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Michal BOLEK[1]

THE FUTURE OF RAILWAY OPERATION IN CENTRAL EUROPE

Costs of railway operation lead to cancelling of operation on some railway lines. But there are some ways to preserve railways for future not only in areas around big cities (commuter trains) and long-distance services, but also on branch lines. One of these ways is the establishing of remotely controlled interlocking systems, which lead to cost reduction and in addition to better quality of railway operation.

PRZYSZŁOŚĆ EKSPLOATACJI KOLEI W ŚRODKOWEJ EUROPIE

Koszt eksploatacji kolei spowodował zakończenie eksploatacji na niektórych liniach kolejowych. Istnieją jednak pewne sposoby na zachowanie kolei na przyszłość nie tylko w obszarach wokół dużych miast (pociągi podmiejskie) i dalekobieżnych, lecz również na liniach odgałęźnych. Jednym ze sposobów jest stworzenie zdalnie sterowanych systemów sterowania, co prowadzi do redukcji kosztów i dodatkowo lepszej jakości działania kolei.

1. INTRODUCTION

Nowadays we live in period of twilight of railways in Czech Republic, Slovak Republic and Poland. There are many railway lines, where the passenger operation was finished or – in worse case – the line is cancelled at all and other lines where it is planned. The main reason is the costs of railway operation. But there is a way to preserve railways by not small, but very effective investment to railway network by establishing of remotely controlled interlocking systems. Establishing of these systems leads to distinct reduction of costs of railway operation. In addition we will not pay enormous costs of renewal of cancelled lines in view of possible future renaissance of railways as in some west European countries today.

[1] AŽD Praha, Žirovnická 2, 106 17 Praha 10, bolek.michal@azd.cz

2. REMOTELY CONTROLLED INTERLOCKING SYSTEMS

In period of development of remotely controlled systems (RCS) we should have in mind distinctions, which result from different situation at different lines. It is clear that there is not necessity to equip all lines with the same equipment. So it is necessary to build interlocking system with acceptable risk level and acceptable costs in view of importance of line and character of traffic.

2.1 TRACK INTERLOCK

Track interlock is the kind of remote control, which is useful for branch lines. It reduces costs of interlocking system, because there is only one interlock for more stations. It means that these stations are as one station in view of interlocking. There are technological computers in one station only and there are only executive components in other stations. So it naturally reduces costs of system. Basic difference between this system and classic system of remote control is the possibility of local control of system in classic form. Stations, which are connected to track interlock, cannot be controlled locally, because there are not technological computers for particular stations. This system naturally keeps benefits and problems of classical remote control.

2.2 BENEFITS OF RCS

Establishing of remotely controlled interlocking systems (RCS) brings important benefits due to them makes building of these systems sense.

2.2.1 VOCATIONAL STRUCTURE

Such a principal change of the operating control system has clearly consequences in vocational structure, because there becomes decrease in personnel need in stations. On the other side there is increase of personnel need in centre.

Personnel savings are accordingly clear on the decentred level – in stations. There are many other circumstances, of course. It is not problem to leave stations without personnel in the case of secondary lines.

On the contrary there is personnel increase on the central level, where is necessary to employ people as RCS dispatchers and RCS heads. There is also increased need of equipment maintenance, which can be executed by existing interlocking systems maintenance staff, but it is rather difficult activity, both finance and time-consuming.

The next aspect is personnel qualification structure. It is clear that together with RCS establishing (as with establishing of any modern interlocking system) there are increasing demands to qualification and skill of personnel.

2.2.2 TRAFFIC ACCELERATION

The next benefit of RCS is principal increase of traffic controlling quality on the railway line. Owing to traffic check and control from the only centre there is more punctual and up-to-date view of situation on line. With regard to remote control of more stations and so the longer line section the dispatcher has information about train movement in timing advance and more complex.

