

2019



11

Mobility and
transport

Neuchâtel 2019

Methodology report for the CFT statistics

Version 2.0



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Editors	Infras AG; MOBIL Section, FSO
Contents	Markus Maibach, Infras AG; Daniel Sutter, Infras AG; Christian Gigon, FSO; Alexandra Quandt, FSO
Published by	Federal Statistical Office (FSO)

Neuchâtel 2019

Published by: Federal Statistical Office (FSO)

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Editors: Infras AG; MOBIL section, FSO

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Series: Swiss Statistics

Topic: 11 Mobility and transport

Original text: German

Translation: FSO language services

Layout: Mobility section, FSO

Online: www.statistics.admin.ch

Print: www.statistics.admin.ch
Federal Statistical Office, CH-2010 Neuchâtel,
order@bfs.admin.ch, tel. +41 58 463 60 60
Printed in Switzerland

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FSO number: 1986-1901-05

ISBN: 978-3-303-11270-0

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1 Introduction

1.1 Key questions addressed by the CFT statistics

The Costs and funding of transport statistics (CFT statistics) serve as a basis for transport studies and research as well as for transport planning, policy and practice. To meet these different requirements, they are organised around the following key questions:

- What are the costs generated by transport in Switzerland?

All costs generated by transport are of interest here, included those passed on to third parties. Costs are included regardless of whether a corresponding payment is involved or not. An example of this is the suffering caused by a traffic accident (so-called intangible costs), which is also included.

- What causes the costs?

Costs are broken down according to how they arise: these include means of transport costs, infrastructure costs, accident costs, environmental and health costs.

- Who bears the costs?

The statistics should show what share of the costs transport users bear themselves and how much is paid for by the public sector, transport companies and the general public.

- Which transport-specific financial flows occur at Confederation, cantonal and communal level?

The three State levels of the Confederation, cantons and communes play different roles in the funding of transport. The transport-specific revenue and expenditure are shown for each level.

1.2 The history of transport accounts

The costing and calculation of transport costs has a long history in Switzerland. The road accounts, as they were then known, were published for the first time in 1968. Since then the costs of road infrastructure have been regularly evaluated and compared with revenue (FSO 2018). The rail accounts were introduced a few years later to provide information about the outlay and revenue of the rail companies.

Over the years the methodology used to categorise and record the costs has continued to evolve. An early milestone was the introduction of the road accounts. These began to take shape as part of the "Gesamtverkehrskonzeption" project (overall transport planning) and have been revised several times since. Although the initial focus was on infrastructure costs, in the 1990s the first calculations of *external costs* (accident and environmental costs) were added. In 2006 the different topics and methodologies were combined and based on an expert report, the FSO published comprehensive transport accounts for road and rail transport for the first time (FSO 2006 and Infras, Ecoplan 2006). A harmonised methodology for road and rail was developed for these accounts and the cost coverage was extended to include total costs – also known as *social costs*. This led to the inclusion of not only expenditure in monetary terms, but also of *intangible costs*, which are not based on any cash flows (see Chapter 5). Table 1 shows the main events in the development of Switzerland's transport costs accounts.

The costs and funding of transport statistics are a further development of the transport accounts. In 2010 human-powered mobility and aviation were included as new transport categories. A closer look was also taken at the funding side of transport, by identifying the direct and final cost carriers. The accounts were first published in this form with data for the year 2010.

Inland waterways transport was first incorporated into the costs and funding of transport statistics with the publication of the CFT statistics in 2015.

History of the transport cost accounts in Switzerland

T 1

Year	Event
1960	Based on the Federal Council Decision of 23.12.1959 on the fuel tax share, the Federal Council decides to create road accounts
1968	First road accounts: Road costs and their coverage (FSO 1968)
1976	First rail accounts (1946-1975), based on the Wenger motion (1970)
1982	Road accounts reviewed and methodology improved (especially cost assignment) by Nydegger commission (FSO 1992)
1985	Restructuring of road accounts on the basis of a commission recommendation made by an interdepartmental working group. New methodology for depreciation and interest and new cost allocation for heavy goods transport (FSO 1995)
1997	First total accounts for the external costs of road and rail for 1993 on the basis of various expert studies on individual cost components (GVF 1997)
1997	Federal Act of 19 December 1997 on the Mileage-related Heavy Vehicle Charge Article 7 refers specifically to the costs not covered and the duty to regularly update the external cost accounts
2000	Revision of rail accounts, business and economic accounts (Infras 2000)
2003	2000 revision of the road accounts including handling of taxes, expenditure / capital ratio, adjustment of accounting system, adjustment of factors for the assignment of heavy goods transport costs in light of the 40-tonne limit (FSO 2003)
2006	Introduction of the transport accounts: Development of a methodology to combine all transport costs with focus on road and rail (Infras, Ecoplan 2006)
2006	First transport accounts 2003, FSO 2006
2008	External costs 2005: Methodology development and total accounts of external costs for road and rail 2005
2009	Second transport accounts 2005, FSO 2009
2010-2014	Revision of the transport accounts with various expert reports on individual methodological questions and inclusion of further modes of transport (various reports, cf. Table 2)
2014	External costs 2010: Recalculation of external costs for all modes of transport (ARE 2014)
2015	FSO – Statistics on costs and funding of transport (CFT statistics): Newly revised version of the total accounts (FSO 2015)
2019	Integration of inland waterways transport into the CFT statistics 2015

Source: FSO – Statistics on costs and funding of transport (CFT)

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1.3 2010 revision

1.3.1 Revision work

The revision of the 2010 CFT statistics was led by the Federal Statistical Office. The different transport offices (ARE, FEDRO, FOT and FOCA) as well as the Federal Finance Administration were also involved. This revision was essentially an overhaul of the previous statistics (transport accounts). Because the statistics underwent considerable change, they were published after the revision with a new title: "Costs and funding of transport".

The objectives of the revision were as follows:

- **Methodology** to simplify the structure and update the methodology in the individual accounts in line with the latest scientific findings (especially road infrastructure costs and accident and environmental costs).
- **System boundaries**: to include further modes of transport: public transport by road (buses, trolleybuses and trams), human-powered mobility (walking and cycling), and aviation. Inland waterways transport was included for the first time for the reference year 2015.
- **Update**: Based on the current statistical bases, findings have been updated to the year 2015.

Summary of the main revision work on the 2010 CFT statistics

T 2

Subject	Finding	Methodology report page no.	Basis
Methodological questions			
Review of the items to be revised in road transport	Confirmation of quotas for cantonal and communal roads for motorised road transport; basis for adjustment to the chart of accounts and the cost allocation for heavy goods transport	p. 23	Infras, Ecoplan 2008
Handling of congestion costs	No inclusion of congestion costs in CFT statistics	p. 17	Infras 2006
Additional economic costs (rail)	Confirmation that net interest (interest from surpluses or on deficits from previous periods) is not to be included; re-introduction of public sector costs for major rail projects (e.g. NRLA) as "additional economic costs for non-capitalised investments"	p. 24	FSO 2013
Update of methodology for cost allocation for heavy goods transport.	Complete change to the methodology and revaluation of the assignment of infrastructure costs to the different means of road transport	p. 44/45	SNZ, Infras, Ecoplan 2013
Handling of VAT	The CFT statistics are based on a calculation of expenditure and revenue without VAT. The procedure for eliminating VAT was clarified.	p. 22	Ecosys 2013
Transport mode accounts			
Review of items to be revised in road transport	Confirmation of the quotas for cantonal and communal roads for motorised road transport; basis for adjustment to the chart of accounts and the cost allocation for heavy goods transport	p. 23	Infras, Ecoplan 2008
Handling of congestion costs	Congestion costs not included in the CFT statistics because the CFT is based on a transport carrier approach and these transport carriers occur internally. The basis is important for justifying the Swiss heavy goods vehicle charge (HGVC) (transport means approach, see below).	p. 17	Infras 2006
Additional economic costs (rail)	Confirmation that net interest (interest from surpluses or on deficits from previous periods) is not to be included; re-introduction of public sector costs for major rail projects (e.g. NRLA) as "additional economic costs for non-capitalised investments"	p. 24	FSO 2013
Update of methodology for cost allocation for heavy goods transport.	Complete change to the methodology and revaluation of the assignment of infrastructure costs to the different means of road transport	p. 44/45	SNZ, Infras, Ecoplan 2013
Handling of VAT	The CFT statistics are based on a calculation of expenditure and revenue without VAT. The procedure for eliminating VAT was clarified.	p. 22	Ecosys 2013
External costs/HGVC			
External costs for accident, environment and health	Revision of methodology to calculate the external costs of all modes of transport for 2010 and update of input data for 2015	p. 55	ARE 2014, ARE 2018

Source: FSO – Statistics on costs and funding of transport (CFT)

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1.3.2 Changes to the concept compared with the 2005 transport accounts

The biggest change was the inclusion of human-powered mobility and aviation. Starting from the reference year 2015, inland waterways transport was also included. More space was also given to the funding mechanisms and several aspects of the costing and differentiation methodology improved. In addition to the CFT statistics, the former road accounts were continued under the title "Road infrastructure accounts". This means that detailed analyses of road infrastructure costs and the public sector revenue used to cover them can continue to be published every year. Business management oriented analyses are also made every year for rail transport.

- **Chapter 5** describes the costing of external costs due to accidents and the effects on the environment and health.
- **Chapter 6** shows the procedure for financial flow accounts and explains their basic principles.
- **Chapter 7** comments on the interpretation of transport policy based on an actual example.

1.4 Structure of the methodology report

The present methodology report serves as a basis to understand the updated CFT statistics and the findings published in 2015. The report shows the key elements of the methodology based on the work to update the statistics. It summaries the various publications and serves as a synthesis for interested specialists.

The report is structured as follows:

- **Chapter 2** shows the overall concept and the structure of the CFT statistics. The structure is a key part of the statistics (modes and forms of transport, cost categories and cost carriers) as well as the presentation of the total and specific costs.
- **Chapter 3** discusses the main elements of the methodology relevant to the individual components of the CFT statistics, especially the differentiation of the modes of transport, costing and related valuation questions as well as the assignment of costs to the individual forms of transport.
- **Chapter 4** examines the individual components of the CFT statistics and is organised by modes of transport on one side and by cost categories (infrastructure, means of transport, accidents, environment and health) on the other. This is based around previous statistics and new elements created for the CFT statistics:
 - the road infrastructure accounts with the longest-standing survey (formerly the road accounts);
 - the railway survey (formerly the railway accounts) as a basis for the costing of rail infrastructure and operations;
 - the individual components and surveys used to record data on other modes of transport (public transport by road, human-powered mobility, aviation and inland waterways transport).

2 Concept and structure

2.1 Concept

2.1.1 Legal bases

Various legal bases refer to the provision of statistics on the costs and funding of transport:

- **Federal Act on the Application of the Earmarked Mineral Oil Tax** (MinOO, Art. 36) including the corresponding Ordinance (Ordinance on the Application of the Earmarked Mineral Oil Tax, MinOO, Art. 26 et seq.): The Federal Statistical Office was mandated by the Federal Council as early as 1986 to keep road accounts (Federal Decision of June 1986). The purpose of road accounts is to provide reliable and comparable accounting records on modes of transport and to ascertain the cost coverage or private motorised road transport.
- **Federal Act on the 'Heavy goods vehicle Charge (HGVC)'**: According to the Federal Heavy Vehicle Charge Act (HVCA), the aim of the HGVC is the long-term coverage of infrastructure and external costs that the general public incurs due to heavy vehicle transport. Pursuant to Art. 7 of the HVCA, the external costs of heavy vehicle transport must be calculated periodically. Because the external costs are also important in providing information for the Statistics on the costs and funding of transport, the legal bases for the CFT statistics constitute indirectly a legal basis for recording external costs.
- **Ordinance on the Conduct of Federal Statistical Surveys**: The annex to the Ordinance on the Conduct of Federal Statistical Surveys lists all statistical surveys that are to be conducted within the scope of federal statistics - including the CFT statistics.

Furthermore, the need for statistics on the costs and funding of transport in various parliamentary initiatives and the corresponding responses of the Federal Council is anchored in law. The Commission for transport and communication (TTC) of the National Council and the Council of States have requested that the transport accounts hitherto produced be extended to include further modes of transport.

2.1.2 Objectives

The purpose of the statistics on the costs and funding of transport (CFT statistics) is to provide an overview of costs and funding of the individual modes of transport in Switzerland. Objectives are as follows:

- **Polluter pays principle**: The CFT statistics should make statements about the polluter pays principle as it relates to transport - i.e. the costs of transport, the performance of transport users and the other cost carriers and their share in the cost coverage.
- **Comparison of modes of transport**: The CFT statistics should enable comparisons between modes of transport, i.e. system boundaries and the calculation methodology should be comparable. However, the limits of comparability should also be demonstrated.
- **Completeness**: The CFT statistics should - within the defined system boundaries - be comprehensive and complete, i.e. they should contain all costs relevant from a business management and economic perspective.
- **Update**: The CFT statistics should be updated regularly and the new findings published each time. Calculations should be conducted in accordance with the latest scientific findings.

2.1.3 Key information from the CFT statistics

The statistics on the costs and funding of transport bring together the various transport modes (road, rail, air and water) and the cost categories (infrastructure, means of transport, accidents and environment/health). In this form, these accounts make it possible to obtain an overall picture of:

- all **costs** arising and their structure within the realm of transport, for infrastructure (construction, operation and maintenance), for means of transport (acquisition, operation and maintenance of vehicles or rolling stock), for accidents (private and external accident costs) and the environmental and health costs;

- the level and type of **funding** of costs by the different stakeholders (cost carriers), in addition to the transport users, the public sector, the transport companies and the general public;
- the **kilometre costs** (i.e. the rate per transport performance: average costs) are used as a basis to compare means or forms of transport;
- the **financial flows** that show the origin and use of the financial resources earmarked for transport.

2.1.4 Partial statistics of the CFT statistics

Findings on how costs arise, as well as on the cost carriers and the performance of transport users are usually summarised under the title “CFT statistics”. The following partial statistics also belong to the CFT statistics:

- The **road infrastructure accounts** provide a clear picture of the costs and expenditure for the national, cantonal and communal roads. Detailed information is available about the cantons and aspects of infrastructure (e.g. new constructions or operational or structural maintenance). For decades the road infrastructure accounts have served as a basis for the redistribution of the Confederation’s mineral oil tax revenue to the cantons and communes.
- **Financial data on railway companies**
Railway company data is also used to produce and publish an analysis by category (passenger and goods transport, infrastructure and ancillary activities). This analysis reflects the business management situation of the rail companies.
- **Financial flow accounts**
Transport expenditure and revenue are shown separately for the Confederation, cantons and communes. A distinction is made between the road infrastructure and public transport.

2.1.5 Importance

The importance of the Statistics on the costs and funding of transport is as follows:

- Comprehensive statistical basis: The CFT statistics constitute an **information base for the general public and policy makers**. However, no direct political recommendations (e.g. for pricing or investment decisions) can be drawn from this information.
- **Total accounts**: The CFT statistics provide a comprehensive summary of motorised transport in the transport modes road, rail, air and waterways as well as human-powered mobility.
- **Model-based calculation**: Not all data from the CFT statistics are based on statistical surveys. In part the statistics rely on estimates; the CFT statistics are, therefore – as are many other statistics – a model calculation based on “solid” databases and a series of hypotheses.

Excursus: A look abroad

In Europe, road infrastructure accounts tend to dominate. External costs also play a certain role (usually to set the level of taxes and internalisation measures). A comparison of the total costs specific to the different modes of transport is usually limited to the external accident and environmental costs. In addition, the funding of transport is of particular interest although systematic data sets on this subject are scarce abroad. The following examples serve to illustrate the practice abroad:

- In particular, the **EU** is calling for specific transport cost accounts to justify the HGV toll (in accordance with Directive 2011/76/EU). In addition to infrastructure costs, external costs (i.e. air pollution and noise) are also calculated.
- In the past **Germany** has carried out periodic transport cost accounts for road and rail (cf. DIW et al. 2009; Prognos, IWW 2002; Prograns, IWW 2007). The methodology has been revised several times. Due to the deregulation of the railways, only the road accounts – with focus on the motorways – have been developed further. The current transport cost assessments concentrate on measuring the price of the HGV toll on motorways and main roads and calculate the infrastructure and external costs chargeable to HGVs. An important role is played by the hypotheses regarding the identification and assignment of the weight-dependent costs for heavy goods traffic (cf. BMVBI/Alfen Consult et al. 2014).
- **Austria** also has a long tradition of transport costs accounts (cf. Herry, Sedlacek 2003). These focus on road transport and have also been used to calculate the specific toll rate. Due to the institutional conditions in place, the motorway operator (ASFINAG) carries out the calculations themselves. The calculations are very important in justifying the HGV toll for the Brenner pass.
- Other countries such as the **Netherlands, Sweden or Denmark** report on transport expenditure and revenue, once again with the focus on road transport and heavy goods road transport. They have developed their own methods for assigning heavy goods transport costs (cf. DIW, VTI, ITS 2008).
- In 2018, **Luxembourg** was the only country to produce full-cost accounts for transport based on the Swiss methodology.
- Comparative transport mode accounts are created sporadically, to express the economic advantages and disadvantages of transport. To do so individual routes or corridors are compared with one another (e.g. a European comparison). CE Delft, Infrac, ISI 2011; Germany: Infrac, ISI 2010).

It is important to note that the CFT statistics do **not** represent **a cost-benefit analysis**. The CFT statistics concentrate on the total costs of transport (gross cost principle) and ask who funds (financially relevant costs) or bears (including intangible costs, e.g. environment and health) the costs. In contrast, a cost-benefit analysis compares the costs caused by transport with the benefits it generates. Benefits can be expressed, for example, in the total value added of transport. Cost-benefit analyses are particularly suitable for projects in which the project-specific investment costs of the potential benefit (e.g. time saving)

2.2 Composition and structure

The following table shows a summary of the composition, structure and differentiation of the statistics on the costs and funding of transport. This structure is described in detail in the following sub-chapter.

Summary of the composition and structure of the CFT statistics

T 3

Passenger transport					
Roads			Rail transport	Air	Water
Private motorised transport	Public road transport	Human-powered mobility			

Goods transport			
Roads		Rail transport	Water
Light utility vehicles	Heavy goods vehicles		

Infrastructure	Costs <ul style="list-style-type: none"> - Fixed costs (depreciation and interest) - Material costs (operation and maintenance) - Personnel costs 	Cost carriers (direct and final) <ul style="list-style-type: none"> - Transport users - Public sector - Transport companies 	Performance of transport users <ul style="list-style-type: none"> - Taxes and charges - Tickets, season tickets and transport fees
Means of transport	Costs <ul style="list-style-type: none"> - Fixed costs (depreciation and interest) - Material costs (operation and maintenance) - Personnel costs 	Cost carriers (direct and final) <ul style="list-style-type: none"> - Transport users - Public sector (funding) - Transport enterprises 	Performance of transport users <ul style="list-style-type: none"> - Acquisition, operation and maintenance of one's own means of transport - Tickets, season tickets and transport fees
Accidents	Costs <ul style="list-style-type: none"> - Bodily harm (treatment, production loss and intangible costs) - Damage to property - Police, legal costs 	Cost carriers (direct and final) <ul style="list-style-type: none"> - Transport users - Public sector (e.g. hospital deficits) - General public - Transport companies (Damage to property) 	Performance of transport users <ul style="list-style-type: none"> - Self-borne accident costs: intangible and other costs (insurance payments, excess and personal contribution)
Environment and health	Costs <ul style="list-style-type: none"> - Air pollution - Climate - Noise - Nature and landscape - etc. 	Cost carriers (direct and final) <ul style="list-style-type: none"> - Transport users - Public sector - General public 	Performance of transport users <ul style="list-style-type: none"> - Environmental costs borne by users: internalisation contributions to the environment (HGVC, climate cents, air/noise charges in aviation), internal intangible costs. - <i>External health benefits (only for human-powered mobility)</i>

Source: FSO – Costs and funding of transport statistics (CFT)

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2.2.1 Classification of modes and forms of transport

As is customary in transport statistics, the Costs and funding of transport statistics distinguish between transport function (passenger and goods transport) and transport mode (road, rail, air and water). In addition, transport modes are broken down further into “forms of transport”. The forms of transport are a distinctive feature of the CFT statistics. In the detailed data of the CFT statistics (e.g. online tables), individual means of transport are further broken down (e.g. buses, trolley buses and trams in public transport by road). Table 4 shows the structure of transport modes, functions, forms and means used in the CFT statistics. The basic data of the CFT statistics (e.g. calculation of external costs, road accounts, pilot accounts, human-powered mobility, public road transport, aviation) are also available in the same structure.

2.2.2 Cost concept

The CFT statistics are based on an economic view, which means in principle they include all the economic costs of transport. Besides the operational costs of infrastructure and means of transport, economically-relevant costs are also considered:

- **Operational costs:** the operational costs are incurred through the acquisition, operation and maintenance of means of transport and the building and maintenance of infrastructure (construction, operation and maintenance).
- **Economic costs:** the other economic costs of transport comprise environmental, health and accident costs on the one hand, and other additional costs, such as the imputed interest costs for tied-up public sector capital on the other.

Structure of modes and forms of transport

T 4

Mode of transport	Transport function	Form of transport	Means of transport
Motorised transport			
Road	Passenger transport	Private motorised passenger transport	Passenger cars
			Private buses (coaches)
			Motorbikes and mopeds ¹
	Goods transport	Public road transport	Buses
			Trolleybuses
			Trams
Rail	Passenger transport	Rail passenger transport	-
	Goods transport	Rail freight transport	-
	Passenger and goods transport ²	Scheduled and charter air traffic (including belly freight)	-
Air	Passenger transport	Public passenger transport on inland waterways	-
	Goods transport	Freight transport on the river Rhine	-
Non-motorised transport			
Road	Passenger transport	Human-powered mobility	Pedestrians ³ Bicycles ⁴

¹ including electric bikes with output of 500W or more

² excluding freighters, excluding general aviation

³ including human-powered vehicles (e.g. scooters)

⁴ including electric bikes with output of up to 500W

The costs are recorded based on the gross cost principle, i.e. all incurred costs are disclosed – even those cost components that are immediately paid by transport users themselves (e.g. the costs of a private car).

The CFT statistics are a total cost calculation that comprises all incurred costs – including those known in technical terms as “social costs”. On the one hand, these include costs borne by the transport users themselves. These are known as private costs (or “internal costs”). For example, they include vehicle costs covered by motorists themselves. Social costs also include costs borne by the public sector and the general public. In the case of the public sector, it is usually aware of the costs it bears, for example in the form of public transport subsidies. However, the general public usually covers transport costs involuntarily. Such “external costs” are incurred in particular as a result of accidents and damage to the environment and human health caused by transport. On account of the total costs view, costs are also factored in that are not based on payments. These intangible costs also include bodily harm resulting from transport accidents.

2.2.3 Cost categories

The terms from traditional economic cost accounting (cost types, cost centres and cost units) do not apply in the CFT statistics as this economic account differs too greatly from corporate cost accounting relating to goods or services. However, comprehensible terms must be used for the costs and financing, and these are described below.

