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Notice of Meeting

Cabinet
Councillors Simon Werner (Chair), Lynne Jones (Vice-Chair), Richard Coe, Geoff Hill, Joshua Reynolds, Catherine Del Campo, Adam Bermange, Karen Davies and Amy Tisi

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Royal Borough of Windsor & Maidenhead

Thursday 27 July 2023 7.00 pm
Grey Room - York House - Windsor & on RBWM YouTube

Supplement

Item	Description	Page
12	**Broadway Car Park - Nicholson Quarter Development update report** *Cabinet Member for Highways and Transport, Customer Service Centre & Employment* To delegate authority to the Executive Director of Place in consultation with the Cabinet Member for Highways and Transport, to go out to tender and approve a contract to demolish the Broad Way Multistorey Car Park	3 - 14

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Please contact Oran Norris-Browne, Oran.Norris-Browne@rbwm.gov.uk, with any special requests that you may have when attending this meeting.

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Consulting Engineers

BROADWAY CAR PARK, MAIDENHEAD

7559

STRUCTURAL VISUAL INSPECTION

JANUARY 2023

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Revision	Date	Issue Status	Prepared by	Checked by
A	10.02.23	INFORMATION	MK	

Contents

1 Introduction

Furness Partnership (FP) has been appointed by the Royal Borough of Windsor and Maidenhead to carry out a structural visual inspection of the Broadway multi-storey car park in Maidenhead SL6 1LB, following reports of concrete spalling from the underside of the First Floor level in December 2022.

FP visited the site on 24th and 27th January 2023. The inspection was carried out by walking along each floor level to observe any visible defects, in addition to the one reported in December.

Fig. 1 – Aerial view of the site

2 Observations

2.1 Existing Structure

2.1.1 Overview

The existing building is a concrete-framed, 4-storey car park, about 100m long by 50m wide, and appears to be from the 1960s or 1970s.

Cars enter and exit from two access points directly onto Broadway. Each level can be accessed via a ramped section located towards the back of the building or via a circular ramp by the southwest corner. There are three stair cores and two lift cores located on three corners and in the centre of the building. The top level, also used for parking, is open to the elements as can be seen in the aerial photo (Fig. 1)

An expansion joint that runs north/south across the whole width of the building is clearly visible on each floor level. It is located directly to one side of the circular ramp and effectively divides the building into two structures. This is not unusual for a building of this size and would have been provided to allow for thermal expansion and contraction without damaging the structure.

