



Investigation/Repair Advisory Services/Life Cycle Costing/Technically Led Project Management

Our Core Expertise

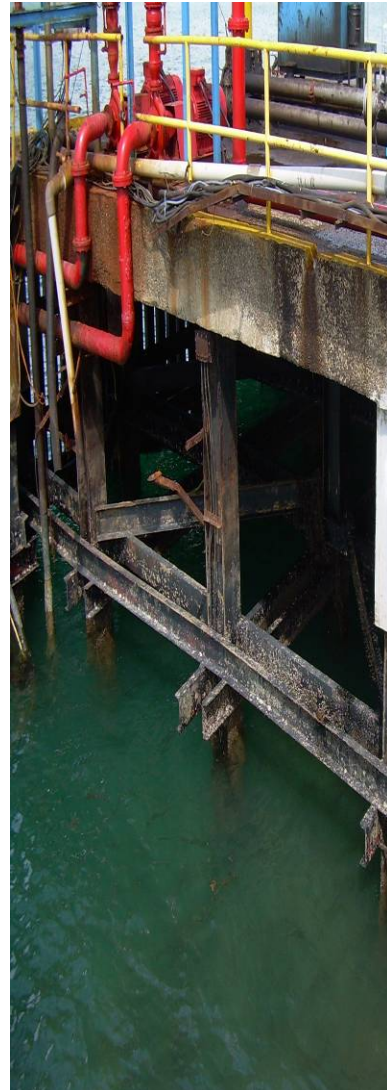
- Reinforced Concrete Corrosion
- Structural Steel Corrosion
- Building Materials Evaluation
- Performance Specification
- Evaluation of Mock-ups
- Material Durability Assessment

Areas of Application

- Structural Surveys
- Defect Assessment
- Remedial Recommendations
- Prediction of Time to Corrosion
- Life Cycle Costing
- Due Diligence Audits
- Project Management

Our Clients

Our Clients include Developers, Facility Owners, Contractors, Trusts Managers from the Building and Infrastructure, Pharmaceutical and Oil & Gas Industries



Company Profile

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ASCENT

Facilities Engineering Pte Ltd

Introduction

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Formed in 2004, Ascent Facilities Engineering Pte Ltd offers an integrated consultancy service in advising the performance of building materials, structures and facilities. Our capabilities stem from knowledge and experience covering 15 years of practical and professional experience uniquely from overseas and local projects. Both directors are ex-staff of Taywood Engineering Ltd, internationally recognized amongst UK consultants in providing engineering consultancy services related structural surveys, diagnosis and retrofitting

Services

Directors :

Fong Weng Khiong

Francis Wee Boon Liang

Company Registration No. :

200409021R

www.ascentfe.com

We assess the current condition and future performance of commercial and residential buildings, civil structures and industrial facilities.

- **Durability Investigations for Concrete Structures:** The causes of reinforcement corrosion may be due to agents like chloride and carbonation. Reinforced concrete can also come under attack by chemicals having high acidity. It can breakdown due to the presence of reactive aggregates (Alkali-Aggregate-Reaction and Alkali-Silica-Reaction) and cracking of concrete can occur through high thermal differentials and restraints arising from casting of concrete.
- **Corrosion Investigations for Steel Structures:** We evaluate the causes of corrosion on steel structures due to exposure to harsh environmental condition during its service life. Many of these structures therefore start to corrode due to the breakdown of the protective paint layer resulting in galvanic corrosion taking place.
- **Building Facade Condition Audits and Investigations:** Curtain wall and other façade systems deteriorate during their service life. We investigate the problems such as seepage, delaminations of finishes, loosening of façade components associated with the building facades and often find that such problems could be the result of expiring of service life, wrong detailing, poor workmanship, bi-metallic corrosion from two different metals.

- **Prediction of Time to Corrosion and Life Cycle Costing:** The data obtained from our field investigations are used in computer models to predict the time to corrosion. This information is useful for planning the maintenance schedule and allows the asset manager to set aside budgets for active maintenance of the structure, rather than wait for defects to surface. In many instances, when defects surface, the rate of deterioration often spiral exponentially. Repairs become costly at this stage. The prediction of time to corrosion therefore helps the asset manager to prepare a cost-effective life cycle cost for his structure.
- **Specification and Repair Proposals:** We determine the causes and recommend ways to prevent the problems from worsening. Many repair methods are available in the industry from structural strengthening to cathodic protection systems and we propose repair proposals based on the knowledge of the current condition and life expectancy required.

We have successfully completed many projects on the above and welcome you to visit our website at www.ascentfe.com where you may download a range of our project profiles for your information.

Ascent Facilities Engineering Pte Ltd have carried out projects in Singapore, Peoples' Republic of China and Seychelles Island.

Our Directors have participated in Conferences as speakers in:

- 3rd Asian Concrete Federation (ACF) International Conference on Sustainable Construction, 2008 - Vietnam
- 10th Annual Conference on Inspection, Appraisal, Repairs and Maintenance of Structures, 2006 – Hong Kong (Recipient of Highly Commendable Paper AWARD 2006)

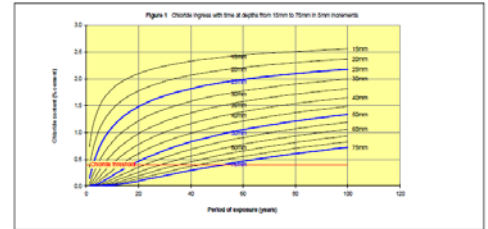
Collective Experience

Prediction of Time to Corrosion for Reinforced Concrete Structures

Example of Application of Computer Models

Modeling of the Time to Corrosion is done through the use of computer software programmes

Mix details and input data	
Strength grade (MPa)	35
w/binder ratio	0.45
Cement type (see below)	pc
Binder content (kg/m ³)	380
Mineral additions (% binder)	0
Density (kg/m ³)	2400
Multiplier	6.32
Diffusion Coefficient Dca (m ² /sec)	9.4E-13
.....at age of (years)	20.00
Age factor	-0.26
Surface chloride, C _{sn} (% concrete)	0.5
Cl threshold level (% binder)	0.4
CR threshold (microns/yr)	1.2
Bar diameter (mm)	20
Cover (mm)	50
Tensile strength (Mpa)	2.25
Corrosion to cause cracking (microns)	51
pitting (yes or no)	no



Field data such as concrete strength, reinforcement cover, bar size, surface chloride content, chloride threshold level are used.

