

Future-proofing Aberdeen's Loch Street Multi-Storey Car Park

It's what's beneath the surface
that counts



BMO Real Estate Partners

BMO  Global Asset Management



Introduction

Introduction to BMO Real Estate Partners, Trident Building Consultancy and Loch Street Multi-Storey Car Park project

BMO Real Estate Partners is an investment boutique and the property specialist within BMO Global Asset Management. Acknowledged as one of the leading property investors and property fund managers in the UK, BMO have a strong presence and critical buying power across all the markets in which they operate.

BMO own a number of shopping centres around the world, many with multi-storey car parks, and are passionate about providing a

facility that complements the retail experience.

Trident Building Consultancy Ltd provides building surveying, cost management and project management services across a wide range of sectors in commercial and residential property, and across all parts of the private sector, local and central government.

The practice was formed in September 1998 and currently employs more than 100 staff across 10 offices in the UK and Ireland, enabling us to have a nationwide capability to deliver sound, reliable advice from a solid base of qualified and experienced surveyors.

The Bon Accord & St Nicholas Shopping Centre dominates retailing in Aberdeen's city centre. The centres are anchored by John Lewis and Marks & Spencer and provide 460,000 sq. ft. of retail accommodation in over 75 shop units let to retailers including Boots, New Look, Next, River Island, Top Shop/Top Man and Hobbs.

The centre benefits from 1,400 car parking spaces including Loch Street multi-storey, and attracts an annual footfall of 13 million people a year.



