full service operators. It should be noted that fares still include taxes and charges passed on to customers. However, a CPC (2009) report found that only 41% of charges included in fares were actually charges by governments or airport authorities, and that the charges included in 2 one-way tickets are not identical to those for a return ticket. This demonstrates that tax-pass-through can be part of the airlines' commercial strategy, and as those costs are inherent to the transport operation, they can be considered a normal cost component of the fare (like fuel or wages).

Table 197: Air fares for selected corridors

Origin	Destination	Air LC* Away leg	Air LC* Return leg	Air FS* Away leg	Air FS* Return leg
Paris	Madrid	139	139	90	142
Paris	Amsterdam			104	89
Antwerp	Warsaw	54	58	124	102
Amsterdam	Frankfurt			138	180
Frankfurt	Budapest			144	141
Rome	Berlin	73	102	119	119
Hamburg	Prague			81	72
Helsinki	Gdansk			356	289
Rotterdam	Lisbon		88	95	185
Stockholm	Hamburg			116	55
Genoa	Rotterdam	50		313	201
Budapest	Milan	52	37	100	100
Bucharest	Warsaw	140	87	134	191
Dublin	Amsterdam	49	105	119	111
Athens	Vienna			224	130
Madrid	Barcelona	70	59	153	154
Paris	Marseille			135	120
Hamburg	Munich	102	102	122	136
Katowice	Gdansk		59	91	73
Milan	Naples	101	105	90	126

*Note: * LC – low cost, FS – full service airline*
Source: www.GoEuro.com for travel on Monday 22/05/2017, consulted 19/05/2017

VAT rates for international corridors are 0. For national corridors, appropriate VAT rates are accounted for in the analysis.

Ferry

For coach transport no fares are available online for the ferry crossings. The same rate as heavy good vehicles is used as both vehicles are similar in size. Part of the fare contains taxes and charges levied to the ferry operators. We expect that these costs are passed on to the passengers.

- Helsinki - Tallinn: €55 (car), €398 (HGV)
- Rostock-Gedser: €126 (car)
- Rostock – Trelleborg: €473 (HGV)
- Dublin - Holyhead: €186 (car), €537 (HGV)
- Patras – Athens: €326 (car), €700 (HGV)

Freight modes

For freight modes, a different source of information is used. Internal costs are based on figures provided by Panteia (2015) for the Netherlands. This comprehensive data source provides validated and regularly updated figures.

Table 198: Freight costs per vkm for the Netherlands (source: Panteia Kostenbarometer)

Mode	Cargo type	Fixed cost	Variable cost	Personnel cost	Specific cost	Other cost	Total cost
SSS	General	3.56	6.28	3.76	2.00	0.74	16.33
Rail	Bulk	6.63	2.85	1.36	3.31	2.12	16.27
Rail	Container	7.41	2.75	1.21	3.58	2.24	17.19
IWT	Bulk	1.65	1.67	3.50		0.64	7.45
IWT	Container	4.93	4.27	7.94		0.85	17.99
Road	Bulk	0.29	0.49	0.65	0.01	0.19	1.64
Road	Container	0.21	0.45	0.60	0.01	0.12	1.39

Source: Panteia (2015)

However, these costs include taxes and charges. Therefore, certain corrections are needed.

- For SSS transport, "specific costs" are port charges, which should not be counted as internal costs.
- For rail transport, "specific costs" cover access charges (which should not be counted)
- For road transport, "fixed costs" include the Eurovignette (which should not be counted)
- Labour taxes, while possibly an important part of personnel costs, are not corrected as they are not specific to transport operations and hence not considered as transport taxes in this study.
- Costs for air transport were calculated based on MIRA.

With these corrections, the following internal costs have been derived:

Table 199: Average freight transport internal costs per vkm for the Netherlands in € (source: Panteia)

Mode	Cargo type	Internal cost per vkm
SSS	General	14.33
Rail	Bulk	12.96
Rail	Container	13.62
IWT	Bulk	18.65
IWT	Container	17.99
Road	Bulk	1.63
Road	Container	1.39
Air	General	3.08

For maritime and air transport, the figures in Table 199 can be used without corrections, as only an international market exists and cost developments for the Netherlands should be close to the EU average. For other modes, a correction is needed to balance the specific national market properties. We use the following correction factors for the different cost components:

- Fixed costs: the price level index for Transport services in Eurostat table *prc_ppp_ind*, as the main component is the procurement cost, but also the insurance Cost.
- Variable costs: diesel costs are corrected with fuel price values by country (see Table 191), while electricity costs are corrected with national electricity prices (Eurostat table *nrg_pc_205)*

- Personnel costs: are corrected with Eurostat wage costs as in Table 193.
- Specific costs (only applicable for road, covering certification and licenses): are not corrected
- 'Other costs' refer to administration and overhead costs, which are set at a fixed percentage of the sum of total costs (based on NL)

These costs do not include handling/transhipment costs. To assess these costs, a number of other sources has been investigated:

- For maritime transport, Raven Trading (2009) provides an overview of terminal handling costs. The following rates are relevant in the context of this study:

Port	Handling cost per container[53]
Antwerp	€129
Rotterdam	€165
Hamburg	€190
Barcelona	€188
La Havre	€188
Genoa	€156

- For transhipment of containers in inland waterway or rail terminals, Panteia's "Kostenbarometer" also provides some estimates:
    - Rail-road transhipment: €30/TEU
    - IWT-road transhipment: €25/TEU

  As the major part of the transhipment costs are not service driven (land, equipment, and fuel make up 65-80% of costs, while labour consists of 20-35%), it may be assumed that they are comparable for all European countries (Wiegmans and Konings, 2015).
- For handling of other goods, we refer to input costs for the transport network model NODUS, which are based on TRANS-TOOLS. Loading and unloading costs per tonne are in the range of 2-3€/tonne. Again, we assume that these cost figures can be used for all corridors.

E.5 Attribution of internal costs to transport operations

Similar to the taxes, charges and subsidies, all internal costs will be converted into distance-based concept (€/km) such that they can be easily compared with each other and the taxes, charges and subsidies. Below, we present the methodology for this conversion for each of the internal cost categories.

Procurement costs

Purchase costs for most vehicles are attributed to operations by taking the purchase cost of the vehicles and dividing it by the expected distance run over the lifetime of the vehicle. We assume that the remaining value in case of a resale is proportional to the remaining operational life of the vehicle.

In case of leasing, the annual leasing cost is divided by the average annual distance travelled of a vehicle of the given type.

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[53] Rates for 20ft and 40ft containers are mostly the same.

Maintenance costs

Maintenance costs are assumed to be a fixed percentage of the procurement costs of the vehicle, on a per annum basis. They are thus attributed to vehicle operation by dividing annual costs through annual distance travelled.

Insurance costs

Insurance costs are paid on a temporal (per year) or permission basis (in case of specific operations). We assume that all operations considered in this study are part of a normal operational cycle, which is why we only consider insurance costs on an annual basis. These are attributed to vehicle operations by dividing them through annual distance travelled.

Vehicle inspection costs

For most vehicle categories, vehicle inspection is mandatory after a certain amount of time, but legal requirements may vary between countries. As a general rule, the costs of vehicle inspection is divided by the average distance covered over the applicable period (in many cases a per annum basis).

Energy costs

For vehicles using conventional fuel (diesel, petrol, kerosene, gas oil or heavy fuel oil), costs are attributed based on average fuel consumption per unit of distance travelled. Real world fuel consumption is taken into account as much as possible.

For electrified rail connections (both conventional and high speed), energy consumption per unit of distance is estimated in order to allocate the electricity costs.

Wage costs

Wage costs are calculated per hour of operation. Where relevant, the annual wages are used, divided by the number of annual working hours. To attribute them to distances, average travel time on the corridors need to be taken into account for the different modes, as do regulations with regard to resting times.

Administrative costs

Professional vehicle operators are required to obtain a licence or certification with various degrees of geographic coverage or operational conditions. While licences in some modes are valid throughout Europe, in other modes they may only cover a certain country or vehicle type. To calculate per distance costs, the periodicity of certification, the cost of the certification process and the amount of certificates required for a given journey are all taken into accounted. The costs per kilometre are estimated by dividing the periodic costs (e.g. annual costs) by the average distance covered over the applicable period in the relevant region.

Loading, unloading and transhipment costs

Costs for loading and unloading the vehicle are incurred at the start and the end of the journey, and depend on the nature of the cargo (bulk, containers, other). In the case of multimodal transport, additional costs may be incurred for transhipment. As these costs are essentially a given per journey, they can be attributed to a unit of distance by dividing their sum by the length of a single journey. Storage costs before and after transport is not included in the assessment.

Profit margin

Profit is the difference between end user price and the sum of fixed and variable costs. We estimated percentages per mode in section E.2.

ANNEX F: RESULTS FOR RETURN TRIPS

F.1 Introduction

In this Annex, we present the main results for the return trips on the corridors (the city mentioned first is considered the origin of the trip). For each of the international corridors the total taxes and charges, the taxes and charges per tkm/pkm, and the ratio of taxes/charges and internal costs is presented for all relevant modes. This is done for both passenger and freight transport (only container/general cargo transport; the results for bulk transport are presented in Annex G).

F.2 Passenger transport

The results for passenger transport are presented in Table 200 to Table 219. For passenger cars and aviation, sometimes two figures are given in the same cell. In that case the first figure refers to the small reference passenger car / airplane, while the second figure refers to the large one.

Table 200 Results for passenger transport on the corridor Amsterdam - Paris

	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	21 / 16	38	68	7 / 11
	Vehicle taxes/charges	28 / 47	11	-	- / -
	Infrastructure taxes/charges	16 / 16	65	9,075	2,405 / 4,901
	VAT	23 / 27	54	1,218	0 / 0
	Total	88 / 106	167	10,360	2,413 / 4,913
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.021/0.016	0.002	-	0.000/0.000
	Vehicle taxes/charges	0.027/0.046	0.001	-	- / -
	Infrastructure taxes/charges	0.016/0.016	0.004	0.056	0.081/0.064
	VAT	0.022/0.026	0.004	0.007	0.000/0.000
	Total	0.087/0.104	0.011	0.063	0.081/0.064
Share taxes/charges in internal costs		0.47/0.47	0.31	0.71	0.61/0.67
Ratio taxes/charges and internal costs		0.90/0.88	0.44	2.49	1.58/2.00

Table 201 Results for passenger transport on the corridor Madrid - Paris

	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	46 / 37	69	287	21 / 32
	Vehicle taxes/charges	9 / 9	8	-	- / -
	Infrastructure taxes/charges	64 / 64	187	24,175	2,524 / 4,823
	VAT	58 / 66	265	3,083	0 / 0
	Total	176 / 175	530	27,544	2,546 / 4,855
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.018/0.014	0.002	0.001	0.000/0.000
	Vehicle taxes/charges	0.004/0.004	0.000	-	- / -
	Infrastructure taxes/charges	0.026/0.026	0.005	0.050	0.041/0.030
	VAT	0.023/0.026	0.007	0.006	0.000/0.000
	Total	0.070/0.069	0.014	0.057	0.041/0.030
Share taxes/charges in internal costs		0.44/0.39	0.23	0.68	0.44/0.48
Ratio taxes/charges and internal costs		0.79/0.65	0.30	2.15	0.80/0.94

Table 202 Results for passenger transport on the corridor Warsaw - Antwerp

	Type of taxes/charges			HSL +	+ HSL
Total taxes and charges (€)	Energy taxes/charges	44 / 33	132	1,855	23 / 35
	Vehicle taxes/charges	1 / 1	6	-	151 / 388
	Infrastructure taxes/charges	26 / 26	64	4,702	2,175 / 3,886
	VAT	46 / 53	221	2,520	0 / 0
	Total	117 / 114	423	9,077	2,348 / 4,309
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.018/0.013	0.004	0.024	0.000/0.000
	Vehicle taxes/charges	0.000/0.000	0.000	-	0.002/0.002
	Infrastructure taxes/charges	0.010/0.010	0.002	0.060	0.032/0.022
	VAT	0.018/0.021	0.006	0.016	0.000/0.000
	Total	0.047/0.045	0.011	0.100	0.035/0.025
Share taxes/charges in internal costs		0.39/0.34	0.24	1.03	0.40/0.43
Ratio taxes/charges and internal costs		0.64/0.51	0.31	2.70	0.65/0.76

Table 203 Results for passenger transport on the corridor Frankfurt - Amsterdam

	Type of taxes/charges			HSL	
Total taxes and charges (€)	Energy taxes/charges	19 / 13	53	1,373	7 / 10
	Vehicle taxes/charges	5 / 6	8	-	- / -
	Infrastructure taxes/charges	0 / 0	0	3,986	2,179 / 5,033
	VAT	14 / 16	100	3,407	0 / 0
	Total	38 / 36	161	8,766	2,186 / 5,043
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.021/0.015	0.004	0.010	0.000/0.000
	Vehicle taxes/charges	0.005/0.007	0.001	-	- / -
	Infrastructure taxes/charges	0.000/0.000	0.000	0.029	0.088/0.079
	VAT	0.016/0.018	0.007	0.025	0.000/0.000
	Total	0.043/0.040	0.012	0.065	0.088/0.079
Share taxes/charges in internal costs		0.34/0.28	0.24	0.72	0.63/0.71
Ratio taxes/charges and internal costs		0.51/0.39	0.32	2.52	1.72/2.47

Table 204 Results for passenger transport on the corridor Budapest - Frankfurt

	Type of taxes/charges			HSL	
Total taxes and charges (€)	Energy taxes/charges	31 / 27	107	3,726	16 / 25
	Vehicle taxes/charges	12 / 13	17	-	- / -
	Infrastructure taxes/charges	6 / 5	11	4,089	2,771 / 6,319
	VAT	35 / 43	152	3,091	0 / 0
	Total	83 / 87	287	10,906	2,787 / 6,344
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.016/0.014	0.004	0.013	0.000/0.000
	Vehicle taxes/charges	0.006/0.006	0.001	-	- / -
	Infrastructure taxes/charges	0.003/0.003	0.000	0.014	0.055/0.049
	VAT	0.018/0.022	0.005	0.011	0.000/0.000
	Total	0.043/0.045	0.010	0.037	0.056/0.049
Share taxes/charges in internal costs		0.36/0.33	0.28	0.60	0.52/0.61
Ratio taxes/charges and internal costs		0.57/0.49	0.40	1.53	1.09/1.53

Table 205 Results for passenger transport on the corridor Berlin - Rome

	Type of taxes/charges			HSL +	
Total taxes and charges (€)	Energy taxes/charges	63 / 51	165	3,607	24 / 36
	Vehicle taxes/charges	16 / 20	26	-	- / -
	Infrastructure taxes/charges	65 / 65	71	8,522	2,408 / 4,832
	VAT	62 / 70	152	5,634	0 / 0
	Total	206 / 206	414	17,762	2,432 / 4,868
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.021/0.017	0.004	0.009	0.000/0.000
	Vehicle taxes/charges	0.005/0.007	0.001	-	- / -
	Infrastructure taxes/charges	0.022/0.022	0.002	0.031	0.035/0.027
	VAT	0.021/0.023	0.003	0.017	0.000/0.000
	Total	0.069/0.068	0.009	0.057	0.035/0.027
Share taxes/charges in internal costs		0.45/0.40	0.20	0.74	0.41/0.46
Ratio taxes/charges and internal costs		0.82/0.67	0.24	1.82	0.68/0.85

