# Jet Grouting for Underpinning of Structures


***By***

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# SOILCRETE & JET GROUTING

**SOILCRETE IS....**

The material formed by mixing soil with cementitous grout.

**JET GROUTING IS....**

The simultaneous controlled injection of cement grouts to replace soils eroded by high pressure water jets.

# JET GROUTING APPLICATIONS

* Underpinning
* Soil stabilization
* Groundwater control
* Excavation support
* Tunneling subsidence prevention

# JET GROUTING SYSTEMS

I. MIX-IN-PLACE METHOD

II. EXCAVATION AND REPLACEMENT METHOD

- Single-Rod System
- Double-Rod System
- Triple-Rod System

# Equipment for Triple-Rod Jet Grouting

1. Delivery System for Air, Water, and Grout
2. Modified Hydraulic Rotary Drill
3. Grout Batching System
4. Waste Removal System

## Table 3.1) Parameters Used in Jet Grouting.

| Parameters | Diameter | |
|---|---|---|
| | 3.5 ft | 4.0 ft |
| Nozzle Size | (2) 1.9 mm each | (2) 1.9 mm each |
| Water Pressure (bar) | 380 | 380 |
| Air Pressure (bar) | 7 | 7 |
| Grout W/c Ratio | 0.58 | 0.58 |
| Pull Rate ( cm/min) | 40 - 45 | 30 - 35 |
| Rotation Rate (rpm) | 15 | 12 |
| Grout Flow (l/min) | 170 | 170 |

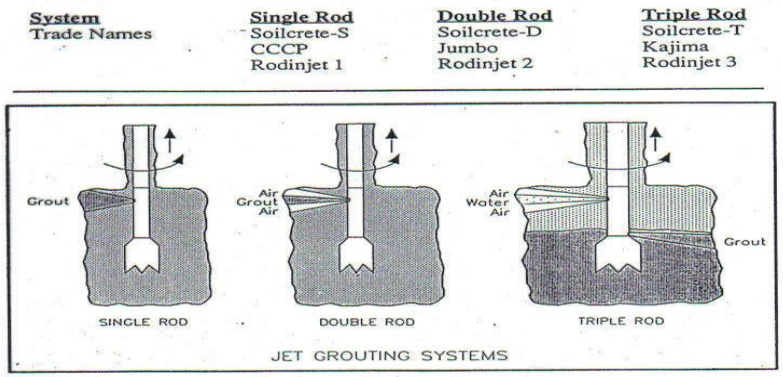
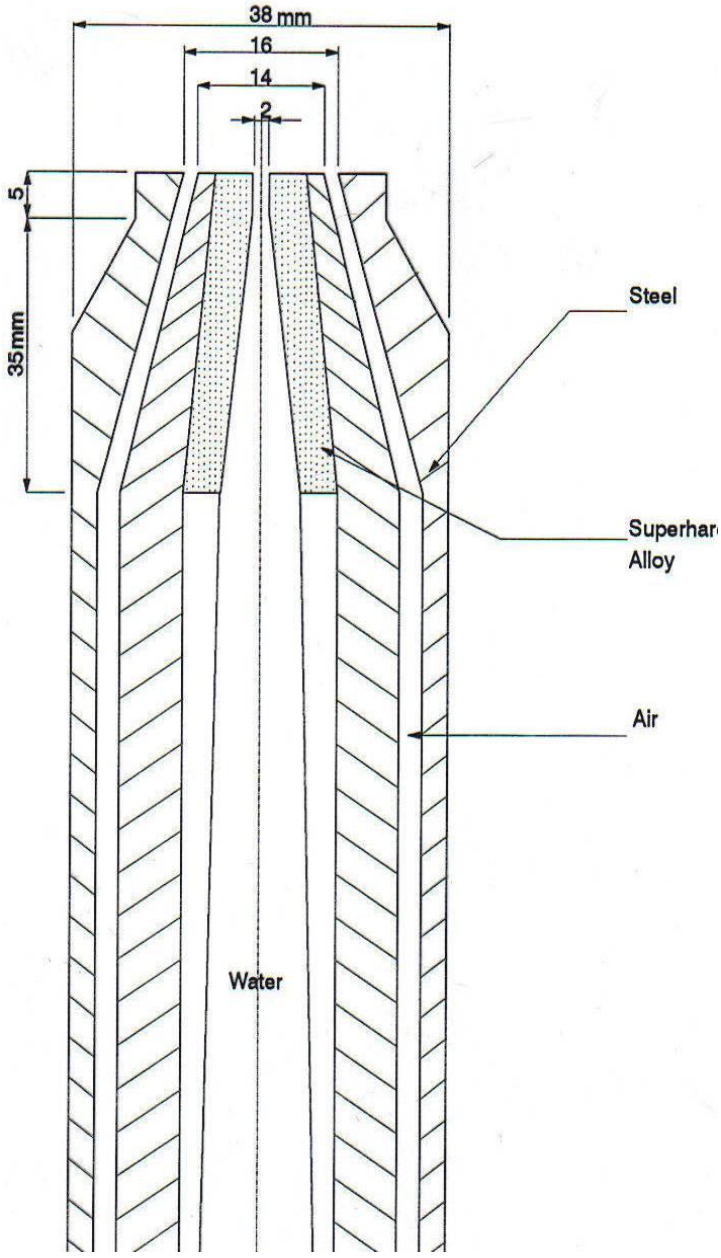



