

# Smooth ride for the Nottingham tram extension



by Ruth Badley

**Nottingham, a city best known for its lace-making heritage and the legend of Robin Hood, is laying foundations for its future prosperity with an expansion to its existing tram network. One of the least car-dependent cities in the UK, the local council's investment in clean, convenient public transport is helping to attract sustainable new businesses and employment opportunities, whilst supporting the commitment to achieve a 26% reduction in carbon emissions by 2020. Starting in early 2015, convenient new routes will offer increased mobility for a growing working age population, which is estimated to be approximately 512,000 across the city region.**

The extension to the Nottingham Express Transit (NET) is being constructed using Appitrack™, a pioneering mechanised system, developed by Alstom Transport, using integrated PaveSmart 3D machine control technology by Leica Geosystems. The concrete slab track and rails are being laid over a

distance of 17.5 km (10.9 mi) and these, within a challenging urban environment, where reliability on both planning and delivery is critical.

## **In tune with the city**

Laying a tramway within a busy city and in close proximity to the local community places particular constraints on productivity. For reasons of safety, there may be tight onsite timelines to adhere to and the need to minimise levels of noise and dust pollution to the environment. The speed, certainty and high precision of the Appitrack™ system guided by Leica PaveSmart 3D allows a construction team to work within these limitations in a unique way, allowing slab track to be built in congested urban environments in a patchwork arrangement.

Following the process of paving and base plate installation, Alstom has developed an innovative method of rail installation and adjustment. Instead of a final phase of intensive manual adjustment, the time spent on site is reduced and the errors minimised by using survey data to pre-determine the shims that are required. A colour-coded shim plan is created



that the workforce follow to ensure the track is in its correct final position.

The technology delivers the necessary consistent and reliable millimetre accuracy during the building process to allow for the successful link up of separate sections during the rail laying stage. The system uses Leica Geosystems' total stations and Leica PaveSmart 3D software to ensure the design calculations, surveying and guidance meet the pro-

ject's demands for the highest tolerances in speed and comfort.

### **First UK city to adopt world class method**

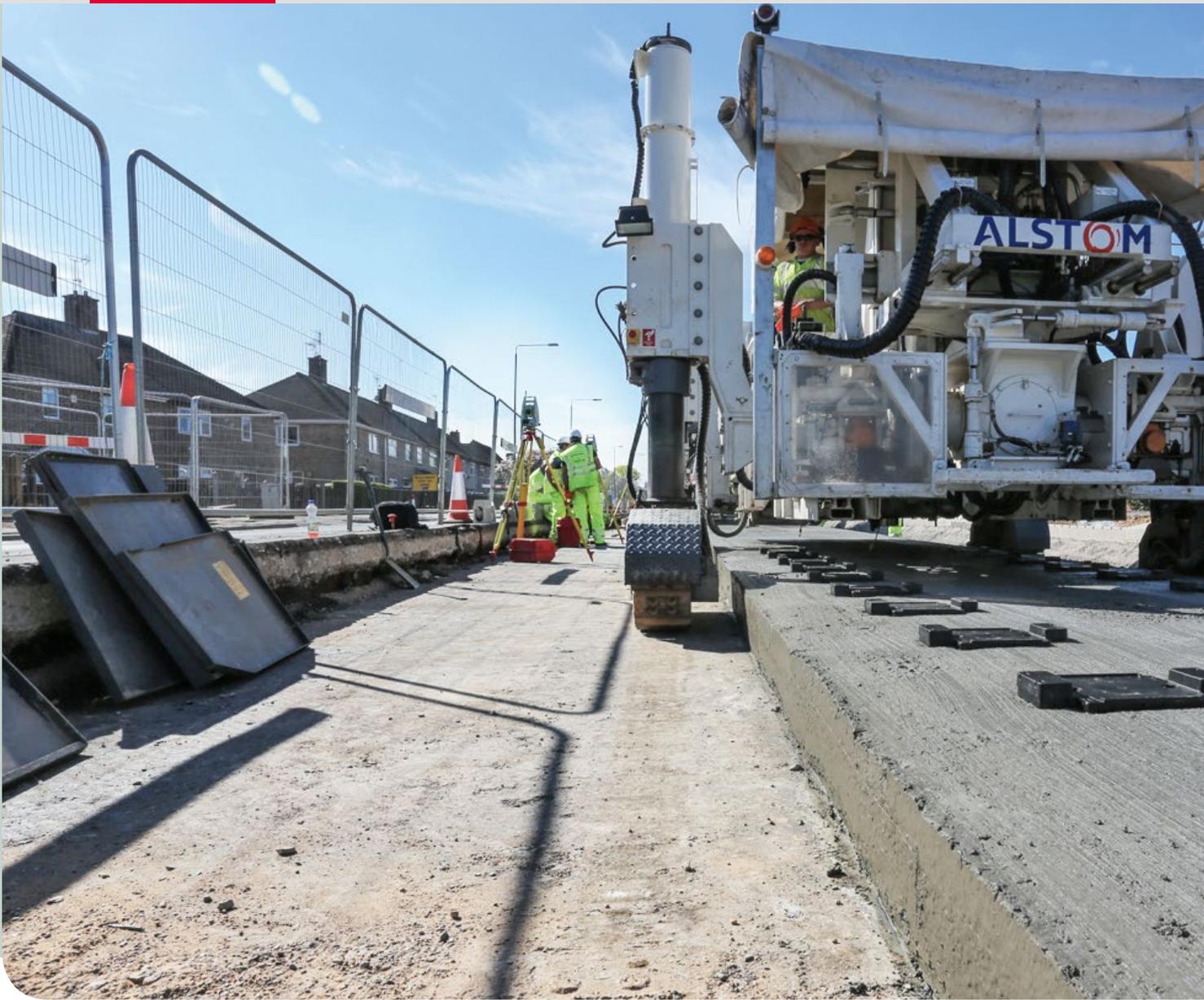
Whilst Nottingham is the first application in the UK utilising the Appitrack™ system, Alstom Transport has used the technique to build Light Rapid Transit systems throughout the world and in similarly sensitive urban environments. It was used in the French



