

Waterproofing

Solutions for Underground Construction



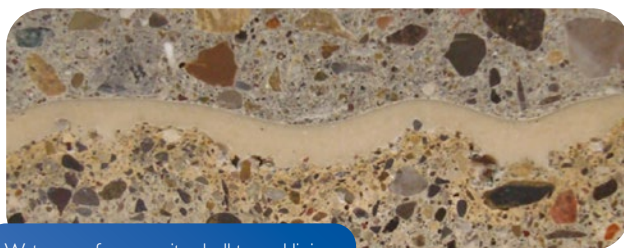
The Bonded Waterproofing Concept



Continuous Structure with a Bonded Membrane

An innovative approach, the MasterRoc® MSL 345 waterproofing membrane.

- This bonded waterproofing membrane establishes a new concept for waterproofing.
- A bonded waterproofing membrane can resolve technical challenges which have proved difficult to resolve with conventional sheet membranes.
- The double bonded membrane prevents migration of water along the concrete-membrane interfaces on either side of the membrane.



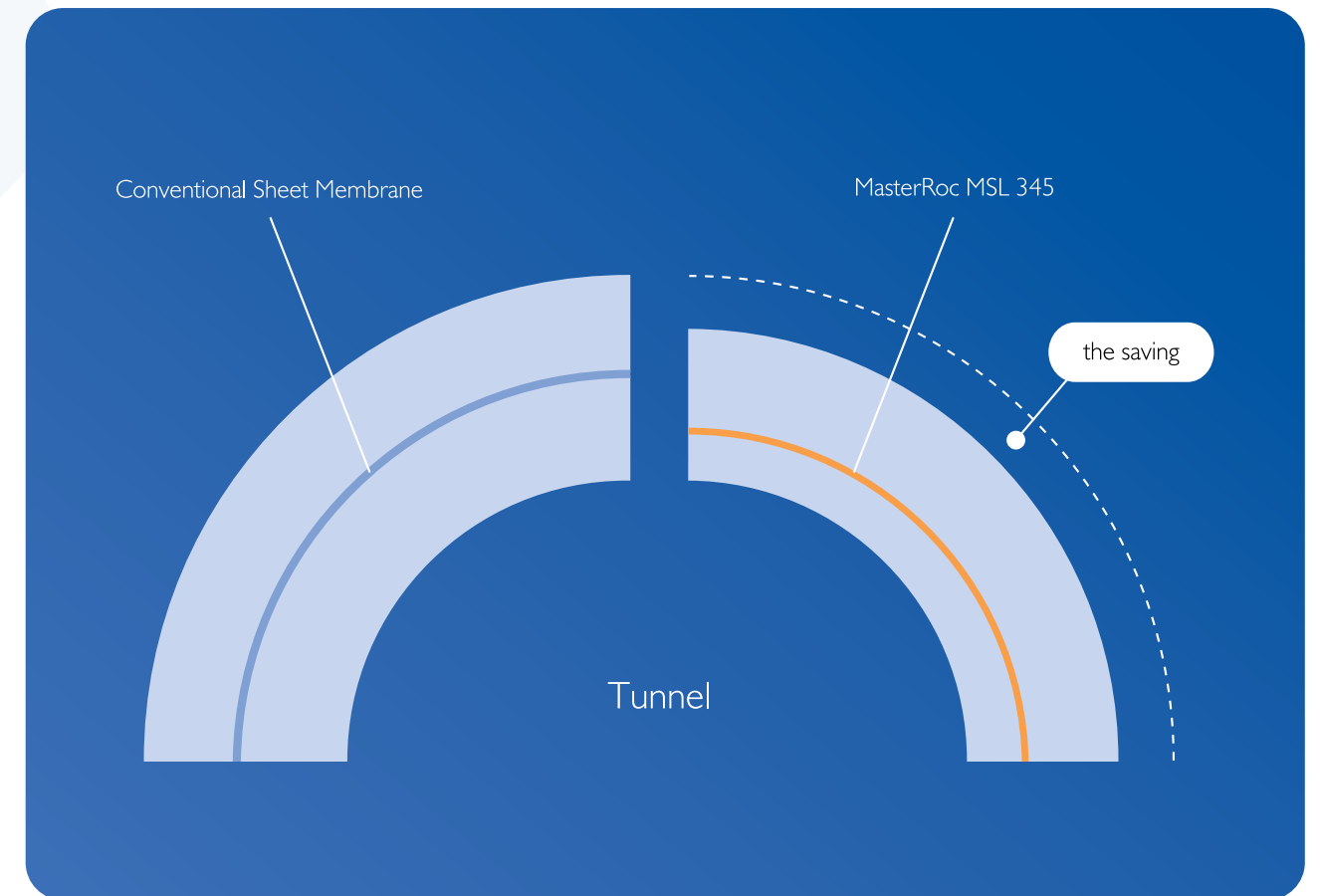
Waterproof composite shell tunnel lining

