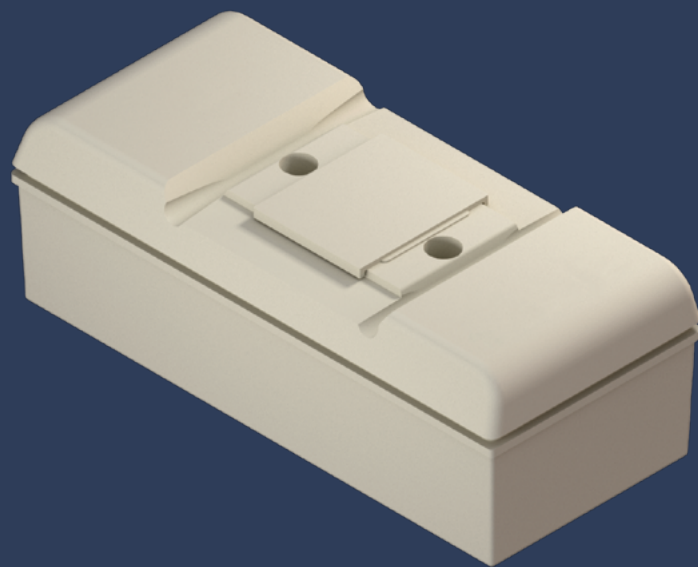


sonneville

LOW VIBRATION TRACK SYSTEM

ENGLISH



LOW VIBRATION TRACK (LVT)

THE SLAB TRACK SYSTEM FOR HIGHEST REQUIREMENTS

THE PIONEERING WORK

More than fifty years ago, Roger Sonnevile developed one of the first slab track systems in the world. This pioneering achievement laid the groundwork for today's LVT-System with its excellent reputation around the world.

It has won through in the most prestigious and demanding railway projects – references on five continents with more than 1'400 km, half of them in the metro sector, speak for themselves. These include the projects of the century Gotthard and Lötschberg Base Tunnels and Channel Tunnel, three of the five longest railway tunnels in the world. LVT also connects the continents of Europe and Asia below the Bosphorus in the Marmaray Tunnel, the deepest immersed railway tunnel in the world.

As a system provider, Sonnevile AG offers project-specific design, technical advice and quality monitoring in all project phases.



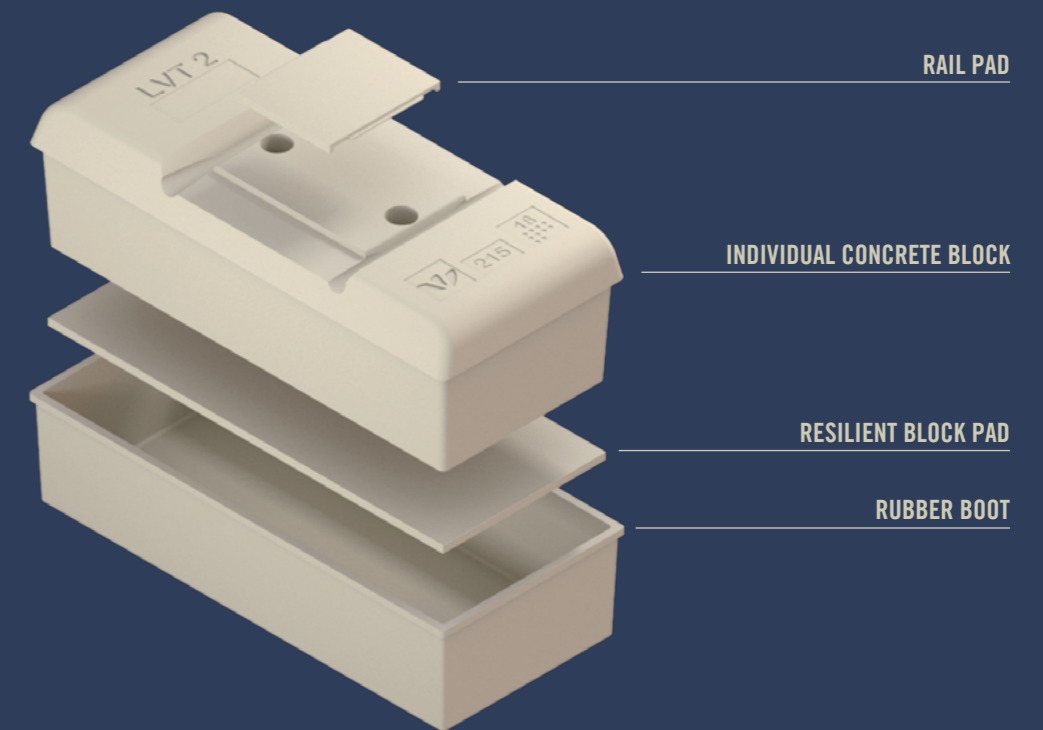
© AlpTransit Gotthard

PIONEER

THE LVT-SYSTEM

BEST VIBRATION PROTECTION THANKS TO DUAL-LEVEL ELASTICITY

SYSTEM



The current, multi-patented LVT-System with individual rail supports for slab track was developed in several innovation stages from the bi-block ties for ballasted tracks. The LVT supports consist of a concrete block, a resilient block pad and a rubber boot and are surrounded by filling concrete.

Both in the design of the LVT supports and in the choice of rail fastenings, the LVT-System can fully meet the customer's requirements. The elastic components of the system are matched to each other on a project-specific basis and provide

