# Chapter 4
# Infrastructure Access Charges

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## 4.1 Introduction

Infrastructure access charges (IACs) and their implications are one of the key difficulties the EU has faced in implementing a liberalised and fully integrated European railway system. This research will consider the current system of rail infrastructure access charges, first outlining their legal basis. It will then continue to examine the network statement and its structure, paying particularly a close attention to its components. The focus will then shift on to a case study of infrastructure access charges and how they are calculated for the case of Croatia. The chapter will then conclude by offering some reflections about the current system of infrastructure access charges and how it could be improved and made more efficient.

In order to achieve these aims, the discussion will touch upon the liberalised access to railway infrastructure since 1991 and the arranged relationships between infrastructure managers (IM) and railway undertakings (RU) and their vertical separation. It will also consider the horizontal separation and ensuing competition between different service providers. Focusing on rail freight, this competition is intense and strong in the entire European Union (Abramović 2012). One of many things that connect infrastructure managers with railway undertakings is infrastructure charges. Figure 4.1 illustrates the separation of railway system and position of infrastructure charges.

Infrastructure charges are a billing model for using rail infrastructure by railway undertakings. The basic principles for constructing such a model must include: (1) simplicity, (2) transparency, (3) neutrality and (4) cost dependency. The simplicity basically indicates that there are no additional hidden or ambiguous calculation terms in the practical application of the model. Also, the term refers to the

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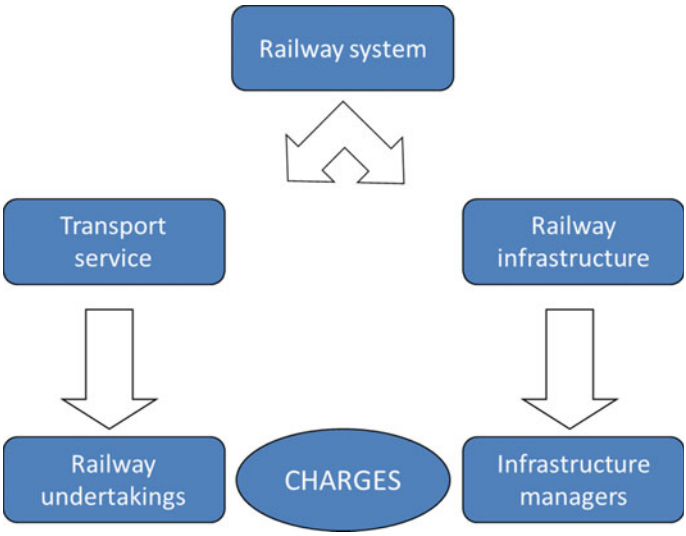


**Fig. 4.1** Railway system and infrastructure charges

clear and logical workings of the calculation. The transparency means that regardless of the undertakings, the charges will be consistent and fair, so the undertakings will be able to check among themselves the amount each has paid for the services. Neutrality is that the infrastructure manager has an equal approach and attitude towards every undertaking. Since the billing model involves charging for various services, the model itself must be based on the actual generated costs for a specific service. This way directly covers the principles of simplicity, transparency and neutrality.

## 4.2 Legal Basis of Infrastructure Charges

The legal basis of the EU railway network is laid out in its four railway packages and is constantly evolving with a framework of directives and regulations. It is important to recognise the difference between a directive and a regulation. A directive is a recommendation that the EU makes regarding best practice and parties can choose which path they will follow. However, a regulation is a legally binding instruction to whomever it concerns and must therefore be followed. In practice, a directive is transferred in national legal act and, on the other hand, a regulation is directly in force (Ljungberg 2013). Due to the complex web of EU regulations and guidelines, we will focus only on the two most relevant directives and regulations regarding infrastructure charges.

The first directive we shall focus on is Directive 2012/34/EU which is defined as a directive recasting the establishment of a single European Railway Area. It aims

to encourage the optimal use of railway infrastructure, which would in turn lead to a reduction in the cost of transport for society. It also clarifies that, to achieve these railway undertakings, we should receive clear and consistent economic signals from capacity allocation and charging schemes which allows railway undertakings to make rational decisions. It sets out two principles of charging:

1. "The charges for the minimum access package and for access to infrastructure connecting service facilities shall be set at the cost that is directly incurred as a result of operating the train service".
2. "The infrastructure charges referred to in paragraph 3 may include a charge which reflects the scarcity of capacity of the identifiable section of the infrastructure during periods of congestion".

