CONCRETE CONDITION ASSESSMENT AND REHABILITATION

CAPABILITY STATEMENT

CTI CONSULTANTS PTY LTD
ABN 56 003 824 815
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INTRODUCTION

CTI Consultants Pty Ltd is recognised as a leading expert in performing condition assessments of concrete structures. CTI also makes recommendations on protective systems or rehabilitation procedures for concrete, with a wide ranging client base including both public and private organisations. We are conversant with the full range of diagnostic techniques used for assessing the condition of concrete, and with today's rehabilitation strategies and technologies for concrete structures.

CTI can perform or arrange all aspects of the assessment of concrete structures and facades, including preparation of work plans, all on-site tasks and procedures, subsequent testing and analysis and reporting. Technical specifications or full tender documentation for protection or repair can be produced; supervision of all work is also offered.

CTI has experience in making condition assessments and repair recommendations for concrete suffering from a range of deterioration mechanisms including chloride attack (marine and near-coastal exposure), sulphate attack, carbonation, alkali aggregate reaction, freeze-thaw attack, magnesite/moisture and fire damage.

Structures assessed include cast-in-situ civil structures such as major buildings, wharves and bridges, cooling towers, stacks and chimneys, concrete-lined tunnels, car-parks, apartment blocks and pre-cast structures including lightweight aggregate and GRC.

CTI can provide all access requirements for projects, including traffic control where required, and its personnel are qualified to carry out work under Confined Space Entry permits. On-water inspections of bridges or wharves are performed using our 14' fibreglass workboat.

A Project Specific Safety Plan is prepared and implemented for each project involving significant site work, and all project personnel undergo a site-specific induction prior to commencing field work.

MAJOR CLIENTS AND PROJECTS

Major clients and recent projects involving assessing the condition of concrete structures include:

- NSW Public Works Sydney Opera House Upgrade Program, Investigation and Specification for Rectification of Water Ingress and Concrete Corrosion, Folded Beams and Podium Levels (1991-93)
- Royal Blind Society – Concrete condition survey, repair specification and works supervision, Enfield (1992)
- Roads and Traffic Authority of NSW; Literature survey and development of laboratory test procedure for evaluating water-repelling treatments; specifications for concrete impregnation (1993 - 97)
- Newcastle City Council; 3 car parks, four surf pavilions, seven bridges, maintenance workshop floor and Queens Wharf (1992-1999)
- NSW Housing; Pre-Cast Concrete Facade Assessment and Repair Specification, High Rise Public Housing Block (James Cook), 1994
- Transfield Construction – Waterproofing embedded plates in concrete walls, Esso Gravity-Base Platforms, Pt Kembla (1995/96)
- NSW Housing; Assessment and Repair Specification, Water Ingress and Concrete Corrosion, Public Housing Blocks; Sirius, The Rocks (1995-96)
- Roads and Traffic Authority of NSW; Concrete Condition Surveys of Bridges; Southern Region (22 coastal bridges, 1996 and 1999; 8 bridges on Kosciusko Road, 1998), Sydney Region (4 bridges, 1996) and Hunter Region (2 bridges, 1998).F.A.C. (as specialist subcontractor to RTA Technology), Airport Tunnel, General Holmes Drive (1996), Arthur Street Railway Bridge, Lidcombe (1997); Grafton Bridge Deck (2000).
- Shoalhaven Shire Council, Assessment and Repair Recommendations, 3 bridges (1994)
- Wyong Shire Council, Assessment and Repair Recommendations, 3 RTA bridges (1997)
- Transfield/NEPCO – Waterproofing joints in water cooling tower, Smithfield Co-Generation Plant (1996)

