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KEMSOLID[®]

build on solid foundations

**Rock cutting technology
for civil engineering —
fast, efficient and
environmentally friendly.**



Content

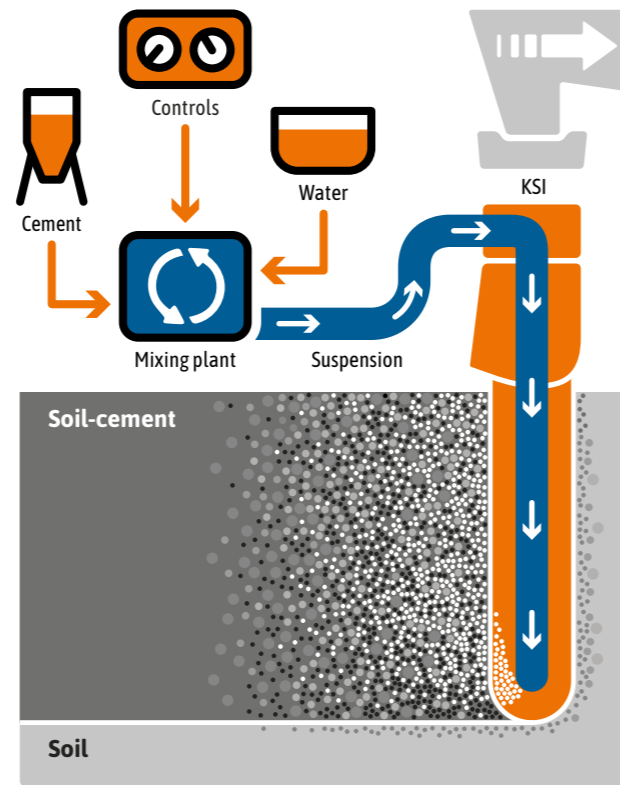
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Mass-Soil-Mixing (MSM)	
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<p>There are many ways rock grinding technology from KEMROC can be used in earthworks and civil engineering.</p>	

Kemsolid is the name of KEMROC's new division dedicated to soil stabilisation and ground improvement. This newly established business is focused on the development, testing and manufacturing of soil mixing attachments. Planning and design firms, construction companies, appraisers and clients also receive a full package of expertise and advice from foundation engineering specialist.

The Kemsolid TSM process

The TSM process or Trench-Soil-Mixing process is a method of creating in-situ soil cement structures. KSI soil mixing attachments can be installed on excavators or drilling and piling equipment to achieve production of soil-cement diaphragm and retaining walls. Once the blade has achieved the required depth using the moving cutter chain binder solution is piped through to the lowest point of the blade and injected into the soil. A mixing process follows until a uniform suspension with the required consistency of soil and cement has been reached. This creates an impermeable, stable soil-cement structure to the required dimensions. Type and concentration of binder solutions will vary according to load bearing and permeability levels required.

Since this method comes from rock grinding technology, handling small unforeseen obstacles is easily overcome. At the same time, it is also feasible to integrate the soil-cement structure into solid ground or rock.



Schematic overview

Depending on soil type and local ground conditions, production rates of more than 100 linear meters per day are possible.

A KSI 12000 producing a soil cement-structure.



