THE STUTTGART–ULM RAIL PROJECT
ON THE CONSTRUCTION SITE
The latest information on all construction sites of the Stuttgart–Ulm rail project: www.bsu.link/auf-der-baustelle

MEDIA CENTRE
Webcams, construction site photos, films and many other media resources: www.bsu.link/media-library

TOURS
Experience the construction site live on a variety of guided tours: www.bsu.link/guided-tours

CONTACT:
Bahnprojekt Stuttgart–Ulm e.V.
Turmforum
Im Hauptbahnhof
Arnulf-Klett-Platz 2
70173 Stuttgart, Germany
Phone: +49 (0)711 2092 2920
Email: info@turmforum.de
www.bsu.link/turmforum-exhibition

WHAT IS THE STUTTGART–ULM RAIL PROJECT?
4–5
THE NEW INFRASTRUCTURE
6–9
TRANSPORT BENEFITS
10–11
FIND OUT MORE
12–13
NUMBERS, FIGURES, FACTS
Fold-out page
14–15
THE NEW MAIN STATION
16–17
URBAN DEVELOPMENT
18–19
WORK AND BUSINESS | PARTNERS AND FINANCING
20–21
ECOLOGY
22–23
CONSTRUCTION METHODS AND LOGISTICS
WHAT IS THE STUTTGART–ULM RAIL PROJECT?

The Stuttgart–Ulm rail project encompasses Stuttgart 21 and the new section of track between Wendlingen and Ulm.

TWO SUB-PROJECTS, MANY ADVANTAGES

The sub-project Stuttgart 21 includes the rearrangement of the Stuttgart rail hub with four new stations and 57 kilometres of new track. The terminus in Stuttgart will become an efficient through station. At the same time, Stuttgart will have a once-in-a-century opportunity to undertake extensive urban development: the old track system can be completely removed, making around 100 hectares of space available for urban development in the very heart of the city.

SHORTER JOURNEY TIMES AND MORE DIRECT CONNECTIONS

The 60-kilometre-long new section of track between Wendlingen and Ulm will enable a fast and convenient way to cross the Swabian Jura region, with over half of the route running in tunnels.

Numerous changes and improvements will be created for Stuttgart and Baden-Württemberg: around 75 per cent of the population of Baden-Württemberg lives in rural districts which will benefit from the shorter journey times and increased numbers of direct connections offered by the rail project. In addition, the Stuttgart–Ulm rail project is part of the important European long-distance corridor from Paris to Bratislava, which is being developed into a high-speed route.

AN ECONOMIC AND ECOLOGICAL PLUS FOR BADEN-WÜRTTEMBERG

The rail network is being optimised for modern long-distance and regional trains, allowing national and international economic regions to grow ever closer together. A more attractive city centre and better infrastructure are increasing the quality of life in Stuttgart and Baden-Württemberg as a place to live and work. More jobs and a larger population mean higher revenues for city and state. The Stuttgart–Ulm rail project is also an ecological one: surveys have shown that Stuttgart 21 and the new section of track will move millions of passenger trips from the roads onto the railways every year.

Visit us on the internet: www.bsu.link/overview
STUTTGART 21: FOUR STATIONS AND 57 KILOMETRES OF NEW TRACK

The Stuttgart 21 project goes far beyond the widely acclaimed conversion of Stuttgart Main Station: the entire Stuttgart rail hub will be rearranged and expanded and passenger movements accelerated. There will be 57 kilometres of new track for long-distance, regional and suburban trains as well as four new stations.

THE NEW MAIN STATION AS CENTREPIECE

At the heart of the project is the new Stuttgart Main Station. Lying at right angles to the present track system, the station connects eight platform tracks and eight adjacent through tracks with around 50 sets of points. The above-ground railway infrastructure can be dismantled and the space made available for urban development.

OPTIMAL CONNECTION VIA A RAILWAY RING

The new main station will be connected to the existing network via short sections of a predominantly underground railway ring. New holding sidings will be built on railway land in Untertürkheim.