A key distinctive feature of the CFT statistics are the cost categories. The following four cost categories show how the costs are incurred:

- **Infrastructure costs:** costs of building, maintaining and operating transport infrastructure (in the field of aviation this includes air traffic control costs)
- **Means of transport costs:** costs of acquiring, operating and maintaining means of transport
- **Accident costs:** tangible accident costs (damage to property, medical expenses, policing costs and legal expenses, economic costs to society such as higher accident insurance premiums and absences from work due to accidents) and intangible accident costs (bodily harm and detrimental effect on quality of life, years of life lost in the event of death)
- **Environmental and health costs:** costs resulting from damage to human health or the environment (for example due to air pollution, noise, climate effects, soil pollution, destruction of ecosystems or landscapes)

The CFT statistics do not distinguish between fixed and variable costs. In principle the CFT statistics cost data include the following **cost types**, although they are not disclosed separately in the results as the costs are not differentiated in this way: personnel costs, material costs (operation and maintenance), fixed costs (depreciation and interest), imputed costs.

Handling time costs

The CFT statistics always take into account the time costs of commercial transport/employees of transport companies as they are part of the business expenditure of transport companies. The private time costs of transport users are not factored in, however. Below is a detailed description of how time costs are handled:

- **Driver costs:** the time costs of drivers – in other words drivers of commercial road transport (HGVs, delivery vans and coaches), drivers of public buses and trams, train drivers and pilots – are included in the CFT statistics. They are part of the operating costs of transport companies (cost category means of transport: personnel costs).
- While the **private time costs** of operating own means of transport (private drivers) such as passenger cars, motorbikes and mopeds or bikes, as well as time costs for pedestrians, are implied personal contributions of transport users, they are not part of the CFT statistics.
- **Congestion and delay costs:** costs of delays (congestion costs in private road transport) are not part of the CFT statistics either. One of the main reasons is that taking account of costs of delays and congestion in the CFT statistics is only meaningful if they can be established for all modes of transport. Up to now, however, only road traffic congestion costs could be calculated.

2.2.4 Cost bearers

The CFT statistics reveal who bears the costs of transport as cost bearers. The term cost bearer refers to those stakeholders who finance the costs (in the case of monetary costs) or who generally bear the costs (including intangible costs). In the Costs and funding of transport statistics, a distinction is drawn between the following four types of cost bearers:

- **Transport users:** transport users are either road users (in the case of private transport), passengers (in commercial passenger transport) or contractors for goods transport (in commercial goods transport). Examples of costs borne by transport users include transport fees (e.g. tickets) and the operation of one's own means of transport.
- **Transport companies:** these include companies that provide transport services or transport infrastructures for a fee, e.g. rail companies, rail infrastructure companies, bus companies, airlines, airport operators and air traffic control services.
- **Public sector:** the public sector comprises the Confederation, cantons and communes. Examples of costs borne by the public sector are public transport subsidies and road infrastructure funding.
- **General public:** this includes those who are not direct transport users but who have to bear some of the transport costs as they are affected by the negative impact of transport. The costs borne by the general public are environmental, health and accident costs that are not covered by insurance or other means.

Direct and final cost bearers

The costs of transport are sometimes shifted between stakeholders so the CFT statistics distinguish between direct and final cost carriers:

- **Direct cost bearers** are those who bear the costs initially (where they are directly incurred). Road infrastructure costs, for example, are initially borne by the public sector, and the operating costs of public transport are borne by the transport company.
- **Final cost bearers** are those who ultimately bear the costs of transport after taking into account compensation payments, financing mechanisms and transfer payments. Costs may pass from a direct to a final cost bearer, if, for example, a transfer arises from a charging or financing system (e.g. to fund road infrastructure). Table 5 shows the direct and final cost bearers, and the transfers occurring between them.

The CFT statistics do not explicitly show other transfer payments that remain within a mode of transport or form of transport, such as track access charges as a transfer between means of transport and infrastructure in rail transport. These transfer payments are implicitly borne by transport users via transport fees and are thus part of that category.

With regard to the ancillary activities of transport companies (e.g. real estate or vehicle maintenance for third parties), it should be noted that the CFT statistics are in principle limited to transport costs and thus to the transport business of transport companies. Ancillary activities are not taken into account. They are only mentioned in the CFT statistics if losses from the transport business can be offset by profits from ancillary activities.

Overview of direct and final cost bearers and transfers

T 5

Mode of transport/ form of transport	Direct cost bearers	Transfer (from → to)	Final cost bearers
Road (motorised) Private motorised transport (passenger and goods transport)	Transport users - Operating own means of transport - Self-borne accident costs Public sector - Road infrastructure (building, operation, maintenance) - Share of accident and environmental costs (e.g. hospitals) General public: environmental, accident and health costs not covered by transport users	Transport-specific taxes and charges paid by transport users (mineral oil tax, motorway toll charge, motor vehicle tax, HGVC, etc.) (Transport users → public sector) Internalisation contribution: HGVC, obligation to offset fossil fuel emissions (KliK) (Transport users → general public)	Transport users - Operating own means of transport - Self-borne accident costs - Taxes and charges General public: environmental, accident and health costs not covered by transport users
	Public road transport Transport companies - Operation of means of transport - Some infrastructure costs - Portion of accident costs (e.g. damage to property) Public sector - Road infrastructure (building, operation, maintenance) - Transport users: self-borne accident costs General public: environmental, accident and health costs not covered by transport users	Tickets and season tickets (transport users → transport companies) Public subsidies (public sector → transport companies) Transport-specific taxes and charges (e.g. mineral oil tax) (transport companies → public sector)	Transport users - Tickets, season tickets - Self-borne accident costs Public sector - Road infrastructure - Operating subsidies - Portion of accident and environmental costs General public: environmental, accident and health costs not covered by transport users

Mode of transport/ form of transport		Direct cost bearers	Transfer (from → to)	Final cost bearers
Road (non-motorised)	Human-powered mobility	Transport users - Operating own means of transport (bikes) - Self-borne accident costs Public sector - Road infrastructure - Portion of environmental, accident and health costs (e.g. hospitals) General public: environmental and accident costs not covered by transport users	External health benefits (transport users → general public)	Transport users - Operating own means of transport - Self-borne accident costs - External health benefits Public sector - Road infrastructure - Portion of environmental, accident and health costs
Rail		Transport companies - Operating means of transport - Some infrastructure costs - Portion of accident costs (e.g. damage to property) Public sector - Special infrastructure projects (e.g. NRLA) - Opportunity costs of tied-up capital due to granted interest-free loans for transport companies Transport users - Self-borne accident costs - Own investment in railway sidings General public: environmental, accident and health costs not covered by transport users	Tickets and season tickets (transport users → transport companies) Public subsidies (public sector → transport companies)	Transport users - Tickets, season tickets - Self-borne accident costs - Own investment in railway sidings Public sector - Special infrastructure projects - Opportunity costs (interest-free loans for transport companies) - Subsidies Transport companies: costs not covered for companies as their revenues were not sufficient to cover their expenditures (loss). General public: environmental, accident and health costs not covered by transport users
Air		Transport companies: - Aircraft operators - Airport operators - Air traffic control General public: environmental, accident and health costs not covered by transport users	Transport fees: Tickets, airport taxes (transport users → transport companies) Taxes, charges: Mineral oil tax (transport companies → public sector) Federal contributions to international air traffic control services (public sector → transport companies) Internalisation contributions: noise and emission-based charges (transport companies → general public)	Transport users: Transport fees Transport companies: Equivalent Single Axle Load costs not covered for companies as their revenues were not sufficient to cover their expenditures (loss). These losses in the airline operations can usually be offset through profits from other business fields. General public: environmental, accident and health costs not covered by transport users
Water	Public passenger transport on inland waterways	Transport companies: infrastructure and transport means cost General public: environmental, accident and health costs not covered by transport users	Transport fees: Tickets and subscriptions (transport users → transport companies) contributions of the public sector (public sector → transport companies)	Transport users: transport fees (tickets and subscriptions) Public sector: contributions and subsidies General public: environmental, accident and health costs not covered by transport users
	Goods transport on the river Rhine	Transport companies: - Infrastructure costs for ports - Transport means Public sector (foreign countries): - Infrastructure costs - Operation and maintenance General public: environmental, accident and health costs not covered by transport users	Transport charges (transport users → transport companies)	Transport users: transport charges Public sector (foreign countries): - Infrastructure costs Operation and maintenance General public: environmental, accident and health costs not covered by transport users

Note: The table only contains items that amounted to at least CHF 10 million in 2015.

Source: FSO – Costs and funding of transport statistics (CFT)

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2.2.5 Calculation method

The cost carriers are calculated in stages:

1. First, the level of infrastructure, means of transport, accident-, environmental and health costs is calculated.
2. Individual cost items can be allocated to direct cost bearers – in other words to the actors who bear these costs when they are incurred. In the case of private road transport, for example, the public sector (the government) initially bears the infrastructure costs, and in the case of rail transport, the transport companies bear the operating costs.
3. In a subsequent step, all transfer payments between cost carriers that are related to the mode of transport are listed. These include, for example, transport fees paid by passengers to

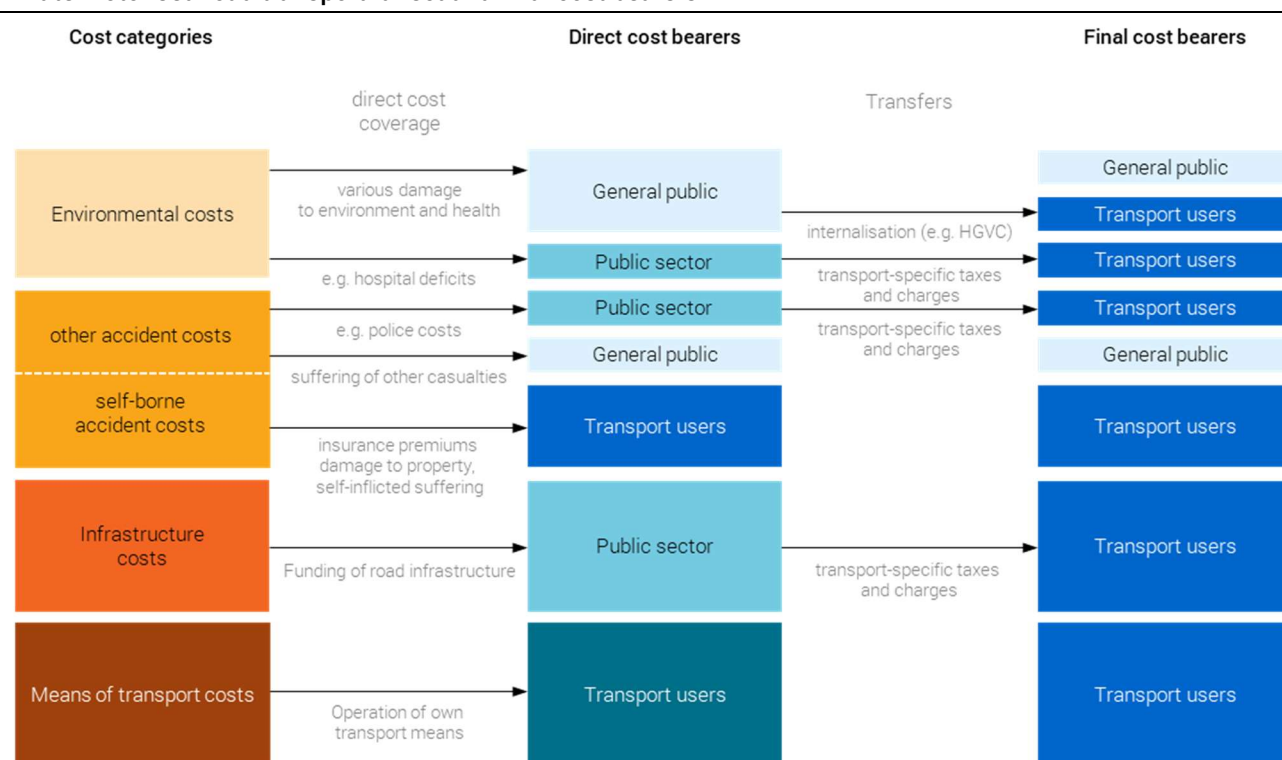
transport companies, or transport-specific taxes paid by road users to the government.

4. The transfers allow costs to be shifted between cost bearers. The final cost bearers indicate who bears the costs after all transfer payments have been taken into account. In rail transport, for example, transport users (via tickets and season tickets) and the public sector (via subsidies) ultimately bear the operating costs that were originally borne by transport companies. In private road transport, transport users ultimately bear the infrastructure costs via taxes and charges.

Using the example of private motorised road transport, the following Figure 1 illustrates the relationship between costs, direct cost bearers and final cost bearers, and the calculation steps.

Private motorised road transport: direct and final cost bearers

F 1



Source: FSO – Costs and funding of transport statistics (CFT)

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2.2.6 Contributions of transport users

One of the key insights provided by the CFT statistics is information on what portion of the costs are ultimately borne by users. However, it is not evident from the presentation of final cost bearers in what way users have contributed to covering costs. This is why all the contributions of transport users, either to use a transport service or to transport themselves, are also listed. These can be both financial and intangible.

It is important to differentiate between private and public transport:

- **Private transport:** private individuals provide a transport service, either for themselves as a personal contribution (e.g. in the case of private cars) or for third parties as commercial transport for a fee. The latter applies to road haulage companies, air carriers and coach operators, for example.
- **Public transport:** one or more operators provide a transport service within the scope of a public contract (concession) that is used by many (mostly private) travellers and is funded by passenger charges (public transport tickets) and/or a public subsidy. This applies to rail transport and public road transport.

The CFT statistics draw a distinction between five types of transport user contributions:

- **Transport fees:** payments by transport users to transport companies for passenger or goods transport services. These include expenditure for public transport tickets, plane tickets, airport charges, etc.
- **Self-borne means of transport costs:** acquisition, operation and maintenance costs for road vehicles operated by transport users (excluding taxes).
- **Transport-specific taxes and charges:** all transport-specific taxes and charges paid by transport users themselves. This concerns taxes and charges for the purchase or operation of means of transport (e.g. mineral oil tax, motor vehicle tax) and for the use of government-funded transport infrastructures (e.g. motorway toll charges, HGVC). Non-earmarked taxes and duties are also taken into account. Environmental levies (e.g. climate cents) are also factored in, but general taxes, e.g. VAT, are not.
- **Self-borne accident costs:** tangible accident costs (e.g. damage to property, insurance premiums) and intangible accident costs (e.g. detrimental effect on quality of life caused by accidents) that are borne by transport users themselves.
- **External health benefits:** reduced health costs for the general public through human-powered mobility.

2.2.7 Surplus contributions

Generally speaking, the contributions of transport users (as final cost bearer) correspond to the costs borne. In exceptional cases, however, transport user contributions may exceed the final costs borne. This occurs when transport users make transfer payments to another cost bearer that are higher than the costs borne by that (direct) cost bearer. In other words, the direct cost bearer can only pass costs on to the final cost bearer that it had previously borne itself – even if it receives transfers that would have been even higher.

A concrete example of such surplus contributions is private motorised road transport in 2015, when transport users paid more to the public sector in transport-specific taxes and charges to use road infrastructure than the public sector incurred in costs. This resulted in a surplus for the public sector, which it was able to use for other purposes. Nonetheless, all taxes and charges paid should be taken into account in the CFT statistics as transport user contributions.

Differences in total due to surplus contributions

Due to surplus contributions, the sums of the individual modes of transport borne by final cost carriers may not correspond to the total amounts for the form of transport. The example outlined in the following chart illustrates this effect.

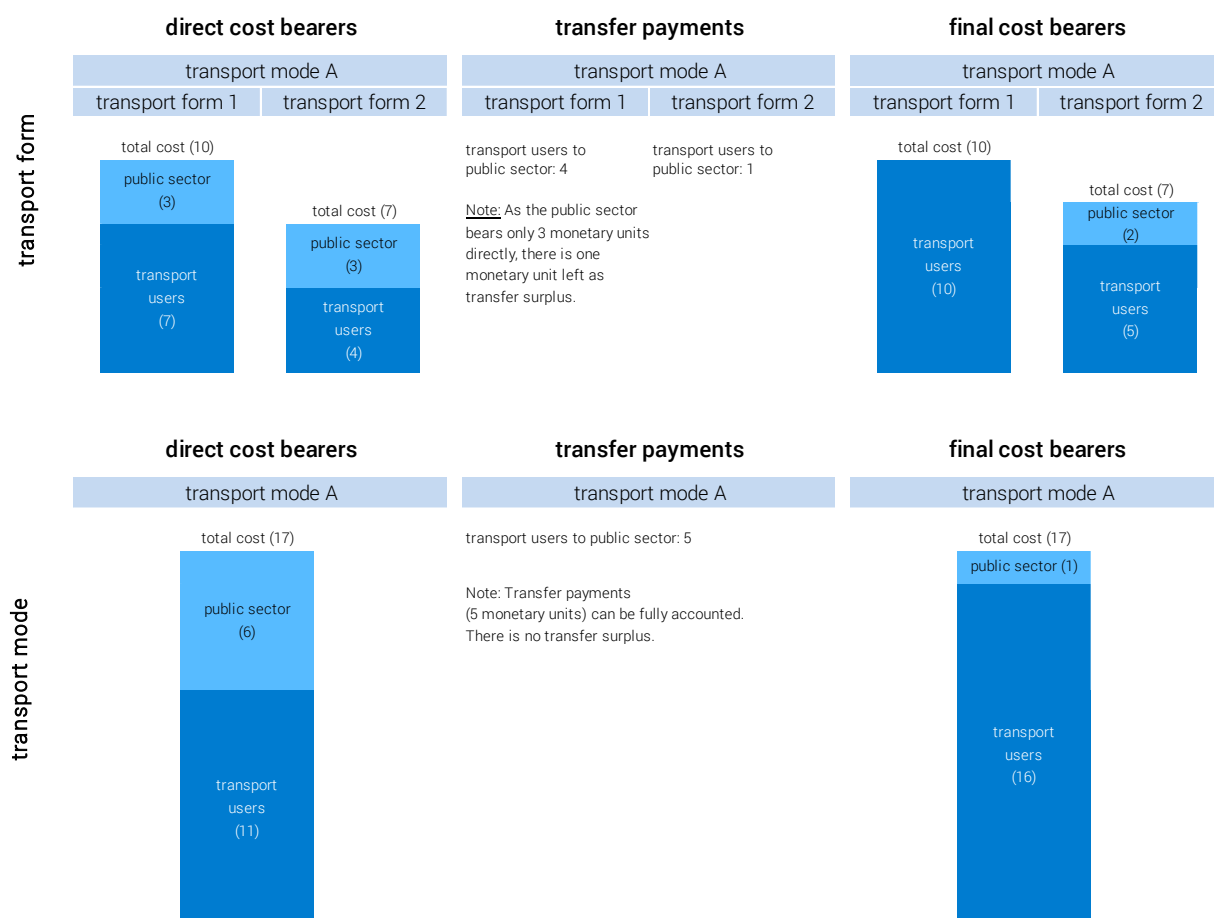
In form of transport 1 belonging to mode of transport A there is a surplus contribution as transport users pay more to the public sector than the costs directly borne by the latter. If we look at the forms of transport under mode of transport A individually (top section of the chart), we see that there is a surplus for the public sector. However, if we take a joint view of mode of transport A (bottom section of chart), there is no surplus. This is because if we look at forms of transport 1 and 2 together, the transfer payments are not sufficient to fully offset the costs directly borne by the government.

The fact that there is a surplus if we take an individual view and not if we take a joint view ultimately results in a difference in total: in the example, the public sector bears final costs totalling 2 monetary units in the individual view and only 1 monetary unit in the joint view.

The same effect occurs in surpluses at the level of “means of transport”. A transfer surplus in an individual means of transport means that the final cost bearer at form of transport level no longer corresponds to the totals of the means of transport that belong to that form of transport.

Total discrepancies due to surplus contributions

F 2



Source: FSO – Costs and funding of transport statistics (CFT)

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2.3 Results indicators

The results of the Costs and funding of transport statistics consist of the following indicators, which are periodically calculated and communicated:

1. **Total costs:** the total economic costs (social costs) are shown for the individual modes and forms of transport. These data serve as a statistical basis for periodic comparisons.
2. **Cost categories:** the cost categories (infrastructure, means of transport, accidents and the environment and health) indicate how the costs are incurred.
3. **Direct and final cost bearers:** the cost bearers provide information on who bears (finances) which portion of the costs: transport users, transport companies, the public sector or the general public. The direct cost bearers show who bears the costs initially when they are incurred. Meanwhile, the final cost bearers reveal who ultimately bears the costs and provide information on the extent to which the polluter pays principle is followed.
4. **Contributions of transport users:** the statistics explicitly show the contributions made by users in order to get from A to B. As a rule, the sum of contributions corresponds to the costs ultimately borne by transport users and therefore indicates through which payments or intangible contributions the costs were covered. In exceptional cases, if there is a surplus contribution (cf Chapter 2.2.6), user contributions are higher than the final costs borne.

All results can be shown in the following units:

- **In absolute figures** (in most cases CHF millions): the results can be compared with other economically important activities in Switzerland (e.g. spending on healthcare, GDP, etc.)
- **Kilometre costs** (average costs per traffic unit): costs per transport performance (passenger-kilometre or tonne-kilometre). In the case of motorised road transport, the costs are additionally presented by distance driven (vehicle-kilometres).

The kilometre costs are a suitable way of comparing forms or means of transport. It should be noted, however, that the CFT statistics only present average values for Switzerland. Comparability is therefore very restricted and can only be shown to a limited extent in areas with similar average distances and similar transport needs. This is usually the case when comparing private road transport (passengers and goods) with rail transport. True comparability would only be assured if the costs for identical transport needs (e.g. journey from A to B with different means of transport or transport chains) were shown.

- **Percentages:** all breakdowns (e.g. cost categories) can be indicated as percentages of the total.

In the new CFT statistics, the cost recovery ratios by mode and form of transport are no longer shown as explicit indicators. However, the relevant information can still be found in the CFT statistics. As the term cost recovery ratio can be ambiguous and ultimately all costs are borne by one stakeholder or another, the CFT statistics have chosen to use the principle of final cost bearers and their percentage shares of cost financing. For example this indicator reveals the portion of costs borne by transport users, or the portion borne by transport users and the public sector combined, or the remaining portion of costs that is borne by the general public.

3 Key elements of the methodology

3.1 Differentiation

3.1.1 Mode of transport approach

The CFT statistics focus on the individual modes of transport. The results are used to compare costs and funding at mode of transport level. This means that costs that individual means of transport (e.g. passenger car or heavy goods vehicle) cause one another are considered as private costs in the CFT statistics. This is particularly relevant in the case of externalities.

Several approaches exist for determining the external effects.

Mode of transport approach: The entire mode of transport is considered as one entity. Within a mode of transport all costs borne by the users of that mode of transport themselves are considered to be private costs (e.g. also accident costs caused by a passenger car to a cyclist). As far as this approach is concerned, external costs only arise when they occur outside of the mode of transport. The mode of transport approach seeks to establish which modes of transport cause which costs and to what extent these costs are covered within the mode of transport itself (cost coverage). The mode of transport approach aims to compare modes of transport and therefore forms the basis of the Cost and funding of transport statistics.

