AD-TECH CONSTRUCTION

PAVEMENT JACKING ■ COMPACTION GROUTING
SUBSEALING ■ SOIL STABILIZATION
GUNITING ■ CAULKING

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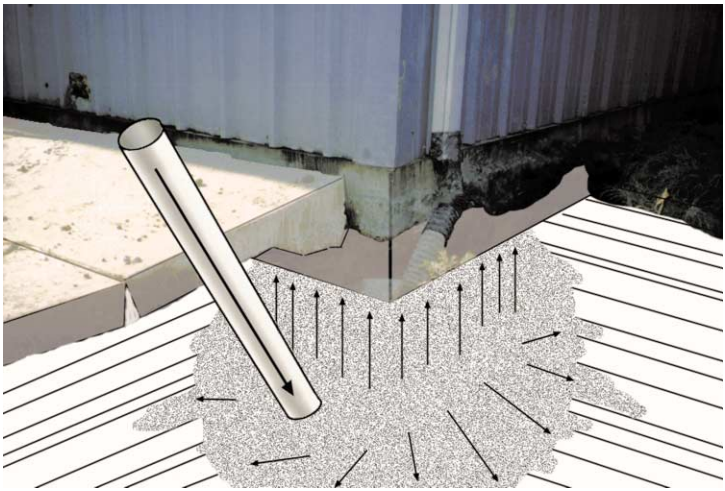
21594 S. Springwater Rd.
Estacada, Oregon 97023

A portion of this sidewalk settled approximately 2" as evidenced by the stringline and measuring tape in the photograph above. The photo above also shows the grout packer inserted in a hole drilled in the concrete pad. Grout is pumped into the hole to fill voids under the pad. The photo at right shows additional grout pipes inserted into the ground next to the walkway. Grout is pumped into these pipes to consolidate the soils beneath the walkway and increase load-bearing capacity of the subsoils. The walkway was leveled and brought up to proper grade with the injection of grout.



Due to settlement and erosion of landfill subsoils, a warehouse structure settled over 8" on one side. Grout pipes were placed at regular intervals in the ground around the foundation to stabilize the subsoils and increase loadbearing capacity. Holes were drilled in the concrete pad to fill voids and lift the structure to desired grade. A vacuum attachment (right) is used to minimize concrete dust generated by the drilling process.

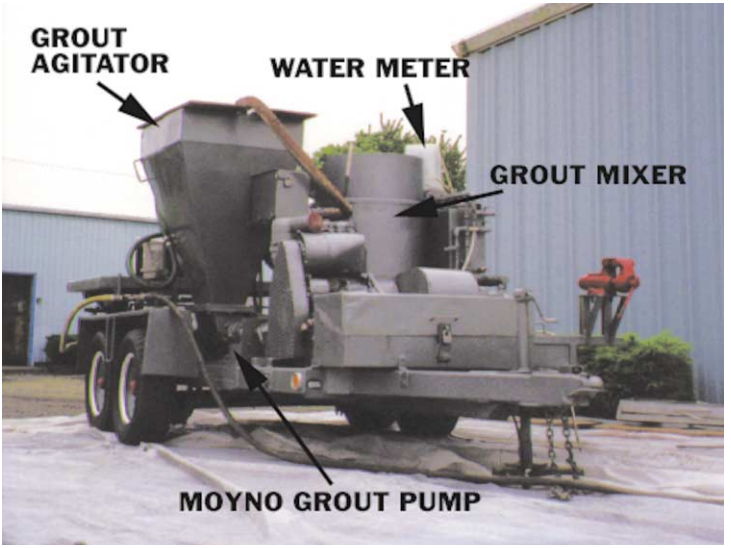
As illustrated above, the pressure of the grout pumped through pipes placed beneath the foundation fills voids and consolidates soils and landfill materials in the subsoil which caused foundation settling and cracking. Grout pipes are placed at regular intervals and pumping pressures are closely monitored as the grout raises the concrete floor to the desired elevation.

Densities and load-bearing capacities of silty soils under this cement plant (above) were less than anticipated and the tremendous weight of the twin silos, loading and unloading of the tractor-trailer rigs and railcars caused twisting and flexing of the concrete pads. Grout was pumped beneath the structure to stabilize the soil and raise the structure.

The concrete cantilever deck surrounding this swimming pool (above right) settled around the outside perimeter. The concrete slab tilted away from the pool causing a wide gap to appear above the pool tile. The deck was successfully raised and leveled to its original elevation with a cement-pozzolan grout pumped through 1 ½" injection pipes.

