KOLATOR - SOFTWARE FOR CALCULATION OF ROAD HAULAGE COSTS

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Abstract

Software Kolator is a classic web application working with a relational database. It is the first software with a focus on the calculation of traffic costs, which is created primarily for the needs of the academic sphere. The aim of the software is to provide students with a simple tool for calculating the costs of road transport and haulage, and its task is to teach the users logical procedures for calculating cost tariffs (CZK/km, CZK/hour, CZK/person, CZK/personkm, CZK/time, CZK/timekm), i.e. the costs of the carriers related to the transport of goods or persons. Calculation of cost tariffs is made possible by a predefined calculation formula and a predefined amount of particular cost types that the user certainly can modify. Within the user account, the user can automatically calculate the cost rate after entering the data on planned transport output of the vehicle fleet. Subsequently, the user can define individual orders and the software determines the appropriate expenses.

Keywords: Kolator, software, application, cost, cost calculation

1. INTRODUCTION

The aim of the article is to introduce the new Kolator software, through which users can easily calculate the cost of their fleet traffic. Cost calculation is the computation of the costs that are essential for arranging of production (products, services). The critical points of each such calculation are selected procedures of cost calculation - a methodology that must be compatible with in-house processes of the company. Indirectly, it follows that also the cost calculations, i.e. price calculations, must be linked to in-house processes. It is therefore important to assign the revenue to the outputs to which the costs are related (according to the calculation formula). This is also related to the necessity to properly define the so-called calculation unit, i.e. the production unit (of output) to which we relate the costs. The purpose of cost calculation is not only the determination and control of the amount of costs, but also the calculation of the costs for the subsequent price calculations to the customer. For this reason, it is necessary to distinguish whether the cost calculation is a preliminary one (plan) or the resulting calculation (reality).

1.1 Motivation to create software

Although the knowledge of cost calculation is necessary to identify and control the cost of transport and haulage, schools apply a minimum of space to this problem, which is detrimental not only to carriers and hauliers but also to civil servants.

For no mode of transport there was no official and legally required calculation methodology (cost calculation method) and is still does not yet exist, although almost every market subject welcomes comparison with its competitors. From the point of view of the transport service clients (and thus from the point of view of the provider of operating subsidies), it is also necessary to have an orientation in the matter for reasons of control of economically justifiable costs that the carrier claims.

1.2 Legislation and history

Before 1990, the Ministry of Finance announced the so-called Directive for Cost-Calculation and other components of the price of performances. In 1990, in the Collection of Laws a decree No. 21/1990 Coll. was

issued, On the calculation of costs, and for the first time, cost calculations were legislatively enshrined. In 1990 came the Act No. 563/1991 Coll., On accounting, which repealed the regulations on the calculation of costs and other components of the price of performances. This status continues to the present.

At present, it is true that the area of calculation of costs is, more or less, legislatively enshrined only very generally in the implementing decree to the Act on Prices. Unlike the procedures for accounting for costs, i.e. for bookkeeping, this is strictly prescribed in the Act on Accounting. Legislative regulations only de facto prescribe the cost structure. [1]

1.3 Current status

In road transport, the Road Transport Tariff, known as TR4, has previously served for orientation for carriers. However, its reporting value declined gradually after 1990, as it was not continuously updated in consequence of the transformation of the economy. Any current efforts (carriers or their associations) are perceived by the Office of Fair Trading as an attempt to influence the price level. That's why it's hard to follow market trends.

The Faculty of Transport of CTU tried to respond to this situation, which, in cooperation with the Association of Carriers of Bohemia and Moravia, created a Methodology for the calculation of road transport costs. It was published on the faculty web site *http://www.fd.cvut.cz* and also on the web page of non-profit organization IODA, z.s. - *http://www.ioda.cz*.

In the area of calculation of costs, the requirement of carriers recently has been confirmed not only for information how to calculate the costs (methodology) but also for data to have a comparison with competitors (data - current status and development). In this sense, the application of **INDEXCESMAD** is offered - *http://www.indexcesmad.cz* - depicting the development of freight transporting goods carried out by the Faculty of Transport of CTU, in cooperation with the ČESMAD Bohemia Association,.

