What is grouting in construction | Purposes, and Application of grouting

What is grouting in construction?

The process of filling gaps, space, or joints between two materials like stones, tiles, marbles, etc is known as grouting in construction.

Grout is a viscous material (a mixture of cement, water, sand, epoxy, acrylic, and polymer) used as a filler to fill the spaces and joints between ceramics and stone tiles.

In civil engineering, grouting refers to inserting the drainable material inside the structure like soil and rock formation, to change its physical properties.
In short, Grouting is done to control the groundwater during civil engineering works. Grouting is done generally for high permeable soil which may cause seepage above the concrete structure.

**Purpose of grouting in construction**

- Grouting is done for repairing concrete cracks, filling gaps in the tiles, and waterproofing.
- Grouting is done for giving additional strength to the foundation of the load-bearing structure.
- Grouting is done to change the physical properties of the structure.
- Grouting is done for seepage control and preventing landslide.
- Grouting is done to reduce surface subsidence.

**Application of grouting in construction**

- It is used in filling cracks, voids in the natural rock formation
- It is used in pressure grouting in the case of cavities and fissures.
- It is used in preventing the collapse of granular soil
- It is used in dams and Reservoir for curtain and compaction.
- It increases soil stability, strength, and rigidity
Advantages of grouting:

1. Grouting can be applied in almost every ground condition.
2. Grouting can be done in limited space.
3. Grouting doesn’t produce vibration and handling carefully can avoid structural damage.
4. Helps to measure the improvement of in-ground structures.
5. It helps to control seepage, groundwater flow.

Types of grouting in construction

A) Types of grouting based on the material used:

1) Cement grouting:

Cement grouting is done to seal a wide crack especially in
gravity dams, canal linings, foundation, and thick concrete wall. This is general grouting in construction.

It is composed of neat cement and water or mixture of a sand (4 parts) to cement (1 parts).

Before injecting, holes are bored around the field to be excavated with a thin grout. The viscosity is then increased by reducing the water-cement ratio. To ensure the complete grouting, secondary holes are bored between the primary holes.

**Cement grouting is further divided into:**

- Ordinary Portland cement grouting
- Microfine cement grouting
- Ultrafine cement grouting

**1.1 Ordinary Portland cement grouting:**

It is commonly used for repairing concrete cracks. Since they have the particulate size of 15 microns they can help in filing the wider cracks.

**1.2 Micro-fine cement grouting:**

Finely ground slag, fine fly ash, or Portland cement are mixed with water to allow penetration into the fine cracks. They have the particulate size in the range of 6 to 10 microns.
1.3 Ultra-fine cement grouting:

This grout is used for sealing the very fine hairline like cracks and have the particulate size of 3 to 5 microns. They are used for stabilizing waste plumes.

How to use white cement to fill gaps?

White cement is used to seal the joints to fill the voids and cracks between the ceramic floors and other materials attached to it. White cement nowadays has been a constant use for filling the voids and gaps, used as an alternative of painting material in the ceiling, etc.

The white cement is mixed with water with the required quantity on how much the tiling needs to be done.

The instruction of the company as instructed in the package
should be followed and the right ratio mix should be made. The mix is mixed properly and applied to the place where the voids and the cracks are to be filled.

2) **Chemical grouts:**

This is a grout that consists of polymers like acrylic, polyurethane, sodium silicates, epoxy, or any other polymer.

It can be introduced into soil pores without any change in original soil volume and structure, and help in changing the support capability of granular soil without disturbing them. This grouting is suitable for tunneling applications without over-excavation.

**Some advantages of chemical grouts:**

- It can easily permeate the deep micro cracks.
- It is stable and reliable.
- It is fast and can be used for emergency repairs.

**Some drawbacks of chemical grout:**

- Only specific types of soil are acceptable,
- Likely to produce pollution.
3) **Bituminous grouting:**

In this method, hot bitumen is used as a grouting material. Hot bitumen is employed associated with solidify based suspension grout. This is often never really grout from spreading and to create the mechanical quality of the finished result.

A hard-oxidized environment friendly, having a high solidification point is used for grouting.

**Process of bituminous grouting**

Firstly, the bitumen is heated up to 200 degrees Celsius. At this time the grout has a dynamic viscosity in the range 15 to 100 cp.

