

From: Mark Seel
To: Kleinberg, Sam; pandersonpe@gmail.com
Cc: MacNeill, Ryan; Rizzo, Jordan; Hernández, Nelson; Mazier, Alejandra
Subject: RE: WEHI
Date: Tuesday, December 9, 2025 4:52:02 PM
Attachments: Ref Miao 2025.pdf
Ref Stevens 2006.pdf

038

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Sam, our responses are provided in red italic font below:

1. A basis or reference should be provided for the selection of $c=100$ psf . For example see attached ref from "Biotechnical Slope Protection and Erosion Control" The values selected should be based on a representative estimate of the root area ratio. *The use of RAR is considered a specialized analytical technique not a universal standard of practice in typical New Jersey geotechnical engineering design. You'll recall that Langan evaluated a higher water table, which in our opinion was a worst-case condition considering there is no groundwater, and the design case you've asked us to consider seems unlikely as you testified to last week that this analysis represents a condition that is extraordinarily unlikely to occur or be problematic. The references on the subject typically relate to tree species and steep slopes in the western US/Canada/Mexico and overseas in China, New Zealand, etc. where steep slopes are generally more susceptible to failure, not specifically to conditions in the eastern US. The slopes east of Building D are generally not steep. References are attached. Miao, et al 2025 indicates trees at least 20 feet in height and 30 years of age have at least 7.5 kPa (156 psf) apparent root cohesion, and larger older trees upwards of 10 kPa (208 psf). Stevens, et al, 2006 indicates natural forests and lab analysis have apparent root cohesion of at least 25 kPa (522 psf) and 4.9 kPa (100 psf), respectively. The site has a very mature older growth woodland setting. Based on these technical references, an effective root cohesion of more than 150 psf is substantiated. See our response to #3 below for more discussion.*
2. The FS decreases quickly with depth. The analysis should, in our opinion be extended to at least 3 feet depth. *Infinite slope stability assumes a uniform slope and homogeneous soil conditions. Only the upper 2 feet of soil is homogeneous. Below the topsoil is predominantly dense sand and gravel (having significantly higher shear strength than the topsoil). Evaluating the upper 3 feet, in our opinion, no longer represents a homogeneous soil profile; thus, further reducing the applicability of this analysis.*
3. Based on our initial review safety factors of 1.2 would be appropriate for an extreme event. *Lowering the effective root cohesion to 50 psf (which approximates effective root cohesion from grassland per the references), reduces the lowest FS (at only one location) to 1.2. As noted in response to #1 above, the literature substantiates higher effective root cohesion than the 100 psf we used. By further reducing the effective root cohesion to 50 psf, the value is approaching the cohesion of a saturated inorganic silt, which is what the topsoil is, and hence, 50 psf in our opinion is*

essentially ignoring the presence of roots. Nonetheless, the FS indicates stability, and reinforces your opinion that such an extraordinary analysis case of sloughing is unlikely to occur.

4. ACS as the designer of the Basins should, in our opinion, provide the evaluation to resolve the comment related to the impact of basin mounding on the slope. *Langan performed the slope stability analysis using a design groundwater level that is higher in elevation in the soil and rock comprising the eastern slope than the high water level in the basins during any storm event. Because water in the basins cannot flow upward against gravity, there is no impact from mounding.*

I trust this satisfies your request.

Mark

Mark Seel
Associate Principal / Vice President

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From: Kleinberg, Sam <SKleinberg@cmeusa1.com>

Sent: Friday, December 5, 2025 3:49 PM

To: Mark Seel <mseel@langan.com>; pandersonpe@gmail.com

Cc: MacNeill, Ryan <rmacneill@cmeusa1.com>; Rizzo, Jordan <jrizzo@cmeusa1.com>; Hernández, Nelson <NHernandez@cmeusa1.com>; Mazier, Alejandra <AMazier@cmeusa1.com>

Subject: RE: WEHI

Hello Mark, Our initial comments are as follows:

1. A basis or reference should be provided for the selection of $c=100$ psf . For example see attached ref from "Biotechnical Slope Protection and Erosion Control" The values selected should be based on a representative estimate of the root area ratio.
2. The FS decreases quickly with depth. The analysis should, in our opinion be extended to at least 3 feet depth.
3. Based on our initial review safety factors of 1.2 would be appropriate for an extreme event.