Similarly, for carriers in public line transportation (PLT) is for comparison and market orientation used the statement of Ministry of Transport of the Czech Republic, called **Dop (MD) 2-04**, which expresses, among other things, the average costs of domestic PLT carriers. This is the only official document in which the absolute data on road transport costs is regularly reported. The reports are available at the portal **VýRočenky** - *http://www.vyrocenky.cz*.

Although the **Kolator** software is primarily designed for calculation of road transport costs, the claim of need to methodically unify and rationalize the costing process can be applied also to other modes of transport (railway, inland waterways, public transport, etc.).

1.4 Expected benefit of Kolator software

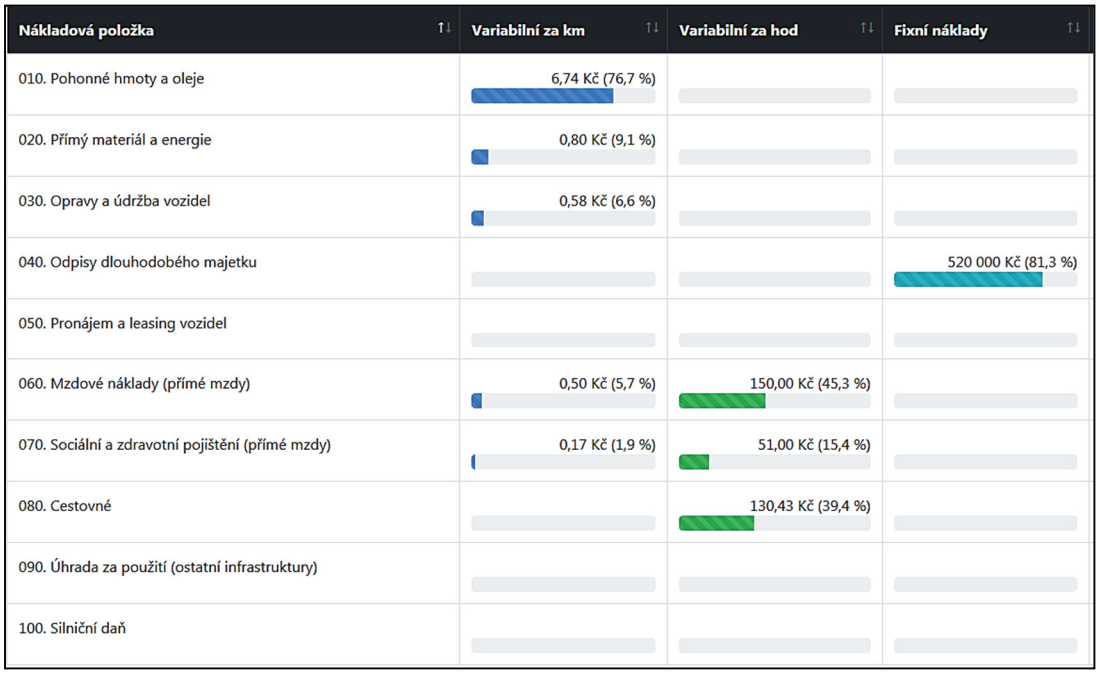
The aim of the Kolator software is to educate students and the academic community about calculation of traffic costs. While this issue is still being taught "in the old-fashioned way", when each student at first creates calculating tables, and then searches for input data, often with no power or time to analyze the results then, the Kolator software should make it possible to simplify (and from the perspective of teacher evaluation it should also unify) the method of calculating the costs and to increase the time determined for data mining and understanding the logical links between the principal quantities.

2. SOFTWARE KOLATOR

The Kolator software is designed to allow the user to create in the administrator environment a so-called initial (default) calculation pattern in the usual generic cost classification, with the option of adding an unlimited number of N-(sub) items of costs, and also adding an unlimited number of N-vehicles and N-orders. Vehicle overview page displays the resulting cost-per-vehicle fares that allow you to compare the benefits of vehicles for use on a given commission.