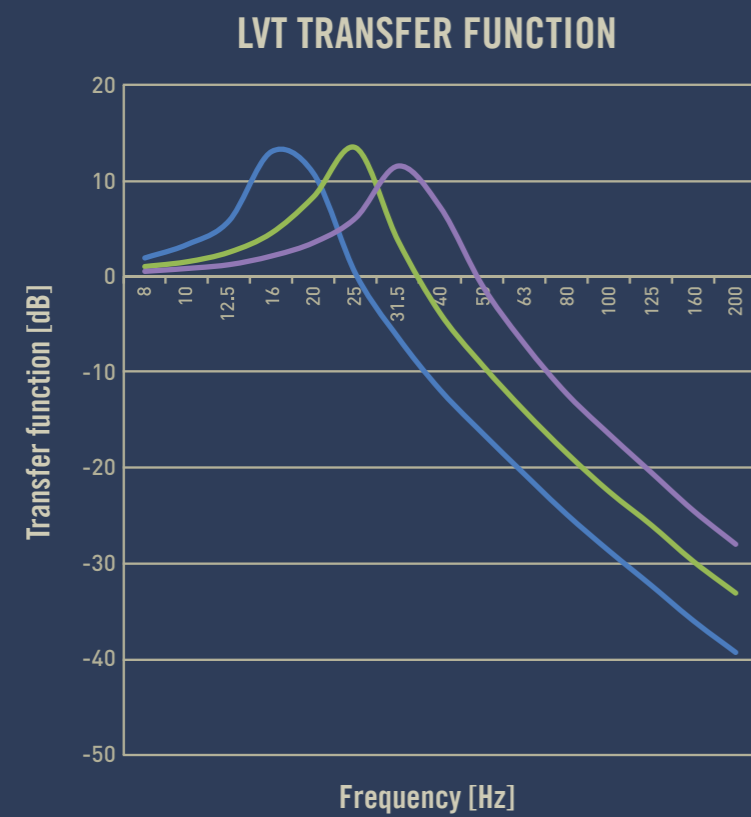
the characteristic properties of dual-level elasticity. Thus, influences in the low as well as in the higher frequency range are reduced to a minimum.

The rubber boot separates the concrete block of the LVT support from the surrounding concrete, which reduces vibrations and at the same time enables the components to be replaced quickly.

THE ADVANTAGES

EFFICIENT IN EVERY ASPECT

EFFICIENCY



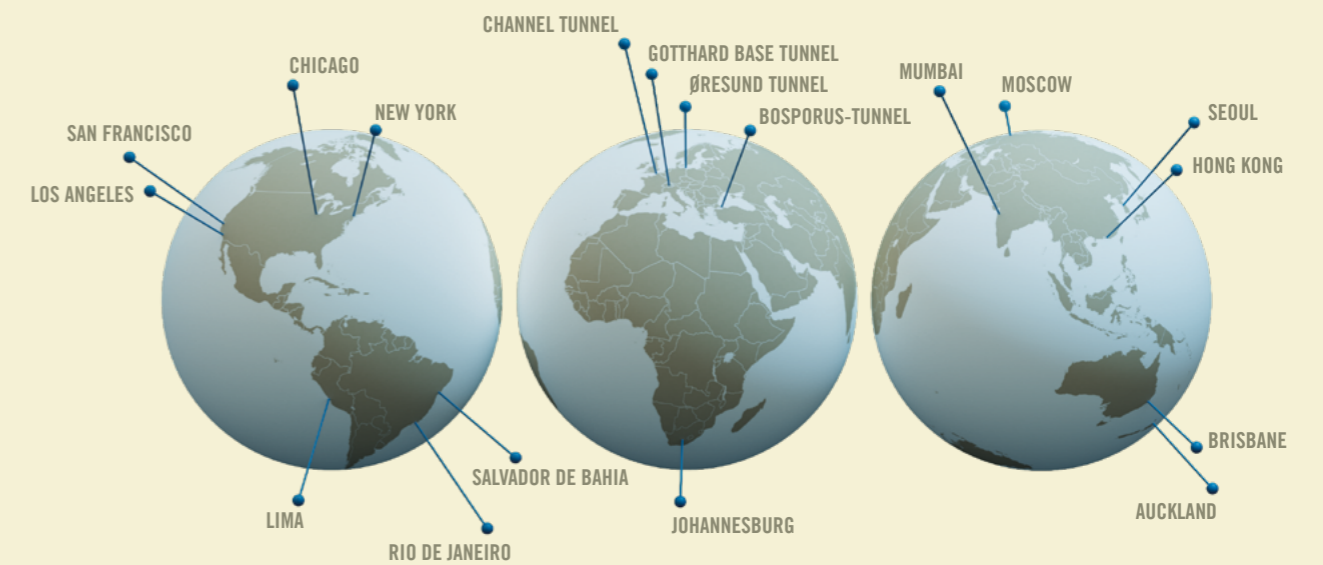
LVT STANDARD 40 KN/MM
GOTTHARD BASE TUNNEL

LVT HA 20 KN/MM
GOTTHARD BASE TUNNEL

LVT HA 6 KN/MM
LOS ANGELES METRO

REFERENCES

THE TAILOR-MADE SOLUTION FOR CUSTOMERS THROUGHOUT THE WORLD



GLOBAL

All variants of the LVT-System offer highly efficient vibration attenuation. By way of example, this is illustrated in the transfer functions of the different LVT-System applications.

Additional benefits:

- highest system flexibility
- efficient installation
- very high track accuracy
- long-lasting system components

- easy access to all components, if necessary
- high electrical insulation effect
- best aerodynamic properties
- flexible arrangement of track drainage, also in the track axis
- installations also possible in the centre of the track

LVT has proven to be the perfect solution for the most diverse requirements, whether on high-speed lines (HS lines), where maximum track accuracy is required, or in inner-city areas, where vibration protection is paramount. Whether heavy goods traffic, HS or metro lines - the longevity and reliability of the LVT-System are frequently decisive. The LVT-System is used not only in the world's longest railway tunnels but also by numerous metro companies.

New York*, San Francisco*, Dallas*, Atlanta*, Minneapolis*, Los Angeles*, Cleveland*, Chicago*, Rio de Janeiro*, Porto Alegre*, Salvador de Bahia*, Lima*, Hong Kong*, Seoul*, Daegu*, Busan*, Taipeh, London**, Glasgow**, Valencia, Barcelona*, Istanbul, Zurich, Geneva, Copenhagen*, Malmö, Moscow*, St. Petersburg*, Sochi. Channel Tunnel, Øresund Tunnel, Bosphorus Tunnel, Taiwan Highspeed Line, Gautrain (Johannesburg), Gotthard Base Tunnel, Lötschberg Base Tunnel.