4. ACS as the designer of the Basins should, in our opinion, provide the evaluation to resolve the comment related to the impact of basin mounding on the slope.

The submittals should be submitted through whatever channel has been established by the board for this purpose. Based on the last meeting, these submittals and our response will be requested by the We Care team in order to resolve the slope issues. We will review them as soon as possible when they are received.

If you have any questions, please do not hesitate to call even on the weekend if you are able to.

From: Mark Seel <mseel@langan.com>

Sent: Friday, December 5, 2025 10:24 AM

To: Kleinberg, Sam <SKleinberg@cmeusa1.com>; pandersonpe@gmail.com

Cc: MacNeill, Ryan <rmacneill@cmeusa1.com>; Rizzo, Jordan <jrizzo@cmeusa1.com>; Hernández, Nelson <NHernandez@cmeusa1.com>; Mazier, Alejandra <AMazier@cmeusa1.com>

Subject: RE: WEHI

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Sam,

As requested on 12/3/2025, attached are:

1. The summaries for the shallow slope stability cases you requested, assuming full saturation and slope parallel seepage; and,
2. Output files from ACS of their NJDEP-approved groundwater mounding analysis.

Regarding #2, ACS presents 100-year peak stormwater elevations for basins 10 and 11 that correspond to groundwater mounding of roughly 2.3 feet and 2.0 feet, respectively within roughly 12 feet of each basin center. ACS files show the mounding dissipates to zero about 45 feet from the center of Basin 10, which indicates no effect outside the basin – note the basin is about 123 feet west of the building. ACS files show the mounding dissipates to zero about 30 feet from the center of Basin 11, which indicates a slight mounding effect to about 18 feet beyond the basin, which is roughly 12 feet west of the building. Note that the groundwater elevations we modelled in our slope stability analysis are just below the building foundations, but are higher on the east side of the building which you can see in the output files we sent you for the high groundwater cases. Therefore, there is no impact on the eastern slope related to mounding.

I trust this satisfies your request.

Mark

Mark Seel

Associate Principal / Vice President

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From: Kleinberg, Sam <SKleinberg@cmeusa1.com>

Sent: Tuesday, December 2, 2025 5:09 PM

To: Mark Seel <mseel@langan.com>; pandersonpe@gmail.com

Cc: MacNeill, Ryan <rmacneill@cmeusa1.com>; Rizzo, Jordan <jrizzo@cmeusa1.com>; Hernández, Nelson <NHernandez@cmeusa1.com>; Mazier, Alejandra <AMazier@cmeusa1.com>

Subject: FW: WEHI

Thank you Mark for your quick reply,; Please see our comments below in red:

From: Mark Seel <mseel@Langan.com>

Sent: Tuesday, December 2, 2025 1:24 PM

To: Kleinberg, Sam <SKleinberg@cmeusa1.com>; pandersonpe@gmail.com

Cc: Hernández, Nelson <NHernandez@cmeusa1.com>; MacNeill, Ryan <rmacneill@cmeusa1.com>; Rizzo, Jordan <jrizzo@cmeusa1.com>; Mazier, Alejandra <AMazier@cmeusa1.com>

Subject: RE: WEHI

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Sam,

A couple observations and thoughts:

1. The infinite slope case assumes water and failure surface parallel to the ground surface and assumes uniform surface and subsurface conditions. The infinite slope case is therefore an approximation because the ideal case doesn't exist (i.e., slopes are not exceptionally long or uniform). The infinite slope case is also a very shallow condition to validate the proportion of depth to length, as opposed to deeper seated potential failures. CME Response: We understand the limitations but maintain our recommendation that the stability evaluation consider the potential impact

of heavy rain events on slope stability. The last Langan submittal included infinite slope evaluations, but those were above the assumed phreatic surface used in the calculation. In our opinion assuming the seepage parallel to the slope and at the ground surface emphasizes the need for the recommended Planning Board development requirements outlined in our report at the last meeting.

