

**3.0 Recommendations**

**3.1 Balcony details**

3.1.1 Provide additional outlets and downpipes at the lowest point of balcony to drain surface water.

3.1.2 Extend downpipes through slab to disperse into below ground drainage.

3.1.3 Asphalt coverings should be renewed as required during the next cyclical redecoration programme.

**3.2 Cavities/flank walls**

3.2.1 Cavities should be cleared of debris where there is a clear link with damp on the inner face of the wall.

3.2.2 All blocked weepholes should be cleared.

**3.3 Windows/doors**

3.3.1 Replace timber doors and windows to match existing as part of the next cyclical redecoration programme.

**3.4 Walkways**

3.4.1 In view of the generally limited damage currently apparent as a result of the leaching, the re-waterproofing of the slabs could be considered a relatively low priority, subject to a general acceptance of the potential of damage to paintwork on vehicles. In the very long term, the concrete itself suffers but a more relevant concern would be the increased likelihood of corrosion damage to reinforcement in the slabs. It is therefore recommended that the slabs be re-waterproofed in a planned and programmed manner within the next 3 to 5 years.

- 3.4.2 A proprietary waterproof barrier protective coating (or damp proof membrane) should be specified for the public walkways. Installation of such a membrane will require removal of the existing walkway finish in phased stages and installation of the new. The finishes should be reinstated and it is recommended that the level of damp proof course upstand be maintained at a minimum of 150mm above finished level. Care and attention to detail should be exercised throughout but particularly at thresholds.
- 3.4.3 Laps and movement joints in the membrane should occur above or adjacent to existing movement joints in the concrete slab. Proprietary products should be installed in accordance with the manufacturers' instructions and at minimum frequencies as required.
- 3.4.4 The work noted above will involve the lifting and subsequent relaying of paving slabs and the removal of the bedding sand. This work should be phased in order to cause least disruption to the residents and estate users. The sand should not be re-used if it is likely to contain salt.

**3.5 Concrete repairs**

- 3.5.1 Proper concrete remedial works and effective corrosion control measures must be designed, in accordance with EN1504, European Standard for concrete repair, to deal with visible and latent damage.
- 3.5.2 Concrete remediation and corrosion control measures are recommended to minimise further deterioration of the structure, to minimise consequent risks to the public from falling debris and to maintain the aesthetics. It is recommended that an approved concrete repair contractor, using quality products and systems, carry out these works. All repairs should be carried out in accordance with an agreed specification and with the manufacturer's instructions and recommendations.
- 3.5.3 The concrete repair and corrosion control recommendations also assumes that all top surfaces of treated concrete slabs will be made fully waterproof, e.g. access deck areas, roofs, balcony slabs etc.
- 3.5.4 All instances of low cover must be attended to and all latent and visible corrosion damage repaired, so that any untreated reinforcement is in a sound alkaline condition. For concrete repair purposes any reinforcement found to be within 5 mm of the average carbonation front depth, must always be considered to be immediately at risk of corrosion.
- 3.5.5 Traditional concrete repair methods are considered appropriate for dealing with areas of visibly deteriorated concrete.
- 3.5.6 This will involve identifying all carbonated or contaminated concrete at the time of repair, which is in contact with reinforcement, which will include an element of latent damage on top of the readily visible problem areas. All such concrete should be removed and replaced with a proprietary concrete repair product, forming part of the full repair system in use. All cutting out for patch repairs should go well beyond the corroded length and behind the bar to ensure effective remediation. A levelling mortar should be applied to the repaired and

unrepaired concrete surfaces in readiness for the protective decorative coatings.

- 3.5.7 Electrochemical remediation techniques may be considered appropriate for ensuring long term durability in areas of higher chloride levels e.g. to the division walls.
- 3.5.8 This would involve identifying all hollow and delaminated areas of concrete for repair. These would be very simple repairs to delaminations, with no special requirements in terms of reinforcement preparation. Steel is never coated when using electrochemical techniques and mortars must have electrochemical compatibility, with the proposed installation.
- 3.5.9 Electrochemical remediation involves the application of a temporary external anode system to the concrete, consisting of a titanium mesh in a shutter filled with electrolyte. This, as well as the reinforcing steel, is attached to a transformer rectifier unit designed to pass a current for a given time period, dependent upon the exact concrete problems. The system reinstates a robust and durable passivity to the reinforcement, and moves chlorides away from the reinforcement.
- 3.5.10 The use of corrosion inhibitors is considered appropriate for dealing with the areas of latent deterioration due to carbonation, low cover and/or moderate chloride levels.
- 3.5.11 With the use of corrosion inhibitor to deal with the latent damage it is only necessary to identify all hollow and delaminated areas of concrete for repair. Repairs must however be to a high standard in line with traditional techniques. The corrosion inhibitor deals with the latent damage via migration through the pore structure of the concrete, and absorption to steel surfaces. A monomolecular layer coats the steel preventing moisture and oxygen reaching it, and hence corrosion.
- 3.5.12 It is important that a proprietary concrete repair system be used with a recognised specialist contractor. Particular attention should be paid to the

selection of decorative and protective coatings. These must be vapour permeable, an anti-carbonation coating and preferably elastomeric.

