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Chapter 1 : Structural Studies, Repairs and Maintenance of Historical Buildings VII

Featuring state-of-the-art research and recent case studies, this book contains papers presented at the Seventh International Conference on Structural Studies, Repairs and Maintenance of Historical Buildings.

The preliminary inspection and observation will include five basic steps: Climate of the surroundings Building type and change in use Age of the building Physical inspection of the building components Repair and maintenance of old building Step 1: Analysis of the Climatic condition of the surroundings It is very essential to consider the climatic conditions of the surroundings of the structure because determining the kind of climate the place has, figuring out the defects in building materials will be easier. Climate has a great effect on building materials. India has a tropical climate. Like many other tropical countries, India has heavy rainfall and warm sunshine all year round. This implies that buildings in the country tend to weather rapidly, particularly in respect to external building materials which are exposed to external causes such as rain, wind, solar radiation including ultra-violet light; and atmospheric pollution. Here are a few examples of the defects that may occur in a structure located in a tropical country: Fungal stain, harmful growth of trees, peeling paint, erosion of mortar joints and defective plastered rendering. Analysis of the Location of the Structure In the analysis of the location of the structure, consideration of the micro-climate is of great importance. Buildings that are located near the sea or rivers tend to have common building defects. This is because the water coming from the ground causes dampness penetration and structural instability. The dampness in the structure causes crystallisation of salt which results into efflorescence the soluble salts present in the bricks dissolve because of damp condition and cause whiting of the external walls. Damp-proof courses have to be installed in order to prevent rising water coming from nearby River or sea. In addition, soluble salt which comes from sea and together with the presence of a polluted atmosphere can cause damage to the exterior surface of the buildings. Building type and change in use Most of old buildings that maintain their original functions or uses appear to have less problem internally, even though there were symptoms of building defects found on the external fabric because of innumerable reasons such as Solar radiaton, scouring action of wind, moisture etc. Many older buildings have been converted into museums and hotels. Salarjung Palace in Hyderabad, India was converted into a general museum and Palaces in Jaipur have been converted into five-star hotels. Buildings that change their use and spaces should consider the effect of the new use on the existing structure. This is because historic buildings were built to only hold certain loads and sometimes may not withstand additional loads. Where buildings which have been converted into either commercial or office purposes, the need to install air-conditioning systems to meet modern building requirements seems necessary. It has been found that in a few cases the air-conditioning units were placed improperly. This not only affects the appearance of the buildings but intervenes with the existing fabric, particularly when ducts are running in full view on the ceiling. The problem about the installation of air-conditioning system mentioned above has also been seen at Salarjung Museum, Hyderabad, India. Analysis of the Age of the Building All the building materials used in the construction tend to deteriorate after a period of time that result in the deterioration of the elements of the buildings at a lesser or greater rate depending upon their location and function. Aging building materials, particularly timber should be checked once there are signs of fungal and termite attacks. Building that were built in the early period of British occupation, for instance, often face problems in building materials. Therefore, proper treatment of building repair and maintenance should be given full consideration. Determining the age of the structure will also help us determine the construction technique used which will make the repair and maintenance of the structure easier. Physical inspection of the building components The physical inspection of the building components will help us detect the minor and major defects in the components of the structure. Prevention of Building defects Building maintenance is the key for the prevention of building defects. Old buildings that neglect building maintenance may fall into several defects which may lead to structural failures. This can be achieved by the inspections carried out by either architects or surveyors which should include checking for any signs of abnormal deterioration, cleaning out gutters of leaves or harmful growth, checking lighting conductors, cleaning out all voids and spaces; and changing tap washers. To secure the general structural stability and life of a building, it is important to regularly inspect not only the main structural elements including foundations, walls and roofs; but other common building problems.

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Chapter 2 : Guide to Repair and Maintenance of Buildings | Civil Engineering Projects

Structural Studies, Repairs and Maintenance of Historical Buildings towards the top until it converges into the outer stack at a height of m (the current height, after the demolition of the end portion).