2. Our cases accounted for a water level shape that is based on the geometrical shape of slope and considering the only source of water is from direct precipitation between the ridge line and the eastern slope, which is limited. **CME Response: We have recommended that the BMP-10 and BMP-11 infiltration basin mounding discharge be controlled to limit the groundwater flow over the slope for that reason. Due to the difficulty in determining natural and forced infiltration on the slope, we have recommended the conservative assumption outlined in our response to Langan Comment No. 1.**
3. The strength values used in both CME and Langan's analysis ignore forms of cohesion as conservative cases. However, if you back calculate the minimum friction values required to achieve $FS=1.0$, the soil's friction would have to be at least 45 degrees, which is not realistic in the upper few feet. Therefore, cohesion is present, likely in the form of roots. If you check the minimum root cohesion required to achieve $FS=1.0$ (assuming friction of 30 degrees for the upper 2 feet), cohesion would have to be at least 35 psf or slope failures would be visible after intense rainfalls, and there is no evidence of this anywhere on the site. Therefore, the root cohesion must be considerably higher. Various researchers have evaluated root cohesion and determined values typically range from 200 psf for clear cuts and natural wooded/forested land to 500 psf. The site is predominantly wooded; however, if $C=100$ psf root cohesion is used, FS values would be well over 1.5 (i.e., 1.7 to 7) for the slopes in question. **CME Response: We recommend that Langan provide a formal response to the Planning Board on the basis described herein, to address this issue.**
4. The existing slopes are not going to be disturbed and the developer must maintain the vegetation, therefore the analyses demonstrate shallow failures are unlikely. **CME Response: We agree that the existing slopes must be protected from disturbance and that the vegetation must be maintained both by the developer and his successors. That is why we have recommended that enforceable requirements based on our review recommendations to the Board be established.**

I trust this addresses your concerns. Please call with any questions.

Mark

Mark Seel
Associate Principal / Vice President

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From: Kleinberg, Sam <SKleinberg@cmeusa1.com>
Sent: Monday, December 1, 2025 5:55 PM
To: Mark Seel <mseel@Langan.com>; pandersonpe@gmail.com
Cc: Hernández, Nelson <NHernandez@cmeusa1.com>; MacNeill, Ryan <rmacneill@cmeusa1.com>;
Rizzo, Jordan <jrizzo@cmeusa1.com>; Mazier, Alejandra <AMazier@cmeusa1.com>
Subject: RE: WEHI
Importance: High

Greetings,

We have attached a partial markup of the output for the cases of elevated GW_Critical and Infinite surfaces as submitted to us. We have completed the infinite slope checks using the basic hand calculation equation for Factor of Safety with phreatic surface at the ground surface and seepage flowing parallel to the slope for sections A&B. Our computations indicate factors of safety ranging from 1.178 and 0.88 at sections A & B respectively. The basis for our recommendation to address this case is included the attachment from Lambe and Whitman which is a valid reference. While the groundwater level has not been established, severe rainfall could develop a perched water condition over the bedrock with seepage parallel to the slope. The output indicates that the infinite slope cases for sections A&B are above the assumed seepage level and do not address our recommendations.

If you have any questions concerning our evaluation, please do not hesitate to call. Vty,
Sam Kleinberg

From: Mazier, Alejandra <AMazier@cmeusa1.com>
Sent: Wednesday, November 26, 2025 4:54 PM
To: Mark Seel <mseel@Langan.com>; Kleinberg, Sam <SKleinberg@cmeusa1.com>
Cc: Hernández, Nelson <NHernandez@cmeusa1.com>
Subject: RE: WEHI

Understood. Thank you Mark. Sam will get in touch with you on Monday in case he requires additional information.

Have a Happy Thanksgiving!

Alejandra

From: Mark Seel <mseel@Langan.com>
Sent: Wednesday, November 26, 2025 4:49 PM
To: Mazier, Alejandra <AMazier@cmeusa1.com>; Kleinberg, Sam <SKleinberg@cmeusa1.com>
Cc: Hernández, Nelson <NHernandez@cmeusa1.com>
Subject: Re: WEHI

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No. All the info is in the output files. The reports contain all the data and
There is no groundwater.

