

Underground Construction

- Movement Joint Seals
- Liquid-Applied Flexible Waterproofing
- Composite Sheet Active Waterproofing
- Waterstops and Non-Movement Joint Seals
- Stabilizing and Leak Sealing Grouts
- Injection Hose Systems



We are
Underground Construction

About Us



FPT Infrastructure® manufactures and markets a portfolio of integrated solutions that expertly restore existing structures and maximize the life of new construction. Serving bridge and highway, tunnel, rail, aviation, transit, water and power market segments, FPT Infrastructure supports, fills, coats, reinforces, seals, and protects the vital infrastructure that moves and connects us.

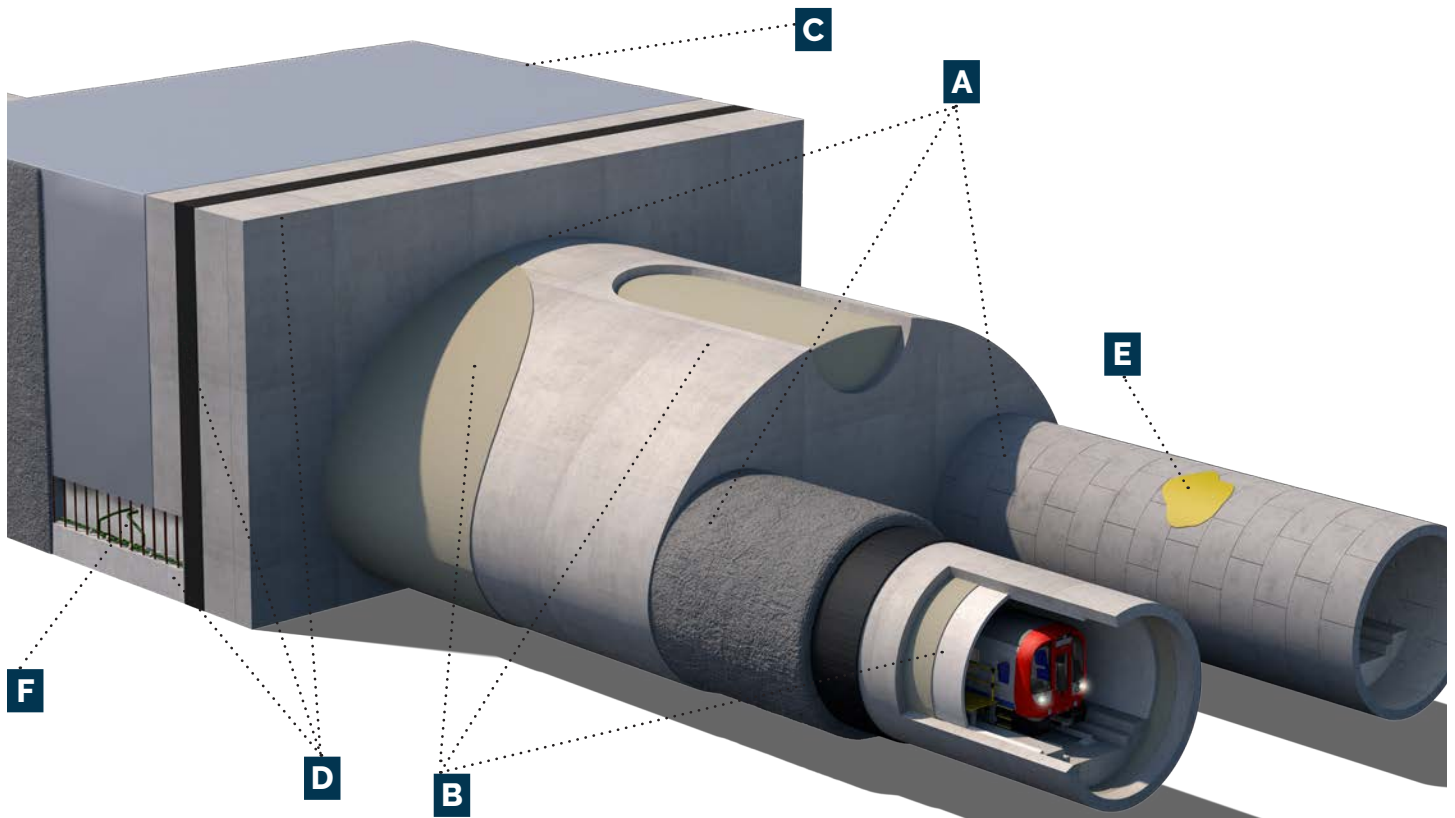
Integration is key. Our solutions are designed to work together for efficient application and seamless system performance. Our products are used in every climate and temperature zone in North America and perform under the most extreme conditions — from blistering heat in Laredo, Texas, to winter in Thunder Bay, Ontario, and everything in between.