“Heavy goods” mode of transport approach: The Federal Court has specified that this approach should be used to calculate the performance-related heavy vehicle fee (HGVC) for the following vehicle categories: company cars, delivery vans and lorries. This approach considers all costs that do not occur within heavy goods transport as external. In contrast to the mode of transport approach, all costs that a lorry, for example, causes to a passenger are considered to be

external. This approach also considers congestion costs, caused by heavy goods transport at the expense of other transport users, as external costs. For this reason the congestion costs of private road transport, and in particular those generated by heavy goods transport, are calculated regularly (most recently: Infrac 2012, recalculation of congestion time costs). The “heavy goods” means of transport approach is based solely on heavy goods transport and cannot simply be applied to other means of transport. It is, therefore, not suitable for statistics designed to compare modes of transport.

Transport user approach: This approach is based on individual transport users in order to differentiate external costs. All costs that are not borne by the causer of a transport activity are considered as external costs. The economically efficient use of the transport infrastructure is central to the transport user approach. External accident costs in particular are calculated in a different way to that used for the mode or means of transport approach. For the calculation of external accident and environmental costs (Ecoplan, Infrac 2018) the costs are therefore also calculated using the transport user approach. The cost rates established are used to determine internalisation contributions.

3.1.2 Content differentiation

In principle, the Costs and funding of transport statistics cover all forms of mobility that are provided for in the Federal Government's global transport and mobility concept. Central to the statistics is a differentiation at content level based on the relevant transport activities and their infrastructure (Ecoplan, ISPMZ, Infrac 2013): *All transport activities on public transport infrastructures are included in the CFT statistics.*¹ *Activities on infrastructures that mainly serve sport, leisure, military, agricultural or forestry activities are not counted as transport.*²

¹ The FSO defines public transport as services that are available to the public, that run according to a timetable and that respond to collective demand. Public transport services require a licence or authorisation to operate. It encompasses public railways (trains and rack railways), public road transport (trams, trolleybuses and buses), cable cars (funicular railways and cable cars) as well as public passenger vessels.

² This means that most hiking, jogging, Nordic walking, mountain biking, motorcross, rowing, canoeing, kayaking, pedaloing, swimming, sailing, motor-boating, gliding, ballooning and skiing are excluded.

In principle transport activities that take place using the following infrastructure are included in the Costs and funding of transport statistics according to this definition:

Relevant modes of transport and infrastructures in the CFT statistics

T 6

Transport mode	Infrastructure	Inclusion in the CFT statistics
Road	Motorways, main roads	2010
	Class 1-3 roads and their cycle lanes ¹	2010
	Infrastructure for human-powered mobility in towns and tarred cycle paths	2010
Rail	Railways (adhesion traction)	2010
	Rack railways	previously not included ²
Air	National airports	2010
	Regional airports (only scheduled and charter flights)	2010
Water	Public passenger vessel quays	2015
	Goods ports and terminals on the River Rhine	2015
Cable cars	Funicular railways	previously not included ²
	Aerial cableways	

¹ this road category also includes parking spaces on public property.

² In theory relevant to the CFT but insufficient data available

Source: FSO – Costs and funding of transport statistics (CFT)

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Because transport whose “primary use is for sport, leisure, military, agricultural and forestry activities” is excluded from the statistics, the following infrastructures are not included:

- Class 4-6 roads including footpaths and bike trails apart from tarred cycle paths
- Airfields
- Yacht harbours and marinas
- Ski lifts

According to the definition the following infrastructure should be included. However, due to the relatively low total costs of under CHF 100 million, it has been decided to omit them:

- Funicular railways
- Heliports
- Lakeside goods ports

From a conceptual point of view, according to this differentiation aerial cableways and rack railways should also have been included in the Costs and funding of transport statistics. As data is at present insufficient, aerial cableways and rack railways have been omitted from the current CFT statistics for 2015. Inland waterways transport were included in the CFT statistics for the first time for the reference year 2015.

3.1.3 Spatial differentiation

The CFT statistics focus on the costs and funding of transport in Switzerland. For road and rail transport, costs (and funding) are calculated according to the **territoriality principle**. This means that the costs investigated are those caused by transport in Switzerland (national territory). The differentiation therefore applies to the place where the costs arose. The calculation of climate costs, for example, is determined by the greenhouse gas emissions caused by transport in Switzerland. The consequences of global warming reflected in the climate costs, however, are not only negative effects occurring in Switzerland but global effects from greenhouse gases caused by transport in Switzerland.

Exceptions to this rule are aviation and freight transport on the Rhine: their transborder character means that the transport performance occurs not only in Switzerland. The **halfway point principle** is used in **aviation and inland waterways transport** (also known in certain contexts as the departure principle), i.e. all transport and its related costs are divided equally between the points of departure and arrival. This means that domestic transport within Switzerland is included in its entirety. Transport abroad or from abroad, on the other hand, is only counted to or from the halfway point. Transit transport (e.g. flights over Switzerland) are not included.

If the territoriality principle were applied to aviation, the entire costs incurred over international waters would not be taken into consideration, as these cannot be assigned to any State. The halfway point principle also enables the calculation of meaningful kilometre costs per person or per tonne kilometre as well as meaningful percentage shares by cost category. A westward-bound flight from Geneva, for example, would virtually incur only infrastructure costs under the territoriality principle, as the plane would leave Swiss territory just a few kilometres after take-off. The territorial principle would also distort the results of the cost categories, as the costs would only be assigned as far as the national boundary.

3.1.4 Other differentiation issues

Ancillary activities of transport companies

In principle these do not form part of the CFT statistics. In other words, transport companies' incidental expenses and subsidiary income are not included. Only the outlay and income of transport companies are incorporated into the CFT statistics.

The main examples of business areas that are not included are the real estate dealings of rail companies (e.g. the management of commercial spaces in stations) and the area of "non-aviation" run by airport operators (e.g. duty free shopping and airport car parks).

Occasionally, ancillary activities may still be mentioned in CFT statistics publications - for example if the profits from ancillary activities can compensate losses from the transport business. In such cases, not all costs borne by the transport company as the direct cost carrier can be passed on to the other cost carriers as a result of transport charges or subsidies. A part of the costs remains at the level of final cost carrier and must be borne by the transport company. This was the case in 2010 in aviation. Profits from the "non-aviation" area served to cross-finance losses from the aviation business.

Internal debits and credits

In the CFT statistics, each cost carrier (transport users, transport companies, the public sector and the general public) is taken as a whole. Payments or intangible performances taking place between parties of the same cost carrier are considered to be internal debits or credits and are therefore not taken into account. This applies for example to railway line charges paid by rail transport companies to rail infrastructure operators, but also to transfer payments between the Confederation, cantons and communes in relation to the funding of road infrastructure.

3.2 Valuation issues

The following methodological guidelines and terms are used to evaluate costs in the CFT statistics.

- **Handling of value added tax (VAT):** A separate expert study (IRENE, Ecosys 2013) has examined in detail the question of including VAT in the CFT statistics. Based on this study's findings, it was decided to report cost data in the CFT statistics without value added tax. Because this means the CFT statistics do not contain any indirect taxes, they are based on factor costs or factor prices. The use of factor prices instead of market prices increases the international comparability of findings.
- Each year's results are shown at **the corresponding year's (nominal) prices**. This means that when comparing cost data between 2005 and 2015, a possible increase in costs due to inflation should be taken into account.

- **Expenditure versus costs:** The focus of the CFT statistics is on costs (e.g. the annual costs of infrastructure construction are the annual depreciation). In the supplementary financial flow accounts, however, focus is placed on the financial flows based on annual expenditure (e.g. construction or investment expenditure) and not on costs (cf. Chapter 6).
- **Performance versus benefit:** In economic analyses the costs of projects or phenomena are often compared with their benefit. Transport undoubtedly generates benefits for the economy (e.g. direct and indirect value-added effect or employment); however, these positive effects are not central to the CFT statistics. Instead, the costs are compared with each contribution the traffic causer has made in order to benefit from a change of place.
- **Handling of investments and capitalisation:** Because the CFT statistics are based on a costs logic, investments are capitalised and shown as annual depreciation and interest costs. To capitalise public sector infrastructure investments, i.e. to establish the depreciation costs, a method known as the perpetual inventory method is used. This continually updates the annual expenditure (cf. Chapter 4). For transport companies, the depreciation costs are taken directly from their company accounts that establish these costs by means of business management methodology from their asset accounting.
- **Social discount rate:** To evaluate long-term negative effects or negative effects that lie in the distant future, it is necessary to reflect on the discounting of these costs at present day costs. The social discount rate plays an important role in this. As far as the Cost and funding of transport statistics are concerned, this subject is only relevant to external costs, i.e. climate costs. These are calculated on the basis of avoidance costs. As these cost rates are based on reflections about how long-term climate goals can be achieved, i.e. future avoidance costs, discount rates must be applied. A discount rate of 3% is used for the calculations (for details see Ecoplan, Infras 2014, p. 301 et seq.).

3.3 Allocation of costs and transfer performances

3.3.1 Allocation principles

In many cases, establishing costs or transfer payments/performances on the basis of a survey is only possible at mode of transport or means of transport level. To assign costs to sub-categories (e.g. allocation to passenger and goods transport or means of transport), a distribution mechanism similar to that used in business management cost accounting must be implemented. This applies in particular to the modes of transport road and rail. Assigning is carried out on the basis of well-established cost assignments (e.g. category accounts from the road accounts, assignment methods from the surveys of other modes of transport and the calculation of external costs). The allocation of rail infrastructure costs (by passenger and goods transport) is based on current railway line price regulations whereby the railway line price is partly calculated on the basis of railway line kilometres and partly using gross tonne kilometres.

The assignment principles for the individual modes of transport or means of transport are described in detail in Chapter 3.3 under the individual components of the CFT statistics.

3.3.2 Allocation rates in the road accounts

The assignment of costs in road infrastructure costs is important and requires a special method. The road accounts allocate infrastructure costs by applying allocation rates to motorised transport and to the other uses of roads (human-powered mobility and uses unrelated to transport). The way these rates are derived (rates, cf. Chapter 4.1.1.) is complex and cannot be deduced exhaustively using a bottom-up approach. The rates applied have been used for many years. Their use was recently endorsed in a study to update the road account methodology (Infras, Ecoplan, SNZ 2011).

Costs that cannot be assigned to motorised road transport come under human-powered mobility and uses unrelated to transport. The proportion assignable to human-powered mobility was explicitly calculated as part of the pilot accounts for human-powered mobility (Ecoplan, ISPMZ 2013: inclusion of human-powered mobility in the transport accounts). According to these calculations, the share of the costs of human-powered mobility on communal roads is 27% and on cantonal roads 9%. The share of the costs assigned to uses unrelated to transport (and therefore not included in the CFT statistics) is only 3% for communal roads and 1% for cantonal roads (see also Chapter 4.3).

3.4 Differentiating the performances of transport users

The performances of transport users are described in Chapter 2.2.6. Several important aspects of the calculation and differentiation of transport users' performances are explained below:

- **Transport charges:** All transport company income from the business areas "passenger and goods transport" is taken into account (e.g. income from public transport passes, air tickets and airport taxes).
- **Means of transport costs borne by users** (private road transport): It is assumed that the means of transport costs incurred are covered completely (borne by users). The amount of funding is the same as the costs. For commercial road transport (goods transport or coaches, etc.) this means that any profit or loss is not taken into account.
- **Transport related taxes and charges:** Transport related taxes are only relevant in road transport as a separate category of user funding. Taxes and charges in rail transport (i.e. railway line charges) and aviation (e.g. landing fees) are transfer payments between transport companies and infrastructure operators. These taxes and charges are borne tacitly by the transport users via transport charges and hence belong to that category. In road transport, the CFT statistics are guided by two basic criteria when deciding whether taxes or charges are assigned to this category.
 - The tax or charge must be "transport-related". The object being taxed must have a direct link to transport.
 - The tax or charge must be paid by the transport users. Consequently, the taxable entity must be the transport user.

Accordingly, the following taxes and charges are taken into account in their entirety, regardless of whether they are actually used for roads or not. Mineral oil tax and mineral oil surtax; charge for using national highways ("motorway vignette"), automobile duty (import duty for motor vehicles), cantonal taxes on vehicles, heavy vehicle fee (HGVC and flat-rate HGVC for heavy passenger cars and coaches), parking fees and motor fuels compensation.

Except for compensation for motor fuel imports, all transport-related taxes and charges go to the State. In calculations to ascertain the final costs carrier, they are therefore imputed as transfers between transport users and the public sector. Compensation for motor fuels makes up a small part of fuel costs and is passed on by the mineral oil groups to the private Klik Foundation for climate protection projects. This contribution is therefore considered as a transfer performance by transport users in favour of the general public.

- **Accident costs borne by users:** There are two categories of accident costs borne by users: intangible costs (for suffering or loss of quality of life, etc.), and self-borne material costs such as insurance premiums, excess and other personal contribution).
- **External health benefits:** The external health benefits of human-powered mobility are also counted as a contribution to the funding of transport costs, although these costs are actually avoided costs. In contrast to the rest of the CFT statistics, only the external health benefits are included here, adopting a net approach.

Payments for public services are not counted as performances by transport users. Transport companies may very well consider public sector orders for transport tenders in public passenger transport (rail and road) as a benefit or utilisation of transport services by the public sector. In the CFT statistics, however, the term “transport users” is very narrowly defined and an entity ordering transport tenders is not counted among users. Consequently payments for bid proposals are assigned to the public sector as the final cost carrier and not to the performances of transport users.

3.5 Differentiating transfer performances

Transfer performances are described in relation to cost carriers in Chapter 2.2.4. Several particular cases of transfer performances that are of special interest are described below:

- **Internalisation contributions:** Part of the environmental, health and accident costs are internalised by means of economic instruments that oblige the causer to make compensation payments. The payers of these contributions are usually transport users and for that reason the internalisation contributions are classified in the CFT statistics as transfer payments by transport users in favour of the general public. There are, however certain internalisation contributions that are not paid directly by the transport users but by the transport companies. This is the case, for example, with noise and emission charges in aviation. In such cases, the internalisation contributions are classified as transfer payments by transport companies in favour of the general public. The CFT statistics consider the following internalisation contributions as transfer payments:
 - Heavy goods vehicle charge (HGVC): First of all the HGVC, together with other transport-related taxes and charges, is used to cover costs borne directly by the State (almost exclusively infrastructure costs). The remainder that is not used to cover public sector costs is counted as a transfer payment in favour of the general public and as such is used for the internalisation of accident, environmental and health costs.

- **Klik:** Following the climate cent, since the start of 2013 the mineral oil industry has been obliged to pay compensation of 1 to 2 cents per litre on fossil fuels. These payments are dealt with by a private foundation (Klik).

Private transport: Transfer payments from transport users to the general public

Public transport: Transfer payments by transport companies in favour of the general public

- Noise and emission charges at airports (part of landing fees): Transfer payments by transport companies in favour of the general public
- **External health benefit:** The external health benefit is the only transfer performance that is not associated with a payment (intangible transfer performance).

3.6 Ancillary economic costs

In addition to economic costs caused by transport due to negative environmental consequences and accidents, there are other relevant additional costs to the economy. An in-depth report by the BFS examined which of these additional economic costs are relevant and should be taken into consideration in the CFT statistics (BFS 2013). On the basis of this report, the project's advisory committee “CFT Statistics 2010”, with representatives from the various federal offices, recommended the inclusion in the CFT of imputed interest on tied-up capital as well as the costs generated by non-capitalised investments.

3.6.1 Imputed interest on tied-up capital

In public sector businesses, capital costs arise for own and borrowed capital. In public limited companies, owners receive a dividend for the capital made available; interest has to be paid on borrowed capital. In public transport companies these capital costs often do not apply if the public sector has made capital available without asking for interest or dividends in return. However, from an economic point of view, the tied-up capital is subject to opportunity costs. If the capital were not tied-up, it could be invested with interest or the State would have fewer debts and therefore lower interest costs. Capital costs are therefore accounted for in the CFT statistics as imputed interest.

To calculate these imputed interests, the accounting value of fixed assets is multiplied by a current interest rate. This interest rate used is the average interest rate of current federal bonds (in 2015: 2.7%). In this way the overall imputed capital costs (own and borrowed capital costs) are obtained. To calculate the imputed interest on a company's own capital, the actual borrowed capital costs (interest) are deducted from the overall imputed capital costs. The imputed interests calculated in this way are

added in the CFT statistics to the business management costs of the two cost categories “means of transport” and “infrastructure”.

3.6.2 Non-capitalised assets / investments

When the public sector engages in investment projects, e.g. with non-repayable contributions, and these are afterwards not shown as assets in the transport companies’ accounts (i.e. and subsequently not depreciated either), this also leads to additional economic costs. These additional costs are comprised of the depreciation of non-capitalised assets and of imputed interest for the tied capital in the non-capitalised assets. The same method is therefore used for calculating capital costs and for investments in road infrastructure.

In rail transport, such non-capitalised assets or investments concern in particular the major tunnel projects of recent years (e.g. Vereina, NRLA). The additional economic costs for non-capitalised investments in rail transport are taken into account in the CFT statistics. What is not taken into account, however, are public sector investment contributions for combined transport.

Neither are the imputed interests on cumulative balances (“balance interest”), i.e. the interest of deficits or surpluses that are covered by the public sector. In the case of accumulated deficits, as can occur in rail transport, balance interest corresponds to the loss of interest revenue incurred by the public sector that is covering the operating deficits. Based on the opportunity costs principle (the public sector’s own capital is reduced by covering deficits) such balance interests have been established in the road

and rail accounts. They have not, however, been established in previous transport accounts. The FSO had the matter of including interest on cumulative balances examined in a scientific study (B,S,S. 2008). The study concluded that the inclusion of interest on cumulative balances gives an imprecise picture of the current cost effectiveness of the means of transport. With a macroeconomic approach (such as that used in the CFT statistics), another problem exists: that not only the transport-related public sector deficits would have to be taken into account. The isolated observation of one year’s cost coverage would be distorted further by the fact that the uncovered costs due to accident, environmental and health problems (external costs) would also have to be cumulated and interest calculated. On the basis of these recommendations - as was the case in the previous transport accounts - it was decided to dispense with the calculation of interest on cumulative balances (balance interest).

3.7 Data sets

Table 7 provides an overview of the components of the Costs and funding of transport statistics and which cost categories they cover.

The two following Chapters 4 (infrastructure and means of transport costs) and 5 (accident and environmental costs) describe in detail the process and data sets used for the individual components of the CFT statistics.

Components of the CFT statistics

T 7

	Road			Rail	Air	Water
	Private motorised passenger transport and goods transport	Public road transport	Human-powered mobility			
Infrastructure costs	Exhaustive survey of federal, cantonal and communal road infrastructure costs; costs are assigned to vehicle categories on the basis of empirical studies (chapter 4.1.1.)			Exhaustive survey of rail companies (chapter 4.4).	Partial survey of airlines and airport operators (chapter 4.5)	Exhaustive survey of public passenger vessels, model accounting for freight transport on the River Rhine (chapter 4.6)
Means of transport costs	Calculation based on import values according to foreign trade statistics (chapter 4.1.2)	Exhaustive survey of transport companies (chapter 4.2).	Bicycles: Estimate based on kilometre rates (chapter 4.3)			
Accident costs	Model calculation from the Federal Office for Spatial Development ARE (chapter 5)					
Environmental and health costs						

Source: FSO – Statistics on costs and funding of transport (CFT)

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Table 8 shows an overview of the main data sets for the CFT statistics. The basis of the individual components of the CFT statistics can be found in detail in the two following chapters.

We plan to publish the CFT statistics once every five years. However, some bases, such as the road infrastructure accounts, the survey of rail companies (formerly the railway accounts) and

aviation will be updated once a year. The modes of transport water and human-powered mobility on roads in contrast will be updated at the same frequency of the CFT statistics, i.e. every five years.

Overview of the main data sets of the CFT statistics

T 8

Cost categories	Data sets	Frequency of updates
Infrastructure costs		
Road: private motorised transport (passenger and goods transport)	Road infrastructure accounts, FSO	Annual
Roads: public road transport	Survey of public road transport companies, public transport statistics, road structure accounts for other infrastructure costs such as bus stops	Annual
Road: human-powered mobility	FSO road infrastructure accounts, proportion of uses unrelated to transport (based on human-powered mobility pilot study); microcensus (FSO) for transport performance	Every 5 years
Rail	Exhaustive survey of railway companies, FSO (formerly railway accounts, FSO)	Annual
Air	Survey of airport operators and air traffic control	Annual
Water: public passenger vessels	Survey of navigation companies	Every 5 years
Water: freight transport on the Rhine	Survey of port operators; model accounts for operating costs of locks and canals	Every 5 years
Means of transport costs		
Road: private motorised transport (passenger and goods transport)	Acquisition costs: Import value of vehicles (Directorate General of Customs); fuel: Average consumption (Manual of emission factors, FOEN); remaining cost components: various kilometre rates	Annual
Road, public road transport	Survey of public transport companies, public transport statistics	Annual
Road: human-powered mobility	Household budget survey (FSO); bicycle inventory according to Velosuisse	Every 5 years
Rail	Exhaustive survey of railway companies, FSO (formerly railway accounts)	Annual
Air	Transport performance (FOCA); airline data, ICAO database, airport survey	Annual
Water: public passenger vessels	Survey of navigation companies	Every 5 years
Water: freight transport on the Rhine	Model accounts based on methodology of German Federal Transport Infrastructure Plan	Every 5 years
Accident costs		
All modes of transport	Model accounts, ARE, based on bfu accident statistics and ARE accident cost estimates	Annual
Environmental and health costs		
All modes of transport	Model accounts, ARE	Annual

Source: FSO – Statistics on costs and funding of transport (CFT)

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4 Infrastructure and means of transport costs

The following sub-chapters describe the planning, procedure and data sets used to calculate the individual components of the CFT statistics in detail.

4.1 Private motorised road transport

4.1.1 Infrastructure costs

Planning and data sets

The **road accounts** are the oldest transport accounts and compare the costs of road infrastructure with the accountable revenue. Originally three partial accounts were created:

- The **expenditure accounts** compare annual expenditure with revenue, without distinguishing between costs for investments and running costs.
- The **capital accounts** capitalise the investments and take their useful life into account. (The CFT statistics' costs for road infrastructure are based on the capital accounts).
- On the basis of the expenditure and capital accounts, the **category accounts** differentiate the various means of transport and

calculate specific degrees of cost coverage. In motorised road traffic, the term "vehicle categories" is used instead of "means of transport".

In the course of the various revisions (road accounts, transport accounts and HGVC-related costs: Infrast, Ecoplan, SNZ 2011; IRENE, Ecosys 2013b; FSO 2013b) the focus is placed on the capital accounts and - based on the allocation principle - on their assignment to the individual vehicle categories of motorised road transport. As far as the methodology is concerned, two key elements are worth mentioning:

- **Acquisition costs:** Costs are calculated based on the actual annual costs of the individual infrastructure projects. The running costs flow directly into these costs. The investment costs flow into costs as annual depreciation and interest costs. Information is required about acquisition costs in each given year, assumptions about the length of projects and the establishment of interest rates (average interest for federal bonds).
- **Allocation:** This requires assumptions about the share of weight-related, dimension-related and capacity-related costs. With the factors calculated (newly revised on the basis of the Infrast Study, SNZ Ecoplan 2013) the costs can be allocated to the individual vehicle categories.

