HUESKER RINGTRAC™ 'GEOSYNTHETIC ENCASED COLUMNS' (GEC) / PILES

GENERAL NOTES

PRODUCT DESCRIPTION

Seamless, cylindrical reinforcement sleeve manufactured from low-creep, high strength polymers such as polyester (PET) or polyvinyl alcohol (PVA). Manufactured in diameters of between 0.40 m and 1.0 m.

DESIGN CONCEPT

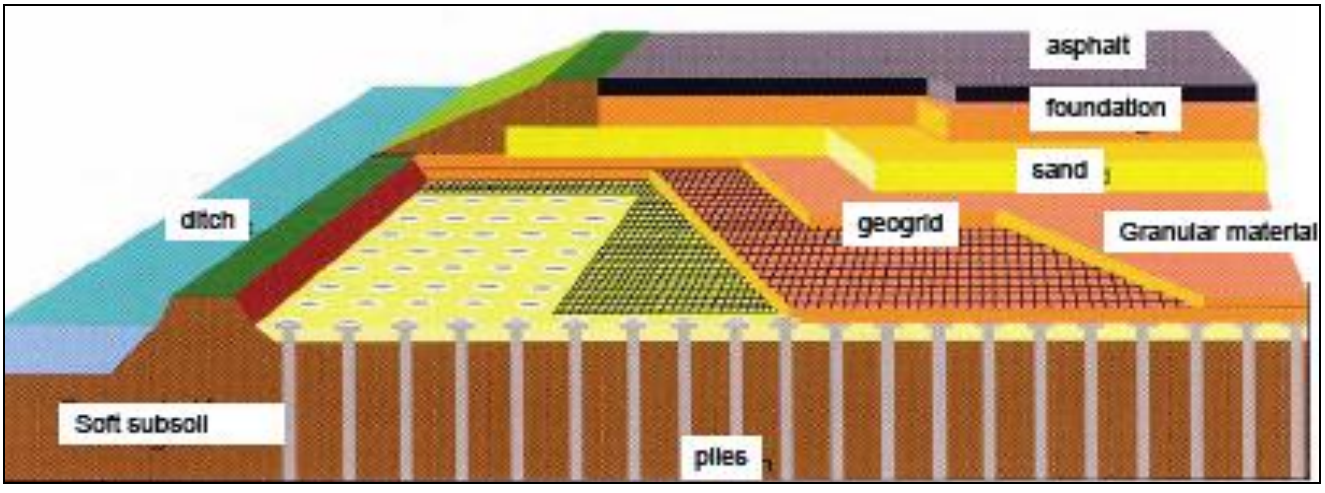
The GEC system transfers the embankment load through the soft soil to a firm stratum thereby the embankment load is borne mainly by the encased columns. However, the surrounding soft soil provides lateral support to the columns and bears a minor part of the vertical surcharge. The system is not rigid and can absorb dynamic loads.

The vertical deformations as well as the load distribution between the columns and the soft soil are defined by the tensile strength and the stiffness of the encasement.
Since the soft soil is involved in the transfer of vertical loads, the ability of the GEC's to act as a vertical drain, is also important as it reduces the consolidation time of the system.
The design method includes but is not limited to an estimation of settlements, an analysis of the required radial tensile strength of the encasement and an analysis of the distribution of vertical stress between the columns and the soft soil.

