

Professional Development In-House Technical Training Courses



Modern Concrete Materials & Practices

Utilizing the Benefits - Avoiding the Problems

**A course which focuses on lessons to be learned,
risks to be reduced and liabilities to be avoided**

Concrete Repair and Protection

Getting it Right the Second Time!

**A course which focuses on the latest advances and knowledge
for the effective restoration of concrete**



Condition Assessment of Concrete Structures

Responsible Stewardship

**A course which focuses on designing and implementing a program
for monitoring, investigating and testing structures**

Concrete Slabs on Grade

Interior Floors & Exterior Flatwork

**A course which focuses on conceptual, practical
and technical aspects for design, specification and construction**



Conservation of Heritage Structures and Older Buildings

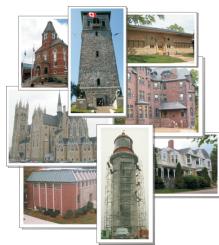
Guiding principles for respecting traditional values

**A course which focuses on combining modern technology
with traditional materials and practices**

Masonry Restoration Projects ~ Case Studies

Learning by Example

**A course which features case studies of projects
that utilised practical strategies based on technical concepts ~
at all stages, from investigation to restoration**



Specialist Consulting Services for the Restoration and Protection of Concrete & Masonry Structures

Proudly Providing Consulting & Educational Services in Canada from 1989

Presenter

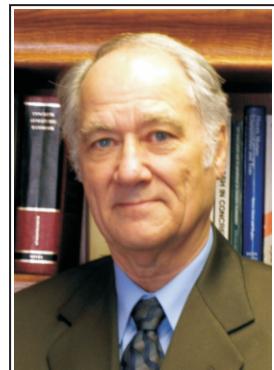
In addition to the provision of consulting services, Paul Jeffs presents professional development technical training courses in Ontario through PJ Materials Consultants Limited and across other Provinces within Canada through the Continuing Technical College of Dalhousie University. Those who have attended these courses, include Engineers, Architects, Authorities, Facility Managers, Contractors, Materials Suppliers, etc.

He has also been an instructor for the Professional Development Centre of the University of Toronto providing course modules and special event courses as part of their Building Science Certificate Program. Paul has also presented for many organizations such as the Capital Projects & Design ~ Precinct Properties Branch of the Legislative Assembly of Ontario, the National Capital Commission, the

American Concrete Institute, the Canadian Society for Civil Engineering, the Canadian Dam Association and the Ontario Building Envelope Council.

Paul has been a guest lecturer at several Canadian universities, he has authored and presented papers at many national and international conferences and has been a regular presenter of technical training courses in the Middle East. He has also written many technical articles for North American magazines and journals.

Paul has a career spanning over 45 years within the construction industry and has experience from around the world. Prior to founding PJ Materials Consultants in 1989, he was employed for almost 20 years by a UK-based multi-national group. In 1976 he transferred from England to the Middle East, living for three years in Bahrain and Iran. During this time he was involved in many construction projects throughout the Arabian Peninsula, including Bahrain, Saudi Arabia, Kuwait, United Arab Emirates and Qatar. In 1979 he moved to Japan and established a regional base, from where he became involved in projects throughout South East Asia and the Far East, including Japan, the Philippines, the Republic of Korea, Hong Kong, Taiwan, Indonesia, Singapore and Malaysia. Prior to emigrating to Canada in 1983, he was involved in construction projects in South Africa and India.



Paul Jeffs

Course Format & Features

The course topics will be presented using digital slide projection with extensive use of photographs, charts and graphs. Educational information will be provided without commercial content.



Manual and USB Memory-stick ~ A course-designed manual for each program will be provided to each attendee, together with a USB flash drive containing the course binder in pdf format. Each manual, which is authored by the presenter, contains comprehensive educational information, photographs, technical data and a Glossary of Terms. Numerous topic-related articles are also included on the memory-sticks.

Certificate of Attendance ~ A Certificate of Attendance will be provided to each attendee that may be used for applying for Professional Development Learning Hour Units where appropriate.

Course Times ~ Courses are typically presented from 8.30 am to noon and 1.00 pm to 4.30 pm with 15 to 20 minute breaks at 10.00 am and 3.00 pm.

Course Themes & Topics

The courses on the following pages are offered for in-house presentations. A basic course is presented over two-days but additional topics may be selected to provide for additional days if required. Please use the reference numbers to indicate the topics you may wish to include. (Please note that not all topics are the same length of time - 5 to 6 topics per day are typical.)

