

INSTALLALLING PIPE CARTRIDGE METHOD PIT TO PIT

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ABSTRACT

In New Zealand, Static Hydraulic Pipe Bursting '*Cartridge Method - Pit to Pit*' (CMPTP), installing segmented Restrain PVC-U Sewer Pipe has become popular, with successful installations completed in many New Zealand cities.

Portable, Static Hydraulic Pipe Bursting (ST-HY-PB) combined with the use of Restrain; installed using the CMPTP methodology has allowed contractors to renew sewers at a pull-rate as quick as 1m per minute. Many contractors have invested in portable ST-HY-PB rigs. Approximately 30 operate in Christchurch City alone where approximately 2000 Km's of sewer laterals were damaged during more than 12,000 seismic events.

A small low impact work site footprint allows the community to go about their normal day to day business with limited disruption. This technique is significantly faster and has lower overall construction cost, when compared to traditional open cut methods.

Contractors that have installed pipes using traditional open cut methods have recognized that ST-HY-PB and segmented PVC pipe systems can assist them to increase their daily production by up to 400%. The new sewer pipe is pulled into the host pipe and connected using traditional PVC Drain Waste & Vent fittings.

This paper will introduce the CMPTP methodology and provide case studies of installations completed in Hastings, Whakatane, Auckland, Wainuiomata, Masterton and Christchurch City.

Keywords

Trenchless, pipe bursting, segmented PVC pipe, Restrain, restrained joint PVC, sewer main replacement and lateral replacement.

1 INTRODUCTION

Construction of replacement sewer mains and lateral connections in highly congested urban environments has led contracting companies in New Zealand to explore faster installation techniques to avoid disruption.

Trenchless technology methodologies including horizontal directional drilling, guided auger boring and static pipe bursting, combined with segmented restrain jointed PVC gravity sewer pipe, installed by CMPTP, has successfully allowed contractors to install new pipes, renew or rehabilitate old pipes in varying lengths cost effectively.

When installing these pipes by Static Pipe Bursting methods, installation rate of 1 lineal metre per minute have been consistently achieved. In some cases, 12 house sewer laterals have been renewed every day.

The use of Portable Static Hydraulic Pipe Bursting (ST-HY-PB) rigs, including the Hammer Head PB30 portable pipe bursting rig, and other larger equipment or different install methods, have successfully installed more than 50 kilometres of gravity sewers using restrain jointed PVC pipes, in New Zealand.

1 RESTRAIN JOINTED PVC PIPE

A restrain jointed segmented PVC-U sewer pipe system was developed by Iplex Pipelines for gravity sewer applications, using trenchless techniques, for the installation, repair or replacement of underground infrastructure.

Restrain™ is a rubber ring jointed, SN16 PVC-U sewer pipe, utilizing a threaded spigot and “low profile” threaded socket, which provides axial end load restraint. Restrain™ holds a New Zealand Patent #561752 and is certified by Standardsmark License No SMK 20184.

The pipe, joint and seal ring system are fully compliant with AS/NZS1260, *PVC pipes and fittings for drain waste and vent applications*. The joint is designed so that either tensile or compressive loads can be accommodated, thereby providing versatility for installation methods.

The pipes are available in sizes DN100, 150, 225 and 300. A range of pipe lengths can be manufactured; these include lengths from 0.5 up to 6 metre (DN225 and DN300 pipes are limited to 3 or 4 metre lengths for ease of handling on site).



Photograph 1: Typical joint arrangement showing the rubber seal ring, threaded spigot and “low profile” threaded socket.

3 CARTRIDGE METHOD PIT TO PIT INSTALLATION (CMPTP)

CMPTP is a method of installing short segmented pipes connecting them within small confined spaces or down deep narrow concrete manholes or temporary shafts.

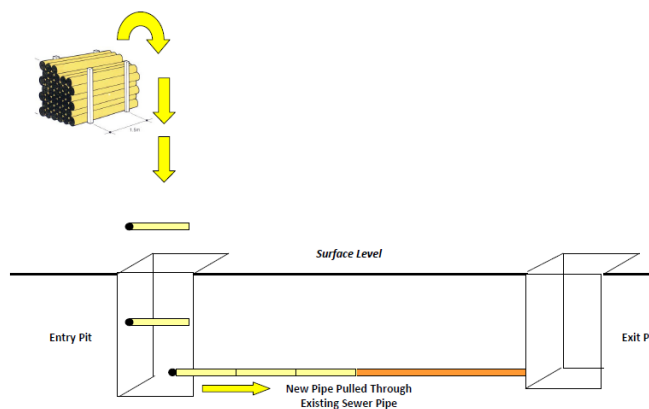


Figure 1: Typical example of CMPTP

When pipe bursting using the CMPTP method, a small compact static hydraulic pipe burster (ST-HY-PB) or winch operates between two small pre-excavated pits. A wire rope, link rod or threaded-rod system, is inserted into the host pipe. A suitable expansion burst-head is attached to the rope or rod, which is in turn connected to the burster.



Photograph 2: Small compact Hammer Head PB30 to the ST-HY portable pipe burster in use.



Photograph 3: Wire rope inserted connecting Pull-head with short starter pipe attached.

The static bursting equipment is operated using a hydraulic power source directly from a nearby excavator or a dedicated hydraulic power pack.

Segmented PVC pipe is then attached within the small pre-excavated launch pit and pulled through the host pipe, connecting pipes simultaneously behind.



