



## Railway access charge systems in Europe

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## Abstract

Railway access charge systems within European countries have been slowly but surely reformed since the 1990's, due to the implementation of European Union transport policies, and, more specifically, with the enforcement of the 2001/14/CE directive<sup>1</sup>, by the beginning of the 21<sup>st</sup> century. Briefly, this has resulted in the separation of railway companies from the state and the separation between infrastructure manager and the railway operating companies. This was a prerequisite for the opening of the liberalized European railway market. As a result, each country is now included in an open train-path allocation system and obliged to adopt a more transparent charging system.

So far, each European country has its own policy and transport specificity, which means that we are far from reaching a unified rail charging system (comprising structure, cost etc.). Besides being a way to finance the infrastructure management, the charging system can also be used as an incentive tool to optimize railway technologies even though, sometimes, this can be delicate in practice. One of the key challenges of international railway traffic is the development of a coherent charging system, through a more harmonized concept on one hand, and, on the other hand, through an improvement of its structure and indicators. Such a system shall of course take into account not only the fact that there are different railway technology levels among the various countries (old national systems, versus new harmonized standards for EU corridors), but also that international railway traffic should not be penalized.

Presented is a benchmark of the railway charging systems in place up to 2010, comprising their structure and associated costs, for several European countries. This analysis demonstrates and highlights the differences in the implementation of railway charging systems. After this, the results of the European project RAILCALC<sup>2</sup> from 2008 are analyzed and benchmarked with the first experiences managed by the European Stakeholders between 2008 and 2010. An emphasis will be put on the way this infrastructure charges best practice guide has been implemented, along with the implemented rules derived from the directive 2001/14/EC in the target countries. The analysis of possible improvements will be given, with a classification of measures rated by a factor of "implementation probability degree", in line

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<sup>1</sup> on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification

<sup>2</sup> lead by CENIT, Center for Innovation in Transport from the Technical University of Catalonia (UPC)

with what infrastructure managers are juggling such potential changes in the pricing methodology.

## **Keywords**

Railway access charging systems – Europe

On the front page: Stuttgart main station, [www.skycrapercity.com](http://www.skycrapercity.com)

## 1. Introduction

Within this last two decades, railway systems in Europe have been, and still are, through a major reform mostly opening the phase of “opening up” their railway market and improving the efficiency of the system. Several European directives were elaborated to set a framework, lay down the law and fix an agenda to this reform.

The European Commission supervised that member states correctly apply the directives. In June 2008 few member states have been warned over their first railway package implementation. Furthermore, international passenger rail services have been opened up for competition as of 1st January 2010

Reform of the charging system for the use of the infrastructure is a prerequisite for the opening of the European railway free market. Several reports have assessed charging practices for railways infrastructure in Europe and its evolution.

This paper has been elaborated with the aim of analyzing the current (2010) charging practice within Europe with the example of seven countries (six member states and a non-member state): France, Germany, Netherlands, Spain, Sweden, Switzerland and United Kingdom.

First, the European context of railway reform is outlined, afterwards the main pricing theory and its stakes will be presented. Then charging practices in every country will be surveyed and compared. Finally a reflection on charging practice philosophy will be presented.

## **2. European context of railway liberalization**

Railway liberalization in Europe officially started in 1991 and was-and still is-a long process involving a heavy transformation process in railways companies - including train operator, infrastructure manager and even sometimes governments.

In aim to understand the actual and historical context in railway policies in Europe, a quick overview of the legal and political context will be given and some of the main reports on the subject will be presented.

### **2.1 Broad outline of European railway policies**

Nineteen years ago , the European policy in railways transport was officially launched with the directive 91/440/EEC. It was followed by several white papers and directives which were more and more specific: from the split between Train Operator and Infrastructure Manager to the international passenger traffic open market

#### **2.1.1 Directive 91/440**

The 29<sup>th</sup> July of 1991, the European Economical Community settled four main points, that every country member should follow in aim to establish an open access so that competition could improve the efficiency of railway companies in Europe and then increase the modal share of railways:

- Stabilize railway companies financial situation to make them competitive, in particular by reducing their debts;
- Make the railway companies independent from the state by a separated accounting system;
- Open access to the railway network for railway companies from other countries;
- Split the Infrastructure management from the train operations in aim to have more transparency in using taxpayers money by separating accounting systems.

#### **2.1.2 Railway packages**

Some years after that, in 1996, the next step concerning charging systems was indirectly the first white paper concerning railway policy: it gave a legal framework. Directives were proposed by package so that government had to choose between applying them all or not at all. This gave birth to the first railways package which had 3 main goals: liberalization of

freight traffic over Europe (2001/12/UE), technical and operational harmonization on railways interoperability and security (2001/13/UE) and set a transparent, fare and accurate charging system for the use of railway infrastructure. The second railway package is aimed to precise the opening-up to competition for freight traffic over Europe and decide on a deadline for it: 2007. The third railway package is supposed to set the legal framework and decide on the deadline for the liberalization of the international passengers rail services for 2010.

The liberalization of freight traffic and international passenger market entail legibility, transparency and fairness of the railway charging system of each membership country (or similar).

### **2.1.3 Directives 2001/14/UE**

Directive 2001/14/UE describes the charging system. Some of the most important points for this article are:

- Incentive for cost effectiveness, and operational efficiency;
- Cost relatedness and balancing of accounts;
- Mark up for scarcity, environmental cost, cost coverage can be implemented;
- Transparency, fairness and non discriminatory access;
- A regulating body, independent from the infrastructure manager, should be put in place in aim to guarantee fairness and transparency.

Finally it is important to mention that a number of European Rail Infrastructure Managers established a common organisation "Railnet" to shape the business of European rail infrastructure in aim to enable fast and easy access to European rail, as well as to increase the quality and efficiency of international rail traffic. They run the EICIS programme: European Infrastructure Charging Information System. It calculates the charges for trains paths, station fees and shunting fees and can thus estimate the price of international train paths.

## **2.2 European studies and investigations on railways systems**

Since the end of the 90's, several EU-reports and independent studies have been carried out in order to survey the liberalization of the railway market and the charging practice over Europe. As most of these studies are used for this paper, a quick overview of them will be presented below.

