LRFD
Load and Resistance Factor Design

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AASHTO LRFD Specifications

Third Edition with 2006 Interim Revisions
LRFD is coming

- Implementation date is July 1, 2007.
- All projects starting preliminary design after the implementation date will have to conform to LRFD specifications.
- The change will affect geotechnical engineering design of foundations and retaining walls.
How LRFD is different from ASD

- LRFD uses load factors and resistance factors instead of safety factors.
- Generally, $FS \approx \gamma / \varphi$
  \(\gamma\) is load factor (not unit weight)
  \(\varphi\) is resistance factor (not friction angle)
- Load factors explicitly consider the uncertainty in loads (live load vs dead load)
- Value of resistance factors depend on analysis or testing method
What geotechnical items are covered?

- Soil and rock properties
- Service limit, strength limit, and extreme event limit states
- Foundations (Section 10)  
  Spread footings, driven piles, and drilled shafts
- Abutments, piers, and walls (Section 11)  
  Retaining walls, including conventional concrete walls, cantilever walls, anchored walls, and MSE walls
Terminology

• Spread footings
  - Ultimate bearing capacity, $q_u$
  - Nominal bearing resistance, $q_n$
  - Allowable bearing capacity, $q_{all} = q_u / FS$
  - Factored bearing resistance, $q_R = \phi_b q_n$

• Piles and drilled shafts
  - Ultimate capacity, $Q_{ult}$
  - Nominal resistance, $R_n$
  - Design capacity, $Q_{all} = Q_{ult} / FS$
  - Factored resistance, $R_R = \phi R_n$
What’s new?

- Horizontal pile movement
- P-y multipliers for pile groups
- Clarification on how downdrag loads are analyzed
- Structural resistance of piles is no longer limited by $0.25F_y$. A drivability analysis is recommended (wave equation analysis). ODOT may require one.
Earth Pressures

- Earth pressures were moved to Section 3 “Loads And Load Factors”.
- This includes the earth pressure diagrams for cantilever and anchored walls, and horizontal earth pressures due to surcharge loads.
LRFD Training

- ODOT is developing four 3-day courses.
  - Steel
  - Reinforced concrete
  - Prestressed concrete
  - Foundations and retaining walls
- Courses will be offered multiple times around the state.