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PROBLEMS AND ISSUES OF DEFINING USER CHARGES FOR RAILWAY INFRASTRUCTURE

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Abstract

The EU Directives accepted in the 90s determined the opening of the Rail Market and the constitutional separation of the European railways (railway operator, *infrastructure manager*).

This article specifies the methodological issues of the Hungarian charge system, demonstrates the European and national practice of the determination of the user charges for railway infrastructure and intends to show the tasks, which have to be done in the near future.

Keywords: user charges for railway infrastructure, infrastructure manager, service standard.

1. Introduction

In the late 80s it became unambiguous that transport (operating of the transport systems) had to be placed on a new ground. Therefore operation improvement and modernisation of the railway transport systems – on the basis of the same principles for every member state – were started.

The 91/440 EU Directive required separating of accountancy, in some countries the effective taking apart (infrastructure; operator) was realized – in Sweden, United Kingdom – or arrangements were made towards it – Germany. [1] Some countries revised their own railway operator and prepared different strategies for the improvement of efficiency (privatisation, cost and staff reduction). In connection with charges for infrastructure the following participants, problems and issues had arisen (*Table 1*).

This article demonstrates and analyses the German and Polish practice of user charges for railway infrastructure and after examination makes a proposal concerning the methodological issues of the Hungarian charge system.

Table 1. Participants and issues in relation with railway infrastructure

Participants	Issues
Infrastructure owners, regulators	Who is paying?
Infrastructure manager	Who should be paying?
User	How much should be paid?
Third partner	How? On what grounds?
Society	What should be paid for?

2. Practice in Germany

Traditionally, the transport sector in Germany was strongly influenced by the government. It usually led to disputes on the market of services. However, for treating it, especially the reasons were always well founded: public welfare, public utility services, externalities and monopolies. As the academic discussions and political agreements have accepted the need of deregulation and privatisation, the first steps towards execution were made [2].

'Private-public-partnership' supported projects – which had been previously used in transport and post office – appeared in the railway system.

After the East-German Railway had merged into the German Railway (DB) they opened their network for a third partner (1999). The first year of introducing their user charges for railway infrastructure was 1994.

The previously mentioned charges in the German Railway Transport had been surveyed and analysed in another study – where the main features of the competition had been discussed.

The most important steps in the reform of the German Railway were:

- separation of the infrastructure and the operation;
- opening of the network for third partners by introducing the user charges for railway infrastructure;
- regionalization of the suburban transport.

Table 2 shows the role and the structure of the different railway transport organizations in 1995.

The German Railway Ltd (DB AG) and other railway companies offered usage of the railway public service in return for user charges for railway infrastructure. The DB AG has made usage of railway network possible for carriage of goods and travel agencies too. Access to the railway infrastructure for different users has been provided in the most comprehensive way in Germany. While there is a lack of regulation framework for a long time in the majority of the member countries of EU, the German regulation on the usage of the railway infrastructure was put into practice very early. The new regulation includes the following:

Table 2. The role and the structure of the different railway transport companies in Germany 1995

	DB AG	Regional railway company	Sum total
Number of companies	1	99	100
Length of network (1000 km) (percentage)	41.7 90	3.4 10	45.1 100
Number of employees (1000) (%)	312 95	16 5	328 100
Passenger traffic (million passengers) (%)	1330 80	323 20	1652 100
Passenger traffic (million pass kms) (%)	60400 95	3110 5	63511 100
Freight traffic (million tons) (%)	296 83	56 17	352 100
Freight traffic (million ton kms) (%)	67910 88	880 12	68790 100
Returns (million DM) (%)	26910 95	1540 5	28450 100

- every railway company which provides access to the railway infrastructure can determine the level and the structure of the fee for third partners;
- there is no independent authority which can regulate charges;
- they can settle average charges for the whole or some part of the network as well as for specified sections;
- the following factors can be taken into account when charges are determined:
  - type of running vehicle,
  - usage of lines,
  - usage of capacity of lines,
  - noise and air pollution caused by trains.
- the infrastructure charging system has to be demonstrated for the customers but it is not necessary to be published;
- customers will be rewarded by a price reduction offered by different railway companies, if their order for train km performance is above a certain level;
- if particular customers compete with each other for access to the infrastructure it is allowed that the best offer will be accepted.

