

Connection Strength Discussion

The evaluation of the structural connection between geosynthetic soil reinforcement and modular block retaining wall facing system has been a significant design consideration since the publication of the 1993 National Concrete Masonry Association (NCMA) Design Manual for Segmental Walls and the American Association of State Highway and Transportation Officials (AASHTO) Standard Specifications for Highway Bridges (design of mechanically stabilized earth (MSE) structures).

Structural and civil engineers have become acutely aware of the need to properly evaluate "connections" as a result of the Hyatt walkway collapse in Kansas City many years ago. The authors of these documents recognize that the design of a structural system must be comprehensive and include an analysis of all its structural components, especially those items not easily determined such as the connection strength between a geosynthetic reinforcement and a wall facing system and the wall facing stability during the construction process.

These documents require that the connection strength between a specific geosynthetic reinforcement and specific wall facing system be evaluated in a laboratory for its ultimate strength and strain characteristics under conditions that simulate the field installed condition. The load capacity of the connection at a specific location is compared to the maximum calculated load in the soil reinforcement and a factor of safety (FS) or capacity-demand ratio (CDR) is calculated. This connection strength calculation is made at each reinforcement level and a minimum FS >1.5 or CDR > 1.0 against rupture must be maintained. AASHTO specifications require additional considerations for sustained load capacity over time in their guidelines.

The typical result of the connection strength analysis in taller walls is that the geosynthetic reinforcement to modular wall unit connection controls the wall design process and limits the maximum tensile load that wall system reinforcement can accept at various levels. The designer must then utilize stronger soil reinforcement and/or closer vertical spacing of the soil reinforcement to resist or lower the tensile loads in each element in order to maintain acceptable connection factors of safety in accordance with the appropriate design methodologies.

Since the connection strength analysis can be a limiting design factor and requires additional soil reinforcement costs to satisfy the required design standards, those not skilled in retaining wall design sometimes ignore, neglect, or down play the connection strength evaluation as a means of reducing cost, increasing competitive position, or otherwise hiding a potential structural limitation of the proposed retaining wall system.

Keystone Retaining Wall Systems has laboratory tested all major geosynthetic soil reinforcement types with the Keystone Pinned and Lip/Lug series wall units and will continue to evaluate the connection strength requirements of each structure as required by good engineering practice and design standards. The connection strength evaluation is an integral part of the design process and can not be neglected.