### **2.2.1 RAILCALC project**

Railcalc is a project led by the Centre for Innovation in Transport, CENIT, of the Technical University of Catalonia, UPC, commissioned by the transport department of the European Commission. Some other universities and institutions from all over Europe were also involved. It provides a current practice assessment on accounting and charging systems of 24 countries of Europe and it proposes a best practice (in accordance with the rules of the 2001/14/CE directive) on charging calculation by a SWOT analysis of the different possibilities for every item (charging, cost modifiers, incentive for performance, mark up). Figures for charging and accounting are based on the year 2006.

### **2.2.2 IBM railways liberalization index**

IBM Business Consulting Services in conjunction with Professor Dr. Dr. Christian Kirchner from the Humboldt University in Berlin provide in the Rail Liberalization Index a comparison of the rail market of the member state of the European Union, Switzerland and Norway. The first report date from 2004 then it was updated in 2007.

One of the three indices used to calculate the rail liberalization index is the access index which takes into account informational barriers, administrative barriers, operational barriers and the share of domestic markets accessible. The charging system is included in the operational barrier and it is the most important parameter in the access index, where it accounts for 25%.

### **2.2.3 ECMT 1998, OECD-ECMT 2005, OECD-ITF, 2008**

The European Conference of Ministers of Transport (ECMT) and the Organisation for Economic Co-operation and Development (OECD) have always followed how the charges for the use of Railway infrastructure were structured and implemented all over Europe.

In 1998 the European Conference on Minister of Transport organized a round table in aim to debate the matter of “user charges for railways infrastructure”. It determined the reasons for establishing a charging system for the use of infrastructure, the stakes involved and how such a charging system could be elaborated.

In 2005, the European Conference on Minister of Transports published the “Railway reform and charges for the use of infrastructure” report. It provided not only a reflex on the practices and issues of railways charging systems or stakes of regulation but also an assessment of current practice in 19 countries over Europe with 2004 and 2005 documents. Figures from this report are a reference for many other papers.



In 2008, the International Transport Forum published an update of the above mentioned report: Railways Access charges in the EU: current status and developments since 2004. It gives also a comparison between the charging amounts calculated within the different studies.

#### **2.2.4 Other recent studies**

Other Governmental or institutional studies have also been elaborates within the last years. Among them

- “Rapport sur la tarification du réseau ferré” led by the Finance General Inspection and the Ecole Nationale Supérieure de Ponts et Chaussées, this report has been elaborate in aim to reform the charging system of railways infrastructure in France
- In 2007 Professor Ulrich Weidman from the ETH proposed a new charging system in Switzerland with the report “Studie zu einem neuen schweizerischen Trassenpreissystem” in aim to improve efficiency. The charging system proposed is based on fluctuation of the traffic charge along the day and the week and the loss of capacity. Environmental matters, wear and tear, the facilities needed and train path quality are also considered.
- “Le prix des sillons: Un enjeu politique-état des lieux et défi à relever” from the Swiss information service for public transport, LITRA, has just been published in June 2010. This paper provides an overview of current practices and stakes of railway charging system in Switzerland. It also compares it with others European countries (OECD- ITF 2008 report figures)

### **3. Railway infrastructure charging: political, economical and technological stakes**

The European Union wishes an open railway market as much for the freight traffic as well as for the international passenger traffic. An open market for the European Union and neighbors countries is indissociable from a reflection on how railways charging systems should be in Europe. In this chapter, the goals will be explained, including some basic points on pricing theory.

#### **3.1 Goals**

Although the EU-member states apply different railway charging systems, some common objectives can be pointed out (ECME-OCDE 107<sup>th</sup> Round table, user charges for railways infrastructure 1998):

- Encourage the best possible use of the rail network capacity
- Cover all or part of the operating and maintenance cost of the rail network
- Reduce railway transport costs and increase productivity
- Contribute to the investment cost of developing the rail network
- Encourage the use of rail transport in intermodal competition
- Contribute to balanced regional development

#### **3.2 Pricing theory**

Pricing theory for the use of the railway infrastructure is a heavily discussed topic. We will try to give here an overview on the main current theories in Europe.

##### **3.2.1 Marginal Cost Pricing**

Marginal cost pricing represents the additional cost caused by operating an additional train. It is supposed to be the optimal if there are no budgetary constrains and no distortion from other markets/transport modes.

The OECD differentiates two different practices in order to consider market distortion and constrains such as budgetary ones:

- CM+: social marginal cost with mark ups

- CF-: full cost recovery after receipt of grants

Other institutions, like in the Railcalc project, introduce another philosophy of differentiation, which is in fact very close to the OECD ones:

- SRMC: Short run marginal cost where not all the fixed cost will be recovered based on the additional operating and maintenance cost caused by an additional operating train. However, it takes into account external effects.
- LRMC: long run marginal cost which include the capital costs of increasing capacity to accommodate an increase output (Railcalc 2007)

Directive 2001/14 set the marginal cost theory as the pricing method to use for member states

### **3.2.2 Ramsey pricing**

Ramsey pricing aims to maximize social welfare under profit constraints. It considers rail infrastructure product as a monopoly. The price markup should then be the inverse to the price elasticity of demand.

### **3.2.3 Average cost pricing**

Short run average costs are the result of the total cost of all the proposed services divided by the number of these services. They can be split in fixed cost and variable costs.

Average cost pricing is a method which sets the price of a product by adding a percentage profit mark up to the average cost or unit cost (Railcalc 2007) .

In practice several pricing theories can be applied for different items in one charging systems.

From an exterior point of view however, accounting practices for the calculation of charges are not always easy to understand.

## **3.3 Pricing practice**

There are two practices to apply with respect to access charges regime: simple-part tariff and two-part tariff.

Simple part tariff will be composed only by variable elements and will directly vary with use of the network (gross tone-km and train-km are the most common measures of infrastructure use).

Simple charges are probably more effective in collecting marginal (direct) costs, and they may be more effective in charging for social costs and externalities. They are more distorting in collecting allocated shares of fixed costs and they may not give effective signals to encourage the financing of added capacity. (OECD, ECMT, 2005)

Two part tariff consist on variable related directly to use and a fixed part based on the capacity forecast to be used or on some estimate of the fixed costs of the system to be recovered. Two-part regimes are more efficient at relating use to economic cost, but they raise an issue of potential discrimination among users. Two-part regimes also tend to be more complex and expensive to implement. (OECD, ECMT, 2005)

Both practices can be weighted by certain parameters: e.g. speed, axle loadings, types of rolling stock, the specific route (including the geometry requirements of the route), time of day, and freight commodity, among many others.