Photograph 4: Restrain™ PVC pipe installed within small confined space beneath existing utilities. Wainuiomata 2012.

When the bursting head is pulled through the host pipe it disintegrates and enlarges the bore of the host, while creating annular space for the new segmented pipe to occupy. In some cases into, through and past manhole chambers.



*Photograph 5:
Pull head exiting manhole.
2012*



*Photograph 6:
Pull head passing through manhole...and, exiting manhole. Masterton*



Photograph 7:

Connections to existing or new pipes are made using standard PVC-U RRJ or SCJ drainage fittings.



Photograph 8: Standard PVC fittings installed onto segmented PVC sewer pipe.

4 OTHER NEW ZEALAND PROJECTS INCLUDE:

4.1 Whakatane District Council Sewer Renewals - 2010

The Whakatane District Council in New Zealand's Bay of Plenty tendered the replacement of almost 2 kilometres of DN150 to 300 gravity sewers, plus 675 metres of DN 100 house sewer laterals.

East Coast Utilities was contracted to install the deep portions of the sewer mains by trenchless methods. In most cases where sewers were replaced in-line, the pipes were up-sized using an ITT 800-G hydraulic static pipe bursting rig. The host pipes varied in diameter and material, including Concrete and Asbestos Cement. Restrain™ installation by CMPTP, using pull lengths of 60 to 90 metres, provided an effective solution, working from within deep, small space and low impact installation pits.

Some very deep DN150 sewer mains were also renewed with segmented PVC pipes using Horizontal Directional Drilling (HDD), where the new pipe was pulled into position, using the CMPTP installation technique.

Most DN 100 sewer house laterals were installed using static pipe burst methods by winching. The small, low impact launch pits were excavated in the road berm between the footpath and each property boundary. 1 metre and 2 metre lengths of segmented sewer lateral pipe were installed to arrive in the receiving pit, at slightly above the new pipe-burst sewer main, to allow connection with a PVC Quick fit Saddle connection.



Photograph 9: 3m lengths, DN300 segmented PVC sewer pipes installed by ST-HY-PB. DN100 House Sewer laterals renewed using a ST-HY-PB winch - both pulls employed the CMPTP method. Connections were made using standard SCJ PVC fittings and “Quick Fit Saddles”. Whakatane 2010.

The laterals were installed at a rate of 1 metre per minute; on many days more than 8 sewer laterals were completed.

4.2 Mount Wellington, Auckland City - Pipe Bursting

In late 2010 an Auckland contractor completed the upsizing of an existing DN225 Asbestos Cement sewer main, by installing DN 300 Restrain™ using the CMPTP technique. The host pipe was installed at a depth of 8m of pipe invert. The pipe was installed in 0.75 metre lengths, introduced into the host from within the existing 1050mm concrete manhole chambers. The contractor tunneled out locally from within the manholes, at invert depth, to create necessary working space, and then lifted the short lengths of pipe down into position before joining.

4.3 Christchurch City Earthquake Rebuild - Sewer House Laterals

Since September 2010, New Zealand's Christchurch City had been struck by at least 5 major earthquakes and more than 12,000 aftershocks. During the February 2011 events 185 lives were lost; approximately 73% of commercial buildings within the Central Business District (CBD) required demolition, and 51,000 houses were destroyed or damaged beyond repair. Large parts of the city's water and waste water pipeline networks were

severely damaged. Approximately 2000 kilometers of mainly ceramic house sewer laterals, require total replacement.

Contractors were introduced to using the CMPTP technique in Christchurch, following the successful installations in Hastings, Whakatane and Auckland.

G N Brewer Ltd began installing segmented PVC sewer pipe full time in Christchurch City from February 2011.

Deane Brewer commented about the use of segmented PVC sewer pipe, he said; *“We use it for all our relay work and where we are short on space or where we need to reduce reinstatement costs as excessive damage can be caused from traditional open trenching methods. We have 100% success rate and have found it very cost effective. I can replace between 8-12 sewer laterals per day which allows me to get through a greater volume of work”*.

Pipeline contractors from throughout New Zealand are working in the Christchurch rebuild. Approximately 30 static pipe bursting rigs are operating there installing segmented PVC sewer pipe using the CMPTP technique.

5 CONCLUSIONS

Segmented - restrain jointed PVC Sewer Pipe has been installed in New Zealand using Horizontal Directional Drilling, Static Pipe Bursting, Micro Tunneling, Guided Tunnel Boring and Slip Lining methods.

Many contractors in New Zealand have purchased portable static pipe bursters, approximately 30 are operating in the Christchurch City rebuild alone.

Most contractors prefer to install segmented PVC gravity sewer pipe, compared with conventional fusion jointed polyethylene pipe strings. They like the Cartridge Method – Pit to Pit technique. There are no pipe-strings to lay-out on site, allowing low impact small entry pipe launch pits. This allows the surrounding community and traffic flow to continue normal day-to-day activity with reduced disruption.

Connections to new or existing services are easily made using conventional PVC drainage fittings.

The CMPTP technique is much faster and has a lower overall construction cost when compared to conventional open cut methods, when allowing for entire reinstatement time and costs.

Contractors have recognized that segmented PVC Sewer Pipe and CMPTP can assist them to increase their daily production when compared with fully open cut sewer main renewal works. They are now able to either use the CMPTP technique for both mains and laterals, or open cut the main and use CMPTP to renew each sewer house lateral from within the confines of the open cut trench.

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REFERENCES

AS/NZS1260;	PVC Pipes and fittings for drain, waste and vent applications
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