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Reliability and LRFD calibration for internal stability limit states for MSE Walls

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Abstract

Mechanically stabilized earth (MSE) walls constructed with steel and geosynthetic reinforcing elements are now well-established technologies. US and Canadian foundation design codes for these systems are based on a load and resistance factor design (LRFD) approach. Satisfying a limit state equation in these codes ensures that the performance function is safe. However, how safe in quantitative probabilistic terms is unknown and most often a specific target margin of safety is not part of the calibration process to develop load and resistance factors. This lecture describes the approach used by the speaker and collaborators to develop a rational basis for the selection of load and resistance factors so that if a limit state function is just satisfied at time of design, then a minimum margin of safety expressed as reliability index or probability of failure is assured. The link between LRFD calibration and reliability analysis is discussed. The latter is used to compute the actual margin of safety using currently prescribed load and resistance factors in North American codes. The lecture shows that actual margins of safety for limit states that are just satisfied at time of design vary widely depending on the type of MSE wall structure and reinforcement type (e.g., geosynthetic sheet, steel strip or grid). This means that different systems performing the same retaining wall function may be advantaged of disadvantaged when competing with alternative wall types. This problem can be avoided by using a rigorous reliability-based design approach which adopts a target margin of safety and is not constrained by prescribed load and resistance factors found in LRFD design codes.