*Metro **Metro and railway

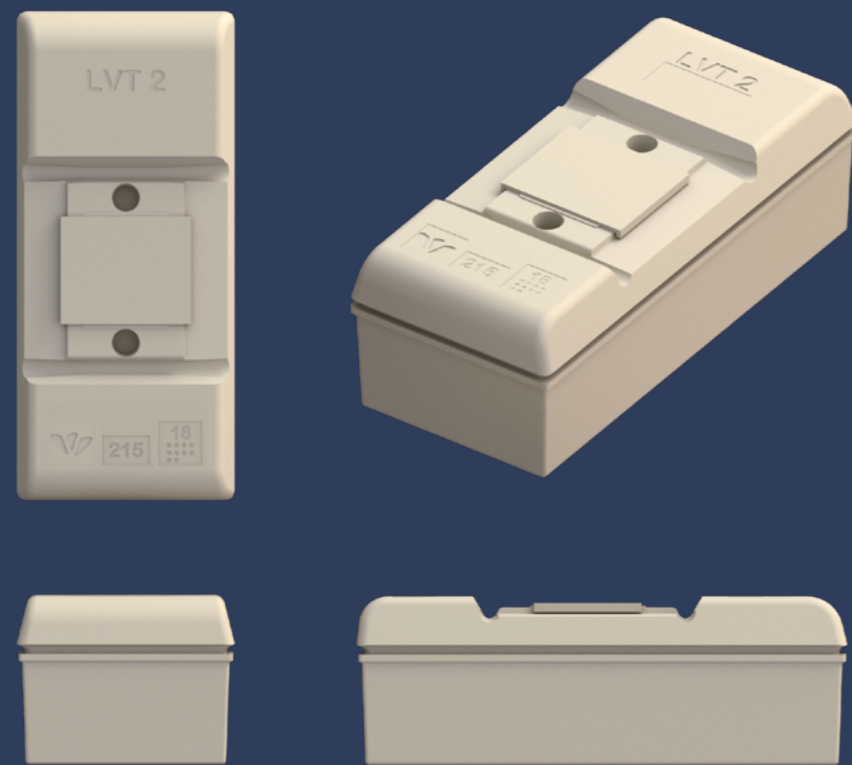
LVT STANDARD SYSTEM

THE MOST USED LVT PRODUCT

LVT STANDARD SYSTEM

THE MOST USED LVT PRODUCT

PRODUCTS



LONDON

LVT Standard is the foundation of the LVT portfolio. Tailor-made solutions for all requirements are developed on this basis. To this day, LVT Standard is the most widely used LVT product.

One of the great strengths of LVT Standard are the individual solution options that allow the system to be adapted to the respective project specifications, especially with regard to support rigidity and choice of rail fastening.

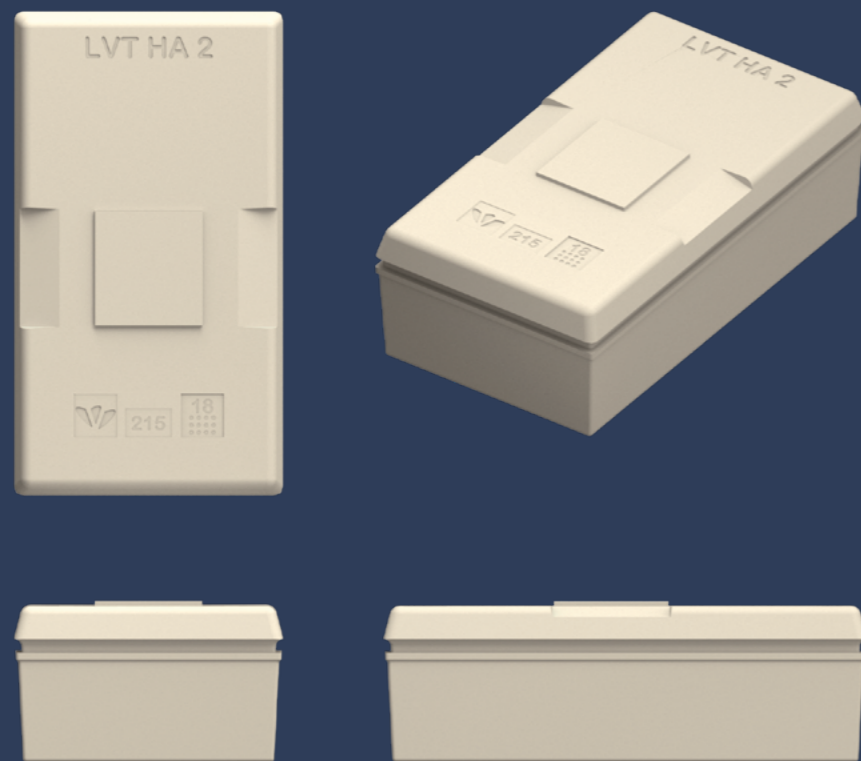
Due to the elasticity and the decoupling of the LVT supports from the surrounding concrete, the system has low natural frequencies and excellent structure-borne noise reduction. LVT Standard is used for a wide variety of track classes, including heavy haul and high speed lines.

The LVT Standard system has proven itself over more than 25 years as a slab track solution for bridges, viaducts, earthworks and tunnels. Demanding projects such as the refurbishment and extension of the East London Line were successfully implemented with LVT Standard.

LVT HA (HIGH ATTENUATION) SYSTEM

MOST EFFECTIVE NOISE AND VIBRATION ATTENUATION

PRODUCTS



LVT HA (HIGH ATTENUATION) SYSTEM

MOST EFFECTIVE NOISE AND VIBRATION ATTENUATION



SWEDEN

LVT HA is a further development of the LVT Standard system. In 2009, LVT HA was installed as a global novelty in the Los Angeles Metro network and subsequently in other prestigious projects such as the Marmaray Tunnel and the Gotthard Base Tunnel.

Compared to LVT Standard, the LVT HA support has larger dimensions and significantly lower rigidity. This combination

creates a slab track system whose performance is in the range of light mass-spring systems, while achieving significant cost savings in both installation and maintenance.

LVT HA is available with support stiffness in the range up to 6 – 7 kN/mm and is also used on high speed lines.

Using the LVT HA system meant there was no need for a light mass-spring system in some projects, such as in the Malmö Citytunnel, in the network of Copenhagen Metro or on the Sha Tin – Central metro line in Hong Kong.