### **3.4 Degrees of freedom of the encouraged pricing methodology**

Directive 2001/14/EC provides some freedom to the pricing authority, in order to modulate the “basic” charge and make the charging system more efficient. In this way, railway charging system can also be used as an incentive tool for e.g.:

- Congestion and scarcity
- Performance (delays related to contractual parties)
- Cost coverage
- Environmental and other external cost issues
- Other incentives like intermodal transport competition or technological issues

In practice these incentives measures can be set up by mark ups, discounts, additional cost and are related to transport policies.

## 4. Infrastructure charging practice over Europe

### 4.1 Current practice (2010) in 7 country of Europe

#### 4.1.1 France

##### Historical Overview

The French railways Infrastructure Manager, Réseau Ferré de France (RFF here after) company was created 6 years after the directive 91/440 in 1997, but at the same time, the historical train operator “Société National des Chemins de Fer Français”, (SNCF hereafter) remained and the accounts were not independent (Crozet 2004). At the beginning, charges paid by SNCF were very low and based on a multiple component tariff with the national network split in 5 areas. Nevertheless, charges have been increased step by step and after some minor modifications, a reform of the railway charging system has been undertaken in 2007 and applied since 2010.

In June 2008, the European Commission pointed out several failures in the first railway package implementation: inadequate performance scheme to encourage railway undertakings and RFF to minimize disruption and improve performance of the network, insufficient independence of RFF from SNCF, insufficient initiatives for RFF to reduce costs and level of access charges, no relation between infrastructure charges and marginal costs. More over, RFF is blamed of not determining charges for use of infrastructure. The lack of a regulatory independent body has also been criticized. However, quality and transparency information in the network statement has been improved since the reform. Since 2008, the allocation of each charge is clear.

Some of the big difference in charging practice between 2009 and 2010 are: access right to the track only for regional train services instead of all services (as in the United Kingdom with its franchised passenger trains companies, cf. below), no more stopping charges in stations and more precise market segmentation in train services.

Furthermore, concerning the regulatory body, the Autorité de Régulation des Activités Ferroviaires has been created and is officially operational since the end of 2009. Veolia is one of the main SNCF competitors.

##### Charging system

The chosen charging access system is a two-part tariff for regional train and a single-part tariff for the rest.

Minimum access package is based on kilometres and includes operating charges, reservation charges and access charges only for the regional trains. Access to electric traction installation and access to traction current are considered as ancillary services. Traction current can also be directly bought at an electricity company

Table 1: Charging system in France

Charge	unit	Market segmentation <sup>3</sup>	Cost covered
Access charge	€/year	Only for regional Trains <sup>4</sup> Region (21)	Fixed cost
Operating charge	€/train -km	Period of the day (4) Route category (13) Train-path length (freight) (2) Speed (freight) (4) Train capacity (passenger) (4) Type of station (passenger) (2)	Capital charge
Reservation charge	€/train -km	Type of service (6)	Variable cost for operating and maintenance

Table 2: Differences of the amounts of minimum package charge for freight trains and passenger trains in France

	Freight minimum-maximum	Passenger minimum-maximum
Access charge €/year		31'108'900 – 198'896'600
Operating charge €/train -km	0.685 - 3.135	2.109 - 4.641
Reservation charge €/train -km	0.003 – 9.149	0.004 - 16.272

<sup>3</sup> Number in brackets are the level of segmentation of every respective item

<sup>4</sup> Transport Express Regional, TER network

## 4.1.2 Germany

### Historical context

In the context of the second railway package, DB Netz, the German infrastructure manager, was created in 1998 as a subsidiary of Deutsche Bahn AG. DBAG is still by far the biggest operator there are a large number of other freight and passenger operations; there is open access for commercial services, and many regional passenger services are put out to competitive tender (ECMT OECD 2005).

The charging system was introduced in Germany in 1994 as part of the institutional reforms that established DB AG. Since then, system has been reformed several times (1998, 2001, 2003, 2005...). The Bundesnetzagentur supervises regulation.

In June 2008, the European Commission pointed out the insufficient independence of DB Netz from DB AG, insufficient initiatives for DB Netz to reduce costs and the level of access charge.

### Charging system

The charging access system is a single-part tariff.

Minimum access package include the use of allocated paths and of facilities for the supply of traction current, train control, train regulation, arranging pilot/route-familiarisation services, further information

Table 3: Charging system in Germany

Charge	Unit	Market segmentation	Cost covered
Basic	€/train -km	Route category (12) Train path product (9) Region (40)	Cost coverage
Load component	€/train -km	For freight trains over then 3000t	Cost coverage

Table 4: Differences of amount of minimum package charge for freight trains and passenger trains in Germany

	Freight minimum-maximum	Passenger minimum-maximum
Basic charge €/train-km	1.235-10.135	1.105-34.572
Load component €/train -km	0 - 0.92	2.109 - 4.641

### 4.1.3 Netherlands

#### Historical context

In 1995, the independent railway operator NS, with daughter companies for railway infrastructure management were established. Infrastructure charges were introduced in 2000 and the Infrastructure Manager ProRail was placed under separate ownership from Nederlandse Spoorwegen, NS. Although NS is still the most important operator, other railway undertakings are also active in passenger traffic (like Arriva) as well as in the freight business. The regulatory body is the “Nederlandse Mededingingsautoriteit”. The Netherlands was the only country in 2008 not recriminated by the EU for how the first railways package was implemented.

#### Charging system

The charging access system is a single part tariff.

The minimum access package includes user path rights and user overhead line rights. Passenger transfer facilities and access to electric traction installation are considered as an extra service.



Table 5: Charging system in Netherlands

Charge	unit	Market segmentation	Cost covered
User train path right	€/train-km €/train-tonne	Route category (3)	cost incurred directly from operating

Table 6: Differences of amount of minimum package charge for freight trains and passenger trains in Netherlands

	Freight minimum-maximum	Passenger minimum-maximum
Basic charge €/train -km	0.675 – 0.732	0.675 – 0.732
Load component €/tone	0.002	0.002

#### 4.1.4 Spain

##### Historical context

The Spanish railway network has been tremendously developed within the last 20 years.

