# Durability design of composite bridges with given life in seasonal freezing region

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## Abstract

Steel-concrete composite bridges are currently widely used in highway bridges in China. To reduce durability problems in seasonal freezing region, a design method with given service life is used. The service life is given on the basis of the environment condition and design requirements; then the structural design and safety analysis are carried out, and the durability design and analysis of the structural components are conducted. With the consideration of the mechanical performance, construction convenience and life-cycle cost, the structural scheme for bridges using twin-I girders, cross beams and precast full-width deck is recommended. Weather resistant steel is recommended to be used in nonmarine seasonal freezing regions with stabilization treatment, waterproof and drainage design, local anti-corrosion coating. Finally, a design process considering material, protective layer thickness and construction control is proposed to improve concrete deck durability.

**Keywords:** Steel plate composite girder bridge; Durability design; Life-cycle design; Bridge maintenance.

## 1 Introduction

Steel-concrete composite bridge is a kind of medium span bridge structure with rapid application in recent years in China. The steel main girders and the concrete bridge deck are connected to form a composite section using shear studs, and the I-steel girders are connected by cross beam, forming a composite system. With the development of industrialized construction, the structural form using fewer main girders and simplified stiffeners is more recommended, which can reduce the construction cost [1].

In the seasonal freezing region, the durability problems of this kind of structure are more severe and complicated due to the severe cold and snowy climate. The main factors affecting the durability of steel-concrete composite girder bridges include: atmospheric corrosion of steel, chloride ion erosion of concrete, concrete carbonization, freeze-thaw cycle and concrete cracking in the negative bending moment area. It is necessary to carry out the durability design of bridges to optimize the service performance and life-cycle cost based on the whole life cycle.

In the past 20 years, structural durability and life cycle design have attracted more and more attention from researchers and designers. Many scholars represented have studied the life-cycle design of engineering projects, involving the environment and ecology, concrete materials, and

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