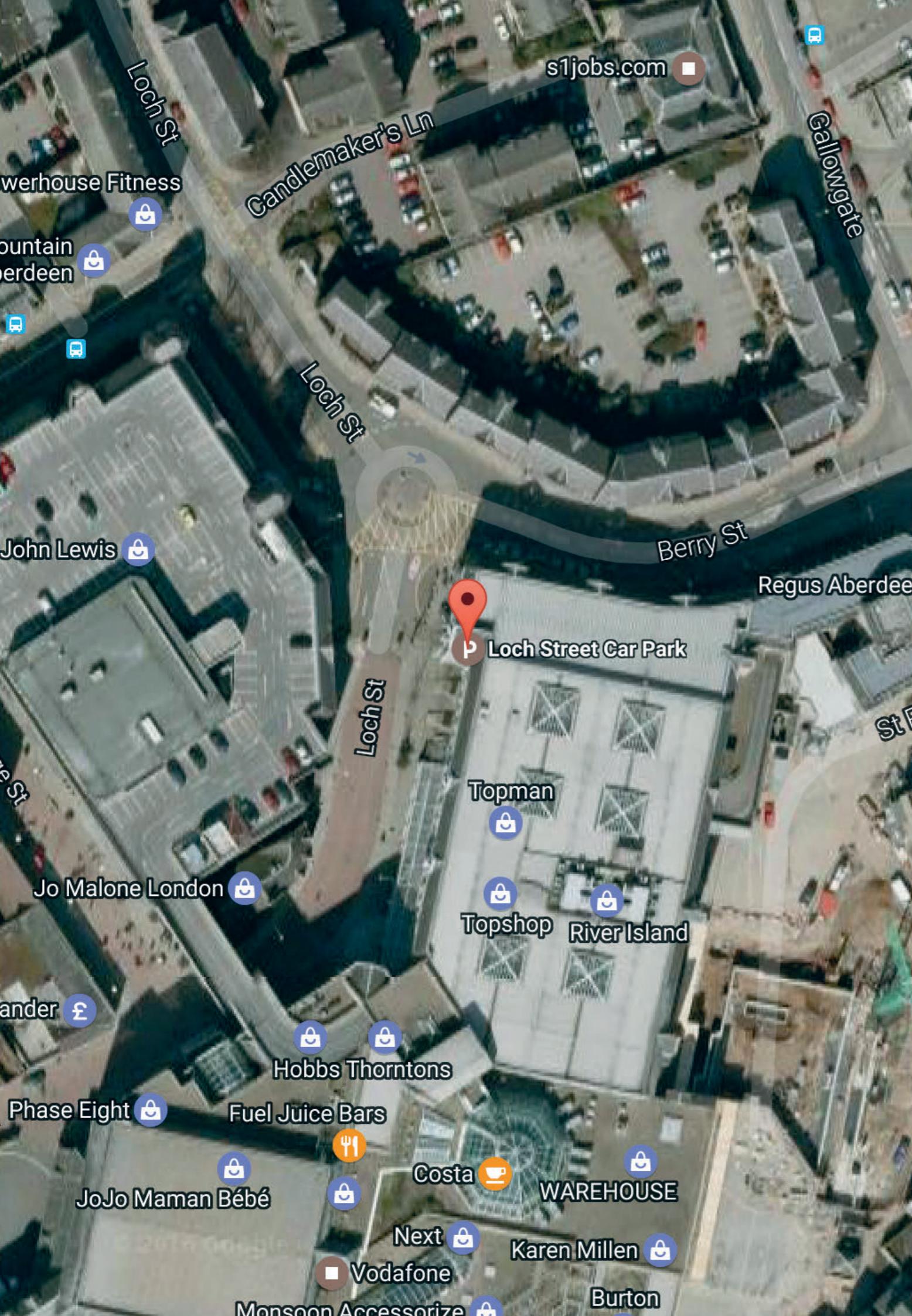
Background to the project

Car parks are unique structures and face more substantial challenges to those of other buildings. They are exposed to extremes of temperature as well as the elements, often neglected and subject to vandalism, face extreme cyclical loading, as well as having to provide a safe, user friendly and clean environment for the general public, particularly when serving a retail facility.

Being located close to the sea in Aberdeen, Loch Street car park had been subjected to all of the above for many years, as well as high levels of salt contamination via widely used de-icing salts

on Aberdeen's roads and of course airborne coastal salts. Over time, and despite the car park owners and operators' best attempts to prevent deterioration of the concrete structure,

degradation had set in, leading to widespread reinforcement corrosion and high levels of chloride contamination.



Recognising the importance of 'understanding' their car park structure

In line with industry recommendations and 'good practice' guidelines (i.e. ICE Recommendations for the Inspection, Maintenance and Management of car parks and Life Care Plan initiatives) BMO and Trident both recognised the importance of understanding what had happened, and was still happening to their car park.

The lower decks of the car park had a mastic asphalt waterproofing system applied to them to protect against water ingress into shop units and the mall below, however the majority of the decks in the car park remained unprotected against water and salt ingress.

Unusually, the roof level is covered by a steel framed roof structure which, whilst protecting the deck from the ravages of the weather and environment, does not prevent the ingress of water and contaminants taken into the structure by cars.

300 No. extra parking spaces had been added in 2009 via a steel framed extension accessed from each of the parking decks but again protective coatings had not been added as a preventative measure. Even the exposed roof deck was unprotected concrete.

"We are keen to carry out a comprehensive hammer survey, dust sample analysis and half cell potential mapping as soon as possible, so that 'shocks' don't arise post-order"

Whilst visually, the parking facility 'didn't look that bad', comprehensive testing was carried out to ensure any refurbishment programme was 'fit for purpose' and addressed the source of the concrete deterioration.

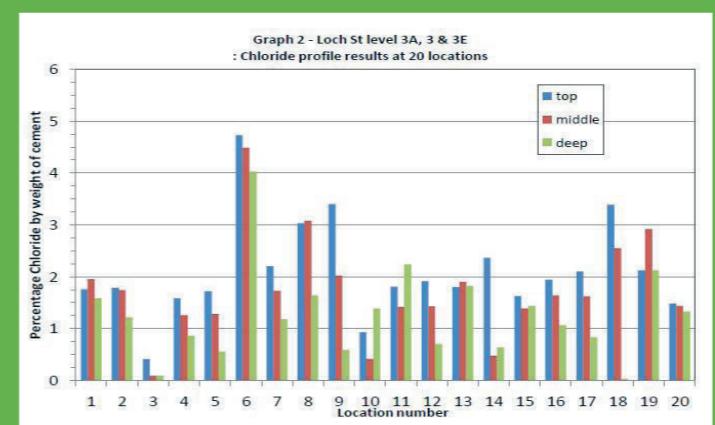
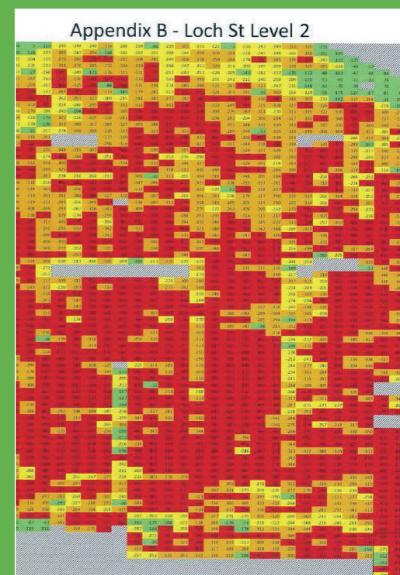