In 2005 Renfe, Red Nacional de Ferrocarriles, has been split into Administrador de Infraestructuras Ferroviarias, ADIF and RENFE Operadora and a legislative and institutional framework to allow market entry was still to be constructed.

Since 2007 private rail freight operator started operating on ADIF network like Continental Railway. However, there is still no other passenger traffic railway undertaking besides Renfe Operadora.

In June 2008, several failures of the implementation of the first railway package were pointed out: inadequate performance scheme to encourage railway undertakings and ADIF to minimize disruption and improve performance of the network, insufficient provisions for cooperation of ADIF for setting national and international train path. More over, ADIF is blamed of not determining charges for use of infrastructures and RENFE for having insufficient management independence.

The lack of a regulatory independent body has also, it insufficient accessibility and the fact that national regulator is not able to participate in international regulatory cooperation been criticized.

## Charging system

The charging access system is a two part tariff. Minimum access package includes user path right, access to electric traction installation or refuelling services and access to passenger station.

Table 7: Charging system in Spain

Charge	unit	Market segmentation	Cost covered
Access charge	€/year	Traffic volume	No specified
Operating charge	€/train -km	Route category (4) Type of service (4)	No specified
Traffic charges	€/100 seats-km	Route category (4) Type of service (4)	cost ensuring from services
Reservation charge	€/train -km	Period of the day (3) Route category (4) Type of service (4)	No specified
Station charges	€/Passenger (Arrival and departure)	Length of journey (4) Type of Station (3)	No specified

Table 8: Differences of amount of minimum package charge for freight trains and passenger trains in Spain

	Freight minimum-maximum	Passenger minimum-maximum
Access Charge €/year	64'309.20 – 1'511'266.31	64'309.20 – 1'511'266.31
Operating charge €/train -km	0.06	0.06 – 2.14
Traffic charges €/100 seats-km	0	0 – 0.135
Reservation charge €/train -km	0.05 – 0.33	0.1 – 3.65
Stations charges €/Passenger	-	0.02-0.84

#### 4.1.5 Sweden

##### Historical context

Sweden didn't wait the directive 91/440 to open railways market to competition: railways have been vertically separated since 1988. Banverket is the Infrastructure Manager and Statens Jarnvagar (which horizontal separation has been achieved in 2001) is the historical Railway Undertaking.

Since then, a charging system for railway infrastructure was implemented in 1988 and was reformed in 1999; since then some minor modification have been carried.

Järnvägsstyrelsen is the state railway authority.

There are several other private undertaking in passenger traffic like Veolia, Merressor AB, as well as in freight traffic like Cargo net as or Bantåg Nordic AB

In June 2008 In June 2008 European Commission pointed out several failures in the first railway package implementation: inadequate performance scheme to encourage railways undertaking and Banverket to minimize disruption and improve performance of the network and no publication of separate income statement and P&L statements for Railway Undertakings versus Infrastructure Managers.

### Charging system

The charging access system is a single tariff.

Minimum access package includes access to track and point allocated, access to electric traction installation, traffic control, traffic information, platforms for the exchange of passengers

Table 9: Charging system in Sweden

<b>Charge</b>	<b>unit<sup>5</sup></b>	<b>Market segmentation</b>	<b>Cost covered</b>
Train path	€/train -km	-	
Additional	€/gross tonne -km	Passenger traffic only	part of fixed cost of infrastructure
Marginal Cost	€/train -km €/gross tonne -km €/litre of diesel fuel	Train type	maintenance cost, socio economical of accident an of environmental health effects

Table 10: Differences of amount of minimum package charge for freight trains and passenger trains in Sweden

	<b>Freight minimum-maximum</b>	<b>Passenger minimum-maximum</b>
Train path charge €/train -km	0.026	0.026
Additional charge €/gross tonne -km	-	0.001
Marginal Cost		
Track charge €/train -km	0.0003	0.0003
Accident charge €/gross tonne -km	0.068	0.068
Emission charge €/litre of diesel fuel	0.032 – 0.058	0.032 – 0.058

#### 4.1.6 Switzerland

##### Historical context

Not a member state from the European Union but positioned in the middle of Europe and through bilateral agreements forced to introduce parts of the railway reform, Switzerland follows some of the trends of the community transport policies.

<sup>5</sup> here Swedish Krona have been converted in Euros: 1SEK=0.0974 €

In Switzerland, Railway reform took place in 1999. The Swiss Federal railways (SBB), and Basel Lötschberg Simplon (BLS), the major historical railway companies both split vertically into Infrastructure manager and Trains operator. Open access for national rail freight transport was also introduced the same year. Historically there have always been several passenger train operators and multiple infrastructure managers. All national transport is still regulated by means of franchises and transport contracts, with exclusive right for the allocated train paths.

Railway regulation is handled by the Federal Transport Authority (Bundesamt für Verkehr).

### Charging system

The charging access system is a single tariff.

Minimum access package includes use of train path, traffic management, access to electric traction installations, and platforms for the exchange of passengers

Table 11: Charging system in Switzerland

Charge	Unit <sup>6</sup>	Market segmentation	Cost covered
Minimal Price	€/gross tones -km	Route category (13)	maintenance marginal cost
	€/trains path-km		Train operating service
	€/gross tones -km	Period of the day <sup>7</sup> (2)	Power consumption
		Type of services (10)	
		Railway Undertaking	
	€/trains path-km		Energy services
	€/arrival/departure	Type of nodes	
Contribution margin	€/gross tonne -km	Railway Undertaking	

<sup>6</sup> here Swiss francs have been converted in Euros: 1CHF= 0.67325 €

<sup>7</sup> the distinction for the period of the day is used in charging for energy costs

Table 12: Differences of amount of minimum package charge for freight and passenger trains in Switzerland

		<b>Freight</b>	<b>Passenger</b>
		<b>minimum-maximum</b>	<b>minimum-maximum</b>
Minimal Price	Maintenance €/gross tones -km	0.001 – 0.002	0.002
	Operating €/trains path-km	0.269	0.269
	Power consumption €/gross tones -km	0.001-0.003	0.001-0.003
	Energy services €/trains path-km	0.088	0.088
	Nodes €/arrival/departure	2.02 - 3.366	2.02 - 3.366
Contribution margin	0-0.0035	0.0027- % <sup>8</sup> franchised Railway Undertaking revenues	

#### 4.1.7 United Kingdom

##### Historical context

The rail sector in United Kingdom has been fundamentally changed in 1994: British Rail has been broken down to about hundred different companies and privatized. At the beginning, the Infrastructure Manager “Railtrack” was privatized, but it collapsed in 2001 and was then replaced by a public company, “Network Rail”.

