# Newton Heath maintenance facility for Arriva Rail North

Stobart Rail & Civils

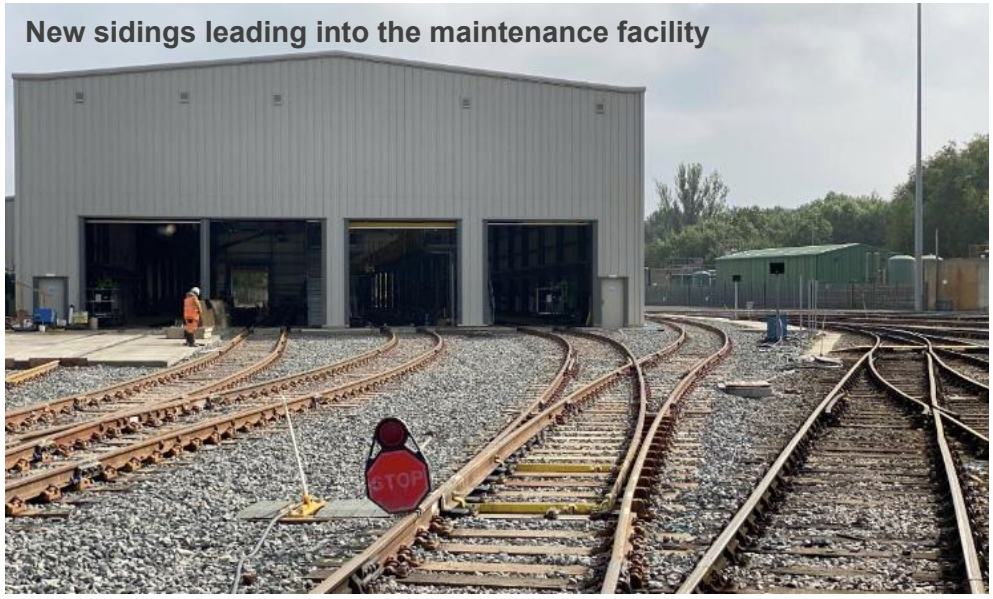
## MAINTENANCE FACILITY

Stobart Rail and Civils delivered the principal contract for the design and build of the new maintenance facility and wheel lathe installation within Arriva Rail North's Newton Heath TMD in Manchester.

Arriva will use this new £20m facility to care for their fifty-five new Class 195 and forty-three new Class 331 trains built in Spain by CAF. This £500m fleet investment is part of their modernisation plans that includes providing more than 2,000 additional weekly services, with faster connections, better stations and improved customer service.

To accommodate these trains Stobart provided a 135m x 24m steel portal framed building that includes four maintenance roads, and a 113m x 6m side annexe with stores, offices, toilets and welfare for the depot team.

A vehicle lifting road fits either two Class 195 2-car units, or one Class 331 4-car unit, with a floor designed with jacking points for sixteen 15-tonne synchronised lifting jacks.



New sidings leading into the maintenance facility

### STOBART'S TRACK EXPERTISE DELIVERS A FULLY INTEGRATED SOLUTION

Stobart's in-house track teams regularly construct new sidings for Network Rail infrastructure, private sidings operators and light rail depots.

Our extensive specialist road rail fleet includes RRVs, laser dozers to grade bottom ballast, Colmar heavy lifters to position S&C components and either our road deliverable 08 S&C tamper or our unique Jack and Tamper unit to deliver a perfect track alignment.

This latest piece of kit was developed when we identified potential for a small format fully remote-controlled S&C and plain line tamping machine. This provides high quality track alignment during small renewals, re-ballasting or maintenance activities and removes the need to jack and pack the track using manual labour, reducing risk and the chance of manual fatigue, and saving time and cost.

For maximum flexibility the Jack & Tamper Unit was designed for road delivery and lifting onto track either by RRV or a small mobile crane, then either towed to the worksite using an RRV or operating entirely under its own power. Twin Kinghoffer four-tool tamping banks allow independent lateral movement around the many obstructions encountered within S&C, making it ideal for completing tamping work in complex sidings layouts.

Maintenance roads are mounted on steel plinths to provide flexible maintenance options to the underside of the vehicles. Fixed roof level access platforms enable safe and effective maintenance of roof mounted HVAC units, helped by two 10-tonne overhead cranes.

To achieve this, the concrete base of the shed needed complex formwork and construction sequencing to deliver the varying finished floor levels. During design development our optimised solution used thickened ground

beams that acted as permanent earthworks support during reduced level excavations. This minimised any temporary support requirements and provided a robust foundation for edge protection for the site team.

