

Pressure Grouting



Fig-1: Cavity Probing and Pressure Grouting works for a site in Al-Hufoof



Fig-2: Inflatable Packer for Pressure grouting.



Fig-3: Pressure Grouting Set-up for a site in Al-Hufoof.

Grouting is the injection of pumpable materials into a soil or rock formation under pressure to change the physical characteristics of the natural formation.

Bullivant Arabia Ltd. brings the same high quality technical expertise to its Pressure Grouting and Cavity Probing technology coupled with extensive equipment resources and proven project experience. It allows us to respond quickly to provide the right grouting solution for your needs. Our commitment to excellence is reflected in the successful completion of projects ranging from residential villas, to large industrial plant foundations.

Bullivant Arabia Ltd. offers the appropriate grouting solution needed for any subsurface conditions, together with innovative methods of drilling and coring through slabs and existing foundations. We also have the capability of combining our ground improvement grouting techniques with one or more of our other minipile technologies to meet unique or complex project requirements cost-effectively and efficiently.

Site Investigation

For successful grouting operation, comprehensive knowledge of subsurface conditions is important. In order to prepare a suitable design and program, a Geotechnical Engineer will develop a site investigation report, which will generally contain site geology and history, soil gradation, and in situ horizontal permeability of each treatment stratum. Type and condition of nearby structures and utilities, together with plan and elevation locations, will further assist program development.

Grouting Applications

- Arresting Structural Settlement of existing Structures under floor slabs and footings.
- Pressure Grouting for cavities and fissures.
- Preventing collapse of Granular soils.
- Increasing soil strength and rigidity.
- Reducing/arresting ground movements.
- Filling voids, cracks fissures in natural rock formations.
- Curtain and compaction grouting for Dams and Reservoirs.

Geotechnical Considerations

Several conditions must exist in order for Pressure grouting to yield its best results:

- Grout hole Location and Geometry.
- Injection rates and Pressure.
- Grout Properties: liquid, transition, set.
- The grout injection rate should be slow enough to allow pore pressure dissipation.

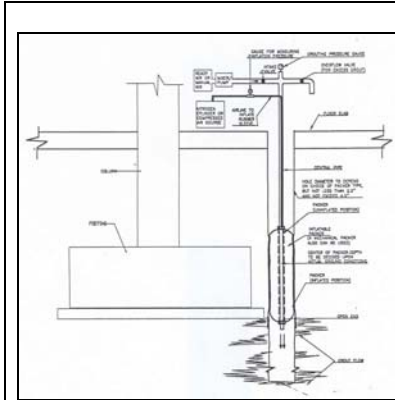


Fig-4: Pressure Grouting Under an existing Footing.

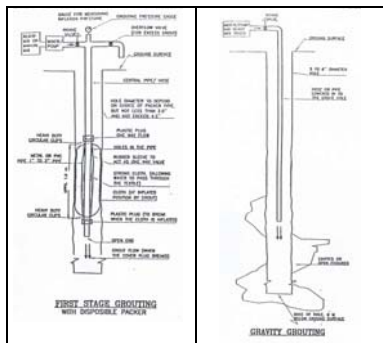


Fig-5: Grouting Details-1

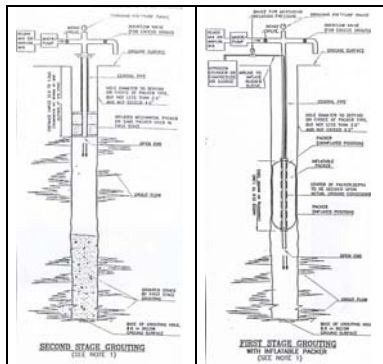


Fig-6: Dust Extractor-2

- Sequencing of grout injection is also important. If the soil is not near saturation, grouting can usually be effective in most silts and sands.
- Soils that lose strength during remolding (saturated, fine-grained soils; sensitive clays) should be avoided.
- Greater displacement will occur in weaker soil strata. Exhumed grout bulbs confirm that grouting focuses improvement where it is most needed.
- Collapsible soils can usually be treated effectively with the addition of water during drilling prior to grout injection.

Advantages of Pressure Grouting

- Pinpoint treatment
- Speed of installation
- Wide applications range
- Effective in a variety of soil and ground conditions
- Can be performed in very tight access and low headroom conditions
- Non-hazardous
- No waste spoil disposal
- No need to connect to footing or column
- Non-destructive and adaptable to existing foundations
- Economic alternative to removal and replacement of loose and low bearing soil
- Able to reach depths unattainable by other methods
- Enhanced control and effectiveness of in situ treatment with inflatable Packers
- Minimal impact to surface environment
- Low noise and vibration

Why should you choose a Bullivant Arabia Ltd. Grouting Solution?

Structural deformation is often the first indicator of a problem at depth. When this happens, owners and their Engineers look for a solution that is fast, effective and economically viable. That solution is often in situ pressure grouting under the Foundations. But Pressure grouting is much more than just a structural remediation tool. The technique is a useful pre-treatment for karstic site improvement, settlement reduction, tunneling and liquefaction mitigation. The range of applications, the ability to treat a variety of subsurface conditions and a proven history of success has made pressure grouting the solution of choice for numerous projects.

As a leading **Specialist Structural & Geotechnical Engineering Contractor** in Saudi Arabia, with more than 15 years of experience in Pressure Grouting technology, Bullivant Arabia Ltd. has the experience, expertise, equipment and resources to provide the quality solution to your geotechnical problem.

Arresting Structural Settlement of existing Structures under floor slabs and footings

Description: Stabilization or upgrading of an existing floor slab can be done by drilling through the slab and injecting connections grout under pressure to fill the voids in the fill, consolidate the under slab fill and potentially lift the settled floor slab in certain favorable instances.

