

DURA.CL BY CHANNELINE

CUSTOMISED SEWER RENOVATION
USING INDIVIDUAL ELEMENTS

HEALTHY SEWERS.
CITIES GOOD TO LIVE IN.

**STEINZEUG
KERAMO** 

SYSTEMATISED RENOVATION.

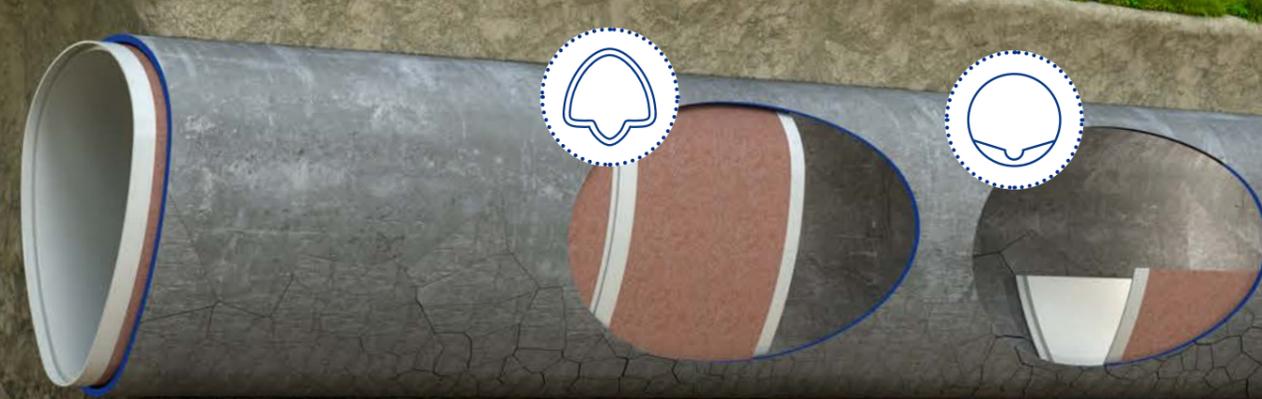
“Form follows function” – in practice this principle is mostly reversed in the case of wastewater systems developed over many years. Sewers have grown to be complex, often made of masonry, and demanding frequent renovation. The lengths of sewer to be renovated often incorporate changes in cross section, curves and bends of various radii, which calls for finding a technically feasible solution that can be adapted to these circumstances.

Adaptability to changing geometries is one of the strengths of the DURA.CL system. Its elements are made of highly resistant, glass reinforced plastic (GRP), here specifically polyester, manufactured to fit the sewer profile precisely. All shapes, cross sections and wall thicknesses are produced individually to suit the requirements of the project.

This allows the formed parts to be adapted to the actual local circumstances. The glass fibre reinforcement also allows relatively thin-walled elements to be manufactured. This makes DURA.CL by Channeline a good alternative in congested environments, because it provides the maximum effective sewer cross section and can therefore carry as much flow as is technically possible.

Overall, the technical and design characteristics of the DURA.CL product range lead to significant cost savings over a sewer's whole operating life.

Would you like to know more? We would be happy to advise you on profile cross sections, technical details, recommended placement methods and how to connect segments together.

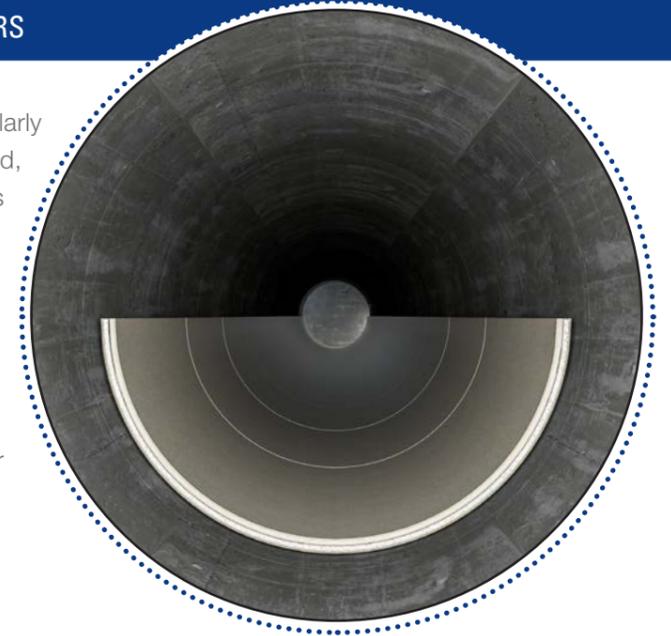


COMPLEXITY ELIMINATED.