Costs and data sets for road transport infrastructure

T 9

Type of cost	Characteristics	Data set
Running costs		
Operating costs I		
Operations maintenance	Small, on-going maintenance works (e.g. cleaning, winter road clearance and minor surfacing work)	Annual survey of FEDRO, cantonal and communal civil engineering departments
Police traffic control and surveillance	Police traffic costs for traffic regulation and controls (incl. heavy traffic controls). Road marking, signs and traffic lights	Annual survey of cantonal and communal traffic police Annual survey of FEDRO, cantonal and communal civil engineering departments
Running costs		
Operating costs II		
Parking spaces and car parks	Operating costs of parking spaces and car parks	Annual survey of cantonal and communal civil engineering departments
Heavy traffic controls and management	Costs of conducting heavy traffic controls	Annual survey of cantonal traffic police
Administrative costs	General costs that can be attributed to roads	Annual survey of FEDRO, cantonal and communal civil engineering departments
Investment costs		
Structural maintenance	Road surface renovation projects	Annual survey of the corresponding projects at FEDRO, cantonal and communal civil engineering departments
Reconstruction	Total reconstruction and construction renovation projects (e.g. bridges)	
Extension**	Road extension (e.g. widening of lanes or redesign of road space)	
New build	New road building (new road connections, above ground, bridges and tunnels)	
Land acquisition	Costs for the land acquisition of individual investment projects	

Source: FSO – Costs and funding of transport statistics (CFT)

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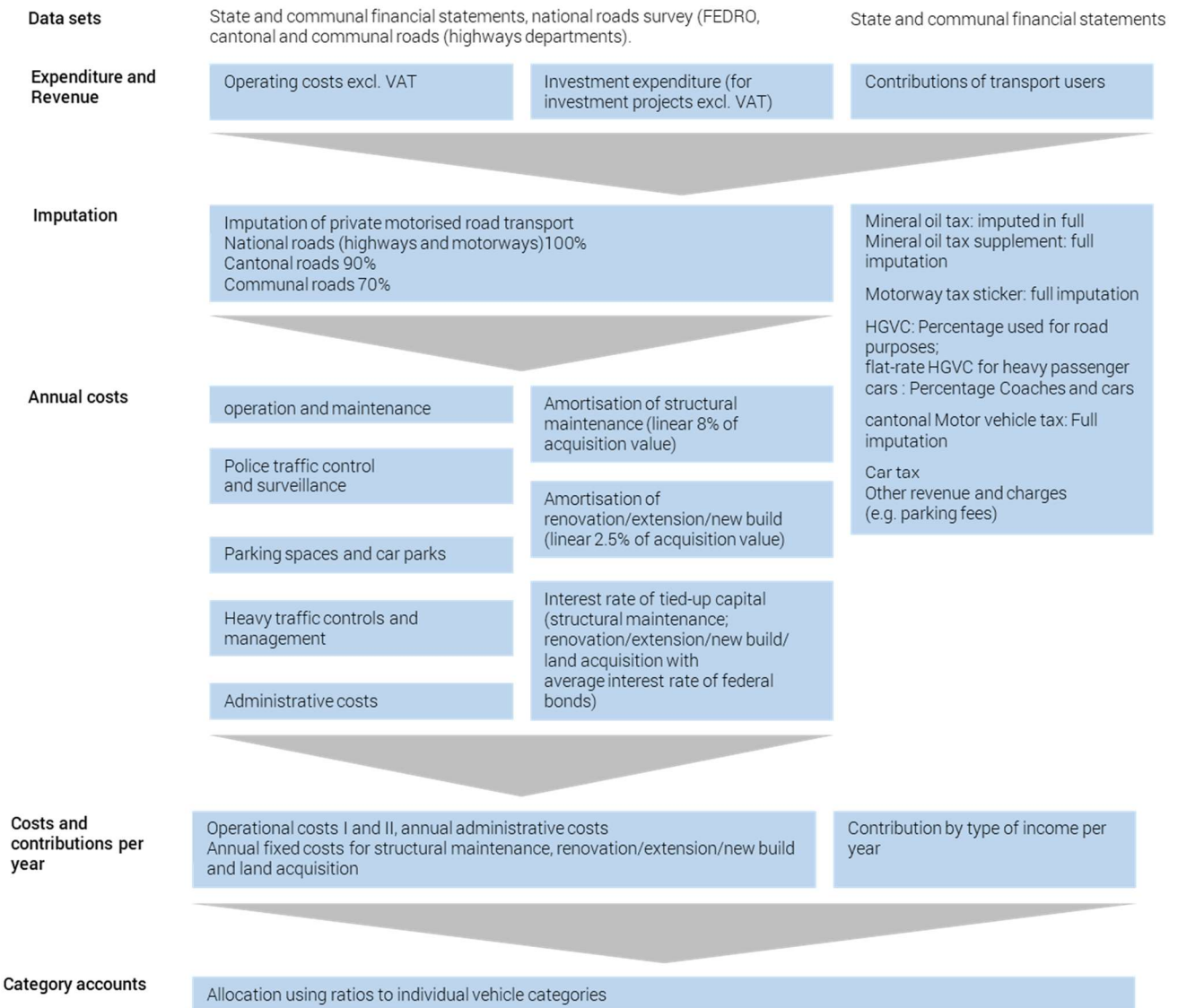
Calculation procedure

The following figure gives an overview of the individual steps to calculating and capitalising the costs and contributions of transport users.

Road infrastructure: Bases and methodological procedure

F 3

Road accounts: Infrastructure costs of motorised road transport



Source: FSO – Costs and funding of transport statistics (CFT)

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1. Acquisition and preparation of information

Based on the state and communal financial statements, the individual costs and project-specific information for national, cantonal and communal roads are collected from the responsible offices by means of an annual standardised survey and allocated to the individual types of costs. Any VAT contributions are deducted. For more complex infrastructure projects, any costs for third parties (e.g. cables, electricity or public transport stops) are deducted.

2. Calculating the infrastructure costs for motorised road transport

General factors are used for the costs calculated, broken down by road category. The rates that had been applied for a long time were backed up in a study to update road accounting (Infras 2011); consensus exists therefore for the continued validity of the following road account rates:

- National highways: Motorised transport share: 100%
- Cantonal roads: Motorised transport share: 90%
- Communal roads: Motorised transport share: 70%

For cantonal and communal roads, the non-accountable shares are used to calculate the costs for human-powered mobility (see Chapter 4.3).

3. Calculating running infrastructure costs (operating costs)

Running costs are divided into operating costs I and II and are allocated straight from the survey to the road categories. Administration costs are also included.

4. Calculating fixed costs (depreciation and interest)

In contrast to the other modes of transport, the road investment costs are collected using the "perpetual inventory method". This involves the processing of annual investment expenditure throughout the useful life of the type of cost.

- Structural maintenance: 12.5 years (annual depreciation rate of 8%)
- Renovation, extension and new build: 40 years (annual depreciation rate of 2.5%)
- Land acquisition: indefinite (no depreciation)

The procedure followed is outlined below:

- a) Calculation of depreciation: 8% or 2.5% of the value of each acquisition in the relevant time period (12.5 years for structural maintenance, 40 years for renovation, extension or new build).

- b) Calculation of the average tied-up capital: Total remaining value (investment total of all investments in the individual projects less depreciation) Year 1.....Year n

- c) Calculation of interest: An interest rate of 2.7% (CFT 2015) is applied to the average tied-up capital.

- d) Fixed costs (depreciation and interest): Only interest costs are incurred for land acquisition costs.

5. Allocating costs to the vehicle categories

The individual cost types are broken down by vehicle category according to specific factors. The method of calculating the costs of heavy transport has been revised and refined several times. Based on a detailed evaluation of individual road projects, new allocation factors were defined for the 2010 CFT statistics. The study calculated the additional costs of heavy transport related to weight, dimension and capacity compared with a (fictional) road construction project without heavy transport (cf. INFRAS, SNZ, Ecoplan 2013). The weight-related heavy transport costs for structural maintenance are allocated to the vehicle categories by specific axle load factors (ESAL, equivalent single axle load).

6. Calculation of the transport specific taxes and charges

The annual contributions come from the federal and cantonal finance statistics. With the exception of the HGVC these transfers are credited entirely to the public sector. The HGVC is considered as a transfer partly to the public sector and partly to the general public. First and foremost, HGVC revenue is used to offset uncovered public sector costs. The remainder is used as an internalisation contribution (i.e. as a transfer in favour of the general public). Compensation for motor fuels (as a further transport-specific charge) does not flow into the road infrastructure accounts but is used as an internalisation contribution to external climate costs (cf. Chapter 5).

7. Allocating transport-specific taxes and charges to the individual vehicle categories

The following table shows the relevant allocation ratio for the individual taxes or charges. The territoriality principle forms the basis for calculating the kilometre performance (vehicle stock, kilometre performance and fuel sales in Switzerland).

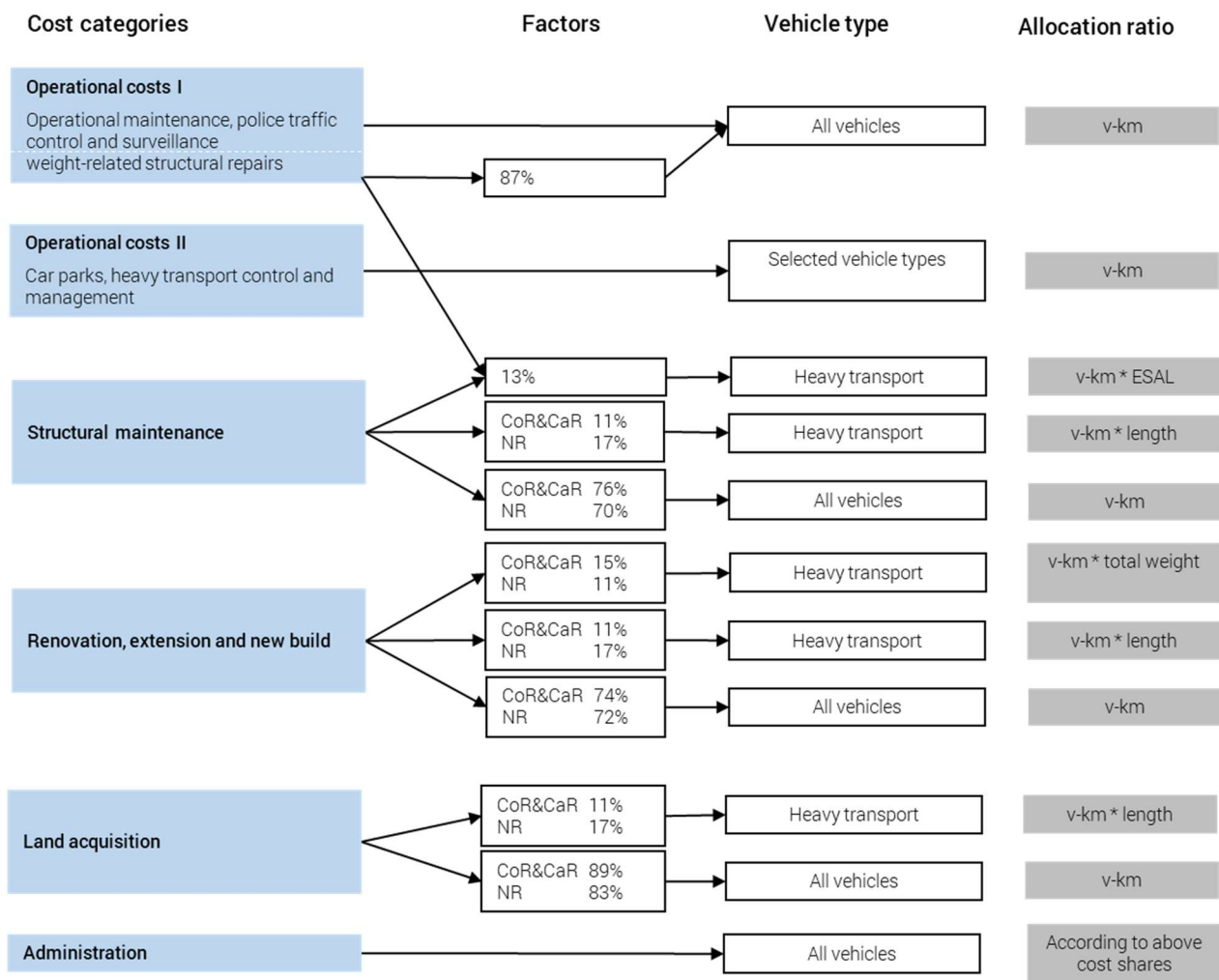
8. Presenting the results

The road infrastructure accounts are the only partial accounts from the transport accounts that continue to be published separately.

CoR = communal roads; CaR = cantonal roads; NR = national roads

Allocation of costs for road infrastructure

F 4



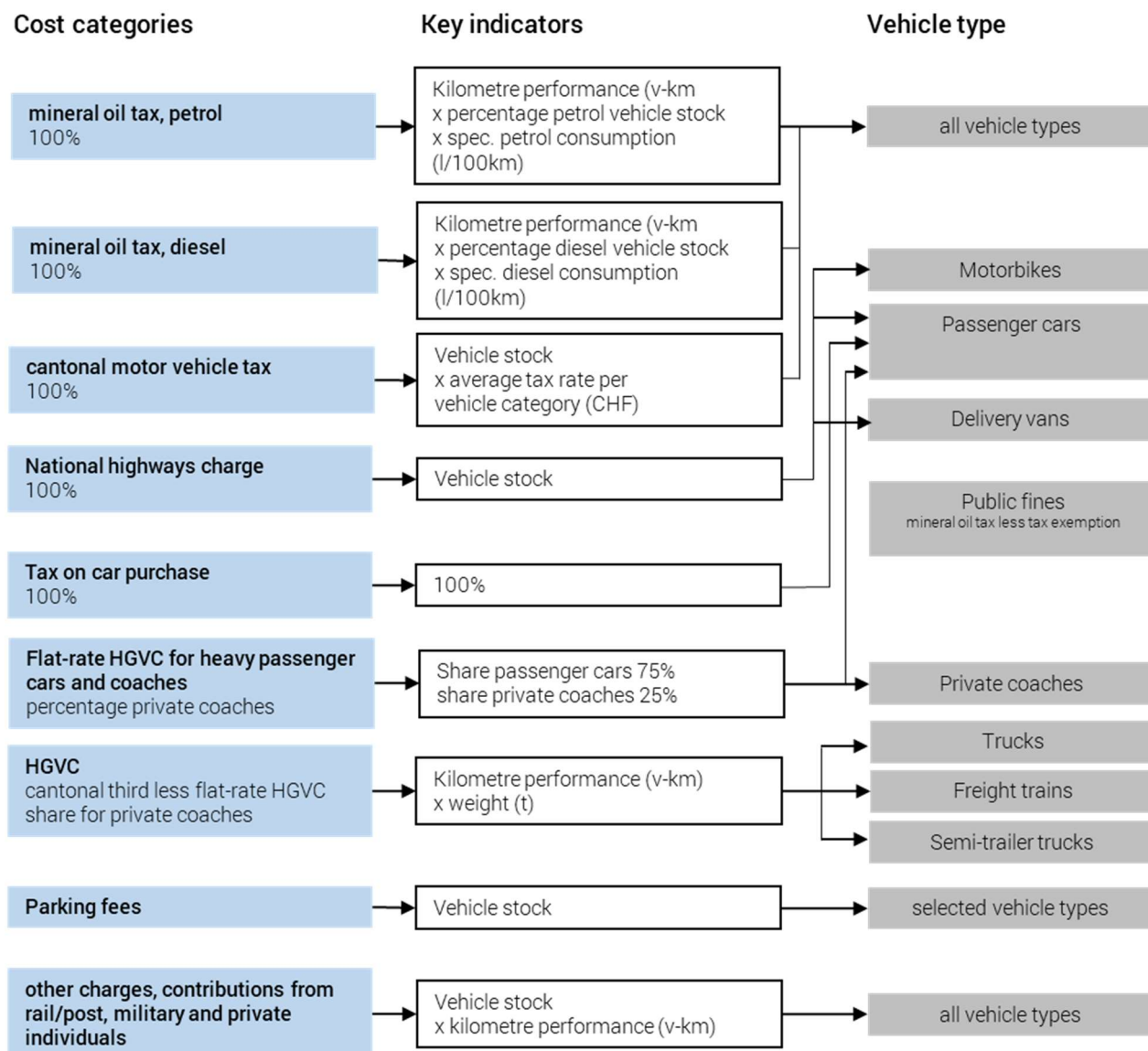
CoR = communal roads; CaR = cantonal roads; NR = national roads

Source: FSO – Costs and funding of transport statistics (CFT)

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Allocating transport-specific taxes and charges for road infrastructure

F 5



Note: Only that part of the heavy goods transport charge earmarked for road purposes flows into the road infrastructure accounts (to offset infrastructure costs caused by heavy transport). The remaining part is considered as an internalisation contribution (to offset external accident and environment costs).

Source: FSO – Costs and funding of transport statistics (CFT)

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4.1.2 Means of transport costs

The means of transport costs of private motorised road transport comprise eight separately calculated cost components. Table 10 provides an overview of the cost components, the methods applied in each case and the relevant data sets.

The main cost components of the vehicles and acquisitions costs are described in slightly more detail below. A detailed description of the methodology concerning all cost components can be found in the final report of the commissioned “Calculation of the means of transport costs of motorised road transport” (Ecoplan 2018a).

Cost components of means of transport costs of private motorised road transport**T 10**

Cost component	Methodological approach	Main data sets	2015 costs ¹
Acquisition	Depreciation of the acquisition value and interest on the residual value.	Import values: Evaluations of the Fed. Customs Administration; Interest rates: Swiss National Bank (SNB)	CHF 12.2 billion
Fuels	Estimate based on average use	Average use: Emissions factors manual; average fuel price: Swiss Petroleum Association	CHF 3.6bn
Maintenance/repair	Cost rate per vehicle-km.	Cost rates according to VSS norm SN 641 827	CHF 3.6bn
Tyres	Cost rate per vehicle-km.	Cost rates according to VSS norm SN 641 827	CHF 2.6bn
Insurance	Annual costs per vehicle	TCS and ASTAG data	CHF 1.2bn
Parking	Annual costs per vehicle	Expert appraisals	CHF 8.6bn
Additional costs (e.g. administrative costs in commercial transport)	Annual costs per vehicle	ASTAG data	CHF 1.6bn
Driving personnel (commercial transport)	Estimate based on hourly wages for driving personnel, average speed and annual performance	Hourly wages: VSS norm SN 641 827; average speeds: Goods transport model (ARE)	CHF 7.3bn

¹ Total of means of transport costs for all vehicle categories of private road transport

Source: FSO – Costs and funding of transport statistics (CFT)

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Acquisition costs

As for investments in road and rail infrastructure, calculations using the components depreciation and residual value interest are used here. The depreciation costs reflect the loss in value of vehicles, the interest reflects the costs of tied-up capital.

Depreciation

Calculation is made using the following steps:

1. Detailed evaluations by the Federal Customs Administration enable the value added tax on imported vehicles to be determined, i.e. the value paid by car importers for the vehicles.
2. With regard to passenger cars, the number of imported vehicles tallies well with the number of newly registered vehicles. In this case the value added tax figures can be used as they are. For the other vehicle categories, an estimate of the average vehicle value has to be made.
3. A dealer's margin is added to the import value (FSO expert estimate) to obtain the sales value of the vehicle.
4. As the cost of tyres is a separate cost component, the cost of a set of tyres is deducted from each vehicle.
5. The acquisition values (including dealers' margins without tyre costs) are depreciated over the average useful life of vehicles. For passenger cars, the loss in value in the first years of use is disproportionately high. For this reason, the value of passenger cars is depreciated on a diminishing scale. A linear loss in value is applied to the other vehicle categories (linear depreciation).

The following useful life is assumed for the individual vehicle categories (source):

- Passenger cars: 15 years
- Motorcycles: 20 years
- Mopeds: 10 years
- Coaches: 19 years
- Delivery van: 18 years
- Lorries: 18 years
- Articulated lorries: 11 years

Interest

The interest on the capital used to purchase a vehicle should be based on the opportunity cost principle. Based on the perpetual inventory method, interest costs are calculated according to the vehicle's residual value. For commercial transport vehicle categories (coaches, delivery vans, lorries and articulated lorries) the average interest rate for fixed interest investment loans is applied. For private transport, the average interest rate for private customer savings is used.

As financing with borrowed capital for leasing vehicles causes considerably higher costs, additional leasing costs are calculated for part of the vehicle stock. In 2015, the percentage of leasing vehicles among newly registered vehicles was 48%.

4.2 Public road transport

4.2.1 Planning and data sets

Public road transport was already included in the 2005 transport accounts. However, detailed FSO studies (Infras, Ecoplan 2008) revealed that there were gaps in data, particularly regarding the infrastructure costs of public road transport. For this reason a detailed study, "Public road transport in the transport accounts" was made (Infras 2013) to close the gaps and improve the procedure for data collection including the allocation of costs. The study forms the planning basis for calculating the costs and funding of public road transport.

Public road transport comprises three vehicle types: buses, trolleybuses and trams. Every five years detailed results are published for the vehicle categories. Results for public transport as a whole are published in the years inbetween.

4.2.2 Infrastructure costs

- **Road costs:** Public sector costs for road infrastructure. In addition to actual roads, these include separate bus lanes, bus stop lay-bys and traffic lights.

- **Other public sector infrastructure costs:** These include costs that are not covered by the road accounts, in particular costs for bus stops and bus stations.
- **Infrastructure costs of transport companies:** Transport companies also have to pay infrastructure costs: Overhead lines, tram rails, electricity supply, turning loops and bus stop equipment.

4.2.3 Means of transport costs

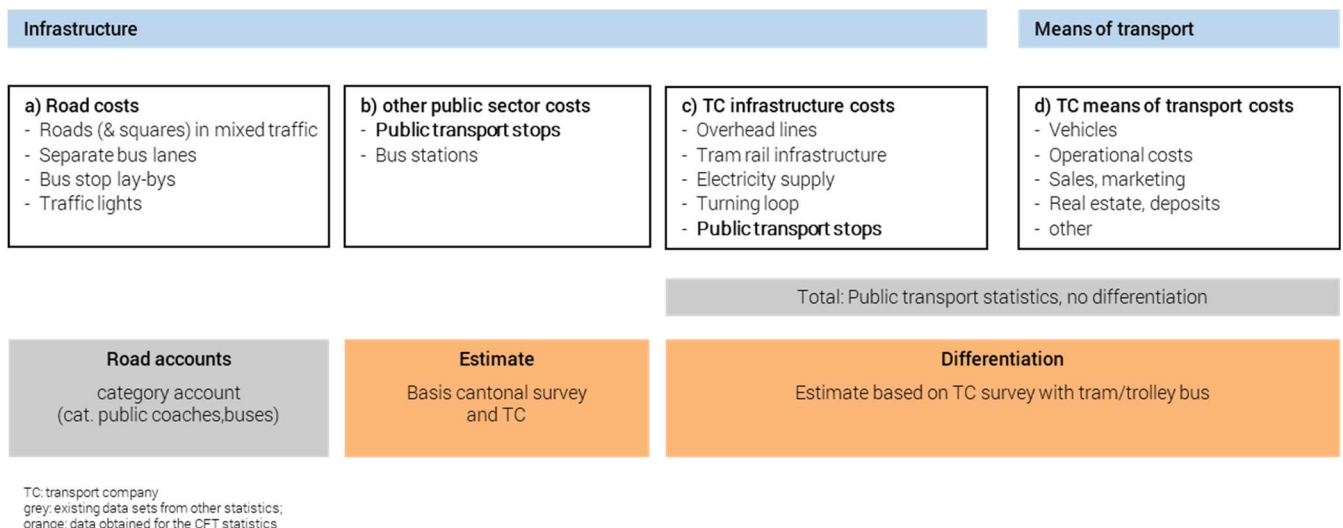
Costs of transport companies (TC) for the means of transport for public transport (PT): vehicles, driving personnel costs, other operating costs, sales and marketing, properties, garages and depots etc.

