

CHAPTER 2

GLOSSARY

GEOTECHNICAL DESIGN MANUAL

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CHAPTER 2

GLOSSARY

2.1 INTRODUCTION

The purpose of this Chapter is to provide consistent definitions of key words and concepts that will be used throughout the GDM. Some of the definitions used herein are exclusive to the GDM, while others are borrowed from the SCDOT Bridge Design Manual (2006) (BDM) or from the SCDOT Seismic Design Specifications for Highway Bridges (2017) (Seismic Specs). Additional definitions are also borrowed from the AASHTO LRFD Specifications referenced in either the BDM or the Seismic Specs. Where there is potential conflict between the GDM and any of these other sources, the GDM shall govern, unless specifically indicated otherwise.

2.2 DEFINITIONS

Active Earth Pressure

Coefficient, K_a

The coefficient of lateral pressure that is developed when a structure, either an ERS or an abutment wall moves away from the backfill resulting in a decrease in pressure on the structure relative to the at-rest pressure

Alternate Profiles

Alternate profiles are sometimes necessary when evaluating settlements; these profiles are typically parallel to the alignment of the roadway at a location that is subject to larger settlements than those at the Profile Grade location; alternately, this profile may be transverse to the Profile Grade and is used to determine differential settlement

**Apparent Opening Size,
AOS (O_{95})**

A property which indicates the approximate largest particle that would effectively pass through a geotextile

Approach Slab

A reinforced concrete structural slab placed on the embankment to transition from the roadway pavement to the bridge surface at the end bent; approach slabs are typically 20 feet in length

Argillaceous Geomaterials

Geomaterials that contain a significant clay fraction (CF) (12 to 40 percent) within the soil matrix

**At-Rest Earth Pressure
Coefficient, K_o**

The coefficient of lateral pressure that exists in level ground for the condition of no lateral deformation

Blinding

Condition whereby soil particles block the surface openings of a geotextile, thereby reducing the hydraulic conductivity

Bridge Embankment

The longitudinal length of embankment where mitigation is required to meet the Global Performance Objectives of the Bridge System as contained in the Seismic Specs or 3.25 times the height of the backwall (see Chapter 14), whichever is longer; in the event mitigation is not required, this embankment shall encompass the front slope and shall extend 3.25 times the height

of the backwall

California Bearing Ratio (CBR)

The ratio of (1) the force per unit area required to penetrate a soil mass with a 3-square-inch circular piston (approximately 2-inch diameter) at the rate of 0.05 inches/minute to (2) the force per unit area required for corresponding penetration of a standard method

Cantilever ERS

An ERS that prevents the advance of an in situ soil mass and is typically constructed from the top of the wall to the base concurrent with excavation operations of the in-situ soil to be removed; cantilever retaining ERS can either be constructed with or without anchors; typical cantilever ERSs used are Sheet Pile Wall with and without anchors, Soldier Pile Wall and Lagging with and without anchors, Tangent/Secant Pile Wall with and without anchors, and Soil Nailed Wall

Check Flood

Storm surge, tide or mixed population flood shall be the more severe of the 500-year flow event or from an overtopping flood of lesser recurrence interval; the Extreme Event II limit state shall apply

Clogging

Condition where soil particles move into and are retained in the openings of a geotextile, thereby reducing hydraulic conductivity

Cross-machine Direction

The direction in the plane of the geosynthetic perpendicular to the direction of manufacture

Cross Section

A slice or section taken perpendicular to the roadway alignment at a specific location (station) of the road

DB/GDS

Design Build – Geotechnical Design Section

Design Flood

Storm surge, tide or mixed population flood shall be the more severe of the 100-year flow event or from an overtopping flood of lesser recurrence interval

Drained Strength

Shear strength when there is no change in effective stress on the failure plane

Earth Retaining Structure (ERS)

An engineered structural system that prevents the lateral advance of a soil mass by resisting the lateral earth pressures exerted by the soil; ERSs shall have a face angle greater than or equal to 70° above the horizontal; ERSs have been classified for Strength limit state design by the type of retaining system as follows:

- Rigid Gravity ERS
- Flexible Gravity ERS
- Cantilever ERS

Further, ERSs are also classified based on the construction method Fill ERS, bottom-up, or Cut ERS, top-down

