APPENDIX H.5

GEOCOMPOSITE DRAINAGE NET CAPACITY

Shaw®

Shaw® Shaw Environmental, Inc.

Client:	**Clinton Landfill, Inc.**
Project:	**Clinton LF. No. 3 Chemical Waste Unit**
Proj. #:	**128017**
Calculated By: PCT	**Date:** 9/26/07
Checked By: JPV	**Date:** 10/9/07

TITLE: GEOCOMPOSITE DRAINAGE NET CAPACITY

Problem Statement

Design a geocomposite drainage system for the proposed Clinton Landfill No. 3 Chemical Waste Unit. The geocomposite drainage system will consist of a geocomposite overlying the 40-mil LLDPE, that drains into the perimeter ditch as shown on Drawing Nos. D7, and D15.

Given

- ☐ Detail of final cover system showing geocomposite drainage layer is presented on Drawing No. D16 contained in this application.
- ☐ Koerner, R.M. and D.E. Daniel, *Final Covers for Solid Waste Landfills and Abandoned Dumps.* Thomas Telford. (Refer to attached pages).
- ☐ Koerner, R.M., Designing with Geosynthetics, Prentice Hall, Fifth Edition. (Refer to attached pages).
- ☐ Richardson, G., *Design of Waste Containment and Final Closure Systems.* ASCE Conference - April 2001. (Refer to attached pages).
- ☐ Richardson, G.N., Giroud, E.C.P., and A. Zhao, *Design of Lateral Drainage Systems for Landfills.* (Refer to attached pages).
- ☐ Hydrogeologic Evaluation of Landfill Performance (HELP) model. (Refer to attached pages).
- ☐ Landfill design specifications for layer types and thickness.

Assumptions

- ☐ The following equation is used to calculate the minimum required transmissivity (T_{min}) of the geocomposite drainage layer of the final cover:

$$T_{min} = \frac{B^2 * q}{h_{max} + B * \sin(\alpha)}$$

Where,
T_{min} = Minimum Transmissivity of Geocomposite (ft^2/sec)
B = Longest Distance along 4H:1V slope of final cover system (feet)
q = Impingement Rate (ft/sec)
h_{max} = Maximum Head Build-up (ft)
α = Slope Angle (degrees)

☐ The distance B is 852 feet (refer to Drawing No. D13).

☐ The impingement rate (q) was conservatively assumed equal to the peak daily rate of drainage through the drainage net during the closure period, years 1 through 30 — q = 0.6418 in/day (see HELP Model results in Appendix I).

☐ The maximum head build-up (h_{max}) is assumed equal to the thickness of the geocomposite equal to 0.325 inches or 0.027 feet.

☐ The slope angle (α) for the drainage path is 14.04° (4H:1V).

☐ Equation used to calculate the required transmissivity ($T_{LAB\ REQUIRED}$) of geocomposite (modified from Koerner and Daniel):

$$T_{LT} = \frac{T_{LAB\ REQUIRED}}{RF_{IN} * RF_{CR} * RF_{CC} * RF_{BC}}$$

Solve for $T_{LAB\ REQUIRED}$:

$$T_{LAB\ REQUIRED} = (T_{LT})(RF_{IN} * RF_{CR} * RF_{CC} * RF_{BC})$$

Where,
$T_{LAB\ REQUIRED}$ = required transmissivity of geocomposite
T_{LT} = long-term transmissivity of geocomposite equal to T_{min}
RF_{IN} = reduction factor for elastic deformation
RF_{CR} = reduction factor for creep deformation
RF_{CC} = reduction factor for chemical clogging
RFBC = reduction factor for biological clogging

☐ The following reduction factors will be used (RF_{IN} = 1.2, RF_{CR} = 1.4, RF_{CC}, = 1.2, and RF_{BC} = 1.5). These values are the upper end values based on testing on geocomposites under low normal stresses. (Refer to Richardson and others).

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☐ Equation used to calculate the design factor of safety (modified from Koener and Daniel):

$$F.S. = \frac{T_{PRODUCT}}{T_{LAB\ REQUIRED}}$$

☐ The product transmissivity $T_{PRODUCT}$ of the geonet is $1.0\text{x}10^{-3}$ m²/sec (see Specifications).