RAILWAY TRAFFIC FLOWING THROUGH AN EFFICIENT RAIL HUB

Most of the arriving long-distance and regional trains are presently guided into the main station via two tracks – from Bad Cannstatt and Feuerbach – which allow maximum speeds of only 30 to 40 km/h in the area of points and platforms. Many departing trains also have to cross the path of arriving trains, for which they have to briefly utilise the arrival tracks. In order to cope with the current volume of trains, over 50 regional trains have to be slotted in between suburban trains every day, the latter operating at an interval of one every five minutes. The resulting “jams” at the entrance to Stuttgart Main Station are therefore an annoyance, especially for commuters.

There are three critical reasons for this:

- Arriving and departing trains will no longer get in each other’s way
- The number of platform tracks for long-distance and regional trains will rise from five to eight
- Where the present speed limit is just 30 to 40 km/h, trains will in future be able to arrive and depart at 60 to 100 km/h

PROVEN PERFORMANCE AT PEAK TIMES: STRESS TEST PASSED

At the end of 2010, in the course of mediation, Deutsche Bahn (DB) undertook to produce detailed evidence that the new main station would be able to handle up to 30 per cent more trains during the morning rush hour (7 to 8 a.m.). Taking the then benchmark of 37 arriving trains, the yardstick was set for 49 arriving trains. In addition, trains that arrive late should be able to reduce their delay on average.

DB succeeded in providing this proof in one of the most sophisticated railway computer simulations ever carried out. The renowned railway engineering office SMA and Partners monitored and investigated every single step on behalf of Deutsche Bahn and the state.

SUBURBAN RAIL: THE NEW STATION ON MITTNACHTSTRASSE

The regional train network is also benefiting from Stuttgart 21. The new suburban train station on Mittnachtstrasse serves the new city district of Rosenstein and creates faster transfers between Feuerbach and Bad Cannstatt. Furthermore, the suburban train tracks in this area will in future be available for use exclusively by suburban trains.

Visit us on the internet: www.bsu-lnk/s21/infrastructure

THE NEW INFRASTRUCTURE
THE NEW WINDLINGEN–ULM SECTION: SHORTER JOURNEY TIME, MORE CAPACITY

The crossing over the River Neckar at Wendlingen marks the beginning of the 60-km-long new section of track between Wendlingen and Ulm. It links seamlessly to the high-speed track that connects the new Stuttgart Main Station with Wendlingen as part of Stuttgart 21. While high-speed trains currently have to decelerate to 70 km/h in order to cross the Swabian Jura, they will be able to use the new track at speeds of up to 250 km/h all the way to the outskirts of Ulm. The ICE journey time of about one hour between Stuttgart and Ulm will be almost halved; as far as regional trains are concerned, the journey time of the fastest trains – with a stop at the airport – will fall from around 60 to 40 minutes. The existing route will be relieved, freeing up capacity for regional and goods trains, for example.

For the most part, the route runs parallel to the A8 autobahn and, where this is not possible, in five long tunnels. One of the tallest railway bridges in Germany is also being constructed in the Filstal valley at Mühlhausen.

THE NEW AIRPORT AND TRADE FAIR STATION: THE TRANSPORT HUB IN THE FILDER AREA

A new station for long-distance and regional trains is being built in the Filder area between Stuttgart Airport and the trade fair centre. The journey time from Stuttgart Main Station to the airport will be cut from 27 to eight minutes. In future, it will be possible to travel to many parts of the country from here without the need to change trains.

In addition to the ten million or so airline passengers and more than a million exposition visitors each year, roughly a quarter of a million people living within the catchment area of the new station are set to benefit from it. With the new long-distance station and a dedicated city railway connection, a unique hub will be created between rail, road and air. In future, trains of the Gäubahn railway arriving from Zurich/Singen will call at the airport. The time needed to cover the associated detour to Stuttgart Main Station (3 km) will be offset by the high-speed tracks of Stuttgart 21. Trains coming from Zurich/Singen and continuing in the directions of Ulm/Munich and Reutlingen would be able to bypass the entire Stuttgart basin.