FPT Infrastructure partners with infrastructure owners and civil engineering experts across North America to design new materials and systems to meet their unique needs. With an abundance of global installations, our professionals possess the material expertise and application experience to deliver value and performance on every project.

Underground Construction

Thousands of miles of underground tunnels span North America, housing transit systems, connecting buildings and facilitating the movement of pedestrians and vehicles on roads, highways and pathways. FPT Infrastructure offers a comprehensive portfolio of solutions to protect, restore and sustain vital underground construction elements. With a focus on movement control, waterproofing and structural integrity, we offer:

- A** ES Seal Systems for movement joints custom engineered by application - pages 4 - 5
- B** Matacryl liquid-applied structural waterproofing and wear surface overlays - pages 6 - 7
- C** Mataproof composite sheet waterproofing with moisture-activated, self-sealing capabilities - pages 8 - 9
- D** Mataproof steel waterstops with moisture-activated sealing properties and cold joint active sealing materials - pages 10 - 11
- E** Prime Resins soil and ground stabilization and void-filling polymers and grouts - pages 12 - 13
- F** Mataproof Injection hose systems for long-term cold joint protection - page 14



ADVANTAGES

- Class-leading solutions
- On-site technical support
- Early project engagement
- Global experience - local relationships
- Experts in movement and waterproofing



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APPLICATIONS

- Cut and Cover Tunnels
- Station to Tube Tunnels
- Immersed Tube Tunnels
- Bored and Mined Tunnels
- Utility Tunnels and Corridors

ES SEAL System

The ES Seal is a robust, flexible, reinforced polymer seal used in various underground construction applications. It is an ideal solution for joints where large movements are expected due to temperature effects, settlements or seismic events and in combination with high water pressure. An extremely flexible system, it meets stringent or unique designs and accommodates installation in constrained areas as well. Technically, the ES Seal allows afor movement in all directions simultaneously between two bridged structures. The construction of the ES Seal consists of multile plies of reinforcement combined with an array of rubber compounds to suit specific project needs. The allowed movement in ES Seal depends on the pressure differential across the seal in combination with the anticipated maximum movement of the structures.

The unique design of the ES Seal allows it to withstand high water pressure — from 3 bars/45 psi and up — in combination with large movements — from 1' and up — in all directions. Based on material testing, ES Seals have a projected service life of over 100 years in an operating environment between -23 F to 160 F (-30 C to 71 C) when protected from contact with hazardous or corrosive materials.

Performance characteristics:

- accommodates large movements 1" and up and various types of movements (P-S-Raley and Love waves)
- performs under high water pressure from 45 psi and up
- widths from 240 mm to 2000 mm (9 inches to 6.5 feet)
- typical movement ranges:
-40 mm/+60 mm to -200 mm/+600 mm
(-1.5 inches/+2.4 inches to -7.9 inches/+23.6 inches)
- may be used on both newly built or remedial projects

Type	Nominal Gap	Typical Movement
ES 240-40	80 mm	-40 to +60 mm
ES 300-70	140 mm	-70 to +65 mm
ES 360-100	200 mm	-100 to +90 mm
ES 400-100	200 mm	-100 to +90 mm