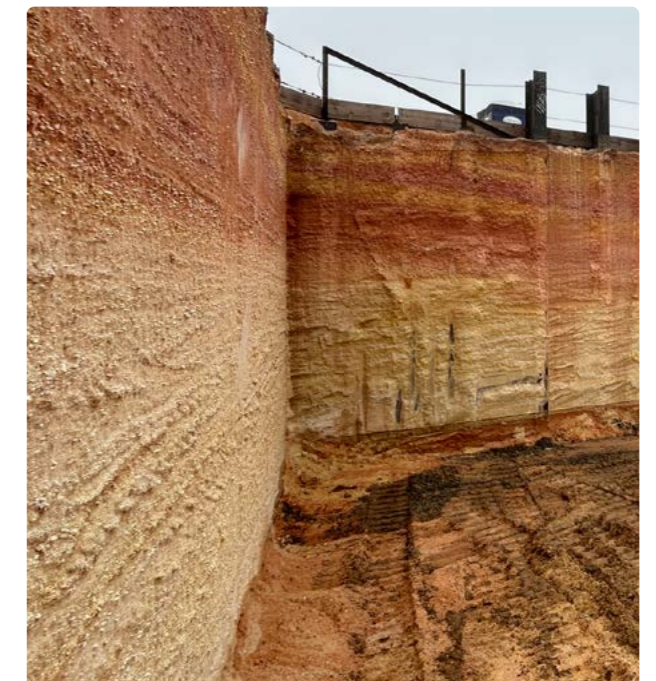
		Confining
		Sealing
		Separating
		Stabilising
		Closing around
		Stabilising for high-speed
		Dam stabilisation
		Creating retaining walls

Process advantages

In contrast to the use of conventional diaphragm wall equipment, which carries out segment by segment walls, the KSI process and its attachments achieve a continuous structure over the entire length of the wall. Misalignment of any individual segments is therefore eliminated. The blade of the KSI attachment mixes the soil in-situ continuously over the entire installation depth. This ensures that the soil-cement structure is uniformly homogeneous in all aspects after curing. The structure can also be integrated into layers of weathered rock to ensure a proper seal at the interface.

The Kemsolid TSM process is extremely versatile for addressing soil permeability and load bearing issues. It can, for example, be used to seal excavations or enclose polluted areas. It can also be used to seal dams, dykes and other bodies of water as well as creating a barrier to prevent waves travelling from sources of vibration. In trenching and construction of large warehouses, it can be used to fill the gaps between supports. It can also be used in applications where new roads are being built on soils with low load bearing capacity or the load bearing capacity must be increased to cope with extra weight or higher traffic speeds. These include some high-speed railway and motorway routes.

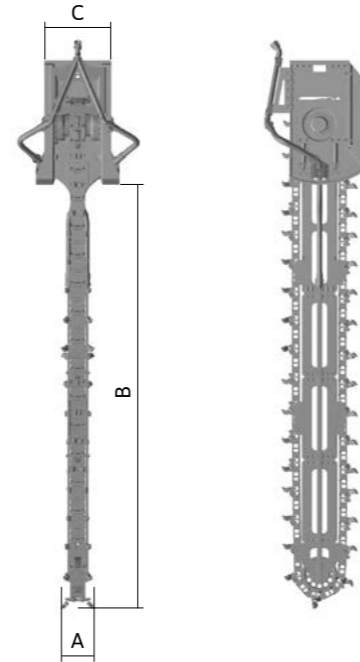
Shoring a pit using a KSI mixing attachment.



The KSI range of mixing attachments

KSI soil mixing attachments are available in three sizes for mounting on excavators between 35 and 200 ton operating weight and can be supplied with a range of blade lengths. The KSI 7000 model can be equipped with blades suitable for mixing depths of 4, 5, 6 or 7 meters, while the larger models KSI 12000 and KSI 16000 can take blades for mixing depths from 6 to 12 and from 6 to 16 meters respectively. Depending on the application, the blades can be produced with cutter plates for different mixing widths.

Thanks to the ability to switch between dragon tooth and round attack picks, the structure can be integrated into layers of weathered rock while maintaining a sealed interface.



		KSI 7000	KSI 12000	KSI 16000
Recommended excavator weight	t	35–55	50–80 ^[1] 80–120	75–120 ^[1] 120–200
Rated hydraulic power	kW	130	220	300
Mixing width (A)	mm	350–500	450–650	600–950
Modular mixing depth (B) ^[2]	m	4 5 6 7	6 8 10 12	6 8 10 12 14 16
Width of gearbox (C)	mm	1,000	1,360	1,630
Recommended chain speed	m/s	2.0–2.5	2.0–2.5	2.0–2.5
Recommended oil flow at 150 bar	l/min	300–400	500–600	650–825
Max. oil flow	l/min	400	650	850
Max. operating hydraulic pressure	bar	400	400	400
Max. permissible ground compressive strength	MPa	10	10	10
Standard mixing tool	Type	DT 22/46/38/22 HC	DT 22/90/70/30 HQ	DT 22/90/70/30 HQ
Weight				
Weight of attachment built for max. mixing depth	kg	4,500	12,500	19,500
Weight per meter for extension	kg	400	800	1,600

^[1] Attachment only with special adaptor to boom and additional counterweight on excavator. Size of counterweight depends on excavator and should be agreed with excavator manufacturer.