Durability investigation of Jetty and prepare Life Cycle Costs using different Remedial Methods

Evaluation of causes of spalling concrete problems, proposing remedial options and estimating of life-cycle-costs for maintenance for high value structures such as jetties and tunnels

Life-Cycle-Cost studies allows the Client to choose between different remedial options vs costs. Some options may involve higher initial capital cost but the overall total cost may be lower over the service life of the structure



Half Cell Potential measurement and other tests can be used for the durability investigation. Using different options of repairs, the initial capital costs and subsequent cyclical costs over the service life can be estimated.

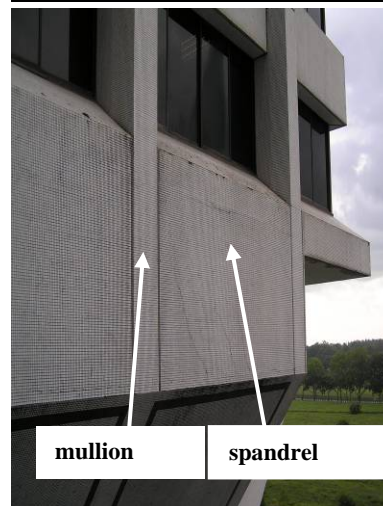
Collective Experience

Repair Recommendations are validated Quantitatively using Finite Element Analysis Programme

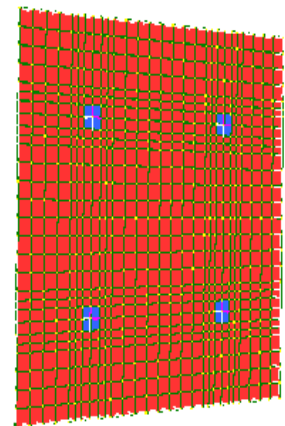
Evaluation of a façade repair system using cementitious materials with anchor pins and fabric mesh

Based on the designed repair system of anchors, mesh and cementitious repairs, the proposed façade repair system (right) is checked for suction, shear and deflection against service loads such as self-weight, wind and temperature

Material	Properties
Anchor with epoxy resin	<u>Pull-out load for 30 mm embedment</u> (when grouted with epoxy resin) : 2500 N (before applying the recommended safety factor of 4) <u>Tensile load for 30 mm embedment</u> (when grouted with epoxy resin) : 1770 N (before applying the recommended safety factor of 4) <u>Spacing of anchors</u> : 600 mm
Fibreglass Mesh	<u>Thickness</u> : 2 mm <u>Density</u> : 15.7 kN/m³ <u>Maximum Tensile Stress</u> : 1.85 N/mm² <u>Maximum Strain</u> : 5%
Cementitious Binder	<u>Thickness</u> : 3 mm on either side of the mesh <u>Density</u> : 24.0 kN/m³ <u>Maximum Tensile Stress</u> : 2.8 N/mm² <u>Maximum Compressive Stress</u> : 25.0 N/mm²



View of precast spandrel and mullion



Snapshot of model of repair system of

The proposed façade repair system is checked for suction, shear and deflection against service loads such as wind and temperature

Collective Experience

Third Party Investigation on Problems such on Concrete Structures

Cracks on Newly Cast Concrete

The effects of crack lines are often a cause of concern to all parties in a construction project. Investigation is called for an independent assessment on the cause and rectification.



Evaluation of the impact of crack lines on the strength of concrete and durability implications

Repair Proposals and Specifications

Reinforcement Corrosion on Existing Concrete

We have designed, specified and supervised numerous repair projects employing cathodic protection, injection and patch repair methods



The specification of corrosion repairs using sacrificial anodes for a reinforced concrete tunnel

Specialists Consultancy on Appraisals of Existing Building Facades

Inspection and retrofitting of existing curtain wall and stone/tile cladded facades

Increasingly, the importance of durability and safety in the maintenance of building facades are evident as many owners now include such appraisals as part of their maintenance programme



Typical defects noted including the loosening of aluminium finishes

Collective Experience

Condition investigations and repair proposals of construction defects in concrete in Energy Power Station in Indonesia, pharmaceutical facilities and buildings in Singapore.

Inspection of steel pipe rack and platforms for corrosion and proposal of remediation measures

Our understanding on the construction management contracts, working restrictions and critical shut-down periods of power, petro-chemical and pharmaceutical facilities have enabled us to integrate our services with existing project parties resulting in success in the projects



Inspection revealed corrosion treatment and replacement of some I beams required

Technical due diligence audits and life-cycle-costs study for various buildings prior to acquisition

Condition audits and compliance to building codes on facilities

Audits on buildings were carried to inform Clients on non-compliance issues, defects and actions for consideration. Life-Cycle-Cost Studies on the building, mechanical and electrical systems were carried out over a 25 year period.



Extent of audits cover the structural, architectural, fire, mechanical & electrical systems of the assets

Enquiries

We would be most happy to share our experience and opportunities to work together. You can contact us at any of the listed contacts on this profile.