The rules of determining unit rates of basic charge and shunting charge effective from 21 December 2022

taking into consideration the decisions of the President of the Railway Transport Office (UTK) no. DRR-WLKD.730.11.2022.AO of 22 July 2022 and no. DRR-WLKD.730.12.2021.AO of 25 March 2022

The rules for determining the unit rates of the basic fee and the shunting fee presented below apply to the draft 2022/2023 price list approved by the President of the Office of Rail Transport with Decision No. DRR-WLKD.730.12.2022.AO dated 21 November 2022.

Pursuant to Article 33(21)(1) and (2) of the Act, the price list shall come into effect 30 days from the date on which the decision is made, i.e., 21 December 2022.

The President of the Office of Rail Transport has provided the following reasons for refusing to approve the draft price list, in the part concerning the method of determining the unit rate of the basic and shunting fee for railroad infrastructure with a track gauge of 1435 mm for the 2022/2023 train timetable:

for Decision No. DRR-WLKD.730.11.2022.AO of 22 July 2022:

- in the opinion of the President of the Office of Rail Transport, the IM should base the draft price list of fees for the use of railroad infrastructure with a track gauge of 1435 mm, in the part concerning the method of determining the unit rate of the basic and shunting fee for the 2022/2023 train timetable, on the data on the costs assigned for 2021 rather than, as it did, for 2020, and on the operating performance in the 2020/2021 train timetable rather than in the 2019/2020 train timetable.

for Decision No. DRR-WLKD.730.12.2021.AO of 25 March 2022 r.:

1) the introduction of a mechanism for adjusting coefficients differentiating the average rate depending on the rail line category and weight of trains for trains with booked commercial stops at platforms, despite the lack of clear indications justifying its application. In the opinion of the President of UTK, introduction of the additional parameter “L”, making the unit rate dependent on the frequency of planned stops, does not result from legal regulations;
2) the introduction of part of the rate related to the type of transport carried out (mark-up), despite the legal conditions preventing its application.
   In the opinion of the President of UTK, the market analysis was carried out in a period of stable economic growth (2019), free from sudden and negative effects of extraordinary situations and economic crises, so it cannot be the basis for the continuation of mark-up collection in timetable 2022/2023.
   In addition, in 2020 there was no increase in the productivity of freight carriers, which according to the President of UTK is a condition for the introduction of mark-up;

3) the method the basic and shunting charges are determined should be assessed jointly. Therefore, in view of the refusal to approve the draft price list, in the part concerning the method of determining the unit rate of the basic charge, it is reasonable to refuse to approve the draft price list in the part concerning the method of determining the unit rate of the shunting charge.

This draft price list takes into consideration the above-mentioned reasons for the refusal to approve the price list in the part concerning the method of determining the unit rate of the basic and shunting charge, i.e.:

1) the price draft based on costs form year 2021 and operation work during the train timetable 2020/2021;
2) coefficients differentiating the average rate depending on the category of the railways and the train mass are not corrected by the parameter "L" depending on the amount of the unit rate on the frequency of planned stops at the platforms included in the timetable ordered by the applicant, therefore, the direct costs of platforms with the infrastructure enabling passengers to reach them, on foot or by vehicle, from a public road or a railway station, are not included in the direct costs (according to a non-approved price list they amounted to PLN 14.4 mln) and
3) the unit rate of the basic charge for freight trains of not less than 660 tonnes carrying out non-intermodal transport does not include the part of the rate related to the type of transport performed (according to the non-approved price list it amounted to PLN 1.28/train-km).

The list of the railway lines managed by PKP Polskie Linie Kolejowe S.A. and tariff categories assigned to them and enforceable as from 11 December 2022, published in the 2022/2023 Network Statement constituting annex 9.3, has been updated.

1. The method of determining the costs incurred directly as a result of the train journey

1.1. Principles for calculating direct costs

Determining costs incurred directly in result of the train journey (hereinafter: "incurred directly in result of the train journey" / "direct costs") for the calculation of unit prices for the access to rail infrastructure were carried out on the basis of:

1) Act of 28 March 2003 on rail transport – hereinafter "Act";
2) Ordinance of the Minister of Infrastructure of 7 April 2017 on the provision of railway infrastructure – hereinafter "Ordinance";
3) Commission Implementing Regulation (EU) 2015/909 of 12 June 2015 on the modalities for the calculation of the cost that is directly incurred as a result of operating the train service – hereinafter: "EC Regulation".

The process of determining direct costs was developed in accordance with the aforementioned legal acts, however the method of marginal costs mentioned in recital 12, 13 and 14 of the EC Regulation was not applied[1].

The following assumptions were made for calculating direct costs:

1) the difference between costs method was applied in accordance with Article 3 section 1 of the EC Regulation:
   "Direct costs on a network-wide basis shall be calculated as the difference between, on the one hand, the costs for providing the services of the minimum access package and for the access to the infrastructure connecting service facilities and, on the other hand, the non-eligible costs referred to in Article 4."
   Through the exclusion of unqualified expenses, the calculation of unit prices for the minimum access package and for the access to the infrastructure connecting service facilities (hereinafter: "for minimum access to railway infrastructure") includes solely costs incurred directly in result of the train journey.
2) in accordance with § 21 section 13 of the Regulation:
   "the planned level of direct costs shall be based on the level of the corresponding direct costs in the last completed financial year".
   In order to maintain coherence, information about technical and operational data is sourced from analogous period as financial data;
3) direct costs are defined taking into account coefficient of variability of operation work and planned inflation indicators; in the case of increases in total payrolls

[1] CJEU Judgment on case C-152/12 did not indicate if the notion of direct cost is identical with the notion of marginal cost or of direct costs should be defined using the marginal cost method. In case C-152/12, CJEU assessed the correctness of the adoption in the Bulgarian national legal order of a charging method based on the marginal costs of rail infrastructure maintenance

– planned indicators of factual dynamics of gross remuneration in national economy (§ 21 section 13 of the Regulation).

Moreover, it has been defined:

1) only those costs for which the experts of the respective industries had no doubt that they were actually incurred directly as a result of the train journey were classified as direct costs;
2) direct costs include the part of the cost of: maintenance and renewal of railway infrastructure, operation of railway traffic and depreciation;
3) for each of the above cost groups, a separate method of calculating direct costs was used, i.e.:
   a) costs of maintenance and renewal of railway infrastructure using the “zero-one” method,
   b) the operation of rail traffic on the basis of the active time commitment of personnel involved in preparing and operating rail traffic,
   c) depreciation determined on the basis of the actual wear and tear to the railway infrastructure due to the train journey.

At the outset, technical and operational data were collected; they are used to establish the direct costs of operating the railway service and the depreciation costs established on the basis of the actual wear and tear on the infrastructure as a result of train movements. After the books for the financial year were closed, financial data was obtained from the SAP Business Objects system, which is fed with data from ledgers maintained in the SAP FI system, SAP FI-AA and controlling data originating from records maintained in the SAP CO system.

The following were used to establish the costs serving as the basis for the calculation of rates for access to railway infrastructure for the price list for train timetable 2022/2023:

1) planned rates of change for 2022 and 2023[2]:

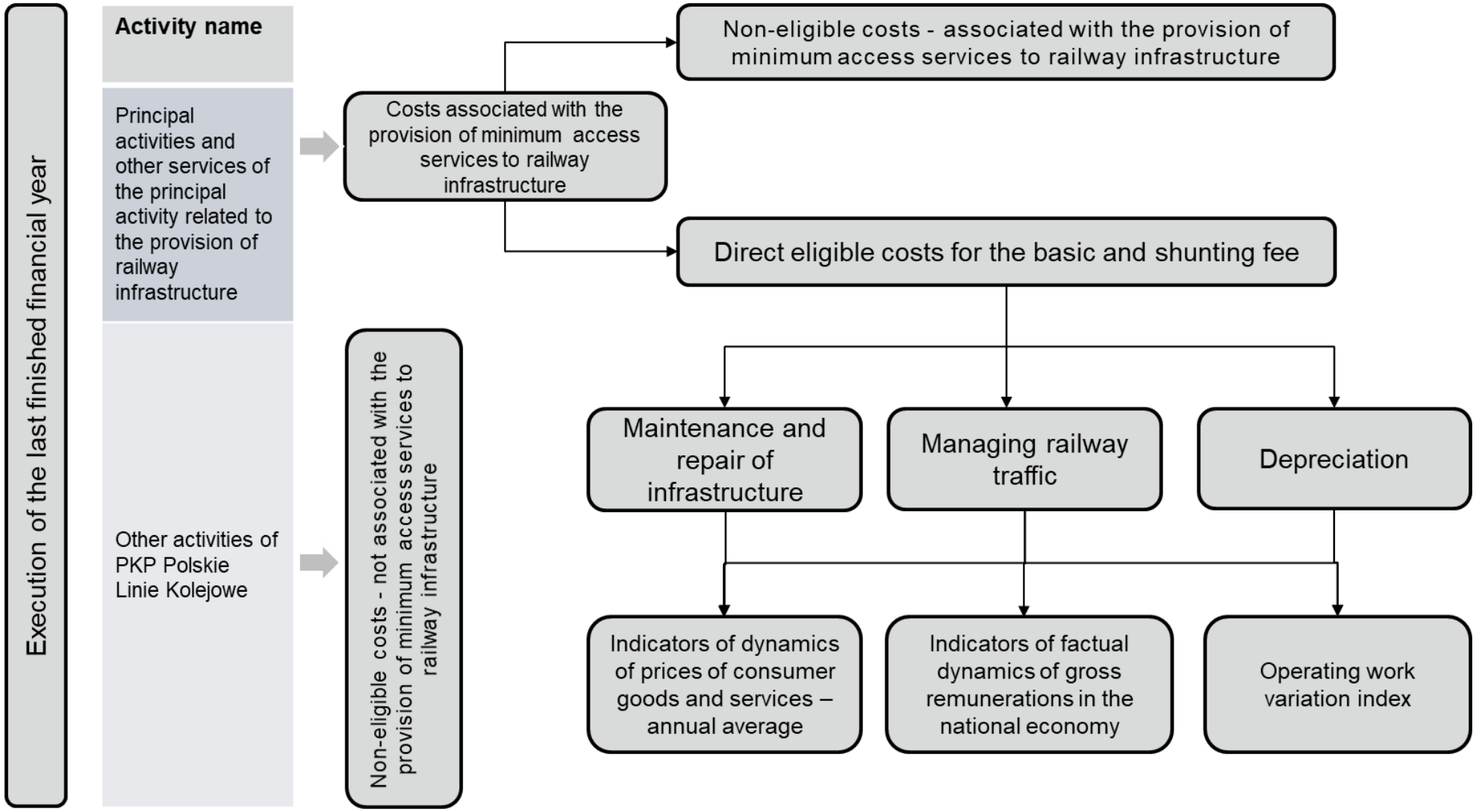
No.	Indicators	2022	2023	Change 2023/2021
1	Dynamics of prices of consumer goods and services – annual average	109,1%	107,8%	117,6%
2	Average gross salary in the national economy – real dynamics	101,0%	101,6%	102,6%