Composed of a mixture of sand, gravel, crushed stone, or other coarse material, bound together with lime or cement, concrete undergoes a chemical reaction and hardens when water is added. Inserting reinforcement adds tensile strength to structural concrete elements. The use of reinforcement contributes significantly to the range and size of building and structure types that can be constructed with concrete. While early twentieth century proponents of modern concrete often considered it to be permanent, it is, like all materials, subject to deterioration. This Brief provides an overview of the history of concrete and its popularization in the United States, surveys the principal causes and modes of concrete deterioration, and outlines approaches to repair and protection that are appropriate to historic concrete. In the context of this Brief, historic concrete is considered to be concrete used in construction of structures of historical, architectural, or engineering interest, whether those structures are old or relatively new. The resulting hydraulic cement became a major feature of Roman building practice, and was used in many buildings and engineering projects such as bridges and aqueducts. Concrete technology was kept alive during the Middle Ages in Spain and Africa. Tabby was later used by the English settlers in the coastal southeastern United States. Lime concrete or "limecrete" was a popular construction material, as it could be made inexpensively from local materials. By , the town had approximately ninety limecrete structures, twenty of which remain. Texas Parks and Wildlife Department. The early history of concrete was fragmented, with developments in materials and construction techniques occurring on different continents and in various countries. In the United States, concrete was slow in achieving widespread acceptance in building construction and did not begin to gain popularity until the late nineteenth century. It was more readily accepted for use in transportation and infrastructure systems. The natural hydraulic cement used in the canal construction was processed from a deposit of limestone found in near Chittenango, southeast of Syracuse. The use of concrete in residential construction was publicized in the second edition of Orson S. Chatterton House was the home of the post trader at Fort Fred Steel in Wyoming, one of several forts established in the s to protect the Union Pacific Railroad. The use of this material presents special preservation challenges. As a result, lime-grout structures were constructed at several western posts soon after the Civil War, including Fort Fred Steele and Fort Laramie, both in Wyoming Figure 2. By the s, sufficient experience had been gained with unreinforced concrete to permit construction of much larger buildings. A notable example from this period is the Ponce de Leon Hotel in St. The Lincoln Highway Association promoted construction of a high quality continuous hard surface roadway across the country. Extensive construction in concrete also occurred through the system of coastal fortifications commissioned by the federal government in the s for the Atlantic, Pacific, and Gulf coasts. Unlike most concrete construction to that time, the special requirements of coastal fortifications called for concrete walls as much as 20 feet thick, often at sites that were difficult to access. Major structures in the coastal defenses of the s were built of mass concrete with no internal reinforcing, a practice that was replaced by the use of reinforcing bars in fortifications constructed after about The use of reinforced concrete in the United States dates from , when S. Fowler obtained a patent for a reinforced concrete wall. In the early s, William E. Ward built his own house in Port Chester, New York, using concrete reinforced with iron rods for all structural elements. Despite these developments, such construction remained a novelty until after , when innovations introduced by Ernest L. Ransome made the use of reinforced concrete more practicable. Ransome made many contributions to the development of concrete construction technology, including the use of twisted reinforcing bars to improve bond between the concrete and the steel, which he patented in Two years later, Ransome introduced the rotary kiln to United States cement production. The new kiln had greater capacity and burned more thoroughly and uniformly, allowing development of a less expensive, more uniform, and more reliable manufactured cement.