Modern Concrete Materials & Practices

Utilizing the Benefits - Avoiding the Problems

Course Description

On many occasions, this two-day course will use the experiences of the presenter to identify concrete failures, defects or deterioration that can often be caused by incorrect practices and/or inappropriate selection of materials - particularly those developed using modern technology. The course also examines the confusions that often exist regarding the use of modern materials and how they can sometimes lead to conflict and controversy. In addition, many advances in technology will be examined - such as high performance concrete and mineral admixtures; how these can provide considerable benefit to the concrete industry and ensure the construction of long-lasting, durable structures will be reviewed. The topics have been designed to facilitate learning from the experiences of others - in order that past problems can be avoided, while the benefits provided by modern materials and practices can be achieved.



Two-Day Basic Course

Modern Concrete - is it really more durable? (MC-1)

An often asked question is "Why does today's concrete not perform as well as traditional concrete used to?" In this opening topic the evolution of concrete is reviewed, so that the many changes in materials and practices that have taken place can be reviewed to reveal the most likely answer to the question.

What is High Performance Concrete and can anyone produce or achieve it? (MC-2)

Confusion often exists regarding the true meaning of High Performance Concrete and particularly regarding whether or not it can be satisfactorily produced using locally available materials and workers. In this topic, the technology is demystified, the benefits explained and the dangers highlighted.

Why low water/cement ratio is not always appropriate for durability (MC-3)

A low water cement ratio has almost always been considered a critical requirement for high strength and good durability - and usually this is true. However, this topic will explain why a low w/c ratio can sometimes be detrimental and why care is therefore required.

Why silica fume can be beneficial - but sometimes disastrous (MC-4)

Silica fume has been used commercially for many years and its benefits are well known. This topic will highlight these benefits, but also explain some lesser known concerns that could cause failures if not well understood and considered during construction and repair.

The epoxy coated rebar controversy explained (MC-5)

When it was introduced in the late 1970's, the use of epoxy coated rebar was hailed as the most effective way to avoid corrosion problems. Today many authorities are exploring alternatives - but the reasons are not widely publicized. This topic explains their concerns and the associated problems.

How clean should rebar be before concrete placement - are we missing the point? (MC-6)

Although most specifications require reinforcement to be free of deleterious materials at the time of concrete placement, many experts claim that bond between concrete and steel is improved by some surface rust. This topic reviews whether this claim can be justified - but also introduces other concerns that are often over-looked and are arguably more important than bond of concrete to steel.

Modern Concrete Materials & Practices

Course Topics (continued)

How important is curing and how does it affect durability? (MC-7)

Curing is arguably the single most influential practice that affects the achievement of durable concrete, but usually it receives the least amount of attention. This topic reviews good and bad practices and uses examples to illustrate the effects that these can have on cracking, strength, surface toughness, etc.

Producing and testing air entrained concrete - avoiding conflict (MC-8)

The benefits of air entrainment are well known and documented - but what effects do modern concrete materials have on the achievement of a satisfactory air void system? - and, are we adequately testing for it any way? This topic examines today's materials and practices and attempts to answer these questions using examples that suggest that this can be a controversial subject.

Surface Scaling - the causes de-mystified and avoidance reviewed (MC-9)

There are many similarities in appearance between the various forms of surface defects that can be described as "scaling" and confusion often prevents correct diagnosis and/or avoidance. In this topic, the various types are classified and the factors that cause them are identified in order that their occurrence - and the conflict that sometimes accompanies them - can be avoided.

Field Testing Concrete (MC-10)

Contractors and ready-mixed concrete producers can sometimes be unfairly penalized when incorrect concrete testing procedures are used - or data from the correct tests are incorrectly interpreted. This topic provides examples of how tests can sometimes evaluate the wrong parameter and it reviews the dangers of not performing tests in accordance with specified requirements.

Coatings, sealers or membranes - do they work and are they necessary? (MC-11)

This topic probably produces the most disagreement among experts, with many arguing that most protection systems are sensitive to application - or that they just don't provide adequate protection. Myths and mysteries are discussed under this topic, together with examples of past mistakes that have led to poor reputations for many systems.

ADDITIONAL TOPICS

The following topics may be added to extend a two-day course or used to substitute for previous topics

An Introduction to Concrete Practice and Technology (MC-12)

This topic is intended to present an introduction to the fundamentals of concrete as a construction material and reviews the basic constituents of concrete. The way in which the primary ingredient - the cement - provides effective properties is discussed in detail, together with an explanation of the reactions that take place when it is mixed with water. The importance of the quality, particle shape and grading of fine and coarse aggregates are also discussed.

