
SECTION 686 - COATING OF CONCRETE

##This section cross-references Sections 160, 175, 610, 685, 687 and 689.

If any of the above sections are relevant, they should be included in the specification.

If any of the above sections are not included in the specification, all references to those sections should be struck out, ensuring that the remaining text is still coherent:

686.01 GENERAL

This section specifies the requirements for the supply and quality of materials, surface preparation, application, relevant testing and acceptance criteria for decorative and protective coatings and surface treatments of concrete.

This section does not cover other types of concrete deterioration including alkali aggregate reaction, sulphate and chemical attack.

Requirements for anti-graffiti protection of concrete are specified in Section 685 of the VicRoads Standard Specification for Roadworks and Bridgeworks.

686.02 STANDARDS

Australian Standards (AS) and additional test methods (ASTM and BS) referred to in this section are listed in Standard Section 175.

686.03 DEFINITIONS

Coating(s): An interchangeable term, meaning either the actual process of covering the concrete surface with a layer(s) of paint, or representing a protective or decorative coating as defined in this Clause.

Coating System(s): Can be either protective or decorative coating system(s) as defined in this clause.

Decorative Coating System(s): These can be either film-forming coatings, surface treatments or combinations of these which can improve the aesthetic appearance of a concrete surface.

Film-Forming Coating(s): Viscous materials which form a pinhole - free film on the concrete surface to improve its aesthetic appearance or provide protection by acting as a barrier to the ingress of aggressive agents. Coatings are generally applied in two or more layers. Thin coatings have a dry film thickness of 100 - 300 micron, high build coatings generally exceed 1mm, whereas cementitious coatings are generally thick applications ranging from 1 to 20mm thick.

Pore-Lining Penetrant(s) (Hydrophobic Impregnation(s): These are low viscosity fluids (i.e. silane, silane/siloxane, siloxane, solid silane or silane cream) which react with the available hydroxyl group of the silicate structure of the concrete substrate in the presence of moisture, thus depositing water-repellent silicone resins chemically bonded to the walls of the concrete pore structure. These hydrophobic products can penetrate the concrete by several millimetres and work by repelling water and waterborne chloride ions.

Protective Coating System(s): These can be either film-forming coatings, surface treatments or combinations of these which can impart protective qualities to the concrete surface against the ingress of aggressive agents.

Sealer(s): These are viscous fluids which are intermediate between pore-lining penetrants and film-forming coatings. They can penetrate and block the pores of the concrete substrate and also form a thin film on its surface.

Surface Treatment(s): These are viscous materials such as pore-lining penetrants (hydrophobic impregnations) and sealers which can penetrate the concrete or block the pores of the concrete to improve its aesthetic or protective qualities.

686.04 MATERIALS

Coatings, surface treatments and decorative/anti-carbonation coatings shall be used in accordance with the manufacturer's recommendations and materials safety data sheets, unless otherwise specified in this section.

The Contractor shall submit for review by the Superintendent not less than twenty-one (21) days prior to the commencement of the coating works, details of the concrete coating operations including information on the proposed coatings, surface treatments, decorative/anti-carbonation coatings, substrate preparation, method of application, equipment and operators, demonstrating compliance with the requirements of this specification.

Material details shall include information on the properties of the proposed products, documented evidence of previous performance and relevant test results which shall not be more than twenty-four (24) months old.

HP Concrete coating works shall not take place until the Contractor's proposed materials and procedures and surface preparation in accordance with Clause 686.06 have been reviewed and accepted by the Superintendent.

686.05 PROTECTIVE AND DECORATIVE COATING SYSTEMS

(a) General Requirements

The protective or decorative coating system shall be clear or pigmented coating to a VicRoads Grey colour, or a combination of these, unless otherwise approved by the Superintendent. All coats in the system or separate coatings/treatments making up the system shall be physically and chemically compatible with each other.

