

**Exhibit 1 – Cell 4 Expansion Design Response Letter
to ADEC with IFB Construction Plans and
Specifications and Subsequent ADEC Approval
Letter**



January 15, 2025

Ms. Annemieke Powers
Environmental Program Specialist III
Alaska Department of Environmental Conservation (ADEC)
555 Cordova St.
Anchorage, AK 99501

Re: Matanuska Susitna Borough Central Landfill (SW1A007-26)
Response to Cell 4 Expansion Design Review Comments

Dear Ms. Powers:

On behalf of Matanuska-Susitna Borough (MSB), Alaska, Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) has prepared this letter to address review comments from the Alaska Department of Environmental Conservation (ADEC) regarding the Cell 4 Expansion Project (Project) at the MSB Central Landfill (Landfill). The review comments were received in a letter dated November 18, 2024.

Review Comments and Responses

Comments from ADEC are summarized below in *italics* with a response to each comment immediately following.

1. *ADEC has concerns about how a liner laid on top of municipal solid waste (MSW) will perform. Any differential settling could lead to instability or damage to the liner. As waste is filled in this area, there will be increased weight on the liner, which, coupled with settlement in the underlying cell, could accelerate the problem.*

A textured, 60-mil linear low-density polyethylene (LLDPE) geomembrane was selected for the base liner over Cell 2A because LLDPE can better accommodate differential settlement compared to a high-density polyethylene (HDPE) geomembrane. LLDPE geomembranes can stretch considerably to accommodate settlement before failing. Per Table 3 in Section 31 05 19.16 of the Specifications, LLDPE geomembranes used in the Project must have a minimum break elongation of 250-percent.

Burns & McDonnell completed a settlement analysis which considered settlement of the existing waste in Cell 2A caused by both mechanical compression from the weight of the new overlying waste and creep settlement caused by stretching and reorientations of the MSW that occurs over time. The results of the settlement analysis showed that long-term tension strain of the GCL will be less than 1-percent, which is acceptable considering the strain capacity for GCLs. The settlement analysis is provided as **Attachment 1**.

2. *Leachate management is a concern at all landfills and preventing excess leachate generation is critical. If the liner is keyed into the cover of the closed area of the landfill,*

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ADEC is concerned about the potential for surface water runoff to be routed onto the liner and ultimately into Cell 4. The design does appear to address this, but MSB should plan to monitor this diversion structure to ensure it works as designed, and have an alternative plan to remedy the situation if needed.

As illustrated in Details 1 and 3 on Drawing C006, perimeter berms will be established as part of the Cell 4 expansion over Cell 2A along the northwest and west edges, respectively. Grading and the subsurface stormwater collection system will direct surface water flow away from the area. MSB strives to minimize leachate generation at the Landfill. Once waste disposal in the Cell 4 expansion area begins, MSB will monitor the new diversion berms and watch for any surface water running into the Cell 4 Expansion and becoming leachate. MSB will install additional storm water controls as needed to prevent run-on from entering Cell 4.

3. *Please note that construction activities in close proximity to CLF-9 may negatively impact the well resulting in the need for well replacement.*

Groundwater monitoring well CLF-9 is approximately 100 feet from the limits of construction (see Drawing G004) and is not anticipated to be impacted by construction activities. If CLF-9 is damaged through contractor activity during construction, MSB will hold the contractor responsible for repairing or replacing the well.

4. *Placing waste close to the northern edge of the property comes with challenges when it comes to operations. The MSB should consider how they will limit impacts of the new cell such as litter, odor, noise, and birds on the residents of the neighborhood. These concerns should be addressed when the MSB applies for the solid waste permit modification.*

The northern edge of waste in the Cell 4 Expansion will be approximately 360 feet from the northern property line. MSB is actively filling Cells 2B and 3, which are approximately 600 feet from the northern property line. As with typical operation, MSB will work to minimize impacts of Cell 4 expansion operation to residents north of the Landfill by completing timely placement of daily cover, utilizing litter fences, and operating new gas collection piping in the Cell 4 Expansion to collect and destroy landfill gas generated in the cell. The area immediately north of the Cell 4 Expansion is wooded, which will provide some visual screening. Additionally, wind at the Landfill predominately blows from the northeast to the southwest, so litter is typically not blown toward the north. Efforts to reduce the bird population at the Landfill have been successful with the count

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in December 2024 65=percent lower than the count in December 2021. These will continue during Cell 4 operation.

5. *If MSB would like to recirculate leachate in the Cell 4 expansion, then the cell design, fill plan and compaction must be compatible with leachate recirculation. A modification request for a revised RD&D permit will be required prior to recirculating leachate in the cell.*

MSB intends to recirculate leachate in the Cell 4 Expansion area and will apply for a revised Research, Development, and Demonstration (RD&D) permit prior to recirculating leachate in the Cell 4 Expansion.

6. *The design document incorrectly states that the landfill permit allows a maximum elevation of 348.5ft. Condition #2 of the permit limits the vertical height of the landfill to 340 feet. Please address this discrepancy.*

The Landfill Permit limits the vertical height of the Landfill to 340 feet above mean sea level, which was defined by utilizing locally established datum (ADEC Solid Waste Permit SW1A007-26). The proposed final cover for the Cell 4 Expansion was graded to an adjusted maximum elevation of 348.5 feet above mean sea level utilizing the current site datum, North American Vertical Datum of 1988 (NAVD 88). The proposed maximum elevation of 348.5 feet in NAVD 88 is equivalent to the 340 feet elevation using the local datum in the Permit. The maximum final cover elevation of 348.5 feet is also consistent with the maximum height limit in the Borough's Landfill Development Plan (2020), which was provided to ADEC.

All Points North, a local surveying company, prepared a "Vertical Datum Memo" in 2019 to document and explain the conversion between the datum used in the Landfill Permit and NAVD 88 which is currently used at the Landfill. The memo from All Points North is provided as **Attachment 2** to this letter.

MSB understands that the purpose of the maximum elevation in the Permit is to limit vertical expansion so that the Landfill does not block mountain views for residents to the north. The intention with the Cell 4 Expansion final cover is to match the existing maximum elevation of Cell 2B. Cell 2A does not currently impede mountain views for residents.

7. *The permit requires a 300-foot buffer between the edge of the waste and the property boundary. Drawings G003 and G004 show the construction limits overstepping the 300-*

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foot buffer to the north but it is not clear where the waste boundary would be. Please provide a drawing showing the boundaries of the waste in relation to the required buffer boundary.

The edge of waste in the Cell 4 Expansion will be approximately 360 feet from the northern property line. Drawing G004 has been revised to show the Cell 4 Expansion waste boundary relative to the 300-foot property boundary buffer. The revised Drawing G004 is provided as **Attachment 3** to this letter.

8. *Please provide a slope stability analysis showing that the cell 4 expansion as described will be stable under both static and seismic conditions. The stability analysis should also address ADEC's concern in Comment 1.*

As part of the Cell 4 Expansion design, Burns & McDonnell completed a geotechnical analysis to evaluate slope stability for the Cell 4 Expansion under both static and seismic conditions. A memorandum summarizing the slope stability analysis is provided as **Attachment 4**. A geotechnical analysis for the Landfill was also completed by Burns & McDonnell in November 2022, as part of the RD&D Permit Application the Borough submitted for leachate recirculation (included as **Attachment 5**). These evaluations conclude that the Cell 4 expansion should be stable under static and seismic conditions during development and after closure.

9. *The outer edge of Cell 2B has to be excavated to tie into the liner system. Please provide information on how this will be done to prevent stability issues in the slope.*

Our understanding is that ADEC is concerned that excavation to tie-in to the existing liner at the toe of the 2B side slope (shown in Detail 4, Drawing C005) could cause slope instability. Under short-term construction conditions, the contractor will need to exercise caution and possibly over-excavate Cell 2B intermediate cover soils up the slope to stabilize the slope until the liner tie-in is complete and soil at the toe of the Cell 2B slope can be replaced with the granular drainage material. This construction is similar to when the liner tie-in of Cell 4 to Cell 3 was completed in 2018. For the Cell 4 expansion construction, only a few feet of soil are anticipated to be removed to complete the liner tie-in, which is expected to have minimal impact on the stability of the slope. A figure that shows the earthwork cut/fill depths from existing grades to the top of liner elevations is provided as **Attachment 6**.

10. *The design contemplates an option of removing the cover from the GCL on top of Cell 2A, and leaving the GCL in place, with the plan to install LLDPE on top of the GCL. It is*

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unclear how the cover soil and rock can be removed in such a way that the GCL would not be damaged, or there would not be remaining soil or rock on the GCL. A liner must be in direct contact with the GCL for the alternative composite liner system to be effective. Any rock or debris left between the GCL and the LLDPE can cause damage to the LLDPE. The design somewhat addresses issues related to damage to the GCL, and the potential need for the contractor to remove and replace the damaged GCL. However, this contingency provides no standard or benchmark for when the GCL must be removed and replaced. Please provide a plan describing how cover soil and rock would be completely removed without damaging the GCL, and what would be the threshold for replacement of the GCL if it were damaged.

MSB and Burns & McDonnell understand ADEC's concerns regarding using the existing Cell 2A GCL. Instead of placing the new LLDPE geomembrane directly over the existing GCL, Burns & McDonnell has removed the option of using the existing GCL from the design. The contractor will remove the existing GCL and install a new GCL. The new LLDPE geomembrane will be placed directly over the new GCL.

The Cell 2A final cover soils will still be removed in the piggyback area, and the existing sand leveling course will be smoothed to provide an adequate subgrade for the new GCL. The new GCL will be installed in accordance with Section 31 05 19.23 of the Specifications. The Cell 4 Expansion Construction Drawings, Specifications, and Permit Reference Drawings have been revised to reflect this change and show the new GCL in the Cell 2A piggyback area. The revised Cell 4 Expansion Construction Drawings are included as **Attachment 7**, revised Specifications are included as **Attachment 8**, and the Revised Permit Reference Drawings are included as **Attachment 9**.

11. *Please provide specifications on the Cell 2A cover system showing that it is designed and capable of holding the weight of waste and equipment as the cell 4 expansion cell is filled on top of it.*

The Cell 2A final cover soils will be removed through the GCL in the area where the Cell 4 Expansion piggybacks over Cell 2A. Please see responses to comments 1, 7, and 10 regarding settlement, slope stability, and installation of a new GCL liner for the Cell 4 Expansion.

12. *At what depth will the liner be buried at the anchor on top of the slope of Cell 2A? It is unclear what the depth is in Details 1 and 3 on Construction Drawing C006. Will the liner be anchored into soil or MSW? Given that there may be unusual pulling on the liner due*

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to settlement of underlying MSW, plus increasing weight of waste disposed over time, we will want to ensure that the liner is adequately anchored.

The intention is that the liner will extend down to the existing Cell 2A GCL, then have a four-foot horizontal “runout” as shown on Details 1 and 3 on Drawing C006. A bentonite seal is to be created between the end of the “runout” and existing GCL to prevent any stormwater from seeping in-between the Cell 4 Expansion base liner and Cell 2A final cover liner. The burial depth of the liner will generally be between three to three-and-a-half feet (with some variation depending on the existing grades of Cell 2A) and be buried in place with general fill soils as part of the perimeter berm.

Liner pull-out calculations are typically completed for HDPE geomembranes to allow for a termination trench design where the HDPE geomembrane will pull out rather than yield and eventually break. However, LLDPE geomembranes do not yield in the same way that HDPE geomembranes do. Instead, LLDPE geomembranes will begin to deform uniformly under tension until they reach their break elongation. This means that the pull out can almost never be the controlling failure mode for an LLDPE geomembrane, as LLDPE will elongate under any tension.

An LLDPE geomembrane is planned to be used as the base liner in the Cell 2A piggyback area. As mentioned in the response to comment 1, the LLDPE geomembrane must be able to elongate a minimum of 250-percent before breaking. The length of the piggyback area slope from the liner termination trench at the top of Cell 2A to the point where the liner transitions to an HDPE geomembrane is around 350 feet. This means that the LLDPE geomembrane could stretch to a length of 1,225 feet before breaking.

13. *The design documents are missing a liner installation QA/QC plan. What are the specs that must be met? How will the Mat-Su Borough ensure they are met?*

Quality assurance, testing and inspection procedures and requirements that must be met for both LLDPE and HDPE geomembrane liner installation is addressed in Part 3 – Execution, Section 31 05 19.16 of the Specifications. Installation requirements for the GCL is address in Part 3 – Execution, Section 31 05 19.23 of the Specifications. MSB intends to retain an engineering firm to provide construction quality assurance, observing and documenting liner installation. Any observed non-compliance with the project specifications would be immediately brought to the attention of the contractor and corrected.

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14. *The entry point from Cell 4 into Expansion Cell 4 is narrow. Please provide a fill sequencing plan showing how the waste will be placed to fill the cell in a manner that does not cause instability.*

The liner connection of existing Cell 4 to the Cell 4 expansion is narrow with a majority of it on a 3:1 slope. However, MSB intends to initially push waste north and east from the existing Cell 2B and 4 waste to establish an initial 10-foot “fluff” lift and to build a deck for customer and operator access from those cells. Once the initial lift is in place, the entry point into the Cell 4 Expansion will be significantly wider, likely 100-200 feet. Once about 30-feet of waste is in place in the Cell 4 expansion area, customers can also enter from the east and north perimeter. Instability with the initial lift is not expected.

15. *The conceptual closure plan has a V-shaped trench on top of the cell (Permit Reference Drawing C004, Detail 1). What is the purpose and extent of this trench?*

The V-shaped area noted on cross section A-A’ on Drawing C004.1 is not a trench, but is the result of the Cell 4 Expansion’s final cover geometry. This V-shaped area is visible on the top of final cover plan (Drawing C002.1) and extends from the crown of the final cover to the stormwater channel at the toe of the northern side slope. After Cell 4 Expansion final cover construction, some stormwater runoff will be channelized into the V-shaped area, and additional erosion control best management practices may be needed to prevent excessive erosion in this area.

16. *The new liner system will create an additional barrier to landfill gas generated by Cell 2A below the “piggyback” area. Once waste overlaps the cover system of Cell 2A, there is not an easy way to install new, or repair existing, gas collection structures if issues arise without impacting what will become the bottom liner of Expansion Cell 4. The design does include a deviation to allow for continued gas extraction from the existing GW-013. Please provide evidence that this well is sufficient to continue to address future gas collection efforts in the “piggyback” area of Cell 2A. Adequate gas collection in Cell 2A is critical to prevent the lateral migration of gas into the neighborhood to the north.*

The existing landfill gas wells installed in Cell 2A have been effective in controlling lateral gas migration. No existing landfill gas wells are being decommissioned as part of the Project. As noted in this comment, GW-013 will be converted into a remote gas well to allow for continued gas extraction.

The eastern corner of Cell 2A east of GW-013 contains a minor portion of waste relative to the rest of the cell. MSB will continue routine monitoring of all gas probes and will be

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vigilant for signs of lateral gas migration, especially to the north. Although not expected, if lateral gas migration does impact Gas Probe CLFP-5 or CLFP-6, MSB can install additional vertical gas wells in Cell 2B immediately south of the Cell 2A boundary. MSB is currently planning to install additional vertical gas wells in Cells 2B and Cell 3 in 2026 which should further mitigate the potential for gas migration.

17. *Construction Drawing C008 shows laterals for the gas collection and control system. Is additional gas collection planned for the Cell 4 expansion? If gas collection piping will be installed as the cell is filled, then plans need to be submitted showing the locations and depths.*

In addition to the gas lateral (GL) to be installed along the base of the Cell 4 expansion, additional horizontal gas collection laterals are planned to be installed in the Cell 4 Expansion as waste filling progresses. The locations of the future gas lateral connections are called out as "6" X 6" HDPE SDR 11 TEE AND BLIND FLANGE FOR FUTURE HORIZONTAL GAS COLLECTOR PIPE..." on Drawing C008. For reference, we have also attached a markup of Section A-A' on drawing C004.1 to illustrate the locations of the future gas collection laterals in the Cell 4 Expansion (**Attachment 10**).

18. *Please explain how the termination berms for managing stormwater will be constructed or managed to prevent ponding on top of the waste cell.*

The northwest liner termination berm over Cell 2A (see plan view on Drawing C003 and Detail 1, Drawing C006) will be constructed parallel to the direction of stormwater flow down the slope. Almost no stormwater flow will be directed towards the northwest liner termination berm, as the existing Cell 2A slope on the north generally slopes away from the berm.

The west liner termination berm over Cell 2A (Detail 3, C006) will be built up above the existing final cover grades to prevent stormwater run-on into the Cell 4 Expansion area. Additionally, a six-inch diameter perforated intercept subdrain pipe will be installed at the liner termination which will function similar to a French drain and will direct drainage into the existing Cell 2A subdrain piping and eventually into the perimeter stormwater channel on the north side of Cell 2A. The new subdrain piping that will be installed as part of the Project is shown on Drawing C003.

19. *Please clarify the purpose and location of the standing water installation shown on Construction Drawing C015.*

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Drawings C015 and C016 include the Alaska Department of Transportation's standard details for silt fence which includes information for a variety of silt fence applications and types of installations. Silt fence installed as part of the Project would follow the "general installation" shown on Drawing C015. The standing water installation is not applicable to the Project.

Closing Comments

Thank you for your continued attention to this project.

If you have any questions or require additional information, please do not hesitate to contact Fred Doran at fdoran@burnsmcd.com or 952-290-6334.

Sincerely,

Burns & McDonnell Engineering Company, Inc.

A handwritten signature in black ink, appearing to read 'Fred Doran'.

Fred Doran, PE
Project Manager

A handwritten signature in black ink, appearing to read 'Marcus Ault'.

Marcus Ault
Project Engineer

Attachments:

- Attachment 1 – Cell 4 Expansion Settlement Analysis
- Attachment 2 – Vertical Datum Memo from All Points North, 2019
- Attachment 3 – Revised Drawing G004
- Attachment 4 – Cell 4 Expansion Slope Stability Memo, 2024
- Attachment 5 – Slope Stability Analysis for RD&D Application, 2022
- Attachment 6 – Cell 4 Expansion Isopach Figure
- Attachment 7 – Revised Cell 4 Expansion Construction Drawings
- Attachment 8 – Revised Cell 4 Expansion Construction Specifications
- Attachment 9 – Revised Permit Reference Drawings
- Attachment 10 – Markup of Drawing C004.1 (Proposed Gas Collection Lateral Locations)

cc: Jeff Smith, MSB
Terry Berger, MSB
Ed Lohr, MSB

ATTACHMENT 1:
CELL 4 EXPANSION SETTLEMENT ANALYSIS

Introduction

This effort involves settlement estimates for a proposed Cell 4 overfill that will be placed over the existing Cell 2A at the Matanuska-Susitna Borough, Alaska landfill. A geosynthetic clay liner (GCL) system will be placed between Cell 4 and Cell 2A prior to filling. Settlement calculations will be performed to estimate strain that will occur in the GCL.

Previous work performed at this site included stability calculations for Cell 4A and cell expansions to the south of Cell 4. Some of the information used for settlement calculations is based on this previous work that is applicable to this work also.

Based on these evaluations, tensile stresses caused by Cell 2A settlement within the GCL are acceptable.

Subsurface Materials

Based on available piezometer logs, the naturally occurring soils at the site beneath all municipal solid waste (MSW) are sands and gravels. These soils will have minimal compressive characteristics and were not considered in these settlement calculations.

Existing MSW is in Cell 2A. The bottom elevation of the MSW is not known. For these calculations, it was assumed to be at elevation 240 feet. The MSW in Cell 2A was placed between 1995 and 2015.

Piezometers indicate groundwater between elevation 210 and 230 feet at the site. It is assumed that there is no piezometric surface within MSW in Cell 2A.

MSW Design Parameters

Design parameters were needed for settlement calculations including unit weight and consolidation characteristics of the MSW. For unit weight, 50 pcf will be used based on the value used in previous stability calculations.

For consolidations characteristics of MSW, it is driven by two (2) separate mechanisms. The first is mechanical compression involving the consolidation of void space within the MSW from additional stress. The second is creep settlement of the MSW as stretching and reorientating of the MSW that occurs over time. Creep settlement magnitude is based solely on time and not additional stress magnitude.

Site specific testing of MSW is difficult given the heterogeneity of MSW, difficulty in proper sampling and large and specialized laboratory equipment required for the testing. In lieu of site-specific testing, published papers were reviewed. The paper entitled "Study of the Mechanical Compression Behavior of Municipal Solid Waste by Temperature-Controlled Compression Tests" by Chen, Chen and Liu (2010) was reviewed. This paper describes a laboratory testing program on multiple MSW samples using large laboratory testing equipment that could control the temperature of the MSW samples during testing. This allowed the authors to separate out the mechanical/creep compression and biological degradation by controlling the stress and temperature of the samples. For these calculations, this is important as biologic degradation of the existing MSW will have greatly occurred prior to the loading being evaluated.

For mechanical compression, testing indicated that there were two (2) distinct regions of compressibility of MSW, with the break occurring at an effective stress of 1,780 psf, termed the interfacial pressure. Below the interfacial pressure, the modified compression index was 0.48. Above the interfacial pressure, the modified compression index was 0.22. This indicates that MSW will become less compressible under higher consolidation stresses.

While placing MSW in landfills, spreading and covering operations will generally lead to significant consolidation of the MSW. Per Chen (2010), the amount of stress and corresponding consolidation will be approximately equal to the interfacial pressure, i.e. the more compressive regime will not be seen under the conditions being evaluated for this case.

For creep settlement, there are primary and secondary portions of creep settlement. Primary generally occurs within an hour of loading of MSW. Based on this, it was not considered given the age of the existing MSW. For secondary creep, a coefficient of 0.02 was used based on the range of measured values in the report.

The Chen (2010) paper is included in Attachment 1.

Settlement Estimate

For settlement, a profile drawn along the Cell 2A slope was reviewed. Based on this profile, seven (7) locations were evaluated for settlement along the slope as noted in Table 1.

Table 1. Calculation Points

Point	Horizontal Distance (ft)	Top of Cell 4 MSW Elev (ft)	Cell 4/Cell 2A Interface Elev (ft)	Bottom of Cell 2A Elev (ft)
1	33	348	348	240
2	105	348	330	240
3	177	348	312	240
4	270	335	288	240
5	304	340	278	240
6	368	339	261	240
7	394	330	255	255

As previously noted, the bottom of Cell 2A is not known based on available information. It is estimated to be at elevation 240 feet for these calculations. While differences in the depth of MSW will affect the magnitude of settlements, it will not have a significant effect on the relative settlements that determine the strain in the GCL.

The Cell 2A edge is located near horizontal distance of 394 feet. It is assumed the MSW bottom surface slopes up from elevation 240 feet to the bottom of the Cell 4 liner at elevation 255 feet at 394 feet.

The profile is included in Attachment 2.

For settlement calculations, the seven (7) calculation points were evaluated separately. As previously discussed, Chen (2010) notes that during placement and operations of a landfill, the MSW will be stressed approximately to the interfacial pressure of 1,780 psf where the consolidation parameter changes from 0.48 to 0.22. This indicates that much of the consolidation that occurs on laboratory testing samples for these lower effective stresses will have already occurred during placement. Settlement for stresses below the interfacial pressure was not considered for this evaluation.

For a given point, the following process was taken for calculating mechanical compaction:

- Determine total depth of Cell 2A existing MSW,
- Determine effective stress profile based on 50 pcf unit weight,
- Determine additional stress from new MSW from Cell 4 based on 50 pcf unit weight,
- Determine final effective stress for Cell 2A existing MSW after piggyback loading,
- Calculate settlement using Chen (2010) with depth. Note that no consolidation is considered for effective stresses less than 1,780 psf,
- Sum up total consolidation from mechanical compaction.

Creep settlement also was estimated for a total time period of 100 years. Settlements for each point are listed in Table 2.

Table 2. Settlements

Point	Mechanical (ft)	Creep (ft)	Total (ft)
1	0.0	8.9	8.9
2	1.8	7.3	9.1
3	3.2	5.7	8.8
4	2.9	3.5	6.4
5	2.9	2.6	5.5
6	1.8	1.0	2.8
7	0	0	0

MSW can also settle from degradation of the organic material. Since the Cell 2A MSW was placed between 1995 and 2015, it is assumed that the majority of organic material degradation has occurred. No consideration for settlement from degradation was considered.

A spreadsheet calculation and hand calculations are included in Attachment 3.

Liner Strain Estimate

Liner strain was calculated between each of the calculation points to determine the effect the estimated settlement will have on the GCL. These calculations were done by calculating the initial GCL distance based on the design elevation and horizontal distance and then the final GCL distance based on the post settlement elevation at 100 years and horizontal distance. This difference was then used to calculate the estimated strain.

Calculations were performed both for the mechanical only consolidation and total (mechanical and creep) consolidation. This was done in case there is some difference in the time for creep to occur. There were differences in the strain values between these cases but they were not significant compared to the strain capacity of the GCL.

For calculations, positive strain values indicate tension and negative strain values indicate compression. Results are listed in Table 3.

Table 3. Strain Values

Points	Mechanical Only (%)	Combined (%)
1 to 2	0.60	0.04
2 to 3	0.48	-0.07
3 to 4	-0.07	-0.61
4 to 5	0.04	-0.66
5 to 6	-0.42	-0.96
6 to 7	-1.32	-1.84

Based on this, all tension strains are less than 1-percent. Compression strains will not affect the GCL capacity.

To understand the acceptability of the noted tension strains, Alaska Department of Transportation's Section 729 Geosynthetics was reviewed. This section includes requirements for testing geotextiles for highway projects. The GCL will be made up of geotextiles making this requirement pertinent to understanding the GCL tension capacity. This section specifies that tensile strength is to be measured at 5-percent strain indicating this is the failure strain. Based on this, tension strains are within an acceptable range.



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MSB Landfill Expansion			Checked by:		
Cell 4 Piggyback Settlement			Prelim:	Final:	

Attachment 1 – Chen (2010) Paper

Study of the mechanical compression behavior of municipal solid waste by temperature-controlled compression tests

Rong-Her Chen · Kuo-Sheng Chen ·
Chia-Nan Liu

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Abstract Understanding the compression behavior of waste materials is important to the operation and rehabilitation of waste landfill sites. Nevertheless, predicting this behavior is extremely difficult because waste materials are heterogeneous and highly biodegradable. In terms of the mechanism, waste settlement comprises mechanical and biodegradation compressions. This research performs a series of tests to study the mechanical compression behavior of waste materials by using a specifically designed testing device. The device has the ability to keep the temperature low enough to impede the biodegradation of organics, thereby allowing the mechanical compression behavior to be determined. In general, the observed mechanical compression indicates that municipal solid waste (MSW) is very compressible. As the load increases, MSW becomes less compressible because the waste is getting denser. MSW also has a very large creep compression rate, whereby the coefficient of compression of the primary phase is only about 2–8 times that of the creep phase. The magnitude of loading and the elapsed time of loading affect the mechanical compression behavior of MSW. The effects of some parameters on the mechanical behavior are studied herein. MSW with higher dry density had a smaller compressibility. Higher water content also

led to a higher compression rate in the primary and creep phases. The waste containing more compressible constituents compressed to a larger extent but with an insignificant increase in the compression rate. The biodegradation of organic constituents did not influence the mechanical compression behavior significantly but increased the rate of creep compression notably. This research also developed a regression relationship between the coefficient of volume compressibility and the dry density of the waste. The prediction of mechanical compression in a field case validated the application of this regression relationship.

Keywords Compression · Laboratory test · Solid wastes · Landfill · Biodegradation

List of symbols

C'_{c1}, C'_{c2}	Modified compression index (kPa^{-1})
C_{zp}	Coefficient of primary compression (dimensionless)
C_{zs}	Coefficient of creep compression (dimensionless)
e	Void ratio (dimensionless)
H	Height of compression cell (cm)
m_v	Coefficient of volume compressibility (kPa^{-1})
p	Pressure (kPa)
t	Time (min or days)
t_s	Start time of creep compression (min or days)
ε	Compressive strain (%)
ε_p	Primary compression strain (%)
Φ	Diameter of compression cell (cm)
ρ_d	Dry density (tons/m^3)
ρ_f	Final total density after test (tons/m^3)
ρ_i	Initial total density before test (tons/m^3)
ω_f	Final water content after test (%)
ω_i	Initial water content before test (%)

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Abbreviations

MSW	Municipal solid waste
EPA-TPE	Environmental Protection Agency of Taipei City

Introduction

Knowledge of landfill settlement is essential to the proper design of a landfill site because settling is potentially harmful to the function of the landfill's gas collection system, liner system, cover system, and other components. Landfill sites nowadays can be rehabilitated and used as parks, golf courses, sport fields, construction sites, or other places for sustainable development of the environment and resources. It is becoming essential now to plan and design municipal solid waste (MSW) landfills. The key factor to the success of rehabilitation is an accurate estimation of landfill settlement.

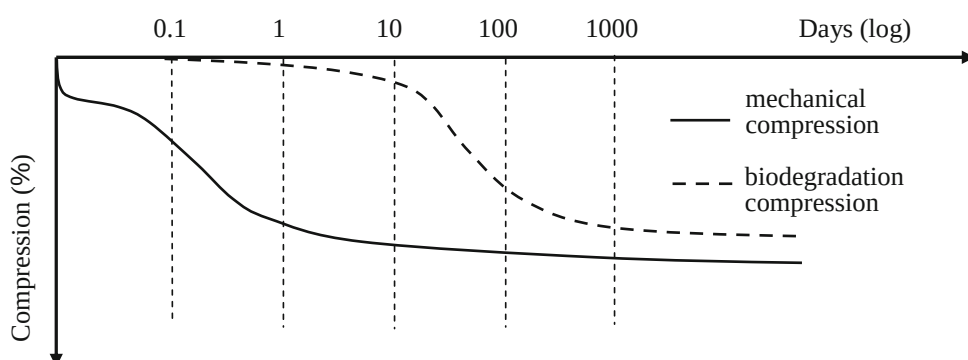
The settlement behavior of an MSW landfill is extremely complex due to the highly heterogeneous components and the biodegradation effect of organic materials. The compression mechanism of MSW is composed of mechanical and biodegradation compressions, as shown in Fig. 1. The mechanical compression includes the instant, the primary, and the creep compressions. The rates of instant compression and primary mechanical compression are so fast that the time to complete these stages is usually about 10 days (Sowers 1973; Morris and Woods 1990; Edil et al. 1990; Stulgis et al. 1995). Mechanical creep, which lasts for a long duration, is relatively slow, and decomposition begins as soon as the waste is placed. The rate of biodegradation compression is quite small in the beginning and then it increases gradually until reaching a maximum rate after several months of loading. As the percentage of decomposable components decreases, the rate slows down gradually with time. This biodegradation compression process may continue for a few years. The mechanical compression and the biodegradation compression are the dominant

mechanisms for short-term and long-term landfill settlement, respectively.

Various approaches have been proposed to estimate the settlement of landfills. Liu et al. (2004) developed an analytical model, based on unsaturated consolidation theory and considering the biodegradation processes, to simulate the long-term settlement of municipal solid landfills. However, the most common approach is to model the historical and observational settlement data collected from the field or from the laboratory. For example, models tailored from Terzaghi's consolidation theory (Sowers 1973; Edil et al. 1990; Morris and Woods 1990; Wall and Zeiss 1995; Boutwell and Fiore 1995; Gourc and Olivier 2005; Ouvry and Page 2005, Sharma and De 2007) or other models (Jesserberger and Kockel 1991; Deutsch et al. 1994; Stulgis et al. 1995; Ling et al. 1998) have been proposed for MSW settlement. The curve-fitting approaches are always used to find the best-fit coefficients for these models. High quality waste settlement data—from field measurements and laboratory tests (Beaven and Powrie 1996; Park and Lee 1997; Machado et al. 2002; Vilar and Carvalho 2005)—are the key to estimating the best-fit coefficients. The waste settlement data comprise a mechanical compression portion and a biodegradation compression portion. Few, if any, research studies have tried to distinguish these two.

An understanding of the mechanical compression of MSW is important to the operation of landfills. Mechanical compression becomes a dominant mechanism when an additional load is applied. For example, during the operation cycle of a landfill, the practice of loading—such as the placement of waste, daily cover, and final cover—causes mechanical compression of MSW. The mechanical settlement is especially important as it is the main cause of rehabilitation construction disputes or facility damages. A recent example is the Shi-Chin-Pu landfill site in Taiwan (Liu et al. 2006). A dispute occurred when the contractor placed the final soil layer cover as a part of the rehabilitation system. The contractor neglected to consider the mechanical settlement induced by the loading of soil fill

Fig. 1 The two compression mechanisms of municipal solid waste



layers. As a result, significant settlement occurred during the placement of the cover soil layer. Ultimately, about an extra 400,000 m³ of soil was needed to conform to the designated elevation. That turned into an additional cost of almost US \$1 million for the contractor, resulting in a controversy between the contractor and the landfill owner.

The objective of this research is to enhance the understanding of the mechanical compression behavior of solid waste materials by conducting systematic laboratory tests. A large testing cell was specifically designed for separating the mechanical compression from the biodegradation compression. In addition, the effects of some parameters, including waste composition, water content, density, and biodegradation on mechanical settlement of MSW, are also studied.

Review of compression tests of waste materials

Table 1 is taken from a review of the literature and shows the conditions of compression tests on waste materials. The test cells have a width ranging from 10 to 71 cm. It is clear that the first concern about the cell dimension is that it accommodates the testing material. Real wastes have only been tested a few times in large cells (Beaven and Powrie 1996), and the effort spent for sample preparation and test conduction is tremendous. Therefore, it seems more attractive to use smaller cells, even if they only allow for testing finer ingredients of the waste. However, the mechanical compressive properties are distinct between coarse and fine materials, and it is improper to estimate the settlement behavior of a landfill directly based on the test results from small cells. Another concern is the boundary effect, i.e., the aspect ratio (Φ/H = diameter/height) of

a compression cell must be large enough to reduce sidewall friction and inconsistent stress distribution (Zeller and Wullimann 1957). However, most of the cells described in Table 1 have a Φ/H ratio close to or even less than 1.0.

Regarding sample preparation, the following methods have been used for compression tests: (1) obtaining samples from landfill sites by boring (Machado et al. 2002; Vilar and Carvalho 2005) or by collection on the surface (Landva et al. 1984); (2) breaking waste material into small pieces (Wall and Zeiss 1995; Park and Lee 1997; Durmusoglu et al. 2006); or (3) mixing simulated constituents (Simpson et al. 1997; Chen and Chou 1998). Among these methods, the boring method cannot obtain a good quality sample due to the variance of the waste components and sample disturbance. The surface collection method also depends on when and where the sample is collected. The breaking and remixing method is more suitable to preserve the characteristics (including size, void ratio, and density, etc.) of real waste.

The compression mechanism of the waste consists of two distinctly different behaviors: mechanical and biodegradation compressions. It is essential to identify the mechanical compression component from the observed settlement records to investigate the mechanical compression behavior. The mechanical compression is explicitly identified in a few compression tests listed in Table 1, such as Chen and Chou (1998) who used hydrogen-peroxide solution to prevent biodegradation.

After reviewing Table 1, some considerations regarding test conditions and data analysis can be made: (1) the scale of a test cell must be large enough to represent samples conforming to the field condition; (2) the aspect ratio (Φ/H) of a test cell needs to be able to reduce the influence of the

Table 1 Compression tests on waste materials

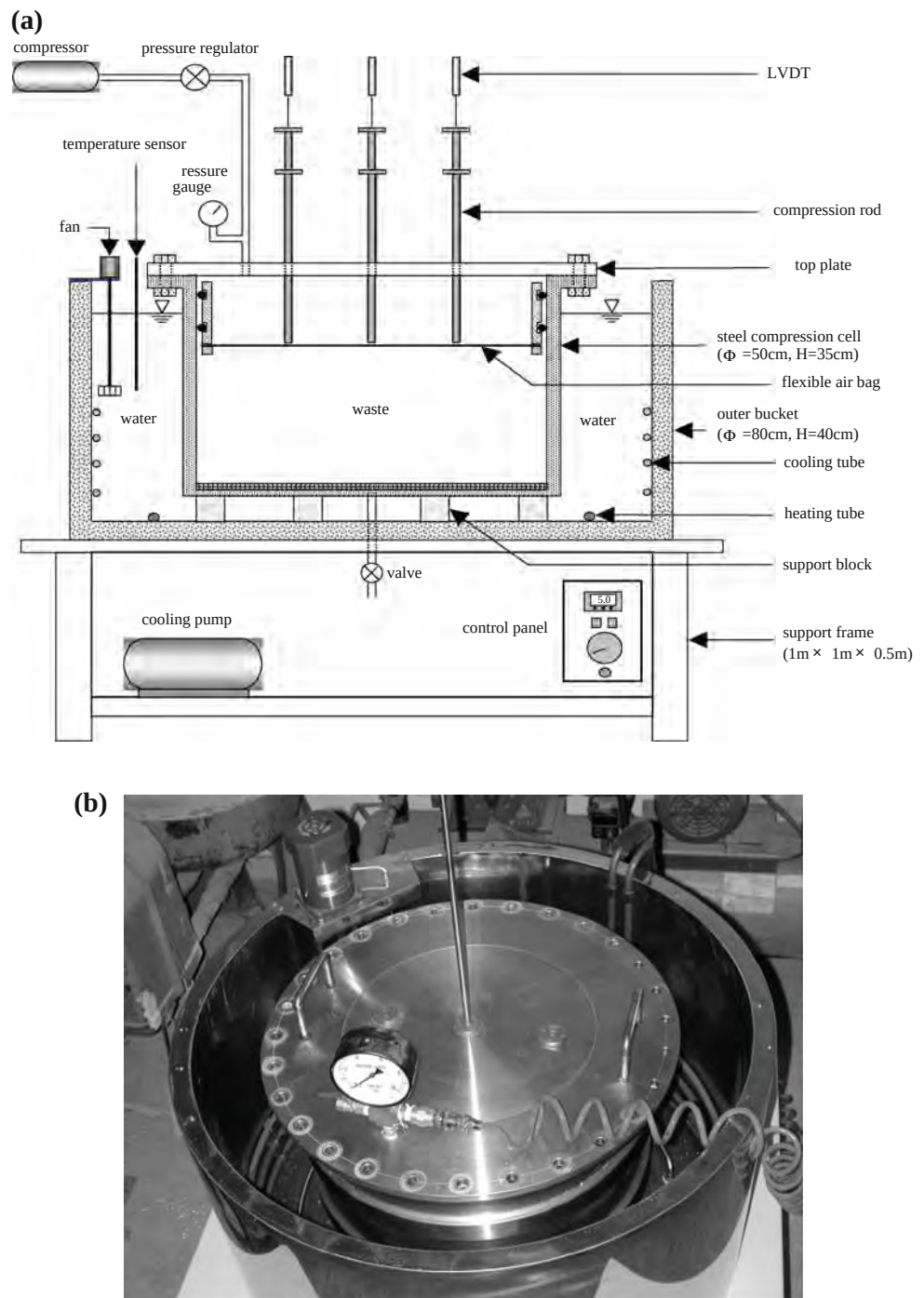
References	Cell dimension		Sample condition		Sample preparation method	Control condition
	Diameter (cm)	Height (cm)	Water content (%)	Unit weight (kN/m ³)		
Rao et al. (1977)	61	22.9	30	2.3–4.0	Simulated constituents	Density
Landva et al. (1984)	45	50	NA	NA	Surface collection	NA
Park and Lee (1997)	25	40	28	NA	Shredded waste	NA
Simpson et al. (1997)	20	21.6	68–99	7.6–11.2	Mixing simulated constituents	Water content, density, and additives
Chen and Chou (1998)	10	4.8	100	13.3	Mixing simulated constituents	Hydrogen-peroxide
Machado et al. (2002)	38.5	36.5	60–68	8–12	Boring from landfill	NA
Vilar and Carvalho (2005)	38.5	36.5	NA	8.0–12.0	Boring from landfill	Density
Xie et al. (2005)	19	32	NA	5.4	Mixing simulated constituents	Temperature, gas pressure
Durmugoglu et al. (2006)	71.1	55.9	NA	NA	Shredded waste	Temperature
Olivier and Gourc (2007)	56	98	NA	5.2	Mixing simulated constituents	Water added

friction between sidewall and waste material as much as possible; (3) the biodegradation process in the waste must be controlled effectively so that biodegradation compression can be separated from mechanical compression; and (4) a systematic program is required to control test conditions in order to investigate the significant parameters affecting the mechanical compression behavior of waste materials.

Testing device

For this study, a special compression device as shown in Fig. 2 was developed. The dimensions of the cell were 500 mm in diameter and 250 mm in height. The dimensions were large enough to accommodate most of the waste material retrieved from the field for testing. The compression cell was made of stainless steel (SS316) to prevent

Fig. 2 The compression apparatus developed in this study: **a** detailed illustration and **b** the photo of the apparatus



corrosion, and the large dimensions with a smooth face design reduced the effect of sidewall friction as well.

The methanogenic bacteria population—the important index of biodegradation in organic waste—mainly comprises mesophiles as well as thermophiles. Pfeffer (1974) assessed the optimum temperature for mesophilic bacteria growth at 35–40°C, and the optimum temperature for thermophilic bacteria activity is about 50–60°C (Farquhar and Rovers 1973). Ham (1988) also indicated that when the temperature is lower than 10–15°C the activity of microbes in a landfill is minimized substantially or even inhibited. A circulating cooling system was thus designed (Fig. 2) to impede organic decomposition in the specimen. The cooling system was composed of a cooling pump, temperature sensor, cooling fan, and cooling tube. The compression cell was placed in the water tank with the temperature controlled by the cooling system. The temperature of the circulating water surrounding the cell was maintained at $8 \pm 2^\circ\text{C}$. At this temperature, the measured waste settlement can be presumably attributed only to mechanical compression.

The specimen in the test cell was compressed by a pressurized flexible air bag to provide a uniform loading on the top. The maximum load that can be applied is 12 tons, equivalent to a stress of 500 kPa. Because waste under good compaction condition has a bulk density of approximately 0.8–1.0 tons/m³, this test device is capable of simulating loads equivalent to a 50–60 m high landfill, which is approximately the upper bound of the height of most landfills. The compression of the specimen was monitored by three LVDTs (KYOWA DT-100A, capacity 100 mm) mounted on the top. The data were recorded automatically by a KYOWA USB-21A scanner and a KYOWA UCAM-20PC data logger. This device can measure a maximum compression of 250 mm. Hence, it can be used to test materials with high compressibility such as waste materials or organic soils.

Testing program

The test specimens were prepared by mixing real wastes to preserve the characteristics of the wastes in field conditions; the composition, density, and water content were taken from the statistical data of the Environmental Protection Agency of Taipei City (EPA-TPE 1998 and 1999). Table 2 lists the compositions of the wastes collected by the EPA-TPE and the test specimens. The test specimens had various components including paper, leftovers, and plastics. Metal was excluded from the test specimens because the policy of the EPA-TPE requires it to be recycled. Hence, the percentages of the other components were adjusted accordingly. To control the specimens well, each component was collected individually. In addition,

Table 2 Average percentage by weight of components of the EPA-TPE waste and those used in this study

Components	EPA-TPE wastes (%)	This study (%)
Paper	31.2	32.9
Leftover	30.9	32.5
Plastics	21.6	22.8
Hard/inert solids	5.1	5.3
Textiles/leather	3.1	3.3
Wood/garden wastes	3.0	3.2
Metals	5.1	0.0

large plastic and paper wastes were cut or shattered into smaller pieces of about 100 mm size to conform to the size of the test cell, if necessary. These constituents were then mixed with the designated water content. This study controlled the water content of the standard test at 88% (EPA-TPE 1998). The mixed samples were then compacted in three layers to a desired density of 0.472 ton/m³. It is noted that this initial density is lower than the field waste density in well-compacted landfill sites (Chen 1990) because of the limitation of compaction energy.

To examine how the manipulation process on site affects the mechanical compression of wastes, a series of tests was designed. The dry densities of test specimens 1, 2, and 3 were designed to study how they affect the mechanical compression of MSW. Tests 4 and 5 were designed to compare with test 1 to study the effects of water content and composition, respectively. The cooling system in test 7 was not activated to allow for the biodegradation of this specimen so that the effect of biodegradation on mechanical compression could be determined by comparing with test no. 6. Table 3 provides the details of the test specimens.

After the test facilities and data log/record system were set up, a 25 kPa compressive pressure was applied. The pressure doubled at subsequent stages until reaching about 400 kPa. At each stage the applied stress was held constant until the compression ceased. For practical purposes, one stage of loading was maintained until the compression rate fell to less than 0.1%/h, mostly finishing within 2 days. In tests 6 and 7, the last loading stage (216 and 211 kPa, respectively) was maintained much longer (17 and 36 days, respectively) when studying the effect of biodegradation. Table 4 lists the loading sequences of each test.

During the test, the water seeping out of the cell through a valve at the bottom was collected so as to calculate the change in the density of the waste with time and the applied pressure. After the test was finished, the inner temperature of the waste was measured to check its decomposition condition. The smell and appearance of the waste were also observed.

Table 3 Summary of test specimen characteristics

Test no.	Description	Test temperature control (°C)	Initial condition		Final condition		
			Water content ω_i (%)	Dry density ρ_i (tons/m ³)	Water content ω_f (%)	Dry density ρ_f (tons/m ³)	Waste temperature (°C)
1	Standard test	8 ± 0.2	88	0.25	59	0.76	8
2	Low density	8 ± 0.2	92	0.19	63	0.77	8
3	High density	8 ± 0.2	88	0.29	60	0.75	8
4	Higher water content	8 ± 0.2	125	0.26	65	0.78	8
5	Less paper content, more plastic content	8 ± 0.2	79	0.26	57	0.76	8
6	Sustained loading with temperature controlled	8 ± 0.2	104	0.24	70	0.62	9
7	Sustained loading without temperature controlled	Uncontrolled	98	0.24	75	0.66	41

Test results

This section presents the general mechanical compression behavior of MSW in terms of loading pressure and loading duration.

Compression versus loading

Figure 3 shows the compression curves of tests 1–7. It can be seen that the waste was a very compressible material. The compression strain was more than 50 and 60% when the specimen was loaded by 200 and 400 kPa, respectively. This high compressible characteristic is attributed to the low density and compressible components (such as plastic) of MSW. The compression curve of test 1 under different loadings is shown in Fig. 4. The curves shown in Fig. 4 indicate that there were two distinct and approximately linear phases. The slope of compression versus loading and the compression amount were larger for the MSW loaded under a lower stress level. The more compressible characteristic of MSW under a lower stress level is attributed to the instant compression of macro-pores and fast compression of highly compressible constituents. As the loading increases, the MSW becomes less compressible because the waste is getting denser.

The interfacial pressure is defined as the pressure that differentiates compression-loading phases. The modified compression index, C'_c , is defined as the slope of the $\Delta \varepsilon - \log p$ compression curve, that is:

$$C'_c = \Delta \varepsilon / \log p. \quad (1)$$

The modified compression indices corresponding to a stress level smaller and larger than the interfacial pressure are denoted as C'_{c1} and C'_{c2} , respectively. The value of the modified compression index is estimated from the

compressive strain–logarithmic loading pressure curve. As shown in Fig. 4, for test 1, the interfacial pressure was about 90 kPa. The modified compression index C'_{c1} was 0.45, while C'_{c2} was 0.17. The compression parameters including total compression strain, modified compression index, and interfacial pressure for tests 1–7 were estimated from the compression test results shown in Fig. 3. Table 5 lists these compression parameters. It shows that the compression strains were greater than 60% regardless of test conditions. The test results are comparable to the test results reported by Landva and Clark (1990), in which the test specimen was retrieved from shredded, fresh waste in an Edmonton, Canada, landfill. Their test results indicate a 61% compression was induced under a load of 200 kPa. The interfacial pressure was between 70 and 100 kPa. The modified compression indices for a stress level lower than the interfacial pressure, C'_{c1} , ranged between 0.42 and 0.52. Compared with the typical values (usually less than 0.16, Mesri 1973) of soils, the compression index of MSW was significantly larger. This indicates that MSW is a very compressible material. The modified compression index for a stress level higher than the interfacial pressure, C'_{c2} , ranged from 0.16 to 0.26, which is still larger than that of soils, showing that MSW is still more compressible than soil even if it has been heavily loaded.

The loading applied in this study was comparable to the field conditions. In practice, newly placed waste is subjected to the weight of operation machines, daily cover soil 15–30 cm thick, and daily waste 3–6 m high. Hence, the instant loading is about 50–100 kPa. The test results shown in Fig. 4 reveal that the amount of compression corresponding to this stress level is about 40%. The subsequent mechanical compression in the field, when the waste is loaded by the successive placement of waste layers, is expected to be about 15%. This amount of compression strain is comparable to the compression measured in the

Table 4 Loading sequence and coefficient of compression for each test

Test no.	Variable	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5
1	Pressure (kPa)	26.5	58.9	93.2	184.5	392.4
	Duration (h)	8.5	7.5	10.3	11.6	18.9
	C_{zp}	0.162	0.082	0.03	0.028	0.023
	C_{zs}	0.03	0.027	0.022	0.018	0.015
2	Pressure (kPa)	19.6	56.9	103.0	188.3	409.1
	Duration (h)	11.2	15.6	15.3	18.8	26.8
	C_{zp}	0.203	0.174	0.026	0.024	0.013
	C_{zs}	0.027	0.026	0.018	0.017	0.013
3	Pressure (kPa)	17.7	58.9	88.3	186.4	377.7
	Duration (h)	8.2	7.1	6.2	7.5	18.8
	C_{zp}	0.15	0.128	0.036	0.032	0.026
	C_{zs}	0.026	0.024	0.018	0.02	0.015
4	Pressure (kPa)	26.5	62.8	90.3	186.4	392.4
	Duration (h)	9.4	9.3	8.1	11.5	22.1
	C_{zp}	0.18	0.13	0.03	0.048	0.037
	C_{zs}	0.04	0.035	0.026	0.025	0.017
5	Pressure (kPa)	25.5	63.8	96.1	191.3	395.3
	Duration (h)	16.4	23.9	28.6	23.5	23.7
	C_{zp}	0.15	0.133	0.024	0.028	0.031
	C_{zs}	0.02	0.025	0.017	0.016	0.015
6	Pressure (kPa)	24.5	61.8	112.8	215.8	–
	Duration (h)	7.5	34.3	46.1	409.1	–
	C_{zp}	0.15	0.133	0.032	0.014	–
	C_{zs}	0.03	0.024	0.021	0.019	–
7	Pressure (kPa)	24.5	61.8	112.8	215.8	–
	Duration (h)	7.5	34.3	46.1	863.5	–
	C_{zp}	0.16	0.114	0.034	0.011	–
	C_{zs}	0.029	0.025	0.021	0.032	–

field (Coduto and Huitric 1990; Edil et al. 1990; Stulgis et al. 1995).

The coefficient of volume compressibility, m_v , is defined as the ratio of the change in compressive strain to the increment of pressure:

$$m_v = \Delta\varepsilon/\Delta p. \quad (2)$$

Figure 5 shows the values of m_v versus pressure for all tests. Each test showed a similar trend in which m_v decreased with an increase in loading pressure. In general, the m_v value ranged from 10^{-2} to 10^{-4} kPa $^{-1}$. This is comparable to the m_v value (7.4×10^{-3} to 6.6×10^{-4} kPa $^{-1}$) determined by Beaven (2000).

Compression versus loading duration

Figure 6 shows the test results of compressive strain versus time under various stages of loading for test 1. Generally, for each stage of loading, the compression strain rate decreased with time. The large compression that occurred within a short time after loading represents the initial

and primary mechanical compressions. It is induced by the continuous compression of macropores and highly deformable waste and the movement of waste particles. The compression that takes place after the primary compression can be treated as the creep compression, which is attributed to the long-term adjustment of particles under constant load.

The coefficient of compression, C_α , is defined as the slope of the compressive strain versus logarithmic time:

$$C_\alpha = \Delta\varepsilon/\Delta\log(t). \quad (3)$$

The coefficients of compression corresponding to the primary compression and creep compression are denoted as C_{zp} and C_{zs} , respectively. Figure 7 shows an example estimating C_{zp} and C_{zs} values for test 1 under the sustained loading of 58.9 kPa. Table 4 lists the C_{zp} and C_{zs} values for each test under various loading stages. In general, C_{zp} ranged from 0.02 to 0.2, while C_{zs} ranged from 0.01 to 0.04. The large value of C_{zp} indicates that the primary compression can be completed within a short duration (usually less than 1 h, Fig. 6). The C_{zp} values are about

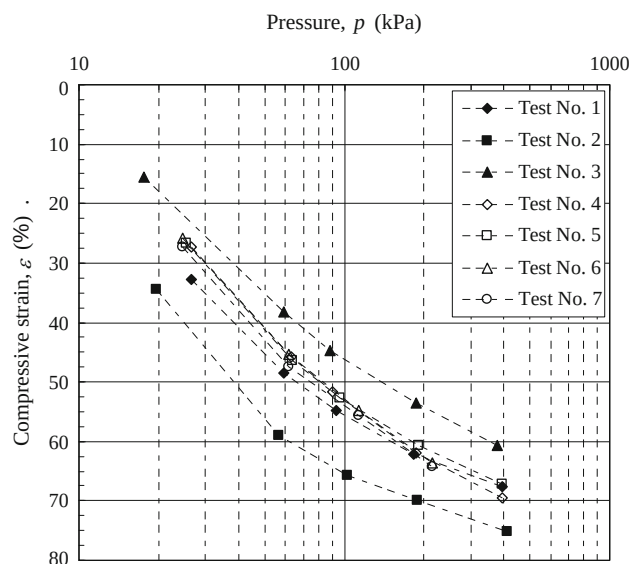


Fig. 3 Compression curves of all tests

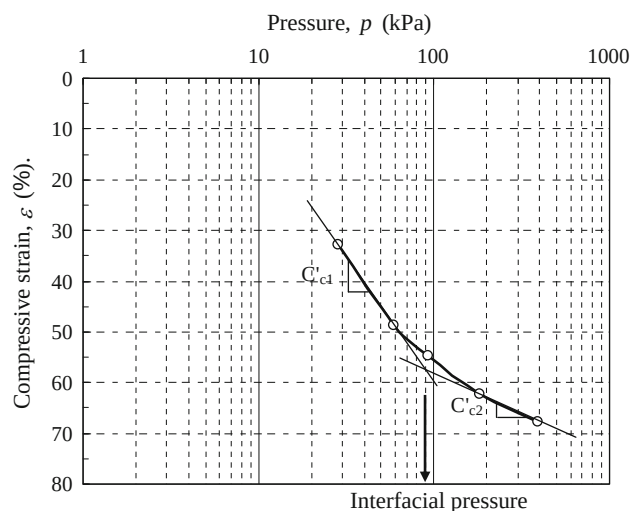


Fig. 4 Compressive strain versus loading pressure of test 1

2–8 times C_{zs} . This ratio is much smaller than the typical ratio of coefficient of primary compression to coefficient of creep compression for soil (10–30, Mesri and Godlewski 1977) and indicates that the MSW has a very large creep compression rate.

Figure 8 shows the compressive strain induced by the successive loading sequence for tests 1–6, where as creep compression converges, another stage of loading is applied. This loading causes another primary compression followed by creep compression. Figure 9 shows the compressive strain and coefficients of compression at different loading stages for tests 1–6. It shows that the compressive strain induced by each stage of loading decreases with increasing pressure. As the specimen was loaded by a pressure greater than the interfacial pressure (70–100 kPa), the compressive

Table 5 Compression strain, modified compression index, and interfacial pressure for each test

Test no.	Compressive strain ε (%)	Modified compression index		Interfacial pressure (kPa)
		C'_{c1}	C'_{c2}	
1	67.2	0.45	0.17	90
2	75.3	0.52	0.16	70
3	60.7	0.42	0.22	100
4	69.5	0.50	0.25	90
5	67.2	0.50	0.23	85
6	63.5	0.49	0.24	85
7	64.2	0.51	0.26	100

strain induced by each stage of loading was about constant. The coefficients of compression (C_{xp} and C_{zs}) also showed a similar trend. Figure 10 shows the compressive strain and coefficients of compression over the elapsed loading time. It shows that the compressibility of MSW decreased as the elapsed loading time increased. The decrease in compressibility was significant at the initial stage of loading and then it decreased slightly as the duration of loading was sustained. This indicates that the stiffness (or dry density) of the waste structure increased after compressing under successive loadings. The compressive strain and strain rate were thus less significant in the later loading stages even when a higher loading was applied or when a constant loading was sustained longer. The next section discusses the relationship between compression strain and dry density and between coefficient of compression and dry density.

It can be noted from Fig. 8 that tests 1 and 6—which have similar specimen conditions (dry density, temperature, and composition) but different loading sequences (Table 4)—present different mechanical compression behaviors. Their modified compression indices (C'_{c1} and C'_{c2}) as shown in Table 5 are also different. These results indicate that the loading sequence is an important factor in the mechanical compression behavior of MSW.

Effects of some selected factors

Dry density

The effect of specimen density on the mechanical compression behavior is indicated by the results of tests 1–3, which involve specimens of different densities. For example, Fig. 3 shows that under the same loading, the denser specimen (test 3) compresses the least among all the tests.

Figure 11 plots the compressive strain (ε) and coefficients of primary compression (C_{xp}) and secondary

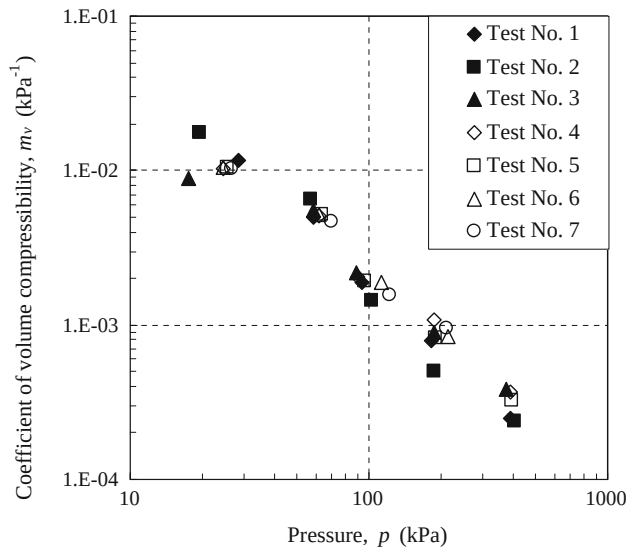


Fig. 5 Relationship between the coefficient of volume compressibility, m_v , and loading pressure

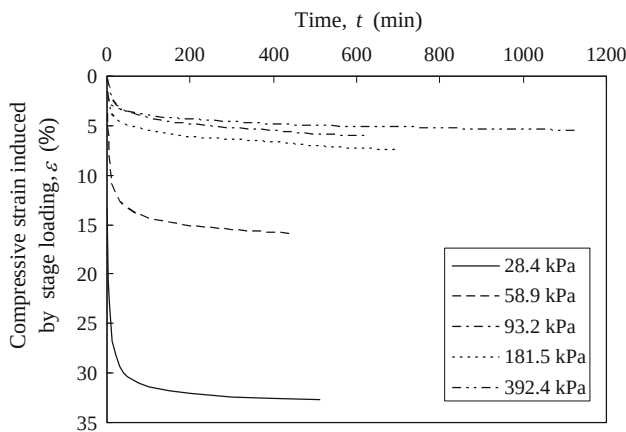


Fig. 6 Compressive strain induced by each stage of loading for test 1

compression (C_{zs}) for different dry densities of the waste specimen. It is obvious that the magnitude and rate of compressive strain decreased with the increase in dry density. This tendency is attributed to the skeleton structure of MSW getting stronger as dry density increases. This tendency is not obvious for the compression strain and for the primary compression rate when the dry density is greater than 0.4 ton/m^3 . However, the increase in dry density still decreased the compression strain and the rate of creep compression of MSW.