Ignorance is NOT bliss

BMO and Trident commissioned a well-respected Structural Engineering practice to oversee concrete testing of Loch Street car park. Despite knowing that test results may well identify the need for costly repairs and corrosion prevention works, the focus remained on ensuring the refurbishment strategy addressed the source of existing as well as future deterioration. Whilst some of the current deterioration was visible and obvious, some was hidden and the client was determined to test the structure in order to obtain a full picture.

"Chloride contamination levels were, not surprisingly, found to be very high. In fact some values were exceptionally high. Results from the top surface of the slabs were in the range 0.72% to almost 4% by weight of cement. The majority were in excess of 1.5%. In addition, high chloride readings were found in all three depth increments, confirming that contamination extended well beyond the upper layer of steel reinforcement" – Charles Darley Associates report

"From an analysis of the half-cell results more negative than -350mV (CSE), the percentage of readings is 54%, 54%, 5%, 40%, 30% and 0% for levels 2a, 2, 2e, 3a, 3 and 3e respectively. These areas have a 90% chance of active corrosion" – Concrete Preservation Technologies



To complement the dust sample analysis, a comprehensive half-cell potential survey was carried out to identify the likelihood of corrosion in certain areas.

The hammer survey had also identified large areas of defective sounding or concrete, some of which was visible through surface cracking and spalling but much of it which was hidden and had not yet fractured the surface of the concrete.

The quantities of repairs required were extracted from survey notes and tabulated into a Concrete Repair Association Standard Method of Measurement compliant format. This aided Trident as the Contract Administrator, by ensuring origination of clearer Bills of Quantities for the concrete repair work, and providing a uniform basis for measuring the concrete repairs themselves.



Considering the options and other refurbishment drivers

Armed with the test results, BMO and Trident were now faced with a challenging decision, how best to address the existing and future corrosion of the car park whilst at the same time delivering a commercially viable and technically functional solution. The centre management team were also very keen to improve aesthetics and the customer experience in the car park, and of course disruption/loss of revenue during any works also had to be factored in.

"We want customers to get their visit to Bon Accord & St Nicholas off to the best possible start and we appreciate the role that a bright, modern and accessible car park plays in an individual's shopping experience" – Craig Stevenson, Centre Manager
The project team therefore considered 5 No. options:

(a) Extensive concrete break out - areas identified as at risk of corrosion can be removed and replaced with fresh cementitious material. Whilst this removes the chloride contaminated material, the process is extensive, noisy, environmentally unfriendly, very expensive and would result in large areas of parking being out of use for long periods of time

(b) Impressed Current Cathodic Protection (ICCP) - electrochemical methods are known to have the facility to offer long term corrosion prevention. ICCP utilises a permanent power supply and installed anode system to provide a protective electrical current to the steel

