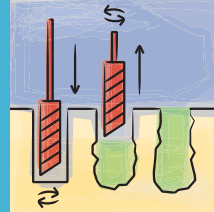


# Controlled Modulus Columns



# Controlled Modulus Columns

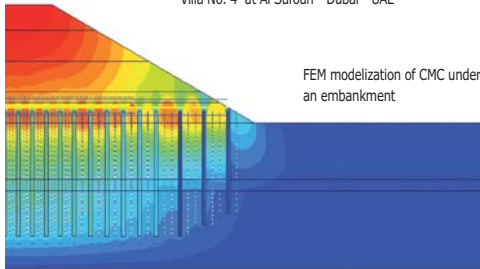


### Advantages

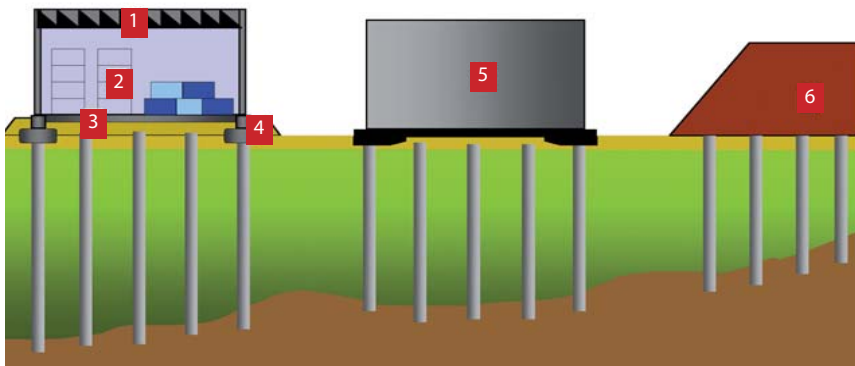
- Well adapted to high uniform surface loading with strict settlement requirements;
- Virtually no spoil thus no need to dispose of contaminated soils, which results in cleaner project sites;
- Very high production outputs; Virtually no limitation in use for any type of compressible soils, including soils with significant organic content (peat, organic clays...);
- The technique is vibration free and can be used in the close vicinity of sensitive structures;
- Uniformly supports slabs-on-grade and shallow footings spread footings, strip foundations and retaining walls thicknesses and reinforcing steel quantities as compared to a Deep Foundation solution requiring pile caps and structural slabs.



Villa No. 4 at Al Sufouh - Dubai - UAE



FEM modelization of CMC under an embankment



### Applications

- 1/ Industrial warehouses and commercial buildings 2/ Heavy storage 3/ Slabs-on-grade  
4/ Shallow footings, spread footings, strip foundations and retaining walls 5/ Tanks, silos  
6/ Road and railways embankments.



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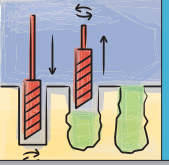


The Controlled Modulus Columns (CMC) are used to improve the soil characteristics of a compressible soil layer on a global scale and to reduce its compressibility by use of semi-rigid soil reinforcement columns. Unlike a piling solution which is designed to support the entire load of the structure on the piles, the objective of a CMC solution is to increase the stiffness of the soil mass to globally reduce both total and differential settlements by sharing the load of the structure between the soils and the CMCs.

Part of the load of a structure is transferred to the competent underlying layers through the Controlled Modulus Columns. The improved soil mass thus behaves as a composite soil/cement ground improvement system with enhanced stiffness characteristics. The entire process is vibration free and does not generate any spoil at the surface which allows a cleaner job environment and limits the risk of contamination.

Controlled Modulus Columns are part of a larger family of Rigid and semi-Rigid Inclusions that can be installed with various means and methods (vibration, percussion...).

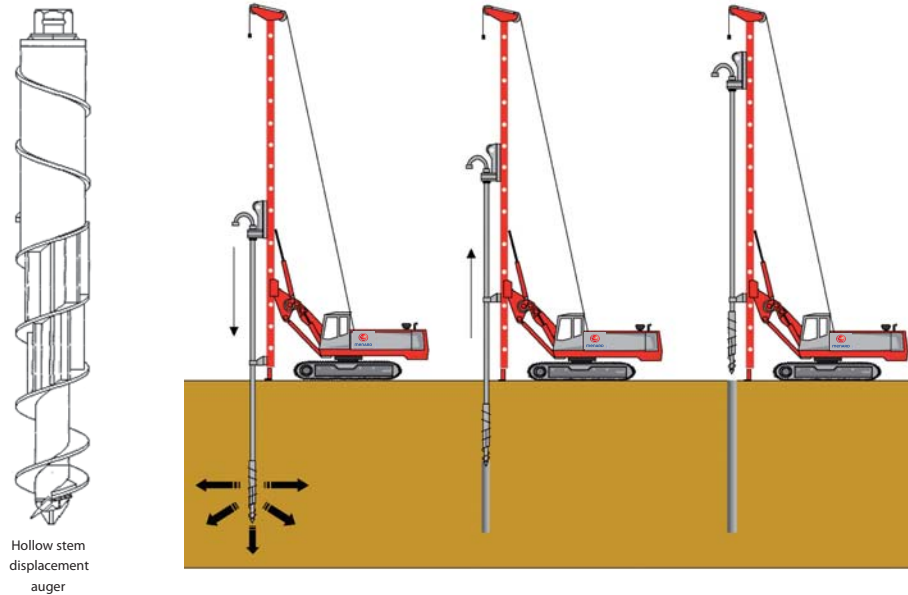
Under uniformly loaded structures such as embankments and slabs, a load transfer platform is designed between the top of the columns and the structure to efficiently transfer the load to the CMCs. This load transfer platform is made of well compacted granular material, and has a thickness of 0.4 to 0.8M. depending on the type of structure and the soil conditions.



# Controlled Modulus Columns

## Implementation and methods

A specially designed auger, powered by equipment with large torque capacity and high static down thrust, displaces the soil laterally, with virtually no spoil or vibration. The displacement auger is pushed into the ground to the required depth resulting in an increment of the density of the surrounding soils.



Hollow stem displacement auger

During the auger extraction process, a column is developed by grouting under controlled limited pressure (less than 5 bars) through the stem of the displacement auger to achieve a predetermined stiffness ratio with the surrounding soil. The result is a composite soil/cement ground improvement system. Current practice is to install columns with diameter varying between 250 and 450 mm.

Controlled Modulus Columns are designed, performed and controlled according specifications that were validated by bureau VERITAS.



ADNEC Parking Access Bridge- Abu Dhabi (UAE)