The main basis for establishing the costs of public road transport are the category accounts of the road infrastructure accounts (for the road infrastructure costs) and the FSO public transport statistics, which establish the transport companies' total costs in an exhaustive survey. In order to calculate other public sector costs for bus stops and bus stations, additional surveys and calculations are required.

The figure below provides an overview of the structure and the main data sets for the individual cost areas of public road transport.

Public road transport costs – structure and data sets

F 6



Source: FSO – Costs and funding of transport statistics (CFT)

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4.2.4 Funding

Direct cost bearers

As direct cost bearers, the public sector and transport companies assume fairly equal parts of the infrastructure costs: The public sector assumes road infrastructure costs and part of the costs for bus stops. The transport companies bear the costs for tram rail installations and the electricity supply for trolleybuses and trams.

The means of transport costs are initially borne almost completely by the transport companies. The public sector has to pay only a very small amount in imputed interest.

Transfer payments

The payments listed in Table 11 are used to calculate the final cost bearers. The largest transfer payments are public sector subsidies and transport charges paid by transport users for transport services. In addition to these are the transport-specific taxes and charges paid by the transport companies (e.g. motor vehicle tax), which constitute a reverse payment from the transport companies to the public sector. With CO₂ compensation payments to the private Klik Foundation, transfer payments are also made on a smaller scale by the transport companies to the general public.

Main transfer payments in public road transport T 11

Transfer payments	from → to	Amount in 2015
Public sector subsidies	Public sector → TC	CHF 1 601m
Transport charges (revenue from fares)	Transport users → TC	CHF 1 571m
Transport-specific taxes and charges (e.g. motor vehicle taxes)	TC → public sector	CHF 25m
CO ₂ compensation (Klik Foundation)	TC → general public	CHF 3m

Source: FSO – Costs and funding of transport statistics (CFT)

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Ancillary activities

Although public road transport companies generate important additional revenue from ancillary activities (e.g. special trips, income from advertising, property revenue or third-party services), the revenue and outlay made in this business sector are not included in the CFT statistics. As is the case for other modes of transport (e.g. rail and air) the findings of the CFT statistics concern only transport costs.

4.2.5 Summary

The procedure, including data sources to establish the individual cost components and transfer payments is illustrated in Table 12.

Procedure and data sources to establish individual cost components and transfers

T 12

Components	Data source	Procedure
Costs		
Road infrastructure costs	FSO road accounts	FSO road accounts
Other public sector infrastructure costs (bus stops and bus stations)	FSO public transport statistics: Number of public road transport bus stops Cantonal and transport company survey (sample survey): - Number of stops with specific infrastructure (bus shelters) - Investment and maintenance costs pro stop	Estimate of annual costs from the number of stops multiplied by the annual depreciation and maintenance costs A similar procedure is used for bus stations (terminals).
TC infrastructure and means of transport costs	FSO public transport statistics: Total TC costs Survey of urban TC with trams and/or trolleybuses (exhaustive survey): differentiated costs	The total TC costs can be obtained from the public transport statistics. The additional urban TC survey helps to differentiate these costs: - Difference between infrastructure and means of transport - by vehicle category: Bus, trolley bus and tram
Additional economic costs (imputed interest on companies' own capital)	Survey of urban TC with trams and/or trolleybuses (exhaustive survey): Accounting value of assets, actual interest Financial reports from other transport companies (buses, only sample survey): Accounting value of assets, actual interest	Calculation of imputed interest: - accounting value of assets multiplied by the average interest rate on federal bonds = total interest costs - minus the actual interest (on borrowed capital) - gives the net imputed interest on tied-up own capital. For bus companies and estimate of the sample survey using number of passengers and total TC costs as extrapolation factor
Transfers		
Transport charges (revenue from fares)	FSO public transport statistics: total transport revenue and subsidies Survey of urban TC with trams and/or trolleybuses (exhaustive survey): differentiated costs	The public transport statistics provide the entire transport revenue as well as all public sector subsidies as a point of reference. With help from the TC survey, these funding components can be allocated to the individual vehicle categories (bus, trolley bus or tram).
Public sector subsidies	FSO public transport statistics (see above)	FSO public transport statistics (see above)
Transport related taxes and charges	FSO road accounts	The accountable taxes and charges of public road transport are a transfer from the TC to the public sector.
CO ₂ -compensation on fuel (Klik)	ARE external effects of transport (Ecoplan, Infrac 2018)	Internalisation contributions by mineral oil importers are quantified in the ARE study.

Source: FSO – Costs and funding of transport statistics (CFT)

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4.3 Human-powered mobility

4.3.1 Planning and the required data sets

Human-powered mobility (on foot and by bicycle) was first shown in the CFT statistics in 2010. The planning basis for establishing the costs and funding of human-powered mobility comes from the pilot study "Integration of human-powered mobility into the transport accounts" (Ecoplan, ISPMZ 2013). Because human-powered mobility mainly takes place on roads, it has been allocated to the mode of transport "road". Within human-powered mobility, the CFT statistics distinguishes between two categories:

- **Pedestrians:** All pedestrians belong to this category, regardless of their transport purpose, i.e. it includes hikers and joggers, etc. Equipment similar to vehicles is also included in this category such as inline skates, scooters, kickboards and skateboards, etc. All pedestrian traffic on the following infrastructure (including transport with equipment similar to vehicles) is included: Class 1 to 3 roads, footpaths and pavements, pedestrian zones, pedestrian over and under passes. All pedestrian traffic using this infrastructure is included, regardless of its purpose.

Transport activities on roads in the classes 4 to 6 are not taken into account. For this reason, most hiking activities are not included in the CFT statistics.

- **Bicycles:** All bicycle transport belongs to the bicycle category, regardless of the purpose of that transport, i.e. it includes racing and mountain bikes, etc. Electric bikes with pedal assist are a special case. These bicycles are known as pedelecs (with motor power up to 500 Watt and motor assistance limited to 25 km/h) and also belong to the bicycle category as they are subject to the same traffic laws as bicycles and no driving licence is required to ride them. E-bikes with motor power of over 500 Watts and a pedal assist of up to 45 km/h, on the other hand, do not belong to the bicycle category. These qualify as motorbikes, requiring a corresponding registration plate and are therefore allocated to the vehicle category motorbikes and mopeds (part of private motorised passenger transport) in the CFT statistics.

All bicycle transport on the following infrastructures are taken into account in the CFT statistics: roads in classes 1 to 3, tarred cycle paths and over and underpasses. In accordance with this, special human-powered mobility infrastructure in residential areas (e.g. bridges and overpasses for human-powered mobility) are included in the CFT statistics.

As is the case for pedestrian transport, for bicycle transport any transport activities on roads in class 4 or under are not included. This means that most mountain bike activity is not covered.

As part of the CFT statistics' "human-powered mobility" pilot accounts, the costs for the infrastructure and means of transport

categories in human-powered mobility are established on the basis of the following planning references:

4.3.2 Infrastructure costs

The human-powered mobility infrastructure costs include - as for the road infrastructure accounts - the current running costs (operational maintenance and management, etc.) as well as depreciation costs (new constructions, extensions and structural maintenance). The pilot study on the integration of human-powered mobility in the CFT statistics came to the conclusion that human-powered mobility infrastructures are almost completely included in the basis data of the road infrastructure accounts. In theory there are other, special pedestrian or bicycle infrastructures, such as pedestrian zones that are neither included nor explicitly excluded from the accounts. However, according to detailed analyses, these contributions are so small that they cannot currently be ascertained and for this reason do not flow into the CFT statistics. In other words, the road infrastructure accounts contain almost all infrastructure costs relevant to human-powered mobility.

The costs of human-powered mobility and their use for purposes not related to transport are differentiated from the costs of motorised transport in the road accounts using fixed rates. The corresponding allocation rates of motorised road transport in the road infrastructure accounts are 70% for communal roads, 90% for cantonal roads and 100% for national highways. Conversely, the cost share of human-powered mobility and uses not related to transport (e.g. markets, meetings and restaurants) are 30% for communal roads and 10% for cantonal roads. In order to identify the costs of human-powered mobility separately, the shares of the costs due to activities not related to transport must be deducted from them. In the pilot study on the integration of human-powered mobility into the CFT statistics (Ecoplan, ISPMZ 2013), the share of human-powered mobility compared with activities not related to transport is established using concrete examples. The resulting calculations showed a human-powered mobility share of 85% in towns (i.e. non-transport related use of 15%) and outside of towns of 100%. For all cantonal and communal roads the following percentages are recommended: for costs that are not imputed to motorised transport, 90% should be imputed to human-powered mobility and 10% to activities. Taking into account the imputed rates for motorised transport, this results in the following rates for the costs of human-powered mobility to the infrastructure costs according to the road infrastructure accounts:

- Communal roads: 27%
- Cantonal roads: 9%
- National roads (national highways and motorways): 0%

4.3.3 Means of transport costs

The running and investment costs for bicycles belong to the means of transport costs. Due to their relatively low importance and to a lack of data, the means of transport costs for appliances similar to non-motorised road vehicles such as inline skates, skateboards, rollers, scooters, etc. are not included. The means of transport costs for bicycles are calculated on the basis of the Household Budget Survey (HBS), from the annual expenditure on the purchase and operation of bicycles.

4.3.4 Cost bearers

With regard to the funding of costs, a distinction is made for all modes of transport between direct and final cost bearers (and for transfer payments between direct and final cost bearers).

Direct cost bearers

To establish the direct cost bearer, it is important to know who bore the costs directly when they were generated. For human-powered mobility, the various costs are funded by the following direct cost bearers:

- **Infrastructure costs:** The infrastructure costs are funded wholly by the public sector. In human-powered mobility there is no funding by the transport users.

- **Means of transport costs:** The transport users cover the means of transport costs themselves (as with private motorised road transport).
- **Accident costs:** The greatest part of accidents costs are borne by the transport users (privately borne accident costs). An important part of the accident costs (external accident costs) however, are also borne by the general public and a small part by the public sector.
- **Environment/health costs:** The relatively small environmental and health costs of human-powered mobility are borne by the general public.

Final cost bearer / transfer payments

In human-powered mobility the following transfer payments are made from the direct to the final cost bearers:

- **External health benefit:** The external health benefit is counted as a transfer payment from transport users to the general public.

The following table shows the main data sets for establishing the infrastructure and means of transport costs in human-powered mobility.

Main data sources for the human-powered mobility pilot study

T 13

Cost categories	Data source
Infrastructure costs	FSO road accounts <ul style="list-style-type: none"> - Annual infrastructure costs per road category (communal and cantonal roads) - Imputed costs for the share of non-motorised traffic in infrastructure costs (communal roads: 30% cantonal roads: 10%) Human-powered mobility pilot accounts (Ecoplan, ISPMZ, 2013) <ul style="list-style-type: none"> - Share of human-powered mobility (vs share of activities not related to transport) in infrastructure costs (always 90% of costs for non-motorised transport)
Means of transport costs (only bicycle)	Household Budget Survey (HBS) FSO: <ul style="list-style-type: none"> - Expenditure per household on bicycles (purchase) including accessories, replacement parts and insurances for non-motorised vehicles. - Estimate for the whole of Switzerland based on number of private households (according to FSO) - Velosuisse bicycle sales statistics - Share of mountain bikes and fast e-bikes (in order to deduct their costs)*

* As mountain bikes are primarily used on roads class 4 to 6, according to the content differentiation they are not relevant to the CFT statistics (see Chapter 3.1). Fast e-bikes belong to the vehicle category "mopeds" and therefore are not part of human-powered mobility.

4.3.5 Calculation procedure

Figure 7 shows the procedure for calculating the infrastructure and means of transport costs of human-powered mobility. The main data source for establishing the infrastructure costs of human-powered mobility is the FSO road infrastructure accounts. The cost share of motorised and non-motorised road transport can be obtained from these accounts by using allocation rates. Once the costs of non-motorised transport have been established, the share of human-powered mobility is calculated by means of simple rates. The basis for these rates comes from the pilot accounts on human-powered mobility (Ecoplan, ISPMZ, 2013). The last step is to divide the total infrastructure costs of human-powered mobility between the categories pedestrians and bicycles. Costs are divided according to the road account

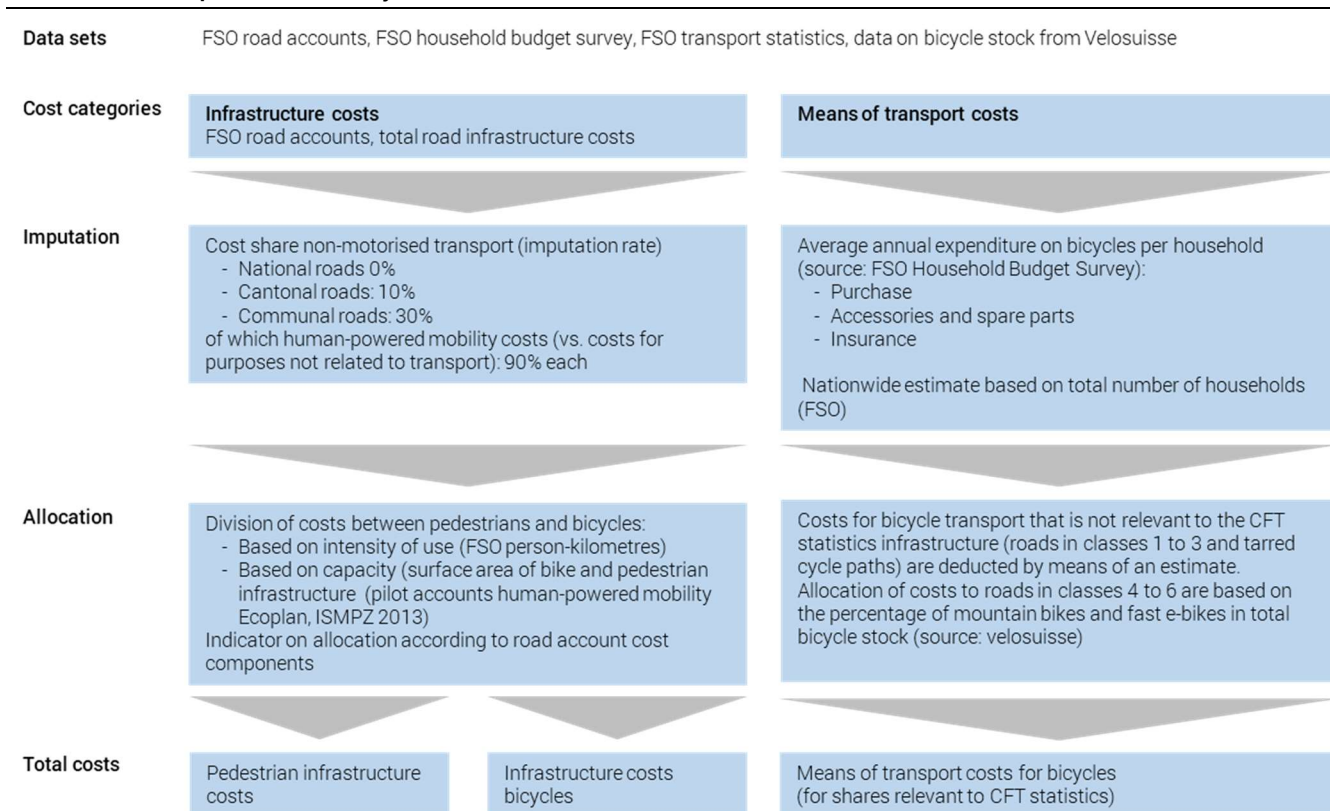
cost components, based on either intensity of use or the infrastructure's capacity. The following indicators are used to allocate costs to the categories:

- Intensity of use: Transport performance (pkm)
- Capacity: Surface area of human-powered mobility infrastructure

The intensity of use is applied as an allocation ratio to all running costs (operational maintenance), renovations, extensions and new constructions for lighting, parking spaces, road signs and policing costs. Capacity as an allocation ratio is used for all costs of structural maintenance as well as renovations, extensions and new constructions of roadways, civil engineering works and land acquisition costs.

Costs of human-powered mobility: Procedure and data sets

F 7



Source: FSO – Costs and funding of transport statistics (CFT)

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4.4 Rail transport

4.4.1 Planning and the required data sets

The accounts for rail transport were originally known as the railway accounts and include the infrastructure costs and the means of transport costs, i.e. all the costs of railway transport companies and railway infrastructure companies in Switzerland. They are equivalent to aggregated company accounts and summarise the annual accounts of the individual transport companies active in Switzerland in a standardised structure. The railway accounts used to be published annually (until 2010), in the form of a business management and an economic account. The difference between the two lies in how the interests are ascertained and whether subsidies are allowable. The CFT calculates interests and depreciations from an economic point of view, based on the asset accounts of the individual transport companies and considers subsidies as a public sector contribution and revenue from fares as a contribution made by transport users.

The basis for calculating the infrastructure and transport costs and their funding is an evaluation of the segment reporting and asset accounts of the individual transport companies.

Transport companies are rail transport companies that hold one or more of the following authorisations or licences: Licence for regular, commercial passenger transport, railway infrastructure licence, federal authorisation pursuant to the Passenger Transport Act (PTA, SR 744.10), access rights and or safety certificate. The following table shows the transport companies currently included in the CFT statistics

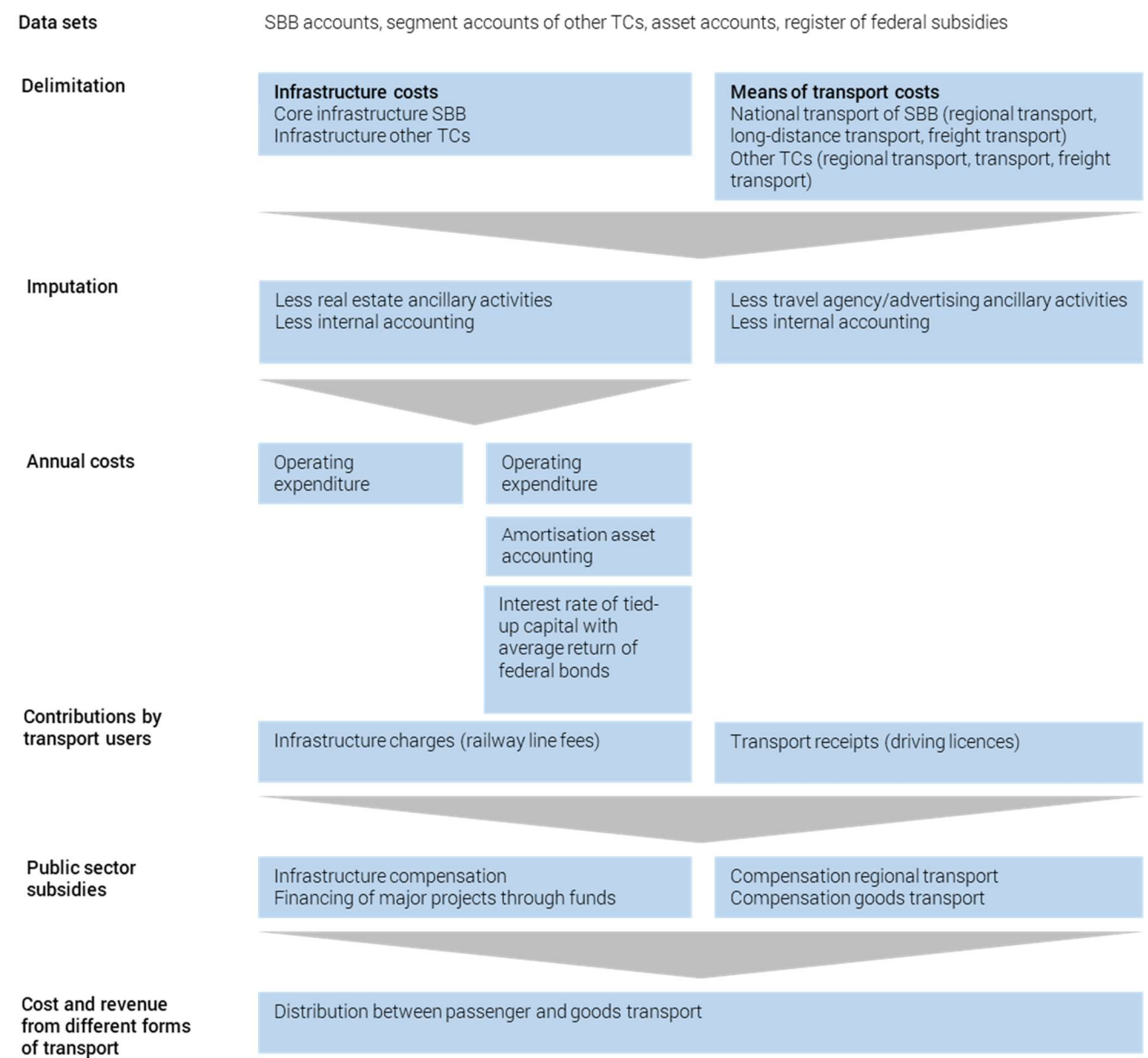
**Rail transport companies included
in the 2015 CFT statistics**

T 14

Name of transport company	Abbreviation
Aare Seeland Mobil	asm
Appenzeller Bahnen	AB
BDWM-Transport AG	BDWM
Berner Oberland-Bahnen	BOB
BLM Lauterbrunnen-Mürren	BML
BLS Cargo AG	BLS-Cargo
BLS Lötschbergbahn (inkl. BLS-Netz AG)	BLS
Chemin de fer Lausanne - Echallens - Bercher	LEB
Chemin de fer Montreux - Oberland Bernois	MOB
Chemin de fer Nyon - St-Cergue - Morez	NStCM
Chemins de fer du Jura	CJ
Crossrail	CROSS
DB Cargo Deutschland	DBCDE
DB Cargo Schweiz	DBCCH
Deutsche Bahn Regio	DBRE
Deutsche Eisenbahn-Infrastruktur in der Schweiz	DICH
Ferrovie Autolinee Regionali Ticinesi	FART
Ferrovie Luganesi	FLP
Forchbahn	FB
Frauenfeld - Wil-Bahn	FW
Hafenbahn Schweiz	HBS
Matterhorn Gotthard Bahn (inkl. Matterhorn Gotthard Infrastruktur)	MGB
Meiringen-Innertkirchen-Bahn (Kraftwerke Oberhasli AG)	MIB
Oensingen - Balsthal-Bahn	OeBB
Railcare	RLC
Regionalverkehr Bern - Solothurn	RBS
Rhätische Bahn	RhB
Schweizerische Bundesbahnen (und Tochtergesellschaften)	SBB
Schweizerische Südostbahn	SOB
Sihltal Zürich Uetliberg Bahn	SZU
Sursee - Triengen-Bahn	ST
Swiss Rail Traffic	SRTAG
TR Trans Rail	TR
Transalpin Eisenbahn AG (vormals Rail4 Chem)	TAE
Transports de Martigny et Régions	TMR
Transports Montreux-Vevey-Riviera	MVR
Transports Morges - Bière - Cossonay	MBC
Transports publics du Chablais	TPC
Transports publics fribourgeois (inkl. TPF infrastructure)	TPF
Transports Publics Neuchâtelois (transN)	TRN
Transports Vallée de Joux / Yverdon-les-Bains Ste-Croix	TRAVYS
TX Logistik	TXLCH
Waldenburgerbahn	WB
Wynental- und Suhrentalbahn	WSB

Source: FSO – Costs and funding of transport statistics (CFT)

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Rail transport: Methodological procedure**F 8**

Source: FSO – Costs and funding of transport statistics (CFT)

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4.4.2 Calculation procedure**1. Differentiation and allocation**

Calculations begin with the railways' key infrastructures. These are the railway lines and facilities for passengers (including platforms and stairways to the railway lines, waiting rooms, the station approach but excluding buildings) and sidings. Private connection lines for goods transport are also included as are terminals provided they are owned by the transport companies listed.

