

## Historic England and Concrete Conservation – Talk to ICOMOS at Dudley Zoo

This talk covers the work of the Building Conservation & Research Team (BCRT) at Historic England, in conserving historic concrete structures; particularly researching and monitoring the performance of patch repairs.

Historic England was set up last year when English Heritage was divided into two. The English Heritage Trust now looks after the 420 monuments in its care, whilst Historic England advises the government on all aspects of the historic environment so deals with archaeology, aerial surveying, archives, listing etc etc. The Listing Team are best known because of the controversy that usually surrounds their recommendations for listing contemporary concrete buildings. Dunelm House is subject to an application for a Certificate of Immunity from Listing which they are considering before making a recommendation to the Secretary of State.

BCRT have recently completed the Practical Building Conservation volumes which includes one on concrete. This sets out the principles for understanding the causes of deterioration, assessing condition and then repair in ways that seek to effect good longevity and which maintains the character and appearance of the building. This often means eschewing many of the accepted materials and methods used by industry today. Matching in new concrete has generally not held to be a major objective. Indeed the use of polymer modified mixes and anti-carbonation coatings preclude the aim of matching into older weathered concrete as examples from Alexandra Road show.

This estate was built in the early 1970s and is listed at Grade II\*. It comprises a mixture of fair-faced and board marked concrete but has suffered from unsympathetic repair methods in the past. So in the late 1990s BCRT started to develop repair methods based on replicating the original mixes and using stone masonry techniques to better match in. These techniques were developed first at their Training Centre and then taken to site. The aim was to try and match the surface finish so just before the concrete cured the repair patches were subject to high pressure jetting to slightly distress the surface, so that it would hopefully weather down more quickly to match the concrete around them.

The same principles were applied to a repair of damaged cast concrete at the Grade II Hornsey Library. The original mix was replicated and masonry repair techniques used to precisely fit the new cast section. Sadly the joints were never finished although the repair has successfully blended in.

Tynemouth Coastal Battery forms part of the important scheduled monument at Tynemouth Priory. The concrete dates from the 1880s with further structures erected during the two wars. Some of it is mass concrete, but most of it is reinforced. Cracking and damage had been caused by a failure of different pours to adequately bond and also to the treatment from scrap dealers extricating the metals in the 1950s. A series of small and large scale repairs were carried out with again, the starting point to prepare and test

different mixes to see which ones blended in best. The works were completed in 2009 and recent inspections show they have weathered down satisfactorily with no signs of cracking or distress.

Underpinning repairs to the scheduled Listening Mirrors near Dungeness provided the opportunity to carry out a number of repair techniques, including the use of modern treatments such as anti-carbonation coatings and migrating vapour phase inhibitors. Various methods were tried to effect patch repairs which matched in, again by replicating the materials and distressing the finish. The work was finished over a decade ago and the condition and performance of the repairs have been recorded and monitored on a regular basis ever since. The anti-carbonation coatings initially conferred benefits but after a few months corrosion was detected in the reinforcement. Most of the patch repairs carried out in matching materials are gradually blending in with no cracking or laminations. Hammer tests indicate these are still performing well and no corrosion was detected in the steels around the repairs.

The 30 Foot Mirror provided an opportunity to test a remote sacrificial anode which had been specifically designed by David Farrell of Rowan Technologies to try and halt the corrosion which was damaging the concrete within the bowl. Two blocks of magnesium were buried in the shingle some distance away and wiring carried underground before it fed up to the bowl. The corroding reinforcement was shot blasted and repaired and a mixed metal oxide grill attached before the whole repair was rendered to match the rest of the surrounding surfaces. Portable reference electrodes have been used to regularly monitor performance and for the last 12 years there has been no corrosion through the full depth of the repair; indeed passivation has also spread to surrounding metal reinforcements which have stopped corroding.

Monitoring the performance of the repairs at Dudley Zoo is ongoing, following recent works to the Bear Pit (Grade II\*) and Meerkat Enclosure. The aim has been to make sure that these are still sound, there is no evidence of cracking or delamination and that the reinforcement is free from corrosion. A number of these tests are repeated every 6 months.

A very sympathetic repair programme has been carried out at The National Theatre where the owners and architects were particularly keen to remove some unsightly and poorly performing earlier repairs carried out in polymer modified mixes, and replace them with something that blends in far better. Again masonry techniques and small purposed designed hand-tools were developed to complete these.

BCRT is continuing to monitor the performance of patch repairs where we know exactly how the works were carried out and have very detailed specifications of what was used. In time we hope to measure other concrete buildings that we were involved with, including Goldthorpe Church which was substantially repaired 20 years ago and Park Hill, Sheffield (Grade II\*) which it is hoped will be repaired in a more conservative manner than was the case in the recent scheme.

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