Figure 3.3) Jet Grouting Systems for the Excavation and Replacement Method (Burke 1989)


38 mm
16
14
2
5
35mm
Steel
Superhar
Alloy
Air
Water

# GROUND MODIFICATION APPLICATIONS

I. ***Site Improvement***

*- Reduce future building settlements due to loads, earthquakes, etc.*

*- Permit construction on marginal soils, i.e. loose sands, fills, mine spoils, collapsible soils, expansive soils.*

2. ***Excavation Support***

***- Underpinning***

***- Control tunnel/excavation settlements***

***- Excavation bracing***

3. **Pollution Control**

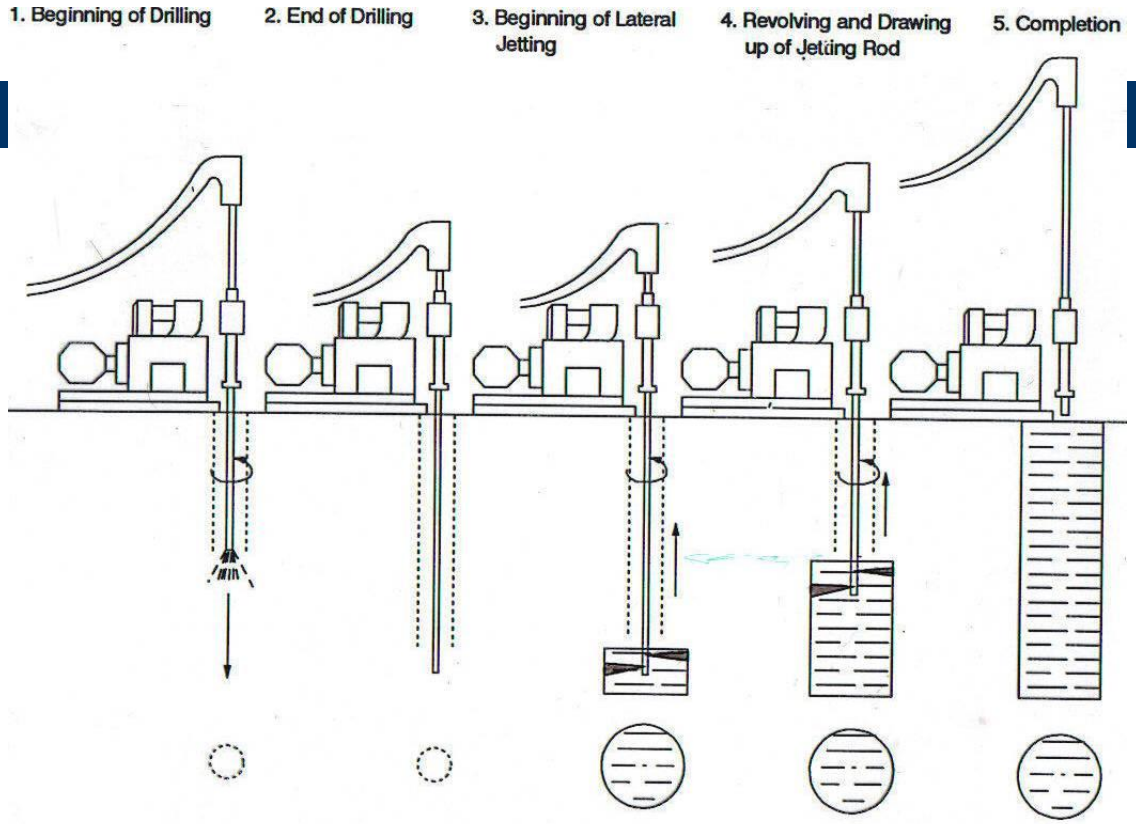
- *Control toxic water*
- *Encapsulate toxic wastes*