Calculations

Impingement Rate (ft/sec) into the Geocomposite

$$q = \left(\frac{0.6418\text{ in}}{\text{day}}\right)\left(\frac{1\text{ ft}}{12\text{ in}}\right)\left(\frac{1\text{ day}}{24\text{ hrs}}\right)\left(\frac{1\text{ hr}}{3{,}600\text{ sec}}\right) = 6.19 \times 10^{-7}\text{ ft/sec}$$

Minimum Transmissivity of Geocomposite

Determine the minimum transmissivity of the geocomposite.

$$T_{min} = \frac{B^2 * q}{h_{max} + B * \sin(a)} = \frac{(852\text{ ft})^2 * 6.19\text{x}10^{-7}\text{ ft/sec}}{.027\text{ ft} + 852\text{ ft} * \sin(14.04^\circ)} = 2.17\text{x}10^{-3}\text{ ft}^2\text{/sec}$$

$$T_{min} = \left(\frac{2.17\text{x}10^{-3}\text{ ft}^2}{\text{sec}}\right)\left(\frac{1\text{m}}{3.28\text{ ft}}\right)^2 = 2.02 \times 10^{-4}\text{ m}^2\text{/sec}$$

Long-Term Transmissivity of Geocomposite

Determine the long-term transmissivity of the geocomposite utilizing T_{MIN} and the reduction factors.

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$$T_{LT} = T_{min} = \frac{T_{LABREQUIRED}}{RF_{IN} * RF_{CR} * RF_{CC} * RF_{BC}}$$

Solven for $T_{LABREQUIRED}$:

$$T_{LABREQUIRED} = (1.2 * 1.4 * 1.2 * 1.5)\ (2.02 \times 10^{-4}\ m^2/sec)$$

$$T_{LABREQUIRED} = 6.11 \times 10^{-4}\ m^2/sec$$

Factor of Safety for Geocomposite

$$F.S. = \frac{T_{PRODUCT}}{T_{LAB\ REQUIRED}} = \frac{1.0 \times 10^{-3}\ m^2/sec}{6.11 \times 10^{-4}\ m^2/sec}$$

$$F.S. = 1.6$$

Conclusion

The above calculation demonstrates that the required transmissivity of the geocomposite is more than adequate to handle the anticipated stormwater infiltration for the proposed Clinton Landfill No. 3 Chemical Waste Unit.

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FINAL COVERS FOR SOLID WASTE LANDFILLS AND ABANDONED DUMPS

Thomas Telford
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> the drainage layer and the underlying geomembrane, and to prevent intrusion, by deformation, of the geomembrane into the geonet or drainage core of the drainage layer.

Since the normal stresses in a drainage system within the final cover are quite low (construction equipment is probably the largest), a wide range of geonets and geocomposites can be used for the drainage layer. Such geosynthetic drains would be an alternative to the granular soil drains just discussed. However, all geosynthetic drains require a geotextile filter acting as a separator to keep the protection soil from directly moving into the apertures of the geonet or drainage core. Furthermore, if the underlying barrier layer contains a geomembrane (as it usually does), a geotextile may have to be on the underside of the geonet or drainage core, as well as above it, to protect the geomembrane from puncture by the drainage geosynthetic.

The design of a geonet or geocomposite drainage core is straightforward. It results in the quantification of a flow rate factor of safety as follows:

$$FS = \frac{q_{allow}}{q_{reqd}} \qquad (2.6)$$

where

FS = factor of safety (to handle unknown hydraulic conditions or uncertainties),
q_{allow} = allowable flow rate, as obtained from laboratory testing, and
q_{reqd} = required flow rate, as obtained from design requirements of the actual system.