Improvements in concrete production initiated by Ransom led to a much greater acceptance of concrete after The Lincoln Highway Association, incorporated in , promoted the use of concrete in construction of a coast-to-coast roadway system. Joy was to educate the country in the need for good roads made of concrete, with an improved Lincoln Highway as an example. The Association believed that as people learned about concrete, they would press the government to construct good roads throughout their states. Following World War II, architects and engineers took advantage of improvements in concrete production, quality control, and advances in precast concrete to design structures such as the Police Headquarters building in Philadelphia, Pennsylvania, constructed in Courtesy of the Philadelphia Police Department. Earley, known as "the man who made concrete beautiful. From the s onward, concrete began to be used with spectacular design results: Continuing improvements in quality control and development of innovative fabrication processes, such as the Shockbeton method for precast concrete, provided increasing opportunities for architects and engineers. The streamlined building exemplifies the applicability of concrete to creating a modern architectural aesthetic. Detailed bas reliefs as well as sculptures, such as this lion at the Bailey Magnet School, could be used as ornamentation on concrete buildings. Sculptural concrete elements were typically cast in molds. Throughout the twentieth century, a wide range of architectural and engineering structures were built using concrete as a practical and cost-effective choiceâ€”and concrete also became valued for its aesthetic qualities. The school is one of many concrete buildings designed and constructed under the auspices of the Public Works Administration. Concrete was also popular for building interiors, with ornamental features and exposed structural elements recognized as part of the design aesthetic See Figs. The Berkeley City Club has significant interior spaces alld features of concrete construction, including the lobby and pool. The expanded use of concrete provided new opportunities to create dramatic spaces and ornate architectural detail on the interiors of buildings, at a significant cost savings over traditional construction practices. The architectural design of the Berkeley City Club in Berkeley, California, expressed Moorish and Gothic elements in concrete on the interior of the building Figure Whether in a circa office left or in a parking garage and retail facility right , exposed concrete structures help characterize these building interiors. Minnesota Historical Society left. The exposed concrete structureâ€" columns, capitals, and drop panelsâ€" is an integral part of the character of this old commercial building in Minneapolis. In concrete warehouse and factory buildings of the early twentieth century, exposed concrete columns and formboard finish concrete slab ceilings are common features as seen in this warehouse, now converted for use as a parking garage and shops. The predominant material in terms of bulk is the aggregate. Portland cement is the binder most commonly used in modern concrete. It is commercially manufactured by blending limestone or chalk with clays that contain alumina, silica, lime, iron oxide and magnesia, and heating the compounds together to high temperatures. The hydration process that occurs between the portland cement and water results in formation of an alkali paste that surrounds and binds the aggregate together as a solid mass. The fountain is constructed primarily of concrete pillars with formboard textures and surrounding elements, patterned with geometric lines, which facilitate the path of water. The pavilion is a distinctive landscape feature, with its reinforced concrete cantilevered slab that provides cover for chess players. The quality of the concrete is dependent on the ratio of water to the binder; binder content; sound, durable, and well-graded aggregates; compaction during placement; and proper curing. The amount of water used in the mix affects the concrete permeability and strength. The use of excess water beyond that required in the hydration process results in more permeable concrete, which is more susceptible to weathering and deterioration. Admixtures are commonly added to concrete to adjust concrete properties such as setting or hardening time, requirements for water, workability, and other characteristics. For example, the advent of air entraining agents in the s provided enhanced durability for concrete. During the twentieth century, there was a steady rise in the strength of ordinary concrete as chemical processes became better understood and quality control measures improved. In addition, the need to protect embedded reinforcement against corrosion was acknowledged. Requirements for concrete cover over reinforcing steel, increased cement content, decreased water-cement ratio, and air entrainment all contributed to greater concrete strength and improved durability. The causes of concrete deterioration must be understood in order to select an appropriate repair and protection system. While reinforcing steel has played a pivotal role in expanding the applications of concrete in twentieth century architecture, corrosion of this steel has also caused deterioration in many historic structures. Reinforcing steel embedded in the concrete is normally surrounded by a passivating oxide layer that, when present, protects the steel from corrosion and aids in bonding the steel and concrete. A reduction in alkalinity results from carbonation, a process that occurs when the carbon dioxide in the atmosphere reacts with calcium hydroxide and moisture in the concrete. When carbonation reaches the metal reinforcement, the concrete no longer protects the steel from corrosion. Corrosion of embedded reinforcing steel may be initiated and accelerated if calcium chloride was added to the concrete as a set accelerator during original construction to promote more rapid curing. It may also take place if the concrete is later exposed to deicing salts, as may occur during the winter in northern climates. Seawater or other marine environments can also provide large amounts of chloride, either from inadequately washed original aggregate or from exposure of the concrete to seawater. The concrete, which was a good quality, high strength mix for its day, is in good condition after almost one hundred years in service. Deterioration in the form of spalling related to corrosion of embedded reinforcing steel has occurred primarily in areas of higher ornamentation such as projecting bands and brackets see close-up photo. Corrosion-related damage to reinforced concrete is the result of rust, a product of the corrosion process of steel, which expands and thus requires more space in the concrete than the steel did at the time of installation. This change in volume of the steel results in expansive forces, which cause cracking and spalling of the adjacent concrete Figure Other signs of corrosion of embedded steel include delamination of the concrete planar separations parallel to the surface and rust staining often a precursor to spalling on the concrete near the steel. Lack of proper maintenance of building elements such as roofs and drainage systems can contribute to water-related deterioration of the adjacent concrete, particularly when concrete is saturated with water and then exposed to freezing temperatures. As water within the concrete freezes, it expands and exerts forces on the adjacent concrete. Repeated freezing and thawing can result in the concrete cracking and delaminating. Such damage appears as surface degradation, including severe scaling and micro-cracking that extends into the concrete. The condition is most often observed near the surface of the concrete but can also eventually occur deep within the concrete. This type of deterioration is usually most severe at joints, architectural details, and other areas with more surface exposure to weather. In the second half of the twentieth century, concrete has utilized entrained air the incorporation of microscopic air bubbles to provide enhanced protection against damage due to cyclic freezing of saturated concrete. The use of certain aggregates can also result in deterioration of the concrete. Alkali-aggregate reactionsâ€"in some cases alkali-silica reaction ASR â€"occur when alkalis normally present in cement react with certain aggregates, leading to the development of an expansive crystalline gel. When this gel is exposed to moisture, it expands and causes cracking of the aggregate and concrete matrix. Deleterious aggregates are typically found only in certain areas of the country and can be detected through analysis by an experienced petrographer. Low-alkali cements as well as fly ash are used today in new construction to prevent such reactions where this problem may occur. Problems Specifically Encountered with Historic Concrete Materials and workmanship used in the construction of historic concrete structures, particularly those built before the First World War, sometimes present potential sources of problems. For example, where the aggregate consisted of cinder from burned coal or crushed brick, the concrete tends to be weak and porous because these aggregates absorb water. Some of these aggregates can be extremely susceptible to deterioration when exposed to moisture and cyclic freezing and thawing.