In line with the basic principles of the CFT statistics (see Chapter 3), ancillary activities are not included unless they serve to cover a specific loss from the transport company's point of view. For this reason, an imputed amount has been taken into account from the ancillary activities of Swiss Federal Railways (SBB) to cover cargo losses in 2015.

2. Cost calculation

Information from the transport companies comes from the best-estimate assumptions which, pursuant to the DETEC Ordinance on Accounting in Licensed Enterprises (ALEO of 18.1.2011), have

to be sent periodically to the Confederation. In particular the operational and results accounts, the asset accounts and details of ancillary income and activities have to be reported. Based on the segment accounts, information for infrastructure, passengers and goods transport are shown separately. The main cost pools are:

- **Running costs** (staff and material costs): These are taken directly from the segment accounts. Energy costs are included in infrastructure costs (as part of infrastructure charges).
- **Depreciation:** The depreciation rates of railway companies are determined by the ALEO rates (appendix). They are taken from the segment accounts and completed for those investments that do not appear in the asset accounts, in particular the Alpine tunnels (Lötschberg-Scheiteltunnel, Albula, Vereina) and major projects (Bahn 2000, HGV-Anschluss and NRLA).³
- **Interest:** Based on the asset accounts and the activation of the Alpine tunnels, the entire asset value (value when new less depreciation) is calculated separately by infrastructure (8 asset groups) and transport (3 asset groups). A uniform interest rate is derived from this value (similar to the road accounts with the cost rate of federal bonds (2015: 3.3%)). This value replaces the interest rates cited in the individual segment accounts.

The internal calculations (amongst others) between infrastructure and transport) are eliminated.

3. Distribution between passenger and goods transport

The distribution takes place in several stages using direct allocation and ratios:

- **Means of transport:** The transport costs are allocated directly, on the basis of the segment accounts.
- **Infrastructure:** Fixed costs are assigned based on train-kilometres. Various ratios are applied to variable costs: Train service costs by train-kilometre; maintenance costs by gross tonne-kilometre; energy costs by hypothetical energy consumption values.

4. Financing

Direct cost bearers: For the direct cost bearers, the cost categories are assigned to those stakeholders who directly assumed those costs:

- Infrastructure costs are mostly incurred by the transport companies. The public sector assumes the economic additional costs (imputed interest and additional costs for non-active investments)
- Infrastructure costs are mostly incurred by the transport companies. The public sector bears imputed interest.

Final cost bearers: The transfers to calculate the final cost bearers are comprised of the following:

- **Contributions by transport users:** Infrastructure charges based on the railway line price system (charges specified by the FOT). These are then in turn deducted on the cost side of the EVU, to eliminate internal accounting.
- **Transport income:** Income from the sale of tickets and other transport services (e.g. trips)
- **Public sector subsidies:**
 - *Infrastructure contributions* according to the segment accounts and the service agreements with the major railway companies (SBB, BLS-Infrastruktur)
 - *Regional transport subsidies* according to the Railways Payments Ordinance (RailPO 1.1.2010) (Confederation, cantons and communes).
 - *Goods transport subsidies* according to the Ordinance on the promotion of goods transport (BGfV of 4.11.2009).

4.5 Aviation

4.5.1 Planning and the required data sets

The planning basis for establishing the costs and funding of human-powered mobility comes from the pilot study "Integration of aviation into the transport accounts" (Infras, Ecoplan 2012). In line with the differentiation in the CFT statistics (Chapter 3.1), only transport activities on the aviation infrastructure on which transport open to the public (i.e. scheduled and charter flights) takes place, are included. This means that in the CFT statistics, scheduled and charter flights (incl. belly freight) at national and regional airports are taken into account but not aviation at airfields, heliports, mountain landing sites or off-field landings, e.g. by helicopters.⁴ Other general aviation as well as air freight transport with cargo planes should, according to the differentiation, also be included in the CFT statistics, but due to a lack of data these cannot be calculated to a reliable degree. Therefore, for general aviation only a rough estimate can be made based on financial data from companies domiciled in Switzerland. Due to the small sample, however, the findings are not statistically robust. No reliable information on costs could be obtained for goods transport in cargo planes. However, in 2015, over 99% of air freight volume was covered by belly freight, which is already contained in the costs of scheduled and charter flights. Due to the problem of differential costs it was decided not to distinguish belly freight business from the costs of passenger transport in scheduled and charter flights.

³ Rail systems (rail and security installations) are active in the asset accounts. Costs for land acquisition and excavation are not, however.

⁴ For this reason all flight movements that take place on national and regional airport infrastructure are taken into account in the CFT statistics. i.e. in addition to scheduled and charter flights also general aviation including helicopter flights.

Military aviation does not form part of the CFT statistics either. Air traffic at Basel national airport on the other hand is counted in its entirety, although it is on French soil.

Whereas the CFT statistics for road and rail transport are established on the basis of the territoriality principle, for aviation (and inland waterways transport) the **halfway point principle** is applied, as it is better suited to the characteristics of aviation (see also Chapter 3.1). With the halfway point principle, domestic transport in Switzerland is covered completely, for flights from or to abroad however, only half of the trip is counted. The halfway point principle ensures that the costs of international aviation are also taken into account (especially the airlines' costs and environmental costs). This is because one of the key questions concerning the CFT accounts is compliance with the polluter pays principle. For this reason all costs incurred must be allocated to a country. But in aviation a large part of transport takes place above international waters and cannot be assigned to a particular country according to the territoriality principle. Furthermore, the kilometre costs would be distorted using the territoriality principle as relatively high costs are incurred at take-off and landing (e.g. the entire infrastructure). To break these down into the short distance up to (or after) the national boundary would distort or inflate the kilometre costs of aviation.

To establish the costs and funding of aviation the following cost areas are used.

- **Means of transport costs:** The transport companies' costs, i.e. the total costs of airlines (without ancillary activities).
- **Infrastructure costs:**
 - Airports: Costs of airport and airfield operators (national and regional airports)
 - Air traffic control: Costs of the national air traffic control company (Skyguide)

With regard to the funding of costs, a distinction is made for all modes of transport between direct and final cost bearers (and for transfer payments between direct and final cost bearers).

Direct cost bearers: To establish the direct cost bearer, it is important to know who bore the costs directly when they were generated. For aviation, the various costs are funded by the following direct cost bearers:

- **Infrastructure costs:** These are covered almost exclusively by the transport companies. Official security costs (e.g. additional

police) are an exception in that they are borne directly by the public sector.

- **Means of transport costs:** These costs are funded directly and completely by the transport companies.
- **Accident costs** are funded by the four following direct cost bearers: Transport companies (damage to property), transport users (a large part of casualties: privately borne accidental costs), as well as external accident costs borne by the general public (e.g. net production loss and social insurance costs) and the public sector (e.g. hospital deficits).
- **Environment/health costs:** These are covered almost exclusively by the general public. A very small part of the costs is borne by the public sector (hospital costs as a result of damage to health).

Final cost bearer / transfer payments: In aviation the following transfer payments are made from direct to final cost bearers:

- **Transport users → transport companies:** Scheduled and charter flights: Transport charges from tickets and airport taxes
- **Transport companies → general public:** Internalisation contributions (noise and emissions-related charges).
- **Transport companies → public sector:** Mineral oil tax (however only for domestic flights, as international aviation is exempt from mineral oil tax).
- **Public sector → transport companies:** Public sector contributions to international civil aviation organisations and for international air traffic control.

Airport charges (charges for using infrastructure) paid by the airlines to the airport operators and fees paid by the aeroplane operators to air traffic control services are internal settlements only and do not therefore constitute additional costs in the CFT statistics.

The main data set for aviation is the Survey on the airlines' financial data undertaken by the International Civil Aviation Organisation (ICAO). While a full survey was conducted of national and regional airports and air traffic control, the financial data of airlines had to be estimated using flight service data from the Federal Office of Civil Aviation (FOCA). Aircraft were divided into two weight categories (</>150t) to distinguish between short and long haul flights.

Data sets for the costs and funding of aviation

T 15

Cost categories	Data set	
Means of transport costs	Scheduled and charter carriers	Sample of financial expenditure by airlines with flights from or to Switzerland (ICAO database), estimate based on data on transport performance (full survey) from FOCA. To make the estimate, a distinction is made between aircraft under 150t and over 150t.
Infrastructure costs	National airports	Full survey of the three national airports.
	Regional airports	In principle a full survey of all 10 regional airports with scheduled and charter traffic.
	Air traffic control	Exhaustive survey: Skyguide

Source: FSO – Costs and funding of transport statistics (CFT)

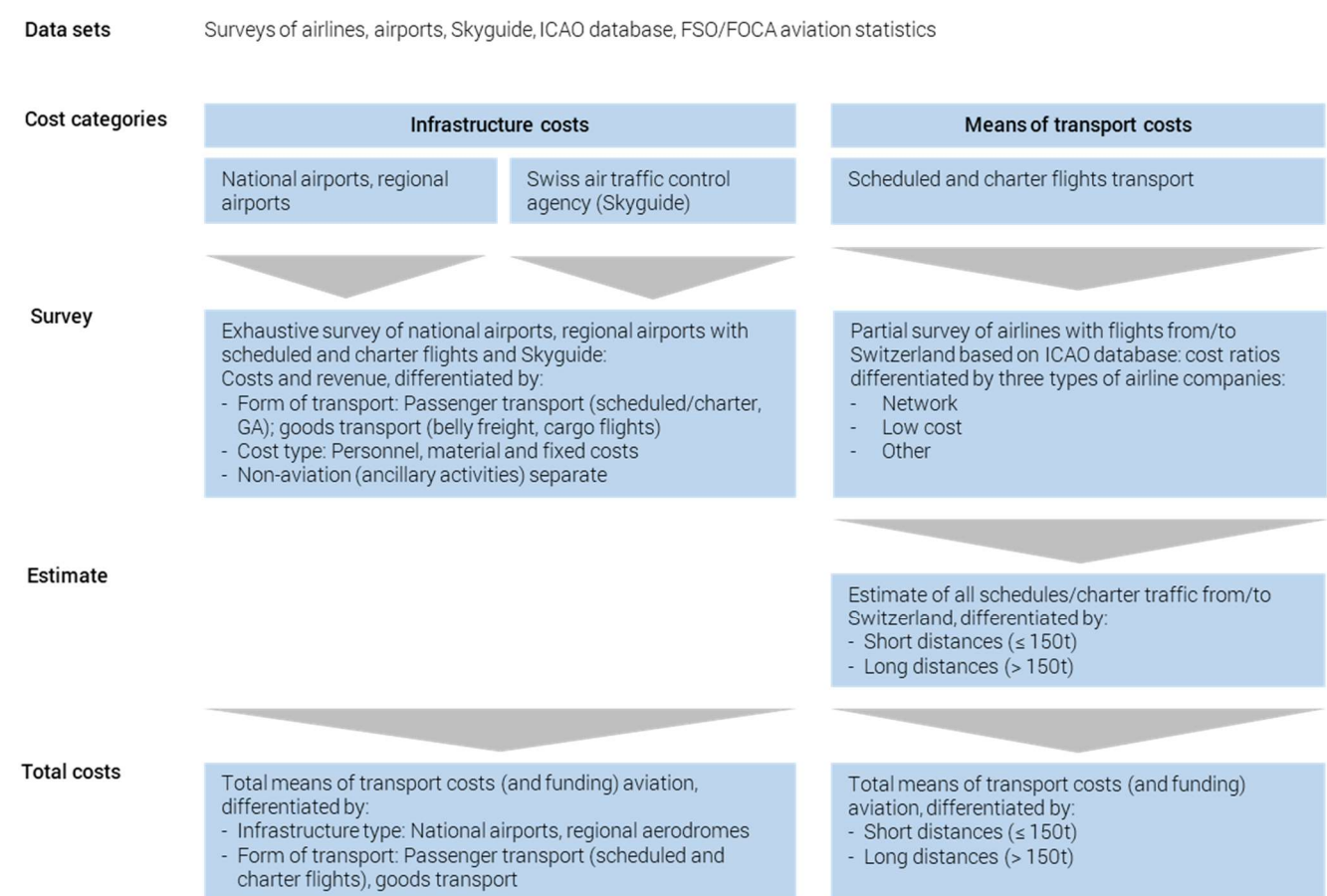
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4.5.2 Calculation procedure

The following figure shows the procedure for calculating the infrastructure and means of transport costs (operational costs) of aviation.

Costs and funding of aviation: Procedure and bases

F 9



Source: FSO – Costs and funding of transport statistics (CFT)

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1. Establishing national airport infrastructure costs

- Survey of all three national airports (full survey): Data on costs and income differentiated by form of transport (passenger or goods transport) and type of cost (staff, material, depreciation, interest etc.)

2. Establishing air traffic control infrastructure costs

- Skyguide survey (air traffic control): Data on costs and income differentiated by form of transport (passenger or goods transport) and type of cost (staff, material, depreciation, interest etc.).

3. Establishing regional airport infrastructure costs

- Survey of regional airports (full survey, although data delivery partially incomplete): Data on costs and income differentiated by form of transport (passenger or goods transport) and type of cost (staff, material, depreciation, interest etc.).
- Missing regional airport data estimated on basis of:
 - Specific average rates for costs and income per flight movement
 - Number of flight movements (source: FOCA annual statistics)

4. Establishing means of transport costs for scheduled and charter flights

- Analysis of financial data of scheduled and charter airlines with flights from/to Switzerland (source: ICAO databank; partial survey): Cost information, differentiated by type of airline (network, low-cost, others) and flying distance (derived from aircraft weight: <150t / >150t)
- Missing data from scheduled and charter flights estimated on basis of:
 - specific average rates for costs and income per flight-km
 - flight-kilometre (source: FOCA annual statistics)

5. Aggregation of all data on infrastructure and means of transport

- Total costs of aviation infrastructure (airports and air traffic control), differentiated by type of infrastructure and form of transport.
- Total means of transport costs in aviation (scheduled and charter flights and general aviation), differentiated by type of infrastructure and form of transport.

4.6 Inland waterways transport

4.6.1 Conceptual framework

Differentiation at content level

According to the definition of content differentiation (Chapter 3.1.2), for the mode of transport "inland waterways transport", the CFT statistics include public passenger vessels on Swiss lakes and rivers as well as goods transport on inland waterways.

With regard to **public passenger vessels**, only passenger transport by water provided and timetabled by licensed transport companies is recorded. Trips with no fixed timetable (e.g. cruises on the Rhine or privately organised trips for social events) should, in principle, not be included. With special trips, however, it is difficult to make a differentiation. In addition to private special trips (charter trips) there are also trips that complete the standard timetable (e.g. on holidays) as well as event trips (mostly included in timetables). In the company accounts it is almost impossible to differentiate the extra trips from other transport and even more difficult to distinguish between different types of extra trips. Due to the difficulty in differentiating trips, extra trips are taken into account in the CFT statistics.

Private passenger vessels (private motor and sailing boats) are not included, according to the differentiation definition (Chapter 3.1.2). The definition states that transport on infrastructure (in this case port installations) that are used predominantly for leisure transport, are excluded.

For **goods transport** on inland waterways, only transport on the Rhine is included. **Goods transport** also takes place, however, on Swiss lakes. Nevertheless, this is usually the transport of gravel and sand that are removed from the lake bed to be processed on the lakeshore. As part of the planning work to integrate inland waterways transport into the CFT accounts, the social costs for goods transport on Swiss lakes were estimated at CHF 34 million. This means that the costs for transport on lakes are below the threshold of CHF 100 established in Chapter 3.1.2.

Spatial differentiation

In contrast to road and rail transport, the CFT statistics use the **halfway point principle** for aviation and goods transport on the Rhine instead of the territoriality principle (transport on Swiss national territory). This means that the costs for transport originating or terminating in Switzerland are attributed half to Switzerland and half abroad. The reason for this exception is the international character of inland waterways transport. As for aviation, it makes no sense to record goods transport on the basis of the territoriality principle (up to the Swiss national border). The distance between Basel and the national border (or the reverse) makes up only a fraction of the total distance covered. According to the territoriality principle, apart from infrastructure costs, almost no other costs would be incurred. This would greatly distort the validity of the CFT statistics.

For public vessels, the results according to the halfway point principle and the territoriality principle are more or less identical. Transborder transport (e.g. Lake Geneva or Lake Constance) is an exception. Moreover, the national border is usually at the halfway point of transborder transport (in the middle of the lake). The question of which principle should be applied is therefore irrelevant in this case.

Periodicity

The mode of transport "inland waterways transport" was first included in the CFT statistics for the reference year 2015. Updates are planned at five-yearly intervals.

Further information

The final report of the externally commissioned "Integration of inland waterways transport in the 2015 CFT statistics" (Infras and Planco 2017) offers detailed information on the methodology that goes beyond the descriptions in this methodology report.

4.6.2 Public passenger transport

Data sets

The basis for the majority of calculations is a survey of the financial data of licensed passenger transport companies. This is a partial survey divided into three size categories. While all companies belonging to the largest size category are surveyed, a sample survey is made of the other two categories.

Infrastructure costs

Roughly 70% of the public passenger vessel quays used belong to the public sector and 30% to transport companies. The ownership structure can be deduced by combining public transport statistics with survey data. Four types of quay have been differentiated with varying cost characteristics: landing stages for car ferries, river wharves, large, traditional wharves and small traditional wharves. The annual costs for each type are known from the survey of companies. The infrastructure costs are acquired in part from the survey findings. The remainder, for those quays not included in the sample survey, is calculated by multiplying the costs (number of quays + cost rate).

Means of transport costs

The means of transport costs are calculated based on the survey findings and on an estimate for companies not included in the survey. Costs per ship-kilometre are used as a ratio to estimate figures for companies not included in the survey.

The greatest challenge, however, lies in extracting the means of transport costs from the company data. In the transport companies' financial data, it is often difficult to separate expenditure on transport operations from on-board catering. A prime example is an employee who works as a sailor when mooring and casting off but who is engaged in catering services during the journey. Two different business models have been identified in order to exclude catering.

1. Catering run by a subsidiary or external partner

No adjustment required.

2. Catering run by transport enterprise

The company is asked to provide personnel and merchandise costs which are deducted from total costs.

Financing

Direct cost bearers

As direct cost bearers, the public sector and transport companies assume the infrastructure costs. The means of transport costs are initially borne completely by the transport companies.

Transfer payments

The payments listed in Table 16 are used to calculate the final cost bearers.

Main transfer payments in public passenger transport

T 16

Transfer payments	from → to	Amount in 2015
Tickets, season tickets and transport fees	Transport users → TC	CHF 132.7m
Public sector subsidies	Public sector → TC	CHF 29.9m
CO ₂ compensation (Klik Foundation)	TC → general public	CHF 0.5m

Source: FSO – Costs and funding of transport statistics (CFT)

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The largest transfers by far as the transport charges (tickets and seasons tickets, etc.). Regional transport subsidies paid by the public sector to the transport companies (TC) play a secondary role because there are only a few lines that connect to other public transport thus making them eligible for subsidies.

4.6.3 Goods transport on the river Rhine

Conceptual foundations

Efforts were already being made to incorporate inland waterways goods transport into the 2010 CFT statistics. However, a pilot survey of inland waterways transport operators domiciled in Switzerland did not result in a sufficiently large database. On one hand, the response rate was too low, and on the other, representative statistical reliability on the basis of only Swiss companies proved to be impossible.

A reliable methodology has been in place from the reference year 2015. The model accounts used are largely based on the methodology of the German Federal Transport Infrastructure Plan 2030 (PTV Group, TCI Rähling, Hans-Ulrich Mann 2016).

Infrastructure costs

The infrastructure costs of goods transport on the Rhine comprise three cost components: Port costs, lock costs and costs for waterway maintenance.

Port costs

The Swiss section of the Rhine navigable for goods transport is only a few kilometres long. With the exception of a few private wharves for goods transport, all ports are run by a single port operator. The "Port of Switzerland" runs the three ports at Kleinhüngen, Birsfelden and Muttenz ("Auhafen").

The areas (excluding ancillary activities) relevant to the CFT statistics can be taken directly from the Port of Switzerland's segment profit and loss accounts. They form by far the largest part of port costs. In addition, annual costs are imputed for the privately run transshipment stations in Switzerland.

The costs for ports abroad are not included. According to the halfway point principle only costs incurred on the section closest to Switzerland have to be taken into account.

Costs for locks

International contracts grant ships on the Rhine free access to the river as far as Basel. This also includes the locks that are generally funded by the public sector (German or French state).

The ten locks relevant to traffic in and out of Switzerland all lie in a section between Karlsruhe and Basel. They are mostly found alongside weirs built to generate electricity. One could argue that the lock costs should not be borne by users of inland waterways but rather by the hydroelectricity power plant operators. For the Karlsruhe-Basel section, however, this is not the case. Before the weirs were built, this section of the Rhine (and the Grand Canal of Alsace connected to it) was unnavigable for larger freight ships due to its gradient. The lock costs are thus assigned to the inland waterways transport.

The costs per passage of a freight ship are known for the ten locks concerned from case studies or expert estimates. Lock costs can be obtained by multiplying the number of passages (freight ships to or from Switzerland) by the relative cost rates.

Costs of maintaining the waterways

As costs are recorded according to the halfway point principle, the partial costs for waterways abroad also have to be taken into account. The Grand Canal of Alsace is relevant for transport to and from Basel. It starts about five kilometres below Basel and is 53 kilometres long. According to the halfway point principle, the infrastructure costs of the canal for all traffic must be counted in full for distances of 110 km or more. As the share of transports with a shorter distance is negligible, the costs therefore have to be counted in full for the CFT statistics.

As construction of the canal was finished in 1961, these costs no longer have to be taken into account. For similar investments for other modes of transport, an amortization period of 40 years is calculated. As far as the CFT statistics (inland waterways transport from reference year 2015) are concerned, therefore, depreciation costs no longer have to be considered.