Chemical Admixtures for Concrete (MC-13)

This topic reviews a wide range of different types of admixture that are available for use in concrete. The way in which they provide modifications to the fluid and hardened properties of concrete are discussed, together with cautions that should be evaluated if problems are to be avoided.

Self Consolidating Concrete (MC-14)

Highly flowable concrete has been available for several decades. However, it is only recently that advances in technology have permitted the development of concrete that requires no vibration at all and does not provide any significant segregation or separation problems. This remarkable new form of concrete is reviewed in this topic, together with the many benefits to be gained from its use - including cost savings and performance enhancement.

Modern Concrete Materials & Practices ~ Additional Course Topics (continued)

Concrete Mix Design Criteria (MC-15)

In this topic, some of the conventional ways in which we can improve durability by good mix design practices are examined.

Handling and Placing Concrete (MC-16)

Effective and efficient handling and placing techniques are reviewed, together with key factors that affect the achievement of durable concrete.

Consolidating and Compacting Freshly Placed Concrete (MC-17)

Effective consolidation of concrete during its placement can improve durability. In this topic, good practices and important factors are reviewed,

The Concrete Finishing Process (MC-18)

Finishing freshly placed concrete to produce a dense, attractive surface is a process that requires great skill. However, the use of modern materials and equipment for placement has significantly affected the finishing processes and today's tools and practices have evolved based on several influencing factors. This topic looks at the various factors and reviews good and bad practices.

Hot and Cold Weather Concreting (MC-19)

In today's "fast-track" world, concrete placement often has to be carried out during the height of summer or the depth of winter. This produces many challenges to the contractor and concrete supplier and these challenges are reviewed in this topic, together with modern practices and techniques for preventing the problems that invariably can otherwise result.

Self-Healing Cracks (MC-20)

There has been very little work published that evaluates the practical effects of the phenomenon known as autogenous healing - and yet it has sometimes been used as a justification for avoiding crack repair. This topic reviews what is known about the phenomenon and examines the practicalities of depending on its efficiency for sealing cracks against future moisture ingress.

Alkali Aggregate Reactivity (MC-21)

AAR is not a modern phenomenon. Test methods to detect the susceptibility of a source of aggregate are well established and there should be little chance that today's concrete will suffer the effects of this destructive phenomenon. However, this topic reveals that problems are still occurring, examines what we can do to avoid them and how to obtain early warning that the potential for future problems may exist.

Sulphate Attack (MC-22)

There is often confusion surrounding the many forms of attack from sulphates - whether they are present in soils, groundwater or industrial processes. In addition, experts are not always in agreement regarding the mechanisms of attack and how serious the problems of potential deterioration really are. This topic examines latest research into the phenomenon and reviews how the effects can be avoided or minimized.

Delayed Ettringite Formation (MC-23)

Delayed ettringite formation (DEF) can arise when elevated temperature curing is either deliberately applied or occurs incidentally due to heat generation during the early hydration reactions of the portland cement. However, experts are once more divided - this time often concerning whether or not DEF needs to be considered a real problem. This topic evaluates what is known about the phenomenon and examines influencing factors - as well as the arguments concerning whether or not it is a serious problem.

Protection Against Corrosion and the Environment (MC-24)

Although well designed and constructed concrete can have good resistance to many forms of attack, durability can usually be considerably improved by using effective protection systems. In this topic, various techniques are discussed, together with their benefits, advantages and limitations

Concrete Repair & Protection

Getting it Right the Second Time!

Course Description

This course has been developed to cover the latest advances in materials and techniques and the current state-of-the-art. The presenter's own experiences as a concrete materials consultant and a "troubleshooting" investigator will be used for many of the topics that will be covered over the two days. Various concrete deterioration mechanisms will be identified, together with the way in which failure to understand them can impact on the development of a repair and protection strategy. Actual examples will be used to highlight failures, defects or deterioration that can often be caused by the selection of incorrect materials and techniques. Additionally, the program will examine the many advances in technology that have occurred over recent years, together with how they can provide considerable benefit to the concrete repair and protection industry - and ensure that we get it right the second time!



Two-Day Basic Course

What are the Problems? (RP-1)

This opening topic sets the scene by reviewing the major problems that affect the performance of concrete structures. Typical failure and deterioration mechanisms are examined together with their potential impact on the design of restoration strategies.

Cause Analysis (RP-2)

Case studies are examined where deterioration mechanisms were not understood and concrete failure became the inevitable result.

