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

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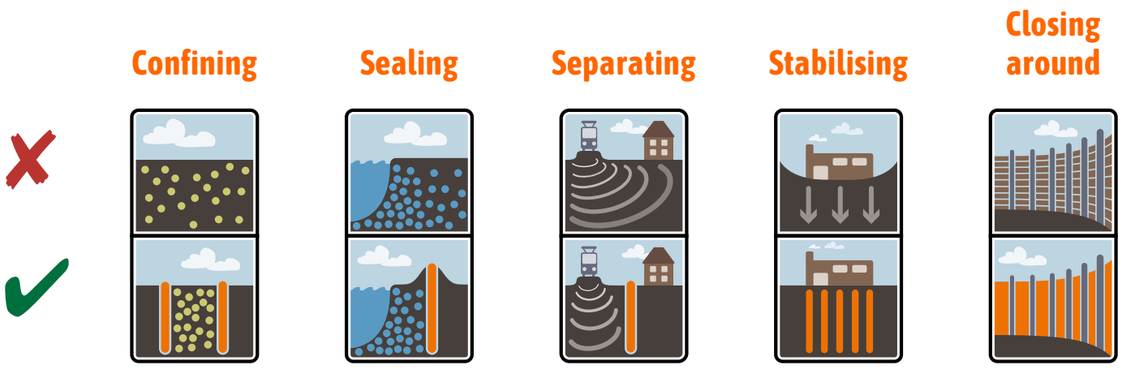
There are many ways rock grinding technology from KEMROC can be used in earthworks and civil engineering.

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 advise from foundation engineering specialist.

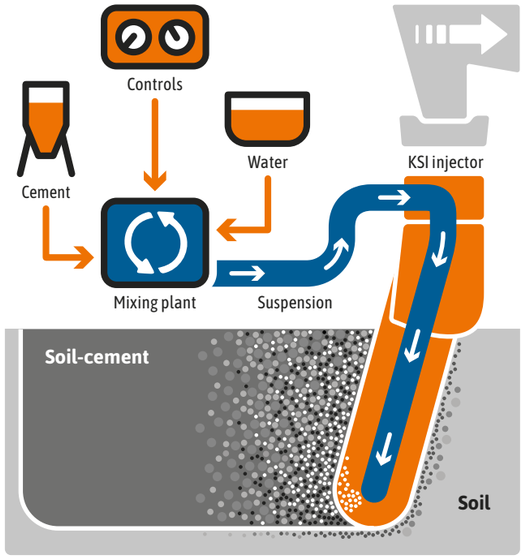
The Kemsolid KSI process

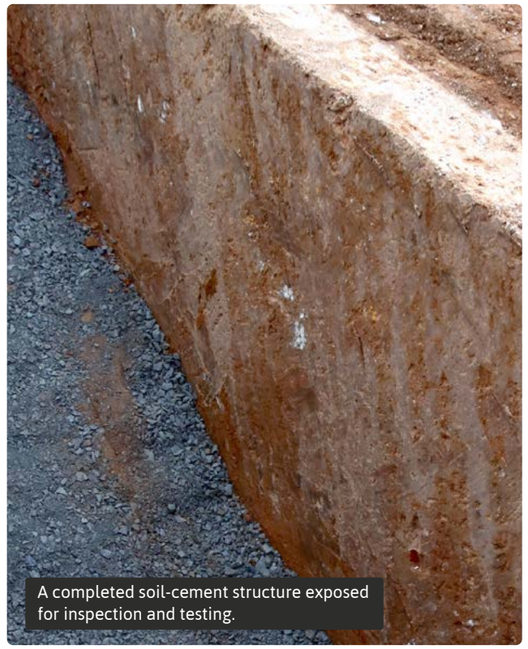


The KSI process is a technology used to produce soil-cement structures. KSI soil mixing attachments can be installed on excavators or drilling and pilling equipment to achieve production of soil-cement diaphragm and retaining walls. Once the blade has achieved the required depth using the moving cutter 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.

The technology evolved from rock cutting attachments, which makes operating in difficult, stony conditions possible. At the same time, it is also feasible to integrate the soil-cement structure into solid ground or rock.

