

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

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### 1.0 Introduction

Ageing infrastructures need periodical repair and maintenance to limit the level of deterioration of the structures. Due to poor maintenance the structures are in badly distressed condition. The present case study discusses the repair and rehabilitation of one of such distressed institutional building located in south India.

### 2.0 Background

The Nehru Memorial College of Sri Kurunji Venkatramana Gowda (KVG) Group of Institutions is located at Sullia near Mangalore, a coastal city in the state of Karnataka. It was established in the year 1967. This 44 year old institution consists of framed structures of G+1 and G+2 storied of different blocks, which has experienced sever water leakage and environmental distress leading to cracking, spalling and deterioration of the structural members. The client was very worried about the safety and stability of the structures. The structural consultant carried out nondestructive testing on the structures and found out that the structure is safe and only needs repair and rehabilitation, and can even carry the load of an additional floor.

### 3.0 Distress Observed

Since the building was very old and located in a coastal area, water leakage and reinforcement corrosion were major issues. There was water leakage on the roof and water seepage through the external walls. The walls were made of laterite stone block masonry. The pointings of the stone masonry disintegrated and water was leaking through these joints. There was spalling of plaster (Fig. 1), cracks in the masonry walls (Fig. 2) and cracks in the ceiling of the RCC roof (Fig. 3). Water seepage and leakage led to the growth of fungus and moss on the walls (Fig. 4) and the

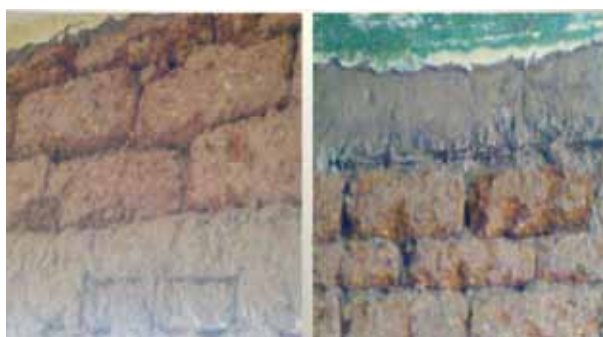


Fig. 1: Spalled plaster, fungus growth on walls

ceiling. The corrosion of reinforcement led to spalling of the concrete. There were cracks in the RCC ceiling and corrosion of reinforcement and spalling of concrete in columns (Fig. 5).



Fig. 2: Cracks in the masonry wall



Fig. 3: Cracks in the ceiling



Fig. 4: Fungal growth on ceiling



Fig. 5: Corrosion of reinforcement and spalling of concrete in columns

## 4.0 Repair of Cracks in Masonry Walls

There were some cracks in the masonry walls (Fig. 6). At these locations the plasterings were chipped and V-grooves cuts were made along the length of the crack with a chisel. The cleaning was done with a high pressure water jet. A wire mesh was fixed along the cracks after which the cracks were repaired with cement based ready to use fine repair mortar (**PAGEL U - 10**) (Fig. 7).



Fig. 6: Cracks in walls



Fig. 7: Plastering cracks repaired

## 5.0 Repair and Strengthening of RCC Columns, Beams and Slabs

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

- Distress and spalled concrete portions were identified and marked for repair and restoration.
- Reinforcements were exposed by proper chiseling with a light weight hammer and chisel.
- The exposed reinforcements were properly cleaned with a wire brush and the entire concrete steel surface was washed with potable water.
- Thereafter the reinforcements were applied with a rust remover (**Dr. Fixit Rust Remover**) and rubbed with gunny sacks, wiped properly and washed with high pressure water jet to remove traces of any residue.

- Then the same reinforcements were applied with anti-corrosive epoxy zinc primer (**Dr. Fixit Epoxy Zinc Primer**) to prevent further corrosion.
- After that the distressed concrete portions were properly applied with epoxy bonding agent (**Dr. Fixit Epoxy Bonding Agent**) which acts as an impervious layer for the restored patches.
- Finally cement based ready to use high early strength structural grade repair mortar of **PAGEL U-40** was applied in mortar consistency to build up the thickness for 10-30 mm cover concrete and **PAGEL U-80** for 40-80 mm cover concrete, as needed at site condition (Fig. 8). The ceiling surfaces of the roof slab and beam were also repaired in a similar manner (Fig. 9).



Fig. 8: Columns repaired with structural grade mortar



Fig. 9: Repairing of ceiling, beam

## 6.0 Strengthening of Corridor Columns

The columns of the corridor needed to be repaired and strengthened to carry additional load. This was achieved by providing steel jackets to those columns. The steel jackets were made of 4-ISA 75 x 75 x 6 mm and braced with tie rods in a zigzag manner. The concreting was done with cement based structural grade repair mortar (**PAGEL U-80**) (Fig. 10). The properties of cement based repair mortar is given in Table 1.



Fig. 10: Strengthening of columns by steel jacking

Table 1: Properties of cement based repair mortar used

Sl.	Properties	PAGEL U-10	PAGEL U-40	PAGEL U-80
1	Granulation (mm) 0-1	0-1	0-4	0-8
2	Compressive strength (Mpa)	7 days	50-55	50-55
		28 days	60-65	55-60
3	28 days Flexural strength (Mpa)	9	9	9
4	Abrasion resistance (Mpa)	> 2	> 2	> 2

## 7.0 External Wall Plastering and Protective Coating

- All the external wall plasters were loosened and debonded from the masonry surface for which plastering was chipped of and replastering was done. It was finished with cement mortar mixed with polymer modified mortar, as shown in Figure 11 (Dr. Fixit Pidicrete URP).



Fig. 11: Plaster finishes with polymer modified mortar

- The surface was applied with an acrylic based primer (Dr. Fixit Prime Seal) to resist efflorescence and to provide excellent adhesion to the surface.
- The surface was finally protected with an acrylic elastomeric coating (Dr. Fixit Rain Coat) (Fig. 12). It is a water based coating with hairline crack bridging ability. Since this coating has higher thickness of 125 micron in two coats, it can provide a relatively longer service life of 6-8 years. The coating is also algae and fungus

resistance and having higher dirt pick up resistance. As a result it can maintain a clean surface.



Fig. 12: Surfaces protected with acrylic elastomeric coating

## 8.0 Conclusion

The building repair and waterproofing were carried out with construction chemical materials in order to increase the service life of the structures. Non-destructive testing helped for proper diagnosis, to assess the existing load carrying capacity of the member of the structure for repair and strengthening and to take a decision for the construction of an additional floor. The photograph before repair of the building is shown in Figure 13 and after repair with the additional floor is shown in Figure 14.



Fig. 13: Before repair in distress conditions



Fig. 14: View of the same building after repair, strengthening and with an additional floor

- Year of repair: 2009-2010
- Structural consultant: Maistry S, Mangalore