The allowable flow rate comes from laboratory testing of the product under consideration. The test setup must simulate the actual field system as closely as possible. If it does not model the field system accurately, then some adjustments to the laboratory value must be made. This is usually the case. Thus, the laboratory-generated flow rate is an ultimate value which must be reduced before use in design; that is,

$$q_{allow} < q_{ult} \qquad (2.7)$$

One way of doing this is to ascribe reduction factors to each of the items not simulated in the laboratory test. This can be accommodated as follows:

$$q_{allow} = q_{ult}\left[\frac{1}{RF_{IN} \times RF_{CR} \times RF_{CC} \times RF_{BC}}\right] \qquad (2.8)$$

or if all of the reduction factors are lumped together,

$$q_{allow} = q_{ult}\left[\frac{1}{\Pi RF}\right] \tag{2.9}$$

where

q_{ult} = flow rate determined from a short-term transmissivity test between solid plates, e.g., ASTM D4716,
q_{allow} = allowable flow rate to be used for final design purposes,
RF_{IN} = reduction factor for elastic deformation, or intrusion, of the adjacent geosynthetics into the drainage core space,
RF_{CR} = reduction factor for creep deformation of the drainage core and/or adjacent geosynthetics into the drainage core space,
RF_{CC} = reduction factor for chemical clogging and/or precipitation of chemicals in the geonet's core space,
RF_{BC} = reduction factor for biological clogging in the drainage core space, and
ΠRF = product of all reduction factors for the site-specific conditions.

Other reduction factors, such as installation damage, temperature effects, and liquid turbidity, might also have to be included. If needed, they can be included on a site-specific basis. On the other hand, if the test procedure has included the particular item, the reduction factor would appear in the foregoing formulation as a value of unity. Details of the design and guidelines for various reduction factors are given in Koerner (1994).

2.3.3.3 Geotextile Filters. As noted previously, a geotextile must cover the geonet or drainage core, and its primary function will be to serve as a filter. In so doing, the geotextile must allow the water to pass without building up pore water pressure and, simultaneously, must retain the upstream soil so that upgradient piping and downgradient clogging of the geonet or drainage core do not occur. Thus, the design is a two-step process; first, for permeability (or permittivity); second, for soil retention (or apparent opening size).

Geotextile permeability is the first part of a geotextile filter design. It formulates a factor of safety using permittivity, which is the permeability divided by the geotextile's thickness, as follows:

$$FS = \frac{\psi_{allow}}{\psi_{reqd}} \tag{2.10}$$

$$\psi = \frac{k_n}{t} \tag{2.11}$$

---

where

ψ = permittiv
k_n = cross-pl
t = thicknes

The testing for g
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where

d_{85} = soil p
O_{95} = the 9

Details of the
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Design of Waste Containment and Final Closure Systems

Presented By

Gregory Richardson

Colorado Department of Health & Environment
April 10-11, 2001

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- Step 2 - Evaluate Hydraulic Capacity of Drain

$Q_{out} = k_2 \, iA_2$

k_2 = permeability of drain layer

i = gradient = $\sin \beta$

Setting $Q_{in} = Q_{out}$

$k_{2min} = (k_1 L) / (\sin\beta \times D)$ OR $(EL)/(\sin\beta \times D)$

<u>D = ft max</u> (MAXIMUM DEPTH OF FLOW)

- <u>Alternative Step 2</u> (FOR USE W/ GEONETS)

Minimum transmissivity of Drain, T_{min}

$$T_{min} = \frac{B^2 \times q}{h_{max} + B \sin \Theta}$$

q = E = IMPINGEMENT

(see next page)

B = ½ PIPE SPACING

DESIGN OF LATERAL DRAINAGE SYSTEMS FOR LANDFILLS

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e 3.3. Guidance for the selection of some of the reduction factors on the flow capacity of geonets and eocomposites having a geonet transmissive core.

Examples of application	Normal stress	Liquid	RF_{IN}	RF_{CR}	RF_{CC}	RF_{BC}
Landfill cover drainage layer, Low retaining wall drainage	Low	Water	1.0 – 1.2	1.1 – 1.4	1.0 – 1.2	1.2 – 1.5
Embankment, Dams, Landslide repair, High retaining wall drainage	High	Water	1.0 – 1.2	1.4 – 2.0	1.0 – 1.2	1.2 – 1.5
Landfill leachate collection layer, Landfill leakage collection and detection layer, Leachate pond leakage collection and detection layer	High	Leachate	1.0 – 1.2	1.4 – 2.0	1.5 – 2.0	1.5 – 2.0

Notes: Table 3.3 was developed using reduction factor values from Koerner (1998). Design engineers are cautioned that the values of the reduction factors may significantly vary depending on the type of geocomposite and the exposure conditions (stress, chemical composition of the soil and liquid). Also, RF_{IN} and RF_{CR} depend on the testing conditions under which the hydraulic transmissivity is measured. The reduction factor values given in Table 3.3 correspond to the case where the seating time is of the order of 100 hours or more and the boundary conditions due to adjacent materials are simulated in the hydraulic transmissivity test. Finally, due to lack of relevant data, no guidance is provided for RF_{CD} and RF_{PC}.

