Newark crossing goes synthetic

Replacement of a critical flat crossing on Network Rail's East Coast Main Line required the development of the longest ever FFU synthetic bearers.

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The flat crossing at Newark on Network Rail's East Coast Main Line has been completely relaid using innovative materials, in a 'first of its kind' project that saw synthetic bearers manufactured in the UK for the first time. The new crossing assembly was installed over the long holiday weekend of August 25-27, during an extensive blockade which saw engineering work undertaken at a number of locations as part of NR's £1·2bn East Coast Upgrade.

Situated just north of Newark Northgate station, the flat crossing is located where the east-west Nottingham – Lincoln line crosses the ECML. It is one of the most complex structures on the route, with no fewer than 16 crossing noses.

Carrying inter-city trains running north-south at 160 km/h and heavy freight traffic on the east-west line, the trackwork on the crossing has had to be replaced every five years. The supporting bearers that hold the crossings in position were renewed every 15 years; because of the importance of the structure hardwood has traditionally been used to ensure the required lifespan. These bearers are 16 m long, 710 mm wide and 350 mm high.

The bearers were last replaced in 2003, but procuring suitable material for a further renewal proved problematic, which led to the decision to adopt alternative

Top: The completed crossing was craned into position on August 26.

Left: The FFU synthetic bearers were assembled by Progress Rail in Nottingham, laminating thinner sections supplied from Japan.

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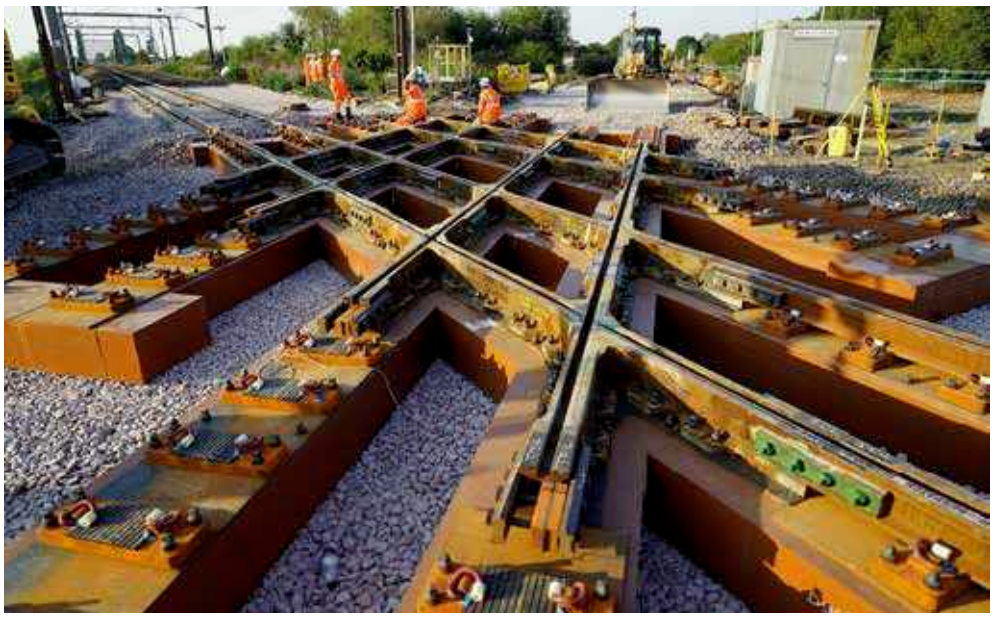

Ballast on the flat crossing has been glued to reduce rotational stresses.

technology. Various teams from Network Rail, including Infrastructure Projects, Safety Technical & Engineering and Route Asset Management, worked with Progress Rail, Sekisui Chemical, the Central Rail Systems Alliance and the S&C North Alliance to develop, manufacture and install new Fibre Reinforced Form Urethane bearers. These have all the workable properties of hardwood and an expected life of 50 years.

FFU synthetic sleepers

Developed in conjunction with Japanese National Railways, FFU synthetic sleepers are made using a pultrusion process. Continuous glass fibres are soaked and mixed with polyurethane, and then hardened at a raised temperature, moulded, pulled and cut to length. This creates a high quality material that has the life expectancy of plastic and the weight of natural wood, which can be worked like natural wood.

First installed in Japan in 1980, and adopted for standard sleepers since 1985, FFU has subsequently been installed on a number of projects in Europe over the past 15 years, particularly turnouts and bridges. Up to the end of 2018, there was more than 1500 km of track with FFU sleepers around the world. Tests of the original 1980 sleepers undertaken by the Railway Technical Research Institute in 2011 predicted that the FFU sleepers could safely continue in use for another 20 years, giving a total life of around 50 years. FFU sleepers have also been certified by Germany's Federal Railway Office for use on tracks operating at up to 230 km/h.

Long beams

For the Newark crossing renewal, Sekisui offered to provide 16 m one-piece beams, matching the existing wooden bearer layout. However, FFU is only currently manufactured in Japan, and due to shipping limitations is produced to a maximum length of 10 m. To produce the required 16 m bearers, Sekisui partnered with Progress Rail to assemble the beams at a facility near Nottingham, which is the first time that this has been done outside Japan.

The bearers were constructed from 30 mm thick layers of FFU, 8 m long; these were manufactured in Japan and shipped to the UK for final assembly. Two densities of FFU (740 and 1000 kg/m^3) were combined to give an increased compressive strength near the surface. Specialists from Sekisui worked with staff from Progress Rail to assemble the bearers. These were then combined with the other railway elements including the rails to complete the huge crossing unit, weighing more than 40 tonnes. The design was complex, with the interlocking components designed to ensure that the construction matched the specification.

After eight weeks, the novel FFU bearers were finished, numbered, painted and assembled. The crossings were then attached by Progress Rail, drilling into the new material which behaves like hardwood. The trackwork has been renewed using CEN56 HP rails instead of the previous 56 kg/m BS113A rails, along with new cast steel crossing inserts.

Once everything had been fitted accurately, each component was marked and the crossing partially dismantled for transport to site. The various components were taken to Newark by rail at the end of July, and reassembled on a site adjacent to the crossing, ready for installation.

Smooth installation

Thanks to close co-ordination between the various partners, the installation weekend all went to plan. After the end of services on August 25, the old trackwork was removed and the supporting ballast replaced, including the installation of geocells to strengthen the formation. The large crossing assembly was then moved into place on August 26, before the top ballast was laid and packed. The ballast was then glued to provide greater resilience against the rotational movements that can be generated by the varying tonnages on the two lines. The line was reopened to traffic on August 28 as scheduled.

Whilst FFU has been used in various countries, this project is the first time that something on this scale has been completed outside Japan. The new bearers are expected to double the life of the crossing assets, which should more than cover the additional cost of the material. Network Rail is now going through the approvals process to see how FFU could be used in other applications, including longitudinal bearers and potentially sleepers. ■

The Newark Crossing on the ECML is constrained by the cramped location, with both lines bridging the River Trent nearby.