Swiss Section

Technical visit to Stuttgart 21 Digital Node Stuttgart (DKS)

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In May, the Swiss Section had the pleasure of visiting Deutsche Bahn (DB) in Stuttgart, Germany.

Peter Reinhart, one of the instigators of Digital Node Stuttgart (DKS) and currently with DB InfraGO, delivered an engaging and comprehensive presentation supported by around 100 slides, giving full insights into technical details. DKS is intended to use Stuttgart as the first complete installation of digital interlocking, ETCS and supporting technology to set standards for the digitalisation of the railway in Germany.

Following the presentation, David Bösinger guided the group through the underground facilities, showcasing the impressive architecture and state-of-the-art railway infrastructure. The Swiss Section was particularly honoured by the presence of IRSE president Bogdan Godziejewski, who joined us for the occasion.

As the start of the design work for DKS, analysis of the impact of introducing ETCS for the S-Bahn Stuttgart, the city's high density suburban railway network, was carried out. Headway was assessed on the four main branches, and it was shown that ETCS Level 2 and Automatic Train Operation at Grade of Automation 2 (ATO GoA2) could increase the overall performance by up to 40 per cent. To take full advantage of the potential gains, the geographical scope of the project was massively enlarged to include a total of 500km of track. Official commissioning is now set for December 2026.

A major task is also to equip the rolling stock with ETCS, ATO and future-proofed technology for FRMCS. Stock to be fitted includes 333 existing trains (BR423, BR430, FLIRT3, TALENT 3) and 184 new trains (Coradia Max and Mireo). Older trainsets that haven't been upgraded will be used in the rest of the federal state, whereas the new sets will be used in Stuttgart.

Changes in architecture will bring a gain in resilience. With the digital interlocking, bus systems are used for field elements, as well as for power distribution. The radio network backbone is set up in rings for more robustness, but this does lead to three times more cabling needed.

To future-proof the design a total of 30 new base stations will be built, first using GSM-R technology, later upgraded to FRMCS. The project has identified a mast height of 15m as bringing advantages during the rollout, as the 20m and 40m masts currently used require much more approval work.

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Swiss Section members with IRSE president Bogdan Godziejewski.


Panoramic view from the visitor centre.

The iconic Stuttgart Main station hall with its chalice-shaped columns.

Track 1 from the passenger distributor level.

A specific problem that has been identified is the placement of balises. The combination of existing rules (intermediate signal, location marker, repositioning, precision stop, start of mission, temporary speed restriction) would lead to a massive overpopulation of the track with balises, the so-called unwanted 'balise carpet'. A simplification has been identified with data preparation only necessary for some vehicles and 'cold movement' detection (technology that allows trains to track any movement when ETCS is not fully operational) fitted on the trains.

A further gain is expected out of reworking the rules about overhead wiring. These rules are over 30 years old and restrict block segmentation in and on approach of stations. A worst-case scenario has been identified in the Fildertunnel, where a 900m signal section is divided into five axle counter sections. The project would like to use axle counter sections as signalling sections, but due to the implied non-stopping area because of overhead wiring, this is not possible.

Traffic management system (TMS) has already been identified as the next enabler for the operation of more trains. The availability of ETCS data from the train, including position and speed, enables a precise forecast which can avoid unwanted braking between stations. The TMS has the potential to hold the trains for a longer period in stations, or to despatch them at a lower speed until the conflict has resolved. Route setting would be optimised with early operation of the points to speed up the whole locking of the route.

In addition to operational improvements, the physical environment of the station also plays a significant role in shaping the passenger experience and reflecting the importance of the railway. The architecture of the new station also indicates the importance of the building.

The design for the new station hall provides a bright, airy atmosphere. During the day, natural light will filter through the skylights, on top of the chalice column structures, evenly illuminating the platform area. At night, the concrete of the roof and chalice columns will reflect artificial lighting, enhancing visibility. This architectural concept places high demands on both the concrete mixture and the formwork techniques. The concrete needs to remain permanently light in colour, be fire-resistant, and have a smooth, pore-free surface. Notably, no two of the 28 column structures are identical in their final form.

Above the station hall, a green and defined open space will integrate into the surrounding Schlossgarten park. This plaza will connect key urban landmarks, including the park, the historic Bonatzbau building, and a new city district.

Following the tour of the main station hall, we enjoyed a reception that provided an excellent opportunity to engage with Bogdan.

Later that evening, we gathered for a traditional Swabian dinner. Some members extended their visit into the following day, which included a visit to the Porsche Museum.

A heartfelt thank you goes to the organisers for their outstanding planning, which made this technical visit both memorable and enjoyable. The visit was initiated by our member Markus Bolli, with the detailed organisation handled by Patrick Sonderegger. We are always pleased to see our members take the initiative, as this often leads to exciting and valuable technical visits.

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