

# Managing a large scale, long term project requires meticulous design and coordination

Tommi Rytkönen

The Kokkola–Ylivieska double track project is one of the most comprehensive signalling system projects ever implemented in Finland. It covers the modernisation of the existing track and the signalling system for the new track being constructed next to it. The total length of the line section is approximately 80 kilometres. The signalling system project will be carried out in three main phases over five years. It includes over 20 subprojects to be commissioned during a single total traffic break of less than 24 hours when the new tracks will be connected to the old ones and the new system will be commissioned as a whole. A large number of construction companies and representatives of various fields are simultaneously working at the site and partially overlapping each other. The importance of meticulous preplanning and coordination is emphasised in a project in which safety cannot be compromised and the continuously running train traffic sets the preconditions for the construction work.

## 1 Increased railway capacity and train speeds

The Kokkola–Ylivieska track section is part of the Seinäjoki–Oulu line on the Finnish west coast. The 335-kilometre line is one of Finland’s busiest railway lines and part of the Trans-European Transport Network (TEN-T). This railway is used for both passenger and freight traffic and is mostly single track, electrified, remote controlled and equipped with an Automatic Train Protection system.

The railway traffic between southern and northern Finland is highly dependent on the capacity and efficiency of the line. The number of daily passenger and freight trains running on the line is reasonably high. Hence the new double track railway sections and the improvement of the existing single track line are significant for several reasons. For example, continuous railway operations can be secured on the section and railway capacity increased. The project will also enable passenger trains to run at an increased speed of up to 200 km/h.

## 2 The most comprehensive signalling system ever built in Finland

Mipro, a Finnish system supplier specialising in total solutions for railway traffic, is responsible for the design, supply and installation of the new signalling system of the Kokkola–Ylivieska railway section. The signalling system is one of the most comprehensive ever built in Finland and covers – in addition to the existing single track section – the new double track section under construction. The challenge of the project is to build the signalling system without interrupting the traffic on the existing track, to ensure the functionality and safety of the interfaces to the existing track, and to provide a reliable and comprehensive project management.

The total length of the Kokkola–Ylivieska section is about 80 line kilometres. The section includes seven operating points, three of which are bigger stations (Riippa, Kannus and Eskola) and four crossovers (Matkaneva, Kälviä, Sievi and Karhukangas). There are about 118 signals along the line section and about 36 centralised turnouts (with two motors).

## 3 Signalling system scope of delivery

For the Kokkola–Ylivieska railway line, Mipro delivers a total SIL4 level interlocking system solution according to EN 50126, EN 50128 and EN 50129. The solution provides:

- a technical nominal speed of 250 kilometres per hour,
- new combined aspect signals,
- clear track detection by an axle counting system,
- new Automatic Train Protection (ATP) control lines.

The scope of delivery includes trackside equipment, interlocking system facilities, interlocking system software and several system interfaces, for example to the ATP system, traffic control system and point heating.

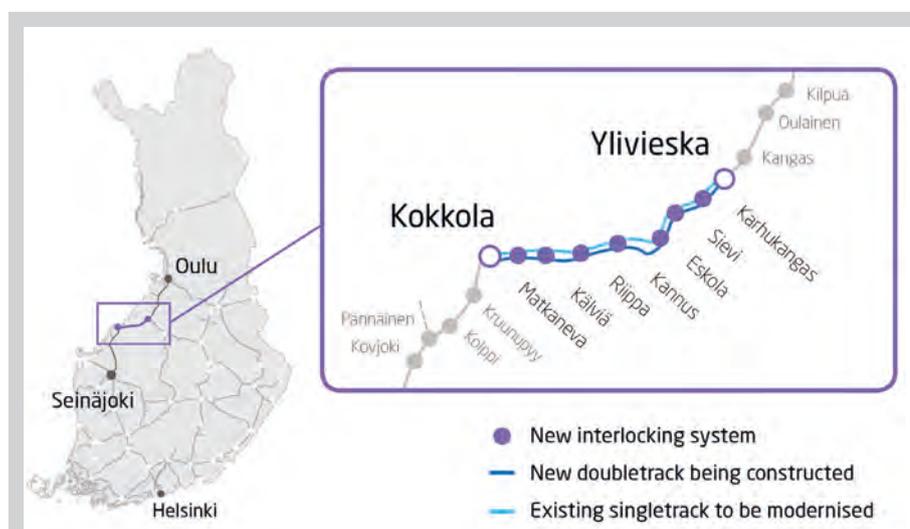


Figure 1: The Kokkola–Ylivieska double track will assure competitive railway operations on one of Finland’s busiest railway lines.