The Contractor shall supply the Superintendent with a certificate from the manufacturer in the form of a guarantee confirming that the coating system and materials comply with the requirements of this section, including a guaranteed outdoor exposure life of not less than ten (10) years prior to the need for re-coating.

The coating system shall be capable of withstanding cleaning with hot water, in the range of 40°C to 50°C, detergent and scrubbing action without loss of adhesion, softening or changing in colour or gloss.

Manufacturer's recommendations shall be satisfied for highly porous concrete substrates which may require a pore-filling primer coat prior to applying a final finish coat. For relatively soft surfaces the primer and/or finish coat shall also offer surface binding and toughening effect.

The Contractor shall provide evidence as to the compatibility of the proposed coating system to the nominated substrate. Such evidence shall include but not be limited to test certificates from a NATA accredited testing laboratory and history of previous performance.

Where a primer or undercoat is required as part of the coating system, the primer or undercoat shall be a different colour to that of the final nominated colour and shall be in accordance with AS 2700.

The coating pigments shall be colourfast, and not subject to fading or discolouration.

The applied coating system shall also satisfy the following requirements:

- (i) bond strength greater than 0.75 MPa when tested fourteen (14) days after application in accordance with AS 1580.408.5;
- (ii) ability to bridge cracks up to 0.3 mm wide;
- (iii) ability to be recoated within 24 hours;
- (iv) have minimum pot life of 1 hour;
- (v) not to sag or run when applied correctly to vertical surfaces;
- (vi) compatibility to an alkaline surface in accordance with ASTM D 4262-83:2005;
- (vii) not have more than an 'Oil' gloss (Boller) panel 70, to AS 1580.602.3.

(b) Performance Requirements for Decorative/Anti-Carbonation Coatings

Where required, concrete surfaces shall be painted with two coats of an approved decorative/anti-carbonation coating product (VicRoads Grey or approved alternative colour) in accordance with the AS 2311 and manufacturer's specification to achieve a uniform colour and texture. If a uniform colour and texture is not achieved the Contractor shall take remedial measures at his own expense to produce the required surface finish.

In addition to the general requirements of Clause 686.05(a), approved coatings shall also satisfy the following minimum performance criteria:

- (i) Equivalent Air Layer Thickness (R) greater than 150 metres;
- (ii) Equivalent Thickness of Concrete (Sc) greater than 450 millimetres;
- (iii) CO₂ Diffusion Co-efficient of less than $2 \times 10^{-7} \text{ cm}^2/\text{s}$;
- (iv) water vapour equivalent air layer thickness of less than 4 metres;
- (v) dry film thickness of at least 150 μm (microns); and
- (vi) water or acrylic based solvent free unless otherwise approved by the Superintendent.

Testing for items (i), (ii), (iii) and (iv) shall be based on the Klopfer Criteria for anti-carbonation coatings and Ficks Law of Diffusion.

(c) Performance Requirements for Moisture and Chloride Resistance

(i) General

Protective coating systems shall be applied in at least two layers and in addition to the general requirements of Clause 686.05(a), they shall satisfy the following minimum performance criteria:

- (1) the water absorption value not to exceed $0.01 \text{ ml m}^{-2} \text{ sec}^{-1}$ at 10 minutes, following the application and curing process in accordance with the manufacturer's instructions and the Initial Surface Absorption Test (ISAT) as per BS 1881, Part 5;
- (2) chloride diffusion co-efficient less than $5 \times 10^{-9} \text{ cm}^2/\text{sec}$, and carbon dioxide (CO₂) diffusion co-efficient less than $2 \times 10^{-7} \text{ cm}^2/\text{sec}$ after 2000 hours of accelerated ultra-violet (UV) weathering; and
- (3) dry film thickness of at least 200 μm (microns) in accordance with AS 1580.108.2;

(ii) Tidal Zone

In addition to the general requirements of Clause 686.05(a) and Clause 686.05(c)(i) coating system for the tidal zone shall satisfy the following requirements:

- (1) the coating system shall be formulated for application onto surface dry but saturated concrete such as in the tidal range in a marine environment;
- (2) the coating system shall cure rapidly between the tidal cycles, such that it may be immersed in seawater within 3 hours of application and shall be capable of withstanding hydrostatic penetration of water.