^[2] Quoted mixing depths are standard. Other mixing depths can be made to measure.

Attachment and adaptor options

Option 1

Excavator adaptor plate with standard hole patterns for use with quick couplers (e.g. Lehnhoff, OilQuick, etc).

Option 2

A mechanical hook for attachment to excavators without a boom on a short arm.

Option 3

Hydraulic quick coupler for attachment on drilling and piling rigs.

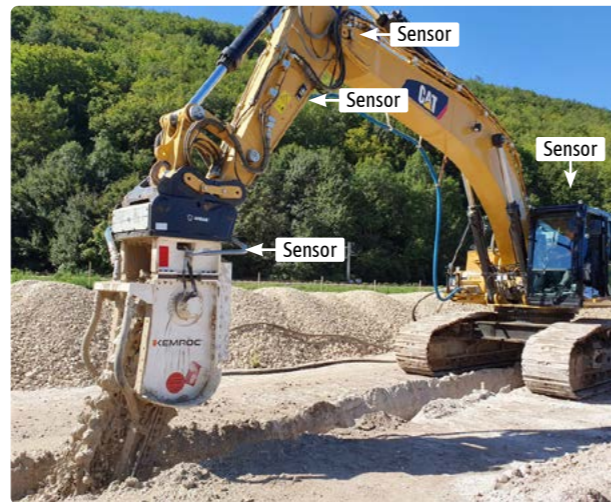


Detailed view of adaptor options.

Kemsolid partner companies offer hardware and software mounted on the mixing attachment and on the excavator to capture digital recording of production parameters. Performance, quality and quantity data is recorded in real time.

Maintenance free and reliable measurement of the mixing depth

Robust, vibration resistant sensors continuously record position of boom segments and the attachment. The data is processed as a kinematic model providing accurate information regarding mixing depth, speed of advance as well as discharge combined with oil pressure and volume.



High-precision positioning of the mixing attachment

Satellite-based navigation via two RTK GNSS/GPS antennas processed data acquisition are integrated in a compact system mounted on the excavator, providing optimal operator assistance for the TSM process. All essential information is available on a single monitor in the operator's cab.



Data management with immediate transparency

PDF reporting and interactive data analysis in a web based application tailored to foundation engineering. We recommend collecting the following data during the TSM process: surface elevation, bottom of the slot, amount of suspension used and location (GPS).



Another Kemsolid innovation is expanding the range of KSI mixing attachments with single blade to KSI attachments with a double blade or even multiple blades. These new variants are called "KSI TWIN" and "KSI HYDRA".

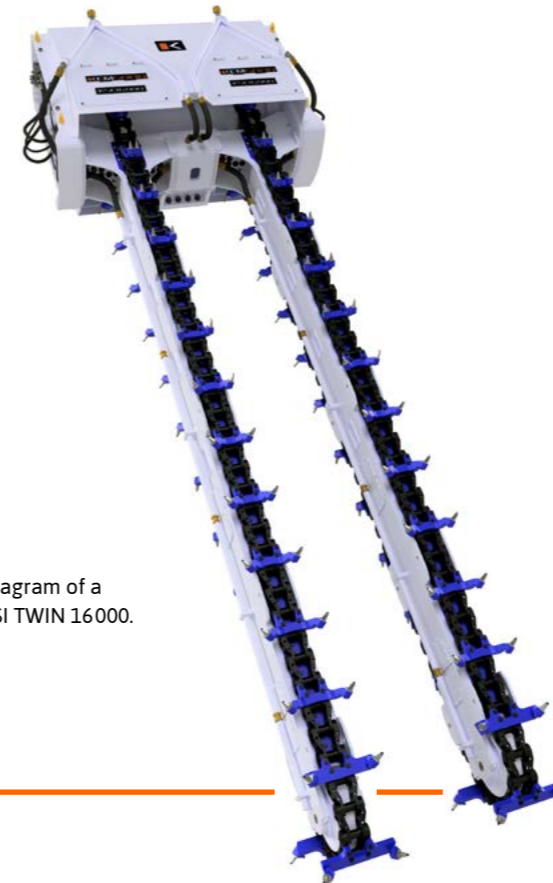
Further development of TSM: KSI TWIN with double blade

