



# Trelleborg, for total engineered tunnel solutions

IMMERSED • BORED • CUT & COVER





# Partner in design and construction





Trelleborg Infrastructure is your partner in the design and production of engineered rubber products and elastomer technology. Our focus is on the markets of civil engineering, offshore oil and gas, dredging, sewage, building and industry. Our specialists cooperate closely with the users of rubber seals to design and manufacture high quality systems to meet the client's most stringent requirements on solutions designed for the most extreme conditions.

Not only are we the leading manufacturer of GINA gaskets and OMEGA seals. We are also a prominent supplier of tunnel segment gaskets. Our waterstops are considered as the standard solution to seal the dilatation joints, which also have to withstand sizeable joint movements, for example at immersed tunnels.

#### **One-stop-shop**

Trelleborg Infrastructure is the only company in the world supplying seals for immersed tube, bored and cut & cover tunnels. We will provide you with all products needed which Seal/Damp and protect provide you with total engineered polymer solutions. For our customers that means a one-stop-shop.

#### **The group**

Trelleborg Infrastructure is a member of the Trelleborg group, a global industrial group offering leading-edge expertise in polymer technology combined with advanced industrial know-how of functional solutions and systems to meet your requirements.



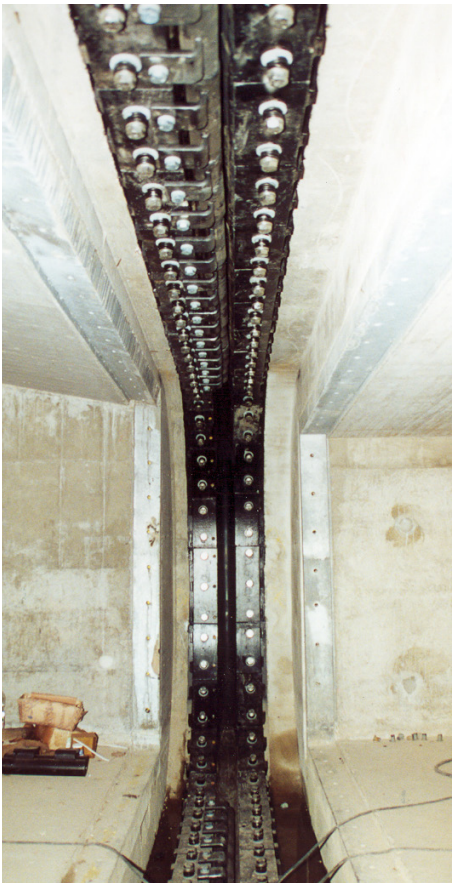
# Immersed tunnels

The Gina gasket and Omega seal are used between the sectional elements of immersed tunnels to prevent water ingress due to external water pressure. This combination of seals not only allows for sealing but also for the transfer of the hydrostatic loads and movements between the tunnel ends due to soil settlement, creep of concrete, temperature effects and seismic activity.

The designs are generally based on the expected tunnel lifetime of 120 years.

## Waterstops

Waterstops are used to accommodate water pressure as well as the natural movement between the individually poured concrete sections of an immersed tunnel. Also tunnel entrances of immersed tunnels (cut & cover tunnels) are often too big to be poured as one monolithic unit and therefore have a number of construction joints. The type of waterstop depends on the water pressure and desired watertightness of these construction joints. To prevent any leakages, due to shrinkages or other causes, a special injectable waterstop has been developed to provide absolute watertightness.



## Clamping and installation Omega

Trelleborg Ridderkerk prefers the system in which the flange is clamped, while the bolt fastens the galvanised steel parts.

Special corner pieces are required in order to prevent leakage in the corners.

Trelleborg Ridderkerk can assist in the design of such a special corner clamp.

This system provides optimum safety and prevention of leakage. The seal installation is also easier.

The exact dimensions and sizes of the required clamping system and fixing bolts have to be calculated on a project basis and can be done by Trelleborg Ridderkerk upon request.

The installation of the Omega seal requires special techniques. Because of this we recommend to supervise the installation of at least the first omega seal by a specialist of Trelleborg Ridderkerk. We shall provide an installation procedure to ensure correct and proper installation. Trelleborg Ridderkerk is also able to advise on the required bolt tension.