Figure 12 shows the relationship between the coefficient of volume compressibility (m_v) and the dry density (ρ_d) at each loading stage of all tests. It indicates that the logarithmic value of m_v decreased linearly with the increase in dry density. The relationship can be described by a best-fit function as:

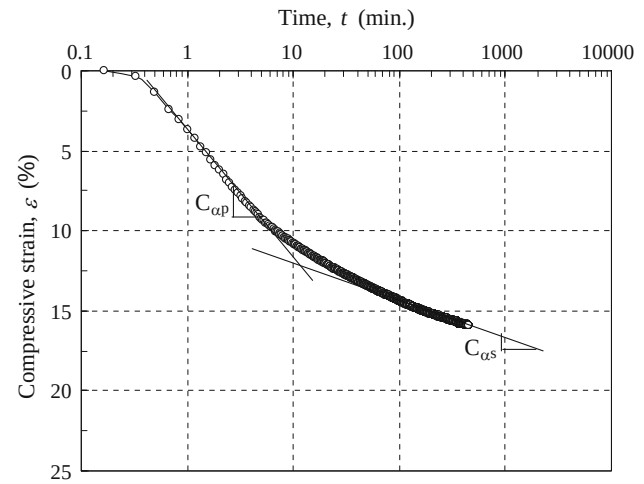


Fig. 7 Estimation of the coefficients of compression C_{zp} and C_{zs} for test 1 with sustained loading of 58.9 kPa

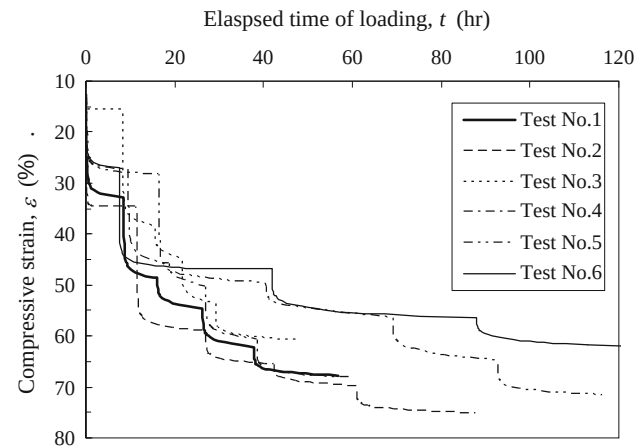


Fig. 8 Compressive strain versus the loading sequence for tests 1–6

$$m_v = 0.096e^{-8.746\rho_d} (R^2 = 0.97). \quad (4)$$

This regression relationship was general because the data points to build this relationship were from tests 1–7. This can provide a means for estimating the coefficient of volume compressibility based on the dry density of waste, thus making it valuable for predicting the mechanical compression in a landfill. For example, for a landfill rehabilitation project, the coefficient of volume compressibility, m_v , of the landfill can be estimated by inserting the field dry density into this equation. Since m_v is the ratio of the change in compressive strain to the increment of pressure ($\Delta\epsilon/\Delta p$), the mechanical compression of the landfill corresponding to the applied loading Δp (such as the placement of the final cover or other rehabilitation construction) can therefore be calculated. The application of this relationship is demonstrated in the “Applications” section.

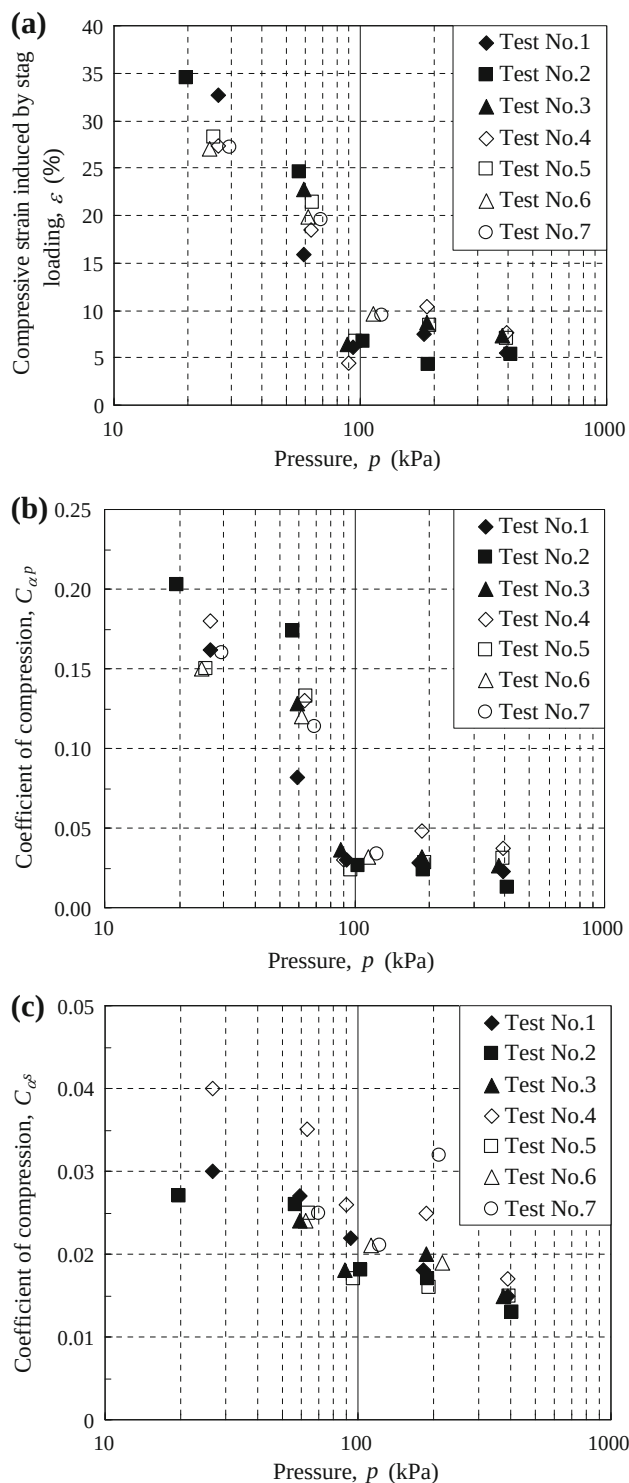


Fig. 9 Compressive strain and coefficients of compression at different loadings for tests 1–7

Water content

The effect of water content on mechanical compression behavior is indicated by comparing the results of tests 1

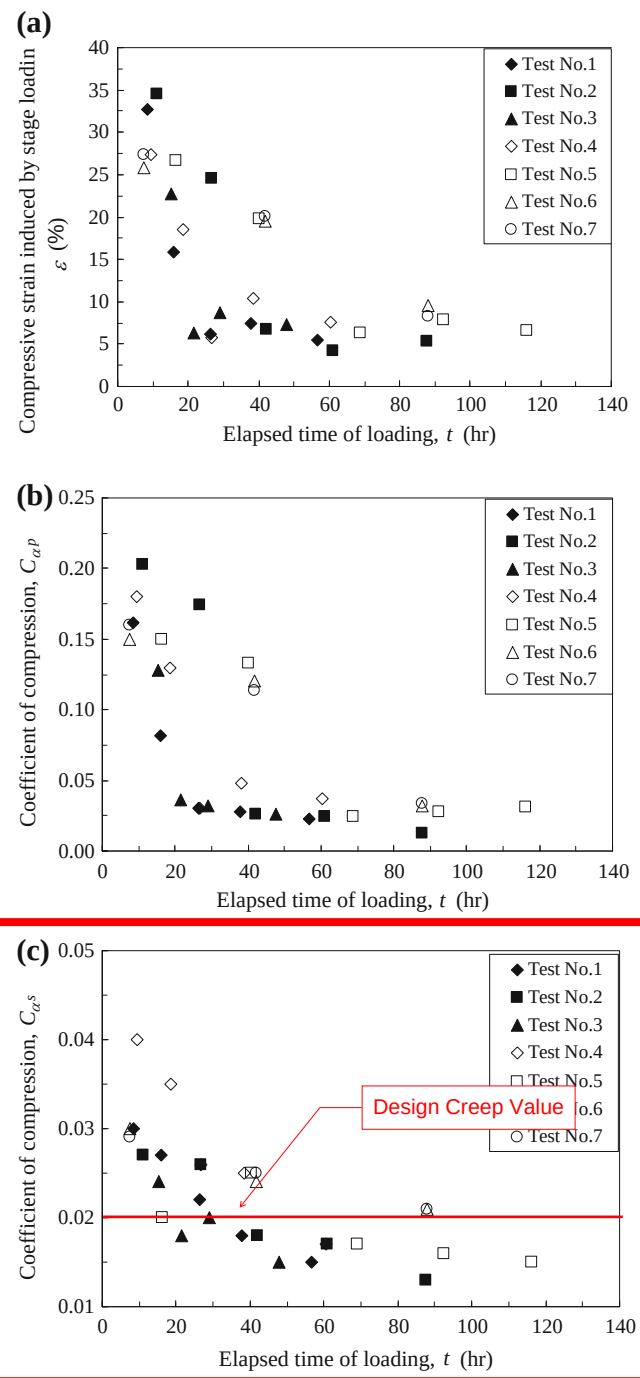


Fig. 10 Compressive strain and coefficients of compression for an elapsed time of loading

and 4, which had different water contents (Table 3). Figure 3 shows that the specimen with higher water content (test 4) exhibited a larger compression ratio than the specimen with less water content (test 1) under the same loading. Moreover, test 4 had a higher value of C_{zp} and C_{zs} than test 1 (Fig. 9). This indicates that the waste with the higher water content will have higher compression rates in the primary compression stage and also in the creep

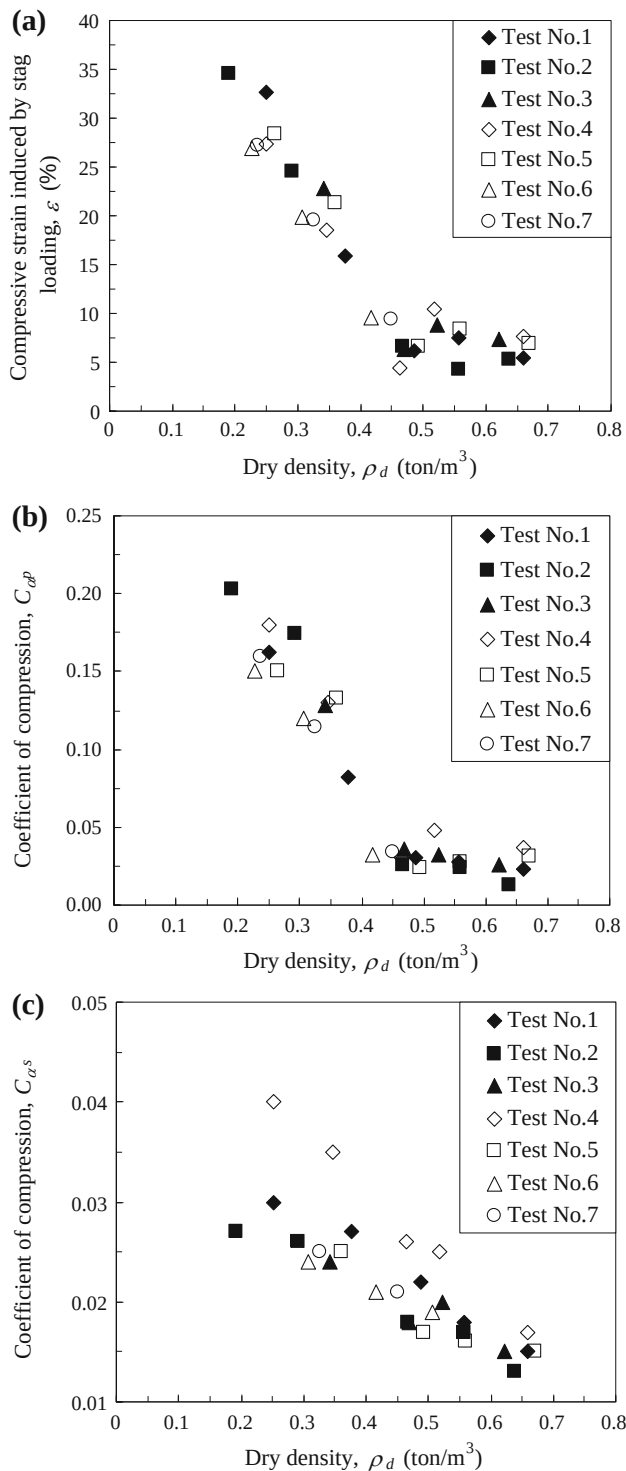


Fig. 11 Compressive strain and coefficients of compression for different dry densities of the waste specimen

compression stage. This effect is mainly attributed to the ingredients in waste material that could be softened and lubricated by the addition of more water. Therefore, the waste with higher water content was more compressible.

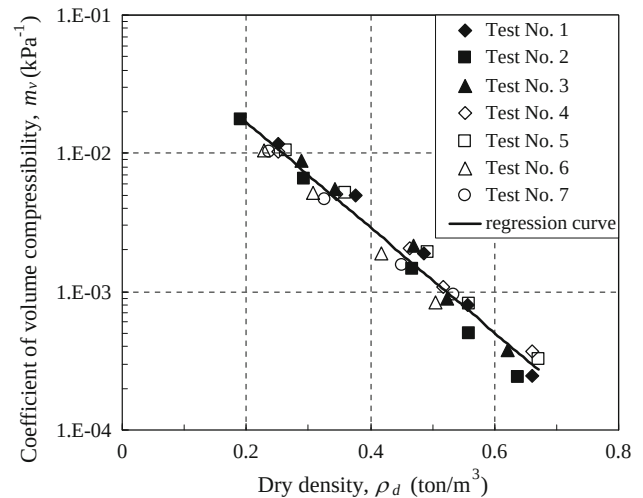


Fig. 12 The plot of the coefficient of volume compressibility versus dry density of all tests

Composition

Test 5 contained less paper, but more compressible plastic waste. This test was conducted to simulate the effect of waste composition on compression behavior. Figure 3 shows that the specimen of test 5 compressed more than the specimen of test 1 under the same loading. However, Fig. 9 shows that test 5 had a similar value for C_{xp} and C_{zs} as test 1. This indicates that waste containing more compressible components will produce a larger compressible strain when it is loaded, but its compression rate will not significantly increase.

Biodegradation

The effect of biodegradation compression behavior of waste was investigated by comparing the results of tests 6 and 7. Test 6 was tested with the temperature controlled at 9°C, and test 7 was tested without temperature control. The ambient temperature of test 7 was a room temperature of about 28°C. The temperature in the center of the waste specimen was measured after the test was finished. For test 6, the average temperature of the waste when the test was finished was 9°C. This indicates that the temperature of the waste specimen was controlled at the designed low temperature, not only at the surface, but also in the inner specimen. However, the temperature in the waste was 41°C, 40 days after the compression test. The temperature affects the biodegradation of the organics in the waste specimen. A visual inspection of the waste 40 days after a compression test showed that the waste of test 6 still maintained a fresh smell and appearance. This indicated that the temperature control device developed in this study retarded the biodegradation of organics effectively. At the

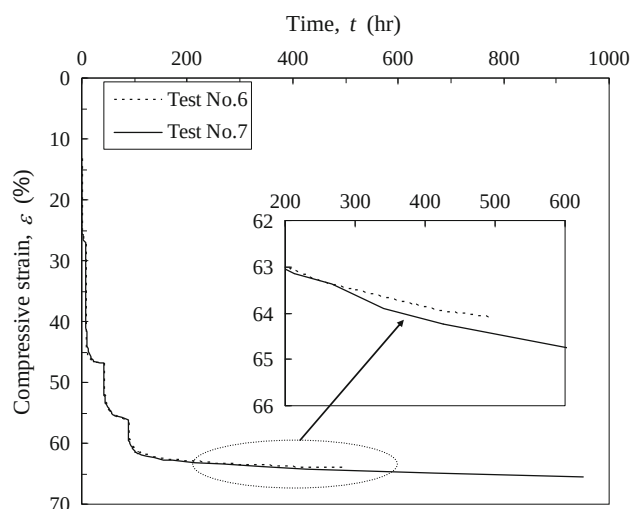


Fig. 13 Compressive strain versus the loading sequence for tests 6 and 7

same time, a visual inspection of test 7 showed the waste was rotted with a very bad smell. This indicates that the organics decomposed during the compression test.

Tables 3 and 4 list the specimens and loading sequences for tests 6 and 7. The two tests were conducted on a similar specimen under identical test conditions except for the control of biodegradation. Figure 13 shows the comparison of compressive strain versus loading sequence. It shows that the compression behaviors of the two tests were almost identical initially. However, a discrepancy between the compressive strains occurred after 12 days. The specimen of test 7 was compressed more than test 6. This increase in the compression was due to the biodegradation of the specimen of No. 7. This comparison indicates that the compression of MSW biodegradation occurs easily in the field, demonstrating that the temperature controlled-testing approach proposed in this study is important for a better understanding of the mechanical compression of MSW.

Applications

As described in the “Introduction” section, a dispute between the contractor and the owner of the Shi-Chin-Pu landfill site was directly induced by the inability to predict the settlement resulting from the placement of the soil fill layer. This section discusses this case to demonstrate the applicability of the test results obtained from this study.

The Shi-Chin-Pu landfill was constructed in 1977 and received municipal solid waste until it closed in 1999. The owner of this landfill planned to rehabilitate it as a multi-functional park for public recreation. The rehabilitation construction included the placement of a 2-m-thick layer of final cover soil overlying a 2-mm-thick geomembrane and

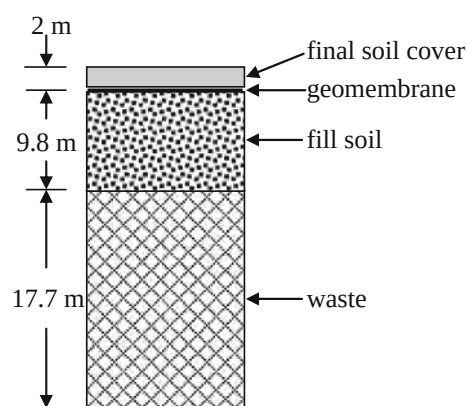


Fig. 14 Schematic cross section of the Shi-Chin-Pu landfill

soil fill layer. The thickness of the soil fill layer varied to level the landfill surface to a designated height. Figure 14 shows the schematic cross section at a measurement point in this landfill. At this location, the thickness of the waste layer was 17.7 m and the thickness of the filled soil layer was 9.8 m to achieve the designed height. The placement of the filled soil layer began in February 2001. After the completion of the placement of the geomembrane layer in July 2001, the rehabilitation construction was postponed for almost 1 year at the request of the landfill owner. The height survey taken between July 2001 and June 2002 indicated that a 0.65 m settlement occurred during this period. This unexpected settlement resulted in a dispute between the contractor and the landfill owner.

The age of the waste in this landfill was 2–26 years old. According to the general settlement behavior of waste (as shown in Fig. 1), most mechanical settlement and biodegradation had been completed. This indicates that the 0.65 m settlement occurring between July 2001 and June 2002 was mostly the mechanical settlement induced by the loading of 9.8 m filled soil. The mechanical settlement at this location could be predicted using the test results in this study.

The average dry density of waste was 0.7 ton/m³ based on field density tests conducted at this location. The coefficient of volume compressibility (m_v) corresponding to this dry density is $2.1 \times 10^{-4} \text{ kPa}^{-1}$ according to Eq. 4. The increasing loading (Δp) of the 9.8-m-thick filled soil layer is about 167 kPa, assuming its unit weight is 17 kN/m³. Therefore, the compressive strain ($\Delta \epsilon$) induced by the loading of 9.8-m-thick filled soil layer is calculated as:

$$\Delta \epsilon = m_v \times \Delta p = 2.1 \times 10^{-4} \text{ kPa}^{-1} \times 167 \text{ kPa} = 3.5\%.$$

The predicted mechanical compression of the waste is 0.62 m ($= 3.5\% \times 17.7 \text{ m}$). In addition, the mechanical compression of the 9.8-m-thick soil induced by its own weight is estimated as 0.02 m (assuming the m_v of filled soil is $2.5 \times 10^{-5} \text{ kPa}^{-1}$). Therefore, the total mechanical

compression at this location could be estimated as 0.64 m, which is comparable to the settlement (0.65 m) measured in the field. This favorable comparison validates the analysis results of this study.

Conclusions

The existing models that predict the settlement of landfills use landfill settlement records or laboratory test results to derive the best-fit model parameters. Therefore, high quality compression test data under well controlled conditions are valuable and important to the study of the compression behavior of wastes and to the accurate prediction of landfill settlement. This study has developed a special compression device that can control the temperature to be low enough to impede the biodegradation of the waste. The purpose of this design is to separate the distinctive mechanical mechanism from the biodegradation mechanism. The measurement of cell temperature and the visual observation of the test specimens indicate that this apparatus was effective at controlling biodegradation. A series of compression tests have been conducted to understand the mechanical compression behavior of MSW. Moreover, the effects of some factors including dry density, water content, composition, and temperature biodegradation on the mechanical compression behavior of MSW have also been studied.

Relative to the typical soil, MSW is more compressible. The compressive strain could be more than 50–60% when the waste is loaded by 200 and 400 kPa, respectively. The test results reveal that the amount of compression corresponding to a field stress level is about 40%. The subsequent mechanical compression in the field when the waste is loaded by the successive placement of waste layers is expected to be about 15%. The loading sequence is an important factor in the mechanical compression behavior of MSW. The compressive strain increases when a higher loading is applied or when the constant loading is sustained longer. However, because the stiffness (or dry density) of the waste structure increases after compressing under successive loadings, the compressibility of MSW decreases with an increase in magnitude or elapsed time of loading. Therefore, the compressive strain and compression rate induced by each stage of loading decrease with increasing stage loading or increasing loading duration. The primary compression of MSW is completed within a short duration. However, MSW has a relatively large magnitude and rate of creep compression.

The test results indicate that the dry density of the waste has a significant effect on the primary mechanical compression behavior. The magnitude and rate of compressive strain decrease as the dry density increases. Waste with

higher water content will have higher compression rates in the primary compression stage and in the creep compression stage as well. Waste containing more compressible constituents (such as plastic) will compress to a larger extent, but its compression rate will not significantly increase. The biodegradation of organic constituents does not influence the mechanical compression behavior significantly until about 12 days after the placement of waste. A regression relationship between the coefficient of volume compressibility and the dry density of the waste is developed herein. It is applicable to predict the mechanical compression in the field. The favorable comparison between the predicted mechanical compression and field survey records validates the application of this regression relationship.

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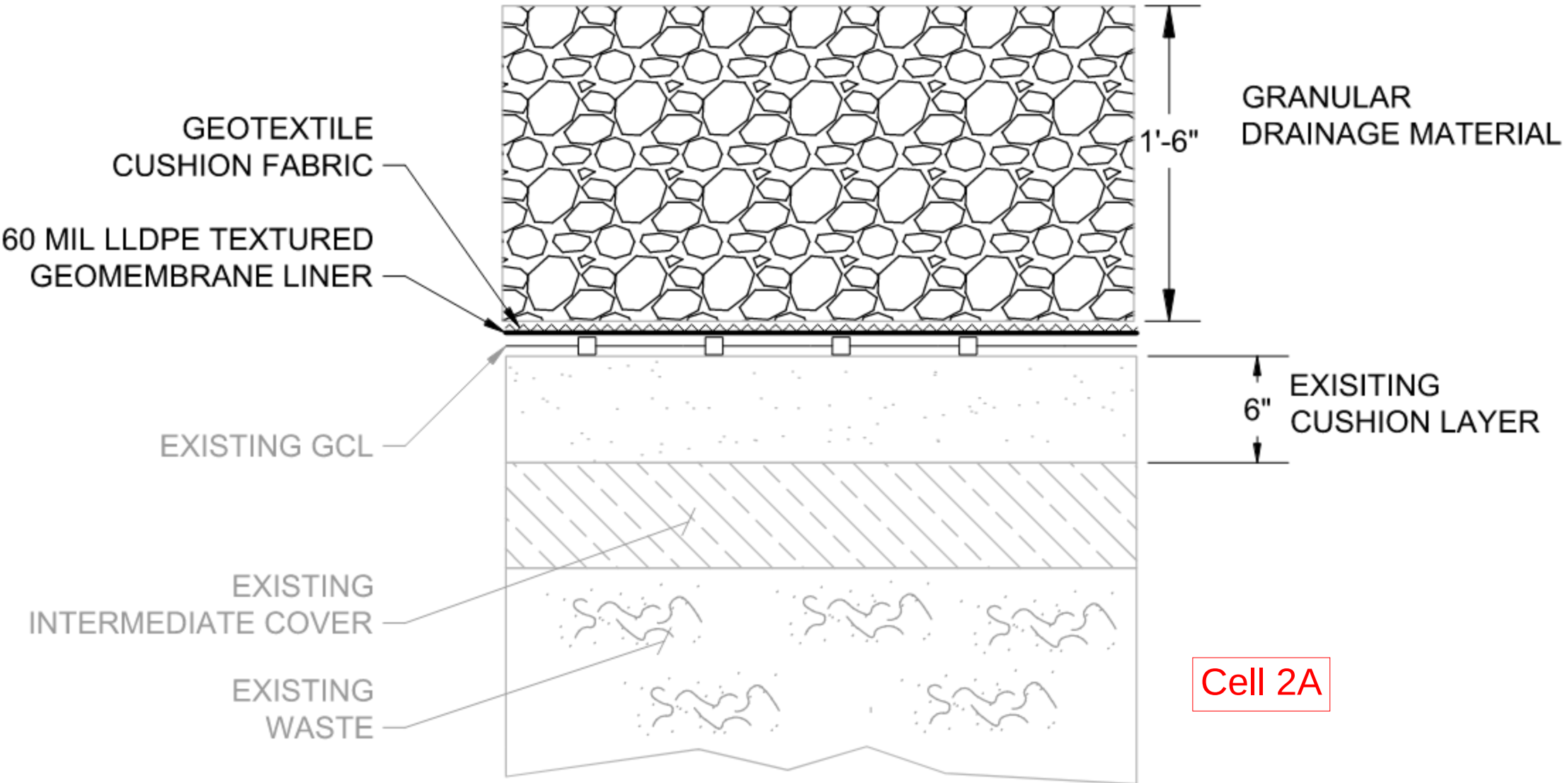
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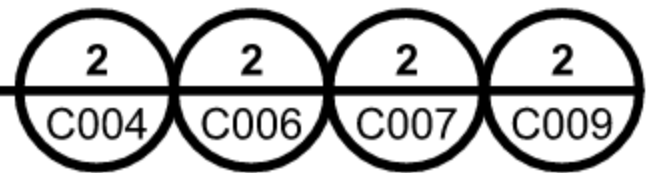
Client:	Matanuska-Susitna Borough, Alaska	Page	6	of	7
Project:	173688	Date:	12/18/2024	Made by:	Textor
MSB Landfill Expansion			Checked by:		
Cell 4 Piggyback Settlement			Prelim:	Final:	

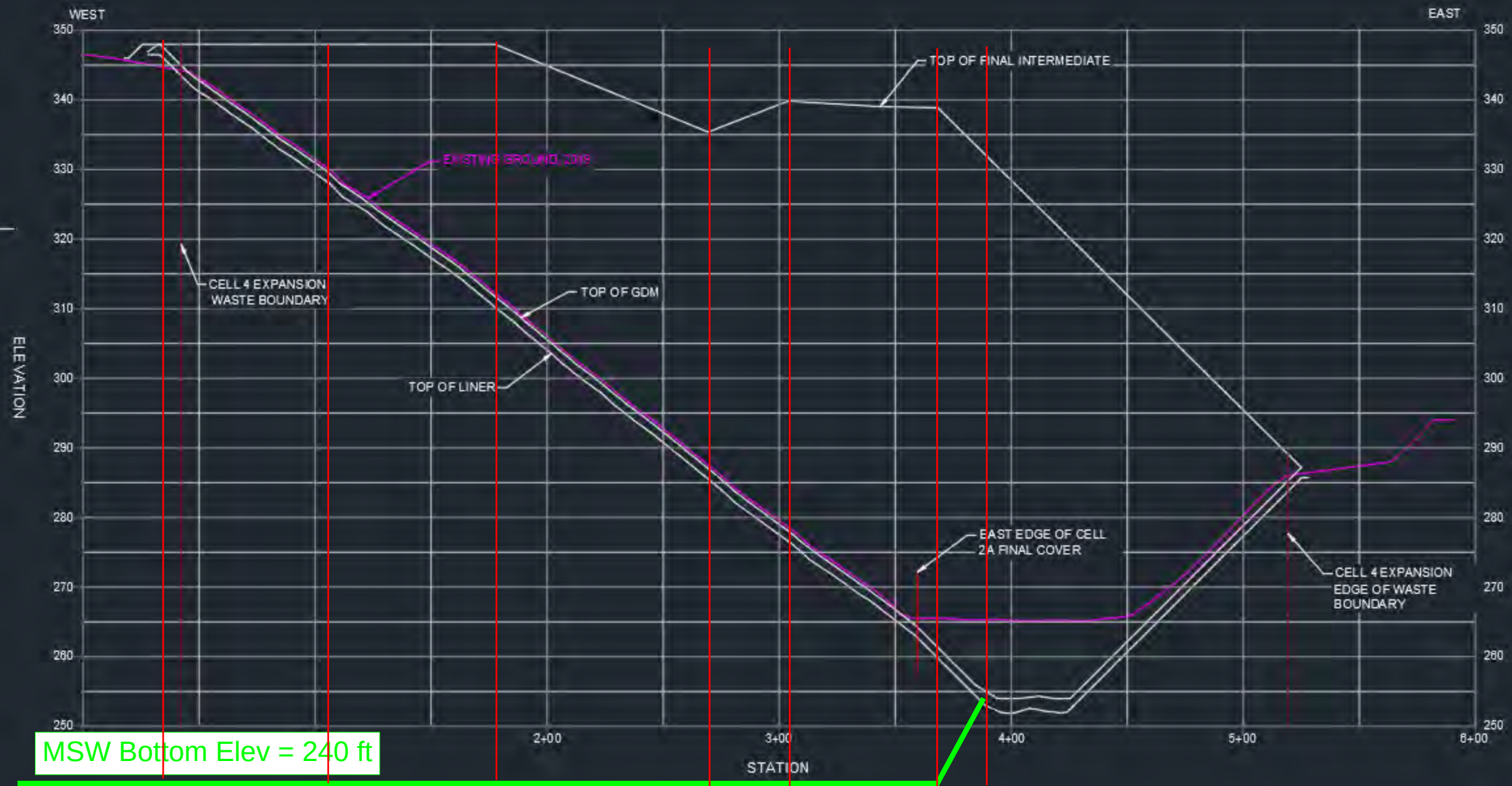
Attachment 2 – Section

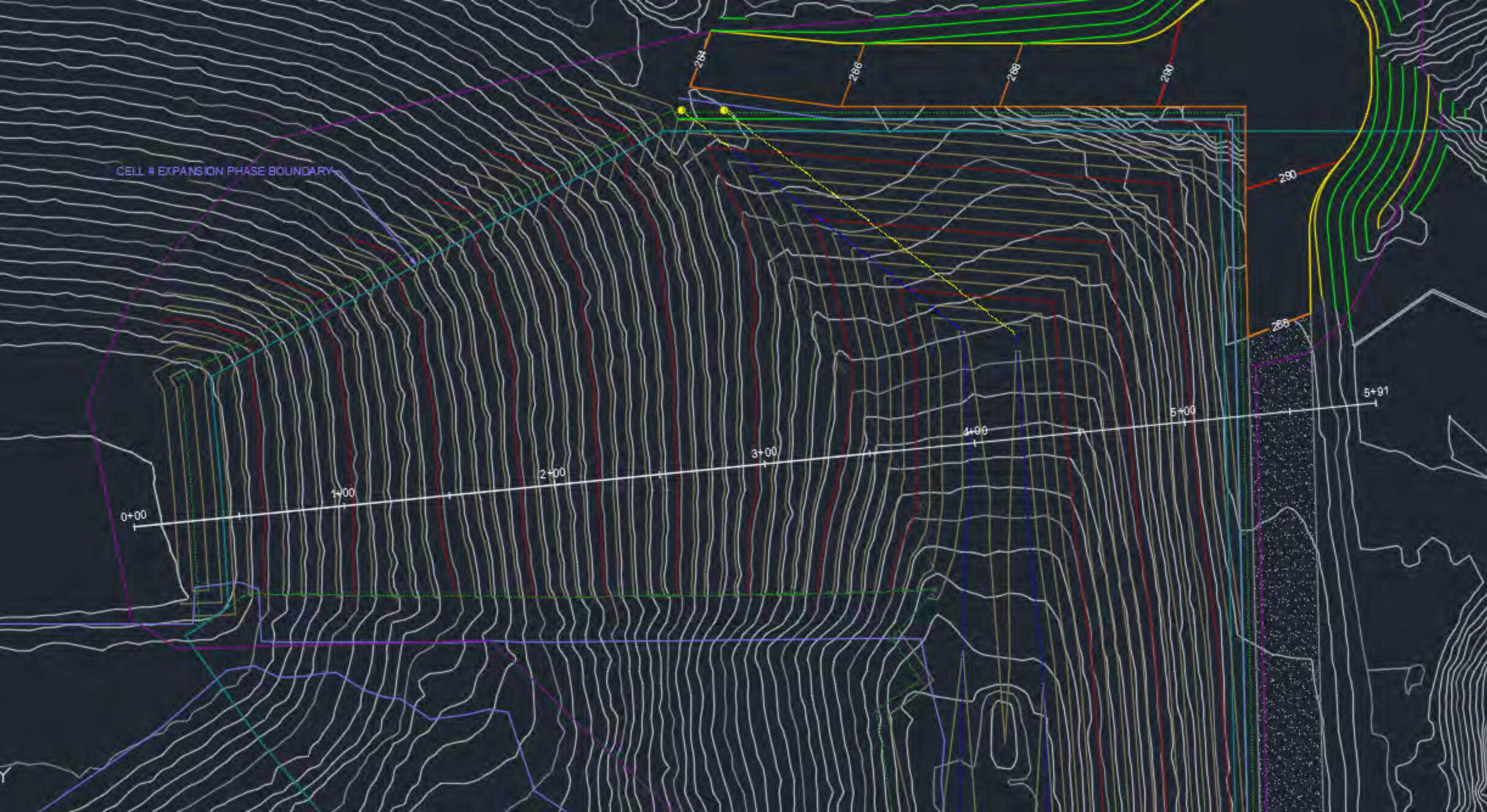


**TYPICAL BOTTOM LINER SYSTEM
OVER CELL 2A EXISTING
FINAL CLOSURE SYSTEM**

SCALE: NTS









Client:	Matanuska-Susitna Borough, Alaska	Page	7	of	7
Project:	173688	Date:	12/18/2024	Made by:	Textor
MSB Landfill Expansion			Checked by:		
Cell 4 Piggyback Settlement			Prelim:	Final:	

Attachment 3 – Settlement and Strain Calculations and Hand Calculation

		Point 1 (x = 33 ft)		Point 2 (x = 105 ft)		Point 3 (x = 177 ft)		Point 4 (x = 270 ft)		Point 5 (x = 304 ft)		Point 6 (x = 368 ft)		Point 7 (x = 394 ft)	
Chen	Existing MSW Thickness (ft)	98	Existing MSW Thickness (ft)	80	Existing MSW Thickness (ft)	62	Existing MSW Thickness (ft)	38	Existing MSW Thickness (ft)	28	Existing MSW Thickness (ft)	11	Existing MSW Thickness (ft)	0.01	
	Existing MSW Unit Weight (pcf)	50	Existing MSW Unit Weight (pcf)	50	Existing MSW Unit Weight (pcf)	50	Existing MSW Unit Weight (pcf)	50	Existing MSW Unit Weight (pcf)	50	Existing MSW Unit Weight (pcf)	50	Existing MSW Unit Weight (pcf)	50	
	Future MSW Thickness (ft)	0	Future MSW Thickness (ft)	18	Future MSW Thickness (ft)	36	Future MSW Thickness (ft)	47	Future MSW Thickness (ft)	62	Future MSW Thickness (ft)	78	Future MSW Thickness (ft)	75	
	Future MSW Unit Weight (pcf)	50	Future MSW Unit Weight (pcf)	50	Future MSW Unit Weight (pcf)	50	Future MSW Unit Weight (pcf)	50	Future MSW Unit Weight (pcf)	50	Future MSW Unit Weight (pcf)	50	Future MSW Unit Weight (pcf)	50	
	Time (years)	100	Time (years)	100	Time (years)	100	Time (years)	100	Time (years)	100	Time (years)	100	Time (years)	100	
	Existing MSW Midpoint Stress (psf)	2450	Existing MSW Midpoint Stress (psf)	2000	Existing MSW Midpoint Stress (psf)	1550	Existing MSW Midpoint Stress (psf)	950	Existing MSW Midpoint Stress (psf)	700	Existing MSW Midpoint Stress (psf)	275	Existing MSW Midpoint Stress (psf)	0.25	
	Future MSW Additional Stress (psf)	0	Future MSW Additional Stress (psf)	900	Future MSW Additional Stress (psf)	1800	Future MSW Additional Stress (psf)	2350	Future MSW Additional Stress (psf)	3100	Future MSW Additional Stress (psf)	3900	Future MSW Additional Stress (psf)	3750	
	Existing MSW Final Midpoint Stress (psf)	2450	Existing MSW Final Midpoint Stress (psf)	2900	Existing MSW Final Midpoint Stress (psf)	3350	Existing MSW Final Midpoint Stress (psf)	3300	Existing MSW Final Midpoint Stress (psf)	3800	Existing MSW Final Midpoint Stress (psf)	4175	Existing MSW Final Midpoint Stress (psf)	3750.25	
	C'p1	0.48	C'p1	0.48	C'p1	0.48	C'p1	0.48	C'p1	0.48	C'p1	0.48	C'p1	0.48	
	C'p2	0.22	C'p2	0.22	C'p2	0.22	C'p2	0.22	C'p2	0.22	C'p2	0.22	C'p2	0.22	
	C'secondary	0.02	C'secondary	0.02	C'secondary	0.02	C'secondary	0.02	C'secondary	0.02	C'secondary	0.02	C'secondary	0.02	
	Mechanical Settlement (ft)	0	Mechanical Settlement (ft)	1.77	Mechanical Settlement (ft)	3.19	Mechanical Settlement (ft)	2.91	Mechanical Settlement (ft)	2.96	Mechanical Settlement (ft)	1.83	Mechanical Settlement (ft)	0.00	
	Creep Settlement (ft)	8.94	Creep Settlement (ft)	7.30	Creep Settlement (ft)	5.66	Creep Settlement (ft)	3.47	Creep Settlement (ft)	2.55	Creep Settlement (ft)	1.00	Creep Settlement (ft)	0.00	
	Total (ft)	8.94		9.06		8.84		6.38		5.52		2.84		0.00	

Total Settlement								
Point	Station (ft)	Initial Elev (ft)	Final Elev (ft)	Initial Slope	Final Slope	Initial Distance (ft)	Final Distance (ft)	Strain
1	33	348	339.06					
2	105	330	320.94	0.25	0.25	74.22	74.25	0.04%
3	177	312	303.16	0.25	0.25	74.22	74.16	-0.07%
4	270	288	281.62	0.26	0.23	96.05	95.46	-0.61%
5	304	278	272.48	0.29	0.27	35.44	35.21	-0.66%
6	368	261	258.16	0.27	0.22	66.22	65.58	-0.96%
7	394	255	255.00	0.23	0.12	26.68	26.19	-1.84%

Only Mechanical								
Point	Station (ft)	Initial Elev (ft)	Final Elev (ft)	Initial Slope	Final Slope	Initial Distance (ft)	Final Distance (ft)	Strain
1	33	348	348.00					
2	105	330	328.23	0.25	0.27	74.22	74.66	0.60%
3	177	312	308.81	0.25	0.27	74.22	74.57	0.48%
4	270	288	285.09	0.26	0.26	96.05	95.98	-0.07%
5	304	278	275.04	0.29	0.30	35.44	35.46	0.04%
6	368	261	259.17	0.27	0.25	66.22	65.94	-0.42%
7	394	255	255.00	0.23	0.16	26.68	26.33	-1.32%

Point 1				0	Point 2				1.8	Point 3				3.2
Sum					Sum					Sum				

Point 7	Sum	0.0	Layers with Initial Stress < 1780				Layers with Initial Stress	
				psf			> 1780 psf	
Depth	Initial Eff Stress	New MSW	Final Eff	Low Stress	High Stress			
(ft)	(psf)	Stress (psf)	Stress (psf)	Consol (ft)	Consol (ft)	High Stress	Consol (ft)	
1	50	1800	1850					
2	100	1800	1900					
3	150	1800	1950					
4	200	1800	2000					
5	250	1800	2050					
6	300	1800	2100					
7	350	1800	2150					
8	400	1800	2200					
9	450	1800	2250					
10	500	1800	2300					
11	550	1800	2350					
12	600	1800	2400					
13	650	1800	2450					
14	700	1800	2500					
15	750	1800	2550					
16	800	1800	2600					
17	850	1800	2650					
18	900	1800	2700					
19	950	1800	2750					
20	1000	1800	2800					
21	1050	1800	2850					
22	1100	1800	2900					
23	1150	1800	2950					
24	1200	1800	3000					
25	1250	1800	3050					
26	1300	1800	3100					
27	1350	1800	3150					
28	1400	1800	3200					
29	1450	1800	3250					
30	1500	1800	3300					
31	1550	1800	3350					
32	1600	1800	3400					
33	1650	1800	3450					
34	1700	1800	3500					
35	1750	1800	3550					
36	1800	1800	3600					
37	1850	1800	3650					
38	1900	1800	3700					
39	1950	1800	3750					
40	2000	1800	3800					
41	2050	1800	3850					
42	2100	1800	3900					
43	2150	1800	3950					
44	2200	1800	4000					
45	2250	1800	4050					
46	2300	1800	4100					
47	2350	1800	4150					
48	2400	1800	4200					
49	2450	1800	4250					
50	2500	1800	4300					
51	2550	1800	4350					
52	2600	1800	4400					
53	2650	1800	4450					
54	2700	1800	4500					
55	2750	1800	4550					
56	2800	1800	4600					
57	2850	1800	4650					
58	2900	1800	4700					
59	2950	1800	4750					
60	3000	1800	4800					
61	3050	1800	4850					
62	3100	1800	4900					
63	3150	1800	4950					
64	3200	1800	5000					
65	3250	1800	5050					
66	3300	1800	5100					
67	3350	1800	5150					
68	3400	1800	5200					
69	3450	1800	5250					
70	3500	1800	5300					
71	3550	1800	5350					
72	3600	1800	5400					

Client Mat Su Brough Page _____ of _____Project 173688 Date 12/10/24 Made By TextenCell 2A Piggy back Settlement Checked By _____

Spreadsheet Hand Calc Preliminary _____ Final _____

Individual Calculation Points

Point 2, Depth = 25 ft

Initial Effective Stress: $(25 \text{ ft}) (150 \text{ pcf}) = 1,250 \text{ pcf}$ New MSW Stress: $(18 \text{ ft}) (150 \text{ pcf}) = 900 \text{ pcf}$ Final Eff Stress = $1,250 + 900 = 2,150 \text{ pcf}$ Less than $\sigma = 1,780 \text{ pcf}$, $C_c = 0.48$

$$S = \log \left(\frac{1,780}{2,150} \right) (0.48) (1 \text{ ft}) = 0.074 \text{ ft} \Rightarrow \text{set to } 0 \text{ ft}$$

Greater than $\sigma = 1,780 \text{ pcf}$, $C_c = 0.22$

$$S = \log \left(\frac{2,150}{1,780} \right) (0.22) (1 \text{ ft}) = 0.018 \text{ ft}$$

Point 2, Depth = 45 ft

Initial Effective Stress: $(45 \text{ ft}) (150 \text{ pcf}) = 2,250 \text{ pcf}$ New MSW Stress: 900 pcf Final Eff Stress: $2,250 + 900 = 3,150 \text{ pcf}$ Greater than $\sigma = 1,780 \text{ pcf}$, $C_c = 0.22$

$$S = \log \left(\frac{3,150}{2,250} \right) (0.22) (1 \text{ ft}) = 0.032 \text{ ft}$$

Summary Results

Point 2

Mechanical Settlement = 1.77 ft

$$\text{Crimp Settlement} = (80 \text{ ft}) (0.02) \log \left(\frac{100 \text{ years}}{0.0027 \text{ years}} \right) = 7.3 \text{ ft}$$



Client Mat Su Borough Page _____ of _____Project 173688 Date 12/10/24 Made By TexterCell 2A Piggyback Settlement Checked By _____Spreadsheet Hand Calcs Preliminary _____ Final _____

Point 1 to Point 2 Strain

Station : 1 = 33 ft
2 = 105 ftInitial Elevation : 1 = 348 ft
2 = 330 ftFinal Elevation : 1 = $348 - 8.94 = 339.06$ ft
2 = $330 - (1.77 + 7.3) = 320.94$ ftInitial Slope : $(348 - 330) / (105 - 33) = 0.250$ Final Slope : $(339.06 - 320.94) / (105 - 33) = 0.252$ Initial Distance : $\sqrt{(348 - 330)^2 + (105 - 33)^2} = 74.22$ ftFinal Distance : $\sqrt{(339.06 - 320.94)^2 + (105 - 33)^2} = 74.25$ ftStrain : $\frac{74.25 - 74.22}{74.22} = 0.04\%$ 

ATTACHMENT 2:
VERTICAL DATUM MEMO FROM ALL POINTS NORTH, 2019

APPENDIX B – ALL POINTS NORTH VERTICAL DATUM MEMORANDUM



LAND SURVEYING &
CIVIL ENGINEERING

P: 907-746-4185 | F: 907-746-4186

To: **Macey "Butch" Shapiro**
Solid Waste Division Manager
Matanuska Susitna Borough
907-861-7606

Date: **8/20/2019**

Job: **19-59 MSB Landfill**

Subject: **Mat-Su Borough Central Landfill Elevation Memo**

Memorandum

Mr. Shapiro,

It has come to our attention that various datums have been used for defining elevations at the MSB Central Landfill conversion values between various datums can be seen below.

The vertical datum of all All Points North surveys is NAVD 88 orthometric heights (computed using GEOID12B).

NAVD88 to NAD_83 ellipsoid heights

The translation value from NAVD 88 orthometric heights to NAD_83 ellipsoid heights were determined for all APN control points. The average geoid separation and therefore translation value for converting from NAVD 88 to ellipsoid heights is +33.11'. The source of this information is the National Geodetic Survey computational software.

NAVD88 to NGVD29

The translation value from NAVD 88, to NGVD 29 was determined by analyzing NGS Data Sheets for nearest benchmark stations, namely TT0610 and TT0650. Note that the Landfill site is situated between these two marks. This value ranges from -5.93' to -6.2' thus a average translation value of -6.1' can be used when converting from NAVD 88 to NGVD 29.

NAVD88 to MLLW (per Aerometric)

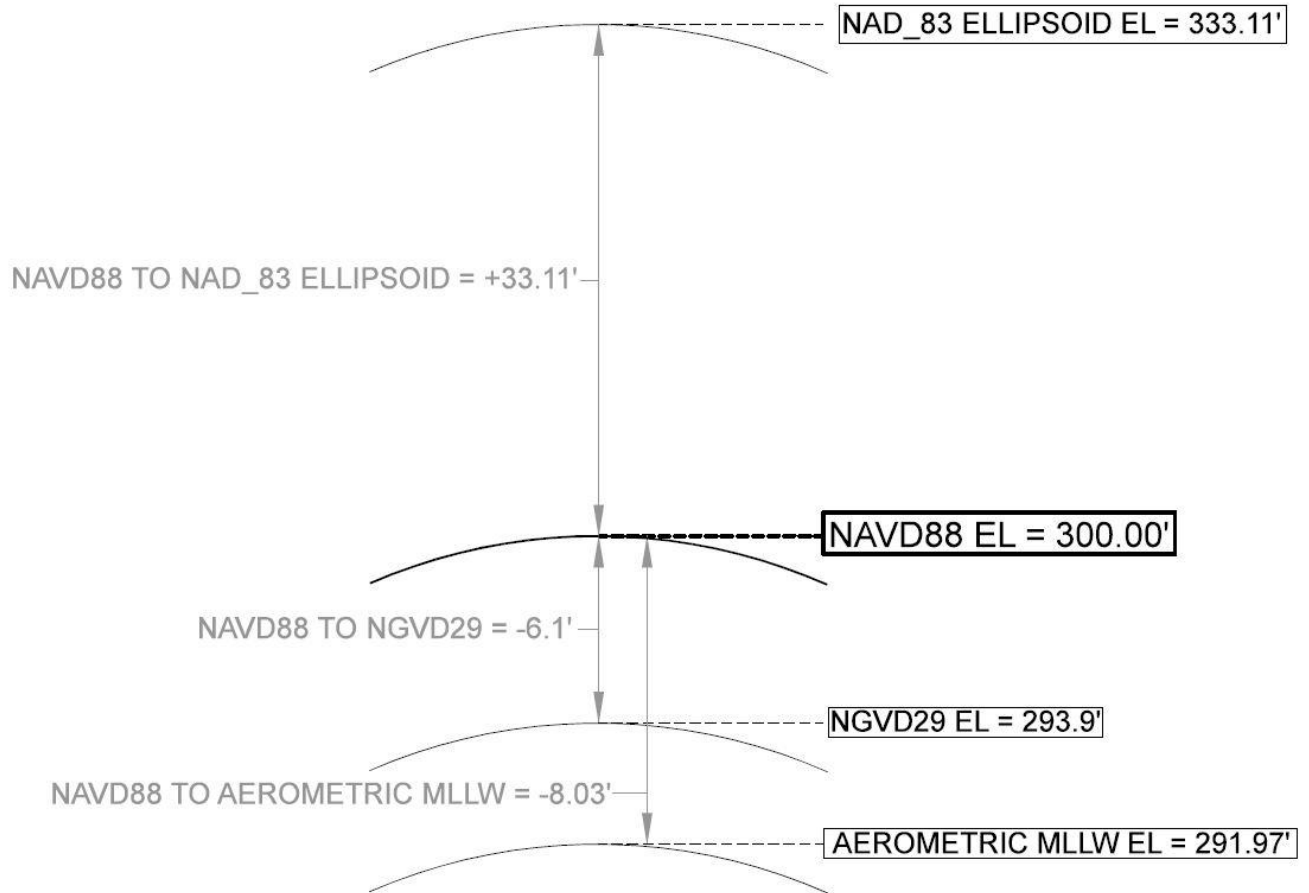
The translation value from NAVD 88, to the MLLW datum used at the MSB Central Landfill was also determined. Per the 2013 Aerometric survey (provided to APN by the Landfill) control point HV-301 has a MLLW elevation of 304.67. APN tied into this as control point #2004 with a NAVD 88 elevation of 312.70. Thus, a translation value of -8.03 can be used when converting between NAVD 88 and the 2013 Aerometric MLLW datum.

Please find attached depiction of the datums, and other supporting information.

Thank you,

Max Schillinger, P.L.S., P.E.
907-746-4185

DATUM TRANSLATION DEPICTION



NAD_83 ELLIPSOID TO NAVD88 ORTHOMETRIC

<u>Point #</u>	<u>Northing</u>	<u>Easting</u>	<u>Description</u>	<u>NAD 83 ELLIPSOID</u>	<u>Geoid Sep.</u>	<u>NAVD88</u>
100	2774382.16	1778122.71	SET PK W/ BLUE FUZZIE	343.39	33.06	310.33
2000	2774385.52	1778127.97	BASE PK "+" TOPw/PENNANT CLOTH	343.61	33.06	310.56
2004	2774729.15	1778250.38	PM CFB	345.78	33.08	312.70
2006	2774764.41	1780891.76	5RB-FS-AGL-RPC-13##S	338.86	33.31	305.54
2011	2772292.17	1777576.59	5rb-FS-AGL-YPC-12039-SET-cc	356.01	32.93	323.08
2014	2772815.07	1779129.51	5rb-FS-AGL-YPC-12039-SET-cc	298.21	33.09	265.12
2016	2773422.66	1779033.74	hld 2-1/2"AC CP-102	297.17	33.10	264.07
2018	2773616.43	1778911.27	5rb-FS-AGL-YPC-12039-SET-cc	306.92	33.10	273.82
2020	2774188.82	1778767.55	FND SS-DR FS "DATUM POINT"	337.13	33.11	304.02
2022	2774286.59	1780682.73	FND 2-1/2inAC-FS-AGL SB116	328.04	33.28	294.76
2027	2773146.42	1778163.79	5rb-FS-AGL-YPC-12039-SET-cc	319.79	33.01	286.78
2036	2773142.28	1779867.87	5rb-FS-AGL-YPC-12039-SET	266.47	33.16	233.30
<u>AVERAGE GEOID SEPERATION =</u>					<u>33.11</u>	

NAVD88 to NGVD29

The NGS Data Sheet

See file [dsdata.pdf](#) for more information about the datasheet.

```

PROGRAM = datasheet95, VERSION = 8.12.5.3
1      National Geodetic Survey, Retrieval Date = AUGUST 21, 2019
TT0610 *****
TT0610 DESIGNATION - W 20 RESET 1968
TT0610 PID - TT0610
TT0610 STATE/COUNTY- AK/MATANUSKA-SUSITNA BOROUGH
TT0610 COUNTRY - US
TT0610 USGS QUAD - ANCHORAGE C-6
TT0610
TT0610 *CURRENT SURVEY CONTROL
TT0610
TT0610* NAD 83(1986) POSITION- 61 35 11. (N) 149 07 39. (W) SCALED
TT0610* NAVD 88 ORTHO HEIGHT - 64.409 (meters) 211.32 (feet) ADJUSTED
TT0610
TT0610 GEOID HEIGHT - 10.461 (meters) GEOID12B
TT0610 DYNAMIC HEIGHT - 64.498 (meters) 211.61 (feet) COMP
TT0610 MODELED GRAVITY - 981,966.7 (mgal) NAVD 88
TT0610
TT0610 VERT ORDER - FIRST CLASS I
TT0610
TT0610.The horizontal coordinates were scaled from a topographic map and have
TT0610.an estimated accuracy of +/- 6 seconds.
TT0610.
TT0610.The orthometric height was determined by differential leveling and
TT0610.adjusted by the NATIONAL GEODETIC SURVEY
TT0610.in June 1991.
TT0610
TT0610.Significant digits in the geoid height do not necessarily reflect accuracy.
TT0610.GEOID12B height accuracy estimate available here.
TT0610
TT0610.The dynamic height is computed by dividing the NAVD 88
TT0610.geopotential number by the normal gravity value computed on the
TT0610.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
TT0610.degrees latitude (g = 980.6199 gals.).
TT0610
TT0610.The modeled gravity was interpolated from observed gravity values.
TT0610
TT0610
TT0610_U.S. NATIONAL GRID SPATIAL ADDRESS: 6VUP870299(NAD 83)
TT0610
TT0610 SUPERSEDED SURVEY CONTROL
TT0610
TT0610 NGVD 29 (??/??/92) 62.602 (m) 205.39 (f) ADJ UNCH 1 1
TT0610
TT0610.Superseded values are not recommended for survey control.
TT0610
TT0610.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
TT0610.See file dsdata.pdf to determine how the superseded data were derived.
TT0610
TT0610_MARKER: DB = BENCH MARK DISK
TT0610_SETTING: 46 = COPPER-CLAD STEEL ROD W/O SLEEVE (10 FT.+)

```


TT0610_STAMPING: W 20 RESET 1968

TT0610_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

TT0610

TT0610	HISTORY	- Date	Condition	Report By
TT0610	HISTORY	- 1968	MONUMENTED	CGS
TT0610	HISTORY	- 1975	GOOD	NGS

TT0610

TT0610 STATION DESCRIPTION

TT0610

TT0610'DESCRIBED BY NATIONAL GEODETIC SURVEY 1975

TT0610'1.1 MI S FROM PALMER.

TT0610'1.1 MILES SOUTH ALONG THE ALASKA RAILROAD FROM THE STATION AT PALMER,

TT0610'0.1 MILE NORTHEAST OF THE CROSSING OF SPRINGER LOOP INNER, 0.25 MILE

TT0610'SOUTHWEST OF THE CROSSING OF A PRIVATE ROAD, 27.6 FEET NORTHWEST OF

TT0610'THE NORTHWEST RAIL, 44 FEET SOUTHEAST OF THE CENTER LINE OF STATE

TT0610'HIGHWAY 1, 61.4 FEET SOUTHWEST OF THE NORTHWEST STEEL LEG OF A STATE

TT0610'TROOPERS 1 MILE SIGN, 8 1/2 FEET SOUTH OF A TELEPHONE POLE, 1.0 FOOT

TT0610'EAST OF A METAL WITNESS POST, ABOUT 1 1/2 FEET LOWER THAN THE HIGHWAY,

TT0610'ABOUT 4 FEET LOWER THAN THE TRACK, AND A DISK ON THE TOP OF A COPPER

TT0610'COATED STEEL ROD DRIVEN TO A DEPTH OF 16 FEET. THE DISK IS 0.8 FOOT

TT0610'ABOVE THE GROUND AND IS PROTECTED BY A 4-INCH PIPE WHICH PROJECTS 1.4

TT0610'FOOT ABOVE THE GROUND. SEC 5, 17 N, R 2E.2 E.

*** retrieval complete.

Elapsed Time = 00:00:03

NAVD88 to NGVD29

The NGS Data Sheet

See file [dsdata.pdf](#) for more information about the datasheet.

```

PROGRAM = datasheet95, VERSION = 8.12.5.3
1      National Geodetic Survey, Retrieval Date = AUGUST 21, 2019
TT0650 *****
TT0650 DESIGNATION - T 102
TT0650 PID - TT0650
TT0650 STATE/COUNTY- AK/MATANUSKA-SUSITNA BOROUGH
TT0650 COUNTRY - US
TT0650 USGS QUAD - ANCHORAGE C-7
TT0650
TT0650 *CURRENT SURVEY CONTROL
TT0650
TT0650* NAD 83(1986) POSITION- 61 34 04. (N) 149 19 15. (W) SCALED
TT0650* NAVD 88 ORTHO HEIGHT - 48.584 (meters) 159.40 (feet) ADJUSTED
TT0650
TT0650 GEOID HEIGHT - 9.482 (meters) GEOID12B
TT0650 DYNAMIC HEIGHT - 48.651 (meters) 159.62 (feet) COMP
TT0650 MODELED GRAVITY - 981,966.9 (mgal) NAVD 88
TT0650
TT0650 VERT ORDER - FIRST CLASS II
TT0650
TT0650.The horizontal coordinates were scaled from a topographic map and have
TT0650.an estimated accuracy of +/- 6 seconds.
TT0650.
TT0650.The orthometric height was determined by differential leveling and
TT0650.adjusted by the NATIONAL GEODETIC SURVEY
TT0650.in June 1991.
TT0650
TT0650.Significant digits in the geoid height do not necessarily reflect accuracy.
TT0650.GEOID12B height accuracy estimate available here.
TT0650
TT0650.The dynamic height is computed by dividing the NAVD 88
TT0650.geopotential number by the normal gravity value computed on the
TT0650.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
TT0650.degrees latitude (g = 980.6199 gals.).
TT0650
TT0650.The modeled gravity was interpolated from observed gravity values.
TT0650
TT0650
TT0650_U.S. NATIONAL GRID SPATIAL ADDRESS: 6VUP767282(NAD 83)
TT0650
TT0650 SUPERSEDED SURVEY CONTROL
TT0650
TT0650 NGVD 29 (??/??/92) 46.69 (m) 153.2 (f) COMPUTED 1 2
TT0650
TT0650.Superseded values are not recommended for survey control.
TT0650
TT0650.NGS no longer adjusts projects to the NAD 27 or NGVD 29 datums.
TT0650.See file dsdata.pdf to determine how the superseded data were derived.
TT0650
TT0650_MARKER: DB = BENCH MARK DISK
TT0650_SETTING: 46 = COPPER-CLAD STEEL ROD W/O SLEEVE (10 FT.+)

```

TT0650_STAMPING: T 102 1965

TT0650_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL

TT0650_SATELLITE: THE SITE LOCATION WAS REPORTED AS NOT SUITABLE FOR

TT0650+SATELLITE: SATELLITE OBSERVATIONS - June 13, 2008

TT0650

TT0650	HISTORY	- Date	Condition	Report By

TT0650	HISTORY	- 1965	MONUMENTED	CGS

TT0650	HISTORY	- 20080613	GOOD	GEOCAC

TT0650

TT0650 STATION DESCRIPTION

TT0650

TT0650'DESCRIBED BY COAST AND GEODETIC SURVEY 1965

TT0650'4.9 MI E FROM WASILLA.

