M6 Drainage & Earthworks improvements
Junction 21a - Junction 26

Project Profile

Client: SMP Alliance / Costain

Designer: WSP

Period: Nov '21—Aug '23

Value: £58m

Scheme Overview and general information:

- Tranche 4 scheme - all lane running. Located with Area 10. 7 junctions including ROC, 10 miles / 16.6km from Croft Interchange at J21a to the Orrell Interchange at J26. Forkers completed works to the North verge, South verge, and 4km in the central reservation between J21a and J23, totalling 37.2km. Peak total gangs - 42no. Working plus 3no compound gangs.

Deep Drainage Key Figures:

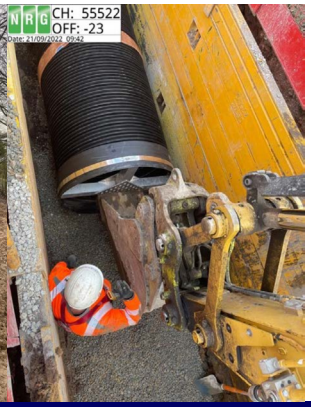
- 1090no. Chambers installed, 32.2km pipes installed, 7no. Vortex HPO chambers installed. Peak at 27no. Drainage gangs.
- Drainage tracker for production monitoring and interrogation for continual improvement - Pipe and chamber installation rates monitored to inform planned outputs and highlight high-performing and low-performing gangs. Data analysed to better understand the reason for variance in outputs.
- Uninhibited installation rate per shift of pipes: ≤300mm diameter pipe = 24lm; 375mm-600mm = 18lm; >600mm = 9lm.

Shallow Drainage (box cut, surface water channel (SWC), Slot Drain, combined kerb drains (CKDs), Bridge Deck Units (BDU's), Key Figures:

- 21km box cut completed, 20.5km edge of carriageway drainage installed.

Other bits to include:

- As-built surveys including CCTV of all pipework pre-HADDMS.
- Red-line mark up of drawings completed daily by hand on paper to record progress and blockers of individual gangs to inform APHEX and P6 programmes. CAD file updated weekly.
- Communication with client regarding design - blockers, design changes, TQs and EWNs raised formally on Client's preferred platform.
- Nights working - Safety concerns where there is interface with carriageway (such as installing CCDs, working across access gates, etc.) meant that working in these areas was only possible on nights where a lane 1 closure could be installed. Logistical issues such as clashes with other works is another reason we have moved work onto nights, ensuring programme and outputs are prioritised.
- Weekend working - purely programme-based at specified workfronts to help our client meet their committed end-date for the scheme.



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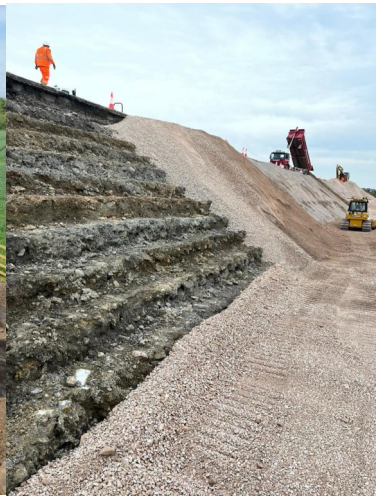

Earthworks overview:

- Full height regrades, granular wedges, cuttings. 148,000m^3 combined cut and fill, 32km verge reinstatement, 31.5km verge re-soiling.
- Peak 20no. gangs spread across both north and south verges. Daily wagon numbers fluctuate 50no +/- 10% depending on weather, location, type of works.
- Programme based on uninhibited combined cut and fill earthworks 150m^3 per shift.
- GPS enabled excavators to reduce need for setting out/engineering resource. Latest compatible and workable model is uploaded to excavator remotely.
- Large earthworks areas - use of a D6 dozer blade.
- Measurement of works by weekly GPS survey and compared to the pre-start GPS survey to confirm exact volumes. As-built surveys and 3D models produced on completion.
- Weekly earthworks output tracker to monitor works location, type of work, amount cut/fill, and gang number to highlight areas of strong and poor performance to start troubleshooting process. Example - rock encountered, causing outputs to drop. Identified early and additional resource provided to maintain higher outputs to mitigate programme impact.
- Wagon tracker to monitor driver, number of loads of stated materials imported, exported or tipped on site. Wagon counts cross referenced with daily allocation sheets to monitor outputs.
- Significant areas of Himalayan Balsam and Japanese Knotweed to be removed, requiring specialist disposal.