PROTECTING THE ENVIRONMENT AND EXISTING SETTLEMENT STRUCTURES

Over its course, the new section of track negotiates a height difference of almost 500 metres. It reaches its highest point of around 750 metres above sea level at the end of the 16-km-long Albaufstieg uphill section. It then falls again by 280 vertical metres towards Ulm.

This ascent requires comparatively steep inclines that are too steep for heavy goods trains. On the other hand, the route is suitable for light and medium-weight goods trains with a total weight of about 1,000 to 1,500 tonnes.

The route resulted from an intensive survey and consideration of a large number of options in the 1980s and 1990s and was favoured over other variants that included an expansion of the more than 160-year-old Filstal section. Short journey times, a significant increase in capacity, no encroachments on urban areas and a relatively minor environmental impact were the clear benefits of this scheme.

Visit us on the internet:
www.bsu/link/s21/airport-and-trade-fair-station

Visit us on the internet:
www.bsu/link/nbl
EUROPEAN CITIES MOVING CLOSER TOGETHER

The new Stuttgart–Ulm axis is part of the European high-speed “Main Line for Europe” network, which links cities and regions with a total of 34 million residents and 16 million employees in five countries. Stuttgart and Ulm are situated near the centre of the 1,500-kilometre-long railway route that connects the European cities of Paris, Strasbourg, Munich and Vienna with Bratislava and Budapest. The main line forms a backbone of the overall European rail network as a central east-west axis. The expansion of the main line will make a decisive contribution to the rapid economic, political and cultural integration of Western and Eastern Europe.

PUBLIC TRANSPORT IN BADEN-WÜRTTEMBERG TO BENEFIT

Public transport is the backbone of mobility in Germany. Efficient and optimally networked transport routes are an important prerequisite for growth and competitiveness. The Stuttgart–Ulm rail project will lay the foundation stone for a sustainable railway infrastructure and for the mobility of people in Baden-Württemberg. Around three quarters of Baden-Württemberg’s almost 11 million inhabitants live in rural districts that are accessed by new, fully connected regional transport lines. This means that over eight million people in Baden-Württemberg will benefit from the transport advantages of the scheme.

Stuttgart 21 and the new section of track will bring regions and economic areas closer together. Living in Ulm and working in Stuttgart will therefore become an achievable social model. The same is true for many other regions in the state, making it an important argument in favour of the location, especially given the current shortage of skilled professionals.

FASTER AND MORE CONVENIENT TRAVEL IN THE STUTTGART REGION

One of the most efficient and modern railway hubs in Germany is being built in Stuttgart and is set to make rail operations faster, more efficient and more flexible. At Stuttgart Main Station, arriving trains will in future simply depart again in the same direction, without having to reverse as at present. This intelligent structure will make it possible to connect the lines that currently end at Stuttgart Main Station. Passengers who presently have to change trains will in future be able to remain in their seats and continue their journey faster and more conveniently.

The construction of a new, dedicated station at Stuttgart Airport will create a mobility hub that connects the distinct transport modalities of car, rail and plane. In future, suburban as well as regional and long-distance trains will stop here, offering improved travel options to the nearly 240,000 residents of the Filder area.

The accessibility of city and region will be noticeably improved by the Stuttgart–Ulm rail project. That in turn will boost economic growth and enhance the quality of life.

Visit us on the internet: www.bsu.link/impact-on-transport
FIND OUT MORE

WEBSITE: THE MAIN INFORMATION PLATFORM ON THE PROJECT

The project website at www.bahnprojekt-stuttgart-ulm.de/en/english/ is the central platform for information about Stuttgart 21 and the new Wendlingen–Ulm section. Extensive texts, construction site information and photos, films, live webcam shots, detailed maps, visualisations and original plans provide a great wealth of information about the Stuttgart–Ulm rail project.

