

On the right track

A Belgian public works and construction company uses Typar® spunbonded polypropylene to consolidate the soil and improve the load-bearing capacity of part of the foundations of the new high speed railway track being built between Lille and Brussels

It was in 1990 that the Belgian Government took its first decisions concerning the construction of a high speed railway line on its territory. There is little doubt that this line, veritable backbone of the Belgian railway system, represents the most important infrastructure project undertaken in Belgium over the last few years. When it is finished, the new network will have a total length of 305 kilometres and will be linked to the older, classic railway lines, which are also being adapted to meet the needs of modern rail traffic. Half of the network, composed of entirely new track, will sustain operating speeds of 300 km/hour, while the other half, composed of upgraded track, will allow trains to operate at speeds of 160 to 220 kilometres per hour.

The network has been planned to provide fast rail travel on three major routes. The 'Western' axis will connect Brussels to the French border, the 'Northern' one will connect Brussels to the Netherlands, while the 'Eastern' route will link the Belgian capital to the German frontier. When construction is completed, at the beginning of the 21st century, TGV high speed trains leaving Brussels 'Midi' station will be able to reach Paris in only 1 hour and 22 minutes. London will be reached in two-and-a-half hours, and Amsterdam and Cologne in 1 hour and 40 minutes.

Work started on the Belgian part of the first route, that between Brussels and Paris, in August 1993. The route comprises 71 kilometres of main line track and 17 kilo-



Georges Karam, of DuPont (left), visits site 1374 to discuss the project with Jean-Marie Genonceaux (centre) and Marc Fleurquin, both of Besix.



metres of modernised track. It is due to enter into service in 1998.

"The TGV crosses the border into Belgium at Esplechin, not far from Tournai," explains Jean Denayer, director of operations at Tuc Rail, a subsidiary of the Belgian National Railway Company (SNCB) which has both private and public shareholders. "Building a high speed railway line requires a tremendous amount of civil engineering work," he says. "It begins with large-scale earth-moving operations and with the construction of the various bridges, viaducts, tunnels and cuttings to be found along the route. It is only when the foundations have been completed that one can start to lay down the ballast, the sleepers and the



Jean Denayer, director of operations at Tuc Rail, the SNCB subsidiary responsible for the TGV project.

welded rails to obtain a continuous, smooth high speed rail track. After this, the overhead power lines have to be erected – the TGV needs an energy source of 25 000 volts AC to reach a speed of 300 km/hour – and the signalling and telecommunications equipment has to be installed."

Work for a Titan

The earth-works consist essentially in banking up the areas where the TGV has to run on raised track, using dry soil which has been excavated from areas where the track will be below ground level.

"But, this initial earth-moving phase can sometimes become a super-human task," continues Jean Denayer. "Prolonged periods of incessant rain can result in the soil becoming waterlogged and this can cause major problems when excavating, transporting, dumping and spreading it. This means that it is necessary first of all to drain the ground, remove the liquid mud and replace the unusable earth with a stable base."

An anti-contaminant geotextile fabric is usually unrolled and laid between, and parallel to, this solid base and the drainage layer. An additional base layer is then laid on top of the drainage layer. This is composed of spe-

cial drainage materials and granulates with a relatively large cross-section, which have been developed specifically for flooded and particularly wet areas. It is only when this has been done that the load-bearing capability of the foundations is restored and that the earth-moving equipment can circulate freely again. The filtering geotextile is also used to prevent the soil and aggregate materials from getting into, and blocking up, the drainage pipes and water collectors located at intervals along the foundations of the 15 metre-wide railway track.

The contract for construction work on site 1374 – the 10 km-long section of the Lille-Brussels high speed railway line between Antoing and Peruwelz – was won by the Brussels-based company, Besix, which is the largest construction company in Belgium. Very active in its formative years in the public works area, the company started in 1980 to redirect its activities towards mainly large national projects, such as the underground railway systems in Charleroi and the Belgian capital, the Euro-Parliament building and Zaventem airport. But, the company also realises a large portion of its turn-over abroad, having won some important contracts in the Middle East, Africa and Eastern Europe.

