RIM-cell Technology
Quality Assurance Solution for Pile Load Verification

Project:	**RIM-cell Trial Installation and Testing**
Location:	Cockburn Central, Perth, Australia
Subcontractor:	Belpile Pty Ltd

Worldwide and for over 20 years, practitioners of foundation engineering have been making good use of the significant advantages of performing static load testing on piles and barrettes using the Osterberg Cell bi-directional test method. Commonly known as the O-cell test, the method provides a high quality and high accuracy static load test, usually, but not always performed on a dedicated foundation element that is not incorporated into the foundation, with the results used to optimise pile design. The Osterberg Cells are usually placed within the pile at the balance point between soil resistances above and below that elevation and targeting applied loads that often exceed 300% of working load.

RIM-cell Attached To Reinforcing Cage

Even with the widespread adoption of O-cell testing, in many cases, variability of the site subsurface and construction technique can result in significant uncertainty about the performance of the working piles that were not load-tested. The RIM-cell offers a practical, cost-effective solution to this problem, allowing all stakeholders the opportunity to enjoy a level of quality assurance not previously possible. Although similar in concept to the O-cell, the patented RIM-cell is best suited as a pile load verification device, which is designed to be installed and deployed on a large number of production piles as a means of assessing the as built performance behaviour of the foundation elements as needed. The low cost allows the RIM-cell to be installed in every pile so that verification can be performed on any pile that may be of concern.

A RIM-cell installed at or near to the toe of the pile applies a continuously increasing load up to the working load or 20-30% beyond it, similar to a proof load test and like the Osterberg cell, applies a bi-directional load to the foundation element but is not designed to duplicate the high-resolution, sensitivity and individual calibration common to a genuine Osterberg Cell. As such, the RIM-cell load verification programme should always be complemented by a full-scale Osterberg Cell static load test used to optimize the deep foundation design prior to constructing the working foundation.

The RIM-cells at Cockburn Central were installed in a cement/sand grout injection continuous flight auger pile. The first installation was performed on a straight shafted pile and the second on an under reamed (belled) pile, a patented method developed by Belpile. For each pile, the single length steel reinforcing cage was assembled with RIM-cell and associated instrumentation and pushed into the wet grouted pile on completion.

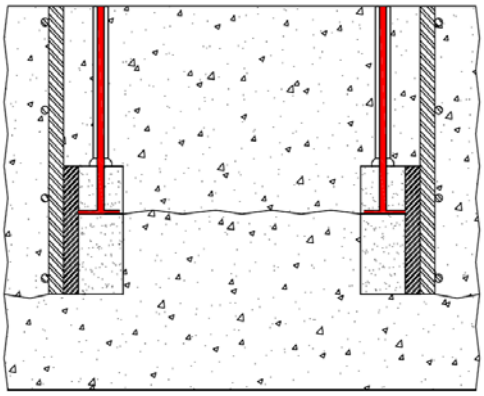
Completed Pile Construction

The RIM-cell comprises a steel pressure confining pipe that fits inside the tip of the reinforcing cage with varying thickness of cement grout inside enclosing the concrete

(continued over page)

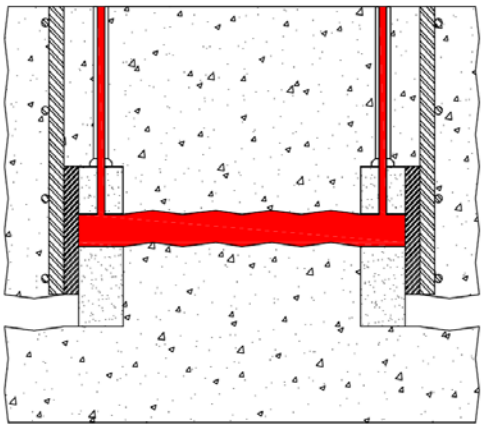
RIM-cell Technology
Quality Assurance Solution for Pile Load Verification

fracture mechanism. While all RIM-cells are custom-sized and made to order, they can also be manufactured in the country of use with locally available materials thus minimizing overall costs.



Schematic Post Concreting and Fracture

The innovative concept of the RIM-cell is a pile fracturing mechanism that creates a pressurized plane not only through the grouted annulus of the RIM-cell but through the entire inner concreted (or grouted) zone of the confining steel pipe. The RIM-cell then acts like a hydraulic jack of a diameter equivalent to the reinforcing cage diameter.

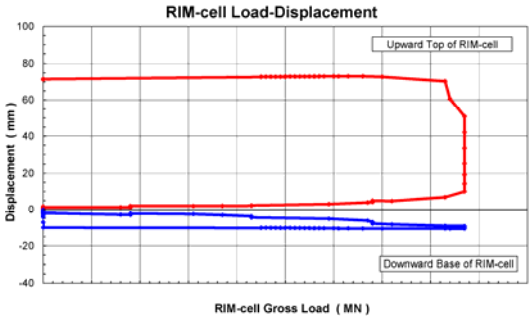


Schematic Post Fracture and Pressurization

The RIM-cells used for this project were designed and fabricated for the pile dimensions and loading requirement i.e. for a pile diameter of 500 mm and cover to the reinforcing bar of 100 mm, the outside diameter of the RIM-cell was 275 mm with a confining pressure of 34.5 MPa and a capacity of 1.75 MN. The embedded instrumentation used to measure pile displacement comprised tell-tale rod extensometers to measure movement at both the top and base of the RIM-cell. Pressure was provided from ground level and monitored by both an electronic transducer and a traditional Bourdon gauge at the pump. Pile top movement was monitored using an automated digital level synchronized to the data logging system.

Test Setup and Testing in Progress

A self-sealing liquid was used to pressurize the RIM-cell from a high pressure grease pump. However, for commercial applications, a proprietary cement grout would be used, which will allow both segments of the pile to be re-connected without the need for a second stage grouting process.



In addition to its primary function as part of a pile load verification procedure, a secondary use of the RIM-cell is as an alternative to traditional base grouting methods. Unlike base grouting, the effectiveness of which is not verifiable, the RIM-cell reliably uses the pile itself to pre-load the base and compress the soil at the toe. Compressing the soil below the toe of a production pile by pre-loading significantly improves load-displacement behaviour of the pile in terms of soil stiffness response and strain compatibility, is fully verifiable and yields load-displacement results.