PARTIAL RENOVATION OF SEWERS

When renovating sewers, often only the particularly badly affected areas are lined with thin-walled, corrosion-resistant elements called linings. This type of renovation is also suitable for sewers with tight bends, curves, changes in direction and sharp-angled transitions from berms to channels. Bonding the DURA.CL elements together is a simple process and produces a reliable connection for the service life of the lining. For every project, you receive a tailor-made solution developed by our experts in consultation with you.



COMPLETE RENOVATION OF SEWERS

Complete renovation is called for where the damage is extensive or severe. In this case, a new sewer is installed inside the existing sewer and permanently bonded to it. This is done by joining and bonding the parts of the new lining together, then using a flowing grout to bond the lining to the existing sewer. The old and new sewers become one inseparable unit. This renovation solution considerably prolongs the service life of the old sewer.

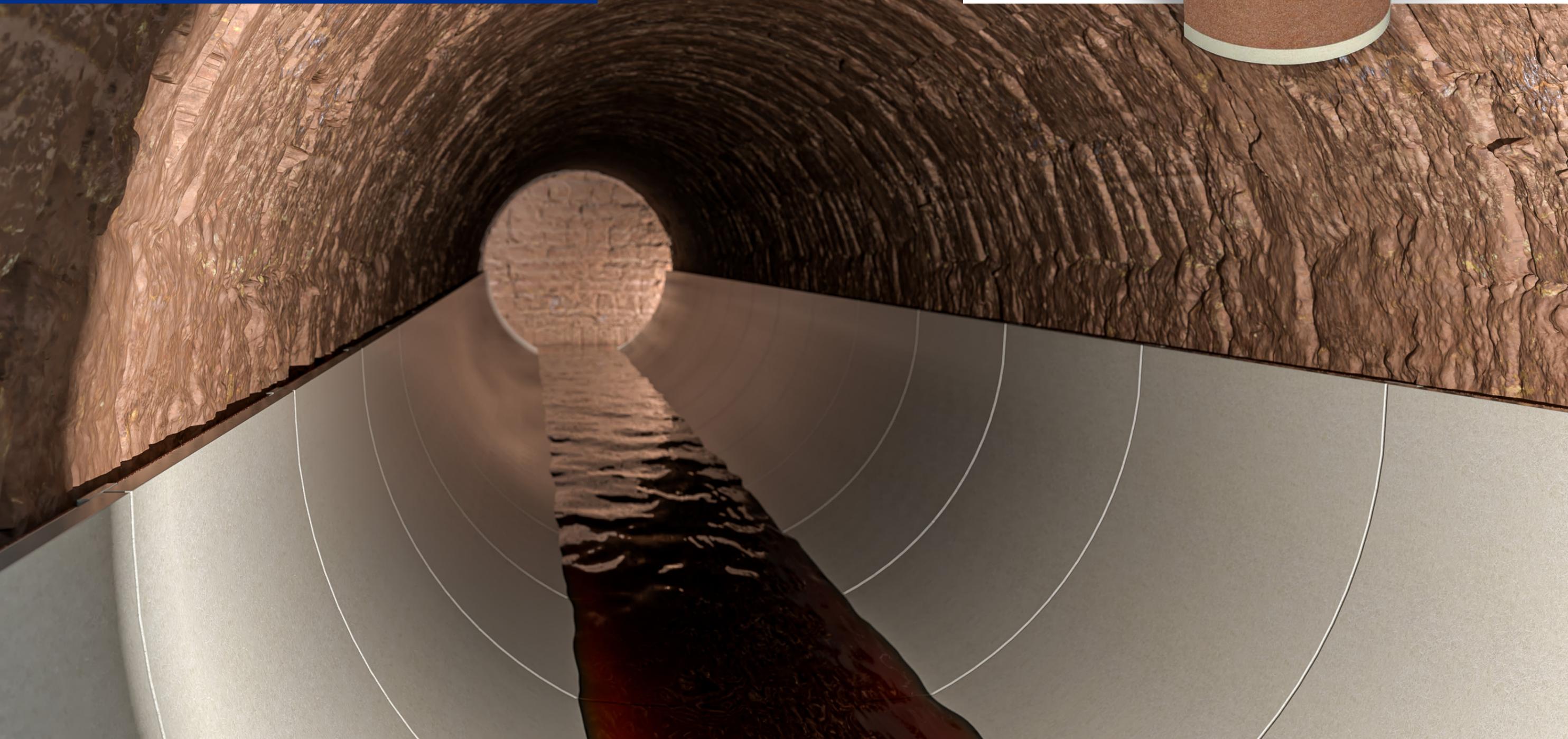


PARTIAL RENOVATION



If a sewer shows damage only in the invert or crown area, a full renovation does not always make economic sense. For accessible sewers, pipe-segment lining is frequently used as a renovation technique.

If the invert is damaged, the part requiring renovation is lined with strong, corrosion-resistant shells. The side berms can be renovated at the same time. It makes no difference whether the channel meets the berm at right angles or at an acute angle. The renovation profiles are finally joined together and bonded to create a waterproof connection only after they have been set up in the sewer. The advantage: the system can be used even on sites where there is no room for trenches large enough to allow assembly work.



COMPLETE RENOVATION



In the case where there are large damaged areas or many smaller, separate areas of damage along a sewer, then complete renovation is the logical course of action.

Depending on the profile shape and accessibility of the installation site, the work can be completed – as with partial lining – using pipe segment linings and in situ bonding. Of course, renovation can also be done with a single pipe lining.

DURA.CL full profiles are supplied from the factory ready for installation when using the single pipe lining method. For pipe segment lining we supply multi-piece profiles. After successful installation in the old sewer as an extremely resistant inner lining, they form the new sewer inner wall.

The annular gap created with either method is then filled with a pumpable special grout. In this way, a new sewer-within-a-sewer is created in just a few steps with a service life comparable to that of a brand-new sewer.

