RESTORATIVE DESIGN

Slope face stabilization for critical surfaces

David W. Yam

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Storm damage sites in mountainous terrain and tight working conditions within limited areas have fostered the development of reinforced and confined embankment slope designs. Geogrid stabilized embankment (GSE) is a common type of reinforced embankment construction that allows for slopes with slope face gradients of up to 45 degrees (1:1, H:V).

Generally, the embankment face, while structurally sound, is difficult to stabilize and compact due to the steep angle of repose. A confined embankment system is essentially the same as a reinforced embankment except that a metal meshed confinement system is used at the slope face to contain the soil. Slope face gradients of up to 60 degrees or more can be achieved using this type of system.

These types of restorative embankment designs are especially relevant in areas with tight working conditions and in environmentally sensitive areas that may not allow for standard construction methods. Although slope stability is achieved through the use of engineered embankment designs, there remains the challenge to compact, stabilize and vegetate the slope face.

Without adequate vegetative protection, a newly stabilized slope face could fail due to super-saturation, excessive erosion and lack of adequate compaction. The slope face stabilization technique utilized should incorporate both mechanical and vegetative erosion control treatments compatible with the type of embankment system utilized.

For a GSE, erosion control twisted coir netting is used in a "burrito wrap" technique to encapsulate the slope face. Weight and friction of the embankment material on netting portions tucked into the embankment resist pullout and easily retain the surface soil, even with limited compaction. The tensile strength of the netting is enough to withstand and retain the soil under super-saturated conditions. The openings in the netting allow adequate exposure for hydraulic applications of fiber, seed and fertilizer to reach the face of the slope.

For confined embankment slopes, a similar approach is used. Multiple installations since 1997 have proven that the slope face stabilization techniques described here are effective in stabilizing the slope face of over-steepened embankments while sustaining long-term vegetative growth.

One major benefit derived through the use of the described facial treatments is that the slope face is stabilized as the embankment is constructed. This is especially important during the winter season, when construction stops periodically. Once completed, the final product is an aesthetically pleasing slope compatible with its surroundings.

Too many dollars and precious construction time are at risk when a slope face fails. A complete technical paper pertaining to this column, available at www.ieca.org, reviews proven treatments and discusses how to effectively combine erosion control nettings, geosynthetic stabilizing materials, slope anchors and vegetation in designing effective erosion control treatments for slope face stability. SWS

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