Gas Pipeline Diversions & AGI Construction for A1 Improvement Scheme

Ref:	RE 5781
Client	Northern Gas Networks
Value	£11.6m
Location	Birtley, Gateshead
Duration	14 Months
Completion	March 2022

PROJECT OVERVIEW

Northern Gas Networks (NGN) own and operate the Lamesley Above Ground Installation (AGI) site at the Team Valley Trading Estate in Gateshead. Adjacent to the A1 motorway, this site supplies Natural Gas, at varying pressures, to the Local Network.

To facilitate the construction of the new A1 Improvement Scheme, NGN needed to relocate their existing infrastructure. The project, spanning from Allerdene Railway Bridge to Birtley Interchange (A1 Junctions 65 to 67), is part of the Highways England broader strategy to upgrade the A1 Newcastle Gateshead Western Bypass, one of the North East's most congested highways. The works included the improvement and widening of 6.5km of carriageway and the replacement of the Allerdene Railway Bridge.

The proximity of the NGN Pipeline(s) and AGI to the proposed roadworks, necessitated relocation in advance. As part of the project, the Pipeline crossing the A1 was upgraded to a new 600mm (24") Steel Pipe, buried at a greater depth with improved geometric alignment to accommodate the widening, repositioning, and new elevation of the highway.

This extensive effort required the demolition of the existing NGN AGI at Lamesley, the construction of two new AGIs, and the diversion of nine gas pipelines, detailed as follows:

- 1 x 450mm (18”) High Pressure (HP) Steel Main.
- 5 x Intermediate Pressure (IP) Mains.
- 2 x Medium Pressure (MP) Mains.
- 1 x Low Pressure (LP) Main.

Due to its critical importance the work was assigned as Nationally Significant Infrastructure Project status, as defined by the Planning Act 2008. For further information, please see – A1 to Birtley to Coalhouse Improvement Scheme Project Information.

See Highways England A1 Birtley to Coalhouse flythrough video

SCOPE

Rayden Engineering Limited (REL) were employed in the role of Principal Contractor (under CDM 2015) to complete all necessary works of this major infrastructure project.

A key factor of the works was to maintain security of gas supply and increase the wider health of the infrastructure by upgrading any aged pipework and equipment, where possible.

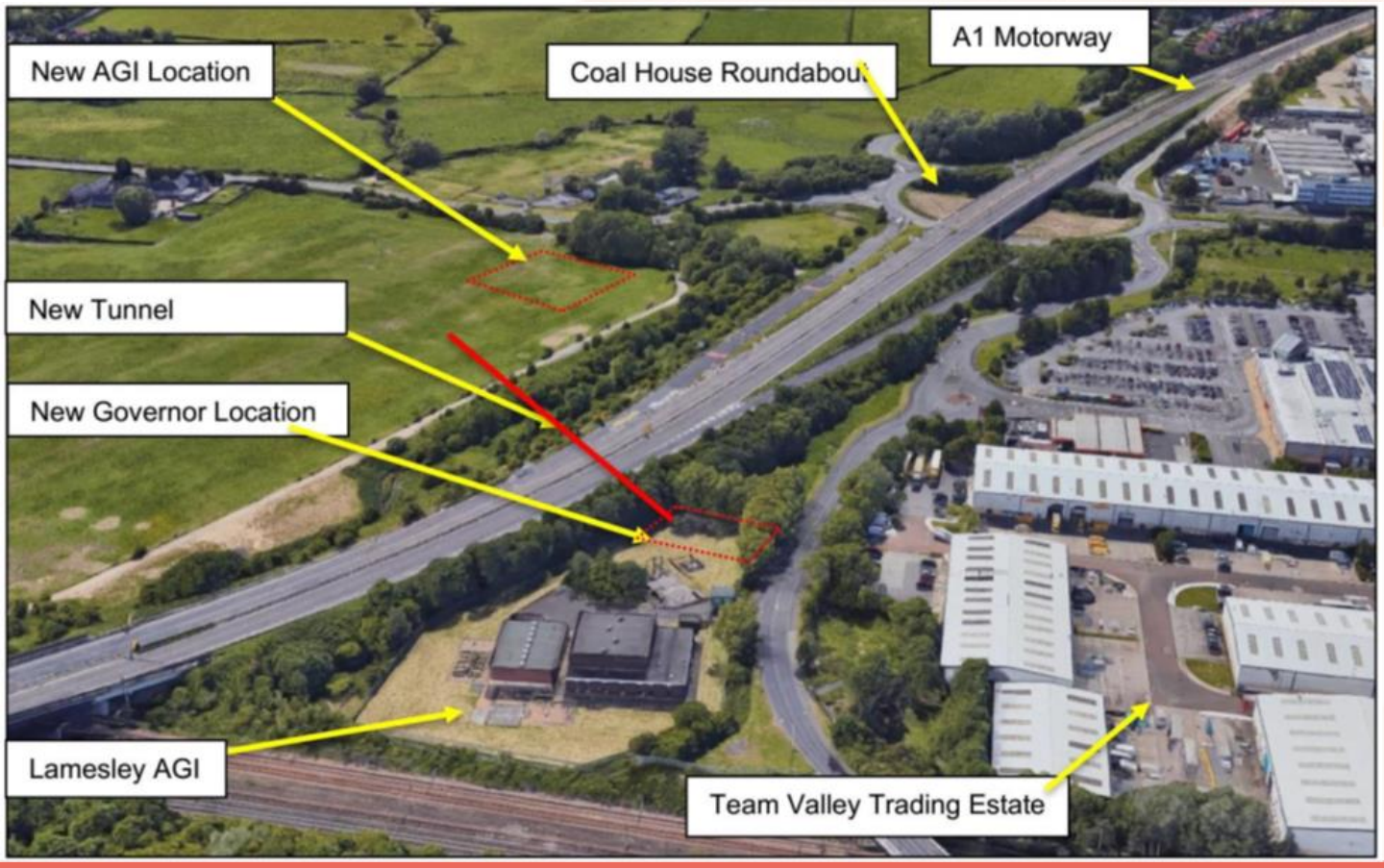
Project scope consisted of all mechanical & civil works for fabrication, construction, installation & commissioning / decommissioning of:

