Case Study

Improvement of Track Quality at Daqin Coal Line, China

- Reduction of maintenance costs
- Elongation of tamping cycles
- Increase of life time of the track

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Improvement of track quality and lower deterioration rates

Project Description

The heavy haul network in China is expanding fast. With total mileage of 653 km the DatongQinhuangdao (short: "Daqin") coal line is the major corridor for transporting coal from the west (Shanxi and Shaanxi provinces and the Inner Mongolian Autonomous Region) to Qinhuangdao, China's largest coal-exporting seaport.

Increased track availability, especially in heavy haul railway lines, is the target of many research and development projects on and off the track for many years. Using elastic polyurethane components in the ballasted track system reduces track maintenance and therefore increases the availability of the line.

Daquin's double-track electrified line with an axle load of 25 tonnes opened in december 1992 and is capable of transporting a total volume of 450 MGT/year. To ensure that the superstructure would be able to cope with these high numbers, an extra-wide subgrade and significantly stronger rails (75 kg/m) were used to ensure proper load distribution. The technology meets international standards: it was China's first heavy haul railway to use a computerised centralised traffic control system and the first line in the country to use an optical fibre communication system.

Based on the breakthroughs implemented in this line, China was able to make substantial progress in heavy haul railway transportation.

Cost drivers on the open track

Heavy haul route operators are faced with a number of challenges. With its very high frequency of trains (100 to 130 trains per day with daily gross tonnage up to 1.3 MGT), the operators require a highly durable superstructure. Damages to the components and increased wear caused by heavy traffic would reduce availability of the route, increase the maintenance requirements and drive up operating costs. Also, destruction of ballast is common on heavy haul lines due to the exceptionally high loads. This causes damage to many essential superstructure components such as breaking of rail clips and sleepers. Only if the ballast, which is the weakest link in the ballasted track, remains intact, the quality of the entire system is preserved and superstructure components such as rails and sleepers are subjected to less stress.

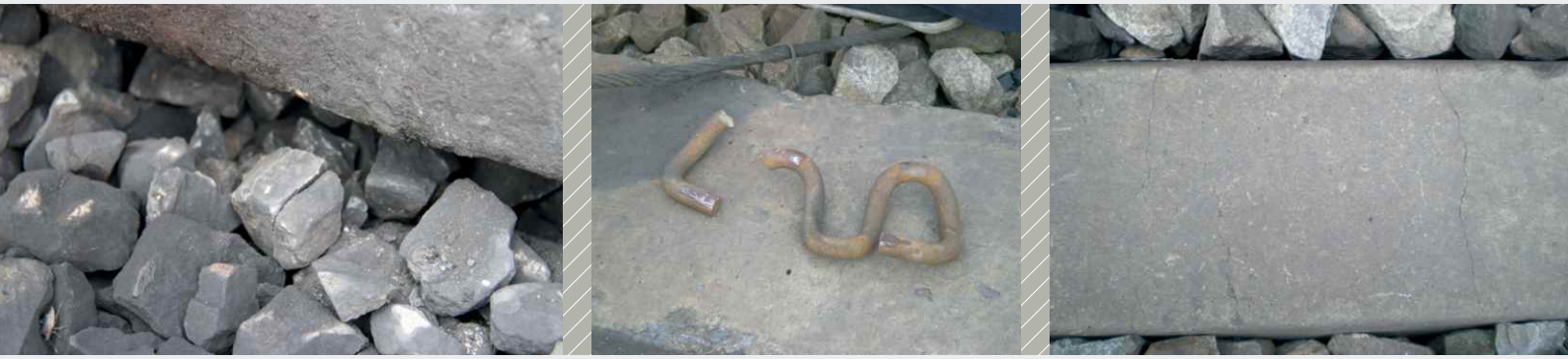
Reducing loads on ballast

Decreasing the load on the ballast can be achieved in two ways: by increasing the size of the contact area between the sleeper and ballast and through improved load distribution over the rail.

