

## **Impact of the Pandemic Disease on the Railway Central Traffic Control Centers**

**M. Šustr<sup>1</sup>, P. Šohajek<sup>2</sup>, P. Setlíková<sup>3</sup>, R. Soušek<sup>4</sup>**

<sup>1</sup>*University of Pardubice, Studentská 95, 532 10, Pardubice, Czech Republic, E-mail: [martin.sustr@upce.cz](mailto:martin.sustr@upce.cz)*

<sup>2</sup>*University of Pardubice, Studentská 95, 532 10, Pardubice, Czech Republic, E-mail: [petr.sohajek@upce.cz](mailto:petr.sohajek@upce.cz)*

<sup>3</sup>*University of Pardubice, Studentská 95, 532 10, Pardubice, Czech Republic, E-mail: [petra.setlikova@upce.cz](mailto:petra.setlikova@upce.cz)*

<sup>4</sup>*University of Pardubice, Studentská 95, 532 10, Pardubice, Czech Republic, E-mail: [radovan.sousek@upce.cz](mailto:radovan.sousek@upce.cz)*

### **Abstract**

Railway transport is an integral part of the transport system in Europe, and also in the Czech Republic it is a part of the national critical infrastructure. For the railway operation are necessary both inanimate parts like railway lines and personnel such as dispatchers. The train dispatcher, a human being as a part of the system which controls the movements of the trains is very sensitive to diseases, especially during pandemics. The paper briefly describes the current situation in the railway transport control of the Czech Republic, shortly deals with historical development which lead to the current situation and finally presents plans for the future. The paper shows weak points of operation control by the Central Traffic Control Centers and points out possible alternatives to eliminate these weaknesses and to prevent the impact of any severe diseases on the train operation.

**KEY WORDS:** *Pandemic disease, Coronavirus, Central Traffic Control Center, Railway, Dispatchers*

### **1. Introduction**

The rail transport is one of the backbone transport means in the Czech Republic, which is being constantly improved not only at the level of reconstruction of existing railways and the construction of the new ones, but also at the level of securing safety of the movements of the trains. A relatively modern trend is a remote railway traffic management. The remote traffic control means that the train dispatchers are not physically present at all stations alongside the lines, but one train dispatcher controls remotely equipment at several train stations from one location. After introducing this mode of traffic management, the traffic on many railways was streamlined, consequently the cost of regional lines decreased changing their overall profitability and it was not necessary to terminate operation on these railways. The train dispatcher is responsible for managing track use, insuring that trains are routed safely and efficiently, and insuring the safety of personnel working on and around railroad track [1].

The latest trend of remote railway traffic control is to allocate the train dispatchers from several control stations to one central dispatching location. The dispatchers then control the train traffic on several long-distance routes from one building. This article builds on the dissertation papers of one of the authors and discusses the possible effects of unification of traffic management in one place or directly into one control room, especially from the point of view of hygiene, with an emphasis on current world development and the spread of diseases from one person to another [1-3].

### **2. Methods**

In the context of the article, an analysis of the scheduling of the employees of the central dispatching office was carried out, as well as processes of the employees' rotation at their workplace. Furthermore, the processes of traffic management on the railways and the functions of the security and protection devices were analyzed. The method of measurement and exploratory observation on the spot, i.e. the central dispatching station, was performed in order to analyze the work of dispatchers in a single work shift and monitoring of the work load of these dispatchers. During the measurement, the authors monitored the activities of the dispatchers and measured the duration of the execution of individual operations related to traffic management.

The results of this measurement accurately reflected the real work flow of dispatchers in one shift including activities that are not directly related to the traffic management, e.g. breaks, satisfying essential bodily needs and the like that cause deviations in work operations. The goal of this observation was to record these deviations and their causes, since other dispatchers behave similarly at random and therefore these records were desirable for acquisition of the net operating times unencumbered by these deviations. This was possible by observation only, since although other time measurement methods are able to record duration of activities more accurately, it is not possible to exclude deviation caused by the exclusive use of that method. To increase the objectivity of the output some other measurement methods were used by the security equipment. The outputs from the electronic remote control systems were also used where the system records, for example, the exact times of the assignment of commands for the position of the train routes by the dispatchers. This information source has greater accuracy of the measurements compared to field measurements. However, it is impossible to determine what deviations arise from dispatcher's activities not related to traffic management. For this reason, the measurement outputs of both methods were compared, combined, and evaluated. This activity

provided the authors with the basis for the work of dispatchers, which is used to determine the possibilities of replacing the dispatchers of the central dispatching station with other possible methods of control, for example, alternative dispatching station [2, 4, 5].