However it does also lay out some exceptions to the charging principles:

- "In order to obtain full recovery of the costs incurred by the infrastructure manager a Member State may, if the market can bear this, levy mark-ups on the basis of efficient, transparent and non-discriminatory principles, while guaranteeing optimal competitiveness of rail market segments. The charging system shall respect the productivity increases achieved by railway undertakings".
- "The level of charges shall not, however, exclude the use of infrastructure by market segments which can pay at least the cost that is directly incurred as a result of operating the railway service, plus a rate of return which the market can bear".
- "For specific future investment projects, or specific investment projects that have been completed after 1988, the infrastructure manager may set or continue to set higher charges on the basis of the long-term costs".

Despite the detail in this directive, it does not set out how these direct costs should be calculated. Nevertheless, there is a Regulation 2015/909 that does. It sets out two methods of calculating the direct unit cost of operating the train service in question. Direct unit cost refers to the direct cost per train kilometres, vehicle kilometres, gross tonne kilometres of a train, or a combination of those. The two methodologies are as follows:

1. "The infrastructure manager shall calculate average direct unit costs for the entire network by dividing the direct costs on a network-wide basis by the total number of vehicle kilometres, train kilometres or gross tonne kilometres forecasted for or actually operated".
2. "By derogation to Article 3(1) and the first sentence of Article 5(1), the infrastructure manager may calculate direct unit costs by means of robustly evidenced econometric or engineering cost modelling, provided it can demonstrate to the regulatory body that the direct unit costs include only direct costs incurred by the operation of the train service and, in particular, do not include any of the costs referred to in Article 4". However these costs must be able to be evidenced to an independent regulatory body which will decide if they are fair.

## 4.3 Network Statement and Its Subsections

This research will now focus on the network statement and its subsections. Network statements present information about rail networks, in particular on commercial and legal access conditions. This document is crucial for both main parties representing the railway system: (1) infrastructure manager and (2) railway undertakings. Network statement is the basis for establishing the relationship between both parties involved. All infrastructure managers must publish a network statement on official website that is available free of charge (Bugarinovic and Boskovic 2014). Network statement must contain all the necessary information for railway undertakings for accessing and using the railway infrastructure. Pursuant to the Directive, it must be published in at least two official languages of the Union. In practice, it is usually published in that nation's native language and in English. Contents of the network statement are defined in Annex IV of Directive, so all network statements must have same structures to allow ease of access and the liberalisation of the European rail network. For these reasons, RailNetEurope (RNE (2016)) was founded in January 2004 as a non-profit making association whose aim is to enable fast and easy access to the European rail network, as well as to increase the quality and efficiency of international rail traffic. One of the main goals of RNE is to promote the harmonisation and publication of a user-friendly and customer-oriented network statement. Therefore, the RNE proposed a common structure of network statement, which presents guidelines for the expected content, organisation and other information useful for creating the network statement. The most important benefit of the guidelines is that in different countries respectively different languages users (railway undertakings) can find the same structure.

Network statement consists of the following six components or subsections:

1. General information,
2. Access conditions,
3. Infrastructure,
4. Capacity allocation,
5. Services and
6. Charges.

In the interest of brevity, we will focus only on the last three subsections in the network statement.

The subsection about capacity allocation of the network statements is concerned with horizontal separation and the competition between railway undertakings for capacity. It defines how to book capacity and how conflicts are resolved. Due to the growing number of rail undertakings it is very important for this section to be precise and to prevent confusion, even lawsuits, regarding capacity allocation. Capacity allocation process is shown in Fig. 4.2.

A very important aspect of capacity allocation is the timeline. Time is also an important resource, so the capacity allocation process must be done in a certain fixed amount of time. Figure 4.3 shows a timeline of capacity allocation activities.

