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Innovative use of Hollow Timber Rounds in Structures and Foundations

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Introduction:

Trees' physiology naturally provides logs with high strength. Many timber processing industries now exist aimed at optimising the strength properties of timber for use in buildings: graded sawn timber; plywood; glulam; orientated strand board; laminated veneer lumber; cross-lam etc. These industries are based around selection of graded material from a processed log, which is then assembled into a new product with the use of glue. However, this degree of processing may not be necessary for many structural applications.

In New Zealand the use of timber in its natural round form has largely been consigned to applications where appearance is not critical as in industrial storage buildings, building platforms, piled foundations and retaining walls. Resistance to the use of naturally round timber can typically be attributed to the quality of the finished appearance and the complexity of connection details.

mlb Consulting, working in conjunction with TTT Products Ltd, have developed a new process where the core material is removed from a log (Figure 1). The removal of the juvenile core wood fibre accelerates the drying process and also leads to a dramatic improvement in the quality of the timber round. By removing the core more even drying through the member is achieved with drying checks minimised.

Preservative treatment of cored rounds has demonstrated 100% treatment penetration giving improved durability for members exposed to the weather or in contact with the ground.

These attributes together with the ability to develop concealed and post tensioned joints present many opportunities for new structural and foundation systems.

Figure 1. Hollow round timber members

Hollow timber piles:

mlb consulting and TTT Products Ltd have recently developed a piling system using hollowed timber rounds. The concept has been reviewed by Geotek Services Ltd.

The system was initially designed for the Christchurch CBD, where the geotechnical issues are particularly challenging. Shallow foundation systems such as pads or rafts are not always appropriate. Piles down to the deep underlying gravel layers provide a secure foundation. Using traditional piling systems has resulted in exorbitant foundation cost for even low-rise buildings.

Cost estimates provided by TTT Products for a Christchurch project indicate that 18m timber piles are approximately 40% of the cost of bored concrete piles. However, there are some potential issues with driving piles through alluvial silts, sands and gravels. Driving resistance in granular material is typically high with associated high levels of ground vibration plus the potential for pile damage.

A hollow round timber piling system has been successfully tested in granular subsoil using a vibrating driving head and water jetting through the centre of the pile to reduce driving resistance. If necessary the pile tip can be grouted, solidifying any disturbed material.

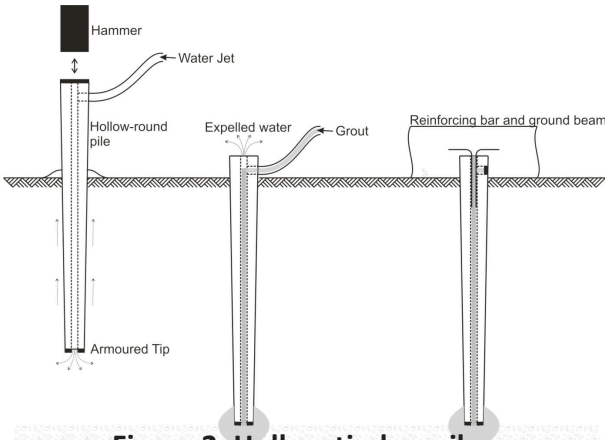

Figure 2. Hollow timber piles

Some key advantages of the piling system are:

- Reduced cost and improved durability.
- Rapid installation with less vibration and noise.
- Easy connection to ground level foundations.
- Cement grouting to limit settlement and potentially increase end-bearing capacity.
- Inherent high flexibility to accommodate lateral spread due to liquefaction.