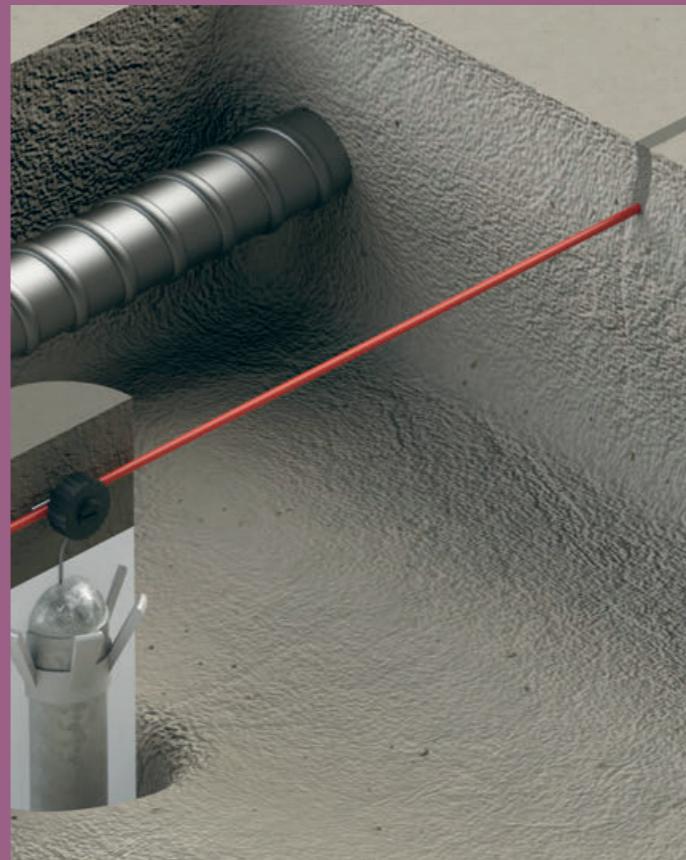
reinforcement to counter the corrosion process. At Aberdeen however, the system was not deemed to be cost effective in protecting 'targeted' areas and also centre management were not keen on the need for and cost of, continual monitoring and maintenance.

(c) Migrating Corrosion Inhibitors (MCI) - the chloride concentrations obtained from testing on Loch Street were significantly beyond the 1-1.5% chloride content limit by weight of cement commonly stated for inhibitor application. In addition, a number of studies have shown the material may not penetrate effectively in practice and opinion of its long term performance and effectiveness is mixed among engineers. BMO and Trident were not willing to take the risk and compromise the longevity of the repair works.

(d) Sacrificial anodes - Patch repairs are commonly treated with sacrificial anodes in order to counter 'incipient anode' corrosion observed around patches

within a relative short period of patch repair. However, the treatment only deals with local corrosion activity adjacent to patch repairs and thus was deemed not suitable for use at Loch Street where chloride salt induced corrosion was rather more extensive over the decks.

(e) Innovative Hybrid Corrosion Protection - this method of corrosion protection uses a short impressed current phase followed by a galvanic phase. This treatment aims to initially stop corrosion (impressed current phase) and then maintain the steel in a passive condition (sacrificial anode phase). The system requires no maintenance of power supplies once installed and can be monitored to demonstrate long term corrosion protection. It also addresses not only repaired areas, but also areas deemed to be at risk of corrosion but are not yet showing any visible signs of deterioration.



The preferred solution for Loch Street Car Park

The Hybrid Corrosion Protection option was ultimately chosen for installation at Loch Street. Whilst offering a commercially competitive solution, the system provided the longevity required by BMO to extend the life of the car park by up to 20 years.

With a long successful track record in the car park market sector, and the ability to deal with high levels of chloride contamination, the hybrid option was considered to

be technically appropriate and commensurate with the condition of the structure and objectives and budget of the project team.



Compiling the schedule of works

As contract administrator, Trident competitively tendered the works but ensured that specifications were suitable for the car park structure, and wherever possible, products complemented each other.

Whilst the main driver for the refurbishment was to address existing and the potential for future corrosion of the reinforcement in the decks, other works were also incorporated into the tender package to improve the customer experience and protect the structure.

These included:

- Protective and decorative deck coatings
- Protective and decorative anti-carbonation coatings
- Lighting improvements
- Localised impact barrier refurbishment and new bollard installation
- Reconfiguration and way finding works
- General decorations
- New mastic asphalt coating to external ramp

Pitchmastic PmB's innovative DeckProtect+ Rapidflex coating system was recommended to protect the car park decks, due to its exceptional performance, easy to clean and tough resilient polyaspartic nature and market leading guarantee.

New lighting was specified throughout to current British Standards with the existing fluroescent tube lighting being replaced with the clients preferred Zumtobel fittings.

New Armco barriers were also recommended as an additional safety measure and to replace the existing and temporary barriers used to separate the lanes of traffic on the mezzanine levels.