2) coefficient of variability of operation work:

No.	Period	Total number of days
1	Train Timetable 2022/2023 (from 11 December 2022 to 9 December 2023)	364
2	Year 2021 (1 January to 31 December 2021)	365
3	Coefficient of variability of operation work Z value (pos.1 / pos.2)	0,99726

[2] Source: Guidelines on the use of uniform macroeconomic indicators as the basis for estimating the financial effects of proposed laws (updated – April 2022). Minister of Finance.

Fig. Diagram of the process of determining the costs



The calculation process specifies the following costs:

1) direct, of which:
   a) part of the costs of maintenance and repairs of railway infrastructure,
   b) a portion of the costs of managing rail traffic,
   c) depreciation calculated on the basis of the actual wear and tear of the infrastructure due to the journey of train;
2) non-eligible[3], including:
   a) non-eligible not related to the provision of minimum access services to railway infrastructure, including
      i. financial,
      ii. other operating activities,
      iii. administrative and company-wide,
      iv. external sales of other services,
      v. sales of materials,
      vi. the sale of in-house services of social facilities,
      vii. investment division,
      viii. Railway Security Guards,
      ix. maintenance of service facilities,
      x. decommissioned infrastructure,
      xi. provision of access services to railway lines for which a timetable is not developed,
      xii. provision of rail infrastructure services with a track gauge of 1520 mm,
      xiii. cost of manufacturing products for own use,
      xiv. depreciation not included in costs relating to the provision of minimum rail infrastructure access services,
   b) non-eligible costs related to the provision of minimum access services to railway infrastructure, including the portion of costs for depreciation, traffic management and maintenance and repair of railway infrastructure, in particular:
      i. railway infrastructure – not directly attributed to lines and stations,
      ii. remedying the consequences of railway accidents,
      iii. operation defined as the costs of owning, maintaining and operating fixed assets, such as electricity consumption (per kWh) and the purchase of distribution services for electricity, district heating, water consumption, rents, maintenance and cleaning services, property

[3] at the same time, bearing in mind the obligation arising from Article 4 section 2 of the EC Regulation, the direct costs do not include capital expenditures which PLK is not obliged to reimburse.

supervision services, telecommunications services including charges for subscriptions and telephone calls, taxes and charges,

iv. diagnostics, defined as the performance of activities aimed at assessing the technical condition and working environment of the owned property,

v. emergency repairs,

vi. protection against theft and costs of restoring the consequences of theft and devastation,

vii. maintenance, current and major repairs except for direct costs,

viii. automation and telecommunications industries,

ix. energy industry with the exception for direct costs,

x. road industry with the exception for direct costs,

xi. passenger infrastructure industry,

xii. other industries,

xiii. by type:

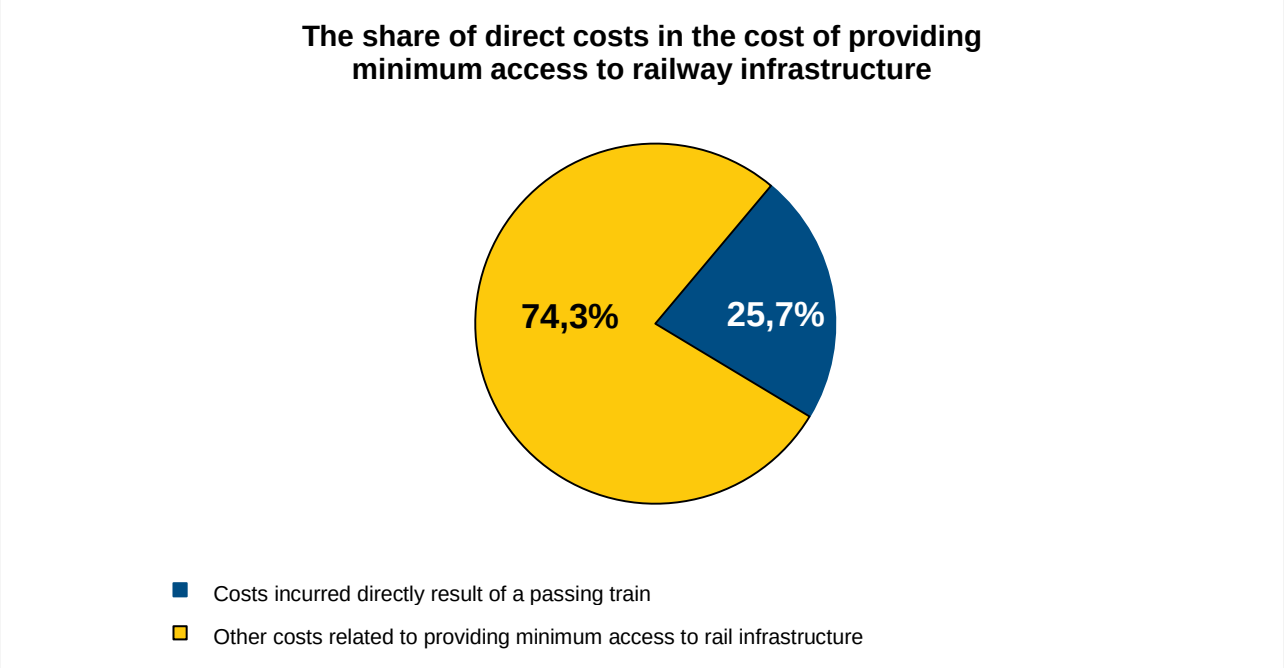
- depreciation allowances which are not set on the basis of the infrastructure's actual wear and tear as a result of the train's journey,
- solid fuel consumption,
- consumption of materials and energy except for direct costs,
- salaries and employee benefits with the exception of wages, which are direct costs,
- outsourced services, except for repair, maintenance and other services constituting direct costs,
- other costs by type,
- taxes and charges,
- internal services purchased.

Presented below is the cost plan for 2023, related to the provision of minimum access services to the PLK railway infrastructure, in millions [PLN].

No.	Specification	Costs not related to the provision of minimum access to railway infrastructure	Costs incurred directly as a result of the train journey	Non-eligible costs
1	2	3	4	5
A	Administrative and overhead expenses			
B	Costs of managing railway traffic	1 559,64	464,51	1 095,13
C	Costs related to maintaining and repairing railway infrastructure	4 250,99	1 501,02	2 749,97
D	Depreciation [1)]	2 388,53	139,34	2 249,19
E	Costs related to Railway Security Guards			
F	Other costs (not included in the railway infrastructure)			
G	Costs of other operating activities			
H	Financial costs			
I	TOTAL EXPENSES RELATED TO BUSINESS ACTIVITY	**8 199,16**	**2 104,87**	**6 094,28**

[1)] columns 3 and 5 contain monthly write-offs on received grants for financing fixed assets under construction

The share of direct costs in the cost of providing minimum access to rail infrastructure is shown in the diagram below.