## 2.1. Central Dispatching Department

The Central Dispatching Department (CDD) is a location from which traffic on specific railways is controlled. In the case of the Czech Republic, the operation is mainly controlled on the backbone railways, which are heavily used by both passenger and freight transport. More than half of all rail transport is carried out via railways controlled from two Central Dispatching Departments. The range of railroads controlled from the CDD is visible on the map of the railway network, which is in Fig. 1 [1, 6, 7].

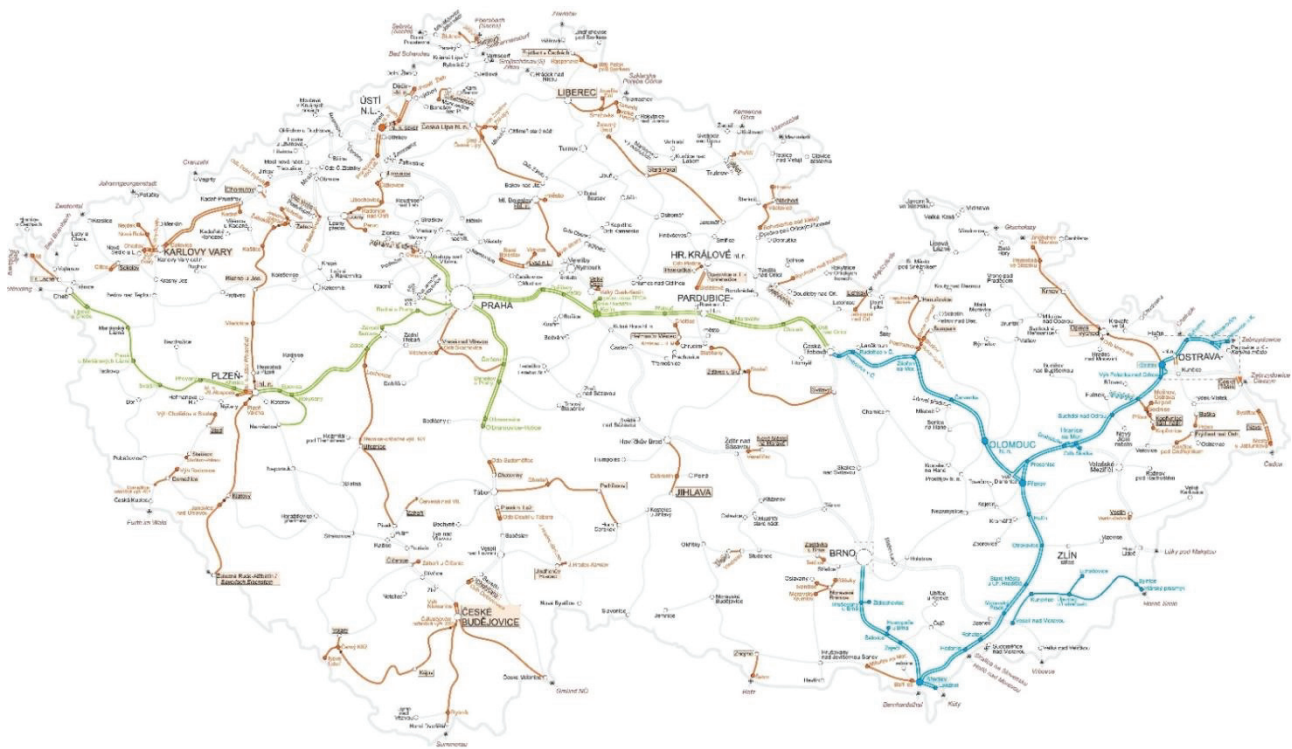


Fig. 1 Map of Railway network with remotely controlled routes

The railways with traffic controlled from CDD in Prague are colored green on the map, they are blue if controlled from CDD in Píerov. The red railways are being remotely controlled from the selected stations in the relevant region. The traffic management that works in one location or in one building reduces the cost to train the employees and in the event of a telephone failure it allows for communication of individual dispatchers face to face. The disadvantage of this system is high cost of technologies to manage traffic from one place and thus the whole network is exceptionally vulnerable to external attack (war, terrorism) [1, 2, 7].

Last but not least, it is a disadvantage to have all traffic management in one place in the case of a possible epidemic or pandemic disease. In a case of having only one contagious person in the CDD leads to quarantine the entire shift of employees and the function of the alternative shift is going to be also significantly impaired. Together this creates a serious limitation of the operations. The deficiency of human resources, such as dispatchers will, consequently, create hindering limitation to the operations of the railway traffic which could cause a serious problem. This article proposes solutions that would minimize the risk of transmission of the spread of a disease between individual dispatchers in one shift [1, 2].