A charging system has been implemented in the middle of the 90s and has been reformed in 2002, 2004, and after 2005. The regulatory body is the Office of Rail Regulation, whose Board is appointed by the Secretary of State for Transport. There are now more than 15 franchised railway undertakings for passenger traffic and about ten rail freight operators. The only criticism by the European Commission in June 2008 was that the regulatory body is not required to decide and take action within two months.

<sup>8</sup> Amount of percentage is fixed by the Swiss Federal Transport Authority

## Charging system

The charging access system is based on two tariffs for franchised passenger railways undertakings and on a simple tariff for the other companies.

The minimum access package includes handling of requests for infrastructure capacity, right to use such capacity (i.e. running track points and junctions), train control, train regulation.

Table 13: Charging system in the UK

Charge	Unit <sup>9</sup>	Market segmentation	Cost covered
Variable track usage charge	€/vehicle -km €/gross tone km	Vehicle type	Marginal cost for the use of the network Cost coverage
Capacity charge	€/train -km	Period of the day (4) Route category (13) Train services Railways undertaking	
Fixed track charge	€/train -km	Franchised passengers railways undertakings	

It is important to notice that the vehicle type is precisely defined through the following information: power type, tare weight, number of axles, unsprung mass, yaw stiffness, maximum speed, seating capacity. For freight wagons, an even more precise characterization has been adopted in order to better reflect their track friendliness.

Freight lines are taxed to mark-ups in order to recover fixed cost.

<sup>9</sup> here Pound Sterlings have been converted to Euros: 1£=1.223 €



Table 14: Differences of amount of minimum package charge for freight trains and passenger trains in UK

	<b>Freight</b>	<b>Passenger</b>
	<b>minimum-maximum</b>	<b>minimum-maximum</b>
Variable track usage charge €/gross tone km - €/vehicle -km	0.017 – 1.583	0.069 – 0.914
Capacity charge €/train -km	0.231 - 0.308	0 – 6.063
Fixed track charge €/train -km	-	4845209.2 – 141953535.4

## 4.2 Benchmarking of charging systems

### 4.2.1 Charging characteristics

Table 15: Minimum package structure

	Access	Operating	reservation	Use of electricity access asset	Use of traction current	Station Stop	Variable	
							km	tone
France	✓	✓	✓	✗	✗	(✓) <sup>10</sup>	✓	✗
Germany	✓	✓	(✓)	(✓)	(✓)	(✓)	✓	✗ <sup>11</sup>
Netherlands	✓	✓	(✓)	(✓)	✗	✓	✓	✓
Spain	✓	✓	✓	(✓)	✗	✓	✓	✗
Sweden	✓	✓	(✓)	(✓)	(✓)	(✓)	✓	✓
Switzerland	✓	✓	(✓)	✓	✓	(✓)	✓	✓
UK	✓	✓	(✓)	✗	✗	✓	✓	✓

Minimum access packages are different between countries, and are not always transparent on what charge pays which cost(s): for example, the use of electric installations for traction current, traction current or station stops are in some cases implicitly included but without being detailed. Despite the fact that the structure of the network statement is supposed to be uniform by European Commission directives, some of them are very legible, whilst some other ones are so accurate that one can get lost in trying to decode the charging system.

<sup>10</sup> (✓): implicitly include

<sup>11</sup> : expect for freight train > 3'000 tons: an additional charge by train km is added

Table 16: Modulation practice

	Congestion	Scarcity	Performance	Cost coverage	Environmental	Other external issues	Cancellation charge
France	✓	✓	✗	✓	✗	✗	✗
Germany	✓	✓	✓	✓	✗	✗	✓
Netherlands	✓	?	✓	?	✗	✗	✓
Spain	✓	✓	✓ <sup>12</sup>	✗	✗	✗	✗
Sweden	✗	✗	?	✓	✓	✓	✗
Switzerland	✓	✓	✗	✓	✓	✗	✓
UK	✓	?	✓	✓	?	✗	✓

Practice in charges modulation also differs between countries.

It is possible to notice that countries that are well known for their environmental concerns are those who apply mark-ups (Sweden) or discount (Switzerland) for environment items like air pollution or a noise.

Performance penalties are double edged: penalty charges for delays are imputable to the one it is the source of delay, in other word it could be the Train Operator as well as the Infrastructure Manager. If Infrastructure Manager aims to improve network performance, it has to accept that it may generate financially damage to itself. In that way, we may suppose that Infrastructure Managers who are not ready yet to be performing will maybe not risk to implement performance penalties. In the sample of countries used in this study, countries that apply incentives to promote performance (against the delays) are those that also apply train path cancellation charge (excepting Switzerland).

In Spain there is an incentive for performance for Stations: stops that exceed 15 minutes generate an additional charge.

<sup>12</sup> For station dwell time

Table 17: Modulation practice: freight traffic charges versus passenger traffic charges for same tonnage/kilometres

	<b>Freight Traffic versus Passenger traffic</b>	<b>Variable use for access charges (kilometers or tone)</b>	
France	<	km	
Germany	<	km	
Netherlands	≈	km	tone
Spain	<	km	
Sweden	≈	km	tone
Switzerland	≈	km	tone
UK	?	km	tone

Freight is advantaged in countries where the charge does not depend on the weight. France, Germany and Spain they not only count kilometres for access charging but also apply lower charges for freight. This can reflect transport policies that aim to increase the rail share of in the freight transport market.

Countries like Switzerland or Netherlands, where freight mostly transits through, could be more interested in implementing a charging system taking into account the weight.