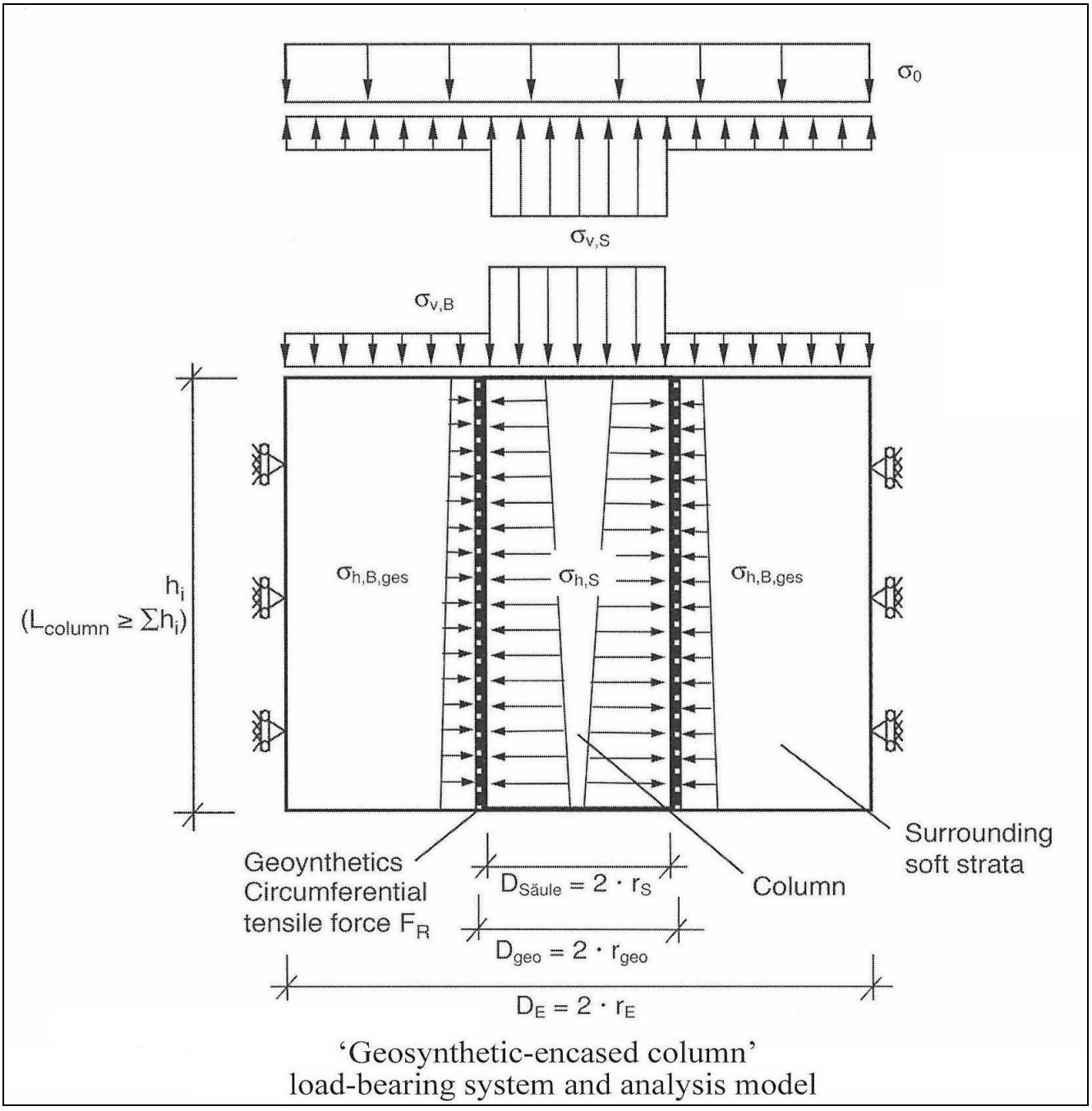
COMMON QUESTIONS

- When to use Ringtrac GEC: Suitable for soft soils with c_u < 15 kN/m^2, Ringtrac confines the aggregate in weak soils. No adverse influence on groundwater flow, base sealing can protect underlying aquifers if required.
- Impact of EQ on piles; The tighter the pile spacing the more support from each other, this reduces buckling. The dewatered weak subgrade and piles act as one and the geotextile sleeve maintains the integrity of the fill.
- What is an economic pile depth ; More than 3 metres, the maximum depth is only limited by plant capability / pile diameter.
- Pile placement; Typically on a square or triangular grid (eg; square grid at 45°) with a total pile cross sectional area of 10% to 20% of the area being remediated.
- What fill material is used ; Coarse sand, high shear strength granular material up to a maximum particle size of 40mm, smooth river gravels or other materials with a fines ratio of less than 5%, crushed angular aggregates can also be used but this will impact on the geotextile design / cost. Permeable fill material can also double as a dewatering wick drain.
  Typically the Ringtrac tube has a pore size 0.2mm.
- Embankment layer build up; Typically embankment built up in layers to allow time for staged settlement / dewatering to take place to enable the shear value of the weak subgrade to increase before more load is applied. Almost all settlement takes place within the construction period and is fully loadable immediately after construction.
- Embankment reinforcing / material; Typically utilised are mono-axial materials ie: geotextiles / geogrids manufactured from Aramide, PVA or PET having very high strength (up to 2,600kN/m) eg: Huesker Robutec and Stabilenka. When two layers are employed they are separated approximately 150mm to 300mm. No end laps allowed in the high strength direction of the reinforcing material.