Typical clamping systems:

- a galvanized or stainless steel strip is mounted with bolts through the rubber flange (*shown at right*)
- the rubber flange is clamped while the bolt fastens the galvanized or stainless steel parts; design utilizes unique corner pieces for watertight seal



CASE STUDY

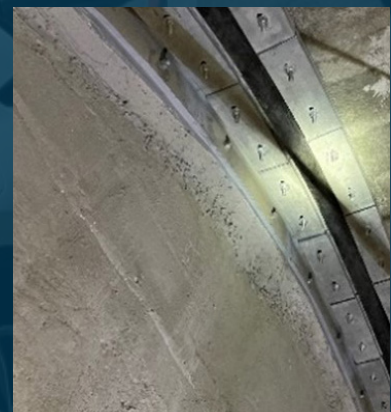
San Diego Courthouse Commons

Location: San Diego, California

Area: 10,260 ft² - 320 ft long

Solution: A new phase of the Courthouse Commons included the construction of a pedestrian tunnel linking the San Diego Central Jail to the new Courthouse. Waterproofing of the tunnel was of paramount importance, and part of the waterproofing specification was for movement joints capable of accepting the high water pressure associated with a tunnel lying some 60 feet below the streets of San Diego. Of equal importance, however, was allowing for the fact that the short tunnel spanned an active seismic fault. Accordingly, the joints needed to be waterproof and accommodate the exceptional multi-directional movements associated with a potential seismic event. They also needed to be fitted along the contours of a curved ceiling within a confined space with limited accessibility after installation.

The ES Seal system provided a waterproofed joint capable of large movements caused by seismic events. A total of 8 bespoke ES Seal Systems were designed, manufactured, and fitted by the contractor to their unique locations with each comprising a full circumference system covering walls, floor and arched ceiling.



Liquid-Applied Flexible Waterproofing

MATACRYL®

Matacryn waterproofing and protective coating systems deliver superior performance using polyurethane methyl methacrylate (PUMA) chemistry, a unique innovation that prevents the degradation of substrates on new structures and restoration projects. Matacryn systems exceed the performance of traditional MMA as well as conventional epoxy and polyurea resins. The adhesive quality of the polymers ensures tenacious bonding to substrate as well as an unbreakable chemical bond between system layers. Exceptional crack-bridging properties (passes ASTM C1305) keep systems watertight even with extreme structure movement.

The Matacryn PS system protects concrete substructures, both exposed and covered or backfilled, in applications including cut and cover tunnel structures, precast and cast-in-place concrete structure components, and earth-filled overpass bridges.

The Matacryn WS system provides a trafficable wear surface for areas adjacent to underground structures including ramps, platforms, and sidewalks while protecting the structure from water, chemicals and other contaminants.

Performance characteristics:

- monolithic system for seamless protection
- highly flexible with crack bridging at below freezing temperatures; withstands movement and stress in the substrate
- excellent chemical, abrasion and puncture resistance to protect bridge substructure against corrosion from water, salt and chemicals
- tenacious bonding in excess of concrete tensile and cohesive strength to concrete, steel and other surfaces
- unique chemistry that promotes interlayer adhesion allowing for easy repairs

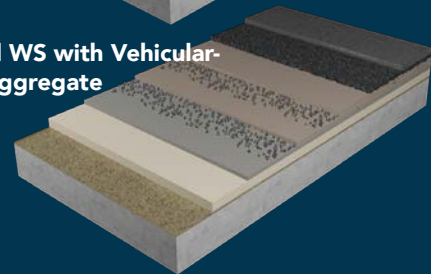
Installation advantages:

- installs at a wide range of ambient and substrate temperatures -4 to 95 °F (-20 to 35 °C) to extend the construction season
- rapid set time - 60 minutes or less per layer- promotes fast installation, lower labor costs and efficient handover to next construction phase
- cold-applied — no heating of materials required
- membrane may be sprayed or manually applied to meet job site conditions