Effective Stress	The stress that includes only the forces (loads) that are transmitted (carried) by grain-to-grain contact
Embankment	An earthen mass structure constructed from select fill material placed in compacted lifts over competent soil (natural or improved) capable of supporting the structure; there are 2 types of embankments: bridge and roadway; embankments have face angles of less than 70° above the horizontal
Embankment Widening	An embankment is considered to be widened when the centerline of the embankment is shifted more than 1/2 of the width of the travelway (all travel lanes combined) in either transverse direction or if 1 travel lane is added in each direction and the centerline of the embankment does not change
ERS Profile	A profile of the wall that indicates the top of the wall, the location where the wall intersects the natural ground and the bottom of the wall (embedment depth of the wall below natural ground); wall profiles typically have their own alignment and stationing and are tied in to the project alignment
ERS Cross Section	A slice or section taken perpendicular to the wall profile at a specific location (station)
Failure Surface	An approximation of the most likely shear failure surface that will develop as a result of instability of an earthen mass; typically this surface has the highest resistance factor ($\phi > 1.0$); a failure surface is not considered present if the resistance factor is equal to or less than 1.0 ($\phi \leq 1.0$); the surface may be either circular or non-circular.
Filtration	The process of retaining soils while allowing the passage of water (fluid)
Flexible Gravity ERS	Flexible gravity walls are typically constructed bottom-up (fill) that have flexible facings and flexible structural elements such as those used in Gabion Wall, MSE (Full Height Panel Facing), MSE (Modular Block Facing), MSE (Precast Panel Facing), MSE (Gabion Facing), and Geosynthetic Reinforced Soil Slopes (face slopes greater than or equal to 70°)
Front Slope	The embankment that extends beneath the bridge and to the end of the approach slab (see Figure 10-1); the front slope begins at the end bent and extends longitudinally from the existing ground surface in front of the end bent to the end of the approach slab and extends transversely to existing ground surface on the sides; front slope grades are given in ratios of horizontal distance to vertical height (i.e., 2(H):1(V)); for bridges without approach slabs, the front slope shall extend 20 feet from either “begin” or “end” of bridge

Functional Evaluation

Earthquake (FEE)	The ground shaking having a 15 percent probability of exceedance in 75 years (15%/75yr) and is equal to the 10 percent probability of exceedance in 50 years (10%/50yr); the FEE PGA and PSA are used for the functional evaluation of transportation infrastructure; annual probability of exceedance (P_E) is 2.11×10^{-3}
GEC	Geotechnical Engineering Consultant, a consultant, specializing in geotechnical engineering, hired by SCDOT to provide geotechnical services including field, laboratory and engineering services, that SCDOT either does not perform or has insufficient personnel to provide the service
Geocell	A 3-dimensional comb-like structure, that may be filled with soil, aggregate or concrete
Geocomposite	A geosynthetic material manufactured of 2 or more geo-materials (i.e., geomembrane and geonet combination)
Geogrid	A geosynthetic formed by a regular network of tensile elements and apertures, typically used for reinforcement applications
Geomembrane	An essentially impermeable geosynthetic, typically used to control fluid migration
Geonet	A geosynthetic consisting of integrally connected parallel sets of ribs overlying similar sets of ribs, for planar drainage of liquids or gases
GEOR	Geotechnical Engineer-of-Record
Geosynthetic	A planar product manufactured from polymeric material used with soil, aggregate, or other geotechnical engineering materials
Geotextile	A permeable geosynthetic comprised solely of textiles
Global Instability	An imbalance of the driving and resisting forces of an earthen mass that causes a shear failure surface to occur and consequently causing the earthen mass to deform
Global Stability Analysis	An estimation of the balance between the driving forces (demand) and resisting forces (capacity) within an earthen mass that is seeking to maintain equilibrium
Gravity ERS	An ERS that prevents the advance of select fill materials placed during construction and is constructed from the base to the top of the wall
HEOR	Hydraulic Engineer-of-Record
Index Test	A test procedure which may contain a known bias but which may be used to establish an order for a set of specimens with respect to the property of interest

Intermediate Geomaterials (IGM)	Earth materials with properties at the boundary between soil and rock that display properties of both materials; the required properties are discussed in Chapter 6.
Machine Direction	The direction in the plane of the geosynthetic parallel to the direction of manufacture
Maximum Average Roll Value (MaxARV)	A quality control tool used by geosynthetic manufacturers to establish and publish <u>maximum</u> property values
Minimum Average Roll Value (MARV)	A quality control tool used by geosynthetic manufacturers to establish and publish <u>minimum</u> property values
Passive Earth Pressure Coefficient, K_p	The coefficient of lateral pressure that is developed when, either an ERS or an abutment wall moves toward the backfill resulting in an increase in pressure on the structure relative to the at-rest pressure
PC/GDS	Preconstruction – Geotechnical Design Section includes Geotechnical Design Sections within each Regional Production Group, the Design Build Section and Preconstruction Support
PC/SDS	Preconstruction – Structural Design Section includes Structural Design Sections within each Regional Production Group, the Design Build Section and Preconstruction Support
PCS/GDS	Preconstruction Support – Geotechnical Design Section
PCS/HDS	Preconstruction Support – Hydraulic Design Section
PCS/SDS	Preconstruction Support – Structural Design Section
Peak Shear Strength	The maximum shear stress that a soil can withstand, τ_{Peak}
Permeability	The rate of flow of a fluid under a differential pressure through a material
Permittivity	The volumetric flow rate of water per unit cross sectional area per unit head under laminar flow conditions, in the normal direction through a geotextile
Pore Pressure	The force (load) transmitted (carried) by the interstitial water (i.e., the water contained in the pore spaces)
Profile Grade	Roadway plans typically have plan and profile sheets; the profiles are given along a specific location of the pavement surface that is referred to in the plans as the Profile Grade (P.G.) or Finished