For the maintenance of waterways costs are incurred in particular for dredging shipping lanes. In order to calculate these maintenance costs, well-known cost rates per waterway-kilometre can be applied. By multiplying the kilometre cost rate by the length of the canal, only an adjustment has to be made to eliminate the costs for passenger transport and for transport without a destination in Switzerland. This elimination follows the same procedure as that for lock costs.

Cargo handling costs

The costs of handling goods, i.e. unloading from ship to rail or road are not included in the CFT statistics. Although it would be possible to calculate these costs for inland waterways transport, for the other modes of transport it is difficult to calculate the costs of loading and unloading and for that reason they are omitted. As the comparability of results across the different modes of transport is of the highest importance, loading costs are not calculated for inland waterways transport either.

Means of transport costs

Means of transport costs are calculated on the basis of a detailed model account that distinguishes between three cost components: Cost of providing equipment, personnel costs and other operational costs.

The basis for calculating all three cost components is a comprehensive quantity structure, compiled from a combination of

data from the Port of Switzerland and the German Federal Statistical Office (DESTATIS). The most important variable in the quantity structure is the number of journeys. It is available by route, type of vessel, category of vessel size and load (full/empty).

Tables could also be accessed that show the distance and travel time for each route. The calculation was able to take place by combining various cost rates (value structure) with the statistical data. Table 17 provides an overview of how the calculation of the individual cost components is done.

The port charges paid by shipping companies have purposely been omitted from the means of transport costs. These are considered (as for the infrastructure charges in rail transport) to be an "internal settlement" between the means of transport operator and the infrastructure operator. As the costs have already been entered in the port operator's accounts, including them again in the shipping operators' accounts would mean they were accounted for twice.

Cost components of means of transport costs of goods transport on the Rhine

T 17

Cost component	Methodological approach	2015 costs
Cost of providing equipment Depreciation, interest, management costs and repairs	The costs of providing equipment are estimated by means of hourly rates for ships. A distinction is made between four types of ships and 9 categories of ship size. The provision of equipment costs are the result of multiplying the hourly ship rates and journey time.	CHF 45.7m
Personnel costs Wages and additional wage costs	Personnel costs are estimated by means of hourly rates for ships. The type of crew (number of ship masters, helmsmen, sailors and engineers, etc.) required by law are taken into account for each combination of ship type and size category. The personnel costs are the result of multiplying the hourly ship rates and journey time.	CHF 25.4m
Other operating costs especially fuel costs	Calculations are based on comprehensive tables that detail the hourly energy consumption and thus the fuel costs for all relevant routes (e.g. Rotterdam-Basel). Other operating costs are the result of multiplying the hourly ship rates and journey time.	CHF 10.1m

Source: FSO – Costs and funding of transport statistics (CFT)

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Financing

Direct cost bearers

As a direct cost bearer, the public sector (German and French states) assumes the infrastructure costs for locks and the maintenance costs for waterways. The port costs and all means of transport costs are assumed by the transport companies.

Transfer payments

The payments listed in Table 18 are used to calculate the final cost bearers.

Transfer payments relevant to freight inland waterways transport on the Rhine T 18

Transfer payments	from → to	Amount in 2015
Transport charges:	Transport users → TC	CHF 88.2m
CO ₂ compensation (Klik Foundation)	TC → general public	CHF 0.4m

Source: FSO – Costs and funding of transport statistics (CFT)

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5 Accident, environmental and health costs

5.1 Main methodological elements and definitions

Calculations of external costs concentrate on **the effects of accidents and the impact on the environment and health**. The most important methodological definitions are summarised below (based on the Ecoplan, Infrastat 2014).

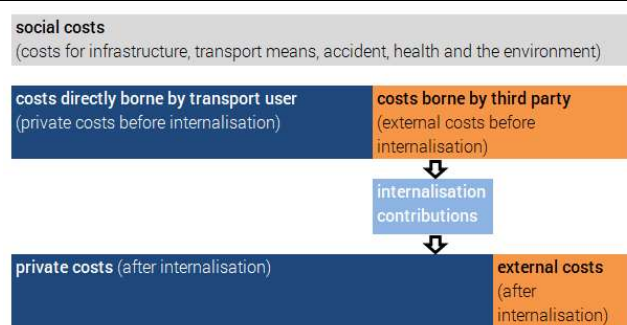
In the calculation of the accident, environmental and health costs, a distinction can be made between the social and external costs (see Figure 10):

- The **social (or economic) costs** of transport include the costs for society that are caused by transport activity. They are composed of both private and external costs.
- The **private costs** (sometimes also referred to as "internal costs") are the costs that transport users cover themselves such as self-borne accident costs (e.g. motor vehicle third party liability premiums) or through internalisation contributions to costs borne (e.g. HGVC).
- The share of the social costs that are not covered by the causes of a transport activity are referred to as **external costs**. A typical example is the noise caused by the transport activity that is not reflected in the price for the journey. The external costs correspond to the social costs minus the private costs.

On the cost side, the total social accident, environmental and health costs are shown in the CFT statistics. The private, i.e. self-borne costs are immediately imputed to transport users (as the direct cost bearers). **Internalisation contributions** such as parts of the HGVC are considered in the CFT statistics as a transfer payment between transport users and the general public. Through the internalisation, transport users cover another share of the total accident, environmental and health costs as the final cost bearer. The remaining accident and environmental costs are the external costs and these are borne by the general public (and in some cases by the state).

Interlinkage between private, external and social costs

F 10



Source: FSO – Costs and funding of transport statistics (CFT)

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5.2 Procedure and bases

The latest calculation of the external effects of transport concentrates on determining external costs in twelve selected cost areas (Ecoplan, Infrastat 2018). In principle, the costs are calculated according to the "at least principle". This means that the underlying assumptions are rather conservative in the event of any doubt. The latest scientific methods are applied to evaluate damage from accidents and to the environment and health. These include the avoidance cost approach, the repair and replacement cost approach and consideration of willingness to pay studies. The latter are particularly important for the evaluation of **immaterial costs**. These are costs that are generally not based on any cash flows and as a result they cannot be determined from market prices. The table below shows the main methodological elements and the calculation methods by cost centre.

Calculation method for accident, environmental and health costs by cost centre

T 19

Cost centre	Methodological approach
Health costs through air pollution	Medical treatment costs, net production loss, reoccupation costs, immaterial costs resulting from a reduction in life expectancy and illness (all cost of damages).
Damage to buildings through air pollution	a) Costs for additional renovations (transport-exposed sites); b) Costs through reduced lifespan of façades (non-transport exposed sites); c) Extra cleaning costs (all cost of damages)
Harvest failures through air pollution	Reduction of agricultural yields due to ozone levels (cost of damages)
Damage to forests through air pollution	a) Reduction of timber yields due to ozone levels; b) Reduction of timber yields due to soil acidification; c) Costs due to increased windfall as the result of soil acidification (all cost of damages)
Loss of biodiversity through air pollution	Costs for (virtual) measures to restore diverse ecosystems (replacement cost approach)
Noise	Disturbance (through a decrease in rental prices) and health costs (comparable with damage to health from air pollution – all cost of damages)
Climate	Costs for preventive measures to achieve long-term global climate targets (avoidance cost approach)
Nature and landscape	Replacement cost approach: a) Loss of habitats: Costs for the (virtual) restoration of lost biotope and ecosystem areas (habitats) b) Habitat fragmentation: Costs for the (virtual) construction of defragmentation structures
Soil damage through toxic substances	Costs for the (virtual) decontamination of soil damaged by toxic substances (repair approach)
Costs of upstream and downstream processes	Climate and air pollution costs for the manufacture, maintenance and disposal of vehicles (means of transport), energy carriers (fuels, electricity) and infrastructure
Accidents	<ul style="list-style-type: none"> - Extrapolation of the number of road accidents with casualties based on an <i>estimate</i> of the number of accidents not recorded by the police + special evaluation of sport and leisure accidents on human-powered transport infrastructure (source: Swiss Competence Centre for Accident Prevention, bfu); - Application of the <i>"polluter pays" principle</i>: Costs are imputed to the responsible form of transport - Evaluation of material costs (medical treatment costs, net production loss, reoccupation costs, administrative costs, damage to property, police and legal costs) and the immaterial costs of accidents (loss of years of life, suffering)
Additional costs in urban areas	a) Time costs due to spatial separation effects for human-powered mobility (cost of damages); b) Negative impact on built heritage and amenity value: costs for the evaluation of heavily used main through roads (repair costs)

Source: ARE – External effects of transport, FSO – Costs and funding of transport statistics (CFT)

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With one exception, the benefits of transport which are undoubtedly vast and predominantly internal are not the subject of the most recent study on the external effects of transport (Ecoplan, Infrastat 2018). Only in the case of human-powered mobility were the internal and external benefits for Switzerland calculated for the first time (longer life expectancy and fewer hospital admissions thanks to physical activity – calculated using the same methodology as for damage to health through air pollution). Other areas of benefit were not considered in the latest calculations on the external effects of transport (for further details see Ecoplan, Infrastat 2014, p. 97 ff.).

Table 20 shows the main methodological elements and data sets for the quantification, dose-effect ratio (payload) and monetisation of the external effects for the most relevant cost centres. All details on the procedure and data sources for all cost areas can be found in the current study on the external effects of transport (Ecoplan, Infrastat 2018).

Main methodological elements and data sets

T 20

Cost centre	Quantification and exposure-effect ratio	Monetisation
Health costs through air pollution	<ul style="list-style-type: none"> - Main pollutant: PM10 - Population weighted PM10 emission concentrations, by vehicle category and age class (source: emission modelling, population land register, FSO) - Exposure-effect ratio: PM10 emissions → risk of illness (epidemiological studies) - Frequency of illness (FSO) 	<p>Cost rates per illness or lost year of life:</p> <ul style="list-style-type: none"> - Medical treatment costs - Net production loss - Reoccupation costs - Immaterial costs based on average of the OECD countries (Value of statistical life, VOSL): 2015 figure used: CHF 6.5 million (OECD 2012)
Damage to buildings through air pollution	<ul style="list-style-type: none"> - Main pollutant: PM10: PM10 emissions by vehicle category and area type (source: emission modelling) - Façade surface (by façade type): Wüest & Partner building database - Exposure-effect ratio: <ul style="list-style-type: none"> - PM10 emissions → renovation cycle - PM10 emissions → façade lifespan - PM10 emissions → cleaning outlay (cleaning frequency) 	<ul style="list-style-type: none"> - Cost rate façade renovation (survey) - Construction costs for building cover (Wüest & Parnter) - Cleaning costs (survey)
Noise	<p>A) Pollution:</p> <ul style="list-style-type: none"> - Noise pollution: Number of dwellings impacted by noise per decibel class and vehicle category (SonBase) - Exposure-effect ratio: Noise pollution → decrease in rental prices (ZKB studies) <p>b) Damage to health:</p> <ul style="list-style-type: none"> - Noise pollution: Number of persons impacted by noise per decibel class and vehicle category (SonBase) - Exposure-effect ratio: Noise pollution → risk of illness (epidemiological studies) - Frequency of illness (FSO) 	<p>A) Pollution:</p> <ul style="list-style-type: none"> - Rental prices: Rented and privately owned dwellings (FSO) <p>b) Damage to health:</p> <ul style="list-style-type: none"> - cost rates per illness or lost year of life: (medical treatment costs, net production loss, reoccupation costs, immaterial costs (Value of statistical life: VOSL)
Climate	<ul style="list-style-type: none"> - Greenhouse gas emissions (CO₂, N₂O, CH₄) by vehicle category (Sources: Switzerland's greenhouse gas inventory, Manual of emission factors for road transport, FOCA) 	<ul style="list-style-type: none"> - Avoidance costs: costs for preventive measures to achieve long-term global climate targets (2 level target) (Kuik et al. 2009) 2015 cost rate used: CHF 107 / t CO₂-equivalent - Sensitivity analysis with minimum and maximum value
Nature and landscape	<ul style="list-style-type: none"> - Length of transport infrastructure (differentiated by mode of transport, region, urban or extra urban) (GIS data) - Damaging functions (Econcept, Nateco): <ul style="list-style-type: none"> - Length of transport infrastructure → loss of habitats (by biotope types) - Length of transport infrastructure → number of fragmentations (by animal group) 	<ul style="list-style-type: none"> - Loss of habitats: Replacement costs per biotope area for the restoration of lost ecosystems (habitats) - Habitat fragmentation: Replacement costs for the construction of defragmentation structures <p>Source: Econcept, Nateco 2004</p>
Costs of upstream and downstream processes	<ul style="list-style-type: none"> - Energy: Energy consumption by vehicle category; emission factors for energy provision (fuels, electricity) (Ecoinvent) - Vehicles, means of transport: kilometre performance per vehicle category (FSO); emission factors for the manufacture, maintenance and disposal of vehicles (Ecoinvent) - Infrastructure: Infrastructure length (FSO); emission factors for the manufacture, maintenance and disposal of infrastructure (Ecoinvent) 	<ul style="list-style-type: none"> - Climate costs: CO₂ cost rate according to the global avoidance costs (see "Climate" above) - Air pollution costs: Cost rates per tonne of air pollutant for nitric oxide (NO_x), fine particles (PM10), sulphur dioxide (SO₂), volatile organic compounds (NMVOC) (source: EU project HEIMTSA)
Accidents	<ul style="list-style-type: none"> - Extrapolation of the number of road accidents with casualties based on an estimate of the number of accidents not recorded by the police, differentiated by vehicle category (source: Swiss Competence Centre for Accident Prevention, bfu) - In addition to transport accidents in human-powered mobility: special evaluation of sport and leisure accidents on foot and bicycle paths (source: bfu) - Application of the "polluter pays" principle: Costs are imputed to the responsible form of transport 	<ul style="list-style-type: none"> - Material accident costs through casualties: medical treatment costs, net production loss, reoccupation costs, administrative costs, damage to property - Immaterial costs through casualties: evaluation of casualties using the statistical value of a human life (Value of Statistical Life, VOSL) pursuant to the OECD (2012), grading by degree of injury (death, invalidity, severely, moderately or slightly injured) - Damage to property: damage per accident (liability insurance) - Police costs / legal costs: costs per accident (police and legal costs insurance data)

Information on the data sources is given in brackets

Source: ARE – External effects of transport; FSO – Costs and funding of transport statistics (CFT)

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6 Financial flow accounts

6.1 Concept

6.1.1 Objectives

The financial flow accounts complete the CFT statistics and present the main annual financial flows for the public sector (broken down by Confederation, cantons and communes) for road and rail. In contrast to the CFT statistics, they deal with annual public sector revenue and expenditure as shown in the financial statistics of the Confederation, the cantons and communes. Key to the accounts is the following distinction:

- **Source of funds:** Source of financial flows: Public sector revenue (from transport users or from other sources);
- **Use of funds:** Public sector expenditure, for transport purposes, directly or by means of a transport company.

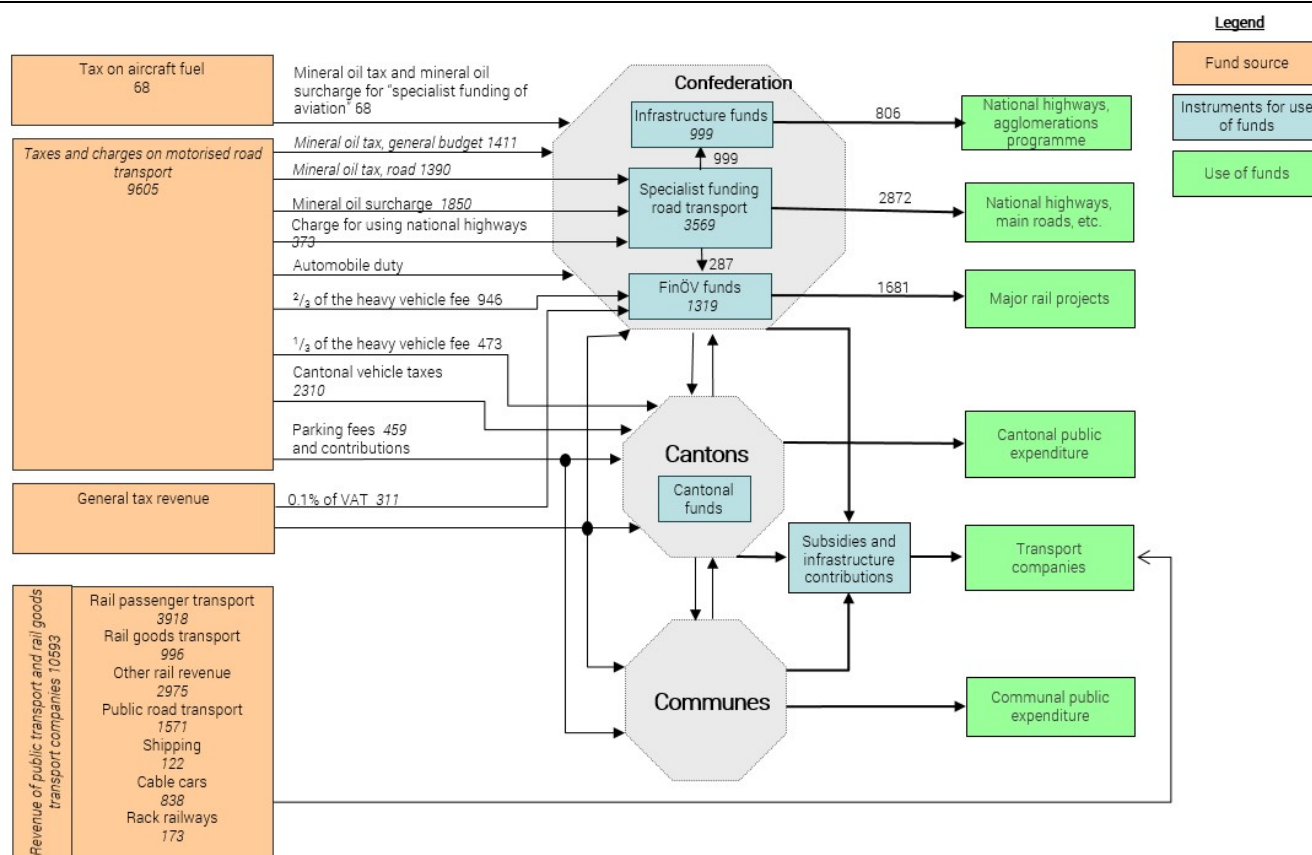
Instruments for use of funds: Special financing and funding solutions for individual transport purposes: Special financing in road transport, infrastructure funds, rail infrastructure funds (BIF), cantonal funds for road transport, public transport or transport in general, transfers (to cantons or communes), infrastructure contributions and charges.

6.1.2 Findings

The findings of the financial flows are chiefly presented in graph form. Of particular interest are the net financial flows at the three official levels of the Confederation, the cantons and the communes.

Schematic representation of the key financial flows in transport in 2015 (in CHF million)

F 11



Source: FSO – Costs and funding of transport statistics (CFT)

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6.1.3 Differences from the CFT statistics

Method

The fundamental differences between the financial flow accounts and the CFT statistics are as follows:

- **Central idea:** The financial flow accounts adopt a financial policy approach, showing public sector revenue and expenditure. In contrast, the CFT statistics take a resources approach and ask what the costs are and who bears them. The accounts consider expenditure at the time of the monetary flow. With regard to investments, no depreciation is made over the entire useful life; they are immediately entered in the books wholly as expenditure.
 - The financial flow accounts are interested only in actual monetary financial flows.
- **Reference units:** The financial flow accounts consider only public sector monetary flows (Confederation, cantons and communes), whereas the CFT statistics involve all stakeholders

(transport users, public sector and the general public). In addition to the Confederation, cantons and communes, public transport companies are also included.

- The financial flow accounts look at the public sector annual balance of payments for transport.

The link between the two accounts is funding; the question of how the costs of transport are borne by the individual stakeholders (as a direct or final cost bearer). The different units are listed below.

Road infrastructure

The following table shows the similarities and differences between the financial flow accounts and the CFT statistics for road infrastructure.

Comparison of financial flow accounts and CFT statistics for road infrastructure

T 21

	Financial flow accounts	CFT statistics
Fund source Financial flow accounts	Taxes and charges on motorised road transport for the Confederation, cantons and communes	Transfer for the calculation of the final cost bearer: Transport user contributions to funding road structure
	General tax revenue	Transfer for the calculation of the final cost bearer: Contributions from the public sector in the form of subsidies to finance the operation and infrastructure of public road transport. Transfer for the calculation of the final cost bearer: Contributions from transport users in the form of indirect taxes to fund road infrastructure.
	Revenue of public road transport companies.	Transfer for the calculation of the final cost bearer: Contributions from road transport users on funding of infrastructure and means of transport.
Fund source Financial flow accounts	Confederation, cantonal and communal road expenditure (operation, maintenance and construction)	Costs (annual operation costs, depreciation and interest) for road infrastructure; calculation of direct cost bearers: Public sector funding
	Expenditure on conurbation programmes	Costs for private road transport, human-powered mobility and public road transport (tram, trolley-bus and bus); calculation of direct cost bearer: Public sector funding
	Subsidies for transport companies	Transfer for the calculation of the final cost bearer: Public sector contributions to public road transport companies

Source: FSO – Costs and funding of transport statistics (CFT)

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Rail and public road transport

The following table shows the similarities and differences between the financial flow accounts and the CFT statistics for rail public road transport.

Comparison of financial flow accounts and CFT statistics for rail and public road transport

T 22

	Financial flow accounts	CFT statistics
Fund source Financial flow accounts	General tax revenue	Transfer for the calculation of the final cost bearer: Contributions from the public sector in the form of subsidies to finance the operation and infrastructure of rail transport.
	Revenue of rail transport companies	Transfer for the calculation of the final cost bearer: Contributions from road transport users on funding of infrastructure and means of transport.
	Contributions from other transport users (rail infrastructure funds)	Transfer for the calculation of the final cost bearer: Contributions from the public sector in the form of subsidies to finance the construction, maintenance and infrastructure
Fund source Financial flow accounts	Subsidies for transport companies	Transfer for the calculation of the final cost bearer: Public sector contributions to transport companies for infrastructure and transport
	Expenditure on rail infrastructure funds	Depreciation and interest for rail infrastructure Calculation of the direct cost bearer: Public sector funding

Source: FSO – Costs and funding of transport statistics (CFT)

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6.2 Explanation of the individual components

6.2.1 Fund source

The following table shows the individual components and their sources. The revenue of the transport companies provides additional information. It does not flow into the fund source for the Confederation, cantons and communes.