TT0650'0.9 MILE EAST ALONG THE ALASKA RAILROAD FROM THE STATION AT WASILLA,
TT0650'THENCE 4 MILES EAST ALONG A DIRT ROAD, AT THE JUNCTION OF THE ALASKA
TT0650'RAILROAD, AT THE JUNCTION OF A DIRT ROAD LEADING SOUTH ACROSS TRACKS,
TT0650'AT THE CROSSING OF A POWER LINE, 151 1/2 FEET SOUTH OF THE CENTER LINE
TT0650'OF THE ROAD, 23 FEET WEST OF THE CENTER LINE OF THE ROAD LEADING
TT0650'SOUTH, 58 FEET SOUTHWEST OF AND ACROSS THE ROAD FROM THE FOURTH
TT0650'TELEPHONE POLE WEST OF MILEPOST 155 ON RAILROAD, 66.1 FEET SOUTH OF
TT0650'THE SOUTH RAIL, 1 FOOT NORTH OF POWER LINE POLE F 51, 1 FOOT WEST OF A
TT0650'WITNESS POST, ABOUT LEVEL WITH THE ROAD LEADING SOUTH, AND A 5/8-INCH
TT0650'COPPER COATED ROD THAT IS DRIVEN TO DEPTH OF 48 FEET AND IS ENCASED IN
TT0650'A 5-INCH ORANGEBURG PIPE WHICH PROJECTS 1.0 FOOT.

TT0650

TT0650 STATION RECOVERY (2008)

TT0650

TT0650'RECOVERY NOTE BY GEOCACHING 2008 (MTT)

TT0650'COORDINATES AT STATION USING HH2 WITH 25 FT OF VARIATION WERE

TT0650'61 34' 03.18, 149 19' 14.76 SOUTHBOUND ROAD FROM THE PREVIOUS

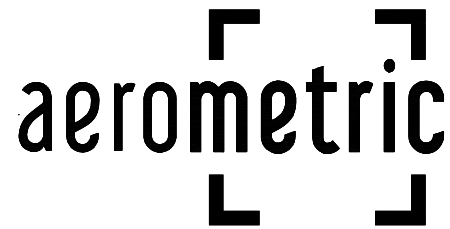
TT0650'DESCRIPTION IS NOW A DRIVEWAY AND RESIDES DIRECTLY SOUTH OF HIGHWAY 3

TT0650'EXIT RAMP, .05 MILES WEST OF A GAS STAION.

*** retrieval complete.

Elapsed Time = 00:00:04

NAVD88 TO MLLW



Geospatial Solutions

2014 Merrill Field Drive
Anchorage, AK 99501
P: 907-272-4495
F: 907-274-3265
www.aerometric.com

NOTES:

Project Name: Central Landfill 2013

Project: 6130502

This map was compiled to meet horizontal accuracy in accordance with ASPRS Class II Accuracy Standards.

This map was compiled to meet vertical accuracy in accordance with ASPRS Class II Accuracy Standards.

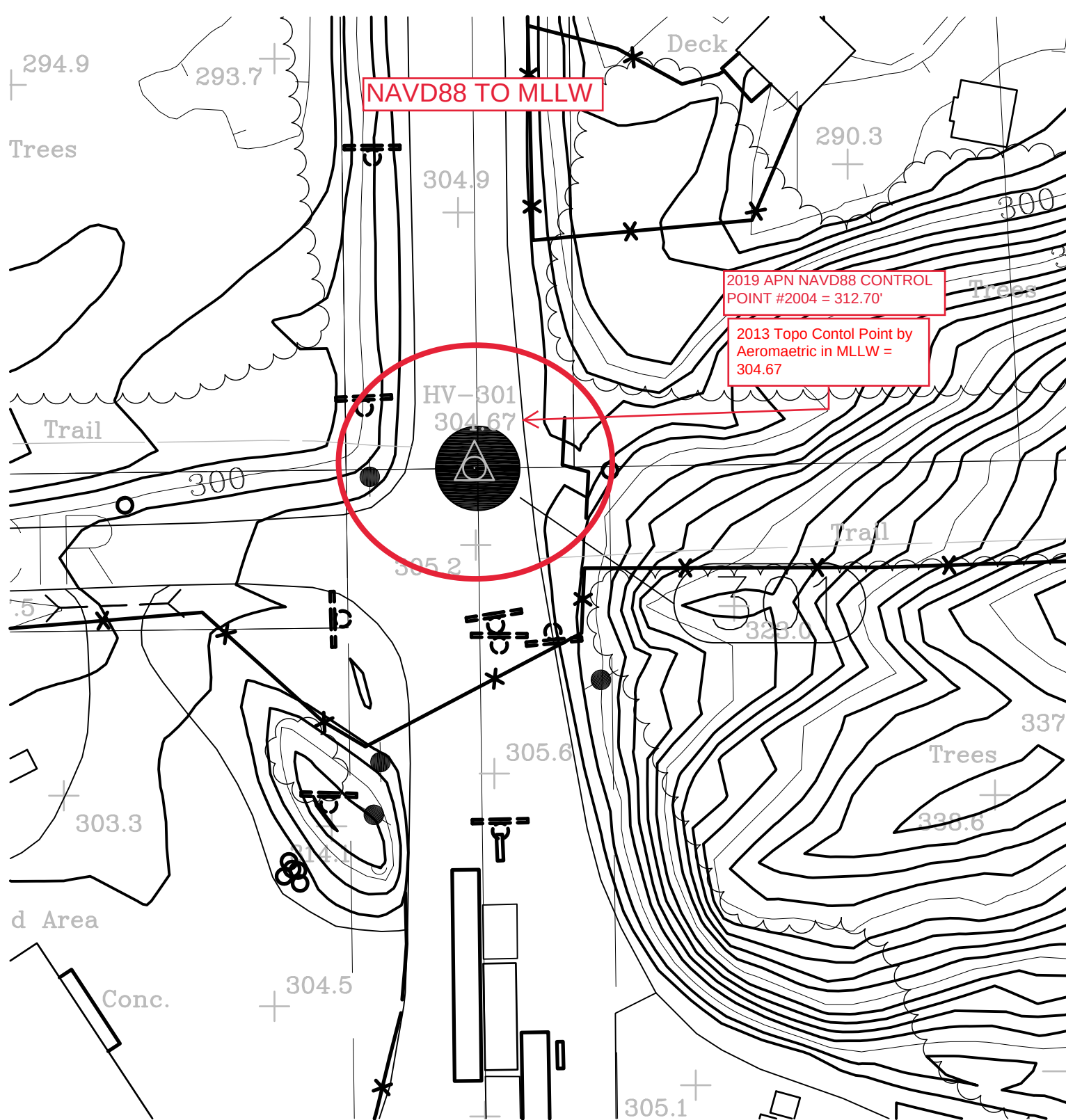
Areas denoting vegetation cover on the ground should be considered less accurate and not used for engineering purposes until field checked in accordance with ASPRS Accuracy Standards.

The map projection is based on NAD83, Alaska State Plane Zone 4, as expressed in U.S. Survey Feet.

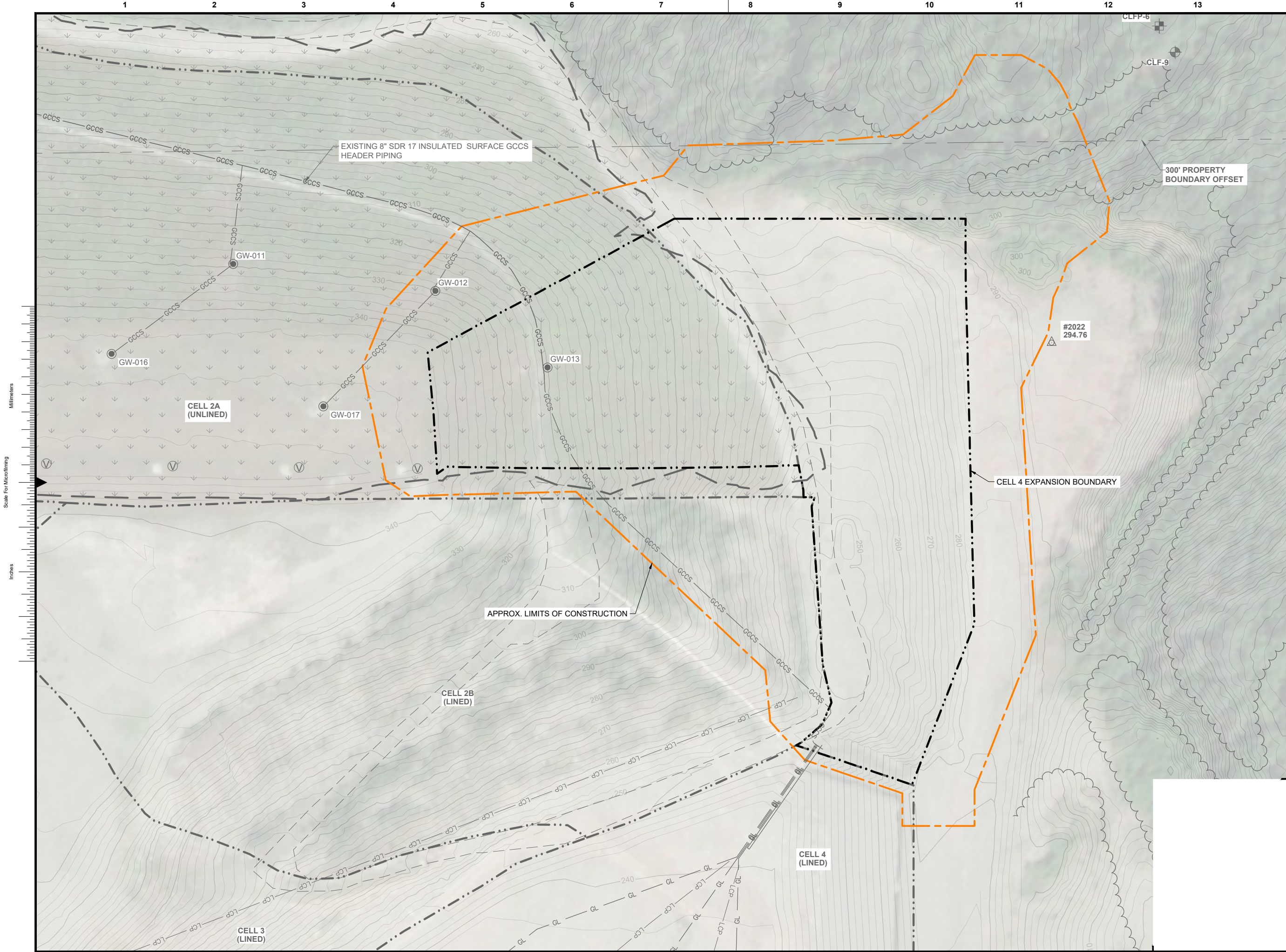
Vertical data is referenced to MLLW.

This map is based on photography acquired 05-24-2013 at a nominal scale of 1"=800' and previous photography dated 05-02-2011 at a nominal scale of 1"=800'.

This map produced for output at a scale of 1"=100' with a contour interval of 2 feet.

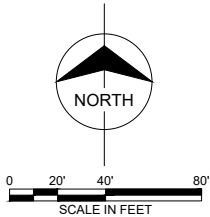


ATTACHMENT 3:
REVISED DRAWING G004



no.	date	by	ckd	description
0	8/6/24	RCH	FJD	ISSUED FOR BID

- NOTES:
- EXISTING SITE FEATURES SHOWN PROVIDED BY MSB.
 - EXISTING SITE TOPOGRAPHY CREATED FROM VARIOUS SURVEYS. MOST RECENT SURVEY OF THE CELL 4 EXPANSION AREA CREATED FROM DRAFT LIDAR DATA FLOWN IN THE FALL OF 2019 BY MSB, THE ACCURACY OF THE DATA IS NOT GUARANTEED.
 - CONTRACTOR SHALL COORDINATE CONSTRUCTION ACTIVITIES WITH LANDFILL OPERATIONS.
 - CONTRACTOR IS RESPONSIBLE FOR PROTECTION OF EXISTING SITE FEATURES.
 - CONSTRUCTION LIMITS SHOWN ARE APPROXIMATE. CONTRACTOR TO LIMIT ACTIVITIES TO AREAS NECESSARY TO COMPLETE THE WORK.
 - CONTRACTOR STAGING AREA TO BE COORDINATED WITH OWNER.



Burns & McDonnell Engineering Co, Inc.
LICENSE NO. AECC322

date AUGUST 2024	detailed R. HEAMAN
designed M. AULT	checked F. DORAN



Matanuska-Susitna Borough, Alaska

CENTRAL LANDFILL (SW1A007-26)
CELL 4 EXPANSION CONSTRUCTION
GENERAL ARRANGEMENT

project 167550	contract AUTHORIZATION #14
drawing G004	rev. 0
sheet	of sheets
file	G004 GENERAL ARRANGEMENT.DWG

ATTACHMENT 4:
CELL 4 EXPANSION SLOPE STABILITY MEMO, 2024

Memorandum



Date: July 18, 2024

To: Fred Doran
Marcus Ault
Becca Heaman

From: Nathan Textor

Subject: 173688 – Matanuska-Susitna Borough, Alaska Landfill – Cell 4 Piggyback Stability Evaluation

Introduction

As part of development of the Matanuska-Susitna Borough Landfill (Landfill), Cell 4 is being designed. Cell 4 will partially piggyback Cell 2A. Cell 2A is closed and covered with a geosynthetic clay liner (GCL). This GCL will be incorporated into the base liner system of Cell 4 by placing additional geosynthetic materials. The stability of the overall system was evaluated after placement of the Cell 4 waste, with the controlling consideration being shear surfaces located along the geosynthetic cover/base liner. These calculations indicated that stability factors of safety were adequate for static conditions. Calculations for seismic conditions indicated that movement of along the cover/base liner will occur but are within allowable limits.

Other cells in the Landfill were evaluated by BMcD in 2022. Parameters determined in this previous work were relied upon for these evaluations as they directly apply.

Section

One (1) section was provided. It was drawn perpendicular to the current Cell 2A slope and proposed Cell 4 slope. The Cell 2A slope is approximately 90 feet tall and slightly steeper than 4H:1V. The proposed Cell 4 will be partially incised into the existing ground surface, with an uphill slope with a height of 32 feet and a 3H:1V slope. The top of waste in Cell 4 will have a top elevation between 339 and 348 feet, a slope height of 53 feet and a slope of approximately 3H:1V.

Material Design Parameters

Soil and waste materials were determined during the 2022 evaluations. Soil parameters were based on existing borings at the site which indicated soils are made up of dense sands and gravel. Waste design parameters were determined from published values. The design parameters are in Table 1.

Table 1. Soil Design Parameters.

Material	Design N₆₀ (blows/ft)	Unit Weight (pcf)	Friction Angle (deg)	Drained Cohesion (psf)
Poorly Graded Gravel	30	130	36	0
MSW		50	35	100

Geosynthetic Design Parameters

The cover/base liner system will be made up of the following materials, from top to bottom:

- 18 inches of granular drainage material
- Geotextile cushion fabric
- 60-mil HDPE textured geomembrane
- Geosynthetic clay liner
- 6 inches of sand cushion layer

To estimate these different interface strengths, published values in the *GRI Report #30* were reviewed. For each interface, both peak and residual strengths are noted. Estimated interface information for the cover/base liner are in Table 2.

Table 2. Liner Interfaces and Strengths

Interface	Peak		Residual	
	Friction Angle (deg)	Adhesion (psf)	Friction Angle (deg)	Adhesion (psf)
Granular Drainage Material (Sand) – NW-NP-GT	33	0	33	0
NW-NP-GT – HDPE-T	25	160	17	0
HDPE-T – GCL	21	160	13	0
GCL-Internal Reinforced	16	750	6	240
GCL-Leveling Sand	33	0	33	0

These values were used in determining the cover/base liner system strength for the range of waste thicknesses. Both peak and residual strengths were evaluated. It is expected that the significant settlement of the Cell 2A waste will lead to development of residual strengths in the geosynthetics.

The geosynthetic interface strengths listed in Table 2 can be incorporated into specifications for interface strength testing.

Seismic Parameters

This area is subject to high seismic shaking. Prior to 2022 work performed by BMcD, another consultant performed evaluations of other cells within the Landfill. These calculations utilized a seismic event with a return period of 50 years, or 10-percent chance of occurrence in 5 years. The peak ground acceleration for this evaluation was 0.26g, with an input value of 0.13g based on reductions to better model the effect of shaking on a landfill. This value was used for the current evaluations.

Other larger earthquake events can be considered which would lead to larger estimated displacements of the liner during a design seismic event.

Stability Results

Slope stability calculations were performed. Shear surfaces were modeled along the cover/base liner surface which is most effectively done using non-circular surfaces. Both peak and residual calculations were performed. The results are in Table 3.

Table 3. Slope Stability Factors of Safety

Case	Liner Strength	F.S.
Static	Residual	1.5
	Peak	3.4
Seismic	Residual	0.9
	Peak	2.0

For the residual case with seismic loading, the factor of safety below 1.0 requires that a Makdisi and Seed displacement evaluation be performed to estimate the amount of movement associated with the seismic event. These calculations indicate displacements between 0.3 and 1.3 feet which are within allowable published limits.

If there are any questions related to this memo, please contact me.

nst

ATTACHMENT 5:
SLOPE STABILITY ANALYSIS FOR RD&D APPLICATION, 2022

Introduction

This project involves the permitting and design of three (3) new cells and piggyback for the existing Matanuska-Susitna Borough, Alaska municipal solid waste (MSW) landfill near Palmer, Alaska. The new cells are located southeast of the existing cells. The new cells have a geosynthetic liner system and side slopes that are 3H:1V. The final side slope crest elevation will be between 320 and 350 feet. A re-circulation system will also be included within the MSW. The re-circulation lines will be vertically spaced 20 feet apart and horizontally offset. Due to this horizontal offset, a vertical cross section of the re-circulation lines within the MSW would show the re-circulation lines being vertically spaced 40 feet apart.

This packet contains slope stability and cover stability for the new cells.

Subsurface Information

Subsurface information was estimated using boring logs documented during previous well installation. Six (6) borings were performed in the general vicinity of the proposed cell expansion. The subsurface materials were made up of mainly poorly graded sands and gravels. The elevation where the MSW and native soil interface was mostly made up of poorly graded gravels. All the borings were sampled using the Standard Penetration Test (SPT), but blow counts were only noted on one of the borings. The soil descriptions are consistent across the borings. Therefore, it was assumed the blow counts associated with the single boring can be applied generally across all locations.

For the purposes of design and based on reviewing the boring logs, the native soil surface beneath the MSW will be conservatively assumed to be a medium poorly graded gravel (GP).

Groundwater was encountered during drilling of borings at an average elevation of 210 feet. A fence diagram and SPT blow counts are included in Attachment A.

Soil Design Parameters

Published correlations were reviewed for determining soil parameters. Discussions for each design parameter and how they were determined are below.

Poorly Graded Gravel

The poorly graded gravel's density and friction angle was based on blow counts and the correlation shown in Table 3-1 of the *United States Army Corps of Engineer (USACE) EM 1110-2-2504, Design of Sheet Pile Walls*. A unit weight of 130 pounds per cubic foot (pcf) and a friction angle of 36 degrees was selected.

MSW

Design parameters for MSW were determined based off published shear strength parameters and estimated densities based on previous information at the landfill. The paper by Diaz-Beltran, Iguaran-Fernandez, Larrahondo and Jaramillo entitled *Shear Strength of Municipal Solid Waste (MSW): Beyond the Raw Values of "Cohesion" and Friction Angles* provides a detailed review of available literature on measurements of shear strength of MSW. There is a significant variation in the cohesion and friction angle values measured by different researchers, with no apparent correlation between the parameters

(i.e. higher cohesion does not correlate with higher friction angles). Based on this paper, the most frequently measured shear strength parameters are 100 to 600 psf for cohesion and 25 to 35 degrees for friction angle. Based on this, a cohesion of 100 psf and a friction angle of 35 degrees were used for MSW shear strength parameters. MSW unit weight was estimated based on the CH2M proposal that stated the unit weight is likely “on the order of 40 to 60 pcf.” Based on this, a unit weight of 50 pcf was assumed.

Design Parameters

<u>Material</u>	<u>Design N₆₀ (blows/ft)</u>	<u>Unit Weight (pcf)</u>	<u>Friction Angle (deg)</u>	<u>Drained Cohesion (psf)</u>
Poorly Graded Gravel	30	130	36	0
MSW		50	35	100

References regarding material properties are included in Attachment B.

Geosynthetic Design Parameters

Geosynthetic materials will be utilized as part of the base liner and cover systems. Interface shear strengths of geosynthetics for the base liner and cover can control slope stability and require special evaluation. For the base liner of the new cells, the system is made up of the following materials, from top to bottom:

- 18 inches of granular drainage material
- Geotextile cushion fabric
- 60-mil HDPE textured geomembrane
- Geosynthetic clay liner
- 6 inches of sand leveling course

The proposed cover system is made up of the following materials, from top to bottom:

- 6 inches of cover soil (cohesive)
- 18 inches of sand drainage material
- 40-mil LLDPE textured geomembrane liner
- 6 inches of sand leveling course

To estimate these different interface strengths, published values in the *GRI Report #30* were reviewed. For each interface, both peak and residual strengths will be noted. Estimated interface information for the cell base liner are noted below:

Table 1. Base Liner Interfaces and Strengths

Interface	Peak		Residual	
	Friction Angle (deg)	Adhesion (psf)	Friction Angle (deg)	Adhesion (psf)
Granular Drainage Material (Sand) – NW-NP-GT	33	0	33	0
NW-NP-GT – HDPE-T	25	160	17	0
HDPE-T – GCL	21	160	13	0
GCL-Internal Reinforced	16	750	6	240
GCL-Leveling Sand	33	0	33	0

For the cover system, the geomembrane is assumed to be textured given the side slopes and lengths of slopes. Estimated interface information for the cover system are listed below:

Table 2. Cells Cover Interfaces and Strengths

Interface	Peak		Residual	
	Friction Angle (deg)	Adhesion (psf)	Friction Angle (deg)	Adhesion (psf)
Granular Drainage Material (Sand) - LLDPE-T	26	160	25	105
LLDPE-T – Granular Drainage Material (Sand)	26	160	25	105

For determining the controlling strength for the base liner, the interface shear strength for every interface was calculated for a range of effective stresses. This was done because different interfaces control for different effective stress ranges.

Based on this evaluation, the following design strength envelope was determined for the cell base liner:

Table 3. Cells Base Liner Design Strength Envelope

Peak		Residual	
Effective Stress (psf)	Interface Shear Strength (psf)	Effective Stress (psf)	Interface Shear Strength (psf)
0	0	0	0
700	455	2000	450
4200	1943	5000	766
5000	2184		

For the cover system, all interface strength values will be evaluated using the parameters listed in Table 2.

Excerpt from the *GRI Report #30* and base liner strength determinations are included in Attachment C.

Sections

Four (4) sections were considered in the analysis. Sections were drawn across the area of the new cells. Sections A and B were drawn to encompass cells 3 and 4, section C encompasses cells 3, 4, and 5, and section D encompasses cells 4 and 5. Each cell piggybacks off each other in numerical order, that is, cell 4 piggybacks cell 3 and cell 5 piggybacks cell 4. Final landfill side slopes were specified as 3H:1V with a crest elevation between 320 and 350 feet, depending on the cell.

Subsurface conditions were assumed to be consistent across the entire site. The poorly graded gravel layer, as described in previous sections, was used as the native soil surface.

Section information is included in Attachment D.

Slope Stability

Slope stability calculations were performed for all sections using UTexas4. Calculations were performed for the following conditions for each section:

- Circular Failure Surface
 - Residual liner strengths
- Non-circular Failure Surface
 - Residual liner strengths
 - Peak liner strengths
- Circular Failure Surface During a Seismic Event
 - Residual liner strengths
 - PGA = 0.13g
- Non-circular Failure Surface During a Seismic Event
 - Residual Liner Strengths
 - PGA = 0.13g
 - Peak liner strengths
 - PGA = 0.13g

Previous engineering evaluations of Cells 1 and 2 by others used a PGA of 0.13g for stability analysis for temporary cell slopes. This value was noted as being half the peak ground acceleration associated with a seismic event with a return period of 50 years. This value can be determined using the USGS Unified Hazard Tool. By assuming a B/C site class and a 50-year return period, the tool reports a PGA of 0.176. The reported PGA was then multiplied by a factor of 1.4 to account for the site class associated with poorly graded gravel which was found to be equivalent to the previous design value. The design acceleration corresponds to 10-percent probability of occurrence over a 5-year time period.

For the circular cases, a “floating grid” search method was used for calculating the stability factor of safety. This method involves setting a gridded location of circular centers and then choosing a point along the surface to run all the circular surfaces through. UTexas4 will then cycle through all the circles

based on the different circular centers. Multiple points along the surface were evaluated to determine the lowest factor of safety.

For the non-circular cases, non-circular surfaces are evaluated. Since this case is to evaluate surfaces along the liner interface, the surface must stay within the base liner system. This requires a noncircular surface. Multiple different points along the slope surface and base liner were evaluated to determine the controlling factor of safety.

The effects of the re-circulation system were also considered for non-seismic cases. The pore pressure within the MSW will vary based on a location's distance from the nearest re-circulation line. A mesh interpolating the pore pressures between re-circulation lines was used to model the re-circulation system. It was assumed that an active re-circulation line will saturate the MSW 10 feet above and 10 feet below each re-circulation line. This creates a maximum pressure head of 20 feet and a minimum pressure head of 0 feet 10 feet below and above each re-circulation line respectively. The 20-foot and 0-foot pressure heads result in pore pressures of 1,248 pcf and 0 pcf respectively.

The 1,248 pcf and 0 pcf mesh points were plotted linearly 10 feet below and above each re-circulation line respectively. Re-circulation lines were vertically spaced 40 feet apart. Additional 0 pcf mesh points were plotted 0.5 feet beneath each 1,248 pcf mesh point. These additional 0 pcf mesh points serve as a boundary preventing the 1,248 pcf mesh points from interpolation beyond the intended depth. An illustration of this model is provided in Figure 1.

The effects of the re-circulation system were not considered for seismic cases to avoid compounding conservative assumptions. It is our understanding that the re-circulation system is manually controlled and does not run continuously. Therefore, it was assumed that the re-circulation system will likely not be operated at the same time as a low probability seismic event.

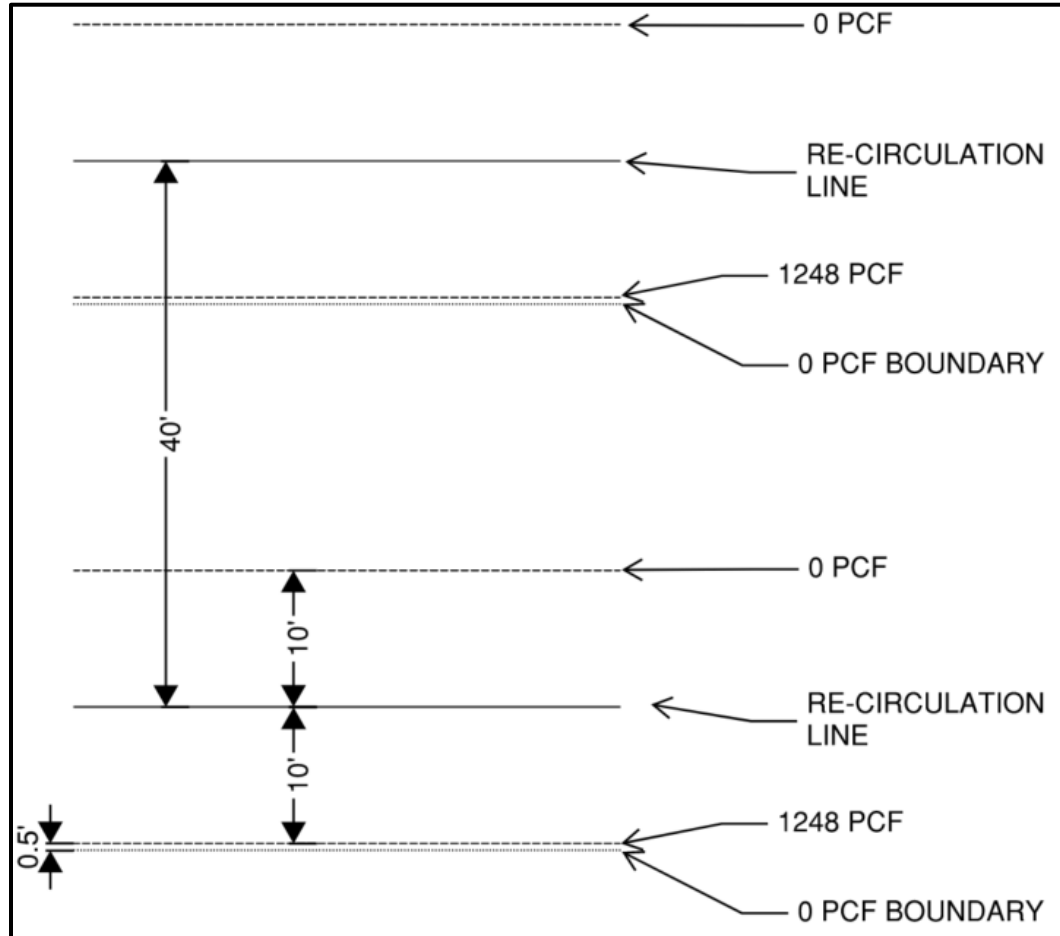


Figure 1: Schematic of re-circulation system interpolation model

For the base liner system, there are peak and residual strengths associated with the geosynthetic interfaces. For the liner strength to pass through the peak zone and into the residual zone, adequate strain must occur. This can be caused by construction disturbance, settlement beneath liner, strain compatibility with MSW shear strength or seismic deformations. Residual strengths were initially used for all evaluations. If adequate factors of safety were calculated using residual strengths, no further evaluation was performed. If residual strengths led to inadequate factors of safety, the peak strengths were also evaluated. Discussion on the implications of peak and residual strengths for specific cases are included later in this report.

Results of the slope stability analyses are listed below:

Table 2. Slope Stability Factors of Safety

Section	Case	Liner Strength	F.S.
Section A	Circular	Residual	1.99
	Non-Circular	Residual	1.40
		Peak	2.31
	Seismic Circular	Residual	1.79
	Seismic Non-Circular	Residual	1.36
		Peak	1.68
Section B	Circular	Residual	1.59
	Non-Circular	Residual	1.43
		Peak	2.54
	Seismic Circular	Residual	1.47
	Seismic Non-Circular	Residual	1.13
		Peak	1.83
Section C	Circular	Residual	1.89
	Non-Circular	Residual	1.04
		Peak	2.20
	Seismic Circular	Residual	1.60
	Seismic Non-Circular	Residual	0.65
		Peak	1.43
Section D	Circular	Residual	1.99
	Non-Circular	Residual	1.23
		Peak	2.10
	Seismic Circular	Residual	1.50
	Seismic Non-Circular	Residual	0.82
		Peak	1.42

No direct guidance for slope stability factors of safety is included in Alaska DEC regulations for MSW landfills. Therefore, generally accepted minimum factors of safety for slope stability were relied upon and are listed below:

- Circular Failure Surface – 1.5
- Non-Circular Failure Surface – 1.5
- Circular Failure Surface During a Seismic Event – 1.0
- Non-Circular Failure Surface During a Seismic Event – 1.0

Factors of safety for all cases are based off generally accepted values for slope stability evaluations of MSW landfills. For cases with residual liner strength, the paper by Stark and Poeppel entitled *Landfill Liner Interface Strengths from Torsional-Ring-Shear Tests* was reviewed. Direction in this paper is to consider a case with fully residual strengths for the liner with a target factor of safety of 1.0.

Inputs and outputs from the UTexas4 program, and the Stark and Poeppel paper are included in Attachment E.

It is concluded the factors of safety are adequate for seismic and non-seismic slope stability except for the Seismic Non-Circular case for Sections C and D with residual liner strengths. To evaluate these cases, deformation of the liners was estimated using a method outlined by Makdisi and Seed in their article titled “A Simplified Procedure for Estimating Earthquake-Induced Deformation in Dams and Embankments”. Section C is the controlling scenario. The result of the calculation for Section C was a liner deformation of about 3.3 feet. It is widely accepted that deformations of 3-4 feet could take place before the liner fails. Therefore, it is concluded that the deformations that could occur in these liners are acceptable. The Makdisi and Seed displacement calculations are included in Attachment F

Cover Stability

Cover stability was also evaluated for cover system that includes geosynthetics. Both dry and saturated conditions were evaluated for peak interface shear strengths for the two different interfaces. For saturated conditions, the maximum allowable water height is the full 2 feet thickness of the soil/granular material cover. A slope of 3H:1V was evaluated based on current grading plans.

Ditches will be constructed as part of the surface water management along the landfill cover slope. To account for this additional driving force from the small earthen embankments, multiple calculations considering different ways to apply the loading were performed.

Interface strengths used in modeling are based on the *GRI Report #30*. Interface shear strengths for interfaces with textured geomembrane include adhesion. Adhesion has a significant effect on the stability of the cover system as the thin soil veneer has a relatively low driving force associated with it.

A PGA acceleration of 0.75g was used in the seismic cover stability analysis. This design acceleration corresponds to 2-percent probability of occurrence over a 50-year time period. A larger PGA was used for this analysis, in comparison to other analyses, due to the long-term service nature of the cover system.

For peak strengths, factors of safety were above 1.5 for the non-seismic case. A factor of safety of 0.8 was calculated for the seismic case. A displacement check, as outlined by Makdisi and Seed, was performed to verify the cover stability for the seismic cases. The result of the calculation was a liner deformation of about 4 inches. As stated previously, deformation of 3-4 feet could occur before the liner is considered failed. Therefore, it is concluded 0.004 inches of deformation is acceptable.

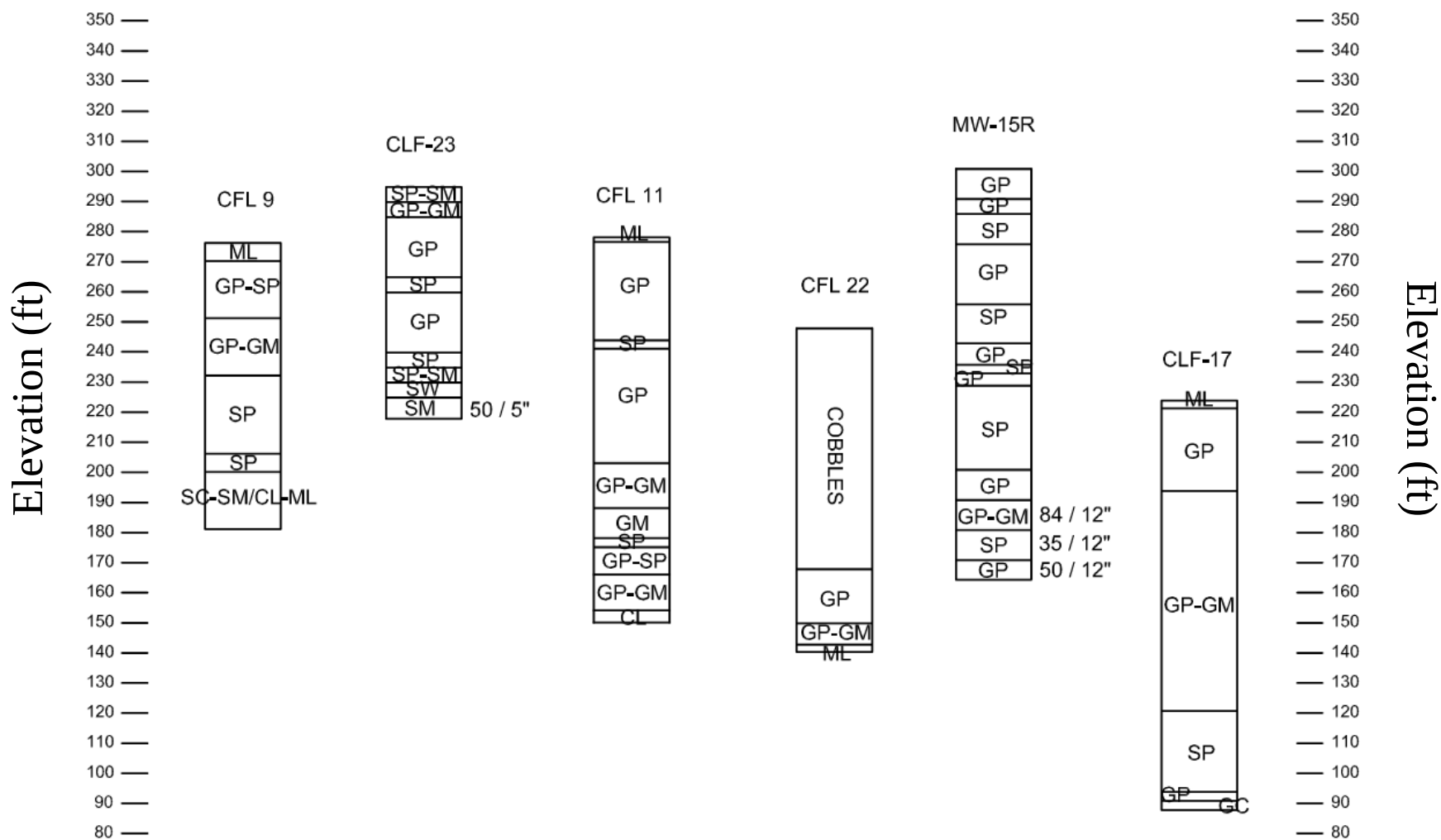
During final construction, confirmation of the assumed interface shear strengths will be required to confirm the final materials are stable. Calculations for the cover stability based on published interface shear strengths are included in Attachment G.



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MSB Landfill Expansion			Checked by:	N. Textor	
Slope Stability			Prelim:	Final:	

Attachment A – Subsurface Information







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MSB Landfill Expansion			Checked by:	N. Textor	
Slope Stability			Prelim:	Final:	

Attachment B – Design Parameters Determination

Table 3-1
Granular Soil Properties (after Teng 1962)

Compactness	Relative Density (%)	SPT N (blows per ft)	Angle of Internal Friction (deg)	Unit Weight	
				Moist (pcf)	Submerged (pcf)
Very Loose	0-15	0-4	<28	<100	<60
Loose	16-35	5-10	28-30	95-125	55-65
Medium	36-65	11-30	31-36	110-130	60-70
Dense	66-85	31-50	37-41	110-140	65-85
Very Dense	86-100	>51	>41	>130	>75

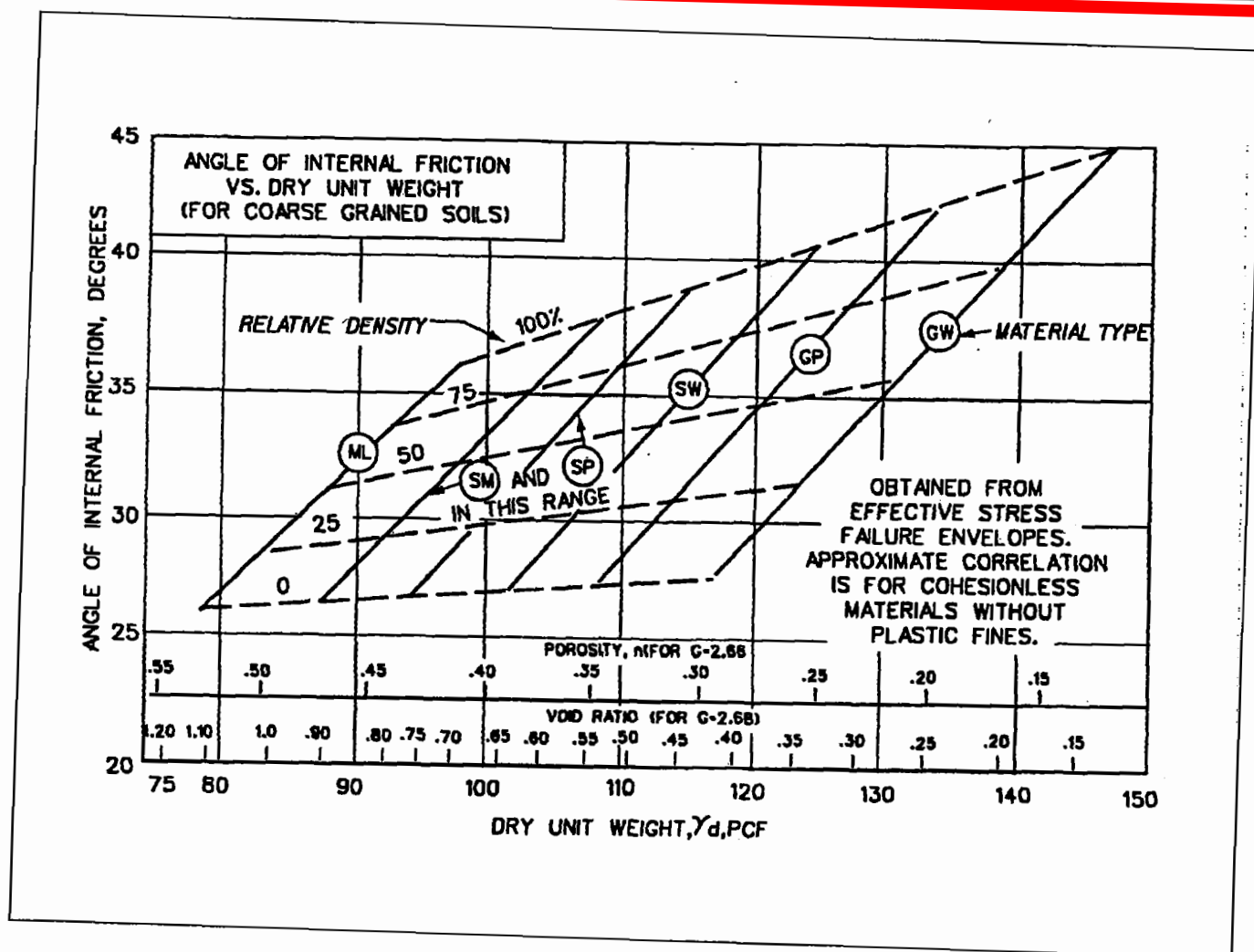


Figure 3-1. Cohesionless Soil Properties (after U.S. Department of the Navy 1971)

Shear Strength of Municipal Solid Waste (MSW): Beyond the Raw Values of “Cohesion” and Friction Angles

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Abstract: Understanding the mechanical behavior of municipal solid waste (MSW) is still a major challenge in engineering. The purpose of this paper is to critically review published literature on MSW shear strength from the past 20 years, including the major strength mechanisms and failure criteria, so a landfill engineer can access key behavioral concepts, beyond just the raw values of friction angle and “cohesion” parameters that are required for design. In addition, this paper explores the relationship of shear strength parameters with MSW composition and urban population, which are useful proxies for economic development. To revisit the state of the practice since the introduction of commonly used design charts, an enhanced database of shear strength parameters as well as Mohr-Coulomb envelopes was compiled. Also, a relationship was developed between strength parameters, MSW composition, and population data for a number of cities in a developing country. This study supports the concept that the consumption habits of an urban area are very relevant when it comes to designing landfills. Furthermore, instead of introducing a new recommended range of design parameters or a new strength envelope, the compiled data are interpreted under a simple statistical basis, so the designer can make informed decisions on which parameters to choose for design.

INTRODUCTION

Municipal solid wastes (MSW) are typically disposed of in engineered landfills obeying geotechnical design criteria. The characterization of MSW normally includes determining or estimating geotechnical-equivalent properties and strength parameters, including unit weight, friction angle, and the “cohesion” intercept. In reality, MSW are highly complex materials of strong spatial and temporal variability. The factors that influence MSW shear strength include composition, age or degree of

probabilities of exceedance, calculated using the 181 data points compiled. The cohesion histogram clearly skews towards the left-hand side of the distribution, the mean is around 15 kPa, the standard deviation is 22 kPa, and the coefficient of variation is 94.3%. On the other hand, unlike the cohesion histogram, the friction angle distribution appears significantly more symmetrical, with mean around 27°, standard deviation of 9°, and coefficient of variation of 34.2%. This simple representation of strength parameters may allow engineers to make more informed decisions about which design parameters to use, perhaps over the traditional c' - ϕ' charts, or even the strength envelope plots.

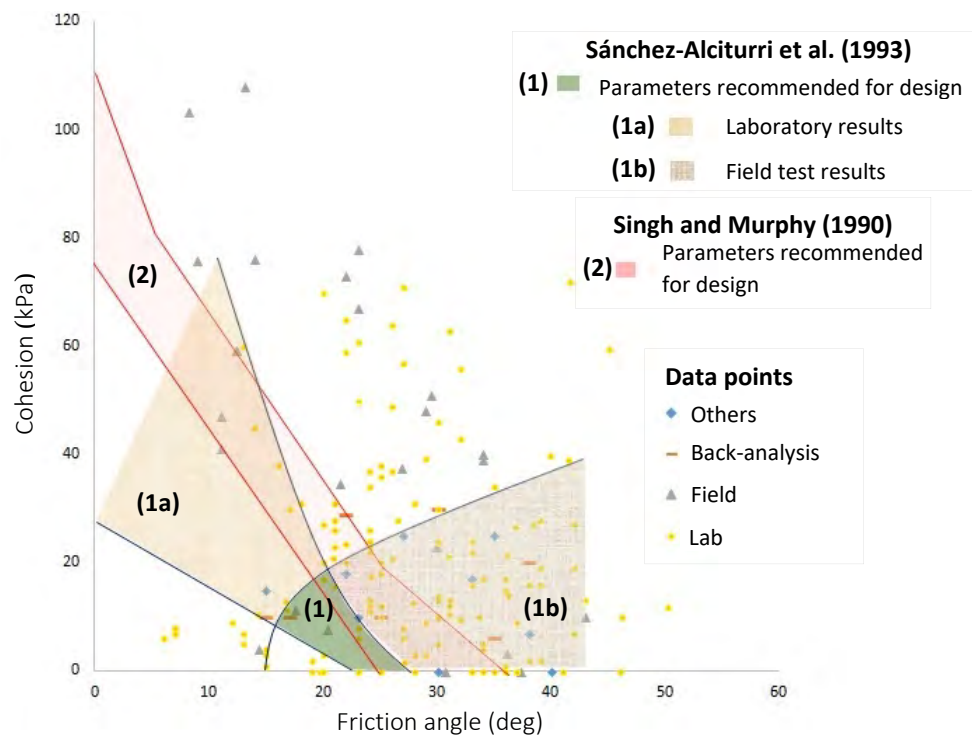


FIG 8. Compilation of c' vs. ϕ' parameters. Data are classified according to their method of determination. Common design regions are superimposed.

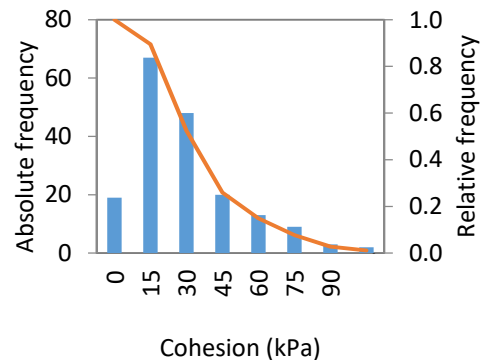


FIG 9. Histogram and probability of exceedance for cohesion

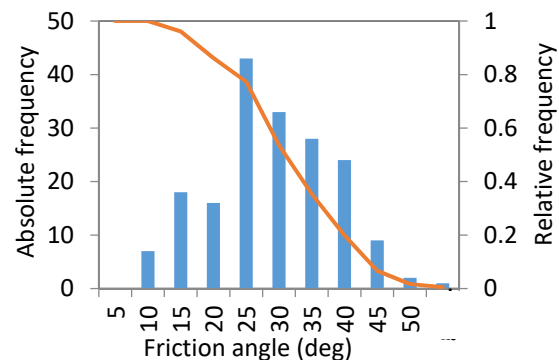
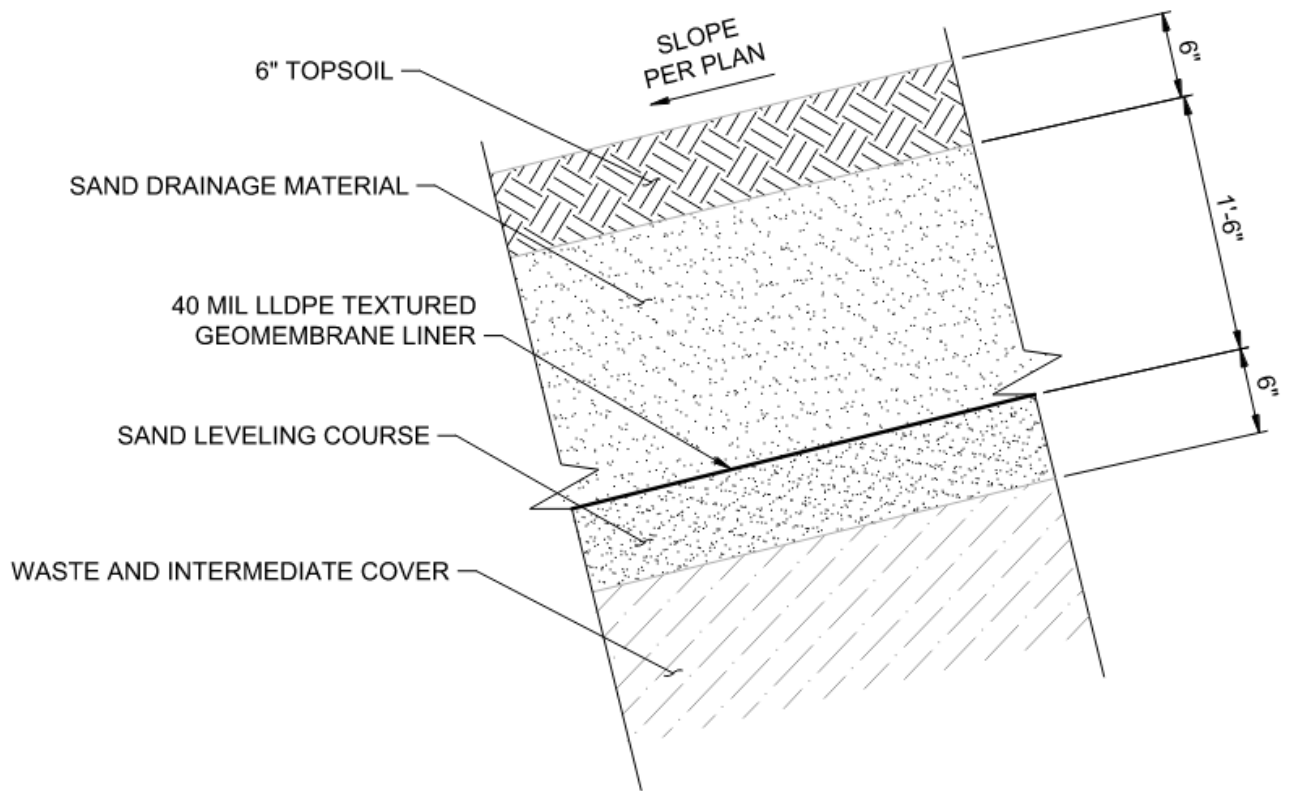


FIG 10. Histogram and probability of exceedance for friction angle

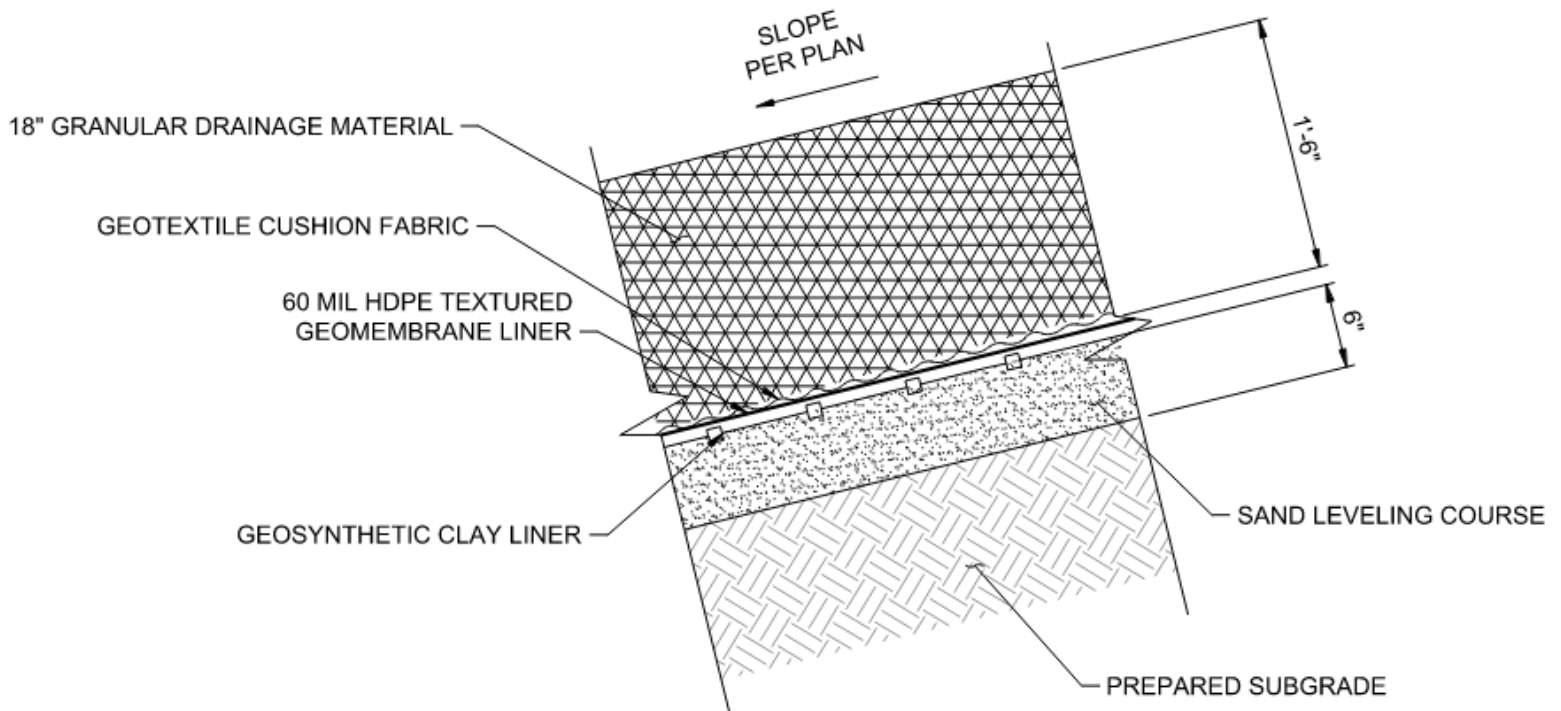
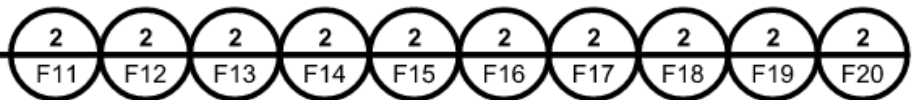


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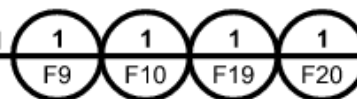
Attachment C –Liner Strength Determination



TYPICAL FINAL COVER SYSTEM
NOT TO SCALE



TYPICAL BOTTOM LINER SYSTEM
NOT TO SCALE





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**Direct Shear Database of
Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces**

by

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GRI Report #30

June 14, 2005

Appendix Table 1. Summary of interface shear strengths.

