

A COLLABORATIVE APPROACH TO A SEWER REHABILITATION PROJECT

McNaught, I.B. Iplex Pipelines (NZ) Ltd

ABSTRACT

With a technically challenging sewer rehabilitation project to be completed, Hastings District Council sought a collaborative approach that would bring together the design team and construction company to achieve the best possible result. The outcome was the successful installation of some 2,400 metres of PVC sewer pipe via open cut trench, HDD and pipe bursting techniques in and around public streets and private homes in Havelock North.

This included a section of 44 metres of 300mm pipe with an invert of 5.7 depth metres and a pipeline route under a shared public driveway close to private homes. RESTRAIN™ threaded joint SN16 PVC pipe manufactured in 1-metre lengths was used for this section and assembled inside the manhole prior to pulling into place with the HDD rig.

This paper reviews the project completed in July 2009 and looks at the installation process, selection of materials and impacts of the construction on the surrounding environs.

KEYWORDS

Collaboration, HDD installation, pipe bursting, PVC sewer pipe

1 INTRODUCTION

Over the last ten years Hasting District Council have been upgrading the gravity sewer network in Havelock North, a small Hawkes Bay town of 10,000 residents about seven kilometers southeast of Hastings. Originally settled in the mid 1800's on the prime horticultural land of the Heretaunga Plains, Havelock North has seen a more recent increase in population driven by new subdivisions and housing developments. This has resulted in further pressure on the aging pipe infrastructure resulting in the most recent trunk sewer upgrade.

The Southern Interceptor Extension project was required to upsize and link sections of the existing sewer network to better manage increased demand. The works were located in three adjacent areas in the middle of the town and had the potential to impact on commercial and residential properties plus major roads and local amenities. As the pipeline routes pass through ninety-two private properties managing the effects of major civil construction in a small urban environment was going to be a key issue for the stakeholders involved.

The design phase of the project was awarded to MWH Hastings, in conjunction with specialist project managers and expertise from HDC/MWH Alliance. This collaborative approach brought together external design expertise along with Councils in-house knowledge and experience and smoothed the communication lines between principal and designer.

Conventional SN16 rubber ring joint PVC-U sewer pipe was selected for the open cut sections of the project however, this also presented the design and construct teams with a conundrum in selecting pipe materials for the trenchless sections. It was recognized that the trenchless sections would not be fully identified until well into the project as site conditions and homeowner consents could change. There was also the issue of connecting back into the RRJ PVC pipe and concrete manholes so a system that was easily compatible with this was required.

The Restrain™ threaded joint PVC-U pipe system was identified as the most suitable trenchless option and could be supplied in a variety of pipe lengths to suit the different trenchless methodologies that were likely to be employed. The Restrain™ pipe is fully compliant to AS/NZS 1260, *PVC-U pipes and fittings for drain, waste and vent applications*, so dimensionally matched the rubber ring joint pipe and industry standard methods for connection into concrete manhole structures.

2 EARLY CONTRACTOR INVOLVEMENT

With the complexities of the project, difficult site access, varying construction methodologies and the need for close public liaison, Council identified that early contractor involvement in the project would be key to a successful outcome. They therefore tendered for Registrations of Interest in the project and accepted two proposals from contracting companies. One of these organizations subsequently withdrew partway through the design process leaving Infracon Hawkes Bay Ltd as the successful partner company.

Infracon and their main sub-contractor East Coast Utilities worked closely with the HDC/MWH Alliance throughout this phase providing information on construction practices and trenchless methodologies that would be best suited for the project. They also undertook site investigations and managed the public liaison aspect of the project, a process that commenced two and a half years prior to works commencing.

2.1 KEY ISSUES

- Providing certainty of the future stability of homes and structures located on or adjacent to the pipeline route.
- Reinstatement of private gardens and properties to a level acceptable to the homeowners
- Contractor operating within property boundaries and ensuring security of homes and property in addition to personal privacy
- Street works, traffic and pedestrian management and safety
- Public safety whilst working within property boundaries
- Installation of the pipelines to grade and alignment within secured easements
- Compatibility of pipe in the open cut and trenchless sections

3 PROJECT LOCATIONS OVERVIEW

The Southern Interceptor Extension Project comprised three sections of work identified as;

- Porter Tanner Interceptor
- Lucknow Road Link
- Palmerston Interceptor

3.1 PORTER TANNER INTERCEPTOR

Section commenced at an existing manhole in Porter Drive and extended a total of 911 metres through to Tanner Street. The bulk of this section was installed by open cut using DN375 and DN300 rubber ring joint PVC pipe. The pipeline route extended around the existing Havelock North Bowling Club, across Christie Terrace and through eleven private properties before entering Joll Road down to Tanner Street.