CONTACT POINT FOR PEOPLE AFFECTED BY CONSTRUCTION

The construction information office is the point of contact for everyone directly affected by the construction sites. Whether citizens, companies or municipalities, whether information on construction procedures, complaints about construction noise or information on negative impacts – the construction information office for the Stuttgart–Ulm rail project exists to listen to all concerns. For acute complaints arising from issues such as noise or vibration, the construction information office can be contacted around the clock on tel. +49 (0)711 2132 1212 and by email at bauen@stuttgart-ulm.de.

TURMFORUM: THE MULTIMEDIA EXHIBITION IN THE STATION TOWER

Experience the Stuttgart–Ulm rail project through the interactive multimedia exhibition in the Turmforum at Stuttgart Main Station. You can get an idea of the project by means of touchscreens and models as well as on the basis of films, maps and visualisations arranged over four levels of the station’s tower. We recommend visitors with a keener interest in the project to register for a guided tour. You can also enjoy a wonderful 360-degree view over Stuttgart from the viewing deck. It’s definitely worth a visit!

Further sources of information can be found at the information centre in Ulm, the InfoPoint at Stuttgart Airport as well as on the visitor platforms at the construction sites in the Mittlerer Schlossgarten, at the Filder portal, at the Pfaffenäcker excavation in Hohenstadt and in Achelberg. The InfoMobil tours the cities and municipalities of Baden-Württemberg as a mobile information unit.

NUMBERS, FIGURES, FACTS

THE MAIN FACTS AND FIGURES ABOUT THE STUTTGART–ULM RAIL PROJECT: SUMMARISED HERE IN THE FOLD-OUT PAGE

Visit us on the internet: www.bsu.link/turmforum-exhibition
The Stuttgart–Ulm rail project comprises Stuttgart 21 and the new Wendlingen–Ulm section.

**THE STUTTGART–ULM RAIL PROJECT MAKES LONG-DISTANCE AND REGIONAL TRANSPORT FASTER AND MORE CONVENIENT**

Dozens of journey times will be shortened, with many routes no longer requiring a change of train.

**FINANCING AND PARTNERS**

The budget for the Stuttgart–Ulm rail project is EUR 9.786 billion, of which EUR 6.526 billion is allocated to Stuttgart 21 and EUR 3.26 billion to the new Wendlingen–Ulm section.

**SHARES OF THE PROJECT PARTNERS**

*Deutsche Bahn and the state have entered into talks over the final agreement on the financing shares of the project partners.*

**HEIGHT DIFFERENCES**

Around 500 m.

**MAXIMUM INCLINE**

2.5 m climb per 100 m of length, as much as 3.1 or 3.5 m over short sections.
The heart of the Stuttgart–Ulm rail project is the new Stuttgart Main Station, which is rotated through 90° to the present terminus and runs at a depth of about eleven metres. It comprises a total of eight tracks at four central platforms, each of which is 420 metres in length.

The existing station building, named “Bonatzbau” after its architect Paul Bonatz, will be retained together with the tower and the large station hall as a reception building and will be given a new platform hall. The future station will form a new complex in an interaction of historic and modern architecture.

SYNTHESIS OF THE ARCHITECTURALLY VALUABLE AND THE ECOLOGICALLY PRACTICAL

The multi-award-winning station design of architect Christoph Ingenhoven sets new standards in form, function and ecology and integrates the Bonatzbau into the modern architecture. An architectural trademark of the new station are 27 glass “light eyes” that allow daylight down to the platform level and afford views of the Schlossgarten, the new Strassburger Platz and the Bonatzbau. Unlike other supersized glazed areas, the station hall with its size-optimised light eyes never gets too warm. The fresh air flowing in through the adjacent tunnels and the insulating effect of the surrounding soil keep the temperature comfortable all year round. The accessible station roof also forms the new Strassburger Platz, which is located immediately adjacent to the Mittlerer Schlossgarten and creates a direct link between the city centre and the new city districts.

