



Challenges in Restoration of structures An Indian Experience

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Summary

Restoration work of any structure is seldom simple and a straight forward activity. As one proceeds with the work, at times, it brings up surprises and unexpected problems. The rehabilitation engineer has to be resourceful and innovative in dealing with such challenging situations. In absence of sufficient data and drawings, he has to make prudent assumptions to resolve complex issues. How this is tackled in India on some projects is brought out here.

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1. Introduction

During the last 4 decades successful rehabilitation of more than 300 structures was carried out. The experience gained has instilled confidence to handle difficult and complex jobs of rehabilitation. It has been acknowledged by the profession that this is a potentially challenging activity. How such challenges are tackled successfully is highlighted here.

2. General scenario of structures in India

Besides bridges, there are structures such as aqueducts, syphons, dams and industrial buildings. All these structures have to be maintained to keep the wheels of growth running.

3. Common problems and challenges

During execution of rehabilitation jobs, at times the situations encountered are complex and throw up challenges to the rehabilitation engineers. Some typical situations faced by us are briefly given below

3.1. Re-alignment of superstructure of bridges

The alignment is affected generally due to settlement of foundation on account of excessive floods and consequent scouring. Earthquakes too disturb the decking.

3.2 Measures for controlling scour for major bridges

In the northern part of India, the bridges' foundations are generally located in alluvial soil which are susceptible to scouring and sometimes are beyond safe level. Measures such as garlanding the foundation by boulders etc are found effective.

3.3 Lifting bridge deck from the top

Water flow in the river or high piers sometime prevent solutions to lift the decking from river bed. Under such circumstances lifting is resorted from the deck top which is not simple.

3.4 Increasing load carrying capacity of the bridge

Generally substructure and foundations have reserves to take on additional loads. But decking needs strengthening which has been carried out in India for Railway and Highway Bridges.

3.5 Re-alignment of Tall Structures

Tall structures such as silos, cooling towers, overhead water tanks, chimneys etc. present more complex situations than other structures and need special attention.

3.6 To increase height of the bridge

Due to change in High Flood Level (HFL) or Full Supply Level (FSL) for canal bridges, decking is required to be raised.

3.7 Damage due to accidents

Natural disasters such as earthquakes, land-slides and very high floods etc. play havoc at times with the structures. The rehabilitation of such structures calls for resourcefulness and special skills to reinstate them satisfactorily.

4. Some examples of structural Restorations

Several structures have been restored by us by using variety of techniques and tackling different problems. A glimpse of these structural rehabilitation jobs is given below:-

4.1. Yamuna Bridge at Khairana

One well foundation of this balanced cantilever bridge settled by 86 cms resulting in collapse of bearing and badly mis-aligning of the decking due to excessive flooding. Slew of measures such as garlanding around the well, lifting the deck and strengthening well cap and pier were taken for restoration.

4.2 Cauvery Bridges

Load carrying capacity of these bridges was enhanced by about 30% by adding external prestressing and new deck slab. Originally these bridges were designed for meter gauge (1000 mm width) loading but now converted to Broad Gauge (1676mm width) loading which is about 30% higher.

4.3 Nizamuddin Bridge

Apart from loss of prestress in 48m long "I" girders, problem of twin water mains supported on inner side girders was tackled. All 208 bearings were inspected and repaired before re-installation.

4.4 Jui creek bridge near Bombay

The decking of this bridge was required to be lifted by as much as 2.65 meters to provide sufficient clearance on the important "Palm-Beach-Road" passing below this bridge. Handling of IPSC girders of 44 m length at a time and uniformly lifting them had to be done meticulously.

4.5 Realigning cement silo

One of the four silos of 37m height got tilted by 2 m and rested against an adjoining one. The concrete at construction joint at 7m height was crushed and eventually tilted the silo. The silo was re-aligned by carefully balancing it on hydraulic jacks.

4.6 Strengthening of Railway Arch Bridges

This 158 year old railway bridge carrying 4 BG tracks was given a life extension by internment of the arches.

4.7 Hirakud Dam

Stability of the right spillway of this dam completed in 1957 was restored by treating cracks and crevices in the body of the dam by special sealants and epoxies in 100 feet depth of water and with the help of divers from Netherlands.

5. Conclusion

Restoration of structures is complex activity and can be tackled by innovative methods.

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