Glencorse WTW Project

pipe production facility bringing major benefits to Edinburgh scheme

by
Richard Anderson

The £130m Glencorse Water Treatment Works Project, currently under construction, will serve approximately 450,000 customers in Edinburgh. As well as a new 175 MLD Water Treatment Works and 90 ML Clear Water Storage Tank being built at Glencorse on the outskirts of Edinburgh, over 15 km of 1200mm diameter pipelines will transfer the treated water.

Glencorse Aerial *Courtesy of Scottish Water Capital Investment Delivery*

A dedicated on site pipe factory has been established to produce the large diameter pipes with the aim of reducing capital costs, manufacturing time, CO_2 emissions, pipe deliveries, pipe welds, handling and the associated construction risks. The mobile pipe manufacture concept is an innovation being implemented for the first time in the world by Scottish Water, pipe innovation partner, KWH Pipe and construction partner, Black & Veatch.

Background

The first decision to be made to allow mobile pipe production to be used was the choice of pipe material. The project team undertook investigations to demonstrate that polyethylene was the most appropriate material, despite the misconception that PE pipes were not suitable at the diameters required.

As well as being the most economically efficient material, its carbon footprint is a fraction of the most commonly used alternative, ductile iron. The energy required to manufacture, transport and install PE pipe is also lower than alternative materials. Further savings are achieved by using PE pipe in the installation phase as the welded pipes do not require thrust blocks which would have required enormous volumes of concrete at this diameter.

Rather than manufacture and transport pipe from KWH Pipe's production units in Scandinavia, it was decided to set-up a pipe manufacturing facility adjacent to the actual pipeline route to achieve further economic and environmental benefits.

This involved KWH Pipe taking over a derelict area of land in Edinburgh's Green Belt adjacent to the pipeline route and transforming it into an area suitable for both on-site pipe production and pipe storage. A large area of land had to be cleared and then prepared and at the same time, a completely new power supply installed.

At the end of the project, the production unit will move onto another project somewhere else in the world and the land will be enhanced by reinstating the site with improved grasslands and trees in line with local planning requirements.

Benefits

To maximise efficiency and ensure the pipeline element of the Glencorse project is delivered on time, the pipe production unit runs 24 hours a day, 7 days a week. Manufactured pipe can be taken directly from the production unit onto the actual pipeline route on a constant basis, without the need for special deliveries or lifting equipment. This also means that irrespective of road / weather conditions, there will always be sufficient pipework available for welding and installation, resulting in no standing time for expensive pipe laying plant and equipment.

In real terms, it means that all 16km of 1200mm pipe can be manufactured and delivered to the pipeline route in approximately six months, which is almost 2.5 times quicker than by traditional road deliveries and off-site pipe production. In addition, there is no need to divert cranes and lifting equipment away from their main tasks in order to off-load vehicles.

Finally, as the pipe is produced "on-site", pipe lengths can be greatly increased (ie 22 metres long), which would not be possible by using traditional delivery vehicles - this means fewer pipe joints and hugely reduced installation costs.

In real terms, existing methodology would deliver the following:

- 16000 metres of pipe produced in Scandinavia
- = 1230 pipes (@ 13m ea.)
- 300 pipe deliveries (@ 4 per truck)
- = 3164 km each delivery journey
- = 975,500 km (each way)

Using the mobile pipe production plant, the following is delivered:

- 16000 metres of pipe produced in Midlothian, resin from Germany
- = 727 pipes (@ 22m ea.)
- 100 resin deliveries (@ 30T per truck)
- = 1515 km each delivery journey
- = 151,500 km (each way)
- i.e. 1/6th distance or 15%

The overall benefit is 1.64 million km (over 1 million miles) in road journeys saved and 1530T CO_2 saved.

