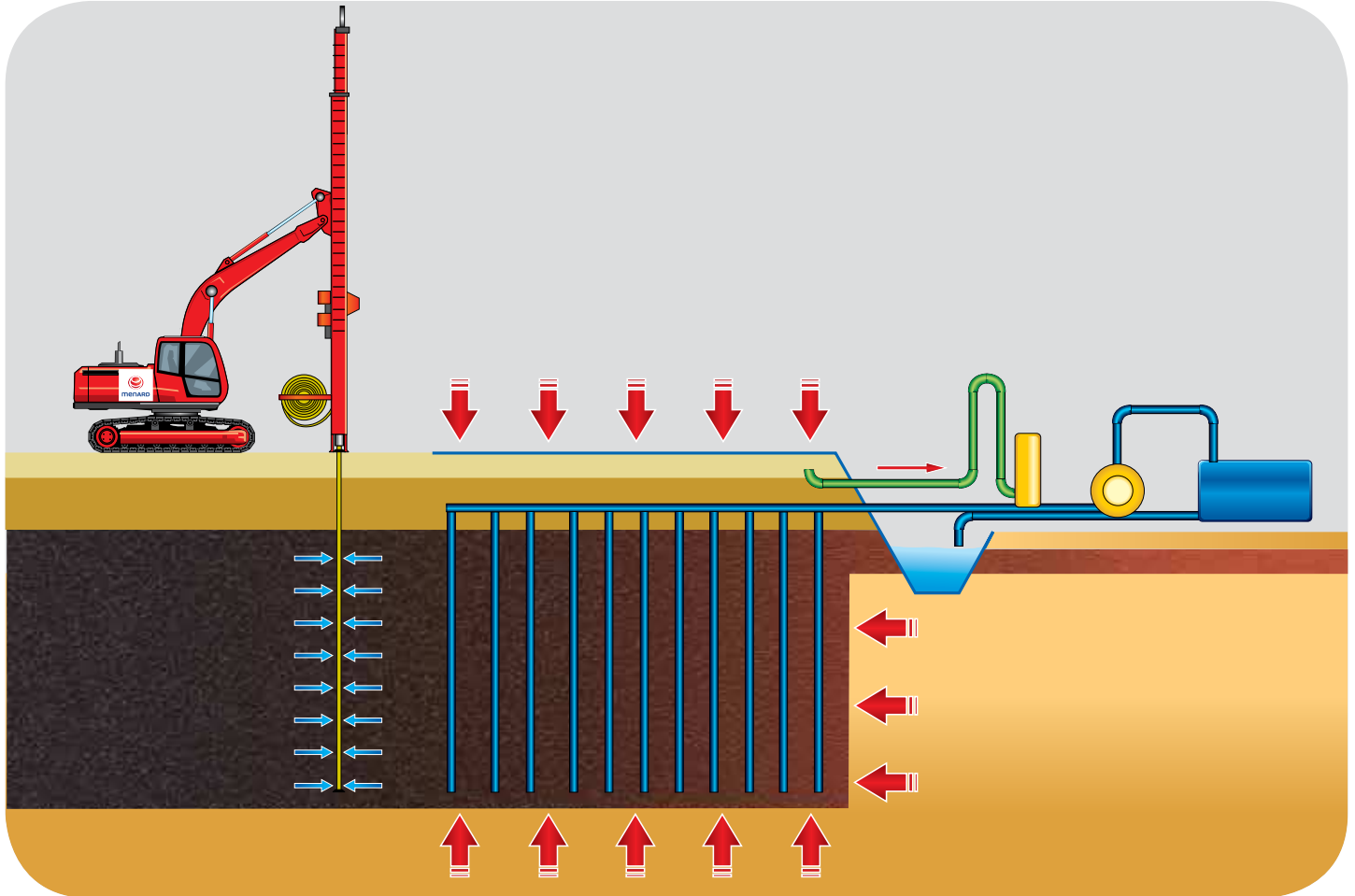


Menard Vacuum (MV)



The Menard Vacuum (MV) consolidation process was developed and implemented at the end of 1980s by Menard company and allowed effective use of vacuum pumps to accelerate the weak soil compression. This technology is an alternative solution used for improvement of weak subsoil compared to the conventional consolidation by the embankment along with overload and vertical drains.