Adding elasticity to the superstructure prevents individual components from being overloaded. Elastic Rail Pads under the rail foot significantly improve the load distribution. Under Sleeper Pads can amplify this effect and also increase the contact area between the sleeper and ballast. Using Under Ballast Mats is another way of introducing a defined level of elasticity into the superstructure. In addition, they relieve the interface between the ballast bed and hard subgrades.

Advantages

- Better track availability and less track possessions
- Lower deterioration rates therefore decrease of maintenance requirements
- Operation of a durable track system with lower life-cycle costs (LCC)
- Positive influence on the lateral track resistance
- Less damage to superstructure components
- Track quality and geometry at a high level



Destroyed ballast, rail clips and sleepers due to inhomogeneously embedded sleepers

By conducting comprehensive statistics and analyses of the track geometry maintenance costs were reduced and several positive effects were witnessed since the application of Getzner USPs.

The Getzner solution

Installation of elasto-plastic Under Sleeper Pads (USPs)

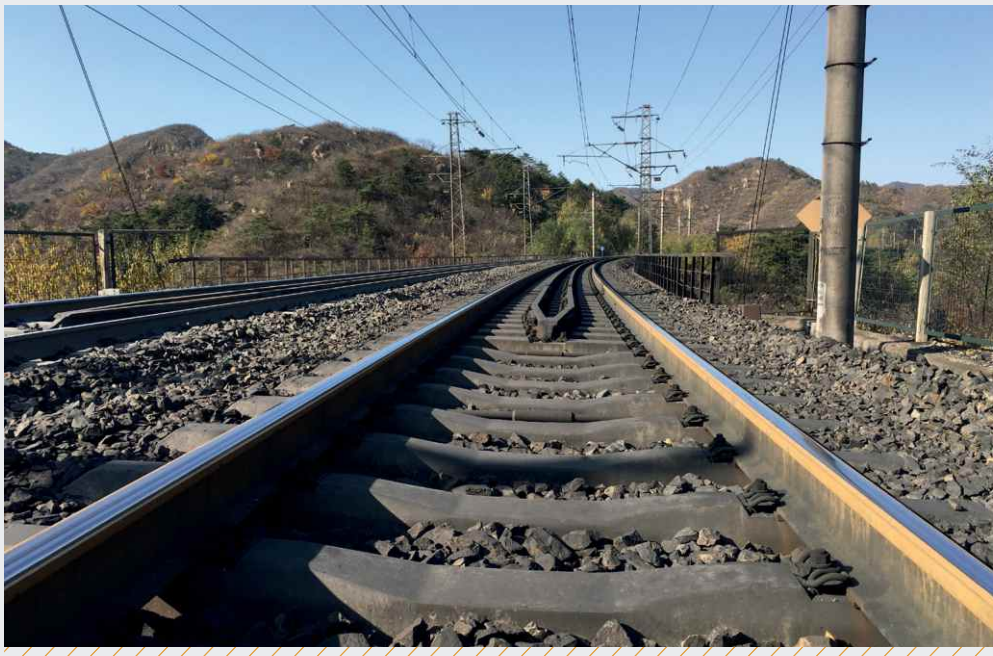
To counteract degrading superstructure, Getzner approached several heavy haul networks within China to install and test elasto-plastic USPs. Along the Daqin coal line, two sections were selected and in 2016 the Taiyuan Railway Bureau applied polyurethane USPs to both tracks (loaded and unloaded directions). The loaded, padded section has a total length of 1.46 km at the mileage of km 296+700 ~ km 298+160. The section includes a curve, three bridges (total length 375.9 m) and three tunnels (total length 277 m). In order to prove the benefits of the elastic superstructure, this track with frequent changes of subgrade conditions (open track/tunnels/bridges) was predestined. The elasto-plastic SLB 2210 G and the slightly more elastic SLB 1510 G USP types were carefully selected by Getzner's engineering department, keeping in mind all boundary conditions of the test track.