Consequences could be summarized to next points:

- Concentration of train traffic control to the one centre leads to bigger operability, because the dispatcher has overview of trains' movement on track and situation in stations and so there is scarcely any delayed route setting.
- Central control enables to optimize trains passing and to decrease delay and effects of traffic irregularities.
- In contrast to classic line control there is not need to precisely care about train importance - it is possible to operatively intervene in operation in view of instant progress and so in the economic view due to global control of whole line section.

So it is distinct that RCS leads to the improvement of fluency and so of traffic speed on line. Enhanced style of trains' movement caused by possibility of making of direct routes through more stations by dispatcher and by better utilisation of tracks in stations in manner, which cannot use local dispatcher because of insufficient information, can lead to distinct savings of traction energy, because there are energy losses in every train stop and start. Due to increase of section speed there is also shorter cycle of locomotives and railway carriages, which leads to other indispensable but difficulty reckonable savings.

Positive influence of remote (centralized) control is distinct in case of traffic closures, accidents etc., when the dispatcher can utilise better line throughput, can react more quickly to actual situation and can immediately make an action due to punctual and timely information.

2.2.3 TRAFFIC SAFETY

Mistake possibility in the course of interlocking system operation is distinctly decreased by concentrating of whole operation to one person – dispatcher, who is not directly exposed to stress situations in station or bad weather conditions. This effect, which can be classed to psychological consequences, is especially emphasized, when required arrangements for better working conditions of dispatchers (illumination, air conditioning) are made. The necessity of station and track interlocking devices of 3rd category, which decreases the possibility of human mistake on its own, also contributes to safety.

2.2.4 LINE THROUGHPUT

There was mentioned above that the fluency and speed of traffic are increased due to control from one place. The remained question is, if the establishing of RCS has measurable effect on line section throughput.

There is not information about existence of RCS in the theoretical calculation. This calculation counts with line speed, which running times in particular sections result of, and with type of interlocking device, which has influence to station and line intervals and the theoretical and practical throughput is counted from these entries.

In so rated value of the throughput is rather big reserve. There is factually possible to run more trains on remotely controlled line than the theoretically counted value without traffic fluency disruption. This fact is especially caused by consequences of whole line situation overview and traffic control from one centre. With regard to this can the dispatcher use possibilities of traffic management in dimension, which is not possible for local dispatchers on classically controlled lines, because of lack of punctual and timely information. There is manifested practically:

- the contraction of station intervals to the least possible level,
- the possibility of timetable reserve decrease by saving of time used to transfer of information to stations and between them,
- the possibility of quick solving of operational situations.

So this practically observed effect is theoretically reasonable in some way, but still it is not possible to express the increase of throughput by some value. It is largely dependent on character and length of line section.

2.3 PROBLEMS OF RCS

In spite of indisputable benefits the realization of RCS on line section brings some problems, which can completely contradict the sense of this system establishing in the worst case. So it is necessary to realize these problems before and make arrangements, which contribute to prevention of insoluble technological, technical or operational complications.

2.3.1 DIRECT SUPERVISION OF TRAIN MOVEMENT

The reduction of number of staff that visually checks the train movement is evident, essentially systematic problem of RCS. It means that there is worse possibility of detecting and removing of some defects on trains, which could be easily and quickly detected in other cases:

- an opened door of passenger train,
- a loose load or cover,
- failures in end-of-train marking,
- a hot bearing, flat wheel or similar technical defect of carriage.

These defects could be detected in two ways:

- classically – there are personnel used to visual check of train movement. But there is less personnel on the lines with RCS, so the number of people who can visually check the train in their stations is distinctly decreased, additionally there are occupied by other duties, especially commercial,
- by technical devices – some defects could be detected by modern devices. Failures in end-of-train marking have not direct influence to traffic safety and interlocking system function, so there is not need to check it so strictly.

Combination of both ways is the most suitable – there are still personnel in some stations even on remotely controlled line, some technical defects could be detected well by technical devices. Radio link with locomotive driver is very important in both cases for possibility to tell locomotive driver about defect, stop the train and eliminate defect.