Concrete Repair Failures (RP-3)

Case studies are used to illustrate repair strategy failures due to inappropriate materials selection, inadequate design and poor workmanship. How further failures can be avoided are also discussed.

Understanding the Investigation Process (RP-4)

Key elements of condition assessments, investigation and monitoring programs, together with procedures, testing methods and techniques required to implement a repair and protection strategy - including the latest non-destructive testing methods, such as impact echo, ground penetrating radar and thermography. Case studies will be used to highlight how an effective investigation can be invaluable for the development of a repair and protection strategy.

Designing a Repair and Protection Strategy (RP-5)

The key factors that should form the basis for an effective repair and protection strategy are examined - together with some of the options that should be considered.

Repair & Protection Strategies - and their effect on electro-chemical compatibility (RP-6)

A variety of different techniques can be used for the repair and protection of concrete structures. However, the effect that each can have on residual corrosion activity is often not considered and the restored structure sometimes continues to deteriorate - often at a faster rate! In this topic, the various systems that are available are evaluated and their impact on the achievement of electrochemical compatibility is examined.

Concrete Repair & Protection Course Topics (continued)

Modern Strengthening Techniques for Concrete Structures (RP-7)

The latest developments in materials and techniques for strengthening concrete - including exterior post-tensioning, fabricated jackets, fibre reinforced composite wrapping, supplemental elements, etc. Examples of where these new materials have been used and the benefits they provided will also be reviewed.

What are the Best Techniques for Concrete Removal and Substrate Preparation? (RP-8)

Regardless of the sophistication of the repair materials to be used, a basic essential for ensuring the long-term success of any repair project is the effective removal of deteriorated concrete. In this topic, the various types of equipment and the techniques for concrete removal and substrate preparation will be discussed.

Substrate Preparation and Bonding Agents - are they really necessary? (RP-9)

Experts' opinions often vary regarding the degree and type of substrate preparation that is required before concrete repair. Opinions also differ regarding whether bonding agents are necessary or, if they are to be considered, which type should be used. In this topic, some of the conflicting theories are examined and the concepts explained. The various types of materials that are used as bonding agents will be discussed, together with their benefits and disadvantages. Test methods will also be reviewed.

Spraying and Forming Repairs - what have we learned? (RP-10)

The latest materials and techniques for spraying and forming repairs are reviewed together with a summary of good and bad practices. Dry Mix, wet mix and low pressure spray techniques will be included, as well as techniques which use gravity pouring and low pressure grouting.

Restoration Case Studies (RP-11)

Examples and details of projects that used many of the repair and protection principles discussed over the course of the two days. The projects include bridge bearing pad replacement, gravity pour repairs, low pressure grouting, underwater grouting repairs, column repairs and concrete slab on grade removal and replacement.

ADDITIONAL TOPICS

The following topics may be added to extend a two-day course or used to substitute for previous topics

Crack Repair Materials & Methods (RP-12)

An evaluation of the various materials and techniques that are used to repair cracked concrete, including leaking, structural and moving cracks. Pressure injection, vacuum impregnation and routing and sealing procedures will be presented.

Joint Repair Techniques and Materials (RP-13)

The problems associated with joint deterioration and damage together with various types of materials and systems available for reinstatement. The latest systems that improve protection against water ingress and the effects of traffic will be presented.

Concrete Repair Materials (RP-14)

An evaluation of the variety of materials used to repair deteriorated concrete. Key performance properties will be discussed together with benefits provided by generic types of product.

Protecting your Investment (RP-15)

A review of the options available for providing protection to concrete structures after restoration - including sealers, coatings and membranes.

Condition Assessment of Concrete Structures

Responsible Stewardship

Course Description

This course has been developed to cover the current state-of-the-art for the condition assessment of concrete structures. It includes comprehensive information concerning methods, techniques and practices for developing and implementing the various components of a program ~ including monitoring, investigation, testing and the development of intervention strategies. The way in which maintenance and structural evaluations interact within a well-developed program are also discussed.

The methods presented for the development and implementation of effective condition assessment programs are applicable for all types of concrete structures, including marine and highway structures, dams, wastewater facilities, parking structures, buildings, etc.



Two-Day Basic Course.