1. New Lamesley AGI on South side of A1.
2. New Allerdene AGI (Governor Station) at on North side of A1 adjacent to existing AGI (to be removed).
3. New HP & IP Pipelines to supply new AGI (Lamesley) running beneath A1 motorway.
4. New MP & IP Pipelines from new AGI (Lamesley) to local network & to new Governor Station (Allerdene AGI).
5. New LP, MP & IP Pipelines from the new Governor Station (Allerdene AGI) to the Local Network.
6. New LP Pipeline at Coal House Roundabout to replace existing.
7. Demolition & decommissioning of existing Lamesley AGI & any redundant pipework.

SERVICES PROVIDED

All work was delivered in accordance with IGEM/TD/1 Edition 5 and required NGN specifications.

Materials recovered during on-site work were recycled where possible, and the site was backfilled and fully reinstated upon completion



Ariel View of 600mm (24") Pipeline Diversion Route Beneath A1 Motorway & New AGIs Sites North & South

Construction of & Installation Work for New Pipelines

New Pipeline Beneath A1 Motorway

A new 600mm (24") IP Pipeline, 300m long, was installed beneath the A1 Motorway using the Microtunnelling Trenchless System. To connect the new Allerdene and Lamesley AGIs, the Pipeline was positioned at a depth exceeding standard requirements and enclosed within a precast structural concrete sleeve to mitigate potential surcharge loading from the motorway's new embankment.

Microtunnelling Works

Over half of the Pipeline, approximately 160m, was routed through the microtunnel and carefully positioned between the foundations of the new Road Bridge. The enabling works involved the Deep Excavation of a Launch Pit (16m deep, 8.2m dia) and a Reception Pit (19m deep, 5m dia) to accommodate the state-of-the-art Microtunnel Boring Machine (MTBM), which served as the entry and exit points for the drill and Pipeline route. Due to the higher ground on the North side of the A1, the Reception Pit was 3m deeper to ensure alignment between the shafts, achieving a positive gradient of approximately 5°.

Caisson Method for Construction of Temporary Shafts

Given the challenging ground conditions, the caisson method was used to construct both temporary shafts. Smooth-bore, segmental, jacked caissons were employed, ensuring structural stability, safety during excavation, and precise alignment for the microtunnel beneath the A1 motorway. Prefabricated reinforced concrete segments were incrementally assembled on-site to line the inside of the shafts. Hydraulic jacks were then used to push the segments downward as soil was excavated from within the caisson.

Temporary Works (TW) were implemented to support shaft construction, including structural reinforcements, safe access and slurry systems to manage groundwater and spoil.