Table 206 Results for passenger transport on the corridor Prague - Hamburg

	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	25 / 18	73	1,166	9 / 14
	Vehicle taxes/charges	1 / 1	5	-	- / -
	Infrastructure taxes/charges	0 / 0	2	3,934	2,201 / 4,638
	VAT	18 / 21	115	776	0 / 0
	Total	44 / 40	196	5,876	2,210 / 4,652
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.020/0.014	0.004	0.021	0.000/0.000
	Vehicle taxes/charges	0.001/0.001	0.000	-	- / -
	Infrastructure taxes/charges	0.000/0.000	0.000	0.071	0.070/0.057
	VAT	0.014/0.016	0.006	0.014	0.000/0.000
	Total	0.035/0.031	0.010	0.106	0.070/0.057
Share taxes/charges in internal costs		0.34/0.27	0.28	0.56	0.58/0.64
Ratio taxes/charges and internal costs		0.51/0.37	0.38	1.30	1.37/1.79

Table 207 Results for passenger transport on the corridor Gdansk - Helsinki

	Type of taxes/charges	+	+	
Total taxes and charges (€)	Energy taxes/charges	27 / 23	91	16 / 24
	Vehicle taxes/charges	1 / 1	5	-/-
	Infrastructure taxes/charges	0 / 0	16	1,322 / 2,758
	VAT	35 / 42	64	0 / 0
	Total	63 / 66	176	1,338 / 2,782
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.012/0.010	0.003	0.000/0.000
	Vehicle taxes/charges	0.000/0.000	0.000	-/-
	Infrastructure taxes/charges	0.000/0.000	0.000	0.028/0.023
	VAT	0.016/0.019	0.002	0.000/0.000
	Total	0.028/0.029	0.005	0.029/0.023
Share taxes/charges in internal costs		0.21/0.20	0.11	0.36/0.42
Ratio taxes/charges and internal costs		0.27/0.25	0.12	0.57/0.72

Table 208 Results for passenger transport on the corridor Antwerp - Lisbon

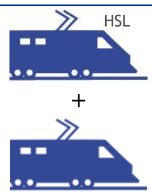
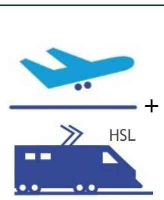
	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	78 / 61	137	120	35 / 52
	Vehicle taxes/charges	44 / 55	15	-	151 / 388
	Infrastructure taxes/charges	104 / 104	286	10,883	3,242 / 6,504
	VAT	97 / 110	353	1,232	0 / 0
	Total	320 / 328	791	12,236	3,428 / 6,945
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.018/0.014	0.002	0.011	0.000/0.000
	Vehicle taxes/charges	0.011/0.013	0.000	-	0.001/0.001
	Infrastructure taxes/charges	0.025/0.025	0.005	0.182	0.032/0.025
	VAT	0.023/0.027	0.006	0.007	0.000/0.000
	Total	0.078/0.079	0.013	0.201	0.034/0.027
Share taxes/charges in internal costs		0.47/0.42	0.22	1.33	0.39/0.45
Ratio taxes/charges and internal costs		0.88/0.73	0.29	2.96	0.65/0.83

Table 209 Results for passenger transport on the corridor Hamburg - Stockholm

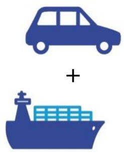
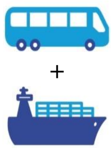
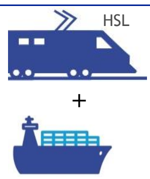
	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	42 / 34	138	622	16 / 25
	Vehicle taxes/charges	11 / 14	18	-	- / -
	Infrastructure taxes/charges	54 / 54	272	2,600	1,718 / 3,660
	VAT	51 / 57	32	667	0 / 0
	Total	159 / 159	459	3,889	1,735 / 3,685
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.020/0.016	0.004	0.002	0.000/0.000
	Vehicle taxes/charges	0.005/0.007	0.001	-	- / -
	Infrastructure taxes/charges	0.026/0.026	0.009	0.009	0.036/0.029
	VAT	0.024/0.027	0.001	0.002	0.000/0.000
	Total	0.076/0.076	0.015	0.013	0.036/0.030
Share taxes/charges in internal costs		0.39/0.36	0.26	0.33	0.41/0.48
Ratio taxes/charges and internal costs		0.64/0.56	0.36	0.50	0.70/0.94

Table 210 Results for passenger transport on the corridor Rotterdam - Genoa

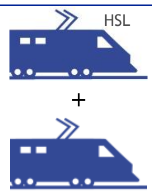
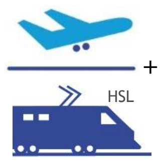
	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	55 / 47	138	1,469	18 / 28
	Vehicle taxes/charges	67 / 108	25	-	371 / 956
	Infrastructure taxes/charges	47 / 47	123	3,796	2,354 / 4,926
	VAT	48 / 57	99	3,419	0 / 0
	Total	216 / 259	386	8,683	2,744 / 5,910
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.023/0.020	0.004	0.012	0.000/0.000
	Vehicle taxes/charges	0.028/0.046	0.001	-	0.007/0.007
	Infrastructure taxes/charges	0.020/0.020	0.003	0.032	0.042/0.034
	VAT	0.020/0.024	0.003	0.028	0.000/0.000
	Total	0.092/0.110	0.011	0.072	0.048/0.040
Share taxes/charges in internal costs		0.49/0.48	0.31	0.90	0.48/0.58
Ratio taxes/charges and internal costs		0.94/0.93	0.44	2.10	0.92/1.24

Table 211 Results for passenger transport on the corridor Milan - Budapest

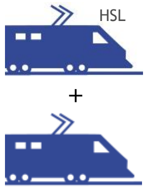
	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	34 / 29	86	2,204	16 / 25
	Vehicle taxes/charges	20 / 20	27	-	- / -
	Infrastructure taxes/charges	45 / 45	95	2,924	2,594 / 5,261
	VAT	43 / 50	54	1,540	0 / 0
	Total	141 / 143	263	6,669	2,611 / 5,286
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.017/0.015	0.003	0.016	0.000/0.000
	Vehicle taxes/charges	0.010/0.010	0.001	-	- / -
	Infrastructure taxes/charges	0.023/0.023	0.003	0.033	0.052/0.041
	VAT	0.022/0.026	0.002	0.008	0.000/0.000
	Total	0.073/0.074	0.009	0.056	0.052/0.041
Share taxes/charges in internal costs		0.46/0.41	0.20	0.74	0.50/0.56
Ratio taxes/charges and internal costs		0.84/0.71	0.25	1.41	1.02/1.28

Table 212 Results for passenger transport on the corridor Warsaw - Bucharest

	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	42 / 36	143	1,092	20 / 30
	Vehicle taxes/charges	1 / 2	8	-	- / -
	Infrastructure taxes/charges	32 / 32	62	3,205	2,086 / 3,936
	VAT	56 / 67	38	59	0 / 0
	Total	131 / 137	251	4,357	2,105 / 3,966
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.012/0.010	0.003	0.008	0.000/0.000
	Vehicle taxes/charges	0.000/0.000	0.000	-	- / -
	Infrastructure taxes/charges	0.009/0.009	0.001	0.043	0.038/0.028
	VAT	0.016/0.019	0.001	0.000	0.000/0.000
	Total	0.038/0.040	0.005	0.052	0.038/0.028
Share taxes/charges in internal costs		0.34/0.31	0.13	0.36	0.43/0.47
Ratio taxes/charges and internal costs		0.52/0.45	0.14	0.57	0.74/0.88

Table 213 Results for passenger transport on the corridor Amsterdam - Dublin

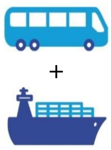
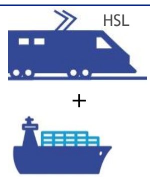
	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	45 / 40	140	38	15 / 22
	Vehicle taxes/charges	64 / 107	25	-	- / -
	Infrastructure taxes/charges	84 / 84	101	12,288	2,214 / 4,746
	VAT	60 / 70	57	906	0 / 0
	Total	252 / 300	323	13,231	2,229 / 4,769
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.019/0.017	0.004	0.000	0.000/0.000
	Vehicle taxes/charges	0.027/0.046	0.001	-	- / -
	Infrastructure taxes/charges	0.036/0.036	0.003	0.106	0.049/0.040
	VAT	0.026/0.030	0.002	0.006	0.000/0.000
	Total	0.108/0.128	0.009	0.113	0.049/0.041
Share taxes/charges in internal costs		0.44/0.45	0.20	0.97	0.49/0.56
Ratio taxes/charges and internal costs		0.79/0.81	0.25	3.79	0.96/1.28

Table 214 Results for passenger transport on the corridors Vienna - Athens

	Type of taxes/charges						
Total taxes and charges (€)	Energy taxes/charges	50 / 33	131	20/17	66	715	26 / 39
	Vehicle taxes/charges	37 / 55	8	37/55	8	-	- / -
	Infrastructure taxes/charges	47 / 47	124	29/29	44	2,097	3,032 / 6,775
	VAT	52 / 65	145	46/60	145	277	0 / 0
	Total	186 / 200	409	133/160	264	3,089	3,057 / 6,814
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.014/0.010	0.003	0.06/0.05	0.001	0.026	0.000/0.000
	Vehicle taxes/charges	0.011/0.016	0.000	0.011/0.016	0.000	-	- / -
	Infrastructure taxes/charges	0.016/0.016	0.003	0.011/0.011	0.001	0.069	0.040/0.035
	VAT	0.015/0.019	0.003	0.013/0.017	0.003	0.003	0.000/0.000
	Total	0.056/0.060	0.008	0.041/0.049	0.005	0.098	0.041/0.035
Share taxes/charges in internal costs		0.39/0.36	0.16	0.19/020	0.09	0.88	0.44/0.52
Ratio taxes/charges and internal costs		0.65/0.57	0.19	0.23/0.25	0.09	1.41	0.80/1.10

Table 215 Results for passenger transport on the corridors Barcelona - Madrid

	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	18 / 14	52	113	12 / 18
	Vehicle taxes/charges	5 / 4	4	-	- / -
	Infrastructure taxes/charges	0 / 0	0	10,558	1,939 / 3,979
	VAT	22 / 26	87	2,036	756 / 1,946
	Total	43 / 43	143	12,707	2,707 / 5,943
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.013/0.010	0.003	0.001	0.000/0.000
	Vehicle taxes/charges	0.004/0.004	0.000	-	- / -
	Infrastructure taxes/charges	0.000/0.000	0.000	0.056	0.062/0.049
	VAT	0.018/0.021	0.005	0.011	0.024/0.024
	Total	0.035/0.035	0.008	0.068	0.086/0.074
Share taxes/charges in internal costs		0.28/0.24	0.15	0.72	0.63/0.70
Ratio taxes/charges and internal costs		0.40/0.32	0.17	2.61	1.68/2.32

Table 216 Results for passenger transport on the corridors Marseille - Paris

	Type of taxes/charges			 + 	
Total taxes and charges (€)	Energy taxes/charges	32 / 26	29	137	16 / 24
	Vehicle taxes/charges	9 / 9	9	-	- / -
	Infrastructure taxes/charges	59 / 59	187	10,962	2,523 / 4,816
	VAT	38 / 43	79	2,062	589 / 1,516
	Total	138 / 137	304	13,161	3,128 / 6,357
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.020/0.017	0.001	0.001	0.000/0.000
	Vehicle taxes/charges	0.006/0.006	0.000	-	- / -
	Infrastructure taxes/charges	0.038/0.038	0.008	0.047	0.061/0.045
	VAT	0.025/0.028	0.003	0.009	0.014/0.014
	Total	0.089/0.088	0.013	0.057	0.075/0.059
Share taxes/charges in internal costs		0.50/0.45	0.23	0.68	0.59/0.65
Ratio taxes/charges and internal costs		1.01/0.83	0.31	2.12	1.47/1.85

Table 217 Results for passenger transport on the corridors Munich - Hamburg

	Type of taxes/charges			 + 	
Total taxes and charges (€)	Energy taxes/charges	31 / 23	91	3,221	15 / 22
	Vehicle taxes/charges	8 / 10	13	-	- / -
	Infrastructure taxes/charges	0 / 0	0	6,163	2,516 / 5,519
	VAT	24 / 28	168	3,576	1,173 / 3,018
	Total	64 / 61	272	12,961	3,703 / 8,560
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.020/0.015	0.004	0.013	0.000/0.000
	Vehicle taxes/charges	0.005/0.007	0.001	-	- / -
	Infrastructure taxes/charges	0.000/0.000	0.000	0.026	0.065/0.055
	VAT	0.016/0.018	0.007	0.015	0.030/0.030
	Total	0.041/0.039	0.012	0.054	0.096/0.086
Share taxes/charges in internal costs		0.33/0.28	0.24	0.68	0.65/0.73
Ratio taxes/charges and internal costs		0.49/0.38	0.32	2.14	1.88/2.69

Table 218 Results for passenger transport on the corridors Gdansk - Katowice

	Type of taxes/charges			 + 	
Total taxes and charges (€)	Energy taxes/charges	13 / 11	45	1,026	12 / 18
	Vehicle taxes/charges	0 / 0	2	-	- / -
	Infrastructure taxes/charges	7 / 7	25	1,402	1,407 / 2,869
	VAT	18 / 22	22	830	364 / 937
	Total	39 / 41	95	3,258	1,783 / 3,824
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.013/0.011	0.003	0.005	0.000/0.000
	Vehicle taxes/charges	0.000/0.000	0.000	-	- / -
	Infrastructure taxes/charges	0.007/0.007	0.002	0.007	0.045/0.036
	VAT	0.018/0.021	0.001	0.004	0.012/0.012
	Total	0.038/0.039	0.006	0.017	0.057/0.047
Share taxes/charges in internal costs		0.34/0.30	0.15	0.39	0.53/0.60
Ratio taxes/charges and internal costs		0.51/0.44	0.17	0.64	1.11/1.47

Table 219 Results for passenger transport on the corridors Naples - Milan

	Type of taxes/charges			HSL +	
Total taxes and charges (€)	Energy taxes/charges	35 / 30	78	0	15 / 23
	Vehicle taxes/charges	17 / 18	24	-	- / -
	Infrastructure taxes/charges	56 / 56	77	6,764	2,238 / 4,573
	VAT	43 / 47	71	1,782	619 / 1,592
	Total	152 / 151	250	8,546	2,872 / 6,188
Taxes and charges per pkm (€/pkm)	Energy taxes/charges	0.023/0.019	0.003	0.000	0.000/0.000
	Vehicle taxes/charges	0.011/0.011	0.001	-	- / -
	Infrastructure taxes/charges	0.036/0.036	0.003	0.009	0.055/0.044
	VAT	0.028/0.031	0.003	0.007	0.015/0.015
	Total	0.098/0.098	0.011	0.016	0.071/0.059
Share taxes/charges in internal costs		0.53/0.48	0.23	0.37	0.58/0.65
Ratio taxes/charges and internal costs		1.13/0.94	0.31	0.58	1.39/1.85

F.3 Freight transport

The results for passenger transport are presented in Table 220 to Table 239.

