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RECONSTRUCTION AND REHABILITATION OF BUILDINGS

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ABSTRACT

The purpose of the paper is to present the reconstruction and rehabilitation of the buildings. Based on information gathered by local building organizations and with the participation of international building and design companies.This paper addresses the existing problems of reconstruction and their solutions by modern scientific methods, and highlights the importance of insurance in the preservation of the historical center.restoration and strengthening buildings which were damaged by an earthquake. Temporary conservation was carried out immediately following the main shock of the earthquake so that its collapse caused by possible aftershocks could be prevented. Retrofitting of these structures was aimed at preservation of initial geometry and appearance by creating composite structures.

Keywords: Earthquake, Reconstruction, Restoration, Rehabilitation, Carbonation test

I. INTRODUCTION

In current scenario of Building Research, Repair and Rehabilitation plays a vital role as it serves important in building applications. It acts as an inevitable solution in maintaining the Integrity of Structures, in case of Heritage structures. Repair and Rehabilitation of heritage buildings has become a concern of greater importance over the world, notably in the developed countries. The major defects reported are discussed and a suitable and economical solution for a particular defect is identified by a tradeoff between cost, lifetime and adaptability of the solution.

Repair and Rehabilitation technique is also used to modify a structure to meet new functional and other requirements. Many structures may need Repair and Rehabilitation for one of the following reasons

1. Deterioration due to Environment effect.
2. New functional or loading requirements entering modifications to a structure.
3. Damage due to accidents.

it is an important topic to be concentrated for review. In this review a tradeoff between the cost, lifetime and adaptability of the technique is archived, thus providing clear and detailed information regarding the repair

methods for the particular problem incurred in the historical buildings.The fact is, in every earthquake we are losing a few good historical heritages.

II. RECONSTRUCTION

2.1 Reconstruction is a term in architectural conservation whose precise meaning varies, depending on the context in which they are used.More broadly, "reconstruction" means returning a damaged building to a known earlier state by the introduction of new materials. It is related to the architectural concepts of restoration (repairing existing building fabric) and preservation (the prevention of further decay), wherein the most extensive form of reconstruction is creating a replica of a destroyed building.

More narrowly, such as under the *Secretary of Interior's Standards* in the United States, "reconstruction" is "the act or process of depicting, by means of new construction, the form, features, and detailing of a non-surviving site, landscape, building, structure, or object for the purpose of replicating its appearance at a specific period of time and in its historic location.

2.1 Reason of reconstruction of building and structure

There may be several reasons for the construction of a building or creation of a replica building or structure.

1. DESTRUCTION OF LANDMARK

Sometimes, it is the result of destruction of landmark monuments that is experienced as traumatic by inhabitants of the region, such as through war, planning errors and politically motivated destruction, other times, merely the result of natural disaster.

2. LACK OF AWARENESS

reconstructions are made in the case of sites where the historic and cultural significance was not recognized until long after its destruction, common in North America, especially with respect to its early history.

Most guidelines for reconstruction suggest that new construction be distinguishable from the original, and that reconstruction not be carried out if insufficient information exists to accurately re-create the building's former state.

2.2 Construction:

In the earthquake-stricken zones, designing earthquake resistant buildings is very important. However, the construction of these structures is equally important. Thus, the construction of these buildings should be done either by certified construction companies or by trained people.

III. QUALITY CONTROL AND SUPERVISION

Quality control and supervision are key elements to a successful reconstruction. Evaluation of reconstructed regions in recent earthquakes and presenting ways to improve the construction quality are quite important in any reconstruction program.

3.1 Reconstruction Material:

Enormous quantities of bricks, timber, mortar, among others, are immediately required for kicking off the reconstruction though adequacy of these materials is not assured. The damaged areas are nowadays more occupied by the rubble of solid wastes like bricks and rubble concrete. Apparently, these materials are discarded as solid wastes though embracing those materials for future reconstruction works is direly needed so as to minimize the cost and address the issues of resource constraints. The increasing encroachments on clay, timber and other resources like sand, gravels and stones have led to severe threats to the ecosystems, environmental losses and other types of threats to livelihoods.

Recently agencies are being anxious for the unmanageable quantity of rubble in Kathmandu Valley; however even if the quantity of solid waste may be equal to a decade's contribution, plausible solutions are not far from us. Those technologies could be more benevolent in case of endorsement and brought into effect. Recycled concrete may be ideal solution for concrete debris; in addition to this, the leftover bricks shouldn't be displayed stockpiling in the streets, rather their re-usability in terms of soling work or re-manufacture should be considered.

