TELEGRA
SMART TRAFFIC MANAGEMENT

Increasing the reliability of Traffic Management System introducing *Local automatic response* within TLS environment

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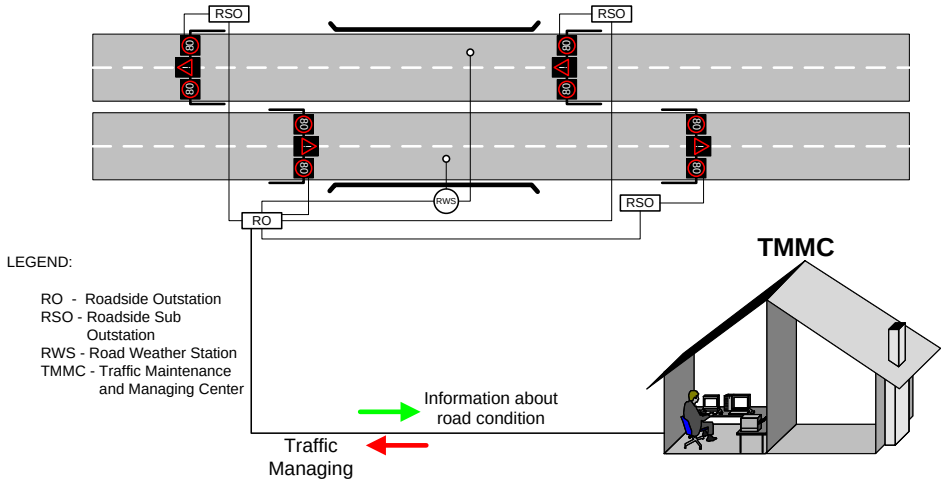
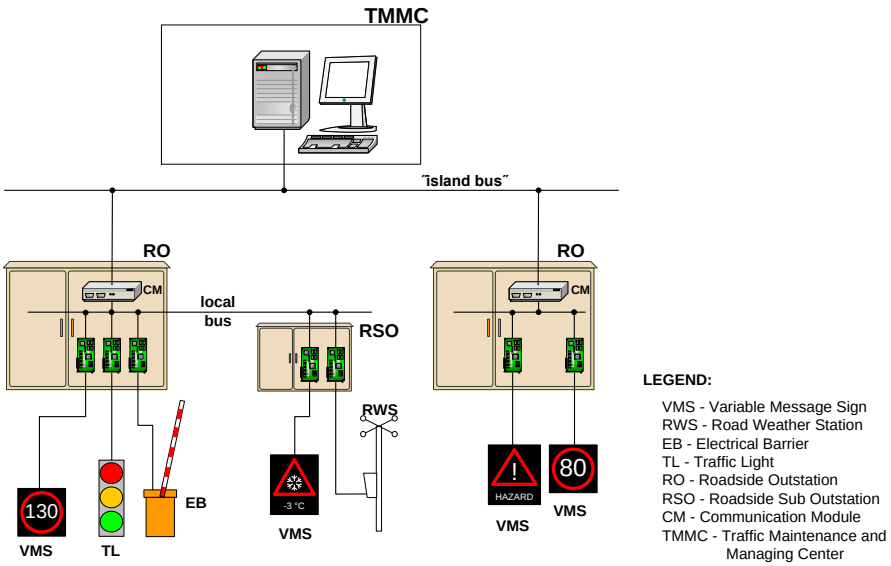
INTRODUCTION

Nowadays, we are witnesses of increased traffic density, and as a consequence of that, less security of traffic participants. From that reason there is a need for construction of modern routs (highways and roads). Thus, experience shows that the problem of traffic density and security on road can't be solved by building new routs. It is also necessary to implement traffic management system that will monitor and regulate traffic, give information about road conditions to drivers and suggest alternative routs etc. Traffic management system, to be fully functional, has to consist of variety of devices that are located on highway route Control and Supervision devices (roadside outstation RO, roadside sub outstation RSO), devices for collecting data (traffic counters, road weather stations, vehicle height detector…) and information devices (variable message signs). On the other hand to be able to do managing on the roads on high standards, road is divide on smaller routs (50-70 km) and control on that routs is given to the Traffic Maintenance and Managing Centers (TMMC). Data collected on the rout is through control-maintenance devices passed into TMMC for additional processing. On the base of processed data, a further action is being done (through defined situation procedures). That means that the data from TMMC is passed on to control-supervision devices that controls variable message signs (*Picture 1*).



Picture 1: Connection of traffic management system

Picture 2 shows traffic management system built according to the TLS standard (TLS – Ger. *Technische Lieferbedingungen für Streckenststionen*). Purpose of TLS is to define the functions and interfaces on unique way, so that the equipment of different manufactures, based on specifications, can be compliant to each other. As shown on *Picture 2*, TLS system is hierarchy based so every route has its own Traffic Maintenance and Managing Center (TMMC) on highest place in traffic management system. Local control center controls Roadside Outstations (RO), RO controls RSO (many of RSO can be connected on the same bus, TLS terminology calls it *Far away concentrators*). At the end of that chain is terminal equipment (variable message signs, traffic counters, road weather stations, vehicle height detectors). RSOs don't have direct connection with Control center. They are connected through *Local bus* in RO.



