



Balanced Design of Flood Structures

Problem

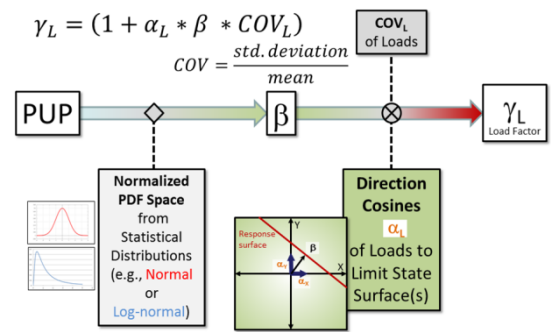
It was only recently recognized in association with HQ's design guidance update effort for Flood and Coastal Storm Damage Reduction Structures that a Corps-centric, R&D effort would be required in order to develop a full LRFD methodology linking the designs of concrete/structural steel and foundation stability. This linkage does not exist in industry so an "off the shelf" methodology could not be adopted by the Corps. These Corps structures, and especially those with pile foundations, have significant soil-structure interaction issues that need to be addressed in the full LRFD methodology.

Approach

To develop Load and Resistance Factors for structural design, Reliability studies must be performed to collect the probability of unsatisfactory performance (PUP). With the PUP information and the statistical characterization of variables affecting the structure, Load and Resistance Factors may be computed.

Products

The product of this research is the development of a full LRFD methodology to design two main categories of the Corps pile founded flood and coastal structures; reinforced concrete flood and retaining structures (e.g., T-Walls, etc.); and I-Walls. This methodology will be used to update the guidance document EM 1110-2-2906 – *Design of Pile Foundations*.



Process for Creating Load Factors

Benefits

This work unit closes the technical gap between balanced engineering design standards used by industry and the Corps engineering methodology currently applied. LRFD allows for a balanced design accounting for multiple limit states, given structure and soil-structure interaction, with formal consideration of uncertainty in engineering properties. The Corps current engineering design process uses Allowable Stress Design, which does not consider these factors.

Limit States

- **Structural**
 - Euler buckling of piles
 - Flexural yielding of superstructure
 - Shear failure of superstructure
 - Flexural yielding of piles
 - Shear failure of piles
- **Design Constraints**
 - Deformation constraints
- **Geotechnical**
 - Pile foundation bearing failure (batter piles)
 - Passive soil resistance for vertical sheet-pile walls (I-Wall)



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