## 2.2 Distribution of Shifts and the Impact of the Disease

In the case of railway operator in the Czech Republic, the shifts schedules and rotation is based on the applicable legislation (Labour Code), which determines the duration of the shortest breaks between the shifts for individual dispatchers and the duration of the longest possible shift. In addition, these restrictions are regulated by the railway operator's applicable regulations. The 12 hours shifts are scheduled for the control dispatchers. The duration of the shift, however, must not exceed 13.5 hours. The maximum working hours per week cannot exceed 60 hours. Only with the consent of an employee can be his/her break shortened. Figure 2 shows the distribution of shifts of the employees, where each employee belongs to one workgroup under the condition that none of the employees is incapacitated or is on a leave of absence. The symbol "!" stands for the day shift (usually 6:00 to 18:00) and "()" stands for the night shift (18:00 to

6:00 the following day) [1, 2].

Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Group 1		( )					( )				( )					( )				( )				( )				( )			
Group 2			( )					( )				( )					( )				( )				( )				( )		
Group 3				( )					( )				( )					( )				( )					( )				( )
Group 4		( )			( )					( )				( )					( )				( )					( )			
Group 5						( )								( )									( )								

Fig. 2 Distribution of employee shifts during normal operations

Fig. 2 shows that 4 shifts are needed to cover the rotating roster. The fifth shift can be used to bridge the gap between the shifts if necessary. However, for sufficient stability, it is advisable to include the fifth shift into a regular rotation. This roster is based directly on standards of the infrastructure manager in the Czech Republic [1, 2].

The option is not to create permanent groups of employees for one shift but to schedule each employee for a different shift. However, this solution is usually not applied because individual employees form a team and their activities in the dispatching center are mutually played. If you don't create permanent groups, the fact is that the performance of the team will not be as high as when one group will form a permanent team [1, 2].

Last but not least, it should be noted that with the regular interchange of employees from one team to another, there is a risk that the carrier of the disease will be a member of several groups, thus increasing the likelihood of interruption of operations due to the necessary quarantine of the employees working with the infected individual. To lower the risk of contagion among employees it is advisable to create a permanent staffing in each shift [1, 2].

At the time of composing this article, a COVID-19 pandemic is spreading in Europe. This fact may greatly influence the possible distribution of the shifts. In the event of an outbreak between dispatchers, the entire shift is automatically quarantined for 14 days. In this case, it would still be theoretically possible to ensure the operation of the rail transport in a particular region (if the composition of the employees in each shift was permanent and all the employees in the shift alternated in the same time exactly to a minute). However, if the employee's rotation would not be permanent within each shift, it would be necessary to isolate all the employees working with the infected individual. In such a case, the rail traffic could be reduced or stopped completely in a region controlled from the affected dispatching point [1, 8].

### 2.3. Option to Prevent Disease Transmission

There are many ways to prevent the transmission of the disease between dispatchers. This article presents the authors' proposal and the measures taken against the spread of the disease in the Czech Republic. The first important rule to prevent the transmission of the disease is an increased emphasis on hygiene such as frequent hands washing, or using hand sanitizer, and using cloth face cover. This proposal complies with regulation issued by the Government of the Czech Republic. This is a way to limit the spread of the viruses. The disadvantage of this regulation is that employees have certain breathing discomfort and are not protected from the transmission of the disease by touching [1, 8].

The second effective course of action would be to divide certain activities of the central dispatching station in crisis situations. According to the authors, much more meaningful solution would be to divide the work of the control dispatchers. There is currently a system of locally situated dispatchers that serves as a support at train junctions. Regional traffic controllers are employees who, at heavy traffic railways, provide local support work at the selected stations (e.g. shunting, track maintenance work, etc.) but in the event of a failure of the central dispatching station, they are not able to fully take over its entire activity [1, 8].

This article proposes to transfer part of the scope of work of the dispatchers from the central dispatching department to the regional traffic controllers. The railways in red (Figure 1) are controlled by a dispatcher located at a regional dispatching station (stations alongside the relevant railway). The regional traffic controllers, who under normal circumstances manage traffic at the chosen railway would, if necessary, also manage traffic at the multiple railways of the backbone network. Regional traffic controllers at local stations would be primarily solving the issues connected to the local traffic (shunting, railway maintenance work) and the dispatcher would take over the activities of the central dispatcher. The scope of the controlled network and the conditions of operation would include the crisis preparedness plan. The crisis preparedness plan for the central dispatching station already exists. In this document it can be found how the CDD traffic will be managed in the event of crisis [1, 8].

