

Testing & Investigation of Concrete & Cementitious Materials

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Kiwa CMT Testing





Inspection, Testing & Sampling of Reinforced Concrete Structures

Chemical Analysis (Concrete, Mortar, Screed, Render, Plaster, Soil, Groundwater)

Investigation of the Cause of Problems & Failures

High Alumina Cement Concrete Testing

Recycled/Re-used Construction Materials

Fire Damaged Concrete

About Kiwa

Kiwa CMT Testing is part of the Kiwa group which is a world top 20 leader in Testing, Inspection and Certification (TIC). Markets we are active in range from street lighting, construction materials testing and energy supply to drinking water, agri food and healthcare.

Kiwa employs over 4,500 people in more than 100 offices in over 40 countries across the world; mainly in Europe, Asia and Latin America.

Kiwa has 6 offices/testing laboratories in the UK, the services for sampling testing and analysis of concrete and other cementitious materials operate from our Derby location.

Kiwa CMT Testing is a site and laboratory materials consultancy, testing and investigation company providing expert structural, geo-environmental, geotechnical and associated services for the construction, civil engineering and highways infrastructure sectors.

We are UKAS and CHAS accredited and HERS, HEA and Constructionline registered. Details of our UKAS Schedule can be found on the UKAS website.



Inspection, Sampling & Testing of Reinforced Concrete Structures

Kiwa CMT Testing provide a full scope of structural investigation, sampling and testing services for a range of buildings and structures:

- Commercial buildings
- Multi-storey car parks
- Utilities infrastructure
- Residential properties
- Support structures
- Storage bunkers
- Ground bearing slabs

Site capabilities include:

- Diamond core drilling
- Incremental concrete "dust" drilling/sampling for chloride ion analysis
- Depth of carbonation
- Half-cell potential
- Depth of cover to steel reinforcement
- Sampling of masonry mortar
- Inspection and sampling of potential HAC concrete
- Investigation of "sulphate attack" of hardened concrete
- Investigation of potential Alkali Silica Reaction (ASR)
- Full range of laboratory testing (see later pages)

Services include factual only or fully interpretative reporting in accordance with client requirements.

Operating UK wide from a central Midlands location, we offer prompt mobilisation with efficient site working and reporting timescales.



Chemical Analysis

Our chemistry laboratory is equipped to analyse concrete, mortar, screed, render, plaster and the main components thereof. Other materials covered include soil, groundwater and recycled aggregates.

Analytical parameters include:

- Cement content & cement : aggregate ratio
- Original total water : cement ratio
- Mix proportions by volume
- Chloride ion content
- pH
- Acid-soluble sulphate
- Water-soluble sulphate
- Alkalis (sodium & potassium oxide, sodium oxide equivalent)
- Magnesium sulphate soundness
- Presence of high alumina cement (HAC)

Testing is carried out to British, European and other relevant standards including BS 1881 : Part 124, BS 4551 and BS EN 1744-1.

We aim to achieve prompt, cost-effective testing supported by added value advice and guidance available at all stages of a project or testing requirement.



Investigation of the cause(s) of problems and failures

Given the vast and varied usage of cement-based construction materials, it is inevitable that problems and failures will occur. Investigation and understanding of the principal cause(s) of such problems is a key step in the process of informing decision making in terms of remedial measures and actions.

From the expansive mechanisms of ettringite or thaumasite "sulphate attack" and alkali silica reaction (ASR) within hardened concrete to various expansive reactions within recycled sub-base materials and the effects of fire on reinforced concrete and masonry construction, Kiwa CMT Testing provide a full range of services for sampling, examination, investigative testing and interpretative reporting.

Testing techniques include:

- Thin section "forensic" petrography
- Scanning electron microscope (SEM/EDX)
- X-ray diffraction (XRD)
- X-ray fluorescence (XRF)
- FTIR (infra-red spectroscopy)
- Supporting chemical analyses

With corresponding broad, in-depth experience and knowledge, we are always happy to discuss and advise on particular situations and scenarios in the interests of delivering optimum levels of investigation to meet overall objectives.



High alumina cement concrete (HACC) testing

Used extensively in the 1960's and 70's, mainly for the manufacture of pre-cast, pre-stressed concrete beams and roof trusses. Used in commercial buildings, high rise blocks, schools and similar structures, HAC concrete is known to undergo a loss of strength due, initially, to compositional changes in a process known as conversion. Beyond this, a further loss of strength can occur as a result of "chemical attack" under persistent damp/humid conditions, giving rise to a risk of sudden structural collapse. Use of structural HACC ceased in the mid-1970's.