What we Need to Avoid (Part 1 ~ Case Studies) (CA-1)

An examination of some of the catastrophic, and often tragic, examples of concrete structure failures ~ including the I-35W bridge collapse in Minneapolis ~ the objective being to learn from past mistakes and avoid their repetition

What we Need to Avoid (Part 2 ~ Learning from Laval) (CA-2)

Following the fatal bridge overpass collapse in Laval, Quebec, the Johnson enquiry report laid blame on multiple parties and events. This topic specifically evaluates the identified causes of the collapse so that we can better attempt to prevent a re-occurrence of such a tragic event.

Understanding the Deterioration Mechanisms that can Lead to Failure (CA-3)

This topic examines the various types of concrete deterioration mechanisms that can ultimately lead to more serious problems. The need to identify cause is discussed, together with ways by which early intervention can prevent them from resulting in failure.

The Concept of a Condition Assessment Program (CA-4)

The assessment of the condition of a concrete structure ~ or the concrete components of a structure ~ should be an ongoing, structured process. This topic provides an overview of the many facets that make up such a program, including routine monitoring and the various stages of investigation that should follow the subsequent identification of the need for pro-active intervention.

The Ongoing Monitoring Component CA-5)

This topic evaluates considerations for the development and implementation of structured monitoring of the ever-changing condition of a structure over time. Included will be the basis for a recommended condition and consequence classification practice, as well as a reporting process.

Preliminary Investigation (CA-6)

Once routine monitoring identifies a change in condition classification and the need for intervention, the investigation process should begin. This topic examines the first stage of this process and identifies its components, including preparation and planning, field verification processes, management and maintenance criteria, preliminary assessment and the identification of the next stage in the program.

Condition Assessment of Concrete Structures

Course Topics (continued)

Detailed Investigation (CA-7)

This topic continues with the evaluation of the essential elements of the detailed investigation stage ~ which should comprehensively analyze the factors that have adversely affected performance and serviceability of individual components, or the structure as a whole.

Non-Destructive Testing (CA-8)

The detailed investigation process typically requires some form of testing ~ particularly to assist in identifying the presence and/or extent of hidden deterioration. This topic evaluates many non-destructive test methods that are available for this purpose - and examines some innovative techniques yet to become commercially available or recognized by standards.

Documentation & Reporting (CA-9)

Documentation and reporting should be an ongoing requirement that takes a structured form. This topic provides a check list summary of the essential components of an effective report and evaluates what they should include.

Options for Intervention (CA-10)

The primary objective of a Condition Assessment Program should be the determination of when intervention should commence and what form it should take. This topic examines the alternative methods for repair, strengthening and protection together with the benefits that they can provide.

PLEASE NOTE - The design aspects of structural and seismic evaluation and analysis are outside the scope of this course which will focus on both the technical and practical aspects of Condition Assessment.

Concrete Slabs on Grade

Interior Floors & Exterior Flatwork

Course Description

This course has been designed to provide an understanding of the conceptual, practical and technical aspects for the design, specification and construction of slabs-on-grade, including commercial and industrial concrete floors, exterior sidewalks driveways, etc. On many occasions, in addition to reviewing the latest materials and practices, the presenter will share his experiences as a consultant specializing in concrete materials technology to identify concrete failures, defects or deterioration that can often be caused by incorrect practices and/or inappropriate selection of materials - particularly those developed using modern technology. Some of the confusion that often exists regarding the use of modern materials will be examined together with how this can sometimes lead to conflict and controversy. In particular, the many advances in technology that have occurred over recent years will be reviewed as well as the way in which they which can provide considerable benefit to the concrete industry - and ensure the construction of long-lasting, durable slabs-on- grade.



Two-Day Basic Course

Defects, Deterioration & Damage (SG-1)

A critical review of slab deterioration mechanisms in order that their cause can be identified and their occurrence avoided.

Specification Criteria (SG-2)

An examination of the key factors considered essential for inclusion in modern technical specifications for slabs on grade, together with a discussion of the current trend toward performance specifications.

Thickness Design Considerations (SG-3)

Important considerations that affect the design of a satisfactory slab thickness for conventional conditions and use.

Fibres or Mesh? (SG-4)

An examination of the various fibre materials and welded wire mesh that are currently available, together with a review of the properties they modify and the benefits they can provide. Some of the manufacturer's claims are also examined.

Dealing with Below Slab Moisture (SG-5)

This topic reviews the key factors that determine whether or not a moisture vapour retarder should be installed beneath a slab on grade, together with expert's conflicting recommendations regarding where it should be positioned - directly under the concrete slab or buried within the subgrade.

Modern Construction Methods & Practices (SG-6)

A review of modern methods and practices - both good and bad - for handling, placing, spreading and consolidating concrete during the construction of slabs on grade.