(iii) Atmospheric and Splash Zones

A dual protective coating system consisting of a pore-lining penetrant (i.e silane, solid silane or silane cream) and two coats of a film-forming top coat shall be applied to atmospheric and splash zones unless otherwise approved by the Superintendent.

In addition to the general requirements of Clause 686.05(a) and Clause 686.05(c)(i) the dual protective coating system shall satisfy the following requirements:

- (1) Silane pore-lining penetrants shall consist of at least 95% active ingredients and shall be applied in two applications at a minimum application rate of 0.3 litres/m² with a minimum interval between coats of at least 6 hours.

Solid silane or silane cream pore-lining penetrants shall consist of at least 80% active ingredients and shall be applied in one thick application at a minimum application rate of 0.4 litres/m².

Silane/siloxane or siloxane pore-lining penetrants shall not be used unless approved by the Superintendent.

- (2) The amount of penetration of silane, solid silane or silane cream pore-lining penetrants into the concrete, shall be a minimum of 5 mm.

The amount of penetration of silane/siloxane or siloxane pore-lining penetrants, shall be a minimum of 3 mm.

- (3) The pore-lining penetrant shall contain a fugitive dye to enable clear differentiation between coated and uncoated areas.
- (4) The pore-lining penetrant and film forming coating shall be compatible.
- (5) The film-forming topcoat shall satisfy the requirements of Clause 686.05(b) for decorative/anti-carbonation coatings, except that its dry film thickness shall be at least 200 µm (microns).

(d) Protective Coatings for Special Applications

Protective coatings requirements for special applications shall be specified on the drawings.

(e) Concrete Subject to Graffiti

Coatings which are subject to graffiti shall satisfy the requirements of Section 685 of the VicRoads Standard Specification for Roadworks and Bridgeworks.

(f) Coatings Applied to Retaining Walls

Where coating systems are applied to the exposed concrete surfaces of retaining walls or other soil retaining structures, adequate waterproofing membranes and/or drainage systems shall be installed behind the retaining wall to prevent the coating system from blistering or peeling off, where applied on exposed concrete surfaces.

(g) Coatings Applied to Parapet Walls

Where coating systems are applied on walls or other vertical concrete components which have exposed top horizontal surfaces, the coating systems shall be taken over the top of the 'parapet' and at least 150 mm down to the back of the wall to prevent the coating system from blistering or peeling off, unless the whole rear wall requires protection.

(h) Use of Pore-Lining Penetrants to Resist Moisture Ingress for General Applications

Pore-lining penetrants alone and in combination with decorative/anti-carbonation coatings may be applied to concrete surfaces which are characterized by the following non-conforming deficiencies subject to review and acceptance by the Superintendent:

- (i) inactive cracks of width equal to or less than 0.20 mm;
- (ii) deficiency in concrete cover to the steel reinforcement;
- (iii) VPV values exceeding the maximum allowable limits as stated in Table 610.061 of Section 610.

The pore-lining penetrants shall comply with the requirements of Clause 686.05(c)(iii) and decorative/anti-carbonation coatings shall comply with the requirements of Clause 686.05(b).

686.06 SURFACE PREPARATION

(a) General

The surface preparation shall be in accordance with the manufacturer's recommendations for the coating system to be applied and as specified in this section.