- Pitt and Sherry (for Tasmanian Transport Department); Investigation and Repair Recommendations for Continuity Connections, 14 Bridges, Tasmania, 1996 & 97).
- Pitt and Sherry; Various Structures (Chipper Pedestal, Grain Silos and Pump Room, Tas, 1996/97).
- NSW Housing; Water Ingress into High Rise Public Housing Towers (Matavai and Turunga), 1997/99
- Australian Water Technologies; NSOOS Concrete and Steel Corrosion Rate Study, (1997/98)
- Newcastle City Council; Facade Condition Assessment and Rehabilitation, Civic Administration Centre (September 1997, ongoing)
- Westrail, Investigation of AAR and mitigating treatment in concrete railway sleepers (1992-95), Performance monitoring of remedial treatment (1999)
- MSB/Sydney Ports; - Concrete condition survey and steel sheet-pile sea-wall corrosion survey and repair specifications, Port Botany BLB (1994/95); Concrete condition, Circular Quay West promenade (1995)
- Installation and monitoring of ongoing sacrificial anode CP trials on concrete bridge piles on two RTA bridges, managed by Newcastle City Council (1995 to present)
- Australian Water Technologies; Investigation of Tie-Bar Corrosion, Johnstons Creek and Whites Creek Aqueducts, Annandale (1997)
- Sydney Ports, Glebe Car Terminal; Assessment of concrete facade elements (1997)
- Hughes Trueman Reinhold; Assessment of various concrete structures including residential towers, swimming pools and heritage structures (1994 to 1999)
- Condition Assessment of Drainage Culverts, Austinmer and Bulli Beaches. Wollongong City Council (1998)
- Assessment of silane application to shell ribs, Sydney Opera House (1998/99)
- Port Vila International Wharf (c/- SMEC) - Concrete condition survey and steel-pile and sea-wall corrosion survey; recommendations and repair specifications (1998)
- Taylor Thomson Whitting/Concrete Construction group – Assessment of concrete strength, Wales House redevelopment (1998)
- Hughes Trueman Reinhold/Richard Crookes Construction – Assessment of Fire Damaged Concrete (1998)
- Coleambally Irrigation; Chloride content of concrete from irrigation structures (1998)
- Review of Water-Proofing Practices for concrete structures, Parbury Technologies (1998)
- Acor Consulting/NPWS; Condition assessments and repair recommendations, historic fortifications at Georges Head, Sydney Harbour National Park (1999)
- Caltex Load-Out Jetty, Kurnell (c/- Sinclair Knight Merz); Concrete condition survey and chloride determinations (1998/99/2000)
- Spring Bay wood-chip wharf, Hobart Ports; assessment of concrete cores (1999).
- Comalco Bell Bay Aluminium Refinery, (c/- Pitt & Sherry); determination of modulus of elasticity of concrete in high-temperature service (1999)
- Assessment of cooling tower and concrete pipe gallery columns, Incitec Ammonia Plant, Kooragang Island, Newcastle (Dockrill Consulting Engineers, 09/99)
- Magnesite floor damage to concrete slabs; Bronte Road, Bronte (Coope Unit Services 1999), Darley Rd, Manly (HTL Reinhold 1997) and Newport (HTL Reinhold 1996)
- Specification for and assessment of repairs to pre-cast high-rise façade structures, Melbourne (Vic. Dept. of Human Services; Office of Housing, 1999)
- Investigation to corrosion and protection of concrete Primary Settling Tanks, ULU Pandan WTP, Singapore (Econ Piling Pte Ltd, 1999/2000)
- Assessment of Concrete Silos for Possible Redevelopment, Newtown (Angus Developments, 12/1999)
- Assessment of drainage culverts and pipes, Warringah Mall (c/- Hyder Australia; 1999/2000)
- Assessment of drainage culverts and pipes, Hawthorne Pde, Haberfield (c/- Hyder Australia; 12/1999)
- Durability investigation and specification for concrete deck slabs, Walsh Bay Wharves 8 & 9 refurbishments, Sydney (Waterway Constructions, 1999/2000).
- Investigation and recommendations, cracks in concrete, Harold Park Raceway (Partridge Partners, 03/2000).
- Assessment and long-term monitoring of cracking in concrete deck slabs, Millennium Wharf, Rozelle Bay, Sydney (Waterway Constructions, 2000).
- Assessment of concrete cores for sewer gas attack, SWSOOS sewer, AWT Engineering - Structures and Reservoirs (05/2000).
- Assessment of 31 PSC Bridges, Laos Department of Transport (ADB, 05/2000).
- Testing of acid resistant gunites for sewer repair (Redner Cell Method), National Starch and Flexitech, 2000 - 2007
- Inspection of Concrete Structures (Cooling Towers, Stacks, Coal Bunkers, etc) , Wallerawang and Pt Piper Power Stations; Delta Electricity (with Burns and Row Worley), 09/2000 to 06/2006.