SHORT AND BARRIER-FREE DISTANCES FOR FAST TRANSFERS

Passengers will have a more convenient way to reach their trains. The new Stuttgart Main Station can be accessed along short and barrier-free distances from all points of the compass. Passengers enter the station at ground level from Königstrasse, the Schloßgarten, the city railway station at Staatsgalerie and from Kurt-Georg-Kiesinger-Platz, where they arrive at the three distribution concourses, which are located above and connect the four platforms. This enables convenient and fast transfers over short distances. Seven escalators, five stairways and three panoramic lifts lead to each platform. Each platform also has direct access to the suburban trains. This considerably shortens walking distances compared to the terminus. All of the main service facilities, such as the DB travel centre and the DB information office, are located on the same level and can be accessed without barriers from Schillerstrasse.

Visit us on the internet:
www.bsu.link/s21/stuttgart-main-station
THE OPPORTUNITY OF THE CENTURY: 100 HECTARES OF SPACE IN THE CENTRE

Stuttgart has a unique opportunity to grow in its centre. As the train tracks will in future run underground, around 100 hectares in the middle of Stuttgart city centre will become available for development – an area the size of 140 football fields. Twenty hectares of this will be turned into parkland. This will noticeably improve the climate in the city centre. In the middle of the city centre, urban development opportunities exist for exemplary, ecological and energy-efficient living. The north of Stuttgart will move closer to the Schlossgarten and the east of Stuttgart. In the new areas of the city, interconnected spaces and short distances will create a pleasant environment in which to live and work. The present bisection of the city by the existing railway infrastructure will be swept aside by Stuttgart 21. The quality of life in the existing districts will improve. Two new districts will be created in the centre of the city: the Europaviertel and the city district of Rosenstein.

THE FRAMEWORK PLAN AS THE PLANNING BASIS

The urban development plan is based on the Stuttgart 21 framework plan adopted by the city of Stuttgart in 1997, which is based on the design of Trojan, Trojan + Neu in Darmstadt. This was preceded by an international urban development competition, in which renowned offices participated, as well as an intensive public discussion process, in which Stuttgart’s citizens, city planners, politicians and associations were involved. The framework plan highlights possible distributions and focal points of use in the new city districts.

PULSATING URBAN LIFE IN THE CENTRALLY LOCATED EUROPAVIERTEL

Up until the 1980s, today’s Europaviertel was home to the central goods station and marshalling yard that supplied Stuttgart city centre. Following the relocation of goods trains to Kornwestheim, the defunct tracks were removed in 1998. The city district being created on the site is an extension of Stuttgart city centre. The development plan for the 16-hectare area came into force back in 2003. The area continues to be owned by Deutsche Bahn. The plots are marketed by the property company DB Immobilien. Moskauer Strasse is the central axis and the only road open to traffic in the new city district; all other roads and squares are pedestrian zones. A big advantage of the Europaviertel are the short distances in a central location. The main station, Königstrasse and the green areas of the Schlossgarten are all within a 500-metre radius. A new cultural centre has been created in the Europaviertel with the construction of the City Library on Mailänder Platz.

CITIZEN INVOLVEMENT FOR A FAMILY-FRIENDLY CITY DISTRICT IN ROSENSTEIN

In 2001, the city of Stuttgart purchased most of the plots from Deutsche Bahn in order to be able to develop the eco-friendly city district of Rosenstein independent of investor interests and with the involvement of citizens. As the plots were purchased using the city’s reserve funds, there is no pressure to commercially exploit the area. The new city district of Rosenstein will be created in a central location surrounded by green spaces. The aim is to work with citizens to develop ideas for how to design the new city district and in doing so to create a family-friendly city culture. The new city district of Rosenstein is of special interest for the residents of Stuttgart due to its location in the heart of the city by the park and for its connection to the transport network. It enables optimal connections between home and work and offers intelligent networking of the transport modes of car, public transport and bicycle. As the state capital, Stuttgart wants to develop an extensively car-free city district with an exemplary character for ecological construction. Centrally located in the heart of the city, it will be ideally connected to the public transport network with its new suburban and underground train links. A cycle network will criss-cross the residential areas.
THE STUTTGART–ULM RAIL PROJECT REQUIRES INVESTMENTS

The Stuttgart–Ulm rail project is an economic programme for the Greater Stuttgart region and beyond. The improved railway infrastructure requires investment decisions in the region and provides corresponding value creation effects. The project will create thousands of new jobs. In the long term, the city of Stuttgart can expect higher tax revenues to flow in from the newly created residential and commercial areas. The construction phase alone is triggering considerable investments.