Table 220 Results for freight transport on the corridor Amsterdam - Paris

Output	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	52	54	-	18
	Vehicle taxes/charges	7	-	-	-
	Infrastructure taxes/charges	83	1,167	12,575	1,875
	Total	141	1,221	12,575	1,892
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.007	0.00	-	0.001
	Vehicle taxes/charges	0.001	-	-	0.000
	Infrastructure taxes/charges	0.012	0.002	0.0127	0.131
	Total	0.021	0.002	0.0127	0.132
Share taxes/charges in internal costs		0.32	0.15	0.64	0.53
Ratio taxes/charges and internal costs		0.47	0.18	1.76	1.12

Table 221 Results for freight transport on the corridor Madrid - Paris

Output	Type of taxes/charges			+	
Total taxes and charges (€)	Energy taxes/charges	91	898	3,615	50
	Vehicle taxes/charges	6	-	1,498	-
	Infrastructure taxes/charges	185	2,436	7,303	2,236
	Total	281	3,334	12,415	2,286
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.005	0.001	0.001	0.002
	Vehicle taxes/charges	0.000	-	0.001	-
	Infrastructure taxes/charges	0.011	0.001	0.0025	0.075
	Total	0.017	0.002	0.0042	0.076
Share taxes/charges in internal costs		0.15	0.12	0.14	0.39
Ratio taxes/charges and internal costs		0.18	0.14	0.16	0.64

Table 222 Results for freight transport on the corridor Warsaw - Antwerp

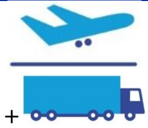
Output	**Type of taxes/charges**			
Total taxes and charges (€)	Energy taxes/charges	174	2,509	54
	Vehicle taxes/charges	8	-	118
	Infrastructure taxes/charges	209	6,006	2,209
	Total	391	8,515	2,382
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.010	0.002	0.002
	Vehicle taxes/charges	0.000	-	0.004
	Infrastructure taxes/charges	0.013	0.004	0.068
	Total	0.024	0.005	0.073
Share taxes/charges in internal costs		0.28	0.29	0.33
Ratio taxes/charges and internal costs		0.38	0.42	0.50

Table 223 Results for freight transport on the corridor Frankfurt - Amsterdam

Output	**Type of taxes/charges**				
Total taxes and charges (€)	Energy taxes/charges	71	968	61	16
	Vehicle taxes/charges	6	-	-	-
	Infrastructure taxes/charges	50	3,692	1,181	1,215
	Total	126	4,659	1,242	1,231
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.012	0.002	-	0.001
	Vehicle taxes/charges	0.001	-	-	-
	Infrastructure taxes/charges	0.009	0.007	0.001	0.102
	Total	0.021	0.008	0.001	0.103
Share taxes/charges in internal costs		0.21	0.42	0.11	0.47
Ratio taxes/charges and internal costs		0.27	0.72	0.12	0.87

Table 224 Results for freight transport on the corridor Budapest - Frankfurt

Output	**Type of taxes/charges**				
Total taxes and charges (€)	Energy taxes/charges	141	2,745	-	39
	Vehicle taxes/charges	11	-	-	-
	Infrastructure taxes/charges	109	4,103	2,674	2,092
	Total	261	6,848	2,674	2,131
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.011	0.002	-	0.002
	Vehicle taxes/charges	0.001	-	-	-
	Infrastructure taxes/charges	0.008	0.003	0.002	0.087
	Total	0.020	0.005	0.002	0.088
Share taxes/charges in internal costs		0.31	0.35	0.20	0.43
Ratio taxes/charges and internal costs		0.44	0.53	0.26	0.75

Table 225 Results for freight transport on the corridor Berlin - Rome

Output	**Type of taxes/charges**			
Total taxes and charges (€)	Energy taxes/charges	214	2,590	57
	Vehicle taxes/charges	18	-	-
	Infrastructure taxes/charges	216	6,899	2,855
	Total	448	9,488	2,912
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.011	0.001	0.002
	Vehicle taxes/charges	0.001	-	-
	Infrastructure taxes/charges	0.011	0.004	0.086
	Total	0.023	0.005	0.087
Share taxes/charges in internal costs		0.23	0.029	0.42
Ratio taxes/charges and internal costs		0.30	0.042	0.74

Table 226 Results for freight transport on the corridor Prague - Hamburg

Output	**Type of taxes/charges**				
Total taxes and charges (€)	Energy taxes/charges	95	1,584	40	22
	Vehicle taxes/charges	11	-	-	-
	Infrastructure taxes/charges	82	3,064	97	2,115
	Total	188	4,648	137	2,137
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.011	0.002	0.00008	0.001
	Vehicle taxes/charges	0.001	-	-	-
	Infrastructure taxes/charges	0.010	0.002	0.00019	0.139
	Total	0.022	0.004	0.00027	0.141
Share taxes/charges in internal costs		0.31	0.35	0.03	0.03
Ratio taxes/charges and internal costs		0.46	0.55	0.03	0.03

Table 227 Results for freight transport on the corridor Gdansk - Helsinki

Output	**Type of taxes/charges**			
Total taxes and charges (€)	Energy taxes/charges	118	-	38
	Vehicle taxes/charges	7	-	-
	Infrastructure taxes/charges	18	18,910	1,746
	Total	143	18,910	1,783
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.008	-	0.002
	Vehicle taxes/charges	0.000	-	-
	Infrastructure taxes/charges	0.002	0.005	0.078
	Total	0.010	0.005	0.080
Share taxes/charges in internal costs		0.11	0.61	0.40
Ratio taxes/charges and internal costs		0.13	1.59	0.68

Table 228 Results for freight transport on the corridor Antwerp - Lisbon

Output	**Type of taxes/charges**				+
Total taxes and charges (€)	Energy taxes/charges	181	744	-	82
	Vehicle taxes/charges	17	-	-	118
	Infrastructure taxes/charges	301	5,790	6,589	3,354
	Total	499	6,534	6,589	3,554
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.007	0.003	-	0.002
	Vehicle taxes/charges	0.001	-	-	0.002
	Infrastructure taxes/charges	0.011	0.004	0.001	0.069
	Total	0.018	0.008	0.001	0.073
Share taxes/charges in internal costs		0.16	0.33	0.19	0.35
Ratio taxes/charges and internal costs		0.19	0.41	0.23	0.53

Table 229 Results for freight transport on the corridor Hamburg - Stockholm

Output	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	181	593	-	39
	Vehicle taxes/charges	13	-	-	-
	Infrastructure taxes/charges	236	5,032	13,129	1,590
	Total	430	5,625	13,129	1,628
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.013	0.000	-	0.002
	Vehicle taxes/charges	0.001	-	-	-
	Infrastructure taxes/charges	0.018	0.003	0.002	0.068
	Total	0.032	0.004	0.002	0.070
Share taxes/charges in internal costs		0.26	0.25	0.42	0.37
Ratio taxes/charges and internal costs		0.36	0.33	0.71	0.59

Table 230 Results for freight transport on the corridor Rotterdam - Genoa

Output	Type of taxes/charges				+
Total taxes and charges (€)	Energy taxes/charges	181	61	-	43
	Vehicle taxes/charges	15	-	-	91
	Infrastructure taxes/charges	386	3,267	17,497	3,409
	Total	581	3,328	17,497	3,544
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.011	0.000	-	0.002
	Vehicle taxes/charges	0.001	-	-	0.003
	Infrastructure taxes/charges	0.026	0.002	0.001	0.138
	Total	0.038	0.002	0.001	0.143
Share taxes/charges in internal costs		0.46	0.18	0.23	0.52
Ratio taxes/charges and internal costs		0.84	0.22	0.29	1.08

Table 231 Results for freight transport on the corridor Milan - Budapest

Output	Type of taxes/charges			
Total taxes and charges (€)	Energy taxes/charges	111	174	39
	Vehicle taxes/charges	15	-	-
	Infrastructure taxes/charges	235	2,558	3,427
	Total	361	2,732	3,466
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.009	0.000	0.002
	Vehicle taxes/charges	0.001	-	-
	Infrastructure taxes/charges	0.018	0.002	0.142
	Total	0.028	0.002	0.144
Share taxes/charges in internal costs		0.27	0.16	0.55
Ratio taxes/charges and internal costs		0.37	0.19	1.22

Table 232 Results for freight transport on the corridor Warsaw - Bucharest

Output	Type of taxes/charges			
Total taxes and charges (€)	Energy taxes/charges	186	890	47
	Vehicle taxes/charges	11	-	-
	Infrastructure taxes/charges	192	4,739	2,553
	Total	389	5,629	2,600
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.008	0.000	0.002
	Vehicle taxes/charges	0.000	-	-
	Infrastructure taxes/charges	0.009	0.005	0.096
	Total	0.018	0.005	0.097
Share taxes/charges in internal costs		0.22	0.300	0.45
Ratio taxes/charges and internal costs		0.29	0.430	0.82

Table 233 Results for freight transport on the corridor Amsterdam - Dublin

Output	Type of taxes/charges			
Total taxes and charges (€)	Energy taxes/charges	181	-	35
	Vehicle taxes/charges	15	-	-
	Infrastructure taxes/charges	112	25,069	1,903
	Total	308	25,069	1,938
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.012	-	0.002
	Vehicle taxes/charges	0.001	-	-
	Infrastructure taxes/charges	0.008	0.004	0.087
	Total	0.021	0.004	0.088
Share taxes/charges in internal costs		0.23	0.56	0.43
Ratio taxes/charges and internal costs		0.30	1.26	0.75

Table 234 Results for freight transport on the corridor Vienna - Athens

Output	Type of taxes/charges			 + 	
Total taxes and charges (€)	Energy taxes/charges	171	1,400	120	61
	Vehicle taxes/charges	20	-	85	-
	Infrastructure taxes/charges	181	4,255	184	2,411
	Total	372	5,655	389	2,472
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.007	0.004	0.005	0.002
	Vehicle taxes/charges	0.001	-	0.003	-
	Infrastructure taxes/charges	0.008	0.005	0.007	0.067
	Total	0.016	0.01	0.016	0.068
Share taxes/charges in internal costs		0.15	0.39	0.19	0.37
Ratio taxes/charges and internal costs		0.18	0.49	0.24	0.58

Table 235 Results for freight transport on the corridor Barcelona - Madrid

Output	Type of taxes/charges			
Total taxes and charges (€)	Energy taxes/charges	66	798	29
	Vehicle taxes/charges	3	-	-
	Infrastructure taxes/charges	-	697	1,750
	Total	69	1,495	1,779
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.008	0.001	0.002
	Vehicle taxes/charges	0.000	-	-
	Infrastructure taxes/charges	-	0.001	0.116
	Total	0.008	0.002	0.118
Share taxes/charges in internal costs		0.08	0.13	0.50
Ratio taxes/charges and internal costs		0.08	0.14	1.00

Table 236 Results for freight transport on the corridor Marseille - Paris

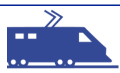
Output	Type of taxes/charges				
Total taxes and charges (€)	Energy taxes/charges	40	95	-	38
	Vehicle taxes/charges	8	-	-	-
	Infrastructure taxes/charges	187	1,480	3,446	2,294
	Total	235	1,575	3,446	2,332
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.004	0	-	0.002
	Vehicle taxes/charges	0.001	0	-	-
	Infrastructure taxes/charges	0.017	0.002	0.00023	0.115
	Total	0.022	0.012	0.00023	0.116
Share taxes/charges in internal costs		0.20	0.12	0.020	0.50
Ratio taxes/charges and internal costs		0.25	0.14	0.0229	0.98

Table 237 Results for freight transport on the corridor Munich - Hamburg

Output	Type of taxes/charges			
Total taxes and charges (€)	Energy taxes/charges	120	2,294	35
	Vehicle taxes/charges	9	-	-
	Infrastructure taxes/charges	100	5,661	1,966
	Total	230	7,954	2,001
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.011	0.002	0.002
	Vehicle taxes/charges	0.001	-	-
	Infrastructure taxes/charges	0.010	0.006	0.105
	Total	0.022	0.008	0.107
Share taxes/charges in internal costs		0.22	0.41	0.48
Ratio taxes/charges and internal costs		0.29	0.71	0.91

Table 238 Results for freight transport on the corridor Gdansk - Katowice

Output	Type of taxes/charges			
Total taxes and charges (€)	Energy taxes/charges	59	708	29
	Vehicle taxes/charges	3	-	-
	Infrastructure taxes/charges	28	1,744	1,836
	Total	91	2,452	1,865
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.009	0.001	0.002
	Vehicle taxes/charges	0.000	-	-
	Infrastructure taxes/charges	0.004	0.002	0.122
	Total	0.013	0.003	0.124
Share taxes/charges in internal costs		0.17	0.20	0.51
Ratio taxes/charges and internal costs		0.20	0.26	1.05

Table 239 Results for freight transport on the corridor Naples - Milan

Output	Type of taxes/charges			 + 	
Total taxes and charges (€)	Energy taxes/charges	102	-	7,574	37
	Vehicle taxes/charges	12	-	1,784	-
	Infrastructure taxes/charges	136	1,836	10,834	5,777
	Total	251	1,836	20,192	5,814
Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.010	-	0.002	0.002
	Vehicle taxes/charges	0.001	-	0.00046	-
	Infrastructure taxes/charges	0.013	0.002	0.00279	0.120
	Total	0.024	0.002	0.0052	0.122
Share taxes/charges in internal costs		0.24	0.13	0.16	0.51
Ratio taxes/charges and internal costs		0.32	0.15	0.19	1.03

ANNEX G: RESULTS FOR BULK TRANSPORT

G.1 Introduction

In this Annex, we present the main results for bulk freight transport. For each of the corridors (both for the outward and return trip) the total taxes and charges, the taxes and charges per tkm, and the ratio of taxes/charges and internal costs is presented for all relevant transport modes. Aviation is not considered in this Annex, as it is not a relevant mode for bulk transport.

G.2 Results

The results for bulk transport are presented per corridor in Table 240 to Table 259.

Table 240 Results for bulk transport on the corridor Paris - Amsterdam

Corridor	Output	Type of taxes/charges			
Paris - Amsterdam	Total taxes and charges (€)	Energy taxes/charges		80	
		Vehicle taxes/charges	6	-	
		Infrastructure taxes/charges	83	1,241	13,427
		Total	141	1,322	13,427
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.008	0.000	-
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.014	0.002	0.0108
		Total	0.023	0.002	0.0108
	Share taxes/charges in internal costs		0.14	0.16	0.52
	Ratio taxes/charges and internal costs		0.16	0.19	1.08
Amsterdam - Paris	Total taxes and charges (€)	Energy taxes/charges	52	80	-
		Vehicle taxes/charges	8	-	-
		Infrastructure taxes/charges	83	1,241	13,427
		Total	142	1,322	13,427
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.008	0.000	-
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.014	0.002	0.0108
		Total	0.023	0.002	0.0108
	Share taxes/charges in internal costs		0.21	0.19	0.620
	Ratio taxes/charges and internal costs		0.27	0.24	1.65

Table 241 Results for bulk transport on the corridor Paris - Madrid

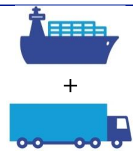
Corridor	Output	Type of taxes/charges			
Paris - Madrid	Total taxes and charges (€)	Energy taxes/charges	91	1,347	3,442
		Vehicle taxes/charges	15	-	1,926
		Infrastructure taxes/charges	185	2,436	7,378
		Total	290	3,782	12,746
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.006	0.001	0.001
		Vehicle taxes/charges	0.001	-	0.001
		Infrastructure taxes/charges	0.012	0.001	0.002
		Total	0.019	0.002	0.0034
	Share taxes/charges in internal costs		0.12	0.18	0.12
	Ratio taxes/charges and internal costs		0.13	0.21	0.13
Madrid - Paris	Total taxes and charges (€)	Energy taxes/charges	91	1,347	3,442
		Vehicle taxes/charges	7	-	1,926
		Infrastructure taxes/charges	185	2,436	7,378
		Total	282	3,782	12,746
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.006	0.001	0.001
		Vehicle taxes/charges	0.000	-	0.001
		Infrastructure taxes/charges	0.012	0.001	0.002
		Total	0.019	0.002	0.0034
	Share taxes/charges in internal costs		0.11	0.17	0.12
	Ratio taxes/charges and internal costs		0.13	0.20	0.13