- Inspection of Concrete Chimney Stacks and Chemical Plant, Caltex Kurnell Refinery; Sinclair Knight Merz, 2000-2007.
- Assessment of Historic Darling Point Road Retaining Wall, Hughes Trueman (for Woollahra Council), 2001.
- Concrete Condition Assessment Sydney Opera House Skirting Panels, Taylor Lauder Bersten for SOH Trust, 2001 and 2006.
- Assessment of columns and footings, 302-308 Crown Street, Sydney, Taylor Lauder Bersten, 2001.
- Condition assessment, transfer slab at Georgetown Apartments, Canberra (for HughesTrueman), 2001
- Condition assessment of concrete lined Murray 1 and 2 pressure tunnels, Snowy Mountains Hydro-Electric Authority, 2001.
- Condition assessment, Vaughan and Therry Buildings, St Ignatius Riverview (for HughesTrueman 2001), Main Building, St Michaels and Wallace Wing (Vild Building Services, 2002).
- Condition assessment, Lambton Pool Diving Tower and Cooks Hill SLSC, Intrados Consulting Engineers (for NCC, 2001).
- Condition assessment, Cooling Tower and Water Tank, David Jones Elizabeth St Store (for Finn International) 2001.
- Condition assessment of floor slabs, Energy Australia Substation at 183 Clarence Street, Sydney (for Hyder Consulting) 2001.
- Condition Assessment, Breakfast Point Jetty Deck; Taylor Lauder Bersten, 2001.
- Review of investigations and preparation of repair specification, Goodwood Island Wharf; Taylor Lauder Bersten, 2001.
- Condition assessment, Newcastle Ocean Baths façade, Intrados Consulting Engineers for NCC, 2001.
- Inspection of Concrete Chimney Stack, Incitec, Port Kembla; SKM, 2001.
- Condition Survey, Lower SWSOOS, Sydney Water Corporation (2002).
- Inspection of Two Concrete Chimney Stacks, Orica/Qenos, Botany NSW, c/- Haliburton KBR, 2002 & 2007.
- Assessment of Concrete Arch, Railway Overbridge at Lawson, NSW, for RTA Bridge Branch (2002)
- Concrete Condition Assessment of Lee and Throsby Wharves at Newcastle (for Connell Wagner, 2002).
- Concrete Condition Assessment, Des Renford Pool, Maroubra (for Acor, 2003).
- Concrete Condition Assessment, Granville Aquatic Centre, (Parramatta Council, 2003).
- Concrete Condition Assessment of Sydney Water Sewage Pumping Stations and Oviform Sewer (for Sewerfix, 2003).
- Crack Assessment, Walsh Bay Wharf, No. 2, Waterway Constructions (2003).
- Condition Assessment, 3 Coastal Bridges in Eurobodella Shire; URS, 2003.
- Condition Assessment, 12 Concrete Bridges, Wollongong City Council, 2004.
- Condition Assessment, 7 Bridges on Light Rail Line, Eptec and Hyder Consulting, 2004.
- Condition Assessment, Wodonga Creek Bridge, VicRoads, 2004.
- Condition Assessment, Concrete Stack at Kurri Smelter, Hydro Aluminium, 2004.
- Concrete Condition Assessment, Facades to Sydney Harbour Bridge, NSW RTA (2005).
- Condition Assessment, Palais-de Dance Pontoon, Luna Park, TLB, 2005.
- Concrete Condition Assessment, Energy Australia Substations (2004-6).
- Concrete Condition Assessment, Lane Cove Swimming Pool, Lane Cove Council (2005).
- Condition Assessments, various Surf Life Saving Clubs Wollongong Council, 2004-7.
- Condition Assessments, various bridges in greater Melbourne, Pitt & Sherry, 2003-6.
- Concrete Assessment, Pyrmont Wharf, Multiplex (2005).
- Concrete Assessment, Eastern Suburbs Railway Tunnel, NSW Railcorp (2005).
- Concrete Assessment, Woolloomooloo W Terraces Wharf, Robert Bird, (2005-6).
- Concrete Assessment, Water Reservoir at Yamba, North Coast Water (2006).
- Concrete Protection, Tugun By-Pass Tunnel, Pacific Alliance (2006).
- Crack survey and concrete assessment, Winmalee STP, PSP Alliance, 2007
- Concrete Assessment, Digesters at North Head STP, United Group (2006).
- Concrete condition assessment; CP performance specification and supervision; retaining wall at Artarmon Substation, Energy Australia (2005 – 2007)
- Crack Assessment, Portside Wharf, Brisbane, Waterway Constructions (2006).
- Concrete Assessment, Nelligen Bridge, Connell Wagner for NSW RTA (2007)
- Concrete Condition Assessment, Energy Australia Underground Substations (2004-7).
- Concrete swimming pool assessments – Geoff Ninnes Fong and clients; 2003 – 2009.
- Concrete Assessment, Broken Hill WTP (2007)
- Concrete Assessment, Tomago WTP (2007)
- Condition assessments, Digesters at North Head STP; United Group (2006).
- Assessment of 20ML reservoir at West Ryde; CHDE JV (2007)
- Concrete Condition Assessment, Parramatta War Memorial Pool, Crystal Pools (2007/08).
- Concrete & Masonry Assessments, Heffron & Delany Buildings, Little Bay (Brookfield Multiplex, 2008)
- Thermal imaging and condition assessment, concrete stack, Caltex Kurnell (2008/09).