2.3.2 PASSENGER SAFETY

There is considerable decrease of passenger safety in case of stations without platforms. Then must be given consideration to provide passenger safety, which is ensured by local dispatcher on classically controlled lines. It means to disallow movement of train on track closer to station exit when there is a passenger train in station. It could be done by special module in interlocking system (its realization is easiest in case of computer system) or by special organizational arrangement, however it is increasing demand on dispatcher attention.

Some technical device must provide the information for passengers about platform change, train delay or connected trains. There is possibility of a direct announcing of this information by dispatcher, but it can lead his overload especially in case of larger controlled area and bigger number of passenger trains. The solution is direct interconnection between passenger information system and RCS, which can send information about train movement, for example by using of GTN system. The way of giving information by this system is presented in [1].

2.3.3 TRAFFIC DOCUMENTATION

Traffic documentation on classically controlled line is made by local dispatcher for his station in paper or computer form. The whole communication with other workers as dispatchers of surrounding stations, train dispatcher etc. is pursued by phone. In the case of operation of electronic traffic documentation in nearby stations the communication could proceed in data.

While a local dispatcher usually writes numbers of used tracks, times of arrival and departure and other traffic details, it is not possible on remotely controlled lines. But these details must be recorded in some way, because they inform about traffic situation and they are confirmative in case of accident or great delay of trains.

It means that recording of these details must be delegated to some technical device, preferably electronic – computer, which evidently needs connection between the interlocking system and the application for traffic documentation making. The example of this system, which is in operation in Czech Republic and Slovak Republic, is GTN. Some details about this system could be found in [2].

3. SUPERSTRUCTURES OF INTERLOCKING SYSTEMS

Superstructure, which provides transmission of information about train movement from interlocking system to railway information systems, can be established. This information can conduce to additional improvement of traffic management effectiveness and they can also conduce to clients of railway, whether in passenger transport (train location) or in freight transportation (monitoring of consignment). One of these systems is GTN [2]. Interconnection of interlocking and information systems has some problems, which result from principles of interlocking.

The main problem of this connection is that between interlocks and RCS devices are transferred safety-relevant information and for their simplification is necessary to have closed network by standard EN 50159-1 in whole area. It means that, aside from another technical

details, there is requirement that device, which is operated in transition network, cannot generate information that appear as RCS information and they cannot create access for trespassers.

Closed network and no generating of reserved information cannot be proved or it would be difficult to keep closed network after longer running period.

Because there is no existing interlocking system prepared for alternative solution by open network in sense of standard EN 50159-2, there is no possibility to establish open interconnection between interlocking system and any superior control system. In this stage is possible only restricted interconnection, when data are sent from interlocking system and access to this system is disabled in sense of requirements of interlocking equipment. Available technical solution is unidirectional connection of fail-safe network and network of other information systems (OIS), which allows OIS to obtain actual and relevant information about traffic through interlocking system, but on the other side it inhibits access from OIS network to RCS network (OIS network means e.g. GTN network and linked system CEVIS, MIS etc.) In no case is possible to control interlocking equipment directly from OIS network.

In their consequences cannot be utilized all possibilities of these systems, e.g. if there is train route to right section of station, etc. If we want to execute these supervisions we have only one possibility now – implement it directly into RCS.

4. CONCLUSIONS

It could be said that the finishing of operation on railway lines is not only way to reduce costs of passenger operation. The costs of operation could be reduced also by establishing of remotely controlled interlocking systems, which decrease mainly, but not only, personnel costs. There could be additional saves by use of superstructures of interlocking system, which could provide automatic route setting. It is obvious that interlocking and information systems contribute to quality of railway transport. In period of development and implementation of these systems we must accept different conditions of individual line and the solution must be adapted to these conditions. Then the system of effective railways could be created without unnecessary costs.

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Reviewer: Prof. Andrzej Lewiński