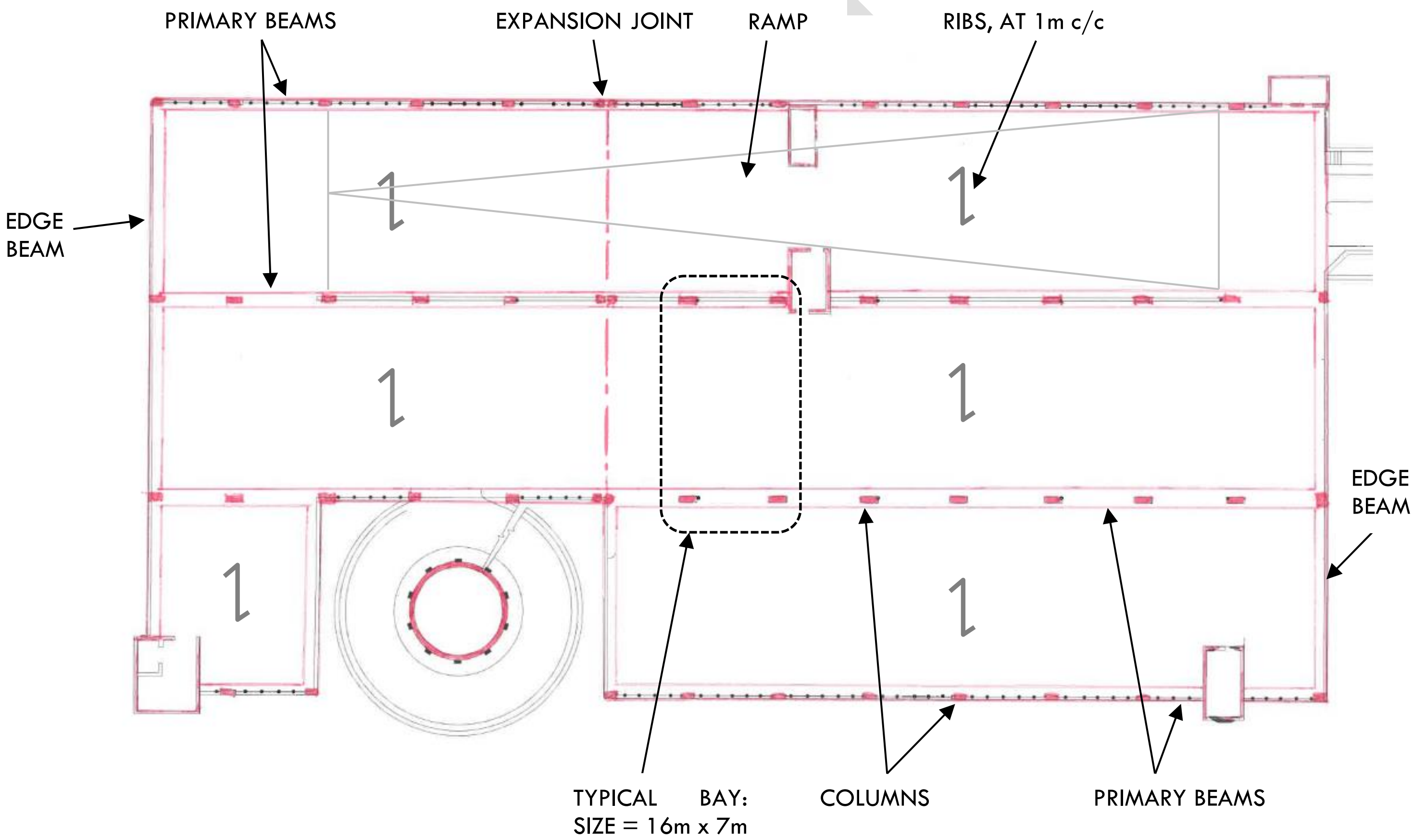

Fig. 2 – Typical Floor Plan

2.1.2 Floors

The undersides of the main reinforced concrete structural elements are generally all visible from each floor level throughout the building (Fig. 3).

Fig. 3 – View of Typical Floor Structure

Each floor is divided into a regular series of bays about 16m x 7m, with 1200mm x 300mm (or, in some locations, round) concrete columns in each corner of the bay. Primary concrete beams run around the building perimeter and also internally in an east-west direction, aligned with the columns. A series of ribs (500mm high x 150mm wide at 1m c/c) span the 16m bay distance in a north-south direction between the primary beams. 2 No. tie beams per bay run perpendicular to the ribs. A typical bay layout can be seen in Fig. 4.