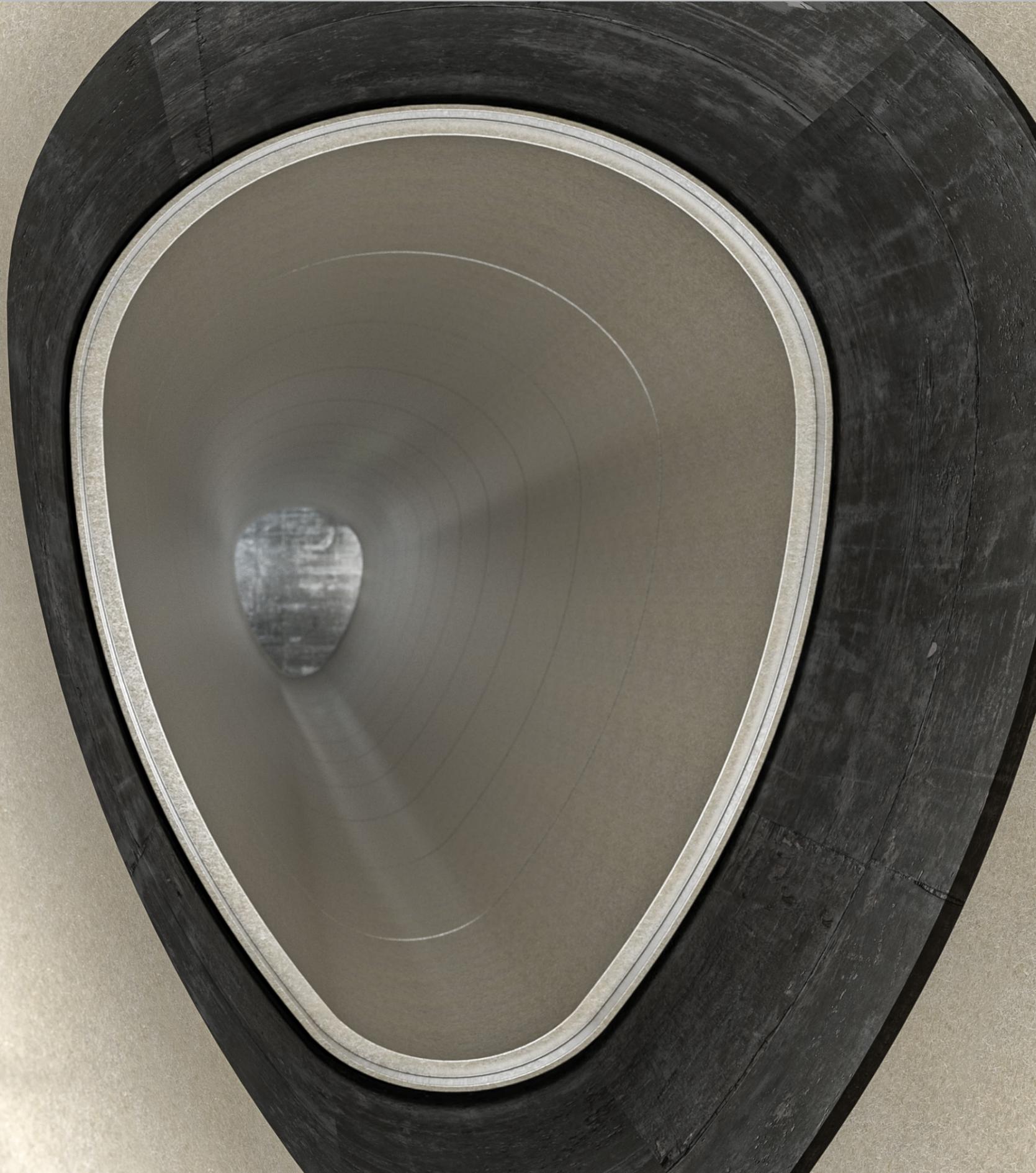
MULTI-PIECE PROFILES

Schwierige Transportverhältnisse, schwer zugängliche Kanalisationen und besonders groß dimensionierte Bauwerke erfordern häufig die Herstellung mehrteiliger Elemente, die erst auf der Baustelle verklebt werden. Dies geschieht ober- oder unterirdisch mit unserer patentierten Nut-Feder-Konstruktion. Die Teilung der Elemente erfolgt dort, wo die geringsten Kräfte auf die spätere Verklebung wirken.



TAILOR-MADE PROFILES

Practically any conceivable shape of profile can be manufactured for lining large sewers. The precision of the manufactured elements minimises any loss of flow capacity caused by the narrowing of the pipe cross section. This solution is very appropriate for renovating historic, masonry or tamped concrete main sewers in sensitive surroundings.



CONNECTION SYSTEMS

For the complete renovation of accessible sewers, single pipe and pipe segment methods often provide the optimum solution, largely because of the ease of handling of GRP renovation elements. With us you can not only choose the shape of the elements but also your preferred method of connecting them together. The following examples give an overview of our portfolio.