The Importance of Efficient Curing (SG-7)

Curing is arguably the single most influential practice that affects the achievement of durable concrete, but usually it receives the least amount of attention. This topic reviews good and bad practices and uses examples to illustrate the effects that these can have on cracking, strength, surface toughness, etc.

Concrete Slabs on Grade Course Topics (continued)

The Finishing Processes (SG-8)

Finishing freshly placed concrete to produce a dense, attractive surface is a process that requires great skill. However, the use of modern materials and equipment for placement has significantly affected the finishing processes and today's tools and practices have evolved based on several influencing factors. This topic looks at the various factors and reviews good and bad practices.

Surface Flatness and Levelness (SG-9)

This topic examines some of the misunderstandings and confusion that often exists regarding what are acceptable surface flatness and levelness tolerances for floor slab construction. How tolerances may be measured will also be discussed, together with the factors that affect their satisfactory achievement.

Joints and Jointing Practices (SG-10)

This topic reviews the various types of joints that are formed in concrete - control (contraction), construction, isolation and expansion joints - and explains why they are needed, how they should be formed, and what materials should be used to fill and seal them. Examples of joint problems are also discussed, together with reasons for the failures.

Polished Concrete Floors (SG-11)

The construction of polished concrete floor slabs has grown considerably over the last few years - the growth has probably been faster than for any other specialist sector of the industry - in particular, the residential and commercial end of concrete construction have shown significant interest. In this topic, the materials and techniques that dominate the industry are examined, together with some of the benefits and cautions that should be considered.

Concrete Surface Hardening Techniques (SG-12)

The important factors that affect the surface toughness of a floor slab - and thereby its ability to resist wear and abrasion - are discussed in this topic. Common causes of surface deterioration are also reviewed, together with factors, materials or techniques that can be utilised to specifically improve surface hardness.

Applying Floor Finishes and Treatments (SG-13)

The problems associated with failed coatings and floor finishes due to excessive moisture vapour emission are expensive and often difficult to resolve. Experts are typically not in agreement with how much moisture should be present at the time of application, the mechanism of failure, nor the types of test that should be used to determine the amount that can be tolerated. This final topic critically examines the conflict and provides advice on how to avoid or minimize associated problems.

Conservation of Heritage Structures & Older Buildings

Understanding the Impact Modern or Traditional Materials and Practices can have on Heritage Masonry

Course Description

Over the last few decades, conservation of older buildings and structures has become recognized as a “stand alone” discipline requiring very specialist knowledge and expertise ~ particularly for historically valuable and architecturally significant structures. This two-day course will evaluate traditional construction materials and techniques and highlight the importance of understanding the impact they can have on achieving restored durability to a building or structure. Additionally, the program will examine the many advances in technology that have occurred over recent years, together with how these can provide considerable benefit to those involved with the conservation of heritage structures and older buildings.



Two-Day Basic Course

(NOTE: This course is an introduction to Masonry Conservation Practices)

Masonry Defects & Deficiencies - Types and Causes (CH-1)

Deterioration and damage of masonry often begins early in its life with poor detailing and/or inadequate construction practices, but can continue to be accelerated by inappropriate restoration materials and practices. This presentation reviews many examples of masonry deterioration caused by poor design and practices and highlights details that provide improved durability. Examples of inappropriate original and restoration materials and practices are also discussed.

Condition Assessment & Conservation Strategy Development (CH-2)

Successful conservation and restoration of heritage structures depends on many factors, each as important as the other. This presentation evaluates the fundamental principles that are essential for implementing a condition assessment that can lead to the development of effective remedial strategies. Factors affecting inspection, diagnosis and cause analysis, as well as material and method determination will be discussed. Non-destructive testing and monitoring techniques that can provide valuable information during the investigative process will also be discussed.

Grouting Destabilized Core Rubble Masonry - The Old and the New (CH-3)

The destabilization of older walls due to the deterioration of the inner core rubble - between the exterior and interior wythes of masonry - can be a major concern, and the remedy is often to grout hidden voids within the loosely bound rubble. Consolidation strategies and techniques must be sensitive to the need to satisfactorily fill the voids using adequate pressure, while maintaining the integrity of the masonry - both during and after the grouting operations. This presentation will review traditional grouting methods as well as modern materials and techniques that are available for effective consolidation and actual case histories will be used. The presentation will also evaluate the many factors that should be considered, including structural stability and pumping techniques, as well as grout materials and mix design.