Explanation of the individual components of fund use

T 23

Fund source	Components	Hierarchy and monetary flows	Source
Taxes and charges on motorised road transport (charges paid by transport users to the public sector) in road transport	Mineral oil tax	Confederation revenue at federal and cantonal level	FCA, net revenue T2.2
	Mineral oil surcharge	Confederation revenue at federal level	FCA, net revenue T2.2
	National highways	Confederation revenue at federal level	FFA, state financial accounts 2015, Vol. 2B
	Automobile duty	Confederation revenue at federal level	FFA, state financial accounts 2015, Vol. 2A
	Heavy vehicle fee	Confederation revenue 1/3 to cantons 2/3 to rail infrastructure	FFA, state financial accounts 2015, Vol. 2B
	Cantonal vehicle taxes	Cantonal revenue to cantons	FSO road accounts
	Parking fees	Communal revenue to communes	FSO road accounts
	Contributions from private individuals	Communal revenue to communes	FSO road accounts
General tax revenue	Valued added tax	VAT revenue to rail infrastructure funds (FinÖV 2010)	FFA, state financial accounts 2015
	Public contributions to transport	General tax revenue to transport companies	FSO, encyclopaedia, public transport statistics: Time series (T3)
Revenue of public transport and rail goods transport companies (transport user charges in public transport)	Railways	Transport companies' revenue from transport activities	FSO calculations of rail infrastructure/transport
	Rack railways	Transport companies' revenue from transport activities	FSO, Statistical Encyclopaedia of Switzerland, public transport statistics: Time series (T3)
	Public road transport	Transport companies' revenue from transport activities	FSO, Statistical Encyclopaedia of Switzerland, public transport statistics: Time series (T3)
	Cable cars	Transport companies' revenue from transport activities	FSO, Statistical Encyclopaedia of Switzerland, public transport statistics: Time series (T3)
	Inland waterways transport	Transport companies' revenue from transport activities	FSO, Statistical Encyclopaedia of Switzerland, public transport statistics: Time series (T3)

Source: FSO – Costs and funding of transport statistics (CFT)

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Instruments for use of funds

The following table shows the key instruments, their revenue, expenditure and data sets

Channels in the financial flow accounts

T 24

Channel	Revenue	Expenditure	Source
Infrastructure funds	<ul style="list-style-type: none"> - Original investment from the Special Fund for the Financing of Road Transport - Annual budgetary means 	<ul style="list-style-type: none"> - Completion of national highways network - Bottleneck relief on existing national highways network - Infrastructure for public and private conurbation transport - Maintenance of assets on main roads in mountain and peripheral regions. 	FFA, state financial accounts 2015, Vol. 4
Special Fund for the Financing of Road Transport	<ul style="list-style-type: none"> - Mineral oil tax 50% - Mineral oil surcharge - Motorway tax sticker 	<ul style="list-style-type: none"> - National highways - Investments in infrastructure funds - Main roads - Contributions earmarked for roadworks - Contributions earmarked for other purposes - Research and management 	FFA, state financial accounts 2015, Vol. 3
Railway infrastructure funds RIF (2010: FinÖV funds)	<ul style="list-style-type: none"> - HGVC - Mineral oil tax - VAT - General federal funding - Cantonal contribution* - Commuter tax deduction* 	<ul style="list-style-type: none"> - Major rail projects - Running of infrastructure** - Extension** 	FFA, state financial accounts 2015, Vol. 4
Subsidy accounts	<ul style="list-style-type: none"> - Federal subsidies for regional transport and goods transport - Cantonal subsidies for regional transport - Communal public transport contributions 	<ul style="list-style-type: none"> - Contributions to transport companies 	FSO, Statistical Encyclopaedia of Switzerland, public transport statistics: Time series (T3)

* with rail infrastructure fund only since 2014 (not included in FinÖV funds)

** use extended to rail infrastructure funds in 2014, FinÖV limited to major projects

Source: FSO – Costs and funding of transport statistics (CFT)

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6.2.2 Use of funds

The following table shows the components of fund use.

Components of fund use

T 25

Channel	Expenditure	Source
National highways	- Expenditure on national highways' construction, operation and maintenance	FFA, state financial accounts 2015, Vol. 3
Conurbation programme	- Annual expenditure on conurbation infrastructure projects	FFA, state financial accounts 2015, Vol. 3
National highways, main roads, etc.	- Contributions to main roads - Contributions earmarked for roadworks - Contributions earmarked for other purposes - Research and management	FFA, state financial accounts 2015, Vol. 3
Major rail projects	- Annual expenditure on major projects - New (with BIF): annual expenditure on running rail infrastructure and expansion	FFA, state financial accounts 2015, Vol. 4
Cantonal transport expenditure	- Annual expenditure on cantonal road infrastructure - Annual contributions for public road and rail transport	FFA, Public finance statistics 2015
Transport companies	- Annual expenditure on major projects - New (with BIF): annual expenditure on running rail infrastructure and expansion	FFA, state financial accounts 2015, Vol. 3
Communal transport expenditure	- Annual expenditure on communal road infrastructure - Annual contributions for public road and rail transport	FFA, Public finance statistics

Source: FSO – Costs and funding of transport statistics (CFT)

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7 Interpretation aid for results

7.1 Presentation and interpretation of results

The main results of the CFT statistics are presented in two stages: the first stage presents the amount and origin of the costs, while the second stage explains how the costs are funded.

7.1.1 Presentation of costs

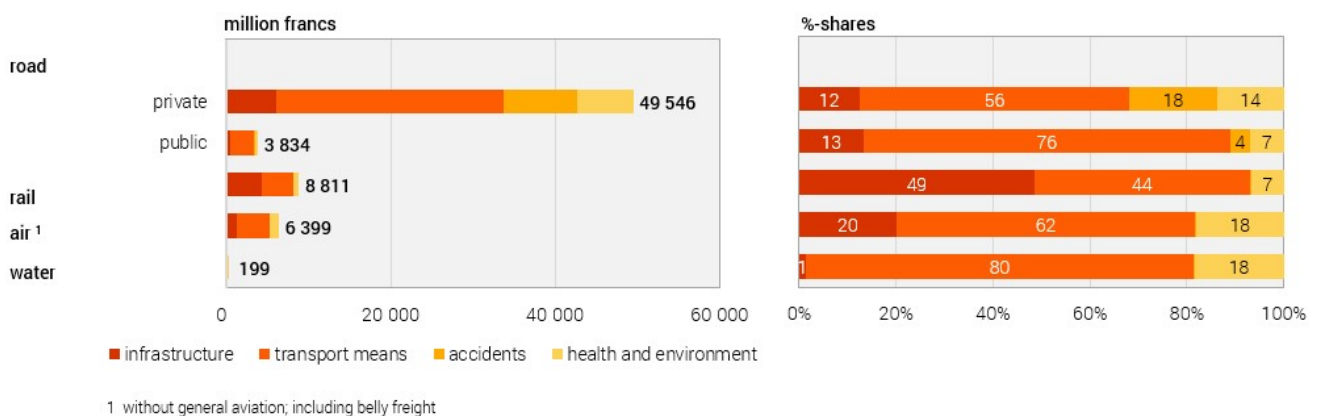
In the first step, the total annual costs of the relevant forms of transport are distinguished based on the four cost categories - infrastructure, means of transport, accidents, and the environ-

ment and health (see Chapter 4 in the CFT publication). For passenger transport, for instance, the costs of the five relevant forms of transport are shown: private motorised road transport, public road transport, human-powered mobility, rail transport and aviation.

By way of example, Figure 12 shows that of the total costs of passenger transport, the overwhelming majority (over two thirds) are generated by private motorised road transport. It is also clear that means of transport costs predominate in private and public road transport and in aviation; in human-powered mobility, accidents constitute the largest cost item, while in rail transport, infrastructure costs make up the greatest share.

Presentation of passenger transport costs by form of transport and cost category, 2015

F 12



Source: FSO – Costs and funding of transport statistics (CFT)

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7.1.2 Presentation of funding

For all forms of transport, the direct cost bearers, final cost bearers and the contributions of transport users are listed in detail. The four-column representation always has the same structure (see Figure 13) and contains the following information:

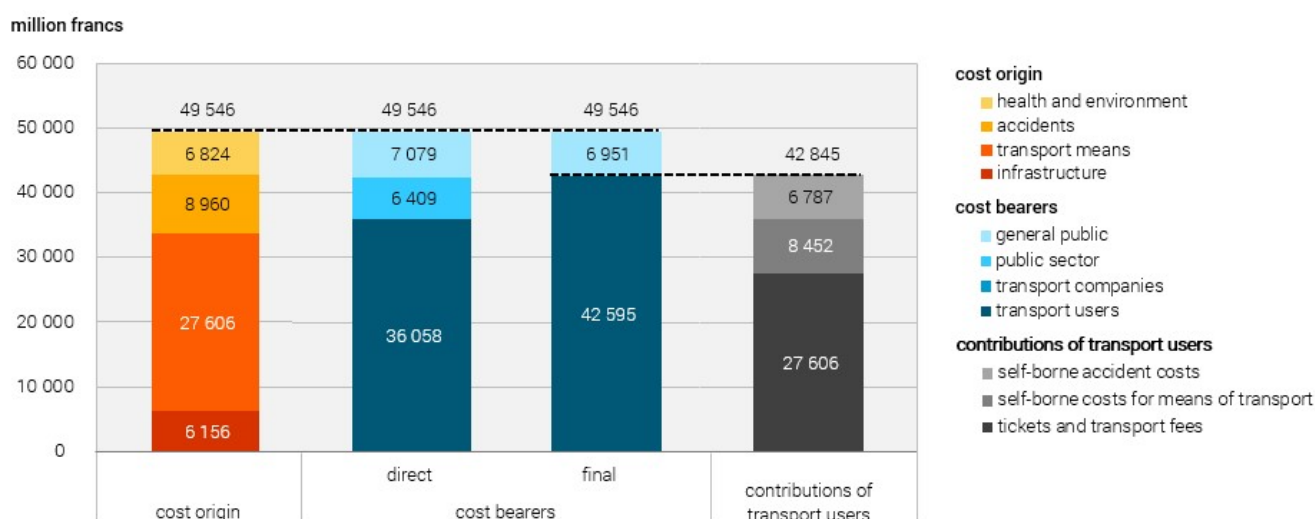
- **Cost origin:** the first column indicates in which of the four cost categories the costs are incurred: infrastructure, means of transport, accidents or environment and health (as with cost presentation).
- **Direct cost bearers:** somebody has to bear the costs when they are incurred. This is what the second column shows. Cost carriers can be transport users, transport companies, the public sector or the general public.
- **Final cost bearers:** in many cases, direct cost bearers subsequently pass the costs on, however. On account of transfer payments, the costs are shifted between the cost bearers involved. Precisely such transfers occur between the second and third columns. The third column then indicates who ultimately bore the transport costs. An example of transfer payments are public transport fees (e.g. tickets and season tickets), which can be interpreted as a transfer from transport users to transport companies and through which transport users ultimately bear a portion of the costs for infrastructure and means of transport.

The first three columns are always the same height as they always concern the same costs. They simply show what the costs were incurred for, who bore them initially and who ultimately covered them.

- **Contributions of transport users:** The fourth and final column shows the contributions made by transport users in order to undertake a journey (both payments and intangible contributions). Generally the contributions of transport users correspond to the costs borne by the final cost carrier and therefore provide an indication of the payments or intangible contributions through which the costs were covered. In the exceptional case of a surplus contribution (see Chapter 2.2.6), the contributions of users are higher than their final costs borne. The surplus contribution can be seen in the chart where the sum of contributions is higher than the costs ultimately borne by transport users. (This is the case in Figure 13.)
- The relationship between costs and direct and final cost bearers can be complex and can vary considerably between the different forms of transport. The following section is intended as an interpretation aid and uses Figure 13 on private motorised road passenger transport to explain the relationship between the four columns. The separate publication "Base values and sources" (FSO, 2017, available in German only) contains a detailed description of all modes and forms of transport.

Financing of private motorised road passenger transport, 2015

F 13



Source: FSO – Costs and funding of transport statistics (CFT)

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1st column: origin of costs

The costs of private motorised transport are composed of the following: the infrastructure costs comprise the costs of overall road infrastructure (construction, preservation, maintenance and operation) in Switzerland that can be attributed to private motorised transport by road. These costs are based on the FSO's Road infrastructure accounts. The largest cost item comprises the direct costs of operating private means of transport (passenger cars, motorbikes or coaches). The accident costs include all costs resulting from accidents involving private motorised passenger transport, regardless of whether they are paid by transport users, the general public or the public sector. The environmental and health costs comprise all social environmental costs that are incurred by the transport activities of private motorised passenger transport.

Unlike infrastructure and means of transport costs, some of the accident, environmental and health costs are not incurred in monetary form (e.g. costs due to shorter useful life or avoidance costs to be incurred in the future).

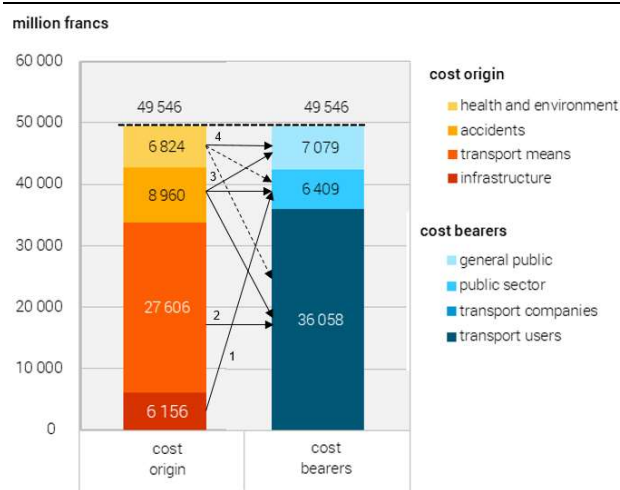
2nd column: direct cost bearers

The individual cost categories are financed/directly borne by the following direct cost carriers (see Figure 14):

- **Infrastructure costs:** These are initially fully funded by the public sector (1).
- **Means of transport costs:** In private motorised road passenger transport, all means of transport costs are financed by transport users (2).
- **Accident costs:** The majority of accident costs (CHF 8,307 million of CHF 8,960 million) are borne by transport users themselves (privately-borne accident costs). A significant portion of the accident costs (external accident costs) is also borne by the general public (CHF 407 million, e.g. in the form of net productivity losses for the economy or social insurance costs), and a small portion (CHF 246 million) is borne by the public sector, e.g. via hospital deficits (3).

- **Environmental and health costs:** The vast majority of environmental costs (over 98% or CHF 6,672 million) are borne by the general public (4). This concerns health costs (net productivity losses), devaluation of properties (e.g. due to noise) or costs resulting from climate change. A small portion of the environmental costs (CHF 145 million) are borne by transport users themselves (namely the costs of spatial separation effects in cities that arise within road traffic, i.e. are borne by human-powered mobility). Furthermore, a very small portion of the environmental costs (CHF 7 million) are financed by the public sector (health costs via hospital deficits).

Costs and direct cost carriers (private motorised road passenger transport, 2015) F 14



Source: FSO – Costs and funding of transport statistics (CFT)

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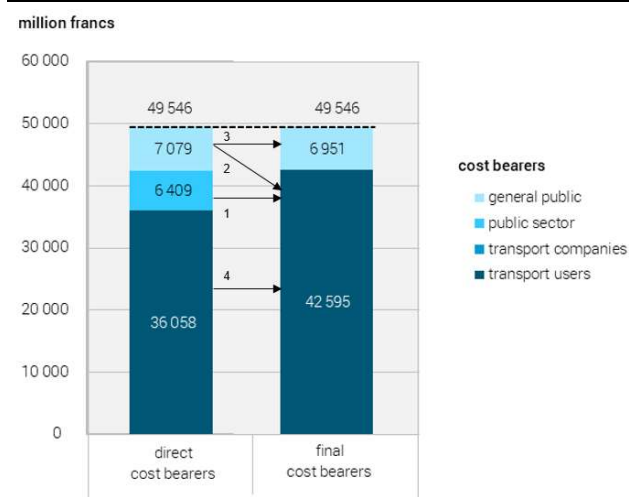
3rd column: final cost bearers

In private motorised road passenger transport there are two types of transfers that can lead to a discrepancy between direct and final cost bearers (see Figure 15):

- **Transport-specific taxes and charges** payable by transport users (mineral oil taxes, motorway toll charges, motor vehicle taxes etc.). These charges constitute a transfer from transport users to the public sector with which the public sector's direct costs (CHF 6,659 million) are fully covered. These costs are thus borne by transport users (1).
- **Internalisation contributions:** payments to the Klik Foundation to offset CO₂ emissions and (to a lesser extent) the heavy vehicle charge (for heavy passenger vehicles) internalise a portion of the environmental and health costs. These contributions (CHF 129 million) are financed by transport users and therefore interpreted as a transfer from transport users to the general public (2). Of the remaining environmental, health and accident costs not covered, those borne by the general public remain (3).

The costs borne directly by transport users (CHF 36,058 million) are also ultimately borne by transport users (4). Together with the two transfers (transport-specific charges and internalisation contributions), transport users as final cost bearers bear a total of CHF 42,595 million. The general public also bears CHF 6,951 million.

Direct and final cost bearers (private motorised road passenger transport, 2015) F 15



Source: FSO – Costs and funding of transport statistics (CFT)

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4th column: contributions of transport users

The last column on the chart shows the contributions made by transport users to be able to use the transport in question (Figure 13).

- **Self-borne means of transport costs:** these directly correspond to the means of transport costs in the 1st column, which are financed by transport users.
- **Self-borne environmental and accident costs:** the self-borne accident costs (CHF 8,307 million) and the self-borne environmental costs (CHF 145 million) have already been mentioned under direct cost bearers (2nd column). In total the self-borne means of transport costs, accident costs and environmental costs correspond to the costs directly borne by transport users in the 2nd column (CHF 36,058 million).
- **Transport-specific taxes and charges:** the taxes and charges mentioned under final cost bearers constitute the final category of transport user contributions. The category consists of actual transport taxes and charges on the one hand (CHF 6,651 million), and internalisation contributions from climate cents and heavy vehicle charges on the other (CHF 136 million). Because the transport-specific taxes and charges paid by transport users (CHF 6,787 million) are slightly higher than all the costs directly funded by the public sector (CHF 6,409 million), transport user contributions exceed the overall costs borne by the public sector by CHF 250 million, which results in a surplus contribution for the public sector (see Chapter 2.2.6).

The sum of all transport user contributions thus amounts to CHF 42,845 million (see Figure 13).

7.2 Comparability of means of transport

The CFT statistics present the various means of transport in relation to one another from different perspectives, broken down by final cost bearers on the one hand and kilometre costs on the other. These form points of reference for comparison of the economic viability or efficiency of individual means of transport. Otherwise, the results should be interpreted with caution. The following section lists various aspects that should be borne in mind when interpreting the results.

- **Specific functions of public rail and road transport:** unlike private road transport, public transport is largely commissioned by the public sector (regional transport). Public transport therefore has an explicit public function, e.g. the basic provision of transport services to the regions. This public service function is related to the means of transport costs and to the necessary infrastructure, leading to a lower portion of transport user contributions and to higher average kilometre costs than if only 'profitable' routes (busy routes that are directly demanded by the market) were operated. In addition, public regional transport's role in bringing passengers to long-distance transport must be taken into account. Public regional transport (e.g. buses) should therefore not be considered in isolation but as part of an entire public transport trip chain where additional stages of trips are made by train.

On the other hand, the absolute level and share of accident, health and environmental costs borne by the general public is lower than for private road transport.

- **Average values for Switzerland:** the CFT statistics do not differentiate between specific relations or areas, but instead provide average values. Comparison at this level is therefore limited and a distinction must be drawn. In reality, however, the rates differ according to distance category of type of traffic and other aspects (e.g. urban versus rural public road transport). So for example types of traffic in urban areas have higher costs as they require more infrastructure and have greater energy consumption and because the health costs are above average due to the exposure levels of the population. Conversely, types of transport travelling longer distances usually have lower kilometre costs as the fixed costs per kilometre decrease as the distance increases. In other words, the kilometre costs of passenger cars in national long-distance traffic are significantly lower than in urban traffic. A comparison of different forms and means of transport should therefore be limited to forms of transport with similar average distances and similar transport needs. For example, the following can be compared: means of transport in urban traffic (e.g. tram/trolleybus versus urban passenger car versus human-powered mobility); in regional transport (regional rail versus regional passenger car versus bus); in national transport (national rail versus national passenger car); or in international transport (continental air traffic versus international passenger car versus international rail). In the

case of aviation in particular, where intercontinental traffic is included in the CFT statistics and which therefore has a very high average transport distance, the comparability of the kilometre costs in the CFT statistics with other forms of transport is limited.

- **Heterogeneity of transport performance:** while comparability is fundamentally ensured in passenger transport as a passenger-kilometre as a metric can always be interpreted the same way, caution should be exercised with goods transport. When using the tonne-kilometre as a metric for specific comparisons, it should be borne in mind that due to the logistical function of the different means of transport, the tonnes transported are not the same. For example, the railways transport a large proportion of heavy goods with a lower value per tonne, while air traffic transports lighter goods (but of higher value). A specific comparison would therefore have to refer to individual groups of goods (that can be substituted by modes of transport).
- **Dealing with time costs and driver costs:** as stated in Chapter 2.2.2, the time costs of private transport and other opportunity costs of driving a vehicle oneself are not taken into account. Also not included are the various possible alternative activities that can be undertaken in modes of transport (e.g. working on the train, making phone calls, eating). This tends to result in private road passenger transport having lower costs than commercial road goods transport, public transport or aviation, where the personnel costs for driving or flying a means of transport are explicitly factored in.

List of abbreviations

ARE	Federal Office for Spatial Development	Klik Foundation	Foundation using the voluntary contributions from petrol importers for CO ₂ compensation projects
ASTAG	Schweizerischer Nutzfahrzeugverband	MinOO	Mineral Oil Tax Ordinance
Belly freight	Air cargo that is transported on passenger flights	N₂O	Nitrous oxide
CaR	Cantonal road	NO_x	nitrogen oxides
CFT statistics	Costs and funding of transport statistics	NR	National roads (national highways and motorways)
CH₄	Methane	NRLA	New Rail Link through the Alps (e.g. Lötschberg and Gotthard Base Tunnel)
CHF	Swiss Francs	OECD	Organisation for Economic Co-operation and Development
CO₂	Carbon dioxide	pkm	Person-kilometre
CoR	Communal road	PM10	Fine particles
DESTATIS	German Federal Statistical Office	PT	Public transport
DETEC	Federal Department of the Environment, Transport, Energy and Communications	RIF	Rail Infrastructure Fund
ESAL	Equivalent Single Axle Load	SBB	Swiss Federal Railways
FCA	Federal Customs Administration	Skyguide	National air traffic control in Switzerland
FEDRO	Federal Roads Office	SNB	Swiss National Bank
FFA	Federal Financial Administration	SO₂	Sulfur dioxide
FOCA	Federal Office of Civil Aviation	TC	Transport company
FOEN	Federal Office for the Environment	TCS	Touring Club Suisse
FOT	Federal Office of Transport	tkm	Tonne-kilometre
FSO	Federal Statistical Office	TTC	Transport and Telecommunications Committee of the National Council and the Council of States
GA	General Aviation: this includes all flight movements that are neither scheduled nor charter traffic.	v-km	Vehicle-kilometre
HBS	Household Budget Survey	VOSL	Value of statistical life
HGV	Heavy goods vehicle	VSS	Schweizerischer Verband der Strassen- und Verkehrsfachleute
HGVC	Heavy goods vehicle charge		
HVCA	Federal Act on the heavy goods vehicle charge		
ICAO	International Civil Aviation Organisation		

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Online

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Print

www.statistics.admin.ch
Federal Statistical Office
CH-2010 Neuchâtel
order@bfs.admin.ch
tel. +41 58 463 60 60

FSO number

1986-1901-05

ISBN

978-3-303-11270-0

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