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From: Mazier, Alejandra <AMazier@cmeusa1.com>
Sent: Wednesday, November 26, 2025 4:11:29 PM
To: Mark Seel <mseel@Langan.com>; Kleinberg, Sam <SKleinberg@cmeusa1.com>
Cc: Hernández, Nelson <NHernandez@cmeusa1.com>
Subject: RE: WEHI

Thank you for the info Mark. Is there a report besides the slope prints that can be
generated with information such as soil parameters, water table etc

From: Mark Seel <mseel@Langan.com>
Sent: Wednesday, November 26, 2025 4:06 PM
To: Mazier, Alejandra <AMazier@cmeusa1.com>; Kleinberg, Sam <SKleinberg@cmeusa1.com>
Cc: Hernández, Nelson <NHernandez@cmeusa1.com>
Subject: Re: WEHI

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We generated the profile using the topography shown on the plan in our report. We
did not have a cadd file, so it was scaled off the drawing and entered into Slope W.

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From: Mazier, Alejandra <AMazier@cmeusa1.com>
Sent: Wednesday, November 26, 2025 2:04:07 PM
To: Mark Seel <mseel@Langan.com>; Kleinberg, Sam <SKleinberg@cmeusa1.com>
Cc: Hernández, Nelson <NHernandez@cmeusa1.com>
Subject: RE: WEHI

Hi Mark,

We want prints of the actual input data that you used to generate the slopes. Is this clearer?

Thank you,

Alejandra

From: Mark Seel <mseel@Langan.com>

Sent: Wednesday, November 26, 2025 12:14 PM

To: Mazier, Alejandra <AMazier@cmeusa1.com>; Kleinberg, Sam <SKleinberg@cmeusa1.com>

Cc: Hernández, Nelson <NHernandez@cmeusa1.com>

Subject: Re: WEHI

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Hi Alejandra,

I'm not understanding your request. We had provided files in January, June, and September associated with 3 different submissions. Sam reviewed them and requested the only missing files, which are the set I sent to you last week.

Please call my mobile phone if we need to discuss more specifically.

Thanks

Mark

724.263.2179

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From: Mazier, Alejandra <AMazier@cmeusa1.com>

Sent: Wednesday, November 26, 2025 11:50:02 AM

To: Mark Seel <mseel@langan.com>; Kleinberg, Sam <SKleinberg@cmeusa1.com>

Cc: Hernández, Nelson <NHernandez@cmeusa1.com>

Subject: RE: WEHI

Good morning Mark,

Thank you for sending the output graphs for the analyses at cross sections A, B, C and D. Could you please also send the input and output files that detail any soil parameters and slope conditions assumed for all cases?

Have a Happy Thanksgiving!

Sincerely,

Alejandra

From: Mark Seel <mseel@langan.com>
Sent: Wednesday, November 19, 2025 4:57 PM
To: Kleinberg, Sam <SKleinberg@cmeusa1.com>
Cc: Mazier, Alejandra <AMazier@cmeusa1.com>
Subject: RE: WEHI

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Sam and Alejandra,

Attached are the requested output files, which show the analysis groundwater level to be above the infiltration basins; hence the ground is saturated in the analysis.

Mark

Mark Seel
Associate Principal / Vice President

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From: Kleinberg, Sam <SKleinberg@cmeusa1.com>
Sent: Friday, November 14, 2025 5:22 PM
To: Paul Anderson <pandersonpe@gmail.com>; Mark Seel <mseel@langan.com>
Cc: Mazier, Alejandra <AMazier@cmeusa1.com>; Hernández, Nelson
<NHernandez@cmeusa1.com>; MacNeill, Ryan <rmacneill@cmeusa1.com>
Subject: RE: WEHI

Good afternoon, Based on our discussion we understand that Langan will forward the high seepage level analysis cases with schematic plot of infiltration basin mound profile

including radius of influence on the analysis sections. Alejandra Mazier will be out Monday through Wednesday and begin reviewing anything you have sent over when she returns.