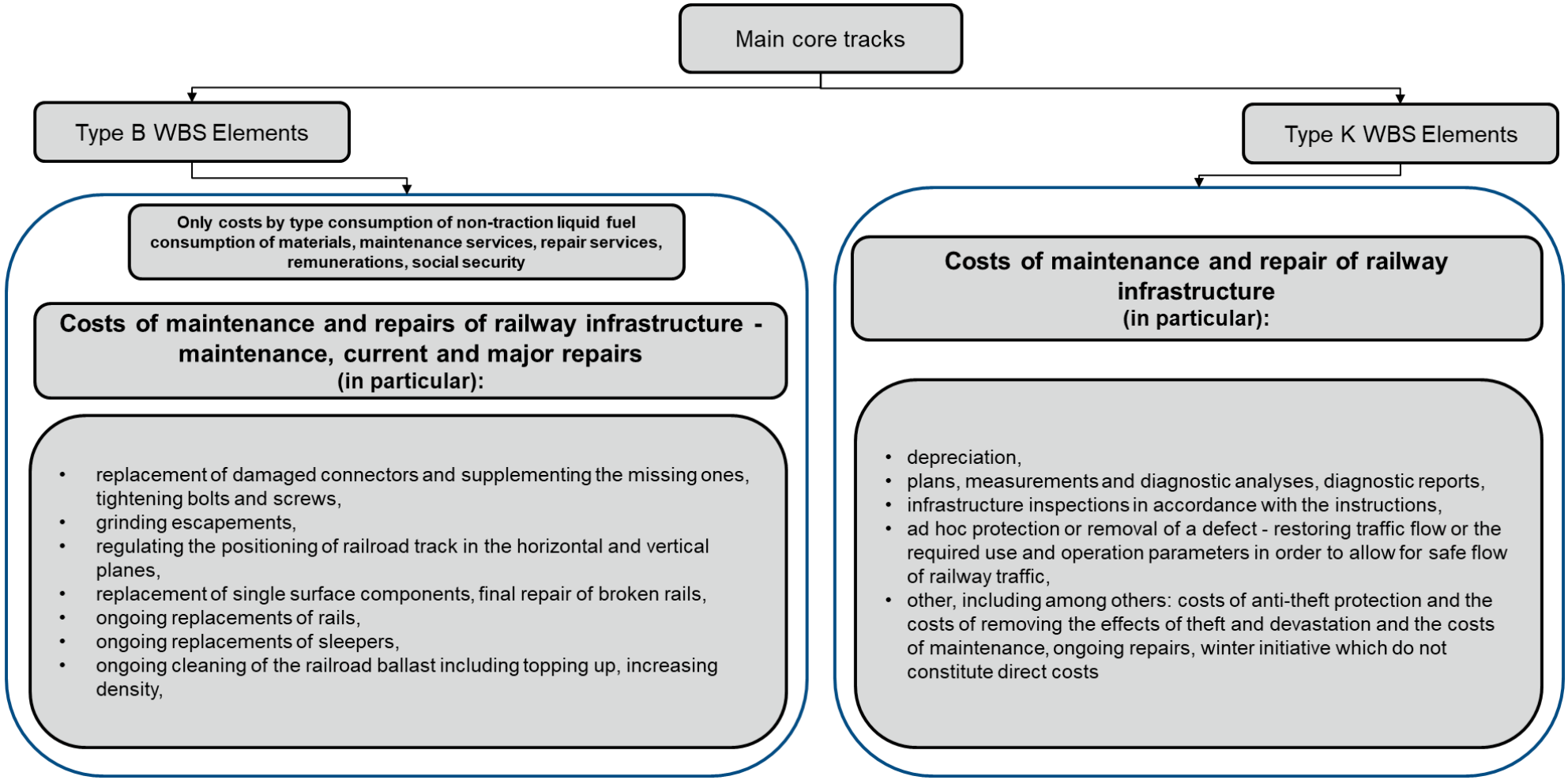
1.2. Costs related to maintaining and repairing railway infrastructure

For the purpose of determining the direct costs of infrastructure maintenance and repairs, the so-called “zero-one” method was applied. The “zero-one” method consists of evaluating individual types of economic events in terms of their occurrence as a direct result of a train journey. In order to categorise particular economic events into those which arise as a result of a train journey and those which will constitute non-eligible costs, the provisions of PLK’s controlling policy have been amended. The group of economic events generating direct costs include only those which did not give rise to any doubt regarding their direct dependence on the train journey. If a team of experts from particular industries, in the course of analyses and consultations, decided that even a part of the activities of a given economic event does not depend on journey of a train – such an event was not eligible for direct costs. The costs of such events shall then be non-eligible costs relating to the provision of minimum rail infrastructure access services. In the SAP CO system, so-called WBS elements (technical name) are used for recording costs connected with providing services of minimum access to railway infrastructure – basic activity assigned directly to lines and stations. In order to precisely distinguish costs incurred directly in result of train journey, new, dedicated type of WBS elements, so called WBS element type B, has been created (in order to register costs incurred directly as a result of train journey on the area of other PLK's railway lines plants WBS

element type M). Non-eligible costs (related to providing services of minimum access to railway infrastructure) of basic activities assigned directly to lines and stations are also registered on separate WBS elements, so called K-type WBS elements (for registration of non-eligible costs incurred on the territory of other PLK's railway lines plants L-type WBS elements). In addition, validations were entered into the SAP CO system for the correct recording of costs. The correctness of cost registration is also confirmed through a three-step verification process, i.e., at the stage of assignment (substantive control), at the stage of entry into the SAP system (control through validations) and at the reporting stage (a report created in the SAP BO system allows for identification of cases of accounting entries that are inconsistent with assumptions). The data generated by the aforementioned SAP BO report are subject to additional verification as to their compliance with the assumptions adopted for qualification as direct costs. In case of ambiguity or unjustified bookkeeping there is a process of consultation with relevant PLK's cost accounting units and with PLK's substantive units. The source document is verified, if a specific cost is booked in accordance with the assumptions (it is a direct cost), in such case, the accounting description is made more precise so that this cost item does not raise doubts as to its correct qualification, otherwise – the cost booked in violation of the assumptions (it is not a direct cost) is excluded from the direct cost base. PLK's practice of multi-level control of direct costs using the SAP ERP system and due to the knowledge of PLK's industry experts, is conducive to maintaining the principles of diligence and reliability in the calculation of direct costs, reliability of data and counteracting randomness in the determination of these costs.

The diagram below shows the example of the breakdown of economic events into direct and non-eligible costs for activities on the main core track, which is the most significant cost group by value.

Fig. The example of the breakdown of economic events into direct and non-eligible costs for activities on the main core track



1.3. Costs of managing railway traffic

The direct costs of running the railway traffic, taken into account in the calculation of the unit rates for minimum access to railway infrastructure, shall be generated in relation to the performance of the activities necessary to carry out the journeys on the following positions:

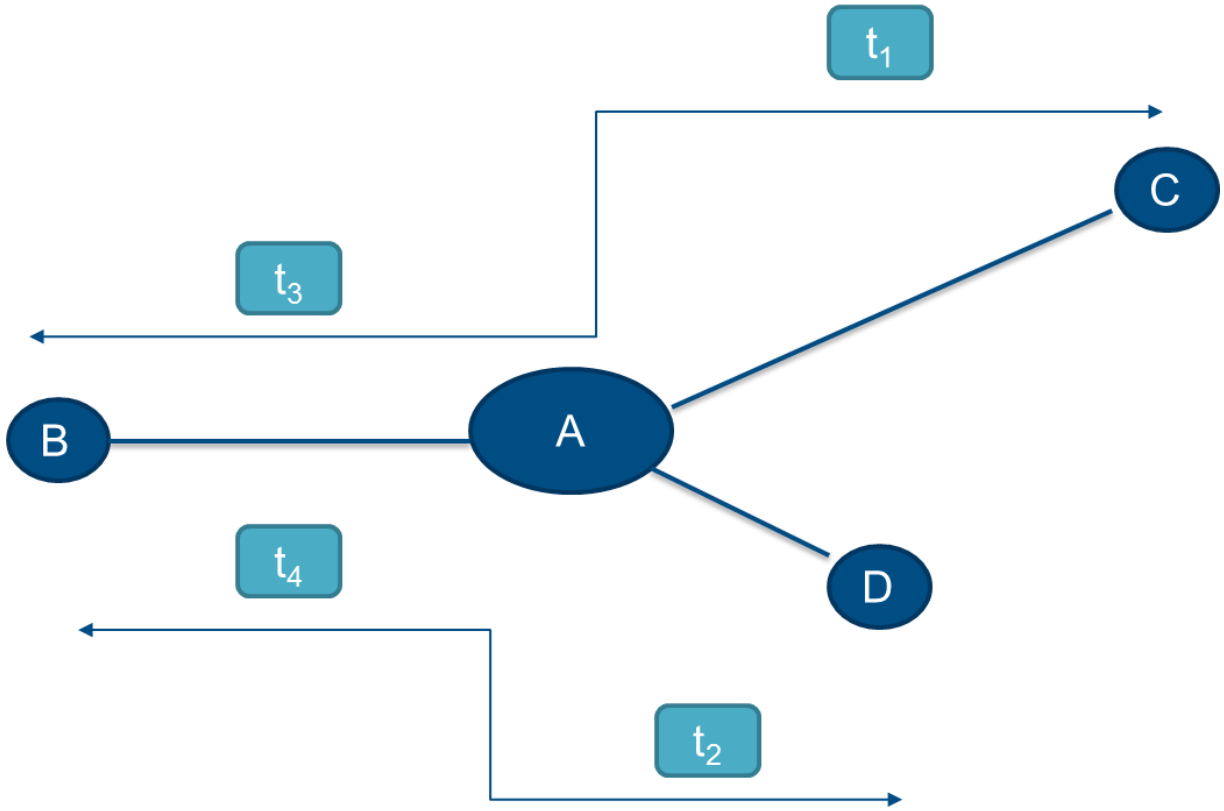
1) signallers, signalmen and rail switch operator;
2) crossing guards;
3) production planning dispatchers and line dispatchers;
4) transport timetable constructors.