Parallel to the introduction of user charges the railway companies were obliged to cover all the expenses including network operation and maintenance as well as depreciation. *Table 3* shows that the originally introduced user charges for railway infrastructure consisted of two sections: partly basic price, which was corrected by customer requirements (reliability, special types of train), partly by reduction factors depending on the used total train km performance during the period of contract. The total user charges for infrastructure included the user charges for station, too, calculated on the basis of number of train stops and types of train [3].

Table 3. The structure of the user charges

Base charges

- Route categories

  Importance: 3 categories
  Quality/implement: 7 categories

- Train categories

  Passenger: 7 categories
  Freight: 5 categories

Factor

- Depends on the required time scheduling

  (0.8 . . . 1.2)

- Depends on the use of the railway track

  (caused by special train type: 0.9 . . . 1.1)

Reduction depending on order-volume

Use of number of tracks:

- 1% . . . 5% local passenger trains
- 1% . . . 20% long-distance passenger trains
- 1% . . . 20% freight trains
- 2% . . . 10% more than 2 years contractual commitment to the ordered infrastructure

The main problem in the previously mentioned version was that the charges were too high, the structure of charging was cross-financing and the corrected coefficients and finally the charges did not cover all the expenses.

Based on the experience the charging system has been revised. The advantage of the new, two-part charging system is that it mirrors the fair cost-structure of the railway infrastructure operation (fixed price components are related to the rail-network fixed-cost loading and independent of the actual use (InfraCard); variable price components allow sufficient freedom for control and flexibility required and are depending on the actual use) and it will assist the aim of the rail reform of attracting more traffic.

Railway operators which enter a long-term – above 2 years – contractual commitment with the infrastructure manager are rewarded with a price reduction (between 2–10%).

Railway operators which have purchased an InfraCard pay a variable price per train path for the corresponding lines (DM/train km). This price is corrected by factors depending on capacity utilisation of the line, timetable flexibility, surcharges and reductions. [4]

The price for the use of low-traffic lines is lower and the price for the bottlenecks or busy lines is higher. *Table 4* shows the value of the factor depending on traffic density classes.

Table 4. Price correcting factor values depending on traffic density

	Traffic density class	Factor
B S	High frequented city lines	1.35
B I	High frequented lines	1.15
B II	Medium frequented lines	1.00
B III	Weakly frequented lines	0.85

An important feature of the modified infrastructure charging system is the consideration of the flexibility for scheduling, granted by the railway operators. More flexibility increases the chances of loading the system economically. Basic interval timetable leads to a very high cost and restricted availability of the infrastructure. More flexible demands for paths cause price reduction. Preconstructed paths offered by the infrastructure manager are the cheapest.

Charge for infrastructure depends on technical standards and traffic density of track. *Table 5* shows the structure of this system.

Table 5. The structure of the charging system

Track categories		Traffic density class		
		High	Medium	Low
K1	Tracks for speeds over 160 km/h	Most expensive		
K2	Tracks for speeds from 120 to 160 km/h			
K3	Tracks for speeds from 120 to 160 km/h*			
K4	Tracks for speeds from 80 to 120 km/h			
K5	Tracks with signalling for speeds up to 80 km/h			
K6	Tracks without signalling for speeds up to 60 km/h			Cheapest

*Mainly for passenger traffic

The system of the additions and reductions will be specified in the near future.

3. Practice in Poland

The basis of users charging for railway infrastructure in Poland has been based on the Minister of Transportation and Maritime Economy decree of 1998. The total route charge consists of several section charges as infrastructure costs change along the line.

The infrastructure expenditure database, which is corrected by the inflation in the previous year, serves as a basis of all calculations.

The infrastructure costs concern maintenance costs, operating costs and administration costs whereas depreciation and investments have not been included. Charge for the access to lines/sections consists of the base charge and the energy charge. Charges for additional services are also included if they have been resorted [5].

The base charge covers the value of basic and mandatory services. Basic services include:

- access right to infrastructure;
- timetable construction;
- necessity of usage of all infrastructure elements;
- power supply;
- traffic management, traffic control and train communication.

Mandatory services comprise:

- traffic safety and security;
- rescue in the case of an accident.