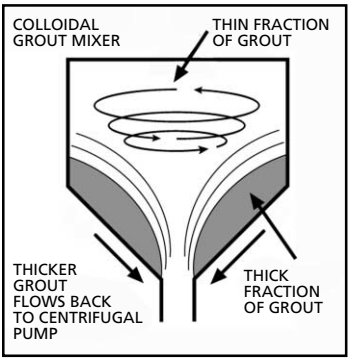
Washington Department of Transportation: Several concrete pavement sags were raised to grade by injecting grout beneath the slabs. An experienced grouting technician monitors the packer during the pressure grouting process. The packer is inserted in holes drilled in the concrete allowing the grout to be pumped under the slab. Controlled grout pressure raises the pavement to the desired grade.

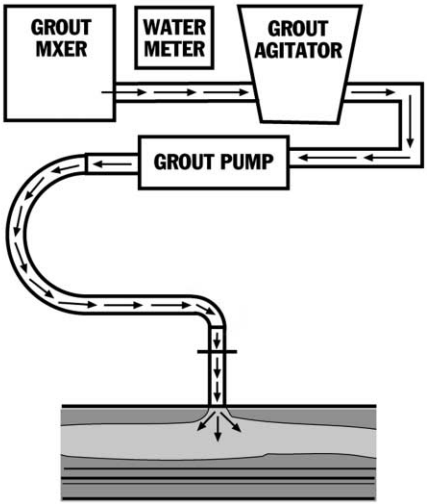
Voids under Washington I-90 were filled with a pressure grouting mixture of cement and fly ash. Precision instruments monitor the grout pressure and any movement of the concrete slab. The grout fills voids and soft spots in the subsurface roadbed structure without raising the concrete slabs. The cured grout provides additional supportive strength to the slab and may prevent future settling, cracks or failure of the concrete pavement.



Grout Mixer

The "colloidal" mixer works by recirculating the grout through a centrifugal pump. The pump, which operates a high speeds, imparts a shearing force to the grout as it passes through the narrow steel pump casing. The pump discharges the grout tangentially into a vertical cylindrical tank causing a vortex to form. The centrifugal force created throws the heavier, unmixed grout fraction of grout against the tank walls, where it then runs down the wall and reenters the pump for further mixing. The speed of mixing and the high output capacity are important attributes of colloidal mixers. Additionally, the mixing action of the colloidal mixer produces grout with superior properties compared to grout mixed in paddle mixers. Currently, the trend is to specify colloidal mixers rather than paddle mixers in contract documents for all grouting.





Agitator

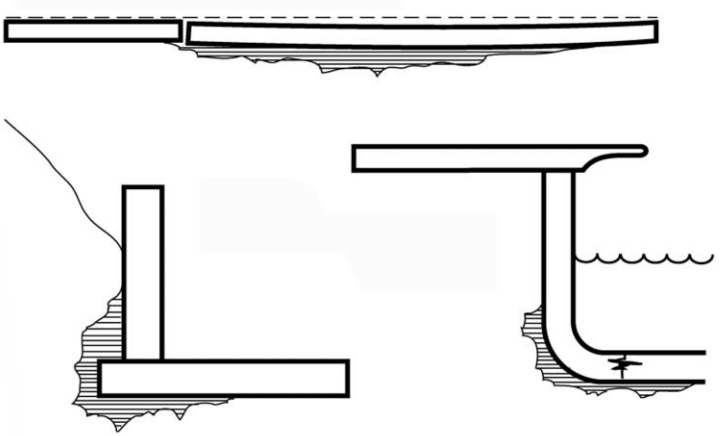
An agitator is a storage tank where the thoroughly mixed grout from the colloidal mixer is stirred by a slowly revolving paddle to keep the particles of unstable grout in suspension while awaiting injection.

Water Meter

The water meter is used to accurately measure the amount of water added to the grout mix. The meter allows a precise and consistent measure of water to grout-mix ratio enabling a continuous flow of grout with the desired slump.

Pump

Commonly referred to as a "Moyno pump", the progressing helical cavity pump produces a continuous, uniform flow of grout into a hole at a relatively constant pressure. The quantity and pressure of grout entering the grout delivery line can be controlled with the grout bypass line. By using a valve to control flow, the bypass line returns grout from the pump discharge back into the mixer or agitator before it enters the grout delivery line. A diesel engine used to power the Moyno pump and engine rpm is used to control pump speed, output and pressure.



Permeation Grouting

In permeation grouting, grout is injected into the pore spaces of the soil. The technique is used to control water or to improve the structure of the soil. A typical cemetitious grout mix consists of cement, bentonite, and water. Fillers such as fly ash and fine sand are often used when grouting gravel or coarse sandy gravel to reduce material costs. Types I and II portland cement are most commonly used. Type III high-early portland cement and ultrafine cements are used to grout fine-graded soil.