Interface 1*	Interface 2*	Peak Strength					Residual Strength				
		Fig. No.	δ (deg)	Ca (kPa)	Points	R ²	Fig. No.	δ (deg)	Ca (kPa)	Points	R ²
HDPE-S	Granular Soil	1a	21	0	162	0.93	1b	17	0	128	0.92
HDPE-S	Cohesive Soil										
	Saturated	1c	11	7	79	0.94	1d	11	0	59	0.95
	Unsaturated	1c	22	0	44	0.93	1d	18	0	32	0.93
HDPE-S	NW-NP GT	1e	11	0	149	0.93	1f	9	0	82	0.96
HDPE-S	Geonet	1g	11	0	196	0.90	1h	9	0	118	0.93
HDPE-S	Geocomposite	1i	15	0	36	0.97	1j	12	0	30	0.93
HDPE-T	Granular Soil	2a	34	0	251	0.98	2b	31	0	239	0.96
HDPE-T	Cohesive Soil										
	Saturated	2c	18	10	167	0.93	2d	16	0	150	0.90
	Unsaturated	2c	19	23	62	0.91	2d	22	0	35	0.93
HDPE-T	NW-NP GT	2e	25	8	254	0.96	2f	17	0	217	0.95
HDPE-T	Geonet	2g	13	0	31	0.99	2h	10	0	27	0.99
HDPE-T	Geocomposite	2i	26	0	168	0.95	2j	15	0	164	0.94
LLDPE-S	Granular Soil	3a	27	0	6	1.00	3b	24	0	9	1.00
LLDPE-S	Cohesive Soil	3c	11	12.4	12	0.94	3d	12	3.7	9	0.93
LLDPE-S	NW-NP GT	3e	10	0	23	0.63	3f	9	0	23	0.49
LLDPE-S	Geonet	3g	11	0	9	0.99	3h	10	0	9	1.00
LLDPE-T	Granular Soil	4a	26	7.7	12	0.95	4b	25	5.2	12	0.95
LLDPE-T	Cohesive Soil	4c	21	5.8	12	1.00	4d	13	7.0	9	0.98
LLDPE-T	NW-NP GT	4e	26	8.1	9	1.00	4f	17	9.5	9	0.96
LLDPE-T	Geonet	4g	15	3.6	6	0.97	4h	11	0	6	0.98
PVC-S	Granular Soil	5a	26	0.4	6	0.99	5b	19	0	6	0.99
PVC-S	Cohesive Soil	5c	22	0.9	11	0.88	5d	15	0	9	0.95
PVC-S	NW-NP GT	5e	20	0	89	0.91	5f	16	0	83	0.74
PVC-S	NW-HB GT	5g	18	0	3	1.00	5h	12	0.1	3	1.00
PVC-S	Woven GT	5i	17	0	6	0.54	5j	7	0	6	0.93
PVC-S	Geonet	5k	18	0.1	3	1.00	5l	16	0.6	3	1.00

Appendix Table 1. (continued)

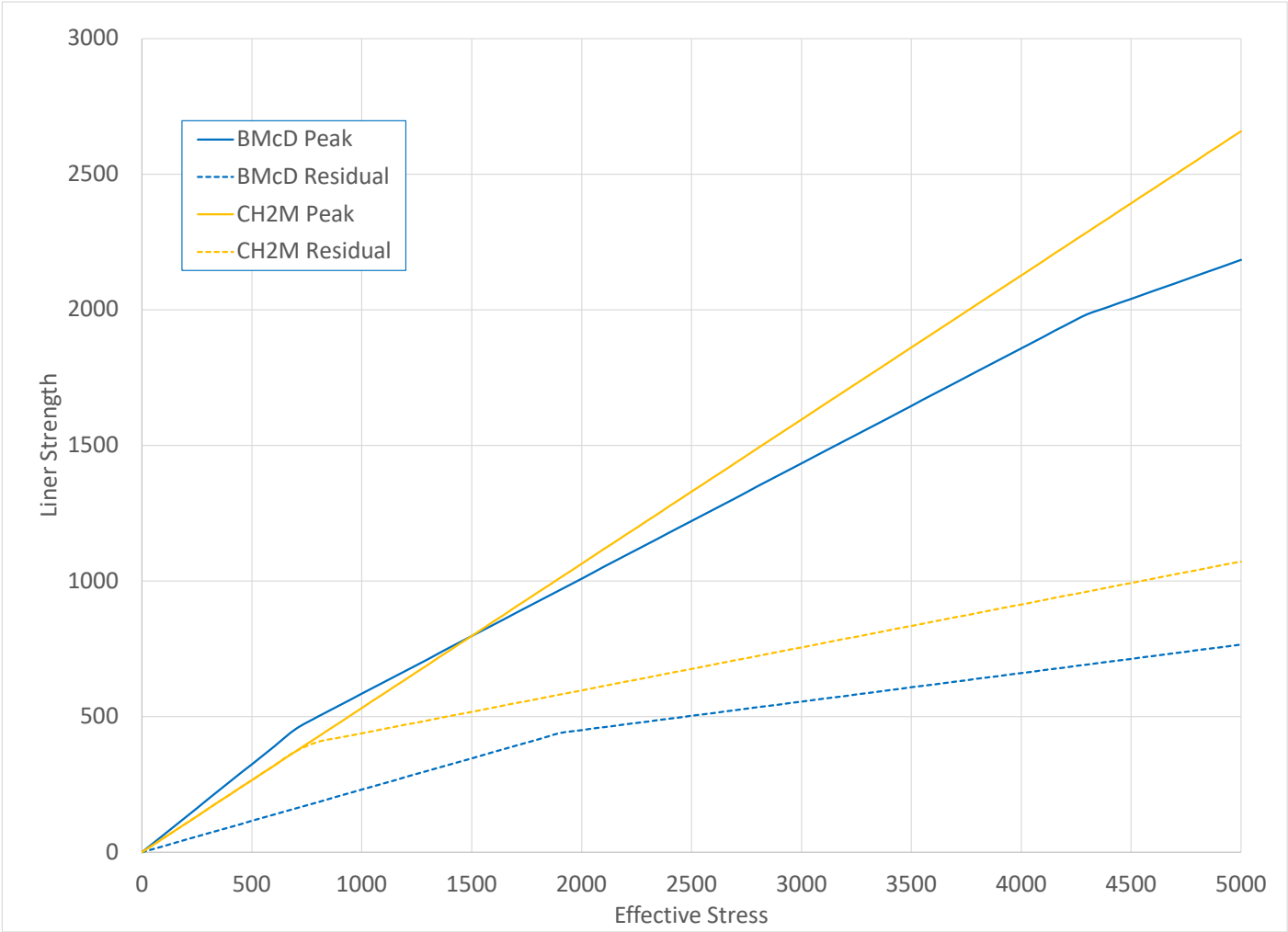
Interface 1*	Interface 2*	Peak Strength					Residual Strength				
		Fig. No.	δ (deg)	Ca (kPa)	Points	R ²	Fig. No.	δ (deg)	Ca (kPa)	Points	R ²
PVC-F	NW-NP GT	6a	27	0.2	26	0.95	6b	23	0	26	0.95
PVC-F	NW-HB GT	6c	30	0	8	0.97	6d	27	0	8	0.90
PVC-F	Woven GT	6e	15	0	6	0.78	6f	10	0	6	0.76
PVC-F	Geonet	6g	25	0	11	1.00	6h	19	0	11	0.99
PVC-F	Geocomposite	6i	27	1.1	5	1.00	6j	22	4.7	6	1.00
CSPE-R	Granular Soil	7a	36	0	3	1.00	7b	16	0	3	1.00
CSPE-R	Cohesive Soil	7c	31	5.7	6	0.71	7d	18	0	6	0.99
CSPE-R	NW-NP GT	7e	14	0	6	0.97	7f	10	0	6	0.98
CSPE-R	NW-HB GT	7g	21	0	3	1.00	7h	10	0	3	1.00
CSPE-R	Woven GT	7i	11	0	6	0.92	7j	11	0	3	1.00
CSPE-R	Geonet	7k	28	0	9	0.87	7l	16	0	9	0.80
NW-NP GT	Granular Soil	8a	33	0	290	0.97	8b	33	0	117	0.96
NW-HB GT	Granular Soil	8c	28	0	6	0.99	8d	16	0	6	0.91
Woven GT	Granular Soil	8e	32	0	81	0.99	8f	29	0	28	0.98
NW-NP GT	Cohesive Soil	9a	30	5	79	0.96	9b	21	0	28	0.79
NW-HB GT	Cohesive Soil	9c	29	0.9	15	0.71	9d	10	0	15	0.83
Woven GT	Cohesive Soil	9e	29	0	34	0.94	9f	19	0	16	0.86
GCL Reinforced (internal)	N/A	10a	16	38	406	0.85	10b	6	12	182	0.91
GCL (NW-NP GT)	HDPE-T	11a	23	8	180	0.95	11b	13	0	157	0.90
GCL (W-SF GT)	HDPE-T	11c	18	11	196	0.96	11d	12	0	153	0.92
Geonet	NW-NP GT	12a	23	0	52	0.97	12b	16	0	32	0.97
Geocomposite (NW-NP GT)	Granular Soil	13a	27	14	14	0.86	13b	21	8	10	0.92

Sand NW-NP-GT		GT HDPE-T		DHDPE-t GCL		GCL - Internal Reinforced	
ϕ_{peak}	33	ϕ_{peak}	25	ϕ_{peak}	23	ϕ_{peak}	16
C_{peak}	0	C_{peak}	160	C_{peak}	160	C_{peak}	750
$\phi_{residual}$	33	$\phi_{residual}$	17	$\phi_{residual}$	13	$\phi_{residual}$	6
$C_{residual}$	0	$C_{residual}$	0	$C_{residual}$	0	$C_{residual}$	240

Effective Stress (psf)	Peak (psf)	Residual (psf)	Peak (psf)	Residual (psf)	Peak (psf)	Residual (psf)	Peak (psf)	Residual (psf)
0	0.0	0.0	160.0	0.0	160.0	0.0	750.0	240.0
100	64.9	64.9	206.6	30.6	202.4	23.1	778.7	250.5
200	129.9	129.9	253.3	61.1	244.9	46.2	807.3	261.0
300	194.8	194.8	299.9	91.7	287.3	69.3	836.0	271.5
400	259.8	259.8	346.5	122.3	329.8	92.3	864.7	282.0
500	324.7	324.7	393.2	152.9	372.2	115.4	893.4	292.6
600	389.6	389.6	439.8	183.4	414.7	138.5	922.0	303.1
700	454.6	454.6	486.4	214.0	457.1	161.6	950.7	313.6
800	519.5	519.5	533.0	244.6	499.6	184.7	979.4	324.1
900	584.5	584.5	579.7	275.2	542.0	207.8	1008.1	334.6
1000	649.4	649.4	626.3	305.7	584.5	230.9	1036.7	345.1
1100	714.3	714.3	672.9	336.3	626.9	254.0	1065.4	355.6
1200	779.3	779.3	719.6	366.9	669.4	277.0	1094.1	366.1
1300	844.2	844.2	766.2	397.4	711.8	300.1	1122.8	376.6
1400	909.2	909.2	812.8	428.0	754.3	323.2	1151.4	387.1
1500	974.1	974.1	859.5	458.6	796.7	346.3	1180.1	397.7
1600	1039.1	1039.1	906.1	489.2	839.2	369.4	1208.8	408.2
1700	1104.0	1104.0	952.7	519.7	881.6	392.5	1237.5	418.7
1800	1168.9	1168.9	999.4	550.3	924.1	415.6	1266.1	429.2
1900	1233.9	1233.9	1046.0	580.9	966.5	438.6	1294.8	439.7
2000	1298.8	1298.8	1092.6	611.5	1008.9	461.7	1323.5	450.2
2100	1363.8	1363.8	1139.2	642.0	1051.4	484.8	1352.2	460.7
2200	1428.7	1428.7	1185.9	672.6	1093.8	507.9	1380.8	471.2
2300	1493.6	1493.6	1232.5	703.2	1136.3	531.0	1409.5	481.7
2400	1558.6	1558.6	1279.1	733.8	1178.7	554.1	1438.2	492.3
2500	1623.5	1623.5	1325.8	764.3	1221.2	577.2	1466.9	502.8
2600	1688.5	1688.5	1372.4	794.9	1263.6	600.3	1495.5	513.3
2700	1753.4	1753.4	1419.0	825.5	1306.1	623.3	1524.2	523.8
2800	1818.3	1818.3	1465.7	856.0	1348.5	646.4	1552.9	534.3
2900	1883.3	1883.3	1512.3	886.6	1391.0	669.5	1581.6	544.8
3000	1948.2	1948.2	1558.9	917.2	1433.4	692.6	1610.2	555.3
3100	2013.2	2013.2	1605.6	947.8	1475.9	715.7	1638.9	565.8
3200	2078.1	2078.1	1652.2	978.3	1518.3	738.8	1667.6	576.3
3300	2143.0	2143.0	1698.8	1008.9	1560.8	761.9	1696.3	586.8
3400	2208.0	2208.0	1745.4	1039.5	1603.2	785.0	1724.9	597.4
3500	2272.9	2272.9	1792.1	1070.1	1645.7	808.0	1753.6	607.9
3600	2337.9	2337.9	1838.7	1100.6	1688.1	831.1	1782.3	618.4
3700	2402.8	2402.8	1885.3	1131.2	1730.6	854.2	1811.0	628.9
3800	2467.7	2467.7	1932.0	1161.8	1773.0	877.3	1839.6	639.4
3900	2532.7	2532.7	1978.6	1192.3	1815.5	900.4	1868.3	649.9
4000	2597.6	2597.6	2025.2	1222.9	1857.9	923.5	1897.0	660.4
4100	2662.6	2662.6	2071.9	1253.5	1900.3	946.6	1925.7	670.9
4200	2727.5	2727.5	2118.5	1284.1	1942.8	969.6	1954.3	681.4
4300	2792.5	2792.5	2165.1	1314.6	1985.2	992.7	1983.0	691.9
4400	2857.4	2857.4	2211.8	1345.2	2027.7	1015.8	2011.7	702.5
4500	2922.3	2922.3	2258.4	1375.8	2070.1	1038.9	2040.4	713.0
4600	2987.3	2987.3	2305.0	1406.4	2112.6	1062.0	2069.0	723.5
4700	3052.2	3052.2	2351.6	1436.9	2155.0	1085.1	2097.7	734.0
4800	3117.2	3117.2	2398.3	1467.5	2197.5	1108.2	2126.4	744.5
4900	3182.1	3182.1	2444.9	1498.1	2239.9	1131.3	2155.1	755.0
5000	3247.0	3247.0	2491.5	1528.7	2282.4	1154.3	2183.7	765.5

BMcD		
Effective Stress (psf)	Peak Strength (psf)	Residual Strength (psf)
0	0.0	0.0
100	64.9	23.1
200	129.9	46.2
300	194.8	69.3
400	259.8	92.3
500	324.7	115.4
600	389.6	138.5
700	454.6	161.6
800	499.6	184.7
900	542.0	207.8
1000	584.5	230.9
1100	626.9	254.0
1200	669.4	277.0
1300	711.8	300.1
1400	754.3	323.2
1500	796.7	346.3
1600	839.2	369.4
1700	881.6	392.5
1800	924.1	415.6
1900	966.5	438.6
2000	1008.9	450.2
2100	1051.4	460.7
2200	1093.8	471.2
2300	1136.3	481.7
2400	1178.7	492.3
2500	1221.2	502.8
2600	1263.6	513.3
2700	1306.1	523.8
2800	1348.5	534.3
2900	1391.0	544.8
3000	1433.4	555.3
3100	1475.9	565.8
3200	1518.3	576.3
3300	1560.8	586.8
3400	1603.2	597.4
3500	1645.7	607.9
3600	1688.1	618.4
3700	1730.6	628.9
3800	1773.0	639.4
3900	1815.5	649.9
4000	1857.9	660.4
4100	1900.3	670.9
4200	1942.8	681.4
4300	1983.0	691.9
4400	2011.7	702.5
4500	2040.4	713.0
4600	2069.0	723.5
4700	2097.7	734.0
4800	2126.4	744.5
4900	2155.1	755.0
5000	2183.7	765.5

CH2M		
Effective Stress (psf)	Peak Strength (psf)	Residual Strength (psf)
0	0.0	0.0
100	53.2	53.2
200	106.3	106.3
300	159.5	159.5
400	212.7	212.7
500	265.9	265.9
600	319.0	319.0
700	372.2	372.2
800	425.4	406.7
900	478.5	422.5
1000	531.7	438.4
1100	584.9	454.2
1200	638.1	470.1
1300	691.2	485.9
1400	744.4	501.7
1500	797.6	517.6
1600	850.7	533.4
1700	903.9	549.3
1800	957.1	565.1
1900	1010.2	580.9
2000	1063.4	596.8
2100	1116.6	612.6
2200	1169.8	628.4
2300	1222.9	644.3
2400	1276.1	660.1
2500	1329.3	676.0
2600	1382.4	691.8
2700	1435.6	707.6
2800	1488.8	723.5
2900	1542.0	739.3
3000	1595.1	755.2
3100	1648.3	771.0
3200	1701.5	786.8
3300	1754.6	802.7
3400	1807.8	818.5
3500	1861.0	834.3
3600	1914.2	850.2
3700	1967.3	866.0
3800	2020.5	881.9
3900	2073.7	897.7
4000	2126.8	913.5
4100	2180.0	929.4
4200	2233.2	945.2
4300	2286.4	961.1
4400	2339.5	976.9
4500	2392.7	992.7
4600	2445.9	1008.6
4700	2499.0	1024.4
4800	2552.2	1040.2
4900	2605.4	1056.1
5000	2658.5	1071.9



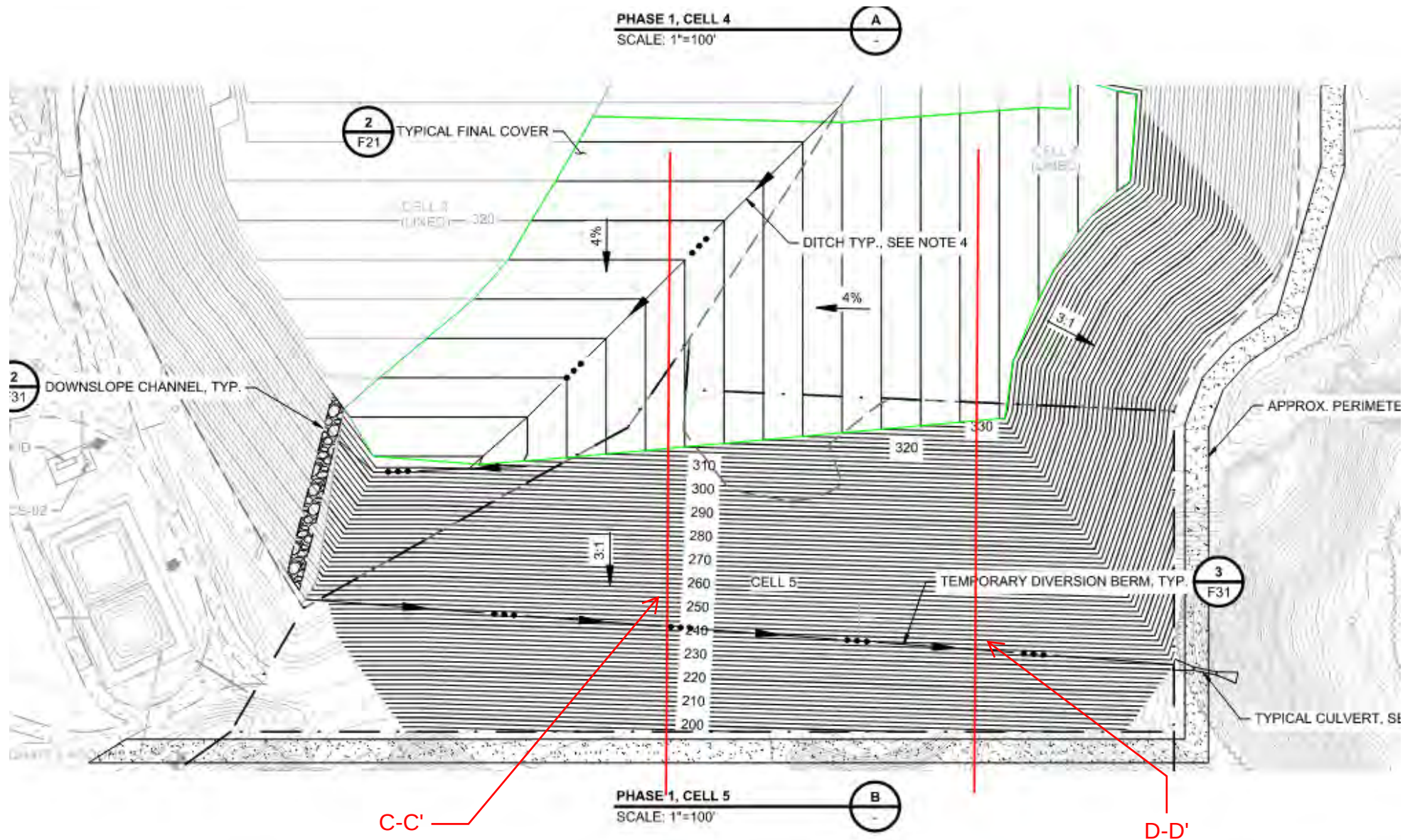


Client:	Matanuska-Susitna Borough, Alaska	Page	12	of	15
Project:	141712	Date:	11/18/2022	Made by:	A. Wilson
MSB Landfill Expansion			Checked by:	N. Textor	
Slope Stability			Prelim:	Final:	

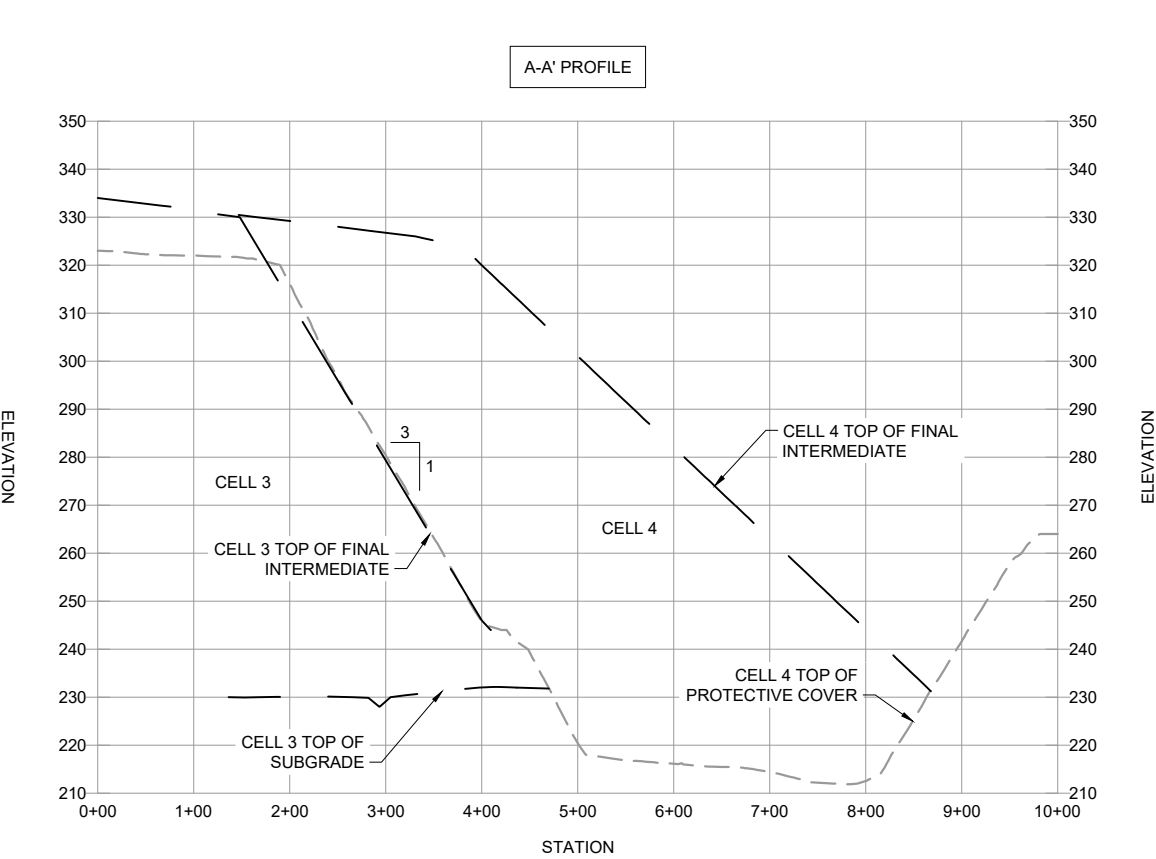
Attachment D – Sections



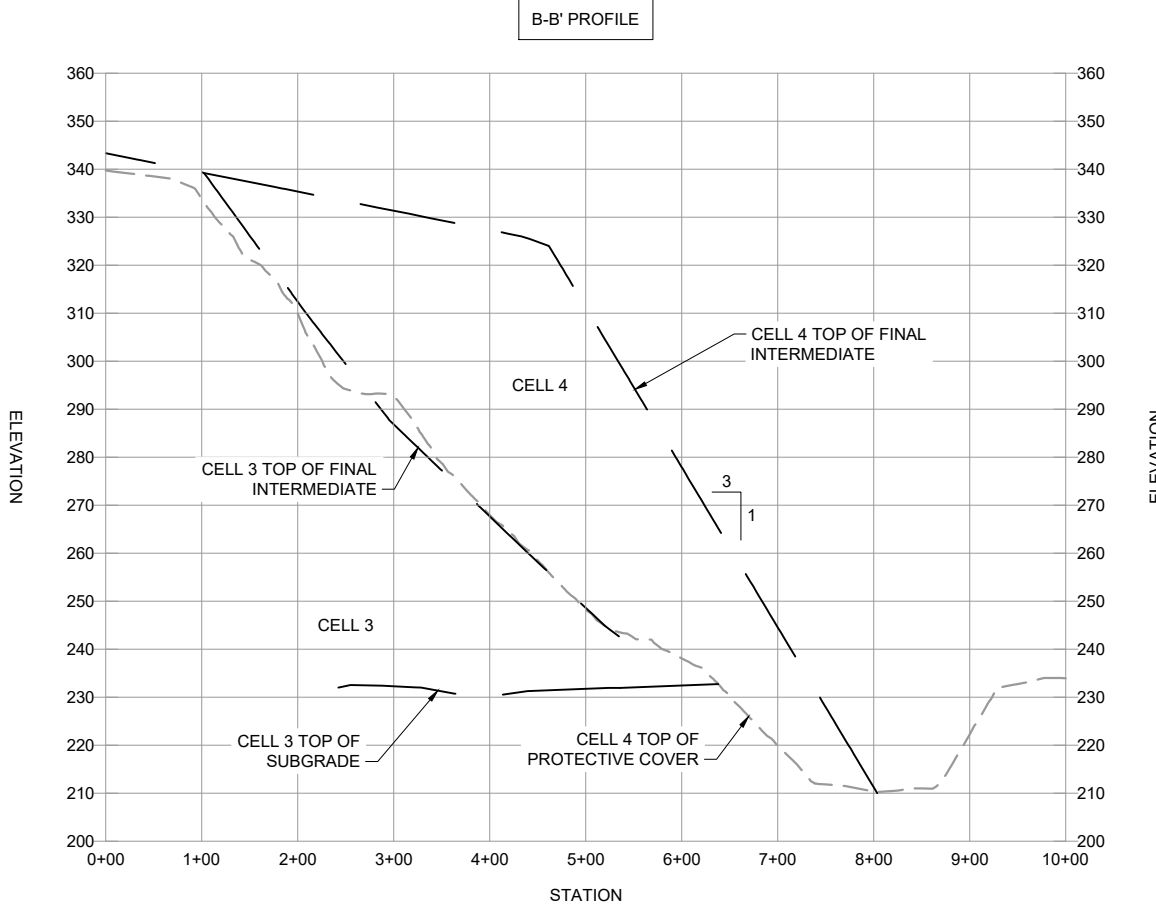




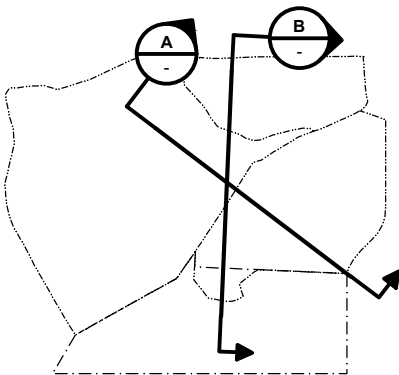
- NOTES:
- EXISTING SITE TOPOGRAPHY CREATED FROM DRAFT LIDAR DATA FLOWN IN THE FALL OF 2019 PROVIDED BY MSB. THE ACCURACY OF THE DATA IS NOT GUARANTEED.



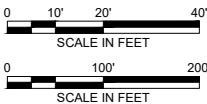
MSW CROSS SECTION
VERTICAL SCALE: 1" = 20'
HORIZONTAL SCALE: 1" = 100'



MSW CROSS SECTION
VERTICAL SCALE: 1" = 20'
HORIZONTAL SCALE: 1" = 100'



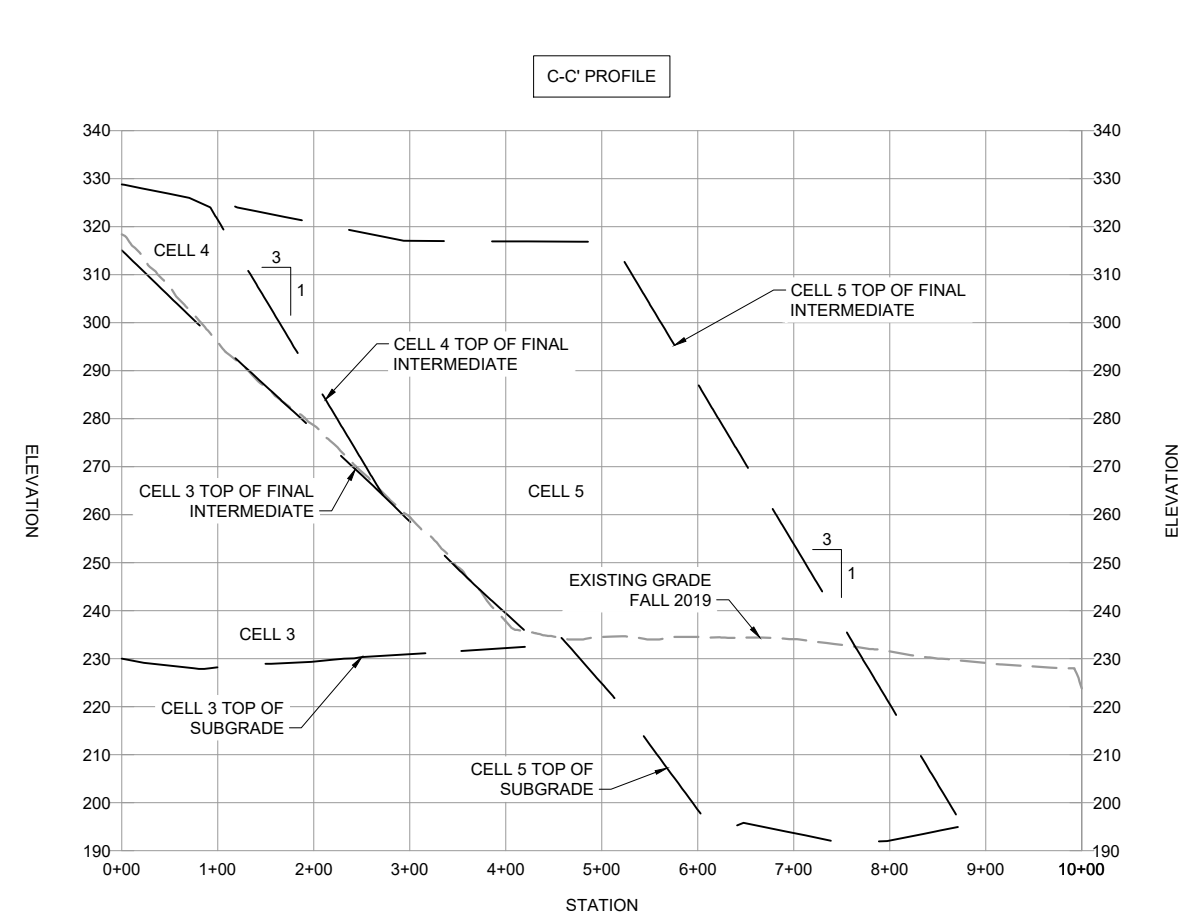
KEY MAP
SCALE: NTS



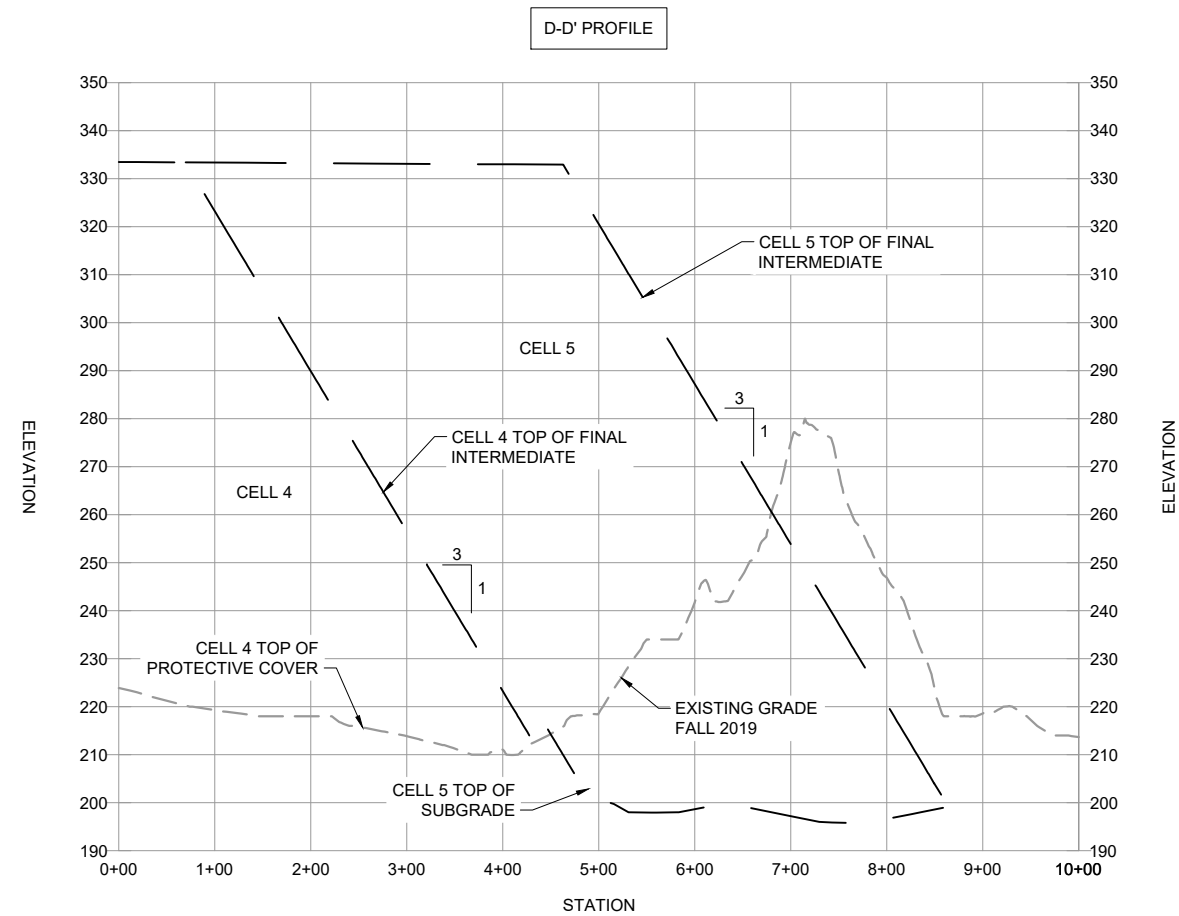
**BURNS
MCDONNELL**

Figure 1
MSB Central Landfill
Cells 3-5 Slope Stability
X-Sections

- NOTES:**
1. EXISTING SITE TOPOGRAPHY CREATED FROM DRAFT LIDAR DATA FLOWN IN THE FALL OF 2019 PROVIDED BY MSB. THE ACCURACY OF THE DATA IS NOT GUARANTEED.



MSW CROSS SECTION
VERTICAL SCALE: 1" = 20'
HORIZONTAL SCALE: 1" = 100'



MSW CROSS SECTION
VERTICAL SCALE: 1" = 20'
HORIZONTAL SCALE: 1" = 100'

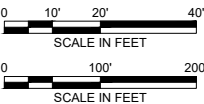
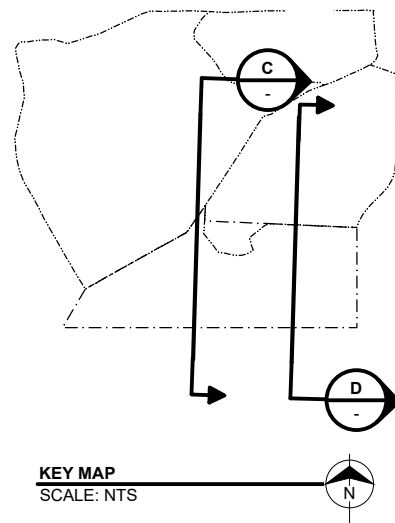


Figure 2
MSB Central Landfill
Cells 3-5 Slope Stability
X-Sections



Client:	Matanuska-Susitna Borough, Alaska	Page	13	of	15
Project:	141712	Date:	11/18/2022	Made by:	A. Wilson
MSB Landfill Expansion			Checked by:	N. Textor	
Slope Stability			Prelim:	Final:	

Attachment E – Utxas4 Input/Output and USGS Deaggregation

Profile: A-A Case: Circular (from top)

Unit Weight Average Effective Average Total Average

Fixed Grid Coordinates

x	y
300	600
500	600
500	800
300	800

Circle Entrance

x	y
147.5529	330.139
Tangent	

Search Grid Subdivisions

25 10

Crack Depth

2

Seismic Acceleration

0

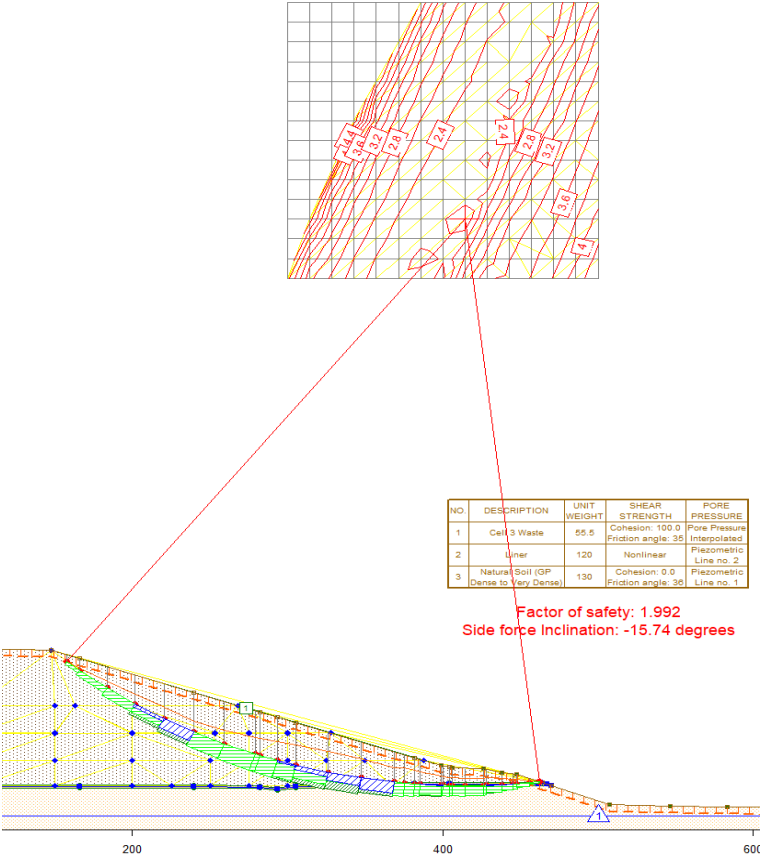
Minimum Weight

5000

Results

		Circle Center		Circle Exit	
Circles Attempted	Circles Completed	x	y	x	y
225	168	414.29	642.86	469.9252	231.892400

Factor of Safety	Errors
1.992	



Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_input (wilson).docx

UTEXAS4 Input File

Page 1 of 4

English units

HEADING follows -MSB

CELL 3

Profile line data follow -

1 1 Cell 3 Surface

0.000000	333.976600
147.552900	330.139000
399.183500	246.250400
406.121800	244.712800
426.040100	244.023100
437.832500	241.284800
447.582100	240.087400

464.4 233.9

2 2 Liner

0 232.1156

166.0471 232.1156

239.5212 232.1992

282.3832 231.8095

293.5372 230.1338

305.1905 232.1918

381.9526 233.8086

404.5544 234.1568

464.4 233.9

469.925200 231.892400

3 3 Native Surface

0.000000	230.115600
166.047100	230.115600
239.521200	230.199200
282.383200	229.809500
293.537200	228.133800
305.190500	230.191800
381.952600	231.808600
404.554400	232.156800
469.925200	231.892400
507.465300	218.060500
546.288900	216.988100
583.471700	216.402500
657.991300	215.510800
741.835000	212.295700
814.990400	214.257600
864.122100	231.583000

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_input (wilson).docx

UTEXAS4 Input File

Page 2 of 4

886.536400	237.805100	
945.522300	256.707600	
969.897400	262.128400	
978.535600	263.868000	
999.028400	264.021200	120 = unit weight

MATerial property data follow -

1 Cell 3 Waste

55.50 = unit weight

Conventional

100.0	35.0

Interpolate Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0.0	0.0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0	36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000	210.000000

1000.000000	210.000000

2 62.40 Piezometric line 2

0 231.1156

166.0471 231.1156

239.5212 231.1992

282.3832 230.8095

293.5372 229.1338

305.1905 231.1918

381.9526 232.8086

404.5544 233.1568

461.6819 232.9

467.1180884 232.9

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_input (wilson).docx

UTEXAS4 Input File

Page 3 of 4

469.925200 231.892400

Interpolation Points

P

0 333.9766 0 1 100 331.3758 0 1

147.5529 330.139 0 1 267.9530575 290 0 1

327.9446654 270 0 1 387.9362733 250 0 1

464.4 233.9 0 1

0 250 0 1 100 250 0 1 150 250 0

1 200 250 0 1 250 250 0 1 275 250

0 1 300 250 0 1 325 250 0 1 350

250 0 1

0 232 1248 1 100 232 1248 1 150 232 1248

1 200 232 1248 1 225 232 1248 1 250 232

1248 1 275 232 1248 1 300 232 1248 1 325

232 1248 1 366.582 232 1248 1 367 232 0

1

0 290 0 1 100 290 0 1 150 290 0

1 200 290 0 1 162.9573 290 0 1

0 270 1248 1 100 270 1248 1 150 270 1248

1 200 270 1248 1 252.9447 270 1248 1 253

270 0 1 275 270 0 1 300 270 0 1

0 269.5 0 1 100 269.5 0 1 150 269.5 0

1 200 269.5 0 1 252.9447 269.5 0 1 253

269.5 0 1 275 269.5 0 1 300 269.5 0 1

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_input (wilson).docx

UTEXAS4 Input File

Page 4 of 4

ANALYSIS/computation data follow

Circle Search 2

15 15

300.000000 600.000000

500.000000 600.000000

500.000000 800.000000

300.000000 800.000000

25 10

Point

147.552900 330.139000

MINimum weight follows:

5000

ITERation limit follows:

100

crack

5 d

GRAPHICS output file

COMPUTE

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

Page 1 of 15

TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Tue Nov 15 08:19:12 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope

Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 3 Surface

Point	X	Y
1	0.00	333.98
2	147.55	330.14
3	399.18	246.25
4	406.12	244.71
5	426.04	244.02
6	437.83	241.28
7	447.58	240.09
8	464.40	233.90

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	232.12
2	166.05	232.12
3	239.52	232.20
4	282.38	231.81
5	293.54	230.13
6	305.19	232.19
7	381.95	233.81
8	404.55	234.16
9	464.40	233.90
10	469.93	231.89

Profile Line No. 3 - Material Type (Number): 3 -----

-----Description:

Native Surface

Point	X	Y
1	0.00	230.12
2	166.05	230.12
3	239.52	230.20
4	282.38	229.81
5	293.54	228.13
6	305.19	230.19
7	381.95	231.81
8	404.55	232.16
9	469.93	231.89
10	507.47	218.06
11	546.29	216.99
12	583.47	216.40
13	657.99	215.51
14	741.84	212.30
15	814.99	214.26
16	864.12	231.58

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

Page 3 of 15

17	886.54	237.81
18	945.52	256.71
19	969.90	262.13
20	978.54	263.87
21	999.03	264.02

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Tue Nov 15 08:19:12 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----

-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 55.5

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----

-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----

-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Tue Nov 15 08:19:12 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	210.00
2	1000.00	210.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	231.12
2	166.05	231.12
3	239.52	231.20
4	282.38	230.81
5	293.54	229.13
6	305.19	231.19
7	381.95	232.81
8	404.55	233.16
9	461.68	232.90
10	467.12	232.90
11	469.93	231.89

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Tue Nov 15 08:19:12 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Search will be conducted using a fixed grid.

Number of Points Across Grid: 15

Number of Points Up Grid: 15

Grid Corner

Number	X	Y
1	300.00	600.00
2	500.00	600.00
3	500.00	800.00
4	300.00	800.00

----- Control Parameters for Finding "Critical" Radius -----Initial

number of subdivisions between maximum and minimum

radius for finding a critical radius/radii: 25

Minimum radius increment for terminating subdivision of radii: 10.000

The following criteria will be used for determining

the maximum and minimum radii:

Point circles pass through - X: 147.55 Y: 330.14

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 5.000

-----The

following represent default values or values that were previously defined:

Subtended angle for slice subdivision: 3.00(degrees)

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Search will be continued after the initial mode to find a most critical circle.

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Radii for each grid point will be sorted in the order of increasing radius.

Critical circles for grid points will be output in the order of increasing factor of safety.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Tue Nov 15 08:19:12 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	333.98
2	147.55	330.14
3	166.05	323.97
4	239.52	299.48
5	282.38	285.19
6	293.54	281.47
7	305.19	277.59
8	381.95	251.99
9	399.18	246.25
10	404.55	245.06
11	406.12	244.71
12	426.04	244.02
13	437.83	241.28
14	447.58	240.09
15	464.40	233.90
16	469.93	231.89
17	507.47	218.06
18	546.29	216.99
19	583.47	216.40
20	657.99	215.51
21	741.84	212.30
22	814.99	214.26
23	864.12	231.58
24	886.54	237.81
25	945.52	256.71
26	969.90	262.13
27	978.54	263.87
28	999.03	264.02

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Name of input data file:

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Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 38

* FINAL SUMMARY OF COMPUTATIONS WITH FIXED-GRID *

Number of circles attempted: 225

Number of circles for which F calculated: 168

Circle with Lowest Factor of Safety:

X coordinate for center: 414.29

Y coordinate for center: 642.86

Radius of circle: 411.022

Factor of safety: 1.992

Side force inclination: -15.74

Time Required for Computations: 0.0 seconds

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *
* Information for Individual Slices for Conventional *
* Computations or First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	157.71	321.75	3171	1	100.0	35.00	0.0
	161.88	318.51					
	166.05	315.26					
2	174.79	308.99	11708	1	100.0	35.00	0.0
	183.53	302.72					
3	192.59	296.92	18308	1	100.0	35.00	0.0
	201.65	291.11					
4	211.00	285.79	24077	1	100.0	35.00	262.8
	220.35	280.47					
5	229.94	275.65	28751	1	100.0	35.00	895.3
	239.52	270.84					
6	249.38	266.52	32456	1	100.0	35.00	0.0
	259.23	262.20					
7	269.30	258.41	34803	1	100.0	35.00	0.0
	279.36	254.61					
8	280.87	254.09	5293	1	100.0	35.00	0.0
	282.38	253.57					
9	287.96	251.77	19535	1	100.0	35.00	0.0
	293.54	249.97					
10	299.36	248.27	20213	1	100.0	35.00	119.6
	305.19	246.58					
11	315.64	243.99	34907	1	100.0	35.00	416.4
	326.08	241.41					
12	336.65	239.38	32510	1	100.0	35.00	736.4
	347.21	237.35					
13	357.87	235.87	28576	1	100.0	35.00	979.8
	368.53	234.39					
14	372.00	234.03	8203	1	100.0	35.00	0.0
	375.47	233.67					
15	378.71	233.39	7228	2	NONLINEAR	ENVELOPE	0.0
	381.95	233.11					
16	383.62	232.98	3592	2	NONLINEAR	ENVELOPE	0.0
	385.28	232.86					
17	392.23	232.49	13736	2	NONLINEAR	ENVELOPE	30.0
	399.18	232.11					
18	399.56	232.10	686	2	NONLINEAR	ENVELOPE	61.2
	399.94	232.09					
19	402.25	232.02	4103	3	0.0	36.00	0.0
	404.55	231.95					
20	405.34	231.93	1355	3	0.0	36.00	0.0
	406.12	231.92					
21	410.20	231.88	6962	3	0.0	36.00	0.0
	414.29	231.84					
22	420.16	231.92	9695	3	0.0	36.00	0.0

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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	426.04	232.00					
23	426.99	232.03	1493	3	0.0	36.00	0.0
	427.94	232.06					
24	432.89	232.29	6684	2	NONLINEAR ENVELOPE		46.4
	437.83	232.51					
25	441.36	232.74	3743	2	NONLINEAR ENVELOPE		15.5
	444.88	232.98					
26	446.23	233.08	1231	2	NONLINEAR ENVELOPE		0.0
	447.58	233.19					
27	451.69	233.56	2495	2	NONLINEAR ENVELOPE		0.0
	455.80	233.94					
28	458.74	234.26	563	1	100.0	35.00	0.0
	461.68	234.58					
29	462.01	234.62	6	1	100.0	35.00	0.0
	462.35	234.65					

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 47

 * Information for the Iterative Solution for the Factor of *
 * Safety and Side Force Inclination by Spencer's Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 4

Allowable moment imbalance for convergence: 1097

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iter- ation	1	3.00000	-17.1887	-3.461e+004	1.142e+007	
First-order corrections to F and Theta					-1.5041	-1.9386
Reduced values - Deltas were too large					-0.5000	-0.6445
2	2.50000	-17.8332	-2.079e+004	6.817e+006		
First-order corrections to F and Theta					-0.3847	-107.2897
Reduced values - Deltas were too large					-0.0103	-2.8648
3	2.48973	-20.6980	-2.024e+004	6.621e+006		
First-order corrections to F and Theta					-0.6774	40.3404
Reduced values - Deltas were too large					-0.0481	2.8648
4	2.44162	-17.8332	-1.881e+004	6.153e+006		
First-order corrections to F and Theta					-0.6046	26.4616
Reduced values - Deltas were too large					-0.0655	2.8648
5	2.37617	-14.9684	-1.675e+004	5.490e+006		
First-order corrections to F and Theta					-0.4371	-8.8893
Reduced values - Deltas were too large					-0.1409	-2.8648
6	2.23530	-17.8332	-1.097e+004	3.528e+006		
First-order corrections to F and Theta					-0.2775	4.4621
Reduced values - Deltas were too large					-0.1782	2.8648
7	2.05713	-14.9684	-3.404e+003	1.159e+006		
First-order corrections to F and Theta					-0.0675	-0.9571
Second-order corrections to F and Theta					-0.0657	-0.7789
8	1.99144	-15.7473	4.675e+000	-1.794e+003		
First-order corrections to F and Theta					0.0001	0.0037
Second-order corrections to F and Theta					0.0001	0.0037
9	1.99152	-15.7436	-2.971e-008	1.152e-005		
First-order corrections to F and Theta					-0.0000	-0.0000

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 1.59304e-011

Summation of Vertical Forces: 2.89919e-011

Summation of Moments: 1.68711e-009

Mohr Coulomb Shear Force/Shear Strength Check Summation: 1.15747e-011

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 1.992 Side Force Inclination: -15.74

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear
			Normal Stress	Normal Stress	
1	161.88	318.51	255.0	255.0	139.9
2	174.79	308.99	477.9	477.9	218.3
3	192.59	296.92	759.4	759.4	317.2
4	211.00	285.79	1030.2	767.4	320.0
5	229.94	275.65	1278.1	382.9	184.8
6	249.38	266.52	1390.7	1390.7	539.2
7	269.30	258.41	1512.3	1512.3	581.9
8	280.87	254.09	1565.5	1565.5	600.6
9	287.96	251.77	1582.4	1582.4	606.6
10	299.36	248.27	1598.0	1478.4	570.0
11	315.64	243.99	1577.0	1160.6	458.3
12	336.65	239.38	1486.0	749.5	313.8
13	357.87	235.87	1313.4	333.5	167.5
14	372.00	234.03	1231.5	1231.5	483.2
15	378.71	233.39	1112.3	1112.3	125.7
16	383.62	232.98	1081.6	1081.6	122.3
17	392.23	232.49	997.9	967.9	109.4
18	399.56	232.10	923.1	862.0	97.4
19	402.25	232.02	970.3	970.3	354.0
20	405.34	231.93	948.5	948.5	346.0
21	410.20	231.88	943.8	943.8	344.3
22	420.16	231.92	928.9	928.9	338.9
23	426.99	232.03	894.2	894.2	326.2
24	432.89	232.29	709.5	663.2	75.0
25	441.36	232.74	563.1	547.6	61.9
26	446.23	233.08	486.4	486.4	55.0
27	451.69	233.56	325.8	325.8	36.8
28	458.74	234.26	138.7	138.7	99.0
29	462.01	234.62	35.1	35.1	62.5

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Circular Failure

Filename: 20221125 Section A-A' Circular_output (wilson).docx

UTEXAS4 Output File

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Time and date of run: Tue Nov 15 08:19:12 2022

Name of input data file:

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Stability\Section A-A'\MSB Section A-A'.input-utexas

MSB CELL 3

TABLE NO. 59

 * Final Results for Side Forces and Stresses Between Slices *
 * (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----						
Slice		Side	Y-Coord. of	Fraction	Sigma	Sigma
No.	X-Right	Force	Side Force	of	at	at
			Location	Height	Top	Bottom
1	166.05	507	317.33	0.238	-32.2	144.4
2	183.53	2771	307.61	0.317	-17.3	363.2
3	201.65	5961	298.14	0.335	2.8	543.8
4	220.35	11138	288.35	0.311	-57.7	901.7
5	239.52	20238	278.45	0.266	-275.4	1635.7
6	259.23	21676	272.29	0.329	-19.7	1378.6
7	279.36	21433	266.74	0.384	198.6	1107.7
8	282.38	21235	266.00	0.393	231.9	1061.1
9	293.54	20129	263.55	0.431	361.1	869.0
10	305.19	18862	261.18	0.471	483.8	687.2
11	326.08	17381	256.51	0.517	630.7	514.8
12	347.21	16771	251.07	0.523	700.7	530.0
13	368.53	17094	244.83	0.473	623.1	867.1
14	375.47	14526	244.61	0.534	820.8	544.3
15	381.95	14330	242.92	0.519	815.5	645.1
16	385.28	14187	242.08	0.511	808.9	706.2
17	399.18	13382	238.62	0.460	692.5	1129.6
18	399.94	13331	238.43	0.453	658.6	1174.7
19	404.55	11770	237.89	0.453	620.9	1107.3
20	406.12	11240	237.72	0.453	609.3	1081.5
21	414.29	8399	237.00	0.410	296.9	986.8
22	426.04	4098	237.29	0.440	209.5	446.9
23	427.94	3398	237.78	0.496	277.7	290.2
24	437.83	2298	236.95	0.507	261.9	242.2
25	444.88	1573	236.45	0.467	163.1	243.5
26	447.58	1312	236.28	0.449	127.0	238.9
27	455.80	743	235.17	0.393	81.8	375.7
28	461.68	46	234.71	0.411	64.3	210.6
29	462.35	-0	234.65	0.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: B-B' Case: Circular

Unit Weight Average Effective Average Total Average

Fixed Grid Coordinates

x

y

700

700

900

700

900

900

700

900

Circle Entrance

x

y

562.0904

323.8434

Tangent

Search Grid Subdivisions

25

10

Crack Depth

4

Seismic Acceleration

0

Minimum Weight

5000

Results

		Circle Center		Radius	
Circles Attempted	Circles Completed	x	y	529.438	
225	83	785.71	742.86		
Factor of Safety		Errors			
1.591					



Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_input (wilson).docx

UTEXAS4 Input File

Page 1 of 5

ENGLISH units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 4 Surface

0 342.9925

53.3791 340.9508

103.5224 338.8839

216.9023 334.482

364.0891 328.5808

435.2507 325.7232

462.0904 323.8434

795.7461 212.2843

2 2 Liner

0 233.9687

241.3595 233.9687

255.373 234.532

329.1175 233.9445

358.7087 232.8241

439.6647 233.2931

636.9606 234.73

736.2644 213.9188

755.9227 213.778

795.7461 212.2843

798.737 211.2843

801.7278 210.2843

3 3 Native Surface

0 231.9687

241.3595 231.9687

255.373 232.532

329.1175 231.9445

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_input (wilson).docx

UTEXAS4 Input File

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358.7087 230.8241

439.6647 231.2931

636.9606 232.73

736.2644 211.9188

755.9227 211.778

801.7278 210.2843

830.3544 210.7192

842.2722 210.9911

860.5027 210.9911

866.5411 211.812

886.081 218.0902

904.7485 224.5428

924.0266 230.9082

958.7877 233.0943

975.4239 234.0329

998.3779 233.9295

MATerial property data follow -

1 Cell 4 Waste

50.00 = unit weight

Conventional

100.0

35.0

Interpolate Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0.0

0.0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_input (wilson).docx

UTEXAS4 Input File

Page 3 of 5

```
Piezometric Line
1
Piezometric line data follow -
1      62.40 Piezometric line 1
              0.000000      210.000000
              1000.000000     210.000000
2      62.40 Piezometric line 2

0 232.9687

241.3595 232.9687

255.373 233.532

329.1175 232.9445

358.7087 231.8241

439.6647 232.2931

636.9606 233.73

736.2644 212.9188

755.9227 212.778

798.737 211.2843

801.7278 210.2843

Interpolation Point
P
200 253 0 1 225 253 0 1 250 253 0
1 275 253 0 1 300 253 0 1 325 253
0 1 350 253 0 1 375 253 0 1
400 253 0 1 425 253 0 1 450 253 0
1 475
0 1 575 253 0 1 598.98 253 0 1 600
253 0 1 658.79 253 0 1 660 253 0 1
200 233 1248 1 225 233 1248 1 250 233 1248
1 275 233 1248 1 300 233 1248 1 325 233
1248 1 350 233 1248 1 375 233 1248 1
400 233 1248 1 425 233 1248 1 450 233 1248
```

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_input (wilson).docx

UTEXAS4 Input File

Page 4 of 5

```
1 475 233 1248 1 500 233 1248 1 550 233
1248 1 575 233 1248 1 598.98 233 1248 1 600
233 1248 1 658.79 233 1248 1 660 233 0 1
200 232.5 0 1 225 232.5 0 1 250 232.5 0
1 275 232.5 0 1 300 232.5 0 1 325
232.5 0 1 350 232.5 0 1 375 232.5 0 1
400 232.5 0 1 425 232.5 0 1 450 232.5 0
1 475 232.5 0 1 500 232.5 0 1 550
232.5 0 1 575 232.5 0 1 598.98 232.5 0 1
600 232.5 0 1 658.79 232.5 0 1 660 232.5 0
1
200 293 0 1 225 293 0 1 250 293 0
1 275 293 0 1 300 293 0 1 325 293
0 1 350 293 0 1 375 293 0 1
400 293 0 1 425 293 0 1 450 293 0
1 479.34 293 0 1 500 293 0 1 539.16 293
0 1
200 273 1248 1 225 273 1248 1 250 273 1248
1 275 273 1248 1 300 273 1248 1 325 273
1248 1 350 273 1248 1 375 273 1248 1
400 273 1248 1 425 273 1248 1 450 273 1248
1 479.34 273 1248 1 500 273 1248 1 539.16 273
1248 1 540 273 0 1
200 272.5 0 1 225 272.5 0 1 250 272.5 0
1 275 272.5 0 1 300 272.5 0 1 325
272.5 0 1 350 272.5 0 1 375 272.5 0 1
400 272.5 0 1 425 272.5 0 1 450 272.5 0
1 479.34 272.5 0 1 500 272.5 0 1 539.16
272.5 0 1 540 272.5 0 1
```

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_input (wilson).docx

UTEXAS4 Input File

Page 5 of 5

216.9 334.5 0 1 300 331.1 0 1 364.1 328.6 0

1 450 325.1 0 1 435.3 325.7 0 1 450

323.8 0 1 795.7 212.3 0 1

ANALYSIS/computation data follow

Circle Search 2

15 15

700.000000 700.000000

900.000000 700.000000

900.000000 900.000000

700.000000 900.000000

25 10

Point

462.0904 323.8434

MINimum weight follows:

5000

ITERation limit follows:

100

crack

4 d

GRAPHICS output file

COMPUTE

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_output (wilson).docx

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Stability\Section B-B'\MSB Section B-B'.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 4 Surface

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	364.09	328.58
6	435.25	325.72
7	462.09	323.84
8	795.75	212.28

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	233.97
2	241.36	233.97
3	255.37	234.53
4	329.12	233.94
5	358.71	232.82
6	439.66	233.29
7	636.96	234.73
8	736.26	213.92
9	755.92	213.78
10	795.75	212.28
11	798.74	211.28
12	801.73	210.28

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	231.97
2	241.36	231.97
3	255.37	232.53
4	329.12	231.94
5	358.71	230.82
6	439.66	231.29
7	636.96	232.73
8	736.26	211.92
9	755.92	211.78
10	801.73	210.28
11	830.35	210.72
12	842.27	210.99
13	860.50	210.99
14	866.54	211.81
15	886.08	218.09
16	904.75	224.54

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

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17	924.03	230.91
18	958.79	233.09
19	975.42	234.03
20	998.38	233.93

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

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Stability\Section B-B'\MSB Section B-B'.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----
-----Description:

Cell 4 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----
-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----
-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- Piezometric Line Number 1 -----

Description: Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	210.00
2	1000.00	210.00

----- Piezometric Line Number 2 -----

Description: Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	232.97
2	241.36	232.97
3	255.37	233.53
4	329.12	232.94
5	358.71	231.82
6	439.66	232.29
7	636.96	233.73
8	736.26	212.92
9	755.92	212.78
10	798.74	211.28
11	801.73	210.28

.....

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Search will be conducted using a fixed grid.

Number of Points Across Grid: 15

Number of Points Up Grid: 15

Grid Corner

Number	X	Y
1	700.00	700.00
2	900.00	700.00
3	900.00	900.00
4	700.00	900.00

----- Control Parameters for Finding "Critical" Radius -----Initial

number of subdivisions between maximum and minimum

radius for finding a critical radius/radii: 25

Minimum radius increment for terminating subdivision of radii: 10.000

The following criteria will be used for determining

the maximum and minimum radii:

Point circles pass through - X: 462.09 Y: 323.84

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 4.000

-----The

following represent default values or values that were previously defined:

Subtended angle for slice subdivision: 3.00(degrees)

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Search will be continued after the initial mode to find a most critical circle.

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Radii for each grid point will be sorted in the order of increasing radius.