Aerial View of Site Works

Construction of New Pipelines (Cont'd)

REL delivered the following works:

1. Conducted full Ground Penetrating Radar (GPR) & geometric survey of site for intended works.
2. Completed all civil works required for pipeline diversion including excavation, backfill & reinstatement.
3. Performed excavation works at tie-in locations to execute P18 works.
4. Diverted & tied-in existing 17 bar 450mm (18") pipeline into new Lamesley AGI, with welding completed to NGN/SP/P/2 & Non-Destructive Testing (NDT) to NGN/SP/NDT/2.
5. Fabricated, welded, tested, installed, coated & painted all pipework.
6. Constructed & performed deep excavations for launch (16m deep, 8.2m dia) & reception pits (19m deep, 5m dia) for MTBM using the jacked caisson method.
7. Delivered TWs including 2m Hardstanding area surrounding Shaft Pits, concrete bases inside shafts & access ladders.
8. Constructed 160m long, 1.2m dia microtunnel beneath A1 using closed face MTBM.
9. Installed pre-cast concrete structural tunnel sleeve to house diverted pipeline.
10. Constructed, installed & tested new 600mm (24") IP pipeline connecting new Lamesley AGI to new Allerdene AGI using open cut method & insertion through concrete sleeve beneath A1.
11. Executed tie-in of 600mm (24") IP Pipeline with swan neck arrangement welded to host pipe, NDT, coating & installation of pipe supports.
12. Carried out flexible grouting of concrete tunnel sleeve & shaft annulus space.
13. Removed TWs & backfilled shafts.
14. Tested all pipework to relevant standards & specifications & dried as applicable.
15. Completed welding at hot-tap locations included material sampling (q/10) & constructed, tested & installed any required bridle / bypass pipework.
16. Removed redundant pipelines (where possible); ground compacted to Highways England specification.
17. Grout filled any non-removable pipework, such as old pipeline running beneath A1.
18. Fabricated, welded & tested all M & LP pipework, hot-taps & bypasses.
19. Ensured welding standards compliance:
    - I. HP Pipeline welding to NGN/SP/P/2 (2018).
    - II. IP, MP, and LP Pipeline welding to NGN/SP/P/1 (2019).
    - III. Hot-tap welding to NGN/SP/P/9 (2019).

Construction of Caisson Shafts Using Hydraulic Jacks

Construction & Installation Work for Two New AGIs

The existing AGI at Lamesley was demolished and replaced with an upgraded facility on the South side of the A1. This included two sets of regulators for pressure reduction across two pressure tiers (IP and MP), new filters, new metering skid, a boiler house package, new heat exchangers, a backup generator and an electrical and instrumentation kiosk (E&I). The work also included provisions for a future Compressed Natural Gas (CNG) filling station.

A second, smaller AGI (Governor Station) was constructed North of the A1 at Allerdene, adjacent to the old AGI. This AGI provides gas to the Team Valley Trading Estate and Low Fell area of Gateshead. It consists of two sets of regulators (IP/MP and IP/LP) and a new E&I kiosk.

REL delivered the following works:

Demolition & Civil Works:

1. Demolished old Lamesley AGI site, including removal & disposal of all pipework & redundant equipment (above & below ground).
2. Demolished redundant transformer & regulator buildings.
3. Executed all civil works required for constructing new Allerdene & Lamesley AGIs, including excavation, buildings, concrete bases, pipe supports, skid units, filter banks, heat exchangers, E&I kiosks, generator, transformer, & meter kiosks.
4. Graded & levelled ground at existing Lamesley AGI site using site-won materials.

Pipework Fabrication & Installation:

5. Fabricated 90% of pipework off-site at REL HQ Workshop, delivered to site by REL haulage team for installation to agreed programme.
6. Completed welding within AGIs to NGN/SP/P/8 (2017).
7. Fabricated & installed all pipe supports for the new pipework.
8. Installed all new pipework & painted to NGN/P/A/10 & CW5.

Completion Works:

9. Constructed new access roads & paths.
10. Supplied & installed new perimeter fencing & entrance gates for AGI compounds.
11. Full site clearance, reinstatement & demobilisation.

OUTCOME

REL worked closely with NGN to successfully deliver this project on time, within budget, and without major issues.

Key efficiencies were achieved in time and cost by completing 90% of the AGI pipework offsite at REL's fabrication facility. This included specification-compliant construction, inspection, pressure testing, and painting before transportation for onsite installation and commissioning.

The use of microtunnelling to install the new pipeline under the A1 motorway offered significant advantages over traditional Open-cut Methods. This technique ensured rapid, safe, and all-weather operation without disturbing the ground above, minimising traffic disruption and local community impact. Reduced soil excavation and backfill requirements also lowered onsite machinery use, resulting in an environmentally friendly process with reduced carbon footprint and minimal impact on local wildlife.

Advanced laser-guided technology enabled precise tunnelling and accurate Pipeline alignment.

The project was completed within 14 months, adhering to the approved design, RAMS, and CDM 2015 requirements. Full handover was delivered in March 2022.

AGI Compound & Pipework

Concrete Lined Caisson Shafts for MTBM Work

600mm (24") Pipeline in Concrete Sleeve Beneath A1

Pipework from Microtunnel Connecting AGIs North & South

Belowground Pipework Supplying AGI