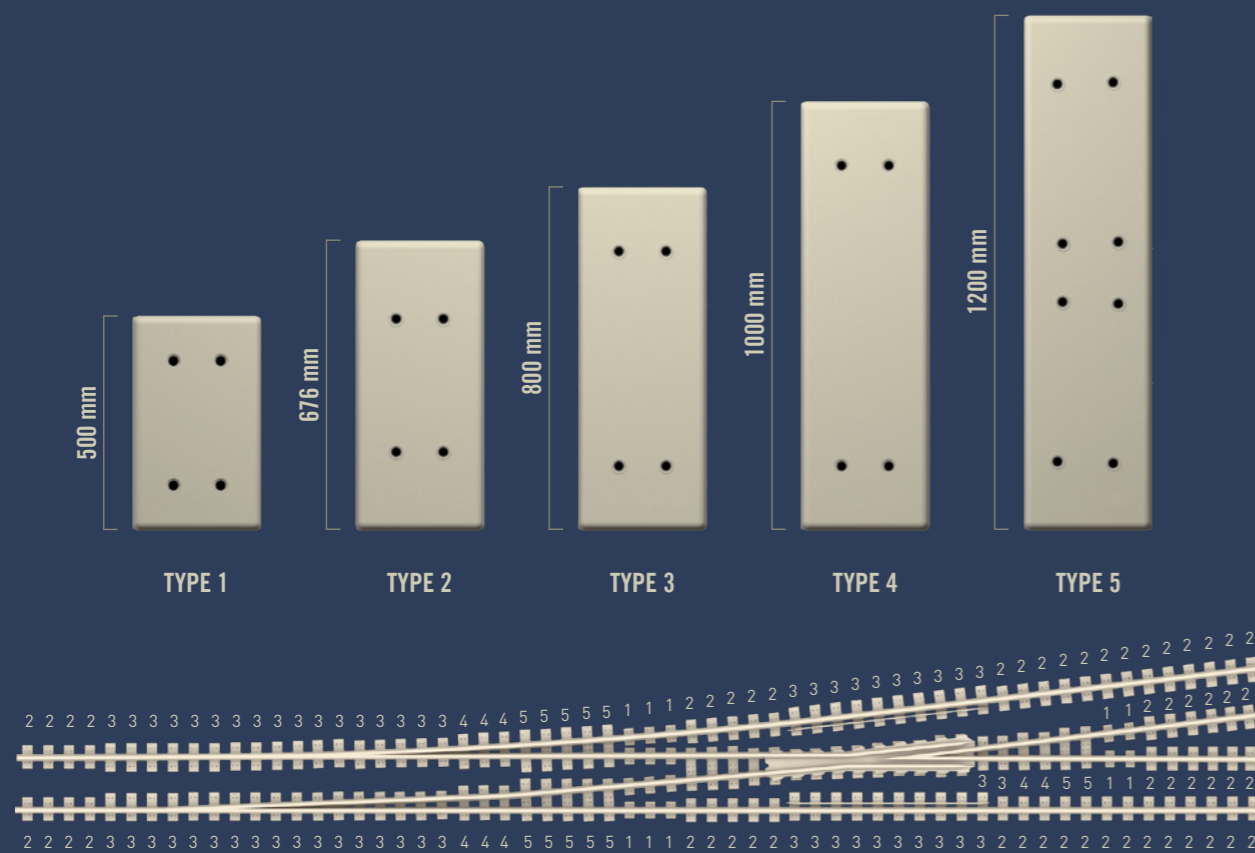
LVT S & C SYSTEM (FOR SWITCHES & CROSSINGS)

SUITABLE FOR EVERY SWITCH TYPE

LVT S & C SYSTEM (FOR SWITCHES & CROSSINGS)

SUITABLE FOR EVERY SWITCH TYPE

PRODUCTS



SALVADOR DE BAHIA

LVT S & C is the LVT solution for switches and crossings and makes use of the well-known system advantage of dual-level elasticity. LVT S & C has already been used worldwide for a vast variety of switches and crossings.

LVT S & C is based on five different LVT supports, which differ in length and support stiffness. In the blocks, each dowel position can be realised for the required base plate in the turnout. This means that turnout layouts used in ballasted

tracks can also be adopted on a one-to-one basis. For the LVT S & C supports type 1 and 2, standard rail fastenings without base plates can also be considered.

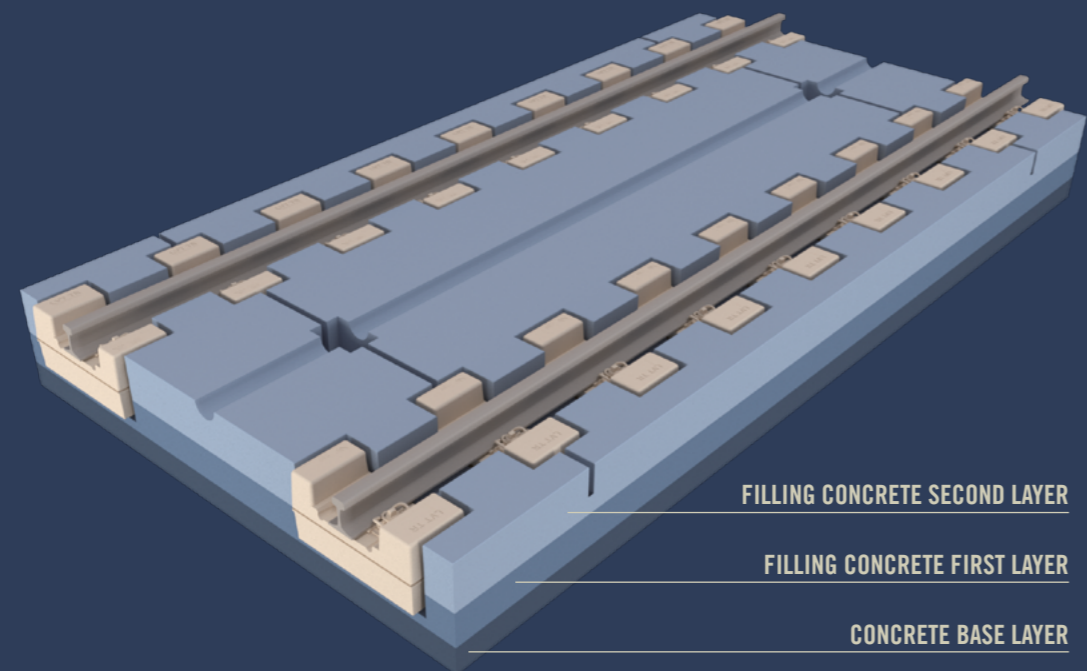
In terms of functionality, LVT S & C offers all the advantages of the LVT Standard system, including effective vibration attenuation and reduction of structure-borne noise, exceptional lateral track stability, high track accuracy, vertical adaptability and low maintenance requirements.

With LVT S & C the same track stiffness can be achieved as in the main line tracks. This and the numerous system advantages are appreciated by railway operators worldwide, for example in New York, Moscow, Zurich or in Salvador de Bahia, as shown above.

LVT TRAFFIC SYSTEM

DEVELOPED FOR MODERN RESCUE CONCEPTS

PRODUCTS



LVT Traffic meets the requirements of modern rescue concepts for railway tunnels by making it possible for emergency vehicles with pneumatic tyres to drive on the track.

