New Cologne-Rhine/Main high-speed line

Assembly activities for equipment engineering controlled via time/distance chart

The new Cologne-Rhine/Main high-speed line connects the Rhine/Ruhr and Rhine/Main economic regions quickly, attractively and economically. On it, the latest construction and equipment engineering allows one of the most modern high-speed trains in the world, the ICE 3, to ply between Cologne and Frankfurt at a top speed of 300 km/h. The companies commissioned with providing the stationary equipment were ABB Energieanlagen GmbH (110 KV traction supply line), Elpro-Bahnstromanlagen GmbH (switchgear), DB Bahnbau (electrotechnical energy equipment) and Siemens AG (overhead line, signal and telecommunications engineering). Also, Siemens AG as the company in charge of the equipment engineering group was commissioned to coordinate the various trades supplying the equipment as well as relations to third-party companies.

Fig. 1: Signals at the south portal of the Limburg tunnel
Source: THOST Projektmanagement für Bauten und Anlagen GmbH, Pforzheim

The most important aspect governing the success of a project of this scale and complexity is project management, in particular scheduling and deadline control. As the Pforzheim company THOST Projektmanagement für Bauten und Anlagen GmbH has extensive experience in project control for traffic systems, Siemens AG, TS TK Berlin, commissioned it to coordinate the deadlines for the processes required for planning, approval and realization of the equipment for the line, including high-level support for the interfaces to the individual schedules of the construction joint ventures. In the final phase of the project, deadline coordination also included the high-level coordination of the processes necessary for operating the line, from taking the signalling equipment into operation to carrying out test trips of the ICE 3 section by section over the whole length of the line.

By way of an example, the following brief description of the structure of the overhead line system will give you an impression of the scale of the line equipment installed in the project.

▶ Structure of the overhead line system

Over a distance of approx. 137.5 km, the trade responsible for the overhead line electrified the double-tracked line between Siegburg and the bridge over the Main at Eddersheim as well as the approximately 10 km long branch line to Wiesbaden. This section of the line includes the stations Montabaur and Limburg with two overtaking lines as well as the transfer facilities Willroth, Lindenholzhausen and Idstein.

3,250 pylons were set up along the line, 1,600 kingposts were installed in the tunnels, 436 km of aluminium cables were fitted as return lines, line feeders and feeder lines, 150 km of fibre-optic cables were attached to the return line, 380 km of overhead line were installed and the corresponding earthing and cable-laying work (approx. 120 km) was carried out [1].

Fig. 2: Overhead line at the northern portal of the Schulwald tunnel
Source: THOST Projektmanagement für Bauten und Anlagen GmbH, Pforzheim

▶ Detailed scheduling is necessary

A project of this scale includes a large number of activities and numerous interfaces between the different trades used for the equipment engineering as well as to third parties (construction engineering etc.). In addition to the many deadlines and dependencies involved, the processes required in linear construction sites also depend on the spatial frame of reference. This can only be displayed clearly and efficiently using a computer-assisted time/distance diagram. This is why planning and control of the deadlines were carried out via TILOS, a system specially developed by the Karlsruhe software company Linear project GmbH for linear construction sites. TILOS stores extensive algorithms containing information on all processes included in the time/distance diagram such as the duration of

▶ Preparation of the basic schedule for the equipment engineering group

First a basic schedule for the entire route from Cologne to Frankfurt was prepared. For this purpose the numerous individual structures such as tunnels, road and railway bridges, viaducts, structures housing equipment etc. were listed in detail. On the basis of the schedules drawn up by the construction joint ventures, a distance scale was established in the time/distance diagram and the structures with the necessary construction times (and additional settlement times for embankments) included in order to have a general idea of when the different trades required for equipment engineering can start work. The processes necessary here and the relevant deadlines were coordinated with the project managers of the companies commissioned to supply the equipment engineering and with the construction joint ventures. For the sake of clarity, the basic schedules for the processes foundation / pylons, cable installation, assembly of the outdoor installation, testing work and test trips as well as for test operation are shown hatched in various colours.

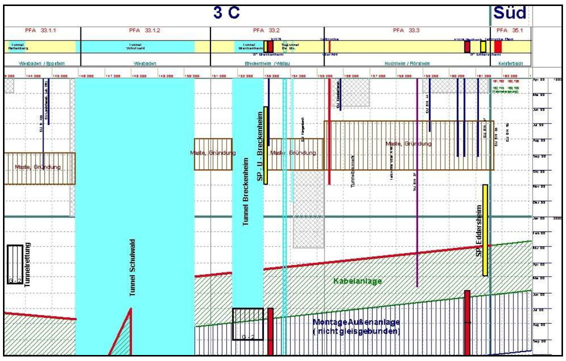

Fig. 3: Excerpt from the basic schedule of the equipment engineering group
Source: THOST Projektmanagement für Bauten und Anlagen GmbH, Pforzheim

Of importance for the clear representation of the individual processes is the selection of the colours and hatchings used. Important processes are shown in striking colours and less important ones in more subtle shades. As the individual operations are always coded in the same way, the reader can identify the processes by the colour and the hatching used. To explain the processes, they and their codings were also printed on the chart in the form of a legend.

The colours and forms of representation corresponding to the different assembly types are stored as models in a library. This makes it possible to resort to the existing models at all times for planning purposes. For example, it also allows all processes belonging to one assembly type to be changed throughout the entire chart by one click of the mouse. This is all in the interests of efficient preparation of a time/distance diagram.