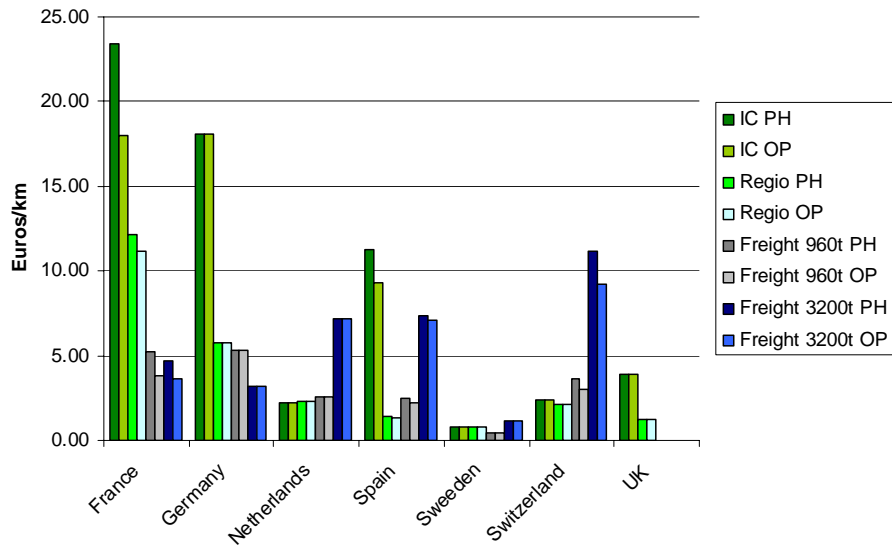
#### 4.2.2 Charging fees

Charging fees have been calculated for typical train services, using the information provides in the network statements. As structure of the charging system is different in each country, access fees have been computed as the minimum package charges, to which has been added the charge to access to electric traction installations and the charge for traction current.

For the United Kingdom, the passenger charge is estimated for a non-franchised passenger railway undertaking. As charges for freight are extremely accurate (accurate characteristics of rolling stock and of the gross weight), estimation of the charge for a typical service has been impossible to do.

For Spain, the charges for stopping in stations could not be calculated without information on passenger volumes, using instead a flat one euro increase of the fees.

Figure 1: Access charge over Europe

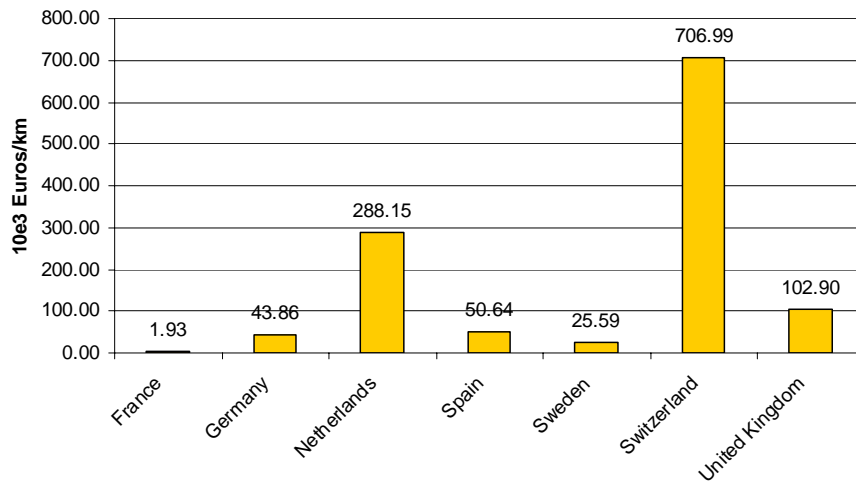


Data based on the 2010 Network Statements

### 4.2.3 Influential parameters

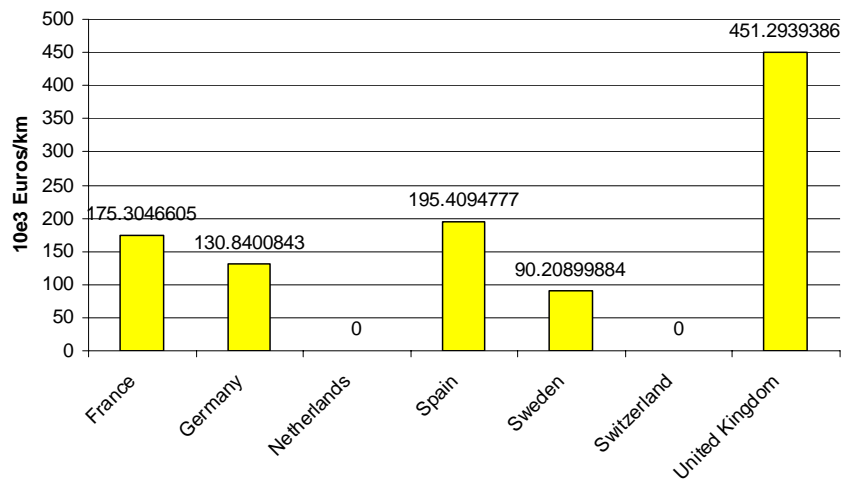
In trying to understand differences between access charges, three expenditure items have been taken into account: personnel cost, investment cost, and maintenance cost for the Infrastructure manager.

Figure 2: Infrastructure Manager personnel cost per km of track in 2007



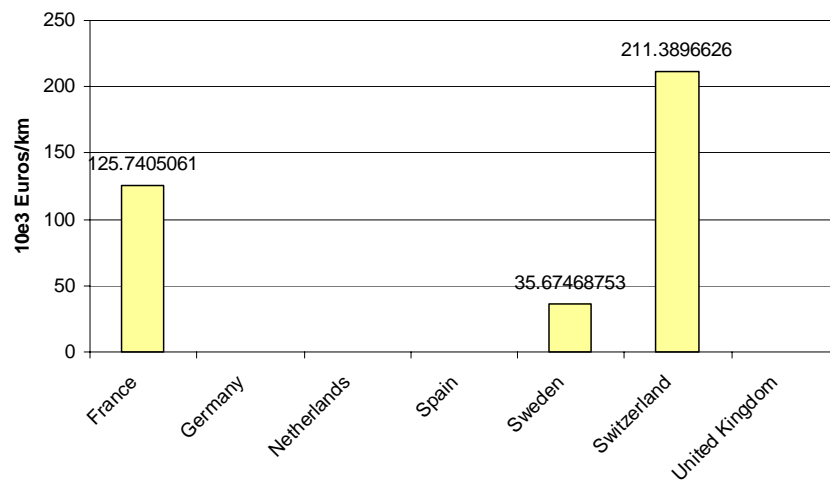
Data based on the 2007 and 2008 Network Statements

Figure 3: Investment cost per km of track 2008



Figures from ITF, [www.internationaltransportforum.org](http://www.internationaltransportforum.org)

Figure 4: Maintenance cost per km of track 2008



Figures from ITF, [www.internationaltransportforum.org](http://www.internationaltransportforum.org)

Comparing figures calculated with the 2010 access charges with 2008 figures for investment and maintenance, and 2007 ones for personnel cost shows some possible correlations: For the countries selected in this study, there is apparently no correlation between personnel and investment costs. One should notice, about investment costs that, firstly, it is maybe too early to see the influence of investment cost on access charging; secondly, not all the countries

cover fixed costs... Theoretically, we may expect some correlation between the value of the fixed cost and the investments expenses of the Infrastructure Manager.