As we discussed we are surprised that the analysis for seepage parallel to the slope would yield a FS on the order of 1.5. We agree that that would be an extreme event which may justify a lower Factor of Safety upon review of relevant standards. We agree that the Hazus mapping likely corresponds to the Feltville sandstone and disintegrated sandstone. As we mentioned in our report that this may begin near Langan Borings LB2 and LB4. Unfortunately neither we nor Langan have been able to locate a report describing the mechanism of the slope mode of failure on which they identified the area of the hazard. In closing we understand that you both did not take any exception to the recommended conditions of approval included in our report. If you need to contact us, you can contact Nelson Hernandez and/or Alejandra Mazier. I hope everyone has a wonderful thanksgiving. Vty, Sam Kleinberg

From: Paul Anderson <pandersonpe@gmail.com>

Sent: Thursday, November 13, 2025 3:50 PM

To: Mark Seel <mseel@langan.com>

Cc: Kleinberg, Sam <SKleinberg@cmeusa1.com>

Subject: Re: WEHI

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Ok, Can we all agree to 2:30?

Paul

On Thu, Nov 13, 2025 at 3:45 PM Mark Seel <mseel@langan.com> wrote:

I am available after 2pm

Mark Seel
Associate Principal

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From: Paul Anderson <pandersonpe@gmail.com>

Sent: Thursday, November 13, 2025 3:39 PM

To: Mark Seel <mseel@langan.com>; Sam Kleinberg <SKleinberg@cmeusa1.com>

Subject: WEHI

Sam & Mark

Are each of you available for a conference call tomorrow?

We would like to discuss the 3 open issues before you go on vacation Sam

I can do between 8 and 930 and after 2 pm

Paul

Paul W. Anderson PE PP CME

Anderson Consulting Services LLC

40 Miller Drive

Boonton NJ 07005

pandersonpe@gmail.com

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--

Paul W. Anderson PE PP CME

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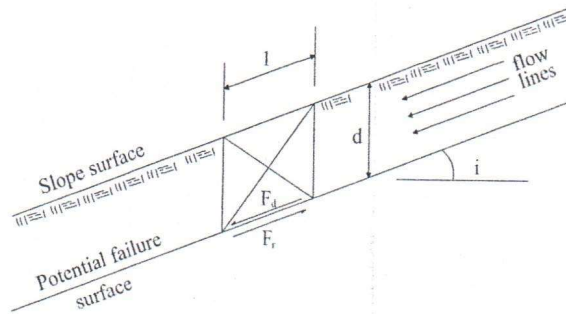
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SURFICIAL SLOPE STABILITY

Project: WEHI
Location: Cross Section A

Project No.: 101049801
Date: 12/2/25

Soil Description: Top Soil



PARAMETERS

cohesion, $c =$	100	psf
Friction Angle, $\phi =$	30	deg
wt. soil _(sat) , $\gamma_s =$	115	pcf

$$F.S. = F_r/F_d = (d (\gamma_s - 62.4) \cos^2 i \tan \phi + c) / (d \gamma_s \sin i \cos i)$$

FACTOR OF SAFETY, FS

Assumes full soil saturation to ground surface

Critical Slope Radians, i (deg)	0.34
Critical Slope Angle, i (deg)	19.33

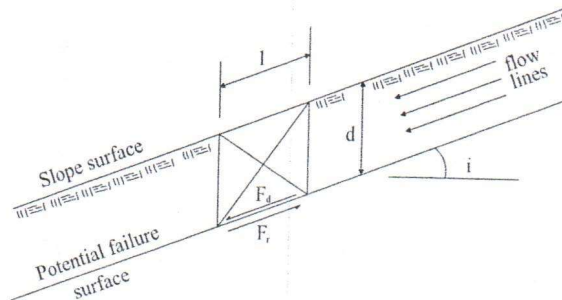
	FS for Critical Slope Ratio (horiz.:vert.)
Depth, d (ft.)	2.85H:1V
0.5	6.32
1	3.54
2	2.14

SURFICIAL SLOPE STABILITY

Project: WEHI
Location: Cross Section B

Project No.: 101049801
Date: 12/2/25

Soil Description: Topsoil



PARAMETERS

cohesion, $c =$	100	psf
Friction Angle, $\phi =$	30	deg
wt. soil _(sat) , $\gamma_s =$	115	pcf

$$F.S. = F_r/F_d = (d (\gamma_s - 62.4) \cos^2 i \tan \phi + c) / (d \gamma_s \sin i \cos i)$$