The individual planning permission sections with the relevant structures such as tunnels, viaducts, stations, power-feeding stations etc. are shown in the upper part of the time/distance diagram. The opportunity of showing the entire route with all necessary individual structures on one chart was an advantage here. In addition, a table prepared via Excel was included next to the chart header on the right-hand side of the chart, which has a width of just under 3 m. This table describes in more detail the assembly work of the trades responsible for overhead line, telecommunications, signal engineering, electrotechnical equipment, switchgear and lifts planned in the time windows entered. In addition, the chart includes a detailed chart header showing the logos of the companies involved. To allow identification of the schedule, the chart header shows the chart version number, the date of preparation, the reference number as well as the basic planning data, i.e. the individual schedules of the joint ventures which go to make up the basic schedule.

Fig. 4: Chart header of basic schedule
Source: THOST Projektmanagement für Bauten und Anlagen GmbH, Pforzheim

▶ Detailed schedules for overhead line and signal engineering

In the further course of the project, the trades responsible for overhead line and signal engineering also commissioned THOST Projektmanagement Bauten und Anlagen to prepare the detailed schedule. Here the times for assembly procedures had to be shown clearly on the time/distance diagram to give those involved in the project a clear and transparent overview of the construction process. This was based on the basic schedule, from which the processes of no importance for these trades were deleted in a first step. In a second step, THOST Projektmanagement added the detailed processes important for these two trades. For this purpose, lines of different colours for the individual processes drilling, unloading pylons, pre-assembly of the accessories, pylon erection, fibre-optic return line and outriggers were added to the rectangular time windows

TILOS project report: new Cologne-Rhine/Main line

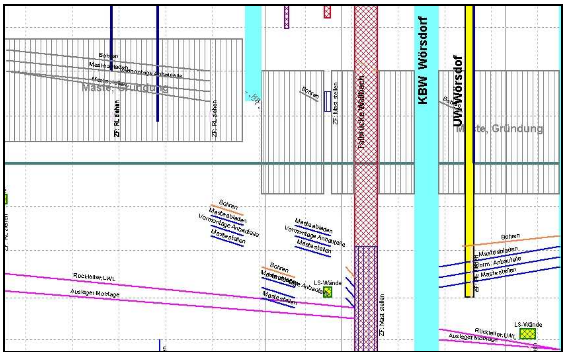

Fig. 5: Excerpt from the detailed chart for the overhead line
Source: THOST Projektmanagement für Bauten und Anlagen GmbH, Pforzheim

Resources

THOST Projektmanagement planned the equipment and personnel required for the overhead line and calculated the expected utilization of resources. The process models stored in the system were used and the performances of the resources were then stored there. When a process is selected from the model, it is simply drawn over the corresponding line in the diagram and the system carries out the necessary calculations automatically. All expenditures can be displayed as curves in historiograms. TILOS displays the values in the form of a table below the diagram. If changes are necessary and the user moves individual processes, the effects of this on resources are shown on the resource diagram displayed in parallel.

Fig. 5: Bearer cable for overhead line
Source: THOST Projektmanagement für Bauten und Anlagen GmbH, Pforzheim

Changes made in the course of the project

In a project of this scale, complexity and turn-around time, deadlines have to be adapted constantly. When it was noticed that final deadlines coordinated with the client were at risk due to external influences, activities had to be reorganized and partly speeded up. The updating of the detailed schedule for the overhead line was one of the foundations for a new schedule, whose main purpose was the high-level control of the track-specific assembly activities of the companies involved.

Accelerated procedures for the critical processes were coordinated with the project managers of the trades responsible for equipment engineering and included in the new schedule. Increasingly simultaneous execution of the assembly processes allowed work to be speeded up still further, the ultimate result being compliance with the final milestones coordinated with the client (deadlines for taking the line into operation). As a result, the federal chancellor was able to open the line on schedule on 25 July 2002. Conventional operation started six years after the official start of work on 1 August 2002.

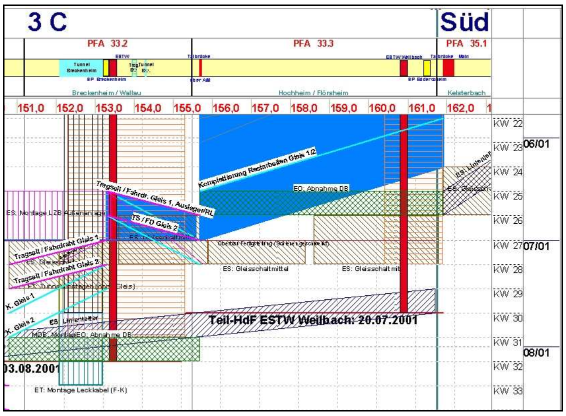

Fig. 7: Excerpt from the accelerated rough schedule for equipment engineering
Source: THOST Projektmanagement für Bauten und Anlagen GmbH, Pforzheim

Author:

Qualified engineer Alexander Neumann, responsible since 1997 for high-level scheduling and deadline control of the equipment engineering used on the new high-speed line Cologne-Rhine/Main for the company THOST Projektmanagement für Bauten und Anlagen GmbH based in Pforzheim

References:

[1] Schmidt, Alt: Aufbau der Oberleitungsanlage an der Neubaustrecke Köln-Rhein/Main,
in: Das Projekt Neubaustrecke Köln-Rhein/Main, 12/2002

Linear project GmbH
G.-Braun-Str. 14
76187 Karlsruhe
Germany

Tel.: **+49 721 / 46 47 –280**

Info@TILOS.org
www.TILOS.org