

# Soil Mixing

## CSM Wall (Cutter Soil Mixing)



### Construction of retaining and cut-off walls by mixing soil in situ with a cement/bentonite grout

The CSM wall (Cutter Soil Mixing) provides a cost effective solution for the rapid construction of retaining and cut-off walls by mixing soil in situ with a cement / bentonite grout.

Like traditional walls (concrete diaphragm walls, reinforced slurry cut-off walls, thick slurry cut-off walls, etc.), the CSM wall consists of adjacent male and female panels, with thickness typically ranging from 500 mm to 1000 mm.

Depending on soil conditions and specific project requirements, the soil is mixed and grouted, following pre-determined procedures during the drilling and the extraction phases.

#### The equipment

The CSM wall is constructed using new equipment developed from diaphragm wall cutter technology. It consists of cutting and mixing drums mounted on compact hydraulic motors. The drums are essentially designed to combine high penetration rates with excellent soil/ cement mixing.

The precise positioning and verticality of the wall is achieved using a telescopic kelly bar down to 30 m depth. For deeper walls, rope suspended equipment, with in-trench guidance mechanisms, is recommended.

CSM incorporates the latest monitoring technologies. Real-time processing of the construction parameters ensures optimum control and a high standard quality product.



*The CSM Tool*



*8m diameter CSM shaft*

**Advantages of CSM**

CSM provides an adaptable and cost-effective solution with many advantages:

- mixing the soil in place considerably decreases the spoil volume compared to traditional walls. Important savings are also achieved on natural materials incorporated in the wall,
- guide wall is generally cheaper or in certain situations may not be required,
- the CSM equipment does not require a dedicated rig. It can be mounted on standard high torque rotary piling machines.

*CSM is particularly effective in medium dense granular soils and soft clays.*

**Main CSM panel features**

With our expertise in grout and slurry formulation, Bachy Soletanche has the skills to design specific mixes and mixing procedures to suit particular ground conditions and project specifications. CSM panels exhibit significant structural resistance, based on a high quality soil/cement mix with UCS values ranging from 5 to 15 MPa.

Steel beams may be installed in the fresh soil mix to provide further structural capacity where necessary. CSM can also be combined with reinforced bored piles offering interesting alternative solutions.

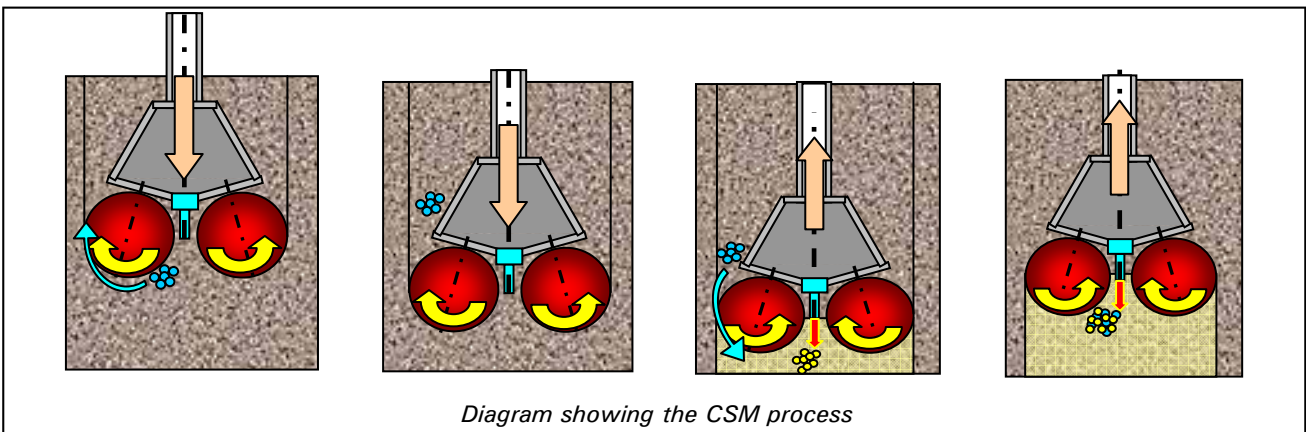
**Applications**

CSM offers versatile construction solutions suitable to various types of retaining structures: circular shafts, temporary walls for urban excavations, "In-situ" Berlin walls, etc.

Grout formulation and construction parameters can be designed to achieve specific permeability and strength, providing an efficient and effective cut-off wall solution.

*The new CSM technology is a product of joint development between Soletanche Bachy and Bauer Maschinen.*

*It was awarded the innovation prize at the BAUMA Award 2004.*



*Diagram showing the CSM process*

