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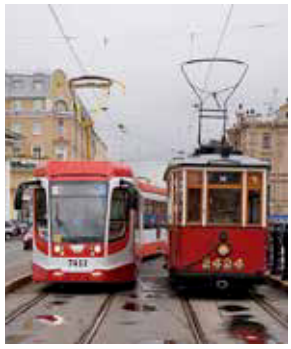

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Twin Cities light rail set to expand

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London Underground sleepers go synthetic

The first FFU synthetic timber sleepers have been installed on the London Underground, replacing life-expired softwood timber.

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Earlier this year London Underground installed its first fibre-reinforced foamed urethane sleepers, when life-expired softwood longitudinal bearers were replaced on a section of eastbound Piccadilly Line track at Chiswick Park. Sekisui supplied the synthetic timber components.

FFU sleepers and large baulks in the form of longitudinal supports had previously been deployed by Network Rail at three locations on Britain's national network, and these had demonstrated that the synthetic material performed well: longitudinal baulks and sleepers were installed on two bridges near Ashford in 2014, on a bridge near Faversham in 2015 and at a bridge in Rochester in 2016.

In late summer 2015 the first contact between London Underground and Sekisui was made to determine whether synthetic sleepers would be a suitable alternative for timber sleepers on the network in London. A delivery time of 12 to 16 weeks was possible, and March 2016 was set as a target date for the work to take place. The sleeper replacement was undertaken over the weekend of March 4-6.

Manufacture

FFU synthetic timber is manufactured using the process of pultrusion. Oriented glass-fibre strands are drawn through a pulling device, coated in polyurethane and cured at a high temperature, resulting in a high-grade, pore-free material. It is possible to manufacture the synthetic wood to millimetre precision in the form of semi-finished products.

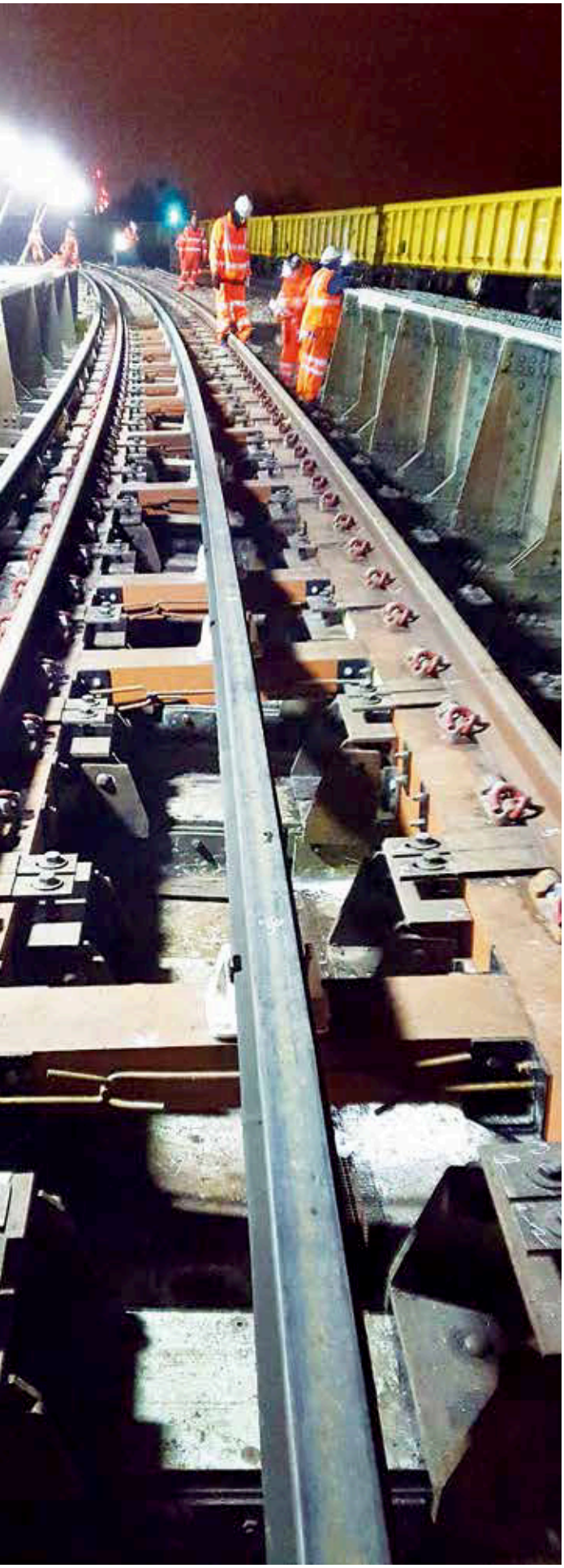
Various manufacturing processes can be applied to suit the requirements of specific locations. Examples include cutting the material to produce the correct angle to match the designed cant of track, drilling screw holes, milling out spaces for accommodating other parts of the structure and surface sanding. Each sleeper is given a unique identification, to ensure that it is laid at the intended location on site. Tests carried out by Japan's Railway Technical Research Institute suggest that FFU has a lifespan of around 50 years.