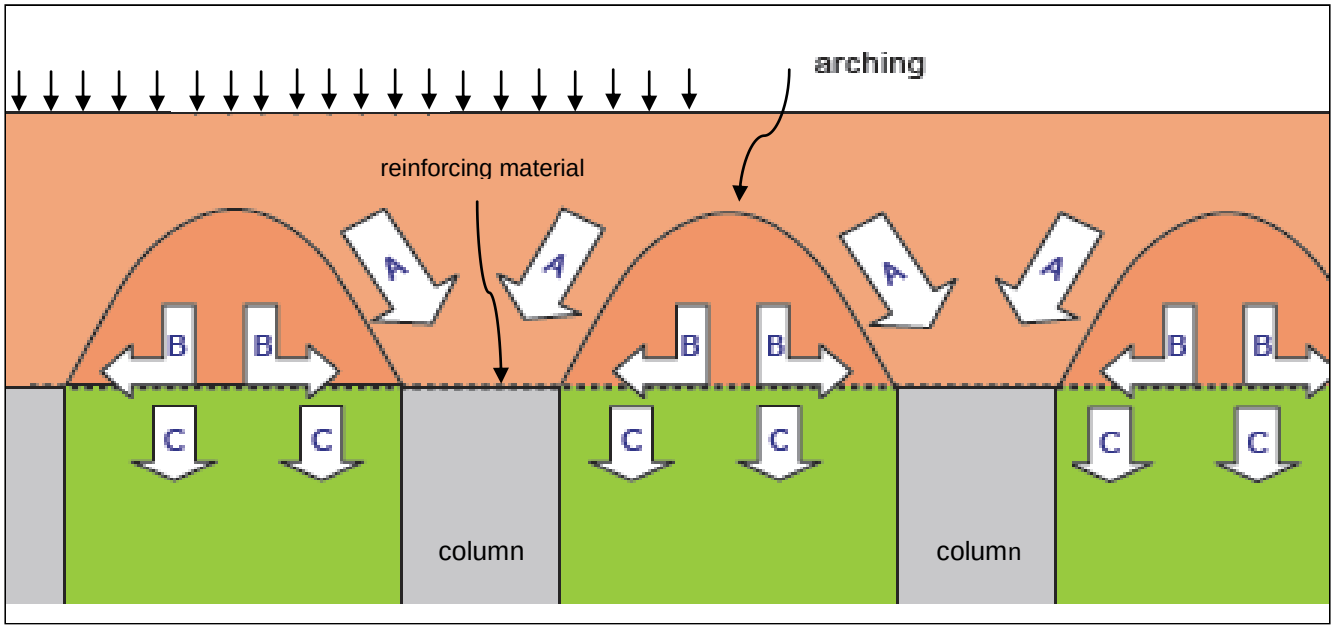
HUESKER DESIGN SERVICE AVAILABLE : CONTACT GEOTECH SYSTEMS LTD



TYPICAL 'GEC' / EMBANKMENT ARRANGEMENT



'Geosynthetic-encased column'
load-bearing system and analysis model



DIAGRAMATIC SKETCH OF HOW 'GEC' COLUMNS / PILES FUNCTION

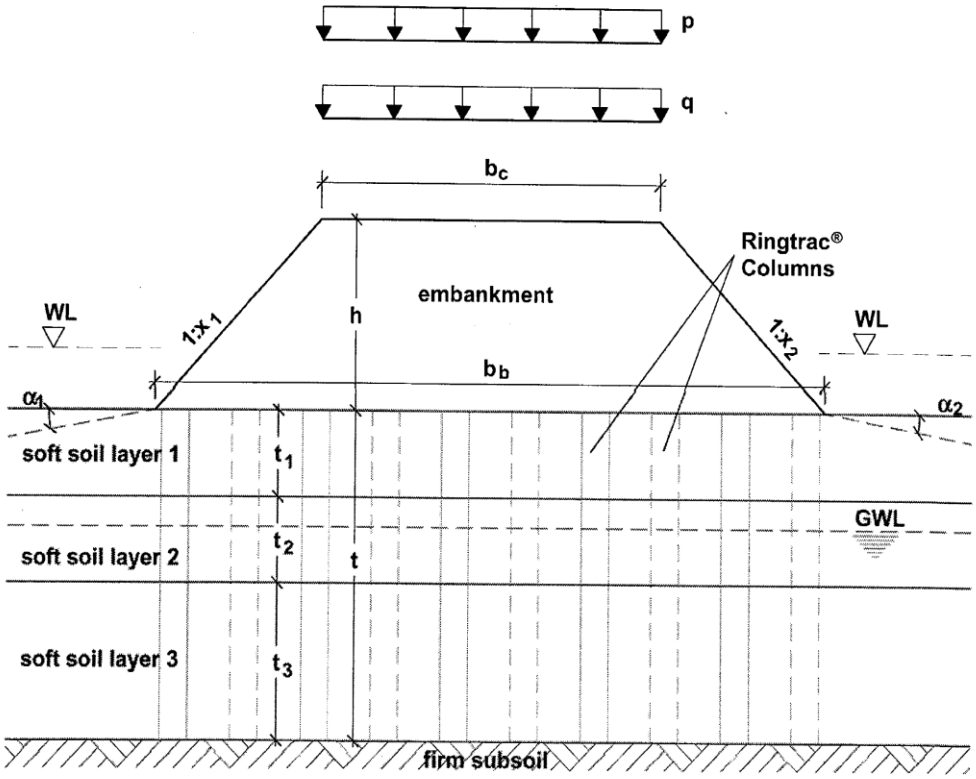
ELBE RIVER : HAMBURG GERMANY : RECLAMATION

HUESKER
Engineering with Geosynthetics

Questionnaire Embankment on Ringtrac®-Encased Columns

1. General

Project/object name: _____
Company/client: _____
Contact person: _____
Telephone number: _____
Fax number: _____
E-Mail: _____
Internal person in charge: _____



In addition to this questionnaire a representative cross section drawing illustrating soil stratification, geometry, loads and water levels as well as a location plan showing an overview of the entire structure are required.