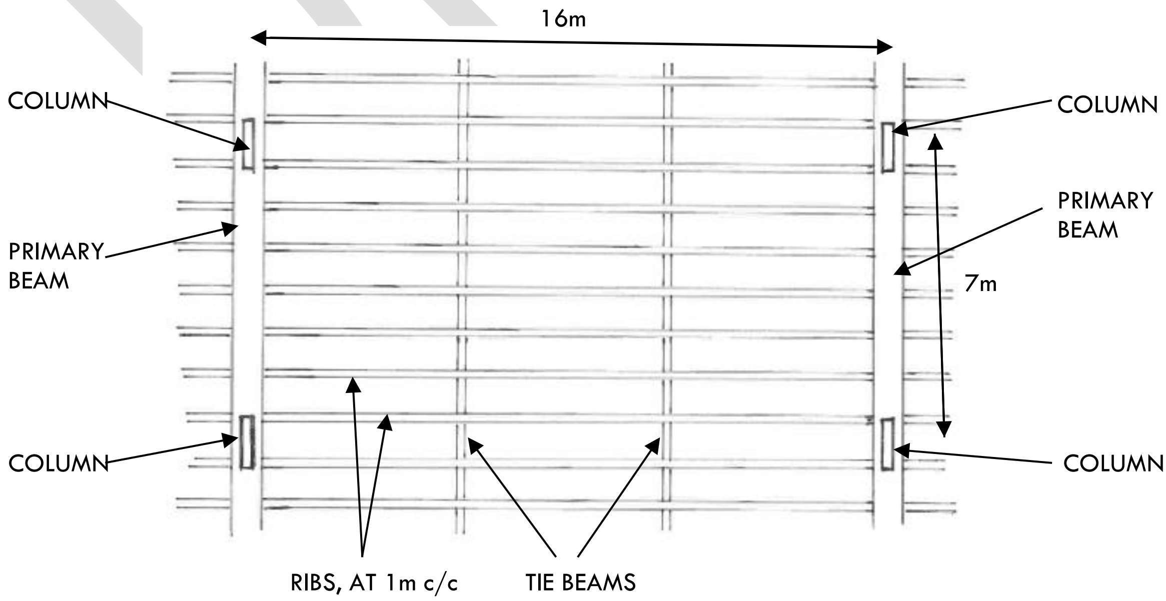

Fig. 4 – Typical 16m x 7m bay: Floor Structure

During the construction of this building it is likely that each concrete floor would have been poured sequentially in long strips across the building, in widths of 6m to 7m (each containing 6 or 7 ribs), separated by construction joints. These joints are visible throughout the building, and appear to have opened up gradually over time, likely due to water ingress, so that they currently appear as regular cracks at the top of every 6^{th} or 7th rib. A lot of them have water stains making them clearly visible (Fig. 5). A typical bay layout showing these crack/joint locations is shown in Fig. 6 below.

Fig. 5 – Typical crack at original construction joint, along top of rib

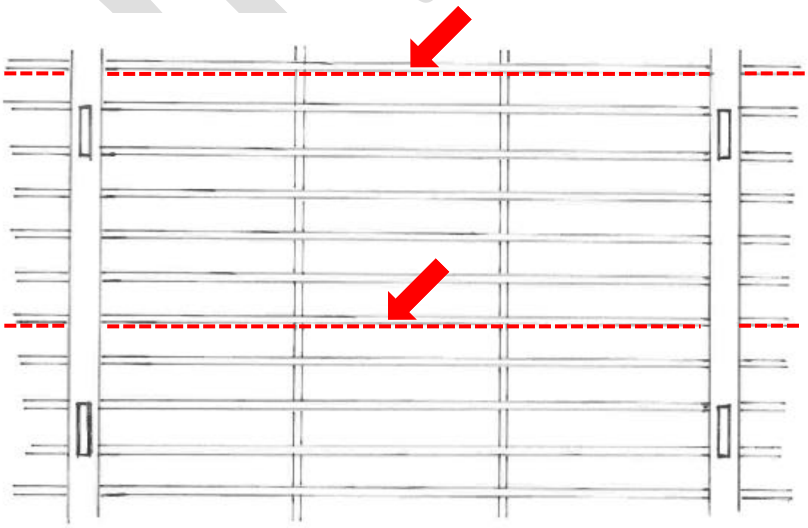

Fig. 6 – Typical 16m x 7m bay, showing typical crack at original construction joint, along top of rib

2.1.3 Elevations

The external elevations are generally clad in brick slips. The stair cores likewise appear to be clad in brick slips, though these could also be full bricks forming part of a cavity wall.

Several areas of brick slip have been covered in square meshes, presumably due to prevent locally damaged slips from falling off the building.

On the west elevation there are a series of precast concrete cladding panels fixed to the 2nd, 3rd and 4th Floors. Some of these panels have had additional bolts installed fixing them back to the main structure, presumably as a remedial repair at some point in the past.

2.2 Defects

2.2.1 Concrete

The main defects that prompted this report are several sections of spalled concrete that occurred on the underside of some of the First Floor ribs, close to the circular ramp area (Fig. 7). Fairly large sections of concrete have come off, revealing corroded reinforcement bars. This damage has occurred on ribs containing the cracked construction joint discussed above. Water staining is also clearly visible on these ribs.