The system is installed in seven device facilities located on the railway crossovers or stations. In addition, tens of system cabinets and approximately ten sheds are located between the stations and crossovers.

When the project is completed, the Kokkola–Ylivieska track section will be an electrified and remote controlled double track line based on automatic block control and provided with Automatic Train Protection.

#### 4 Modular and distributed technical solution

The new double track line will be built in three separate phases and the overall project is divided into 21 interim targets. This means that the technical solution must allow for a phase by phase and component by component construction of the overall facility. The interlocking system delivered by Mipro is modular and can be decentralised according to the geometry and operative areas. Consequently, there is no need for long trunk cabling and additional signal relays. Furthermore, the modular system structure enables changes and modifications that cannot be avoided in such a comprehensive and long term project. Installations, commissioning and modifications can be made by areas.

The interlocking system is implemented by installing the system's core hardware (the control elements for the trackside equipment) in system cabinets located along the line section and directly connected to the trackside equipment. The interlocking system structure is divided into operational areas – western and eastern track – and the system cabinets are located as near as possible to each element that belongs to the respective cabinet's control area. The interlocking system core safety logics are located in the device facilities which include interface equipment to the trackside elements.

#### 5 Risk assessment and testing to ensure the safety of interfaces

The final system structure includes two line block interfaces; one to the Kokkola interlocking system and the other to the Ylivieska interlocking system. In addition, numerous line block interfaces or interfaces to relay interlocking systems are needed when the new or modernised track section is connected to the existing track and old interlocking system. These temporary interfaces are used until the



Figure 2: In the Kokkola–Ylivieska double track project, the continuously running train traffic sets the preconditions for construction work.

next track section is connected under the control of the new interlocking system.

Building an interface between a new and old interlocking system is a challenging task. Each interface is unique and its safety is an absolute requirement so as not to compromise train operational safety under any circumstance. The project must first focus on a careful planning and risk assessment, and then on comprehensive testing before the track section that includes the interface is commissioned.

#### 6 Goals of pre-planning: capacity and safety of train traffic

A large number of various construction companies and other parties are involved and tied to or connected to each other in the Kokkola–Ylivieska double-track project – as generally happens in any large-scale railway project. These include construction companies for the substructure, superstructure, catenary power, signalling and cabling, power supplies and telecommunications for centralised traffic control.

Constructors work simultaneously and overlap with each other according to a detailed plan. The customer (the Finnish Traffic Agency) is responsible for the high-level planning which defines the order in which the track sections are built and modernised. The targets of the plan are to ensure the least possible disturbance to train operations, safe operation and ensured construction work safety.

Site safety management plays a key role in a project which is carried out in

an environment with continuously running train traffic. Risk management is accordingly focused on identifying and eliminating risks that appear during the construction period. The track sections are commissioned in phases and each phase is methodically processed as a specific case on its own. In practice this means that specific plans are made for each work phase to ensure the safety of workers and train traffic.

#### 7 Commissioning with a single total traffic interruption

Especially during commissioning, the importance of scheduling and managing communications is crucial. All commissioning activities will take place during a single total break lasting less than 24 hours, usually 16 to 20 hours. Together, the customer and constructors plan a precise schedule for the duration of the interruption.

The challenge is that the construction works can only be finalised in the commissioning phase because the last connections between new and existing tracks must be completed in this phase. After the break, traffic must continue to run safely. The customer and various parties must meet clear criteria to guarantee safety.

#### 8 Professional teamwork with a good spirit

The project manager of the signalling system project is responsible for planning and scheduling the appropriate works according to the higher level

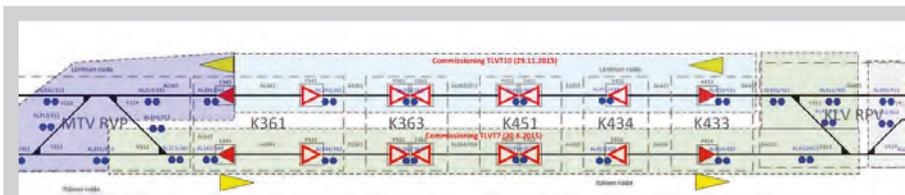


Figure 3: Mipro's signalling system solution can be installed, commissioned and modified area by area.

