

Revolutionary foundations

When Russia's Nicholas I laid the foundations for Russia's first railway system back in 1838, he could barely have guessed that, 160 years later, new foundations would be giving it a further lease of life

Capital of Russia'. This was the exalted status bestowed by Tzar Peter 1 on a tiny village in the Gulf of Finland in the early years of the 18th century. Apart from a brief spell during the reign of Peter II when the Imperial Court was restored to the Kremlin in Moscow, Peter the Great's eponymous St Petersburg was to remain Russia's royal seat for more than 200 years.

When it was founded in 1703 as the visionary Tzar's 'Gateway to the west', St Petersburg was nothing more than a small collection of huts on the marshy delta of the River Neva. Over the following years the seaport, as St Petersburg was to become, expanded steadily as Russia, now with access to the important Baltic sea routes, opened up its trade with the rest of Europe. However, it was the arrival of the Russian Imperial Court, in 1712, that really heralded a spectacular period of growth, influence and splendour for the new city.

Meanwhile, despite being displaced as the capital, and temporarily eclipsed, Moscow remained a large and important centre. And, although its resumption as principal city after the Revolution in 1918, by order of Lenin, may have owed more to strategic than com-



Insignia from the Soviet era can still be seen on railway cars.

mercial or governmental reasons, it never lost its industrial and cultural importance.

Iron horse

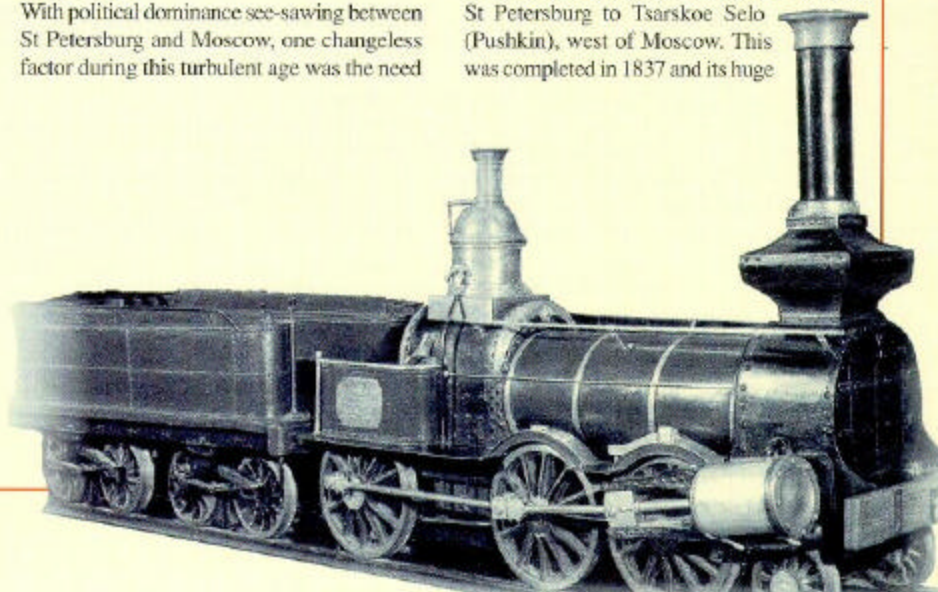
With political dominance see-sawing between St Petersburg and Moscow, one changeless factor during this turbulent age was the need

for adequate communication links across the 700 kilometres of near-wilderness which separated the two great cities. For centuries, waterways and crude roads had sufficed but, by the beginning of the 19th century, the rapid growth in mercantile trade was necessitating improved methods of overland transport, especially to reach the ports.

Surprisingly, despite the sheer size of the country and the difficulties that this presented for the development of trade, the distribution of resources and the movement of troops, the huge potential for the 'iron horse' was at first largely overlooked. Indeed, it was not until 1835 that Tsar Nicholas I, having belatedly recognised the great success of railways in western Europe and North America, invited the renowned Austrian railway engineer Franz Anton von Gustav to submit proposals for a railway system in Russia.

Tsar Nicholas wanted the Empire's two principal cities to be linked by rail, but finance for this proved difficult to raise. Instead, von Gustav reluctantly built a shorter line from St Petersburg to Tsarskoe Selo (Pushkin), west of Moscow. This was completed in 1837 and its huge

A 1-3-0 steam locomotive of the type used on the Moscow to St Petersburg railway in the 19th century.



success quickly resulted in a start to the vital St Petersburg to Moscow line, a massive project which was completed in 1851.

Vital artery

Now known as the 'Oktyabrskaya', or October Railway, the St Petersburg to Moscow line was built to a very high standard. Although periodically maintained and now electrified, the track still sits on its original foundations. Substantially unchanged for 160 years, these are a lasting tribute to the skills and workmanship of the Russian railway pioneers. Today, the Oktyabrskaya is one of the republic's most vital transportation arteries, carrying around 2 million passengers and upwards of 100 million tonnes of freight per year between the nation's first and second cities.

The great importance of the Oktyabrskaya has never been in doubt and, for many years, it has enjoyed a reputation as the best maintained and safest of all the major Russian tracks. But time, heavy use and a general deterioration in the Russian rail infrastructure have taken their toll, causing frequent disruptions and the imposition of severe speed restrictions over much of its length. In the early nineteen-nineties, a comprehensive programme of track foundation repairs was announced, the first complete upgrade in the railway's entire history, with the objective of halting this decline and returning the line to some of its former glory.