Included in this section was the traverse of an existing weir structure for a small tree lined stream running through the back of a number of the private properties. After placement of the new pipeline, the concrete weir was rebuilt with the surrounding stream area reinforced with rock gabions.

The first section of trenchless pipe installation also took place with approximately 70 metres of DN300mm Restrain pipe used in pipe bursting of the existing DN150 earthenware and un-reinforced concrete pipe. The experience gained in this first trenchless installation was to prove invaluable to the construction and design teams when the more difficult trenchless sections in the later part of the project were tackled.

3.2 LUCKNOW ROAD LINK

Section commenced at the newly installed DN375 PVC sewer adjacent to the weir structure and passed through two private properties before entering Plassey Street, onto Crosby Street then finally connecting into a new 1050 diameter manhole on Lucknow Road. A total of 343 metres of DN300 rubber ring joint pipe was installed by open cut along with eight new 1050 diameter manholes.

3.3 PALMERSTON INTERCEPTOR

Section commenced at a new manhole installed in Middle Road and transited down Palmerston Road for 258 metres into a 2.2 metre deep manhole before an alignment change taking the pipeline path beneath existing private properties. The pipeline ultimately terminates at a manhole at the junction of Iona road and Margaret Ave, a total distance of 887 metres of which 255 metres was installed by trenchless methods.

Two key trenchless sections were installed in this part of the project, a 44-metre horizontal directional drill under a private right-of-way and a 77-metre pipe burst between two private residential properties. These two trenchless sections presented the greatest potential construction challenge but ultimately, proved the most

straightforward to construct due to good planning and innovative thinking by the contractor. A further directional drill installation of 134 metres was also completed down Iona Road.

4 INSTALLED PIPE MATERIALS

4.1 RUBBER RING JOINT PVC-U SEWER PIPE

Industry standard rubber ring joint socket and spigot SN16 PVC-U sewer pipe manufactured in accordance with AS/NZS 1260, *PVC pipes and fittings for drain, waste and vent applications* in diameters DN375, DN300 and DN225 was supplied by Iplex Pipelines. A mix of 6 metre and 4 metre effective lengths were used, depending on depth to invert and individual site requirements.

4.2 RESTRAIN™ THREADED JOINT PVC PIPE

RESTRAIN™ PVC pipe was developed specifically for installation by trenchless methods. It comprises a threaded socket and spigot joint with integral rubber seal ring. The joint and seal ring system are compliant with AS/NZS1260. The joint is designed so that either tensile or compressive loads can be accommodated thereby providing versatility for installation methods including;

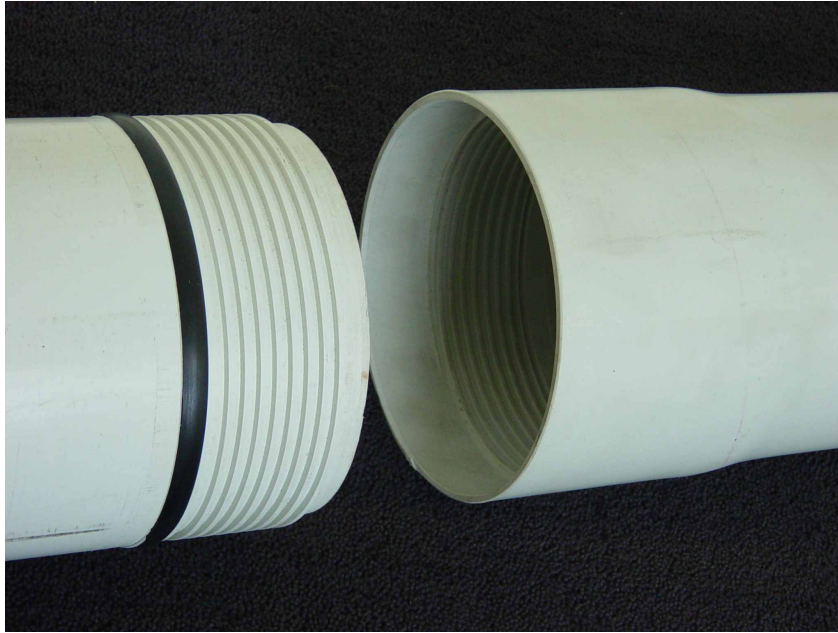
- Horizontal directional drilling
- Auger boring
- Guided boring
- Static pipe bursting/cracking
- Micro tunneling