SHORTER TRAVEL TIMES DELIVER A BETTER BALANCE BETWEEN WORKING AND LIVING

The considerable reduction in travel times is bringing the economic regions of Stuttgart, Ulm, Augsburg and Munich closer together, creating new possibilities for people to move into and work in the region. On the Stuttgart–Ulm route, shorter travel times mean a convenient connection between the two cities with the character of a suburban train link. Living in one and working in the other will become a real alternative. The positive effects of the new railway infrastructure will extend into large parts of Baden-Württemberg. Considerable value creation effects are expected across the state, with many regions set to benefit to a high degree from being closer to the Stuttgart economic area.

THOUSANDS OF NEW JOBS WILL BE CREATED IN THE LONG TERM

Expert reports forecast that the Stuttgart–Ulm rail project will have a significantly positive effect on employment. The construction phase alone will generate around 5,000 new temporary full-time positions. The large number of appointed construction firms and their subcontractors are triggering the creation of additional jobs with their demand for materials and services. There will also be lasting employment effects that extend well beyond the construction phase. The expert report forecasts that the improved transport connections will result in new investments and 8,000 to 9,500 new full-time jobs in Baden-Württemberg. An additional 2,600 jobs are expected in the new Stuttgart city districts.

HIGHER TAX REVENUES FOR CITY AND STATE

Investments, new residents and new jobs will translate into much higher revenues from sales tax, income tax, business tax, property tax and property transfer tax for the state of Baden-Württemberg and the city of Stuttgart over the long term. The city of Stuttgart will collect more taxes in the long term than it will spend on financing its portion of the rail project. The improvements made to the business location will create further jobs and lead to higher tax revenues.

DEUTSCHE BAHN SETS UP PROJECT COMPANY FOR PLANNING AND IMPLEMENTATION

The client of the Stuttgart–Ulm rail project is Deutsche Bahn AG (DB). On 1 September 2013, DB AG founded an independent project company whose core tasks are the planning and technical implementation of the Stuttgart–Ulm rail project: DB Projekt Stuttgart–Ulm GmbH. This company is also responsible for project, contract and risk management as well as for controlling in close collaboration with the partners of DB, the project partners of the financing agreement and with the appointed construction companies and engineering firms.

The other project partners and additional project cost carriers are the Federal Republic of Germany, the state of Baden-Württemberg, the state capital Stuttgart and Verband Region Stuttgart. The project is also funded by the European Union, and Flughafen Stuttgart GmbH is also making a financial contribution to the project.
ECOLOGY

FOR A BETTER CLIMATE: TAKING THE STRAIN OFF THE ROADS

Studies have revealed that the rail project will shift millions of passenger trips from road to rail each year. The additional capacities created by the Stuttgart–Ulm rail project will also benefit goods traffic because in future it will be possible to transport more goods by rail on the existing track through the Filstal valley instead of by road.

PROTECTING RESOURCES: LESS NEED FOR SPACE AND ENERGY

To minimise the impact on the landscape, large parts of the new Wendlingen–Ulm section will run parallel to the A8 autobahn.

The new Stuttgart Main Station also preserves resources: the air that flows in from the adjacent tunnels keeps the temperature in the platform hall at a comfortable level all year round, avoiding the need for any kind of artificial heating. Scarcely any artificial light is required during the daytime either, as the light eyes in the roof deliver sufficient daylight to the interior of the platform hall.

MINERAL WATER: PROTECTING THE SPRINGS HAS TOP PRIORITY

Stuttgart’s mineral springs enjoy special legal protection. For the construction of the new Stuttgart Main Station, specialists are installing an extensive groundwater management system in the vicinity of the Mittlerer Schlossgarten that is designed to regulate the groundwater level during each stage of construction. To create a dry excavation pit, the groundwater and rain are first removed and then cleaned and returned to the surrounding soil. This method also keeps pressure conditions in the soil constant to prevent any rising and associated contamination of the mineral water. Direct effects of the construction activities on the water sources have been ruled out: the floor slab of the new main station is around 40 metres above the geological layers that carry the mineral water.

