



Waterproofing

Solutions for Underground
Construction





The Bonded Waterproofing Concept



Continuous Structure with a Bonded Membrane

An innovative approach, the **MasterSeal 345 waterproofing membrane**.

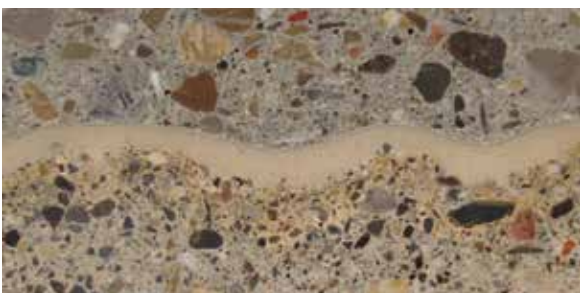
- This bonded waterproofing membrane establishes a new concept for waterproofing.
- A bonded waterproofing membrane can resolve technical challenges which have proved difficult to resolve with conventional sheet membranes.
- The double bonded membrane prevents migration of water along the concrete-membrane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

Composite Mechanical Behavior

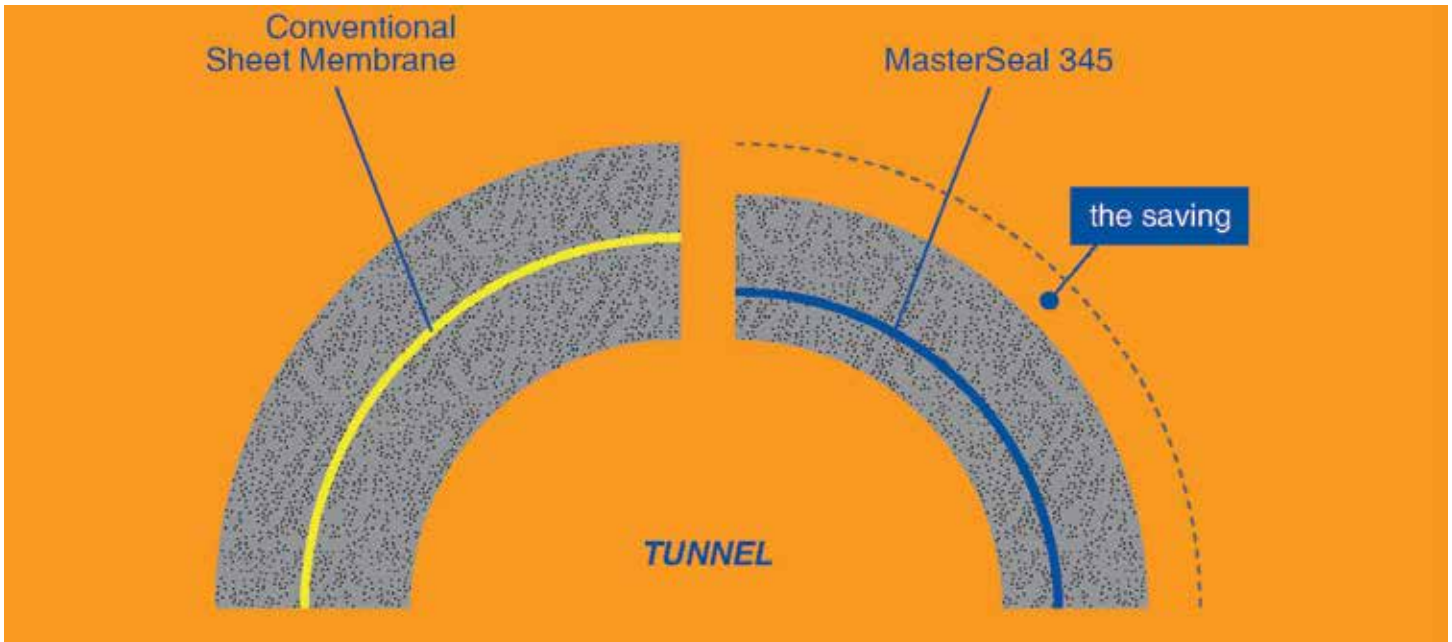
- The tensile bonding and shear strengths of the concrete-membrane result in a mechanical behavior of a composite structure. Therefore the primary support lining and inner final lining act together and can be considered as part of the permanent support structure.