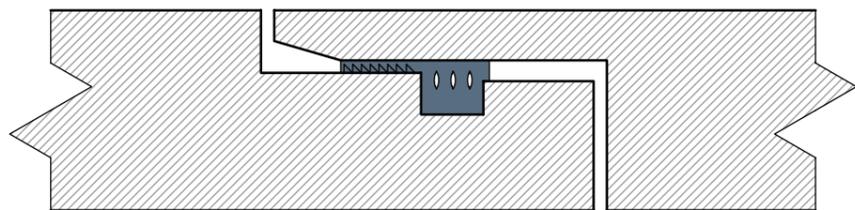
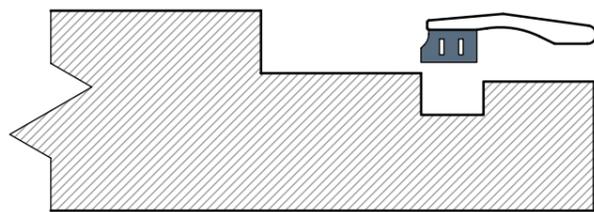
1 BONDING THE ELEMENTS

- Most common type of connection in the single pipe method for non-circular profiles
- Rebate connections are bonded with epoxy resin
- Transition in the rebate joint area (flush or surface-mounted), depending on profile wall thickness



2 SEALING SYSTEM

- Used especially for round or egg-shaped profiles
- Seal can be installed and inspected outside the excavation trench
- EPDM seal
- Transition in the rebate area (flush or surface-mounted), depending on profile wall thickness



3 MULTI-SEGMENT CONNECTION

In cases where access to the existing pipe is limited, renovation using multi-segmental pieces offers an effective alternative. Depending on the situation at the installation site, the segments can be connected on site either before being moved into the area to be renovated or after they are in place inside the sewer.

Our patented tongue and groove connections are incorporated at the points of contraflexure. Once the segments have been bonded together using the high-performance synthetic resin adhesive, our lining system offers the same structural strength and stability as one of our single piece elements.