Also, it should be noted that RF_{CR}, RF_{CD}, RF_{CC} and RF_{BC} (and, to a lesser degree, RF_{IN} and RF_{PC}) correspond to time-dependent mechanisms. Therefore, the values of RF_{CR}, RF_{CD}, RF_{CC} and RF_{BC} (and, to a lesser degree, RF_{IN} and RF_{PC}) selected by the design engineer depend on the design life of the liquid collection layer. In cases where the liquid supply rate varies with time, the design engineer may consider several time periods. For e ple, in the case of landfills with no leachate recirculation, three phases may be considered: (i) ruction and pre-operational phase; (ii) operational phase; and (iii) post-closure phase. As time elapses, the ate collection system will typically experience a reduction in the rate of leachate that needs to be collected, but may concurrently experience a reduction of its flow capacity due to time-dependent mechanism such as creep and clogging.

The above discussion is for geocomposites, in particular, for geocomposites whose transmissive core is a geonet (which are the most frequently used geosynthetic liquid collection layers). In the case where the geosynthetic liquid collection layer is a thick needle-punched nonwoven geotextile, the mechanisms described above exist with the exception of geotextile intrusion into the transmissive core since, in this case, the geotextile itself is the transmissive medium. In this case, the reduction factors presented above exist, but no guidance is proposed herein regarding their values.

Finally, it should be noted that the various reduction factors may not be completely independent. For example, chemical degradation may affect creep resistance (i.e. may increase RF_{CR}), and, as shown by Palmeira and Gardoni (2000), the presence of soil particles in a needle-punched nonwoven geotextile (i.e. particulate clogging) may reduce the geotextile's compressibility (i.e. it may reduce RF_{IMCO} and RF_{CR} while increasing RF_{PC}).

In the absence of site specific testing data, the authors recommend the upper limits of the above default values for landfill covers, average default values for leachate collection systems, and lower limits for leakage detection systems. This reflects the service life of the final cover, the potential for significant compressive creep or intrusion of the leachate collection systems, the large quantity of leachate to be handled by the leachate collection system, and the expected lower level of intrusion and leachate volume to be conveyed by the leakage detection system. When a design drainage safety factor of 2 is used, the total default long-term ce reduction factor (including the reduction factors) suggested (Richardson and Zhao, 1998) is as follows:

- 6 for landfill closures (design drainage safety factor (2), intrusion (1.2), creep (1.4), biological clogging (1.2), chemical clogging (1.5), i.e., 2*1.2*1.4*1.2*1.5 = 6.0);
- 20 for leachate collection systems (2*1.2*2.0*2.0*2.0 = 19.6);
- 20 for leakage detection systems (2*1.2*2.0*2.0*2.0 = 19.6).

Thus

$\theta_{ultimate} = 6*3*10^{-5}$ m^3/sec-m $= 1.8*10^{-4}$ m^3/sec-m for cover drains
$\theta_{ultimate} = 20*3*10^{-5}$ m^3/sec-m $= 6*10^{-4}$ m^3/sec-m for leachate collection drains.
$\theta_{ultimate} = 10*3*10^{-5}$ m^3/sec-m $= 6*10^{-4}$ m^3/sec-m for leakage collection drains.

3.3 Laboratory Long-Term Transmissivity Evaluation Base On Site Conditions

As discussed above, an ideal transmissivity test would perfectly simulate all the field mechanisms that reduce the transmissivity during the service life such that all of the reduction factors would be equal to 1.0. Unfortunately, this is not possible. This means that the designer must clearly understand to what degree each of the reduction factors has been simulated in the laboratory transmissivity test. Information of such considerations is currently not incorporated in ASTM D-4716. This section discusses what information is currently known regarding such considerations.