Delivering the project on time and on budget - despite various challenges

"Work will only be carried out on one level at a time in an effort to avoid disruption for those coming and going from the car park. We look forward to welcoming visitors to the enhanced parking provision in the coming months"

– Craig Stevenson, Centre Manager

USL StructureCare were engaged in February 2016 to undertake the works commencing in March. The client had a clear objective to ensure that the project be complete by mid November.

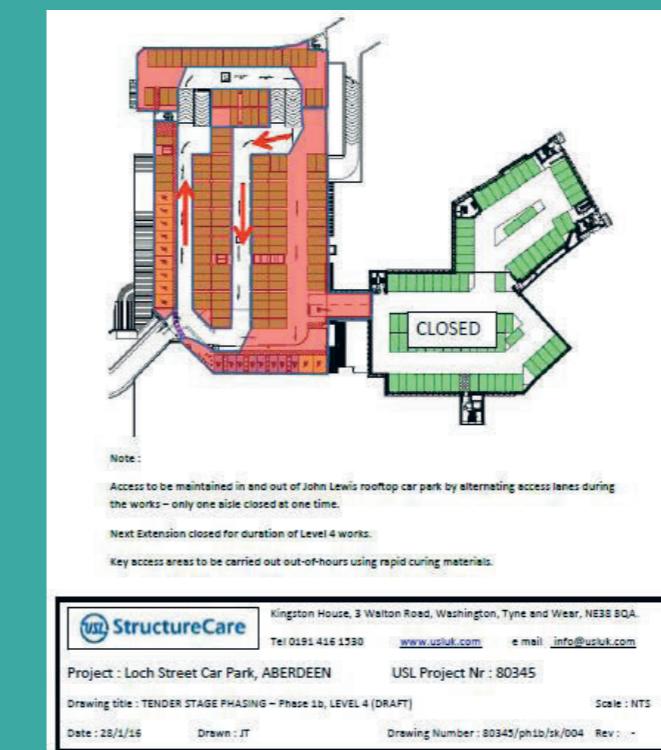
The original programme was phased so as to minimise disruption to the shoppers using the car park. However it soon became clear that the demand on parking spaces coupled with the extent of work required to 'pinch-points' would make this a particularly challenging project. In addition, local by-laws prohibited certain works at night due to the close proximity of residents. Phasing drawings were produced to ensure that disruption to the centre was

minimised and that access to open areas of the car park were safely maintained.

Not surprisingly, minor issues were encountered in the first couple of weeks leading to programme 'slippage', however the application of anti-carbonation coatings was switched to night shifts, clawing back the deficit. Various variations were also received during the project, yet these were all completed within the same overall programme.

USL's site manager worked hard to build a close working relationship with Aberdeen City Council's Environmental Health Officer, and USL were granted frequent exemptions to the times when noisy

work could be undertaken. If these exemptions had not been granted a large proportion of the concrete repair and anode installation could not have been carried out without closing the car park for significant periods of time. This would have led to significant revenue loss and disappointed shoppers. USL also installed acoustic barriers to minimise the amount of noise, both during the day and during evening and weekend shifts. Ultimately, USL's Site Manager was recognised by the Considerate Constructors scheme who presented an award for exceeding standards (copy attached).





It's what beneath the surface that counts

Over 21,000 No. hybrid anodes were installed into the decks of Loch Street car park. The anodes, whilst completely hidden from view and 'buried' beneath the new deck coating are now acting in galvanic phase to protect the steel reinforcement against corrosion for up to 20 years. The c.£750k investment in the anodes alone, represents a truly proactive approach adopted by BMO and Trident, and one which will prolong the life of the car park well beyond that which would have been expected using traditional repair techniques.

In order to demonstrate the added-value hybrid anodes bring to a Life Care Planning process, reference electrodes have also been embedded within the decks of the car park to monitor and measure any future corrosion activity.

The Loch Street car park project is a unique example of recognising the importance of a fit for purpose repair strategy for a busy coastal structure riddled with chloride contamination. Furthermore, the ability to target key

areas rather than adopt a 'blanket approach', meant funds remained available for aesthetic and safety improvements in the car park too.