PARK EXTENSION: MORE GREEN SPACES IN THE HEART OF STUTTGART

The rail project is creating splendid new green spaces in the heart of Stuttgart. The approximately 60 hectares of net construction land available in the city centre will also prevent any further spread of development into Stuttgart’s peripheral districts. As a direct consequence of Stuttgart 21, 62 hectares of development land on greenfield sites have been removed from the Stuttgart zoning plan.

NOISE REDUCTION: TUNNELS AS NATURAL SILENCERS

In future, residents of the Stuttgart basin – the large natural depression in which the city sits – will hear almost no more noise from passing trains. This is because the layers of soil above the newly built railway tunnels function as a natural silencer. However, the weight of even the quietest trains can send vibrations through the surrounding area. For this reason, the platform structures on sections of track susceptible to vibration will be equipped with the so-called mass-spring system or similar technologies that reduce the vibrations caused by train movements to the lowest levels possible.

Visit us on the internet: www.bsu.link/environment
CONSTRUCTION METHODS AND LOGISTICS

TUNNELLING METHOD: GEOLOGY AS THE CRITICAL FACTOR

Tunnelling methods are primarily based on the geological conditions, soil conditions and infills. A tunnel can be constructed using either the cut-and-cover or the boring method.

The cut-and-cover method involves building the tunnel in an open trench. This approach is used when a tunnel lies just beneath the surface, such as the Widderstall tunnel near Merklingen.

The tunnel boring method involves cutting the tunnel inside the hill without having to excavate a trench. Almost all of the tunnels in this rail project make use of the tunnel boring method. Two common methods are used: the sprayed concrete method and the use of a tunnel boring machine.

SPRAYED CONCRETE METHOD: REMOVING, LOADING, CONCRETING

The sprayed concrete method involves the tunnel builders creating the cavity for the future tunnel by first excavating rock and stone out of the hill metre by metre. Immediately after excavating, the cavity created is secured using prefabricated arched tunnel sections and steel mats and by applying sprayed concrete. This produces an initial provisional tube, mostly with a semi-circular profile (calotte) to begin with. Next, a complete circular profile is created by excavating the lower half (bench/base) of the future tunnel tube, which will subsequently carry the foundation and rail bed.

The tunnel wall is sealed with plastic membranes in order to give it permanent protection against groundwater and water in the hillside. In the final step of the shell construction phase, a formwork carriage passes through the tunnel and the inner lining is concreted.

TUNNELLING: THE TUNNEL GROWS RING BY RING

The rotating cutting wheel of the tunnel boring machine loosens the rock, which is transported away through the machine. Having driven a set distance, the machine is stopped and the cavity behind it lined with prefabricated parts called tubbings. Once any gaps between the hill and tubbings have been filled, the tunnel shell construction is finished in this area. To drive the next section, the tunnel boring machine braces itself against the tubbings with hydraulic presses.

LOGISTICS CONCEPT: DEDICATED ROADS FOR TRANSPORTING AWAY THE SPOIL

To ensure that construction proceeds as optimal- ly and cost-efficiently as possible in the centre of Stuttgart and to minimise dirt and noise emissions as well as traffic disruption, a tailored construction logistics concept has been developed. The soil excavated from the tunnels and the construction site of the new main station is transported by lorry along the construction road system to the central logistics area at Nordbahnhof, where it is deposited. Transporting materials along these internal logistics roads avoids placing any additio- nal burden on the extremely busy roads in the city centre. At Nordbahnhof, the material is loaded onto trains and transported by rail to the disposal facilities, where it is stored or processed according to its load class.

In total, Stuttgart 21 and the new Wendlingen–Ulm section will each produce spoil amounting to around 20 million tonnes. On the new section of track, this spoil will be disposed of by the con- struction companies.