The virgin top soil and other good clay for brick manufacturing are not easily available nowadays in Kathmandu, thus reusing the brick pieces in the form of filling materials or recycling as new bricks are surely a viable solution for Nepal. The environmental degradation from brick kiln chimneys should be reconsidered for every urban setup; there are some clear indications of smoke effects in the north-eastern part of Kathmandu Valley where the majority of the brick kiln chimneys are situated.

The enormous quantity of construction materials shouldn't be expected to be supplanted necessarily by fresh construction materials. In doing so, grave threat towards the environment and ecosystem would be inevitable. Thus, obscure challenges should be convertible into the prognosis of recycling and reuse. In case of industrialized recycling and reusing being functional, the desired quality of construction materials could be reassured by blending some additives along with the rubble.

Rubble is not waste, rather it has potential to be converted into good construction materials, which ultimately resolves the issues of solid waste management in the other hand wisely. Immediate establishment of recycling industries rather than revitalizing the aggravated brick kiln chimneys should be the priority of the Government before people throw away all the debris beside the streets.

GOLDEN TEMPLE

Fig. 1. Reconstruction work inside the golden temple

Fig. 2. Reconstruction work after earthquake in Nepal

Fig.3. scaffolding building for repair and reconstruction

IV. REHABILITATION

The rehabilitation envisages restoration of structural system as close as possible to the original position. The distressed structure needs to be brought in line, level and to required strength so that it can be put into service without endangering its safety and utility.

4.1 INVESTIGATIONS VISUAL INSPECTION

Before carrying out detailed investigation, the distressed structure should be inspected visually Specially the joints, nature of distress i. e. cracking, any deflection & other valuable information which may find relevance while going for NDT evaluation.

Fig. 4. Visual inspection of structure

Fig. 5. Signs of deterioration of concrete

V. INVESTIGATION

5.1 (NDT) Non destructive techniques using Schmit Hammer PUNDIT –

Rebound hammers test the surface hardness of concrete, which cannot be converted directly to compressive strength. ASTM C 805-97, Standard Test Method for Rebound Number of Hardened Concrete, states that "because of the inherent uncertainty of estimating strength with a rebound number, the test is not intended as the basis for acceptance or rejection of concrete." The rebound numbers must be correlated with the compressive strength of molded specimens or cores taken from the structure. The procedure used to develop this relationship is described in ACI 228.1R-03.

Pulse Velocity Test

Most popular & handy method of analysis the qualitative properties of hardened concrete. The underlying principle of assessing the quality of concrete from UPV method is that comparatively higher velocity is obtained when the quality of concrete in terms of density, homogeneity and uniformity is good. In case when the ultrasonic pulse is traveling through concrete arrives at a interface between concrete and air i.e. a crack or void, there is a negligible transfer of energy across the interface, diffraction of pulse resulting in increase of time of travel.

5.2 . Concrete core testing as per IS: 516 to assess the strength of existing concrete. (Core Testing)

Core test as a part of non destructive testing helps in arriving at a conclusion on the type of concrete, its uniformity, compressive strength, physical behavior and many other tests such as cement content in the concrete by chemical analysis & petrographic analysis on chemical attacks. The cores were cut by a core drilling machine, The edges were capped & then tested in accordance with ASTM C 42, C192, BS 1881 & IS: 516.

5.3. Half Cell Measurement to assess magnitude of corrosion in the bars.

CORROSION & ITS EFFECTS Reduction of the cross sectional area steel Creation of local discontinuities in the steel surface & these effect reduces Tensile capacity of steel Reduces steel's resistance to fatigue damage

POTENTIAL MEASUREMENT The half cell potential measurement generally carried out to ascertain the possibility of corrosion in the reinforcement. The test procedure involves measuring of potential variation between the concrete & reinforcement using reference electrodes & high impedence voltmeter.

Accordingly if copper –copper sulphate electrode is used then Steel not corroding should have a potential more positive than -250Mv Steel corroding should have a potential more negative than -350Mv.

