



## Design and Durability of Highway Overpasses

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## Summary

The scope of this paper is to compare durability of different types of concrete overpasses constructed on Croatian highways in past forty years. Bridge condition assessment was conducted due to new categorization of the roads in Republic of Croatia and in accordance with State Bridge Management System. During examinations, some characteristic damages on prefabricated overpasses were noticed: rapid construction degradation around the expansion joints and damages on drainage system. In order to minimise maintenance expenses, it is necessary to optimize construction in the course of design phase by choosing more adequate types of construction and details. Considering overpasses are one of the major bridge group, viewed in elevation by those traveling on a road below, the structure type, span lengths, and proportions as viewed in elevation should be carefully considered.

The purpose of this paper is to describe and to compare most frequent structural solutions implemented in design of concrete overpasses on Croatian highways in last thirty years. Emphasis is placed on durability of each type of structure, construction time and costs and maintenance costs. Great part of all overpasses in Croatia is constructed with prefabricated concrete elements, as a result of fast construction requirement. Fewer overpasses were constructed with continuous solid slab. Recently, on new highways, construction of integral bridges is planned. The pros and cons of different structures considered are discussed. Improvements applied in design, based on rebound information of structural behaviour and durability will be presented.

**Keywords:** concrete overpasses, design, durability, construction, maintenance, service life.

## 1. Introduction

The perception of concrete as indestructible construction material has changed in the last few years. Today, it is recognized that concrete is as susceptible to degradation as other materials. Its causes are durability problems, poor characteristics and faults resulting from repair works. Premature repairs of concrete structures are the most obvious manifestation of bad decisions on bridge design and detailing, and inappropriate practice on the site. Bridges built forty years ago have sustained great damage over the years, mostly due to the salt water ingress that affects reinforcement. The problem of chloride attack is the first issue to address in establishing a design method for long-life concrete bridges, although there are various causes of deterioration, because some concrete bridges have been fatally degraded by salt air.

Prefabricated bridge elements and systems can be constructed off-site and brought to the project location ready to erect. They can also be constructed adjacent to the project site but out of the way of traffic and then moved into position when they are needed. Their use provides bridge owners, designers, and contractors with options and advantages in terms of construction time, work-zone safety, environmental impact, constructability, quality and cost.

Overpasses with slab are constructed in-site on scaffolding. This construction requires significant access underneath the bridge for construction personnel and equipment. Erection of formwork and placement of steel reinforcement and concrete necessitate access to specific locations. Because of unavoidable traffic disruption this procedure is more suitable when constructing new highways.