Ground Engineering:

- Treatment of 8no. mineworking shafts along the network for gantry locations (drilling and grouting).

Logistics overview:

- Access and egress gates along motorway spaced 1km apart, creating approximately 30no. Workfronts.
- Targeted works through accesses to maintain flow of works traffic and avoid saturation of work areas.
- Fully integrated programme - collaborative planning systematically.
- Daily SOS meeting to collaborate and discuss changes to access/exit gates with other contractors.

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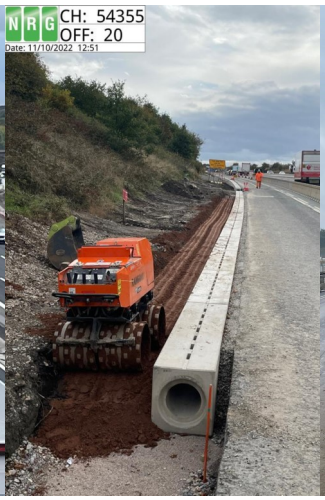

Environmental

- Embraced innovation, biodiversity and carbon reduction.
- Plant idling down from 55% to 17% through use of Machine Max; obtaining real data from machines and drivers on the scheme, analysis of data and briefings to drive behavioural change.
- 70,000T of hard dig removed from site was transported to the main compound where it was processed, tested and classified for use on site by our Earthworks crews.
- Wagon tracker to monitor driver, number of loads of stated materials imported, exported or tipped on site.

Innovation:

- Spillard Safety System AI detection for PPI incursions.

Resources:

- Peak production September to November 2022; gangs undertaking drainage and earthworks within the verges and logistics management within the compounds—45no. Total split over days and nights.
- Planned labour and plant resource allocation to work areas communicated weekly and updated daily as works progress.
- Trackers installed on hired vans to monitor gang movements and reduce wastage.
- Relationships with key supply partners - Albatross, Kilkern, Flannery's, Groundshore, Tracey Concrete, Polypipe, Bettamix, Hansons, Tarmac, SED Environmental.

Other things we did:

- Weekly foreman's and engineers round table to discuss and resolve all issues across site
- Training supplied—TWS and Redzone training
- CHECKEDSAFE
- 5no. NB ERAs and 5no. SB ERAs constructed as part of the scheme. Forkers completed drainage, earthworks and kerbing but handed work area over for other trades (technology/ducting/comms, surfacing, structures).
- Quality assurance handover - hard drive issued to client containing all drainage CCTV footage, all Manhole Cards, 2D as-built drainage drawings, 3D as-built earthworks models, all materials datasheets, all completed trackers, and tools to maintain new assets.