The direct cost is the cost determined by the time of active involvement of employees in the above positions in the preparation and operation of rail traffic. Active involvement time shall be construed as the time spent on activities related to the preparation and implementation of train runs and shunting.

The direct costs also include the part of the cost of wages which represents the cost of the active time engaged by signallers, signalmen and rail switch operators, crossing guards, production planning dispatchers, line dispatchers, transport timetable constructors, and in the case of signallers, signalmen and rail switch operators in preparing and carrying out train runs and shunting. Non-eligible costs are other costs, in particular standby costs, for annual leave, special leave, additional leave, training, medical examinations and other absences.

1.3.1. Signallers, signalmen and rail switch operators

The train service time of a traffic station is defined in accordance with the diagram below:



where:

A – the signalling station for which the calculations are made,

B, C, D – adjacent call stations,

signal station – a station that has the possibility to change the order of trains running on the line adjacent to this station,

t_1 – train running time from station B to station C,

t_2 – train running time from station B to station D,

t_3 – train running time from station C to station B,

t_4 – train running time from station D to station B.

In the case of the start/end of the journey at station A, the time was measured as follows:

t_1 – train running time from station A to station C or from C to A,

t_2 – train running time from station A to station D or from D to A,

t_3 – train running time from station A to station B or from B to A.

Note: in Local Control Stations (LCS), where train movements are managed by a section signaller, the time is counted from the LCS section contact station to the LCS section contact station.

PLK railway lines facilities adjust the working time of the stations to the ordered train routes. Posts are not manned 24 hours a day on all days unless trains are scheduled to run during that time according to a fixed timetable.

In case of no train movement on particular sections of the railway line, the direct costs of the employment of trackmen, crossing foremen, signalmen, rail switch operators and signallers are not charged for those sections.

According to a legal opinion obtained by PLK[4], the work of crossing trackmen, signalmen, rail switch operators and signallers is related to the provision of railway infrastructure and a part of remuneration costs incurred for these positions is a direct cost. This is also confirmed by paragraphs 81 and 82 of the CJEU judgment in Case C-512/10:

"81 As the Advocate General pointed out in point 99 of his Opinion, the costs connected with signalling, traffic management, maintenance and repairs are liable to vary, at least partially, depending on traffic and, accordingly, may be considered, in part, to be directly incurred as a result of operating the train service.

82 It follows, conversely, that because they include fixed costs relating to the provision of a stretch of line on the rail network which the IM must bear even in the absence of train movements, the maintenance and traffic management costs referred to in Article 8(1) of the 2009 Ministerial Regulation must be considered to be only partially directly incurred as a result of operating the train service.".

Taking the above into account it should be stated that since in case of lack of train traffic on particular sections of railway lines made available by PLK the costs of remuneration of crossing trackmen, signalmen, rail switch operators and signallers servicing traffic on these sections of lines are not incurred (these posts are not staffed if train traffic does not take place on these sections of lines), then the costs of remuneration of crossing trackmen, signalmen, rail switch operators and signallers are not costs referred to in 4 section 1 letter a of EC Regulation.

Following the general definition of direct cost in Article 2(1) of the EC Regulation, it is therefore possible to examine whether there is "attributability" of a given cost or part of it to a train journey or shunting. If a cost is incurred because it was incurred specifically for the purpose of making a train run or shunting, then that cost without

[4] The EC Regulation does not contain an enumeration of the costs of operating rail traffic, including the direct costs of train drivers, signalmen, rail switch operators or crossing guards. Considering the above, a decision was taken as a precaution to assist in the interpretation of the above EC Regulation by the law firm of Prof. Wierzbowski & Partners, through the implementation of the task titled: "How to interpret the direct cost of running traffic, i.e. whether the remuneration of crossing guards, signalmen, rail switch operators and signallers may be included by the railway infrastructure manager in the direct cost of running train traffic in the light of Article 4 section 1, Article 1, Article 3 section 1 and Article 4 section 4 of the Regulation 2015/909"

a doubt a direct cost. It should also be noted that the English version of this definition uses the term “train service” which means more a railway service and not just a single train journey.
As the calculated part of direct costs does not include all remuneration of employees connected with railway traffic, but only such a part that falls within the period of active engagement and was calculated on the basis of measurable and verifiable objective criteria, these costs are direct costs according to the definition according to Article 3 section 4 of the EC Regulation. Article 3 section 4 of the EC Regulation is not a closed catalogue of costs.

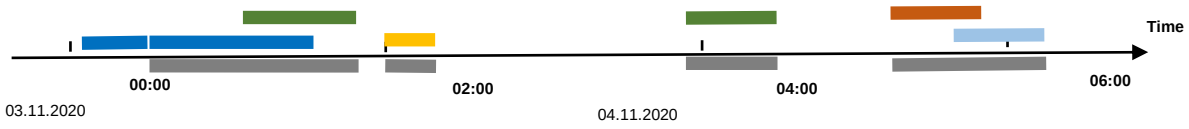
The time of active involvement of the signallers was determined on the basis of the recording of train journeys. A signaller must be actively involved from the moment a train departs from the previous control station until the moment the train enters the next control station. Then, the signaller shall carry out a series of actions as specified in the technical rules and regulations and instructions in order to ensure that the train arrives/ arrives safely from/to the next station.

The input data for determining the active engagement time included:

1) the set of all timetabling points on PLK’s railway lines, each assigned to a control station. This set was created on the basis of data from the EDR [*Elektroniczny Dziennik Ruchu*] (Electronic Traffic Log) system and the POS [*Prowadzenie Opisu Sieci*] (Maintaining Network Description) database;
2) a set of information on trains, their routes and times of passing particular scheduled points along the route, created on the basis of data from the SEPE [*System Ewidencji Pracy Eksploatacyjnej*] (Operational Work Record System).

The route of each train taken into account in the calculations is divided into sections served by individual call stations located on the route of the train. For each section of the route, the time of active involvement of PLK’s employees in maintenance of this route section by a given control station was determined.
In result of the calculations, separate time slots for each day are defined within which the train service takes place at the respective control station. Overlapping periods of active involvement, are due to the simultaneous running of trains serviced by a given signalling station; they are not summed up.

Examples of time intervals included in the calculations are marked in grey in the figure below.



Depending on the type of signalling equipment, train journey is carried out also through the active involvement of the signalman and the rail switch operators.
Based on data established for PLK's 1435mm gauge network and for specific months of 2021 with regard to:

1) the total time of active involvement of train dispatchers expressed in the number of hours;
2) the total operating performance expressed in train-kilometres;
3) the total number of calculated train dispatcher stations per day,

correlation coefficients were calculated for:

a) the total time of active involvement of train dispatchers and the total operating performance in each month and
b) the total number of calculated train dispatcher stations per day

and the total operating performance per day in each month.

The calculation results show that:

1) the correlation coefficient for the case mentioned under (a) is 0.895, so there is a very high correlation between the total time of active involvement of train dispatchers and the volume of operating performance,
2) the correlation coefficient for the case mentioned under (b) is -0.062, so there is no correlation between the state of employment in the period under review and the volume of operating performance.

This means that while employment costs are costs that can be considered fixed (independent of changes in the volume of operating performance) during the period under analysis, direct costs resulting from active involvement time are variable and depend very much on the volume of operating performance.

Shunting service times for signallers, signalmen and rail switch operators are also included. Shunting operations are recorded in the EDR system. In this system, employees of PLK’s receive the applications for allocating infrastructure capacity for shunting submitted by railway undertakings (or they register such applications in emergency mode – on request of railway undertaking’s employee – e.g., when the engine driver in case when the railway undertaking did not submit the application).

The data recorded in the EDR system served as the basis for the calculation of direct costs with respect to shunting, including:

1) the volume of shunting work expressed in kilometres travelled;
2) the number of shunting operations performed, including the number of train formation operations performed.

The time of active involvement of the manoeuvring personnel included the averaged times resulting from:

1) ordering and agreeing manoeuvres;
2) the total time of the manoeuvres.

The total time of engagement with shunting services at stations where shunting was recorded in the EDR system was calculated on the basis of the aforementioned data.

1.3.2. Crossing guards

The basis for establishing direct costs is the time spent by a crossing guard actively engaged in servicing a passing train. This is the time between notifying the crossing guard about the approaching train and the train leaving the level crossing. The average values of active engagement time were established for each level crossing by employees of PLK's railway lines plants operation section on the basis of technical and operation documentation.
The average active involvement times is determined separately for trains in odd and even directions. The active time of the crossing guard is calculated taking into account:

1) number of trains in the odd direction during the year;
2) the average time from the notification to the crossing guard to the moment when the train in odd direction leaves the crossing;
3) the number of trains in the even direction during the year;
4) the average time from the notification to the crossing guard to the moment when the train in even direction leaves the crossing.