To complete the external civils, we constructed a road rail transfer point and a new site access road that includes a widened and upgraded connection to the public highway. This route also provides a link to Network Rail's nearby track access point and the depot's fuel stores – both remained open and unobstructed throughout the construction programme.

A new surface water drainage system includes attenuation beneath the new access road and a connection into both the existing sewer and the site's grey water system that maximises recycling of rainwater – these are just a few of the features that contribute towards the building design qualifying for a BREEAM Good rating.

Owing to the enormous complexity of the numerous systems within the maintenance facility, our design used BIM to create a full 3D model that we used to during project development to identify potential clashes that we then designed out. This eliminated the potential that emerging constraints would affect the works and helped us deliver a right-first-time solution.

## OUR COLLABORATIVE TEAM

To deliver this project we assembled a team including Craddys, who provided civils and structural design, Border Steelwork Structures who completed the building superstructure, and Novus Rail completed the track design.

McLennan Group completed the M&E installations, Depot Rail provided the specialist maintenance equipment such as cranes and jacks, Zonegreen installed the extensions to the existing depot protection system, and Franki Foundations completed the piling throughout the site

Two new plinth mounted roads within the maintenance facility

## WHEEL LATHE INSTALLATION

Separate from the maintenance building we also converted the TMD's redundant paint shed to create a new wheel lathe facility. This re-used a refurbished double headed wheel lathe relocated from Old Oak Common Depot by Richardson Machine Tool Services.

To complement the wheel lathe, we installed new electrical supplies, a swarf removal conveyor system, and an overhead gantry crane. To ensure a perfect interface between the trains and the wheel lathe we altered the alignment of the existing siding - with this then requiring changes to the shed's gable ends to ensure adequate clearance for the trains.

## OUR COLLABORATION ENSURED TROUBLE-FREE DELIVERY

Within a depot environment the major challenge is invariably delivering the works programme alongside normal depot operations without causing disruption that might affect vital maintenance work. At Newton Heath this was a particular challenge owing to the extensive earthworks needed for the new shed – with thirty thousand tonnes of spoil removed from site before we started piling.

Additionally, the works for the wheel lathe took place in an existing building at the very centre of the depot. Our solution here used the siding that would eventually connect to the wheel lathe to run our road rail plant to carry materials and spoil between the workface and a remote staging point far away from daily activity. Only minor modification was then needed to a depot walking route to enable us to totally segregate our site.

During construction we operated a strict Any Line Open plan that used some of the latest technology to ensure that our plant could safely work without any safety risk for the normal depot operations.

### OUR INNOVATIVE METHODOLOGY SAVED OUR CLIENT £200K

To receive the wheel lathe the paint shed required major modification, not least forming the 3m deep pit that it sits inside. Excavating this pit within the confines of the existing shed posed a major challenge that was further complicated by the high water table found on the site.

Our innovative solution used secant piles to form a contiguous wall to a depth well below the pit's formation level. As well as preventing water ingress during the pit's construction, this solution also removed the need for separate temporary earthwork support using sheet piles.

This was particularly welcome because the limited roof height within the shed didn't allow use of a piling rig of sufficient size to install full length sheet piles, meaning that shorter piles would have been the only option, with the piles welded together sequentially as they are driven into place, greatly increasing cost and the programme duration.

## WE ADDED VALUE THROUGH OPTIMISED GI/SI

We ensured we completed all GI/SI works for the entire project in a single visit and provided all information to our design team at the same time. This enabled us to prepare a comprehensive permanent works and temporary works solution from the outset. By doing this we minimised the programme and design cost and ensured that we developed our construction methodology once, without having to revisit it as later designs progressed. This led to efficient on-site delivery and complete compatibility between our planning of all activities for a safer on-site solution.

This complex project had numerous challenges that we addressed through our GI/SI strategy, including:

- The existing site included an area with a long-standing spoil heap that we removed during initial site clearance activities. Owing to the industrial nature of the site we anticipated that this spoil heap would include contaminated material that would require specialist disposal at a potentially high cost. To understand the nature of the material and minimise the disposal cost we recognised that a comprehensive sampling regime would enable us to segregate differing levels of contamination for the most cost-effective disposal solution.
- The outline design anticipated using 600 piles to support the building and we determined that the most effective solution would use CFA piles that provided certainty of loading capacity and predicable installation period. To develop the data needed to design the pile solution we identified that we would require a grid of boreholes up to 25m deep throughout the site.
- Early investigations indicated the site had a high water table. The proposed maintenance shed layout included numerous inspection pits and other voids constructed below ground level that required an understanding of groundwater conditions to determine the appropriate tanking requirements.