As mentioned previously in the article, the crisis preparedness procedure should also include a situation where there is not a sufficient number of staff available. The authors of the article propose to address the lack of actively-working employees by handing over responsibility for controlled sections to the regional traffic controllers. This act may cause employees at regional dispatching sites to be overloaded and not to be able to effectively manage traffic on the railways that are under normal circumstances assigned to them. The solution to this problem should include a list of prioritized railways that have utmost importance for the rail traffic. These railways will be divided based on the importance with the highest priority assigned to the railways which are part of the state critical infrastructure, the so-called state designated railway network [1, 8].

If the dispatcher at the Regional Dispatching Office is not able to control the traffic in the areas newly assigned to him/her, the crisis preparedness plan determines which railways can possibly temporarily suspend operations. There is no doubt that the suspension of operations must be carried out in such a way as to ensure that the state's economy is the least

affected and that the trains currently moving can reach the nearest suitable transport hub, possibly with reduced quality of transport, but never with reduced level of safety. A sufficient level of safety is usually ensured by the very core of the security equipment. [1, 8].

### 3. Discussion

The rules for handing over some of the control from the CDD to the regional control areas will happen on both technical as well as personnel level. As to the regards of the technical rules, dispatcher's workplaces in the Czech Republic operate according to the standards for the single control place of the Czech Infrastructure Manager (SŽCZ JOP). There are several remote control systems from different manufacturers, however all these systems and their parts must provide such a level of safety that would exclude human error and all logical operations would be solved based on the logical core of the electronic railway switch. Similarly, the security equipment of all manufacturers must be compatible with traffic control and information from this security device transferable to the CDD to the workplace of the regional traffic controllers (emergency dispatcher's workplace) and vice versa. For this reason, it can be argued that technically, the transfer of part of the scope of work and powers can be transferred from central dispatching centers to the regional dispatching stations [9].

Personnel rules are, in this case, far more complex than technical side of the transfer. First, it is necessary to address the issue of a sufficient number of employees, which are needed to manage the operation in required quality. If the traffic controllers of the Central Dispatching Department are not able to control the operation on assigned railways, it is desirable that they transfer their powers to the regional control stations. The downside, however, is that even regional dispatching offices do not have enough actively serving employees. In this case, it is desirable to draw on the crisis preparedness plan, which will focus on the importance of the railways and train traffic operations. Next, it is necessary to mention the need to train dispatchers of regional dispatching stations for the eventual takeover of railway control on the main railway lines. The best way to prepare dispatchers for the takeover of traffic on the main lines is to train regularly to control traffic in the given sections. According to the authors, the best training is the actual management of traffic within the central dispatching station. This training can also be a whole shift in the control office at the central dispatching station. The methods of training of the employees should be laid down in the crisis preparedness plan described in the previous chapter.

### 4. Conclusion

The reason for choosing this topic was the need to address the issue of crisis management in railway industry in the Czech Republic. Unfortunately, the prevention is often underestimated until the crisis, consequently the relevant entities are not ready to address such an event. One of the authors has been drawing attention to this issue for a long time now in his dissertation work, but it was not until the first half of 2020 that the timeliness and the need to solve this problem proved to be up-to-date.

This article shows the need to address the issue of railway traffic management and proposes solutions. In the first half of 2020, the COVID-19 disease pandemic made it clear that the issue of the central dispatching department blackout is a topical issue even in countries with a low probability of terrorist attacks or a state of war.

According to the authors, one possible viable scheme could be as follows: there is a subsystem of regional dispatching offices, where employees are capable to manage and to control train traffic in the regions that are under normal conditions controlled from the Central Dispatching Department. However, it is necessary that the employees at regional dispatching offices have a firm grasp of the local conditions at the stations that will be handed over to them (e.g. electrified tracks, loading ramp location, etc.). Another rule should be followed, the so-called rotation of the work, i.e., the employees who can take control over a given territory, must be trained to manage the area (e.g. shifts at the central dispatching department). To implement this proposal is not organizationally easy, however by taking into account the cost of crisis preparedness and the level of security, and the possible consequences of failure, it is the optimal option for managing railway transport.

It should be noted that at the time of the submission of this article there had not been such a situation in the Czech Republic that the train operations had to be suspended due to illness of the employee working at the dispatcher's office or due to the subsequent quarantine of the colleagues working with him/her in a team. The research was funded by the University of Pardubice, Faculty of Transport Engineering through the SGS project.

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