FACTOR OF SAFETY, FS

Assumes full soil saturation to ground surface

Critical Slope Radians, i (deg)	0.37
Critical Slope Angle, i (deg)	21.04

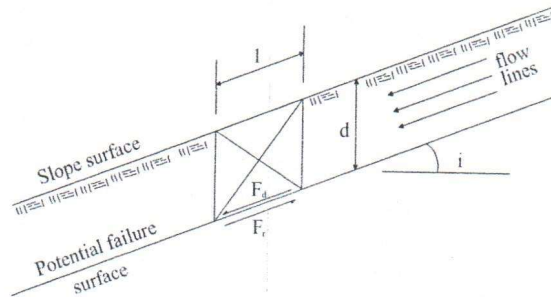
Depth, d (ft.)	FS for Critical Slope Ratio (horiz.:vert.)
	2.6H:1V
0.5	5.88
1	3.28
2	1.98

SURFICIAL SLOPE STABILITY

Project: WEHI
Location: Cross Section C

Project No.: 101049801
Date: 12/2/25

Soil Description: Topsoil



PARAMETERS

cohesion, $c =$	75	psf
Friction Angle, $\phi =$	30	deg
wt. soil _(sat) , $\gamma_s =$	115	pcf

$$F.S. = F_r/F_d = (d (\gamma_s - 62.4) \cos^2 i \tan \phi + c) / (d \gamma_s \sin i \cos i)$$

FACTOR OF SAFETY, FS

Assumes full soil saturation to ground surface

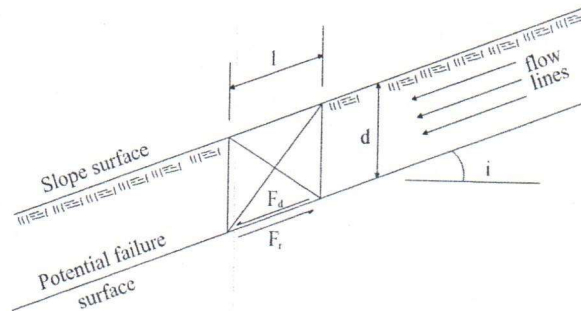
Critical Slope Radians, i (deg)	0.41
Critical Slope Angle, i (deg)	23.50

	FS for Critical Slope Ratio (horiz.:vert.)
Depth, d (ft.)	2.3H:1V
0.5	4.17
1	2.39
2	1.50

SURFICIAL SLOPE STABILITY

Project: WEHI	Project No.: 101049801
Location: Cross Section D	Date: 12/2/25

Soil Description: Topsoil



PARAMETERS

cohesion, $c =$	100	psf
Friction Angle, $\phi =$	30	deg
wt. soil _(sat) , $\gamma_s =$	115	pcf

$$F.S. = F_t / F_d = (d (\gamma_s - 62.4) \cos^2 i \tan \phi + c) / (d \gamma_s \sin i \cos i)$$

FACTOR OF SAFETY, FS

Assumes full soil saturation to ground surface

Critical Slope Radians, i (deg)	0.32
Critical Slope Angle, i (deg)	18.43

	FS for Critical Slope Ratio (horiz.:vert.)
Depth, d (ft.)	3H:1V
0.5	6.59
1	3.69
2	2.24

► Example 24.2

Given. $H = 10$ ft, $\gamma_t = 122.4$ pcf, $\phi = 12^\circ$, submerged slope without seepage.

Find. Combinations of slope angle and $\bar{c}$ which will give failure.

Solution. From Eq. 24.3:

$\bar{c} = \gamma_b H_c \cos^2 i (\tan i - \tan \phi) = 600 \cos^2 i (\tan i - 0.212)$
Values of $\bar{c}$ and i satisfying this equation are plotted in Fig. E24.2.

