



▶ CASE STUDY: COMMERCIAL APPLICATION

Keystone Meets 2000 Olympic Standards for Australia Stadium!

With all eyes on the **Sydney 2000 Olympics**, the Australia Stadium will be the focus of many an event and celebration. Building this stadium meant following a complex and rigid specification. **Boral Besser Masonry** succeeded in not only delivering a superior product using the Keystone Retaining Wall System, but more than satisfied the customers requirements every step of the way in its installation.

Located at **Homebush Bay**, the **Australia Stadium** is the largest sporting venue in the country with a seating capacity of 110,000. Boral Masonry became a part of this monumental event when the Keystone Retaining Wall System was chosen to act as an internal wall 1.2km (3935 ft.) long; 6-meters (19.68 ft.) high around the service tunnel.

In 1996, Multiplex won the bid as the main contractor on the stadium and invited bidders for the design and construction of the retaining walls. The specifications called for a 2-hour fire rating and a 50-year guarantee. The added challenge was that the client wanted Boral Masonry not only to supply the materials but also to construct the wall.

The bid originally specified Reinforced Earth concrete panels. Boral Masonry submitted a non-conforming tender specifying the Keystone segmental block retaining wall system. In order to achieve the 2-hour fire rating, a series of comprehensive fire tests were performed on the Keystone/Tensar system at the Warrington Fire Research Centre in London, UK in August, 1995. These tests were conducted for 30 minutes with the successful results being deemed as highly conservative in that the tests were performed with no backfill material in the blocks or behind the wall. Even under these conditions, the blocks, fiberglass pins and geogrid withstood the effects of high temperature.

The project consultant stipulated that the Keystone system would be capable of achieving the 120 minute requirement provided the strength of the pin/geogrid material at 190°C was sufficient to support the calculated maximum lateral loads imposed on the wall. The designer would therefore need to assume the connection of the heated pin to the heated geogrid was negligible. Although extensive testing of the Keystone /Tensar system has shown that the pins actually contribute approximately 20-25% of the connection strength, the RTA has adopted a design method that overlooks this contribution and assumes that the pins do not contribute any strength at all. It is the RTA's opinion that the system derives all of its connection strength from the frictional interaction between the concrete blocks, the granular infill and the polyethylene geogrid. Thus, the



- ▶ **PROJECT:** Olympic Stadium
- LOCATION:** Homebush Bay, Australia
- PRODUCT:** Keystone Compac Unit
- SQUARE FOOTAGE:** 80,000 (7420 m²)
- CONTRACTOR:** Multiplex - Construction
- SPECIFIER:** Boral Besser Masonry Retaining Wall Contractor
- KEYSTONE REPRESENTATIVE:** Boral Besser Masonry Sydney, Australia



High quality results using smooth texture Keystone units and multiple radii layout.

proposal to design the Australia Stadium retaining walls was in accordance with the RTA specifications.

Boral's solid reputation gave **Multiplex Construction** the confidence to award them the design and construct contract in October, 1996.

To ensure Boral met the standards required by OCA, Incoll Management was engaged to provide quality assurance procedures and policy for the site. Environmental management plans and safe work method statements were also produced. This was the first time Boral Masonry had been involved with a project where they were responsible for full time site management.

The corduroy textured Keystone Unit was originally proposed, however, OCA was concerned that the rough surface of the block would be difficult to keep clean and asked Multiplex to find an alternate texture solution. Boral offered a custom-made smooth face block that included the original modifications to meet the fire tests.

Many challenges arose from the change in face texture. The smooth face of the block is more susceptible to chipping than a split-face or corduroy texture unit, which meant that 15% of the custom made blocks had to be replaced compared to only 1% of the original block. Due to the complexity of the design, which included radii that ranged from 9m (29.5 ft.) to 180m (590 ft.), 15,000 of the 80,000 blocks used were individually cut to ensure that the many wall curves were perfectly smooth.

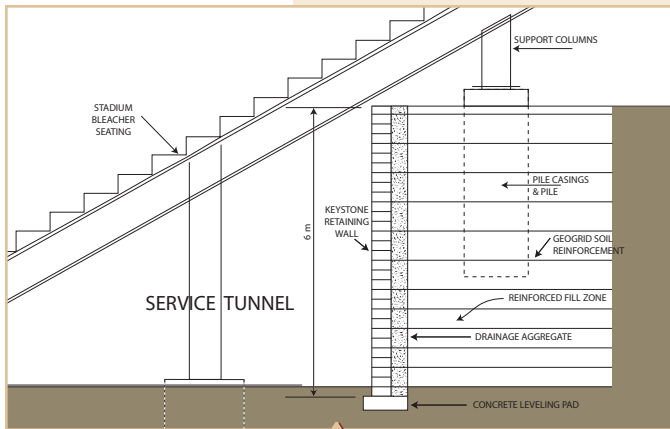
Midway through the stadium construction, Multiplex was faced with the problem of installing utility services through the walls and the pile casings required for the stadium structure. Openings (ducts) were installed through the walls to accommodate the services once the wall was complete. During construction of the retaining wall, pile casings were built,



Keystone offers durable structure with flexible design capabilities



Construction continues with Keystone and geogrid



Typical cross section for service tunnel area

making it possible for the contractors to finalize the piles soon after the walls completion. To assure Multiplex that the structural integrity of the wall would not be compromised, tests were conducted on a specially constructed sample wall. The tests illustrated that only in sections where utilities ran very close to the wall were expensive ducting solutions required.

The project was completed in four months - on time and on budget! Despite the challenges presented during the project, focus on quality and service to the client always came first.

This has been the first large-scale design and construct project that Boral Besser has undertaken with Keystone and may set the standard for future commercial ventures.