4.3 RESTRAIN™ SPECIFICATION FOR DN300 PIPE

Manufacturing Standard AS/NZS1260 (PVC-U)

Stiffness rating	SN16
Pipe OD	315mm
Maximum tensile load	12,000 kg
Maximum compressive load	12,0000 kg

Photograph 1: Restrain™ pipe threaded joint system



5 PALMERSTON INTERCEPTOR TRENCHLESS INSTALLATION

The first trenchless section to be installed in the Palmerston Road interceptor was under a private right-of-way, Iona Mews, as the original pipeline path was not viable due to insufficient room. The lead manhole at the intersection with Iona Road had a depth of 5.7 metres and was installed as an open caisson by sinking the manhole as material was excavated from the inside. Photograph 2 shows the planned pipeline route between Sections 32 and 34.

Photograph 2: Iona Mews; Proposed pipeline routes



The Horizontal Directional Drilling (HDD) rig was located adjacent to the new manhole location in the bowl of the cul-de-sac, with the drill directed up the centre of Iona Mews from a start depth of 2.9 metres to the caisson manhole. Once the initial pilot bore was completed, the bore was back reamed with the DN300 Restrain™ pipe pulled in directly behind the reaming head in a single shot.

The DN300 Restrain™ pipe was supplied in 1 metre overall lengths so that they could be passed down inside the 5.9m deep manhole on Iona Road. Here they were connected onto the preceding pipe and drawn into the bore by the HDD rig. A pipe string such as welded polyethylene was not considered a suitable option due to the limited installation space via the manhole and traffic / pedestrian management issues associated with a pipe string above ground. Richard Saunders, Company Director of East Coast Utilities commented, “Restrain™ was the only product available that we could install by drilling to a manhole, then join within the structure at that depth. If PE had been used then Iona Road would have been closed to the public”.

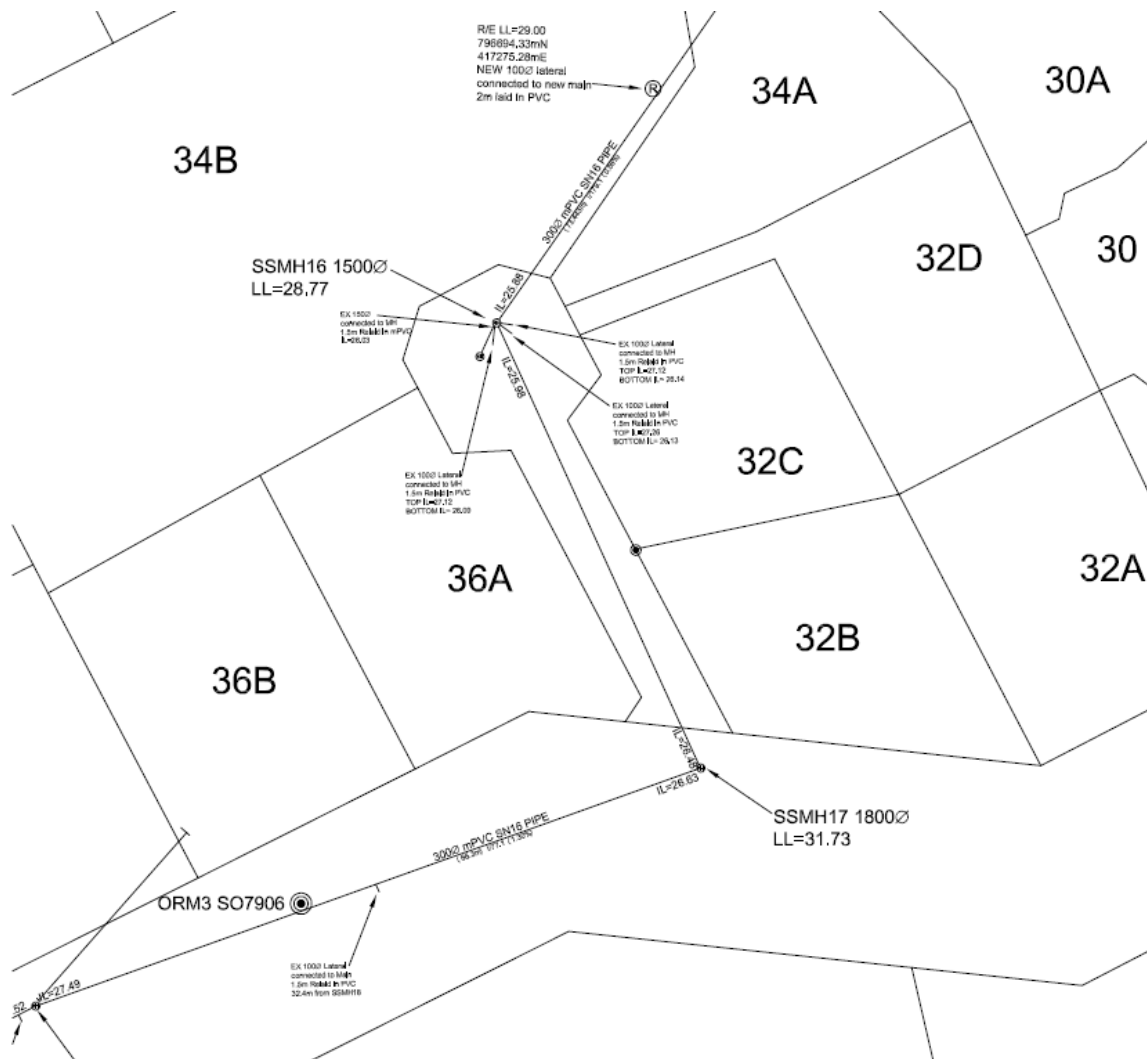
Photograph 3: Iona Mews; Tracking the HDD pilot boring head.