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.



Waterproof single-shell composite tunnel lining



For Owners

Main system advantages

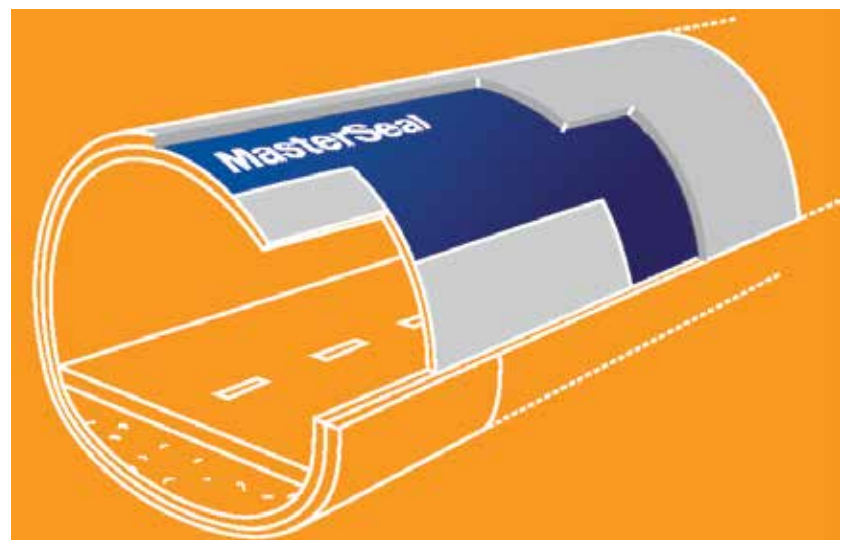
- Reduced total construction time and costs
- Reduced maintenance and operational costs
- Versatile and reliable technical solution

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 or upgrading of existing tunnels and underground structures, with minimum impact on the traffic.

For Contractors

- Straight forward application methods
- High rate of application
- Robotic, fully automatic application available
- Direct application of fiber-reinforced sprayed concrete onto 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. BASF can assist you with this design concept.
- The use of MasterSeal 345 membrane in combination with sprayed concrete will have a relatively low impact on the geometry of a tunnel during rehabilitation.

Drained and Undrained Design Options Possible

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

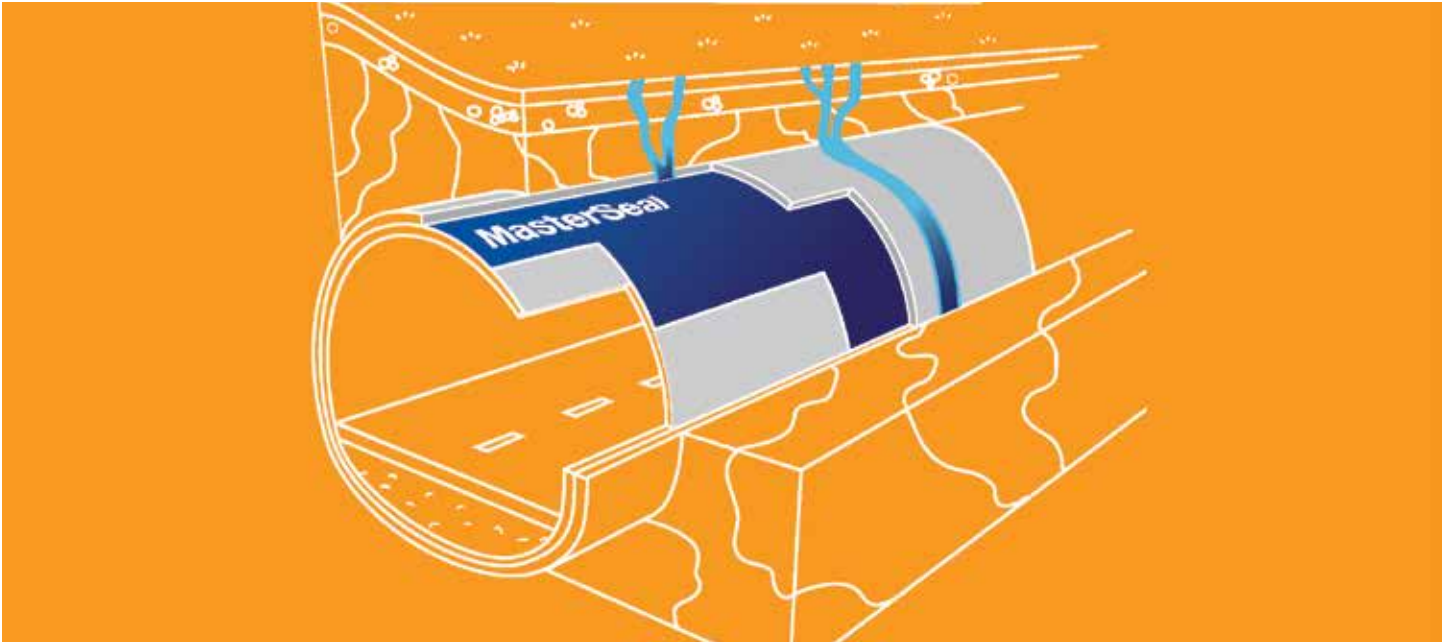
- Both drained and undrained or tanked solutions are possible. For drained solutions, systematic drainage pipes (conduits) can be used.
- BASF can supply you with a generic specification compiled by an international tunnel consultant.

