

Sika at Work



## Structural Strengthening

Bridge Strengthening with the  
Sika<sup>®</sup> StressHead Prestressing System

International Case Studies



# Bridge Strengthening with the Sika® StressHead Prestressing System

## A3 Escher Canal Bridge, Glarus (Switzerland)

### Project

The three span bridge on the A3 Sargans Zürich motorway, built in 1957, crosses the Escher Canal near Weesen. The structure is a fully prestressed box girder type.

### Problem

During an inspection in 1964, a crack running the whole length of the bridge was found in the centre of the underside of the deck. This was then continuously monitored by the engineers until a possible solution could be found.

### Sika Solution

The deck slab was strengthened transversely for positive and negative moments with **Sika® CarboDur® CFRP** plates. The tensioned plates on the underside of the deck slab act as external prestressing. The tensioning force is transferred to the concrete only at the ends of the plates and these were carefully located to achieve the maximum strengthening effect.

### Project Participants

Client: Canton of Glarus Building Authority, Public Works Dept.  
Consultant: Locher AG, Zürich, Engineering Dept.  
Contractors: Spaltenstein AG, Zürich / Sika Bau AG / VSL-Schweiz AG  
CFRP prestressing system: **Sika® StressHead**  
Completion: September 2002



## Hütten Bridge, Werthenstein, Lucerne (Switzerland)

### Project

The "Hütten Bridge" was built in the 1950's and was designed for vehicles with a maximum total loading of 28 tons.

### Problem

The management of the surrounding forests now required the bridge to carry heavier loads of timber with larger trucks taking up to 40 tons. Neither of the two main bridge beams on the three span bridge could take this new loading and they both had to be strengthened for the increased flexural and shear force loadings.

### Sika Solution

Both beams were strengthened with prestressed **Sika® CarboDur® CFRP** plates up to 30 metres long on both sides. The end anchorage of the prestressed plates consisted of continuous shear connectors through the beams, which introduced the tensioning forces into the beam. **SikaWrap®** fabric loops were used for the shear strengthening. Slots were first cut vertically in the deck slab so that the loops could completely surround both the tension and compression zones of the beams. The loops were then inserted in several layers and bonded together with **Sikadur® Adhesive**.



### Project Participants

Client: Canton of Lucerne Agriculture Dept.  
Consultant: Peter Stalder, Engineering AG, Malters  
Contractors: Sika Bau AG, Lucerne / VSL-Schweiz AG  
CFRP prestressing system: **Sika® StressHead**  
Completion: 2003

# Sung San Bridge, Seoul (Korea)

## Project

The "Sung San bridge" is a reinforced concrete multispans two way bridge in the City of Seoul, South Korea, with a total length of 120 meters (8x15 m) and a width of 17 meters.

## Problem

The deck slab on the bridge had large transverse cracks in several places. They were as a consequence of ever increasing traffic loads for which the longitudinal reinforcement in the deck slab had not been designed. Strengthening of the tensile resistance underneath was particularly necessary around the abutments and supports. In some cases the end anchorages also had to be located directly in the supports, i.e. in the haunch.

## Sika Solution

The longitudinal strengthening was achieved with prestressed **Sika® CarboDur® CFRP** plates. The plates were deflected around the haunches by a steel saddle to prevent the plates becoming attached. The end anchorage of the CFRP plate could then be transferred directly to the sloping part of the haunch.

## Project Participants

Client: Western Roads & Bridges Maintenance Office,  
Seoul Metropolitan Government  
Consultant: SUKWO Corporation  
Contractors: Sika Korea Ltd. / SUKWO Corporation  
CFRP prestressing system: **Sika® StressHead**  
Completion: 2002



# Clinton & Hopkins Bridges, Ohio (USA)

## Project

Both of these 6 span bridges are of precast box girder construction, which were precast by the prestressing bed method and then jointed on site. They are 155m and 131m in length respectively.

## Problem

Leaking drains and a defective drainage system caused corrosion damage to the prestressing wires, requiring the box girders to be strengthened.

## Sika Solution

The precast box girders had been designed to be very slender and therefore in the end anchorage zones, the concrete was also strengthened locally with **SikaWrap®** fabrics. The prestressed **Sika® CarboDur® CFRP** plates supplemented the main damaged tensile reinforcement and restored the structural strength and integrity of the bridges.

## Project Participants

Client: State of Ohio, Dept. of Transportation  
Consultant: WOOLPERT LLP: Transportation Dept.,  
University of Dayton, Dept. of Civil Engineering  
Contractors: SPS /VSL  
(Structural Preservation Systems)  
CFRP prestressing system: **Sika® StressHead**  
Completion: September 2003



# Bridge Strengthening with the Sika® StressHead Prestressing System

## A7 Bridge Viaduct, Zaandijk (Netherlands)

### Project

The "A7" is the main motorway connection between the city of Amsterdam and the northern provinces of Friesland and Groningen. The viaduct is located near Zaandijk, some 10 km north of Amsterdam. The two span viaduct is constructed with a prestressed concrete deck supported by 2 transverse beams in the middle section and another beam at each end. Columns support the beams.

### Problem

During routine maintenance work, one of the pretensioning cables at the edge of the west part of the viaduct (traffic direction north to south) was severely damaged. The cable was touched by the drilling equipment for a new rain water drain. The extent of the damage was difficult to assess, but the Rijkswaterstaat (Dutch Ministry of Transport) estimated a potential loss of approximately 50% of pretensioning capacity. The viaduct was therefore closed to traffic above 28 tons in the southerly direction. Heavy traffic was then forced to go the longer way around via Zaandijk.

### Sika Solution

Two **Sika® StressHead** units, each 8m long and loaded to 220 kN underneath the bridge deck have been installed. Additionally 3 **Sika CarboDur® CFRP** plates were bonded alongside the end anchors.

### Project Participants

Client: Rijkswaterstaat, Dutch Ministry of Transport  
Construction Engineer: A. Boone  
Sub-Contractor: IOB, Netherlands  
CFRP prestressing system: **Sika® StressHead**  
Completion: 2004



### Sika Services AG

Corporate Construction  
CH-8048 Zürich  
Switzerland  
Phone +41 44 436 40 40  
Fax +41 44 436 46 86  
[www.sika.com](http://www.sika.com)

