

## Strengthening of box girder bridges with external prestressing - case study for the Langeland Bridge.

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### Abstract

This paper presents the basic principles for strengthening of bridges and other structures through the use of external prestressing. A case study that includes strengthening of the approach spans for the Langeland Bridge in the south-eastern part of Denmark is included.

During a recent rehabilitation, corrosion of the post-tensioned tendons was discovered inside the box girders of the bridge. Additional analysis of the extent of the corrosion and a structural assessment was undertaken. Based on this, a strengthening project was carried out, and strengthening with external prestressing is currently being implemented.

**Keywords:** Bridges, structural assessment; strengthening; external prestressing; Design, structural monitoring; corrosion of tendons; inspection; condition assessment; rehabilitation.

### 1 Introduction

Over the past few decades, most countries have experienced an increase in traffic both in terms of weight and volume. In addition, the general condition of many bridges has deteriorated and environmental conditions including e.g. the usage of de-icing salts have caused a reduction in the load-carrying capacity for several bridges. As a result of this, there is an increase in the number of bridges requiring strengthening or replacement in order to meet future traffic requirements. For

bridges with a box girder or beam-slab superstructure, external prestressing has in many cases proven a financially feasible method with minimum impact to the traffic below and on the bridges themselves.

This paper contains a general introduction to bridge strengthening with external prestressing. In addition, a case study for a major ongoing strengthening project that involves external prestressing of the Langeland Bridge is presented.

The bridge is situated between the islands Siø and Langeland in the south-eastern part of Denmark.