PE PIPE NETWORKS AND THE INSTALLATION OF ELECTROFUSION JOINTS – LESSONS FROM THE CHRISTCHURCH EARTHQUAKE

Mark Habel, Technical Manager, Plasson Australia

ABSTRACT

In February 2011, a 6.2 magnitude earthquake caused devastation to buildings, roading and infrastructure in Christchurch, New Zealand. Over 6,500 people were injured and 185 people lost their lives.

Following the earthquake, Christchurch City Council (CCC) was faced with a major rebuild of the city's water and wastewater pipeline network. Due to its flexibility and ductility, the existing polyethylene (PE) watermain pipeline network performed remarkably well during the quake and CCC chose PE as the material of choice for new water and wastewater pressure pipelines.

As the rebuild began, a large number of construction workers arrived in the city to work on the rebuild. Many of the workers were inexperienced in the installation of PE pipelines and specifically the installation of electrofusion jointing used to connect the pipework. The lack of knowledge resulted in wide spread failures of newly installed pipeline joints.

CCC implemented testing and monitoring oversight which installers were required to follow. The result was electrofusion weld failures fell from 30% after the earthquake, to less than 1% within the next 18 months. The system is still in place today and mandatory weld testing shows failures account for less than 0.3% of all welds tested.

1.0 INTRODUCTION

Due to its range of attributes including ductility, flexibility and non-corrosiveness, Polyethylene (PE) is increasingly being selected as the material of choice for pipeline applications ranging from municipal water and waste water networks to irrigation, mining, gas and plumbing.

Butt welding and electrofusion are the 2 common methods used to join PE pipework. There has long been an underestimation of the knowledge and skill required for the successful installation of electrofusion joints and as the use of PE increases, the shortfall in installation skill is leading to concerns about pipeline integrity.

Some asset owners have tried to prevent the installation of EF joints. Alternative joining methods can add significant time and expense to new pipeline networks. A better approach is to improve the oversight of electrofusion installations by asset owners and the skill of installers. Christchurch City Council showed a well managed installation system can mitigate installation risks and deliver a long lasting, leak proof and robust pipeline system.

Christchurch, New Zealand 22 February 2011

2.0 DISCUSSION

The paper is based on the author's experience in the supply of electrofusion joiners to post-quake Christchurch. It includes (i) observations of the steps CCC undertook to guarantee it's pipeline network integrity (ii) interactions with material testing laboratories (iii) discussion with design engineers and (iv) training of installers.

CCC developed an oversight methodology which drove down installation risk and improved the integrity of a key asset.

2.1 Installation Statistics

Table 1:

Length of Chritchurch's water and wastewater supply pipeline newtork	3400 km
Pressure waterman pipe OD's	75 - 600 mm
Number of workers immediately post earthquake carrying out installation work	200 +
% Electrofusion test welds which failed lab testing	30% +
Number of installers within 18 months of CCC oversite system implementation	20
% Electrofusion test welds which failed lab testing following oversite	< 1%

2.2 Challenges

The council oversite system met with initial resistance from contractors. Contractors had to choose between upskilling or declining certain types of work. Contractors had to invest in equipment required to carry out work required for varying pipe sizes. They were also forced to stand behind their workmanship – joint failures were replaced at their expense.

As the oversite system 'bedded in', contractor skills improved, trust developed between the CCC and installers and the system flowed well.

3.0 CONCLUSION

- Current electrofusion installation processes are frequently substandard
- Asset owners must develop oversight systems for pipeline installers to follow
- The cost of oversight is low compared to the increased lifespan of the asset
- Oversight ensures key pipeline assets have long term integrity

4.0 ACKNOWLEDGEMENTS

The author wishes to thank Donald Booth, Christchurch City Council for his contributions and input to this paper. Residents of Christchurch can thank Donald and his team for implementation and management of a system which has produced a world class water and wastewater pipeline asset.

5.0 REFERENCES

- Donald Booth, Contract Supervisor, Reticulation & Maintenance, Christchurch City Council
- Leighton Read, Fusion Solutions Ltd
- Kiwi Testing Laboratories
- O'Rourke, Jeon, Toprak et al 2014
- Noell, B. Seismic Performance of Plastic Pipe, 2013