DURA.Glue

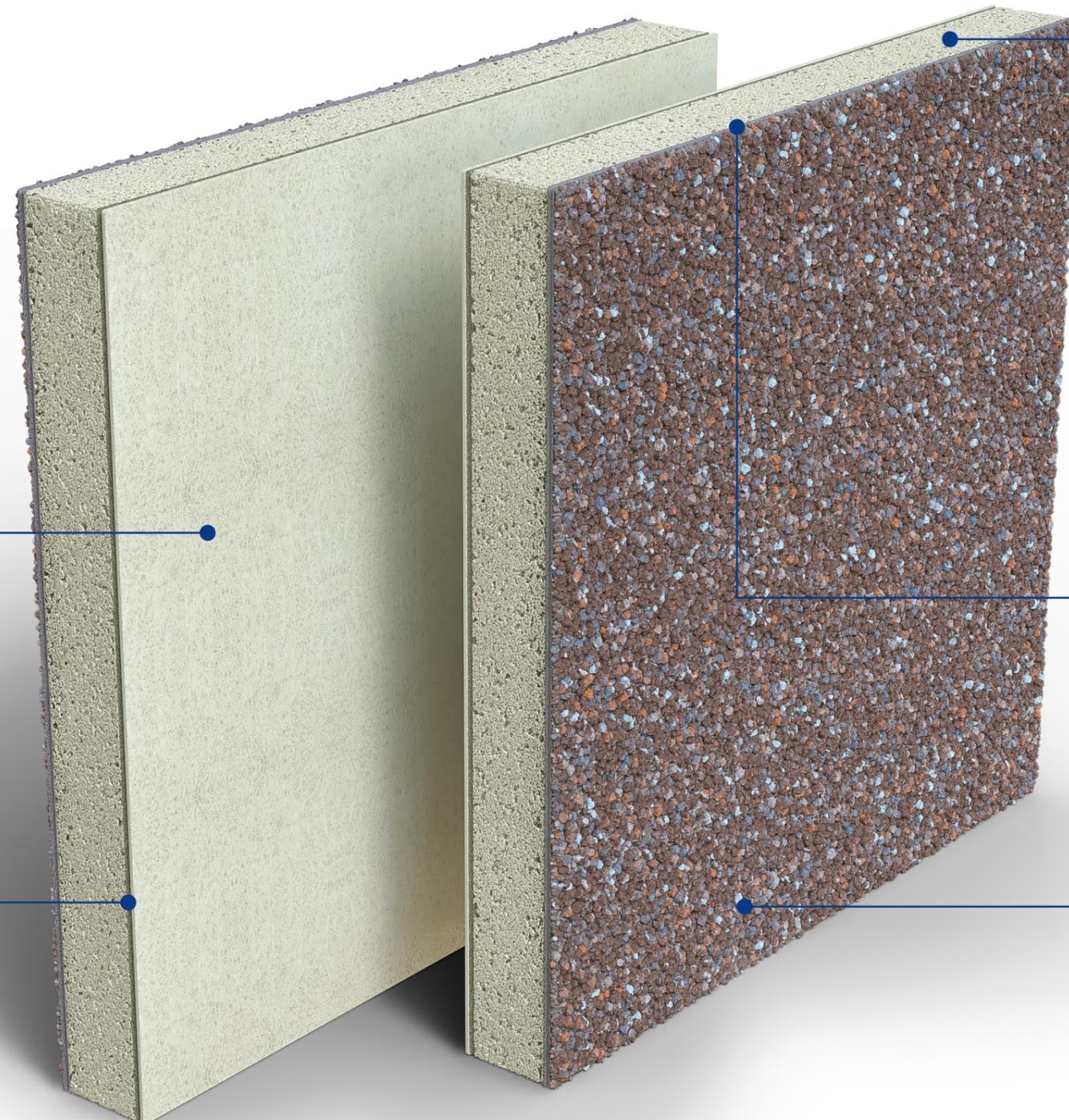
The adhesive for an optimal connection of DURA.CL elements is added directly to every order.



The shell segments of DURA.CL by Channeline are especially stiff and stable but comparatively thin. The system differs from ordinary GRP pipes in several important ways.

Hand- or filament-wound GRP pipes consist of several layers of resin-rich glass fibres impregnated with sand, which achieve their final stiffness only once the walls are the required thickness. However, elements of DURA.CL by Channeline derive their robustness and strength through a special core of polymers and additives and the mechanical action of the sandwich shell construction.

