Jet Grouting for Underpinning of Structures

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SOILCRETE & JET GROUTING

SOILCRETE IS....
The material formed by mixing soil with cementitious 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.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Diameter</th>
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<tbody>
<tr>
<td></td>
<td>3.5 ft</td>
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<tr>
<td>Nozzle Size</td>
<td>(2) 1.9 mm each</td>
</tr>
<tr>
<td>Water Pressure (bar)</td>
<td>380</td>
</tr>
<tr>
<td>Air Pressure (bar)</td>
<td>7</td>
</tr>
<tr>
<td>Grout W/c Ratio</td>
<td>0.58</td>
</tr>
<tr>
<td>Pull Rate (cm/min)</td>
<td>40 - 45</td>
</tr>
<tr>
<td>Rotation Rate (rpm)</td>
<td>15</td>
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<tr>
<td>Grout Flow (l/min)</td>
<td>170</td>
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Figure 3.3) Jet Grouting Systems for the Excavation and Replacement Method (Burke 1989)
1. **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.
Figure 3.1) Cross Section and Soil Profile Near Footing R10 (Suncoa 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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