Repair and Rehabilitation of Nehru Memorial College of K.V.G. Group of Institutions at Mangalore - A Case Study

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Abstract
Ageing infrastructures need periodical repair and maintenance to limit the level of deterioration of the structures. Due to poor maintenance one such structure was in badly distressed conditions. The present case study discusses the methods and materials that were adopted for repair and rehabilitation of the same Institutional building located in south India. The building repair was carried out with construction chemical products. This helped to increase the service life of the structures for some more years with a nominal investment as compared to the present cost of the same structure.

Key words
Distresses, Repair, Structural strengthening, Construction chemical products

Introduction
The skyline of metro cities in India is changing very fast due to construction of high-rise buildings. The world's tallest residential building is going to be constructed in Mumbai. Durability is the major concern in such structures. Durability can be defined as ability of a structure to withstand deterioration which is caused under the influence of environment throughout its desired life, without the need for undue maintenance. To increase the service life of these structures, there is need to enhance the building envelope durability which can be addressed by waterproofing, protective coating and periodical maintenance.

A survey was conducted by Canada Mortgage and Housing Corporation in the city of Toronto to develop a better understanding of the condition of existing high-rise buildings in order to determine the more cost-effective repair methods [1]. The survey indicated that the average cost/unit for repairs over 10 years was approximately four lakh rupees for all work, excluding regular maintenance items such as interior finishes. This amount is equal approximately to one month's rent per year. It was found out that water penetration and air leakage through the building envelope was the main cause which resulted in structural and other damage [1]. The condition in other metro cities will be more or less similar and cost will be even higher in costal cities associated with severe environmental distresses. Repair materials and methodology will be similar for any type of concrete structures either a low or a high-rise building. To study the

distress and its repair methodology, an Institution building in a costal environment which was repaired and rehabilitated was selected as a case study.

Back ground

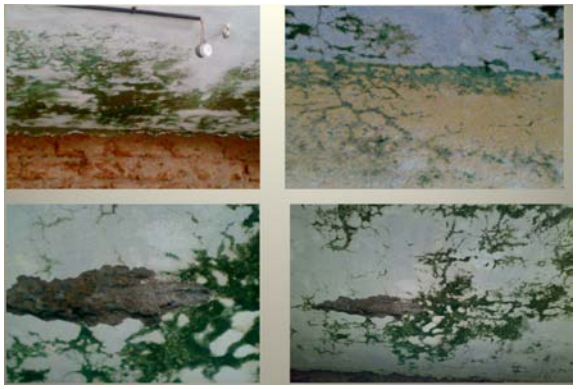
Nehru Memorial College of Sri Kurunji Venkatramana Gowda (KVG) Group of Institutions is located at Sullia near Mangalore, a costal city in the State of Karnataka. It was established in the year 1967. This 40 year old Institution consists of framed structures of G+1 and G+2 storyed of different blocks which experienced severe water leakages and environmental distress leading to cracking, spalling and deterioration of the structural members. The client was very much worried about the safety and stability of the structures. The structural consultant carried out non-destructive testing on the structures and found out that the structure is safe and need only repair and retrofitting and even can carry the load of an additional floor.

Distress Observed

Since the building was very old and located in a marine climate, the water leakages and reinforcement corrosion were major issues. There were leakages in the roof and water seepage through the external walls. The walls were made of laterite stone block masonry. The pointings of the stone masonry were disintegrated and water was leaking through these joints. There were spalling of plaster, cracks in the masonry walls and also cracks in the ceilings of the RCC roof. The water seepages and leakages led to growth of fungus and mosses on the walls and the ceilings. The corrosion of reinforcement led to spalling of concrete. There were cracks in the RCC ceilings and columns.

Spalled plaster, fungus growth in walls

Cracks in the ceiling and masonry wall



Fungal growth in ceilings

Corrosion and spalling of concrete in columns

Repair of Cracks in Masonry walls

There were some cracks in the masonry walls. At those locations the plastering was chipped of and cutting of V-grooves were made along the length of the crack by chiseling. The cleaning was made by a high pressure water jet. A wire mesh was fixed along the cracks after which the cracks were repaired with medium structural grade repair mortar.

Cracks in walls

Plastering cracks repaired

Repair and Strengthening of RCC Columns, Beams and Slabs

The reinforcements in the most of the columns were corroded. There was complete loss of cover concrete in some columns. The following steps were taken:

• Distress and spalled concrete portions were identified and marked for repair and restoration.
• Reinforcements were exposed by chiseling properly with light weight hammer and chisel.
• The exposed reinforcements were properly cleaned by wire brushed and entire concrete and steel surface were washed with potable water.
• Thereafter the reinforcements were applied with a rust remover and rubbed with gunny sacks, wiped properly and washed with high pressure water jet to wash out the traces of any residues.
• Then the same reinforcements were applied with anti-corrosive epoxy zinc primer to prevent further corrosion.
• After that the distressed concrete portions were properly applied with epoxy bonding agent for acting as an impervious layer to restoration patch.
• Finally a cementitious high structural grade repair material was applied in mortar consistency to build the thickness of the cover concrete as needed at site condition.

The ceiling surface of roof slab and beam were also repaired in the similar manner.

Columns being repaired with structural grade mortar

Repairing of ceiling, beam

Strengthening of Masonry Columns

The masonry columns of the corridor needed to be repaired and strengthened for carrying out additional loads. This was achieved by providing steel jacketing to those masonry columns. The steel jackets were made of 4-ISA 75x75x6 and braced with tie rod in a zigzag way. The concreting was done with cementious high grade structural repair mortar.

Strengthening of masonry columns by steel jacketing

External Wall Plastering and Protective Coating

All the external wall plasters were loosened and debonded from the masonry surface for which plastering was chipped out and replastering was done. It was finished with cement mortar admixed with polymer modified mortar and finally protected with an elastomeric acrylic coating.

Before repair

After repair

Before repair in distress conditions

After Repair and Strengthening

Acknowledgement

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- Year of repair-2009-2010
- Structural consultant: Maistry S, Mangalore
- Repair material supplier: Pidilite Industries Ltd.
- Products used :Dr. Fixit and PAGEL range of products
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References

[1] Technical Series 99-104 and 02-101 of Canada Mortgage and Housing Corporation “Healthy High-Rise: A Guide to Innovation in the Design and Construction of High-Rise Residential Buildings” http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/tech02-101-e.html