The sandwich manufacturing process is continuously monitored and precisely controlled to ensure that all the layers are very reliably bonded to one another.



INTERNAL LAYER

Resin-rich layer. Isophthalic acid polyester resin, reinforced with a C- or ECR-glass nonwoven. The thickness of this abrasion- and corrosion-resistant layer is approximately 0.5 mm.

BARRIER LAYER

This consists of two layers and has two functions: provides abrasion/ corrosion resistance and contributes to structural strength. It consists of isophthalic acid polyester resin with chopped strand mats (CSM), unidirectional (UD) or bidirectional (BD) glass mats. The barrier layer is at least 3 mm thick.

CENTRAL CORE

This has a 1.5 mm thick corrosion barrier on the inside face manufactured out of a high-grade veil precisely impregnated with isophthalic or vinyl-ester resin. Next comes a central core consisting of sand with orthophthalic polyester resin. The precisely batched quantities of sand and resin are preprepared, then mixed and applied evenly to achieve the required thickness. The thickness of this layer varies with the thickness of the element.

INTERMEDIATE LAYER

Second layer of CSM, UD or BD glass mats with isophthalic polyester resin. The minimum thickness is 2 mm. Contributes to strength and stability.

OUTER LAYER

The outer sandwich skin is then formed using further layers of multi-axial fabric, CSM and resin. The outer layer is treated with a bonded granular aggregate to improve the adhesion to the grout used to fill the annular gap during installation. Outer layer consisting of orthophthalic polyester resin and quartz sand with a grain size of 1–3 mm.

10 GOOD REASONS

FOR SUSTAINABLE RENOVATION



1 QUALITY OF THE MATERIAL

The lining segments consist of glass fibre reinforced polyester and fully comply with the Water Research Council's (WRc) materials standards for GRP (Guidance note WIS 4-34-02). They are manufactured in accordance with standards BS 5480, ASTM D3262 and ISO 16611:2017.

3

CORROSION RESISTANCE

The formation of corrosive sewer gases and oxidation of hydrogen sulphide into sulphuric acid lead to damage to wastewater sewers and culverts. One consequence of this is porous mortar, which is frequently discovered for the first time only during an inspection. Corrosion attacks even the stabilising structural elements. This often causes loss of strength and the failure of the structures.

The resins used in the production of DURA.CL are extremely resistant to sewer gases and most industrial wastewaters. They can be additionally adapted for each individual project if the lining has to fulfil special requirements. Please ask DURA.CL about this. A team member would be happy to give you precise guidance about corrosion resistance.

4

ABRASION RESISTANCE

The premium gelcoats we use for manufacturing our shells and in our surface coatings provide a high degree of impact and abrasion resistance. Wet abrasion tests

comparing our system with other lining processes show impressive results. The Barcol hardness of our cured DURA.CL material is Shore D 30.



2

MECHANICAL PROPERTIES

An extensive analysis is performed before the start of any project to determine the precise structural demands on the lining. The analysis considers many factors, including the buried depth, condition of the existing pipe, ground surface load and the presence of groundwater.

In order to produce shells that act as adequately strong and stiff linings, our engineers have developed an innovative sandwich wall construction.



5

HYDRAULIC CAPACITY

The hydraulic capacity of a sewer depends on its cross-sectional area and surface roughness. These factors can compensate for or add to the other's effects. Sewers in need of renovation often have areas of wall that are rough, uneven, have fallen in or project into the flow. These reduce the cross-sectional area and increase the coefficient of friction, thus over-proportionately reducing the hydraulic capacity.

An important result of sewer renovation is the reduction of hydraulic roughness. Therefore, even though the installed new elements may reduce the cross section, the improved flow characteristics of the renovated

system may cancel out the effect of the smaller cross section or even provide an improved flow capacity.

DURA.CL elements produce a considerable improvement of the flow capacity of pipelines or culverts with large cross-sectional areas – even after subtracting the effect of the reduced cross section. In general, this improvement can be between 12–25%. These good results are achieved because of the low coefficient of friction: the GMS (Manning) formula gives a roughness coefficient $n = 0.009$ (masonry = 0.025, concrete formed with timber formwork = 0.015).