Composite Mechanical Behavior

- The tensile bonding and shear strengths of the concrete-membrane result in a mechanical behavior of a composite structure. Therefore the primary support lining and inner final lining act together and can be considered as part of the permanent support structure.

Permanent Long-term Durable Tunnel Lining

- Combined properties of primary and secondary lining with double bonded membrane can be incorporated for permanent structures requiring a long term durable waterproof lining system.



For Owners

Main system advantages

- Reduced total construction time and costs
- Minimize maintenance and operational costs
- Versatile and reliable technical solution

For Designers

- Composite waterproof tunnel lining provides opportunities for (new) cost effective design options.
- Potential for reduction in overall lining thickness when designed as composite structure or when composite structure design philosophy is applied.
- Versatile system compatible with other waterproofing techniques allows for flexibility in design.
- Cost effective system for the rehabilitation upgrading of existing tunnels & underground structures, transport envelope maintained.

For Contractors

- Straightforward application methods
- High-rate of application
- Robotic, fully automatic application available
- Fiber reinforced spray concrete application direct to cured membrane using standard methods



Design Flexibility



Cost-effective Waterproof Single-shell Tunnel Linings

Enhanced opportunities.

- The spray-applied membrane facilitates the construction of monolithic, single-shell tunnel linings using permanent sprayed concrete. Recent projects adopting this approach have shown significant project savings over the double-shell method. Master Builders Solutions® can assist you with this design concept.
- MasterRoc® MSL 345 in combination with sprayed concrete can be applied with minimum reduction of transportation envelope profile or kinematic profile for refurbishment of existing tunnels.

Drained and Undrained Design Options Possible

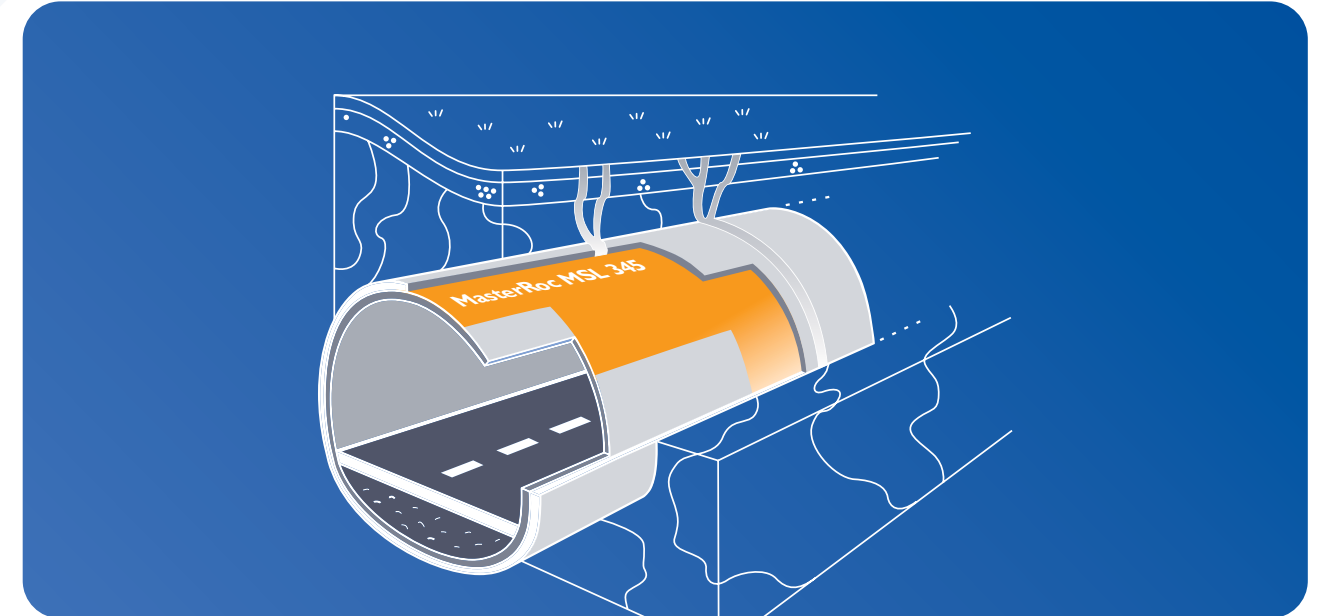
- MasterRoc® MSL 345 can be used in combination with sheet membranes. Standard joint details between MasterRoc® MSL 345 and sheet membranes have been established, providing a versatile and flexible waterproofing system.