## **Extending the vision**

Nottingham's innovative commitment to cleaner, greener public transport began in 2004 with the opening of the city's first tram line. The current extension to the Nottingham Express Transit (NET), an Alstom /Taylor Woodrow joint project, links areas south of the city to the centre, via two new lines. When the project is completed in early 2015, some

20 million passenger journeys a year will be made by tram, supporting the local council's commitment for Nottingham to remain one of the least car dependent cities in the UK. The three-line network has 13 substations with the potential to input electricity into the grid via the tram's regenerative systems.



■ Guided by Leica Viva TS15 total stations and PavSmart 3D, Alstom's Appitrack™ ensures a smooth tram platform.

cities of Toulouse and Lyon, the Israeli capital, Jerusalem and in Singapore. A recent major contract win will take Appitrack™ to Riyadh, Saudi Arabia where there are ambitious plans to transform the city's transport infrastructure with a modern metro network.

### Joint approach for R&D

Over several years a close working relationship between Alstom and Leica Geosystems has spearheaded research and development work on Appitrack™, with the software for the control and guidance of the system's convoy vehicles tailored to meet Alstom's particular requirements.

Track Survey Manager James Douglas at Alstom Transport, said that the highly specified interface of Leica Geosystems' instruments and software helped

his team develop customised, quality-controlled solutions that increase efficiency.

James Douglas said, "The traceability of the data flow, cross checks and balances with existing software, coupled with the comprehensive nature of the MMI gives professionals exactly what they need to develop their own solutions. This powerful contract-winning tool is the result of continuous refinement and improvement over the last decade to achieve the unparalleled level of accuracy, speed and flexibility that survey and paving innovators require. I believe on NET 2 we have perfected this system. This technology gives us a 30 – 40% saving in production time, therefore contact in the environment is significantly reduced. The technology used on this project has contributed greatly to our timely and efficient delivery of the new tramway for Nottingham." ■



## Speed with high precision

Appitrack™ or Automatic Plate and Pin Insertion uses a concrete paver to lay the track slab, guided by Leica PaveSmart 3D software. Some 10,000m<sup>3</sup> (13,080yd<sup>3</sup>) of concrete has been laid on the NET 2 project to date. The convoy comprises a Wirtgen SP25 concrete slipform paver, the Appitrack™ laying vehicle, concrete delivery trucks and five Leica Viva TS15 total stations.

As the paver moves forward, the Appitrack™ machine follows, inserting base plates into the track slab whilst the concrete is still curing. Both machines are continually tracked and positioned by the total stations. The high level of accuracy is achieved as measurements made to both machines are individual. This system ensures the baseplates are inserted to the correct position, independent of the actual level of the concrete laid by the paver. The setting out, concreting and adjustment is carried out in one pass.

Planning work on the baseplate insertions is carried out in the office, then the design data is uploaded into Leica PaveSmart 3D which integrates with Alstom's in-house AppiWay software. As the convoy moves forward, two other total stations are set up, one to overlap on the Appitrack™ machine and the other to 'leapfrog' on the paver. Machine outputs are checked and monitored to allowed millimetre adjustment of the paving and baseplate insertion. As each cycle is completed two total stations are rotated out of the convoy and set up in readiness for the next.

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For more information and a video demonstration of Appitrack™:  
[http://www.leica-geosystems.com/appitrack\\_video](http://www.leica-geosystems.com/appitrack_video)