Loading capacities: Loading is based upon the bearing strata. Grouts of varying strengths may be used to enhance or stabilize to the level of bearing capacity of the strata immediately underlying the floor slab. Further upgrading would be achieved by combining pressure grouting with minipiling.

Objective: To stabilize the grade slab affected by excessive settlement or to accommodate additional loading on the grade slab.

Application:

a) Floor slab stabilization – Grout mixes can be introduced under pressure to consolidate the under slab loose material and any voids that may exist. In some instances the pressure grouting process can be used to raise the defected slab into the correct position.

b) Floor slab upgrading – Particularly applicable in industrial situations where enhancement of the load carrying capacity of a floor slab may be required and the quality of the under slab fill is capable of being upgraded by grout injection.

Minipiling may be necessary to combine with pressure grouting to attain the final solution.

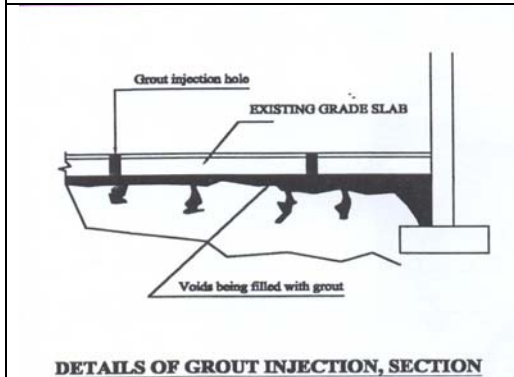
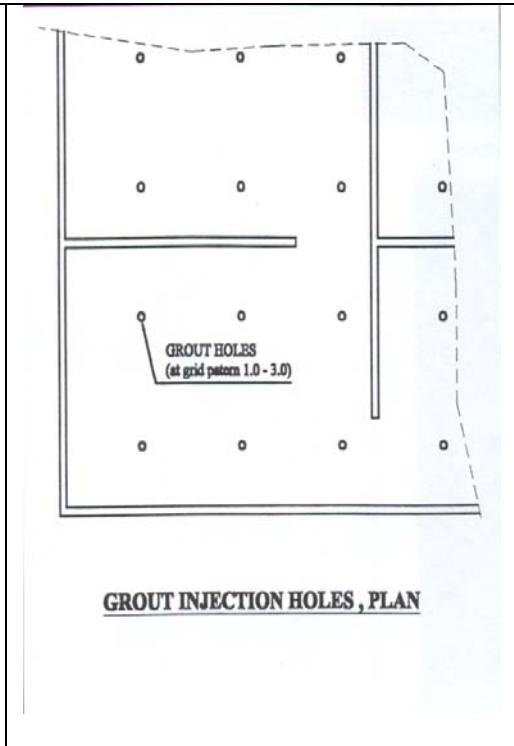
Installation procedure: Holes to a pre-determined grid pattern can be drilled across the slab to be stabilized. The pattern will be determined from trial hole investigations and an assessment of the location of the voids. The pattern is normally a grid of 1.0 X 1.0 to 3.0 X 3.0m. Grout mixes constituents and pressure will all depend upon loading requirement and quality of under slab fill. Grout injection holes are sealed temporarily until initial "set" has taken place.

Advantages:

1. Fast operation.
2. Efficient way of stabilizing floor slab or upgrading without undue disruption or disturbance.
3. Considerable cost savings achieved by lifting settled slabs, minimizing screed and finishing replacement.

Typical projects undertaken:

1. King Abdulaziz Military Academy – Several floor slabs, Riyadh.
2. Several residential villas, Riyadh.
3. National Guard, Riyadh.



Pressure Grouting for cavities and fissures

Description: Filling the cavities or fissures within a soil or rock mass by means of injecting a grout mix under pressure using a packer and a grout pump.

Applications:

1. To fill the voids or cavities encountered in a fill or rock mass under an existing building which causes settlement problems to the building.
2. To fill the voids or cavities under the foundation area of a proposed building to increase the bearing capacity of the underlying strata below the footing.
3. To pressure grout existing embankments as dam embankment.

Equipment:

1. Drilling rigs with associated supporting machinery as power packs, compressors and dust extractors.
2. Grout mixer and pump with grout hoses.
3. Inflatable or mechanical packers and extension rods.

Grouting material: The grout material shall consist of OPC, sand and water with an admixture for flow if necessary. The mix ratio shall be 1:1:1 in general or as may be modified at the site based on grout intake data.

Type of packer, location of packer & grouting pressure: Packers are available as compressed air inflated or nitrogen inflated packers, mechanical packers or disposable packers. Grouting in a particular hole can be done in a single stage or in multiple stages, the multistage can be done in a descending or ascending stage. The selection of type of packers, number of stages of grouting, the location of packers at each stage and the grouting pressure, all depend on the nature of the soil strata, as recorded in the pre-grouting probe holes.

Procedure:

1. Probe holes/grout holes are drilled using drill rigs.
2. Insert the packer at the specified depth and inflate it.
3. Pump the design grout mix under pressure until the specified pressure is attained.
4. Remove the packer and seal balance length of hole.

Control of Grout mixes: Regular sampling and testing of the grout shall be carried out to ensure that it confirms with the design properties.

Post Grouting Tests: Post grouting test holes can be drilled at selected locations to verify the extent of grout ingress in the voids or fissures.

Advantages:

1. Suitable for filling the fissures or voids under proposed structures.
2. Suitable for supporting of existing building with settlement.
3. Suitable for existing earth dam embankments.

Typical projects undertaken:

1. Residential villa, Riyadh.
2. SCECO Substation, Al – Hafouf.