Unlike another grouting, the hot bitumen’s curing is thermally driven. This hot bitumen turns from its fluid state to a highly viscous elastoplastic state, when it is injected into medium saturated water. Finally, when this is injected the pass is plugged.

4) **Resin grouting:**

In traditional resin grout, it is the composition of epoxy resin mixed with the filler. But new type of water-based resin has been recently developed that is better than the traditional ones.
Some advantages of Resin grouting are:

- They set harder
- do not break down easily

Some disadvantages Resin grouting are:

- They are expensive
- May have an aggressive chemical
- Based on the method
- Permeation grouting

It is also known as penetration grouting and is the most conventional grouting for use. This grouting method is used in non-cohesive soil, sand, and other porous media for filling cracks and joints.

It is injected inside the porous medium without disturbing its original structure. It is commonly used in soil and rock deposits to change its geotechnical properties.

There are two types of permeation grouting injecting system:

- Circulating grout system
- Direct grout system

Advantages of permeation grouting:
- Its help to give strength to sand and gravel,
- It helps in the solidification of unstable gravels and sand, at depth up to 60m.
- It fills the voids in the sand.

**B) Types of Grouting based on the the Process**

**1) Compaction grouting:**

Compaction grouting is done to strengthen the subsurface or surface of the permeable soil to reduce the voids and sinkholes.

It is driven to the depth through the drill. Cement, sand, fly ash, and water is then placed from bottom to top according to the pressure criteria. After each step, the drill is lifted up until it is fully taken out. This grouting is commonly called low mobility grouting.

**Uses of compaction grouting:**

- It helps to improve the bearing capacity of soil
- It helps to solve the soil density problem
- It helps in stabilizing underground formations for pipes
- Helps to manage sites with sinkhole activity
Advantages of compaction grouting:

- Rapid installation
- Structural foundation connections not required
- No spoil generation
- Reduce the foundation settlements
- Mitigation of liquefaction potential

2) Bentonite grouting:

Bentonite is made up of the clay having thixotropic properties that is a highly water-resistant gel which forms the permanent barrier to water flow when mixed with additives.

This method is used in the soil particles that cannot accept the cement grouting. This is commonly used for plugging old wells.

It is composed of 50 pounds of powdered bentonite to 34 gallons of water in which 50 pounds of washed sand is added.

3) Fracture grouting:

In this method, grout uses the low viscosity grouts that splits by hydraulic fracture under the high pressure and enters into the cracks by creating the lenses. It is also known as compensation grouting and is commonly used for structural releveling.
Procedure of hydraulic fracture:

In this method, a hydraulically pressurized liquid composed of water, sand, and chemical mixture is used to fracture the rock. Artificial cracks are provided with pre-split holes. Then, the grout is passed down the holes.

The casing is inserted to the fracture section and grouted. A pressurized fluid carrier is inserted into the opening casing and spread throughout fractures. The casing remains open after fracturing.

4) Jet grouting in construction:

This is a process of creating soil concrete column or jet grouted column using high-pressure jet through the nozzle in a borehole.

The specially designed drill stem and the monitor are raised and rotated at slow, smooth, and constant speed cutting the
soil with water or/and air at high pressure to create the soil concrete column. The end product is then cemented round column. This grout is effective for almost soil.

Procedure of jet grouting:

1. Initially, the hole is drilled in the required place and depth.
2. The drill is done until a weak subsoil exists. It may be up to 10 to 20 cm.
3. Then, equipment is placed in the hole to conduct an injection process that consists of a jet grouting string of almost 7 to 10 cm.
4. The string consists of a nozzle to have an injection on high velocity, having a diameter of 1 to 10mm.
5. Then, the string is raised and rotated to seal the whole column with soil and the fluid system. Now, the jetting starts. The string is raised when the fluid is injected. For every raising, there is rotation performed smoothly and constantly. This gives a perfectly refined grouting column.

Types of jet grouting system

a. Single
b. Double
c. Triple fluid system.

Application of jet grouting

• Horizontal barriers
- Groundwater control
- Tunneling
- Supporting excavation
- Underpinning

I hope this post remains helpful for you.

Happy Learning – Civil Concept

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