After London Underground placed the order, its carpenters and engineers were given three demonstrations of FFU sleeper installation in late 2015. Synthetic sleepers were drilled, cut with a regular hand saw and chainsaw, chiselled, prepared with drill holes and repaired so that all staff involved could familiarise themselves with handling FFU and its characteristics.

Installation

Installation took place on bridge D70, which carries the District and Piccadilly lines over Acton Lane, immediately to the west of Chiswick Park station. It is a

FFU sleepers are made of glass fibres (below), and FFU is also used for wedges (bottom). LU's Trade Manufacturing Division prefabricated panels at its workshop before installation (left).



The prefabricated FFU frame is brought in to rest on FFU wedges (above). Work was finished on March 6 (left).

DEVELOPMENT

FFU spreads from Japan to Europe

Sekisui began developing FFU synthetic sleepers in the 1970s, after Japanese National Railways found that the prevailing weather conditions were causing its wooden sleepers to rot. This led to the development of a longer lasting material that retained the characteristics of wood. FFU has virtually the same specific mass as wood, but it is less affected by weather.

FFU sleepers have been laid on more than 1 400 track-km, generally at points and on bridges. Applications range from light rail to heavy rail with axleloads in excess of 30 tonnes. They have been used on metros and light rail networks in Wien, Hamburg, Berlin, Düsseldorf, München, Bochum and Toulouse. In addition to the London Underground, the metros in Paris and Lille are installing their first FFU sleepers this year. ■

'half-through' steel bridge with longitudinal main girders and 24 cross girders; the five longitudinal bearer frames are attached to the bridge via an elastic fixing system bolted to each cross girder below each rail.

As part of the sleeper renewal, five longitudinal bearer frames were spliced together at angled overlaps to allow for track curvature. All frame components were made of FFU: longitudinal bearers, transoms and positive conductor rail blocks. Materials were supplied in pre-ordered lengths and then machined and prefabricated in panels by London Underground's Track Manufacturing Division at its workshop at Lillie Bridge Depot in west London in advance, in order to save installation time during the weekend track closure.

To provide the required track cant, packing wedges were fitted between the cross girders and the bearers at each girder. These wedges were also made of FFU, machined to precise tolerances by Sekisui and supplied with the longitudinal bearer frame materials.

The bearers were installed during a weekend possession, which enabled other major works in the area to be carried out. After the track was closed to traffic, rails, fastenings, wooden bearer frames and other items were removed. Each beam was surveyed and the packing wedges were placed between the retaining brackets. Once all were in the correct position, a road-rail vehicle was used to place in position the prefabricated FFU frames, which were then bolted together. The fastening plates were then installed, holes were drilled for the baseplates, the rails relaid and the gauge checked before the track was finally returned to use. ■

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