	Grade (F.G.); often this location is the same as the centerline of the road; there may be multiple profile grades along a divided roadway or intersection for each traffic direction; the location of the roadway alignment in plan view typically coincides with the location of the profile grade
Reinforced Embankment	An embankment that typically has a face angle less than 1H:1V but greater than 2H:1V, and requires the use of geosynthetic reinforcement within the embankment to maintain stability; a reinforced embankment can use borrow materials as defined in the Standard Specifications
Reinforced Soil Slope (RSS)	An embankment that typically has a face angle greater than or equal to 1H:1V but less than 70°, has geosynthetic or metallic reinforcement within the embankment and generally has a face element of some kind (see Chapter 17 for face elements)
REOR	Roadway Engineer-of-Record
Residual Shear Strength	The minimum shear stress that a soil can maintain regardless of the amount of displacement, τ_r
Right-of-Way (ROW)	A privilege to pass over the land of another in some particular path; usually an easement over the land of another; a strip of land used in this way for railroad or highway purposes, for pipelines or pole lines, and for private or public passage
Rigid Gravity ERS	Rigid gravity ERSs are typically constructed bottom-up (fill) that have rigid facings and rigid structural elements such as those used in Concrete Barrier Walls, Concrete Retaining Walls, and Concrete Stem (cantilever) walls with and without buttresses; rigid gravity ERSs depend on the mass (weight) of the concrete to resist the driving forces placed on the wall
Roadway Embankment	The portion of the embankment that extends beyond the bridge embankment and extends between the toes of the slopes on either side
Rock	Naturally occurring solid aggregate of minerals that occur in large masses or fragments; consolidated accumulation of solid particles
RPG/GDS	Regional Production Group – Geotechnical Design Section
Safety Evaluation Earthquake (SEE)	The ground shaking having a 3 percent probability of exceedance in 75 years (3%/75yr) and is equal to the 2 percent probability of exceedance in 50 years (2%/50yr); the SEE PGA and PSA are used for the safety evaluation of transportation infrastructure. Annual probability of exceedance (P_E) is 4.04×10^{-4}
SEOR	Structural Engineer-of-Record

Side Slopes	The embankment that extends perpendicular to the travelway and has been graded to meet traffic safety and stability requirements; the side slope begins at the shoulder break and extends to the existing ground surface; side slope grades are given in ratios of horizontal distance to vertical height (i.e., 3(H):1(V)), transverse to the roadway travel direction
Standard Specifications	The <u>Standard Specifications for Highway Construction</u> , latest version as published by SCDOT; the Standard Specifications also includes Supplemental Specifications, Supplemental Technical Specifications and Special Provisions
Soil	Sediment or other unconsolidated accumulation of solid particles produced by the physical and chemical disintegration of rock materials which may or may not contain organic matter
Soil Shear Strength Loss (SSL)	The reduction in soil shear strength caused by seismically induced cyclic loading of soil; in loose cohesionless soils this is termed cyclic liquefaction while in plastic cohesive soils, SSL is termed cyclic softening
Station	Locations along a reference base line on the plan or profile that is based on measurements from a reference point (i.e., Sta. 1+00.00 = 100.00 feet)
Temporary	Structure or embankment having design life of 5 years or less
Transmissivity	The volumetric flow rate of water per unit cross sectional area per unit head under laminar flow conditions, in the in-plane direction through a geotextile
Total Stress	The stress that includes all of the forces (loads) that are transmitted (carried) by not only grain-to-grain contact but also by the interstitial water
Undrained Strength	Shear strength when there is no change in water content (i.e., no volume change)
Unreinforced Embankment	An embankment that typically has a face angle flatter than or equal to 2H:1V; an unreinforced embankment can use borrow materials as defined in the Standard Specifications