

*interlocking systems of railways,  
information and control systems*

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## TRAFFIC MANAGEMENT ON SECONDARY LINES

Delegation of the interlocking system operation from particular intermediate, branch and junction station to one area control centre is a breakthrough in the quality of the transport processes control. There is also possibility of cost saving especially in case of secondary lines, where is possibility to have stations without personnel. This paper is focused on idea of traffic management on secondary railway lines, which brings either higher quality of the transport processes control and lower costs.

## ZARZĄDZANIE RUCHEM NA LINIACH DRUGORZĘDNYCH

Przekazanie działania systemu zależnościowego z danej pośredniej, odgałęznej i węzłowej stacji do jednego regionalnego centrum sterowania stanowi przełom w jakości kontroli procesów transportowych. Istnieje również możliwość oszczędności kosztów, szczególnie w przypadku linii drugorzędnych, gdzie możliwe jest posiadanie stacji bez personelu. Referat ten koncentruje się na idei zarządzania ruchem na drugorzędnych liniach kolejowych, która podnosi jakość kontroli procesów transportowych, jednocześnie obniżając koszty.

### 1. INTRODUCTION

The importance of establishing of modern interlocking systems on main lines was stressed many times. The secondary lines are often aside of attention, however the benefit of modern interlocking systems could be also used there and cost saving and the investment payback period could be better there then on main lines. The aim of this paper is to bring up benefits and problems of remotely controlled systems on secondary lines.

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## 2. BENEFITS OF RCS

Establishing of remotely controlled interlocking systems (RCS), which naturally needs extensive investments and technological arrangements, brings important benefits due to them makes sense to build these systems. The most important benefits are in next sections.

### 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 number of personnel in centre.

Personnel savings are accordingly clear on the decentred level – in stations. There are many other circumstances, of course. There could be this saving in the case of reduction of staff in stations, e.g. when we leave only emergency dispatcher also with commercial functions there or we leave station on local level without personnel. RCS systems naturally aimed to this state, but it is not essential condition and there are personnel in many stations on remotely controlled lines. In the case of secondary lines, which is this paper engaged in, it is not problem to leave stations without personnel.

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, so it is necessary to count with the increase of personnel costs also in this area.

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. 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 he 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, but there 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.

### 2.3. 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 3<sup>rd</sup> category, which decreases the possibility of human mistake on its own, also contributes to safety.

### 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.

### 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.

#### 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.

#### 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.

The possibility of giving information for passengers about platform change, train delay or connected trains is lower. It is clearly not problem in classically controlled station with local dispatcher or operator, who announces information for passengers regardless of station position next to remotely controlled section. Information for passengers in remotely controlled station, both acoustic and visual, must be ensured by station personnel on the basis

of information received by dispatcher. We must take into account that there is more communication between dispatcher and stations. The second possibility is a direct announcing of this information by dispatcher, but there is possibility of 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].

### 3.3. MENTAL STRESS OF DISPATCHERS

The RCS dispatcher work is similar to work of local dispatcher, who control traffic in area of one station. But he has bigger incidence of train traffic controlling in comparison with local dispatcher. He has some important information, e.g. about train position, not directly from the yard, but from information panel or computer monitor. Contrary to local dispatcher he is not directly stressed by weather conditions. On the other site the dispatcher must solve bigger number of traffic situation during shift.

So the RCS dispatcher work requires good combining ability, decision-making, memory and imagination.

The mental stress of dispatchers results especially from:

- conflict situations,
- time pressure at complicated traffic situations solving,
- demands on mental processes, esp. thinking, consideration, decision-making, memory,
- communication with other workers.

Qualities, which are needed for reliable service of an RCS dispatcher, are especially promptness, accuracy, endurance, decisiveness, adequate self-confidence and sense of cooperation. For functions of a dispatcher are usually chosen local dispatchers, however it is necessary to use more strict criteria of psychological examination.

Dispatchers themselves rate their work as a very difficult especially because of eminent responsibility and necessity of constant promptness. They consider it as so difficult that it cannot be performed for years with the same efficiency.

### 3.4. 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 arrive 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.

To the electronic form could be so converted other auxiliary documents with data about trains, locomotives etc. It is very important for connection for RCS system to other systems as RCS systems in nearby line sections or other information systems of railways.

#### 4. CONCLUSIONS

The RCS system brings a new quality to process of railway traffic controlling. In case of secondary lines, where could be leaved stations without personnel and it is not a big complication in the event of system failure, it brings extensive savings of personnel costs. Other savings are possible by better way of train movement, which result from more actual and punctual information for a dispatcher. This better information also leads to better quality of traffic management in case of an accident or traffic irregularity. In addition there could be used more reasonable system for secondary lines, so the capital cost repayment period of RCS system could be very short for the case of infrastructure investment.

So finally must be said that the RCS system is a way to future not only for main but also for secondary lines.

#### ABBREVIATIONS

GTN	Graphical and Technological Superstructure of interlocking system
RCS	Remotely controlled systems

#### BIBLIOGRAPHY

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