- The site drainage design also required a broader understanding of the location's groundwater conditions to develop an effective solution.
- During installation of heavy superstructure components later in the programme, including the shed steelwork and cladding panels as well as internal maintenance plant including overhead gantry cranes, we anticipated using mobile cranes that would require the installation of temporary crane pads.

By understanding these requirements from the outset, we developed a fully integrated solution that included a borehole and trial hole grid covering the entire site to provide comprehensive data from the outset in a single visit by our geotechnical team.

We used a small format drilling rig and completed all borehole drilling under an approved ALO plan so that the collapse radius oriented the rig to fail safe and fall away from the nearby track. This eliminated any programme risk owing to having to complete borehole drilling during rules of the route possessions.

The wheel lathe pit under construction

## OUR GI/SI SOLUTION MITIGATED AGAINST HIDDEN BURIED STRUCTURES

We installed the new depot wheel lathe within an existing building formerly used as a store.

By reviewing historic drawings and engaging with the depot management team we identified that the building location might have previously site redundant structures.

We therefore developed an integrated GI solution that cored holes in the slab and used probes to detect the presence of numerous concrete structures below ground that probably formed redundant foundations.

By using this GI strategy we were able to excavate and break out the redundant concrete in advance of installing the pit temporary works. This ensured that our temporary works were designed right-first-time and our construction methodology worked first time with no adverse impact on programme owing to the late discovery of hidden buried structures.

We deployed a track monitoring regime on all tracks and sidings that the borehole drilling activity might affect and we maintained a contingency track capability within our site teams, supported with jacking and packing tools and a supply of new ballast to attend to any arising track quality issues, although we never encountered any throughout the project.

We captured all information needed to deliver our piling and ground beam design and used this to also develop a temporary earthworks support solution within our permanent works design to excavate to reduced level to form the inspection pits. This removed the requirement to carry out further GI works once the piles were installed, and by incorporating the earthworks support into the permanent ground beam construction we considerably reduced the construction programme and delivery cost.

We used the material extracted from the boreholes within the spoil heap to carry out material WAC tests to determine the level of contamination. This eliminated the requirement to carry out separate sampling and ensured that we fully understood the nature of contamination from the outset. This enabled us to properly segregate differing contaminants to deliver our client the most cost-effective solution.

We used the boreholes for the groundwater wells to inform the inspection pit tanking design. This eliminated the requirement to carry out separate drilling operations and ensured that we could complete the 12-week monitoring period at the earliest possible date to minimise the overall construction programme. We positioned boreholes in the areas where we constructed the pits to deliver accurate information. This removed any requirement for further GI work once the pit construction was underway and eliminated any need for follow up design work to refine the tanking design to suit emerging ground conditions.

We also used the boreholes for the groundwater investigation to inform the drainage design. This ensured that our design included accurately sized pipes and layout, so the drainage installation worked first time and provided the most cost-effective solution.

We positioned boreholes and trial holes in the areas where we would eventually need temporary crane pads to install heavy superstructure elements. This enabled us to complete cost-efficient temporary works designs at the same time that we completed the permanent works design and therefore eliminated requirement for return GI visits to develop our temporary works designs. This also ensured that there were no unexpected ground conditions that would impact on our preferred construction methodology.

## WE VALUE-ENGINEERED AN OPTIMISED PILING SOLUTION

By working collaboratively with our subcontractor, we identified the potential project risks and developed a value-adding solution. By making this change early during the development stage we eliminated the risk and provided cost and programme certainty for our client.

The original Form 001 included a driven pile solution for the site's 600 piles. Driven piles rely on post-installation testing to ensure they achieve the required load bearing capacity. If the piles do not perform as anticipated this would either require additional piling depth or adding additional piles that would have a knock-on effect on the completion of the rest of the foundations. This would add cost and time risk to the programme and potentially introduce a delay during construction.

We worked with Franki Foundations during Early Contractor Involvement to develop an alternative solution that used Continuous Flight Auger (CFA) piles for the piles that are required to support the depot buildings.

The CFA piles are installed faster and more predictably that driven piles – reducing the overall construction programme by four weeks – and provide certainty over their load bearing capacity.

We then worked with Franki Foundations and Craddys to optimise the ground slab design to incorporate temporary earthworks support for the excavation of the depot's pit walls into the permanent works arrangement to save cost and time.