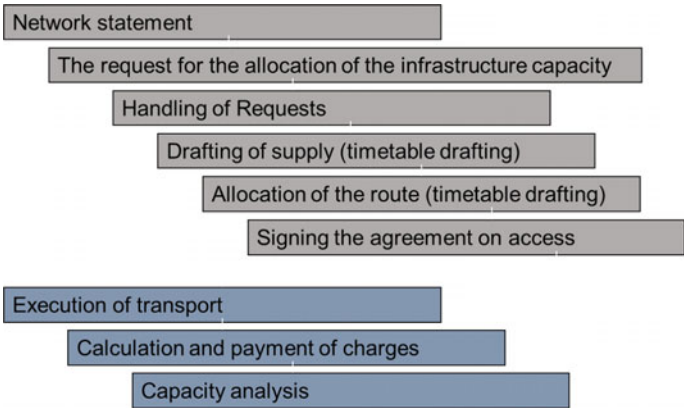


**Fig. 4.2** Capacity allocation process *Source* Network Statement, HŽ Infrastructure Ltd 2016

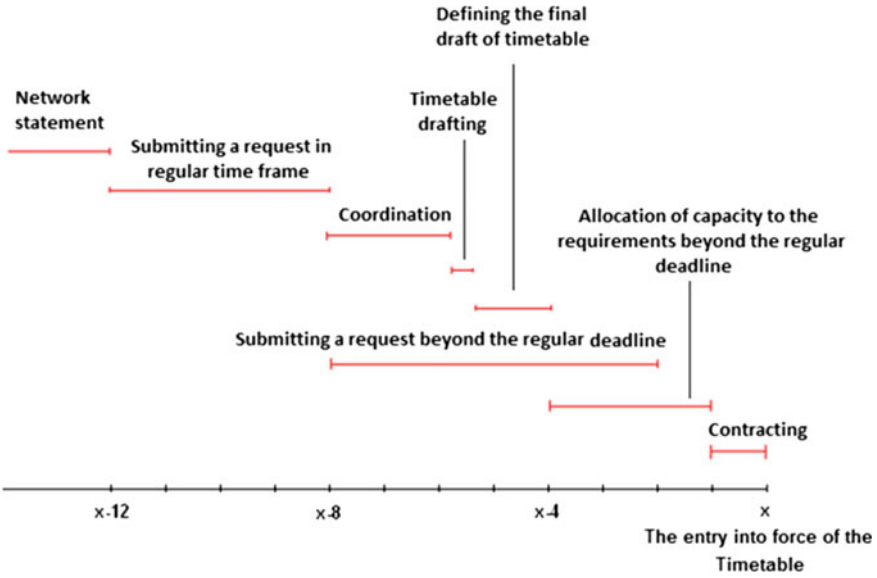


**Fig. 4.3** Timeline of capacity allocation activities *Source* Network Statement, HŽ Infrastructure Ltd 2016

There is a subsection on services of the network statement, which defines four different services:

1. Minimum access package
2. Access to services facilities and supply of services
3. Additional services
4. Ancillary services

Services 1 and 2 are obligatory services, whereas 3 and 4 are available depending on the strength of the infrastructure manager.
The minimum access package is concerned with the following points:

- Handling of requests for railway infrastructure capacity
- The right to utilise capacity which is granted
- Use of the railway infrastructure, including track points and junctions
- Train control including signalling, regulation, dispatching and the communication and provision of information on train movement
- Use of electrical supply equipment for traction current, where available
- All other information required to implement or operate the service for which capacity has been granted.

The access to service facilities and the supply of services concerns railway undertakings' access to service facilities, such as access to passenger stations, freight terminals and sidings, basically, any facility on the network that is run or controlled by the infrastructure manager.

Additional services can refer to a number of extra services such as a traction current, preheating/preliminary air conditioning of passenger trains, control of transport of dangerous goods and assistance in running exceptional consignment trains.

Ancillary services can refer to services such as access to telecommunication networks, provision of supplementary information, technical inspection of rolling stock, ticketing services in passenger stations and heavy maintenance services, supplied in maintenance facilities dedicated to high speed trains or to other types of rolling stock requiring specific facility.

The section on charges simply focuses on the charging principles, charging system, tariffs, financial penalties and incentives, performance scheme, changes to charges and billing arrangements.

A measure that has been incredibly helpful in this section is the use of EICIS (European Infrastructure Charging System) run by RNE, which provides a single online location where any railway undertaking can calculate potential infrastructure charges. This is a hugely liberalising innovation that brings more transparency to a sometimes confusing system.

## 4.4 Case Study

We will now look into some of these guiding principles in action by focusing on one country. In our case study of Croatia, this work will evaluate on how the Croatian network statement operates in practice, in comparison to the guiding principles we have already laid out.