The source of data on the actual number of trains passing in odd and even directions during the year is the Operational Work Record System (SEPE).
The times of active involvement of crossing guards during the year, determined for individual positions of crossing guards are later summed up for the entire PLK network.
The total annual working time of the crossing guards is determined on the basis of the number of calculated posts of the crossing guard, where one calculated post of a crossing guard means one single 24-hour post of a crossing guard.

1.3.3. Production planning dispatchers and line dispatchers

Work of dispatchers is aimed at preparation (planning) and performance of transport timetable, including organisation of train traffic in cases of difficulties in transport process, supervision of current operational work of PLK's organisational units and documentation of realisation of operational work and its quality.

The task of the production planning dispatcher is to cooperate with the carriers in organising and planning the transport work, to receive for planning the data on trains that the carriers intend to run or cancel within the 6-hour dispatching planning and to check the correctness of the data entered into the SEPE system. In addition, the production planning dispatcher implements the notification process for the transport of extraordinary consignments (EC) and high-risk dangerous goods (HRDG) with the required information flow (notifications). In the event of operational difficulties, it agrees with the carriers on diversions (circular) routes and modifies the implementation of the timetable in an emergency procedure. The regulation and coordination of the timely implementation of the transport timetable, directly resulting from the passage of these trains together with the derogations, shall be carried out on a continuous basis.

Dispatcher for production planning as part of the activities resulting from the train journey:

1) cooperates with railway undertakings running trains on the railway lines under dispatching control in the field of organising and planning the transport work;
2) plans with the operators' dispatchers for the activation and cancellation of trains;
3) receives calls from carriers with information for trains with high-risk goods and exceptional consignments in the dispatching planning process;
4) enters the information received from the carriers for trains with high-risk goods and exceptional consignments into the SEPE, participates in organising train movements in situations of emergency, crisis or other difficulties to rail traffic, and agrees with the carriers the diversionary routes and their modifications in the contingency procedure;
5) cooperates with the dispatchers of other dispatching centres and the dispatchers of the carriers as regards disconnected or abandoned trains and other identified irregularities in order to ensure the correct and safe conduct of the transport process;
6) informs the regional post dispatcher of the Railway Security Guards having jurisdiction over the station where the train is launched about the intention to switch on the wagons with SEPE;

7) clarifies anomalies in the data entered into the SEPE system on the basis of information received from carriers for trains with high-risk dangerous goods and exceptional consignments generated at the moment of declaring a train ready;
8) provides railway undertakings with information on execution of transport schedule with exceptional and HRDG consignments, on technical and operational conditions of railway lines for execution of ad hoc transport needs.

The task of the line dispatcher is to supervise the movement of trains on designated railway lines, to direct the movement of trains and to document on an ongoing basis the operational work carried out. In addition, the line dispatcher cooperates with carriers' dispatchers in the area of cancellations, changes of train relations, train connections, directing a train along a diversion (round trip), assigning unscheduled stops at stations or passenger stops (agreeing on locations of unscheduled changes of locomotives and train crews in the case of operational difficulties). Receives information and notifies relevant dispatchers (including carriers), signallers of occurring difficulties due to emergency, extraordinary or operational situations that may cause train delays, giving the estimated time of train delays and the removal of their cause.
As part of the activities resulting from the train journey, the line dispatcher:

1) monitors train movements to ensure that the timetable is implemented correctly;
2) regulates the movement of delayed trains and establishes the order of departure of trains in the event of operational impediments;
3) acquires, processes and communicates schedule-related information to the actors involved in the transport process for the efficient running of the train service;
4) informs the traffic engineers on the section to be managed of any difficulty caused by a crisis, emergency or operational situation likely to cause train delays;
5) provides information on the execution of the timetable to the signaller on the managed section in case of damage to the system supporting the signaller;
6) records operational work in order to create a database for billing purposes.

1.3.4. Transport timetable constructors

According to Article 3 section 4 letter d of the EC Regulation, direct costs include "personnel costs necessary for the preparation of the allocation of train routes and timetables insofar as they are directly incurred as a result of train runs". According to the provisions of article 4 item 23 of the Act, "transport timetable – a plan, according to which train journeys are to take place on a given railway network or its part in the time when it is in force".

The development of the timetable is the first stage in the capacity allocation process. In accordance with the § 25 section 1 of the Regulation of the Minister of Infrastructure of 18 July 2005 on general conditions for railway traffic and signalling: "Train traffic is based on the transport timetable".

The allocation of capacity shall be made in accordance with the provisions of the Act, the Ordinance, the Regulations and the Train Timetable Instruction Ir-11.
The following positions are involved in the timetabling process:

1) position for ATS construction,
2) position for STS construction,
3) position for ITS construction.

The transport timetable shall aim to guarantee the punctuality of rail traffic and shall be drawn up in cooperation with the applicants concerned. The timetable is drawn up after the designer has thoroughly familiarised himself or herself with the technical and operational conditions of the railway sections. Each activity carried out by the constructors at various stages of the timetable preparation is directly linked to the allocation of a specific train path within the timetables prepared by PLK.

For the calculation of direct costs, the time of active involvement was adopted, understood as "physically" worked hours (after deduction of breaks resulting from work regulations of PLK Railway Traffic Management Centre), allocated directly to preparation of timetables and allocation of capacity for development of:

1) annual timetable;
   The process is carried out in accordance with the dates indicated in the Schedule for the development of the Annual Timetable of trains contained in the Regulations. A detailed description of the process is contained in the Train Timetable Instruction Ir-11 and Network Statement Regulations.
   As a result of the work on the ATS, capacity is allocated for passenger and freight applicants. Throughout the validity of the ATS, PLK allows timetable update consisting both in updating allocated capacity and submitting applications for new train routes. Updating takes place in accordance with the deadlines set out in the Rules.
2) individual transport timetable
   In addition to the ATS, applicants may apply for capacity allocation under the ITS in accordance with the provisions of the Regulations. Unlike the ATS, the applications under the ITS are processed throughout the entire day each day of the year. Individual timetable posts are not subject to a timetable – work is carried out on an "order and go" basis within the available free capacity in accordance with the provisions of the Train Timetable Instruction Ir-11 and

Network Statement Regulations.

The ITS shall allocate capacity for passenger and freight applicants.

1.4. Depreciation costs

Considering Article 4 section 1 letter n of the EC Regulation, the necessity to apply the precautionary approach to the calculation of direct costs and international practices, PLK decided to get support from external experts by carrying out the task titled: “Establishing a concept for the estimation of depreciation allowances, which are determined on the basis of the actual wear and tear of the infrastructure as a result of train movements, and preparing an IT tool”. At the same time, the compliance of the developed method with the applicable legal regulations was assessed by the law office of Prof. Wierzbowski & Partners in an opinion: “Whether depreciation determined on the basis of the actual wear and tear of the infrastructure as a result of train journey (Article 4(1)(n) of the EC Regulation), can be eligible as a direct cost in the light of the exclusion of fixed costs from eligible costs (Article 4(1)(a) of the EC Regulation)”.

In order to define how to determine the direct cost of depreciation calculated on the basis of the actual wear and tear of the infrastructure caused by train journey, an analysis of European practices was carried out regarding ways of assessing the wear and tear of infrastructure caused by the passage of a train. A number of factors influence the wear and tear of railway infrastructure (tracks, overhead line, engineering structures). This infrastructure is worn out both by the passage of trains and by natural (always occurring, regardless of use) degradation (e.g., biological corrosion, atmospheric corrosion, hydro-erosion). The factors associated with train travel that affect the wear and tear of railway infrastructure make this process exceptionally complex.
In result of the analysis, due to limited or no information on the dependence of infrastructure wear and tear on train movements which is difficult to apply in practice, depreciation determined on the basis of the actual wear and tear of the infrastructure as a result of train movements was abandoned for the overhead contact line and engineering structures. As there is by far the richest body of scientific knowledge on track wear in relation to train movements, calculations were carried out for the main tracks. The wear of the main tracks as a function of train movements depends on a number of design and operational parameters related to the moving vehicles such as weight, speed, power, axle load, number of axles, structural geometry, etc.
On the basis of recitals 4 and 5 and Article 3 section 3 of the EC Regulation, the historical values of fixed assets, based on the amounts paid for their acquisition, which PLK was obliged to pay, were used to calculate direct depreciation costs. To fixed assets (subtype of main tracks) downloaded from SAP FI-AA system the information on

nominal durability was assigned on the basis of "Methods of assessment of serviceability of railway superstructure construction SOKON[5] and technical information, which are the basis for correcting the nominal life by real traffic indicators (influence of train speed and train axle load on the degradation of railway superstructure, influence of goods trains on the life of track, influence of geometrical quality of track - vertical horizontal unevenness expressed by synthetic index J, influence of curves on the life of rails and sleepers). On this basis, the corrected life is determined. In turn, the annual wear and tear on fixed assets as a result of train movements is calculated as the ratio of annual load to adjusted life. On the other hand, depreciation costs directly attributable to train operations are the product of the depreciation of fixed assets financed from own resources and the quotient of the consumption coefficient and the accounting depreciation rate.

Using the above method of determining depreciation costs on the basis of the actual wear and tear of the infrastructure as a result of the train running, the non-eligible cost is the difference between the depreciation costs calculated in accordance with accounting rules and the direct depreciation costs.

A diagram of the process for calculating the depreciation cost determined on the basis of the actual wear and tear on the infrastructure as a result of the train passage is shown below.