6

SELF CLEANING

The tendency of sediment to build up in a wastewater sewer depends directly on the surface roughness, specifically the way the flow slows down at the interface of the fluid with the pipe wall. Experience shows that the extremely smooth surface of the GRP material reduces the friction between the flowing fluid and the pipe wall so that sewers and culverts are self-cleaning under normal flow conditions after lining.



8

SERVICE LIFE

The lining elements used for sewer renovation are intentionally designed for a long service life. Based on the determined empirical durability and performance data, a realistic estimate of the product service life is of the order of 50–100 years or more, depending on the operating conditions.

10

CONNECTIONS

More often than not, a renovation project requires transition pieces: it could be because the pipe changes cross-sectional shape, an outlet has to be left open in the lining or there is a major junction in the pipe. With DURA.CL by Channeline, you can have any required connection designed and manufactured for projects of this type. These include:

- Concentric reducers
- Eccentric reducers
- Y pieces
- Equal tees
- Reducing tees



ELECTRICAL PROPERTIES

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- Surface resistance = $3,30 \times 10^{12} \Omega$
- Sensitivity = $6,54 \times 10^{13} \Omega/\square$

FORMEN UND GRÖSSEN

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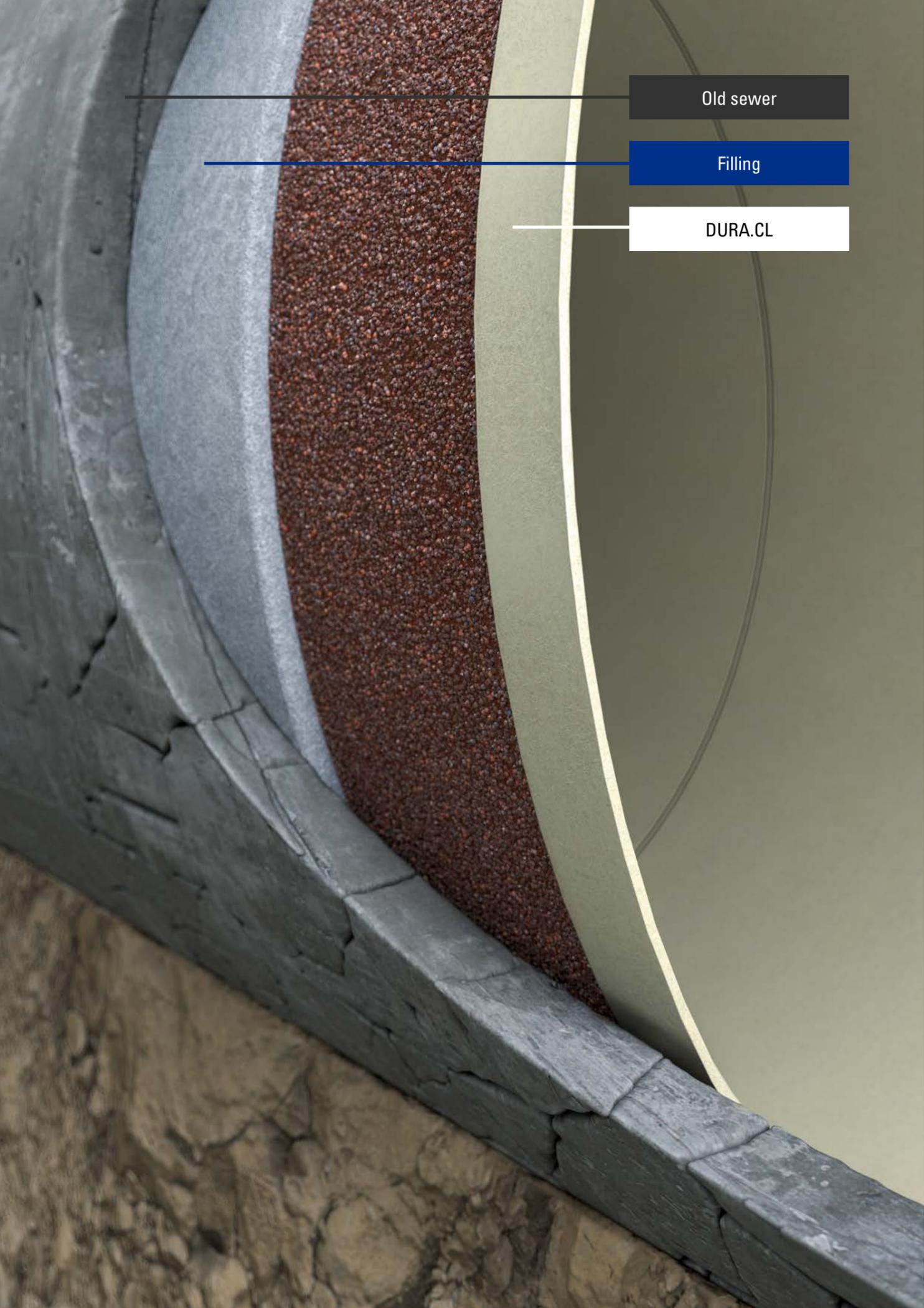
There are no limiting factors in practice on the shape and size of a DURA.CL element. Renovation projects involving extremely large diameters or unusually shaped walls can be completed without problem using our patented solutions. Because our technology and methods also allow multi-piece segment construction, even extremely large elements can be manufactured using appropriately shaped pieces.