Wall Anchoring, Reinforcing & Stabilizing Systems (CH-4)

This presentation evaluates the options and considerations that should be evaluated when faced with the need for stabilizing and/or strengthening heritage structures and older buildings that have suffered from damage caused by overload, differential movement, inner core rubble or collar joint deterioration, missing or corroding wall ties and anchors, etc. Available systems are discussed together with key factors that should be considered.

Conservation of Heritage Structures & Older Buildings

Course Topics (continued)

Repointing Masonry Walls - Matching the Techniques for Success or Disaster (CH-5)

The incorrect selection of materials and techniques for repointing has the potential to accelerate the deterioration of masonry structures more than any other process - apart, perhaps, from incorrect cleaning practices. This presentation evaluates the choices of mortar and repointing techniques that can have adverse effects - or can provide effective long term performance.

Damaged Masonry Units - Should They be Replaced, Repaired or Strengthened? (CH-6)

Badly deteriorated masonry units are often left unrestored as part of a restoration strategy which attempts to maintain the weathered appearance of older buildings - particularly if they are classified as heritage structures. However, to maintain durability, selected repair is sometimes a justifiable option while, on other occasions, replacement is the best course of action. This presentation evaluates the key factors to be considered in the decision making process and explores techniques - old and new - which can be used to repair or strengthen masonry units and retard the decaying process.

Cleaning Masonry - The Benefits and the Cautions (CH-7)

Some experts claim that if masonry cleaning cannot be undertaken without strong justification it should not take place at all. However, there are many occasions when cleaning is justified and the most important consideration then is the selection of a system which effectively does the job without damaging the underlying fabric. This presentation examines the principles surrounding the decision making process, evaluates traditional cleaning, and looks at the latest techniques.

Coating or Sealing Heritage Concrete and Masonry - The Facts & The Fiction (CH-8)

The practice of applying sealers and coatings to masonry has not been widely acclaimed. In addition, past treatments have often caused more problems than they have resolved. However, modern penetrating, "breathable" sealer technology can sometimes provide excellent protection without harmful side effects - and some surface coatings can beautify otherwise drab and weathered concrete masonry, while bridging cracks and permitting adequate moisture vapour emission. This presentation examines why prejudice against treatments exists today and looks at some situations where they may be of value, while also highlighting the dangers associated with incorrect selection.

A History of Restoration - A Case Study (CH-9)

This presentation highlights the oldest reinforced concrete lighthouse in North America as an example of how addressing the result of deterioration of some structures - instead of analysing the causes of the problem - can often fail to provide the answer. The case study documents the history of the construction and restoration of the lighthouse since the beginning of this century and uses the strategies discussed to illustrate some interesting aspects that can be applied to almost all masonry structures requiring restoration.

Putting the Theory into Practice - Case Studies (CH-10)

This presentation highlights actual projects that have applied the theories and technologies illustrated by the various presentations detailed above. The studies are intended to illustrate all stages of project specific restoration, including the investigation stage, the development of the restoration strategies and the way in which the work was carried out.

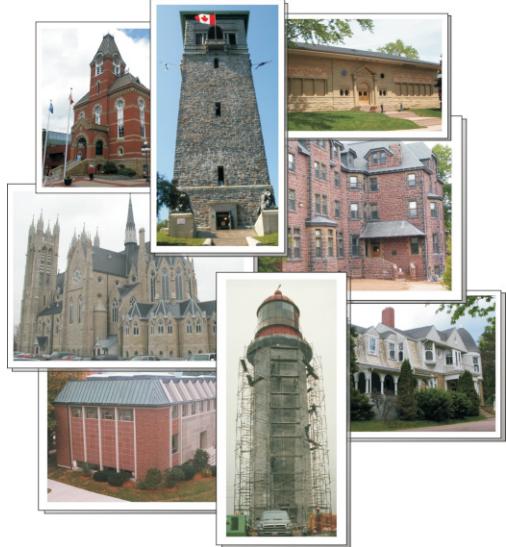
Masonry Restoration Project Case Studies

Case Studies to Illustrate the Use of Practical Strategies Based on Technical Concepts

Course Description

This course has been developed to provide examples of critical factors that can influence the successful restoration of heritage structures and older buildings. Projects will be visually presented as case studies to highlight key technical and practical aspects. Sometimes the presentations will use an individual project - from the investigation stage through to completion of the restoration - and sometimes a number of abbreviated (mini) case studies will be used to cover specific factors.

The investigation phases of the projects will illustrate how non-destructive testing methods can be used to examine hidden conditions and examples will be used to highlight the importance of addressing the original cause of damage and deterioration - rather than just the result.