5.4. To study the RC members, at random, to map the peripheral reinforcement and cover provided using cover meter.

CONCRETE COVERMETER TEST

Profometer or Covermeter serves as an effective instrument for measuring cover concrete, location & diameter of reinforcement. However it is limited to only the first layer of reinforcement. This instrument or the test method gives as fairly indication of extent of corrosion in terms of cover concrete. If the thickness is less then there a chance of ingress of moisture. In aggressive conditions such as the prevailing structure, the soluble salts

had accelerated the corrosion of steel at a fast rate. In randomly selected members of the structure, profometer is used

5.5. Carbonation test to assess the extent of damage to carbonation

It is natural for concrete to comes in contact with carbon di oxide present in the moisture. This reaction, over a period of time tends to reduce the alkalinity of concrete. If the concrete is dense, compact & impervious then there will little chance for carbon di oxide to penetrate & the reaction will be limited to surface. Since the concrete here was porous, honeycombed at several places, the carbonation tests were carried out to assess the extent of damage.

The chemical reaction is

$Ca(OH)2 + CO2 \text{ --}\Diamond CaCO3 + H2O$

When Ca(OH)2 is removed from the paste hydrated CSH will liberate CaO which will also carbonate. The rate of carbonation thus depended on the porosity & moisture content of the concrete. Fully carbonated paste in the concrete surface. Carbonated paste appears orangebrown in crossed polarized light.

VI. METHODOLOGY PROPOSED

1. Restoring & preserving Passivity
2. Restoration of damaged reinforced concrete
3. Consolidation of columns, beams by pressure grouting low viscous epoxy.
4. Jacketing of columns using microconcrete
5. Wrapping & coating with carbon fibre
6. Finally protective coating on the surface

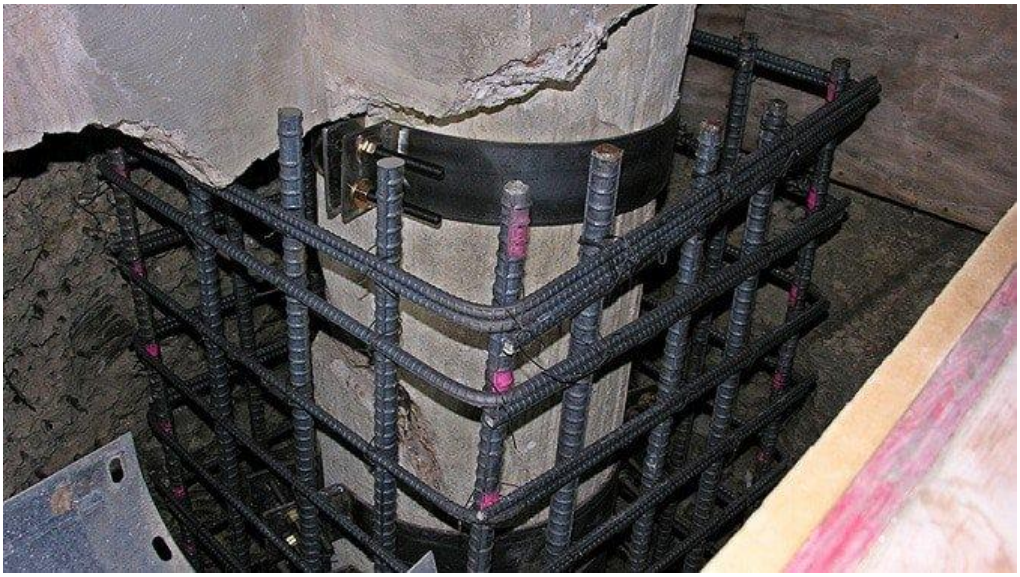

Fig. 6 repair and rehabilitation of structure for failure and defects

Fig. 7. Rehabilitation of manhole

VII. CONCLUSIONS

This paper provides a comprehensive study of repair and rehabilitation of buildings. The existed problems and its reported solutions are finely reviewed. An effective solution for the reported problem and adaptability of the solution. Hence this paper delivers its usefulness to those who as an objective of doing Repair and Rehabilitation in a Heritage Building.Deterioration of the structure may be caused due to various reasons, some of which are long life, lack of maintenance, unchecked growth of trees & creepers on the structures, improper drainage system, irregular inspection, material deterioration and weathering effect etc. Also, modern codes and building standards, observance of cultural context, conservation criteria, attainable benefit, traditional and innovative methods etc. pose major challenges in restoration of heritage structure. The best therapy to reduce decay is preventive maintenance.The repair process requires the existing condition of the structure to be identified and its causes of its deterioration. It is also necessary to define how ongoing deteriorative factors should be monitored given the effects of such processes on the rehabilitation of the structure.

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