Using the double blade (KSI TWIN) productivity can be increased, time required can be reduced and CO₂ emissions saved while using the TSM process to build and upgrade roads and railway lines as well as working on dams and dykes.

For example, parallel sealing or retaining walls can be produced in one step. This reduces working hours, especially when building new or renovating existing rapid transit routes.

This also makes sealing and stabilising dykes more effective and sustainable.

Diagram of a KSI TWIN 16000.

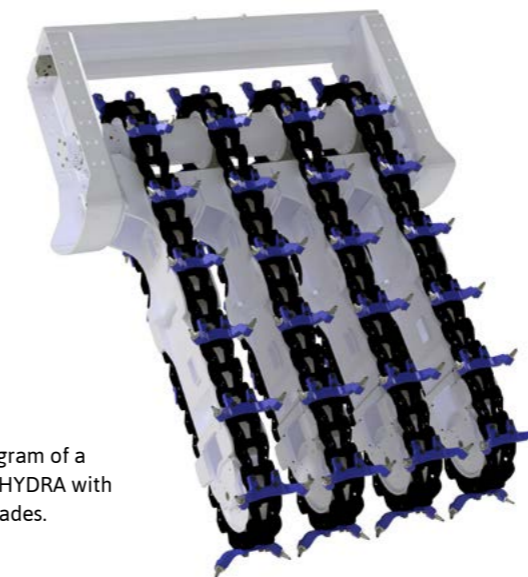


Further development of TSM: KSI HYDRA with multiple blades

The multiple blade variant (KSI HYDRA) is used for more efficient and precise production in larger projects involving stabilisation and strengthening of sub soils. The blade widths and separation can be precisely and individually adapted to suit the local conditions on the job site thanks to a sophisticated modular construction.

Not only do these innovations make KSI attachments and the TSM process more effective and faster for the construction site, they also make them more environmentally friendly, reducing CO₂ emissions.

Diagram of a KSI HYDRA with 4 blades.



The Kemsolid MSM process

The Kemsolid MSM process — where “MSM” stands for “Mass Soil Mixing” — is a sub soil improvement and soil stabilisation technique using mixing attachments from the KRD MIX range on a standard excavator.

The MSM process is used for very soft to fluid soils. By using a KRD MIX attachment to mechanically mix the in-situ soil with either a dry binder or a suspension of mortar or cement, the soil can be consolidated or strengthened as required. Compressed air or pumps are used to supply the additive via a line on the attachment to the middle of the KRD MIX in the soil.

Due to the operating characteristic of the attachment, mixing can continue through solid layers as well as in sandy or silty soils. Using surface material in the additive for mixing into subsurface soils is also possible.

The extension can be assembled depending on job requirement.

The MSM process is used to stabilise or to improve the load bearing capacity of very soft to fluid soils.