**Fig. 4.4** Railway lines in Croatia *Source* Network Statement, HŽ Infrastructure Ltd 2016

The railway network in Croatia is comprised of 2,722, 2,468 km (90.7%) single-track and 254 km double-track lines (9.3%). There are 980 km (36%) of electrified railway lines, 977 of which use the 25 kV/50 Hz electrification system, and only 3 km use 3 kV ((Šapjane–Ilirska Bistrica (SI)). The railway infrastructure of the Republic of Croatia is connected to the railway infrastructure of Slovenia, Hungary, Serbia and Bosnia and Herzegovina (Abramović and Šipuš 2016).

When Croatia became a member of the European Union in 2013, there was a follow-up of directives and regulations of the EU. Compared to the network size, the competition between different railway undertakings is very high. Service providers in passenger transport are protected (closed) and run by the national railway company HŽ Putnički prijevoz (HŽ Passenger transport). On the other hand, the services in freight transport have been liberalised. Currently there are seven active freight railway undertakings. The biggest one, with around 90% market share, is still the national railway company HŽ Cargo (Fig. 4.4).

The network statement of HŽ Infrastructure in chapter 6 Charges lists the following equation for minimum access package [1]:

$$C = ((T + d_m + d_n) \cdot \sum ((L \cdot l) \cdot C_{vlkm})) + (l_{el} \cdot C_{el}) \cdot K, \quad (1)$$

where

C minimum access package charge
T train path equivalent

$d_m$ additional charge for train mass
$d_n$ additional charge for the use of tilting technique
L line parameter
$C_{vlkm}$ basic price [kn/trainkm]
$l_{el}$ length of train path with electric traction [km]
$C_{el}$ additional charge on trainkm price for the train path with electric traction
K price correction coefficient

Train path equivalent is the coefficient divided into three groups: (1) passengers train ($T_{1m}$), (2) freights train ($T_{2n}$) and (3) locomotives train ($T_{31}$). Train path equivalent is shown for passenger trains in Table 4.1 and for freight trains in Table 4.2. Train path equivalent for locomotive trains in freight and passenger transport is 0.20.

Line parameter is determined by the integration of three elements which influence the definition of its value and they are: (1) technical line parameter, (2) line operation equivalent and (3) line costs equivalent. Overall there are six line parameters and they are shown in Table 4.3.

The basic price per train kilometre for the use of the minimum access package is 5.99 kn/trainkm + VAT for passenger trains, 14.31 kn/trainkm + VAT for freight trains and 14.31 kn/trainkm + VAT for locomotive trains in passenger and freight transport.

The most problematic part of Eq. (1) is K which stands for price correction coefficient, since there is no officially methodology on how to calculate this coefficient. Theoretically, lower border is more than 0, but the upper border is infinite.

**Table 4.1** Train path equivalent for passengers train

| Train path equivalent | Train type | Value |
|---|---|---|
| $T_{11}$ | EuroCity, InterCity, express, agency | 2.27 |
| $T_{12}$ | Fast, semi-fast | 1.84 |
| $T_{13}$ | Passenger, cross-border | 0.95 |
| $T_{14}$ | Suburban | 1.32 |
| $T_{15}$ | Empty train sets | 0.91 |

*Source* Network Statement 2016, HŽ Infrastructure Ltd

**Table 4.2** Train path equivalent for freights train

| Train path equivalent | Train type | Value |
|---|---|---|
| $T_{21}$ | Trains with individual waggons, trains with single-type loads, intermodal trains, express, fast, direct, block trains | 1.13 |
| $T_{22}$ | Section trains | 0.86 |
| $T_{23}$ | Pickup goods trains, circuit-working trains and industrial trains | 0.51 |
| $T_{24}$ | Trains with empty waggons | 0.55 |

*Source* Network Statement 2016, HŽ Infrastructure Ltd

**Table 4.3** Line parameter

| Category line | Line parameter |
|---|---|
| $L_1$ | 2.00 |
| $L_2$ | 1.60 |
| $L_3$ | 0.90 |
| $L_4$ | 0.50 |
| $L_5$ | 0.80 |
| $L_6$ | 0.30 |

*Source* Network Statement 2016, HŽ Infrastructure Ltd

The coefficient is established by Ministry of the Sea, Traffic and Infrastructure for each year in advance, but the main problem is that it can be changed throughout the current year. We can, therefore, raise the question of transparency. Hopefully, in the near future this coefficient will be removed from equation.