Table 242 Results for bulk transport on the corridor Antwerp - Warsaw

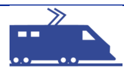
Corridor	Output	Type of taxes/charges		
Antwerp - Warsaw	Total taxes and charges (€)	Energy taxes/charges	174	3,762
		Vehicle taxes/charges	12	-
		Infrastructure taxes/charges	209	6,685
		Total	394	10,447
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.011	0.002
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.014	0.004
		Total	0.027	0.006
	Share taxes/charges in internal costs		0.15	0.38
	Ratio taxes/charges and internal costs		0.18	0.62
Warsaw - Antwerp	Total taxes and charges (€)	Energy taxes/charges	174	3,762
		Vehicle taxes/charges	8	-
		Infrastructure taxes/charges	209	6,685
		Total	391	10,447
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.011	0.002
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.014	0.004
		Total	0.026	0.006
	Share taxes/charges in internal costs		0.19	0.39
	Ratio taxes/charges and internal costs		0.23	0.64

Table 243 Results for bulk transport on the corridor Amsterdam - Frankfurt

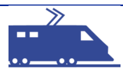
Corridor	Output	Type of taxes/charges			
Amsterdam - Frankfurt	Total taxes and charges (€)	Energy taxes/charges	71	1,451	61
		Vehicle taxes/charges	7	-	-
		Infrastructure taxes/charges	50	3,739	1,356
		Total	128	5,190	1,417
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.013	0.003	0.00006
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.010	0.007	0.00132
		Total	0.024	0.009	0.00138
	Share taxes/charges in internal costs		0.22	0.55	0.150
	Ratio taxes/charges and internal costs		0.28	1.21	0.180
Frankfurt - Amsterdam	Total taxes and charges (€)	Energy taxes/charges	71	1,451	61
		Vehicle taxes/charges	6	-	-
		Infrastructure taxes/charges	50	3,739	1,356
		Total	127	5,190	1,417
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.013	0.003	0.00006
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.010	0.007	0.00132
		Total	0.024	0.009	0.00138
	Share taxes/charges in internal costs		0.16	0.51	0.120
	Ratio taxes/charges and internal costs		0.19	1.04	0.130

Table 244 Results for bulk transport on the corridor Frankfurt - Budapest

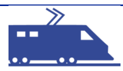
Corridor	Output	Type of taxes/charges			
Frankfurt - Budapest	Total taxes and charges (€)	Energy taxes/charges	141	4,116	
		Vehicle taxes/charges	14	-	
		Infrastructure taxes/charges	109	4,407	3,674
		Total	263	8,522	3,674
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.012	0.003	-
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.009	0.004	0.00201
		Total	0.022	0.007	0.00201
	Share taxes/charges in internal costs		0.15	0.43	0.180
	Ratio taxes/charges and internal costs		0.17	0.76	0.210
Budapest - Frankfurt	Total taxes and charges (€)	Energy taxes/charges	141	4,116	-
		Vehicle taxes/charges	14	-	-
		Infrastructure taxes/charges	109	4,407	3,674
		Total	263	8,522	3,674
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.012	0.003	-
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.009	0.004	0.00201
		Total	0.022	0.007	0.00201
	Share taxes/charges in internal costs		0.20	0.47	0.230
	Ratio taxes/charges and internal costs		0.25	0.87	0.300

Table 245 Results for bulk transport on the corridor Rome - Berlin

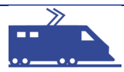
Corridor	Output	Type of taxes/charges		
Rome - Berlin	Total taxes and charges (€)	Energy taxes/charges	214	3,882
		Vehicle taxes/charges	27	-
		Infrastructure taxes/charges	216	6,996
		Total	457	10,878
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.012	0.002
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.012	0.004
		Total	0.025	0.006
	Share taxes/charges in internal costs		0.16	0.38
	Ratio taxes/charges and internal costs		0.20	0.61
Berlin - Rome	Total taxes and charges (€)	Energy taxes/charges	214	3,882
		Vehicle taxes/charges	20	-
		Infrastructure taxes/charges	216	6,996
		Total	450	10,878
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.012	0.002
		Vehicle taxes/charges	0.002	-
		Infrastructure taxes/charges	0.012	0.004
		Total	0.025	0.006
	Share taxes/charges in internal costs		0.17	0.38
	Ratio taxes/charges and internal costs		0.20	0.62

Table 246 Results for bulk transport on the corridor Hamburg - Prague

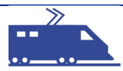
Corridor	Output	Type of taxes/charges			
Hamburg - Prague	Total taxes and charges (€)	Energy taxes/charges	95	2,374	40
		Vehicle taxes/charges	9	-	-
		Infrastructure taxes/charges	82	3,247	47
		Total	186	5,622	87
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.012	0.003	0.00007
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.011	0.004	0.00008
		Total	0.025	0.007	0.00014
	Share taxes/charges in internal costs		0.22	0.47	0.020
	Ratio taxes/charges and internal costs		0.27	0.87	0.020
Prague - Hamburg	Total taxes and charges (€)	Energy taxes/charges	95	2,374	40
		Vehicle taxes/charges	11	-	-
		Infrastructure taxes/charges	82	3,247	47
		Total	188	5,622	87
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.012	0.003	0.00007
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.011	0.004	0.00008
		Total	0.024	0.007	0.00014
	Share taxes/charges in internal costs		0.16	0.44	0.020
	Ratio taxes/charges and internal costs		0.19	0.78	0.020

Table 247 Results for bulk transport on the corridor Helsinki - Gdansk

Corridor	Output	Type of taxes/charges		
Helsinki - Gdansk	Total taxes and charges (€)	Energy taxes/charges	118	-
		Vehicle taxes/charges	17	-
		Infrastructure taxes/charges	18	16,554
		Total	153	16,554
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.009	-
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.002	0.004
		Total	0.012	0.004
	Share taxes/charges in internal costs		0.07	0.58
	Ratio taxes/charges and internal costs		0.07	1.39
Gdansk - Helsinki	Total taxes and charges (€)	Energy taxes/charges	118	-
		Vehicle taxes/charges	7	-
		Infrastructure taxes/charges	18	17,132
		Total	143	17,132
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.009	-
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.002	0.004
		Total	0.011	0.004
	Share taxes/charges in internal costs		0.08	0.59
	Ratio taxes/charges and internal costs		0.09	1.44

Table 248 Results for bulk transport on the corridor Lisbon - Antwerp

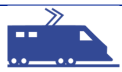
Corridor	Output	Type of taxes/charges			
Lisbon - Antwerp	Total taxes and charges (€)	Energy taxes/charges	181	1,116	-
		Vehicle taxes/charges	27	-	-
		Infrastructure taxes/charges	301	5,805	6,744
		Total	509	6,921	6,744
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.007	0.005	-
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.012	0.004	0.001
		Total	0.020	0.009	0.001
	Share taxes/charges in internal costs		0.19	0.53	0.19
	Ratio taxes/charges and internal costs		0.24	0.72	0.23
Antwerp - Lisbon	Total taxes and charges (€)	Energy taxes/charges	181	1,116	-
		Vehicle taxes/charges	20	-	-
		Infrastructure taxes/charges	301	5,805	6,825
		Total	502	6,921	6,825
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.007	0.005	-
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.012	0.004	0.001
		Total	0.020	0.009	0.001
	Share taxes/charges in internal costs		0.12	0.45	0.19
	Ratio taxes/charges and internal costs		0.13	0.59	0.24

Table 249 Results for bulk transport on the corridor Stockholm - Hamburg

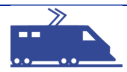
Corridor	Output	Type of taxes/charges			
Stockholm - Hamburg	Total taxes and charges (€)	Energy taxes/charges	181	889	
		Vehicle taxes/charges	19	-	
		Infrastructure taxes/charges	236	6,053	16,118
		Total	436	6,942	16,118
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.014	0.001	-
		Vehicle taxes/charges	0.002	-	-
		Infrastructure taxes/charges	0.020	0.004	0.003
		Total	0.036	0.005	0.003
	Share taxes/charges in internal costs		0.19	0.32	0.47
	Ratio taxes/charges and internal costs		0.23	0.48	0.87
Hamburg - Stockholm	Total taxes and charges (€)	Energy taxes/charges	181	889	
		Vehicle taxes/charges	14	-	
		Infrastructure taxes/charges	236	6,053	16,297
		Total	431	6,942	16,297
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.014	0.001	-
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.020	0.004	0.003
		Total	0.036	0.005	0.003
	Share taxes/charges in internal costs		0.21	0.35	0.47
	Ratio taxes/charges and internal costs		0.26	0.54	0.88

Table 250 Results for bulk transport on the corridor Genoa - Rotterdam

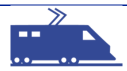
Corridor	Output	Type of taxes/charges			
Genoa - Rotterdam	Total taxes and charges (€)	Energy taxes/charges	181	91	
		Vehicle taxes/charges	22	-	
		Infrastructure taxes/charges	386	3,814	15,866
		Total	588	3,905	15,866
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.013	0.000	-
		Vehicle taxes/charges	0.002	-	-
		Infrastructure taxes/charges	0.029	0.003	0.001
		Total	0.043	0.003	0.001
	Share taxes/charges in internal costs		0.26	0.22	0.21
	Ratio taxes/charges and internal costs		0.35	0.28	0.27
Rotterdam - Genoa	Total taxes and charges (€)	Energy taxes/charges	181	91	
		Vehicle taxes/charges	18	-	
		Infrastructure taxes/charges	386	3,814	18,326
		Total	584	3,905	18,326
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.013	0.000	-
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.029	0.003	0.001
		Total	0.043	0.003	0.001
	Share taxes/charges in internal costs		0.33	0.24	0.24
	Ratio taxes/charges and internal costs		0.50	0.32	0.31

Table 251 Results for bulk transport on the corridor Budapest - Milan

Corridor	Output	Type of taxes/charges		
Budapest - Milan	Total taxes and charges (€)	Energy taxes/charges	111	260
		Vehicle taxes/charges	13	-
		Infrastructure taxes/charges	235	3,173
		Total	359	3,433
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.010	0.000
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.020	0.003
		Total	0.031	0.003
	Share taxes/charges in internal costs		0.26	0.25
	Ratio taxes/charges and internal costs		0.35	0.33
Milan - Budapest	Total taxes and charges (€)	Energy taxes/charges	111	260
		Vehicle taxes/charges	17	-
		Infrastructure taxes/charges	235	3,173
		Total	363	3,433
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.010	0.000
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.020	0.003
		Total	0.031	0.003
	Share taxes/charges in internal costs		0.20	0.23
	Ratio taxes/charges and internal costs		0.25	0.29

Table 252 Results for bulk transport on the corridor Bucharest - Warsaw

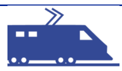
Corridor	Output	Type of taxes/charges		
Bucharest - Warsaw	Total taxes and charges (€)	Energy taxes/charges	186	1,335
		Vehicle taxes/charges	11	-
		Infrastructure taxes/charges	192	5,680
		Total	389	7,015
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.009	0.001
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.010	0.005
		Total	0.020	0.006
	Share taxes/charges in internal costs		0.15	0.39
	Ratio taxes/charges and internal costs		0.17	0.64
Warsaw - Bucharest	Total taxes and charges (€)	Energy taxes/charges	186	1,335
		Vehicle taxes/charges	11	-
		Infrastructure taxes/charges	192	5,680
		Total	389	7,015
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.009	0.001
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.010	0.005
		Total	0.020	0.006
	Share taxes/charges in internal costs		0.15	0.37
	Ratio taxes/charges and internal costs		0.18	0.59

Table 253 Results for bulk transport on the corridor Dublin - Amsterdam

Corridor	**Output**	**Type of taxes/charges**		
Dublin - Amsterdam	Total taxes and charges (€)	Energy taxes/charges	181	-
		Vehicle taxes/charges	12	-
		Infrastructure taxes/charges	112	22,500
		Total	305	22,500
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.013	-
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.009	0.003
		Total	0.023	0.003
	Share taxes/charges in internal costs		0.13	0.53
	Ratio taxes/charges and internal costs		0.14	1.13
Amsterdam - Dublin	Total taxes and charges (€)	Energy taxes/charges	181	-
		Vehicle taxes/charges	17	-
		Infrastructure taxes/charges	112	22,600
		Total	310	22,600
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.013	-
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.009	0.003
		Total	0.023	0.003
	Share taxes/charges in internal costs		0.17	0.53
	Ratio taxes/charges and internal costs		0.20	1.13

Table 254 Results for bulk transport on the corridor Athens - Vienna

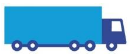
Corridor	**Output**	**Type of taxes/charges**			 + 
Athens - Vienna	Total taxes and charges (€)	Energy taxes/charges	171	2,099	120
		Vehicle taxes/charges	43	-	110
		Infrastructure taxes/charges	181	4,073	184
		Total	395	6,172	415
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.008	0.006	0.005
		Vehicle taxes/charges	0.002	-	0.004
		Infrastructure taxes/charges	0.009	0.005	0.007
		Total	0.019	0.012	0.016
	Share taxes/charges in internal costs		0.14	0.58	0.19
	Ratio taxes/charges and internal costs		0.16	0.83	0.23
Vienna - Athens	Total taxes and charges (€)	Energy taxes/charges	171	2,099	120
		Vehicle taxes/charges	22	-	110
		Infrastructure taxes/charges	181	4,073	184
		Total	374	6,172	415
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.008	0.006	0.005
		Vehicle taxes/charges	0.001	-	0.004
		Infrastructure taxes/charges	0.009	0.005	0.007
		Total	0.018	0.012	0.016
	Share taxes/charges in internal costs		0.11	0.53	0.17
	Ratio taxes/charges and internal costs		0.13	0.74	0.21

Table 255 Results for bulk transport on the corridor Madrid - Barcelona

Corridor	Output	Type of taxes/charges		
Madrid - Barcelona	Total taxes and charges (€)	Energy taxes/charges	66	1,196
		Vehicle taxes/charges	3	-
		Infrastructure taxes/charges	-	697
		Total	70	1,893
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.009	0.002
		Vehicle taxes/charges	0.000	-
		Infrastructure taxes/charges	0.000	0.001
		Total	0.009	0.002
	Share taxes/charges in internal costs		0.06	0.19
	Ratio taxes/charges and internal costs		0.06	0.23
Barcelona - Madrid	Total taxes and charges (€)	Energy taxes/charges	66	1,196
		Vehicle taxes/charges	3	-
		Infrastructure taxes/charges	-	697
		Total	70	1,893
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.009	0.002
		Vehicle taxes/charges	0.000	-
		Infrastructure taxes/charges	0.000	0.001
		Total	0.009	0.002
	Share taxes/charges in internal costs		0.06	0.19
	Ratio taxes/charges and internal costs		0.06	0.23

Table 256 Results for bulk transport on the corridor Paris - Marseille

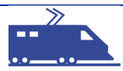
Corridor	Output	Type of taxes/charges			
Paris - Marseille	Total taxes and charges (€)	Energy taxes/charges	40	142	
		Vehicle taxes/charges	9	-	
		Infrastructure taxes/charges	187	1,480	3,466
		Total	236	1,622	3,466
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.004	0.000	-
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.019	0.002	0.0002
		Total	0.024	0.002	0.0002
	Share taxes/charges in internal costs		0.15	0.15	0.02
	Ratio taxes/charges and internal costs		0.17	0.17	0.02
Marseille - Paris	Total taxes and charges (€)	Energy taxes/charges	40	142	
		Vehicle taxes/charges	9	-	
		Infrastructure taxes/charges	187	1,480	3,466
		Total	236	1,622	3,466
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.004	0.000	-
		Vehicle taxes/charges	0.001	-	-
		Infrastructure taxes/charges	0.019	0.002	0.0002
		Total	0.024	0.002	0.0002
	Share taxes/charges in internal costs		0.15	0.15	0.02
	Ratio taxes/charges and internal costs		0.17	0.17	0.02

