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Rehabilitation: The Chance for Extending the Life of Structures

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Summary

Independently of its imposing achievements, structural engineering has to accomplish a less attractive task of solving the existing structures future. The essential factor of structural durability is searching and insisting upon the quality of design and construction which should be kept by regular and preventive maintenance. Rehabilitation is the chance for life extending of deteriorated, defected and damaged structures, and strengthening for structures with the increased requirements. Although rehabilitation and strengthening of structures have different purposes, the same methods are used for their implementation. Possible methods of rehabilitation and strengthening of structures are reduced to: changing the structural system, decreasing the span, changing the actions, increasing the cross section and replacing the structural members.

Keywords: Structure; service life; deterioration; damage; maintenance; rehabilitation; strengthening.

1. Introduction

Structural engineering is very proudly entering the third millenium. Numerous great and important structures have been built, impressive for their size and beauty. Searching for and insisting upon quality in all stages from research and design to construction and maintenance significantly contributed to excellent structural achievements. However, independently of the imposing success, structural engineering has to cope with a very serious, but maybe less attractive task. It is inevitable to successfully solve the problem of the existing structures future. As many of them are quite old or approaching the end of their service life,it is urgent to decide on their destiny. Rehabilitation is a chance to extend the service life of structures.

2. Rehabilitation Purposes

The purpose of rehabilitation of the existing structures, deteriorated, defected or damaged is to re-establish their capability to accept all the effects of actions and to respond to all functional requirements of the original design. With the appropriate reliability level, a sufficient safety, the required serviceability and the necessary durability should be secured again. Thereat, it should be kept in sight that rehabilitation is not only an engineering problem of its implementation but also the economic problem of profitability.

The service life of structures is a period of time during which they have the sufficient safety and the required serviceability. It is absolutely clear that reaching the service life of structures does not mean it becomes indispensable to replace them. However, that is the ultimate time to decide on their

future destiny. It should be estimated if the rehabilitation inevitable to extend the service life, including the future maintenance, is technically justified and economically more favourable then the replacement of the existing structure by the construction of the new one.

The specific measures required to provide the durability of structures are reached studying the basic forms and relevant factors of their time-dependent deterioration and gradual ageing. To take those specific measures mean to prevent, decrease or slow down the deterioration processes. The study of deteriorations is particularly important for concrete structures due to reinforcement and especially prestressing wires corrosion danger which can cause really serious problems.

Regarding the requirements defined during the planning of the structures, they can be subject to various defects. Defects are the consequences of very different failures, omissions, and mistakes, which can arise during the design and construction of structures.

During their service life, the structures can be more or less damaged due to unexpected events. Structural damages can come as a result of overloadings or because of other kinds of inadequate use during the service life. Damages of structures might also arise due to accidental actions which appear only rarely. As accidental actions up to the specific magnitude are provided for in the design they are only exceptionally of such an intensity to cause structural damages.

Special care should be taken of preservation and protection of the structures having historical and architectural heritage and the monuments of culture. However, the requirements to extend the service life of such existing structures by their rehabilitation are dominant and frequently they are claimed compulsory independently of their costs.

During the service life of structures, necessity may arise to change their purpose. When the requirements are increased the matter of their strengthening is considered. The purpose of strengthening of the existing structures which need not necessarily be deteriorated, defected, or damaged at all, is to make them capable to accept the increased effects of actions and to respond to the higher functional requirements compared to those anticipated by the original design. Although strengthening and rehabilitation of structures or structural members have different purposes, basically the same methods are used for their implementation.

3. Importance of Maintenance

The adequate maintenance during the service life is an essential factor to keep the level of quality of structures which significantly influences their durability. Advantage given to regular and preventive maintenance is the most convenient way from both engineering and economic points of view.

Optimization of engineering and organizational solutions in bridge management, the choice of an objective system of classifying and estimating the conditions of bridges and evaluating their remaining service life, and optimization in long-term planning the required engineering capacities and financial resources of the corresponding funds according to the priorities of the anticipated works in order to secure undisturbed and safe traffic on roads and railways require a scientific approach in solving those very complex problems. Bridge Management System is developed in many countries and its practical application greatly secures the achievement of the set purposes.

4. Rehabilitation Methods

Methods of rehabilitation of deteriorated, defected and damaged existing structures or strengthening of structures which need not necessarily be damaged at all, are very different. The ideas of possible methods of rehabilitation and strengthening of structures are most easily attained if the basic principles of dimensioning are reached. Possible methods of rehabilitation and strengthening can be achieved by changing the structural systems, decreasing the spans, changing the actions, increasing the cross sections, or replacing the structural members. The best illustration of rehabilitation and strengthening methods is with concrete structures.