

SOFT ROCK MINING / HARD ROCK MINING

LOKSET® LONG TERM INTEGRITY

A HISTORY OF RELIABILITY

The oldest reference Minova has for Lokset® resin anchors was the strengthening of the London Heathrow Airport road access tunnel in 1963. The access tunnel was strengthened to allow heavy jets to land. Since then, there have been numerous applications in Great Britain including highway tunnels, civil applications and a submarine base.

The use of Lokset® polyester resin anchors in tunneling applications in North America began with the Washington DC Metro tunnels in 1972. The polyester resin anchoring system was used in conjunction with shotcrete and steel sets (originally cement grouted rockbolts were specified). The contractor used the drill and blast method and demonstrated through examination that resin anchor support was superior. This conclusion was reached in part due to instrumentation indicating that close proximity blasting did not fracture the resin column around the rockbolt (unlike cement grouts).

The US Army Corps of Engineers would not permit approval for the use of polyester resin anchors until one year of in-place physical testing was completed at a Corps test site in Nebraska in 1973. In early 1972, the Corps retrieved a boat hull from the Houston (Texas) Ship Channel that was fabricated for the US Navy in 1941. The hull material was fiberglass and polyester resins as the vessel was a mine sweeper that had to be constructed from non-metallic materials other than wood. They found that although UV degradation had occurred with the glass fibre, the cured polyester resins were not affected by both UV and the brackish “back waters” of the harbour. The longevity and durability of polyester resins in this case enabled the Chief of Engineers, Washington DC, to approve the polyester resin anchoring system for all Corps works.

The US Bureau of Reclamation ran longevity studies of polyester bonded sewer/water pipe. Their conclusion; a “100 year life expectancy” is anticipated after “extensive physical and chemical testing”.



Resin capsule quality testing - Nowra NSW

It should be noted that cement grouts are permeable and unlike cured polyester resins can, under certain ground conditions, be attacked by leachates that will erode the cement grout. This has happened in the United States, specifically at NORAD, the underground air defense complex in Colorado. An examination by A.A. Mathews Inc. for the US Government discovered that “a number of cement grouted rock bolts revealed that no grout remained around the bolts and that bolt corrosion was evident”. This finding led to Minova providing Lokset® resin anchors for the Department of Defense e.g., the underground “protective chambers” (in case of a national emergency) for federal officials in Washington DC, located in Maryland Mountains are supported with Lokset® resin encapsulated rock bolts.

The degradation of cement anchors by sulphate and chloride attack from acidic or saline ground water is of real concern and should not be overlooked. Cured Lokset® polyester resin anchors on the other hand are resistant to degradation by water (fresh, brackish or salt), petrol, oils, grease, salts and many types of acids, alkalis and solvents.

The trend over recent times in both mining and tunnelling industries has been to use polyester resin anchors in preference to cement and mechanical type anchors because of the many advantages that polyester resin anchors offer.

Advantages of polyester resin anchors

- Superior corrosion resistance when the rockbolts are fully encapsulated
- Rapid curing time allows the rock bolt to take design loading immediately after installation. This is of great importance in highly stressed and/or convergent ground (this is not the case with cement anchors)
- Rockbolts can be both fully encapsulated and pre-tensioned by using a combination of Fast and Slow setting anchor capsules (this is not the case with cement anchors)
- When using polyester resin anchors the ability to pre-tension and fully encapsulate a rockbolt, and to be able to load up a rockbolt immediately after installation, leads to a great improvement in mining/drivage cycle times. There is no need to wait considerable lengths of time for the anchor to cure (as is the case with cement anchors) before blasting can be carried out adjacent to the last line of installed rockbolts
- Lokset® resin anchors are manufactured with set mastic/catalyst ratios etc. There is no risk of inconsistency of the installed anchor which can occur when cement grouts are batched on site
- Unaffected by vibration and close proximity blasting
- Rapid installation of point anchored rockbolts using a single, short Fast Set anchor cartridge
- Rapid insertion, quick and easy to use
- High compressive strength and modulus
- A large range of lengths (330mm to 1500mm), diameters (20, 25, 26, 30, 32, 36 and 38mm) and setting times (4 secs to 30 mins) are available

LOKSET® TODAY

Today, polyester resin anchors are used almost exclusively in the underground coal mining industries around the world, when rockbolts are used as primary support. In the underground metalliferous mining industry, polyester resin anchored rockbolts are rapidly gaining acceptance worldwide. A similar situation exists in the international tunnelling industry with some regions e.g. Australia, using polyester resin anchors almost exclusively.

PROJECTS COMPLETED

Below are a number of significant tunnelling and hydroelectric planned and completed projects in the Australasian and South East Asian regions

where Lokset® polyester resin anchors were utilised.

- Bakun Hydroelectric Project, Philippines
- Manapouri Tailrace Tunnel, New Zealand
- Karak Tunnel Malaysia
- Lamthaklong Hydroelectric Project, Thailand
- Tai Lam Project Hong Kong
- Sydney Airport Link Tunnel, Australia
- Sydney Opera House car park
- Sydney Harbour Tunnel, Australia
- North Side Storage Tunnel
- Outfall Tunnels Manly, Bondi, Malabar
- Blue Mountains Sewerage Scheme
- Bondi Sewerage Outfall Tunnel, Sydney, Australia
- Brisbane Rail Duplication Tunnels
- Roma Street Rail Tunnel, Brisbane, Australia
- Tully Millstream Hydroelectric Project, Australia
- Melbourne City Link Project
- NW Sewer Melbourne
- Pindari Dam Project NSW
- Upper Yarra Dam Tunnel
- Boulder Bay Outfall
- Hazelbrook Carrier
- SRA Helensburg Cuttings/Balk Hill Tunnels

AUSTRALIAN METALLIFEROUS SECTOR

- Mt Isa Mines
- Lead Mine
- George Fisher Mine
- Ridgeway Project
- Cadia
- Stawell
- Darlot
- Silver Swan
- Telfer
- Cannington
- Osbourne
- North Parkes
- Kundana

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