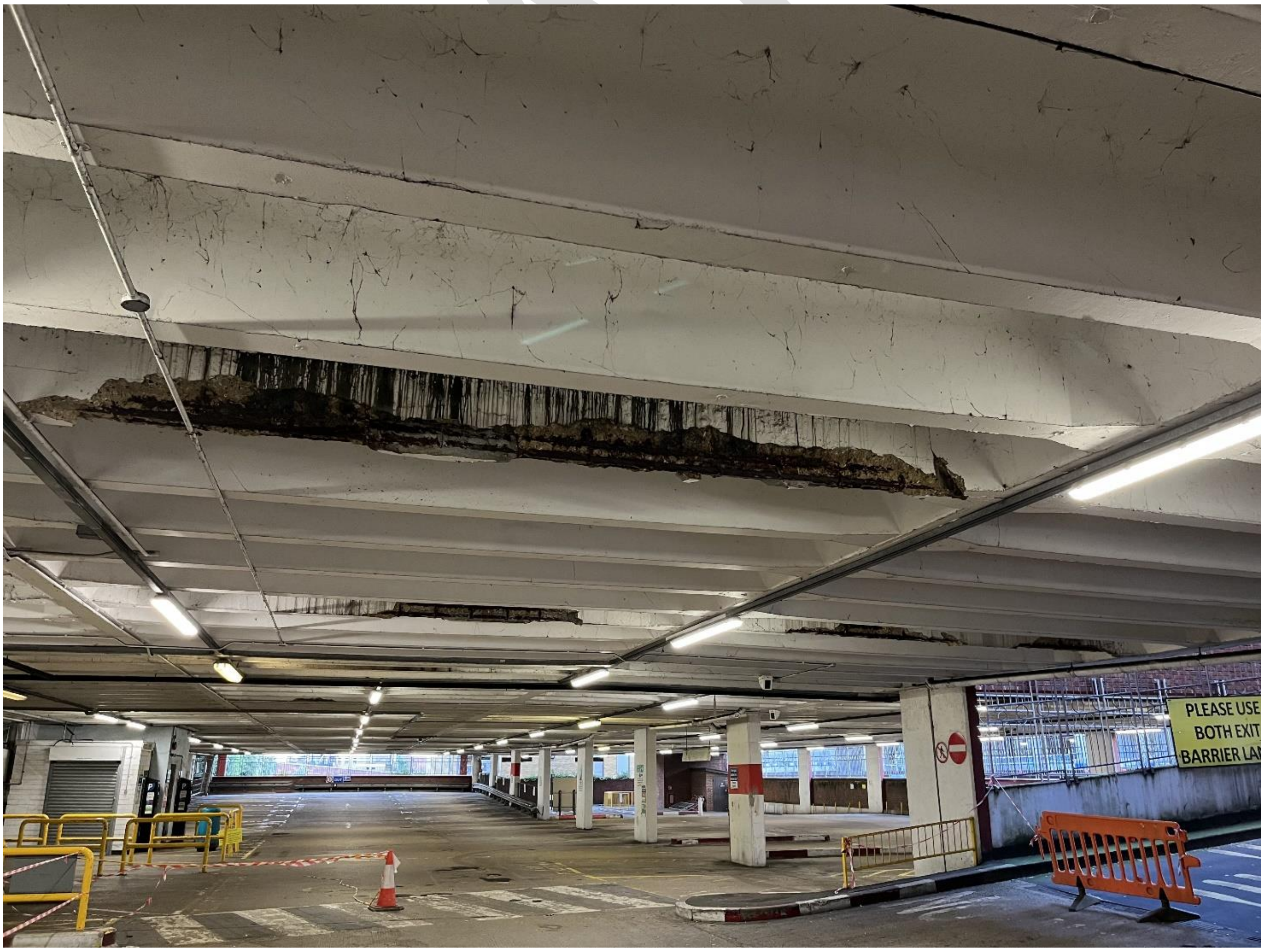

Fig. 7 – Spalled concrete ribs revealing corroded reinforcement

Some of the material that remains around the corroded reinforcement appears to have a different composition to the rest of the concrete in the rib, suggesting this defect may have originally happened years ago and had already been subject to a repair using a particular kind of cementitious material. The exposed reinforcement bars are a twisted square type, commonly used in the 1960s, but no longer in use today. This just confirms the likely age of the building of at least 50 years.