Photograph 4: Iona mews; Assembling 1 metre Restrain™ inside the 1800 dia manhole at a depth of 5.7 metres



Figure 5: Iona Mews; As-built drawing of final pipeline routes



Once this installation was completed, the pit in the cul-de-sac was then used to locate a pipe bursting rig for the next section of pipe installation, a 76-metre burst of DN150 earthenware pipe. This pipeline had the further complication of a 200mm horizontal misalignment where the pipes merged in an existing manhole approximately 39 metres from the start point. The decision was made to remove the manhole and allow the inherent flexibility of the PVC pipe to accommodate the alignment as the pipe was drawn through.

The connecting rods from the Grundoburst TT bursting machine were passed through the existing pipe to the location of new manhole 1033719, which at this point was an open trench. Here the bursting head was attached, with the Restrain™ pipe in two metre lengths connected behind this. Pull back and bursting then commenced with a new length of pipe connected every two metres thereby avoiding the need for a long pipe string and limiting the size of the overall site footprint.

The pull through was completed without complication with the pipe taking up a simple curve to correct the misalignment of the host pipes. As a consequence, the new 1050 diameter concrete manhole that was scheduled for this section was no longer required.

6 CONCLUSIONS

The project spanned a nine-month construction period and was completed on time and within budget. Hastings District Council were satisfied that the pipeline design and installation was completed to the standard they required and that all key performance criteria were met.

In addition to successfully completing the pipeline installation, the contractor also completed full restoration of private properties to a level generally considered above that found prior to construction and to the satisfaction of all home owners.

The collaborative approach between Council, the design engineers and the construction company provided the best management conditions for a successful project outcome.

ACKNOWLEDGEMENTS

Binns, G. Blackley Construction Ltd

Clarke, G. Infracon Hawkes Bay Ltd

Cottier, N. HDC/MWH Alliance

Dench, T. Hastings District Council

Randell, T. Iplex Pipelines (NZ) Ltd

Saunders, R. East Coast Utilities Ltd

Kneebone, M. MWH Ltd

REFERENCES

AS/NZS 1260; PVC pipes and fittings for drain, waste and vent applications

McNaught, I.B. and O'Callaghan, F.W. (2008) 'Pipe reaming replacement of earthenware sanitary sewer pipe with PVC-U pipe specifically designed for trenchless installation'