By analysing Eq. (1), we can notice that there is a fixed coefficient product of train path equivalent and category line. In order to establish the limits of product, it can be calculated as matrix. Interesting results arise when the matrix represents the substantial difference between the calculated products. But interesting results can be matrix that represent how much is the different between calculated products. Of course, there are two matrices, one for passenger transport and the other for freight transport.

In passenger transport, the difference between the highest and the lowest product is 16.63. Table 4.4 shows the full calculation of products for passenger transport. To further clarify, Fig. 4.5 represents surface plot of differentness between the highest and the lowest product.

**Table 4.4** Calculation of products for passenger transport

| | $L_1$ | $L_2$ | $L_3$ | $L_4$ | $L_5$ | $L_6$ |
|---|---|---|---|---|---|---|
| $T_{11}$ | 4.54 | 3.63 | 2.04 | 1.14 | 1.82 | 0.68 |
| $T_{12}$ | 3.68 | 2.94 | 1.66 | 0.92 | 1.47 | 0.55 |
| $T_{13}$ | 1.90 | 1.52 | 0.86 | 0.48 | 0.76 | 0.29 |
| $T_{14}$ | 2.64 | 2.11 | 1.19 | 0.66 | 1.06 | 0.40 |
| $T_{15}$ | 1.82 | 1.46 | 0.82 | 0.46 | 0.73 | 0.27 |

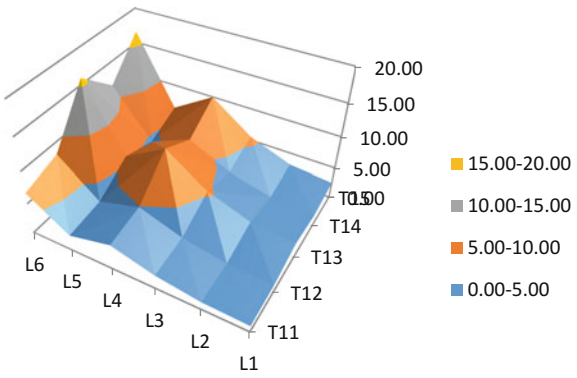


**Fig. 4.5** Surface plot of differentness for passenger transport

**Table 4.5** Calculation of products for freight transport

| | $L_1$ | $L_2$ | $L_3$ | $L_4$ | $L_5$ | $L_6$ |
|---|---|---|---|---|---|---|
| $T_{21}$ | 2.26 | 1.81 | 1.02 | 0.57 | 0.90 | 0.34 |
| $T_{22}$ | 1.72 | 1.38 | 0.77 | 0.43 | 0.69 | 0.26 |
| $T_{23}$ | 1.02 | 0.82 | 0.46 | 0.26 | 0.41 | 0.15 |
| $T_{24}$ | 1.10 | 0.88 | 0.50 | 0.28 | 0.44 | 0.17 |

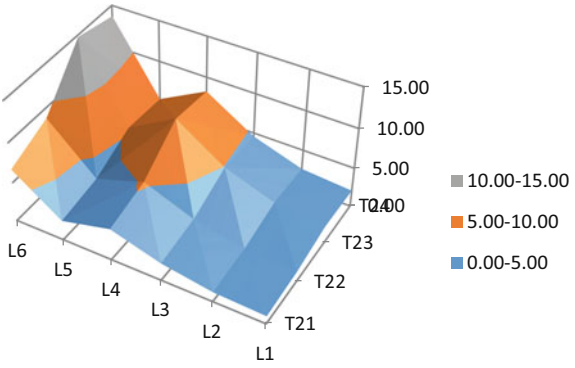


**Fig. 4.6** Surface plot of differentness for freight transport

In freight transport, the difference between the highest and lowest product amounts to 13.70. Table 4.5 represents the full calculation of products for freight transport. For a better understanding, Fig. 4.6 represents surface plot of differentness between the highest and lowest product.

### *4.4.1 Passenger Transport*

Two typical passenger lines were chosen for this research: (1) long distance with electric traction (25 kV/50 Hz) and (2) local with diesel traction.

The long distance line is 203 km long and classified as international line. The line route connects Savski Marof gr. (Slovenia Border) to Tovarnik gr. (Serbian Border), passing through Zagreb and Slavonski Brod along the river Sava.

The local line is 34 km long and classified as local line. The line route connects Varaždin with small village Golubovec passing via towns Ivanec and Lepoglava.

According to Eq. (1), the following calculation was made for passenger transport.