Table 257 Results for bulk transport on the corridor Hamburg - Munich

Corridor	Output	Type of taxes/charges		
Hamburg - Munich	Total taxes and charges (€)	Energy taxes/charges	120	3,439
		Vehicle taxes/charges	11	-
		Infrastructure taxes/charges	100	5,661
		Total	231	9,100
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.013	0.004
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.011	0.006
		Total	0.025	0.009
	Share taxes/charges in internal costs		0.17	0.51
	Ratio taxes/charges and internal costs		0.20	1.06
Munich - Hamburg	Total taxes and charges (€)	Energy taxes/charges	120	3,439
		Vehicle taxes/charges	11	-
		Infrastructure taxes/charges	100	5,661
		Total	231	9,100
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.013	0.004
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.011	0.006
		Total	0.025	0.009
	Share taxes/charges in internal costs		0.17	0.51
	Ratio taxes/charges and internal costs		0.20	1.06

Table 258 Results for bulk transport on the corridor Katowice - Gdansk

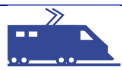
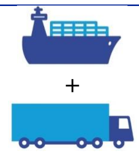
Corridor	Output	Type of taxes/charges		
Katowice - Gdansk	Total taxes and charges (€)	Energy taxes/charges	59	1,062
		Vehicle taxes/charges	3	-
		Infrastructure taxes/charges	28	2,367
		Total	91	3,429
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.009	0.001
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.005	0.003
		Total	0.015	0.005
	Share taxes/charges in internal costs		0.12	0.30
	Ratio taxes/charges and internal costs		0.13	0.44
Gdansk - Katowice	Total taxes and charges (€)	Energy taxes/charges	59	1,062
		Vehicle taxes/charges	3	-
		Infrastructure taxes/charges	28	2,367
		Total	91	3,429
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.009	0.001
		Vehicle taxes/charges	0.001	-
		Infrastructure taxes/charges	0.005	0.003
		Total	0.015	0.005
	Share taxes/charges in internal costs		0.12	0.30
	Ratio taxes/charges and internal costs		0.13	0.44

Table 259 Results for bulk transport on the corridor Milan - Naples

Corridor	Output	Type of taxes/charges			
Milan - Naples	Total taxes and charges (€)	Energy taxes/charges	102	-	6,241
		Vehicle taxes/charges	14	-	1,914
		Infrastructure taxes/charges	136	1,836	9,775
		Total	252	1,836	17,931
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.011	-	0.002
		Vehicle taxes/charges	0.001	-	0.000
		Infrastructure taxes/charges	0.015	0.002	0.0024
		Total	0.027	0.002	0.0044
	Share taxes/charges in internal costs		0.18	0.16	0.15
	Ratio taxes/charges and internal costs		0.22	0.19	0.18
Naples - Milan	Total taxes and charges (€)	Energy taxes/charges	102	-	6,241
		Vehicle taxes/charges	14	-	1,914
		Infrastructure taxes/charges	136	1,836	9,985
		Total	253	1,836	18,141
	Taxes and charges per tkm (€/tkm)	Energy taxes/charges	0.011	-	0.002
		Vehicle taxes/charges	0.002	-	0.000
		Infrastructure taxes/charges	0.015	0.002	0.0025
		Total	0.027	0.002	0.0045
	Share taxes/charges in internal costs		0.18	0.16	0.15
	Ratio taxes/charges and internal costs		0.22	0.19	0.18

ANNEX H: RESULTS FOR TRANSPORT OPERATORS

In Chapter 4 and 5 the total burden of taxation and charging for passengers of coaches, trains and aviation is presented per corridor. These results may differ from the total tax/charge burden for operators of these modes for two reasons:

- In contrast to passengers, transport operators may reclaim their VAT payments.
- Some of the aviation taxes are levied on passengers and hence are not relevant for the calculation of the tax/charge burden of airlines.

In this Annex, we provide an overview of the total tax/charge burden for the operators of coaches, passenger trains and passenger aviation (see Table 260). Furthermore, the results per passenger kilometres are presented in Table 261. For aviation, each cell contains two figures; the first one refers to the small reference airplane (Embraer 170), while the second one refers to the large one (Airbus A320).

Table 260 Total taxes and charges (€/trip) for transport operators on the various corridors

Corridor			
Paris – Amsterdam	108	9,143	2,257 / 4,998
Amsterdam – Paris	113	9,143	2,413 / 4,913
Paris – Madrid	272	24,462	2,922 / 5,928
Madrid – Paris	265	24,462	2,546 / 4,855
Antwerp – Warsaw	205	11,640	3,429 / 6,870
Warsaw – Antwerp	202	11,640	2,348 / 4,309
Amsterdam – Frankfurt	63	5,360	2,240 / 5,347
Frankfurt – Amsterdam	61	5,360	2,186 / 5,043
Frankfurt – Budapest	135	7,815	2,941 / 6,174
Budapest – Frankfurt	134	7,815	2,787 / 6,344
Rome – Berlin	281	14,448	3,588 / 7,210
Berlin – Rome	262	14,448	2,432 / 4,868
Hamburg – Prague	87	5,100	2,164 / 4,473
Prague - Hamburg	81	5,100	2,210 / 4,652
Helsinki – Gdansk	116	-	1,454 / 3,081
Gdansk – Helsinki	112	-	1,338 / 2,782
Lisbon – Antwerp	440	22,685	2,488 / 4,646
Antwerp – Lisbon	438	22,685	3,428 / 6,945
Stockholm – Hamburg	431	3,222	1,820 / 3,747
Hamburg – Stockholm	427	3,222	1,735 / 3,685
Genoa – Rotterdam	296	9,588	2,497 / 5,274
Rotterdam – Genoa	286	9,588	2,744 / 5,910
Budapest – Milan	198	7,101	2,527 / 5,471
Milan – Budapest	209	7,101	2,611 / 5,286
Bucharest – Warsaw	218	4,297	2,572 / 5,107
Warsaw – Bucharest	213	4,297	2,105 / 3,966
Dublin – Amsterdam	252	19,671	1,559 / 3,045
Amsterdam – Dublin	266	19,671	2,229 / 4,769
Athens – Vienna	225	5,383	2,747 / 6,217
Vienna – Athens	205	5,383	3,057 / 6,814
Madrid – Barcelona	56	10,671	2,010 / 4,267
Barcelona – Madrid	56	10,671	1,951 / 3,997
Paris – Marseille	225	11,099	2,588 / 5,456
Marseille – Paris	225	11,099	2,538 / 4,840
Hamburg – Munich	105	9,384	1,941 / 4,158
Munich - Hamburg	105	9,384	2,530 / 5,541
Katowice - Gdansk	73	2,429	1,546 / 3,213
Gdansk – Katowice	73	2,429	1,749 / 3,561

Corridor			
Milan - Naples	177	6,764	2,300 / 4,716
Naples - Milan	179	6,764	2,253 / 4,596

Note: Rail encompasses both HSL and regular rail. Furthermore, for the corridors Antwerp – Warsaw, Lisbon – Antwerp, Rotterdam – Genoa and Katowice – Gdansk (and their respective return trips) aviation covers the complete multimodal trip (i.e. taxes and charges levied on rail/road transport used in combination with aviation on these corridors are taken into account as well). Lastly, the bus route shown for Athens –Vienna goes by land, no part is by ferry.

Table 261 Average taxes and charges (€/pkm) for transport operators on the various corridors

Corridor			
Paris – Amsterdam	0.007	0.056	0.076 / 0.065
Amsterdam – Paris	0.007	0.056	0.081 / 0.064
Paris – Madrid	0.007	0.051	0.047 / 0.037
Madrid – Paris	0.007	0.051	0.041 / 0.030
Antwerp – Warsaw	0.005	0.041	0.051 / 0.040
Warsaw – Antwerp	0.005	0.041	0.035 / 0.025
Amsterdam – Frankfurt	0.005	0.040	0.090 / 0.084
Frankfurt – Amsterdam	0.005	0.040	0.088 / 0.079
Frankfurt – Budapest	0.005	0.027	0.059 / 0.048
Budapest – Frankfurt	0.005	0.027	0.056 / 0.049
Rome – Berlin	0.006	0.030	0.052 / 0.041
Berlin – Rome	0.006	0.030	0.035 / 0.027
Hamburg – Prague	0.005	0.092	0.069 / 0.055
Prague - Hamburg	0.004	0.092	0.070 / 0.057
Helsinki – Gdansk	0.003	-	0.031 / 0.026
Gdansk – Helsinki	0.003	-	0.029 / 0.023
Lisbon – Antwerp	0.007	0.065	0.025 / 0.018
Antwerp – Lisbon	0.007	0.065	0.034 / 0.027
Stockholm – Hamburg	0.014	0.011	0.038 / 0.030
Hamburg – Stockholm	0.014	0.011	0.036 / 0.030
Genoa – Rotterdam	0.008	0.035	0.044 / 0.036
Rotterdam – Genoa	0.008	0.035	0.048 / 0.040
Budapest – Milan	0.007	0.025	0.051 / 0.043
Milan – Budapest	0.007	0.025	0.052 / 0.041
Bucharest – Warsaw	0.004	0.030	0.046 / 0.036
Warsaw – Bucharest	0.004	0.030	0.038 / 0.028
Dublin – Amsterdam	0.007	0.062	0.034 / 0.026
Amsterdam – Dublin	0.008	0.062	0.049 / 0.041
Athens – Vienna	0.004	0.029	0.037 / 0.032
Vienna – Athens	0.004	0.029	0.041 / 0.035
Madrid – Barcelona	0.003	0.057	0.064 / 0.053
Barcelona – Madrid	0.003	0.057	0.062 / 0.050
Paris – Marseille	0.010	0.048	0.062 / 0.051
Marseille – Paris	0.010	0.048	0.061 / 0.045
Hamburg – Munich	0.004	0.039	0.050 / 0.042
Munich - Hamburg	0.004	0.039	0.065 / 0.056
Katowice - Gdansk	0.005	0.013	0.045 / 0.036
Gdansk – Katowice	0.005	0.013	0.052 / 0.040
Milan - Naples	0.008	0.027	0.057 / 0.045
Naples - Milan	0.008	0.027	0.056 / 0.044

Note: Rail encompasses both HSL and regular rail. Furthermore, for the corridors Antwerp – Warsaw, Lisbon – Antwerp, Rotterdam – Genoa and Katowice – Gdansk (and their respective return trips) aviation covers the complete multimodal trip (i.e. taxes and charges levied on rail/road transport used in combination with aviation on these corridors are taken into account as well). Lastly, the bus route shown for Athens –Vienna goes by land, no part is by ferry.

Finally, the share of taxes/charges in the total internal costs for transport operators is presented in Table 262. Notice that the internal costs of transport operators differ from the costs for passengers, mainly because of the profit margin operators apply.

Table 262 Share of taxes/charges in the total internal costs for transport operators on the various corridors

Corridor			
Paris – Amsterdam	0.15	0.68	0.61/0.68
Amsterdam – Paris	0.24	0.70	0.62/0.68
Paris – Madrid	0.15	0.67	0.49/0.55
Madrid – Paris	0.14	0.67	0.45/0.49
Antwerp – Warsaw	0.11	0.89	0.50/0.56
Warsaw – Antwerp	0.14	0.96	0.41/0.44
Amsterdam – Frankfurt	0.16	0.63	0.65/0.73
Frankfurt – Amsterdam	0.11	0.61	0.64/0.72
Frankfurt – Budapest	0.11	0.51	0.55/0.61
Budapest – Frankfurt	0.16	0.53	0.53/0.61
Rome – Berlin	0.15	0.70	0.51/0.57
Berlin – Rome	0.14	0.69	0.42/0.47
Hamburg – Prague	0.11	0.50	0.58/0.64
Prague - Hamburg	0.14	0.54	0.59/0.65
Helsinki – Gdansk	0.06	0.00	0.39/0.46
Gdansk – Helsinki	0.08	0.00	0.37/0.43
Lisbon – Antwerp	0.22	1.45	0.33/0.36
Antwerp – Lisbon	0.14	1.32	0.40/0.46
Stockholm – Hamburg	0.23	0.30	0.44/0.49
Hamburg – Stockholm	0.25	0.31	0.42/0.49
Genoa – Rotterdam	0.20	0.86	0.47/0.54
Rotterdam – Genoa	0.25	0.90	0.49/0.56
Budapest – Milan	0.22	0.76	0.51/0.58
Milan – Budapest	0.17	0.72	0.51/0.57
Bucharest – Warsaw	0.11	0.27	0.48/0.54
Warsaw – Bucharest	0.11	0.26	0.44/0.48
Dublin – Amsterdam	0.13	0.93	0.41/0.46
Amsterdam – Dublin	0.18	0.97	0.50/0.57
Athens – Vienna	0.12	0.91	0.43/0.51
Vienna – Athens	0.09	0.88	0.45/0.53
Madrid – Barcelona	0.06	0.69	0.57/0.63
Barcelona – Madrid	0.06	0.69	0.56/0.62
Paris – Marseille	0.19	0.65	0.56/0.62
Marseille – Paris	0.19	0.65	0.55/0.59
Hamburg – Munich	0.11	0.62	0.50/0.58
Munich - Hamburg	0.11	0.62	0.57/0.65
Katowice - Gdansk	0.12	0.33	0.48/0.54
Gdansk – Katowice	0.12	0.33	0.51/0.57
Milan - Naples	0.18	0.51	0.54/0.59
Naples - Milan	0.18	0.51	0.53/0.59

Note: Rail encompasses both HSL and regular rail. Furthermore, for the corridors Antwerp – Warsaw, Lisbon – Antwerp, Rotterdam – Genoa and Katowice – Gdansk (and their respective return trips) aviation covers the complete multimodal trip (i.e. taxes and charges levied on rail/road transport used in combination with aviation on these corridors are taken into account as well). Lastly, the bus route shown for Athens –Vienna goes by land, no part is by ferry.

ANNEX I: VARIABLE VS. FIXED TAXES AND CHARGES

I.1 Introduction

In this Annex, we present the distinction between fixed and variable taxes/charges per transport mean, per corridor (outward trip). We show both the total figures as well as the figures per pkm and tkm. Furthermore, the ratios of fixed taxes/charges vs. fixed costs and of variable taxes/charges vs. variable costs is presented.

In Section 3.2.1, every tax/charge considered in this study is labelled as fixed or variable. This categorisation is used to calculate the breakdown of fixed and variable taxes/charges for a trip on the twenty corridors.

I.2 Passenger transport

The distinction between fixed and variable taxes and charges is presented for passenger transport in Table 263 to Table 282. For passenger cars and aviation, each cell contains two figures; the first one refers to the small reference car / airplane, while the second one refers to the large ones.