Critical circles for grid points will be output in the order of increasing factor of safety.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

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Stability\Section B-B'\MSB Section B-B'.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	241.36	333.50
6	255.37	332.94
7	329.12	329.98
8	358.71	328.80
9	364.09	328.58
10	435.25	325.72
11	439.66	325.41
12	462.09	323.84
13	636.96	265.37
14	736.26	232.17
15	755.92	225.60
16	795.75	212.28
17	798.74	211.28
18	801.73	210.28
19	830.35	210.72
20	842.27	210.99
21	860.50	210.99
22	866.54	211.81
23	886.08	218.09
24	904.75	224.54
25	924.03	230.91
26	958.79	233.09
27	975.42	234.03
28	998.38	233.93

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 38

* FINAL SUMMARY OF COMPUTATIONS WITH FIXED-GRID *

Number of circles attempted: 225

Number of circles for which F calculated: 83

Circle with Lowest Factor of Safety:

X coordinate for center: 785.71

Y coordinate for center: 742.86

Radius of circle: 529.438

Factor of safety: 1.591

Side force inclination: -14.42

Time Required for Computations: 0.0 seconds

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	471.61	316.66					
	482.98	308.73	9238	1	100.0	35.00	0.0
	494.35	300.81					
2	506.11	293.48	18404	1	100.0	35.00	0.0
	517.88	286.16					
3	530.02	279.47	26290	1	100.0	35.00	844.5
	542.15	272.77					
4	554.62	266.72	32650	1	100.0	35.00	0.0
	567.09	260.67					
5	579.85	255.28	37271	1	100.0	35.00	0.0
	592.62	249.89					
6	605.65	245.17	39972	1	100.0	35.00	488.5
	618.69	240.46					
7	627.82	237.60	28170	1	100.0	35.00	960.9
	636.96	234.75					
8	637.05	234.72	289	1	100.0	35.00	1140.8
	637.15	234.69					
9	644.62	232.63	23063	2	NONLINEAR ENVELOPE		0.0
	652.08	230.56					
10	665.58	227.42	40809	2	NONLINEAR ENVELOPE		19.8
	679.08	224.27					
11	690.74	222.14	31613	2	NONLINEAR ENVELOPE		19.8
	702.41	220.01					
12	710.08	218.91	17420	2	NONLINEAR ENVELOPE		0.0
	717.75	217.80					
13	727.00	216.77	17132	1	100.0	35.00	0.0
	736.26	215.73					
14	746.09	215.00	13653	1	100.0	35.00	0.0
	755.92	214.26					
15	769.78	213.84	9873	1	100.0	35.00	0.0
	783.63	213.42					
16	784.67	213.42	268	1	100.0	35.00	0.0
	785.71	213.42					
17	788.97	213.44	362	1	100.0	35.00	0.0
	792.23	213.46					

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_output (wilson).docx

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Stability\Section B-B'\MSB Section B-B'.input-utexas

MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

Filename: 20221125 Section B-B' Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of *
* Safety and Side Force Inclination by Spencer's Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 3

Allowable moment imbalance for convergence: 2165

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iter- ation	1	3.00000	-17.1887	-4.959e+004	2.068e+007	
First-order corrections to F and Theta					-2.6241	-0.4440
Reduced values - Deltas were too large					-0.5000	-0.0846
2	2.50000	-17.2733	-3.825e+004	1.594e+007		
First-order corrections to F and Theta					-1.4074	-0.6251
Reduced values - Deltas were too large					-0.5000	-0.2221
3	2.00000	-17.4954	-2.126e+004	8.810e+006		
First-order corrections to F and Theta					-0.4986	-1.4928
Second-order corrections to F and Theta					-0.4520	12.7611
Reduced values - Deltas were too large					-0.1015	2.8648
4	1.89853	-14.6306	-1.697e+004	6.719e+006		
First-order corrections to F and Theta					-0.3652	-0.1378
Second-order corrections to F and Theta					-0.3152	0.3445
5	1.58330	-14.2861	4.561e+002	-1.713e+005		
First-order corrections to F and Theta					0.0072	-0.1237
Second-order corrections to F and Theta					0.0073	-0.1324
6	1.59059	-14.4185	-7.530e-003	2.484e-001		
First-order corrections to F and Theta					-0.0000	0.0000

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 1.66125e-011

Summation of Vertical Forces: 1.64277e-011

Summation of Moments: -8.12230e-007

Mohr Coulomb Shear Force/Shear Strength Check Summation: 9.61364e-012

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 1.591 Side Force Inclination: -14.42

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear
			Normal Stress	Normal Stress	
1	482.98	308.73	275.8	275.8	184.3
2	506.11	293.48	574.7	574.7	315.9
3	530.02	279.47	923.5	79.0	97.7
4	554.62	266.72	1056.9	1056.9	528.1
5	579.85	255.28	1226.9	1226.9	603.0
6	605.65	245.17	1360.3	871.8	446.6
7	627.82	237.60	1413.4	452.5	262.1
8	637.05	234.72	1418.0	277.3	184.9
9	644.62	232.63	1438.3	1438.3	203.5
10	665.58	227.42	1430.8	1411.0	199.7
11	690.74	222.14	1307.1	1287.3	182.2
12	710.08	218.91	1112.5	1112.5	157.4
13	727.00	216.77	968.5	968.5	489.2
14	746.09	215.00	751.7	751.7	393.8
15	769.78	213.84	408.3	408.3	242.6
16	784.67	213.42	162.5	162.5	134.4
17	788.97	213.44	81.6	81.6	98.8

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 59

* Final Results for Side Forces and Stresses Between Slices *

* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Slice No.	X-Right	Side Force	Y-Coord. of Side Force Location	Fraction of Height	Sigma at Top	Sigma at Bottom
1	494.35	189	305.81	0.408	6.7	23.1
2	517.88	1203	291.92	0.302	-11.3	133.8
3	542.15	11525	277.32	0.187	-402.7	1321.2
4	567.09	11134	271.17	0.374	94.0	674.4
5	592.62	8894	267.78	0.590	438.1	130.3
6	618.69	10119	258.75	0.589	485.4	146.2
7	636.96	13508	249.33	0.476	366.3	488.0
8	637.15	13553	249.24	0.475	364.4	492.9
9	652.08	16547	242.74	0.409	245.2	831.8
10	679.08	20276	233.62	0.346	55.0	1398.3
11	702.41	21631	227.09	0.301	-171.3	1955.9
12	717.75	21681	223.13	0.259	-453.7	2495.9
13	736.26	14393	220.39	0.283	-255.3	1951.2
14	755.92	7545	217.93	0.324	-35.5	1324.1
15	783.63	957	214.47	0.361	52.5	584.0
16	785.71	668	214.28	0.387	93.1	490.1
17	792.23	-0	213.46	0.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: C-C'Case: Circular

Unit Weight Average Effective Average Total Average

Fixed Grid Coordinates

x

y

700

400

900

400

900

600

700

600

Circle Entrance

x

y

523.8643

312.6729

Tangent

Search Grid Subdivisions

25

10

Crack Depth

6

Seismic Acceleration

0

Minimum Weight

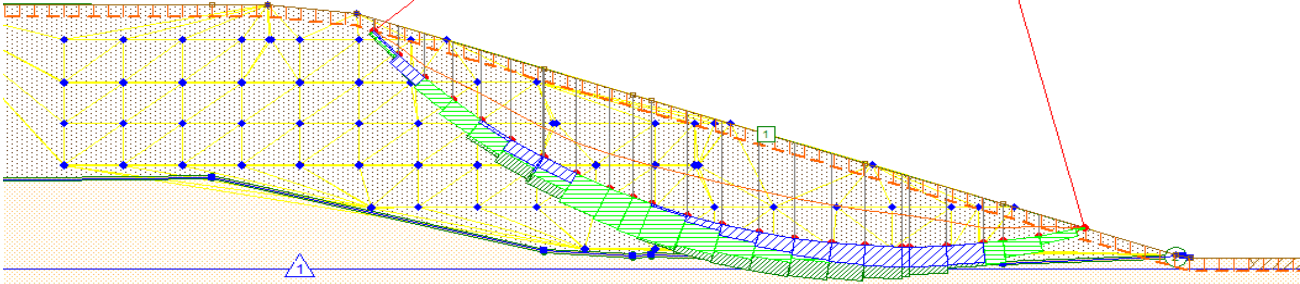
5000

Results

		Circle Center		Radius	
Circles Attempted	Circles Completed	x	y	299.183	
225	95	757.14	500		
Factor of Safety		Errors			
1.892					

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Cell 4 Waste	50	Cohesion: 100.0 Friction angle: 35	Pore Pressure Interpolated
2	Liner	120	Nonlinear	Piezometric Line no. 2
3	Natural Soil (GP Dense to Very Dense)	130	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1

Factor of safety: 1.892
Side force Inclination: -16.67 degrees



Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

Filename: 20221125 Section C-C' Circular_input (wilson).docx

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English units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 5 Surface

0 328.8926

71.051 326.0616

188.5248 321.3252

296.7885 317.0329

337.8051 317.0858

486.3848 316.9548

523.8643 312.6729

869.918712 197.1749

2 2 Liner

0 232.1147

82.3776 229.8661

149.6914 230.9902

353.4471 233.6161

462.8547 235.1779

602.9616 199.777

640.4418 197.3469

648.5372 197.872

738.6968 194.1687

796.7718 193.9902

869.918712 197.1749

875.9111 195.1749

3 3 Native Surface

0 230.1147

82.3776 227.8661

149.6914 228.9902

353.4471 231.6161

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

Filename: 20221125 Section C-C' Circular_input (wilson).docx

UTEXAS4 Input File

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462.8547 233.1779

602.9616 197.777

640.4418 195.3469

648.5372 195.872

738.6968 192.1687

796.7718 191.9902

875.9111 195.1749

1000 195.2685

MATerial property data follow -

1 Cell 4 Waste

50.00 = unit weight

Conventional

100.0

35.0

Interpolate Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0.0

0.0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000

190.000000

1000.000000

190.000000

2 62.40 Piezometric line 2

0 231.1147

82.3776 228.8661

149.6914 229.9902

353.4471 232.6161

462.8547 234.1779

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

Filename: 20221125 Section C-C' Circular_input (wilson).docx

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602.9616 198.777

640.4418 196.3469

648.5372 196.872

738.6968 193.1687

796.7718 192.9902

872.914906 196.1749

875.9111 195.1749

Interpolation Point

P

337.8051 317.0858 0 1 486.3848 316.9548 0

1 523.8643 312.6729 0 1 561.8347653 300 0

1 681.6825203 260 0 1 741.6063977 240 0 1

801.5302752 220 0 1 869.918712 197.1749 0 1

530 220 0 1 550 220 0 1 575 220 0

1 600 220 0 1 625 220 0 1 650 220

0 1 675 220 0 1 700 220 0 1

726.5302752 220 0 1 750 220 0 1 775 220

0 1 786.4542 220 0 1

530 220 0 1 620 200 1248 1 650 200 1248

1 675 200 1248 1 700 200 1248 1 725 200

1248 1 750 200 1248 1 775 200 1248 1

786.4542 200 1248 1 787 200 0 1

530 219.5 0 1 620 199.5 0 1 650 199.5 0

1 675 199.5 0 1 700 199.5 0 1 725

199.5 0 1 750 199.5 0 1 775 199.5 0 1

786.4542 199.5 0 1 787 199.5 0 1

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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```
400 260 0 1 425 260 0 1 450 260 0
1 475 260 0 1 500 260 0 1 525 260
0 1 550 260 0 1 575 260 0 1
606.6825 260 0 1 608 260 0 1 650 260
0 1 666.6064 260 0 1 675 260 0 1
400 240 1248 1 425 240 1248 1 450 240 1248
1 475 240 1248 1 500 240 1248 1 525 240
1248 1 550 240 1248 1 575 240 1248 1 600
240 1248 1 625 240 1248 1 650 240 1248 1
666.6064 240 1248 1 668 240 0 1
400 239.5 0 1 425 239.5 0 1 450 239.5 0
1 475 239.5 0 1 500 239.5 0 1 525
239.5 0 1 550 239.5 0 1 575 239.5 0 1
600 239.5 0 1 625 239.5 0 1 650 239.5 0
1 666.6064 239.5 0 1 668 239.5 0 1

400 300 0 1 425 300 0 1 450 300 0
1 475 300 0 1 486.8347653 300 0 1 488
300 0 1 500 300 0 1 525 300 0 1
546.7586428 300 0 1

400 280 1248 1 425 280 1248 1 450 280 1248
1 475 280 1248 1 500 280 1248 1 525 280
1248 1 546.7586428 280 1248 1 548 280 0 1
575 280 0 1 600 280 0 1
400 279.5 0 1 425 279.5 0 1 450 279.5 0
1 475 279.5 0 1 500 279.5 0 1 525
279.5 0 1 546.7586428 279.5 0 1 548 280 0
```


Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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1

ANALYSIS/computation data follow

Circle Search 2

15 15

700.000000 400.000000

900.000000 400.000000

900.000000 600.000000

700.000000 600.000000

25 10

Point

523.8643 312.6729

MINimum weight follows:

5000

ITERation limit follows:

100

crack

6 d

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Cross-Section: C-C'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 5 Surface

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	188.52	321.33
4	296.79	317.03
5	337.81	317.09
6	486.38	316.95
7	523.86	312.67
8	869.92	197.17

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	232.11
2	82.38	229.87
3	149.69	230.99
4	353.45	233.62
5	462.85	235.18
6	602.96	199.78
7	640.44	197.35
8	648.54	197.87
9	738.70	194.17
10	796.77	193.99
11	869.92	197.17
12	875.91	195.17

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	230.11
2	82.38	227.87
3	149.69	228.99
4	353.45	231.62
5	462.85	233.18
6	602.96	197.78
7	640.44	195.35
8	648.54	195.87
9	738.70	192.17
10	796.77	191.99
11	875.91	195.17
12	1000.00	195.27

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----
-----Description:

Cell 4 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----
-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----
-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

Filename: 20221125 Section C-C' Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1000.00	190.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	231.11
2	82.38	228.87
3	149.69	229.99
4	353.45	232.62
5	462.85	234.18
6	602.96	198.78
7	640.44	196.35
8	648.54	196.87
9	738.70	193.17
10	796.77	192.99
11	872.91	196.17
12	875.91	195.17

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Search will be conducted using a fixed grid.

Number of Points Across Grid: 15

Number of Points Up Grid: 15

Grid Corner

Number	X	Y
1	700.00	400.00
2	900.00	400.00
3	900.00	600.00
4	700.00	600.00

----- Control Parameters for Finding "Critical" Radius -----Initial

number of subdivisions between maximum and minimum

radius for finding a critical radius/radii: 25

Minimum radius increment for terminating subdivision of radii: 10.000

The following criteria will be used for determining

the maximum and minimum radii:

Point circles pass through - X: 523.86 Y: 312.67

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 6.000

-----The

following represent default values or values that were previously defined:

Subtended angle for slice subdivision: 3.00(degrees)

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Search will be continued after the initial mode to find a most critical circle.

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Radii for each grid point will be sorted in the order of increasing radius.

Critical circles for grid points will be output in the order of increasing factor of safety.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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Stability\Section C-C'\MSB Section C-C'.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	82.38	325.60
4	149.69	322.89
5	188.52	321.33
6	296.79	317.03
7	337.81	317.09
8	353.45	317.07
9	462.85	316.98
10	486.38	316.95
11	523.86	312.67
12	602.96	286.27
13	640.44	273.76
14	648.54	271.06
15	738.70	240.97
16	796.77	221.59
17	869.92	197.17
18	875.91	195.17
19	1000.00	195.27

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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Stability\Section C-C'\MSB Section C-C'.input-utexas

MSB CELL 3

TABLE NO. 38

* FINAL SUMMARY OF COMPUTATIONS WITH FIXED-GRID *

Number of circles attempted: 225

Number of circles for which F calculated: 95

Circle with Lowest Factor of Safety:

 X coordinate for center: 757.14

 Y coordinate for center: 500.00

 Radius of circle: 299.183

Factor of safety: 1.892

Side force inclination: -16.67

Time Required for Computations: 0.0 seconds

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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Name of input data file:

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MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	530.79	304.36					
	536.06	298.57	5290	1	100.0	35.00	89.1
	541.34	292.78					
2	546.91	287.28	9861	1	100.0	35.00	643.0
	552.48	281.77					
3	558.33	276.57	14395	1	100.0	35.00	0.0
	564.18	271.36					
4	570.30	266.47	18779	1	100.0	35.00	0.0
	576.41	261.58					
5	582.77	257.01	22908	1	100.0	35.00	186.6
	589.14	252.44					
6	595.73	248.22	26683	1	100.0	35.00	735.3
	602.32	243.99					
7	602.64	243.80	1359	1	100.0	35.00	1011.0
	602.96	243.60					
8	609.78	239.75	30158	1	100.0	35.00	613.9
	616.59	235.89					
9	623.60	232.39	32933	1	100.0	35.00	0.0
	630.61	228.89					
10	635.52	226.70	23949	1	100.0	35.00	0.0
	640.44	224.52					
11	644.49	222.87	20053	1	100.0	35.00	0.0
	648.54	221.23					
12	655.91	218.57	36868	1	100.0	35.00	88.9
	663.28	215.92					
13	670.77	213.66	37474	1	100.0	35.00	395.5
	678.27	211.40					
14	685.88	209.53	37320	1	100.0	35.00	653.1
	693.48	207.67					
15	701.18	206.20	36382	1	100.0	35.00	861.0
	708.87	204.74					
16	716.63	203.68	34654	1	100.0	35.00	1018.6
	724.39	202.62					
17	731.54	202.00	29585	1	100.0	35.00	1123.1
	738.70	201.39					
18	746.52	201.11	29155	1	100.0	35.00	1178.8
	754.35	200.83					
19	755.75	200.82	4811	1	100.0	35.00	1196.6
	757.14	200.82					
20	764.97	201.02	24410	1	100.0	35.00	1184.2
	772.80	201.23					
21	780.61	201.84	19629	1	100.0	35.00	1133.1
	788.42	202.46					
22	792.59	202.95	8367	1	100.0	35.00	0.0
	796.77	203.45					

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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23	804.50	204.69	11069	1	100.0	35.00	0.0
	812.24	205.93					
24	819.89	207.58	4819	1	100.0	35.00	0.0
	827.55	209.22					
25	829.35	209.67	188	1	100.0	35.00	0.0
	831.15	210.11					

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of *
* Safety and Side Force Inclination by Spencer's Procedure *

Allowable force imbalance for convergence: 5

Allowable moment imbalance for convergence: 3501

	Trial	Trial				
Iter-	Factor	Side Force	Force	Moment		Delta
ation	Safety	Inclination	Imbalance	Imbalance	Delta-F	Theta
		(degrees)	(lbs.)	(ft.-lbs.)		(degrees)
1	3.00000	-17.1887	-5.665e+004	2.329e+007		
First-order corrections to F and Theta					-1.7512	-0.1888
Reduced values - Deltas were too large					-0.5000	-0.0539
2	2.50000	-17.2426	-3.722e+004	1.529e+007		
First-order corrections to F and Theta					-0.7945	-0.4209
Reduced values - Deltas were too large					-0.5000	-0.2649
3	2.00000	-17.5075	-7.848e+003	3.127e+006		
First-order corrections to F and Theta					-0.1199	1.5937
Second-order corrections to F and Theta					-0.1086	0.8556
4	1.89145	-16.6519	2.128e+001	-4.945e+003		
First-order corrections to F and Theta					0.0004	-0.0228
Second-order corrections to F and Theta					0.0004	-0.0229
5	1.89189	-16.6748	-9.068e-007	-2.119e-003		
First-order corrections to F and Theta					-0.0000	0.0000

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 3.51577e-011

Summation of Vertical Forces: 4.18652e-011

Summation of Moments: 2.42435e-008

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.64606e-011

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 1.892 Side Force Inclination: -16.67

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear
			Normal Stress	Normal Stress	
1	536.06	298.57	299.0	209.9	130.5
2	546.91	287.28	652.9	9.9	56.5
3	558.33	276.57	807.4	807.4	351.7
4	570.30	266.47	1059.0	1059.0	444.8
5	582.77	257.01	1319.2	1132.6	472.0
6	595.73	248.22	1591.6	856.3	369.8
7	602.64	243.80	1722.1	711.1	316.0
8	609.78	239.75	1781.2	1167.4	484.9
9	623.60	232.39	1912.2	1912.2	760.6
10	635.52	226.70	2044.7	2044.7	809.6
11	644.49	222.87	2128.1	2128.1	840.5
12	655.91	218.57	2212.5	2123.6	838.8
13	670.77	213.66	2290.4	1894.9	754.2
14	685.88	209.53	2319.1	1666.1	669.5
15	701.18	206.20	2297.2	1436.2	584.4
16	716.63	203.68	2223.1	1204.5	498.7
17	731.54	202.00	2102.5	979.4	415.3
18	746.52	201.11	1929.3	750.4	330.6
19	755.75	200.82	1802.0	605.4	276.9
20	764.97	201.02	1644.6	460.4	223.2
21	780.61	201.84	1337.1	204.1	128.4
22	792.59	202.95	1264.8	1264.8	521.0
23	804.50	204.69	946.6	946.6	403.2
24	819.89	207.58	458.6	458.6	222.6
25	829.35	209.67	112.6	112.6	94.5

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure

Filename: 20221125 Section C-C' Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope

Stability\Section C-C'\MSB Section C-C'.input-utexas

MSB CELL 3

TABLE NO. 59

* Final Results for Side Forces and Stresses Between Slices *

* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Y-Coord. of Slice	Fraction X-Right	Sigma Side Force	Sigma Side Force Location	of Height	at Top	at Bottom
1	541.34	2176	296.99	0.299	-30.2	326.7
2	552.48	9023	287.55	0.271	-152.4	962.2
3	564.18	13503	280.98	0.345	33.6	895.1
4	576.41	18642	273.82	0.365	101.0	963.3
5	589.14	24947	266.24	0.359	95.6	1147.6
6	602.32	33902	258.05	0.331	-11.0	1539.4
7	602.96	34383	257.66	0.329	-17.8	1561.6
8	616.59	41834	250.75	0.324	-47.2	1795.8
9	630.61	44668	245.52	0.345	64.2	1713.0
10	640.44	45697	242.19	0.359	135.9	1641.9
11	648.54	45905	239.68	0.370	195.7	1569.0
12	663.28	45245	235.54	0.391	296.7	1429.4
13	678.27	44254	231.49	0.404	360.8	1343.8
14	693.48	42658	227.67	0.413	405.1	1283.7
15	708.87	40299	224.18	0.421	439.5	1232.1
16	724.39	37145	221.08	0.428	468.8	1181.2
17	738.70	33639	218.56	0.434	490.5	1137.7
18	754.35	29357	216.07	0.436	498.4	1112.4
19	757.14	28574	215.64	0.436	496.0	1114.3
20	772.80	24221	213.16	0.421	428.3	1207.9
21	788.42	20413	210.15	0.351	95.1	1689.0
22	796.77	14552	210.04	0.363	139.0	1398.4
23	812.24	5592	210.28	0.414	246.5	774.6
24	827.55	460	210.21	0.471	173.3	247.4
25	831.15	-0	210.11	0.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: D-D' Case: Circular

Unit Weight Average Effective Average Total Average

Fixed Grid Coordinates

x

y

700

500

900

500

900

700

700

700

Circle Entrance

x

y

462.9171

332.8662

Tangent

Search Grid Subdivisions

25

10

Crack Depth

10

Seismic Acceleration

0

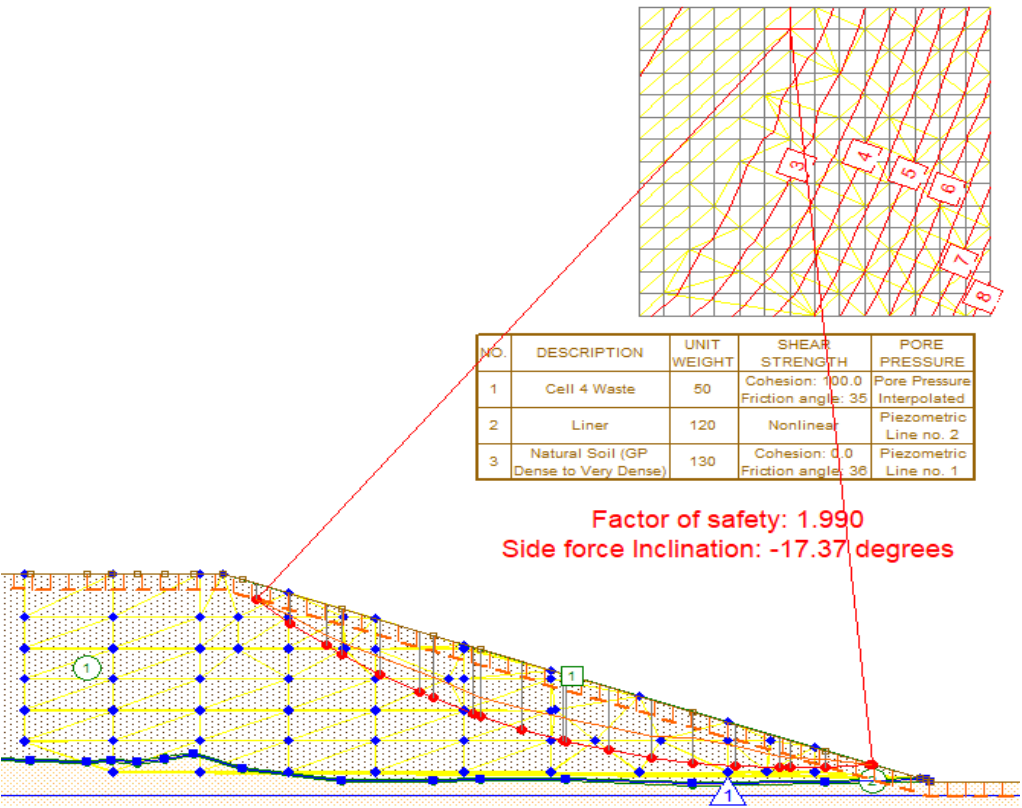
Minimum Weight

5000

Results

		Circle Center		Radius	
Circles Attempted	Circles Completed	x	y	478.226	
225	143	785.71	685.71		

Factor of Safety	Errors
1.99	



Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_input (wilson).docx

UTEXAS4 Input File

Page 1 of 7

ENGLISH units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 5 Surface

0 333.4446

70.2135 333.2671

462.9171 332.8662

859.9918497 200.6787

2 2 Liner

0 225.941

60.295 222.8622

96.3755 221.4547

222.67 219.9925

229.574 218.9521

238.2127 218.2238

281.1197 216.7649

317.0974 215.141

353.4706 213.1896

385.299 212.1641

399.5351 213.1354

414.0331 211.9903

429.8377 214.4455

446.6344 217.3867

474.0832 208.2405

531.0248 200.0882

582.5672 200.0792

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_input (wilson).docx

UTEXAS4 Input File

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609.5593 201.0805

658.2285 200.9409

730.2071 198.071

806.2818 199.0468

859.9918497 200.6787

862.9957248 199.6787

865.9996 198.6787

3 3 Native Surface

0 223.941

60.295 220.8622

96.3755 219.4547

222.67 217.9925

229.574 216.9521

238.2127 216.2238

281.1197 214.7649

317.0974 213.141

353.4706 211.1896

385.299 210.1641

399.5351 211.1354

414.0331 209.9903

429.8377 212.4455

446.6344 215.3867

474.0832 206.2405

531.0248 198.0882

582.5672 198.0792

609.5593 199.0805

658.2285 198.9409

730.2071 196.071

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_input (wilson).docx

UTEXAS4 Input File

Page 3 of 7

806.2818 197.0468

865.9996 198.6787

1500 199.105

MATerial property data follow -

1 Cell 4 Waste

50.00 = unit weight

Conventional

100.0 35.0

Interpolated Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0.0 0.0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0 36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000 190.000000

1500.000000 190.000000

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_input (wilson).docx

UTEXAS4 Input File

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	2	62.40 Piezometric line 2
0	224.941	
60.295	221.8622	
96.3755	220.4547	
222.67	218.9925	
229.574	217.9521	
238.2127	217.2238	
281.1197	215.764	
317.0974	214.141	
353.4706	212.1896	
385.299	211.1641	
399.5351	212.1354	
414.0331	210.9903	
429.8377	213.4455	
446.6344	216.3867	
474.0832	207.2405	
531.0248	199.0882	
582.5672	199.0792	
609.5593	200.0805	
658.2285	199.9409	
730.2071	197.071	
806.2818	198.0468	
862.9957248	199.6787	
865.9996	198.6787	

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

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UTEXAS4 Input File

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Interpolation Point

P

```
350 332.9814739 0 1 400 332.9304303 0 1 450
332.8793867 0 1 462.9171 332.8662 0 1 500
320.5211797 0 1 550 303.876014 0 1 600
287.2308483 0 1 650 270.5856826 0 1 700
253.9405169 0 1 750 237.2953512 0 1 800
220.6501856 0 1 859.9918497 200.6787 0 1
350 225 0 1 400 225 0 1 450 225 0
1 500 225 0 1 550 225 0 1 600 225
0 1 650 225 0 1 675 225 0 1
711.9336598 225 0 1 750 225 0 1 775 225
0 1
350 225 0 1 400 205 1248 1 450 205 1248
1 500 205 1248 1 550 205 1248 1 600 205
1248 1 650 205 1248 1 700 205 1248 1 750
205 1248 1 772.0111558 205 1248 1 773 205 0
1 800 205 0 1
350 224.5 0 1 400 204.5 0 1 450 204.5 0
1 500 204.5 0 1 550 204.5 0 1 600
204.5 0 1 650 204.5 0 1 700 204.5 0 1
750 204.5 0 1 800 204.5 0 1
350 265 0 1 400 265 0 1 450 265 0
1 500 265 0 1 550 265 0 1 591.7786679
265 0 1 600 265 0 1 650 265 0
350 245 1248 1 400 245 1248 1 450 245 1248
1 500 245 1248 1 550 245 1248 1 600 245
1248 1 651.8561639 245 1248 1 652 245 0 1
```

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_input (wilson).docx

UTEXAS4 Input File

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```
1 500 244.5 0 1 550 244.5 0 1 600
244.5 0 1 650 244.5 0 1
350 305 0 1 400 305 0 1 450 305 0
1 471.6236759 305 0 1 500 305 0 1
531.7011719 305 0 1
350 285 1248 1 400 285 1248 1 450 285 1248
1 471.6236759 285 1248 1 500 285 1248 1
531.7011719 285 1248 1 532 285 0 1 600 285
0 1
350 284.5 0 1 400 284.5 0 1 450 284.5 0
1 471.6236759 284.5 0 1 500 284.5 0 1
531.7011719 284.5 0 1 532 284.5 0 1 550
284.5 0 1 600 284.5 0 1
```

ANALYSIS/computation data follow

Circle Search 2

15 15

700.000000 500.000000

900.000000 500.000000

900.000000 700.000000

700.000000 700.000000

25 10

Point

462.9171 332.8662

MINimum weight follows:

5000

ITERation limit follows:

100

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

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UTEXAS4 Input File

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crack

10 d

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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UTEXAS4 Output File

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Name of input data file:

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Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 5 Surface

Point	X	Y
1	0.00	333.44
2	70.21	333.27
3	462.92	332.87
4	859.99	200.68

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	225.94
2	60.30	222.86
3	96.38	221.45
4	222.67	219.99
5	229.57	218.95
6	238.21	218.22
7	281.12	216.76
8	317.10	215.14
9	353.47	213.19
10	385.30	212.16
11	399.54	213.14
12	414.03	211.99
13	429.84	214.45
14	446.63	217.39
15	474.08	208.24
16	531.02	200.09
17	582.57	200.08
18	609.56	201.08
19	658.23	200.94
20	730.21	198.07
21	806.28	199.05
22	859.99	200.68
23	863.00	199.68
24	866.00	198.68

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	223.94
2	60.30	220.86
3	96.38	219.45
4	222.67	217.99
5	229.57	216.95
6	238.21	216.22
7	281.12	214.76
8	317.10	213.14

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

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UTEXAS4 Output File

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9	353.47	211.19
10	385.30	210.16
11	399.54	211.14
12	414.03	209.99
13	429.84	212.45
14	446.63	215.39
15	474.08	206.24
16	531.02	198.09
17	582.57	198.08
18	609.56	199.08
19	658.23	198.94
20	730.21	196.07
21	806.28	197.05
22	866.00	198.68
23	1500.00	199.10

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

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Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----
-----Description:

Cell 4 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----
-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

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UTEXAS4 Output File

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Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----
-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

UTEXAS4 Output File

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Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	224.94
2	60.30	221.86
3	96.38	220.45
4	222.67	218.99
5	229.57	217.95
6	238.21	217.22
7	281.12	215.76
8	317.10	214.14
9	353.47	212.19
10	385.30	211.16
11	399.54	212.14
12	414.03	210.99
13	429.84	213.45
14	446.63	216.39
15	474.08	207.24
16	531.02	199.09
17	582.57	199.08
18	609.56	200.08
19	658.23	199.94
20	730.21	197.07
21	806.28	198.05
22	863.00	199.68
23	866.00	198.68

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Search will be conducted using a fixed grid.

Number of Points Across Grid: 15

Number of Points Up Grid: 15

Grid Corner

Number	X	Y
1	700.00	500.00
2	900.00	500.00
3	900.00	700.00
4	700.00	700.00

----- Control Parameters for Finding "Critical" Radius -----Initial

number of subdivisions between maximum and minimum

radius for finding a critical radius/radii: 25

Minimum radius increment for terminating subdivision of radii: 10.000

The following criteria will be used for determining

the maximum and minimum radii:

Point circles pass through - X: 462.92 Y: 332.87

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 10.000

-----The

following represent default values or values that were previously defined:

Subtended angle for slice subdivision: 3.00(degrees)

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Search will be continued after the initial mode to find a most critical circle.

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Radii for each grid point will be sorted in the order of increasing radius.

Critical circles for grid points will be output in the order of increasing factor of safety.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

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Name of input data file:

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Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	333.44
2	60.30	333.29
3	70.21	333.27
4	96.38	333.24
5	222.67	333.11
6	229.57	333.10
7	238.21	333.10
8	281.12	333.05
9	317.10	333.02
10	353.47	332.98
11	385.30	332.95
12	399.54	332.93
13	414.03	332.92
14	429.84	332.90
15	446.63	332.88
16	462.92	332.87
17	474.08	329.15
18	531.02	310.19
19	582.57	293.03
20	609.56	284.05
21	658.23	267.85
22	730.21	243.88
23	806.28	218.56
24	859.99	200.68
25	863.00	199.68
26	866.00	198.68
27	1500.00	199.10

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

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Name of input data file:

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Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 38

* FINAL SUMMARY OF COMPUTATIONS WITH FIXED-GRID *

Number of circles attempted: 225

Number of circles for which F calculated: 143

Circle with Lowest Factor of Safety:

X coordinate for center: 785.71

Y coordinate for center: 685.71

Radius of circle: 478.226

Factor of safety: 1.990

Side force inclination: -17.37

Time Required for Computations: 1.0 seconds

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Mon Nov 14 15:03:03 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	481.59	316.65	14228	1	100.0	35.00	0.0
	491.46	308.94					
	501.32	301.24					
2	511.58	294.06	23185	1	100.0	35.00	682.6
	521.83	286.88					
3	526.43	283.92	12777	1	100.0	35.00	0.0
	531.02	280.95					
4	541.79	274.56	34501	1	100.0	35.00	0.0
	552.56	268.18					
5	563.64	262.36	40987	1	100.0	35.00	164.6
	574.73	256.55					
6	578.65	254.66	15549	1	100.0	35.00	645.0
	582.57	252.78					
7	594.04	247.76	47541	1	100.0	35.00	1075.7
	605.50	242.74					
8	607.53	241.93	8678	1	100.0	35.00	0.0
	609.56	241.11					
9	621.31	236.81	50930	1	100.0	35.00	0.0
	633.07	232.50					
10	645.03	228.82	51947	1	100.0	35.00	0.0
	657.00	225.14					
11	657.61	224.97	2652	1	100.0	35.00	2.2
	658.23	224.79					
12	670.38	221.77	51058	1	100.0	35.00	201.3
	682.53	218.75					
13	694.82	216.37	48291	1	100.0	35.00	538.3
	707.11	213.99					
14	718.66	212.36	40857	1	100.0	35.00	0.0
	730.21	210.72					
15	742.67	209.59	37578	1	100.0	35.00	961.3
	755.14	208.47					
16	767.65	207.99	29304	1	100.0	35.00	1061.2
	780.16	207.52					
17	782.94	207.50	5227	1	100.0	35.00	0.0
	785.71	207.49					
18	796.00	207.71	14678	1	100.0	35.00	0.0
	806.28	207.93					
19	818.77	208.80	7000	1	100.0	35.00	0.0
	831.26	209.66					
20	831.94	209.73	20	1	100.0	35.00	0.0
	832.61	209.79					

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of *
* Safety and Side Force Inclination by Spencer's Procedure *

Allowable force imbalance for convergence: 5

Allowable moment imbalance for convergence: 3458

	Trial	Trial				
Iter-	Factor	Side Force	Force	Moment		Delta
ation	Safety	Inclination	Imbalance	Imbalance	Delta-F	Theta
		(degrees)	(lbs.)	(ft.-lbs.)		(degrees)
1	3.00000	-17.1887	-5.463e+004	2.283e+007		
First-order corrections to F and Theta					-1.5274	0.0757
Reduced values - Deltas were too large					-0.5000	0.0248
2	2.50000	-17.1640	-3.316e+004	1.386e+007		
First-order corrections to F and Theta					-0.6437	0.1861
Reduced values - Deltas were too large					-0.5000	0.1445
3	2.00000	-17.0194	-9.461e+002	4.459e+005		
First-order corrections to F and Theta					-0.0101	-0.3709
Second-order corrections to F and Theta					-0.0101	-0.3477
4	1.98989	-17.3671	7.236e-002	-4.807e+001		
First-order corrections to F and Theta					0.0000	0.0001

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 2.76401e-011

Summation of Vertical Forces: 3.91083e-011

Summation of Moments: 1.36424e-004

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.09184e-011

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 1.990 Side Force Inclination: -17.37

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	491.46	308.94	495.0	495.0	224.4
2	511.58	294.06	888.4	205.7	122.6
3	526.43	283.92	1041.5	1041.5	416.7
4	541.79	274.56	1236.6	1236.6	485.4
5	563.64	262.36	1493.8	1329.2	518.0
6	578.65	254.66	1665.0	1020.0	409.2
7	594.04	247.76	1790.0	714.4	301.6
8	607.53	241.93	1845.9	1845.9	699.8
9	621.31	236.81	1909.0	1909.0	722.0
10	645.03	228.82	1983.5	1983.5	748.2
11	657.61	224.97	2006.1	2003.9	755.4
12	670.38	221.77	1990.3	1789.0	679.8
13	694.82	216.37	1912.4	1374.1	533.8
14	718.66	212.36	1805.9	1805.9	685.7
15	742.67	209.59	1518.9	557.5	246.4
16	767.65	207.99	1182.9	121.7	93.1
17	782.94	207.50	1070.4	1070.4	426.9
18	796.00	207.71	834.2	834.2	343.8
19	818.77	208.80	354.8	354.8	175.1
20	831.94	209.73	42.6	42.6	65.2

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure

Filename: 20221125 Section D-D' Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope

Stability\Section D-D'\MSB Section D-D'.input-utexas

MSB CELL 3

TABLE NO. 59

* Final Results for Side Forces and Stresses Between Slices *

* (Results are for the critical shear surface in the case of a search.) *

VALUES AT RIGHT SIDE OF SLICE						
Slice		Side	Y-Coord. of	Fraction	Sigma	Sigma
No.	X-Right	Force	Side Force	of	at	at
			Location	Height	Top	Bottom
1	501.32	3353	305.86	0.245	-89.8	429.5
2	521.83	14080	292.90	0.228	-321.6	1340.8
3	531.02	16539	288.90	0.272	-198.9	1278.6
4	552.56	22140	279.39	0.322	-41.7	1254.5
5	574.73	28311	269.50	0.331	-8.1	1390.3
6	582.57	31519	265.67	0.320	-59.4	1554.1
7	605.50	43098	254.65	0.279	-314.1	2242.7
8	609.56	43274	253.33	0.284	-282.0	2205.9
9	633.07	42710	246.14	0.312	-119.3	1984.1
10	657.00	39263	239.85	0.341	41.6	1696.5
11	658.23	39008	239.56	0.343	50.6	1679.0
12	682.53	34299	233.89	0.369	171.1	1425.6
13	707.11	30091	228.11	0.376	194.0	1334.4
14	730.21	19686	227.30	0.500	566.6	566.5
15	755.14	16835	221.84	0.493	568.7	616.3
16	780.16	15567	214.83	0.370	166.9	1338.9
17	785.71	13120	214.30	0.380	195.3	1202.4
18	806.28	5325	212.80	0.458	356.9	599.5
19	831.26	98	209.94	0.477	138.6	184.0
20	832.61	-0	209.79	1.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: A-A' Case: Non Circular - Peak Liner Strength

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates Shifting Points

x y 10

75 332.026 5
166.0471 231.1
239.5212 231.1992 fixed
282.3832 230.8095 fixed
293.5372 229.1338 fixed
305.1905 231.1918 fixed
381.9526 232.8086 fixed
404.5544 233.1568 fixed
464.4 232.9 fixed
469.9252 232.8924 fixed

Crack Depth

1

Seismic Acceleration

Minimum Weight

5000

Results

Noncircular Shear Surface

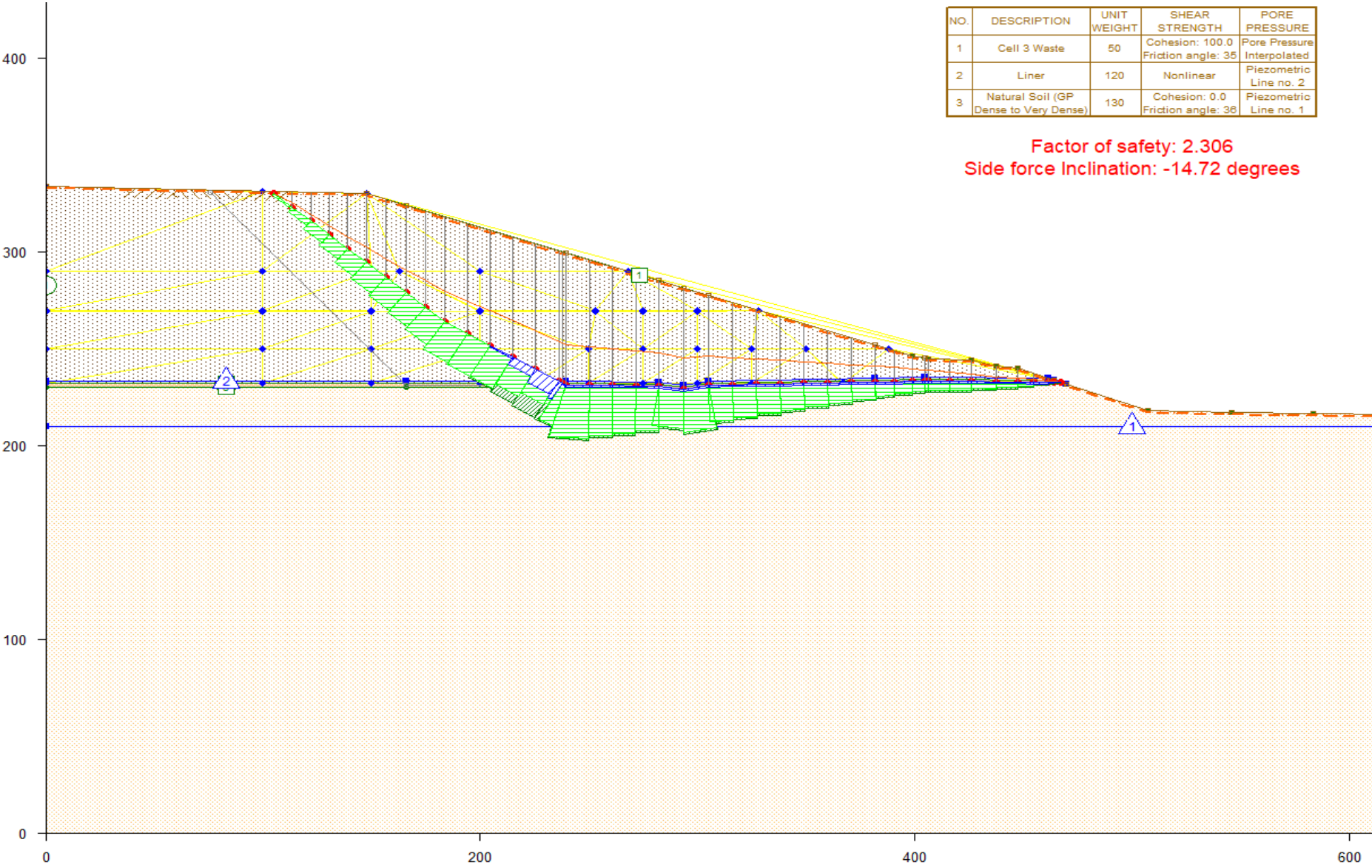
118.59	329.89
185.68	266.54
239.52	231.2
282.38	230.81
293.54	229.13
305.19	231.19
381.95	232.81
404.55	233.16
464.4	232.9
467.16	232.9

Factor of Safety

2.306

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Cell 3 Waste	50	Cohesion: 100.0 Friction angle: 35	Pore Pressure Interpolated
2	Liner	120	Nonlinear	Piezometric Line no. 2
3	Natural Soil (GP Dense to Very Dense)	130	Cohesion: 0.0 Friction angle: 36	Piezometric Line no. 1

Factor of safety: 2.306
Side force Inclination: -14.72 degrees



Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section A-A' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 1 of 5

English units

HEAding follows -MSB

CELL 3

PROfile line data follow -

1 1 Cell 3 Surface

0.000000	333.976600
147.552900	330.139000
399.183500	246.250400
406.121800	244.712800
426.040100	244.023100
437.832500	241.284800
447.582100	240.087400

464.4 233.9

2 2 Liner

0 232.1156

166.0471 232.1156

239.5212 232.1992

282.3832 231.8095

293.5372 230.1338

305.1905 232.1918

381.9526 233.8086

404.5544 234.1568

464.4 233.9

469.925200 231.892400

3 3 Native Surface

0.000000	230.115600
166.047100	230.115600
239.521200	230.199200
282.383200	229.809500
293.537200	228.133800
305.190500	230.191800
381.952600	231.808600
404.554400	232.156800
469.925200	231.892400

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section A-A' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 2 of 5

507.465300	218.060500
546.288900	216.988100
583.471700	216.402500
657.991300	215.510800
741.835000	212.295700
814.990400	214.257600
864.122100	231.583000
886.536400	237.805100
945.522300	256.707600
969.897400	262.128400
978.535600	263.868000
999.028400	264.021200

MATeRIal property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0 35.0

Interpolate Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0.0 0.0

700 454.6

4200 1942.8

5000 2183.7

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0 36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000 210.000000

1000.000000 210.000000

2 62.40 Piezometric line 2

0 233.1156

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section A-A' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 3 of 5

166.0471 233.1156

239.5212 233.1992

282.3832 232.8095

293.5372 231.1338

305.1905 233.1918

381.9526 234.8086

404.5544 235.1568

461.6819 234.9

464.4 233.9

469.925200 231.892400

Interpolation Point

P

0 333.9766 0 1 100 331.3758 0 1

147.5529 330.139 0 1 267.9530575 290 0 1

327.9446654 270 0 1 387.9362733 250 0 1

464.4 233.9 0 1

0 250 0 1 100 250 0 1 150 250 0

1 200 250 0 1 250 250 0 1 275 250

0 1 300 250 0 1 325 250 0 1 350

250 0 1

0 232 1248 1 100 232 1248 1 150 232 1248

1 200 232 1248 1 225 232 1248 1 250 232

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section A-A' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 4 of 5

1248 1 275 232 1248 1 300 232 1248 1 325

232 1248 1 366.582 232 1248 1 367 232 0

1

0 290 0 1 100 290 0 1 150 290 0

1 200 290 0 1 162.9573 290 0 1

0 270 1248 1 100 270 1248 1 150 270 1248

1 200 270 1248 1 252.9447 270 1248 1 253

270 0 1 275 270 0 1 300 270 0 1

0 269.5 0 1 100 269.5 0 1 150 269.5 0

1 200 269.5 0 1 252.9447 269.5 0 1 253

269.5 0 1 275 269.5 0 1 300 269.5 0 1

ANALYSIS/computation data follow

Noncircular Search 2

75 332.0259775

166 231.1

239.5212 231.1992 fixed

282.3832 230.8095 fixed

293.5372 229.1338 fixed

305.1905 231.1918 fixed

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section A-A' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 5 of 5

381.9526 232.8086 fixed

404.5544 233.1568 fixed

464.4 232.9 fixed

469.925200 232.892400 fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

1 d

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

Page 1 of 19

TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Non-Circular - Peak_output (wilson).docx

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to
weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Name of input data file:

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Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 3 Surface

Point	X	Y
1	0.00	333.98
2	147.55	330.14
3	399.18	246.25
4	406.12	244.71
5	426.04	244.02
6	437.83	241.28
7	447.58	240.09
8	464.40	233.90

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	232.12
2	166.05	232.12
3	239.52	232.20
4	282.38	231.81
5	293.54	230.13
6	305.19	232.19
7	381.95	233.81
8	404.55	234.16
9	464.40	233.90
10	469.93	231.89

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	230.12
2	166.05	230.12
3	239.52	230.20
4	282.38	229.81
5	293.54	228.13
6	305.19	230.19
7	381.95	231.81
8	404.55	232.16

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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9	469.93	231.89
10	507.47	218.06
11	546.29	216.99
12	583.47	216.40
13	657.99	215.51
14	741.84	212.30
15	814.99	214.26
16	864.12	231.58
17	886.54	237.81
18	945.52	256.71
19	969.90	262.13
20	978.54	263.87
21	999.03	264.02

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Time and date of run: Tue Nov 15 08:19:12 2022

Name of input data file:

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Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----
-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----
-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	700.0	454.6
3	4200.0	1942.8
4	5000.0	2183.7

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----
-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	210.00
2	1000.00	210.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	233.12
2	166.05	233.12
3	239.52	233.20
4	282.38	232.81
5	293.54	231.13
6	305.19	233.19
7	381.95	234.81
8	404.55	235.16
9	461.68	234.90
10	464.40	233.90
11	469.93	231.89

UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	75.00	332.03	angle to be computed - moveable
2	166.00	231.10	angle to be computed - moveable
3	239.52	231.20	- fixed
4	282.38	230.81	- fixed
5	293.54	229.13	- fixed
6	305.19	231.19	- fixed
7	381.95	232.81	- fixed
8	404.55	233.16	- fixed
9	464.40	232.90	- fixed
10	469.93	232.89	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 1.000

-----The

following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

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Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	333.98
2	147.55	330.14
3	166.05	323.97
4	239.52	299.48
5	282.38	285.19
6	293.54	281.47
7	305.19	277.59
8	381.95	251.99
9	399.18	246.25
10	404.55	245.06
11	406.12	244.71
12	426.04	244.02
13	437.83	241.28
14	447.58	240.09
15	464.40	233.90
16	469.93	231.89
17	507.47	218.06
18	546.29	216.99
19	583.47	216.40
20	657.99	215.51
21	741.84	212.30
22	814.99	214.26
23	864.12	231.58
24	886.54	237.81
25	945.52	256.71
26	969.90	262.13
27	978.54	263.87
28	999.03	264.02

Left end point on noncircular shear surface adjusted to:

X: 75.92, Y: 331.00

Adjustment was made to put end point at bottom of crack.

Right end point on noncircular shear surface adjusted to:

X: 467.16, Y: 232.90

Adjustment was made to put end point on the slope.

Noncircular Shear Surface Points After End Point Adjustment

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	75.92	331.00	angle to be computed - moveable
2	166.00	231.10	angle to be computed - moveable
3	239.52	231.20	- fixed

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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4	282.38	230.81	- fixed
5	293.54	229.13	- fixed
6	305.19	231.19	- fixed
7	381.95	232.81	- fixed
8	404.55	233.16	- fixed
9	464.40	232.90	- fixed
10	467.16	232.90	- fixed

Computed crack depth: 1.00

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 105.12 Y: 330.24

X: 183.85 Y: 264.09

X: 239.52 Y: 231.20

X: 282.38 Y: 230.81

X: 293.54 Y: 229.13

X: 305.19 Y: 231.19

X: 381.95 Y: 232.81

X: 404.55 Y: 233.16

X: 464.40 Y: 232.90

X: 467.16 Y: 232.90

Minimum factor of safety: 2.306

Side force inclination: -14.72

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 9

Total number of shear surfaces attempted: 45

Total number of shear surfaces for which the factor of safety
was successfully calculated: 45

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	2.4981	5	5
2	10.0000	2	10.000	2.3932	10	10
3	10.0000	1	10.000	2.3423	15	15
4	10.0000	1	10.000	2.3266	20	20
5	10.0000	1	10.000	2.3153	25	25
6	10.0000	1	10.000	2.3090	30	30
7	10.0000	1	10.000	2.3061	35	35
8	10.0000	2	3.265	2.3058	40	40
9	5.0000	1	5.000	2.3058	45	45

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
	105.12	330.24					
1	109.36	326.68	1891	1	100.0	35.00	0.0
	113.60	323.11					
2	117.85	319.55	4823	1	100.0	35.00	0.0
	122.09	315.98					
3	126.34	312.41	7756	1	100.0	35.00	0.0
	130.58	308.85					
4	134.82	305.28	10688	1	100.0	35.00	0.0
	139.07	301.72					
5	143.31	298.15	13620	1	100.0	35.00	0.0
	147.55	294.59					
6	152.18	290.70	17521	1	100.0	35.00	0.0
	156.80	286.82					
7	161.42	282.93	19688	1	100.0	35.00	0.0
	166.05	279.05					
8	170.50	275.31	20993	1	100.0	35.00	0.0
	174.95	271.57					
9	179.40	267.83	23000	1	100.0	35.00	0.0
	183.85	264.09					
10	189.07	261.00	28917	1	100.0	35.00	0.0
	194.30	257.91					
11	199.53	254.82	30325	1	100.0	35.00	0.0
	204.76	251.73					
12	209.99	248.64	31733	1	100.0	35.00	94.0
	215.22	245.55					
13	220.45	242.46	33141	1	100.0	35.00	522.4
	225.68	239.37					
14	230.91	236.29	34549	1	100.0	35.00	950.9
	236.14	233.20					
15	236.99	232.70	5712	1	100.0	35.00	1199.7
	237.83	232.20					
16	238.68	231.70	5808	2	NONLINEAR ENVELOPE		93.6
	239.52	231.20					
17	244.88	231.15	36402	2	NONLINEAR ENVELOPE		124.8
	250.24	231.10					
18	255.59	231.05	34540	2	NONLINEAR ENVELOPE		124.8

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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	260.95	231.00				
19	266.31	230.96	32678	2	NONLINEAR ENVELOPE	124.8
	271.67	230.91				
20	277.03	230.86	30816	2	NONLINEAR ENVELOPE	124.8
	282.38	230.81				
21	287.96	229.97	30539	2	NONLINEAR ENVELOPE	124.8
	293.54	229.13				
22	299.36	230.16	29579	2	NONLINEAR ENVELOPE	124.8
	305.19	231.19				
23	310.67	231.31	25140	2	NONLINEAR ENVELOPE	124.8
	316.16	231.42				
24	321.64	231.54	23009	2	NONLINEAR ENVELOPE	124.8
	327.12	231.65				
25	332.61	231.77	20878	2	NONLINEAR ENVELOPE	124.8
	338.09	231.88				
26	343.57	232.00	18746	2	NONLINEAR ENVELOPE	124.8
	349.05	232.12				
27	354.54	232.23	16615	2	NONLINEAR ENVELOPE	124.8
	360.02	232.35				
28	365.50	232.46	14484	2	NONLINEAR ENVELOPE	124.8
	370.99	232.58				
29	376.47	232.69	12353	2	NONLINEAR ENVELOPE	124.8
	381.95	232.81				
30	386.26	232.87	8221	2	NONLINEAR ENVELOPE	124.8
	390.57	232.94				
31	394.88	233.01	6926	2	NONLINEAR ENVELOPE	124.8
	399.18	233.07				
32	401.87	233.12	3743	2	NONLINEAR ENVELOPE	124.8
	404.55	233.16				
33	405.34	233.15	1029	2	NONLINEAR ENVELOPE	124.8
	406.12	233.15				
34	411.10	233.13	6380	2	NONLINEAR ENVELOPE	124.7
	416.08	233.11				
35	421.06	233.09	6229	2	NONLINEAR ENVELOPE	124.6
	426.04	233.06				
36	431.94	233.04	6494	2	NONLINEAR ENVELOPE	124.5
	437.83	233.01				
37	442.71	232.99	4433	2	NONLINEAR ENVELOPE	124.3
	447.58	232.97				
38	451.11	232.96	2550	2	NONLINEAR ENVELOPE	124.2
	454.63	232.94				
39	458.16	232.93	1646	2	NONLINEAR ENVELOPE	124.1
	461.68	232.91				
40	463.04	232.91	393	2	NONLINEAR ENVELOPE	93.2
	464.40	232.90				
41	465.78	232.90	166	2	NONLINEAR ENVELOPE	31.2
	467.16	232.90				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *

* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 4.73825e-011

Summation of Vertical Forces: 6.21299e-011

Summation of Moments: -1.33150e-008

Mohr Coulomb Shear Force/Shear Strength Check Summation: 3.05498e-011

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 58

 * Final Results for Stresses Along the Shear Surface *
 * (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 2.306 Side Force Inclination: -14.72

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear Stress
			Normal Stress	Normal Stress	
1	109.36	326.68	141.6	141.6	86.4
2	117.85	319.55	389.1	389.1	161.5
3	126.34	312.41	636.6	636.6	236.7
4	134.82	305.28	884.1	884.1	311.8
5	143.31	298.15	1131.6	1131.6	387.0
6	152.18	290.70	1339.2	1339.2	450.1
7	161.42	282.93	1507.1	1507.1	501.0
8	170.50	275.31	1671.8	1671.8	551.1
9	179.40	267.83	1833.3	1833.3	600.1
10	189.07	261.00	2191.8	2191.8	709.0
11	199.53	254.82	2299.1	2299.1	741.6
12	209.99	248.64	2413.9	2319.9	747.9
13	220.45	242.46	2555.2	2032.7	660.7
14	230.91	236.29	2696.5	1745.6	573.5
15	236.99	232.70	2778.6	1578.8	522.8
16	238.68	231.70	2814.3	2720.7	569.8
17	244.88	231.15	3566.8	3442.0	702.8
18	255.59	231.05	3385.0	3260.2	669.3
19	266.31	230.96	3203.2	3078.4	635.7
20	277.03	230.86	3021.4	2896.6	602.2
21	287.96	229.97	2692.6	2567.8	541.6
22	299.36	230.16	2931.6	2806.8	585.7
23	310.67	231.31	2446.9	2322.1	496.3
24	321.64	231.54	2240.6	2115.8	458.2
25	332.61	231.77	2034.3	1909.5	420.2
26	343.57	232.00	1828.1	1703.3	382.2
27	354.54	232.23	1621.8	1497.0	344.1
28	365.50	232.46	1415.5	1290.7	306.1
29	376.47	232.69	1209.2	1084.4	268.0
30	386.26	232.87	1023.3	898.5	233.8
31	394.88	233.01	864.3	739.5	204.4
32	401.87	233.12	748.9	624.1	175.8
33	405.34	233.15	697.6	572.8	161.3
34	411.10	233.13	680.2	555.5	156.5

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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35	421.06	233.09	664.0	539.4	151.9
36	431.94	233.04	583.5	459.0	129.3
37	442.71	232.99	480.0	355.7	100.2
38	451.11	232.96	379.9	255.6	72.0
39	458.16	232.93	241.8	117.7	33.1
40	463.04	232.91	148.6	55.3	15.6
41	465.78	232.90	62.3	31.1	8.7

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 59

* Final Results for Side Forces and Stresses Between Slices *

* (Results are for the critical shear surface in the case of a search.)