[5] Bałuch H. Method of assessing the serviceability of railway superstructure "SOKON", Railway Research Institute. Warsaw, 2004

Fig. Diagram of the process for calculating the depreciation cost determined on the basis of the actual wear and tear on the infrastructure as a result of the train passage

$$Wz = \frac{Q_a}{T_s}$$

W_z – wear and tear coefficient
Q_a – annual load
T_s – adjusted durability

$$A_b = \frac{W_z}{A_k}$$

W_z – wear and tear coefficient
A_b – direct depreciation
A_k – accounting depreciation rate

* Original title: *Metoda oceny zdatności eksploatacyjnej konstrukcji nawierzchni kolejowej „Sokon", Zadanie nr 3072/11. Podstawy opracowania oraz instrukcja użytkowania, Henryk Bałuch, Warszawa, 2004.* Opracowanie stanowi instrukcję do programu komputerowego służącego do oceny zdatności eksploatacyjnej stosowanych w Polsce konstrukcji nawierzchni kolejowych

1. **Assignment of nominal durabilities (in accordance with H. Bałuch's "SOKON" study*) for individual assets depending on the combination of rails, tracks and sleepers while maintaining the nominal parameters of speed, axle loads, track maintenance index and freight trains index**

2. **Correction of the nominal durability in relation to the actual speed, axle load, track maintenance index, freight train index and curve count index (using the formulas in accordance with H. Bałuch's "SOKON" study*)**

3. **Calculation of the annual wear and tear on fixed assets as a result of train movements is calculated as the ratio of annual load to adjusted life**

4. **The quotient of the annual use and the depreciation rate is the part of accounting depreciation directly attributable to train traffic**

Non-eligible costs – depreciation calculated in accordance with the accounting principles

Operating work variation index

Indicators of dynamics of prices of consumer goods and services – annual average

2. The method for defining the unit price of the basic fee on the basis of sub-rates and correction coefficients and their values, and method of establishing the unit rate of the shunting fee

2.1. Rules on how to determine the unit rates of the basic fee and the shunting fee

In accordance with Article 33 section 4 to section 6 of the Act:

1) the infrastructure manager (IM) shall levy a charge from the railway undertaking for the services provided as a minimum access to railway infrastructure and related to the completed train journey, hereinafter referred to as the “basic fee”;
2) the basic fee shall be calculated as the product of the train kilometre and the unit rate indicated for a train journey of one kilometre;
3) the unit rates of the basic fee shall be set by the IM at the direct cost to the IM of the train journey. In order to recover all costs incurred, the IM may, if he can demonstrate that market conditions permit, increase rates.

In accordance with Article 33 sections 8-9 of the Act:

1) the IM may levy a charge on railway undertakings for services provided as a minimum access to railway infrastructure and related to the shunting operations concerned, hereinafter referred to as the “shunting fee”;
2) the unit rates of the shunting fee shall be determined by the IM at the direct cost to the IM of the shunting operations.

In accordance with § 21 section 1-4 of the Regulation:

1) the unit rate of the basic fee referred to in Article 33 section 4 of the Act shall be established as the sum of the part of the rate depending on direct costs referred to in Article 33 section 6 of the Act and the part of the rate related to the type of transport performed;
2) the direct cost related part of the tariff is set as the sum of the train weight and line category related part and the train traction related part of the tariff;
3) the portion of the fee depending on the mass of the train and the category of railways is defined as the product of the average fee depending on the mass of the train and the category of railways and;
    a) coefficient differentiating the average rate depending on the total planned gross mass of the train,
    b) coefficient differentiating the average rate depending on the category of the railways.

In accordance with § 21 section 10 item 3 and § 21 section 11 item 3 of the Regulation the planned revenue from the basic fee and the shunting fee, excluding revenue related to the type of traction and the type of service, is to be equal to the planned level of direct costs, excluding the costs of making available the equipment supplying traction energy.

In accordance with § 21 section 12 of the Regulation, part of the rate depends on the train traction:

1) shall be established as the quotient of the planned direct cost of making available the equipment supplying traction energy and the planned operational work for trains with electric traction;
2) is PLN 0.00 per train kilometre for trains with non-electric traction.

In accordance with § 24 section 1 of the Regulation:

1) the shunting fee for services provided under minimum access to railway infrastructure in relation to the shunting operations performed shall be set as the basic fee for a train journey on the lowest category railway line;
2) the network IM may determine, in the network statement, the average weight of the trainset subject to shunting or the average distance travelled to be used to calculate the charge.

2.2. Portion of the basic fee rate

2.2.1. Portion of the fee depending on the direct costs

2.2.1.1. Portion of the fee depending on the mass of the train and the category of railways

2.2.1.1.1. The average rate depending on the train mass and the category of railways:

The determination of the average rate depending on the weight of the train and the category of railway lines involves the following steps:

1) determination of the direct costs of minimum access to railway infrastructure;
   The planned level of direct costs is based on the level of the corresponding direct costs in the last completed financial year, including:
   a) coefficient of variability of operation work, determined as the quotient of the number of days in the annual timetable for which the rates are set and the number of days in the last completed year,
   b) either the planned inflation rates for two consecutive years following the year which has come to an end, or, in the case of wage costs, the planned rates of growth of the real gross wage in the national economy.

Direct costs were established in accordance with the EC Regulation.
The following amount of direct costs has been assumed for the calculation of unit rates for minimum access to railway infrastructure:

Specification	Planned costs [PLN]
Direct costs depending on the mass of the train and the category of railways	2 042 742 417
Direct costs related to the provision equipment supplying electricity	62 132 064
Total	2 104 874 481

2) determining the planned volume and structure of operational work expressed in terms of train kilometres (pockm) and kilometres (km) of shunting work.
   The planned amount of operational work was determined on the basis of the amount of operational work in the last completed annual transport timetable (2020/2021) taking into account the coefficient of variation of operational work, determined as the quotient of the number of days in the annual timetable for which the rates are set and the number of days in the last completed annual transport timetable.

The operating work variation index is:

Specification	Amount
Number of days in Train Timetable 2020/2021 – L_1	364
Number of days in Train Timetable 2022/2023 – L_2	364
Operating work variation index (number of days) $W_L = L_2 / L_1$	1.0000

The planned operational work for the duration of Train Timetable 2022/2023 is:

Specification	All types of traction	Electric traction
Operational work [km]	254 914 212	212 771 119

The average rate ***S*** depending on train weight and rail line category is the quotient of the planned direct costs, excluding the costs of making available the equipment supplying traction energy and planned operational work:

$$S = \frac{2\ 042\ 742\ 417\ \text{PLN}}{254\ 914\ 212\ \text{km}} = \text{PLN } 8{,}01/\text{km}$$

2.2.1.1.2. Categories of railway sections

In accordance with § 21 section 5 of the Regulation:

1) the IM shall define categories of railway lines according to parameters which significantly influence the costs of their maintenance and renewal;
2) the IM may in particular define categories of lines according to the permitted speed or the permitted axle load;
3) the IM shall assign a numerical designation to each category such that the numerical designation decreases with the increase of the line characteristics;
4) a railway line category shall be assigned to the entire railway line or to its individual sections.

The factors associated with train travel that affect the wear and tear of railway infrastructure make this process exceptionally complex. This is due to the exceptionally large number of factors influencing wear and tear and their mutual relationships.
The influence of a moving train on the wear of railway infrastructure elements depends on multiple construction and operational parameters related to the moving vehicles such as mass, speed, power, axle load, number of axles, construction geometry, etc.
As a result, studies in which the authors try to determine the dependence of wear and tear of railway infrastructure elements, i.e., degradation of the track surface, on particular operational parameters are usually limited to the selection of one or several parameters and determination of their influence, the most important of which include:

1) speed of trains;
2) transport volume (expressed in Tg/year);
3) pressure;
4) track condition;
5) the share of freight trains;
6) the geometrical layout of the track.

Degradation of the track is a complex function of many variables, the most important of which is[6]:

1) the structural properties of the surface (type of rails, type of sleepers, type of fastenings, thickness of ballast, etc.);
2) the properties of the track formation (soil type, drainage, protection against flooding, etc.);
3) geometrical characteristics of the track (curve radius, length of transition curve, curve value, etc.);
4) the quality of construction and maintenance work on the surface and substructure;
5) operating characteristics (speed, traffic volume, characteristics of the railway vehicles, axle loads, unsprang mass, suspension rigidity, quality of maintenance, weight of trains, frequency of runs).

The “performance” parameter mentioned above, including in particular the permitted speed and permitted axle load mentioned in the Regulation, is also a complex function of many interacting variables. Railways consist of a large number of components which are not subject to even wear and tear. This means that any attempts made by scientists to estimate the wear and tear of the rails as a consequence of train traffic are simplified. The analysis of the wear and tear of tracks as a system of integrally combined tracks and sleepers is reflected in the SOKON expert system developed by Prof. Henryk Bałuch, where different performance indicators are determined for different track superstructure combinations. The relationships presented in the following section were used in the SOKON expert system.

Accordingly, the category of a railway section was defined on the basis of 2 parameters that “significantly affect the costs of their maintenance and repair”:

1) **the permissible speed** limits, taking into account the following intervals:

[6] Bałuch M. *Interpretacja pomiarów i obserwacji nawierzchni kolejowej*. *Zakład Poligraficzny Politechniki Radomskiej*. Radom, 2005.