DURA.CL BY CHANNELINE – SUMMARY OF FEATURES

- Special components in any required shape and size
- Full structural renovation solution
- Maximised hydraulic capacity
- Outstanding corrosion resistance
- High impact and abrasion resistance
- Expected service life up to 100 years or more





Old sewer

Filling

DURA.CL

MATERIAL CHARACTERISTICS

	Short term	Long term
Flexural modulus (EN ISO 11296-4 and EN ISO 178)	≥ 10.000 N/mm ²	≥ 5.300 N/mm ²
Bending strenght (EN ISO 11296-4 and EN ISO 178)	≥ 120 N/mm ²	≥ 63,6 N/mm ²
Elongation in flexion at break (EN ISO 11296-4 and EN ISO 178)	≥ 1,2 %	
Elongation in flexion at break in acid medium (ISO 10952 and ISO 10928 method A)		≥ 1,0 %
Tensile strength (on the active section) in hoop direction (ISO 8513:2016 method A)	≥ 90 N/mm ²	≥ 47,7 N/mm ²
Tensile strength (on the active section) in longitudinal direction (ISO 8513:2016 method A)	≥ 45 N/mm ²	≥ 22,5 N/mm ²
Roughness coefficient Ks	0,03	
Poisson coefficient	0,30	
Water tightness	keine Leckagen	
Abrasion Darmstadt-test EN 295-3	< 20 mm nach 100.000 Zyklen	
Barcol hardness NF T57-106	> 30	
Shearbond GN 4-34-02 p.6	≥ 1 N/mm ²	
Thermal stability		
- Glass transition temperature EN ISO 11357-2	≥ 70 °C	
- liquid effluent	0 °C bis 35 °C	
- ambient air	-25°C bis +50°C	

STANDARDS

Guidance note WIS 4-34-02: WRc material standards for GRP

ASTM D3262: Standard Specification for Fiberglass Sewer Pipes

BS 5480: Standard Specification for Reinforced Plastic (GRP) Pipes and Fittings for Water Supply and Sewerage

ISO 16611: Plastics Piping systems for drainage and sewerage without pressure - Non-circular pipes and joints made of glass-reinforced thermosetting plastics (GRP) based on unsaturated polyester resins (UP) - Dimensions, requirements and tests

CERTIFICATIONS

ISO 9001: 2015

ISO 14001: 2015

ISO 45001: 2018

QB (CSTB) 26/01-296 as per Standard Avis technique n°17/15-296

BENOR (BCCA) in accordance with the PTV BB-652-100

DURA.CL AT A GLANCE

- ✓ When extremely long service life is a mission-critical factor.
- ✓ When your construction demands highly flexible geometry of the individual components.
- ✓ When being reliably watertight is top priority on your projects.
- ✓ When perfect dimensional stability under heavy loads is a must.
- ✓ When access to the sewer is tight.
- ✓ When you need sustained abrasion resistance under constant stress.
- ✓ When you have to ensure long-term, high-level chemical resistance.
- ✓ When frost and heat resistance are part of your project's specifications.
- ✓ Our experts are happy to inform you about the strengths and opportunities offered by the DURA.CL system.

If your project reaches the boundaries of the technical data provided, please do not hesitate to contact us. We will do our best to find a solution to match your needs.

Do you have a specific project in mind? We would be happy to put our expertise to work to support you in this area as well. We are there for you – from the initial concept to the planning process and construction.

Get in touch!

Our team is at your disposal for technical advice.

Customer Service: +49 2234 507-507

www.steinzeug-keramo.com