----- VALUES AT RIGHT SIDE OF SLICE -----						
Slice		Side	Y-Coord. of	Fraction	Sigma	Sigma
No.	X-Right	Force	Side Force Location	of Height	at Top	at Bottom
1	113.60	286	325.56	0.310	-4.9	74.9
2	122.09	1738	319.24	0.220	-77.2	304.0
3	130.58	4354	313.58	0.218	-134.6	522.2
4	139.07	8136	308.01	0.220	-187.3	736.8
5	147.55	13084	302.48	0.222	-238.0	949.9
6	156.80	19539	296.56	0.242	-257.2	1196.5
7	166.05	26856	290.75	0.260	-252.9	1409.2
8	174.95	34710	285.18	0.275	-236.4	1594.6
9	183.85	43362	279.61	0.288	-212.8	1767.6
10	194.30	49699	274.67	0.296	-191.0	1888.3
11	204.76	56369	269.74	0.303	-165.0	2002.8
12	215.22	63704	264.72	0.309	-145.3	2132.0
13	225.68	72885	259.34	0.308	-162.3	2340.8
14	236.14	83912	253.74	0.305	-206.0	2613.9
15	237.83	85866	252.83	0.304	-215.1	2663.3
16	239.52	87775	251.93	0.304	-222.0	2708.7
17	250.24	80348	250.90	0.306	-199.9	2598.3
18	260.95	73274	249.87	0.308	-178.6	2489.7
19	271.67	66554	248.82	0.310	-158.2	2383.4
20	282.38	60186	247.76	0.312	-139.2	2280.1
21	293.54	58605	245.27	0.308	-162.9	2329.0
22	305.19	45311	246.19	0.323	-57.2	1946.4
23	316.16	39100	245.44	0.330	-18.7	1798.0
24	327.12	33369	244.70	0.338	22.8	1648.5
25	338.09	28119	243.97	0.348	68.4	1497.6
26	349.05	23349	243.24	0.361	119.6	1344.6
27	360.02	19060	242.51	0.377	179.0	1188.6
28	370.99	15252	241.78	0.399	251.0	1027.7
29	381.95	11924	241.03	0.429	343.4	858.7
30	390.57	9701	240.38	0.460	439.1	720.6
31	399.18	7762	239.67	0.501	572.5	566.9
32	404.55	6721	239.17	0.505	562.4	529.8
33	406.12	6465	238.99	0.505	556.2	525.3
34	416.08	4884	237.84	0.421	219.6	619.3
35	426.04	3349	236.81	0.342	14.7	576.4
36	437.83	1803	235.61	0.314	-24.0	445.7

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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37	447.58	814	234.68	0.240	-61.8	283.0
38	454.63	301	234.19	0.275	-22.6	150.4
39	461.68	67	233.53	0.309	-4.7	69.6
40	464.40	25	233.26	0.361	4.0	43.9
41	467.16	-0	232.90	0.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: B-B' Case: Non Circular - Peak Liner Strength

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates

x	y
364.09	328.58
439.66	232.29
630	233.68 fixed
635	233.72 fixed
639	233.3 fixed
644	232.26 fixed
736.26	212.92 fixed
755.92	212.78 fixed
798.74	211.28 fixed

Shifting Points

10
5

Adjustments
Corp Procedure

Crack Depth

10

Seismic Acceleration

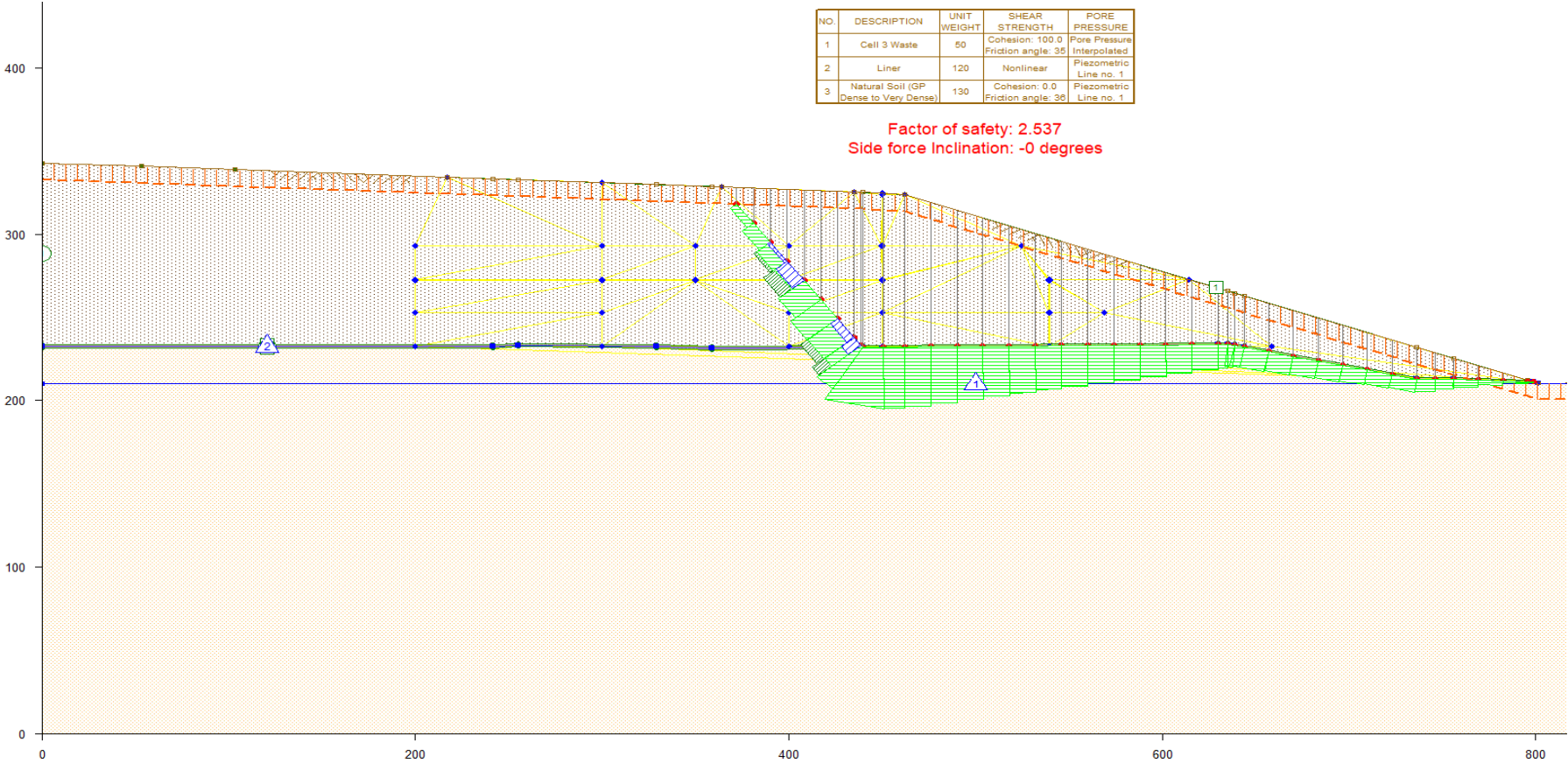
Minimum Weight
5000

Results

Noncircular Shear Surface

367.2	318.46
440.05	232.9
630	233.68
635	233.72
639	233.3
644	232.26
736.26	212.92
755.92	212.78
798.74	211.28

Factor of Safety
2.537



Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section B-B' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 1 of 6

English units

Heading follows -MSB

CELL 3

Profile line data follow -

1 1 Cell 4 Surface

0 342.9925

53.3791 340.9508

103.5224 338.8839

216.9023 334.482

364.0891 328.5808

435.2507 325.7232

462.0904 323.8434

795.7461 212.2843

2 2 Liner

0 233.9687

241.3595 233.9687

255.373 234.532

329.1175 233.9445

358.7087 232.8241

439.6647 233.2931

630 234.6793062

635 234.715721

639 234.303

644 233.255

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section B-B' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 2 of 6

736.2644 213.9188

755.9227 213.778

795.7461 212.2843

801.7278 210.2843

3 3 Native Surface

0 231.9687

241.3595 231.9687

255.373 232.532

329.1175 231.9445

358.7087 230.8241

439.6647 231.2931

630 232.6793062

635 232.715721

639 232.303

644 231.255

736.2644 211.9188

755.9227 211.778

801.7278 210.2843

830.3544 210.7192

842.2722 210.9911

860.5027 210.9911

866.5411 211.812

886.081 218.0902

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section B-B' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 3 of 6

904.7485 224.5428

924.0266 230.9082

958.7877 233.0943

975.4239 234.0329

998.3779 233.9295

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0 35.0

Interpolate Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0.0 0.0

700 454.6

4200 1942.8

5000 2183.7

Piezometric Line

1

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0 36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000 210.000000

1000.000000 210.000000

2 62.40 Piezometric line 2

0 232.9687

241.3595 232.9687

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section B-B' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 4 of 6

255.373 233.532

329.1175 232.9445

358.7087 231.8241

439.6647 232.2931

630 233.6793062

635 233.715721

639 233.3026008

644 232.2547457

736.2644 212.9188

755.9227 212.778

798.7369573 211.2843

801.7278 210.2843

Interpolation Point

P

200 253 0 1 300 253 0 1 400 253 0

1 450 253 0 1 539.155 253 0 1 569.0634359

253 0 1 540 253 0 1

200 233 1248 1 300 233 1248 1 400 233 1248

1 450 233 1248 1 539.0634 233 1248 1

658.7887 233 1248 1 540 233 0 1

200 293 0 1 300 293 0 1 350 293 0

1 400 293 0 1 450 293 0 1 449.4297

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section B-B' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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293 0 1 450 293 0 1 524.4297 293 0
1

200 273 1248 1 300 273 1248 1 350 273 1248

1 400 273 1248 1 450 273 1248 1 539.155 273

1248 1 540 273 0 1 614.1550094 273 0 1

200 272.5 0 1 300 272.5 0 1 350 272.5 0

1 400 272.5 0 1 450 272.5 0 1 539.155

272.5 0 1 540 272.5 0 1

216.9023 334.482 0 1 300 331.1486294 0 1

364.0891 328.5808 0 1 450 325.1315 0 1

435.2507 325.7232 0 1 450 323.8434 0 1

462.0904 323.8434 0 1 801.7278 210.2843 0
1

ANALYSIS/computation data follow

Noncircular Search 2

364.0891 328.5808

439.6647 232.2931

630 233.6793062 Fixed

635 233.715721 Fixed

639 233.303 Fixed

644 232.255 Fixed

736.2644 212.9188 Fixed

755.9227 212.778 Fixed

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section B-B' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 6 of 6

798.7369573 211.2843 Fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

10 d

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section
B-B'\MSB Section B-B' - Non Circular - Corp.input-utexas

TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

----- Profile Line No. 1 - Material Type (Number): 1 -----

Description: Cell 4 Surface

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	364.09	328.58
6	435.25	325.72
7	462.09	323.84
8	795.75	212.28

----- Profile Line No. 2 - Material Type (Number): 2 -----

Description: Liner

Point	X	Y
1	0.00	233.97
2	241.36	233.97
3	255.37	234.53
4	329.12	233.94
5	358.71	232.82
6	439.66	233.29
7	630.00	234.68
8	635.00	234.72
9	639.00	234.30
10	644.00	233.26
11	736.26	213.92
12	755.92	213.78
13	795.75	212.28
14	801.73	210.28

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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----- Profile Line No. 3 - Material Type (Number): 3 -----

Description: Native Surface

Point	X	Y
1	0.00	231.97
2	241.36	231.97
3	255.37	232.53
4	329.12	231.94
5	358.71	230.82
6	439.66	231.29
7	630.00	232.68
8	635.00	232.72
9	639.00	232.30
10	644.00	231.26
11	736.26	211.92
12	755.92	211.78
13	801.73	210.28
14	830.35	210.72
15	842.27	210.99
16	860.50	210.99
17	866.54	211.81
18	886.08	218.09
19	904.75	224.54
20	924.03	230.91
21	958.79	233.09
22	975.42	234.03
23	998.38	233.93

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- DATA FOR MATERIAL NUMBER 1 -----

Description: Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 2 -----

Description: Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	700.0	454.6
3	4200.0	1942.8
4	5000.0	2183.7

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 3 -----

Description: Natural Soil (GP Dense to Very Dense)

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- Piezometric Line Number 1 -----

Description: Piezometric line 1
Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	210.00
2	1000.00	210.00

----- Piezometric Line Number 2 -----

Description: Piezometric line 2
Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	232.97
2	241.36	232.97
3	255.37	233.53
4	329.12	232.94
5	358.71	231.82
6	439.66	232.29
7	630.00	233.68
8	635.00	233.72
9	639.00	233.30
10	644.00	232.25
11	736.26	212.92
12	755.92	212.78
13	798.74	211.28
14	801.73	210.28

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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Name of input data file:

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MSB CELL 3

TABLE NO. 8

* NEW INTERPOLATION DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Input Point No.	Assigned Point No.	X	Y	Variable	Material Type
1	1	200.00	253.00	0.0 Pore Pressure	1
2	2	300.00	253.00	0.0 Pore Pressure	1
3	3	400.00	253.00	0.0 Pore Pressure	1
4	4	450.00	253.00	0.0 Pore Pressure	1
5	5	539.15	253.00	0.0 Pore Pressure	1
6	6	569.06	253.00	0.0 Pore Pressure	1
7	7	540.00	253.00	0.0 Pore Pressure	1
8	8	200.00	233.00	1248.0 Pore Pressure	1
9	9	300.00	233.00	1248.0 Pore Pressure	1
10	10	400.00	233.00	1248.0 Pore Pressure	1
11	11	450.00	233.00	1248.0 Pore Pressure	1
12	12	539.06	233.00	1248.0 Pore Pressure	1
13	13	658.79	233.00	1248.0 Pore Pressure	1
14	14	540.00	233.00	0.0 Pore Pressure	1
15	15	200.00	293.00	0.0 Pore Pressure	1
16	16	300.00	293.00	0.0 Pore Pressure	1
17	17	350.00	293.00	0.0 Pore Pressure	1
18	18	400.00	293.00	0.0 Pore Pressure	1
19	19	450.00	293.00	0.0 Pore Pressure	1
20	20	449.43	293.00	0.0 Pore Pressure	1
21	21	524.43	293.00	0.0 Pore Pressure	1
22	22	200.00	273.00	1248.0 Pore Pressure	1
23	23	300.00	273.00	1248.0 Pore Pressure	1
24	24	350.00	273.00	1248.0 Pore Pressure	1
25	25	400.00	273.00	1248.0 Pore Pressure	1
26	26	450.00	273.00	1248.0 Pore Pressure	1
27	27	539.15	273.00	1248.0 Pore Pressure	1
28	28	540.00	273.00	0.0 Pore Pressure	1
29	29	614.16	273.00	0.0 Pore Pressure	1
30	30	200.00	272.50	0.0 Pore Pressure	1
31	31	300.00	272.50	0.0 Pore Pressure	1
32	32	350.00	272.50	0.0 Pore Pressure	1
33	33	400.00	272.50	0.0 Pore Pressure	1
34	34	450.00	272.50	0.0 Pore Pressure	1

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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35	35	539.15	272.50	0.0 Pore Pressure	1
36	36	540.00	272.50	0.0 Pore Pressure	1
37	37	216.90	334.48	0.0 Pore Pressure	1
38	38	300.00	331.15	0.0 Pore Pressure	1
39	39	364.09	328.58	0.0 Pore Pressure	1
40	40	450.00	325.13	0.0 Pore Pressure	1
41	41	435.25	325.72	0.0 Pore Pressure	1
42	42	450.00	323.84	0.0 Pore Pressure	1
43	43	462.09	323.84	0.0 Pore Pressure	1
44	44	801.73	210.28	0.0 Pore Pressure	1

Number of new interpolation points read: 44

Number of old interpolation points retained: 0

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	364.09	328.58	angle to be computed - moveable
2	439.66	232.29	angle to be computed - moveable
3	630.00	233.68	- fixed
4	635.00	233.72	- fixed
5	639.00	233.30	- fixed
6	644.00	232.26	- fixed
7	736.26	212.92	- fixed
8	755.92	212.78	- fixed
9	798.74	211.28	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 10.000

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 0.00

The following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	241.36	333.50
6	255.37	332.94
7	329.12	329.98
8	358.71	328.80
9	364.09	328.58
10	435.25	325.72
11	439.66	325.41
12	462.09	323.84
13	630.00	267.70
14	635.00	266.03
15	639.00	264.69
16	644.00	263.02
17	736.26	232.17
18	755.92	225.60
19	795.75	212.28
20	801.73	210.28
21	830.35	210.72
22	842.27	210.99
23	860.50	210.99
24	866.54	211.81
25	886.08	218.09
26	904.75	224.54
27	924.03	230.91
28	958.79	233.09
29	975.42	234.03
30	998.38	233.93

Left end point on noncircular shear surface adjusted to:

X: 372.19, Y: 318.26

Adjustment was made to put end point at bottom of crack.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Noncircular Shear Surface Points After End Point Adjustment

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	372.19	318.26	angle to be computed - moveable
2	439.66	232.29	angle to be computed - moveable
3	630.00	233.68	- fixed
4	635.00	233.72	- fixed
5	639.00	233.30	- fixed
6	644.00	232.26	- fixed
7	736.26	212.92	- fixed
8	755.92	212.78	- fixed
9	798.74	211.28	- fixed

Computed crack depth: 10.00

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X:	372.19	Y:	318.26
X:	439.66	Y:	232.29
X:	630.00	Y:	233.68
X:	635.00	Y:	233.72
X:	639.00	Y:	233.30
X:	644.00	Y:	232.26
X:	736.26	Y:	212.92
X:	755.92	Y:	212.78
X:	798.74	Y:	211.28

Minimum factor of safety: 2.537

Side force inclination: -0.00

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 2

Total number of shear surfaces attempted: 10

Total number of shear surfaces for which the factor of safety was successfully calculated: 10

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	2	3.974	2.5365	5	5
2	5.0000	1	5.000	2.5365	10	10

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	372.19	318.26					
	376.70	312.52	7007	1	100.0	35.00	0.0
	381.20	306.78					
2	385.71	301.04	12014	1	100.0	35.00	0.0
	390.21	295.30					
3	394.71	289.56	17020	1	100.0	35.00	214.5
	399.22	283.82					
4	403.72	278.09	22026	1	100.0	35.00	930.6
	408.23	272.35					
5	412.73	266.61	27033	1	100.0	35.00	0.0
	417.23	260.87					
6	421.74	255.13	32039	1	100.0	35.00	0.0
	426.24	249.39					
7	430.75	243.66	37046	1	100.0	35.00	583.1
	435.25	237.92					
8	437.07	235.60	16346	1	100.0	35.00	1085.6
	438.88	233.29					
9	439.27	232.79	3647	2	NONLINEAR ENVELOPE		0.0
	439.66	232.29					
10	445.27	232.33	52749	2	NONLINEAR ENVELOPE		0.0
	450.88	232.37					
11	456.48	232.42	52263	2	NONLINEAR ENVELOPE		0.0
	462.09	232.46					
12	469.09	232.51	63244	2	NONLINEAR ENVELOPE		0.0
	476.08	232.56					
13	483.08	232.61	59899	2	NONLINEAR ENVELOPE		0.0
	490.08	232.66					
14	497.07	232.71	56555	2	NONLINEAR ENVELOPE		0.0
	504.07	232.76					
15	511.06	232.81	53210	2	NONLINEAR ENVELOPE		0.0
	518.06	232.86					
16	525.06	232.92	49866	2	NONLINEAR ENVELOPE		0.0

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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	532.05	232.97				
17	539.05	233.02	46522	2	NONLINEAR ENVELOPE	0.0
	546.05	233.07				
18	553.04	233.12	43177	2	NONLINEAR ENVELOPE	0.0
	560.04	233.17				
19	567.03	233.22	39833	2	NONLINEAR ENVELOPE	0.0
	574.03	233.27				
20	581.03	233.32	36488	2	NONLINEAR ENVELOPE	0.0
	588.02	233.37				
21	595.02	233.42	33144	2	NONLINEAR ENVELOPE	0.0
	602.02	233.48				
22	609.01	233.53	29799	2	NONLINEAR ENVELOPE	0.0
	616.01	233.58				
23	623.00	233.63	26455	2	NONLINEAR ENVELOPE	0.0
	630.00	233.68				
24	632.50	233.70	8642	2	NONLINEAR ENVELOPE	0.0
	635.00	233.72				
25	637.00	233.51	6650	2	NONLINEAR ENVELOPE	0.0
	639.00	233.30				
26	641.50	232.78	8120	2	NONLINEAR ENVELOPE	0.0
	644.00	232.26				
27	650.59	230.87	20657	2	NONLINEAR ENVELOPE	0.0
	657.18	229.49				
28	663.77	228.11	19573	2	NONLINEAR ENVELOPE	0.0
	670.36	226.73				
29	676.95	225.35	18489	2	NONLINEAR ENVELOPE	0.0
	683.54	223.97				
30	690.13	222.59	17405	2	NONLINEAR ENVELOPE	0.0
	696.72	221.21				
31	703.31	219.82	16321	2	NONLINEAR ENVELOPE	0.0
	709.90	218.44				
32	716.49	217.06	15237	2	NONLINEAR ENVELOPE	0.0
	723.08	215.68				
33	729.67	214.30	14153	2	NONLINEAR ENVELOPE	0.0
	736.26	212.92				
34	741.18	212.88	9360	2	NONLINEAR ENVELOPE	0.0
	746.09	212.85				
35	751.01	212.81	7779	2	NONLINEAR ENVELOPE	0.0
	755.92	212.78				
36	762.56	212.55	8104	2	NONLINEAR ENVELOPE	0.0
	769.20	212.31				
37	775.83	212.08	5433	2	NONLINEAR ENVELOPE	0.0
	782.47	211.85				
38	789.11	211.62	2762	2	NONLINEAR ENVELOPE	0.0
	795.75	211.39				
39	797.24	211.34	161	2	NONLINEAR ENVELOPE	0.0
	798.74	211.28				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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B-B'\MSB Section B-B' - Non Circular - Corp.input-utexas

MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Trial No. 1 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	3.477e+004	-0.541
Reduced value - Delta was too large			-0.500
2	2.50000	-3.245e+003	0.036
3	2.53606	-4.250e+001	0.000
4	2.53654	-7.479e-003	0.000

After trial 1 the following changes were computed for the nonlinear strength envelopes:

Maximum change in shear strength: 0.000 (percent)

Maximum change occurred for slice 22

Normal stress where max. change occurred: 2132.72

Old strength at this slice: 1063.79

New strength at this slice: 1063.79

Strengths from nonlinear envelope have converged.

Final computations will be performed next.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	3.477e+004	-0.541
Reduced value - Delta was too large			-0.500
2	2.50000	-3.245e+003	0.036
3	2.53606	-4.250e+001	0.000
4	2.53654	-7.479e-003	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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Name of input data file:

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B-B'\MSB Section B-B' - Non Circular - Corp.input-utexas

MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 7.82951e-011

Summation of Vertical Forces: 9.91633e-011

Mohr Coulomb Shear Force/Shear Strength Check Summation: 7.12427e-003

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *
* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 2.537 Side Force Inclination: -0.00

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	376.70	312.52	538.3	538.3	188.0
2	385.71	301.04	949.5	949.5	301.5
3	394.71	289.56	1416.4	1202.0	371.2
4	403.72	278.09	2013.9	1083.3	338.5
5	412.73	266.61	2182.9	2182.9	642.0
6	421.74	255.13	2594.1	2594.1	755.5
7	430.75	243.66	3157.0	2573.9	749.9
8	437.07	235.60	3574.2	2488.6	726.4
9	439.27	232.79	3781.1	3781.1	695.7
10	445.27	232.33	4710.4	4710.4	826.5
11	456.48	232.42	4667.0	4667.0	821.4
12	469.09	232.51	4525.7	4525.7	804.6
13	483.08	232.61	4286.5	4286.5	776.2
14	497.07	232.71	4047.2	4047.2	740.3
15	511.06	232.81	3807.9	3807.9	700.2
16	525.06	232.92	3568.6	3568.6	660.1
17	539.05	233.02	3329.3	3329.3	620.0
18	553.04	233.12	3090.0	3090.0	579.8
19	567.03	233.22	2850.7	2850.7	539.7
20	581.03	233.32	2611.3	2611.3	499.6
21	595.02	233.42	2372.0	2372.0	459.5
22	609.01	233.53	2132.7	2132.7	419.4
23	623.00	233.63	1893.4	1893.4	379.3
24	632.50	233.70	1731.0	1731.0	352.0
25	637.00	233.51	1628.1	1628.1	334.8
26	641.50	232.78	1556.3	1556.3	322.8
27	650.59	230.87	1501.5	1501.5	313.6
28	663.77	228.11	1422.0	1422.0	300.3

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

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29	676.95	225.35	1342.6	1342.6	286.9
30	690.13	222.59	1263.1	1263.1	273.6
31	703.31	219.82	1183.7	1183.7	260.3
32	716.49	217.06	1104.3	1104.3	247.0
33	729.67	214.30	1024.8	1024.8	233.7
34	741.18	212.88	950.7	950.7	221.2
35	751.01	212.81	790.1	790.1	194.3
36	762.56	212.55	605.1	605.1	154.9
37	775.83	212.08	405.7	405.7	103.9
38	789.11	211.62	206.2	206.2	52.8
39	797.24	211.34	53.3	53.3	13.6

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 60

* Final Results for Side Forces Between Slices *
* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Slice No.	X-Right	Resultant			
		Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	381.20	4485	-0.00	4485	-0
2	390.21	12665	-0.00	12665	-0
3	399.22	25578	-0.00	25578	-0
4	408.23	45643	-0.00	45643	-0
5	417.23	64913	-0.00	64913	-0
6	426.24	87879	-0.00	87879	-0
7	435.25	117356	-0.00	117356	-0
8	438.88	131259	-0.00	131259	-0
9	439.66	134480	-0.00	134480	-0
10	450.88	124828	-0.00	124828	-0
11	462.09	115237	-0.00	115237	-0
12	476.08	103517	-0.00	103517	-0
13	490.08	92220	-0.00	92220	-0
14	504.07	81448	-0.00	81448	-0
15	518.06	71263	-0.00	71263	-0
16	532.05	61663	-0.00	61663	-0
17	546.05	52649	-0.00	52649	-0
18	560.04	44221	-0.00	44221	-0
19	574.03	36378	-0.00	36378	-0
20	588.02	29121	-0.00	29121	-0
21	602.02	22450	-0.00	22450	-0
22	616.01	16364	-0.00	16364	-0
23	630.00	10864	-0.00	10864	-0
24	635.00	9041	-0.00	9041	-0
25	639.00	8374	-0.00	8374	-0
26	644.00	8391	-0.00	8391	-0
27	657.18	8405	-0.00	8405	-0
28	670.36	8376	-0.00	8376	-0
29	683.54	8302	-0.00	8302	-0
30	696.72	8185	-0.00	8185	-0
31	709.90	8024	-0.00	8024	-0

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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32	723.08	7819	-0.00	7819	-0
33	736.26	7570	-0.00	7570	-0
34	746.09	5462	-0.00	5462	-0
35	755.92	3608	-0.00	3608	-0
36	769.20	1831	-0.00	1831	-0
37	782.47	641	-0.00	641	-0
38	795.75	35	-0.00	35	-0
39	798.74	-0	-0.00	-0	0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: C-C' Case: Non Circular - Peak Liner Strength

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates

x	y
523.86	312.67
602.96	198.78
640.44	196.35 fixed
648.54	196.87 fixed
738.7	193.17 fixed
796.77	192.99 fixed
872.91	196.17 fixed

Shifting Points

10
5

Adjustments

Crack Depth

4

Seismic Acceleration

Minimum Weight

5000

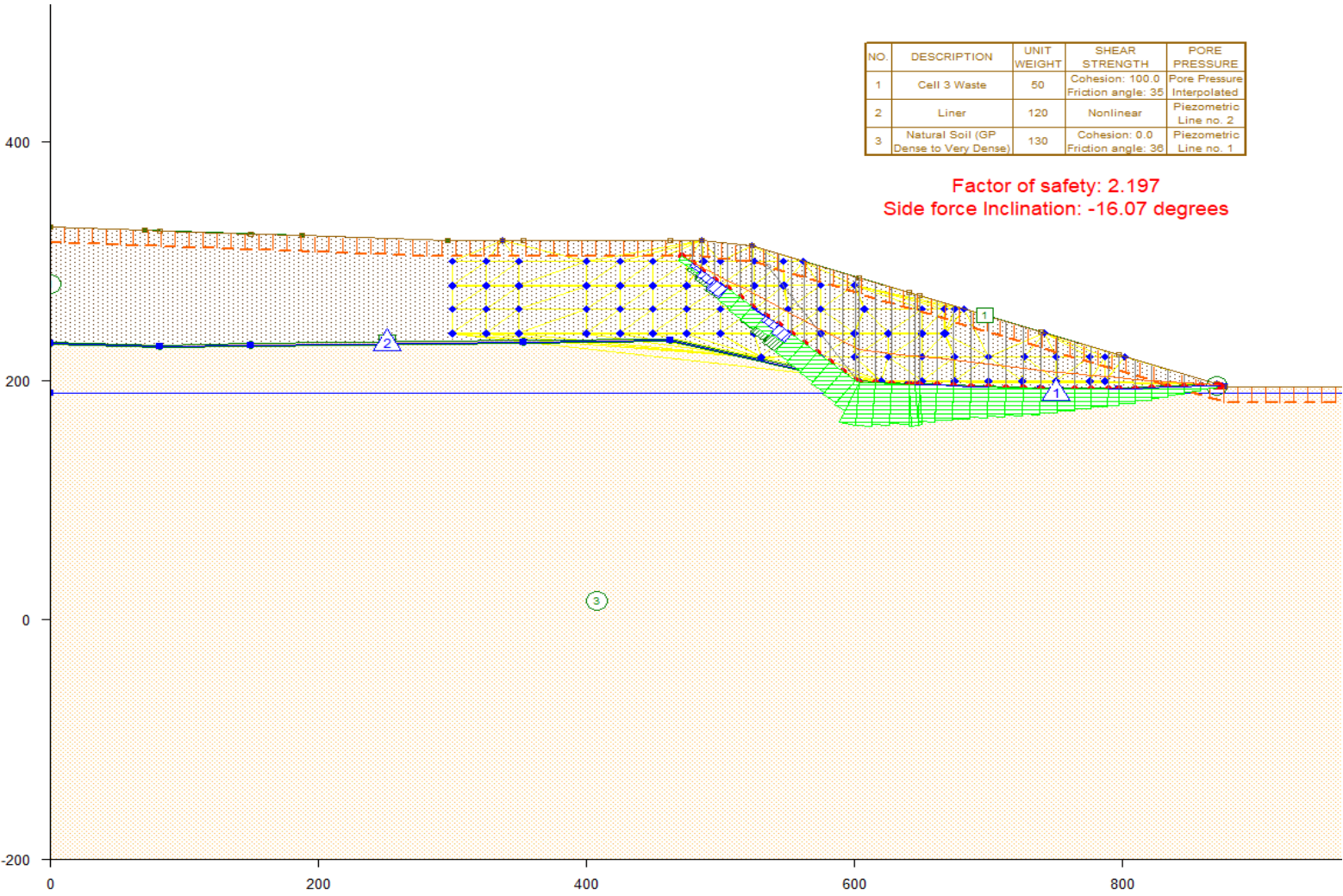
Results

Noncircular Shear Surface

510.38	310.21
602.96	198.78
640.44	196.35
648.54	196.87
738.7	193.17
796.77	192.99
872.91	196.17

Factor of Safety

2.197



Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section C-C' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 1 of 6

English units

Heading follows -MSB

CELL 3

Profile line data follow -

1 1 Cell 5 Surface

0 328.8926

71.051 326.0616

188.5248 321.3252

296.7885 317.0329

337.8051 317.0858

486.3848 316.9548

523.8643 312.6729

869.918712 197.1749

2 2 Liner

0 232.1147

82.3776 229.8661

149.6914 230.9902

353.4471 233.6161

462.8547 235.1779

602.9616 199.777

640.4418 197.3469

648.5372 197.872

738.6968 194.1687

796.7718 193.9902

869.918712 197.1749

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section C-C' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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875.9111 195.1749

3 3 Native Surface

0 230.1147

82.3776 227.8661

149.6914 228.9902

353.4471 231.6161

462.8547 233.1779

602.9616 197.777

640.4418 195.3469

648.5372 195.872

738.6968 192.1687

796.7718 191.9902

875.9111 195.1749

1500 195.2685

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Interpolate Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0.0

0.0

700 454.6

4200 1942.8

5000 2183.7

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section C-C' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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```
Piezometric Line
2
  3 Natural Soil (GP Dense to Very Dense)
    130.00 = unit weight
    Conventional
      0.0          36.0
Piezometric Line
1
PIEzometric line data follow -
  1    62.40 Piezometric line 1
      0.000000      190.000000
      1500.000000    190.000000
  2    62.40 Piezometric line 2

0 231.1147

82.3776 228.8661

149.6914 229.9902

353.4471 232.6161

462.8547 234.1779

602.9616 198.777

640.4418 196.3469

648.5372 196.872

738.6968 193.1687

796.7718 192.9902

872.914906 196.1749

875.9111 195.1749

Interpolation Point
P

337.8051 317.0858 0 1 486.3848 316.9548 0

1 523.8643 312.6729 0 1 561.8347653 300 0
```

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section C-C' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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1 681.6825203 260 0 1 741.6063977 240 0 1

801.5302752 220 0 1 869.918712 197.1749 0 1

530 220 0 1 550 220 0 1 575 220 0

1 600 220 0 1 625 220 0 1 650 220

0 1 675 220 0 1 700 220 0 1

726.5302752 220 0 1 750 220 0 1 775 220

0 1 786.4542 220 0 1

530 220 0 1 620 200 1248 1 650 200 1248

1 675 200 1248 1 700 200 1248 1 725 200

1248 1 750 200 1248 1 775 200 1248 1

786.4542 200 1248 1 787 200 0 1

530 219.5 0 1 620 199.5 0 1 650 199.5 0

1 675 199.5 0 1 700 199.5 0 1 725

199.5 0 1 750 199.5 0 1 775 199.5 0 1

786.4542 199.5 0 1 787 199.5 0 1

300 260 0 1 325 260 0 1 350 260 0

1 400 260 0 1 425 260 0 1 450 260

0 1 475 260 0 1 500 260 0 1 525

260 0 1 550 260 0 1 575 260 0 1

606.6825 260 0 1

608 260 0 1 650 260 0 1 666.6064 260

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section C-C' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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0 1 675 260 0 1

300 240 1248 1 325 240 1248 1 350 240 1248

1 400 240 1248 1 425 240 1248 1 450 240

1248 1 475 240 1248 1 500 240 1248 1 525

240 1248 1 550 240 1248 1 575 240 1248 1

600 240 1248 1 625 240 1248 1

650 240 1248 1 666.6064 240 1248 1 668 240

0 1

300 239.5 0 1 325 239.5 0 1 350 239.5 0

1 400 239.5 0 1 425 239.5 0 1 450

239.5 0 1 475 239.5 0 1 500 239.5 0 1

525 239.5 0 1 550 239.5 0 1 575 239.5 0

1 600 239.5 0 1 625 239.5 0 1

650 239.5 0 1 666.6064 239.5 0 1 668

239.5 0 1

300 300 0 1 325 300 0 1 350 300 0

1 400 300 0 1 425 300 0 1 450 300

0 1 475 300 0 1 486.8347653 300 0 1

488 300 0 1 500 300 0 1 525 300 0

1 546.7586428 300 0 1

300 280 1248 1 325 280 1248 1 350 280 1248

1 400 280 1248 1 425 280 1248 1 450 280

1248 1 475 280 1248 1 500 280 1248 1 525

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section C-C' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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280 1248 1 546.7586428 280 1248 1 548 280 0

1 575 280 0 1 600 280 0 1

300 279.5 0 1 325 279.5 0 1 350 279.5 0

1 400 279.5 0 1 425 279.5 0 1 450

279.5 0 1 475 279.5 0 1 500 279.5 0 1

525 279.5 0 1 546.7586428 279.5 0 1 548 280
0 1

ANALYSIS/computation data follow

Noncircular Search 2

523.86 312.67

602.96 198.78

640.44 196.35 fixed

648.54 196.87 fixed

738.7 193.17 fixed

796.77 192.99 fixed

872.91 196.17 fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

13 d

GRAPHICS output file

COMPUTE

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section C-C' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Wed Nov 16 06:41:13 2022

Name of input data file:

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Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to
weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 5 Surface

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	188.52	321.33
4	296.79	317.03
5	337.81	317.09
6	486.38	316.95
7	523.86	312.67
8	869.92	197.17

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	232.11
2	82.38	229.87
3	149.69	230.99
4	353.45	233.62
5	462.85	235.18
6	602.96	199.78
7	640.44	197.35
8	648.54	197.87
9	738.70	194.17
10	796.77	193.99
11	869.92	197.17
12	875.91	195.17

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	230.11
2	82.38	227.87
3	149.69	228.99
4	353.45	231.62
5	462.85	233.18
6	602.96	197.78

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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7	640.44	195.35
8	648.54	195.87
9	738.70	192.17
10	796.77	191.99
11	875.91	195.17
12	1500.00	195.27

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----

-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----

-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	700.0	454.6
3	4200.0	1942.8
4	5000.0	2183.7

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----

-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	231.11
2	82.38	228.87
3	149.69	229.99
4	353.45	232.62
5	462.85	234.18
6	602.96	198.78
7	640.44	196.35
8	648.54	196.87
9	738.70	193.17
10	796.77	192.99
11	872.91	196.17
12	875.91	195.17

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 8

* NEW INTERPOLATION DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Input Point No.	Assigned Point No.	X	Y	Variable	Material Type
1	1	337.81	317.09	0.0 Pore Pressure	1
2	2	486.38	316.95	0.0 Pore Pressure	1
3	3	523.86	312.67	0.0 Pore Pressure	1
4	4	561.83	300.00	0.0 Pore Pressure	1
5	5	681.68	260.00	0.0 Pore Pressure	1
6	6	741.61	240.00	0.0 Pore Pressure	1
7	7	801.53	220.00	0.0 Pore Pressure	1
8	8	869.92	197.17	0.0 Pore Pressure	1
9	9	530.00	220.00	0.0 Pore Pressure	1
10	10	550.00	220.00	0.0 Pore Pressure	1
11	11	575.00	220.00	0.0 Pore Pressure	1
12	12	600.00	220.00	0.0 Pore Pressure	1
13	13	625.00	220.00	0.0 Pore Pressure	1
14	14	650.00	220.00	0.0 Pore Pressure	1
15	15	675.00	220.00	0.0 Pore Pressure	1
16	16	700.00	220.00	0.0 Pore Pressure	1
17	17	726.53	220.00	0.0 Pore Pressure	1
18	18	750.00	220.00	0.0 Pore Pressure	1
19	19	775.00	220.00	0.0 Pore Pressure	1
20	20	786.45	220.00	0.0 Pore Pressure	1
21	21	530.00	220.00	0.0 Pore Pressure	1
22	22	620.00	200.00	1248.0 Pore Pressure	1
23	23	650.00	200.00	1248.0 Pore Pressure	1
24	24	675.00	200.00	1248.0 Pore Pressure	1
25	25	700.00	200.00	1248.0 Pore Pressure	1
26	26	725.00	200.00	1248.0 Pore Pressure	1
27	27	750.00	200.00	1248.0 Pore Pressure	1
28	28	775.00	200.00	1248.0 Pore Pressure	1
29	29	786.45	200.00	1248.0 Pore Pressure	1
30	30	787.00	200.00	0.0 Pore Pressure	1
31	31	530.00	219.50	0.0 Pore Pressure	1
32	32	620.00	199.50	0.0 Pore Pressure	1
33	33	650.00	199.50	0.0 Pore Pressure	1
34	34	675.00	199.50	0.0 Pore Pressure	1
35	35	700.00	199.50	0.0 Pore Pressure	1
36	36	725.00	199.50	0.0 Pore Pressure	1
37	37	750.00	199.50	0.0 Pore Pressure	1
38	38	775.00	199.50	0.0 Pore Pressure	1
39	39	786.45	199.50	0.0 Pore Pressure	1

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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40	40	787.00	199.50	0.0	Pore Pressure	1
41	41	300.00	260.00	0.0	Pore Pressure	1
42	42	325.00	260.00	0.0	Pore Pressure	1
43	43	350.00	260.00	0.0	Pore Pressure	1
44	44	400.00	260.00	0.0	Pore Pressure	1
45	45	425.00	260.00	0.0	Pore Pressure	1
46	46	450.00	260.00	0.0	Pore Pressure	1
47	47	475.00	260.00	0.0	Pore Pressure	1
48	48	500.00	260.00	0.0	Pore Pressure	1
49	49	525.00	260.00	0.0	Pore Pressure	1
50	50	550.00	260.00	0.0	Pore Pressure	1
51	51	575.00	260.00	0.0	Pore Pressure	1
52	52	606.68	260.00	0.0	Pore Pressure	1
53	53	608.00	260.00	0.0	Pore Pressure	1
54	54	650.00	260.00	0.0	Pore Pressure	1
55	55	666.61	260.00	0.0	Pore Pressure	1
56	56	675.00	260.00	0.0	Pore Pressure	1
57	57	300.00	240.00	1248.0	Pore Pressure	1
58	58	325.00	240.00	1248.0	Pore Pressure	1
59	59	350.00	240.00	1248.0	Pore Pressure	1
60	60	400.00	240.00	1248.0	Pore Pressure	1
61	61	425.00	240.00	1248.0	Pore Pressure	1
62	62	450.00	240.00	1248.0	Pore Pressure	1
63	63	475.00	240.00	1248.0	Pore Pressure	1
64	64	500.00	240.00	1248.0	Pore Pressure	1
65	65	525.00	240.00	1248.0	Pore Pressure	1
66	66	550.00	240.00	1248.0	Pore Pressure	1
67	67	575.00	240.00	1248.0	Pore Pressure	1
68	68	600.00	240.00	1248.0	Pore Pressure	1
69	69	625.00	240.00	1248.0	Pore Pressure	1
70	70	650.00	240.00	1248.0	Pore Pressure	1
71	71	666.61	240.00	1248.0	Pore Pressure	1
72	72	668.00	240.00	0.0	Pore Pressure	1
73	73	300.00	239.50	0.0	Pore Pressure	1
74	74	325.00	239.50	0.0	Pore Pressure	1
75	75	350.00	239.50	0.0	Pore Pressure	1
76	76	400.00	239.50	0.0	Pore Pressure	1
77	77	425.00	239.50	0.0	Pore Pressure	1
78	78	450.00	239.50	0.0	Pore Pressure	1
79	79	475.00	239.50	0.0	Pore Pressure	1
80	80	500.00	239.50	0.0	Pore Pressure	1
81	81	525.00	239.50	0.0	Pore Pressure	1
82	82	550.00	239.50	0.0	Pore Pressure	1
83	83	575.00	239.50	0.0	Pore Pressure	1
84	84	600.00	239.50	0.0	Pore Pressure	1
85	85	625.00	239.50	0.0	Pore Pressure	1
86	86	650.00	239.50	0.0	Pore Pressure	1
87	87	666.61	239.50	0.0	Pore Pressure	1
88	88	668.00	239.50	0.0	Pore Pressure	1
89	89	300.00	300.00	0.0	Pore Pressure	1
90	90	325.00	300.00	0.0	Pore Pressure	1
91	91	350.00	300.00	0.0	Pore Pressure	1

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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92	92	400.00	300.00	0.0	Pore Pressure	1
93	93	425.00	300.00	0.0	Pore Pressure	1
94	94	450.00	300.00	0.0	Pore Pressure	1
95	95	475.00	300.00	0.0	Pore Pressure	1
96	96	486.83	300.00	0.0	Pore Pressure	1
97	97	488.00	300.00	0.0	Pore Pressure	1
98	98	500.00	300.00	0.0	Pore Pressure	1
99	99	525.00	300.00	0.0	Pore Pressure	1
100	100	546.76	300.00	0.0	Pore Pressure	1
101	101	300.00	280.00	1248.0	Pore Pressure	1
102	102	325.00	280.00	1248.0	Pore Pressure	1
103	103	350.00	280.00	1248.0	Pore Pressure	1
104	104	400.00	280.00	1248.0	Pore Pressure	1
105	105	425.00	280.00	1248.0	Pore Pressure	1
106	106	450.00	280.00	1248.0	Pore Pressure	1
107	107	475.00	280.00	1248.0	Pore Pressure	1
108	108	500.00	280.00	1248.0	Pore Pressure	1
109	109	525.00	280.00	1248.0	Pore Pressure	1
110	110	546.76	280.00	1248.0	Pore Pressure	1
111	111	548.00	280.00	0.0	Pore Pressure	1
112	112	575.00	280.00	0.0	Pore Pressure	1
113	113	600.00	280.00	0.0	Pore Pressure	1
114	114	300.00	279.50	0.0	Pore Pressure	1
115	115	325.00	279.50	0.0	Pore Pressure	1
116	116	350.00	279.50	0.0	Pore Pressure	1
117	117	400.00	279.50	0.0	Pore Pressure	1
118	118	425.00	279.50	0.0	Pore Pressure	1
119	119	450.00	279.50	0.0	Pore Pressure	1
120	120	475.00	279.50	0.0	Pore Pressure	1
121	121	500.00	279.50	0.0	Pore Pressure	1
122	122	525.00	279.50	0.0	Pore Pressure	1
123	123	546.76	279.50	0.0	Pore Pressure	1
124	124	548.00	280.00	0.0	Pore Pressure	1

Number of new interpolation points read: 124

Number of old interpolation points retained: 0

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	523.86	312.67	angle to be computed - moveable
2	602.96	198.78	angle to be computed - moveable
3	640.44	196.35	- fixed
4	648.54	196.87	- fixed
5	738.70	193.17	- fixed
6	796.77	192.99	- fixed
7	872.91	196.17	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 13.000

-----The
following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	82.38	325.60
4	149.69	322.89
5	188.52	321.33
6	296.79	317.03
7	337.81	317.09
8	353.45	317.07
9	462.85	316.98
10	486.38	316.95
11	523.86	312.67
12	602.96	286.27
13	640.44	273.76
14	648.54	271.06
15	738.70	240.97
16	796.77	221.59
17	869.92	197.17
18	875.91	195.17
19	1500.00	195.27

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 471.45 Y: 303.97

X: 602.96 Y: 198.78

X: 640.44 Y: 196.35

X: 648.54 Y: 196.87

X: 738.70 Y: 193.17

X: 796.77 Y: 192.99

X: 872.93 Y: 196.17

Minimum factor of safety: 2.197

Side force inclination: -16.07

CAUTION - THE FACTOR OF SAFETY WAS NOT COMPUTED WHEN SOME OF THE
POINTS ON THE MOST CRITICAL NONCIRCULAR SHEAR SURFACE WERE SHIFTED.

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 9

Total number of shear surfaces attempted: 45

Total number of shear surfaces for which the factor of safety
was successfully calculated: 36

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	2.3707	5	4
2	10.0000	1	10.000	2.3172	10	8
3	10.0000	1	10.000	2.2748	15	12
4	10.0000	1	10.000	2.2370	20	16
5	10.0000	1	10.000	2.2350	25	20
6	10.0000	1	10.000	2.2233	30	24
7	10.0000	1	1.016	2.2233	35	28
8	5.0000	1	5.000	2.1968	40	32
9	5.0000	1	0.626	2.1968	45	36

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
	471.45	303.97					
1	475.18	300.98	5967	1	100.0	35.00	0.0
	478.92	298.00					
2	482.65	295.01	8195	1	100.0	35.00	311.4
	486.38	292.02					
3	491.07	288.28	13185	1	100.0	35.00	731.6
	495.75	284.53					
4	500.44	280.78	16195	1	100.0	35.00	1199.3
	505.12	277.03					
5	509.81	273.29	19205	1	100.0	35.00	0.0
	514.49	269.54					
6	519.18	265.79	22214	1	100.0	35.00	0.0
	523.86	262.04					
7	528.69	258.18	25538	1	100.0	35.00	113.5
	533.52	254.32					
8	538.35	250.46	27713	1	100.0	35.00	595.6
	543.18	246.59					
9	548.01	242.73	29887	1	100.0	35.00	1077.6
	552.84	238.87					
10	557.67	235.00	32061	1	100.0	35.00	0.0
	562.50	231.14					
11	567.33	227.28	34235	1	100.0	35.00	0.0
	572.16	223.42					
12	576.99	219.55	36410	1	100.0	35.00	0.0
	581.82	215.69					
13	586.65	211.83	38584	1	100.0	35.00	0.0
	591.48	207.96					
14	596.31	204.10	40758	1	100.0	35.00	0.0
	601.14	200.24					
15	602.05	199.51	7999	2	NONLINEAR ENVELOPE		0.0
	602.96	198.78					
16	602.96	198.78	7	2	NONLINEAR ENVELOPE		0.0
	602.96	198.78					
17	609.21	198.37	54475	2	NONLINEAR ENVELOPE		0.0
	615.45	197.97					

Matanuska-Susinta, AK Landfill

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18	621.70	197.56	52376	2	NONLINEAR ENVELOPE	0.0
	627.95	197.16				
19	634.19	196.75	50278	2	NONLINEAR ENVELOPE	0.0
	640.44	196.35				
20	640.44	196.35	7	2	NONLINEAR ENVELOPE	0.0
	640.44	196.35				
21	642.85	196.50	18781	2	NONLINEAR ENVELOPE	0.0
	645.27	196.66				
22	646.90	196.76	12468	2	NONLINEAR ENVELOPE	0.1
	648.54	196.87				
23	648.54	196.87	11	2	NONLINEAR ENVELOPE	0.1
	648.54	196.87				
24	654.95	196.61	47222	2	NONLINEAR ENVELOPE	0.1
	661.35	196.34				
25	667.76	196.08	44819	2	NONLINEAR ENVELOPE	0.1
	674.16	195.82				
26	680.57	195.56	42416	2	NONLINEAR ENVELOPE	0.0
	686.97	195.29				
27	693.38	195.03	40014	2	NONLINEAR ENVELOPE	0.0
	699.79	194.77				
28	706.27	194.50	38064	2	NONLINEAR ENVELOPE	0.0
	712.76	194.23				
29	719.24	193.97	35601	2	NONLINEAR ENVELOPE	0.0
	725.73	193.70				
30	732.21	193.44	33138	2	NONLINEAR ENVELOPE	0.0
	738.70	193.17				
31	738.70	193.17	8	2	NONLINEAR ENVELOPE	0.0
	738.70	193.17				
32	744.97	193.15	29567	2	NONLINEAR ENVELOPE	0.0
	751.25	193.13				
33	757.52	193.11	26964	2	NONLINEAR ENVELOPE	0.0
	763.80	193.09				
34	770.07	193.07	24360	2	NONLINEAR ENVELOPE	0.0
	776.35	193.05				
35	782.62	193.03	21757	2	NONLINEAR ENVELOPE	0.0
	788.89	193.01				
36	792.83	193.00	12327	2	NONLINEAR ENVELOPE	0.0
	796.77	192.99				
37	796.77	192.99	3	2	NONLINEAR ENVELOPE	0.0
	796.77	192.99				
38	802.87	193.24	16900	2	NONLINEAR ENVELOPE	0.0
	808.96	193.50				
39	815.06	193.75	14127	2	NONLINEAR ENVELOPE	0.1
	821.15	194.01				
40	827.25	194.26	11355	2	NONLINEAR ENVELOPE	0.1
	833.35	194.52				
41	839.44	194.77	8583	2	NONLINEAR ENVELOPE	0.2
	845.54	195.03				
42	851.63	195.28	5811	2	NONLINEAR ENVELOPE	0.2
	857.73	195.54				
43	863.82	195.79	3039	2	NONLINEAR ENVELOPE	0.3
	869.92	196.05				

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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44	871.42	196.11	204	2	NONLINEAR ENVELOPE	0.3
	872.91	196.17				
45	872.92	196.17	0	2	NONLINEAR ENVELOPE	0.1
	872.93	196.17				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of *

* Safety and Side Force Inclination by Spencer's Procedure *

Trial No. 1 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Allowable moment imbalance for convergence: 6470

	Trial	Trial				
	Factor	Side Force	Force	Moment		Delta
Iter-	of	Inclination	Imbalance	Imbalance	Delta-F	Theta
ation	Safety	(degrees)	(lbs.)	(ft.-lbs.)		(degrees)
1	3.00000	-17.1887	-6.737e+004	2.602e+007		
First-order corrections to F and Theta					-1.0342	-1.8457
Reduced values - Deltas were too large					-0.5000	-0.8923
2	2.50000	-18.0810	-2.844e+004	1.060e+007		
First-order corrections to F and Theta					-0.3970	5.9595
Reduced values - Deltas were too large					-0.1909	2.8648
3	2.30914	-15.2163	-1.350e+004	5.392e+006		
First-order corrections to F and Theta					-0.1120	-1.2820
Second-order corrections to F and Theta					-0.1115	-0.8691
4	2.19764	-16.0853	3.513e+001	-1.826e+004		
First-order corrections to F and Theta					0.0002	0.0118
Second-order corrections to F and Theta					0.0002	0.0118
5	2.19780	-16.0735	-1.622e-006	8.971e-004		
First-order corrections to F and Theta					-0.0000	-0.0000

After trial 1 the following changes were computed for the nonlinear
strength envelopes:

Maximum change in shear strength: -0.879 (percent)

Maximum change occurred for slice 20

Normal stress where max. change occurred: 4341.96

Old strength at this slice: 2003.16

New strength at this slice: 1985.55

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of *
* Safety and Side Force Inclination by Spencer's Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Allowable moment imbalance for convergence: 6470

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iteration	1	3.00000	-17.1887	-6.740e+004	2.603e+007	
First-order corrections to F and Theta					-1.0361	-1.8532
Reduced values - Deltas were too large					-0.5000	-0.8944
Iteration	2	2.50000	-18.0831	-2.853e+004	1.063e+007	
First-order corrections to F and Theta					-0.3984	6.0127
Reduced values - Deltas were too large					-0.1898	2.8648
Iteration	3	2.31020	-15.2183	-1.368e+004	5.459e+006	
First-order corrections to F and Theta					-0.1143	-1.2794
Second-order corrections to F and Theta					-0.1136	-0.8621
Iteration	4	2.19660	-16.0804	3.652e+001	-1.890e+004	
First-order corrections to F and Theta					0.0002	0.0121
Second-order corrections to F and Theta					0.0002	0.0121
Iteration	5	2.19677	-16.0683	-1.759e-006	9.757e-004	
First-order corrections to F and Theta					-0.0000	-0.0000

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TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *

* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 1.01680e-010

Summation of Vertical Forces: 7.14167e-011

Summation of Moments: -3.67296e-008

Mohr Coulomb Shear Force/Shear Strength Check Summation: 3.74039e-011

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 2.197 Side Force Inclination: -16.07

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear Stress
			Normal Stress	Normal Stress	
1	475.18	300.98	556.8	556.8	223.0
2	482.65	295.01	807.3	495.8	203.6
3	491.07	288.28	1078.8	347.1	156.2
4	500.44	280.78	1364.0	164.7	98.0
5	509.81	273.29	1454.1	1454.1	509.0
6	519.18	265.79	1684.6	1684.6	582.5
7	528.69	258.18	1893.9	1780.4	613.0
8	538.35	250.46	2111.9	1516.3	528.8
9	548.01	242.73	2329.8	1252.2	444.6
10	557.67	235.00	2365.2	2365.2	799.4
11	567.33	227.28	2526.7	2526.7	850.9
12	576.99	219.55	2688.3	2688.3	902.4
13	586.65	211.83	2849.8	2849.8	953.9
14	596.31	204.10	3011.3	3011.3	1005.4
15	602.05	199.51	3273.4	3273.4	705.0
16	602.96	198.78	4567.9	4567.9	934.8
17	609.21	198.37	4482.8	4482.8	923.2
18	621.70	197.56	4312.8	4312.8	899.9
19	634.19	196.75	4142.1	4142.1	873.2
20	640.44	196.35	4339.0	4339.0	903.4
21	642.85	196.50	4287.6	4287.6	896.4
22	646.90	196.76	4201.5	4201.5	884.6
23	648.54	196.87	4166.0	4165.8	877.8
24	654.95	196.61	3841.8	3841.7	815.0
25	667.76	196.08	3647.3	3647.2	777.4
26	680.57	195.56	3452.8	3452.7	739.7
27	693.38	195.03	3258.2	3258.2	702.1
28	706.27	194.50	3062.5	3062.5	664.2
29	719.24	193.97	2865.5	2865.5	626.1
30	732.21	193.44	2668.6	2668.6	588.0
31	738.70	193.17	2570.1	2570.1	568.9
32	744.97	193.15	2512.9	2512.9	557.8
33	757.52	193.11	2293.6	2293.6	515.4
34	770.07	193.07	2074.2	2074.2	472.9
35	782.62	193.03	1854.9	1854.9	430.5

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36	792.83	193.00	1676.4	1676.4	395.9
37	796.77	192.99	1648.6	1648.6	390.5
38	802.87	193.24	1525.5	1525.5	366.7
39	815.06	193.75	1279.5	1279.4	319.1
40	827.25	194.26	1033.4	1033.3	271.4
41	839.44	194.77	787.3	787.2	223.8
42	851.63	195.28	535.3	535.1	158.2
43	863.82	195.79	279.9	279.6	82.7
44	871.42	196.11	76.4	76.1	22.5
45	872.92	196.17	0.3	0.2	0.0

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Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 59

* Final Results for Side Forces and Stresses Between Slices *

* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----						
Slice		Y-Coord. of	Fraction	Sigma	Sigma	
No.	X-Right	Side Force	of Height	at Top	at Bottom	
1	478.92	1728	299.91	0.101	-122.2	297.2
2	486.38	5163	295.21	0.128	-245.3	643.3
3	495.75	12054	289.32	0.153	-400.1	1138.9
4	505.12	21736	283.42	0.169	-545.1	1650.9
5	514.49	28114	278.73	0.208	-460.1	1682.4
6	523.86	35573	273.60	0.228	-425.8	1776.2
7	533.52	44637	267.97	0.248	-400.3	1956.4
8	543.18	56301	261.85	0.256	-422.1	2236.6
9	552.84	70563	255.48	0.259	-471.2	2585.7
10	562.50	81544	250.13	0.277	-388.3	2671.6
11	572.16	93305	244.64	0.290	-317.1	2768.9
12	581.82	105848	239.05	0.301	-254.9	2875.0
13	591.48	119172	233.38	0.309	-199.9	2988.2
14	601.14	133277	227.65	0.316	-150.7	3106.9
15	602.96	136907	226.38	0.315	-161.0	3168.2
16	602.96	136906	226.38	0.315	-161.0	3168.2
17	615.45	128682	224.46	0.315	-163.0	3102.5
18	627.95	120619	222.54	0.314	-164.8	3034.7
19	640.44	112758	220.61	0.313	-167.3	2966.6
20	640.44	112756	220.61	0.313	-167.3	2966.6
21	645.27	106873	220.51	0.316	-142.0	2862.6
22	648.54	102944	220.46	0.318	-123.2	2789.9
23	648.54	102941	220.46	0.318	-123.2	2789.8
24	661.35	94177	218.82	0.319	-110.4	2679.9
25	674.16	85808	217.16	0.320	-98.6	2571.3
26	686.97	77835	215.50	0.321	-87.9	2464.5
27	699.79	70257	213.82	0.322	-78.8	2360.0
28	712.76	62988	212.09	0.322	-71.8	2257.1
29	725.73	56124	210.35	0.323	-67.7	2158.1
30	738.70	49666	208.56	0.322	-67.5	2064.4
31	738.70	49664	208.56	0.322	-67.5	2064.4
32	751.25	42481	207.25	0.323	-55.4	1925.8
33	763.80	35844	205.92	0.325	-45.0	1788.9
34	776.35	29752	204.57	0.326	-37.3	1654.7
35	788.89	24206	203.18	0.326	-33.8	1524.7
36	796.77	21003	202.29	0.325	-34.5	1446.0

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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37	796.77	21003	202.29	0.325	-34.5	1445.9
38	808.96	15542	201.34	0.326	-25.9	1269.4
39	821.15	10816	200.38	0.327	-18.8	1087.9
40	833.35	6824	199.41	0.329	-10.8	893.1
41	845.54	3568	198.53	0.341	15.0	651.6
42	857.73	1277	197.70	0.380	59.9	370.2
43	869.92	80	196.54	0.437	42.5	93.8
44	872.91	0	196.17	0.439	0.1	0.2
45	872.93	0	196.17	1.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: D-D' Case: Non Circular - Peak Liner Strength

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates Shifting Points

x	y	
462.92	332.87	10
582.57	199.08	5
609.56	200.08	fixed
658.23	199.94	fixed
730.21	197.07	fixed
806.28	198.05	fixed
863	199.68	fixed
866	198.68	fixed

Crack Depth 8

Seismic Acceleration

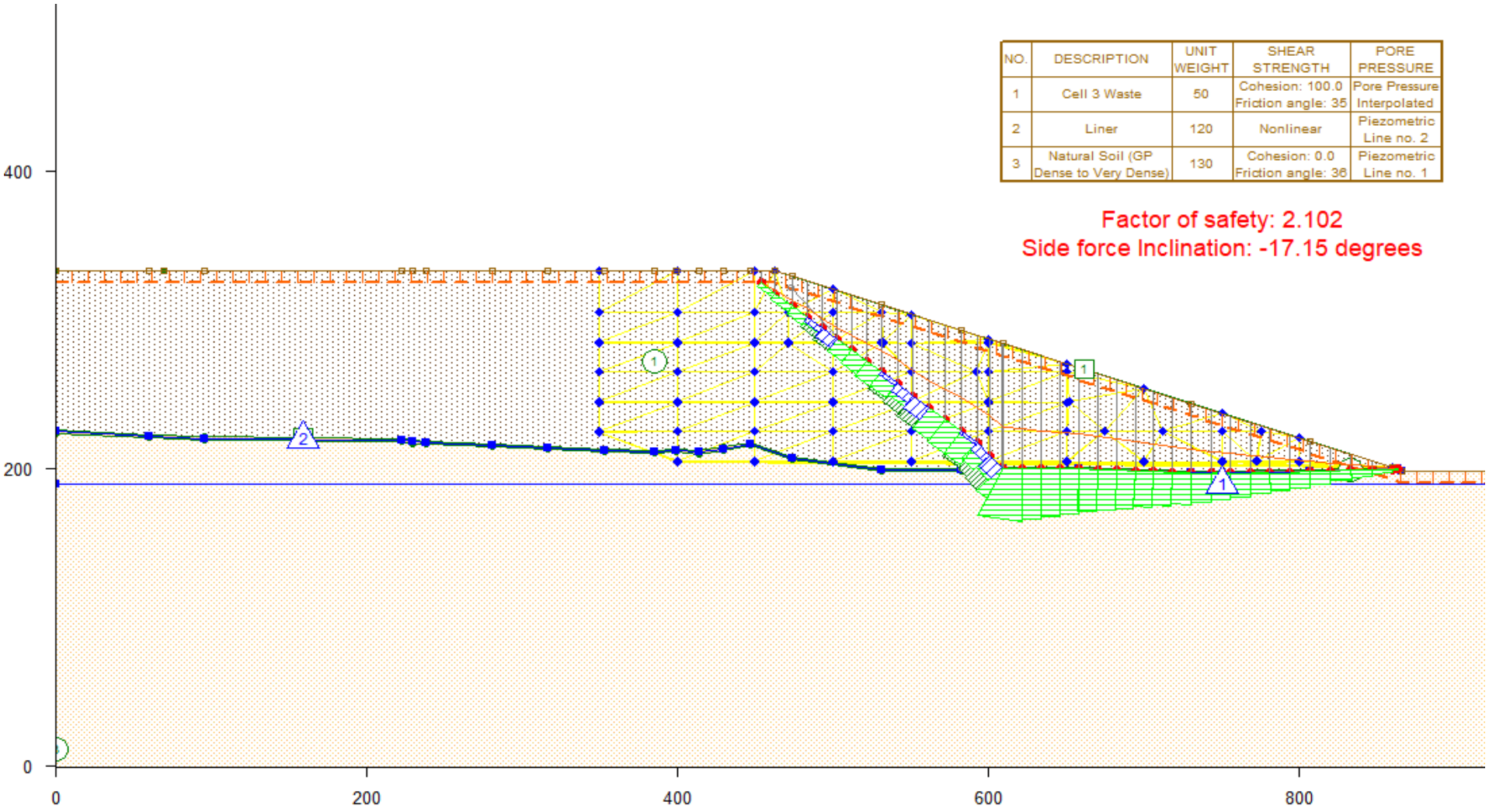
Minimum Weight
5000

Results

Noncircular Shear Surface

482.59	318.32
582.57	199.08
609.56	200.08
658.23	199.94
730.21	197.07
806.28	198.05
863	199.68

Factor of Safety
2.102



Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section D-D' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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English units

Heading follows -MSB

CELL 3

Profile line data follow -

1 1 Cell 5 Surface

0 333.4446

70.2135 333.2671

462.9171 332.8662

859.9918497 200.6787

2 2 Liner

0 225.941

60.295 222.8622

96.3755 221.4547

222.67 219.9925

229.574 218.9521

238.2127 218.2238

281.1197 216.7649

317.0974 215.141

353.4706 213.1896

385.299 212.1641

399.5351 213.1354

414.0331 211.9903

429.8377 214.4455

446.6344 217.3867

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section D-D' Non-Circular-Peak_input (wilson)

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474.0832 208.2405

531.0248 200.0882

582.5672 200.0792

609.5593 201.0805

658.2285 200.9409

730.2071 198.071

806.2818 199.0468

859.9918497 200.6787

862.9957248 199.6787

865.9996 198.6787

3 3 Native Surface

0 223.941

60.295 220.8622

96.3755 219.4547

222.67 217.9925

229.574 216.9521

238.2127 216.2238

281.1197 214.7649

317.0974 213.141

353.4706 211.1896

385.299 210.1641

399.5351 211.1354

414.0331 209.9903

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section D-D' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 3 of 7

429.8377 212.4455

446.6344 215.3867

474.0832 206.2405

531.0248 198.0882

582.5672 198.0792

609.5593 199.0805

658.2285 198.9409

730.2071 196.071

806.2818 197.0468

865.9996 198.6787

1500 199.105

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0 35.0

Interpolated Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0.0 0.0

700 454.6

4200 1942.8

5000 2183.7

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0 36.0

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section D-D' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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Piezometric Line

1

PIEzometric line data follow -

1	62.40	Piezometric line 1	
		0.000000	190.000000
		1500.000000	190.000000
2	62.40	Piezometric line 2	

0 224.941

60.295 221.8622

96.3755 220.4547

222.67 218.9925

229.574 217.9521

238.2127 217.2238

281.1197 215.7649

317.0974 214.141

353.4706 212.1896

385.299 211.1641

399.5351 212.1354

414.0331 210.9903

429.8377 213.4455

446.6344 216.3867

474.0832 207.2405

531.0248 199.0882

582.5672 199.0792

609.5593 200.0805

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section D-D' Non-Circular-Peak_input (wilson)

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658.2285 199.9409

730.2071 197.071

806.2818 198.0468

862.9957248 199.6787

865.9996 198.6787

Interpolation Point

P

350 332.9814739 0 1 400 332.9304303 0 1 450

332.8793867 0 1 462.9171 332.8662 0 1 500

320.5211797 0 1 550 303.876014 0 1 600

287.2308483 0 1 650 270.5856826 0 1 700

253.9405169 0 1 750 237.2953512 0 1 800

220.6501856 0 1 859.9918497 200.6787 0 1

350 225 0 1 400 225 0 1 450 225 0

1 500 225 0 1 550 225 0 1 600 225

0 1 650 225 0 1 675 225 0 1

711.9336598 225 0 1 750 225 0 1 775 225

0 1

350 225 0 1 400 205 1248 1 450 205 1248

1 500 205 1248 1 550 205 1248 1 600 205

1248 1 650 205 1248 1 700 205 1248 1 750

205 1248 1 772.0111558 205 1248 1 773 205 0

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section D-D' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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1 800 205 0 1

350 224.5 0 1 400 204.5 0 1 450 204.5 0

1 500 204.5 0 1 550 204.5 0 1 600

204.5 0 1 650 204.5 0 1 700 204.5 0 1

750 204.5 0 1 800 204.5 0 1

350 265 0 1 400 265 0 1 450 265 0

1 500 265 0 1 550 265 0 1 591.7786679

265 0 1 600 265 0 1 650 265 0 1

350 245 1248 1 400 245 1248 1 450 245 1248

1 500 245 1248 1 550 245 1248 1 600 245

1248 1 651.8561639 245 1248 1 652 245 0 1

350 244.5 0 1 400 244.5 0 1 450 244.5 0

1 500 244.5 0 1 550 244.5 0 1 600

244.5 0 1 650 244.5 0 1

350 305 0 1 400 305 0 1 450 305 0

1 471.6236759 305 0 1 500 305 0 1

531.7011719 305 0 1

350 285 1248 1 400 285 1248 1 450 285 1248

1 471.6236759 285 1248 1 500 285 1248 1

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure - Peak Liner Strength

Filename: 20221125 Section D-D' Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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531.7011719 285 1248 1 532 285 0 1 600 285

0 1

350 284.5 0 1 400 284.5 0 1 450 284.5 0

1 471.6236759 284.5 0 1 500 284.5 0 1

531.7011719 284.5 0 1 532 284.5 0 1 550

284.5 0 1 600 284.5 0 1

ANALYSIS/computation data follow

Noncircular Search 2

500 315.4

602.96 198.78

640.44 196.35 fixed

648.54 196.87 fixed

738.7 193.17 fixed

796.77 192.99 fixed

872.91 196.17 fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

8 d

GRAPHics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

Filename: 20221128 Section D-D' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Wed Nov 16 06:41:13 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to
weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

Filename: 20221128 Section D-D' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 5 Surface

Point	X	Y
1	0.00	333.44
2	70.21	333.27
3	462.92	332.87
4	859.99	200.68

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	225.94
2	60.30	222.86
3	96.38	221.45
4	222.67	219.99
5	229.57	218.95
6	238.21	218.22
7	281.12	216.76
8	317.10	215.14
9	353.47	213.19
10	385.30	212.16
11	399.54	213.14
12	414.03	211.99
13	429.84	214.45
14	446.63	217.39
15	474.08	208.24
16	531.02	200.09
17	582.57	200.08
18	609.56	201.08
19	658.23	200.94
20	730.21	198.07
21	806.28	199.05
22	859.99	200.68
23	863.00	199.68
24	866.00	198.68

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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UTEXAS4 Output File

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Native Surface

Point	X	Y
1	0.00	223.94
2	60.30	220.86
3	96.38	219.45
4	222.67	217.99
5	229.57	216.95
6	238.21	216.22
7	281.12	214.76
8	317.10	213.14
9	353.47	211.19
10	385.30	210.16
11	399.54	211.14
12	414.03	209.99
13	429.84	212.45
14	446.63	215.39
15	474.08	206.24
16	531.02	198.09
17	582.57	198.08
18	609.56	199.08
19	658.23	198.94
20	730.21	196.07
21	806.28	197.05
22	866.00	198.68
23	1500.00	199.10

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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Name of input data file:

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Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----
-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----
-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	700.0	454.6
3	4200.0	1942.8
4	5000.0	2183.7

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----
-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

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Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

Filename: 20221128 Section D-D' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	224.94
2	60.30	221.86
3	96.38	220.45
4	222.67	218.99
5	229.57	217.95
6	238.21	217.22
7	281.12	215.76
8	317.10	214.14
9	353.47	212.19
10	385.30	211.16
11	399.54	212.14
12	414.03	210.99
13	429.84	213.45
14	446.63	216.39
15	474.08	207.24
16	531.02	199.09
17	582.57	199.08
18	609.56	200.08
19	658.23	199.94
20	730.21	197.07
21	806.28	198.05
22	863.00	199.68
23	866.00	198.68

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Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

Filename: 20221128 Section D-D' Non-Circular - Peak_output (wilson).docx

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Time and date of run: Wed Nov 16 06:41:13 2022

Name of input data file:

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Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 8

* NEW INTERPOLATION DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Input Point	Assigned Point			Variable	Material Type
No.	No.	X	Y		
1	1	350.00	332.98	0.0 Pore Pressure	1
2	2	400.00	332.93	0.0 Pore Pressure	1
3	3	450.00	332.88	0.0 Pore Pressure	1
4	4	462.92	332.87	0.0 Pore Pressure	1
5	5	500.00	320.52	0.0 Pore Pressure	1
6	6	550.00	303.88	0.0 Pore Pressure	1
7	7	600.00	287.23	0.0 Pore Pressure	1
8	8	650.00	270.59	0.0 Pore Pressure	1
9	9	700.00	253.94	0.0 Pore Pressure	1
10	10	750.00	237.30	0.0 Pore Pressure	1
11	11	800.00	220.65	0.0 Pore Pressure	1
12	12	859.99	200.68	0.0 Pore Pressure	1
13	13	350.00	225.00	0.0 Pore Pressure	1
14	14	400.00	225.00	0.0 Pore Pressure	1
15	15	450.00	225.00	0.0 Pore Pressure	1
16	16	500.00	225.00	0.0 Pore Pressure	1
17	17	550.00	225.00	0.0 Pore Pressure	1
18	18	600.00	225.00	0.0 Pore Pressure	1
19	19	650.00	225.00	0.0 Pore Pressure	1
20	20	675.00	225.00	0.0 Pore Pressure	1
21	21	711.93	225.00	0.0 Pore Pressure	1
22	22	750.00	225.00	0.0 Pore Pressure	1
23	23	775.00	225.00	0.0 Pore Pressure	1
24	24	350.00	225.00	0.0 Pore Pressure	1
25	25	400.00	205.00	1248.0 Pore Pressure	1
26	26	450.00	205.00	1248.0 Pore Pressure	1
27	27	500.00	205.00	1248.0 Pore Pressure	1
28	28	550.00	205.00	1248.0 Pore Pressure	1
29	29	600.00	205.00	1248.0 Pore Pressure	1
30	30	650.00	205.00	1248.0 Pore Pressure	1
31	31	700.00	205.00	1248.0 Pore Pressure	1
32	32	750.00	205.00	1248.0 Pore Pressure	1
33	33	772.01	205.00	1248.0 Pore Pressure	1
34	34	773.00	205.00	0.0 Pore Pressure	1
35	35	800.00	205.00	0.0 Pore Pressure	1
36	36	350.00	224.50	0.0 Pore Pressure	1
37	37	400.00	204.50	0.0 Pore Pressure	1
38	38	450.00	204.50	0.0 Pore Pressure	1
39	39	500.00	204.50	0.0 Pore Pressure	1
40	40	550.00	204.50	0.0 Pore Pressure	1

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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UTEXAS4 Output File

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41	41	600.00	204.50	0.0	Pore Pressure	1
42	42	650.00	204.50	0.0	Pore Pressure	1
43	43	700.00	204.50	0.0	Pore Pressure	1
44	44	750.00	204.50	0.0	Pore Pressure	1
45	45	800.00	204.50	0.0	Pore Pressure	1
46	46	350.00	265.00	0.0	Pore Pressure	1
47	47	400.00	265.00	0.0	Pore Pressure	1
48	48	450.00	265.00	0.0	Pore Pressure	1
49	49	500.00	265.00	0.0	Pore Pressure	1
50	50	550.00	265.00	0.0	Pore Pressure	1
51	51	591.78	265.00	0.0	Pore Pressure	1
52	52	600.00	265.00	0.0	Pore Pressure	1
53	53	650.00	265.00	0.0	Pore Pressure	1
54	54	350.00	245.00	1248.0	Pore Pressure	1
55	55	400.00	245.00	1248.0	Pore Pressure	1
56	56	450.00	245.00	1248.0	Pore Pressure	1
57	57	500.00	245.00	1248.0	Pore Pressure	1
58	58	550.00	245.00	1248.0	Pore Pressure	1
59	59	600.00	245.00	1248.0	Pore Pressure	1
60	60	651.86	245.00	1248.0	Pore Pressure	1
61	61	652.00	245.00	0.0	Pore Pressure	1
62	62	350.00	244.50	0.0	Pore Pressure	1
63	63	400.00	244.50	0.0	Pore Pressure	1
64	64	450.00	244.50	0.0	Pore Pressure	1
65	65	500.00	244.50	0.0	Pore Pressure	1
66	66	550.00	244.50	0.0	Pore Pressure	1
67	67	600.00	244.50	0.0	Pore Pressure	1
68	68	650.00	244.50	0.0	Pore Pressure	1
69	69	350.00	305.00	0.0	Pore Pressure	1
70	70	400.00	305.00	0.0	Pore Pressure	1
71	71	450.00	305.00	0.0	Pore Pressure	1
72	72	471.62	305.00	0.0	Pore Pressure	1
73	73	500.00	305.00	0.0	Pore Pressure	1
74	74	531.70	305.00	0.0	Pore Pressure	1
75	75	350.00	285.00	1248.0	Pore Pressure	1
76	76	400.00	285.00	1248.0	Pore Pressure	1
77	77	450.00	285.00	1248.0	Pore Pressure	1
78	78	471.62	285.00	1248.0	Pore Pressure	1
79	79	500.00	285.00	1248.0	Pore Pressure	1
80	80	531.70	285.00	1248.0	Pore Pressure	1
81	81	532.00	285.00	0.0	Pore Pressure	1
82	82	600.00	285.00	0.0	Pore Pressure	1
83	83	350.00	284.50	0.0	Pore Pressure	1
84	84	400.00	284.50	0.0	Pore Pressure	1
85	85	450.00	284.50	0.0	Pore Pressure	1
86	86	471.62	284.50	0.0	Pore Pressure	1
87	87	500.00	284.50	0.0	Pore Pressure	1
88	88	531.70	284.50	0.0	Pore Pressure	1
89	89	532.00	284.50	0.0	Pore Pressure	1
90	90	550.00	284.50	0.0	Pore Pressure	1
91	91	600.00	284.50	0.0	Pore Pressure	1

Number of new interpolation points read: 91

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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Number of old interpolation points retained: 0

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	462.92	332.87	angle to be computed - moveable
2	582.57	200.08	angle to be computed - moveable
3	609.56	200.08	- fixed
4	658.23	199.94	- fixed
5	730.21	197.07	- fixed
6	806.28	198.05	- fixed
7	863.00	199.68	- fixed
8	866.00	198.68	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 8.000

-----The

following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

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Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	333.44
2	60.30	333.29
3	70.21	333.27
4	96.38	333.24
5	222.67	333.11
6	229.57	333.10
7	238.21	333.10
8	281.12	333.05
9	317.10	333.02
10	353.47	332.98
11	385.30	332.95
12	399.54	332.93
13	414.03	332.92
14	429.84	332.90
15	446.63	332.88
16	462.92	332.87
17	474.08	329.15
18	531.02	310.19
19	582.57	293.03
20	609.56	284.05
21	658.23	267.85
22	730.21	243.88
23	806.28	218.56
24	859.99	200.68
25	863.00	199.68
26	866.00	198.68
27	1500.00	199.10

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 453.73 Y: 324.88

X: 592.96 Y: 217.15

X: 609.56 Y: 200.08

X: 658.23 Y: 199.94

X: 730.21 Y: 197.07

X: 806.28 Y: 198.05

X: 863.00 Y: 199.68

Minimum factor of safety: 2.102

Side force inclination: -17.15

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 4

Total number of shear surfaces attempted: 20

Total number of shear surfaces for which the factor of safety
was successfully calculated: 18

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	2.1638	5	4
2	10.0000	2	10.000	2.1024	10	8
3	10.0000	2	3.972	2.1024	15	13
4	5.0000	1	5.000	2.1024	20	18

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
	453.73	324.88					
1	458.32	321.32	5305	1	100.0	35.00	0.0
	462.92	317.77					
2	468.50	313.45	9804	1	100.0	35.00	0.0
	474.08	309.13					
3	478.83	305.46	10493	1	100.0	35.00	0.0
	483.57	301.78					
4	488.32	298.11	12478	1	100.0	35.00	429.7
	493.06	294.44					
5	497.81	290.77	14463	1	100.0	35.00	887.9
	502.55	287.10					
6	507.30	283.43	16449	1	100.0	35.00	0.0
	512.04	279.76					
7	516.79	276.08	18434	1	100.0	35.00	0.0
	521.53	272.41					
8	526.28	268.74	20419	1	100.0	35.00	0.0
	531.02	265.07					
9	536.18	261.08	24429	1	100.0	35.00	244.5
	541.33	257.09					
10	546.49	253.11	26771	1	100.0	35.00	742.2
	551.64	249.12					
11	556.80	245.13	29113	1	100.0	35.00	1239.9
	561.95	241.14					
12	567.10	237.15	31456	1	100.0	35.00	0.0
	572.26	233.17					
13	577.41	229.18	33798	1	100.0	35.00	0.0
	582.57	225.19					
14	587.76	221.17	36442	1	100.0	35.00	239.1
	592.96	217.15					
15	596.87	213.12	29424	1	100.0	35.00	741.1
	600.79	209.10					
16	604.71	205.07	31555	1	100.0	35.00	1243.5
	608.62	201.05					
17	609.09	200.56	3959	2	NONLINEAR ENVELOPE		0.0
	609.56	200.08					

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Cross-Section: D-D'

Case: Non-Circular Failure

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18	615.64	200.06	50713	2	NONLINEAR ENVELOPE	0.0
	621.73	200.05				
19	627.81	200.03	48270	2	NONLINEAR ENVELOPE	0.0
	633.89	200.01				
20	639.98	199.99	45827	2	NONLINEAR ENVELOPE	0.0
	646.06	199.98				
21	652.14	199.96	43385	2	NONLINEAR ENVELOPE	0.0
	658.23	199.94				
22	664.23	199.70	40517	2	NONLINEAR ENVELOPE	0.0
	670.22	199.46				
23	676.22	199.22	38408	2	NONLINEAR ENVELOPE	0.0
	682.22	198.98				
24	688.22	198.75	36299	2	NONLINEAR ENVELOPE	0.0
	694.22	198.51				
25	700.22	198.27	34191	2	NONLINEAR ENVELOPE	0.0
	706.21	198.03				
26	712.21	197.79	32082	2	NONLINEAR ENVELOPE	0.0
	718.21	197.55				
27	724.21	197.31	29974	2	NONLINEAR ENVELOPE	0.0
	730.21	197.07				
28	736.55	197.15	29176	2	NONLINEAR ENVELOPE	0.0
	742.89	197.23				
29	749.23	197.31	26397	2	NONLINEAR ENVELOPE	0.0
	755.57	197.40				
30	761.90	197.48	23618	2	NONLINEAR ENVELOPE	0.0
	768.24	197.56				
31	774.58	197.64	20839	2	NONLINEAR ENVELOPE	0.0
	780.92	197.72				
32	787.26	197.80	18060	2	NONLINEAR ENVELOPE	0.0
	793.60	197.88				
33	799.94	197.97	15281	2	NONLINEAR ENVELOPE	0.0
	806.28	198.05				
34	813.00	198.24	13091	2	NONLINEAR ENVELOPE	0.0
	819.71	198.43				
35	826.42	198.63	9851	2	NONLINEAR ENVELOPE	0.0
	833.14	198.82				
36	839.85	199.01	6611	2	NONLINEAR ENVELOPE	0.0
	846.56	199.21				
37	853.28	199.40	3371	2	NONLINEAR ENVELOPE	0.0
	859.99	199.59				
38	861.49	199.64	196	2	NONLINEAR ENVELOPE	0.0
	863.00	199.68				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 44