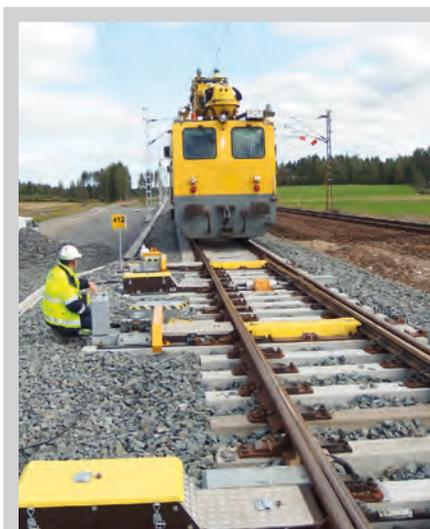


Figure 4: Accurate preplanning and open communication are required to enable various construction companies to simultaneously carry out their work.



Figure 5: The interlocking system delivered by Mipro can be implemented according to the operative areas.

construction plan. When the substructure of the new track is ready, rail works and catenary power installations will start. After these have been completed, signalling and cabling work can start, usually in a very tight schedule. Tight schedules are, of course, the concerns of other constructors as well.

The project manager has to be able to communicate with and pay attention to numerous partners, including designers, people working on site, other constructors, customer representatives and safety officers, external safety assessors and hardware and component suppliers. He must have a good expert team to work with and manage the project. The site manager and lead designer are some of the most important team members. All team members including the project manager must continuously consider and be prepared for changes that may require new solutions. The project will not succeed without a professional project team working together in a good team spirit to cope with tight schedules and stressful commissioning activities. It is thus worthwhile to invest time in strong leadership: to select the right people for the key positions and to en-

sure that everyone knows his/her tasks and responsibilities.

## 9 Open cooperation at all project levels

In long term projects, changes can always appear in the geometry, individual elements and the schedule. It is advantageous if the effects of such changes on other parties can be taken into account. Open communication is required throughout the whole project to take all views into consideration and to implement changes. It is also good to understand that there are no tricks in the management of comprehensive long term projects. Nothing beats accurate communication, open cooperation and strong leadership at all project levels.

By spring 2015 over one third of the Kokkola–Ylivieska signalling system project has been commissioned. The final commissioning is scheduled to take place in the middle of 2017. Mipro has created efficient practices and functioning models to manage such long-term and large scale projects, and they are being successfully applied throughout this entire project.

### The author

Tommi Rytönen  
Project Manager  
Mipro Oy  
Address: Kunnanmäki 9,  
FI-50600 Mikkeli, Finland  
E-mail: tommi.rytkonen@mipro.fi

## ■ ZUSAMMENFASSUNG

### Ein umfassendes, langfristiges Projekt erfordert sorgfältige Planung und Koordination

Das Kokkola–Ylivieska-Doppelspur-Projekt ist eines der größten jemals in Finnland verwirklichten Signaltechnikprojekte. Es beinhaltet die Modernisierung des bestehenden Gleises und das Signalsystem für die Doppelspur, die durch das gleichzeitig parallel zu bauende zweite Gleis entsteht. Die Gesamtlänge des Streckenabschnitts beträgt rund 80 km. Das Signaltechnikprojekt wird in drei Hauptphasen über fünf Jahre ausgeführt und beinhaltet rund 20 Inbetriebnahmen von Teilsystemen. Die Inbetriebnahme des Gesamtsystems stellt hohe Ansprüche, weil das neue Gleis während einer Betriebsunterbrechung von weniger als 24 Stunden mit dem bestehenden verbunden werden muss. Im Projekt arbeiten zahlreiche Auftragnehmer und Vertreter unterschiedlicher Fachgebiete gleichzeitig und parallel auf der Baustelle. Sorgfältige Vorausplanung und Koordination sind in diesem Projekt, in dem es kein Sicherheitsrisiko geben darf, äußerst wichtig. Dabei stellt der durchgehend laufende Zugverkehr noch zusätzliche Bedingungen für die Implementierungsarbeiten.

Der finnische Eisenbahnsystemspezialist Mipro ist für Planung, Lieferung und Einbau des neuen Signaltechniksystems für den Gleisabschnitt Kokkola–Ylivieska verantwortlich. Dazu liefert Mipro eine modulare dezentralisierte Lösung, die Einbau, Inbetriebnahme und Änderungen phasenweise und bereichsweise ermöglicht.