(b) Uncoated Concrete

Concrete surfaces shall be dry unless otherwise approved by the Superintendent, and shall be free from oil (e.g. from release oils), grease, laitance and loose particles, remnants of curing compounds and organic contaminants (i.e. moss, algae etc). The concrete surface shall be prepared by high pressure jetting with potable water, either with or without added abrasive (i.e. up to 3000 psi or 20.7 MPa), steam cleaning, wire brushing, abrasion with angle grinder, or by other means to provide a strong, hard surface. Areas of persistent contamination shall be removed from the surface by the use of appropriate solvents or detergents followed by washing with potable water in accordance with AS 1627.1. Any abrasive blast cleaning shall be carried out in accordance with AS 1627.4 and other OH&S and Environmental regulations imposed by the local government authority and the EPA.

Any blow holes, areas of honeycombing, loose surface layers and weak concrete, shrinkage cracks of width less than 0.2 mm or other defects, either revealed by a grinding process or exposed by other surface preparation methods, shall be filled with a suitable fairing coat cementitious repair material in accordance with the requirements of Section 689. If the surface of the concrete is weak, more material shall be removed and repaired in accordance with the requirements of Section 689. Such repairs shall be sufficient to result in a strong, sound substrate suitable for the intended protective or decorative coating system. Projecting fins, rough spots and sudden steps shall be removed by light abrasion with an angle grinder to provide a surface which can be easily coated.

Inactive cracks of width equal to or greater than 0.20 mm shall be sealed by resin injection in accordance with Section 687. Active cracks equal to or greater than 0.20 mm shall be treated by methods approved by the Superintendent and in accordance with Section 687.

A trial application to check the suitability of the surface, the surface preparation methods and other requirements shall be undertaken as set out in Clause 686.17.

(c) Previously Painted Surfaces

Previously painted surfaces shall be clean and sound. All traces of dust, dirt and other contaminants (i.e. oils, grease, etc.), peeling or loose coating shall be removed by suitable methods as stated in Clause 686.06(b) approved by the Superintendent. The compatibility and adhesion of the existing coating to the concrete surface shall be evaluated by the cross-cut adhesion test in accordance with AS 1580.408.4 and as stated in Clause 686.13.

A trial application and adhesion testing shall be undertaken to establish the effectiveness of the bond between the existing and new coating in accordance with AS 1580.408.5 and Clauses 686.13 and 686.17.

If the compatibility and adhesion tests prove unsatisfactory the existing coatings shall be removed and the concrete surface prepared appropriately to receive the new coating in accordance with Clause 686.06(b).

686.07 METHOD OF APPLICATION

(a) Dry Concrete Surfaces

(i) General

All concrete surfaces to receive a coating shall be dry at the time of application. Sufficient drying time shall be allowed after wet preparation methods to satisfy the requirements of Clause 686.13.

The coating shall be applied following the manufacturer's recommended application methods, overcoating times and coverage rates, mixing requirements, current materials safety data sheets and as specified in this section. The coating may be applied by brush, spray, roller, hand/glove or other technique to achieve the desired surface finish. Coverage rates shall be checked for compliance with the manufacturer's requirements. The surface area of the concrete structure subject to application and the volume of coating used shall be recorded by the Contractor.

The coating system shall be applied as soon as possible (i.e. within 24 hours unless otherwise expressed in writing by the manufacturer) after the preparation of the concrete surface. The prepared surface shall be protected against contamination if it is left uncoated for more than 24 hours.

For multiple coat applications, the manufacturer's stated minimum and maximum overcoating times for the prevailing weather conditions shall be satisfied, and successive coats shall have slightly different colour shades to assist in achieving uniform coverage. The difference in colour shall be such that a coat when either wet or dry shall be clearly distinguishable by means of colour difference, from the preceding coat.

No application of coatings shall be made if any of the conditions stated in Clause 686.11 exist.

No coating shall be applied over any coat which contains application defects or any damage until such defects have been repaired.

If the coating is too thin, or shows evidence of having been applied under unfavourable conditions, or the workmanship is poor, or the specified requirements are not fulfilled, the surface shall be re-treated to the extent required by the Superintendent, at no additional cost to VicRoads.

