

# **An Examination of Rail Infrastructure Charges**

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This Report has been prepared for the European Commission by NERA, national economic research associates, (UK) in conjunction with Nomisma (IT); Statens väg- och transport-forskningsinstitut, VTI, (SE); Institut für Verkehrswesen, Eisenbahnbau und –betrieb, Universität Hannover, IVE, (DE); Ecole Nationale des Ponts et Chaussées, ENPC, (FR) and Business and Projects Management, BPM, (GR). The main objective of the Report is to provide input for a Community Code of Conduct on rail infrastructure charging. Its findings are based on both an examination of the current method (if any) of charging for rail infrastructure in each Member State, and a consideration of general issues related to the construction of charges, the structure of charges and the effect of the charging system. We would like to thank all those organisations and individuals who have co-operated with our research.

## **1.1 The Role and Objectives of Rail Infrastructure Charges**

An important objective for rail infrastructure charges is to promote the efficient use of the rail network. This relates to both the level of infrastructure use, so that there are neither too few nor too many trains using the network, and the pattern of infrastructure use, so that scarce capacity is allocated efficiently between different train operators. These objectives will be promoted by a system of charges which is cost-reflective, so that the charge for each train reflects the additional costs (to society) which result from allowing that train onto the network.

Rail infrastructure charges may also play a key role in promoting the efficient provision of rail infrastructure. In particular, it may be possible to construct a charging framework which rewards infrastructure managers for improving cost efficiency, for reducing delays to train services and for undertaking investment to expand or enhance the rail network.

A third possible objective for the charging framework is to promote efficiency in other parts of the rail industry, particularly among train operators. The level and structure of infrastructure charges can have a significant impact on the nature of competition, if any, between train operators. Charges may also be structured so as to reward good performance (and penalise poor performance) by train operators.

In some Member States, moreover, governments have set a further objective of raising a minimum amount of revenue from infrastructure charges. This applies whenever governments limit their contributions to rail infrastructure costs, leaving infrastructure charges to make up the difference between total infrastructure costs and government's contribution.

No charging framework can satisfy all of these objectives. There are potential conflicts, particularly between encouraging the efficient use of the network and meeting the government's cost recovery target, but also between some of the other objectives. There are also other instruments available to policy makers, including mechanisms for planning and financing rail infrastructure, mechanisms for regulating the conduct of infrastructure managers and mechanisms for allocating access rights between train operators.

Taking account of these potential conflicts and the availability of other policy instruments, we consider that rail infrastructure charges should be regarded as the primary instrument for securing the efficient use of the rail network. But it is important to recognise the limits of what can be achieved purely through the charging framework. Even though the correct price signals and incentives may be provided, there may be no guarantee that firms will respond appropriately.

## **1.2 Efficient Pricing in Theory**

Economic theory tells us that setting charges equal to short run marginal cost (SRMC) will promote the efficient use of the rail network. SRMC measures the cost to society of providing rail infrastructure access at a particular time, and therefore considers only the existing rail network (even if it is too large or too small). If charges are above SRMC, some train operators may be priced off the network even though they would be willing to pay more than the SRMC. Conversely, if charges are below SRMC, some train services may be allowed onto the network even though the benefits generated by these services are less than the costs of providing them.

The SRMC of accommodating an additional train on the rail network will include some or all of the following elements:

the additional costs incurred by the infrastructure manager as a direct result of the additional train, including additional track wear and tear, any traction current provided, any additional signal operations costs and any additional train planning or management and administration costs;

the costs of external impacts of the additional train, including additional noise, pollution, accidents and environmental emissions;

disruption costs, reflecting delays which the additional train causes other services; and

opportunity costs, reflecting the value of services which could have run instead of the additional train, but are now excluded from the network because of capacity constraints.

Infrastructure charges which cover these costs should ensure an appropriate level of infrastructure use, and also that scarce capacity is allocated efficiently between competing train operators. The only costs which should be excluded are the disruption costs associated with delays caused to the train operator's own services, since that operator will already bear the cost of this disruption (for example, through reduced fares revenues).