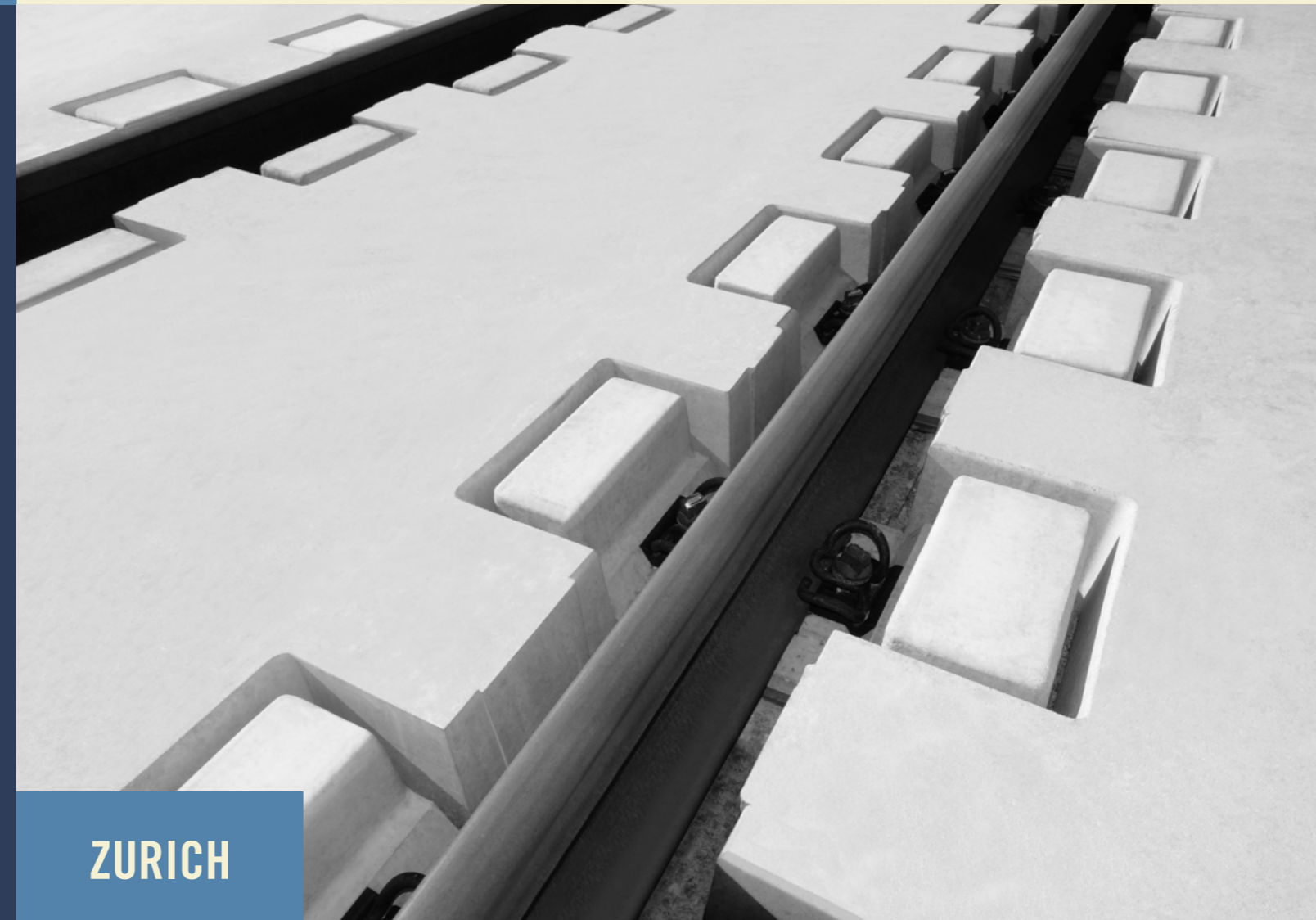
An additional in-situ concrete layer, which is applied to the first filling concrete layer in the LVT Traffic system, creates a roadway for rescue vehicles. The specially developed LVT Traffic supports are characterised by raised shoulders, which reduce the gap to the running edge of the rail to a minimum.

Specially shaped formwork covers, which are made available for installation, ensure that the surrounding concrete is decoupled from the LVT supports. LVT Traffic thus offers all the advantages of the LVT-System.

LVT Traffic can also be used to create slab track crossings and provides a safe escape route for passengers during an evacuation in the tunnel.

LVT TRAFFIC SYSTEM

DEVELOPED FOR MODERN RESCUE CONCEPTS

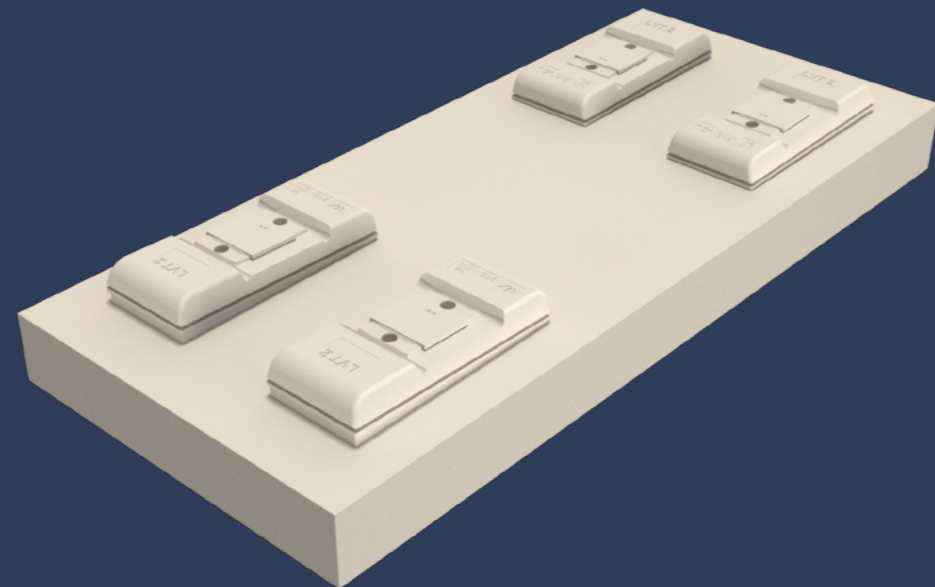


LVT solutions were used to cover the most varied project requirements for the Cross-City Link in Zurich. To make the track crossings monolithic and maintenance-free, LVT Traffic was used for all pedestrian crossings.