Where the methods of application are unacceptable to the Superintendent because of undesirable effects such as over spray, spatter or significant disruption to the public, alternative methods shall be used at the Contractor's expense.

If, in the opinion of the Superintendent, conditions become unsatisfactory, work shall not be continued, and newly coated surfaces shall be protected with shelters from rain or other damage as approved by the Superintendent.

Further to the other requirements of this clause pore-lining penetrants (i.e. silane, silane/siloxane, siloxane, solid silane or silane cream) shall be applied by an airless pump system with an operating pressure not exceeding 70 kPa in order to ensure that no atomization or misting of the material occurs. Application shall be carried out in a series of continuous operations. The material shall be applied by a continuous spray technique giving saturation flooding, working from the lowest level and proceeding upward toward higher elevations. The treated area shall have a 'wet look' for a few seconds after application. Areas to be treated with a pore-lining penetrant shall, where necessary, be protected from adverse weather conditions and shall be surface dry for a minimum of 24 hours before application commences.

A trial application to check the suitability of the method of coating application shall be undertaken as set out in Clause 686.17.

(ii) Specific Requirements

All multi-part coating materials shall be mixed according to the coating material manufacturer's instructions. The components shall be mixed in the specified proportions. The specified reaction period shall be allowed from the time the components are mixed until the application begins. No coating material shall be excessively thinned and any thinners used shall be the correct type as specified by the material manufacturer. The coating material shall be strained as specified by the material manufacturer.

No coating material shall be applied after its pot life has expired.

Where quantities of coating material are being applied by spraying successive batches of premixed multi-part material, the equipment shall be flushed and purged with clean solvent after 2/3 of the pot life of the material has expired from either the mixing of the first batch or since the last purge and cleaning of the equipment. Coating material ingredients shall be kept properly mixed in the spray pots or container during the application of the material whether by continuous mechanical agitation or intermittent manual agitation as required.

Where brush or roller techniques are used, the brushes or roller heads shall be used for the day only and then discarded. The equipment shall not be cleaned for re-use.

All coating operations shall be performed in a neat and workmanlike manner by personnel with experience in the use of protective coatings and application methods.

Each coat shall have the required colour, gloss and opacity.

Each coat shall have the specified dry film thickness. This film thickness shall be applied to all edges and corners. Coats which, in the opinion of the Superintendent show excessive film builds shall be removed.

Each coat shall be smooth, uniform and free from sags, runs, mud cracking, wrinkling, fat edges, blisters, pinholes, holidays, dry spray, entrapped foreign bodies and heavy brush marks.

(b) Damp Concrete Surfaces

Coatings for application on damp concrete substrates shall be specifically formulated for tolerance to moisture during application, curing and subsequent service.

All concrete surfaces to receive coating shall be surface-dry at the time of application. Where this requirement is not satisfied, temporary protection shall be provided to encase the concrete and coating applicator and prevent moisture penetration, ensuring adequate ventilation is provided. Deposits of salt crystals which collect on coated surfaces shall be washed off with potable water and the surface allowed to dry, prior to further coating application.

With the exception of the surface moisture condition of concrete the coating shall be applied in accordance with Clause 686.07(a).

686.08 SPRAY EQUIPMENT

The spray equipment shall be suitable for the work intended. It shall be capable of properly atomising the coating material to be applied and shall be equipped with accurate pressure regulators and gauges. The spray gun, nozzles and needles shall conform to the coating material manufacturer's recommendations for the coating to be applied. The spray equipment shall be kept in such condition to permit efficient and effective coating material application. An efficient air line filter shall be fitted as close as possible to the pressure pot to eliminate line condensate and oil in the air supply to the spray gun. The air of the spray gun impinging against the surface shall show no condensed water or oils.

686.09 DRYING AND CURING

The Contractor shall adhere to the manufacturer's instructions regarding drying and curing requirements, and overcoating time intervals, for the prevailing weather conditions.