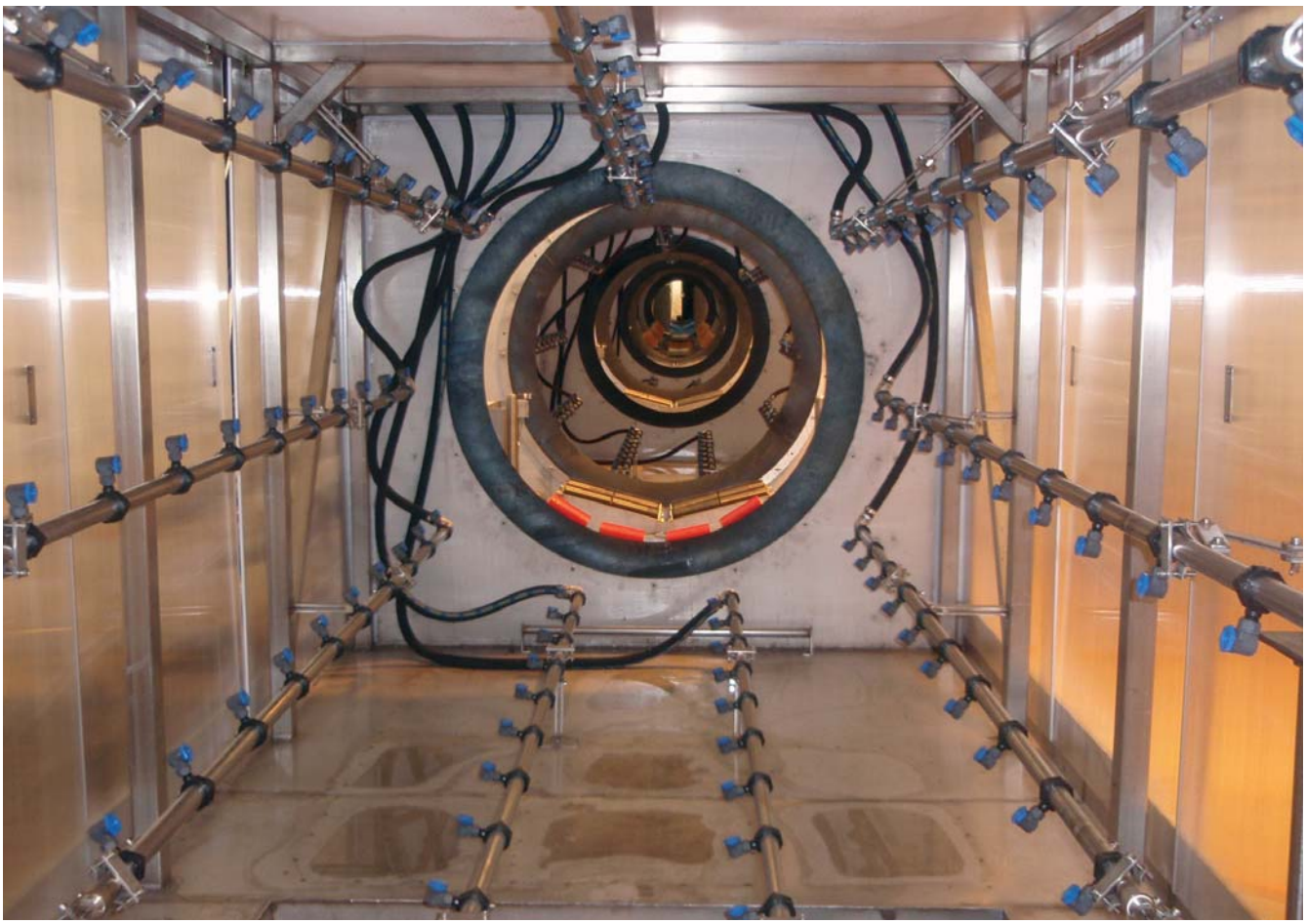
In terms of construction benefits, the traditional solution would require:

- 16000 metres of pipe produced in Scandinavia
- = 1230 pipes (@ 13m ea.)
- = 1229 pipe welds
- 205 welding days (@ 6 welds per day)

Using the mobile pipe production plant, the following benefits are realised:

- 16000 metres of pipe produced in Midlothian, resin from Germany
- = 727 pipes (@ 22m ea.) = 1/3 less pipes to string along site
- = 726 pipe welds

Glencorse Aerial *Courtesy of Scottish Water Capital Investment Delivery*



Glencorse Pipe Production plant *Courtesy of Scottish Water Capital Investment Delivery*

- 121 welding days (@ 6 welds per day)
- = 503 pipe welds saved (energy)
- = 84 welding days saved (cost)
- = 16 weeks saved (time)

PE pipe also has a significant advantage over other pipe materials in that it offers a wide range of different pressure ratings. The project team examined the pipeline route to identify where lower pressure rated pipes could be installed. This provided significant cost and time savings over using a uniform pressure rating of pipe. The mobile pipe production plant has the flexibility to modify the pipe wall thickness to suit different pressure ratings. The thinner walled pipes require less material, can be welded quicker and are lighter and therefore easier to transport and install.

Once operational, the site and pipe production process has zero wastage. There is no waste stream or sewer requirement, the raw material is brought in pallets of 25kg bags of polymer and the pallets are recycled and even the plastic bags of pellets are returned to the manufacturer for recycling. Water, required for cooling, is retained within the process and goes through a recycling facility on site to be continually re-used in the pipe cooling process.

H&S Benefits

The benefits include a significant reduction in the number of pipes, joints, handling and transport needs. The pipe material also significantly reduces the amount of time that construction operatives require to spend within excavations compared to more traditional pipe materials. Also, the reduction in highway traffic has a major local benefit to the local community who use the roads in the area.

Risks

The two main risks identified by Scottish Water in KWH Pipe setting up the mobile production unit were (a) what would happen if no electrical power were available (b) how to monitor the produced pipework for QA requirements.

When the possibility of setting up the mobile unit was first discussed, Scottish Water requested that a completely new power supply solely to service the mobile production unit be installed. Scottish Water were able to monitor and control the risk of delayed power installation by instructing KWH Pipe to have this element of their operation planned and installed by Integrated Utility Services, a Scottish Water Framework supply chain partner, who have responsibility for all Scottish Water's electrical installations.

Scottish Water have also insisted that on a weekly basis, copies of production records, detailing pipe dimensions for each and every pipe produced (each pipe has its own unique number), be supplied to Black & Veatch.

In addition, on a joint visit to KWH Pipe's production unit by representatives of the English and Scottish Drinking Water Quality Regulators and Scottish Water, it was agreed to send samples of manufactured and jointed pipe from the on site factory to an independent laboratory for testing and that a sample of a welded joint be sent to KWH Pipe's own accredited laboratory for weld testing. The weld testing will be repeated several times during the duration of the project.

Further, with all pipes, the key risk to integrity is the joints or welds in the case of plastic pipes. By employing longer lengths of pipe, over 500 joints/welds are removed and provides a more robust pipeline.

The Glencorse project is due to complete in 2011.

Note: ***The Editor & Publishers thank Richard Anderson, Senior Project Manager with Scottish Water Capital Investment Delivery.***■

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