- 3.5.13 Anti-carbonation coatings can come in a variety of colours (including 'clear') and can therefore be applied to exposed concrete elements of the estate without deviating excessively from existing aesthetic schemes.
- 3.5.14 Exposed concrete elements exhibiting high levels of free chlorides should be treated with an appropriate repair system that reduces the level of free, unbound chlorides to acceptable levels.
- 3.5.15 Levels of free chlorides need to be reduced to within an acceptable range, subsequently reducing the risk of corrosion. Employing a recognised appropriate system can do this. Methods vary according to the system employed. Generally, these repair methods are more involved than the standard repair methods noted above.
- 3.5.16 It is strongly recommended that localised treatment is not attempted but rather the entire exposed area of the concrete element should be treated in order to not 'push' the chlorides to a previously unaffected area. In order to maintain aesthetics and enhance the long-term durability of the exposed concrete elements, a high alkalinity fairing coat would be recommended along with an anti-carbonation coating, as the standard repair.
- 3.5.17 Several of the representative sample areas on the estate assessed were in need of high priority action to reduce the very high levels of unbound chlorides. These areas included the car parks and service yard. Areas that did not indicate levels of unbound chlorides requiring such action were the balcony soffits, link bridge upstands and entrance soffits. These three generic areas could be excluded from the special repair system required for the car park and service yard providing more detailed testing, carried out as part of the repair programme confirmed the current findings. Normal concrete repair will be necessary.

**3.6 Fire damaged areas**

- 3.6.1 It may be prudent to consider incorporating fire protection or fire control systems for the garage areas at the design stage of the project.
- 3.6.2 The testing of the core samples indicated localised deterioration of the concrete due to fire.
- 3.6.3 All deteriorated concrete (pink coloured concrete, cracked concrete and hollow or delaminated concrete) should be removed. All exposed concrete surfaces should be cleaned (the soot removed).
- 3.6.4 The concrete should then be reinstated using a suitable proprietary concrete repair system (e.g. sprayed concrete or traditional recasting). The areas of the garage, unaffected by fire, will require repair system to improve and maintain the concrete durability against carbonation and chloride attack.

**3.7 Subsidence damage**

- 3.7.1 The length of existing "retaining wall" that is leaning over should be reconstructed. It may be prudent to consider the use of dense blockwork and class i) or ii) cement: lime: sand mortar. Vertical reinforcement may also be considered to help increase the resistance to lateral loading.
- 3.7.2 It would also be preferable to reduce the height of the new wall to the minimum required to retain the earth behind it.

**3.8 Drainage**

**Surface water drainage**

- 3.8.1 High pressure jetting is recommended to clear slip drains throughout the estate.

**Below ground drainage**

- 3.8.2 It appears from the CCTV survey and report that the below ground drainage system is in a fair to good condition. This is probably due to the fact that the pipe is of cast iron and not vitrified clay, which is more prone to damage.

- 3.8.2 All areas would benefit from specialist cleaning using scale cutting equipment. This is due to a natural build up over a period of time.
- 3.8.3 Approximately 25% of the site is suffering from an additional build up of either silt or fat and grease. The specialist cleaning process mentioned above may rectify these areas.
- 3.8.4 Therefore in general the below ground drainage system is in a good condition with no obvious or serious corrosion or structural damage and only requires the descaling process to be carried out in order to provide an effective drainage system for the next few years.
- 3.8.5 In order to minimise further damp penetration to the structural slab, the system to get rid of surface water should be overhauled, repaired and made effective.

#### **Car park drainage**

- 3.8.6 It is recommended to replace the existing open drains in the car park with a below ground drainage system  
This would involve the breaking out of the existing drain runs and 100mm diameter plastic drain pipes being installed into the slab and reinstated with concrete to finished floor level. The new drainage runs would disperse into the existing storm water main drain system.  
It is recommended to replace the existing plastic gutters beneath slip drains with cast iron gutters.

#### **3.9 Cyclical redecoration**

- 3.9.1 Cyclical redecoration of the estate is due as part of 2002/2003 programme. It is recommended that the repair works and redecoration work are programmed to produce a logical sequence of repair and redecoration works for the estate.

**3.10 Estate Lighting**

- 3.10.1 The main areas where the lighting levels are insufficient are :- Area 1, Area 3, Area 4, Area 6 and Underground Car Park and Workshop Area No2.
- 3.10.2 The amenity lighting to these areas requires major upgrading. The use of bollard style lighting to Area 1, Area 4, Area 6 would enhance the lighting levels whilst adding to the aesthetic appearance of the estate. The use of low level lighting also ensures that the residents are not affected by increased glare and light pollution.
- 3.10.3 Area 3 is the walkway behind 1-24 Redcar Close. This area requires wall mounted lighting to bring the lighting levels in line with current requirements.
- 3.10.4 The Underground Car Park and Workshop Area No2 are inadequately lit in some parts and is a dangerous environment at night both in terms of security and also personal safety. This area requires additional soffit mounted lighting to bring it in line with other underground areas of the estate.
- 3.10.5 There are a number of areas around the estate where individual luminaires were not functioning during the survey. These have not been addressed in terms of the improvement proposals as they should form part of a regular maintenance programme.

**Sports Pitch Floodlighting**

- 3.10.6 The existing floodlighting to the sports pitch appears to be functioning at all times during the night hours and is the only lighting to the two walkways around the sports pitch area. This type of flood lighting is not appropriate for use as the amenity lighting. Some additional amenity lighting using four metre high columns should be introduced to the landscaped areas with timed control of the floodlighting in order to improve the efficiency of the lighting in this area.