3.3.1 Geotextile Intrusion, RF_{IN}

transmissivity value must be obtained under normal loads exceeding the field-anticipated long-term aximum pressure and site-representative hydraulic gradient. The test boundary conditions must replicate actual field service conditions. For the surface water removal layer in landfill covers and the leachate collection layer in landfill liners, the upper boundary is either a vegetative supporting soil layer or drainage/protection layer. The appropriate overlying material must be included in the transmissivity test to properly simulate the intrusion of the geotextile into the geonet and the resulting loss of transmissivity. For leakage detection system testing, the upper boundary of the geonet is either another geomembrane or a filter geotextile/soil barrier layer forming part of a composite primary liner system. In the case of a composite primary liner, the upper boundary in the transmissivity test must include both the filter geotextile and a soil layer. Holtz et al. (1997) suggests that the sustained normal load in transmissivity tests needs to be at least 300 hours or until equilibrium is reached, whichever is greater. Figure 3.2 presents the long-term transmissivity test data for a triplanar geonet composite tested under in-soil condition and normal load of 720 kPa (15,000psf).

Figure 3.2 Long-term transmissivity for a triplanar Geocomposite (with soil boundary, 270 g/m^2 nonwoven each face, normal load =720 kPa)

Transmissivity test data indicate that the default reduction value for geotextile intrusion might be greatly underestimated, especially under high normal loads. Even if a soil layer is simulated in the transmissivity test, an increased reduction factor for intrusion should still be considered in design to account for variance of soil types, moisture content, compaction effort, and scale effect.

GSE®

GSE HyperNet*
HDPE Geonet

GSE HyperNet products are geosynthetic drainage materials composed of two bonded, overlapping HDPE strands commonly referred to as geonet. HyperNet transmits fluids (liquids and gases) in the plane of the net by creating open channels that allow flow. HyperNet is a premium grade geonet with excellent chemical resistance, mechanical properties and life expectancy.

GSE HyperNet HF*
HDPE High Flow Geonet

GSE HyperNet HF products are manufactured in the same manner as standard GSE HyperNet but are designed specifically for use in situations where high flow and high loads are expected such as in landfill cell designs.

GSE HyperNet CP*
HDPE Capping Geonet

GSE HyperNet CP products are manufactured in the same manner as standard GSE HyperNet but are designed specifically for use in situations where lower normal loads are expected such as in landfill cap designs.

TESTED PROPERTY	TEST METHOD	MINIMUM AVERAGE VALUES[e]		
		HyperNet	HyperNet HF	HyperNet CP
Transmissivity, m^2/sec	ASTM D 4716	1×10^{-3} [a]	2×10^{-3} [b]	1×10^{-3} [c]
Thickness, mil (mm)	ASTM D 5199	200 (5)	250 (6.3)	200 (5)
Density, g/cm^3	ASTM D 1505	0.94	0.94	0.94
Tensile Strength (MD), lb/in (N/mm)	ASTM D 5034/5035	45 (7.9)	55 (9.6)	32 (5.6)
Carbon Black Content, %	ASTM D 1603	2.0	2.0	2.0
Roll Width, ft (m)		14 (4.3)	14 (4.3)	14 (4.3)
Roll Length[d] ft (m)		300 (90)	300 (90)	300 (90)

[a] Gradient of 1.0, normal load of 10,000 psf, water at 70°F between stainless steel plates

[b] Gradient of 0.1, normal load of 10,000 psf, water at 70°F between stainless steel plates

[c] Gradient of 1.0, normal load of 4,000 psf, water at 70°F between stainless steel plates

[d] Other roll lengths may be available upon request.

[e] These are typical values and are based on the cumulative results of specimens tested and as determined by GSE Quality Assurance practices.

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SECOND EDITION

FOUNDATION DESIGN

Principles and Practices

DONALD P. CODUTO

considering a slice of the foundation of length b and taking moments about Point A, w obtain the following:

$$M_A = (q_{ult}Bb)(B/2) - (s_u \pi Bb)(B) - \sigma_{zD}Bb(B/2) \qquad \text{(6.1}$$

$$q_{ult} = 2\,\pi\,s_u + \sigma_{zD} \qquad \text{(6.2}$$

It is convenient to define a new parameter, called a *bearing capacity factor*, N_c, an rewrite Equation 6.2 as:

$$\boxed{q_{ult} = N_c s_u + \sigma_{zD}} \qquad \text{(6.3}$$

Equation 6.3 is known as a *bearing capacity formula*, and could be used to evaluate the bearing capacity of a proposed foundation. According to this derivation, $N_c = 2\pi = 6.28$.