No damages or maintenance

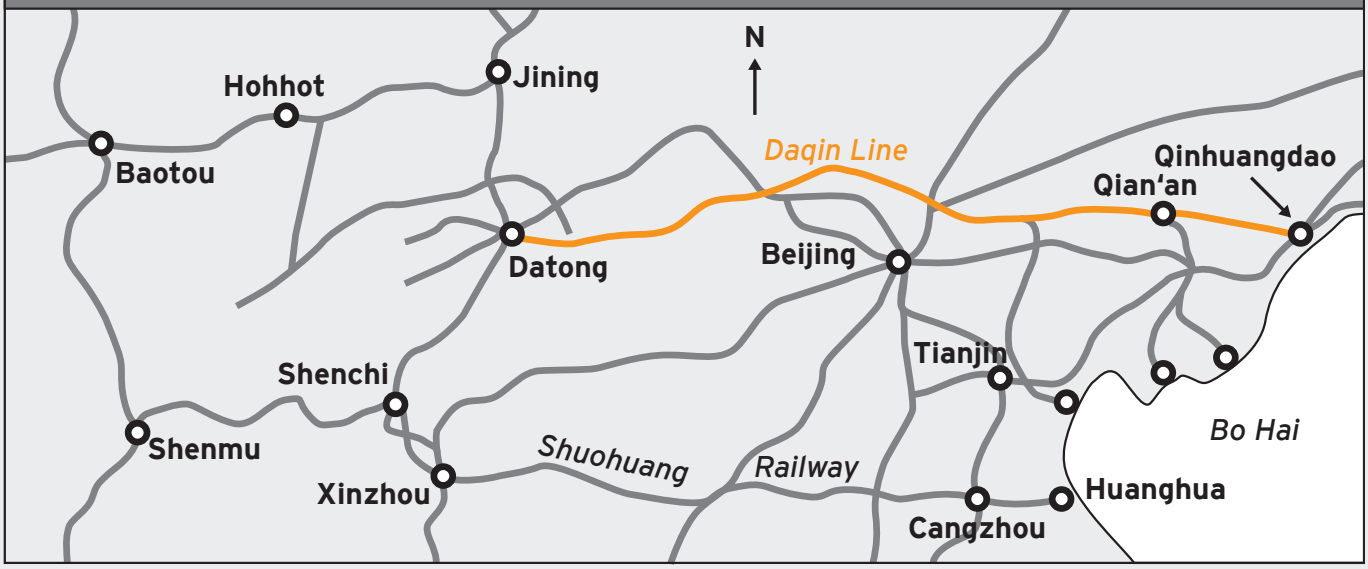
Fourteen months after the installation, the total tonnage amounted to 519 MGT. Within this time the unpadded section had been tamped twice during major maintenance undertakings, whilst the padded section showed no need of tamping or maintenance at all. On top of this, no other defects such as fractured sleepers or rail clips, white spots or hanging sleepers could be detected within the padded section. The track quality and geometry were kept at a very high level.

Durable and economical track system

With the installation of polyurethane USPs of types SLB 2210 G and SLB 1510 G on the Daqin coal line, maintenance activity was dramatically reduced. This saves money and significantly increases the track availability. Until today the padded track needed no tamping with USPs (compared to four times without), even after more than 1000 MGT. The use of USPs in the track superstructure enables the operation of a durable low life-cycle cost track system for China's heavy haul network.



Daqin Line



Facts and figures

Line mileage (over which the material was installed):	1.46 km of Under Sleeper Pads
Operator:	Taiyuan Railway Bureau
Material used:	Under Sleeper Pads of type SLB 1510 G and SLB 2210 G (at the transition, 25 m at each side)
Axle loads on the heavy freight line:	25 metric tons and total tonnage of 1000 MGT

Getzner Werkstoffe GmbH

Foundation:	1969 (as a subsidiary of Getzner, Mutter & Cie)
Chief Executive Officer:	Ing. Jürgen Rainalter
Employees:	490 (360 in Bürs)
2018 turnover:	EUR 100.3 million
Business areas:	Railway, construction, industry
Headquarters:	Bürs (AT)
Locations:	Berlin (DE), Munich (DE), Stuttgart (DE), Lyon (FR), Amman (JO), Tokyo (JP), Pune (IN), Beijing (CN), Kunshan (CN), Charlotte (US), Decatur (US)
Ratio of exports:	93 %