KSI process schematic



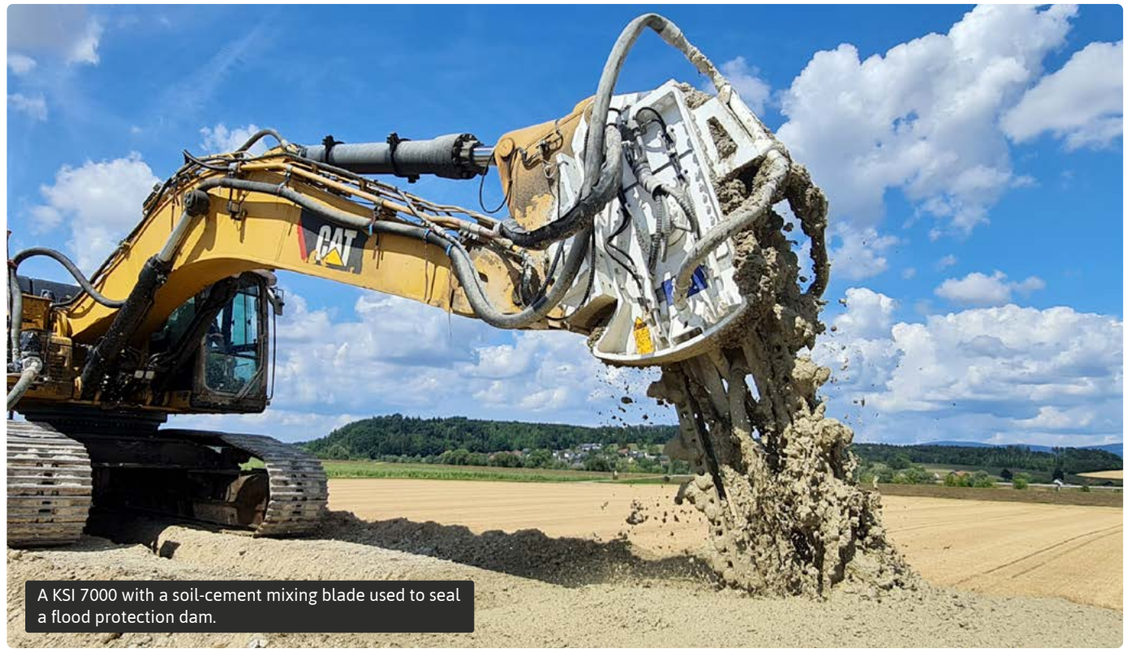

A completed soil-cement structure exposed for inspection and testing.

Production rates depend on soil types and ground conditions. Daily rates of 100 linear meters to depths of 10 meters using a 0.45 meters wide blade are possible to achieve.

Advantages of the KSI process

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. As the chain is fitted with dragon teeth cutters, the soil-cement structure can be easily integrated into existing rock deposits to ensure proper sealing at the connecting points.

The KSI 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.

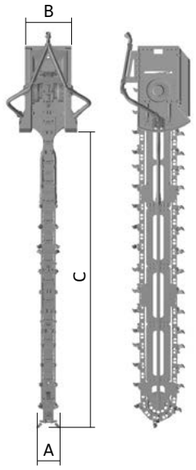


A KSI 7000 with a soil-cement mixing blade used to seal a flood protection dam.

The KSI range of mixing attachments

KSI soil mixing attachments are available in two sizes for mounting on excavators between 35 and 120 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 5, 6 or 7 meters, while the larger KSI 12000 model can take blades for mixing depths of 6, 8, 10 or 12 meters. Depending on the application, the blades can be produced with cutter plates for different mixing widths. Both models can be supplied with a rotation module as an optional extra.

		KSI 7000	KSI 12000
Recommended excavator weight	t	35–55	50–80[1] | 80–120
Rated hydraulic power	kW	130	220
Mixing width (A)	mm	350–500	450–600
Width of gearbox (B)	mm	1,000	1,360
Modular mixing depth (C)	m	5 | 6 | 7	6 | 8 | 10 | 12
Recommended chain speed	m/s	2.0–2.5	2.0–2.5
Recommended oil flow at 150 bar	l/min	300–400	550–700
Max. oil flow	l/min	400	700
Max. operating hydraulic pressure	bar	400	400
Max. permissible ground compressive strength	MPa	10	10
Standard mixing tool	Type	DT 22/46/38/22 HC	DT 22/90/70/30 HQ
Weight			
Weight of attachment built for max. mixing depth	kg	4,500	12,500
Weigth per meter for extension	kg	350	700

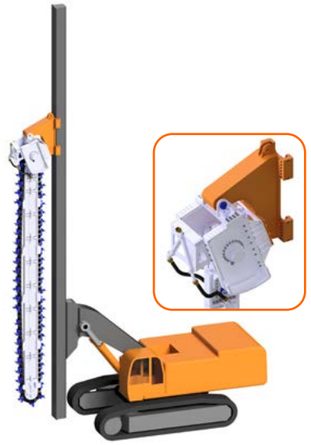


[1] Attachment only with special adaptor to boom and additional counterweight on excavator. Size of counterweight depends on excavator and should be agreed with excavator manufacturer.