686.10 CLEAN UP AND PROTECTION OF WORKS AND PROPERTY

The Contractor shall protect already painted or galvanised surfaces, services, bearings, joints, painted signs and nameplates during abrasive blasting operations or any other surface preparation process and during coating application processes.

The Contractor shall remove all coating drips and droppings, smudges and over spray from all surfaces, including surfaces not being treated. The Contractor shall remove from the site all spent abrasive and all other rubbish accumulated during the work. The Contractor shall dispose of such wastes to the satisfaction of the Superintendent and by a means which conforms to Clauses 686.11(b) and 686.11(c).

The Contractor shall ensure that the coated works are protected from adverse conditions, dust and debris during the curing period of the coating system in accordance with the requirements of Clause 686.11.

No spray painting shall be carried out within ten (10) metres of buildings, footpaths, roadways, pedestrians or vehicles without protective measures or methods being used which shall be submitted to the Superintendent for approval, a minimum of two working days in advance of the proposed works.

686.11 ENVIRONMENTAL CONDITIONS

(a) General

Coating systems shall not be applied under any of the following conditions:

- (i) windy conditions where over spray and/or spatter may be generated;
- (ii) when wind-borne debris is likely to contaminate the uncured surface of the freshly applied coating;
- (iii) when the ambient temperature exceeds 35°C or is below 10°C unless otherwise expressed in writing by the manufacturer;
- (iv) when the relative humidity exceed 85% or where it may be expected to exceed 85% during the subsequent 12 hour curing period;
- (v) when rain spatter or run-off, including leakage through deck joints, contaminating the surface and adversely affecting the adhesion to the substrate, may occur;
- (vi) when the substrate surface is wet or damp, unless the coating is specifically required to be applied on a damp concrete surface in accordance with the requirements of Clause 686.07(b);
- (vii) the surface temperature of the substrate is less than 3°C above the dew point calculated in accordance with AS 2312 (Fig. 8.1) or exceeds 40°C.

(b) Environmental Requirements

The Contractor shall adhere to Environment Protection Authority and other local, state and federal government requirements with respect to how waste generated during surface preparation, coating application, and clean up will be collected, segregated, handled, controlled and disposed of.

(c) Disposal of Waste Materials

Waste materials including liquid wastes shall be deposited in suitable containers and disposed of at sites to be located by the Contractor that are acceptable to the Environment Protection Authority and other relevant authorities.

Liquid or other waste material shall not be disposed of in creeks, waterways or the stormwater drainage systems.

686.12 COATING MATERIAL, HANDLING AND STORAGE

Materials shall remain in their original, sealed containers until the time of use and shall be stored in strict accordance with the manufacturer's recommendations. Storage facilities shall provide protection from the elements and be safe and secure. Relevant warning signs shall be displayed.

All material shall be brought to site in the original unopened cans clearly labelled with the manufacturer's name, product type, reference and batch numbers.

The Contractor shall provide a certificate from the manufacturer for each batch of coating material confirming:

- (a) manufacturer's name and address;
- (b) product reference;
- (c) batch number of identification;
- (d) quantity manufactured in the batch; and
- (e) date of manufacture.

The Contractor shall maintain records showing which elements were treated with each coating batch. These records shall be handed over to the Superintendent before the Date of Practical Completion.

Materials stored beyond the manufacturers recommended shelf-life shall not be used.

All coating materials to be used on the works shall be free from contamination, gelling, drying out, heavy skin formation and severe segregation of ingredients.

686.13 TESTING BEFORE AND AFTER APPLICATION OF COATING

The Contractor shall carry out testing in at least one 1 m² test area in accordance with this clause.

(a) Testing before Application

All concrete surfaces prepared for coating shall be sampled and tested in accordance with the requirements of this section. Each sample of prepared concrete surface shall be tested as required for surface moisture condition, moisture content of concrete, environmental conditions and cross-cut adhesion of previously painted surfaces as specified in this section.