Table 263 Results for passenger transport on the corridor Paris - Amsterdam

	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	17 / 21	6	-	2,044 / 4,699
	Variable taxes/charges	48 / 41	141	10,360	214 / 299
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.017/0.021	0.000	-	0.069/0.061
	Variable taxes/charges	0.047/0.041	0.009	0.063	0.007/0.004
Ratio fixed taxes/charges and internal costs		0.24 / 0.23	0.01	0.00	2.07 / 2.88
Ratio variable taxes/charges and internal costs		3.07 / 2.73	2.30	9.66	0.45 / 0.41

Table 264 Results for passenger transport on the corridor Paris - Madrid

	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	43 / 52	15	-	2,289 / 5,040
	Variable taxes/charges	139 / 128	486	27,385	633 / 887
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.017/0.021	0.000	-	0.037/0.032
	Variable taxes/charges	0.055/0.050	0.013	0.063	0.010/0.006
Ratio fixed taxes/charges and internal costs		0.25 / 0.24	0.01	0.00	1.11 / 1.48
Ratio variable taxes/charges and internal costs		3.49 / 3.30	3.06	10.04	0.63 / 0.59

Table 265 Results for passenger transport on the corridor Antwerp - Warsaw

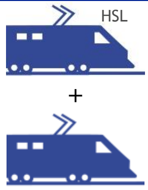
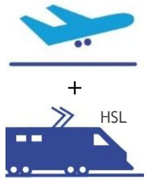
	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	56 / 73	9	-	2,803 / 5,992
	Variable taxes/charges	91 / 79	417	17,655	626 / 877
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.022/0.029	0.000	-	0.042/0.034
	Variable taxes/charges	0.036/0.031	0.011	0.055	0.009/0.005
Ratio fixed taxes/charges and fixed internal costs		0.32 / 0.33	0.01	0.00	1.18 / 1.56
Ratio variable taxes/charges and variable internal costs		2.25 / 2.00	2.58	12.99	0.57 / 0.52

Table 266 Results for passenger transport on the corridor Amsterdam - Frankfurt

	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	36 / 56	10	-	2,016 / 5,032
	Variable taxes/charges	25 / 18	185	8,766	225 / 315
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.040/0.063	0.001	-	0.081/0.079
	Variable taxes/charges	0.028/0.020	0.014	0.065	0.009/0.005
Ratio fixed taxes/charges and internal costs		0.52 / 0.63	0.04	0.00	2.45 / 3.70
Ratio variable taxes/charges and internal costs		1.79 / 1.31	3.29	12.12	0.56 / 0.52

Table 267 Results for passenger transport on the corridor Frankfurt - Budapest

	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	42 / 51	28	-	2,457 / 5,496
	Variable taxes/charges	41 / 37	259	11,215	484 / 678
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.021/0.026	0.001	-	0.049/0.043
	Variable taxes/charges	0.021/0.019	0.009	0.038	0.010/0.005
Ratio fixed taxes/charges and internal costs		0.33 / 0.32	0.03	0.00	1.48 / 2.00
Ratio variable taxes/charges and internal costs		1.36 / 1.22	2.08	6.81	0.60 / 0.56

Table 268 Results for passenger transport on the corridor Rome - Berlin

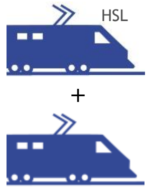
	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	71 / 84	45	-	2,800 / 6,105
	Variable taxes/charges	157 / 142	385	22,431	788 / 1,104
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.024/0.028	0.001	-	0.041/0.034
	Variable taxes/charges	0.052/0.047	0.009	0.045	0.011/0.006
Ratio fixed taxes/charges and internal costs		0.35 / 0.33	0.03	0.00	1.22 / 1.61
Ratio variable taxes/charges and internal costs		3.22 / 3.02	2.00	8.07	0.71 / 0.66

Table 269 Results for passenger transport on the corridor Hamburg - Prague

	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	25 / 31	11	-	1,855 / 4,039
	Variable taxes/charges	32 / 25	203	5,876	310 / 434
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.020/0.024	0.001	-	0.059/0.050
	Variable taxes/charges	0.025/0.020	0.011	0.107	0.010/0.005
Ratio fixed taxes/charges and internal costs		0.30 / 0.29	0.02	0.00	1.77 / 2.33
Ratio variable taxes/charges and internal costs		1.61 / 1.27	2.52	9.81	0.61 / 0.57

Table 270 Results for passenger transport on the corridor Helsinki - Gdansk

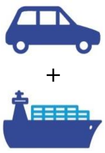
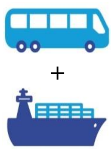
	Type of taxes/charges			
Total taxes and charges (€)	Fixed taxes/charges	58 / 80	24	1,196 / 2,719
	Variable taxes/charges	40 / 35	156	258 / 362
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.025/0.035	0.001	0.026/0.023
	Variable taxes/charges	0.018/0.015	0.005	0.006/0.003
Ratio fixed taxes/charges and internal costs		0.25 / 0.29	0.02	0.78 / 1.07
Ratio variable taxes/charges and internal costs		1.04 / 0.94	1.02	0.35 / 0.32

Table 271 Results for passenger transport on the corridor Lisbon - Antwerp

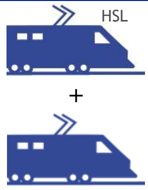
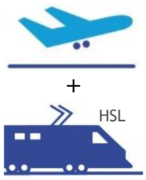
	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	96 / 142	17	-	1,549 / 3,330
	Variable taxes/charges	230 / 209	760	24,982	940 / 1,317
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.023/0.034	0.000	-	0.015/0.013
	Variable taxes/charges	0.055/0.050	0.012	0.068	0.009/0.005
Ratio fixed taxes/charges and internal costs		0.30 / 0.35	0.01	0.00	0.44 / 0.59
Ratio variable taxes/charges and internal costs		3.54 / 3.29	2.92	8.03	0.57 / 0.53

Table 272 Results for passenger transport on the corridor Stockholm - Hamburg

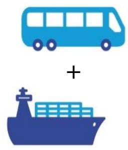
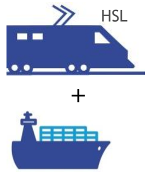
	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	41 / 53	21	-	1,376 / 3,124
	Variable taxes/charges	127 / 118	441	3,889	444 / 623
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.020/0.025	0.001	-	0.028/0.025
	Variable taxes/charges	0.061/0.057	0.014	0.013	0.009/0.005
Ratio fixed taxes/charges and internal costs		0.20 / 0.22	0.02	0.00	0.86 / 1.18
Ratio variable taxes/charges and internal costs		3.73 / 3.56	3.25	2.41	0.57 / 0.53

Table 273 Results for passenger transport on the corridor Genoa - Rotterdam

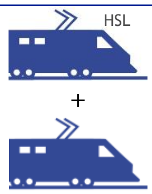
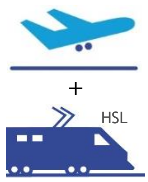
	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	72 / 82	98	-	1,893 / 4,429
	Variable taxes/charges	100 / 92	298	15,594	604 / 846
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.030/0.035	0.003	-	0.033/0.030
	Variable taxes/charges	0.042/0.039	0.008	0.051	0.011/0.006
Ratio fixed taxes/charges and internal costs		0.46 / 0.41	0.09	0.00	0.99 / 1.41
Ratio variable taxes/charges and internal costs		2.71 / 2.60	2.06	9.08	0.66 / 0.62

Table 274 Results for passenger transport on the corridor Budapest - Milan

	Type of taxes/charges			HSL +	
Total taxes and charges (€)	Fixed taxes/charges	46 / 53	27	-	2,050 / 4,802
	Variable taxes/charges	84 / 78	221	9,253	477 / 669
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.024/0.027	0.001	-	0.041/0.037
	Variable taxes/charges	0.043/0.040	0.008	0.032	0.010/0.005
Ratio fixed taxes/charges and internal costs		0.41 / 0.37	0.05	0.00	1.24 / 1.75
Ratio variable taxes/charges and internal costs		2.59 / 2.50	1.73	4.80	0.59 / 0.55

Table 275 Results for passenger transport on the corridor Bucharest - Warsaw

	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	55 / 65	49	-	2,239 / 4,639
	Variable taxes/charges	62 / 56	207	4,357	333 / 468
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.016/0.019	0.001	-	0.040/0.032
	Variable taxes/charges	0.018/0.016	0.004	0.031	0.006/0.003
Ratio fixed taxes/charges and internal costs		0.28 / 0.26	0.03	0.00	1.22 / 1.53
Ratio variable taxes/charges and internal costs		1.14 / 1.02	0.92	2.02	0.37 / 0.35

Table 276 Results for passenger transport on the corridor Dublin - Amsterdam

	Type of taxes/charges	+	+	HSL +	
Total taxes and charges (€)	Fixed taxes/charges	70 / 80	10	-	1,058 / 2,343
	Variable taxes/charges	158 / 152	299	21,195	501 / 702
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.030/0.034	0.000	-	0.023/0.020
	Variable taxes/charges	0.068/0.065	0.009	0.067	0.011/0.006
Ratio fixed taxes/charges and internal costs		0.27 / 0.26	0.01	0.00	0.70 / 0.94
Ratio variable taxes/charges and internal costs		4.40 / 4.27	2.05	9.30	0.68 / 0.63

Table 277 Results for passenger transport on the corridor Athens - Vienna

	Type of taxes/charges						
Total taxes and charges (€)	Fixed taxes/charges	113 / 247	46	105/136	8	-	2,291 / 5,579
	Variable taxes/charges	111 / 94	334	37/33	266	5,731	455 / 639
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.033/0.072	0.001	0.030/0.039	0.000	-	0.031/0.029
	Variable taxes/charges	0.032/0.027	0.006	0.011/0.010	0.005	0.029	0.006/0.003
Ratio fixed taxes/charges and internal costs		0.54 / 0.92	0.03	0.45	0.45	0.00	0.92 / 1.36
Ratio variable taxes/charges and internal costs		2.04 / 1.61	1.40	0.11	0.09	2.32	0.38 / 0.35

Table 278 Results for passenger transport on the corridor Madrid - Barcelona

	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	19 / 23	4	-	1,638 / 3,745
	Variable taxes/charges	26 / 21	139	12,580	1,124 / 2,455
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.015/0.019	0.000	-	0.052/0.046
	Variable taxes/charges	0.020/0.016	0.007	0.067	0.036/0.030
Ratio fixed taxes/charges and internal costs		0.21 / 0.21	0.01	0.00	1.58 / 2.18
Ratio variable taxes/charges and internal costs		1.29 / 1.02	1.62	12.92	2.23 / 3.24

Table 279 Results for passenger transport on the corridor Paris - Marseille

	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	26 / 32	9	-	2,121 / 4,801
	Variable taxes/charges	112 / 105	303	13,466	1,130 / 2,360
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.017/0.021	0.000	-	0.050/0.039
	Variable taxes/charges	0.072/0.067	0.013	0.056	0.025/0.020
Ratio fixed taxes/charges and internal costs		0.24 / 0.23	0.01	0.00	1.54 / 2.11
Ratio variable taxes/charges and internal costs		4.64 / 4.65	3.28	9.55	1.69 / 2.34

Table 280 Results for passenger transport on the corridor Hamburg - Munich

	Type of taxes/charges				
Total taxes and charges (€)	Fixed taxes/charges	23 / 31	13	-	1,412 / 3,417
	Variable taxes/charges	41 / 31	307	13,676	1,581 / 3,448
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.015/0.020	0.001	-	0.036/0.034
	Variable taxes/charges	0.026/0.020	0.013	0.057	0.041/0.035
Ratio fixed taxes/charges and internal costs		0.23 / 0.24	0.02	0.00	1.10 / 1.61
Ratio variable taxes/charges and internal costs		1.69 / 1.30	3.15	11.86	2.54 / 3.67

Table 281 Results for passenger transport on the corridor Katowice - Gdansk

	Type of taxes/charges				 + 
Total taxes and charges (€)	Fixed taxes/charges	11 / 14	2	-	1,240 / 2,636
	Variable taxes/charges	28 / 26	93	3,258	543 / 1,188
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.010/0.014	0.000	-	0.044/0.037
	Variable taxes/charges	0.027/0.025	0.006	0.017	0.017/0.015
Ratio fixed taxes/charges and internal costs		0.19 / 0.19	0.00	0.00	1.19 / 1.54
Ratio variable taxes/charges and internal costs		1.61 / 1.54	1.34	2.40	1.08 / 1.57

Table 282 Results for passenger transport on the corridor Milan - Naples

	Type of taxes/charges	 +			
Total taxes and charges (€)	Fixed taxes/charges	34 / 40	22	-	1,763 / 3,965
	Variable taxes/charges	116 / 109	234	8,291	978 / 1,888
Taxes and charges per pkm (€/pkm)	Fixed taxes/charges	0.022/0.026	0.001	-	0.044/0.038
	Variable taxes/charges	0.075/0.071	0.010	0.033	0.024/0.018
Ratio fixed taxes/charges and internal costs		0.33 / 0.31	0.03	0.00	1.31 / 1.79
Ratio variable taxes/charges and internal costs		4.44 / 4.45	2.33	4.57	1.50 / 1.92

F.2 Freight transport

The results for freight transport are presented in Table 283 to Table 302, distinguishing both container/general cargo transport and bulk transport.

Table 283 Results for freight transport on the corridor Paris - Amsterdam

Corridor	Output	Type of taxes/charges				
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	13	-	12,574	1,513
		Variable taxes/charges	128	1,221	-	380
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	0.000	0.013	0.064
		Variable taxes/charges	0.018	0.002	-	0.026
	Ratio fixed taxes/charges and internal costs		0.02	0.00	2.9	1.74
	Ratio variable taxes/charges and internal costs		1.22	0.52	0.00	0.33
Bulk	Total taxes and charges (€)	Fixed taxes/charges	13	-	13,427	-
		Variable taxes/charges	128	1,322	-	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	-	0.010	-
		Variable taxes/charges	0.020	0.002	-	-
	Ratio fixed taxes/charges and internal costs		0.02	0.00	1.40	-
	Ratio variable taxes/charges and internal costs		0.51	1.12	0.00	-

Table 284 Results for freight transport on the corridor Paris - Madrid

Corridor	Output	Type of taxes/charges			+	
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	13	-	5,089	1,512
		Variable taxes/charges	275	3,334	7,326	1,125
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.002	0.051
		Variable taxes/charges	0.016	0.002	0.0025	0.038
	Ratio fixed taxes/charges and internal costs		0.01	0.00	0.08	1.36
	Ratio variable taxes/charges and internal costs		1.06	0.53	0.47	0.46
Bulk	Total taxes and charges (€)	Fixed taxes/charges	15	-	5,769	-
		Variable taxes/charges	275	3,782	6,978	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.002	-
		Variable taxes/charges	0.018	0.002	0.002	-
	Ratio fixed taxes/charges and internal costs		0.01	0.00	0.09	-
	Ratio variable taxes/charges and internal costs		0.44	1.44	0.25	-

Table 285 Results for freight transport on the corridor Antwerp - Warsaw

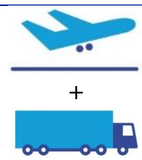
Corridor	**Output**	**Type of taxes/charges**			
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	26	-	2,300
		Variable taxes/charges	367	8,515	1,113
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	-	0.071
		Variable taxes/charges	0.022	0.005	0.034
	Ratio fixed taxes/charges and internal costs		0.02	0.00	1.14
	Ratio variable taxes/charges and internal costs		1.37	1.44	0.40
Bulk	Total taxes and charges (€)	Fixed taxes/charges	27	-	-
		Variable taxes/charges	367	10,447	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	-	-
		Variable taxes/charges	0.024	0.006	-
	Ratio fixed taxes/charges and internal costs		0.02	0.00	-
	Ratio variable taxes/charges and internal costs		0.57	4.14	-

Table 286 Results for freight transport on the corridor Amsterdam - Frankfurt

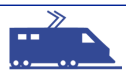
Corridor	**Output**	**Type of taxes/charges**				
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	12	-	1,104	875
		Variable taxes/charges	115	4,659	138	398
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	-	0.001	0.073
		Variable taxes/charges	0.019	0.008	0.000	0.033
	Ratio fixed taxes/charges and internal costs		0.07	0.00	0.26	1.97
	Ratio variable taxes/charges and internal costs		1.21	2.34	0.05	0.41
Bulk	Total taxes and charges (€)	Fixed taxes/charges	12	-	982	-
		Variable taxes/charges	115	5,190	435	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	-	0.001	-
		Variable taxes/charges	0.021	0.009	0.000	-
	Ratio fixed taxes/charges and internal costs		0.05	0.00	0.19	-
	Ratio variable taxes/charges and internal costs		0.51	6.59	0.17	-