Attachment and adaptor options

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

Adaptation for 50-t and bigger excavators with short boom and no dipper stick



Adaptation for a leader on a drill or pile driving rig

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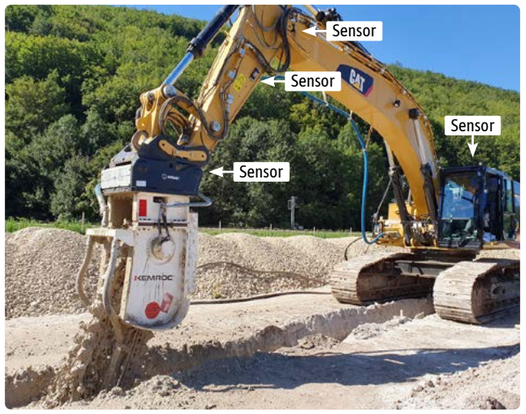
Digital and individual recording of process parameters on the KSI mixing attachment and excavator to document performance, quantity and quality.

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 presented as a kinematic model providing real-time information for mixing depth and delivery accurate to the nearest centimeter.

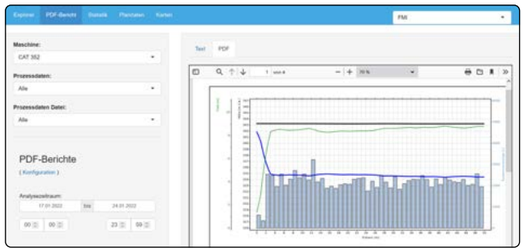


High-precision positioning of the mixing attachment using 2-antenna RTK GNSS/ GPS sensors located on the excavator

Satellite-based navigation and data acquisition processing are integrated in a compact system enabling optimal operator assistance for the KSI process. All essential information is immediately available on a single monitor in the operator's cab.

Data management with immediate availability of process data

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



The Kemsolid MSM process

The Kemsolid MSM process is a subsoil improvement and soil stabilisation technique using the KRD MIX range of mixing cutters on a standard excavator.

The MSM process is used for very soft to fluid soils, with MSM standing for “Mass Soil Mixing”. 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.

MSM process using a KRD MIX attachment to produce consolidated soil segments and blocks.

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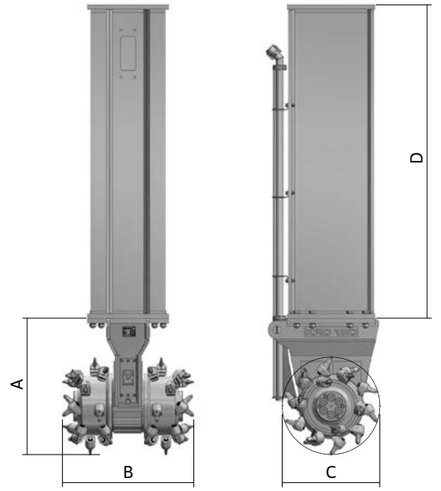
The MSM process is a technology used for subsoil improvement and soil stabilisation in very soft to fluid soil conditions.

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. Maximum mixing depth of 6 meters can be achieved with these attachments.



		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 at 10 bar	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.

The KRX range and the Kemsolid CFA process

The KRX range of Powertool drive units with attachments for milling, drilling and mixing (selection of relevant models)

The KRX range of Powertool drive units are extremely robust and use a radial piston motor to generate extremely high torque and cutting forces. With a selection of very heavy duty tools, they are an ideal attachment for your excavator for a wide variety of civil engineering applications.

Drive

Milling attachment

Cutter head with round attack or dragon tooth picks

Cutter head with spiral extension

Drilling attachment

Drilling auger with pilot bit

		KRX 70	KRX 110	KRX 120	KRX 130	KRX 140
Recommended excavator weight	t	15–25	20–35	25–40	25–40	30–50
Rated power	kW	70	110	120	120	140
Length of drive unit	mm	830	842	842	842	875
Torque at 380 bar	Nm	16,000	25,400	30,300	33,000	36,400
Max. oil flow at 10 bar	l/min	300	320	350	350	390
Max. hydraulic pressure	bar	400	400	400	400	400
Weight without attachment	kg	520	540	540	540	900
Hex connection, standard	mm	160	160	160	160	160

KRX 120 drilling holes for anchors in concrete retaining walls.

Another application for the KRX range is the production of in-situ concrete piles using a flushing head, hollow stem auger and an auger drill bit.

The Kemsolid CFA process

The CFA process is used to produce in-situ concrete piles up to 3 meters and CFA piles from 3 to 6 meters. Using conventional excavators, together with the KRX attachment range, makes the process very flexible and cost-effective. Productivity is higher when compared to using cased drilling methods.

