French experience in prestressed structures repair

Autor(en): **Poineau, D. / Lacombe, J.-M.**

Objekttyp: **Article**

Zeitschrift: **IABSE reports = Rapports AIPC = IVBH Berichte**

Band (Jahr): **83 (1999)**

PDF erstellt am: **01.05.2024**

Persistenter Link: https://doi.org/10.5169/seals-62908

French Experience in Prestressed Structures Repair

D. POINEAU
Technical Director
S.E.T.R.A.
Bagneux, France

Born 1937.
Throughout his carrier he has worked on engineering structures.
For about 25 years, specialised in pathology.

J-M. LACOMBE
Senior Engineer
D.R.E.I.F.
Vincennes, France

Born 1959, civil engineering degree 1983.
Experience in concrete and composite bridges.
For about 10 years, specialised in pathology.

1. Introduction

1.1 History of prestressing in France

On France's national roads, only 19% of bridges are made of prestressed concrete, but they account for 48% of the deck surfaces! In fact although Eugène Freyssinet filed his patent on prestressed concrete back in 1928, it was only after the second world war that this technique really began to develop and particularly since 1970.

1.2 History of prestressed bridge repairs

Like every other type of bridge, prestressed concrete bridges have shown specific defects. There are many reasons for these defects: inadequacies in calculations of some structures built before 1975, corrosion of tendons with insufficient protection, and so on... Furthermore, there are more and more socio-economic demands such as widening or live load increases.
In France, the first significant operations on prestressed concrete bridges took place in the early seventies. A recent inventory shows that about fifty large prestressed concrete bridges have been reinforced or repaired, in most cases with additional external prestressing.
Most of the defects encountered in France, principally tendon corrosion or structural defects, concern deck girder bridges and box girders using staged construction.

2. Repair techniques

2.1 The different techniques

Depending on the origins of the defects, various repairing or strengthening techniques can be used. We will limit the scope of this paper to the repair technique by the addition of force, currently widely used in France [1].

2.2 Additional prestressing

Additional prestressing, generally external to the concrete, is the best known repair and/or strengthening method for bridges and other prestressed concrete structures. It can be used on bridges cracked through errors in design or construction, on bridges with highly-corroded prestressing reinforcements and even on bridges in good condition but whose load-carrying capacity must be increased.
In France, many structures have been strengthened by this technique, in which structural detailing and efficiency checks have made great progress since the first repairs in the seventies.
The additional prestressing may be longitudinal, transversal or vertical.

3. The lessons drawn

France has 25 years experience of repairing prestressed structures in order to extend their life span or to update their performance for contemporary needs.

3.1 Lessons drawn for repairs

3.1.1 Methodology
It is essential to use a strictness methodology for expert appraisals and repairs [2], which must respect the following three stages:
- preliminary diagnosis ;
- performance of tests and studies specified in the investigation programme;
- synthesis and finalisation of a diagnosis to explain the causes of observed defects and quantify the resulting weak points in the load-carrying capacity. Experience has shown that repairs made without this prior analysis have more often than not been failures.

3.1.2 Repairs by additional prestressing
For repair work by additional prestressing, specific requirements must be met, such as stop trafic during the hardening phase of the additional concrete or do radiographies before drilling, etc.

3.2 Lessons drawn for new structures

We can also draw lessons from this experience to design new structures.

3.2.1. Basic rules to limit the ageing of structures
For example :
- Any change in usage requirements of a bridge (future widening, increase in load-carrying capacity) must have been already taken into account in the design.
- All monitoring and maintenance operations on all parts of the structure must be simple, easy to perform and must not adversely affect durability.
- Systematically carrying design regulations to their limits results in a build-up of reinforcements and tendons incompatible with good installation of the concrete, proper concrete cover and positioning of the reinforcements.
- etc.

3.2.2. Technological changes and durability
The durability problems that sometimes occur with bonded post-tensioning (grouting with cement) may induce engineers to consider new methods of protecting prestressing.
But experience has shown that opting for such solutions is sometime like jumping out of the frying pan into the fire, due for example to the incompatibility that may exist between some cements and some additives when preparing a grout mix with a controlled grouting time, that make cause settlement phenomena and grout setting defects in the prestressing ducts.

4. Conclusion

In order to improve the Quality of structures, it is important to draw lessons from experience and build it up. This analysis made in France has resulted in a considerable reduction in defects, even though further progress remains to be made.
Requirements in terms of durability must remain the absolute priority and it is particularly important for future European technical approvals for prestressing systems to take them into account.

References
[1]Réparation et renforcement de structures de bâtiments et d'ouvrages d'art - N° 501 des Annales de l'ITBTP, February 1992,
[2] La méthodologie des expertises et de la réparation - Ouvrages d'Art N° 31, bulletin de liaison du CTOA du SETRA,