```
*****
* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations.                *
* (Information is for the critical shear surface in the    *
* case of an automatic search.)                             *
*****
```

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of *

* Safety and Side Force Inclination by Spencer's Procedure *

Trial No. 1 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Allowable moment imbalance for convergence: 5905

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iter- ation	of Safety					
1	3.00000	-17.1887	-7.364e+004	2.938e+007		
First-order corrections to F and Theta					-1.2729	-0.0250
Reduced values - Deltas were too large					-0.5000	-0.0098
2	2.50000	-17.1985	-3.897e+004	1.554e+007		
First-order corrections to F and Theta					-0.8410	22.9727
Reduced values - Deltas were too large					-0.1049	2.8648
3	2.39512	-14.3337	-3.379e+004	1.360e+007		
First-order corrections to F and Theta					0.0837	-30.2774
Reduced values - Deltas were too large					0.0079	-2.8648
4	2.40304	-17.1985	-3.058e+004	1.220e+007		
First-order corrections to F and Theta					-0.3421	0.1323
Second-order corrections to F and Theta					-0.3026	0.0307
5	2.10042	-17.1678	4.927e+002	-1.954e+005		
First-order corrections to F and Theta					0.0042	-0.0028
Second-order corrections to F and Theta					0.0042	-0.0029
6	2.10466	-17.1707	-2.000e-003	7.696e-001		
First-order corrections to F and Theta					-0.0000	0.0000

After trial 1 the following changes were computed for the nonlinear
strength envelopes:

Maximum change in shear strength: -1.588 (percent)

Maximum change occurred for slice 18

Normal stress where max. change occurred: 4462.89

Old strength at this slice: 2054.58

New strength at this slice: 2021.96

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of *
* Safety and Side Force Inclination by Spencer's Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Allowable moment imbalance for convergence: 5905

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iteration	1	3.00000	-17.1887	-7.371e+004	2.941e+007	
First-order corrections to F and Theta					-1.2760	-0.0403
Reduced values - Deltas were too large					-0.5000	-0.0158
Iteration	2	2.50000	-17.2045	-3.910e+004	1.559e+007	
First-order corrections to F and Theta					0.6922	-72.8355
Reduced values - Deltas were too large					0.0272	-2.8648
Iteration	3	2.52723	-20.0693	-3.754e+004	1.490e+007	
First-order corrections to F and Theta					-0.9938	32.9316
Reduced values - Deltas were too large					-0.0865	2.8648
Iteration	4	2.44078	-17.2045	-3.407e+004	1.358e+007	
First-order corrections to F and Theta					-0.3978	0.3959
Second-order corrections to F and Theta					-0.3444	0.0567
Iteration	5	2.09641	-17.1479	6.885e+002	-2.722e+005	
First-order corrections to F and Theta					0.0059	-0.0061
Second-order corrections to F and Theta					0.0059	-0.0062
Iteration	6	2.10235	-17.1541	-5.491e-003	2.070e+000	
First-order corrections to F and Theta					-0.0000	0.0000

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Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 1.02318e-010

Summation of Vertical Forces: 6.23288e-011

Summation of Moments: 5.60831e-008

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.41158e-011

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Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 2.102 Side Force Inclination: -17.15

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear Stress
			Normal Stress	Normal Stress	
1	458.32	321.32	398.5	398.5	180.3
2	468.50	313.45	614.1	614.1	252.1
3	478.83	305.46	777.4	777.4	306.5
4	488.32	298.11	975.3	545.5	229.3
5	497.81	290.77	1176.3	288.4	143.6
6	507.30	283.43	1227.7	1227.7	456.5
7	516.79	276.08	1377.8	1377.8	506.5
8	526.28	268.74	1527.9	1527.9	556.4
9	536.18	261.08	1711.6	1467.1	536.2
10	546.49	253.11	1930.0	1187.7	443.2
11	556.80	245.13	2148.3	908.4	350.1
12	567.10	237.15	2173.5	2173.5	771.5
13	577.41	229.18	2336.6	2336.6	825.8
14	587.76	221.17	2526.8	2287.7	809.5
15	596.87	213.12	2505.3	1764.2	635.1
16	604.71	205.07	2757.5	1513.9	551.8
17	609.09	200.56	2846.0	2846.0	650.3
18	615.64	200.06	4458.0	4458.0	961.1
19	627.81	200.03	4248.2	4248.2	931.0
20	639.98	199.99	4035.3	4035.3	890.8
21	652.14	199.96	3821.5	3821.5	847.5
22	664.23	199.70	3546.6	3546.6	792.0
23	676.22	199.22	3363.1	3363.1	754.9
24	688.22	198.75	3179.7	3179.7	717.7
25	700.22	198.27	2996.2	2996.2	680.6
26	712.21	197.79	2812.7	2812.7	643.5
27	724.21	197.31	2629.2	2629.2	606.4
28	736.55	197.15	2497.4	2497.4	579.7
29	749.23	197.31	2261.9	2261.9	532.1
30	761.90	197.48	2026.5	2026.5	484.5
31	774.58	197.64	1791.1	1791.1	436.9
32	787.26	197.80	1555.7	1555.7	389.3
33	799.94	197.97	1320.3	1320.3	341.7
34	813.00	198.24	1083.7	1083.7	293.8

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Cross-Section: D-D'

Case: Non-Circular Failure

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35	826.42	198.63	822.3	822.3	241.0
36	839.85	199.01	555.1	555.1	171.5
37	853.28	199.40	283.0	283.0	87.4
38	861.49	199.64	73.5	73.5	22.7

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 59

 * Final Results for Side Forces and Stresses Between Slices *
 * (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----						
Slice		Y-Coord. of	Fraction	Sigma	Sigma	
No.	X-Right	Side Force	of Height	at Top	at Bottom	
1	462.92	1231	319.90	0.141	-89.7	245.5
2	474.08	3838	313.24	0.206	-140.5	506.8
3	483.57	6768	307.58	0.239	-150.8	685.1
4	493.06	11986	301.16	0.237	-233.6	1040.5
5	502.55	19599	294.77	0.235	-337.8	1487.7
6	512.04	24500	289.86	0.275	-223.1	1496.9
7	521.53	30058	284.66	0.299	-144.3	1547.4
8	531.02	36273	279.25	0.314	-87.9	1624.1
9	541.33	44776	272.92	0.319	-75.9	1798.7
10	551.64	56105	266.06	0.312	-123.6	2101.4
11	561.95	70261	258.98	0.304	-203.8	2489.0
12	572.26	80082	253.32	0.318	-108.7	2526.3
13	582.57	90677	247.50	0.329	-34.3	2588.5
14	592.96	103136	241.31	0.334	1.7	2719.7
15	600.79	119041	235.28	0.336	25.9	2895.5
16	608.62	137754	228.93	0.335	12.5	3147.3
17	609.56	139990	228.19	0.335	13.3	3172.8
18	621.73	127915	226.91	0.336	24.3	3033.1
19	633.89	116215	225.67	0.338	40.1	2884.6
20	646.06	105019	224.45	0.340	58.4	2732.1
21	658.23	94367	223.25	0.343	78.9	2576.8
22	670.22	86199	221.60	0.344	80.5	2477.8
23	682.22	78405	219.94	0.344	80.4	2381.0
24	694.22	70986	218.26	0.344	78.1	2286.9
25	706.21	63940	216.55	0.344	73.0	2196.4
26	718.21	57269	214.82	0.343	64.1	2110.5
27	730.21	50972	213.05	0.341	50.1	2030.6
28	742.89	42854	211.78	0.343	54.8	1875.3
29	755.57	35407	210.50	0.344	58.5	1720.0
30	768.24	28633	209.20	0.346	60.7	1564.8
31	780.92	22531	207.89	0.347	60.9	1409.7
32	793.60	17100	206.55	0.348	58.4	1254.2
33	806.28	12342	205.19	0.348	52.2	1097.6
34	819.71	7774	203.92	0.350	48.5	900.4
35	833.14	4055	202.73	0.362	61.2	656.4
36	846.56	1421	201.62	0.407	100.8	356.2

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

Filename: 20221128 Section D-D' Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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37	859.99	78	200.10	0.467	54.8	82.4
38	863.00	-0	199.68	0.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: A-A' Case: Non Circular - Residual Liner Strength

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates Shifting Points

x	y	10
75	332.026	5
166.0471	231.1	
239.5212	231.1992	fixed
282.3832	230.8095	fixed
293.5372	229.1338	fixed
305.1905	231.1918	fixed
381.9526	232.8086	fixed
404.5544	233.1568	fixed
464.4	232.9	fixed
469.9252	232.8924	fixed

Crack Depth

1

Seismic Acceleration

Minimum Weight

5000

Results

Noncircular Shear Surface

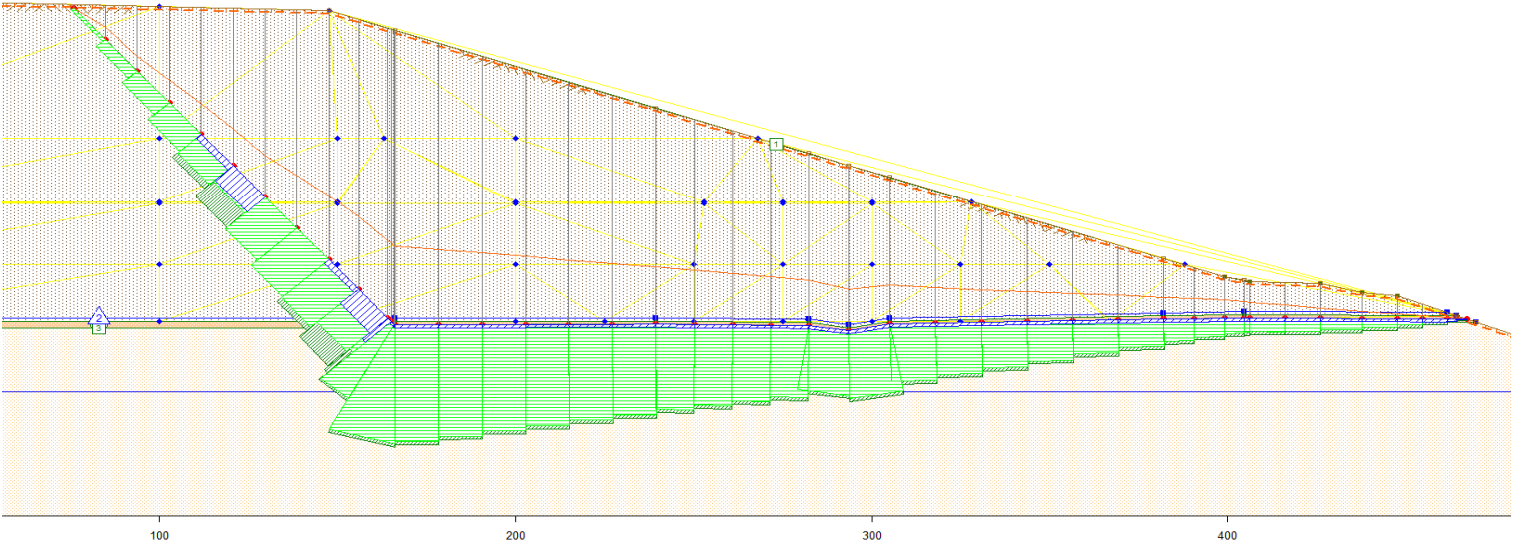
75.92	331
166	231.1
239.52	231.2
282.38	230.81
293.54	229.13
305.19	231.19
381.95	232.81
404.55	233.16
464.4	232.9
467.16	232.9

Factor of Safety

1.403

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Cell 3 Waste	50	Cohesion: 100.0 Friction angle: 35	Pore Pressure Interpolated
2	Liner	120	Nonlinear	Piezometric Line no. 2
3	Natural Soil (GP Dense to Very Dense)	130	Cohesion: 0.0 Friction angle: 35	Piezometric Line no. 1

Factor of safety: 1.443
Side force Inclination: -12.9 degrees



Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section A-A' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 1 of 5

ENGLISH units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 3 Surface

0.000000	333.976600
147.552900	330.139000
399.183500	246.250400
406.121800	244.712800
426.040100	244.023100
437.832500	241.284800
447.582100	240.087400
464.4 233.9	

2 2 Liner

0 232.1156

166.0471 232.1156

239.5212 232.1992

282.3832 231.8095

293.5372 230.1338

305.1905 232.1918

381.9526 233.8086

404.5544 234.1568

464.4 233.9

469.925200 231.892400

3 3 Native Surface

0.000000	230.115600
166.047100	230.115600
239.521200	230.199200

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section A-A' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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282.383200	229.809500
293.537200	228.133800
305.190500	230.191800
381.952600	231.808600
404.554400	232.156800
469.925200	231.892400
507.465300	218.060500
546.288900	216.988100
583.471700	216.402500
657.991300	215.510800
741.835000	212.295700
814.990400	214.257600
864.122100	231.583000
886.536400	237.805100
945.522300	256.707600
969.897400	262.128400
978.535600	263.868000
999.028400	264.021200

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0 35.0

Interpolate Pore Pressures

2 Liner

120 = unit weight

Nonlinear

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section A-A' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 3 of 5

0 0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0 36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000 210.000000

1000.000000 210.000000

2 62.40 Piezometric line 2

0 233.1156

166.0471 233.1156

239.5212 233.1992

282.3832 232.8095

293.5372 231.1338

305.1905 233.1918

381.9526 234.8086

404.5544 235.1568

461.6819 234.9

464.4 233.9

469.925200 231.892400

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section A-A' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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Interpolation Point

P

```
0 333.9766 0 1 100 331.3758 0 1
147.5529 330.139 0 1 267.9530575 290 0 1
327.9446654 270 0 1 387.9362733 250 0 1
464.4 233.9 0
0 250 0 1 100 250 0 1 150 250 0
1 200 250 0 1 250 250 0 1 275 250
0 1 300 250 0 1 325 250 0 1 350
250 0 1
0 232 1248 1 100 232 1248 1 150 232 1248
1 200 232 1248 1 225 232 1248 1 250 232
1248 1 275 232 1248 1 300 232 1248 1 325
232 1248 1 366.582 232 1248 1 367 232 0
1
0 290 0 1 100 290 0 1 150 290 0
1 200 290 0 1 162.9573 290 0 1
0 270 1248 1 100 270 1248 1 150 270 1248
1 200 270 1248 1 252.9447 270 1248 1 253
270 0 1 275 270 0 1 300 270 0 1
0 269.5 0 1 100 269.5 0 1 150 269.5 0
1 200 269.5 0 1 252.9447 269.5 0 1 253
269.5 0 1 275 269.5 0 1 300 269.5 0 1
```


Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section A-A' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 5 of 5

ANALYSIS/computation data follow

Noncircular Search 2

75 332.0259775

166 231.1

239.5212 231.1992 fixed

282.3832 230.8095 fixed

293.5372 229.1338 fixed

305.1905 231.1918 fixed

381.9526 232.8086 fixed

404.5544 233.1568 fixed

464.4 232.9 fixed

469.925200 232.892400 fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

1 d

GRAPHICS output file

COMPUTE

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 3 Surface

Point	X	Y
1	0.00	333.98
2	147.55	330.14
3	399.18	246.25
4	406.12	244.71
5	426.04	244.02
6	437.83	241.28
7	447.58	240.09
8	464.40	233.90

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	232.12
2	166.05	232.12
3	239.52	232.20
4	282.38	231.81
5	293.54	230.13
6	305.19	232.19
7	381.95	233.81
8	404.55	234.16
9	464.40	233.90
10	469.93	231.89

Profile Line No. 3 - Material Type (Number): 3 -----

-----Description:

Native Surface

Point	X	Y
1	0.00	230.12
2	166.05	230.12
3	239.52	230.20
4	282.38	229.81
5	293.54	228.13
6	305.19	230.19
7	381.95	231.81
8	404.55	232.16
9	469.93	231.89
10	507.47	218.06
11	546.29	216.99
12	583.47	216.40
13	657.99	215.51
14	741.84	212.30
15	814.99	214.26
16	864.12	231.58
17	886.54	237.81

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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18	945.52	256.71
19	969.90	262.13
20	978.54	263.87
21	999.03	264.02

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

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Name of input data file:

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Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----
-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of

specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----
-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----
-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	210.00
2	1000.00	210.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	233.12
2	166.05	233.12
3	239.52	233.20
4	282.38	232.81
5	293.54	231.13
6	305.19	233.19
7	381.95	234.81
8	404.55	235.16
9	461.68	234.90
10	464.40	233.90
11	469.93	231.89

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	75.00	332.03	angle to be computed - moveable
2	166.00	231.10	angle to be computed - moveable
3	239.52	231.20	- fixed
4	282.38	230.81	- fixed
5	293.54	229.13	- fixed
6	305.19	231.19	- fixed
7	381.95	232.81	- fixed
8	404.55	233.16	- fixed
9	464.40	232.90	- fixed
10	469.93	232.89	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 1.000

-----The
following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

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Name of input data file:

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Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	333.98
2	147.55	330.14
3	166.05	323.97
4	239.52	299.48
5	282.38	285.19
6	293.54	281.47
7	305.19	277.59
8	381.95	251.99
9	399.18	246.25
10	404.55	245.06
11	406.12	244.71
12	426.04	244.02
13	437.83	241.28
14	447.58	240.09
15	464.40	233.90
16	469.93	231.89
17	507.47	218.06
18	546.29	216.99
19	583.47	216.40
20	657.99	215.51
21	741.84	212.30
22	814.99	214.26
23	864.12	231.58
24	886.54	237.81
25	945.52	256.71
26	969.90	262.13
27	978.54	263.87
28	999.03	264.02

Left end point on noncircular shear surface adjusted to:

X: 75.92, Y: 331.00

Adjustment was made to put end point at bottom of crack.

Right end point on noncircular shear surface adjusted to:

X: 467.16, Y: 232.90

Adjustment was made to put end point on the slope.

Noncircular Shear Surface Points After End Point Adjustment

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	75.92	331.00	angle to be computed - moveable
2	166.00	231.10	angle to be computed - moveable
3	239.52	231.20	- fixed
4	282.38	230.81	- fixed
5	293.54	229.13	- fixed
6	305.19	231.19	- fixed
7	381.95	232.81	- fixed
8	404.55	233.16	- fixed
9	464.40	232.90	- fixed
10	467.16	232.90	- fixed

Computed crack depth: 1.00

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 75.92 Y: 331.00

X: 166.00 Y: 231.10

X: 239.52 Y: 231.20

X: 282.38 Y: 230.81

X: 293.54 Y: 229.13

X: 305.19 Y: 231.19

X: 381.95 Y: 232.81

X: 404.55 Y: 233.16

X: 464.40 Y: 232.90

X: 467.16 Y: 232.90

Minimum factor of safety: 1.443

Side force inclination: -12.90

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 2

Total number of shear surfaces attempted: 10

Total number of shear surfaces for which the factor of safety
was successfully calculated: 10

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	1.4431	5	5
2	5.0000	1	5.000	1.4431	10	10

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	75.92	331.00					
	80.40	326.04	2618	1	100.0	35.00	0.0
	84.88	321.07					
2	89.35	316.11	6960	1	100.0	35.00	0.0
	93.83	311.14					
3	98.31	306.18	11301	1	100.0	35.00	0.0
	102.78	301.21					
4	107.26	296.25	15643	1	100.0	35.00	0.0
	111.74	291.28					
5	116.21	286.32	19984	1	100.0	35.00	229.9
	120.69	281.35					
6	125.17	276.39	24325	1	100.0	35.00	849.6
	129.65	271.42					
7	134.12	266.45	28667	1	100.0	35.00	0.0
	138.60	261.49					
8	143.08	256.52	33008	1	100.0	35.00	0.0
	147.55	251.56					
9	151.71	246.95	34010	1	100.0	35.00	211.6
	155.87	242.34					
10	160.03	237.73	36691	1	100.0	35.00	851.0
	164.18	233.12					
11	164.63	232.62	4140	1	100.0	35.00	1205.3
	165.08	232.12					
12	165.54	231.61	4269	2	NONLINEAR ENVELOPE		94.1
	166.00	231.10					
13	166.02	231.10	222	2	NONLINEAR ENVELOPE		125.8
	166.05	231.10					
14	172.17	231.11	56479	2	NONLINEAR ENVELOPE		125.7
	178.29	231.12					
15	184.42	231.12	53967	2	NONLINEAR ENVELOPE		125.5
	190.54	231.13					
16	196.66	231.14	51455	2	NONLINEAR ENVELOPE		125.4
	202.78	231.15					
17	208.91	231.16	48944	2	NONLINEAR ENVELOPE		125.2
	215.03	231.17					
18	221.15	231.17	46432	2	NONLINEAR ENVELOPE		125.0
	227.28	231.18					
19	233.40	231.19	43920	2	NONLINEAR ENVELOPE		124.9
	239.52	231.20					
20	244.88	231.15	36402	2	NONLINEAR ENVELOPE		124.8
	250.24	231.10					
21	255.59	231.05	34540	2	NONLINEAR ENVELOPE		124.8
	260.95	231.00					
22	266.31	230.96	32678	2	NONLINEAR ENVELOPE		124.8
	271.67	230.91					

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

Page 11 of 16

23	277.03	230.86	30816	2	NONLINEAR ENVELOPE	124.8
	282.38	230.81				
24	287.96	229.97	30539	2	NONLINEAR ENVELOPE	124.8
	293.54	229.13				
25	299.36	230.16	29579	2	NONLINEAR ENVELOPE	124.8
	305.19	231.19				
26	311.59	231.33	29123	2	NONLINEAR ENVELOPE	124.8
	317.98	231.46				
27	324.38	231.60	26222	2	NONLINEAR ENVELOPE	124.8
	330.78	231.73				
28	337.17	231.87	23321	2	NONLINEAR ENVELOPE	124.8
	343.57	232.00				
29	349.97	232.13	20421	2	NONLINEAR ENVELOPE	124.8
	356.37	232.27				
30	362.76	232.40	17520	2	NONLINEAR ENVELOPE	124.8
	369.16	232.54				
31	375.56	232.67	14619	2	NONLINEAR ENVELOPE	124.8
	381.95	232.81				
32	386.26	232.87	8221	2	NONLINEAR ENVELOPE	124.8
	390.57	232.94				
33	394.88	233.01	6926	2	NONLINEAR ENVELOPE	124.8
	399.18	233.07				
34	401.87	233.12	3743	2	NONLINEAR ENVELOPE	124.8
	404.55	233.16				
35	405.34	233.15	1029	2	NONLINEAR ENVELOPE	124.8
	406.12	233.15				
36	411.10	233.13	6380	2	NONLINEAR ENVELOPE	124.7
	416.08	233.11				
37	421.06	233.09	6229	2	NONLINEAR ENVELOPE	124.6
	426.04	233.06				
38	431.94	233.04	6494	2	NONLINEAR ENVELOPE	124.5
	437.83	233.01				
39	442.71	232.99	4433	2	NONLINEAR ENVELOPE	124.3
	447.58	232.97				
40	451.11	232.96	2550	2	NONLINEAR ENVELOPE	124.2
	454.63	232.94				
41	458.16	232.93	1646	2	NONLINEAR ENVELOPE	124.1
	461.68	232.91				
42	463.04	232.91	393	2	NONLINEAR ENVELOPE	93.2
	464.40	232.90				
43	465.78	232.90	166	2	NONLINEAR ENVELOPE	31.2
	467.16	232.90				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of *
* Safety and Side Force Inclination by Spencer's Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Allowable moment imbalance for convergence: 2076

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iter- ation	1	3.00000	-17.1887	-9.009e+004	2.590e+007	
First-order corrections to F and Theta					-4.0264	30.2657
Reduced values - Deltas were too large					-0.3811	2.8648
2	2.61888	-14.3239	-7.989e+004	2.298e+007		
First-order corrections to F and Theta					-2.2556	9.6414
Reduced values - Deltas were too large					-0.5000	2.1372
3	2.11888	-12.1867	-5.764e+004	1.666e+007		
First-order corrections to F and Theta					-0.9276	-2.0203
Reduced values - Deltas were too large					-0.5000	-1.0889
4	1.61888	-13.2757	-1.856e+004	5.284e+006		
First-order corrections to F and Theta					-0.1958	0.4758
Second-order corrections to F and Theta					-0.1774	0.3826
5	1.44147	-12.8931	1.862e+002	-5.172e+004		
First-order corrections to F and Theta					0.0016	-0.0088
Second-order corrections to F and Theta					0.0016	-0.0088
6	1.44309	-12.9019	-1.932e-004	5.038e-002		
First-order corrections to F and Theta					-0.0000	0.0000

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 6.80576e-011

Summation of Vertical Forces: 6.74447e-011

Summation of Moments: -1.05792e-008

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.41727e-011

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 1.443 Side Force Inclination: -12.90

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	80.40	326.04	137.7	137.7	136.1
2	89.35	316.11	426.1	426.1	276.1
3	98.31	306.18	714.6	714.6	416.0
4	107.26	296.25	1003.0	1003.0	556.0
5	116.21	286.32	1349.8	1119.9	612.7
6	125.17	276.39	1795.7	946.1	528.4
7	134.12	266.45	1868.3	1868.3	975.8
8	143.08	256.52	2156.7	2156.7	1115.8
9	151.71	246.95	2450.6	2239.0	1155.7
10	160.03	237.73	2804.9	1953.9	1017.4
11	164.63	232.62	3001.2	1795.9	940.7
12	165.54	231.61	3430.6	3336.5	409.2
13	166.02	231.10	4833.9	4708.1	508.9
14	172.17	231.11	4729.2	4603.5	501.3
15	184.42	231.12	4520.5	4394.9	486.1
16	196.66	231.14	4311.8	4186.4	471.0
17	208.91	231.16	4103.1	3977.9	455.8
18	221.15	231.17	3894.4	3769.4	440.6
19	233.40	231.19	3685.7	3560.8	425.5
20	244.88	231.15	3480.2	3355.4	410.5
21	255.59	231.05	3304.0	3179.2	397.7
22	266.31	230.96	3127.8	3003.0	384.9
23	277.03	230.86	2951.6	2826.8	372.1
24	287.96	229.97	2673.6	2548.8	351.9
25	299.36	230.16	2797.9	2673.1	360.9
26	311.59	231.33	2370.3	2245.5	329.8
27	324.38	231.60	2138.2	2013.4	312.9
28	337.17	231.87	1901.4	1776.6	277.1
29	349.97	232.13	1664.2	1539.4	240.1
30	362.76	232.40	1427.1	1302.3	203.1
31	375.56	232.67	1190.0	1065.2	166.2
32	386.26	232.87	990.7	865.9	135.1
33	394.88	233.01	833.9	709.1	110.6
34	401.87	233.12	722.3	597.5	93.2
35	405.34	233.15	675.3	550.5	85.9
36	411.10	233.13	658.7	533.9	83.3
37	421.06	233.09	643.0	518.4	80.9
38	431.94	233.04	565.6	441.2	68.8
39	442.71	232.99	466.2	341.9	53.3
40	451.11	232.96	369.9	245.7	38.3
41	458.16	232.93	237.2	113.1	17.6
42	463.04	232.91	146.4	53.2	8.3
43	465.78	232.90	61.0	29.8	4.7

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure

Filename: 20221125 Section A-A' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section A-A'\MSB Section A-A' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 59

* Final Results for Side Forces and Stresses Between Slices *

* (Results are for the critical shear surface in the case of a search.) *

		VALUES AT RIGHT SIDE OF SLICE				
		Y-Coord. of		Fraction	Sigma	Sigma
Slice		Side	Side Force	of	at	at
No.	X-Right	Force	Location	Height	Top	Bottom
1	84.88	152	325.01	0.368	2.9	24.9
2	93.83	1958	315.69	0.223	-61.8	249.0
3	102.78	5416	308.22	0.233	-105.7	456.6
4	111.74	10527	300.85	0.241	-143.5	659.3
5	120.69	18651	292.92	0.234	-219.5	954.3
6	129.65	32091	284.37	0.219	-363.1	1420.1
7	138.60	42161	278.29	0.244	-320.3	1513.6
8	147.55	53884	271.72	0.257	-307.7	1644.5
9	155.87	67210	265.10	0.268	-303.6	1844.6
10	164.18	85067	257.65	0.268	-354.5	2167.4
11	165.08	87276	256.81	0.268	-362.5	2208.3
12	166.00	90466	255.71	0.265	-389.4	2288.0
13	166.05	90441	255.71	0.265	-389.3	2287.8
14	178.29	84064	254.66	0.265	-377.0	2223.1
15	190.54	77880	253.62	0.266	-364.7	2157.8
16	202.78	71890	252.57	0.266	-352.3	2091.7
17	215.03	66095	251.52	0.266	-339.8	2024.7
18	227.28	60493	250.47	0.266	-327.1	1956.5
19	239.52	55086	249.42	0.267	-314.0	1886.8
20	250.24	50921	248.35	0.266	-308.4	1840.2
21	260.95	46879	247.29	0.265	-303.4	1793.5
22	271.67	42960	246.21	0.264	-299.0	1746.6
23	282.38	39165	245.12	0.263	-295.4	1699.4
24	293.54	39735	242.37	0.253	-357.2	1837.3
25	305.19	29513	243.46	0.265	-256.0	1496.1
26	317.98	24529	242.70	0.269	-222.0	1364.4
27	330.78	19830	242.06	0.277	-176.1	1211.9
28	343.57	15667	241.44	0.288	-126.6	1058.1
29	356.37	12056	240.86	0.304	-72.8	904.6
30	369.16	8995	240.31	0.328	-12.4	751.6
31	381.95	6485	239.77	0.363	58.6	600.4
32	390.57	5157	239.32	0.394	113.6	507.6
33	399.18	4065	238.78	0.433	179.7	421.8
34	404.55	3490	238.38	0.439	180.8	390.9
35	406.12	3357	238.22	0.439	178.7	387.3
36	416.08	2535	237.22	0.365	42.1	396.7
37	426.04	1737	236.32	0.297	-34.0	343.0
38	437.83	934	235.27	0.273	-39.9	260.0
39	447.58	420	234.46	0.209	-43.1	158.3
40	454.63	155	234.03	0.239	-18.7	84.9
41	461.68	34	233.45	0.271	-6.3	39.9
42	464.40	13	233.21	0.315	-1.4	26.7
43	467.16	0	232.90	1.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section B-B' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 1 of 5

ENGLISH units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 4 Surface

0 342.9925

53.3791 340.9508

103.5224 338.8839

216.9023 334.482

364.0891 328.5808

435.2507 325.7232

462.0904 323.8434

795.7461 212.2843

2 2 Liner

0 233.9687

241.3595 233.9687

255.373 234.532

329.1175 233.9445

358.7087 232.8241

439.6647 233.2931

630 234.6793062

635 234.715721

639 234.303

644 233.255

736.2644 213.9188

755.9227 213.778

795.7461 212.2843

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section B-B' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 2 of 5

801.7278 210.2843

3 3 Native Surface

0 231.9687

241.3595 231.9687

255.373 232.532

329.1175 231.9445

358.7087 230.8241

439.6647 231.2931

630 232.6793062

635 232.715721

639 232.303

644 231.255

736.2644 211.9188

755.9227 211.778

801.7278 210.2843

830.3544 210.7192

842.2722 210.9911

860.5027 210.9911

866.5411 211.812

886.081 218.0902

904.7485 224.5428

924.0266 230.9082

958.7877 233.0943

975.4239 234.0329

998.3779 233.9295

MATerial property data follow -

1 Cell 3 Waste

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section B-B' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 3 of 5

50.00 = unit weight

Conventional

100.0 35.0

Interpolate Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0 0

2000 515.2

5000 825

Piezometric Line

1

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0 36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000 210.000000

1000.000000 210.000000

2 62.40 Piezometric line 2

0 232.9687

241.3595 232.9687

255.373 233.532

329.1175 232.9445

358.7087 231.8241

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section B-B' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 4 of 5

439.6647 232.2931

630 233.6793062

635 233.715721

639 233.3026008

644 232.2547457

736.2644 212.9188

755.9227 212.778

798.7369573 211.2843

801.7278 210.2843

Interpolation Point

P

200 253 0 1 300 253 0 1 400 253 0

1 450 253 0 1 539.155 253 0 1 569.0634359

253 0 1 540 253 0 1

200 233 1248 1 300 233 1248 1 400 233 1248

1 450 233 1248 1 539.0634 233 1248 1

658.7887 233 1248 1 540 233 0 1

200 293 0 1 300 293 0 1 350 293 0

1 400 293 0 1 450 293 0 1 449.4297

293 0 1 450 293 0 1 524.4297 293 0

1

200 273 1248 1 300 273 1248 1 350 273 1248

1 400 273 1248 1 450 273 1248 1 539.155 273

1248 1 540 273 0 1 614.1550094 273 0 1

200 272.5 0 1 300 272.5 0 1 350 272.5 0

1 400 272.5 0 1 450 272.5 0 1 539.155

272.5 0 1 540 272.5 0 1

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section B-B' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 5 of 5

216.9023 334.482 0 1 300 331.1486294 0 1
364.0891 328.5808 0 1 450 325.1315 0 1
435.2507 325.7232 0 1 450 323.8434 0 1
462.0904 323.8434 0 1 801.7278 210.2843 0
1

ANALYSIS/computation data follow

Noncircular Search 2

364.0891 328.5808
439.6647 232.2931
630 233.6793062 Fixed
635 233.715721 Fixed
639 233.303 Fixed
644 232.255 Fixed
736.2644 212.9188 Fixed
755.9227 212.778 Fixed
798.7369573 211.2843 Fixed
10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

10 d

Procedure

Corps of Engineers

0

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

Filename: 20221125 Section B-B' Non-Circular_output (wilson).docx

UTEXAS4 Output File

Page 1 of 15

TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

Filename: 20221125 Section B-B' Non-Circular_output (wilson).docx

UTEXAS4 Output File

Page 2 of 15

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section B-B'\MSB Section B-B' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 4 Surface

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	364.09	328.58
6	435.25	325.72
7	462.09	323.84
8	795.75	212.28

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	233.97
2	241.36	233.97
3	255.37	234.53
4	329.12	233.94
5	358.71	232.82
6	439.66	233.29
7	630.00	234.68
8	635.00	234.72
9	639.00	234.30
10	644.00	233.26
11	736.26	213.92
12	755.92	213.78
13	795.75	212.28
14	801.73	210.28

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	231.97
2	241.36	231.97
3	255.37	232.53
4	329.12	231.94
5	358.71	230.82
6	439.66	231.29
7	630.00	232.68
8	635.00	232.72
9	639.00	232.30
10	644.00	231.26
11	736.26	211.92
12	755.92	211.78
13	801.73	210.28
14	830.35	210.72

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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15	842.27	210.99
16	860.50	210.99
17	866.54	211.81
18	886.08	218.09
19	904.75	224.54
20	924.03	230.91
21	958.79	233.09
22	975.42	234.03
23	998.38	233.93

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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Stability\Section B-B'\MSB Section B-B' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----

Description: Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----

-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	515.2
3	5000.0	825.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----

-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	210.00
2	1000.00	210.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	232.97
2	241.36	232.97
3	255.37	233.53
4	329.12	232.94
5	358.71	231.82
6	439.66	232.29
7	630.00	233.68
8	635.00	233.72
9	639.00	233.30
10	644.00	232.25
11	736.26	212.92
12	755.92	212.78
13	798.74	211.28
14	801.73	210.28

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	364.09	328.58	angle to be computed - moveable
2	439.66	232.29	angle to be computed - moveable
3	630.00	233.68	- fixed
4	635.00	233.72	- fixed
5	639.00	233.30	- fixed
6	644.00	232.26	- fixed
7	736.26	212.92	- fixed
8	755.92	212.78	- fixed
9	798.74	211.28	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 10.000

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 0.00

-----The
following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	241.36	333.50
6	255.37	332.94
7	329.12	329.98
8	358.71	328.80
9	364.09	328.58
10	435.25	325.72
11	439.66	325.41
12	462.09	323.84
13	630.00	267.70
14	635.00	266.03
15	639.00	264.69
16	644.00	263.02
17	736.26	232.17
18	755.92	225.60
19	795.75	212.28
20	801.73	210.28
21	830.35	210.72
22	842.27	210.99
23	860.50	210.99
24	866.54	211.81
25	886.08	218.09
26	904.75	224.54
27	924.03	230.91
28	958.79	233.09
29	975.42	234.03
30	998.38	233.93

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 367.20 Y: 318.46

X: 440.05 Y: 232.90

X: 630.00 Y: 233.68

X: 635.00 Y: 233.72

X: 639.00 Y: 233.30

X: 644.00 Y: 232.26

X: 736.26 Y: 212.92

X: 755.92 Y: 212.78

X: 798.74 Y: 211.28

Minimum factor of safety: 1.431

Side force inclination: -0.00

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 3

Total number of shear surfaces attempted: 15

Total number of shear surfaces for which the factor of safety
was successfully calculated: 15

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	1.4445	5	5
2	5.0000	1	5.000	1.4307	10	10
3	5.0000	1	1.580	1.4307	15	15

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	367.20 371.45 375.70	318.46 313.46 308.47	6305	1	100.0	35.00	0.0
2	379.96 384.21	303.47 298.48	10409	1	100.0	35.00	0.0
3	388.46 392.72	293.48 288.49	14513	1	100.0	35.00	0.0
4	396.97 401.22	283.49 278.50	18616	1	100.0	35.00	593.3
5	405.48 409.73	273.50 268.51	22720	1	100.0	35.00	1216.7
6	413.98 418.24	263.51 258.52	26824	1	100.0	35.00	0.0
7	422.49 426.74	253.52 248.53	30927	1	100.0	35.00	0.0
8	431.00 435.25	243.53 238.54	35031	1	100.0	35.00	590.8
9	437.46 439.66	235.95 233.35	19780	1	100.0	35.00	1064.2
10	439.69 439.72	233.32 233.29	237	1	100.0	35.00	1227.8
11	439.88 440.05	233.10 232.90	1545	2	NONLINEAR	ENVELOPE	0.0
12	445.56 451.07	232.92 232.95	51053	2	NONLINEAR	ENVELOPE	0.0
13	456.58 462.09	232.97 232.99	50630	2	NONLINEAR	ENVELOPE	0.0
14	469.09 476.08	233.02 233.05	62382	2	NONLINEAR	ENVELOPE	0.0
15	483.08 490.08	233.08 233.11	59113	2	NONLINEAR	ENVELOPE	0.0
16	497.07 504.07	233.13 233.16	55843	2	NONLINEAR	ENVELOPE	0.0
17	511.06 518.06	233.19 233.22	52574	2	NONLINEAR	ENVELOPE	0.0
18	525.06 532.05	233.25 233.28	49304	2	NONLINEAR	ENVELOPE	0.0
19	539.05 546.05	233.31 233.34	46035	2	NONLINEAR	ENVELOPE	0.0
20	553.04 560.04	233.36 233.39	42765	2	NONLINEAR	ENVELOPE	0.0
21	567.03 574.03	233.42 233.45	39496	2	NONLINEAR	ENVELOPE	0.0
22	581.03 588.02	233.48 233.51	36226	2	NONLINEAR	ENVELOPE	0.0

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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23	595.02	233.54	32957	2	NONLINEAR ENVELOPE	0.0
	602.02	233.56				
24	609.01	233.59	29687	2	NONLINEAR ENVELOPE	0.0
	616.01	233.62				
25	623.00	233.65	26417	2	NONLINEAR ENVELOPE	0.0
	630.00	233.68				
26	632.50	233.70	8642	2	NONLINEAR ENVELOPE	0.0
	635.00	233.72				
27	637.00	233.51	6650	2	NONLINEAR ENVELOPE	0.0
	639.00	233.30				
28	641.50	232.78	8120	2	NONLINEAR ENVELOPE	0.0
	644.00	232.26				
29	650.59	230.87	20657	2	NONLINEAR ENVELOPE	0.0
	657.18	229.49				
30	663.77	228.11	19573	2	NONLINEAR ENVELOPE	0.0
	670.36	226.73				
31	676.95	225.35	18489	2	NONLINEAR ENVELOPE	0.0
	683.54	223.97				
32	690.13	222.59	17405	2	NONLINEAR ENVELOPE	0.0
	696.72	221.21				
33	703.31	219.82	16321	2	NONLINEAR ENVELOPE	0.0
	709.90	218.44				
34	716.49	217.06	15237	2	NONLINEAR ENVELOPE	0.0
	723.08	215.68				
35	729.67	214.30	14153	2	NONLINEAR ENVELOPE	0.0
	736.26	212.92				
36	741.18	212.88	9360	2	NONLINEAR ENVELOPE	0.0
	746.09	212.85				
37	751.01	212.81	7779	2	NONLINEAR ENVELOPE	0.0
	755.92	212.78				
38	762.56	212.55	8104	2	NONLINEAR ENVELOPE	0.0
	769.20	212.31				
39	775.83	212.08	5433	2	NONLINEAR ENVELOPE	0.0
	782.47	211.85				
40	789.11	211.62	2762	2	NONLINEAR ENVELOPE	0.0
	795.75	211.39				
41	797.24	211.34	161	2	NONLINEAR ENVELOPE	0.0
	798.74	211.28				

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	1.140e+005	-2.966
Reduced value -	Delta was too large		-0.500
2	2.50000	9.141e+004	-1.724
Reduced value -	Delta was too large		-0.500
3	2.00000	5.923e+004	-0.757
Reduced value -	Delta was too large		-0.500
4	1.50000	9.240e+003	-0.072
5	1.42784	-3.947e+002	0.003
6	1.43068	-6.638e-001	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 6.80576e-011

Summation of Vertical Forces: 6.74447e-011

Summation of Moments: -1.05792e-008

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.41727e-011

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 1.431 Side Force Inclination: -0.00

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear Stress
			Normal Stress	Normal Stress	
1	371.45	313.46	418.6	418.6	274.7
2	379.96	303.47	724.9	724.9	424.7
3	388.46	293.48	1031.2	1031.2	574.6
4	396.97	283.49	1554.1	960.8	540.1
5	405.48	273.50	2088.0	871.3	496.3
6	413.98	263.51	1950.3	1950.3	1024.4
7	422.49	253.52	2256.6	2256.6	1174.3
8	431.00	243.53	2778.6	2187.8	1140.6
9	437.46	235.95	3181.9	2117.7	1106.4
10	439.69	233.32	3319.9	2092.1	1093.8
11	439.88	233.10	4033.6	4033.6	506.9
12	445.56	232.92	4635.0	4635.0	550.3
13	456.58	232.97	4596.6	4596.6	547.5
14	469.09	233.02	4460.5	4460.5	537.7
15	483.08	233.08	4226.8	4226.8	520.8
16	497.07	233.13	3993.0	3993.0	504.0
17	511.06	233.19	3759.3	3759.3	487.1
18	525.06	233.25	3525.6	3525.6	470.2
19	539.05	233.31	3291.8	3291.8	453.4
20	553.04	233.36	3058.1	3058.1	436.5
21	567.03	233.42	2824.4	2824.4	419.6
22	581.03	233.48	2590.6	2590.6	402.7
23	595.02	233.54	2356.9	2356.9	385.9
24	609.01	233.59	2123.2	2123.2	369.0
25	623.00	233.65	1889.4	1889.4	340.2
26	632.50	233.70	1730.7	1730.7	311.6
27	637.00	233.51	1632.3	1632.3	293.9
28	641.50	232.78	1564.8	1564.8	281.8
29	650.59	230.87	1510.2	1510.2	271.9
30	663.77	228.11	1431.0	1431.0	257.7
31	676.95	225.35	1351.7	1351.7	243.4
32	690.13	222.59	1272.5	1272.5	229.1
33	703.31	219.82	1193.2	1193.2	214.8
34	716.49	217.06	1114.0	1114.0	200.6
35	729.67	214.30	1034.7	1034.7	186.3
36	741.18	212.88	951.0	951.0	171.2
37	751.01	212.81	790.5	790.5	142.3
38	762.56	212.55	606.7	606.7	109.2
39	775.83	212.08	406.7	406.7	73.2
40	789.11	211.62	206.8	206.8	37.2
41	797.24	211.34	53.4	53.4	9.6

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure

Filename: 20221125 Section B-B' Non-Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 60

 * Final Results for Side Forces Between Slices *
 * (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----					
Resultant					
Slice No.	X-Right	Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	375.70	1844	-0.00	1844	-0
2	384.21	5473	-0.00	5473	-0
3	392.72	10887	-0.00	10887	-0
4	401.22	21818	-0.00	21818	-0
5	409.73	38454	-0.00	38454	-0
6	418.24	49222	-0.00	49222	-0
7	426.74	61776	-0.00	61776	-0
8	435.25	79830	-0.00	79830	-0
9	439.66	91440	-0.00	91440	-0
10	439.72	91584	-0.00	91584	-0
11	440.05	92996	-0.00	92996	-0
12	451.07	86723	-0.00	86723	-0
13	462.09	80482	-0.00	80482	-0
14	476.08	72702	-0.00	72702	-0
15	490.08	65172	-0.00	65172	-0
16	504.07	57892	-0.00	57892	-0
17	518.06	50861	-0.00	50861	-0
18	532.05	44079	-0.00	44079	-0
19	546.05	37547	-0.00	37547	-0
20	560.04	31264	-0.00	31264	-0
21	574.03	25231	-0.00	25231	-0
22	588.02	19447	-0.00	19447	-0
23	602.02	13913	-0.00	13913	-0
24	616.01	8628	-0.00	8628	-0
25	630.00	3760	-0.00	3760	-0
26	635.00	2138	-0.00	2138	-0
27	639.00	1636	-0.00	1636	-0
28	644.00	1868	-0.00	1868	-0
29	657.18	2455	-0.00	2455	-0
30	670.36	3012	-0.00	3012	-0
31	683.54	3538	-0.00	3538	-0
32	696.72	4033	-0.00	4033	-0
33	709.90	4497	-0.00	4497	-0
34	723.08	4931	-0.00	4931	-0
35	736.26	5333	-0.00	5333	-0
36	746.09	3717	-0.00	3717	-0
37	755.92	2374	-0.00	2374	-0
38	769.20	1205	-0.00	1205	-0
39	782.47	421	-0.00	421	-0
40	795.75	23	-0.00	23	-0
41	798.74	-1	-0.00	-1	0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: C-C' Case: Non Circular - Residual Liner Strength

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates

x	y
337.81	317.09
462.85	234.18
602.96	198.78 fixed
640.44	196.35 fixed
648.54	196.87 fixed
738.7	193.17 fixed
796.77	192.99 fixed
872.91	196.17 fixed

Shifting Points

10
5

Adjustments

Crack Depth

13

Seismic Acceleration

Minimum Weight
5000

Forced failure
through
sloped
portion of the
liner

Results

Noncircular Shear Surface

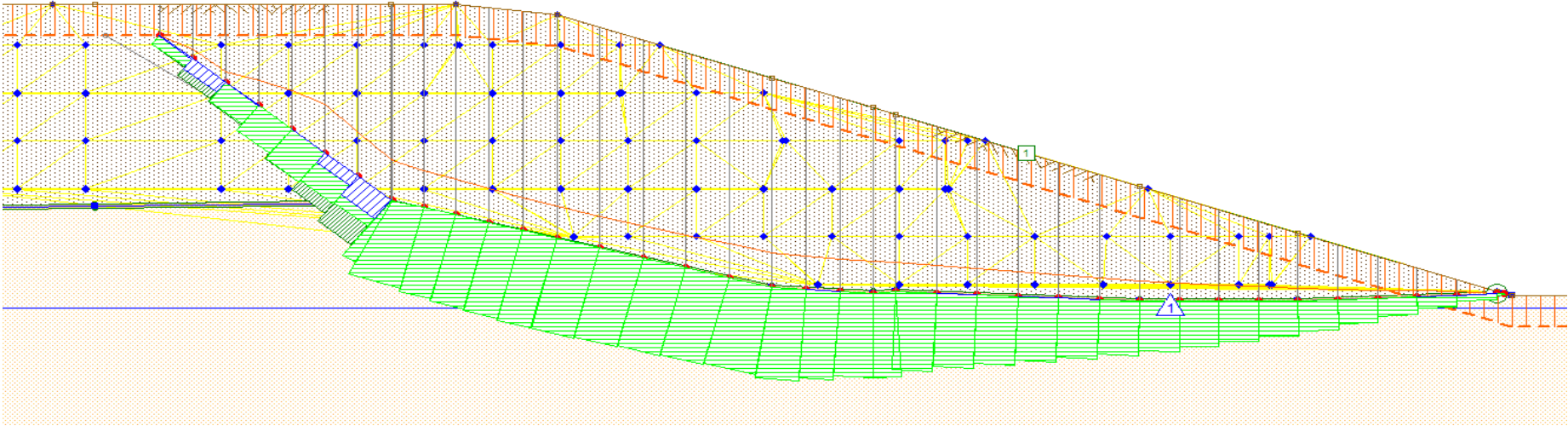
377.44	304.05
463.26	235.02
602.96	198.78
640.44	196.35
648.54	196.87
738.7	193.17
796.77	192.99
872.91	196.17

Factor of Safety

1.044

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Cell 3 Waste	55	Cohesion: 100.0 Friction angle: 35	Pore Pressure Interpolated
2	Liner	120	Nonlinear	Piezometric Line no. 2
3	Natural Soil (GP Dense to Very Dense)	130	Cohesion: 0.0 Friction angle: 36	Piezometric Line no. 1

Factor of safety: 1.044
Side force Inclination: -9.02 degrees



Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section C-C' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 1 of 6

ENGLISH units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 5 Surface

0 328.8926

71.051 326.0616

188.5248 321.3252

296.7885 317.0329

337.8051 317.0858

486.3848 316.9548

523.8643 312.6729

869.918712 197.1749

2 2 Liner

0 232.1147

82.3776 229.8661

149.6914 230.9902

353.4471 233.6161

462.8547 235.1779

602.9616 199.777

640.4418 197.3469

648.5372 197.872

738.6968 194.1687

796.7718 193.9902

869.918712 197.1749

875.9111 195.1749

3 3 Native Surface

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section C-C' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 2 of 6

0 230.1147

82.3776 227.8661

149.6914 228.9902

353.4471 231.6161

462.8547 233.1779

602.9616 197.777

640.4418 195.3469

648.5372 195.872

738.6968 192.1687

796.7718 191.9902

875.9111 195.1749

1500 195.2685

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Interpolate Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0 0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section C-C' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 3 of 6

130.00 = unit weight

Conventional

0.0 36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000 190.000000

1500.000000 190.000000

2 62.40 Piezometric line 2

0 231.1147

82.3776 228.8661

149.6914 229.9902

353.4471 232.6161

462.8547 234.1779

602.9616 198.777

640.4418 196.3469

648.5372 196.872

738.6968 193.1687

796.7718 192.9902

872.914906 196.1749

875.9111 195.1749

Interpolation Point

P

337.8051 317.0858 0 1 486.3848 316.9548 0

1 523.8643 312.6729 0 1 561.8347653 300 0

1 681.6825203 260 0 1 741.6063977 240 0 1

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section C-C' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 4 of 6