STANDARD WORK PROCEDURES – FIELD SURVEY FOR CONCRETE CONDITION ASSESSMENTS

Site Establishment

On arriving on site and mobilising all equipment, representative elements and locations to be core-sampled and/or surveyed are selected or identified. A defect survey is carried out first, noting all spalling and other defects on a field sheet or in a note-book, and highlighting certain defects with coloured chalk to allow them to be photographed using digital cameras.

Each specific location selected for detailed investigation is marked clearly in coloured chalk with a number indicating the CTI project number, the number of the structure and/or relevant field identification number of the element (pier, bay, wall unit, etc).

Cover Survey

Using the Kolectric Micro Covermeter set with audio alarm, each target surface is surveyed for location of reinforcing steel and depth of cover. The position of the major steel bars and stirrups are identified and marked with chalk. Typical cover readings are noted, and the low cover for the area marked and noted.

Due to the nature of cover detection instruments, the cover recorded where a number of bars adjoin or intersect is usually erroneously low, by up to 10 mm although normally much less than this. To avoid incorrect interpretation of cover readings, the actual depth of cover is usually verified by drilling to the steel at selected locations, including the low-cover reading, and reading the depth directly[1].

Verifying Cover and Inspection of Reinforcing Steel

An electric hammer drill fitted with a 16 mm masonry bit or a small diameter hand-held coring bit[2] is used to make a hole to the steel, widening the hole or drilling adjacent holes as required until the steel surface is unmistakably identified. The true cover is then measured directly with a depth gauge and noted. If required, further excavation can take place to examine the condition of the steel and measure its cross section.

Core Sampling for Compressive Strength Determination, Chemical Analysis and/or Cement Content

Where required, core sections are taken from selected locations using a mobile electric coring rig. After marking the location of the reinforcing steel with a covermeter, a 83 mm coring bit[3] is used to obtain the cores, avoiding reinforcing steel (and any electrical conduits that may be present) wherever possible. Unless otherwise specified, core length will be 50 mm short of full depth or 400 mm (maximum length of coring bit).

The target area is first marked using indelible ink or crayon to show the orientation of the sample (usually to show “up” and/or field north). When the core sample has been retrieved it is marked with a unique identifying number and its location, and is photographed.

Core samples are taken to the laboratory and are fully dimensioned and logged. They are trimmed to provide a 2:1 aspect ratio[4], and are stored under standard conditions for 7 days. The core samples are then tested for density according to AS 1012.14, and for Compressive Strength according to AS 1012.09. Off-cuts from each core can also be examined for alkali aggregate reaction, aggregate type, content and grading, air entrainment and other features of interest.

Performing the Half-Cell Potential Survey

The electrode circuit is connected to the reinforcing steel, using the steel exposed for visual inspection and/or verifying low cover. Since the low cover as determined by instrument commonly corresponds to overlapping or adjoining steel, this presents a larger target for physically locating the steel by drilling than a single bar, and as a result the connection to the steel is normally made at the low-cover mark.

Once the steel has been located and exposed as above, a 4.5 mm drill-bit for steel is used to drill a hole into the steel bar to a depth of some 6 to 8 mm. A 100 mm or longer nail (6 mm diameter) is then driven into the hole to provide electrical contact. The positive terminal lead from a voltmeter is connected to the outer end of this nail outside the surface of the concrete by means of a vice-clamp.

