Exploratory Drilling

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Soil Exploration

Failing Truck Mounted Rig

All-Terrain Rig
Soil Exploration

- Wireline Rig
- Water Boring from Barge for Bridge Crossing

Soil Exploration

- Track Rig
- Track Mounted Rig
Drilling & Sampling of Soil & Rock

Objectives:
- Recognize various drilling techniques
- Be familiar with undisturbed vs. disturbed sampling methods
- List rock exploration methods
- Familiarity with core bits & barrels
- Observations to be made during drilling, including Rock Quality Designation (RQD).
- Appreciate role of geologic mapping in obtaining information on rock masses.

Soil & Rock Drilling

Soil Exploration
- Advancing a Boring/Borehole
- Sampling (Drive, Undisturbed)
- Transport of Samples to Laboratory

Rock Exploration
- Rock Coring and Non-coring Techniques
- Logging of Rock Core (CR and RQD)
Selection of Drilling methods

- Depth of drilling: all drilling methods have certain limitations;
- Sample recovery: type of samples desired, i.e. soil, groundwater, disturbed or undisturbed, frequency of sampling, yield estimation;
- Target lithology: well installation completed in unconsolidated or consolidated formation.
- Health and Safety
  - Level of contamination
  - High yield of formation may produce high pressures;
  - Underground fire hazards in gaseous areas

Selection of Drilling methods

- Access and Noise
  - Terrain roughness;
  - Space and height limitations;
  - Municipal noise ordinance
- Disposal of drilling fluids and cuttings
  - Contaminated cuttings and groundwater may have to be handled as hazardous wastes and be transported to landfill or special waste disposal facilities.
- Lithology and Aquifer characteristics
  - Soil type (sand, clay, boulders)
  - Depth to water table
  - Depth to bedrock
- Cost
Drilling Methods

Methods which do not use circulation (drilling) fluids
- Displacement boring
- Driven wells
- Solid-stem auger
- Hollow-stem auger
- Sonic drilling

Drilling Methods

Methods which use circulation (drilling) fluids to carry drill cuttings to the surface
1. Rotary Drilling
   - Rotary (direct) Drilling
   - Reverse Circulation Rotary Drilling (RC)
   - Dual-wall Reverse Circulation Drilling
2. Percussion Drilling
   - Cable-tool percussion
   - Air percussion down-the-hole hammer
   - Air percussion casing hammer
   - ODEX percussion down-the-hole hammer
## Drilling Methods

<table>
<thead>
<tr>
<th>Common name of method</th>
<th>Materials in which used</th>
<th>Method of advancing the hole</th>
<th>Method of sampling</th>
<th>Value for foundation purposes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auger boring</td>
<td>Cohesive soils and cohesionless soils above groundwater elevation</td>
<td>Augers rotated until filled with soil and then removed to surface</td>
<td>Samples recovered from material brought up on augers</td>
<td>Satisfactory for highway exploration at shallow depths</td>
</tr>
<tr>
<td>Well drilling</td>
<td>All soils, rock, and boulders</td>
<td>Churn drilling with power machine</td>
<td>Bailed sample of churned material or clay socket</td>
<td>Clay socket samples are dry samples Bailed samples are valueless</td>
</tr>
<tr>
<td>Rotary drilling</td>
<td>All soils, rock, and boulders</td>
<td>Rotating bits operating in a heavy circulating liquid</td>
<td>Samples recovered from circulating liquid</td>
<td>Samples are of no value</td>
</tr>
<tr>
<td>Test pits</td>
<td>All soils. Lowering of ground water may be necessary</td>
<td>Hand digging or power excavation</td>
<td>Samples taken by hand from original position in ground</td>
<td>Materials can be inspected in natural condition and place</td>
</tr>
</tbody>
</table>