LVT PANEL SYSTEM

FOR TRACK RENEWAL DURING SHORT MAINTENANCE BREAKS

PRODUCTS



LVT PANEL SYSTEM

FOR TRACK RENEWAL DURING SHORT MAINTENANCE BREAKS



SWITZERLAND

LVT Panel is the solution for track renewal during short maintenance breaks.

On LVT Panel, four LVT supports are integrated into a precast slab which can be installed at the construction site without separating the rails and grouted with rapidly hardening concrete to enable quick installation and trafficability of the track. The combination of LVT supports and precast concrete elements significantly reduces the amount of concrete to be poured on site and thus also shortens the installation time.

This makes it possible to resume operation in record time.

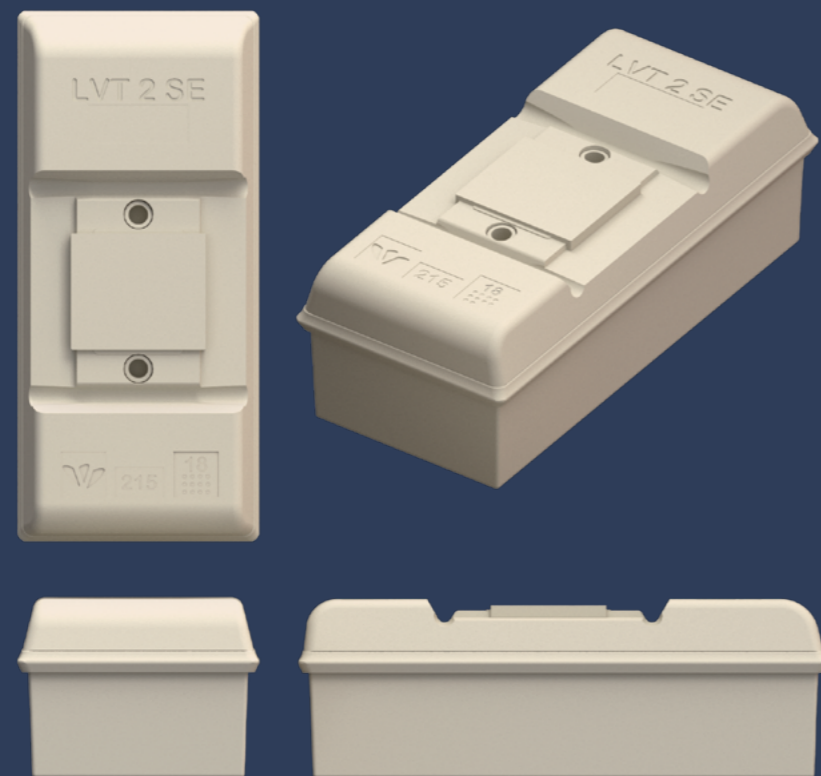
LVT Panel is particularly suitable for railway and metro operators who have only minimal closures available for maintenance work on the track and want to upgrade their track infrastructure to a durable slab track with additional vibration attenuation. Due to the low construction height compared to the ballasted superstructure, it is also possible to eliminate clearance restrictions.

LVT Panel combines the advantages of the LVT single supports with those of a prefabricated part and was used for the first time for the renewal of the tracks in Axentunnel, on the access route to the Gotthard and Ceneri Base Tunnels.

LVT SE (SEVERE ENVIRONMENT) SYSTEM

OPTIMISED FOR SPECIAL ENVIRONMENTAL INFLUENCES

PRODUCTS



LVT SE (SEVERE ENVIRONMENT) SYSTEM

OPTIMISED FOR SPECIAL ENVIRONMENTAL INFLUENCES



ENGLAND

LVT SE offers a simplified installation of the LVT-System and allows use under special environmental influences.

For this purpose, the LVT support was extended by a rubber gasket, which fixes the rubber boot to the concrete block, serves as a marking for placing the filling concrete and prevents the ingress of fine particles and liquids into the

rubber boot. The efficiency of the system in terms of elasticity and vibration attenuation is thus permanently optimised even under the exposure of unfavourable environmental influences, while at the same time all LVT components are always exchangeable.

Thanks to the special properties of the LVT SE system, it can also be used in washing tracks such as in the depots of Blackburn, Blackpool and Wigan in England or in an environment with high dust and sand loads.

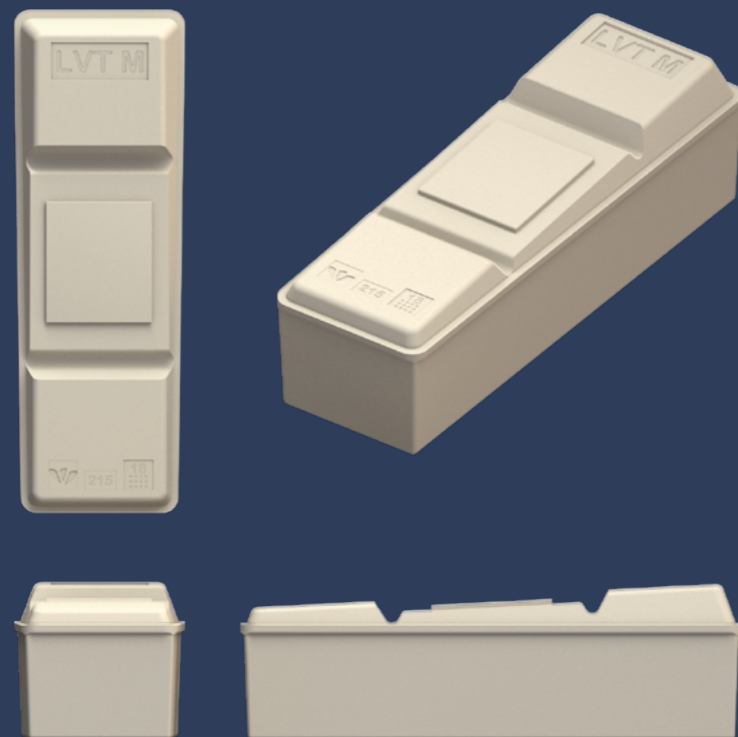
LVT M (METRO) SYSTEM

THE TRAPEZIUM FOR METRO APPLICATIONS

LVT M (METRO) SYSTEM

THE TRAPEZIUM FOR METRO APPLICATIONS

PRODUCTS



MOSCOW

Originally intended for the replacement of wooden blocks in concrete slabs, the trapezoidal LVT M is now the standard product for use in the metro sector.