The base charge is calculated by the following formula:

$$\boxed{K_{i\ \mathrm{base}}^{p} = \beta_{1999/1998} * L_i * k_z * N_i^p * s_i^p * \alpha_{i1}^p * \alpha_{i2}^p * \alpha_{i3}^p * \alpha_{i4}^p * \alpha_{i5}^p * \alpha_{i6}^p,}$$

where $K_{i\ \mathrm{base}}^{p}$: base charge for N_i^p route given to operator to run p train on i line,

L_i : length of line i,

$\beta_{1999/1998}$: ratio of materials, energy and services prices in current year related to former year prices,

k_z : profit rate (max. 1.05; for non PKP[1] operators only),

N_i^p : number of routes thrown open for p train on i line,

s_i^p : unit base charge for p train on section of i line,

$\alpha_{i1}^p - \alpha_{i6}^p$: corrective coefficient defined for p train on i line.

[1] Polish Railway Company

The unit base charge is calculated for every section of railway line as well as every train category. The calculation depends on the infrastructure expenditure borne and the transportation work performed by a given train sort.

In addition the unit base charge is influenced by six corrective factors (technical standard of line, traffic density, hour within the day, week day, punctuality, train weight).

The energy cost consists of energy unit price, energy volume used for traction matters and energy distribution, transfer and transformation components. The energy charge can be defined in two ways. Firstly according to the vehicle's onboard energy meter indications, secondly by separate contract conditions. Using an onboard consumption meter the energy consumption charge is defined on the basis of three factors all together (energy consumption measured; energy purchase unit price; correcting factors). In the other arrangement (no onboard meter) – according to fixed contracts – the energy charge is calculated by the multiplication of price ratio, section length, train gross weight, average traction energy price, average unit energy consumption as well as using other correcting factors.

The supplementary charges are defined on the basis of individual calculations depending on the usage of different optional and offered services.

These charges can be the following:

- shunting and additional manoeuvres;
- extra trains supervision during train stops;
- public terminals, marshalling and formation yards, train serving and repair tracks access – separate contracts with object administration required;
- access to telecommunication and information networks, additional information;
- demands of other operators.

4. Hungarian Methodological Issues of User Charges for Railway Infrastructure

The Act of 1993 on the railways determines the responsibility of the State – among others – to provide the non-local public railway infrastructure and the non-local mass transport by rail qualified as public service. As the mode to take these responsibilities the Act provides a contract between the State and the national railway company (MÁV).

The fee – according to 91/440 EU Directive and the government decision linked with the planned overall reform of MÁV – must be determined on the basis of technical standard and use of infrastructure [6].

Analysing the general practice in Europe it can be proved that infrastructure managers take the real infrastructure expenses as a basis and calculate base charge on this basis – in compliance with the used service standard. The base charge is corrected with additional services, surcharges and they refund the innocent operators in the case of decrease of standard.

The Hungarian methodology uses the following rudiments:

- Railway track expenditures needed theoretically: technical cost (expenditure), standard (outlay requirements) of the railway track according to EU Directives and arrangements
- Real technical standard of the track: comparing the ratio of the real level to former standards (norms).
- Base charge for railway infrastructure: paid by operators, corrected by different surcharges (region-developmental, business-political, furthering modern environment-friendly transport modes, etc.).

A charge-system must be worked out which is suitable for

- train, category of train;
- route;
- statistical section;
- line, part of network;
- category of line;
- total network

fee determination separately for passenger and freight transport.

On account of the 'Rules to calculate costs of production in railway business' the costs of passenger and freight trains must be separately determined in order to avoid cross-financing between the mentioned two main activities [7]. The controlling approach is a very important factor, too. [8]

Fundamentally, user charges for railway infrastructure can be determined by statistical sections and fees should be summarised at any level, route – separately for passenger and freight transport.

The charges to be paid by the users of railway infrastructure are composed of the following elements [9]:

1. Base charge
2. Additional charge
3. Extra charges
4. Reductions
5. Repayments

4.1. Base Charge

The base charge can be calculated in knowledge of the technical standard of the lines and the corrected expenditure for the infrastructure.

The corrected infrastructure costs include the real costs of the infrastructure (maintenance, depreciation and operational costs), the costs of traffic control, the technologically justified additional maintenance and depreciation, the costs of backward improvement and the quantifiable externalities.

The mentioned cost elements constitute the corrected expenditure normative demand of the infrastructure manager. If this claim is satisfied, then the infrastructure manager will provide the gradually improving infrastructure, even if the technical standard of lines is behind the EU-standards.

Table 6 shows the technical parameters and the factors which determine the quality of the railway infrastructure.