Range of speed	1	2	3	4
Average permissible speed determined for the railway section	V_{max}>120	80<V_{max}≤120	40<V_{max} ≤80	0<V_{max}≤40

The above ranges take into account the classification of railway lines in accordance with the Regulation of the Minister of Transport and Maritime Economy of 10 September 1998 on technical conditions to be met by railway structures and their location (Journal of Laws of 1998, No. 151, item 987, as amended) in the scope of main and first-line lines (120 km/h and 80 km/h). The limit between band 3 and band 4 at 40 km/h was adopted due to the significant differences in the investments necessary to maintain the line in a technical condition guaranteeing the safe running of trains at the speeds included in these ranges.

The permissible line speed characterising the technical standard of the accessible part of the railway line shall be the average maximum speed including permanent restrictions calculated for the section of the railway line. The average permissible speed values for the section including fixed restrictions separately for odd and even directions shall be calculated on the basis of the data contained in the POS database and the data on fixed restrictions for the next train running timetable. The algorithm adopted takes into account the nature of the restriction – fixed or spot and the effect of the restriction on the permitted technical speed. The lower of the calculated values of the mean permissible technical speed shall be selected to determine the section category, i.e., for a single-track line the lesser of 2 calculated values for odd and even directions and for a double-track line the lesser of 2 calculated values taking into account the speeds for tracks 1 and 2 for odd and even directions.

Once the average permitted speed has been set, the condition shall be checked that at least half of the length of track in the chosen direction, for which the speed has been used to establish the category, has a speed at the lower limit of the set range. If this condition is not fulfilled, the category resulting from the speed is reduced by 1 category (e.g., from 3 to 4), after which the condition is checked again.

2) **railway line classes**.
The class of a section of railway line is defined by the following codes based on maximum axle and linear loads in accordance with the following rules:

Code	Axle load [kN/axle]	Line load [kN/m]
A	157	49
B1	177	49
B2	177	63
C2	196	63
C3	196	71
C4	196	78
D2	221	63
D3	221	71
D4	221	78

The classes of lines are defined on the basis of Module A1 “Classification of line and vehicle loads” of the Technical Specifications for the Maintenance of the Superstructure on Railways “Id-1” (D-1). Module A1 was developed according to the methodology adopted in PN-EN 15528:2015-12 Railway applications – Line categories for managing the interface between load limits of vehicles and infrastructure.

In the case of different axle or linear load values on a section of line, the lowest axle or linear load value is used to determine the line class for the section.
The source of data on the class of railway sections is the POS database.

Taking into account the speed limit and the line classes aggregated to one of the 4 classes (A, B, C, D), the following 4 categories of line sections have been defined:

Range of speed	Class of line for the purpose of defining rates	Category of railway section
4	A	4
4	B	4
4	C	4
4	D	4
3	A	4
3	B	4
3	C	3
3	D	3
2	A	4

Range of speed	Class of line for the purpose of defining rates	Category of railway section
2	B	4
2	C	3
2	D	2
1	A	4
1	B	4
1	C	3
1	D	1

whereby the class of railway lines distinguished above for the purpose of setting rates include:

1) class B: line classes B1 and B2,
2) class C: Line classes C2, C3 and C4,
3) class D: line classes D2, D3 and D4.

2.2.1.1.3. Coefficients differentiating the average rate depending on the category of the railways

The coefficients differentiating the average rate according to the category of railway lines were determined based on:

1) degradation factor v_s depending on the average permissible speed according to the formula defining the effect of train speed on the degradation of the track superstructure:

$$v_s = \sqrt[3]{(1 + 0{,}012V)^2}$$

where:

v_s – degradation factor,

V – train speed.

2) coefficient η expressing the influence of the axle loads of the rail vehicles on the life of the rails according to the equation:

$$\eta = 5 \cdot 10^{-3} \cdot P_n,$$

where:

P_n – axle load expressed in [kN]

The above formulas were used in the SOKON of railway superstructure SOKON developed by Prof. Henryk Bałuch[7].

Further steps in determining the coefficient differentiating the average rate depending on the category of the railways are presented below:

1) defining a pricelist category for each section according to the principles set out in subsection 2.2.1.1.2;
2) determining v_s coefficient for each j section depending on the average permitted speed calculated for the section of railway line according to the formula:
$$v_{sj} = \sqrt[3]{(1 + 0{,}012Vj)^2}$$
3) determining the coefficient η for each j section expressing the influence of the axle loads of the rail vehicles on the life of the rails according to the formula:
$$\eta = 5 \cdot 10^{-3} \cdot P_{nj}$$
4) determining the product of the following coefficients for each j section;
$$W_{kat\,j} = v_{sj} * \eta_j$$
5) determining for each category of a section of railway line (there are 4 pricing categories designated as: 1, 2, 3 and 4) the $\boldsymbol{W_{kat\,n}}$ coefficient (where n is the numerical designation of the category) as the average value (weighted by the length of the accessible sections of the given category) of the product of the $\boldsymbol{v_{sj}}$ ***and*** $\boldsymbol{\eta_j}$ coefficients calculated for each j- section;
6) determining, on the basis of the values of 4 $\boldsymbol{W_{kat\,j}}$ coefficients calculated in accordance with item 5, the function defining the coefficient differentiating the average rate depending on the category of the railway section for average categories calculated for individual train routes with decimal precision, i.e., for the average category 1.0; 1.1; ... 3.9; 4.0);
7) determining, in accordance with the functions under point 6, the $\boldsymbol{W_K}$ coefficients that differentiate the average rate according to the categories of railway lines, specified to the nearest tenth;
   This method allows to define the $\boldsymbol{W_K}$ coefficients for 31 average categories calculated for individual train routes (from average category 1,0; 1,1: ... to an average category of 3.9; 4.0).
8) determining the average category of railway line for which the value of the coefficient differentiating the average rate depending on the category of the railways is 1, to the nearest decimal point, on the basis of data on the journeys of all trains during the period of validity of the 2020/2021 timetable, taking into

[7] Bałuch H. Method of assessing the serviceability of railway SOKON. Basis of development and instructions for use. Railway Research Institute. Warsaw, 2004

account the categories of sections planned at the date of entry into force of the 2022/2023 timetable, as a weighted average of the length of train journeys on the sections of railway lines in a given category;

$$K_{avg} = 2.1$$

9) correction of coefficients determined according to point 7 in such a way that the condition according to § 21 section 11 item 1 of the Regulation is fulfilled:
   - for the average railway line category, the value of the coefficient was 1. Coefficients set according to point 7 shall be recalculated according to a proportion being the quotient of the size of the coefficient set for each of the 31 average categories calculated for individual train routes (from average category 1.0; 1.1: ... to the average category 3.9; 4.0) and the amount of the coefficient determined for the average category of the railway line $K_{avg} = 2.1$.

2.2.1.1.4. Coefficients differentiating the average rate depending on the total planned gross mass of the train

In accordance with § 21 section 9 of the Regulation:

1) in the network statement, the IM defines a formula for determining the value of the coefficient differentiating the average rate depending on the total planned gross mass of the train;
2) as an alternative solution the IM may fix the weight ranges of not less than 10 tonnes and not more than 100 tonnes for which he or she defines coefficients differentiating the average rate depending on the total planned gross mass of the train.

Weight ranges of 60 tonnes have been adopted for which coefficients differentiating the average rate depending on the total planned gross mass of the train are adopted.

In accordance with § 21 section 25 of the Regulation the IM shall determine the weight of the train for the calculation of the unit weight of the basic fee and for the determination of the basic fee on the basis of either the actual or the projected situation.

Planned train weights were used to calculate the unit basic fee rate and to determine the basic fee.

Coefficients differentiating the average rate depending on the total planned gross mass of the train were determined based on the traffic volume coefficient $\boldsymbol{\varpi}$ describing the dependence of pavement degradation on traffic volume[8]:

$$\varpi(q) = 0{,}38 + 0{,}08 \cdot q - 0{,}0009 \cdot q^2$$

where:

$\boldsymbol{\varpi}$ – traffic volume coefficient,

q – traffic volume [Tg/year].

For each weight interval, the traffic volume ***q*** was calculated as the product of the average weight of a train in a given compartment and the average number of trains per 1 km of track for the duration of the TS 2022/2023.

The next steps in determining the coefficients that differentiate the average rate according to train weight include:

1) determining for each i-mass interval, of the traffic volume in accordance with the following formula:

$$q_i = M_{avg\ i} * N_{poc}$$

where:

$M_{avg\ i}$ – average gross weight of the train in the i weight interval,

N_{poc} – average number of trains per 1 km of track.

The average gross weight of a train within a weight range shall be determined as a weighted average of the length of journeys made by trains with the given weight.

In the absence of train runs in a given weight interval, the average weight shall be the middle of the interval;

2) determining for each i mass interval, the traffic volume coefficients $\boldsymbol{W_{Mi}}$ in accordance with:

$$W_{Mi} = 0.38 + 0.08 * q_i - 0.0009 * q_i^{\,2}$$

3) determination of the average train weight to the nearest 1 tonne on the basis of train data running in TS 2020/2021 as a weighted average over the length of journeys of trains with a given weight;

$$\boldsymbol{M_{avg}} = 626 \text{ tonnes}$$

4) adjustment of the $\boldsymbol{W_{Mi}}$ coefficients for the individual mass range so that for the interval 600 ≤ M < 660 tonnes containing the average mass $\boldsymbol{M_{avg}}$ = 626 tonnes, the $\boldsymbol{W_M}$ factor is 1.