The grid-marks for the potential surveys (usually at 500 x 500 mm centres unless otherwise indicated) are marked on the surfaces with chalk, and are wetted with fresh water from a hand-held pressurised spray dispenser.

1 CTI standard practice is to calibrate the covermeter on-site by direct measurement to the steel using a drill. This also allows verification of actual bar sizes.

2 If core sampling is also required the coring rig can be conveniently used to expose the steel.

3 This is the minimum acceptable size allowed in AS 1012.14, and minimises the chance of striking reinforcing steel.

4 Where the length allows this; otherwise AS 1012.14 allows adjustment for lesser aspect ratios.

The half-cell potential survey[5] is carried out in accordance with ASTM C876-92[6], using a combined copper/copper sulphate electrode (Model RE-5, made by M.C. Miller Co. of New Jersey) connected to the “common” terminal of a digital voltmeter (Fluke 10, 10MΩ input impedance).

Once the equipment is checked and found to be functioning satisfactorily, individual readings are taken at all grid points by bringing the reference electrode into contact with the surface and recording the LED display read-out value on a field sheet.

Rebound Hammer Survey for Concrete Strength

If knowledge of the concrete strength is required, but coring is not considered viable, a rebound hammer survey may be carried out in accordance with Standards Australia Hand Book HB34, “*Near-to-surface testing of hardened concrete*”. A 5x 5 grid is marked on the surface after location of the main reinforcing steel, and the rebound hammer reading are taken on all grid points and recorded on a field sheet. The concrete strength is then calculated[7] according to the procedure outlined in HB34.

Resistivity Measurement

The resistivity of the concrete is measured at four locations[8] using a Proceq RESI Resistivity Meter. The WENNER Probe is applied to the surface and the resistivity is read from the LCD display.

Determining Depth of Carbonation

Using the 18 mm masonry bit fitted to the electric hammer drill, a shallow mark is made on the surface to expose a fresh surface of the outermost concrete. A drop of a 0.5 % phenolphthalein solution in alcohol is applied from a syringe and the surface inspected for colour change from grey to red or reddish/purple.

If such a colour change occurs, indicating a pH unaffected by carbonation, the depth of the surface impression is measured and recorded as the depth of carbonation.

If no such colour change occurs, a progressively deeper impression is made (at about 2 mm intervals) and more phenolphthalein applied. This process is repeated until a colour change does occur, and the depth of carbonation is recorded.

Depth of carbonation can also be determined from core samples (whether obtained by CTI or by others) by splitting the samples and applying the phenolphthalein solution directly to the freshly exposed faces.

Chloride and/or Sulphate Profile Determinations[9]

Using an electric hammer drill fitted with a 16 mm drill bit, three holes are drilled into the concrete at each sampling location within an area 100 x 100 mm, to a depth of 10 mm, collecting all the powder from each hole in a plastic cap placed over the hole, through which the drill bit passes. The powder from the three drill holes is combined and placed in a pre-labelled and numbered resealable plastic bag.

Drilling is continued to the depth of 20 mm, the powder collected and placed in a plastic bag labelled with the sampling location number and the word “retain”. After cleaning the holes by blowing out all residual powder, and with the drill perfectly straight, drilling is continued to 30 mm, ensuring all powder from the interval 20-30 mm is collected and placed in a labelled sample bag.

A further sample is then collected from a 10 mm interval at the average depth of cover to the reinforcing steel[10], using the same procedure as above. The powder from the interval between 30 mm and the final sampling depth is collected and combined with the earlier “retain” sample. The “retain” samples may be sent for analysis of cement content in accordance with AS 1012.15 9 (unless core samples are used for this purpose).

The three powder samples (from depths 0-10 mm, 20-30 mm, and the 10 mm interval at the depth of cover) are analysed for chloride[11] or sulphate content in accordance with AS1012.20.

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5 CTI prefer to use a single hand-held electrode for half-cell potential surveys, instead of more automated equipment. This technique provides direct feed-back in the field, and is applicable to all concrete surfaces, regardless of complexity or morphology.

6 This procedure was re-approved by ASTM in 1999 without change.

7 Note that for the greatest reliability, rebound hammer results for a particular concrete mix should be calibrated against UCS determined from core samples. One or two cores is usually adequate for calibration of a particular concrete mix.

