

Project: Mt Pleasant Road Keystone TW3 Wall  
Date: Oct 2014  
Client: SCIRT  
Location: Christchurch



## Keystone TW3 Wall System

An old crib wall supporting approximately 40m stretch along Mount Pleasant Road was damaged during the 2011 earthquake. The maximum retained height of this wall was 4.2m. Being a major arterial road linking a number of suburbs in the area, it was paramount that the road was reconstructed to pre-earthquake standards to service the residents in the community.

SCIRT – the consortium of engineers and contractors for the Christchurch infrastructure rebuild works was tasked to undertake the design of the reconstruction of the retaining wall. **Keystone TW3** retaining wall system was proposed for the aesthetic appearance as well as its ease of installation. The **Keystone TW3** are dry-cast machine formed concrete modular blocks that provide a high strength durable concrete facing for the wall system. **Tensar RE500** series geogrids are positively connected in between the blocks and extend back into the fill to form a reinforced soil mass.

Among the many design considerations the most important factor was the retaining wall needed to survive another severe earthquake event. Frictional connections between the modular blocks and geogrid reinforcement, common to a number of wall systems, is the weakest point in the entire wall system; and therefore makes the wall vulnerable to potential failure under seismic loading.

For this reason, **Keystone TW3** system was selected as it utilises a mechanical connector inserted in between the blocks to form a 'positive connection'. The use of mechanical connector to form the positive connection between the **Tensar** geogrid and modular block facing has undergone full scale large shaking table testing at a research facility near Vyborg, Russia. The permanent deformation of the wall under the maximum horizontal acceleration of up to 0.63g was found to be < 2mm.

The Geofabrics team assisted with the design suggestion for the retaining wall with the seismic Peak Ground Acceleration of up to 0.6g. TensarSoil software was used to design the retaining wall based on AS4678:2002. The software is available free of charge from the Geofabrics team.



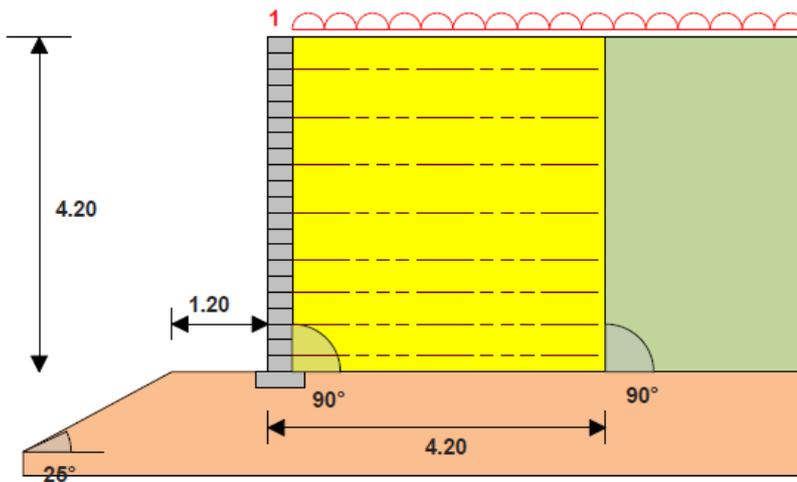


Figure 1: Snapshot from TensarSoil design software

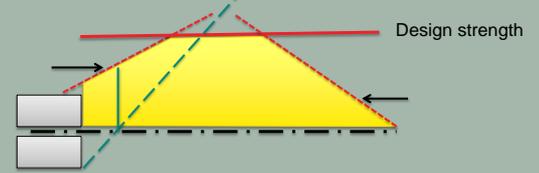
The Geofabrics team provided on-site installation training to the contractor at the start of the project to ensure that all aspects of this mortar less construction methodology were covered.

The installation of the retaining wall took a 3 man team approximately 16 weeks to complete. This includes the excavation and removal of the existing crib wall, preparation and casting of the concrete levelling pad, installation of the **Keystone TW3** blocks, laying of Tensar geogrids, back filling of the granular fill material and completion of the final pavement.



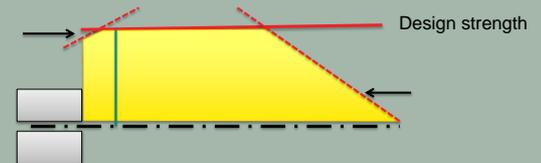
The attributes and differences between the 'Frictional' and 'Positive' connection for modular block walls facing:

- **Frictional Connection**



- Rely on confining stress of the block
- Geogrid strength is not fully utilise at the front of wall
- Best for low height and static load case retaining walls

- **Positive Connection**



- Rely on mechanical connection
- Geogrid strength is fully utilise at the front face
- Suitable for taller and seismic load case retaining walls

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