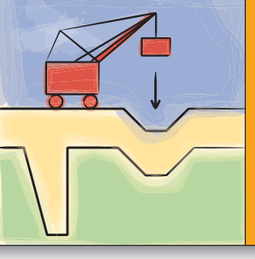


Dynamic Replacement

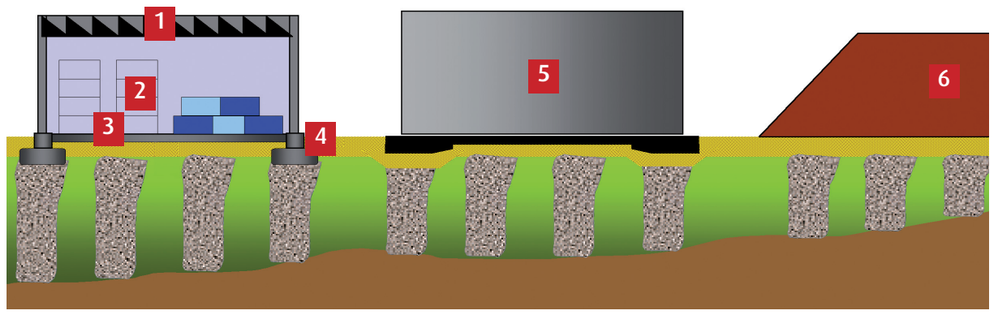
Advantages

- Dynamic Replacement is well adapted to substantial loading conditions (up to 150 tons per column) as well as under embankments to improve the factor of safety against slope failure. With this technique, replacement ratios of up to 20-25% can be achieved;
- While Vibro Stone Columns have a limited range of application is organic soft soils (peat and organic clays), Dynamic Replacement Columns can be used in peat or in soils with high organic content without the risk of bulging due to their relatively low slenderness (ratio of height over diameter);
- Dynamic Replacement Columns can increase the time rate of consolidation due to their draining potential;
- Very efficient and high production rate can be achieved.

Applications

Dynamic Replacement has been successfully used in the following applications :

- Stability and settlement control for road and railway embankments;
- Foundation of commercial and industrial buildings, ...
- Stabilisation of landfills.



Classical applications

1/ Steel or concrete structures **2/** Logistic platforms and warehouses **3/** Slabs-on-grade
4/ Shallow, spread and strip footings **5/** Heavy storage and tanks **6/** Embankments

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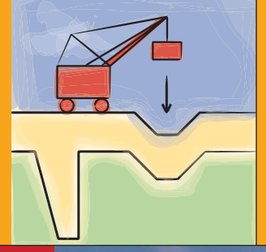
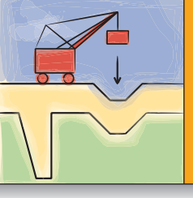


Dynamic Replacement

Dynamic Replacement is an extension of Dynamic Compaction to highly compressible and weak soils. In this application, the tamping energy drives granular material down into the compressible soils to form large diameter soil reinforcement columns (with diameter around 2 to 3.5 m). Additional improvement can be obtained in the underlying layers through the transmission of the energy of the weight at depth. This method thus combines advantages from both Dynamic Consolidation and Stone Columns by creating large-sized Dynamic Replacement Inclusions with high internal shear resistance.

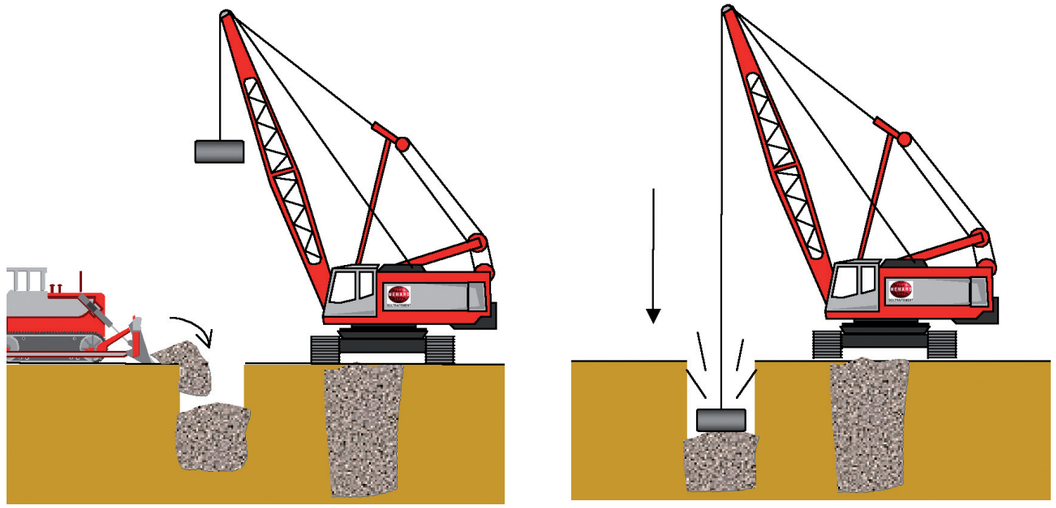
Dynamic Replacement columns are formed by dropping a 10 to 35 tons pounders from heights ranging from 10 to 30 m . With this technique, replacement ratios of up to 20 to 25% can be achieved. Each Dynamic Replacement Column can support loads of up to about 150 tons.

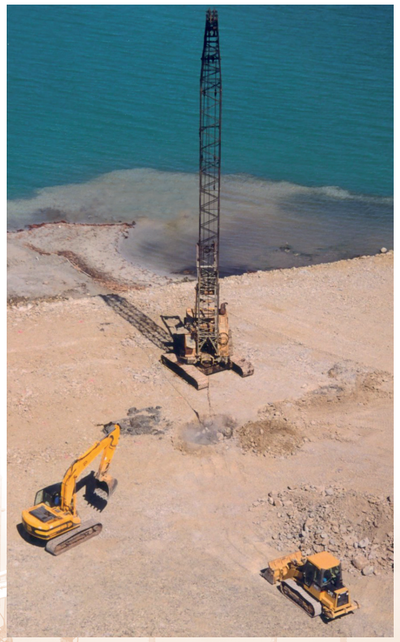


Dynamic Replacement

Implementation and methods

Dynamic Replacement Columns are formed using a process described in the sketch below, through a succession of tamping and print backfilling phases. The dynamic Replacement process usually uses weights with smaller section as compared to Dynamic Compaction to improve the penetration and punching of the weight through the soft layer.





In some cases, the location of the Dynamic Replacement Columns can be pre-excavated. The excavation is then partially backfilled with a “plug” of granular material. This initial plug is then driven into the soft layer by the tamping energy of the weight to the required depth of treatment. This crater is regularly backfilled with additional granular material between each tamping phase.

Pre-excavation is used in the following cases:

- Presence of dense and compact layers at the surface;
- Need to reach deeper soft layer and create longer Dynamic Replacement Columns;
- To minimize heaving of the surrounding soils.

The backfill material can be either placed over the whole treatment site before pounding, thus creating a working and load transfer platform once the work is completed, or stockpiled at regularly spaced intervals across the site.

Crater Backfill material

Dynamic replacement can be formed using a large variety of material. Typically a granular fill material (generally up to 400 mm size) with low fines content (usually less than 15%) and free from vegetation or organic matter is recommended. The backfill material is selected for each Project depending on local availability. However, successful jobs have been completed with a large variety of material including demolition debris (without wood, metal and plaster) or crushed granular backfill material with large blocks (up to 400 to 600 mm).

Crater Backfill to carry on Dynamic Replacement columns.
Terminal Container - Beirut (LEBANON).