Table 287 Results for freight transport on the corridor Frankfurt -Budapest

Corridor	Output	Type of taxes/charges				
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	12	-	1,096	2,355
		Variable taxes/charges	250	6,848	1,638	859
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.001	0.097
		Variable taxes/charges	0.019	0.005	0.001	0.036
	Ratio fixed taxes/charges and internal costs		0.01	0.00	0.08	2.62
	Ratio variable taxes/charges and internal costs		1.20	1.53	0.59	0.44
Bulk	Total taxes and charges (€)	Fixed taxes/charges	14	-	974	-
		Variable taxes/charges	250	8,522	2,760	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.001	-
		Variable taxes/charges	0.021	0.007	0.002	-
	Ratio fixed taxes/charges and internal costs		0.01	0.00	0.07	-
	Ratio variable taxes/charges and internal costs		0.50	4.65	1.00	-

Table 288 Results for freight transport on the corridor Rome - Berlin

Corridor	Output	Type of taxes/charges			
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	24	-	1,767
		Variable taxes/charges	430	9,488	1,398
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.053
		Variable taxes/charges	0.022	0.005	0.042
	Ratio fixed taxes/charges and internal costs		0.02	0.00	1.43
	Ratio variable taxes/charges and internal costs		1.38	1.34	0.52
Bulk	Total taxes and charges (€)	Fixed taxes/charges	27	-	-
		Variable taxes/charges	430	10,878	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	-	-
		Variable taxes/charges	0.024	0.006	-
	Ratio fixed taxes/charges and internal costs		0.02	0.00	-
	Ratio variable taxes/charges and internal costs		0.58	3.57	-

Table 289 Results for freight transport on the corridor Hamburg - Prague

Corridor	Output	Type of taxes/charges				
Container /general cargo	Total taxes and charges (€)	Fixed taxes/charges	8	-	137	2,220
		Variable taxes/charges	177	4,648	-	549
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.000	0.146
		Variable taxes/charges	0.021	0.006	-	0.036
	Ratio fixed taxes/charges and internal costs		0.02	0.00	0.05	3.93
	Ratio variable taxes/charges and internal costs		1.36	1.60	0.00	0.44
Bulk	Total taxes and charges (€)	Fixed taxes/charges	9	-	87	-
		Variable taxes/charges	177	5,622	-	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	0.000	0.000	-
		Variable taxes/charges	0.023	0.007	0.000	-
	Ratio fixed taxes/charges and internal costs		0.01	-	0.02	-
	Ratio variable taxes/charges and internal costs		0.57	4.96	0.00	-

Table 290 Results for freight transport on the corridor Helsinki - Gdansk

Corridor	Output	Type of taxes/charges			
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	30	10,446	1,321
		Variable taxes/charges	120	7,886	462
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	0.003	0.059
		Variable taxes/charges	0.008	0.002	0.021
	Ratio fixed taxes/charges and internal costs		0.02	1.56	1.59
	Ratio variable taxes/charges and internal costs		0.48	1.51	0.25
Bulk	Total taxes and charges (€)	Fixed taxes/charges	33	8,668	-
		Variable taxes/charges	120	7,886	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	0.002	-
		Variable taxes/charges	0.009	0.002	-
	Ratio fixed taxes/charges and internal costs		0.02	1.29	-
	Ratio variable taxes/charges and internal costs		0.20	1.51	-

Table 291 Results for freight transport on the corridor Lisbon - Antwerp

Corridor	Output	Type of taxes/charges				 + 
Container /general cargo	Total taxes and charges (€)	Fixed taxes/charges	23	-	6,508	1,004
		Variable taxes/charges	482	7,344	-	1,671
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.001	0.021
		Variable taxes/charges	0.017	0.003	-	0.034
	Ratio fixed taxes/charges and internal costs		0.03	0.00	0.40	0.38
	Ratio variable taxes/charges and internal costs		1.12	0.74	0.00	0.41
Bulk	Total taxes and charges (€)	Fixed taxes/charges	27	-	6,744	-
		Variable taxes/charges	482	7,873	-	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.001	-
		Variable taxes/charges	0.019	0.003	-	-
	Ratio fixed taxes/charges and internal costs		0.02	0.00	0.42	-
	Ratio variable taxes/charges and internal costs		0.47	1.84	0.00	-

Table 292 Results for freight transport on the corridor Stockholm - Hamburg

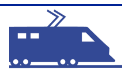
Corridor	Output	Type of taxes/charges				
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	41	-	7,308	1,325
		Variable taxes/charges	391	5,625	5,643	790
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.003	-	0.001	0.057
		Variable taxes/charges	0.028	0.004	0.001	0.034
	Ratio fixed taxes/charges and internal costs		0.03	0.00	0.70	1.53
	Ratio variable taxes/charges and internal costs		1.77	1.06	0.70	0.42
Bulk	Total taxes and charges (€)	Fixed taxes/charges	45	-	12,278	-
		Variable taxes/charges	391	6,942	3,840	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.004	-	0.002	-
		Variable taxes/charges	0.031	0.005	0.001	-
	Ratio fixed taxes/charges and internal costs		0.03	0.00	1.18	-
	Ratio variable taxes/charges and internal costs		0.74	3.32	0.47	-

Table 293 Results for freight transport on the corridor Genoa - Rotterdam

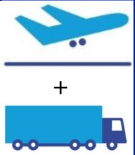
Corridor	**Output**	**Type of taxes/charges**				
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	48	-	15,037	2,472
		Variable taxes/charges	537	3,328	-	1,071
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.003	-	0.001	0.091
		Variable taxes/charges	0.034	0.002	-	0.039
	Ratio fixed taxes/charges and internal costs		0.05	0.00	0.45	1.53
	Ratio variable taxes/charges and internal costs		2.26	0.63	0.00	0.45
Bulk	Total taxes and charges (€)	Fixed taxes/charges	51	-	15,866	-
		Variable taxes/charges	537	3,905	-	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.004	-	0.001	-
		Variable taxes/charges	0.038	0.003	-	-
	Ratio fixed taxes/charges and internal costs		0.04	0.00	0.47	-
	Ratio variable taxes/charges and internal costs		0.94	1.49	0.00	-

Table 294 Results for freight transport on the corridor Budapest - Milan

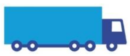
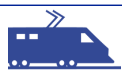
Corridor	**Output**	**Type of taxes/charges**			
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	11	-	1,769
		Variable taxes/charges	346	2,732	848
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.074
		Variable taxes/charges	0.027	0.002	0.035
	Ratio fixed taxes/charges and internal costs		0.03	0.00	1.98
	Ratio variable taxes/charges and internal costs		1.66	0.59	0.43
Bulk	Total taxes and charges (€)	Fixed taxes/charges	13	-	-
		Variable taxes/charges	346	3,433	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	-
		Variable taxes/charges	0.030	0.003	-
	Ratio fixed taxes/charges and internal costs		0.02	0.00	-
	Ratio variable taxes/charges and internal costs		0.69	1.37	-

Table 295 Results for freight transport on the corridor Bucharest - Warsaw

Corridor	Output	Type of taxes/charges			
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	30	-	2,224
		Variable taxes/charges	358	5,629	597
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.083
		Variable taxes/charges	0.016	0.003	0.022
	Ratio fixed taxes/charges and internal costs		0.03	0.00	2.24
	Ratio variable taxes/charges and internal costs		0.97	0.78	0.28
Bulk	Total taxes and charges (€)	Fixed taxes/charges	31	-	-
		Variable taxes/charges	358	7,015	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	-	-
		Variable taxes/charges	0.017	0.004	-
	Ratio fixed taxes/charges and internal costs		0.02	0.00	-
	Ratio variable taxes/charges and internal costs		0.41	1.79	-

Table 296 Results for freight transport on the corridor Dublin - Amsterdam

Corridor	Output	Type of taxes/charges			
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	26	24,969	1,050
		Variable taxes/charges	279	-	889
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	0.004	0.048
		Variable taxes/charges	0.018	-	0.040
	Ratio fixed taxes/charges and internal costs		0.02	2.23	1.29
	Ratio variable taxes/charges and internal costs		1.19	0.00	0.50
Bulk	Total taxes and charges (€)	Fixed taxes/charges	26	22,500	-
		Variable taxes/charges	279	-	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	0.003	-
		Variable taxes/charges	0.020	-	-
	Ratio fixed taxes/charges and internal costs		0.02	2.01	-
	Ratio variable taxes/charges and internal costs		0.50	0.00	-

Table 297 Results for freight transport on the corridor Athens - Vienna

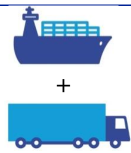
Corridor	Output	Type of taxes/charges				
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	40	-	85	1,714
		Variable taxes/charges	352	6,188	305	815
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	-	0.003	0.047
		Variable taxes/charges	0.015	0.003	0.012	0.023
	Ratio fixed taxes/charges and internal costs		0.03	0.00	0.07	1.28
	Ratio variable taxes/charges and internal costs		0.90	0.73	1.93	0.28
Bulk	Total taxes and charges (€)	Fixed taxes/charges	43	-	110	-
		Variable taxes/charges	352	7,105	305	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.002	-	0.004	-
		Variable taxes/charges	0.017	0.003	0.012	-
	Ratio fixed taxes/charges and internal costs		0.03	0.00	0.08	-
	Ratio variable taxes/charges and internal costs		0.38	1.59	0.80	-

Table 298 Results for freight transport on the corridor Madrid - Barcelona

Corridor	Output	Type of taxes/charges			
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	3	-	1,006
		Variable taxes/charges	66	1,495	661
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.000	-	0.067
		Variable taxes/charges	0.008	0.002	0.044
	Ratio fixed taxes/charges and internal costs		0.00	0.00	1.80
	Ratio variable taxes/charges and internal costs		0.48	0.51	0.54
Bulk	Total taxes and charges (€)	Fixed taxes/charges	3	-	-
		Variable taxes/charges	66	1,893	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.000	-	-
		Variable taxes/charges	0.009	0.002	-
	Ratio fixed taxes/charges and internal costs		0.00	0.00	-
	Ratio variable taxes/charges and internal costs		0.20	1.84	-

Table 299 Results for freight transport on the corridor Paris - Marseille

Corridor	Output	Type of taxes/charges				
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	8	-	3,466	1,189
		Variable taxes/charges	227	1,575	-	829
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.0002	0.059
		Variable taxes/charges	0.021	0.002	-	0.041
	Ratio fixed taxes/charges and internal costs		0.01	0.00	0.03	1.60
	Ratio variable taxes/charges and internal costs		1.44	0.51	0.00	0.51
Bulk	Total taxes and charges (€)	Fixed taxes/charges	9	-	3,466	-
		Variable taxes/charges	227	1,622	-	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.0002	-
		Variable taxes/charges	0.023	0.002	-	-
	Ratio fixed taxes/charges and internal costs		0.01	0.00	0.03	-
	Ratio variable taxes/charges and internal costs		0.60	1.11	0.00	-

Table 300 Results for freight transport on the corridor Hamburg - Munich

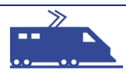
Corridor	Output	Type of taxes/charges			
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	9	-	1,296
		Variable taxes/charges	220	7,954	938
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.069
		Variable taxes/charges	0.021	0.008	0.050
	Ratio fixed taxes/charges and internal costs		0.01	0.00	1.87
	Ratio variable taxes/charges and internal costs		1.37	2.29	0.62
Bulk	Total taxes and charges (€)	Fixed taxes/charges	11	-	-
		Variable taxes/charges	220	9,100	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	-
		Variable taxes/charges	0.023	0.009	-
	Ratio fixed taxes/charges and internal costs		0.01	0.00	-
	Ratio variable taxes/charges and internal costs		0.57	7.39	-

Table 301 Results for freight transport on the corridor Katowice - Gdansk

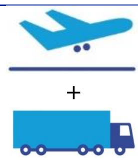
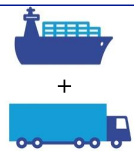
Corridor	**Output**	**Type of taxes/charges**			
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	3	-	1,100
		Variable taxes/charges	87	2,452	321
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.000	-	0.074
		Variable taxes/charges	0.013	0.003	0.021
	Ratio fixed taxes/charges and internal costs		0.01	0.00	1.97
	Ratio variable taxes/charges and internal costs		0.77	0.86	0.26
Bulk	Total taxes and charges (€)	Fixed taxes/charges	3	-	-
		Variable taxes/charges	87	3,429	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	-
		Variable taxes/charges	0.014	-	-
	Ratio fixed taxes/charges and internal costs		0.01	0.00	-
	Ratio variable taxes/charges and internal costs		0.32	2.44	-

Table 302 Results for freight transport on the corridor Milan - Naples

Corridor	**Output**	**Type of taxes/charges**				
Container/ general cargo	Total taxes and charges (€)	Fixed taxes/charges	12	-	6,839	5,140
		Variable taxes/charges	239	1,836	13,143	951
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.002	0.264
		Variable taxes/charges	0.023	0.002	0.003	0.049
	Ratio fixed taxes/charges and internal costs		0.02	0.00	0.08	7.10
	Ratio variable taxes/charges and internal costs		1.44	0.48	0.85	0.60
Bulk	Total taxes and charges (€)	Fixed taxes/charges	14	-	7,101	-
		Variable taxes/charges	239	1,836	10,830	-
	Taxes and charges per tkm (€/tkm)	Fixed taxes/charges	0.001	-	0.002	-
		Variable taxes/charges	0.025	0.002	0.003	-
	Ratio fixed taxes/charges and internal costs		0.02	0.00	0.10	-
	Ratio variable taxes/charges and internal costs		0.60	0.93	0.37	-

ANNEX J: GENERAL TAXES AND CHARGES FOR AUXILIARY SERVICES

J.1 Introduction

In this study, we have defined transport taxes and charges as all fees that are directly related to the ownership and use of transport vehicles, including the levies related to the use of transport infrastructure (see Section 3.2.1). Although most of the taxes and charges considered in this study are clearly in line with this definition, some debate may exist on some taxes/charges because they can be considered general taxes or charges for covering the costs of auxiliary services. These two types of taxes/charges are discussed in more detail in this Annex by clearly defining them and estimating their size.

J.2 General taxes

Defining general taxes

Some of the taxes considered in this study can be considered general taxes rather than transport taxes, as they are not directly related to owning or using a transport vehicle but are levied on (all) economic sectors. In this study, the following taxes are considered to be general taxes:

- *Insurance taxes*: as insurance taxes are applied on all insurance premiums, it affects all economic sectors in a similar way. Therefore, they do not affect relative prices on the transport market and hence can be considered general taxes instead of transport taxes.[54]
- *VAT*: as insurance taxes, VAT is levied on products/services in all economic sectors and hence does not influence relative prices in the transport market in the same way other transport taxes do. Therefore, VAT should be considered a general tax instead of a transport tax (Eurostat, 2001). However, as stated by Steinbach et al. (2009), there is one exception where VAT can be considered a transport tax. In cases where VAT is charged on a tax/charge that is considered a transport tax/charge, VAT should be included in the concept of transport taxes. This implies that the VAT charged on fuel excise duties, registration taxes, road charges, etc. are assumed to be transport taxes, while VAT on the production and operational costs of vehicles is not.

When considering transport taxes and charges from a social perspective, discussing issues like the user pays and polluter pays principles, general taxes should often be excluded from the analyses. However, as these general taxes may affect the level playing field between transport modes from an end-user perspective, they are relevant for the purpose of this study. Therefore, the distinction between transport and general taxes made in this section is only for informative purposes and may be helpful for applying the results of this study in other assessments.