Key Project Facts and Figures

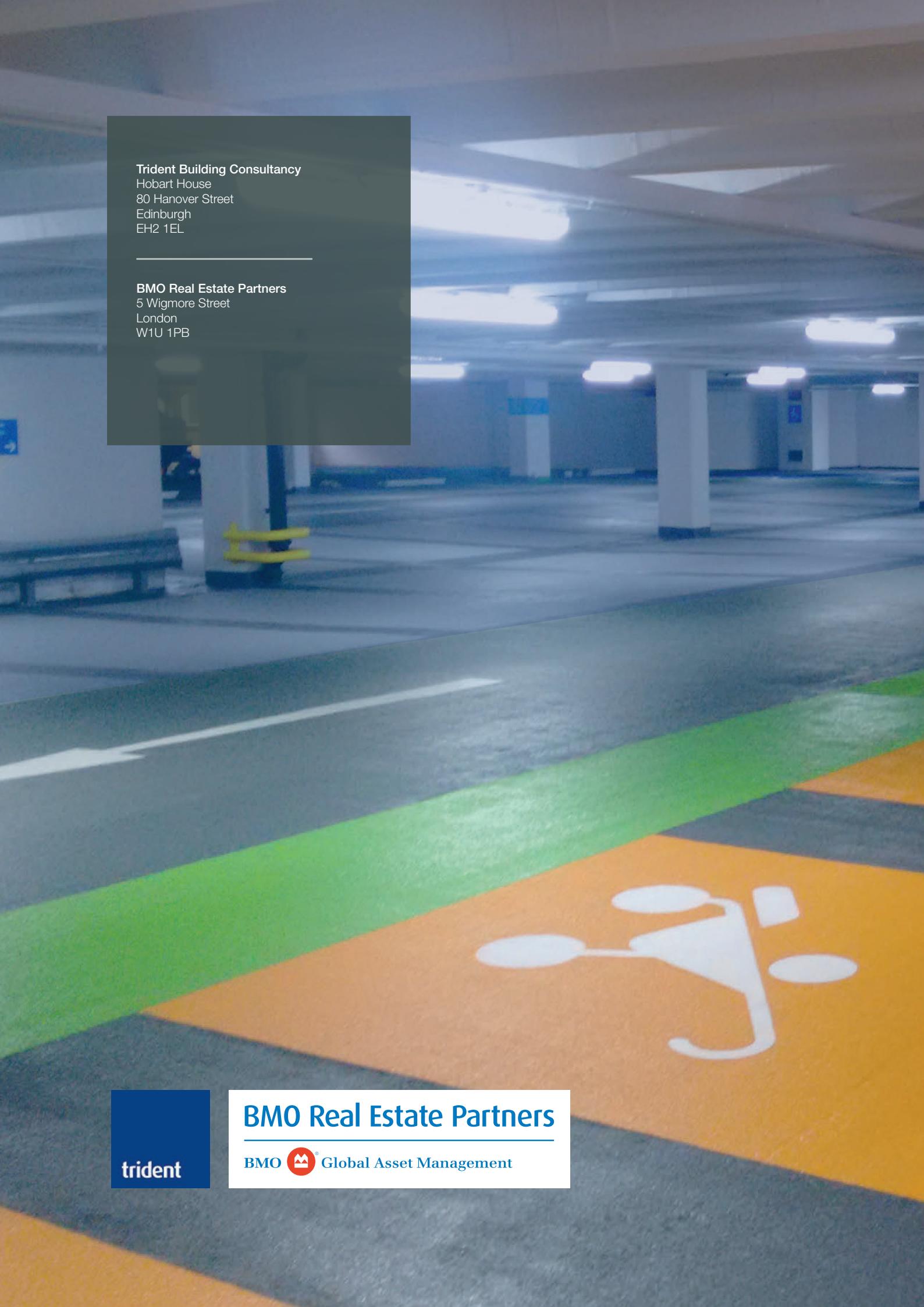
Value - £1.85m

m² of Pitchmastic PmB deck coating - 22,285m²

No. of hybrid anodes installed into decks - 21,740 No. This represents a c.£1.5m saving over ICCP which would have been the only other technically fit for purpose solution at Aberdeen

m² anti-carbonation paint to soffits, walls and columns - 43,150m²

Programme duration – completed on programme in 35 weeks



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