Departures from SRMC pricing may be necessary, however, if infrastructure charges are to address some of the other possible objectives noted above, since:

SRMC pricing is likely to recover only a small proportion (typically between 10% and 20%) of total infrastructure costs;

worthwhile investment may be discouraged by SRMC pricing, as measures to relieve a capacity constraint might lead to a significant reduction in charges (reflecting the reduction in disruption and opportunity costs);

charges based on SRMC may vary significantly over time and between different parts of the network, which may make it more difficult for train operators to plan future services;

SRMC pricing may fail to reward good performance, for example because the benefits of a reduction in infrastructure costs would be passed on immediately to train operators; and

other government policy objectives (for example to correct for distortions in the pricing of road transport) may require departures from SRMC pricing.

Attempting to meet some (or all) of these other objectives will inevitably involve a departure from a strict application of SRMC pricing, with the risk that the rail network will be either under- or over-used as a result.

### **1.3 Current Approaches to Infrastructure Charging**

Seven Member States already operate a system of rail infrastructure charging, and another has set charges at zero while a longer term approach is being developed. Most of the remaining seven Member States plan to introduce rail infrastructure charges in the medium term, though only one has decided on a timeframe and a proposed methodology for achieving this.

There are substantial differences between the approaches to rail infrastructure charging adopted so far by individual Member States. These reflect significant differences between the market structures and the nature of the rail network in each Member State, and also clear differences between government policies in relation to public transport and the availability of public funds. Nevertheless, most of the existing charging frameworks can be assigned to one of two broad approaches.

The Scandinavian Approach is applied in Sweden and Finland, and also to a large extent in Denmark. It features a relatively simple charging system with low variable charges based on SRMCs (including external costs), but adjusted in some cases to take account of comparisons with other modes of transport. There are also some (generally low) fixed charges, which are based on a comparison with the taxation of road users.

The Adjusted Average Cost Approach is applied, though with some differences, in Germany, France and Austria. It aims to raise a target amount of revenue, mainly (but not exclusively) through variable charges. Although these charges are adjusted to reflect a number of cost and market factors, and some revenues are raised through fixed charges, this approach can lead to variable charges which are substantially higher than SRMC, depending on the level of state contributions available.

A key difference between these two approaches is the relationship between state contributions and the level of infrastructure charges. Under the Scandinavian Approach, the level of infrastructure charges is determined mainly by cost conditions and comparisons with other modes of transport, with the level of state contributions determined by the difference between total infrastructure costs and the income from these charges. In contrast, state contributions under the Adjusted Average Cost approach are generally related to wider decisions on public spending priorities, and infrastructure

charges therefore need to generate sufficient revenues to cover the difference between state contributions and total infrastructure costs.

The approach adopted in Great Britain does not fit easily into either of these categories. The particular market structure and financing framework adopted in Great Britain allows very high fixed charges to be applied without distorting competition. Thus a high level of cost recovery can be achieved while holding most variable charges at (or, in fact, below) SRMC. Alone among the Member States, some access charges in Great Britain are determined by negotiation between train operators and the infrastructure manager.

## **2 The Funding of Rail Infrastructure Costs**

State contributions have been provided for many years to railways in Europe, and only in recent years has there been pressure to justify these contributions. Looking forward, state contributions to rail infrastructure in particular might be justified on the grounds of providing a minimum level of service to rural or peripheral areas, or more generally because of the beneficial impact of improved transport links. Other objectives, including the provision of socially-necessary services and encouraging traffic to switch from road to rail, may be better promoted by providing subsidies to train operators, rather than the infrastructure manager.

State contributions to rail infrastructure can also be justified on the grounds of economic efficiency. If infrastructure charges are set above SRMC because of the need to meet a cost recovery target, the costs to society of the trains which are priced off the network may be larger than the costs of raising an equivalent amount of revenue through general taxation. Economic theory alone cannot identify the efficient level of cost recovery (which would require a combination of complex theoretical and detailed empirical analyses), but it strongly suggests that it is likely to be low, and probably not very far above that which results from SRMC pricing.