[8] Bałuch M. *, Interpretacja pomiarów i obserwacji nawierzchni kolejowej. Zakład Poligraficzny Politechniki Radomskiej*. Radom, 2005.

The factors set under point 2 shall be recalculated according to the ratio between the factor for a given weight bracket and the factor for the average weight of the train.

The calculated W_{Mi} coefficients are used to differentiate the average rate according to the gross weight of the train and to check, taking into account the coefficients differentiating the average rate according to W_K railway line categories determined according to subsection 2.2.1.1.3, whether the envisaged revenues excluding those related to the type of traction are equal to the direct costs excluding the costs of making available the equipment supplying traction energy.

2.2.1.1.5. Adjustment of the coefficients that differentiate the average rate according to the weight of the train resulting from the condition "planned revenues = direct costs"

Based on the determined volumes:

1) the average rate depending on train weight and line category according to subsection 2.2.1.1.1;
2) coefficients for differentiating the average rate by category of railways W_K in accordance with the subsection 2.2.1.1.3;
3) the coefficients that differentiate the average rate according to train weight W_{Mi} in accordance with subsection 2.2.1.1.4;
4) train operating work in individual 80 weight ranges and 31 average categories of railway lines as well as shunting work assuming average weight of train set subject to shunting in the range $120 \leq M < 180$ tons and 4th category of railway line established on the basis of § 24 rec. 1 of the Regulation;

the planned revenues from the basic fee and the shunting fee are calculated.
In case of a difference between the planned revenues from the basic fee and the shunting fee and the direct costs depending on train weight and railway line category, an adjustment of the coefficients differentiating the average rate according to train weight W_{Mi} is carried out.

Coefficients differentiating the average rate depending on the category of the railways WK defined in accordance with subsection 2.2.1.1.3 were adopted as final, due to the fact that the parameters on which the category of a railway section depends (permissible speed, class of line) influence the costs of maintenance and overhaul in a way described by the given dependencies.

As unit rates are rounded to the nearest penny, the difference "planned revenues – direct costs" resulting from the adjustment of the coefficients differentiating the average rate according to train weight is close to "0".

2.2.1.2. Portion of the fee depending on the traction

The traction-dependent part of the rate ***T*** is the quotient of the planned direct cost of making available the equipment supplying traction energy and the planned operational work for trains with electric traction plus the planned number of kilometres of shunting work performed with electric traction.

$$T = \frac{62\ 132\ 064\ \ \text{PLN}}{212\ 771\ 119\ \ \text{km}} = \text{PLN } 0{,}29/\text{km}$$

2.2.1.3. Unit prices of shunting fee

The unit rate of the shunting fee is equal to the average unit rate depending on the weight and category of railway lines and:

1) a coefficient differentiating the average rate according to the weight of the train set for the weight range of shunting vehicles of 120≤M<180 tonnes;
2) a coefficient differentiating the average rate according to the category of railway lines determined for the 4th category of railway lines.

2.2.1.4. Amounts of the unit rates for the basic fee and the shunting fee

As a result of the calculations carried out on the basis of the methodology presented in subsection 2.1-2.3, the Draft Price List for Charges for the Use of Railway Infrastructure with a track width of 1435 mm in force from 11 December 2022, including in particular the part concerning the determination of the basic and shunting fee, was developed. The volumes of the parts of the basic fee unit rates, the differential coefficients and the shunting fee unit rates are presented below.

Basic fee unit rate

Fee components

Portion of the fee depending on the direct costs

Portion of the fee depending on the mass of the train and the category of railways

The portion of the fee depending on the mass of the train and the category of railways is defined as the product of the average fee depending on the mass of the train and the category of railways and:

1) coefficient W_M differentiating the average rate depending on the total planned gross mass of the train;
2) coefficient W_K differentiating the average rate depending on the category of the railways.

The average rate depending on the mass and the category of railways:

S = PLN 8,01 /pockm.

Differentiating coefficients

Differentiating coefficients W_M depending on the total planned gross mass of the train

Average category	Coefficient W_K
M<60	0,3770
60≤M<120	0,5059
120≤M<180	0,6254
180≤M<240	0,7464
240≤M<300	0,8473
300≤M<360	0,9079
360≤M<420	0,9724
420≤M<480	0,9792
480≤M<540	0,9842
540≤M<600	0,9900
600≤M<660	1,0000
660≤M<720	1,0483
720≤M<780	1,0869
780≤M<840	1,1283
840≤M<900	1,1720
900≤M<960	1,2131
960≤M<1020	1,2548
1020≤M<1080	1,2991
1080≤M<1140	1,3376
1140≤M<1200	1,3890
1200≤M<1260	1,4321
1260≤M<1320	1,4755
1320≤M<1380	1,5229
1380≤M<1440	1,5670
1440≤M<1500	1,6180
1500≤M<1560	1,6648
1560≤M<1620	1,7098
1620≤M<1680	1,7575

Average category	Coefficient W_K
1680≤M<1740	1,7948
1740≤M<1800	1,8524
1800≤M<1860	1,8983
1860≤M<1920	1,9441
1920≤M<1980	1,9911
1980≤M<2040	2,0355
2040≤M<2100	2,0851
2100≤M<2160	2,1311
2160≤M<2220	2,1738
2220≤M<2280	2,2176
2280≤M<2340	2,2593
2340≤M<2400	2,3086
2400≤M<2460	2,3495
2460≤M<2520	2,3955
2520≤M<2580	2,4295
2580≤M<2640	2,4714
2640≤M<2700	2,5164
2700≤M<2760	2,5520
2760≤M<2820	2,5937
2820≤M<2880	2,6266
2880≤M<2940	2,6683
2940≤M<3000	2,7060
3000≤M<3060	2,7357
3060≤M<3120	2,7742
3120≤M<3180	2,8080
3180≤M<3240	2,8402
3240≤M<3300	2,8749
3300≤M<3360	2,9030
3360≤M<3420	2,9291
3420≤M<3480	2,9592
3480≤M<3540	2,9867
3540≤M<3600	3,0147

Average category	Coefficient W_K
3600≤M<3660	3,0403
3660≤M<3720	3,0675
3720≤M<3780	3,0836
3780≤M<3840	3,1076
3840≤M<3900	3,1284
3900≤M<3960	3,1479
3960≤M<4020	3,1669
4020≤M<4080	3,1821
4080≤M<4140	3,2003
4140≤M<4200	3,2162
4200≤M<4260	3,2242
4260≤M<4320	3,2395
4320≤M<4380	3,2466
4380≤M<4440	3,2562
4440≤M<4500	3,2646
4500≤M<4560	3,2717
4560≤M<4620	3,2774
4620≤M<4680	3,2807
4680≤M<4740	3,2847
4740≤M<4800	3,2861

Differentiating coefficients W_K depending on the category of railways

The category of railways for the specific train route is defined as the average category of railway weighed with the length of the sections, defined with a precision to the decimal fraction.

The categories of railway sections are defined in the Statement of railways managed by PKP Polskie Linie Kolejowe S.A. with the classification of price list categories applicable from 11 December 2022 published in the Network Statement 2022/2023.

Average category	Coefficient W_K
1,0	1,1790
1,1	1,1652
1,2	1,1507

Average category	Coefficient W_K
1,3	1,1357
1,4	1,1201
1,5	1,1041
1,6	1,0876
1,7	1,0707
1,8	1,0535
1,9	1,0359
2,0	1,0181
2,1	1,0000
2,2	0,9818
2,3	0,9634
2,4	0,9450
2,5	0,9265
2,6	0,9080
2,7	0,8895
2,8	0,8711
2,9	0,8528
3,0	0,8346
3,1	0,8167
3,2	0,7991
3,3	0,7817
3,4	0,7647
3,5	0,7480
3,6	0,7318
3,7	0,7161
3,8	0,7009
3,9	0,6862
4,0	0,6721

Portion of the fee depending on the traction

Portion of the fee depending on the traction for trains and shunting carried out through electrical traction: **PLN 0,29 /km**

Unit prices of shunting fee

No.	Specification	Unit rate of shunting fee [PLN/km of journey]
1	Rail vehicle or a combination of rail vehicles with the use of electrical traction	3,66
2	Rail vehicle or a combination of rail vehicles with the use of other type of traction	3,37

The planned average unit rates of the basic fee and the shunting fee according to the draft price list 2022/2023 and the draft price list 2018/2019 also in force in TS 2019/2020, 2020/2021 and 2021/2022 are shown below:

Specification	Average unit rate of the basic fee [PLN/pockm] according to the project 2018/2019	Average unit rate of the basic fee [PLN/pockm] according to the project 2022/2023	Change % 2022/2023 /2018/2019
Total carriers of passengers and goods, including:	7,77	8,01	3,1%
carriers of passengers	6,10	6,31	3,4%
carriers of goods	12,80	12,77	-0,2%
Shunting	3,35	3,48	3,9%