As least one test per sample shall be carried out immediately prior to the commencement of each day's coating application to ensure that:

- (i) surface moisture conditions of concrete or other substrates satisfy the manufacturer's recommendations;
- (ii) moisture content of concrete and other substrates is free of water back pressure to satisfy the manufacturer's recommendations, in accordance with ASTM D4263-83:2005;
- (iii) the environmental conditions, as specified in Clause 686.11, are satisfied.

For previously painted surfaces, the cross-cut adhesion of the existing coating shall be tested in accordance with AS 1580.408.4 and shall be deemed to be satisfactory, if 75% of the cross-cut surface remains attached to the concrete and provided the surface is free from cracking, blistering or heavy chalking.

At least three measurements per sample of cross-cut adhesion shall be carried out for every 25 m² of previously painted surface for the first 100 m² and then at least three measurements per sample for every 100 m² thereafter.

(b) Testing after Application

All applied coating shall be sampled and tested in accordance with the requirements of this section. Each sample of applied coating shall be tested as required for bond strength, wet and dry film thickness, amount of penetration of pore-lining penetrant and water absorption, as specified in this section.

At least three measurements per sample of each of the following tests shall be carried out after the application of materials to ensure that:

- (i) The bond strength to the substrate and between separate coats shall be tested using aluminium dollies with a minimum diameter of 50 mm in accordance with AS 1580.408.5 and shall be greater than 0.75 MPa, fourteen (14) days after the application and curing process.
- (ii) Wet and dry film thickness of the film-forming coating is as specified by the material manufacturer; however in any case the total dry film thickness shall not be less than 150 µm (microns) and 200 µm (microns) as specified in Clause 686.05(b)(v) and 686.05(c)(iii) respectively. The wet film thickness shall be checked in accordance with ASTM D4414-84:2007. The dry film thickness shall be checked in accordance with AS 1580.108.2.

The dry film thickness of coatings may be measured using the coating remnants attached to the aluminium dollies from the adhesion testing provided the coating material remains intact and the correct frequency of testing is satisfied in accordance with the requirements of Clause 686.13(c).

No more than 15% of all measurements from all test samples of dry film thickness shall be less than 90% of the minimum specified thickness.

- (iii) Where a coating system is applied to resist the ingress of moisture and chloride ions, the water absorption value shall not exceed 0.01 ml m⁻² sec⁻¹ at 10 minutes, in accordance with the Initial Surface Absorption Test (ISAT), as set out in BS 1881, Part 5, when tested fourteen (14) days after the application and curing process.
- (iv) Where a pore-lining penetrant is applied, the amount of penetration shall be determined on concrete cores 50 mm in diameter x 50 mm deep in accordance with an acceptable national or international standard and shall not be less than that specified in Clause 686.05(c)(iii). A fugitive dye shall be used to enable clear differentiation between the treated and untreated depths of concrete.

- (v) For previously painted surfaces, pull-off testing shall be made in accordance with this clause and AS 580.408.5, fourteen (14) days after application and curing, and adhesion shall be deemed to be satisfactory if adhesion failure of three dollys attached to the new coating, occurs at the interface of the concrete substrate and the existing coating.

(c) Location and Frequency of Sampling and Testing after Application of Coating

Sampling and testing in accordance with Clause 686.13(b) shall be undertaken in at least one 1 m² test area for every 50 m² on completion of the application of the final coat of the protective or decorative coating system and the application of the pore-lining penetrant.

686.14 INSPECTION AND TESTING

The Contractor shall undertake all inspection and testing as specified in this clause and Clause 686.13. The Contractor shall maintain all required documentation and results as specified in this section and Section 160 of the specification for all stages of the work.

The work shall be inspected by the Contractor at each stage of the coating operation as a minimum, i.e. after surface preparations, prior to each coat and after final top coat application and any touch-up coats that may be required.

For the purpose of surveillance and audits as specified in Clause 160.A7, the Contractor shall give the Superintendent five (5) days written notice of its intention to coat the concrete and shall provide adequate access to enable surveillance of the Works by the Superintendent.