Consequently, existing buildings dating from the 1960's and 70's require assessment and testing of potential HAC concrete structural members (mostly beam and block floor and roof construction), particularly when there is a change of use or when such buildings change hands.



Our experienced structural and analytical chemistry staff combine to cover all aspects of HACC investigation, summarised as follows:

- *In situ* examination and sampling of potential HACC structural members in line with guidance from BRE SD3 and other relevant publications
- Initial laboratory testing for the presence of HAC using BRE IS 15/74 rapid chemical test
- Where required, confirmatory testing for HAC via BS 1881 : Part 124 (aluminium, silica & calcium oxide) or differential thermal analysis (DTA)
- "Phase 2" testing of confirmed HACC to determine whether chemical attack has occurred and if so, the extent of impact, using thin section petrographic examination (depth of carbonation, "sulphate attack") and, where necessary, X-ray diffraction (XRD) for determination of alkaline hydrolysis

Our interpretative reports enable structural engineers to make decisions on the feasibility and extent of necessary repair/remediation or calculate residual strength and bearing capacity where chemical deterioration has not occurred.

Recycled construction materials

The Hierarchy of Waste and the need to reduce the amount of waste going for landfill disposal drives the requirement to consider recycling and re-use wherever possible. The philosophy of recycling does not, however, constitute a “deregulation”; recycled materials used in construction must be demonstrated to be suitable for purpose.



Kiwa CMT Testing are conversant with testing requirements for recycled materials such as secondary aggregates for example, from source testing, factory production control (FPC), potential in-service impacts and end of service life considerations. Frequent chemical tests include:

- Acid-soluble sulphate
- Water-soluble sulphate
- Total sulphur
- Oxidisable sulphides
- Total potential sulphate
- Loss on ignition
- 10 : 1 leaching/leachate testing
- Monolithic (tank) testing
- Petrological examination
- Free calcium and magnesium oxide
- Accelerated expansion testing (steel slag, blast furnace slag)



Testing is carried out to current published standards or suitably documented methodologies.

Our services extend to consultancy input on subjects such as interpretation of tank testing results and formulation of documented quality protocols for specific material types and our staff are happy to discuss all aspects of the process.

Fire damaged concrete

The generally good fire-resistant qualities of concrete are a “given”. It follows therefore, that, in most cases, the focus of assessments carried out on concrete structures sustaining fire damage is the determination of the nature and extent of the damage and hence the necessary extent of repair needed to place the structure back in service.

Kiwa CMT Testing have carried out investigation and testing of fire damaged concrete on numerous occasions over the years on various buildings and structures.



The means of investigation may involve:

- Visual inspection/appraisal to gain an indication on likely temperatures reached via the effects on various materials, fixtures and fittings
- Break outs to provide an initial indication of the depth of weakened concrete
- Hammer tap surveys to identify delaminated/hollow areas
- Site sampling including diamond core drilling
- Initial photographing and visual assessment of samples for colour change/indication of temperature range/gradient, likely loss of strength
- Compressive strength & density (BS EN 12504 & 12390)

- Thin section petrographic examination of core samples to obtain more detailed data on issues such as extent and depth of fire induced cracking and microcracking, confirmation of aggregate colour changes and corresponding heating temperatures, changes within the cement matrix and overall effects of heating/quenching

Our investigations are conducted with reference to guidance given by Concrete Society Technical Report 68 and other current publications.

Comprehensive reporting informs subsequent decision making by engineers in terms of design and implementation of structural repairs.

We also offer post remedial elemental load testing to confirm the efficacy of repairs.



Other Services

Our services are delivered by five inter-cooperative departments: Concrete/Building Products, Chemistry, Geo-environmental, Geotechnical and Structures offering a wide spectrum of testing within these disciplines.

As a long-established testing laboratory our extensive experience enables us to supply the optimum level of service utilising the most appropriate methodologies from initial appraisals to recommendations for subsequent phases of testing and investigation.

Our range of services includes:

- Building product testing, including concrete, asphalt, brick and masonry
- All phases of ground contamination site investigation
- Geotechnical site investigation
- Waste soil characterisation and classification
- Topsoil sampling, testing and assessment
- Coal tar and tarmacadam assessment

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