Chapter 3 : Grant aid for repair of historic buildings

*Structural Studies, Repairs and Maintenance of Historical Buildings - Advances in Architecture Vol 3 [S. Sanchez-Beitia, C. A. Brebbia] on www.nxgvision.com *FREE* shipping on qualifying offers. This book comprises the papers presented at the Fifth International Conference on Structural Studies.*

In any case your local district council should be contacted to discuss any such grants before any work is carried out. It should be remembered also that the budget available towards such grants is often limited. As a result, claims are considered in terms of their significance and prioritised accordingly. There are several points to consider for such grants but it should be remembered that these are only typical conditions and not mandatory guidelines. In order for a grant to be offered the building must have been inspected by an officer from your local planning department before any work is started. If the work is urgent it may be possible for an officer to visit before you make an application. In any case you should ask for the officer who deals with Historic Building Grants. Before you make any application it is important to note that grants are not normally considered for: This includes all freehold, leasehold and tenancy agreements. It is that it is assumed that the price of the property should reflect the cost of any immediate repairs needed. How much can I expect? It should be emphasised that these figures are approximate and councils reserve the right to refuse applications or offer token amounts. How long does a grant last? Any work that has been offered a grant must be completed within one year of the date of issue. If for any reason the work or repair is not completed within this time you are required to reapply or request a renewal of the grant. It should be considered that the council is under no obligation to guarantee a renewal since grant finances are allocated annually. The grant year may run at a different time to the calendar year, for example April to the following March. Be sure to contact your District Council as soon as possible so as to organise any works to coincide with the When is a grant issued? The payment of a grant is made after the work has been completed and an inspection completed by your local planning office. If the inspector is satisfied that the work has been carried out in accordance to the grant application you will be asked to supply a copy of the bill and a receipt. If figures are deemed correct the council will issue a cheque. If for any reason the final cost of the work is lower than estimated the council may reduce the grant proportionally. In the case of the bill being higher the council can only pay the original amount to start with. A full explanation would be required before any increase to the original grant is considered. It remains up to the discretion of the planning office considering available budget as to whether more money will be awarded. It should not be assumed that the council will offer more than the original agreed sum. How to apply for a grant When a claim is made the appropriate application form should be completed and sent to the District Council. Typically an application will be supplied with copies of the following documents: The amount that can be reclaimed is normally in relation to the time from the work being completed. For example the total amount could be reclaimed within twelve months, two-thirds within the second year and a third if the house is sold within the third year.

Chapter 4 : Fodor Engineering & Design | Services

Contains the procedings of the Fifth International Conference on Structural Studies, Repairs and Maintenance of Historical Buildings (STREMA 97), held in San Sebastian, Spain, in June

Chapter 5 : The Structural Repair of Historic Buildings | Scottish Lime Centre Trust

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Chapter 7 : Preservation Brief Preservation of Historic Concrete

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