This simplified formula has only limited applicability in practice because it considers only continuous footings and undrained soil conditions ($\phi = 0$), and it assumes the foundation rotates as the bearing capacity failure occurs. However, this simple derivation illustrates the general methodology required to develop more comprehensive bearing capacity formulas.

Terzaghi's Bearing Capacity Formulas

Various limit equilibrium methods of computing bearing capacity of soils were advanced in the first half of the twentieth century, but the first one to achieve widespread acceptance was that of Terzaghi (1943). His method includes the following assumptions:

- The depth of the foundation is less than or equal to its width ($D \leq B$).
- The bottom of the foundation is sufficiently rough that no sliding occurs between the foundation and the soil.
- The soil beneath the foundation is a homogeneous semi-infinite mass (i.e., the soil extends for a great distance below the foundation and the soil properties are uniform throughout).
- The shear strength of the soil is described by the formula $s = c' + \sigma' \tan \phi'$.
- The general shear mode of failure governs.
- No consolidation of the soil occurs (i.e., settlement of the foundation is due only to the shearing and lateral movement of the soil).
- The foundation is very rigid in comparison to the soil.
- The soil between the ground surface and a depth D has no shear strength, and serves only as a surcharge load.
- The applied load is compressive and applied vertically to the centroid of the foundation and no applied moment loads are present.

Terzaghi considered three zones in the soil, as shown in Figure 6.5. Immediately beneath the foundation is a *wedge zone* that remains intact and moves downward with the

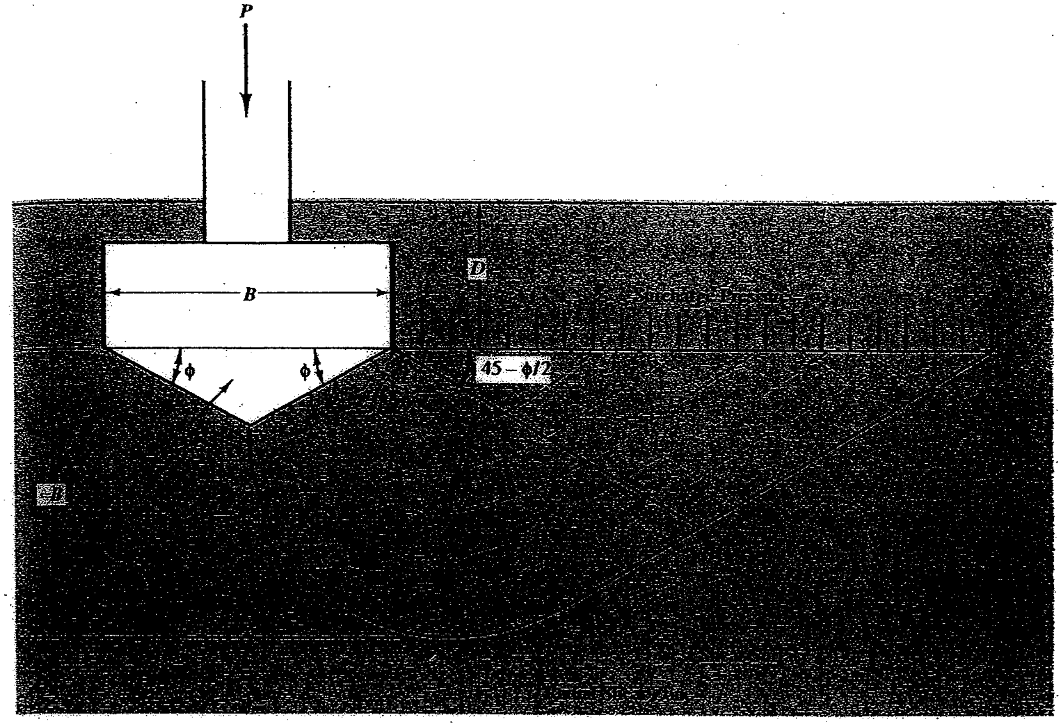

Figure 6.5 Geometry of failure surface for Terzaghi's bearing capacity formulas.

foundation. Next, a *radial shear zone* extends from each side of the wedge, where he took the shape of the shear planes to be logarithmic spirals. Finally, the outer portion is the *linear shear zone* in which the soil shears along planar surfaces.