Table 6. Technical parameters and service standard determining factors

Technical parameters of the lines (T_p)	Factors which determine the service standard
Speed of line (km/h)	Linear scale
Axle load (ton)	Linear scale
Electrified line	Yes/No
Number of track	Single track; Double-track
Safety of line (Signalling)	Key interlocking
	Key wedging device
	Mechanical
	Mechanical with light signal
	All-relay interlocking (D55, D70)
	Electronic
Train stopping control	Mechanical with light signal
	All-relay interlocking (D55, D70)
	Electronic
Traffic control	Between stations
	Mechanical block
	Automatic block
Socio-economic value of line	Volume of passenger/freight transport

The AGC-agreement is fundamental for the improvement of the '*A*-category' national lines. The AGC-agreement contains the characteristics of the average European railway infrastructure. *Table 7* demonstrates the AGC-standards.

After comparing the Hungarian railway infrastructure with the AGC-standards the backwardness of the technical standard of the Hungarian railtrack can be determined.

Before that comparison the service-package – which is offered by the rail track – should be analysed and factors of the service standard should be defined.

The passenger transport and the freight transport have different requirements towards the infrastructure manager, therefore certain factors of the service standard

Table 7. AGC-standards for the European railways

	Speed of line	Axle load	Electrified line	Number of track	Safety of line	Train stopping control	Traffic control
Stat. Section	160 km/h	22.5 ton	Yes	Double-track	All-relay interlocking	All-relay interlocking	Automatic block

have to be separately determined. *Table 8* lists the factors of parameters, which specify the service standard of the passenger and the freight transport.

Table 8. Factors of parameters, which specify the service standard of the passenger and the freight transport

Factors which determine the service standard	Factors of certain parameters (%) (α_j)	
	Passenger transport	Freight transport
Speed of line	α_{1p}	α_{1f}
Axle load	α_{2p}	α_{2f}
Electrified line	α_{3p}	α_{3f}
Number of track	α_{4p}	α_{4f}
Safety of line	α_{5p}	α_{5f}
Train stopping control	α_{6p}	α_{6f}
Traffic control	α_{7p}	α_{7f}
Socio-economic value of the line	α_{8p}	α_{8f}
Total	100	100

Comparison of the national railway infrastructure (technical standard) with the European network is important in several respects:

1. As-is analyses (region and size of the backwardness);
2. Increasing of competitiveness of the Hungarian railway infrastructure (neighbouring countries, improvement of transit routes);
3. Drafting of the strategic goals (EU-corridors, increasing of the transport capacity and capacity utilization);
4. Access to the railway infrastructure and determination of the user charges for infrastructure;
5. How does service standard influence the change (increase/decrease) of the expenditures for infrastructure?

The AGC-agreement parameters can be considered as a basis of comparison with the standard of railway infrastructure (common service standard).

Condition of the national railway lines has to be assessed by considering the AGC-parameters, and after that the service standard of the statistical sections should be determined.

Table 9 contains 'servicing factors (β_b)' (which are characteristic of the sections) and the scales (which belong to certain parameters).

Table 9. Servicing factors and scales

Speed of line (β_s)

$$\beta_s = \text{Section max speed}/160 * 100\%$$

Axleload (β_a)

$$\beta_a = \text{Section max axle load}/22.5 * 100\%$$

Electrified line (β_e)

$$\beta_e = 100\%\text{, if the line is electrified, otherwise } \beta_e = 0\%$$

Number of track (β_t)

$$\beta_t = 100\%\text{, if the line is double-track, otherwise } \beta_e = 0\%$$

Safety of line (β_{sa})

Signalling	Key interlocking	Key wedging device	Mechanical	Mechanical with light signal	All-relay interlocking	Electric
Servicing factors	β_{sa1}	β_{sa2}	β_{sa3}	β_{sa4}	β_{sa5}	β_{sa6}

Train stopping control (β_{tsc})

Signalling	Mechanical	Mechanical with light signal	All-relay interlocking	Electric
Servicing factors	β_{tsc1}	β_{tsc2}	β_{tsc3}	β_{tsc4}

Traffic control (β_{ts})

Traffic system	Between stations	Mechanical block	Automatic block
Servicing factors	β_{tsc1}	β_{tsc2}	β_{tsc3}

Socio-economic value of the line (β_{sev})

Socio-economic value of the line	Passenger transport (seat-km)	Freight transport (gross ton weight)
Servicing factors	β_{sev1}	β_{sev2}

Total of the service standard of all statistic sections can be calculated (for the passenger and freight transport) with the following formula:

$$\boxed{\text{Total service standard } (Tss) = \sum_i (l_i * \sum_j Tp_{ij} * \alpha_{ij} * \beta_{ij}),}$$

where l_i : length of line i,
Tp_{ij} : technical parameter of the line,
α_{ij} : factor of standard (passenger and freight transport separately),
β_{ij} : factor of the parameter (passenger and freight transport separately).