686.15 APPROPRIATE TIMINGS FOR APPLICATION OF COATINGS

(a) Newly Constructed Cast In-Situ Concrete/Non-Accelerated Cured Precast Concrete

Protective or decorative coating systems shall be applied no earlier than twenty-eight (28) days after concrete has been placed or earlier if it can be established that the concrete moisture content is less than 8% (in accordance with test method ASTM D4263-83:2005), but not prior to fourteen (14) days after concrete has been placed, and provided the concrete surface is dry at the time of application.

(b) Steam or Radiant Heat Cured Concrete

Application of coatings shall be carried out no earlier than fourteen (14) days after concrete has been placed.

(c) Repaired Concrete

Where concrete repairs have been completed with proprietary cementitious materials, the application of coatings shall be carried out no earlier than fourteen (14) days after completion of repair.

Where normal concrete is used for repair, coatings shall be applied no earlier than twenty-eight (28) days after the completion of repair.

686.16 COATING REPAIRS

Should any of the coating application work not comply with the provisions of this specification then the areas concerned shall be repaired to the satisfaction of the Superintendent. Such repair work may include removal of the coating, followed by surface preparation and application of a new coating. The procedure for any repair work shall be reviewed by the Superintendent. All repair works undertaken in accordance with this clause shall be performed at the Contractor's expense.

For the purpose of this clause, non-complying work shall include coating failure due to yellowing, loss of adhesion, and colour change during the contract liability period.

All areas of coatings damaged by the Contractor during its operation shall be made good to the satisfaction of the Superintendent.

686.17 TRIAL APPLICATION

Unless otherwise approved by the Superintendent a trial application on a test area of the actual substrate of not less than 10 m² or a test panel made from the same substrate shall be conducted fourteen (14) days prior to the commencement of coating work. The test area or test panel shall be prepared and coated by the Contractor to satisfy the requirements of Clauses 686.06, 686.07, 686.11, 686.13, and 686.14, and in accordance with the material manufacturer's recommendations.

Actual coverage rates of the coating system shall be recorded, in order that due allowance may be made in the full scale application for rough, irregular or highly absorbent concrete substrate. Additional requirements or observations shall be recorded and considered for the full scale application.

If the coating trial application is deemed by the Superintendent not to comply with the requirements of this section a further coating application shall be made until the performance criteria of this specification are met.

In the event that the trial application is rejected, the Contractor shall remove and dispose of any work deemed as unacceptable by the Superintendent, submit a new proposal to rectify the deficiencies (including prequalification testing of any new materials/methods) and repeat the trial application as described above. Any delays caused through rejection shall not constitute justification for extension of time.

686.18 REQUIREMENTS FOR FUTURE MAINTENANCE OF COATINGS

The Contractor shall provide the manufacturer's recommendations as follows:

- (a) The methods of preparation to be used in the event that re-coating of the coated surface is required.
- (b) Which types of coating, other than the original product, are compatible with the finish coat for re-coating purposes.
- (c) The technique which can be used to repair local damage to the coating, with particular reference to colour and gloss matching of finish coats applied after a time lapse of 5 years.

The most appropriate techniques for cleaning of the finish coat to remove surface soiling, with particular reference to ease of removal of graffiti or glued posters, where possible, without damage to the existing finish.

686.19 CONTRACTOR COMPETENCY

The coatings application supervisor and sub-contractors undertaking this work shall have a minimum of 5 years experience and a demonstrated competency for surface preparation and application of protective coatings. All application personnel undertaking this work shall also have a minimum of 2 years experience.

The coatings application supervisor shall be trained and qualified on all aspects of application techniques and shall be present at all times during coating work. Application personnel shall be trained and skilled in the application procedures of the coating to be applied.

Documented evidence shall be available to demonstrate experience, qualification, skills and training of all personnel and sub-contractors.