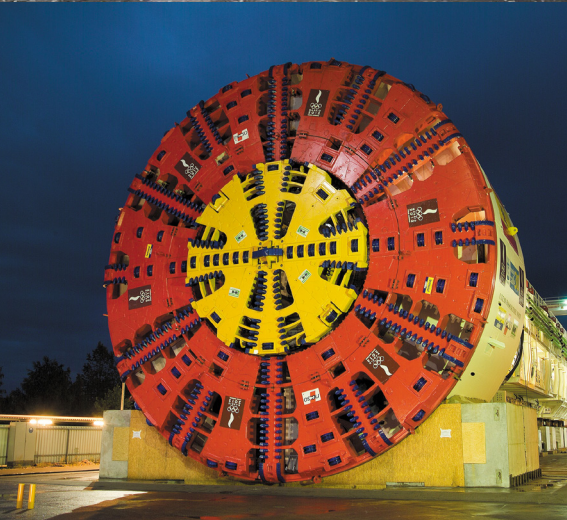








# Bored tunnels





For the segmental lining of bored tunnels Trelleborg Ridderkerk BV supplies tunnel segment gaskets (TSGs). For years Trelleborg TSGs have been successfully supplied to major segmentally lined tunnel projects around the world. The TSGs provide a secure rubber-to-rubber waterproof seal as soon as the segments are together. They are located in precast grooves encircling the mating faces of each segment. The low compression set and stress relaxation values of the elastomeric compound enable elastomeric TSGs to recover under reduced applied load. Thereby maintaining a positive seal between segments despite ground movements.

Trelleborg TSGs are easy to install and create a very effective and reliable seal. Durability has been proven over the years and by extensively testing. After installation the TSGs immediately create dry joints after installation of the segments in the tunnel and protect against many types of ground conditions.

### **Waterstop and Omega**

Tunnel entrances, also known as cut & cover tunnels, are often too large to be poured as one monolithic unit and therefore have a number of construction joints. Waterstops are used to accommodate water pressure as well as the natural movement between the individually poured concrete sections. The type of waterstop depends on the water pressure and desired watertightness of the joint. To prevent any leakages, due to shrinkages or other causes, a special injectable waterstop has been developed to provide absolute watertightness. The joint between the entrance and the bored tunnel will mostly be formed by an omega seal due to differential settlement between the structures.

Trelleborg Ridderkerk BV manufactures a range of Trelleborg TSGs designed for precast concrete segments used in the lining of tunnels.





# Cut & Cover tunnels





The Dutch have always had to struggle with the sea to “keep their feet dry”. Therefore special construction methods were engineered to ensure watertightness in structures such as tunnels. Cut & Cover tunnels are widely used for shallow tunnels. The tunnel consists of an in-situ cast concrete structure in an excavated trench. The trench will later be covered. These concrete sections are often too big to be poured as one monolithic unit and therefore have a number of construction joints.

Waterstops are used to accommodate water pressure as well as the natural movement between the individually poured concrete sections of the tunnel. The type of waterstop depends on the water pressure and desired watertightness of these construction joints. To prevent any leakages, due to shrinkages or other causes, a special injectable waterstop has been developed to provide absolute watertightness.

Trelleborg Ridderkerk is the specialist in the design and production of waterstops and upon request we can also offer on-site assistance during installation. Our waterstops are considered as the standard solution to seal the dilatation joints.





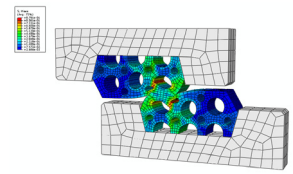


Engineering  
Service and installation





**Trelleborg Infrastructure is unrivalled in seal design and elastomer technology. Special construction methods have been developed to solve various problems in ensuring a watertight structure.**



Sealing problems occur especially where concrete structures are too large to be poured as one unit. Ensuring joint watertightness is therefore of paramount concern particularly for underwater and immersed structures such as tunnels. For the applications special joint sealing systems have been developed to ensure watertight joints. Trelleborg Infrastructure engineers, produces, installs and provides the service needed by our customers to ensure a total engineered tunnel solution.

Since the early 1960's we design polymer solutions for tunnels.

Our high qualified engineering department is well equipped with the latest technology to simulate(FEM), develop and design a tailored made polymer solution for every challenge or need. Our engineering team of Trelleborg Infrastructure can provide the support and advice in the design of seal, damp and product.

### **Service**

Trelleborg Infrastructure has a very experienced and qualified team of people that provide supervision, installation and repair on site. Well equipped with a mobile mini factory, state of the art measuring devices and of course the required safety gear. We will offer you support anywhere at any time when necessary.







Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Our innovative engineered solutions accelerate performance for customers in a sustainable way. The Trelleborg Group has local presence in over 40 countries around the world.

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