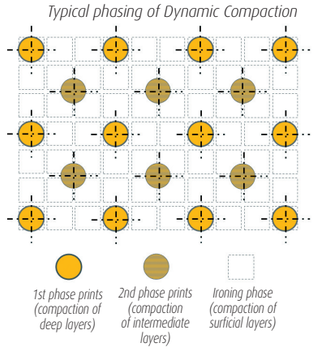
Dynamic Compaction

Typical phasing of Dynamic Compaction



The parameters of the treatment such as spacing between impacts, number of drops per location, number of compaction phases..., are usually confirmed on site during the pilot test area (calibration zone) that can include confirmatory testing such as weight penetration tests, global settlement measurement and in-situ testing. Dynamic Compaction is performed in phases until the achievement of design requirements, usually requiring several compaction phases with a final ironing phase of lower energy high density drops.

Very high energy of Dynamic Compaction (4000 T.m) Nice Airport (1978)

Applications

- Treatment for industrial warehouses, port and airport platforms, road and railways embankments, heavy storage, tanks;
- Well adapted to the treatment of non-organic heterogeneous fill or made ground containing larges blocks that can create obstructions for inclusions and columns solutions (Stone Columns, Rigid Inclusions...);
- Well adapted to the improvement of very large flat platform because of very high production rates (> 10,000 m²/month);
- Well adapted and commonly used for liquefaction mitigation.
- Well adapted for improvement of land fills.

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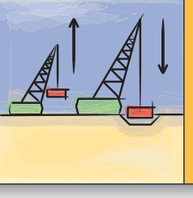
Dynamic Compaction

The Dynamic Compaction Technique achieves deep ground densification using the dynamic effects of high energy impacts resulting from the drop of large pounders. The technique was invented and developed by Mr. Louis MENARD. Since the late 60's, The MENARD company has applied this technique to thousands of sites for very different types of structures and conditions (port and airport platforms, heavy storage, buildings, landfills...).

The basic principle behind the technique consists in the transmission of high energy waves through a compressible soil layer in order to improve at depth its geotechnical properties. Dynamic Compaction is usually associated with an intensive in-situ testing program in order to verify that the required improvement has been achieved.

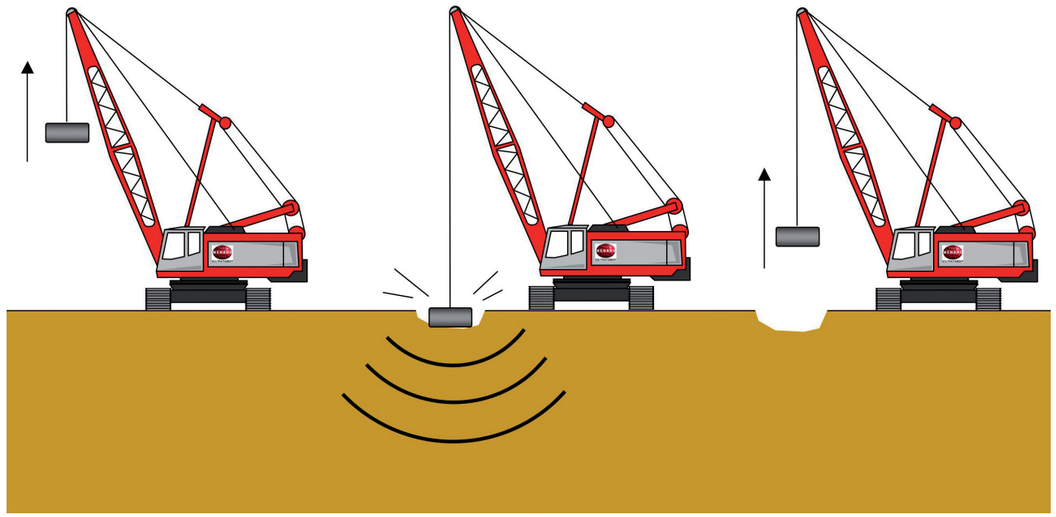
Dynamic Compaction is applicable in any type of granular soils. This technique is particularly well-adapted to non-organic heterogeneous fill, made ground and reclamation areas with variable characteristics, even with the presence of large blocks.
Dynamic Compaction is effective in both unsaturated and saturated soils below the water table.

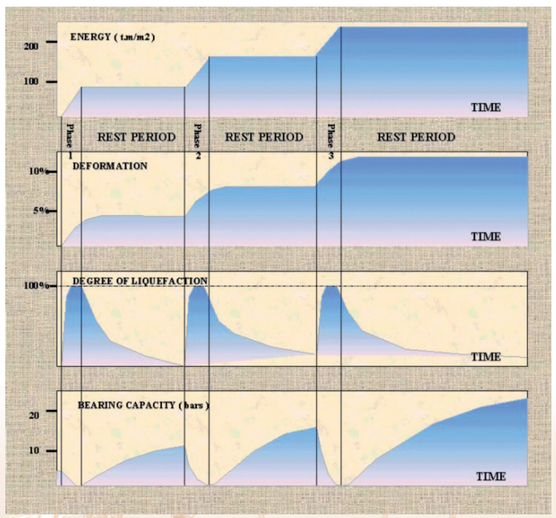


Dynamic Compaction

Implementation and methods

Pounders weighing 10 to 40 tons are released in free or quasi-free fall, from a height of 10 to 30 meters. The arrangement of the impact points and the other parameters of the treatment (unit energy, phasing..) depend on the characteristics of the soils and the improvement required to support the structure within the settlement tolerances. For regular energy, crawler cranes weighing 80 to 120 tons are mobilized with features specially designed for this purpose.





During Dynamic Compaction, an immediate effect and a differed phenomenon can usually be distinguished:

1) The immediate effect,
predominant in most cases, result in an instantaneous reduction of the void ratio of the soil which is directly measured on site by the global settlement after impact.

2) A slower differed phenomenon
can occurs in certain type of saturated soils. The high energy impact can result in a sudden increase in the pore water pressure that can create partial temporary liquefaction of the soil. This pressure build up is rapidly followed by a dissipation or rest period during which the grains of the soil structure are reorganized into a denser state.

High Energy Dynamic Compaction

For compaction of soil to depths exceeding 10 to 12 m, High Energy Dynamic Compaction (HEDC) can be performed. High compaction energy of more than 600 T.m is achieved using specialized equipment (weights > 30 tons, drop heights > 30 m, Cranes > 120 tons).

For this type of application, very specialized equipments are generally used in order to be achieve maximum efficiency with the complete free fall of the weight, generally through the use of a specially designed weight release system (hydraulic clamps, hooks..). After an initial phase with equal acceleration, the clamping device releases the weight in total free fall (no damping or friction effect from the winches or cables). After the impact, the device grabs the weight to lift it back and repeat a new cycle (MARS system).

For treatment at great depth, the design of the different compaction phases is particularly important to obtain an homogeneous compaction over the whole thickness of the soil mass.