Figure 5: Revenues from charges as a proportion of total expenditure on the network on operations, maintenance, renewals, interest and depreciation;



Figures from OECD 2005

Comparing the 2004 figures from the OECD ECMT 2005 report on average charges for passenger and freight trains, and the percent of total cost covered by charges infrastructure, some correlation can be seen. As directive 2001/14 does not set a compulsory threshold, every country can choose the part of the cost covered by access charges.... This is linked to the national transport policies and subsidies philosophy.

### 4.3 Limits of the comparison and the limits of current charging systems

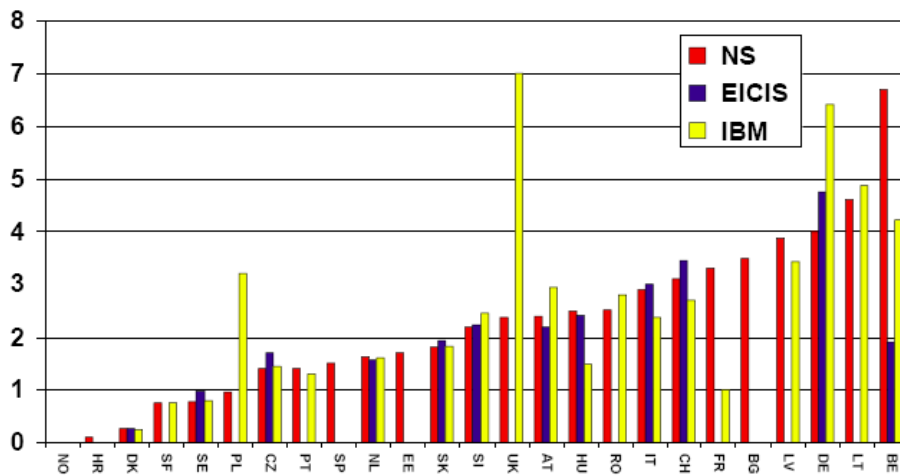
The charging theory is uniform over these countries: marginal cost pricing. Nevertheless, the practice differs: single part or two-part tariff, market segmentation and the modulation practices are different: first, the choice of what to create incentives for, and second the way to do implement incentives. This reflects among others, not only differences in transport policy, but also potential issues with the networks. In this work, and above all for the calculation of access charges in 2010, it was hard to identify what is comparable, and on which criteria to base a possible comparison (For example is access charge for a TGV Paris-Lyon journey comparable to an AVE Madrid-Cordoba journey?). What is actually a typical journey? How

to calculate an average charge whereas there are so many criteria,? How to deal with a station stop charge by passenger?

What is more, the amount of information needed was sometimes extremely important and not always available, or at least not easily available

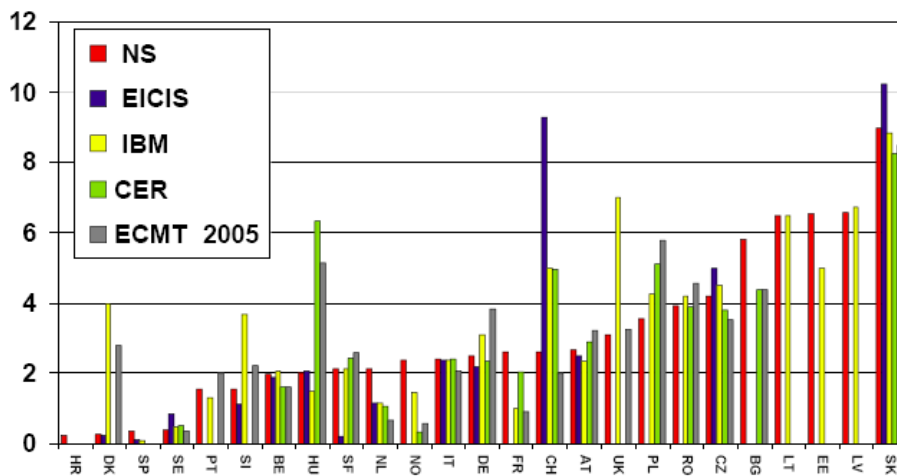
Figures 6 and 7 demonstrate clearly that those concerns about comparisons are also raised when one goes back to all the works published since 1001 on this matter.

Figure 6: Intercity Passenger Access Charges, , € /train-km



Figures from OECD 2005

Figure 7: Freight Access Charges, € /train-km, 960 Gross Tonne Train



Figures from OECD 2005



## 5. Towards a better charging system?

### 5.1 Best Practice Guide (Railcalc)

The Railcalc project proposed a set on best practice for several charging items... This assessment has been elaborated by a SWOT analysis and a ratio between the number of fulfilled objectives of the 2001/14 directive and the number of fulfilled requirements of the same directive.

The following paragraph is entirely based on *Macário Rosário, Marques Carlos, Railcalc Best practice on charging calculation- best practice on charging calculation.*

#### Charging system

*“A recommended approach for a relatively simple charging system is to set charges as to recover marginal operation, maintenance and renewal costs per train.km or per vehicle.km according to the type of line/vehicles characteristics and the type of service.”*

Access charges could be structured as above:

- Variable Basic Costs: running costs and maintenance & renewal costs are captured in a basic price, without differentiating between the various cost components. This includes in basic price reservation/administrative costs and access to “nodes”.
- Variable Cost of Use of Facilities/Services: access to facilities (e.g., stations, marshalling yards) is charged separately. Access charges that are fixed (i.e., independent of the number of trains) are also included.
- Variable Cost of Energy Supply: diesel and electricity.