Ideal for Complex Shapes of Underground Structures

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



Application



Cost-effective in Challenging Conditions Simple and flexible application methods

- Manual application rates of up to 1,100 ft²/hour (100 m²/hour).
- Mechanized robotic application rates of up to 1,900 ft²/hour (180 m²/hour).
- A small team of 3 operators would be sufficient for application.

Simple Surface Preparation

- Water seepages in substrate are handled using small temporary drainage holes.
- Suitable surface roughness for the application of MasterSeal 345 membrane can be 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.
- MasterSeal 345 membrane can be used in conjunction with fiber-reinforced sprayed or cast-in-place 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-in-place or sprayed concrete.





Operational Security



Less Risk of Water Ingress

- Technically sound and reliable system.
- The bonding characteristics of MasterSeal 345 membrane ensure that no migration of water occurs along the concrete-membrane interfaces.

Low Maintenance and Repair Costs

- Rehabilitation or repairs of leaks simpler and less time consuming compared to most of the other waterproofing systems.

Long-term Durability

- MasterSeal 345 membrane is made of durable chemical compounds.
- No decomposition of MasterSeal 345 membrane occurs 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 MasterSeal 345 system is its versatility and cost-effectiveness in rehabilitation situations.





Know-how and Service



Assistance During Design

BASF provides assistance to owners and designers in the layout of complete system solutions with permanent sprayed concrete and MasterSeal 345 System.

Important issues in this process are:

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

BASF brings extensive know-how gained through many years of experience solving challenging situations.

Practical Training and Technical Service

BASF provides technical training of operator personnel for all phases of the application of MasterSeal 345 Membrane system. 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 MasterSeal 345 membrane, technical specialists from BASF 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 www.master-builders-solutions.com.

Documentation available on request:

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



Master Builders Solutions from BASF

The Master Builders Solutions brand brings all of BASF's expertise together to create chemical solutions for new construction, maintenance, repair and renovation of structures. Master Builders Solutions is built on the experience gained from more than a century in the construction industry.

The know-how and experience of a global community of BASF construction experts form the core of Master Builders Solutions. We combine the right elements from our portfolio to solve your specific construction challenges. We collaborate across areas

of expertise and regions and draw on the experience gained from countless construction projects worldwide. We leverage global BASF technologies, as well as our in-depth knowledge of local building needs, to develop innovations that help make you more successful and drive sustainable construction. The comprehensive portfolio under the Master Builders Solutions brand encompasses concrete admixtures, cement additives, chemical solutions for underground construction, waterproofing solutions, sealants, concrete repair and protection solutions, performance grouts, performance flooring solutions.

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Solutions for manufactured concrete products

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Contact

United States

23700 Chagrin Boulevard
Cleveland, Ohio 44122-5544
Tel: 800 628-9990 ■ Fax: 216 839-8821

Canada

1800 Clark Boulevard
Brampton, Ontario L6T 4M7
Tel: 800 387-5862 ■ Fax: 905 792-0651

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