8 More locations can be measured if required, or if variable half-cell results suggest this should be done.

9 For chloride profiles CTI normally analyse the concrete at three depth, *viz.* the outer 20 mm, another 10 mm interval between 20 mm and 30 mm, and a third 10 mm interval at the average depth of cover. This is an economical approach and usually provides sufficient information for the required interpretation. A greater number of samples can be analysed if required.

10 Alternatively the third sampling depth can be 40-50 mm if consistent depths are preferred, or if cover is > 60 mm.

11 CTI currently use a chloride-ion selective electrode method for analyzing chlorides in-house.

The result are expressed either as parts per million on the concrete, or as the percentage chlorides by weight of cement, using the cement content and concrete density as determined from the core or powdered "retain" samples[12].

Retain or excess samples can also be analysed for other chemicals such as organic admixtures or contaminants.

Ion profiles can also be carried out on core sections by slicing and pulverising the target depth intervals.

Reinforcement Continuity Testing

Reinforcement continuity testing is performed by the DC resistance method as described in clause 5.2 of AS 2832.5-2008, *Cathodic protection of metals, Part 5: Steel in concrete structures*.

Using a digital voltmeter (Meterman 5XP, 10MΩ input impedance), the terminals are brought into contact with the exposed steel at the two test locations and the DC resistance is recorded.

AS 2832.5 provides an acceptance criterion for electrical continuity of a stable resistance of less than 2 Ω.

Petrographic Analysis

Core samples or other specimens can be submitted to specialised laboratories for petrographic analysis. Such analysis seeks to identify petrology of aggregates, consistency and air content of the cement matrix, and evidence of mechanisms of deterioration or alteration, including sulphate attack, alkali aggregate reaction, fire damage and micro-cracking (stress induced or other).

Petrographic analysis is usually reported separately, with photomicrographs as appropriate.

Metallurgical Analysis

Samples of reinforcing steel or other embedments may be submitted for micro-analysis using polishing techniques and a metallurgical microscope to identify the microstructure and major alloy phases. Testing for Vickers Hardness is also carried out, allowing tensile and yield strengths to be calculated.

Where relevant, appropriate weld procedures can be recommended for the type of steel detected.

Repairing Holes in Concrete

Core holes and larger holes from excavations to steel are patched using an appropriate proprietary polymer modified cementitious repair mortar[13].

Small holes (< 20 mm diameter) are cleaned of all loose powder and debris, and are sealed using a suitable flexible concrete-grade sealant from a caulking gun, ensuring the entire hole is filled with material and that a good seal is made to the edge of the hole.

Output

The UCS, core descriptions and general make-up of the concrete are reported for each core sampling location (as dictated by the scope for eac project).

The half-cell potential measurements for each element of each structure surveyed are transferred to a sketch of the surfaces of the element ("folded out" where appropriate) and with the reading grid pattern superimposed. Contour lines (commonly at 50 mV intervals are drawn to best-fit (where appropriate). For emphasis, all readings and all contours for values more negative than -300 mV are printed in red, and all positive values are shown in green.

The point of connection to the reinforcing steel is also shown on these drawings, as are other data such as the depth of carbonation and the location of the chloride profile sampling.

The results for the chloride or sulphate ion analyses for each location are presented in a table showing the sampling depth and the corresponding analysis result, expressed as the ion concentration as a percentage by weight of cement. A graph of each set of results is also presented.

The ion concentration graph for each location will also shows the currently accepted threshold concentration of chloride ions for reinforced steel in the corresponding exposure environment, as shown in Australian Standard HB-84 (2006), *Guide to Concrete Repair and Protection*.

Cover survey results are presented on sketches showing typical steel patterns, and the average and minimum cover to the steel. Significant defects in each structure are also shown on drawings.

A full report will be produced containing:-

- a written description of the survey and findings
- comprehensive set of photographs
- full interpretation and discussion of the results
- recommendations for repair or maintenance, with options and cost-estimates if required.

12 Where the determination of the cement content is not warranted, such as on small projects, the chloride concentration by weight of cement is calculated using an assumed density of 2300 kg/m^3, and an assumed cement content of 350 kg/m^3.

13 Usually Renderoc HB 40 or Guncerte E from Parchem Construction Products.

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