Jean-Marie Genonceaux, manager of site 1374, points out that the amount of soil that had to be

"The drains are covered along their whole length by a filtering, anti-contaminant sheet of Typar®."

shifted during the earth-moving phase of the contract was impressive. "For our section of the track alone, this represented a volume of about 2 million cubic metres. Of this, about 1.3 million cubic metres were used as infill for other sections of the track, whilst

about 700 000 cubic metres were used to remodel the agricultural land and landscape the 11 bridges connecting the farm land on both sides of the track.

"The compaction of the ground caused by the banking up of so much earth has



A layer of DuPont Typar® geotextile fabric is laid between the stabilised base layer and the aggregate layer on the Brussels-Lille high speed rail track.



Typar® geotextile used in the trackside drainage helps to filter the ground-water.

complicated our task enormously," says Jean-Marie Genonceaux. "In order to speed up the whole earth-moving and stabilisation operation, which can last several years, we have covered the infill materials with 1 to 2 metres of top-soil.

"This technique has been combined with the installation of a system of vertical drainage. These drains, which reach a depth of up to 15 metres below ground level, are composed of a rigid corrugated polypropylene core with a high draining capacity. These are covered along their whole length by a filtering, anti-contaminant sheet of Typar®. The weight of the top-soil compresses the wet earth, provoking a

'sponge' effect which separates the water from the marshy ground. The greater the number of vertical drains, the faster the water is evacuated towards the collectors. In this way, the consolidation of the soil lasts only 6 to 12 months, which allows compaction of the earth even when construction work is in progress."

A natural graduated filter

Jean Polet, responsible for the earth-moving and restoration operations on the Besix section, explains: "We had no problems laying the Typar® because its good rigidity means that it can be handled and cut to size easily. In addition, its properties are in no way affected by exposure to the elements on site. Its use around the concrete and other drainage materials which encase the water collectors enables it to act as a filter. When the water flows towards the collectors, it carries with it fine earth particles, some of which are trapped by the Typar®. Larger particles then come and lodge against the smaller particles, thus forming a natural graduated filter, which progressively reduces the erosion of the soil until it stops."

For Georges Karam, an engineer with DuPont in Luxembourg, who has technical responsibility for geotextiles and is in charge of sales of Typar® in the Benelux countries, the use of this DuPont spunbonded product satisfies a real need. "Typar® was initially produced in the United States, but has been produced at our manufacturing plant in the



One of the several bridges that had to be built to link the farmland on both sides of the railway track.

Grand Duchy of Luxembourg since 1974," he says. "Its particular structure allows it to fulfill several important criteria. Thanks to its excellent permeability, the non-woven geotextile, made of continuous 100 per cent spunbonded polypropylene fibres, allows the interstitial water to flow freely, thus preventing clogging, even in the presence of large hydraulic gradients.

"Its high resistance to tearing eliminates the pos-

sibility of damage to the product while it is being laid, whilst its dimensional stability prevents it from being forced into the grooves and channels of the geocomposite draining core, even under heavy pressure from the earth. Additional advantages are that it does not rot and it is resistant to the chemicals commonly found in the soil.

"All of these favourable properties have also led to the product's ready acceptance by British Rail, which recommends its use as an anti-contaminant separation layer between the railway banking and the drainage layer supporting the ballast of the railway track.

"In-depth studies carried out in Germany and in Norway have confirmed its suitability as a load-bearing support for roads as well, but its versatility is such that it can also be used as a reinforcement material for shoes, as a waterproof covering membrane and as a backing material for carpets and rugs. Modified versions of the material, such as Plantex®, which is used to protect growing plants from weeds, complete the product range.

"With all these desirable properties," concludes Georges Karam, "who can doubt that this DuPont material will have made a major contribution towards placing the TGV high speed train on the right track?"



When completed, the new high speed rail track will cut journey times between Brussels and Paris to 1 hour and 22 minutes.