- Both drained and undrained or tanked solutions are possible. For drained solutions systematic drainage pipes (conduits) can be used.
- Master Builders Solutions® can supply you with a generic specification compiled by an international tunnel consultant.

Ideal for Complex Shapes of Underground Structures

- The MasterRoc® MSL 345 spray applied system is ideally suited to underground structures with complex geometries, such as lay-by niches, cross passages, turnouts and crossover caverns.
- MasterRoc® MSL 345 may be applied to discrete sections such as crown section only to waterproof above overhead conductor cables for electric trains.
- MasterRoc® MSL 345 is a continuous waterproofing system that requires no water stops or compartmentalization.

Application



Cost-effective in Challenging Conditions

Simple and flexible application methods

- Manual application rates up to 100 m²/hour.
- Mechanized robotic application rates up to 180m²/hour.
- A small team of 3 operators is required for application.

Cost-effective in Challenging Conditions

- Water seepages in substrate are handled using small temporary drainage holes.
- Suitable surface roughness for the application of MasterRoc® MSL 345 is achieved through adjustments of the mix design of the primary lining sprayed concrete.

Fast and Safe Application with a Small Working Team and Simple Equipment

- Application using dry spray equipment.
- Basic Personal Protective Equipment required for application crew.
- MasterRoc® MSL 345 can be used in conjunction with fibre reinforced sprayed – and cast concrete.

Final Inner Lining

- The final inner lining is applied when the waterproofing membrane has achieved a sufficient curing condition.
- Final inner lining is established by either cast or sprayed concrete.



Operational Security



Less Risk of Water Ingress

- Technically functional and reliable system.
- The bonding characteristics of MasterRoc® MSL 345 ensure that no migration of water along the concrete-membrane interfaces occurs.