Matacryn PS with UV-Resistant Top Coat



Matacryn WS with Vehicular-Grade Aggregate



Liquid-Applied Flexible Waterproofing



CASE STUDY

Rt. Hon. Herb Gray Parkway

Location: Windsor, Ontario

Area: 107,640 ft² (10,000 m²)

Solution: The \$1.4 billion, massive infrastructure project included highway extensions and park trailways to improve traffic and pedestrian flow in the Windsor-Essex region of Ontario. 11 tunnel tops and 17 kilometers of trail complement the extended highway system. A Matacyl PS system was used on buried structure surfaces to seal and protect from degradation that would exacerbate damage to roadways. With the same requirement to protect roadways, Matacyl WS was used on overpass bridges to provide substructure waterproofing and a suitable friction wear surface for walking, biking and vehicular traffic.



Photo used with permission of Windsor Essex Mobility Group

Composite Sheet Active Waterproofing

MATAPROOF™

Mataproof composite active waterproofing membranes are co-extruded with a unique fleece that is impregnated with a water-absorbing polymer. This self healing system is active waterproofing, offering both physical and reactive protection for reinforced concrete structures. Mataproof membranes are suitable for waterproofing tunnels, retaining walls, foundations, buried utility tunnels and other below grade/underground structures to protect against ground water and ground contaminants.

Mataproof DualProof consists of a swellable fleece co-extruded with a flexible, PVC membrane that prevents any lateral water movement between the membrane and concrete. An optional transparent membrane allows for inspection of concrete for defects and imperfections.

Mataproof SilverSeal consists of a swellable fleece co-extruded with a high-density PE membrane. The lightweight, self-healing membrane seals small cracks in the concrete from the pressure of swelling polymers.

DualProof performance characteristics:

- installed with heat-welded or adhesive-bonded overlaps
- highly-flexible waterproofing and crack-bridging guard against concrete cracking from shrinkage; fleece forms a mechanical bond with freshly poured concrete
- self-healing properties of DualProof S membranes offer reliable protection as a post-applied membrane
- favorable aging-resistance provides a durable barrier against mechanical stresses, water pressure and gas intrusion
- installs at a temperatures from 22 to 120 °F (-5 to 50 °C)

SilverSeal performance characteristics:

- two sealing functions: PE-membrane and swelling polymers
- lightweight and easy to install - 450 g/m²
- may be installed in every season; no temperature or weather condition limitations
- two meter long rolls reduce overlapping waste; overlaps sealed with adhesive
- tough and tear resistant — high compound shear strength
- replaces traditional materials such as bituminous liners, coatings and synthetic membranes

Application:

1) Pre-application

Membrane is attached to formwork or lagging wall with fleece facing out to the where concrete will be poured. The PP fleece forms a permanent mechanical bond with the freshly poured concrete.

2) Post-application

Membrane is attached to concrete with fleece facing into the cured concrete. Edges must be overlapped a minimum 50 mm and detailed with CEM805 adhesive.



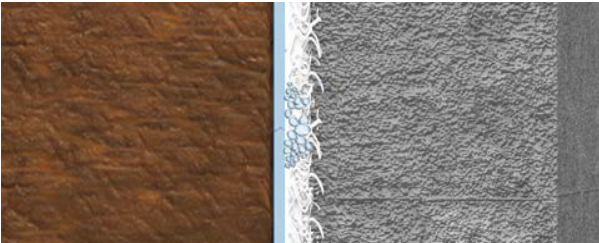
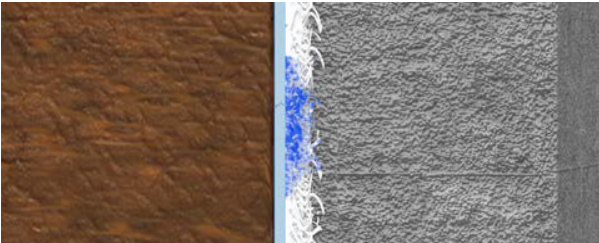
Composite Sheet Active Waterproofing