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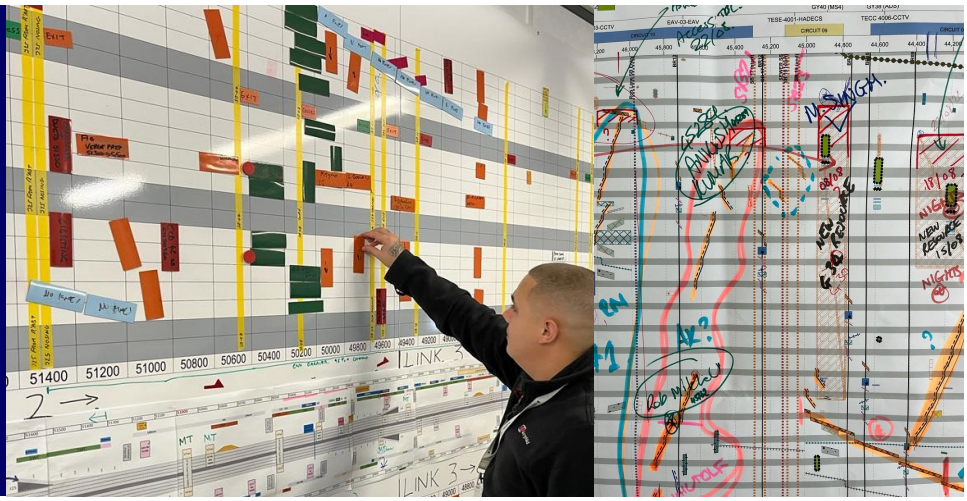
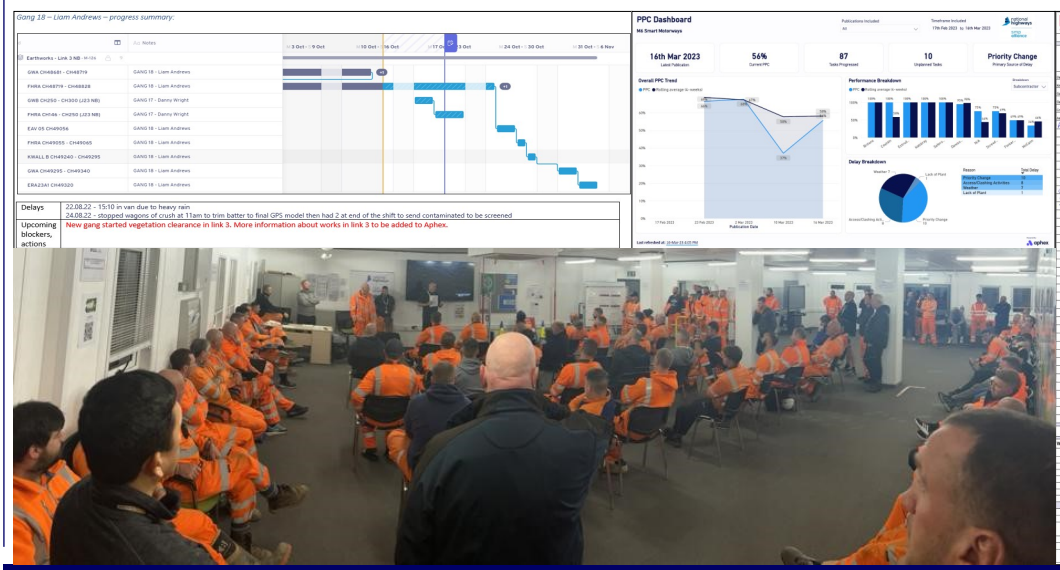
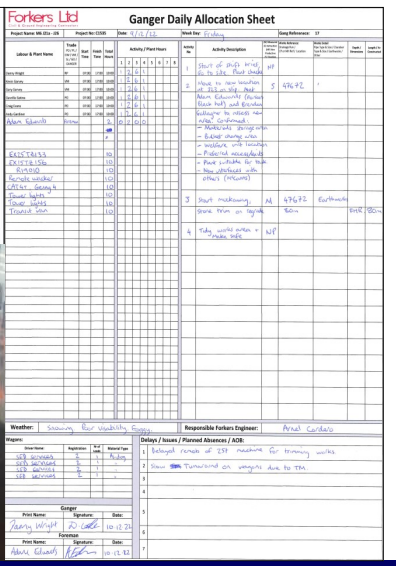


Planning and Production Monitoring:

- Fully integrated planning and monitoring system involving all drainage and earthworks.
- SMA collaborative plan signed by contractors senior managers to commit to significant milestones.
- Weekly "magnet meetings" take place to review planned upcoming works with other contractors to highlight any expected saturated works areas. Where this is likely to occur and outputs are likely to be impacted, works are either reschedules to later in the programme, or work can be moved to the nightshift if it is time-critical. In some cases works were double-shifted on days and nights in order to hand the works areas over to others earlier, bringing the end date in.
- Changes to the planned works as a result of the magnet meeting are reflected in APHEX before it is reviewed weekly in a collaborative environment. The weekly APHEX meeting is to review progress and confirm planned works.
- Daily "start of shift" meetings to discuss the planned works for the next shift and any changes to access and exit gates.
- Planned activities/sequence is loaded into APHEX. Each activity is assigned a unique ID number. APHEX is a collaborative online software used by all contractors on the project to continually monitor planned and actual production, and to highlight any interface on planned works. Delays to production are assigned reason codes and these are analysed by the Forkers' team to find common themes that cause reduced production. Weekly meetings with the other contractors to discuss works completed and upcoming planned works have been essential to mitigate any interface and reschedule work. APHEX is used to update the master programme for the scheme monthly, and is converted to TILOS diagrammatic programme.
- Collaborative working to produce a detailed master programme through programme and design workshops, monthly joint TILOS detailed review sessions, and bi-weekly reviews to track significant changes to programme.
- Forkers' Efficiency Dashboard was created to capture and monitor variables that may have impacted on productivity as reported on ganger's daily allocation sheets as well as APHEX. Understanding the impact of the delays enabled the PM to make informed decisions regarding resourcing and logistics to deliver the works without impacting heavily on productivity. This was achieved by cross referencing the daily output drainage tracker alongside the qualitive information recorded