(a) Calculation on line Zagreb–Slavonski Brod:

$$C = ((1.84 + 0 + 0 \cdot \sum((2.00 \cdot 203) \cdot 5.99)) + (203 \cdot 2.05) \cdot 1$$

$$C = 4,890.92kn + VAT(25\%)$$

$$C = 6{,}113.65kn \cong 804.43€$$

(b) Calculation on line Varaždin–Golubovec:

$$C = ((0.95 + 0 + 0) \cdot \sum((0.30 \cdot 34) \cdot 5.99)) + (0 \cdot 2.05) \cdot 1$$

$$C = 58.04kn + VAT(25\%)$$

$$C = 72.55kn \cong 9.55€$$

After the calculation of minimum infrastructure package, we can calculate the overall average price stated per train kilometre for passenger transport. For our case, we need to extract the price of electricity on line Zagreb—Slavonski Brod and the VAT. On line Zagreb—Slavonski Brod the price is 22.04 kn/trainkm or 2.90 €/trainkm and on line Varaždin—Golubovec the price is 1.71 kn/trainkm or 0.23 €/trainkm.

An interesting fact is that in the overall price excluding VAT, the cost of electricity on the line Zagreb—Slavonski Brod amounts to 8.51%.

### *4.4.2 Freight Transport*

In this research two typical freight lines were chosen: (1) domestic line that combined electric and diesel traction and (2) transit line from Savski Marof gr. (Slovenia Border) to Tovarnik gr. (Serbian Border) with electric traction.

The first line is from Šibenik (port on Adriatic) and Kutina (famous fertilisers producer). This line is divided into three sections according to the line classification. The first section goes from Šibenik to Ogulin and covers a distance of 300 km with diesel traction, the second section is from Ogulin to Zagreb Ranžirni kolodvor (marshalling yard), a distance of 109 km and electric traction and the third section connects Zagreb Ranžirni kolodvor to Kutina with a distance of 81 km and electric traction. All three sections have different line parameters: 0.50 first, 1.60 s, and 2.00 third.

The second line is the main international line with the total distance of 327 km with electric traction. The allowed gross mass of train on this line is 2,000 tonnes, so additional charge for train mass must be added in calculation.

According to Eq. (1), the following calculation was made for freight transport.

(c) Calculation on line Šibenik—Kutina:

$$C = ((1.13 + 0 + 0) \cdot \sum((0.50 \cdot 300) + (1.6 \cdot 109) + (2.00 \cdot 81)) \cdot 14.31) + (190 \cdot 2.05) \cdot 1$$

$$C = 8,254.73kn + VAT(25\%)$$

$$C = 10{,}318.43kn \cong 1{,}357.69€$$

(d) Calculation on line Savski Marof gr.—Tovarnik gr.:

$$C = ((1.13 + 0.30 + 0) \cdot \sum((2.00 \cdot 327) \cdot 14.31)) + (327 \cdot 2.05) \cdot 1$$

$$C = 17{,}566.69kn \cong 2{,}311.41€$$

$$C = 14{,}053.35kn + VAT(25\%)$$

After calculation of minimum infrastructure package, we can determine the overall average price stated per train kilometre in freight transport. For our case, we need to extract the price for electricity and VAT. This is because only one part of the line Šibenik—Kutina is electrified. On line Šibenik—Kutina, the price is 16.05 kn/trainkm or 2.11 €/trainkm and on line Savski Marof gr.—Tovarnik gr. the price is 40.93 kn/trainkm or 5.39 €/trainkm.

Interestingly, in the overall price excluding VAT the cost of electricity on the line Savski Marof gr.—Tovarnik gr. is 4.77%.

### *4.4.3 Analysis of Relation Between IAC and GDP*

A very neutral parameter for measuring the development of infrastructure access charge is gross domestic product (GDP). Using GDP makes it possible to measure the total production of a country. In fact, GDP represents the market value of all the final goods and services produced in a country during one year. In this way the economic power of a country is measured. In comparative analyses, the absolute value of the gross domestic product is not a relevant indicator since absolute values of the economy of one country cannot be compared with those of another country. This would mean that in comparative analyses, the relative parameter has to be used. Such relative parameter is the gross domestic product per capita (GDPc). In our research, we are using data for GDPc from Croatian National Bank (Hrvatska narodna banka (2016)).