Since Terzaghi neglected the shear strength of soils between the ground surface and a depth D, the shear surface stops at this depth and the overlying soil has been replaced with the surcharge pressure σ_{zD}'. This approach is conservative, and is part of the reason for limiting the method to relatively shallow foundations ($D \leq B$).

Terzaghi developed his theory for continuous foundations (i.e., those with a very large L/B ratio). This is the simplest case because it is a two-dimensional problem. He then extended it to square and round foundations by adding empirical coefficients obtained from model tests and produced the following bearing capacity formulas:

For square foundations:

$$\boxed{q_{ult} = 1.3\,c'N_c + \sigma_{zD}'N_q + 0.4\gamma' B N_\gamma} \tag{6.4}$$

For continuous foundations:

$$\boxed{q_{ult} = c'N_c + \sigma_{zD}'N_q + 0.5\gamma' B N_\gamma} \tag{6.5}$$

Caterpillar Performance Handbook

Edition 32

CATERPILLAR®

Waste Disposal Landfill Compactors

MODEL	816F		826G		836G	
Flywheel Power	164 kW	220 hp	235 kW	315 hp	358 kW	480 hp
Operating Weight*	22 780 kg	50,115 lb	33 350 kg	73,370 lb	49 790 kg	109,760 lb
Engine Model	3306 DITA		3406C DITA		3456 DITA	
Rated Engine RPM	2200		2100		1900	
No. Cylinders	6		6		6	
Displacement	10.5 L	638 in³	14.6 L	893 in³	15.8 L	964 in³
Speeds:						
Forward	4		2		2	
Reverse	4		2		2	
Clearance Turning Circle with Blade	12.8 m	42'2"	14.69 m	48'2"	18.26 m	59'10"
Fuel Tank Refill Capacity	446 L	117.8 U.S. gal	630 L	166.5 U.S. gal	795 L	210 U.S. gal
WHEELS:	CHOPPER		CHOPPER		PLUS-TIPS	
Each Drum Width	1.02 m	3'4"	1.2 m	3'11"	1.4 m	4'7"
Diameters, over Blade Tips	1.6 m	5'3"	1.83 m	6'0"	—	
Drum only	1.3 m	4'3"	1.53 m	5'0"	1.49 m	5'8"
Blade Tips per Wheel	20		24		35	
Blade Length	348 mm	13.7"	419 mm	16.5"	294 mm	11.6"
Blade Height	152 mm	6"	152 mm	6"	165 mm	6.5"
Blade Thickness/Width	22 mm	0.87"	28.6 mm	1.125"	150 mm	5.9"
TIPS per Wheel	20		25		35	
Two Pass Coverage	4.5 m	14'9"	4.78 m	15'8"	5.67 m	18'7"
ENERAL DIMENSIONS:						
Height (to top of ROPS)	3.45 m	11'4"	3.82 m	12'7"	4.17 m	13'8"
Height (stripped top)**	2.5 m	8'3"	2.74 m	9'0"	3.2 m	10'6"
Wheel Base	3.35 m	11'0"	3.7 m	12'2"	4.55 m	14'11"
Overall Length with Dozer	7.79 m	25'7"	8.42 m	27'7"	10.18 m	33'5"
Width over Drums	3.33 m	10'11"	3.8 m	12'6"	4.28 m	14'1"
Ground clearance	532 mm	1'9"	505 mm	1'8"	596 mm	23.5"
DFILL BULLDOZER:						
Width	3.65 m	12'0"	4.5 m	14'9"	5.19 m	17'0"
Height***	1.91 m	6'3"	1.9 m	6'3"	2.22 m	7'3"

ing Weight includes coolant, bulldozer, hydraulics, ROPS cab, full fuel tank, and operator.
ht (stripped top) — without ROPS cab, exhaust, seat back or other easily removed encumbrances.
p of trash screen.

KEY
1 – 1st Gear
2 – 2nd Gear
3 – 3rd Gear
4 – 4th Gear