Two-Day Basic Course

The Importance of Investigation, Monitoring and Cause Analysis (MR-1)

A compilation of mini-case studies will be used to illustrate where structured investigations formed a critical part of the restoration strategy development process. The studies will feature the use of non-destructive testing techniques - such as Ground Penetrating Radar to investigate hidden conditions - as well as movement and moisture monitoring devices, such as laser measuring equipment, displacement gages, and relative humidity sensors. The rationale for selection of the techniques and devices will be presented, together with details of the sometimes critical information they provided.

Accommodating Excessive Differential Movement (MR-2)

An institutional building and a church will be used to illustrate where strategies can be developed to counter excessive differential movement that sometimes occurs between building components. How the strategies can help to prevent re-occurrence of damage will also be presented.

Understanding Masonry Construction & How it Influences Durability (MR-3)

Several mini-case studies will be used to illustrate the considerable number of different masonry assemblies that can be encountered during condition assessments of buildings and structures. The presentation will visually examine and discuss how the transition from traditional mass masonry construction to modern cavity walls sometimes created buildings that suffered accelerated deterioration and damage due to inappropriate design.

Masonry Shelf Angle Remediation (MR-4)

This presentation features the restoration of an institutional building that had suffered from the inappropriate construction of shelf angles. The presentation will discuss the overall restoration scope of work and, in particular, how support of upper levels of masonry was provided while remedial work was carried out to correct the design deficiencies which had resulted in damage to the masonry. Mini-case studies will also be included to illustrate other buildings which also suffered the effects of defective shelf angle construction.

Masonry Restoration Case Studies Course Topics (continued)

Stabilizing, Repairing & Strengthening Cracked Traditional Masonry (MR-5)

The restoration of two buildings will be presented to illustrate techniques that may be considered when faced with restoring structures suffering from severe cracking of masonry components. The causes of the cracking will be evaluated and how this influenced the development of restoration strategies. Below grade waterproofing and the use of core rubble grouting techniques will be presented, together with the installation of retrofit masonry ties and joint reinforcement.

A Holistic Approach to Conserving Heritage Structures (MR-6)

A comprehensive study of how a badly damaged art gallery was restored to a durable condition will be presented from investigation to completion. The primary and influencing causes of the damage will be examined, together with some novel techniques that countered what had happened to the building during past restoration and renovation work. The importance of the investigation process and understanding how the masonry assembly can be vulnerable to original design factors will be presented, as well as lessons to be learned when renovation work includes a dramatic change to the gravity load distribution dynamics of a structure.

Cape Race Lighthouse - A History of Restoration (MR-7)

Constructed in 1905, Cape Race Lighthouse is believed to be the oldest reinforced concrete lighthouse in North America. Over the decades, it has undergone three major attempts at restoration, each failing to address the cause of the deterioration - with more damage being the result. The history of these attempts is reviewed by the presentation, together with details of the most recent comprehensive and novel restoration project which - hopefully - addressed both the cause and the result.

Restoration of Fredericton City Hall (MR-8)

Built in 1876, Fredericton City Hall is a National Historic Site. Over the years, restoration work had been carried out to restore cracked masonry - but the cracks either reopened or continued to occur at other locations. This case study will review details of the investigation which identified several influencing factors that caused the cracks, as well as the restoration work which addressed the causes and restored the building to a durable condition.

Cladding Panel Deterioration ~ Solving the Mystery (MR-9)

For many years a mystery existed regarding Mount Allison University's Convocation Hall - why were the sandstone cladding panels at the base of the imposing entrance deteriorating so badly? How the mystery was solved and how the cause was addressed are the topics of this presentation.

A Tale of Two Towers (MR-10)

This presentation highlights the award-winning restoration of a National Historic Site in Guelph, Ontario - the Church of Our Lady Towers Restoration project. The deterioration mechanisms will be discussed, as well as the condition assessment process. Also examined will be the way in which the investigations assisted in the development of a restoration strategy to address the serious damage that had occurred - despite major restoration work carried out just 15-years before.

A Tale of One Tower! (MR-11)

The concluding case study highlights major restoration work recently carried out on the Dingle Memorial Tower in Halifax, Nova Scotia, to address the extensive damage that had occurred to both the interior and exterior of the stone tower. The causes of the damage will be discussed, together with the reasons why the masonry had continued to crack - even after previous restoration work had been carried out some years before. The presentation will also highlight the combination of conventional and novel restoration materials and techniques that were used to restore the tower to a durable condition.