2. Geometry, loads and soil parameters

2.1 Geometry			
Embankment height	h		[m]
Crest width	b_c		[m]
Base width	b_b		[m]
Length of the embankment	l		[m]
Slope inclination (left)	$1 : x_1$		[-]
Slope inclination (right)	$1 : x_2$		[-]
Angle of the terrain (left)	α_1		[°] (respectively 1:n)
Angle of the terrain (right)	α_2		[°] (respectively 1:n)
Total thickness of all soft soil layers	t		[m]
Thickness of soft soil layer 1	t_1		[m]
Thickness of soft soil layer 2	t_2		[m]
Thickness of soft soil layer 3	t_3		[m]

2.2 Loads			
Dead load	p		[kN/m²]
Live load	q		[kN/m²]

2.3 Soil parameters of the embankment fill			
Soil designation			[e.g. sandy gravel]
Effective angle of internal friction	φ'		[°]
Effective cohesion	c'		[kN/m²]
Soil unit weight	γ		[kN/m³]

2.4 Soil parameters of the columns filling material			
Soil designation*			[e.g. sand]
Effective angle of internal friction	φ'		[°]
Effective cohesion	c'		[kN/m²]
Oedometric (constrained) modulus	E_s		[kN/m²]
Soil unit weight	γ		[kN/m³]

* additionally a gradation curve should be provided

2.5 Soil parameters of the soft soil layers			
Soft soil layer 1			
Soil designation			[e.g. soft clay]
Effective angle of internal friction	φ'		[°]
Effective cohesion	c'		[kN/m²]
Unconsolidated shear strength	s_u		[kN/m²]
Soil unit weight	γ		[kN/m³]
Poisson's ratio	ν		[-]
Oedometric (constrained) modulus $E_{s,ref}$ at a reference normal stress p_{ref}	$E_{s,ref}$		[kN/m²]
	p_{ref}		[kN/m²]
Soft soil layer 2			
Soil designation			[e.g. fine sand]
Effective angle of internal friction	φ'		[°]
Effective cohesion	c'		[kN/m²]
Unconsolidated shear strength	s_u		[kN/m²]
Soil unit weight	γ		[kN/m³]
Poisson's ratio	ν		[-]
Oedometric (constrained) modulus $E_{s,ref}$ at a reference normal stress p_{ref}	$E_{s,ref}$		[kN/m²]
	p_{ref}		[kN/m²]
Soft soil layer 3			
Soil designation			[e.g. silty clay]
Effective angle of internal friction	φ'		[°]
Effective cohesion	c'		[kN/m²]
Unconsolidated shear strength	s_u		[kN/m²]
Soil unit weight	γ		[kN/m³]
Poisson's ratio	ν		[-]
Oedometric (constrained) modulus $E_{s,ref}$ at a reference normal stress p_{ref}	$E_{s,ref}$		[kN/m²]
	p_{ref}		[kN/m²]

2.6 Soil parameters of the firm subsoil			
Soil designation*			[e.g. silty gravel]
Effective angle of internal friction	φ'		[°]
Effective cohesion	c'		[kN/m²]
Oedometric (constrained) modulus	E_s		[kN/m²]
Soil unit weight	γ		[kN/m³]

2.7 Water levels			
☐ Ground water level (below the base of the embankment)	GWL		[m]
☐ Water level (above the base of the embankment)	max WL		[m]
	min WL		[m]

3. Method of installation and installation equipment (if known or preferred)

☐ Replacement method of installation		
Drilling rig (producer and type)		
Operating weight		[kN]
Crowd pull force		[kN]
Crowd push force		[kN]
Vibrator (producer and type)		
Inner diameter of the steel casing (tube)		[mm]
Outer diameter of the steel casing (tube)		[mm]
☐ Displacement method of installation		
Drilling rig (producer and type)		
Operating weight		[kN]
Crowd pull force		[kN]
Crowd push force		[kN]
Vibrator (producer and type)		
Inner diameter of the steel casing (tube)		[mm]
Outer diameter of the steel casing (tube)		[mm]

4. Additional information (Construction time? Allowable total and post-construction settlements? Preferred column grid (triangular or rectangular) and spacing? Et cetera)

5. Target date of project completion

Date: _____ Signature: _____

Version 07.08

BLANK