

Bridge strengthening



Earthquake strengthening

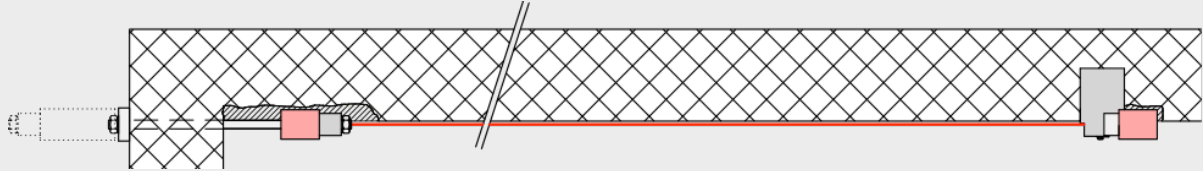
Strengthening of structures with post-tensioned CFRP plates  
**StressHead<sup>®</sup>-CarboStress<sup>®</sup> post-tensioning system**

Bridge strengthening – Earthquake strengthening – Structural strengthening

## Strengthening of structures with post-tensioned CFRP plates

StressHead®-CarboStress® is a system for strengthening by the post-tensioning of carbon fiber reinforced plastic (CFRP) plates. The post-tensioned plate is anchored with a compact StressHead that remains permanently on the

structure. Movable and fixed anchors are used to transfer the tensioning force into the structure and these can be combined and positioned according to the needs of the project.



### Advantages

- Easy to handle
- Lightweight
- Low space requirements
- Non corroding
- Concentrated transfer of force at plate ends
- Outstanding fatigue behaviour
- High movement range – no tension loss
- Can be applied under operational conditions

## StressHead®-CarboStress® post-tensioning system components

### StressHead® 220

- Material CFRP
- Tensioning force  $F_{P0}$  = 220 kN
- Anchored force  $F_{Spk,min}$  = 300 kN

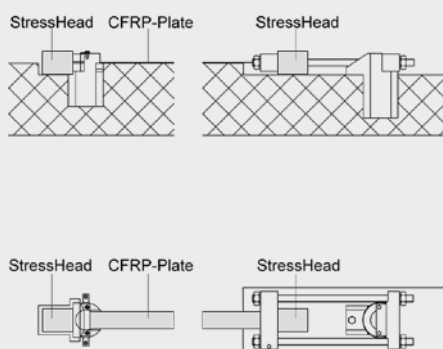


### Sika® CarboDur® S626 CFRP plate

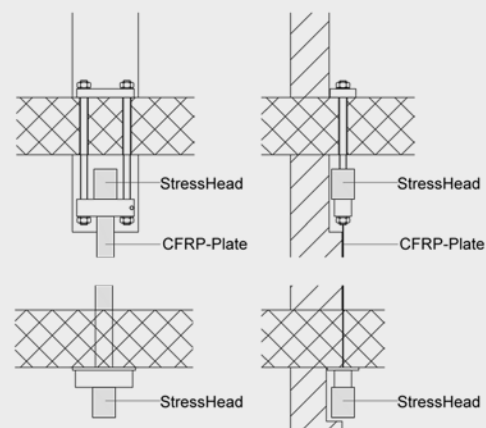
- High-strength CFRP plate
- Post-tension  $\sigma_{P0}$  = 1'410 N/mm<sup>2</sup>
- Post-strain  $\epsilon_{P0}$  = 8.5 ‰
- Tensile strength  $f_{tk}$  ≥ 2'800 N/mm<sup>2</sup>
- Longitudinal modulus ≥ 165'000 N/mm<sup>2</sup>
- Protective plastic duct optional

## Movable and fixed anchorage

### Type III anchor

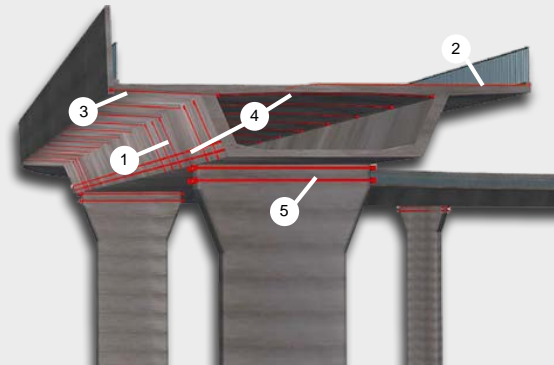


### Type II anchor



## Bridge structures

The load-bearing capacity or functionality of bridges can deteriorate due to higher than anticipated live loads, changes to the structural system, corrosion, or defects in their design and construction. Insufficient longitudinal or transverse bearing capacity of the concrete deck can often lead to cracks. CFRP plates post-tensioned with the StressHead®-CarboStress® system can reduce crack widths due to the active tensioning force that is applied.

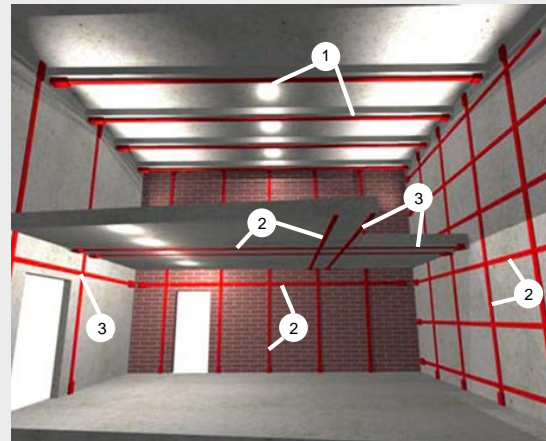


### Advantages

- Low space requirement on the bridge deck
  - Can be used both transversely and longitudinally
  - Secure end anchorage
  - Large movement range – low tension losses
  - No corrosion
- 1) Shear strengthening
  - 2) Reduction in crack widths and damage
  - 3) Strengthening for additional demands
  - 4) Transverse and longitudinal bending strength enhancement
  - 5) Structural support and pier strengthening

## Industrial and high-rise buildings (incl. earthquake strengthening)

Slabs and beams often have to be strengthened to allow for higher live loads and changes of use for example. The concentrated transfer of force at the end of the CFRP plates results in clearly configured structural conditions. When the strengthening requirements cannot be achieved with bonded CFRP plates without tension, the StressHead®-CarboStress® system is the best solution. Masonry walls often have insufficient load-bearing capacity to absorb the horizontal forces generated by earthquakes. Vertical post-tensioning with CFRP plates utilises the shear strength of the masonry to its fullest capacity.



### Advantages

- Vertical post-tensioning utilises the shear strength of the masonry to the full
  - Lightweight units, no lifting gear
  - Improved durability
  - Can also be used to strengthen historic buildings
- 1) Ceiling / soffit strengthening
  - 2) Earthquake resistance strengthening
  - 3) Strengthening due to change of use

## Installation process



**Step 1:**  
Drilling for the anchors



**Step 2:**  
Fitting the fixed and movable anchors



**Step 3:**  
Installing the CFRP plate at the anchors



**Step 4:**  
Post-tensioning the CFRP plate

## Reference projects



**Earthquake strengthening**  
Hospital Aarau, Switzerland



**Bridge strengthening**  
Bridge N29, Qatar



**Beam strengthening**  
Paper mill "Perlen", Switzerland

## Further information

**Publications und Downloads**  
[www.stresshead.ch](http://www.stresshead.ch)

**StressHead AG**  
Leumattstrasse 33  
CH-6002 Lucerne  
T +41 41 210 40 30