Low Maintenance and Repair Costs

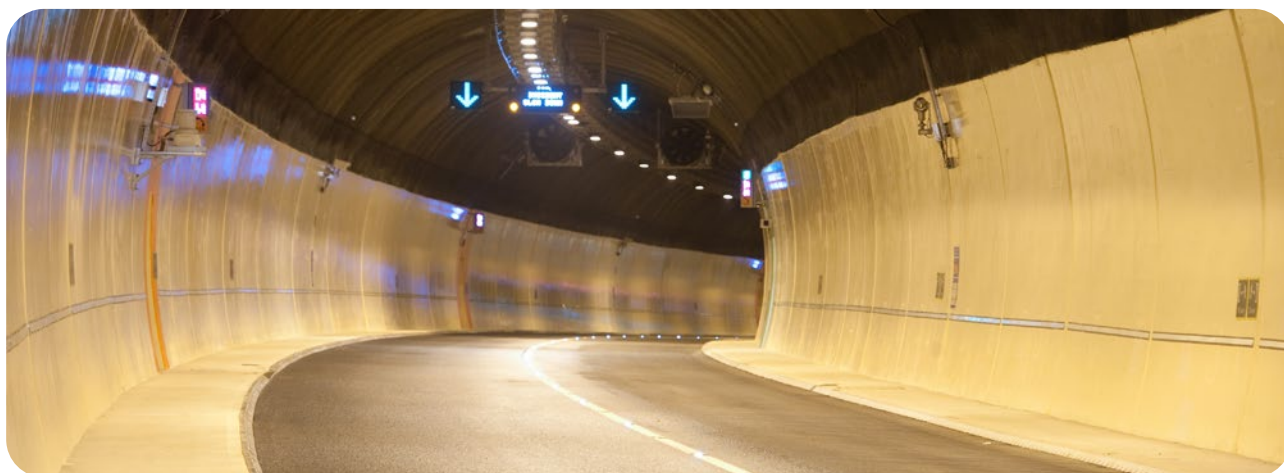
- Eventual rehabilitation or repairs of leaks simpler and less time consuming than most other waterproofing systems.

Long-term Durability

- MasterRoc® MSL 345 contains long-term durable chemical compounds.
- No decomposition of MasterRoc® MSL 345 under most known groundwater conditions.
- Functional requirements for waterproofing fulfilled over the design life of the underground facility.

New Life to Old Tunnels

- A unique asset of the MasterRoc® MSL 345 system is its versatility and cost-effectiveness in rehabilitation situations.



Know-how & Service



Assistance During Design

Master Builders Solutions® provides assistance to owners and designers in the layout of complete system solutions with permanent sprayed concrete and MasterRoc®.

Important issues in this process are:

- interface possibilities with other waterproofing systems
- specification details of the required properties of sprayed concrete
- correct substrate characteristics.

Master Builders Solutions® brings extensive know-how gained through many years' experience solving challenging situations.

Assistance During Design

Master Builders Solutions® provides technical training of operator personnel for all phases of the application of MasterRoc®. Technical training is generally offered as on-site practical education in which all details of the application process, including the correct substrate treatment, are covered. During ongoing works with the application of MasterRoc®, technical specialists from Master Builders Solutions® are available for assistance and troubleshooting in order to secure a good technical result, as well as optimizing the application process.

More brochures on our underground construction solutions are available at:

ugc.master-builders-solutions.com

Documentation available on request:

- Reference list
- Project reports
- Technical data sheets
- Design guidelines
- Method statements



Master Builders Solutions® for the Construction Industry

MasterAir®

Complete solutions for air entrained concrete

MasterCast®

Solutions for the manufactured concrete product industry

MasterCem®

Solutions for cement manufacture

MasterCO₂re™

Solutions for low-clinker concrete

MasterEase®

Low viscosity for high performance concrete

MasterFinish®

Solutions for formwork treatment and surface improvement

MasterFiber®

Comprehensive solutions for fiber reinforced concrete

MasterGlenium®

Solutions for high performance concrete

MasterKure®

Solutions for concrete curing

MasterLife®

Solutions for enhanced durability

MasterMatrix®

Advanced rheology control for concrete

MasterPel®

Solutions for hydrophobization, anti-efflorescence and surface protection

MasterPolyheed®

Solutions for mid-range concrete

MasterPozzolith®

Solutions for water-reduced concrete

MasterRheobuild®

Solutions for high strength concrete

MasterRoc®

Solutions for underground construction and surface improvement

MasterSet®

Solutions for set control

MasterSphere®

Solutions for guaranteed freeze-thaw resistance

MasterSuna®

Solutions for sand and gravel in concrete

MasterSure®

Solutions for extraordinary workability retention

Master X-Seed®

Advanced accelerator solutions for concrete

Quantified sustainable benefits. Advanced chemistry by Master Builders Solutions®.

Let the numbers do the talking: We have portrayed some of our most eco-efficient product solutions for concrete and precast production, construction, civil engineering, and flooring.

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