

**Tunneling****Reference Details:**

**Owner** Kantonales Tiefbauamt BL (Foundation Engineering Office), Switzerland +++  
**Contractor** JV Chienbergtunnel Sissach, Batigroup AG Tunnelbau, Basel, Switzerland +++  
**Engineering Joint Venture** Aegerter und Bosshardt/Grüner, Switzerland

**DSI Unit** SpannStahl AG, Hinwil, Switzerland / SUSPA-DSI GmbH, Königsbrunn, Germany  
**SpannStahl Services** Supply of 21,000 m double corrosion protected *GEWI*<sup>®</sup> Anchors including accessories, technical assistance for installation, testing and post-tensioning.

**Rehabilitation Works during Construction of the Chienberg Tunnel, Sissach**

**The 2.3 km long Chienberg Tunnel is the principal element of the 3.5 km long Sissach ring road scheduled for completion in 2006**

Construction of the Chienberg Tunnel began in 1998. In January 2000, during the process of mining the tunnel, a number of technical problems were encountered. Between the fall of 2002 and January 2004, uplifts of the tunnel floor measuring nearly 10 cm discovered at tunnel meter 880 during the process of conducting routine measurements posed yet another problem. Based on model calculations uplifts of this magnitude had only been expected in 50 to 100 years.

The tunnel floor was lifted by a swelling process caused by geological conditions that primarily occurs with changing moisture conditions in the ground. To secure the invert level of the tunnel the *GEWI*<sup>®</sup> Pile System, traditionally used in pile foundations, was selected for the job. The *GEWI*<sup>®</sup> Pile System, also known as a micro pile system, is particularly well suited for use where space is limited, e.g. restricted head room.

In cooperation with SUSPA-DSI GmbH, Königsbrunn, Germany, SpannStahl AG, Switzerland, supplied approximately 600 t of double corrosion protected *GEWI*<sup>®</sup> Anchors for the tunnel to resist uplift forces. The 21,000 m *GEWI*<sup>®</sup> Anchors were installed during the ongoing construction and extension work and their installation was subject to very tight schedules. The pile lengths were typically 21 m.

To deal with space and access limitations, the factory fabricated double corrosion protected bars C were supplied in 6-7 m long sections that were coupled as they were installed in the drilled hole. Once the entire *GEWI*<sup>®</sup> Anchor was installed, the sheathing was injected and grouted. Installation of the *GEWI*<sup>®</sup> Anchors will be completed in summer 2006.