4. **Foundation Rehabilitation**

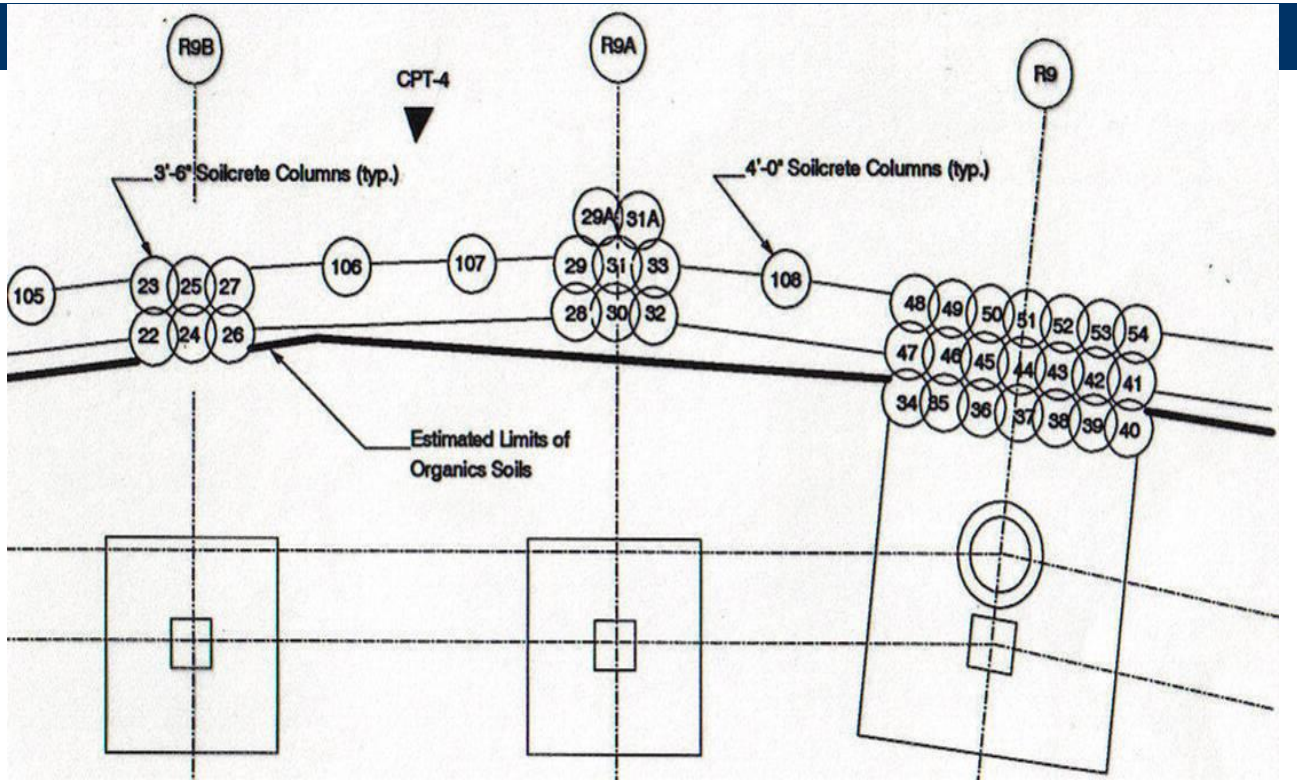
- *Underpinning*
- *Renovation*

5. **Groundwater Control**

- *Control groundwater flow into excavation*
- *Underground waterproofing of structures*




Steps of Jet Grouting Column Construction.


R9B
CPT-4
R9A
R9
3'-6" Soilcrete Columns (typ.)
4'-0" Soilcrete Columns (typ.)
105
23
25
27
22
24
26
106
107
29A
31A
29
31
33
28
30
32
108
48
49
50
51
52
53
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40
Estimated Limits of
Organics Soils

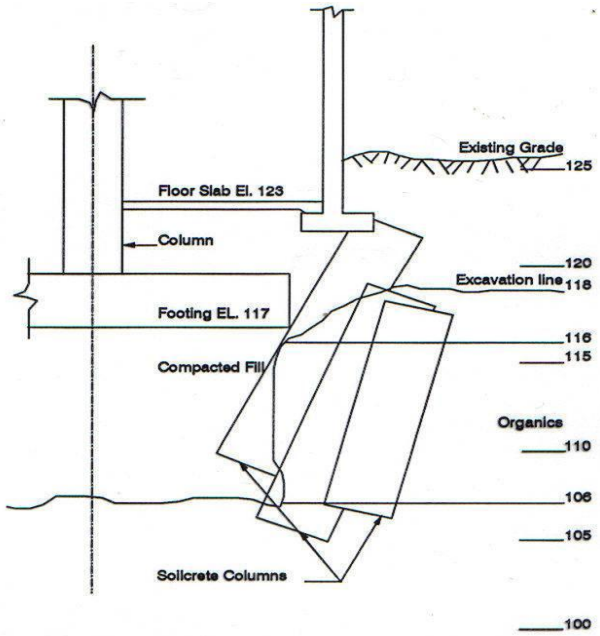


Figure 3.1) Cross Section and Soil Profile Near Footing R10 (Suncoas
Dome Stadium, Tampa, Florida).

# Advantages of Jet Grouting....

a. It is least likely to pressurize the subsurface and heave the ground since the water-soil-air mixture is of lower density and easily flows up the drill annulus as waste.
b. It is an excavation and replacement technique that produces a pre-engineered soil Crete material that is controlled more by the grout mix than by the soil material.
c. It is applicable to a wider range of soil conditions.
d. It permits improving a 2 meter diameter column of soil while requiring only a 13 cm diameter access hole.
e. It can be used indoor and in confined areas and only requires about 2 meters of headroom.

# QUALITY ASSURANCE / QUALITY CONTROL

* On-Site Test Program
* Settlement Monitoring
* Work Sequencing
* Early Testing of Soilcrete
* Soilcrete Coring and Testing

# Jet Grouting

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