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GROUND STABILISATION USING THIXOTROPIC EPOXY RESINS



TEAM VALUES

Safety | Integrity | Collaboration | Determination | Passion for improvement | Responsibility and accountability

Company profile

Dynaciv is the culmination of many years of experience in the application of various epoxy resins to strengthen structures. We have learnt how to adapt epoxy compounds to specifically suit the purpose to improve quality and increase value.

We pride ourselves on our technical expertise and how it knits well with the practical experience we have gained working on large underground infrastructure projects to the smallest repair project.

The Situation

Queensland Rail train drivers reported irregularities on the track going through the Fortitude Valley Tunnel. These irregularities suggested subsidence of the ground support beneath the track slab. In many places, the track and concrete slab had dipped.

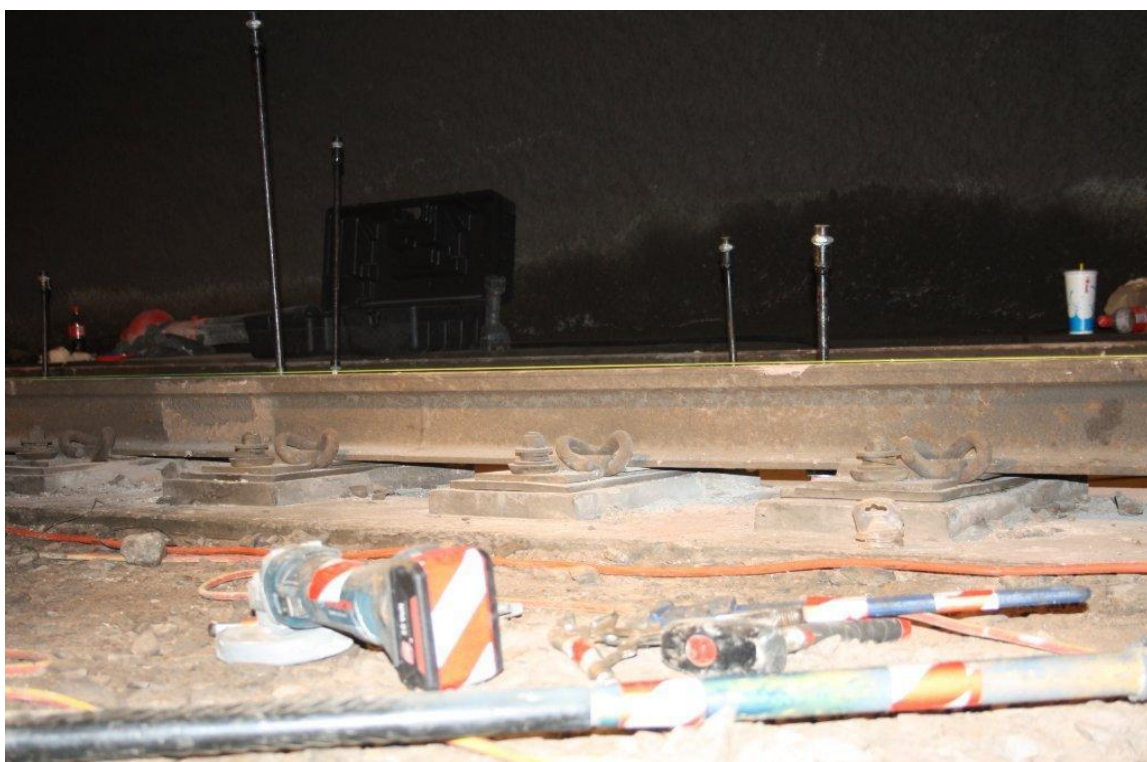


Photo illustrating a dip in the track

After careful consideration, the engineers at Queensland Rail contacted Dynaciv to provide a solution to the problem. Dynaciv were asked to work within certain parameters. These were:

- Driving the spears at least 1 metre below the track slab, or until bed rock was reached – this presented a challenge as the ground was hard and consisted of compacted clay, sand and large stones.
- Not to pollute the drains –With drains running though the formation, it was imperative not to have contaminants or any material flow into the drains that might pollute the environment or block the drain.
- Limited installation times. The track is in high demand, and this meant that Dynaciv had to work on set weekends.
- Quick cure. Queensland Rail required a fast curing grout.
- The tunnel presented challenges. With the work being carried out in a tunnel, this presented issues such as lighting, air and confined space.