2.1 Input data

In order to calculate cost rates, the user of Kolator software must enter certain values that are divided into the so-called performance-related (traffic and transport performance - km, hour, km/h, t, tkm, person, person/km) and economic (fuel consumption, unit prices etc.). By dividing the costs (**Figure 1**) of direct and overhead expenses, fixed costs (independent of performance) and variable costs (depending on time or performance) and their conversion to the required cost rates CZK/km (and derivatives) and CZK/hour, the user will achieve the desired effect, i.e. he will quickly get cost rates with the chance to think over the alternative mode of transport in order to minimize transport costs. [2,3]



Nákladová položka	Variabilní za km	Variabilní za hod	Fixní náklady
010. Pohonné hmoty a oleje	6,74 Kč (76,7 %)		
020. Přímý materiál a energie	0,80 Kč (9,1 %)		
030. Opravy a údržba vozidel	0,58 Kč (6,6 %)		
040. Odpisy dlouhodobého majetku			520 000 Kč (81,3 %)
050. Pronájem a leasing vozidel			
060. Mzdové náklady (přímé mzdy)	0,50 Kč (5,7 %)	150,00 Kč (45,3 %)	
070. Sociální a zdravotní pojištění (přímé mzdy)	0,17 Kč (1,9 %)	51,00 Kč (15,4 %)	
080. Cestovné		130,43 Kč (39,4 %)	
090. Úhrada za použití (ostatní infrastruktury)			
100. Silniční daň			

Figure 1 Preview on calculation formula

(Note: In rows descending - Fuels and oils, Direct material and energy, Maintenance, Depreciation, Leasing, Wages, Social and health insurance, Travel, Fee for infrastructure, Road Tax, In columns - Costs, Variable costs per km, variable costs per hod, Fixed costs)

2.2 Administrator and user environment

The use of the Kolator software application should be gradually in a way that the user defines the calculation formula in the administration environment (direct vs indirect and fixed vs variable costs, the costs in the tariff vs outside the tariff) and the key for dividing of the overhead expenses (non-homogeneous park or company structure).

In the user environment, it is subsequently allowed to passportize the transport park (number of means of transport and their parameters), the definition of calculating units of transport and haulage (person, person/km, t, tkm, ...), quantification of transport and haulage, calculation of cost fares for transport (CZK/km, CZK/hour of standing), calculation of cost fares (including profit) for transport performance (CZK/person/km, CZK/tkm), calculation of vehicle operation or contracts, addition of non-tariff costs and determination of prices.

2.3 Outputs and their interpretation

The output of the application (**Figure 2**) is the cost tariffs - CZK/covered km (excluding parking costs), CZK/covered km (including parking costs), CZK/bulk km (removed from the impact of handling km), CZK/hour

of standing (used only for certain types of transport, such as travel transportation). Together with the predefined calculation formula, the user of the application obtains a detailed overview of the structure and amount of costs within the cost rates and may consider the appropriate method and the corresponding transport price.

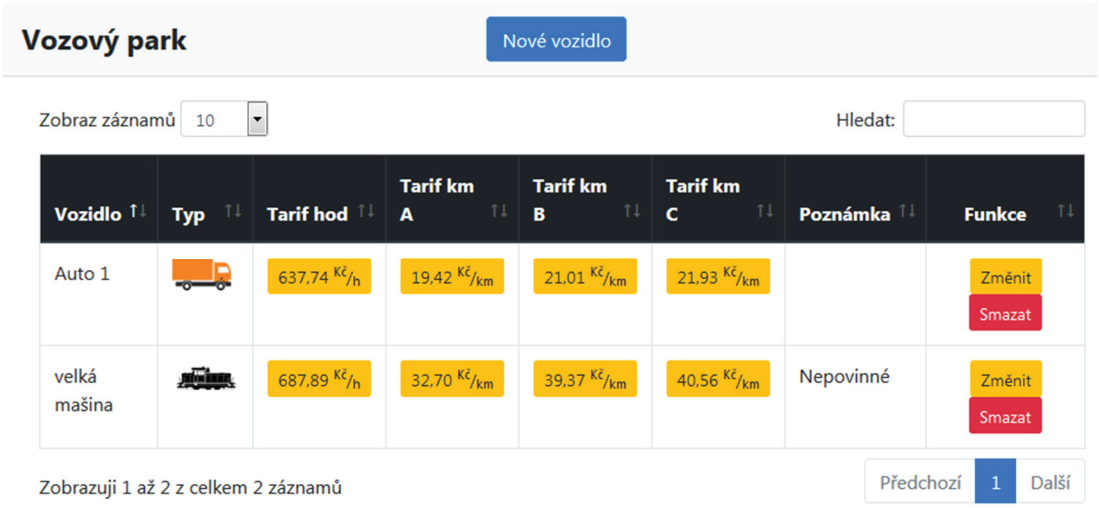


Figure 2 View calculated cost rates
(Note: In rows - car, train, in columns - vehicle, type, hourly tariff, tariff km A, tariff km B, tariff C, note, function, změnit = change, smazat = delete)