Suffering

The upgrade is scheduled for completion in the year 2002, by which time the duration of the 700 km trip will have been halved to around 4 hours. "Until now, attention to the track foundations has been limited to the localised addition of new ballast on a periodic basis," says Alexei Volkov, a Moscow-based supplier of DuPont materials for the project. "The importance of the line upgrade has assumed further importance with the collapse of plans, in June 1998, for a new, privately financed rail line between St Petersburg and Moscow, which would have operated in parallel with the Oktyabrskaya line."

The Oktyabrskaya renovation work involves the removal, re-grading and relaying of much of the track ballast which has deteri-

orated badly over the years. "The track is suffering over much of its length from settlement and inadequate drainage caused by changing soil conditions and the ingress of soil particles into the ballast," says DuPont's Malik Zeniti, who was involved in the protracted pre-contract negotiations with the Russian Ministry of Railways, spanning more than two years. "We were asked to help provide a solution which would be both permanent and cost-effective."

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of repairing the track
foundations without actually
removing the track itself.**

But, the problem faced by the Russian authorities was not just the huge cost of this giant undertaking. The Oktyabrskaya railway's economic and social importance meant that it could not be simply shut down while the work took place. A way had to be found of repairing the track foundations without actually removing the track itself. The severity of the Russian winter also meant that the work had to be limited largely to the summer months. "The laying season is restricted to between May and October," says Volkov. "During this period, the railway authorities expected to upgrade 300 kilometres of track which translates into a target rate of 120 metres per hour."

Continuous

This challenging performance target, the condensed laying season and the need to keep the line open during the work led to the commissioning of an extraordinary multi-function track-laying machine capable of rebuilding the railway bed without removal of the track or sleepers. At the heart of the operation, this huge, 100 metre-long machine bears no resemblance to any normal locomotive. Austrian-built, it is capable of removing a uniform 40-50 centimetre layer of contaminated ballast from beneath the rails, cleaning and re-grading the extracted gravel, laying down a Typar® geotextile membrane, reinstating the ballast beneath the rails and consolidating the result in a single, continuous operation.

The possibility of simply adding another layer of aggregates onto the existing track bed was not a feasible option, according to

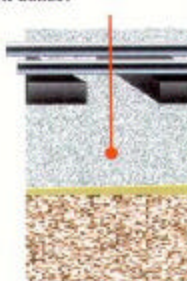


Exterior view of the railway station in St Petersburg.



Because of the importance of keeping the line open, removing the track or sleepers.

40-50 cm of cleaned and new ballast

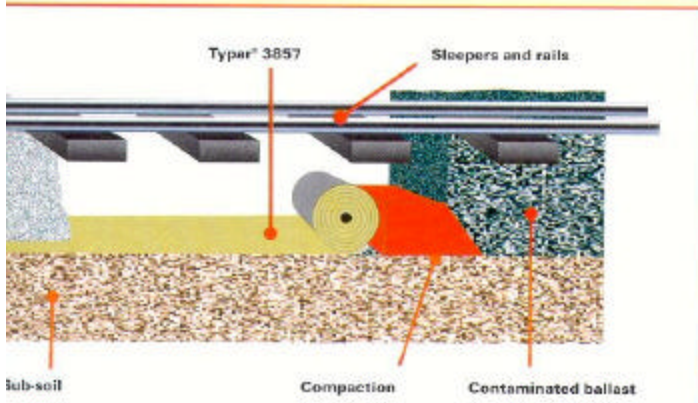


Schematic showing the work involved





ing the line open, a multi-function machine is used to rebuild the railway bed without



in rebuilding the track.



Over a million square metres of Typar® geotextile separating barrier were laid on the track during 1998.

Volkov. "Due to the presence of overhead power lines and the desire to minimise movement of the track, it was essential that the foundation work did not raise the track level," he explains.

The role of the Typar® membrane has been critical to the success of the upgrade. This geosynthetic acts as a separating barrier between the underlying soil and the track ballast preventing particle ingress and ensuring adequate drainage. "In some sections, the Typar® is even being used in conjunction with a foam insulation base to prevent the possibility of the permafrost thawing and causing unwanted track movement," says Zeniti.

The Russian authorities undertook extensive pre-contract evaluations of the Typar® geotextile. "Field tests were conducted to demonstrate

its resistance to dynamic load under real conditions," says Tamara Ivanova, DuPont Nonwovens' representative in Moscow. "Delegates from the Russian state railway inspected similar rail upgrade projects in the Benelux countries and conducted quality inspections of the DuPont plant to assess our ability to perform."



A roll of Typar® geotextile is prepared alongside the railway track.

Monolithic

The rebuilt Oktyabrskaya will regain its status as the showpiece of the Russian railway system, which is probably the last of the great monolithic infrastructure institutions to survive the collapse of the Soviet Union. The importance of railway communications to the Russian economy and social structure is underlined by the fact that three-quarters of all freight and nearly half of all the passenger miles are carried by rail. And, with a total of 87 500 kilometres of track, Russia boasts the world's largest railway system after the United States, carrying as much freight as the rest of the world's railways put together.

In a country where much has been done to eradicate the past, the 'October Railway' bears enduring testimony to the vision of some of Russia's great historical figures. And, with its new foundations, there is little doubt that this important railway will continue to weld together, quite literally, the cities of Moscow and St Petersburg for generations to come.

This bronze monument to Peter the Great is in St Petersburg, the city he founded in 1703.