Hydrofracture Grouting

The hydrofracture, or soil-fracture, grouting method involves locally confined and controlled fracturing of a soil unit by injecting a stable but fluid, cement-based grout at high pressure and is used primarily to increase the bearing capacity and shear resistance of the soil.

Consolidation Grouting

Consolidation grouting involves filling open joints, separated bedding planes, faulted zones, cavities, and other defects in the rock. Consolidation grouting strengthens foundation materials and reduces the flow of groundwater into the structure.

Structural Grouting

Structural grouting is used to improve the ground-structure interface by filling any voids left by the construction process. The filling of voids helps ensure full contact, thus maximizing the transfer of loads between the foundation material and the structure.

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Ground-Penetrating RADAR
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August 27, 1987

To whom it may concern:

For a number of years I have called upon Lynn Peterson to handle demanding grouting jobs and have been impressed with his depth of experience and his skillfull approach to the art of lifting building components with grout.

Conventional wisdom is that building components are best lifted by using "compaction grouting" with zero-slump grout. The idea is that the thick grout stays in a ball so its pressure is used in lifting. Liquid grout is looked upon as unpredictable, and likely to lance out in unknown directions and be wasted.

Lynn Peterson and I have been developing the idea of carefully injecting liquid grout slowly enough that a pond or lens is formed where needed. The escape of fresh, new grout is constrained by the partial hardening of the older grout and the use of liquid grout allows structural lifting to occur at very low grout pressures.

Shallow applications of this concept are used where a firm underlying base is present and there is no danger of the weight of the grout causing additional settlement. Here a number of grout pipes are put down in the area of interest and small amounts of grout are sequentially injected until a pond or lens is formed and grout injected into one pipe comes out another. This grout is allowed to start hardening and then the avenue of escape for any new grout is upward and in toward the center of the lens. By using a surveyor's level to monitor the lifting of various parts of the structure, injections are made into the various pipes to equalize and coordinate the lifting. If pressure drops, or grout is injected to no effect, work is stopped and time is given for more partial hardening to take place before pumping is resumed.

For deep applications of this concept the best description is "table top and table legs", and it is suited to the alternating firm and soft layers in the north Portland area. Sections of grout pipe are successively pushed down until they have penetrated several feet into a firm layer at depth. In effect, the pipe performs its own penetration test, and it is pushed to near refusal. Grout is then injected while the pipe is slowly jacked upward. In a firm soil layer the grout is not able to laterally expand the hole so the excess grout rises along the pipe until a soft layer is reached,

and then lateral spreading occurs. The thicker the firm layer is, the wider out the grout spreads on top of it. After the tip of the pipe gets up into the soft layer a vertical column is formed whose diameter is determined by the rate of injection and of jacking.

As the tip of the pipe enters the bottom of an intermediate firm layer, the grout spreads out along the bottom of the layer. After the pipe rises more than halfway through the layer, the grout starts coming out on top of the layer. In this manner there is no detrimental effect of the grout necking down because, instead of a column, two footing pads are formed.

It is emphasized that these marvelous things happen only when the operation is conducted slowly enough that partial hardening is taking place only a short distance below where the new grout is being injected. The way this is done in practice is to work sequentially and simultaneously on all the "table legs".

After all the "table legs" are brought up closely under the area to be lifted, more partial hardening is allowed, and then the "table top" or lens of grout is formed as in shallow applications.

There is no magic in this concept that requires the displacement of the present soils engineer by another. The present soils engineer is perfectly capable of calculating where and how many "table legs" are to be formed, and what diameter they should be. All that needs to be done is to give this information to Lynn Peterson, and he does the rest.

My own personal satisfaction in urging adoption of this general approach to grout lifting problems would come from seeing fewer of these cliff-hanging exercises in isostasy and more settlement problems solved permanently on the first try.

Very truly yours,

REGISTERED PROFESSIONAL ENGINEER 8687 OREGON JULY 8 1966 JOHN K. McDONALD

John K. McDonald

SPECIALTY CONTRACTOR

Ad Tech Construction is a specialty contractor with experience and equipment to do pressure grouting, guniting, caulking and swimming pool plastering. All classes of work utilize similar equipment in various sizes. The diversity of equipment and experience within a specialized field can save additional time and /or money on some projects.

PAVEMENT JACKING Fills voids and raises the slab to desired grade.

COMPACTION GROUTING Consolidates and strengthens foundation soils under buildings, bridge piers and equipment. Increases shear strength in soils for excavation and tunneling. Controls ground water in soils and rock at dam sites and mines.

SUBSEALING Fills voids under the pavement without lifting the slab.

SOIL STABILIZATION Reduces soil permeability and improves stability.

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