Picture 2: Hierarchy of TLS system

PROBLEMS OF TLS TRAFFIC MANAGEMENT SYSTEMS

Best functionality of traffic management system and safety of traffic participants is in case of constant connection of RO with local TMMC. In that case, operators have insight on traffic condition and can react on proper time on any scenario. But, there are some situations in which functionality of control center is not complete, and drivers safety is reduced

In case when traffic signalization is controlling the traffic on critical objects, like crossroads, bridges, viaducts, tunnels, and communication between TMMC and RO is broken up. So operators in TMMC donćt have insight on traffic conditions on the rout, and ability to control the traffic signalization.

When traffic management system is implemented on isolated locations which are not temporary connected to control center. In this case there is no control center (its not build jet or not fully functional) and there is a problem with controlling traffic signalization.

In cases (e.g. fires in the tunnel tube) when the reaction of the traffic management system is critical. In systems build according to the TLS standard information flow is always through the control center. That means that if the fire in the tunnel tube had happened, measuring devices that detected it will send the information to the control and supervision device, and he will send it to control center. After the information is processed in control center, returned information goes to control and supervision device (not necessarily the same device that send the information to the center). The device will manage the traffic signalization (close the tunnel, re-rout the traffic etc.). We can see that information about the fire has passed through the whole system (from the lowest point to highest and back) what is unacceptable in cases of critical situations dangerous to human lives (from detection to reaction can pass 10 to 30 sec!).

Question is How, in this kind of situations, to keep maximal efficiency and reliability of traffic management system, and safety of drivers as a final goal.

HOW DOES "LAR" WORKS

Telefon-Gradnja Ltd has been developing, designing, producing, implementing and maintains intelligent traffic management systems for a long time and it is deeply involved in this kind of problems. We understand that the safety of passengers is in the first place and can not be endangered. From that reason we have developed a brand new concept of traffic management systems in critical situations in form of Local Automatic Response.

In a simplest manner, Local Automatic Response presents extending of control and supervision devices functionality on highway routs (roadside outstations, RO) in regard to TLS standard. As mentioned, usual procedure in TLS systems is that all commands about changing traffic signalization comes from control center (TMMC). Local Automatic Response allows that the RO in some cases can control traffic signalization. We should mention that implementing of LAR in traffic management system does not undermine functioning of the system by the TLS standard. For that purpose in Telefon-Gradnja Ltd we have build new function group inside the TLS that allows the Local Automatic Response. That means that inside of RO are additional program module that activate itself in situations that are predefined (communication brake with control center). That module is in fact interpreter and allows so called p-code. P-code is program independent of device (same p-code can be used in verity of devices) and written in special program language (*script*), translated and carried in RO. Interpreter of p-code has access to devices (Road weather stations, variable message signs) that belong to other function groups and can affect on their functioning. The additional configuration is possible, that functions in two ways locally (through notebook connected on RO) or remote from control center through standard TLS protocol. It has to be noted that configuration is done on line and in that time RO can function normally.

HOW CAN "LAR" SOLVE THESE PROBLEMS

We should go back on three previously mentioned problem cases in functioning of traffic management system (communication breakdown with control center, traffic management on isolated locations of highway and to slow reaction of the system). How can LAR help us in solving these problems?

Communication breakdown with control center. Communication module inside the RO follows the state of communication network to the control center. If that communication from some reason is collapsed, RO goes to LAF. Managing the traffic signalization which is connected on RO and related RSO is carried out through predefined algorithms. That means that the managing is being done on base of collected data from measuring devices (meteorological stations, traffic counters, vehicle height detectors). Control algorithms executed through LAR are much more complicated then those done by classic controller estimated with TLS standard which means that traffic management is more intelligent. When the communication with control center is restored RO goes out from LAF mode and goes to remote way of functioning (controlled from TMMC).

Isolated locations of highway that are not temporary connected to the control center. In this case situation is pretty clear because there is no control center so there is no need for monitoring communication network RO works in LAR mode all the time and controls variable traffic signalization mentioned in previous case. Often, in this case, managing consist of a larger area (traffic junction, up to few km). According to TLS standard communication between RO and RSO (far away concentrators on local bus) is through cupper wire. In this case that is not possible (to fare distance) so we have solved this problem by switching the local bus on optical media with additional implementation of multimode and single mode optical converters.

Slow reaction of the system in critical situations. As mentioned there are situations (e.g. fire in the tunnel tube) when reaction of the system is critical, regard of the usual flow of informationćs in TLS systems that is too long. Then RO goes to LAR alarm mode regardless on the status of communication with control center. Information about critical situation can send some of measuring devices connected directly to RO or some other system (e.g. fire detection system) which is also directly connected on RO. Possibility of communication with other system means that program module of LAR can communicate through other protocols than TLS (some of *FIELDbus* protocols). In

case of activation of alarm algorithm information about changed status of traffic signalization, cause of alarm mode of LAR and the status of alarm mode is passed on to control center.

Picture 3: Roadside Outstation independently controls traffic in Local automatic response mode

CONCLUSION

More and more traffic density requires building a large number of modern roads and for need to control and manage traffic it is necessary to build Traffic Management Systems which will satisfy set up functional and safety standards. Experience and practice shows that systems build according to TLS standards satisfy that demands. Thus, there are situations in which functionality and reliability of Traffic Management Systems can be increased. That basically refers on situations in which communication brake down between control center and RO or slow reaction of the system in critical situations can endanger human lives. Telefon-Gradnja Ltd has successfully overcome this problems implementing Local Automatic Response inside of TLS standard which allows RO to act independent and control the traffic no matter the communication status with control center.