To create piles, hydraulic power from the excavator is used to continuously rotate an auger attached to the excavator that is the full length of the pile. The auger is driven into the soil to the desired depth (piling depth) and then raised while at the same time concrete is pumped via the flushing head and hollow auger to the drill bit to fill the hole. During the entire process, the auger keeps the borehole stabilised.

As required, reinforcement cages, steel girders or casing can be subsequently installed into the fresh concrete.

The low vibration process can be used in almost all soil types regardless of the groundwater level.

Flushing head adapted for pumping concrete

KRX 70 with concrete pumping swivel

KRX 120 processing bored pile heads.

KRX 110 cutting bored piles.

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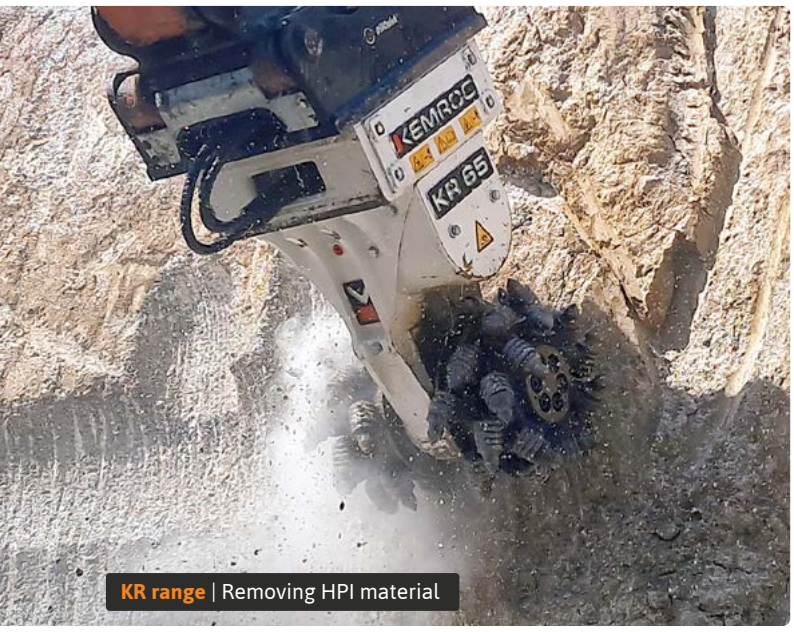
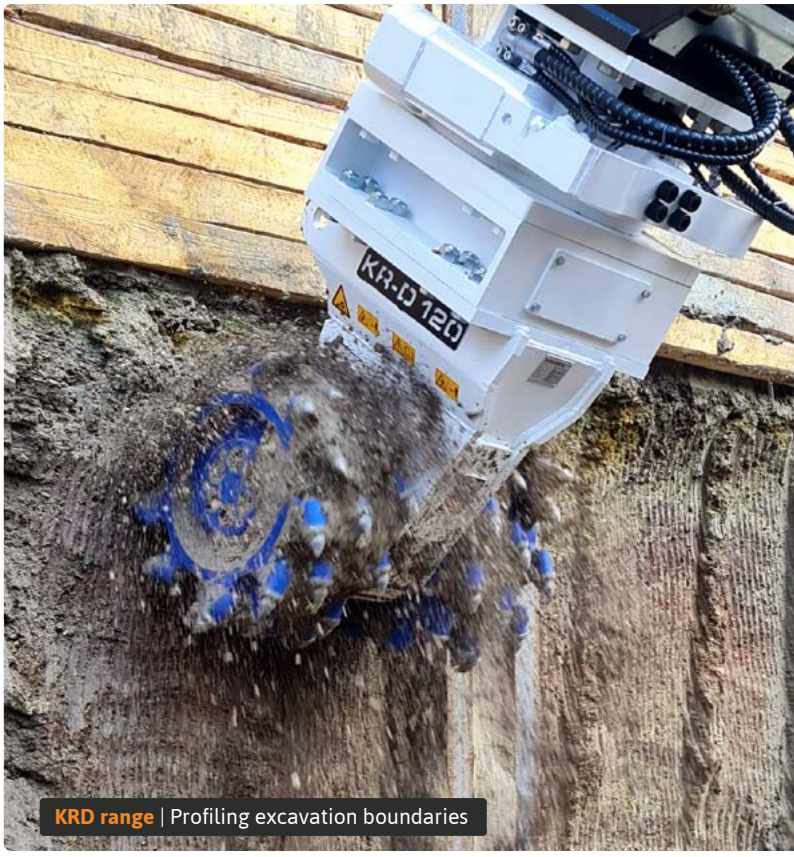
Other applications in earthworks and civil engineering

ES range | Profiling diaphragm walls

KRX range | Working bored piles



KR range | Removing HPI material



KRD range | Profiling excavation boundaries

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