In choosing a composite sheet active waterproofing membrane, consider:

- 1) environmental and ground conditions,
- 2) functional use, 3) expected service life,
- 4) additional waterproofing, joint sealing and movement control solutions in the design and
- 5) owners' total cost objectives

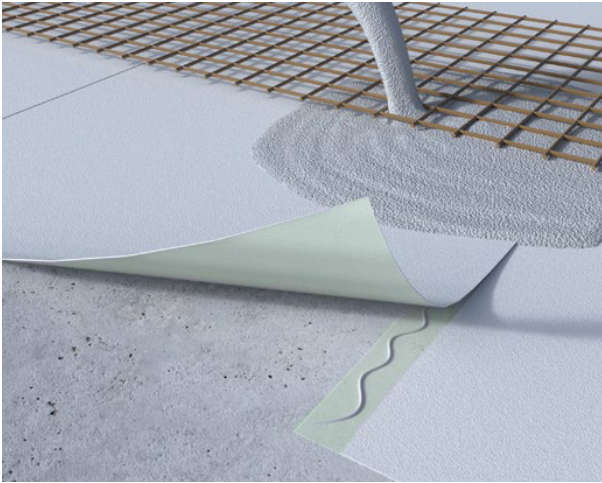
Function of the membrane

The unique properties of Mataproof are attained through two functions. The first sealing function lies in the high density PE membrane (SilverSeal) or PVC membrane (DualProof). The second sealing function is only activated if the membrane is damaged and the incoming moisture activates the water-reactive polymer. The polymer swells, creating a gel-like film that permanently seals the concrete structure. Even small cracks and voids in the concrete are sealed. Further, the swelling capacity and self healing function prevent water tracking between the membrane and the concrete structure.



Seams and Details

Mataproof CEM805 Adhesive one component adhesive is used to seal seam overlaps and details.

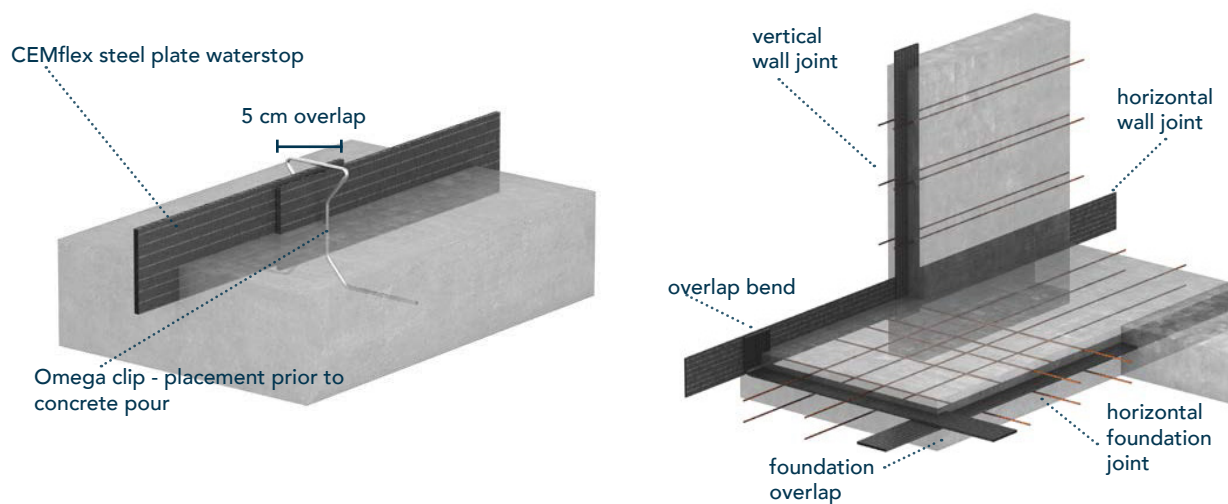


MATAPROOF™ CEMflex®

Mataproof CEMflex waterstop consists of a galvanized steel plate encapsulated in a special patented, active coating which reacts with water and moisture when embedded in concrete. It provides both an active and passive barrier to water transmission in horizontal and vertical cold joints in 'in situ' reinforced concrete.