In practice, however, governments' taxation and spending decisions are influenced by a wider range of social, political and macroeconomic factors. Notions of fairness are also relevant, and seem to underpin the Commission's statement (in the Green Paper *Towards Fair and Efficient Pricing in Transport*) that, in the long run, infrastructure charges for the transport sector as a whole should cover total infrastructure costs. We therefore treat the existence of different (and sometimes high) cost recovery targets as an externally imposed constraint.

### **3.1 Efficient Pricing with No Cost Recovery Target**

In the absence of a cost recovery target, there is no good reason why infrastructure charges should not be based on SRMCs. Special provisions are required to deal with disruption and opportunity costs, but these are applied within a charging framework based almost entirely on SRMCs.

The additional costs incurred by the infrastructure manager and the costs of external impacts should be reflected in a published tariff, differentiated by the main cost drivers (which are likely to include the type of rolling stock, type of infrastructure, train weight and possibly train speed). These costs are already included in SRMC-based charging systems in some Member States.

Adjustments to rail infrastructure charges, though perhaps convenient, do not provide an effective way of correcting for distortions in the pricing of other transport modes. In the long run, the best approach is to remove these distortions altogether. Even in the short to medium term, changes to end user prices (ie fares and freight charges) or the use of specific taxes and subsidies are both likely to be more effective than changes to infrastructure charges.

Disruption costs, and in particular the impact of delays caused to other train operators' services, should be reflected in a performance regime. It would be difficult to include these costs in a published tariff, and in any case the use of performance regimes will provide incentives for operators to reduce the incidence of disruption. Delays attributable to infrastructure managers should also be included, which will help to reduce the risk that infrastructure managers will benefit from capacity constraints. Compensation payments should be based on the estimated cost of disruption, as measured, for example, by the impact on revenues (from fares or freight charges).

Opportunity costs, which occur when potentially profitable services are excluded from the network, are very difficult to measure. If they are over-estimated, for example in a published tariff, this could lead to some of the most sought-after train paths on the network remaining unused. For most capacity constraints, therefore, access rights and charges should be negotiated between train operators and the infrastructure manager. This will help to ensure that scarce capacity is allocated to those operators who value it most highly, while reducing (and perhaps removing) the risk that valuable train paths will remain unused. Additional regulatory measures will be needed to ensure that infrastructure managers undertake investment to relieve capacity constraints wherever this is beneficial (to society).

Where capacity constraints are widespread, however, and particularly where demand is growing, ensuring that the right amount of capacity is provided may be more important than ensuring that existing capacity is used efficiently. In such cases, which we expect to be quite rare, better (though still imperfect) investment incentives can be provided by setting charges on the basis of long run average incremental cost (LRAIC), which is an average measure of the cost of accommodating more trains over a timescale in which capacity can be expanded, where necessary. These charges should be applied to a broadly based "peak", defined by geographical area and time of day. Additional regulatory measures will still be required, as with negotiated charges.

Since SRMC-based charges will recover a relatively small proportion of total infrastructure costs, state contributions are likely to account for the majority of infrastructure managers' income. These contributions should:

be determined at three to five yearly reviews, based on expected revenues and costs for the period until the next review, so as to provide incentives for infrastructure managers to improve cost efficiency; and

allow a reasonable return on the value of infrastructure assets (and recent investment in particular), so as to ensure that infrastructure managers are rewarded for undertaking appropriate investment.

### **3.2 Efficient Pricing Under A Cost Recovery Target**

The use of a two-part tariff, involving fixed and variable charges, can allow infrastructure managers to meet a cost recovery target while keeping variable charges equal to SRMC. This may prevent traffic from being priced off the network, but high fixed charges can deter entry and force existing

small operators out of the market. Two-part tariffs should be used only where there is no risk that fixed charges will eliminate the profits of either existing or potential train operators.

There are several ways in which two-part tariffs can be adjusted so as to reduce the adverse impact on entrants and small operators. Fixed charges can be applied in a different form, such as a charge per route-km, or small operators can be offered an alternative tariff with no fixed charge but a high variable charge instead. Neither of these approaches removes the impact on entrants and small operators, and they also introduce additional distortions of their own. In view of the considerable difficulties already faced by entrants and small operators, we place considerable emphasis on avoiding a charging mechanism which itself distorts competition.