The inspection continued, floor by floor, across the rest of the building, where several more defects (and previously repaired defects) were observed. A clear pattern emerged in that the vast majority of these defects occur on the ribs containing the construction joint. It would appear that, where water can get through the joints it may over time also seep into the bottom of the rib itself, causing the reinforcement bars here to corrode.

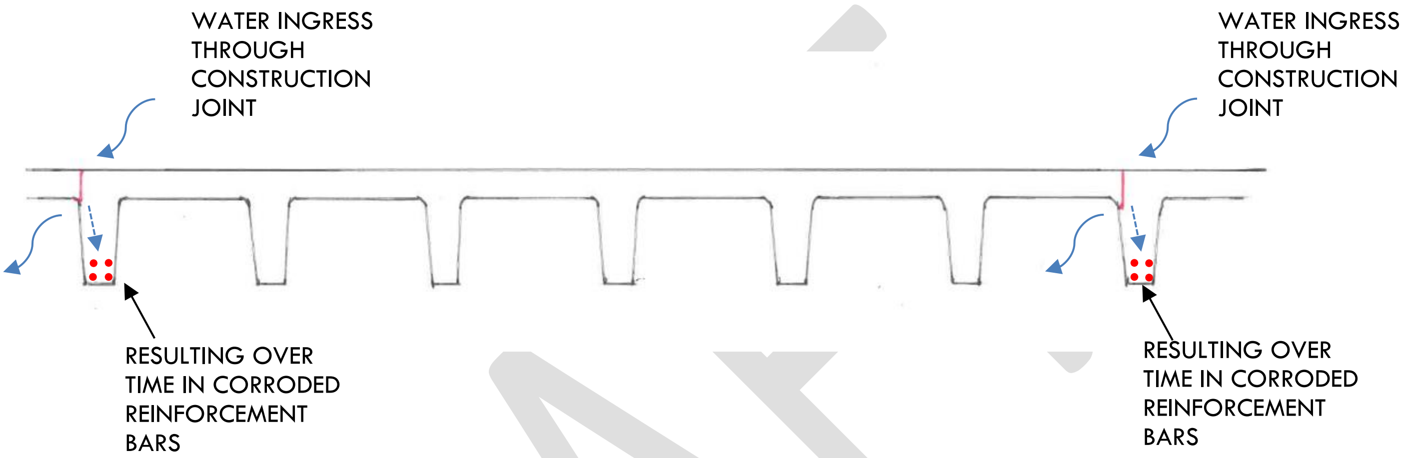

Fig. 8 – Typical section through floor slab: water ingress through construction joints (every 6th or 7th rib) with the potential to result in corrosion of the rib reinforcement

Some defects also appear as cracks to the underside of the short section of slab between ribs, either perpendicular or parallel to the ribs. These have probably been caused by other cracks in the top of the slab that have appeared over time, possibly through the repeated action of vehicles on the slab. This type of defect occurs much less often than the type on the ribs, and is limited to certain localised areas rather than throughout like the rib construction joint crack.

Fig. 9 – Transverse crack, slab underside

Fig. 10 – Longitudinal crack, slab underside

2.2.2 Top Level and Water Ingress

The top level, which is open to the elements, has had some kind of waterproofing membrane applied to the top surface of the concrete floor, and various joints in the concrete surface have been sealed with additional waterproofing.

However large areas of the waterproofing are clearly damaged, which will result in water ingress. It appears this water ingress finds its way through the building to all floors below. While we were on site various areas of the floor underside were clearly wet, and even dripping wet.

There is a natural fall in the floors towards one of the lines of internal columns, where several rainwater pipes have been placed. It is possible some of these rainwater pipes may have blockage problems.

Fig. 11 – Damaged waterproofing

Fig. 12 – Damaged waterproofing

Fig. 13 – Damaged waterproofing

Fig. 14 – Damaged seal over joint

3 Conclusion

The great majority of defects have occurred in the concrete floor ribs, caused by water finding its way through the original construction joints in the floors, which over time has caused the steel reinforcement bars in the ribs to corrode. As the bars have corroded they have expanded and exerted pressure on the surrounding concrete, eventually leading it to break off locally around the bars. All these defects need to be repaired. (For more details refer to the **Repair Schedule** below.)