CEMflex's rigid design and short spans make application of waterstops far less labor intensive than traditional PVC waterstops, and allows for placement in formwork prior to concrete placement, or direct placement into freshly poured concrete. Because of the dual action water barrier / active crystallization, only a 5 cm overlap of panels is required for a completely waterproof cold joint. Material is easily bent for corners and overlaps on cross joints.

CEMflex panel clips are designed with retention loops to hold adjacent injection hose system when they are specified for post-construction leak mitigation systems.



Performance characteristics:

- active coating with crystallization properties performs infinite sealing cycles under water pressure up to 8 bars
- can be used in conjunction with other waterstop systems: PVC waterstops for movement joints, injectable hose systems or hydrophilic waterstops
- no collapse or displacement of the waterstop when subjected to the weight of concrete poured from above
- bonding of overlaps is not required; overlapping of 5 cm is held in place with easily installed clips



MATAPROOF™ CEMswell

CEMswell is an expanding joint seal profile that swells when in contact with water, but remains dimensionally stable. It is primarily used for sealing precast concrete structures in basements, tunnels and mine shafts. It is a TPE-based compound made from rubber, hydrophilic resin, polyethylene, silicone and special admixtures.

Performance characteristics:

- expands up to 400% and is fully reversible
- stops water ingress through prefabricated concrete elements up to 5 bar hydrostatic pressure
- reliably seals on contact with water by controlled expansion under confinement
- available in various sizes and profiles for different applications

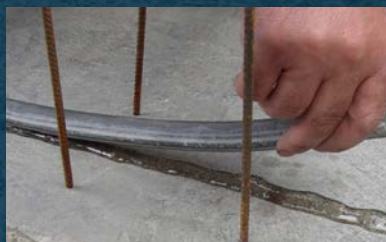


MATAPROOF™ Quellmax®

Quellmax bentonite water stop tapes are designed to stop water ingress through non-movement joints in reinforced concrete structures. It expands up to 500% upon contact with water, forming a durable seal through sintering and free lime formation. Applications include both horizontal and vertical non-movement joints in reinforced concrete as well as complex joints such as wall penetrations and concrete pilings.

Performance characteristics:

- tested up to 7 bar hydrostatic pressure and approved for use in both continuous immersion and changing water tables (wet/dry cycles)
- self-injecting properties seal and fill even the smallest voids and cracks in concrete
- swelling and shrinking process are infinitely repeatable due to the high sodium bentonite content



Stabilizing and Leak Sealing Grouts

PRIME RESINS® Prime Flex® & SoILok®

FPT Infrastructure partners with Prime Resins to provide products for leak sealing and soil/ground stabilization projects. These products range from cutting-edge acrylate resins to hydrophilic and hydrophobic polyurethane grouts that serve a variety of applications including leak sealing on underground construction projects.

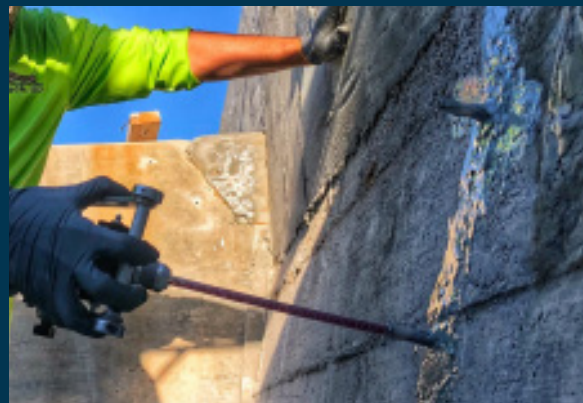
For large scale soil stabilization, FPT Infrastructure offers Prime Resin's SoILok, with strength-adding, water-tight encapsulation capabilities. Over time, decomposing soils, erosion, freeze-thaw cycles and groundwater migration can alter concrete foundations and cause instability.