A better approach is to use a published tariff which varies between different market segments on the basis of Ramsey Pricing principles. Charges should be marked-up over SRMC according to the relative price sensitivities of different types of traffic, with low mark-ups for the most price sensitive traffic. This should be applied by multiplying SRMCs by a set of published modulation factors, based on observable variables (such as the type of train, the time of day and week and the location of the infrastructure) which are likely to be correlated with the price sensitivity of different types of traffic. Neither the SRMC nor the modulation factor should be affected by the identity of the train operator.

The modulation factors should be based on market evidence of the price sensitivity of different types of traffic, which over time will comprise a mixture of empirical demand studies and practical experience about the impact of setting charges at different levels. For international services, this should include evidence about the price sensitivity of traffic along its entire route (rather than the impact of a price increase in one country alone). Initially at least, it will be important to review the modulation factors at regular intervals, and to make adjustments in cases where their impact is either stronger or weaker than expected.

We expect such a charging system to lead to relatively low charges for many freight services, particularly where there is strong competition from road transport. Some passenger services might pay higher charges, reflecting a mixture of inelastic demand for some services (such as some commuter services) and the availability of state contributions for other services.

Additional regulatory measures will be required to ensure that:

modulation factors are indeed set on the basis of Ramsey Pricing principles (aiming to minimise the distortions caused by having to meet a cost recovery target), and are reviewed at regular intervals;

charges based on Ramsey Pricing principles are not used either to raise more revenue than is necessary to meet the cost recovery target, or to discriminate between train operators.

#### **4.1 A Community Code of Conduct**

Adoption of a Community Code of Conduct on rail infrastructure charging might lead to significant improvements in the charging methodologies employed in some Member States, and the adoption of best practice by those Member States which are either reviewing their current charging frameworks or considering introducing infrastructure charges for the first time. Harmonisation for its own sake is

not an appropriate goal. But a set of common principles can be established which will help to promote best practice and deliver some improvements in the use and provision of rail infrastructure.

The impact of the Code of Conduct will depend on other developments in European railways. Most infrastructure managers and train operators are still publicly owned, and financial incentives and price signals may have little if any impact on their behaviour. Entry opportunities are still severely restricted in some countries, and this situation may be exacerbated by less than full separation between infrastructure managers and train operators. The full benefits of the Code of Conduct may only be realised, therefore, if it is accompanied by measures to ensure a proper separation between infrastructure managers and train operators in all Member States, measures to ensure that infrastructure managers and train operators are managed on a proper commercial basis and, where possible, further measures to increase the exposure of infrastructure managers and train operators to market forces.

The proposed Code of Conduct is set out below.

#### **4.2 Short run marginal cost pricing**

With the one exception noted below (the case of widespread capacity constraints and growing demand), all rail infrastructure charges should be based on short run marginal cost. In the cases noted below, these charges may be supplemented by fixed charges, or multiplied by modulation factors.

There should be a published tariff which reflects short run marginal costs (“the published tariff”), but excluding the costs of delays caused to other operators’ services (“disruption costs”) and the costs of services excluded from the network because of capacity constraints.

The published tariff should therefore reflect the infrastructure manager’s costs which vary directly with traffic volumes (additional track wear and tear, traction current, additional signal operations costs, additional train planning and administration costs, etc.), and the additional cost of impacts external to the rail sector (accidents, noise, air pollution, etc.). It should be differentiated according to those factors which determine the size of these costs (type of rolling stock, type of infrastructure, train weight, train speed, etc).

Negotiated departures from the published tariff should be permitted where train operators have special requirements which are not reflected in the tariff. Departures from the published tariff should be based on the impact of such requirements on the infrastructure manager’s costs (and short run marginal costs in particular), except where additional contributions, based on operators’ willingness to pay, can reasonably help the infrastructure manager to meet a cost recovery target.