The average service standard of the railway network can be defined with the next formula:

$$\boxed{\text{Average service standard } (Ass) = Tss/\sum_i l_i,}$$

where Tss : total service standard,
l_i : length of line i.

The theoretical base charge can be calculated in knowledge of the average service standard and the corrected expenditure for the infrastructure with the following formula:

$$\boxed{\begin{array}{c}\text{Theoretical base charge = Corrected expenditure for the}\\ \text{infrastructure/Ass}\end{array}}$$

After definition of the planned performance ratio (on the basis of train km) between passenger and freight transport the specific factors must be formed for the determination of the real base charge (separate own performance of the passenger and goods transport).

The specific base charge can be expressed by means of the theoretical base charge and the total service standard:

$$\boxed{\begin{array}{ll}\text{Specific base charge}_{\text{passenger}} & = \text{Theoretical base charge}_{\text{pass.}}/Tss_{\text{pass.}};\\ \text{Specific base charge}_{\text{freight}} & = \text{Theoretical base charge}_{\text{freight}}/Tss_{\text{freight}}\end{array}}$$

Their specific base charge must be re-multiplied by the real own performance of the passenger and goods transport and after that the base charge (passenger and freight separately) can be defined to the statistic sections, levels, routes and network.

$$\boxed{\begin{array}{ll}\text{Base charge}_{\text{section } p,f} & = \text{Specific base charge}_{p,f} * l_i * \sum_j Tp_{ij} * \alpha_{ij} * \beta_{ij};\\ \text{Base charge}_{\text{route } p,f} & = \sum_i \text{Specific base charge}_{p,f} * l_i * \sum_j Tp_{ij} * \alpha_{ij} * \beta_{ij}\end{array}}$$

The base charge includes the mandatory services and it has overriding importance, because of assuring the operation of the railway network. The mandatory services comprise guarantee of traffic safety, giving assistance in the case of accident, dangerous and special goods transport.

On payment of the base charge the infrastructure manager provides the following services: access to the tracks, stations, public freight facilities, yards/depots, basic information to the public and assistance in case of accidents.

4.2. Charge of Additional Services

It includes services, which are needed for secure railway transport (traffic control, traffic security), the usage of the catenary, refuelling and the use of different services at the stations, yards, warehouses.

4.3. Extra Charges

Extra charges are justified in the following cases (over the base charge):

1. Additional trains on the heavy-traffic lines;
2. Use of Budapest's terminals for passenger trains;
3. Exceeding of the punctuality needed (set down in the services contracts);
4. Access to information and communication network;
5. Non-use of booked paths;
6. Depending on the time when the train is running (day, period of day).

4.4. Reductions

Infrastructure manager can give reductions in the following cases:

1. Taking advantage of the path for more years – on the basis of the contracts;
2. Use of the weakly frequented lines;
3. Running train at the same time (on all days of the week);
4. Shifting paths from saturated lines to alternative lines/services;
5. Shifting paths from peak to off-peak hours.

4.5. Repayments

If the infrastructure manager does not perform or incompletely complies with his obligation (that was undertaken in the 'services contract'; e.g. infrastructure failure, bad signalling or plan delays in all services) then railway operators can claim a penalty. If a railway operator's train breaks down and delays other services, then he pays penalty to the infrastructure manager and after that the railtrack pays penalty to other (innocent) operators. If the services run better than benchmark due to good network performance then the operators pay bonus to the infrastructure manager.

5. Conclusions

The fee is an index number, which expresses the quality of the railway infrastructure. Value of the charge shows how the service standard changes. The user charges for the railway infrastructure involve a direct feedback and they show how the increase/decrease of the state subsidy influences standard level of the rail transport [9].

The user charges have to be determined so that they demonstrate the condition of the national railway infrastructure – in comparison with EU-railways – and the national/foreign railway companies should be informed about the volume of the fee.

The following have to be done in the near future:

- Adjustment to EU Directives;
- The methodology should be implemented;
- Opening the Hungarian rail transport market.

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