Technology specification

The application of the Menard Vacuum consolidation method requires initial preparation of the subsoil for entrance of heavy equipment installing vertical drains. For this purpose, a sand layer with sufficient thickness is formed, which at the same time acts as a working platform and drainage. Later, a grid of horizontal drains is installed, which connects vertical drains with the pump station. The consolidated area is bordered with an open drain along with a narrow excavation filled with bentonite in order to separate the area intended for improvement. Then, the pumping system creates underpressure under the membrane causing the accelerated isotropic consolidation in the soil mass. The pressure with a value of 1 bar equals to approximately 100 kN/m^2 , which corresponds to the pressure exerted by a 5 meter high surcharge embankment. For calculations 80% of this value is assumed.

An important point in the process is the installation of the metering instruments – observation wells, inclinometers, a manometer and datum points. This allows for constant monitoring of the consolidation progress. The pumping process terminates when the planned settlements or assumed parameters are achieved (porosity ratio, shear strength). The Menard Vacuum method takes time and typically the whole process takes about 6 months. However, the process is not considerably dependant on the soil parameters as it is with the conventional method, but on the efficiency of the process system. The experience shows that with proper construction planning the application of the Menard Vacuum consolidation technology does not extend the duration of the project.

Application

The MV consolidation technology has a wide range of applications from the construction of roads and highways, areas designated for different types of tanks (for fuels, granular materials) to large spatial areas such as airport terminals or harbor container terminals.

This method is often the only alternative solution to intermediate piling, in particular for organic soils with high moisture content and a thickness exceeding 25.0 m found in the subsoil and existing in large areas. The MV technology can be successfully applied not only to organic soils (peats, aggragate muds, gyttjas), but also to soft cohesive soils (loams) with a thickness of non-bearing soils reaching up to 30 m. Maximum loads transferred to the consolidated soil (after its draining) depend directly on the type, degree of the consolidation and the nature of the structure.

Taking into account the technical and economical aspects of this technology the application of underpressure for the compressive soil consolidation leads to economical and safe solutions.

Projects

Enclosed buildings:

Residential buildings, office buildings:

- Aircraft factory EADS AIRBUS Hamburg, Germany, 238,000 m²

Infrastructure:

Road and rail embankments:

- A837 highway (stage I and stage II), France, 44,500 m² and 10,000 m²
- RN1-RD1 road, Guadalupe, 6,150 m²
- Calais Eurotunnel highway, France, 56,909 m²
- Access roads to the Quebec bridge, Canada, 1,000 m²

Special structures:

Wastewater treatment plants, silos, tanks, wind farms:

- Container Terminal, Lubeck Port, Germany, 22,500 m²
- Sewerage system, Khimae STP, South Korea, 83,580 m²
- Container Terminal, Kuching Port, Malaysia, 12,000 m²
- Pump station, Khimae PS, South Korea, 20,000 m²
- Container Terminal, Wismar Port, Germany, 15,000 m²
- Wastewater treatment plant, Jangyoo STP, South Korea, 70,000 m²
- EPEC Power Plant, Thailand, 30,000 m²





Advantages:

- Economy** – the main idea of the Menard Vacuum consolidation technology, i.e. possibly maximum use of the soil bearing capacity, makes the MV technology one of the most economically beneficial soil improvement method. The additional advantage is the elimination of the horizontal displacements which significantly reduces the quantity of the soil material used for surcharge filling. Therefore, the cost of the road embankment construction is significantly reduced.
- Effectiveness in the macro scale** – the Menard Vacuum consolidation technology allows for effective and safe improvement of the subsoil in the area of 50,000 m² and more.
- Performance scale** – one of few technologies of the soil improvement applied for non-bearing layers with a thickness even up to 50 m.
- Time saving** – the MV technology is time saving compared to other consolidation methods. Next stages of the construction project can be implemented even two weeks after commencing the vacuum soil consolidation.
- Environmentally friendly** – the use of the vacuum consolidation technology does not require concrete additions or cement injections.

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