The compact size and shape are ideal for axle loads up to 18 tons and a speed range up to 100 km/h. Metro operators from New York via Moscow to Seoul rely on the advantages

of LVT M such as easy and economical installation, great flexibility with regard to the choice of fastening system and convincing noise and vibration attenuation. And this applies to the replacement of wooden blocks in concrete slabs as well as to new constructions.

The LVT M system is successfully in use at the Moscow Metro, among others, where it is used both for equipping new sections of line and for refurbishing the old track system with wooden blocks.

LVT CUSTOMIZED

TAILOR-MADE SOLUTIONS FOR ALL REQUIREMENTS

PRODUCTS

LVT STANDARD SYSTEM



LVT HA SYSTEM

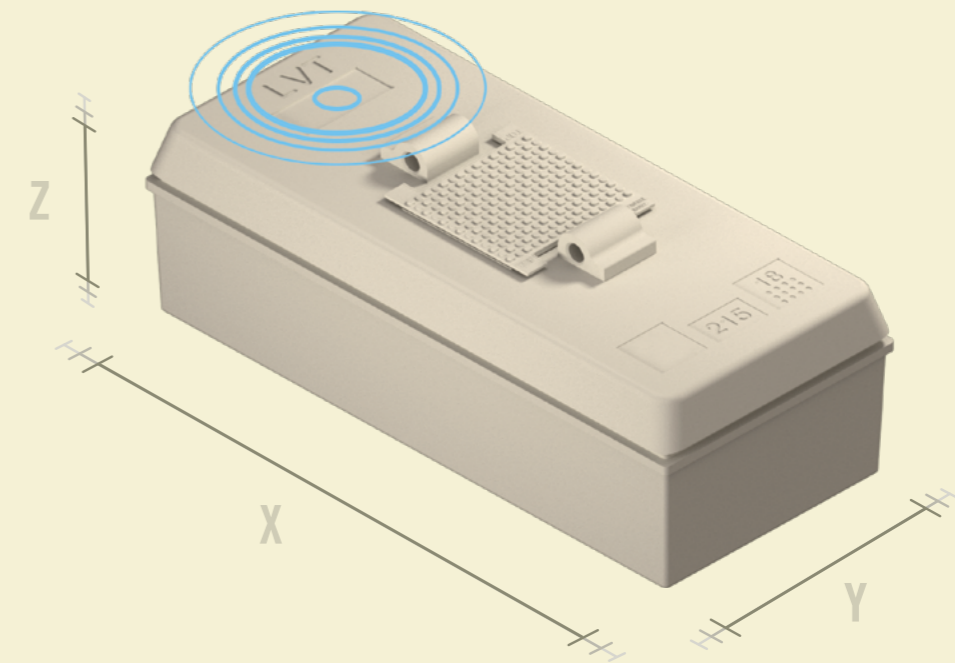


LVT M SYSTEM



LVT CUSTOMIZED

TAILOR-MADE SOLUTIONS FOR ALL REQUIREMENTS



CUSTOMIZED

The range of existing LVT applications can be extended by customer-specific solutions. In this way, dimensions and elasticity of the LVT supports can be individually adapted for each project. This gives operators, consultants and contractors freedom that is unique for a slab track system.

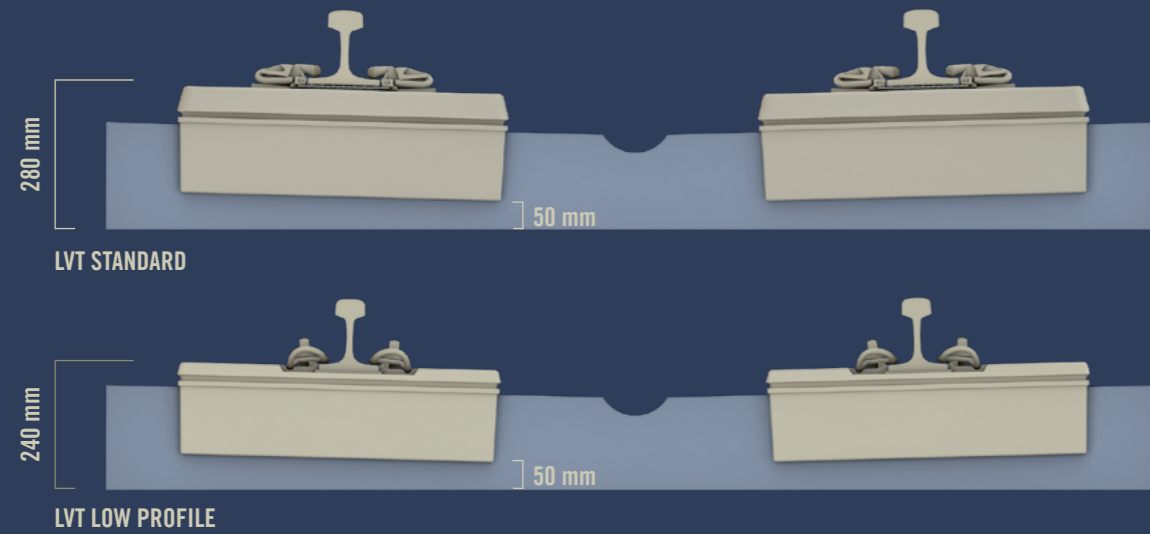
All LVT supports are also available in a Low Profile version and are particularly suitable for restricted clearance conditions. The construction height can thus be reduced by up to 40 mm.

Sonneville also relies on state-of-the-art technology for traceability. Each LVT support point can be equipped with an RFID tag so that, on the one hand, all components can be 100% tracked and, on the other hand, the operator is able to record maintenance information over the entire life cycle of the track via a data base in the accuracy of each LVT support position.

PLANNING WITH LVT

HIGHEST FLEXIBILITY FOR EVERY DEMAND

DESIGN



The LVT-System offers maximum flexibility right from the design phase. Projects with rail profiles from S49 to 136RE, support distances of 500 – 750 mm and track gauges of 1'000 – 1'676 mm have already been realised.

The low construction height is a further advantage. Only 50 mm of concrete is required between the lower edge of the rubber boot and the concrete base slab. With a system height of only 280 mm up to the rail base, LVT also offers

unbeatable advantages with regard to the necessary space requirements. By using LVT Low Profile supports, this value can be reduced to 240 mm.