It appears these same types of defects have occurred previously, possibly many years ago, as evidenced by several ribs with clear signs of old repairs.

As discussed in Section 2 these types of defects occur, or have the potential of occurring, on roughly every 6^{th} or 7^{th} rib, where the original construction joints were made.

Some of these ribs where concrete spalling has not yet occurred have multiple cracks in addition to the typical construction joint crack at the top, indicating that spalling could happen in the not too distant future. These should all be hammer-tested and, if the concrete breaks off revealing corroded reinforcement, repaired.

The second type of defect occurs to a much lesser extent and consists of cracks to the underside of the section of slab between ribs. These are either short transverse cracks perpendicular to the ribs, or longitudinal cracks parallel to the ribs. These cracks usually have rusty stains on them indicating that they are also caused by water ingress locally corroding bars within the slab. These should be hammer-tested and repaired locally where concrete breaks off revealing corroded reinforcement.

The third type of defect occurs to the top of the slab, where small patches of concrete surface have been damaged and the top reinforcement is visible. This is limited to small local areas, possibly caused by the action of vehicles over a long period of time. It appears these have already been identified for possible local repair since there are paint marks around the small damaged patches. These can be repaired with proprietary cementitious products.

With the exception of a single, relatively small spalled patch, the primary beams do not appear to show signs of spalling.

The columns likewise do not appear to show any signs of spalling.

The underside of the circular ramp is showing signs of water ingress along radial joints, although they do not appear to show signs of spalling, nor do they have rusty coloured staining. A number of these radial joints should be hammer tested to confirm there is no loose concrete cused by corroded reinforcement.

In conclusion, we would recommend that a specialist contractor such as CRL (Concrete Repairs Limited) carry out the concrete repair work, including systematically hammer-testing all the construction-joint ribs on all floors.

The waterproofing to the top level is severely damaged in places, meaning water can percolate down the whole structure causing all the spalling defects mentioned above. It should be repaired if there are any long-term plans for this car park.

3.1 Repair Schedule

3.1.1 Defect Type 1: Ribs

- On all spalled ribs, remove any loose concrete around reinforcement bars and patch repair locally. This work would include:
  - Removing corrosion on bars by grit blasting or similar method
  - Applying proprietary primer coating to the bars
  - Depending on the size of the patch repair, inserting a length of new stainless steel bar alongside the existing
  - Applying a proprietary cementitious repair, e.g. Fosroc

- On all remaining ribs containing a construction joint (every 6th or 7th rib on all floors), and on all previous repairs, hammer test the rib
  - If concrete breaks off revealing corroded reinforcement, carry out the repair as outlined above

3.1.2 Defect Type 2: Cracks to underside of slab between ribs

- Remove any loose concrete around reinforcement bars and patch repair locally. This work would include:
  - Removing corrosion on bars by grit blasting or similar method
  - Applying proprietary primer coating to the bars
  - Depending on the size of the patch repair, inserting a length of new stainless steel bar alongside the existing
  - Applying a proprietary cementitious repair, e.g. Fosroc

3.1.3 Defect Type 3: Damaged patches to top of slab

- Remove any loose concrete around reinforcement bars and patch repair locally. This work would include:
  - Removing corrosion on bars by grit blasting or similar method
  - Applying proprietary primer coating to the bars
  - Depending on the size of the patch repair, inserting a length of new stainless steel bar alongside the existing
  - Applying a proprietary cementitious repair suitable for traffic use, e.g. Fosroc

3.1.4 Defect Type 4: Circular ramp

- Hammer test at least 2 radial joints showing signs of water ingress per storey.
  - If concrete breaks off revealing corroded reinforcement, carry out the repair as per defect type 1.

3.1.5 Defect Type 5: Waterproofing

- Repairing the defects mentioned above will provide a short-term structural solution. Since the concrete has been damaged by water ingress, a long-term solution would have to include applying new water-proofing to the top level of the car park.