Borehole Logging Procedures

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In Review

- Literature search and evaluation of existing information
- Preliminary Reports
- Identified the information required for design and bidding
  - Soil and Rock Locations (vertical and horizontal)
  - Soil Characteristics
    - shear strength, consolidation, liquefaction susceptibility
  - Rock Characteristics
    - Strength, hardness, fracturing
  - Groundwater
- Planned an appropriate investigation to characterize the site
  - Four boreholes, sampling, field testing, lab testing
Borehole Information will be used to:

• Select appropriate foundation types
• Perform design calculations
• Make constructability recommendations
• Produce Log of Test Borings (LOTB)
• Provide bidders with a record of known subsurface conditions via the Information Handout

Log of Test Borings
Soil and Rock Logging, Classification, and Presentation Manual

- Department’s standard for
  - Logging procedures
  - Reporting terminology
  - LOTB presentation
  - Legends
- Creates a uniform and predictable product for our clients
- Available at:

Sec. 2: Field Identification and Description of Soil

- Soil identification is based on ASTM D 2488
- Present identification and descriptors in the sequence shown
- Items marked REQUIRED shall be used when applicable
Example presenting required and optional components:

Well graded SAND with GRAVEL (SW); medium dense; brown and light gray; wet; 75% SAND, coarse to fine, rounded; 20% GRAVEL, coarse, subrounded to rounded, flat and elongated; 5% fines; weak cementation.

Example presenting only required components:

Well graded SAND with GRAVEL (SW); medium dense; brown and light gray; wet; little coarse GRAVEL; trace fines; weak cementation.

Sec. 2: Field Identification and Description of Rock

- Based on the International Society of Rock Mechanics and the USBR Engineering Geology Field Manual
Rock Example:

*IGNEOUS ROCK (GRANITE)*; light gray and light yellowish brown; intensely weathered; soft; unfractured

Core Recovery: \[
\text{REC} = \frac{\sum (\text{Length of the recovered core pieces, inches})(100\%)}{\text{Total length of the core run, inches}}
\]

Rock Quality Index: \[
\text{RQD} = \frac{\sum (\text{Length of intact core pieces } \geq 4 \text{ inches})(100\%)}{\text{Total length of the core run, inches}}
\]

Section 3: Laboratory Testing

- Optional not required for many designs
- Laboratory testing may be used to revise/refine the following:
  - Soil
    - Group Name
    - Group Symbol
    - Percent or Proportion of Soils
    - Particle Size Range
    - Consistency
    - Plasticity
  - Rock Strength
Section 4: Methods of Presentation of Subsurface Data

- Revising/Combining sample observations and creating layers.

Section 5: Boring Log and Legend Presentation Formats

- Presents the formats for:
  - Log of Test Borings (LOTB)
  - Boring Records (BR)
  - Legends

Group Exercise

- Build a descriptive sequence for the sample provided
  - Group Name
  - Group Symbol
  - Apparent Density (N 16) (ERi 75%)
  - Color
  - Moisture
  - Percent or Proportion of Soils
  - Particle Size Range
Some Help

• Estimate the % (by weight) of
  Gravel (Coarse and Fine)
  Sand (Coarse, Medium, Fine)
  Fines (Silt and Clay)

• Navigate the Table to select a Group Name and Group Symbol
  Well graded vs. Poorly graded

• Calculate $N_{60}$ then select an Apparent Density

• Use “Proportion” terms to describe amount of Gravel, Sand, and fines in order of their abundance.

More Help

$N_{60} = N \times \left(\frac{ER_i}{60}\right)$

$N_{60} = 16 \times \frac{75}{60} \quad 20 \quad \Rightarrow \text{Medium Dense}$
Group Exercise Answers

1. Well graded SAND with GRAVEL (SW); medium dense; light brown and gray; little fine GRAVEL; trace fines
2. Well graded GRAVEL with CLAY (GW GC); medium dense; light brown and gray; dry; few medium SAND
3. Well graded GRAVEL (GW); medium dense; light brown and gray; dry; some well graded SAND
4. Poorly graded SAND with GRAVEL (SP); medium dense; light brown; dry; medium SAND; some well graded GRAVEL; trace fines
5. Clayey SAND (SC); medium dense; brownish gray; dry; well graded SAND; some fines, high plasticity; trace fine GRAVEL

Dry Creek Bridge Update

• Logged four holes
• Performed field testing (SPT, Pocket Pen, Torvane)
• Collected samples for Laboratory Testing
  Unconfined Compression (Qu) on Rock
  Particle Size analysis (PA) on Sand
  Plasticity Index (PI), Triaxial (UU), and Consolidation on Soft Clay
  Corrosion on Sand and Clay

• Produce field log sheets and a draft geologic profile
Draft Geologic Profile

Questions?