SoiLok is a super low viscosity grout that penetrates fine silts, sands, coarse sands and top soil to the desired depth, then reacts to bind together whatever it contacts. SoILok is an economical option to polyurethane grouts for stabilization projects on underground construction projects where substrate stability is paramount to the long-term life of the tunnel structure.

Weeping and Gushing Leaks

With weeping or small leaks, focus on the viscosity, or thickness, of the resin. Low viscosity resins easily penetrate cracks repair all leaks. For a gushing leak, set times are important. The resin must react with any water present and expand quickly enough to form a watertight, rigid foam before it's washed away. Where hydrostatic pressures are high, a hydraulic cement patching material or oakum can stop or slow the flow enough for the chemical grout to react.

Equally important is expansion rate. Gushing leaks are caused by larger water flows, so a large area must be sealed to stop the leak. Products with higher expansion rates offer greater coverage of the void area. In below-grade structures, the large expansion rate also serves to fill any voids behind the structure to form a 360-degree curtain shield.



Product selection criteria:

- volume of leaks (weeping or gushing)
- size of crack or defect
- accessibility of the site and environmental conditions
- expansion rate, set time and viscosity of the grout
- Physical properties of the reacted grout

How hydrophilic grouts work

Hydrophilic chemical grouts are attracted to water and 'chase moisture.' In doing so, the grout follows all paths along the crack to reach and seal the leaks. When sealing leaks with chemical grouts, a hairline crack is one that is 1/16" or less. Several Prime Resins products are independently verified to meet NSF/ANSI Standard 61.5 for contact with potable water. This makes them ideal for water treatment, transport and storage structures.



CASE STUDY

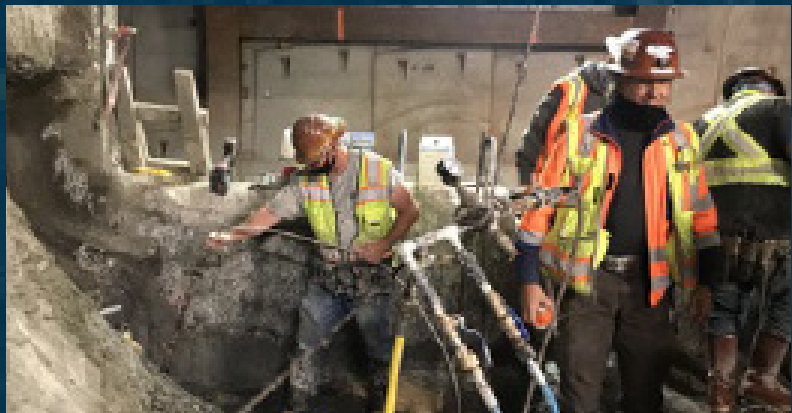
27th Street Tunnel Project

Location: Denver, Colorado

Area: 22 ft diameter - 13,680 ft long with 14 cross passages

Solution: The 27th Street Tunnel project involved stabilizing soils under a light rail transit system where the contractor was boring a 78-inch diameter tunnel under the rail tracks. To prevent any movement or settlement of the tracks, the soil under the tracks and above the tunnel bore needed to be stabilized.