Regularly, usually every year, Independent Regulators' Group—Rail (IRG—Rail (2016)) publishes a document entitled Annual Market Monitoring Report. From this document for the purposes of our research, the data of average infrastructure manager revenue from track charges per kilometre for freight and passenger services have been taken.

The comparison of those two sets of data, GDPc and IACs from freight (FT) and passenger services (PT) is shown in Fig. 4.7, from which we can determine the development of infrastructure manager revenue related to GDPc from 2010 until 2013. The charges are indexed to the average revenue in 2010, the index is 100.

It is evident that the infrastructure manager revenue has been growing at an incredible pace, and comparing the movement of GDP, it can be concluded that the

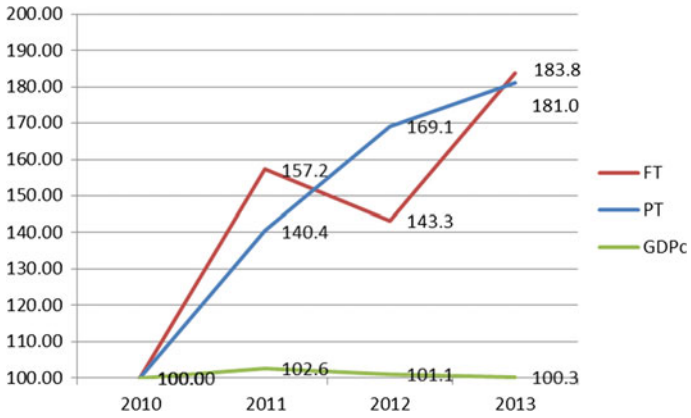


**Fig. 4.7** Relation between IACs and GDP

amount of the infrastructure access charge has not adhered to the economic situation. It is suffocating the railway undertakings instead. At that time, the traffic was operated only by national railway undertakings in passenger and freight transport.

## 4.5 Conclusion

This analysis showed that the Croatian network statement is not fit for purpose. Calculations are too complicated. Businesses, looking to utilise rail freight, are not in a position to understand these calculations. The process in Croatia needs to be simplified and made easier to understand. How otherwise is the rail network planning to attract new customers and fully utilise the infrastructure? Accessibility to rail freight must be increased. After all, the network statement is there for railway undertakings to benefit and therefore it must be designed in a way suit them.

The process of infrastructure access charge calculation must be simplified and access to customers improved. A measure that could alleviate the accessibility problems would be to offer all potential customers a software package to calculate infrastructure charges. This would allow customers—railway undertakings—to have a precise idea of the costs associated with rail freight and make a uniformed decision on rail freight in comparison to alternative means of transport. This would satisfy EU Directive 2012/34 which aims to increase the use of railway infrastructure, leading to a reduction of transport costs for society. This is a goal that everyone in the railway business can agree on and therefore efforts must be made to achieve it. There is a little excuse for not solving a problem which has an obvious solution.

## References

Abramović B (2012) Liberalization of railway market as a challenge for the national operator. In: Proceedings of globalization trends and their impact on the transport system in terms of the EU common market HORIZONS 2012, University of Žilina, Strečno, pp 12–18

Abramović B, Šipuš D (2016) Analysis of railway infrastructure charges fees on the local passengers lines in Croatia. In: Proceedings of international conferences on traffic and transport engineering ICTTE 2016, Assoc Italiana Ingn Traffico Trasporti Res Ctr Belgrade, Belgrade, pp 918–923

Bugarinovic M, Boskovic B (2014) A systems approach to access charges in unbundling railways. Eur J Oper Res 240(3):848–860

Commission Implementing Regulation (EU) 2015/909 (2015) on the modalities for the calculation of the cost that is directly incurred as a result of operating the train service of 12 June 2015. http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32015R0909&from=EN

Croatian National Bank (Hrvatska narodna banka). www.hnb.hr (accessed on 22 June 2017)

Directive 2012/34/EU (2012)of the European Parliament and of the Council of 21 November 2012 establishing a single European railway area. http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32012L0034&from=EN

Independent Regulators' Group—Rail (IRG—Rail). http://www.irg-rail.eu/ (accessed on 22 June 2017)

Ljungberg A (2013) Impacts of increased rail infrastructure charges in Sweden. Res Trans Econ 39 (1):90–103

Network Statement, HŽ Infrastructure Ltd. http://www.hzinfra.hr/network-statement-2016 (accessed on 22 June 2017)

RailNetEurope (RNE). www.rne.eu (accessed on 22 June 2017)