3. TECHNICAL SOLUTION OF THE KOLATOR SOFTWARE

From a technical point of view, Kolator is a web application based on PHP and Javascript. Communication between modules is secured by Ajax's advanced techniques. Application data is stored in the MySQL database (**Figure 3**). Application strictly separates the user and administrative part. Based on the login information, the user is redirected from the start-up screen to the appropriate service modules that are no longer interconnected, except for data sharing through the SQL database. This ensures the maximum safety of both parts when, from the point of view of protection against external attack, this solution can be imagined as separate flood chambers in the ship's deck.

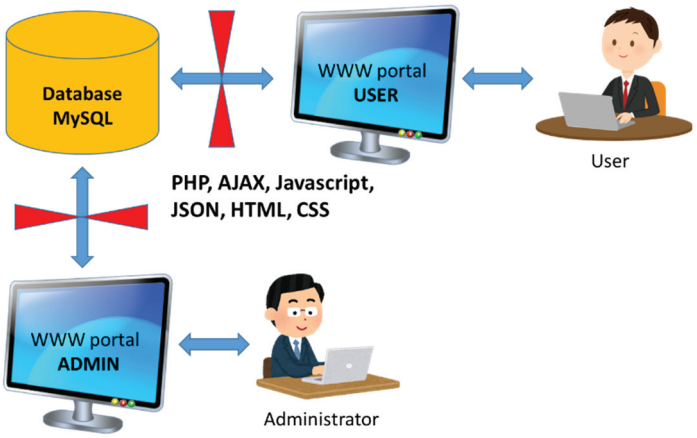


Figure 3 Kolator Application schema

In addition to SQL data communication, some internal messages are forwarded in the JSON universal format. Design of the application has the standard solution by using HTML and CSS. The application is responsive

and dynamically adjusts its appearance of the display on mobile phones, however, the table nature of the application considered as the optimal device for the user a typical desktop or laptop or larger tablet.

Due to the used solution, the application has minimum requirements for end user equipment. From the point of view of the claim to the server, the application is functionally optimized for the middle PHP 7.1. and MySQL 5.6.12. Because of the way of work with databases, at least PHP 7.0 is required.

4. CONCLUSION

The goal of the Kolator software is to create real user-friendly platform for cost calculation of various transport modes, especially road and rail. Database-based software has been developed for an unlimited number of users. Within the current version of the software, the default calculation formula and default values were defined to serve the user as an excellent guideline for cost calculation. From the context of input data as well as their value, students will better understand what input data they need to calculate cost rates.

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REFERENCES

[1] TICHÝ, Jan. *Kalkulace nákladů v silniční dopravě.* ISBN 978-80-270-1405-7, IODA, z.s., 2017.

[2] ŘÍHA, Zdeněk, TICHÝ, Jan. *The Measure for Costs Indexation in Road Freight Transport*, In: Proceedings of 20th International Conference Transport Means 2016. Kaunas: Kauno technologijos universitetas, 2016. pp. 778-783. ISSN 1822-296X.

[3] ŘÍHA, Zdeněk, TICHÝ, Jan, SMÍŠEK, Ondřej. *Utilization of CNG and LNG in Transportation*, In: 16th International Multidisciplinary Scientific Geoconference SGEM 2016, book 5: Ecology, Economics, Education and Legislation. Sofia: Bulgarian Academy of Sciences, 2016. pp. 901-907. ISSN 1314-2704. ISBN 978-619-7105-66-7.

[4] ŘÍHA, Zdeněk., TICHÝ, Jan. *The Costs Calculation And Modelling In Transport*, In: Transport Means 2015. Kaunas: Kauno technologijos universitetas, 2015, pp. 388-391. ISSN 1822-296X.