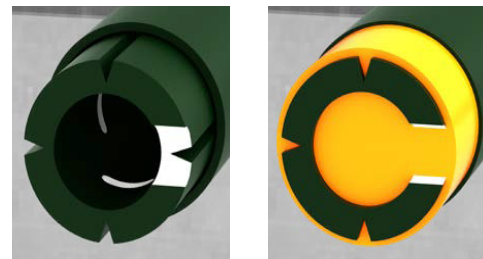
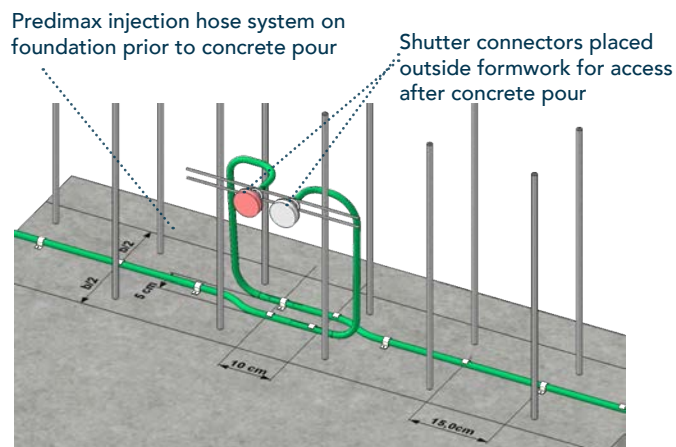
SoiLok was used by the contractor to grout loose and poorly compacted soils encountered while boring the tunnel and cutting the cross passage on the project. Over 30,000 gallons were used over several months of the boring phase to penetrate soil, fine silts, and sand to congeal and stabilize the subterranean matter. The set time — adjustable in the field from minutes — was balanced with the timing and voracity of the boring work. SoiLok's resistance to contaminants and extensive service life matches the strict requirements of geotechnical applications.



MATAPROOF™ Predimax®

Mataproof Predimax PVC injection hose systems with a patented, double-jacketed design, are a unique way to 'future-proof' underground construction by allowing for multiple injections of leak sealing resins into horizontal and vertical construction and cold joints. Whether injections are initial, scheduled or for remedial sealing of joints, Predimax actively protects against leaks caused by settlement or structural movement.

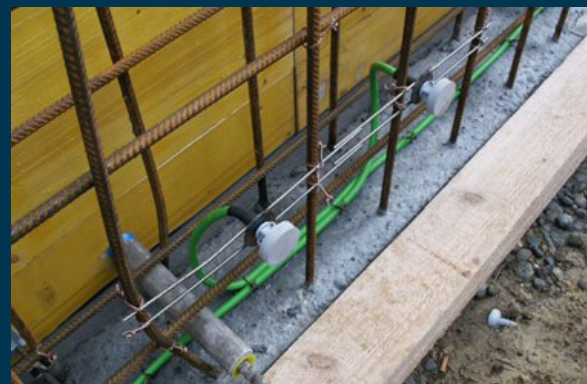
Predimax systems are formulated to be durable, robust and fully resistant to continuous immersion in ground water, saline, sewage, acids, chemicals and alcohol. Predimax 11 is suitable for injection with all PU/EP resins, acrylates, gels and fine and microfine cement. Predimax 19 is suitable for injection with all PU/EP resins, acrylates, gels, fine and microfine cement, and Portland cement.



The double jacketed injection hose consists of an inner core with big slots for material injection and an outer PVC sleeve with perforations offset to those on the inner core. This unique design prevents fresh concrete paste from entering and blocking the injection hose system.

Performance characteristics:

- simple installation, even at complicated details
- circular hose prevents unwanted twisting or crimping when installed from the reel
- suitable for operation even under low injection pressure
- smooth surface prevents bonding between injection hose and concrete, an issue when nylon wrapped hoses are used
- multiple injection capability protects the full service life of the structure
- full range of accessories including hose clamps and clips, connectors, shutter connectors and end boxes at access points, and ventilation hose with sealing plug



Protect. Repair. Enhance.

Our portfolio:

We only manufacture and supply innovative solutions that protect, repair and enhance infrastructure assets. We aim to optimize total project spend rather than supply low-cost, low-performing commodity products.

Our team:

Operations and logistics specialists, product managers, R&D scientists, and business development professionals focus on customer service, quality, sustainability and safety.

Our reach:

From our headquarters in Mount Airy, North Carolina, we serve owners, engineers and installers throughout North America with a touch of southern hospitality, backed by the global resources and expertise of the USL Group.

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