#### Modulation

*“The 1<sup>st</sup> best classes identified for scarcity cost accounting are based on different type of services and time periods and on levying an access fee defined through auction procedure. it has the advantage of providing a clear framework for RU planning of activities, whereas auction procedure charging allows for a maximization of revenue.”*

*“Discounts to stimulate the use of a new link of the network are selected as the 1<sup>st</sup> best compliant practice. It is positively rated for its ability of encouragement of new rail itineraries, promotion of a more balanced use of the network, incentive operational efficiency and the opportunity given for the recovery of the initial investment. However, this practice is limited in the way that it is directed at specific services only and it holds a risk of unfairness*

*in some cases. Other 2nd best scenarios could perform better under these aspects. Either through discounts for maintenance/repair vehicles or discounts for empty passenger trains or single locomotives, flexibility of application or fairness aspects are better addressed. Applying a combination of both schemes may be especially favourable in scenarios where scarcity concerns and operational efficiency are not a priority.”*

The more compliant practices in relation to environmental issues are those that “refer to air emission charges”. “It can reflect marginal emission cost recovered per ton.km” (and “differentiated per type of service and type of traction”), or, it can “consider climate change costs and calculate emission amount based on fuel consumption” (“differentiated per type of traction unit”)

The best practice selected “aim at recovering fixed costs through a charge levied per path.km”. These charges could be “differentiated on time band, type of service and route category”.

### **Incentive for performance**

“The most compliant practices in relation to performance related charging practices are those which “adopt performance regimes applied to all services”, based on delay minutes accountancy system and allowing compensations for secondary delays”.

### **Cost coverage**

If “intermodal competition effects matters and when a specific investment on the infrastructure is intended to be partially recovered through market conditions”, “mark-ups allocating part of the general investment costs to a specific type of services over the rest of the network according to gross tone.km” should be selected

If IM identifies “market segments where demand for railway transport may increase”, “mark-ups allocating part of fixed infrastructure costs to passenger trains running in the whole network according to line category and traffic” should be selected.

Railcalc project has been finalized by the end of 2008. It is too early to say if it had any influence on the charging systems practiced or on European commission directives.

## **5.2 New concept and other possible ameliorations**

Vehicle type should be more often taken into account to better value the aggressiveness of the rolling stock on the track. Influential parameters are: axle load, bogie suspension, yaw stiffness, wheel diameter. The UK offers currently a good example on taking into account rolling stock parameters. In the same way, some aspects of the train maintenance (such as

wheel profiling) and of loading conditions on freight trains should also be counted for, by means of penalty charges, for instance. This will require the Infrastructure Manager to tighter monitor the operating trains on its network

Furthermore, the charging system should always reflects the policy objectives. As an example, to favour interoperability in railways, charging systems may offer discounts for ERTMS equipped trains.

Finally, the charging system should be anticipative, or at least adapt early to new technologies, in order to encourage train operators in adopting faster solutions that solve issues like, for example, environment or aggressiveness of the rolling stock. It will thus encourage optimal railway technologies development.

### **5.3 Toward harmonized, charging systems?**

Trying to understand diversity on charging practice, four factors should be considered:

- When has the reform on railway infrastructure started?
- Which is the geographical position of the country within Europe?
- How the railway network has developed, how complex is it, and how is it used?
- What are the trends in transport policies?

The earlier countries proceeded with separation of IMs and RUs, like Sweden, the United Kingdom or The Netherlands, the most mature is their reflection on charging practices. The same observation can be done for Switzerland, where multiple railway companies exist since a long time. Those countries received no or very little criticism from the European Commission on how their railway marked is prepared for competition.

Geographical position in Europe may matter. For example, the Iberian Peninsula is at the southern extremity of Western Europe, bordering only on France. What is more, it has a different gauge track making it cumbersome for a foreign train to cross the border. Unlike countries like Switzerland or The Netherlands, there is little pressure to rush in opening to competition.

Socio-demographical characteristic of a country and its geographical morphology can influence the charging system, as well as traffic density and the complexity of the network. Population density is linked with the density of the rail network: in Spain, there are large low-density areas (average for population density in 2007: 88 inhabitants/km<sup>2</sup>, compared to Switzerland's average population density of 210 inhabitants/km<sup>2</sup>). We can thus expect that

those two railway networks will not develop in the same way<sup>13</sup>; as a consequence, congestion, land scarcity, maintenance volumes are not comparable. On the other hand, maintenance cost depends on the track geometry and the number of switches: for example in Switzerland, there is an average of a switch every 220 meters whereas in Holland there is an average of a switch every 315 meters. In the same way, 9% of the Swiss network is underground, whereas in Sweden the length of tunnels only represents 0.6% of the total of the Banverket network (Isenmann LITRA 2010).

Finally, as we have already mentioned, transport policies differ between countries. The costs of the system for railway infrastructure are usually covered by access charges and by government subsidies. Every government is free to decide on the fixed amount that railway charges infrastructure should cover for the total of the expenditures of the Infrastructure Manager. Now, there are no European directives that govern the expenditure coverage by the railway access charges or the subsidies system for railway infrastructure.... Also, it is a matter of policy options to promote freight transport by rail and to use the charging system for it. In some countries, despite higher track wear, freight trains pay less charges than passenger traffic (France and Germany, for instance). In other countries, generally those that base their charges on weight (or weight and kilometers) like The Netherlands or Switzerland, freight trains charges are higher than passenger trains are. In this case, it is also important to notice that Netherlands and Switzerland are transit corridors.

This is a possible explanation on why currently there is no trend towards a harmonized charging system, being for its structure or for the fees. An attempt to harmonize the charging systems should take into account these differences.

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<sup>13</sup> moreover, except Basque Country and Catalonia, Spain missed the industrial revolution and the opportunity of the big railways development in the middle of the 19<sup>th</sup> century, and its railway network developed fairly late

## 6. Conclusion

The first railway package (directive 2001/14/EC) gave a general framework to the charging system, but still left a large margin on how to organize and modulate it.

Because of the diversities within Europe of national transport policies, national transport issues and stakes, the charging systems differ between European countries: not only structures are different, but modulation, and the precise amounts charges too.

Not all the countries are on the same stage of maturity in applying measures advocated by several European railway directives. As a consequence, not all the European countries are equally ready for the open their rail market to international passenger traffic. Issues that the European Commission pointed out in 2008 on the application of the first railway package are not fully settled. Owing to cultural and stage diversities, railways reform in Europe will need some more time until it is being completely achieved.

Finally, the charging system for the use of railway infrastructure should reflect fundamental transport policy options. Issues like congestion, land scarcity and the environment can be deserved by the charging system itself.

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