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[54] However, insurance taxes may also be seen as a mark-up on the insurance premiums and hence as a direct internalisation measure of accident costs

Size of general taxes

As shown in Figure 159 and Figure 160, general taxes (VAT and insurance tax) may contribute significantly to the total fiscal burden of passenger cars and coaches. For passenger cars this contribution ranges between 15% and 55%, while for coaches it ranges from 10% to 70%. This wide range is explained by the VAT and insurance tax levels applied on the various corridors on the one hand, and the level of specific transport taxes and charges on the other hand.

Figure 159 Share of general taxes in total transport taxes for end-users of passenger cars

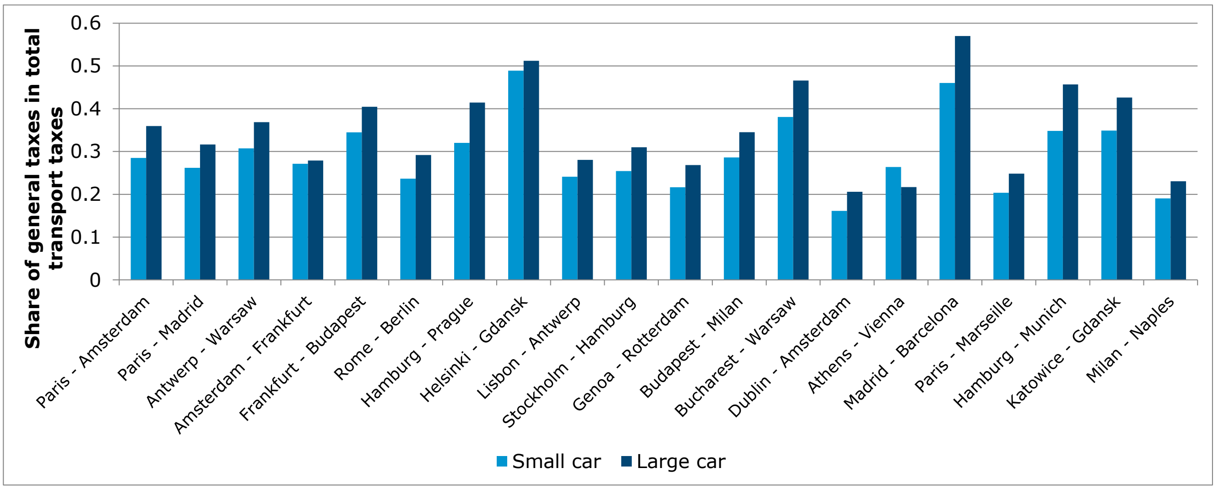
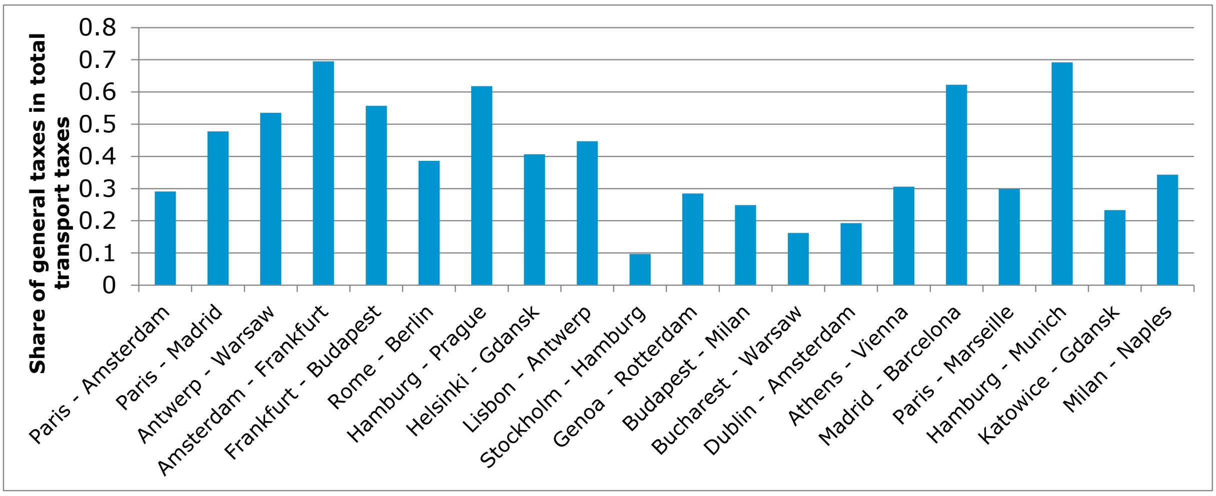


Figure 160 Share of general taxes in total transport taxes for end-users of coaches



For passenger rail transport and passenger aviation (national corridors only), general taxes are relevant as well. For these transport modes, VAT is the only general tax that should be considered. This has already been done in the main analyses of this study. For the results of this analysis, see Chapter 4.

J.3 Charges for auxiliary services

Defining charges for auxiliary services

Some of the transport charges are related to auxiliary or supporting services. In order to get a good overview of the share of charges that are related to actual transport operations, it has been investigated which share of the services are related to auxiliary services. For this purpose we have first defined auxiliary services. In Table 173 an overview is given of all transport services that are considered auxiliary or supporting services according to the World Trade Organisation (GATS W120).

Table 174 Auxiliary transport services

Transport mode	Auxiliary services	Comment
All modes	Cargo-handling services	This includes both container handling services (services of freight terminal facilities, including the loading, unloading and discharging of vessels' containerized freight) and other cargo handling services (services provided for non-containerized freight or for passenger baggage (e.g. at airports, bus, rail or highway services).
	Storage and warehouse services	This includes all storage and warehouse services
	Freight transport agency services	Freight brokerage services; freight forwarding services (primarily transport organisation or arrangement services on behalf of the shipper or consignee); ship and aircraft space brokerage services; freight consolidation a break-bulk services.
	Other	Bill auditing and freight rate information services; transportation document preparation services; packing and crating and unpacking and de-crating services; freight inspection, weight and sampling services; freight receiving and acceptance services (including local pick-up and delivery)
Road	Commercial road vehicle maintenance and minor repair services	
Rail	Railway passenger terminal services	All services except cargo handling
Maritime and inland shipping	Port and waterway operation services	This includes: port operation services (e.g. wharves, docks, piers) and other marine terminal facilities related services; operating and maintenance services of boat, barge and ship canals of canalised rivers and of other artificial inland waterways; services of locks, boat lifts, weirs and sluices.
	Pilotage and berthing services	This is mainly related to maritime transport
	Navigation aid services	
	Vessel salvage and refloating services	
	Other supporting services for water transport	This includes: cleaning, disinfecting, fumigating, vermin control and similar services; on board docked or anchored vessel; icebreaking, vessel registration, vessel laying-up and storage services, etc.
Aviation	Aircraft repair and maintenance services	Activities undertaken on an aircraft or a part thereof while it is withdrawn from service and do not include so-called line maintenance.
	Selling and marketing of air transport services	All aspects of marketing related to air transport services, e.g. market research, advertising and distribution.
	Computer reservation system services	Computerised systems that contain information about air carriers' schedules, availability, fares and fare rules, through which reservations can be made or tickets may be issued.

From Table 173 it becomes clear that there are differences in the scope of auxiliary services between shipping and the other transport modes. For shipping, services related to the efficient use of transport infrastructure (port and waterway operation services, pilotage and berthing services and navigation services) are considered auxiliary services by the World Trade Organisation, while comparable services for other transport modes (e.g. air navigation services for aviation) are not. Therefore, we propose to leave these three shipping services (indicated in grey in Table 173) out of the list of auxiliary services to be considered in this study.

Size of charges for auxiliary services

Based on the publicly available data it is rather difficult to clearly identify which (shares of) transport charges should be considered as payments for auxiliary services. For example, port charges (for maritime and inland shipping) cover payments for a wide range of services offered by the port, probably including some auxiliary services as well. However, as detailed information on the composition of port charges are often difficult to find, it was not feasible to identify which share of these charges should be considered as payments for auxiliary services. For that reason, we don't have estimated the size of this specific type of charges. Instead, we only present some qualitative conclusions from the detailed assessment of charging schemes applied on the various corridors:

- Aviation charges do include payments for auxiliary services (e.g. ground-handling charges). It seems that from all transport modes, aviation has the most charges implemented to cover the costs of auxiliary services. As for other transport modes these costs are part of the internal cost, comparing the charge levels between aviation and other modes may be misleading. This is particularly the case for freight transport.
- For inland and maritime shipping, some charges do cover the costs of auxiliary services (e.g. waste charges). As mentioned above, it is not clear to what extent port charges do include other payments for auxiliary services.
- For rail transport, it is not clear to what extent the infrastructure charges do include payments for auxiliary services.
- For road transport, it seems that the infrastructure charges applied do not include payments for auxiliary services.

ANNEX K : FISCAL BURDEN PER VEHICLE KILOMETRE

Chapter 4 and Annex F have reported the fiscal burden for the different modes in totals and in passenger- or tonne- kilometre. While both provide useful information, an overview of the fiscal burden of vehicle-kilometre offers insight as well. Table 303 shows the results for passenger transport. For passenger cars and aviation, each cell contains two figures; the first one refers to the small reference car / airplane, while the second one refers to the large ones.

Table 303 Fiscal burden per vehicle kilometre for passenger transport

Corridor				
Paris – Amsterdam	0,13 / 0,12	0,29	18	4 / 9
Amsterdam – Paris	0,17 / 0,21	0,33	18	4 / 9
Paris – Madrid	0,14 / 0,14	0,40	16	3 / 5
Madrid – Paris	0,14 / 0,14	0,42	16	2 / 4
Antwerp – Warsaw	0,12 / 0,12	0,34	11	3 / 5
Warsaw – Antwerp	0,09 / 0,09	0,34	10	2 / 3
Amsterdam – Frankfurt	0,14 / 0,17	0,44	18	5 / 12
Frankfurt – Amsterdam	0,09 / 0,08	0,36	18	5 / 11
Frankfurt – Budapest	0,08 / 0,09	0,29	11	3 / 7
Budapest – Frankfurt	0,09 / 0,09	0,29	10	3 / 7
Rome – Berlin	0,15 / 0,15	0,29	11	3 / 6
Berlin – Rome	0,14 / 0,14	0,28	10	2 / 4
Hamburg – Prague	0,09 / 0,09	0,34	9	4 / 8
Prague - Hamburg	0,07 / 0,06	0,31	9	4 / 8
Helsinki – Gdansk	0,09 / 0,1	0,16	0	2 / 4
Gdansk – Helsinki	0,06 / 0,06	0,16	0	2 / 3
Lisbon – Antwerp	0,16 / 0,17	0,38	13	1 / 2
Antwerp – Lisbon	0,16 / 0,16	0,38	13	2 / 4
Stockholm – Hamburg	0,16 / 0,16	0,44	4	2 / 4
Hamburg – Stockholm	0,15 / 0,15	0,44	4	2 / 4
Genoa – Rotterdam	0,15 / 0,15	0,34	10	2 / 5
Rotterdam – Genoa	0,18 / 0,22	0,33	10	3 / 6
Budapest – Milan	0,13 / 0,14	0,26	7	3 / 6
Milan – Budapest	0,15 / 0,15	0,27	7	3 / 6
Bucharest – Warsaw	0,07 / 0,07	0,15	3	3 / 5
Warsaw – Bucharest	0,08 / 0,08	0,15	3	2 / 4
Dublin – Amsterdam	0,2 / 0,2	0,26	14	2 / 4
Amsterdam – Dublin	0,22 / 0,26	0,28	14	3 / 6
Athens – Vienna	0,13 / 0,2	0,22	4	4 / 4
Vienna – Athens	0,11 / 0,12	0,25	4	2 / 5
Madrid – Barcelona	0,07 / 0,07	0,23	19	5 / 11
Barcelona – Madrid	0,07 / 0,07	0,23	19	5 / 10
Paris – Marseille	0,18 / 0,18	0,40	16	4 / 9
Marseille – Paris	0,18 / 0,18	0,39	16	4 / 8
Hamburg – Munich	0,08 / 0,08	0,41	16	4 / 10
Munich - Hamburg	0,08 / 0,08	0,35	15	5 / 12
Katowice - Gdansk	0,08 / 0,08	0,18	5	3 / 7
Gdansk – Katowice	0,08 / 0,08	0,18	5	4 / 7
Milan - Naples	0,19 / 0,19	0,33	9	4 / 8
Naples - Milan	0,2 / 0,2	0,32	10	4 / 8

Table 304 shows the results for freight transport. A "–" indicates that a mode is not considered on this route because it is not a viable option.

Table 304 Fiscal burden per vehicle kilometre for freight transport

Corridor					
Paris – Amsterdam	0,26	1,2	-	15,4	2,4
Amsterdam – Paris	0,27	1,2	-	15,4	3,4
Paris – Madrid	0,23	1,3	-	4,9	2,3
Madrid – Paris	0,22	1,3	-	4,9	2,0
Antwerp – Warsaw	0,31	3,6	-	-	2,7
Warsaw – Antwerp	0,31	3,6	-	-	1,9
Amsterdam – Frankfurt	0,27	5,7	2,0	-	2,8
Frankfurt – Amsterdam	0,27	5,7	2,0	-	2,7
Frankfurt – Budapest	0,26	3,8	2,5	-	3,5
Budapest – Frankfurt	0,26	3,8	2,5	-	2,3
Rome – Berlin	0,30	3,3	-	-	2,5
Berlin – Rome	0,30	3,3	-	-	2,3
Hamburg – Prague	0,29	3,9	0,2	-	4,7
Prague - Hamburg	0,30	3,9	0,2	-	3,7
Helsinki – Gdansk	0,13	-	-	19,0	2,1
Gdansk – Helsinki	0,13	-	-	19,7	2,1
Lisbon – Antwerp	0,24	1,9	-	3,2	1,4
Antwerp – Lisbon	0,24	1,9	-	3,3	1,9
Stockholm – Hamburg	0,41	2,7	-	12,0	2,4
Hamburg – Stockholm	0,41	2,7	-	12,1	1,8
Genoa – Rotterdam	0,49	1,5	-	3,7	3,4
Rotterdam – Genoa	0,49	1,5	-	4,2	3,4
Budapest – Milan	0,37	1,5	-	-	2,8
Milan – Budapest	0,37	1,5	-	-	3,7
Bucharest – Warsaw	0,23	1,9	-	-	2,7
Warsaw – Bucharest	0,23	1,9	-	-	2,5
Dublin – Amsterdam	0,26	-	-	15,5	2,3
Amsterdam – Dublin	0,27	-	-	15,6	2,3
Athens – Vienna	0,23	2,2	-	0,24[55]	1,8
Vienna – Athens	0,22	2,2	-	0,24	1,8
Madrid – Barcelona	0,11	1,3	-	-	2,9
Barcelona – Madrid	0,11	1,3	-	-	3,1
Paris – Marseille	0,29	1,2	-	0,2	2,6
Marseille – Paris	0,29	1,2	-	0,2	3,0
Hamburg – Munich	0,29	5,6	-	-	3,1
Munich - Hamburg	0,29	5,6	-	-	2,8
Katowice - Gdansk	0,18	2,2	-	-	2,5
Gdansk – Katowice	0,18	2,2	-	-	3,2
Milan - Naples	0,32	1,2	-	20,4	8,1
Naples - Milan	0,32	1,2	-	20,7	7,8

[55] The results for maritime transport on the corridor Athens – Vienna show the route for a heavy goods vehicle using a ferry from Patras and Trieste. The results are thus comparable with those of the first column.

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