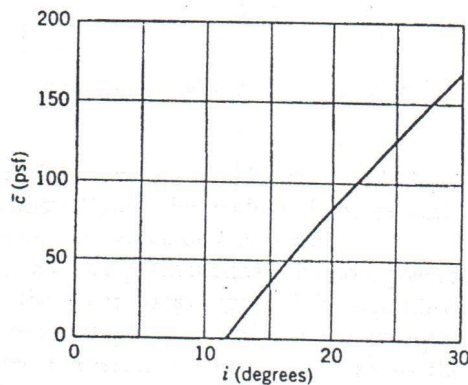


Fig. E24.2

Equations 24.2 and 24.3 have practical value in cases where soil overlies a rock surface at shallow depth and parallel to the slope.¹ In addition, there have been numerous cases in which a shallow slide, with sliding plane parallel to the slope, develops in a soil mass of great depth. This happens because the strength parameters of an overconsolidated soil are not constant with depth. A typical situation is depicted in Fig. 24.7. Here weathering has weakened the soil near the surface, destroying most of the cohesion intercept. The sliding plane develops on the stronger, less weathered soil which exists at depth. Equations 24.2 and 24.3 may be used to analyze the equilibrium of such slides. If a clay has no cohesion intercept, then of course the maximum slope angle is related directly to the friction angle, as in the case of sands.

The safety factor F for a slope is usually defined as

$$F = \frac{\text{available shear strength}}{\text{shear stress required for equilibrium}} \quad (24.4)$$

This safety factor must be evaluated for the most critical surface through the slope. For the case of soil having vertical thickness H overlying rock, this critical surface is the soil-rock interface. Thus, for seepage parallel to the slope,

$$F = \frac{\bar{c} + \bar{\sigma} \tan \bar{\phi}}{\tau} = \frac{\bar{c} + \gamma_b H \cos^2 i \tan \bar{\phi}}{\gamma_t H \sin i \cos i} \quad (24.5)$$

¹ See page 431 of Taylor (1948) for a similar equation which applies when the top flow line is parallel to but at some distance below the sloping ground surface.

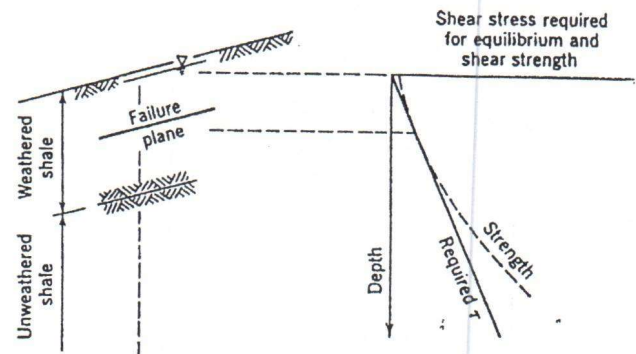


Fig. 24.7 Development of failure plane within weathered soil or rock.

If the strength parameters $\bar{c}$ and $\bar{\phi}$ vary with depth, as Fig. 24.7, then F must be evaluated for several depths until the minimum value of F is found.

For a slope with a given inclination and a given seepage condition, the shear stress required for equilibrium can be determined with great accuracy. Uncertainty as to the stability hence arises from uncertainty as to the shear strength. The safety factor F for an infinite slope thus expresses the amount by which the shear strength can be in error and still have equilibrium. When an infinite slope nature fails, it usually means that the shear strength of the soil has decreased through weathering and other geological processes. Such a failure may take the form of a gradual downhill creep or may involve a very sudden and extensive slip. Actually, the depth to the phreatic surface will generally vary somewhat throughout the year, and so too will the shear stress required for equilibrium. The worst condition usually occurs during severe rains, and most failures also occur during such periods. In evaluating F for an infinite slope, the worst condition—the phreatic line at the surface of the slope—is generally assumed.

24.3 GENERAL BEHAVIOR OF SLOPES OF LIMITED HEIGHT

In many problems $\bar{c}$ is large enough so that the critical depth becomes quite large: 25 ft, 100 ft, or even more. When H_c approaches the height of the slope, the problem must be treated as a slope of limited height.

The first signs of imminent failure of a slope are usually an outward or upward bulging near the toe and the development of cracks near the crest of the slope. Failure involves a downward and outward motion of the soil until a new position of equilibrium is achieved. During this movement the sliding mass often breaks up into smaller blocks. Often the surface of sliding is more or less circular, as in Fig. 24.8a. In some problems the location of the failure surface and the shape of the sliding mass are influenced by weak strata within the soil, as indicated in Figs. 24.8b and 24.8c.