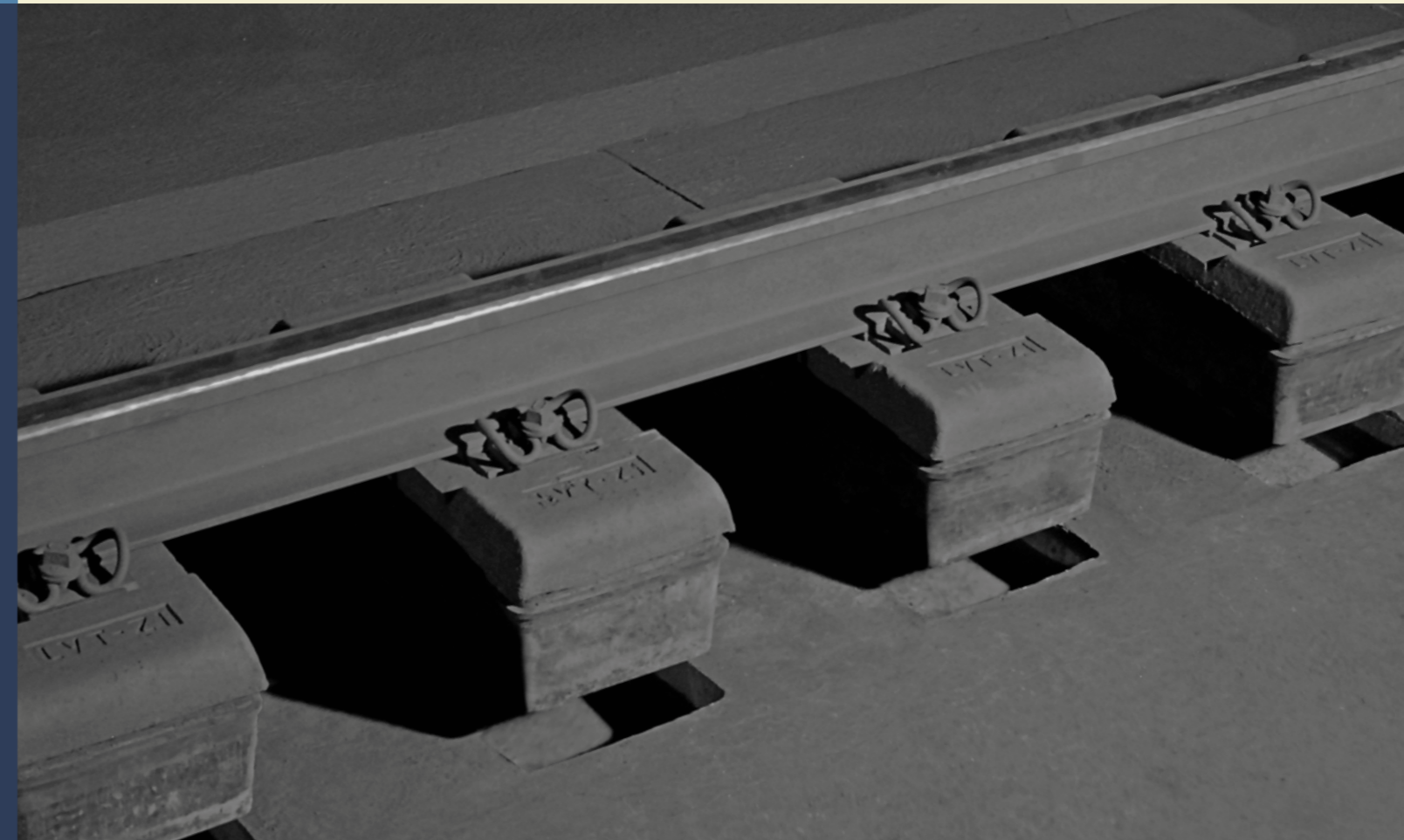
In addition, the LVT-System can be used by trains although no filling concrete has been poured. Hence installation sites behind the laid track can always be supplied with material.

PLANNING WITH LVT

HIGHEST FLEXIBILITY FOR EVERY DEMAND

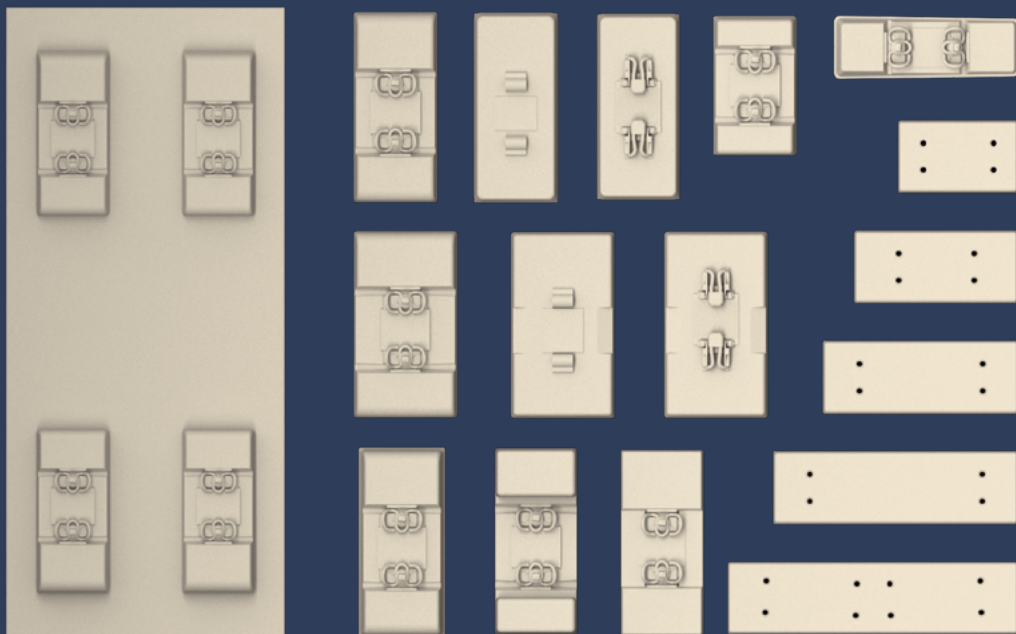
EXCHANGE

The LVT-System is characterised by an almost maintenance-free life cycle. If necessary (e.g. derailments), all system components can be easily replaced. In the event of unforeseen settlements of up to 25 mm, the top of the rail can be brought back to the desired height without concreting work by using HDPE shims.



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