The Solution

The solution comprised of pumping epoxy into the ground at high pressure. The benefits of this were twofold: (1) improved bearing capacity from the now-consolidated soils, and (2) high strength support columns built below the slab as shown in **Error! Reference source not found.** below.

A grout coupling used to pump epoxy below the slab was then epoxied into place using CHEMRITE® Epoxy Paste 20. The coupling is shown in the photo below.



Showing the grouting of the coupling with CHEMRITE® Epoxy Paste

Once the coupling was epoxied in the slab the spear was driven to bed rock. This was done by predrilling a pilot hole into the formation and driving hollow spears in by hand. Once the spears were in place, the epoxy pumping commenced. The first ball of CHEMRITE® Spear Epoxy – T was then pumped under very high pressure.

When pumped under high pressure (up to 3300 PSI) the CHEMRITE® Spear Epoxy displaces water and air in the ground formation, forming a more stable foundation. CHEMRITE® Epoxy reaches strengths of over 80 MPa and this coupled with the consolidation of soils provides a foundation with significantly higher bearing capacity.

The grouting continues in a similar fashion, where the second ball of grout is pumped on top of the first. This process is repeated until a solid column of high strength CHEMRITE® Spear Epoxy is built.

Once an epoxy column is constructed, CHEMRITE® HSMC Epoxy is then pumped below the slab to raise the slab (if required). This final pump bridges any gap between the concrete slab and supporting ground support (now stabilised).

The diagram illustrates the process. The yellow grout represents the slab grout that is used to lift the slab.

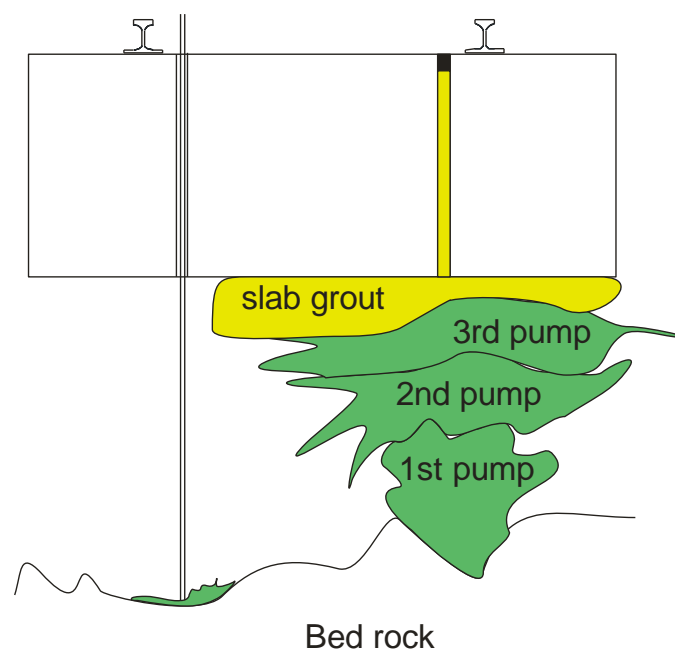


Figure Illustrating the pumping process adopted to stabilise the formation and build a high strength epoxy column to support the track slab

Once the spear and section below the slab was grouted, the hole was plugged and epoxy allowed to cure for 4 hours before the rail opened for traffic.

Benefits

The benefits of using Dynaciv and CHEMRITE® epoxies are:

- Reduced risk as the product is manufactured by the contractor
- The epoxy can be modified easily, on site if required
- Early high strengths meaning the track can be opened earlier.
- The thixotropic properties of CHEMRITE® Spear Epoxy – T mean that the epoxy will only flow under pressure (i.e. Less likely to flow to drains, ground water or any unwanted area)
- CHEMRITE® Spear Epoxy – T reaches strengths over 80 MPa, which is much higher than similar urethane systems.
- CHEMRITE® Spear Epoxy – T is environmentally friendly once mixed and cured.
- CHEMRITE® HSMC Epoxy – It is great for fulling voids below slabs as its ahigh flow and it reaches high early strengths.