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# Sydney Markets ramp upgrade provides quality answer to challenges posed by increasing loads on Australia's carparks



*The Sydney Markets carpark where the ramp upgrade was undertaken by RKR Engineering, as designed by Griffiths Engineers for Sydney Markets using Hercules slip joint technology*

As multi-level carparks around Australia age, while traffic volumes through them continue to rise, engineering upgrades are increasingly required to maintain their optimum capacity and designed degrees of freedom with high levels of safety.

Entire generations of such carparks have grown up over the past 70 years, with the steeply increasing rate of private car ownership since the 1950s making the structures an increasingly valuable asset for a host of private businesses and public facilities dependent upon high rates of utilisation.

One such business is Sydney Markets – which sells an estimated \$3 billion worth of fresh fruit and vegetables annually – where structural engineering specialists, Griffiths Engineers Pty Ltd and project engineering & steel fabricator RKR Engineering were contracted by Sydney Markets to upgrade a ramp to provide extra stability and longevity, using a custom-fabricated slip joint from Hercules Engineering.

An engineering assessment identified that the strain placed on the ramp from expansion and contraction – due to temperature, and vehicular momentum from more than 300,000 vehicles that it handles each year – was overstressing the corbel and causing a structural concern.

“The solution we recommended and installed has reinstated the building’s ability for lateral translation in this area, which had seized and was causing damage to the structure. Similar methodologies can be adopted in numerous circumstances in similar structures,” says Mr Josh Griffiths, Structural Engineer, of Griffiths Engineers, whose firm is involved in diverse structural engineering work, ranging from detailed but vital structural upgrades, such as this ramp, through to major projects involving high-rise apartments, bridges and industrial and commercial complexes. The company’s engineering has won numerous MBA awards.



*Extraction of the old slip joint being removed by RKR Engineering team, left and close-up of the slip joint, right*

The solution to the challenges at Sydney Markets involved a custom-engineered Hercules slip joint, produced to the specifications arising from Griffiths Engineers’ report on the issue.

The joint, which runs the full width of the ramp, utilises two layers of stainless steel, Grade 304, 0.55mm thick and 200mm wide, with graphite grease applied between layers.

Grade 304 stainless steel was specified to prevent corrosion or seizure over time, which were problems with the original joint. The new joint is configured to allow the two layers of concrete to move fractional amounts separately, to allow for applied external forces and movements and prevent the concrete from cracking.

For installation, the supported slab was jacked up to allow the original slip joint to be removed and the new bearing to be installed properly.

Special attention was paid to long-term lubrication of the joint. A problem identified with the original slip joint was a sticky tar-like black substance, which may originally have been a grease product containing an aluminium complex thickener soap, which is nowadays

known to harden and set over time. The graphite grease used in the specified Hercules joint does not contain an aluminum complex thickener, but rather uses a lithium/calcium soap, which is known to be stable over the long term.

The original joint comprised two sheets of galvanised iron, which, with large amounts of corrosion, had bound together and prevented lateral movements (induced from concrete shrinkage, thermal changes and vehicular momentum from braking and accelerating).



*Installing the new bearing, left, and the deteriorated original slip joint*

“This restraint had overstressed and cracked the corbel, which had been identified as an emerging structural concern. On top of the corbel failure from a seized joint, calculations showed that the corbel itself was moderately overstressed, so basic strengthening works were carried out simultaneously with the slip joint replacement,” said Mr Griffiths. The issues observed with the corbel are not uncommon and clearly indicate that close attention needs to be paid to the long term effects of shrinkage, movements and slip joint deterioration.

“The Hercules joint will not corrode or seize like the original and has reinstated the ramp’s intended articulation. With the new joint installed, cracks repaired and the corbel strengthened, the useful life of this ramp has been extended and it will now be able to articulate more freely.”

“By applying technical analysis, proven methods and using quality products, we’ve achieved an optimum result, with the benefit that the useful life of the asset has been increased,” he said. “The project was completed successfully.”

Hercules Engineering Manager Mr David Booty says gradual slip joint failure and emerging issues such as those encountered at Sydney Markets are increasingly common as buildings age and owners seek cost-efficient solutions.

These are often provided by Hercules’ extensive stock ranges of Hercules™ composite slip joints, as well as Shearstrip products and the Herculon™ bearing range. “However, a quality long-term solution also depends on a thorough inspection of the structure by the engineers and a discussion with them about the agreed optimum solution. In this instance, we were invited to apply the benefits of our specialised experience and knowledge – extending over more than 30 years – to complement the extensive knowledge and experience of Griffiths Engineers.

The result is a high quality, long-life and cost-efficient solution to a challenge of a type that can only become more and more common as ageing carpark structures are called upon to handle greater and greater loads.