Disruption costs should be reflected in a separate performance regime. Train operators should pay for delays caused to other operators’ services, and should receive compensation for delays to their own services caused either by the infrastructure manager or by another train operator. Payments should be based on the estimated impact of disruption on rail users.

#### **4.3 Capacity constraints**

Where capacity is constrained, and potential services are excluded from the network, the infrastructure manager should normally enter negotiations over access rights and charges to ensure

that capacity is allocated to those operators who value it most highly. Negotiated charges should not be higher than is necessary to clear the market, except where additional contributions, based on operators' willingness to pay, can reasonably help the infrastructure manager to meet a cost recovery target.

Where capacity constraints are widespread, however, and particularly where demand for train paths is growing, then a "peak" should be defined, on the basis of particular areas and times of day or week, to cover those parts of the network where capacity constraints may occur in the short to medium term. A supplementary published tariff based on long run average incremental costs ("the supplementary published tariff") should apply to all train paths in the peak, irrespective of whether or not capacity is constrained at particular locations or particular times within the peak.

#### **4.4 Cost recovery targets**

Where, either because services are franchised or for other reasons, fixed charges can reasonably be introduced without a risk of eliminating the profits of existing or potential train operators (taking account of any impact such charges may have on competition between train operators), then such charges should be used to allow the infrastructure manager to meet any cost recovery target. Variable charges should reflect the published tariff.

Where these conditions are not satisfied, variable charges should be increased by multiplying the published tariff by a set of modulating factors for different market segments based on Ramsey Pricing principles. These modulating factors, which should also be published, should be based on market evidence about the price sensitivity of each market segment, and should aim to minimise the distortions caused by having to meet a cost recovery target. They should be related to observable variables (such as type of train, time of day or week and location) which are correlated with the likely price sensitivity of different types of traffic.

In exceptional circumstances, where neither non-distortionary fixed charges nor modulating factors based on Ramsey Pricing principles can be reasonably applied, access rights and charges should be determined by negotiations between train operators and the infrastructure manager.

#### **4.5 The role of government**

State contributions may be provided to cover the difference between total infrastructure costs and income from infrastructure charges (which should be retained by the infrastructure manager).

Regulation of infrastructure charges should be carried out by government or, preferably, an independent regulatory body. The infrastructure manager's total revenues and expected profits should be controlled through the determination of state contributions, fixed charges and, if necessary, variable charges. These should be reviewed at intervals of three to five years, based on projected costs, demand and investment over the period until the next review, with the aim of providing the infrastructure manager with an appropriate return on the value of its assets (including new and recent investment).

Regulation should generally ensure that infrastructure charges are determined in accordance with the principles set out above, and in particular that:



access charges are set in accordance with the published tariff (or the supplementary published tariff), except where negotiated charges are used to deal with excess demand for train paths at particular locations, to accommodate with trains operators' special requirements which are not provided for in the published tariff, or in exceptional circumstances where the published tariff cannot reasonably be applied;

negotiations over access charges do not have the effect of discriminating unfairly between train operators, and take account of train operators' willingness to pay (rather than cost and capacity implications) only where this will reasonably help the infrastructure manager to meet a cost recovery target;

the infrastructure manager does not apply the supplementary published tariff to geographical areas and/or times of day where there is no realistic likelihood of capacity being constrained in the short to medium term;

where charges are based on Ramsey Pricing principles, the modulating factors applied to short run marginal costs are based on market evidence of relative price sensitivities, are reviewed at regular intervals and aim to minimise the distortions caused by having to meet a cost recovery target;

the modulating factors applied to international services in particular are based on the price sensitivity of services over the route as a whole (rather than over individual country segments).

Additional tasks for the regulatory body will be to ensure that:

investment appraisals are carried out where capacity is constrained, and in particular in situations where charges are negotiated or where the supplementary published tariff is applied;

investment is carried out promptly and efficiently wherever these investment appraisals demonstrate net benefits (to society) from investment to relieve a capacity constraint;

charges based on Ramsey Pricing principles are not used either to raise excessive revenues for the infrastructure manager or to discriminate between train operators;

charges relating to external impacts do not give the infrastructure manager incentives to discriminate in favour of traffic with high external impacts.