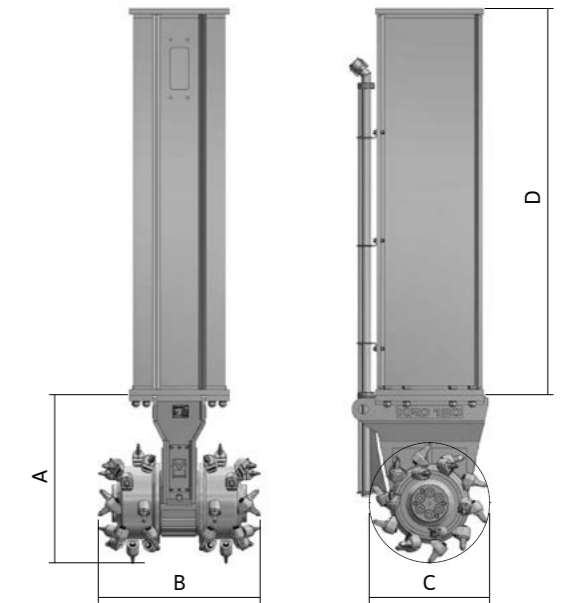


Images above:
A KRD 120 MIX producing consolidated soil structures using the MSM process

Image below:
Processing already solidified soil structures

The KRD MIX range of mixing attachments

Mixing attachment in the KRD MIX range are available in three sizes for 25 to 50 ton excavators. A variety of mixing depths can be achieved by changing the extension segments.



		KRD 120 MIX	KRD 150 MIX	KRD 165 MIX
Recommended excavator weight	t	25–40	30–40	35–50
Rated power	kW	120	120	160
Max. mixing depth	m	6	6	6
Length of mixing cutter without extension (A)	mm	1,070	1,070	1,072
Width of mixing head (B)	mm	1,000	1,000	1,260
Diameter of mixing head (C)	mm	730	730	720
Recommended rotation speed	rpm	70	65	60
Recommended oil flow	l/min	250–330	280–350	300–390
Max. oil flow	l/min	350	350	400
Max. operating hydraulic pressure	bar	400	400	400
Weight of mixing cutter without extension	kg	1,500	1,500	2,020
Number of mixing tools	Pcs	48	48	58
Standard mixing tool	Type	DT 22/90/70/30 HQ	DT 22/90/70/30 HQ	DT 22/90/70/30 HQ
Extension				
Possible extensions (D) ^[1]	m	2–5	2–5	2–5
Length of standard extension (D)	m	2	2	2

^[1] Extension on request.

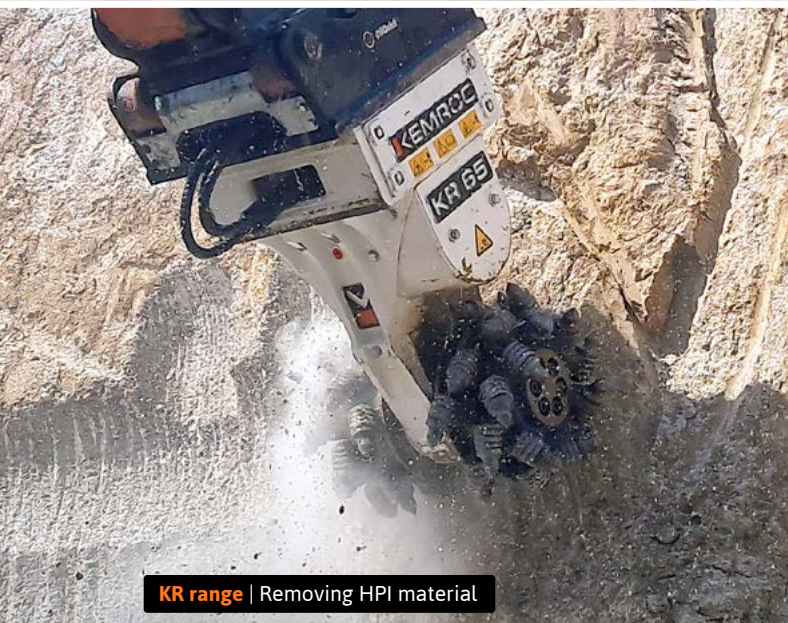
Further applications in civil engineering



ES range | Profiling diaphragm walls



KRX range | Working bored piles



KR range | Removing HPI material



KRD range | Profiling excavation boundaries



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