```
801.5302752 220 0 1 869.918712 197.1749 0 1
530 220 0 1 550 220 0 1 575 220 0
1 600 220 0 1 625 220 0 1 650 220
0 1 675 220 0 1 700 220 0 1
726.5302752 220 0 1 750 220 0 1 775 220
0 1 786.4542 220 0 1
530 220 0 1 620 200 1248 1 650 200 1248
1 675 200 1248 1 700 200 1248 1 725 200
1248 1 750 200 1248 1 775 200
786.4542 200 1248 1 787 200 0 1
530 219.5 0 1 620 199.5 0 1 650 199.5 0
1 675 199.5 0 1 700 199.5 0 1 725
199.5 0 1 750 199.5 0 1 775 199.5 0 1
786.4542 199.5 0 1 787 199.5 0 1
300 260 0 1 325 260 0 1 350 260 0
1 400 260 0 1 425 260 0 1 450 260
0 1 475 260 0 1 500 260 0 1 525
260 0 1 550 260 0 1 575 260 0 1
606.6825 260 0 1
608 260 0 1 650 260 0 1 666.6064 260
0 1 675 260 0 1
300 240 1248 1 325 240 1248 1 350 240 1248
1 400 240 1248 1 425 240 1248 1 450 240
1248 1 475 240 1248 1 500 240 1248 1 525
240 1248 1 550 240 1248 1 575 240 1248 1
600 240 1248 1 625 240 1248 1
650 240 1248 1 666.6064 240 1248 1 668 240
0 1
```

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section C-C' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 5 of 6

```
300 239.5 0 1 325 239.5 0 1 350 239.5 0
1 400 239.5 0 1 425 239.5 0 1 450
239.5 0 1 475 239.5 0 1 500 239.5 0 1
525 239.5 0 1 550 239.5 0 1 575 239.5 0
1 600 239.5 0 1 625 239.5 0 1
650 239.5 0 1 666.6064 239.5 0 1 668
239.5 0 1
300 300 0 1 325 300 0 1 350 300 0
1 400 300 0 1 425 300 0 1 450 300
0 1 475 300 0 1 486.8347653 300 0 1
488 300 0 1 500 300 0 1 525 300 0
1 546.7586428 300 0 1
300 280 1248 1 325 280 1248 1 350 280 1248
1 400 280 1248 1 425 280 1248 1 450 280
1248 1 475 280 1248 1 500 280 1248 1 525
280 1248 1 546.7586428 280 1248 1 548 280 0
1 575 280 0 1 600 280 0 1
300 279.5 0 1 325 279.5 0 1 350 279.5 0
1 400 279.5 0 1 425 279.5 0 1 450
279.5 0 1 475 279.5 0 1 500 279.5 0 1
525 279.5 0 1 546.7586428 279.5 0 1 548 280
0 1
```

ANALYSIS/computation data follow

Noncircular Search 2

337.8051 317.0858

462.8547 234.1779

602.9616 198.777 Fixed

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section C-C' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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640.4418 196.3469 Fixed

648.5372 196.872 Fixed

738.6968 193.1687 Fixed

796.7718 192.9902 Fixed

872.914906 196.1749 Fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

13 d

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 5 Surface

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	188.52	321.33
4	296.79	317.03
5	337.81	317.09
6	486.38	316.95
7	523.86	312.67
8	869.92	197.17

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	232.11
2	82.38	229.87
3	149.69	230.99
4	353.45	233.62
5	462.85	235.18
6	602.96	199.78
7	640.44	197.35
8	648.54	197.87
9	738.70	194.17
10	796.77	193.99
11	869.92	197.17
12	875.91	195.17
13	875.91	195.17
14	875.91	195.17
15	842.27	210.99
16	860.50	210.99
17	866.54	211.81
18	886.08	218.09
19	904.75	224.54
20	924.03	230.91
21	958.79	233.09
22	975.42	234.03
23	998.38	233.93

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	230.11
2	82.38	227.87
3	149.69	228.99
4	353.45	231.62
5	462.85	233.18
6	602.96	197.78
7	640.44	195.35
8	648.54	195.87

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

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UTEXAS4 Output File

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9	738.70	192.17
10	796.77	191.99
11	875.91	195.17
12	1500.00	195.27

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope

Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----
-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----
-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----
-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

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Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	231.11
2	82.38	228.87
3	149.69	229.99
4	353.45	232.62
5	462.85	234.18
6	602.96	198.78
7	640.44	196.35
8	648.54	196.87
9	738.70	193.17
10	796.77	192.99
11	872.91	196.17
12	875.91	195.17

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	337.81	317.09	angle to be computed - moveable
2	462.85	234.18	angle to be computed - moveable
3	602.96	198.78	- fixed
4	640.44	196.35	- fixed
5	648.54	196.87	- fixed
6	738.70	193.17	- fixed
7	796.77	192.99	- fixed
8	872.91	196.17	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 13.000

-----The
following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	82.38	325.60
4	149.69	322.89
5	188.52	321.33
6	296.79	317.03
7	337.81	317.09
8	353.45	317.07
9	462.85	316.98
10	486.38	316.95
11	523.86	312.67
12	602.96	286.27
13	640.44	273.76
14	648.54	271.06
15	738.70	240.97
16	796.77	221.59
17	869.92	197.17
18	875.91	195.17
19	1500.00	195.27

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 377.44 Y: 304.05

X: 463.27 Y: 235.03

X: 602.96 Y: 198.78

X: 640.44 Y: 196.35

X: 648.54 Y: 196.87

X: 738.70 Y: 193.17

X: 796.77 Y: 192.99

X: 872.91 Y: 196.17

Minimum factor of safety: 1.064

Side force inclination: -9.20

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 6

Total number of shear surfaces attempted: 30

Total number of shear surfaces for which the factor of safety
was successfully calculated: 30

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	1.1343	5	5
2	5.0000	1	5.000	1.1067	10	10
3	5.0000	1	5.000	1.0920	15	15
4	5.0000	1	5.000	1.0775	20	20
5	5.0000	1	5.000	1.0639	25	25
6	5.0000	1	5.000	1.0639	30	30

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *

* Information for Individual Slices for Conventional *

* Computations or First Stage of Multi-Stage Computations. *

* (Information is for the critical shear surface in the *

* case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	377.44	304.05					
	383.54	299.14	10922	1	100.0	35.00	53.4
	389.64	294.24					
2	395.74	289.33	16902	1	100.0	35.00	665.7
	401.84	284.43					
3	407.94	279.52	22882	1	100.0	35.00	49.5
	414.05	274.61					
4	420.15	269.71	28862	1	100.0	35.00	0.0
	426.25	264.80					
5	432.35	259.90	34842	1	100.0	35.00	6.6
	438.45	254.99					
6	444.55	250.08	40822	1	100.0	35.00	618.8
	450.65	245.18					
7	456.75	240.27	46802	1	100.0	35.00	1231.1
	462.85	235.36					
8	463.02	235.23	1379	1	100.0	35.00	0.0
	463.19	235.09					
9	463.23	235.06	303	2	NONLINEAR ENVELOPE		0.0
	463.27	235.03					
10	469.05	233.53	48289	2	NONLINEAR ENVELOPE		0.0
	474.83	232.03					
11	480.61	230.53	50081	2	NONLINEAR ENVELOPE		0.0
	486.38	229.03					
12	492.63	227.41	55700	2	NONLINEAR ENVELOPE		0.0
	498.88	225.79					
13	505.12	224.17	56909	2	NONLINEAR ENVELOPE		0.0
	511.37	222.55					
14	517.62	220.93	58118	2	NONLINEAR ENVELOPE		0.0
	523.86	219.31					
15	531.77	217.25	73953	2	NONLINEAR ENVELOPE		0.0
	539.68	215.20					
16	547.59	213.15	73144	2	NONLINEAR ENVELOPE		0.0
	555.50	211.09					
17	563.41	209.04	72336	2	NONLINEAR ENVELOPE		0.0
	571.32	206.99					
18	579.23	204.94	71527	2	NONLINEAR ENVELOPE		0.0
	587.14	202.88					
19	595.05	200.83	70719	2	NONLINEAR ENVELOPE		0.0
	602.96	198.78					
20	609.21	198.37	54482	2	NONLINEAR ENVELOPE		0.0
	615.45	197.97					
21	621.70	197.56	52383	2	NONLINEAR ENVELOPE		0.0
	627.95	197.16					
22	634.20	196.75	50284	2	NONLINEAR ENVELOPE		0.0
	640.44	196.35					

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23	644.49	196.61	31250	2	NONLINEAR ENVELOPE	0.0
	648.54	196.87				
24	656.05	196.56	55141	2	NONLINEAR ENVELOPE	0.0
	663.56	196.25				
25	671.08	195.95	51837	2	NONLINEAR ENVELOPE	0.0
	678.59	195.64				
26	686.10	195.33	48532	2	NONLINEAR ENVELOPE	0.0
	693.62	195.02				
27	701.13	194.71	45228	2	NONLINEAR ENVELOPE	0.0
	708.64	194.40				
28	716.16	194.09	41924	2	NONLINEAR ENVELOPE	0.0
	723.67	193.79				
29	731.18	193.48	38619	2	NONLINEAR ENVELOPE	0.0
	738.70	193.17				
30	745.96	193.15	33975	2	NONLINEAR ENVELOPE	0.0
	753.22	193.12				
31	760.47	193.10	30490	2	NONLINEAR ENVELOPE	0.0
	767.73	193.08				
32	774.99	193.06	27005	2	NONLINEAR ENVELOPE	0.0
	782.25	193.03				
33	789.51	193.01	23519	2	NONLINEAR ENVELOPE	0.0
	796.77	192.99				
34	804.09	193.30	19946	2	NONLINEAR ENVELOPE	0.0
	811.40	193.60				
35	818.72	193.91	15952	2	NONLINEAR ENVELOPE	0.0
	826.03	194.21				
36	833.35	194.52	11959	2	NONLINEAR ENVELOPE	0.0
	840.66	194.83				
37	847.97	195.13	7966	2	NONLINEAR ENVELOPE	0.0
	855.29	195.44				
38	862.60	195.74	3972	2	NONLINEAR ENVELOPE	0.0
	869.92	196.05				
39	871.42	196.11	202	2	NONLINEAR ENVELOPE	0.0
	872.91	196.17				

No water in crack.

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

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Name of input data file:

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MSB CELL 3

TABLE NO. 47

 * Information for the Iterative Solution for the Factor of *
 * Safety and Side Force Inclination by Spencer's Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 15

Allowable moment imbalance for convergence: 8738

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iter- ation	1	3.00000	-17.1887	-1.967e+005	7.179e+007	
First-order corrections to F and Theta					-5.1517	-2.4740
Reduced values - Deltas were too large					-0.5000	-0.2401
2	2.50000	-17.4289	-1.739e+005	6.337e+007		
First-order corrections to F and Theta					-3.1919	-3.0328
Reduced values - Deltas were too large					-0.5000	-0.4751
3	2.00000	-17.9039	-1.401e+005	5.079e+007		
First-order corrections to F and Theta					-1.6634	-4.4633
Reduced values - Deltas were too large					-0.5000	-1.3416
4	1.50000	-19.2455	-8.445e+004	2.964e+007		
First-order corrections to F and Theta					-0.5561	-14.3102
Reduced values - Deltas were too large					-0.1113	-2.8648
5	1.38868	-22.1103	-6.618e+004	2.267e+007		
First-order corrections to F and Theta					-0.3117	-58.7542
Reduced values - Deltas were too large					-0.0152	-2.8648
6	1.37348	-24.9751	-6.292e+004	2.143e+007		
First-order corrections to F and Theta					-0.0074	-309.5322
Reduced values - Deltas were too large					-0.0001	-2.8648
7	1.37341	-27.8399	-6.237e+004	2.116e+007		
First-order corrections to F and Theta					-0.6079	264.2854
Reduced values - Deltas were too large					-0.0066	2.8648
8	1.36682	-24.9751	-6.173e+004	2.089e+007		
First-order corrections to F and Theta					0.2842	-550.1152
Reduced values - Deltas were too large					0.0015	-2.8648
9	1.36830	-27.8399	-6.144e+004	2.073e+007		
First-order corrections to F and Theta					-0.5561	214.7172
Reduced values - Deltas were too large					-0.0074	2.8648
10	1.36088	-24.9751	-6.065e+004	2.042e+007		
First-order corrections to F and Theta					1.7922	-1831.2955
Reduced values - Deltas were too large					0.0028	-2.8648
11	1.36368	-27.8399	-6.059e+004	2.033e+007		
First-order corrections to F and Theta					-0.5213	183.4222
Reduced values - Deltas were too large					-0.0081	2.8648
12	1.35554	-24.9751	-5.968e+004	1.998e+007		
First-order corrections to F and Theta					-2.2727	1649.6019
Reduced values - Deltas were too large					-0.0039	2.8648
13	1.35160	-22.1103	-5.961e+004	1.991e+007		
First-order corrections to F and Theta					-0.1383	-143.7681
Reduced values - Deltas were too large					-0.0028	-2.8648
14	1.34884	-24.9751	-5.844e+004	1.943e+007		
First-order corrections to F and Theta					-0.8990	484.0654
Reduced values - Deltas were too large					-0.0053	2.8648
15	1.34352	-22.1103	-5.813e+004	1.928e+007		

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First-order corrections to F and Theta	-0.0308	-213.1322
Reduced values - Deltas were too large	-0.0004	-2.8648
16 1.34310 -24.9751 -5.738e+004 1.896e+007		
First-order corrections to F and Theta	-0.6760	300.6726
Reduced values - Deltas were too large	-0.0064	2.8648
17 1.33666 -22.1103 -5.686e+004 1.875e+007		
First-order corrections to F and Theta	0.1866	-363.6535
Reduced values - Deltas were too large	0.0015	-2.8648
18 1.33813 -24.9751 -5.644e+004 1.855e+007		
First-order corrections to F and Theta	-0.5812	225.9131
Reduced values - Deltas were too large	-0.0074	2.8648
19 1.33076 -22.1103 -5.576e+004 1.828e+007		
First-order corrections to F and Theta	0.9908	-940.9220
Reduced values - Deltas were too large	0.0030	-2.8648
20 1.33378 -24.9751 -5.562e+004 1.818e+007		
First-order corrections to F and Theta	-0.5273	185.2828
Reduced values - Deltas were too large	-0.0082	2.8648
21 1.32563 -22.1103 -5.480e+004 1.788e+007		
First-order corrections to F and Theta	-3.5963	2392.6180
Reduced values - Deltas were too large	-0.0043	2.8648
22 1.32132 -19.2455 -5.476e+004 1.782e+007		
First-order corrections to F and Theta	-0.1062	-122.5927
Reduced values - Deltas were too large	-0.0025	-2.8648
23 1.31884 -22.1103 -5.351e+004 1.733e+007		
First-order corrections to F and Theta	-0.8652	418.1506
Reduced values - Deltas were too large	-0.0059	2.8648
24 1.31291 -19.2455 -5.317e+004 1.718e+007		
First-order corrections to F and Theta	0.0341	-206.0026
Reduced values - Deltas were too large	0.0005	-2.8648
25 1.31339 -22.1103 -5.246e+004 1.689e+007		
First-order corrections to F and Theta	-0.6265	250.5064
Reduced values - Deltas were too large	-0.0072	2.8648
26 1.30622 -19.2455 -5.190e+004 1.667e+007		
First-order corrections to F and Theta	0.4267	-455.1686
Reduced values - Deltas were too large	0.0027	-2.8648
27 1.30891 -22.1103 -5.160e+004 1.653e+007		
First-order corrections to F and Theta	-0.5342	188.1176
Reduced values - Deltas were too large	-0.0081	2.8648
28 1.30077 -19.2455 -5.084e+004 1.626e+007		
First-order corrections to F and Theta	1.168e+002	-7.610e+004
Reduced values - Deltas were too large	0.5000	-2.8648
29 1.80077 -22.1103 -1.212e+005 4.587e+007		
First-order corrections to F and Theta	-1.1685	-9.8087
Reduced values - Deltas were too large	-0.3413	-2.8648
30 1.45949 -24.9751 -7.739e+004 2.785e+007		
First-order corrections to F and Theta	-0.4499	-49.1374
Reduced values - Deltas were too large	-0.0262	-2.8648
31 1.43326 -27.8399 -7.279e+004 2.601e+007		
First-order corrections to F and Theta	-0.3198	-166.9467
Reduced values - Deltas were too large	-0.0055	-2.8648
32 1.42777 -30.7047 -7.155e+004 2.547e+007		
First-order corrections to F and Theta	-0.7378	546.3590
Reduced values - Deltas were too large	-0.0039	2.8648
33 1.42391 -27.8399 -7.122e+004 2.528e+007		
First-order corrections to F and Theta	-0.2561	-221.4662
Reduced values - Deltas were too large	-0.0033	-2.8648
34 1.42059 -30.7047 -7.031e+004 2.487e+007		
First-order corrections to F and Theta	-0.6347	361.3349
Reduced values - Deltas were too large	-0.0050	2.8648
35 1.41556 -27.8399 -6.980e+004 2.462e+007		
First-order corrections to F and Theta	-0.1604	-314.0732
Reduced values - Deltas were too large	-0.0015	-2.8648

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36	1.41410	-30.7047	-6.918e+004	2.432e+007		
First-order corrections to F and Theta					-0.5821	275.9892
Reduced values - Deltas were too large					-0.0060	2.8648
37	1.40806	-27.8399	-6.851e+004	2.402e+007		
First-order corrections to F and Theta					0.0228	-506.7301
Reduced values - Deltas were too large					0.0001	-2.8648
38	1.40818	-30.7047	-6.815e+004	2.381e+007		
First-order corrections to F and Theta					-0.5483	226.7935
Reduced values - Deltas were too large					-0.0069	2.8648
39	1.40126	-27.8399	-6.733e+004	2.347e+007		
First-order corrections to F and Theta					0.6091	-1154.5934
Reduced values - Deltas were too large					0.0015	-2.8648
40	1.40277	-30.7047	-6.719e+004	2.335e+007		
First-order corrections to F and Theta					-0.5238	194.7516
Reduced values - Deltas were too large					-0.0077	2.8648
41	1.39507	-27.8399	-6.624e+004	2.297e+007		
First-order corrections to F and Theta					-6.2428	6570.0485
Reduced values - Deltas were too large					-0.0027	2.8648
42	1.39234	-24.9751	-6.625e+004	2.290e+007		
First-order corrections to F and Theta					-0.2353	-139.6315
Reduced values - Deltas were too large					-0.0048	-2.8648
43	1.38752	-27.8399	-6.490e+004	2.234e+007		
First-order corrections to F and Theta					-1.0269	711.4291
Reduced values - Deltas were too large					-0.0041	2.8648
44	1.38338	-24.9751	-6.468e+004	2.221e+007		
First-order corrections to F and Theta					-0.1643	-188.4297
Reduced values - Deltas were too large					-0.0025	-2.8648
45	1.38088	-27.8399	-6.372e+004	2.179e+007		
First-order corrections to F and Theta					-0.7374	397.1352
Reduced values - Deltas were too large					-0.0053	2.8648
46	1.37556	-24.9751	-6.330e+004	2.159e+007		
First-order corrections to F and Theta					-0.0540	-272.4772
Reduced values - Deltas were too large					-0.0006	-2.8648
47	1.37500	-27.8399	-6.266e+004	2.129e+007		
First-order corrections to F and Theta					-0.6284	284.5621
Reduced values - Deltas were too large					-0.0063	2.8648
48	1.36867	-24.9751	-6.206e+004	2.104e+007		
First-order corrections to F and Theta					0.1668	-452.1999
Reduced values - Deltas were too large					0.0011	-2.8648
49	1.36973	-27.8399	-6.170e+004	2.085e+007		
First-order corrections to F and Theta					-0.5688	226.6055
Reduced values - Deltas were too large					-0.0072	2.8648
50	1.36253	-24.9751	-6.095e+004	2.055e+007		
First-order corrections to F and Theta					0.9452	-1109.5659
Reduced values - Deltas were too large					0.0024	-2.8648
51	1.36498	-27.8399	-6.083e+004	2.044e+007		
First-order corrections to F and Theta					-0.5302	191.2347
Reduced values - Deltas were too large					-0.0079	2.8648
52	1.35703	-24.9751	-5.995e+004	2.010e+007		
First-order corrections to F and Theta					-4.4695	3525.1670
Reduced values - Deltas were too large					-0.0036	2.8648
53	1.35340	-22.1103	-5.994e+004	2.004e+007		
First-order corrections to F and Theta					-0.1544	-134.0863
Reduced values - Deltas were too large					-0.0033	-2.8648
54	1.35010	-24.9751	-5.868e+004	1.954e+007		
First-order corrections to F and Theta					-0.9883	558.7711
Reduced values - Deltas were too large					-0.0051	2.8648
55	1.34504	-22.1103	-5.841e+004	1.940e+007		
First-order corrections to F and Theta					-0.0576	-195.3462
Reduced values - Deltas were too large					-0.0008	-2.8648
56	1.34419	-24.9751	-5.758e+004	1.905e+007		
First-order corrections to F and Theta					-0.7049	324.0231

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Reduced values - Deltas were too large	-0.0062	2.8648
57 1.33796 -22.1103 -5.710e+004 1.885e+007		
First-order corrections to F and Theta	0.1255	-320.6765
Reduced values - Deltas were too large	0.0011	-2.8648
58 1.33908 -24.9751 -5.662e+004 1.863e+007		
First-order corrections to F and Theta	-0.5958	237.1782
Reduced values - Deltas were too large	-0.0072	2.8648
59 1.33188 -22.1103 -5.597e+004 1.837e+007		
First-order corrections to F and Theta	0.6879	-722.3379
Reduced values - Deltas were too large	0.0027	-2.8648
60 1.33461 -24.9751 -5.578e+004 1.825e+007		
First-order corrections to F and Theta	-0.5363	191.8989
Reduced values - Deltas were too large	-0.0080	2.8648
61 1.32661 -22.1103 -5.498e+004 1.795e+007		
First-order corrections to F and Theta	-10.5384	7428.4511
Reduced values - Deltas were too large	-0.0041	2.8648
62 1.32254 -19.2455 -5.499e+004 1.791e+007		
First-order corrections to F and Theta	-0.1183	-115.8264
Reduced values - Deltas were too large	-0.0029	-2.8648
63 1.31962 -22.1103 -5.366e+004 1.739e+007		
First-order corrections to F and Theta	-0.9267	461.9499
Reduced values - Deltas were too large	-0.0057	2.8648
64 1.31387 -19.2455 -5.336e+004 1.726e+007		
First-order corrections to F and Theta	0.0098	-191.1197
Reduced values - Deltas were too large	0.0001	-2.8648
65 1.31402 -22.1103 -5.258e+004 1.694e+007		
First-order corrections to F and Theta	-0.6442	262.7293
Reduced values - Deltas were too large	-0.0070	2.8648
66 1.30699 -19.2455 -5.204e+004 1.673e+007		
First-order corrections to F and Theta	0.3397	-399.3014
Reduced values - Deltas were too large	0.0024	-2.8648
67 1.30943 -22.1103 -5.170e+004 1.657e+007		
First-order corrections to F and Theta	-0.5427	193.7594
Reduced values - Deltas were too large	-0.0080	2.8648
68 1.30141 -19.2455 -5.097e+004 1.630e+007		
First-order corrections to F and Theta	5.4765	-3734.2452
Reduced values - Deltas were too large	0.0042	-2.8648
69 1.30561 -22.1103 -5.096e+004 1.626e+007		
First-order corrections to F and Theta	-0.4891	158.8054
Reduced values - Deltas were too large	-0.0088	2.8648
70 1.29678 -19.2455 -5.007e+004 1.595e+007		
First-order corrections to F and Theta	-1.2233	626.1919
Reduced values - Deltas were too large	-0.0056	2.8648
71 1.29119 -16.3808 -4.987e+004 1.585e+007		
First-order corrections to F and Theta	-0.0407	-129.5162
Reduced values - Deltas were too large	-0.0009	-2.8648
72 1.29029 -19.2455 -4.880e+004 1.544e+007		
First-order corrections to F and Theta	-0.6140	235.8649
Reduced values - Deltas were too large	-0.0075	2.8648
73 1.28283 -16.3808 -4.823e+004 1.524e+007		
First-order corrections to F and Theta	0.3658	-366.7061
Reduced values - Deltas were too large	0.0029	-2.8648
74 1.28569 -19.2455 -4.789e+004 1.508e+007		
First-order corrections to F and Theta	-0.4960	163.2277
Reduced values - Deltas were too large	-0.0087	2.8648
75 1.27698 -16.3808 -4.708e+004 1.480e+007		
First-order corrections to F and Theta	-2.3076	1243.0319
Reduced values - Deltas were too large	-0.0053	2.8648
76 1.27166 -13.5160 -4.700e+004 1.474e+007		
First-order corrections to F and Theta	-0.1035	-74.2686
Reduced values - Deltas were too large	-0.0040	-2.8648
77 1.26767 -16.3808 -4.521e+004 1.410e+007		

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First-order corrections to F and Theta	-0.4811	154.0181
Reduced values - Deltas were too large	-0.0089	2.8648
78 1.25873 -13.5160 -4.440e+004 1.384e+007		
First-order corrections to F and Theta	-5.9792	3250.0755
Reduced values - Deltas were too large	-0.0053	2.8648
79 1.25345 -10.6512 -4.439e+004 1.380e+007		
First-order corrections to F and Theta	-0.1670	-26.8340
Reduced values - Deltas were too large	-0.0178	-2.8648
80 1.23562 -13.5160 -3.962e+004 1.217e+007		
First-order corrections to F and Theta	-0.2569	39.0549
Reduced values - Deltas were too large	-0.0188	2.8648
81 1.21678 -10.6512 -3.670e+004 1.132e+007		
First-order corrections to F and Theta	-0.1910	11.4114
Reduced values - Deltas were too large	-0.0480	2.8648
82 1.16882 -7.7864 -2.715e+004 8.592e+006		
First-order corrections to F and Theta	-0.1093	-4.3545
Reduced values - Deltas were too large	-0.0719	-2.8648
83 1.09694 -10.6512 -8.233e+003 2.108e+006		
First-order corrections to F and Theta	-0.0345	1.7968
Second-order corrections to F and Theta	-0.0331	1.4629
84 1.06389 -9.1883 7.668e+000 1.545e+003		
First-order corrections to F and Theta	0.0000	-0.0103
Second-order corrections to F and Theta	0.0000	-0.0103
85 1.06393 -9.1986 -6.796e-008 -1.104e-004		
First-order corrections to F and Theta	-0.0000	0.0000

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 7.55662e-011

Summation of Vertical Forces: 1.33610e-010

Summation of Moments: -1.24273e-008

Mohr Coulomb Shear Force/Shear Strength Check Summation: 3.83338e-011

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 1.064 Side Force Inclination: -9.20

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear Stress
			Normal Stress	Normal Stress	
1	383.54	299.14	552.0	498.7	422.2
2	395.74	289.33	1034.3	368.6	336.6
3	407.94	279.52	1182.2	1132.7	839.4
4	420.15	269.71	1484.3	1484.3	1070.8
5	432.35	259.90	1801.7	1795.1	1275.4
6	444.55	250.08	2283.9	1665.1	1189.8
7	456.75	240.27	2766.2	1535.0	1104.2
8	463.02	235.23	2593.2	2593.2	1800.7
9	463.23	235.06	3311.1	3311.1	552.5
10	469.05	233.53	3951.3	3951.3	615.6
11	480.61	230.53	4098.8	4098.8	630.1
12	492.63	227.41	4218.5	4218.5	642.0
13	505.12	224.17	4310.5	4310.5	651.0
14	517.62	220.93	4402.5	4402.5	660.1
15	531.77	217.25	4424.2	4424.2	662.2
16	547.59	213.15	4375.6	4375.6	657.4
17	563.41	209.04	4327.0	4327.0	652.7
18	579.23	204.94	4278.4	4278.4	647.9
19	595.05	200.83	4229.8	4229.8	643.1
20	609.21	198.37	4378.7	4378.7	657.8
21	621.70	197.56	4210.9	4210.9	641.2
22	634.20	196.75	4043.1	4043.1	624.6
23	644.49	196.61	4044.4	4044.4	624.8
24	656.05	196.56	3716.5	3716.5	592.4
25	671.08	195.95	3495.4	3495.4	570.6
26	686.10	195.33	3274.3	3274.3	548.8
27	701.13	194.71	3053.3	3053.3	527.0
28	716.16	194.09	2832.2	2832.2	505.2
29	731.18	193.48	2611.1	2611.1	483.4
30	745.96	193.15	2412.6	2412.6	463.8
31	760.47	193.10	2168.8	2168.8	439.8
32	774.99	193.06	1923.7	1923.7	407.0
33	789.51	193.01	1675.4	1675.4	354.5
34	804.09	193.30	1435.0	1435.0	303.6
35	818.72	193.91	1147.7	1147.7	242.8
36	833.35	194.52	860.4	860.4	182.0
37	847.97	195.13	573.1	573.1	121.2
38	862.60	195.74	285.8	285.8	60.5
39	871.42	196.11	71.1	71.1	15.0

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure

Filename: 20221125 Section C-C' Non-Circular_output (wilson).docx

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Stability\Section C-C'\MSB Section C-C' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 59

* Final Results for Side Forces and Stresses Between Slices *

* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----						
Slice		Y-Coord. of	Fraction	Sigma	Sigma	
No.	X-Right	Side Force	of	at	at	
		Location	Height	Top	Bottom	
1	389.64	269	298.16	0.172	-11.3	34.5
2	401.84	6389	288.67	0.130	-235.7	622.6
3	414.05	7764	285.25	0.251	-89.4	450.9
4	426.25	9281	280.90	0.308	-26.4	377.3
5	438.45	11425	275.17	0.325	-8.7	372.4
6	450.65	19420	263.27	0.252	-130.3	664.2
7	462.85	33266	252.13	0.205	-308.7	1113.5
8	463.19	33363	252.03	0.207	-305.3	1109.7
9	463.27	33522	251.94	0.206	-307.9	1115.5
10	474.83	38322	247.88	0.187	-392.3	1283.1
11	486.38	43400	244.08	0.171	-474.0	1448.6
12	498.88	49131	240.23	0.161	-559.0	1639.9
13	511.37	55051	236.59	0.153	-640.8	1828.0
14	523.86	61157	233.11	0.148	-719.8	2013.0
15	539.68	68946	228.90	0.149	-818.3	2294.8
16	555.50	76609	224.89	0.152	-906.2	2567.9
17	571.32	84147	221.02	0.156	-982.6	2831.7
18	587.14	91560	217.26	0.162	-1046.8	3085.5
19	602.96	98847	213.58	0.169	-1098.1	3328.5
20	615.45	94115	212.27	0.170	-1081.9	3290.3
21	627.95	89456	210.96	0.171	-1065.2	3251.6
22	640.44	84868	209.65	0.172	-1048.2	3212.5
23	648.54	77593	209.51	0.170	-1010.0	3074.8
24	663.56	70898	208.18	0.171	-977.6	2983.1
25	678.59	64397	206.86	0.172	-943.4	2887.6
26	693.62	58090	205.54	0.173	-907.0	2787.2
27	708.64	51976	204.24	0.174	-867.6	2680.6
28	723.67	46057	202.96	0.176	-823.9	2565.8
29	738.70	40330	201.70	0.178	-774.3	2440.0
30	753.22	33617	200.82	0.179	-715.1	2258.5
31	767.73	27247	199.99	0.181	-643.4	2051.6
32	782.25	21348	199.24	0.186	-559.0	1820.9
33	796.77	16210	198.48	0.192	-474.1	1593.1
34	811.40	10821	198.11	0.195	-383.5	1308.2
35	826.03	6511	197.74	0.200	-291.8	1021.8
36	840.66	3280	197.37	0.210	-197.6	732.1
37	855.29	1128	197.02	0.238	-95.9	432.3
38	869.92	55	196.35	0.271	-17.9	113.7
39	872.91	-0	196.17	0.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: D-D' Case: Non Circular - Residual Liner Strength

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates Shifting Points

x	y	
462.92	332.87	
582.57	199.08	
609.56	200.08	fixed
658.23	199.94	fixed
730.21	197.07	fixed
806.28	198.05	fixed
863	199.68	fixed
866	198.68	fixed

Crack Depth
8

Seismic Acceleration

Minimum Weight
5000

Results

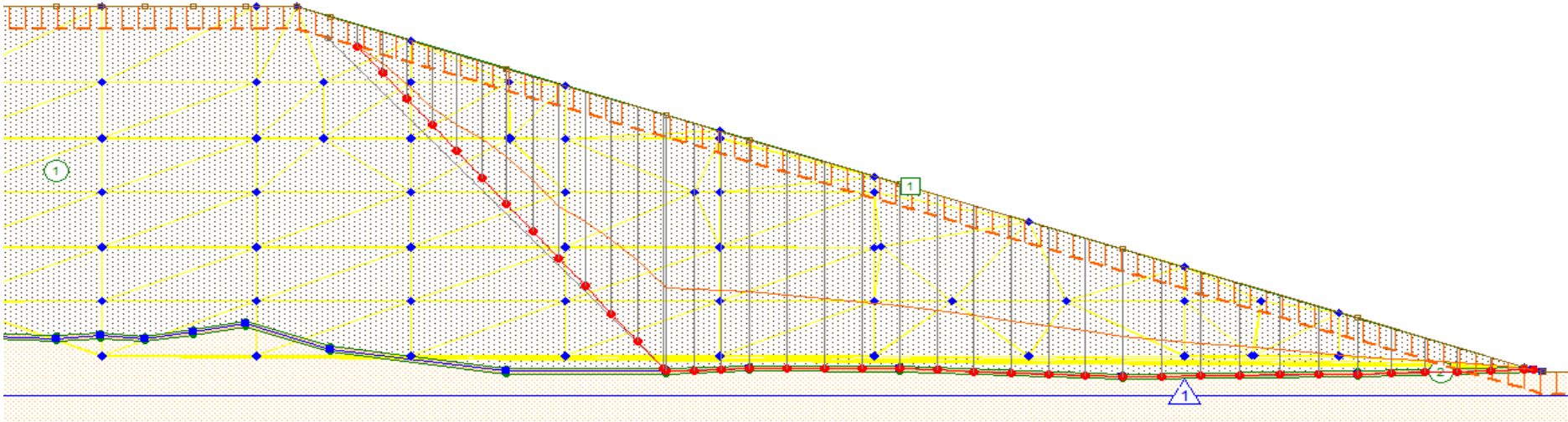
Noncircular Shear Surface

482.59	318.32
582.57	199.08
609.56	200.08
658.23	199.94
730.21	197.07
806.28	198.05
863	199.68

Factor of Safety
1.228

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Cell 3 Waste	50	Cohesion: 100.0 Friction angle: 35	Pore Pressure Interpolated
2	Liner	120	Nonlinear	Piezometric Line no. 2
3	Natural Soil (GP Dense to Very Dense)	130	Cohesion: 0.0 Friction angle: 36	Piezometric Line no. 1

Factor of safety: 1.228
Side force Inclination: -16.45 degrees



Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section D-D' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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English units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 5 Surface

0 333.4446
70.2135 333.2671
462.9171 332.8662
859.9918497 200.6787

2 2 Liner

0 225.941
60.295 222.8622
96.3755 221.4547
222.67 219.9925
229.574 218.9521
238.2127 218.2238
281.1197 216.7649
317.0974 215.141
353.4706 213.1896
385.299 212.1641
399.5351 213.1354
414.0331 211.03
429.8377 214.4455
446.6344 217.3867
474.0832 208.2405
531.0248 200.0882
582.5672 200.0792
609.5593 201.0805
658.2285 200.9409
730.2071 198.071
806.2818 199.0468
859.9918497 200.6787
862.9957248 199.6787
865.9996 198.6787

3 3 Native Surface

0 223.941
60.295 220.8622
96.3755 219.4547
222.67 217.9925
229.574 216.9521
238.2127 216.2238
281.1197 214.7649
317.0974 213.141
353.4706 211.1896
385.299 210.1641
399.5351 211.1354
414.0331 209.9903
429.8377 212.4455
446.6344 215.3867
474.0832 206.2405
531.0248 198.0882
582.5672 198.0792

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure – Residual Liner Strengths

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UTEXAS4 Input File

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609.5593 199.0805
658.2285 198.9409
730.2071 196.071
806.2818 197.0468
865.9996 198.6787
1500 199.105

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Interpolated Pore Pressures

2 Liner

120 = unit weight

Nonlinear

0 0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000

190.000000

1500.000000

190.000000

2 62.40 Piezometric line 2

0 224.941
60.295 221.8622
96.3755 220.4547
222.67 218.9925
229.574 217.9521
238.2127 217.2238
281.1197 215.7649
317.0974 214.141
353.4706 212.1896
385.299 211.1641
399.5351 212.1354
414.0331 210.9903
429.8377 213.4455
446.6344 216.3867
474.0832 207.2405
531.0248 199.0882
582.5672 199.0792
609.5593 200.0805
658.2285 199.9409
730.2071 197.071
806.2818 198.0468

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure – Residual Liner Strengths

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UTEXAS4 Input File

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862.9957248 199.6787

865.9996 198.6787

Interpolation Point

P

350 332.9814739 0 1 400 332.9304303 0 1 450
332.8793867 0 1 462.9171 332.8662 0 1 500
320.5211797 0 1 550 303.876014 0 1 600
287.2308483 0 1 650 270.5856826 0 1 700
253.9405169 0 1 750 237.2953512 0 1 800
220.6501856 0 1 859.9918497 200.6787 0 1
350 225 0 1 400 225 0 1 450 225 0
1 500 225 0 1 550 225 0 1 600 225
0 1 650 225 0 1 675 225 0 1
711.9336598 225 0 1 750 225 0 1 775 225
0 1
350 225 0 1 400 205 1248 1 450 205 1248
1 500 205 1248 1 550 205 1248 1 600 205
1248 1 650 205 1248 1 700 205 1248 1 750
205 1248 1 772.0111558 205 1248 1 773 205 0
1 800 205 0 1
350 224.5 0 1 400 204.5 0 1 450 204.5 0
1 500 204.5 0 1 550 204.5 0 1 600
204.5 0 1 650 204.5 0 1 700 204.5 0 1
750 204.5 0 1 800 204.5 0 1
350 265 0 1 400 265 0 1 450 265 0
1 500 265 0 1 550 265 0 1 591.7786679
265 0 1 600 265 0 1 650 265 0 1
350 245 1248 1 400 245 1248 1 450 245 1248
1 500 245 1248 1 550 245 1248 1 600 245
1248 1 651.8561639 245 1248 1 652 245 0 1
350 244.5 0 1 400 244.5 0 1 450 244.5 0
1 500 244.5 0 1 550 244.5 0 1 600
244.5 0 1 650 244.5 0 1
350 305 0 1 400 305 0 1 450 305 0
1 471.6236759 305 0 1 500 305 0 1
531.7011719 305 0 1
350 285 1248 1 400 285 1248 1 450 285 1248
1 471.6236759 285 1248 1 500 285 1248 1
531.7011719 285 1248 1 532 285 0 1 600 285
0 1
350 284.5 0 1 400 284.5 0 1 450 284.5 0
1 471.6236759 284.5 0 1 500 284.5 0 1
531.7011719 284.5 0 1 532 284.5 0 1 550
284.5 0 1 600 284.5 0 1

ANALYSIS/computation data follow

Noncircular Search 2

462.9171 332.8662

582.5672 199.0792

609.5593 200.0805 Fixed

658.2285 199.9409 Fixed

730.2071 197.071 Fixed

806.2818 198.0468 Fixed

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure – Residual Liner Strengths

Filename: 20221125 Section D-D' Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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862.9957248 199.6787 Fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

8 d

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

Filename: 20221125 Section D-D' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 5 Surface

Point	X	Y
1	0.00	333.44
2	70.21	333.27
3	462.92	332.87
4	859.99	200.68

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	225.94
2	60.30	222.86
3	96.38	221.45
4	222.67	219.99
5	229.57	218.95
6	238.21	218.22
7	281.12	216.76
8	317.10	215.14
9	353.47	213.19
10	385.30	212.16
11	399.54	213.14
12	414.03	211.99
13	429.84	214.45
14	446.63	217.39
15	474.08	208.24
16	531.02	200.09
17	582.57	200.08
18	609.56	201.08
19	658.23	200.94
20	730.21	198.07
21	806.28	199.05
22	859.99	200.68
23	863.00	199.68
24	866.00	198.68

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	223.94
2	60.30	220.86
3	96.38	219.45
4	222.67	217.99
5	229.57	216.95
6	238.21	216.22
7	281.12	214.76
8	317.10	213.14

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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UTEXAS4 Output File

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9	353.47	211.19
10	385.30	210.16
11	399.54	211.14
12	414.03	209.99
13	429.84	212.45
14	446.63	215.39
15	474.08	206.24
16	531.02	198.09
17	582.57	198.08
18	609.56	199.08
19	658.23	198.94
20	730.21	196.07
21	806.28	197.05
22	866.00	198.68
23	1500.00	199.10

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----
-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----
-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----
-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

Filename: 20221125 Section D-D' Non-Circular_output (wilson).docx

UTEXAS4 Output File

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Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	224.94
2	60.30	221.86
3	96.38	220.45
4	222.67	218.99
5	229.57	217.95
6	238.21	217.22
7	281.12	215.76
8	317.10	214.14
9	353.47	212.19
10	385.30	211.16
11	399.54	212.14
12	414.03	210.99
13	429.84	213.45
14	446.63	216.39
15	474.08	207.24
16	531.02	199.09
17	582.57	199.08
18	609.56	200.08
19	658.23	199.94
20	730.21	197.07
21	806.28	198.05
22	863.00	199.68
23	866.00	198.68

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

Filename: 20221125 Section D-D' Non-Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	462.92	332.87	angle to be computed - moveable
2	582.57	199.08	angle to be computed - moveable
3	609.56	200.08	- fixed
4	658.23	199.94	- fixed
5	730.21	197.07	- fixed
6	806.28	198.05	- fixed
7	863.00	199.68	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 8.000

-----The
following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	333.44
2	60.30	333.29
3	70.21	333.27
4	96.38	333.24
5	222.67	333.11
6	229.57	333.10
7	238.21	333.10
8	281.12	333.05
9	317.10	333.02
10	353.47	332.98
11	385.30	332.95
12	399.54	332.93
13	414.03	332.92
14	429.84	332.90
15	446.63	332.88
16	462.92	332.87
17	474.08	329.15
18	531.02	310.19
19	582.57	293.03
20	609.56	284.05
21	658.23	267.85
22	730.21	243.88
23	806.28	218.56
24	859.99	200.68
25	863.00	199.68
26	866.00	198.68
27	1500.00	199.10

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 482.59 Y: 318.32

X: 582.57 Y: 199.08

X: 609.56 Y: 200.08

X: 658.23 Y: 199.94

X: 730.21 Y: 197.07

X: 806.28 Y: 198.05

X: 863.00 Y: 199.68

Minimum factor of safety: 1.228

Side force inclination: -16.45

CAUTION - THE FACTOR OF SAFETY WAS NOT COMPUTED WHEN SOME OF THE
POINTS ON THE MOST CRITICAL NONCIRCULAR SHEAR SURFACE WERE SHIFTED.

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 3

Total number of shear surfaces attempted: 15

Total number of shear surfaces for which the factor of safety
was successfully calculated: 9

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	1.2279	5	3
2	10.0000	1	0.909	1.2279	10	6
3	5.0000	1	0.120	1.2279	15	9

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	482.59	318.32	4629	1	100.0	35.00	0.0
2	486.63	313.50	7430	1	100.0	35.00	70.2
3	490.66	308.69	10231	1	100.0	35.00	670.9
4	494.70	303.88	13032	1	100.0	35.00	301.2
5	498.74	299.06	15833	1	100.0	35.00	0.0
6	502.77	294.25	18634	1	100.0	35.00	0.0
7	506.81	289.43	22510	1	100.0	35.00	592.0
8	510.84	284.62	25580	1	100.0	35.00	1220.9
9	514.88	279.81	28650	1	100.0	35.00	0.0
10	518.92	274.99	31719	1	100.0	35.00	0.0
11	522.95	270.18	34789	1	100.0	35.00	611.7
12	526.99	265.37	37859	1	100.0	35.00	1240.6
13	531.02	260.55	3954	2	NONLINEAR ENVELOPE		0.0
14	535.25	255.51	42148	2	NONLINEAR ENVELOPE		0.0
15	539.48	250.47	40651	2	NONLINEAR ENVELOPE		0.0
16	543.70	245.43	39153	2	NONLINEAR ENVELOPE		0.0
17	547.93	240.39	50713	2	NONLINEAR ENVELOPE		0.0
18	552.15	235.36	48270	2	NONLINEAR ENVELOPE		0.0
19	556.38	230.32	45827	2	NONLINEAR ENVELOPE		0.0
20	560.60	225.28	43385	2	NONLINEAR ENVELOPE		0.0
21	564.83	220.24	40517	2	NONLINEAR ENVELOPE		0.0
22	569.05	215.20	38408	2	NONLINEAR ENVELOPE		0.0
	573.28	210.16					
	577.50	205.12					
	581.73	200.08					
	582.15	199.58					
	582.57	199.08					
	587.07	199.25					
	591.56	199.41					
	596.06	199.58					
	600.56	199.75					
	605.06	199.91					
	609.56	200.08					
	615.64	200.06					
	621.73	200.05					
	627.81	200.03					
	633.89	200.01					
	639.98	199.99					
	646.06	199.98					
	652.14	199.96					
	658.23	199.94					
	664.23	199.70					
	670.22	199.46					
	676.22	199.22					
	682.22	198.98					

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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23	688.22	198.75	36299	2	NONLINEAR ENVELOPE	0.0
	694.22	198.51				
24	700.22	198.27	34191	2	NONLINEAR ENVELOPE	0.0
	706.21	198.03				
25	712.21	197.79	32082	2	NONLINEAR ENVELOPE	0.0
	718.21	197.55				
26	724.21	197.31	29974	2	NONLINEAR ENVELOPE	0.0
	730.21	197.07				
27	736.55	197.15	29176	2	NONLINEAR ENVELOPE	0.0
	742.89	197.23				
28	749.23	197.31	26397	2	NONLINEAR ENVELOPE	0.0
	755.57	197.40				
29	761.90	197.48	23618	2	NONLINEAR ENVELOPE	0.0
	768.24	197.56				
30	774.58	197.64	20839	2	NONLINEAR ENVELOPE	0.0
	780.92	197.72				
31	787.26	197.80	18060	2	NONLINEAR ENVELOPE	0.0
	793.60	197.88				
32	799.94	197.97	15281	2	NONLINEAR ENVELOPE	0.0
	806.28	198.05				
33	811.65	198.20	10732	2	NONLINEAR ENVELOPE	0.0
	817.02	198.36				
34	822.39	198.51	8658	2	NONLINEAR ENVELOPE	0.0
	827.77	198.66				
35	833.14	198.82	6585	2	NONLINEAR ENVELOPE	0.0
	838.51	198.97				
36	843.88	199.13	4511	2	NONLINEAR ENVELOPE	0.0
	849.25	199.28				
37	854.62	199.44	2437	2	NONLINEAR ENVELOPE	0.0
	859.99	199.59				
38	861.49	199.64	196	2	NONLINEAR ENVELOPE	0.0
	863.00	199.68				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

 * Information for the Iterative Solution for the Factor of *
 * Safety and Side Force Inclination by Spencer's Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Allowable moment imbalance for convergence: 6067

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iter- ation	1	3.00000	-17.1887	-1.295e+005	5.078e+007	
First-order corrections to F and Theta					-3.9743	-0.2223
Reduced values - Deltas were too large					-0.5000	-0.0280
2	2.50000	-17.2167	-1.102e+005	4.320e+007		
First-order corrections to F and Theta					-2.4051	-0.2851
Reduced values - Deltas were too large					-0.5000	-0.0593
3	2.00000	-17.2760	-8.204e+004	3.215e+007		
First-order corrections to F and Theta					-1.1825	-0.4718
Reduced values - Deltas were too large					-0.5000	-0.1995
4	1.50000	-17.4755	-3.704e+004	1.440e+007		
First-order corrections to F and Theta					-0.2817	-4.3014
Reduced values - Deltas were too large					-0.1876	-2.8648
5	1.31236	-20.3403	-9.541e+003	2.947e+006		
First-order corrections to F and Theta					-0.1007	5.5098
Reduced values - Deltas were too large					-0.0523	2.8648
6	1.26002	-17.4755	-4.266e+003	1.408e+006		
First-order corrections to F and Theta					-0.0339	1.1944
Second-order corrections to F and Theta					-0.0322	1.0320
7	1.22786	-16.4435	2.808e+000	3.335e+002		
First-order corrections to F and Theta					0.0000	-0.0051
Second-order corrections to F and Theta					0.0000	-0.0051
8	1.22791	-16.4486	-2.530e-009	-2.456e-005		
First-order corrections to F and Theta					-0.0000	0.0000

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 6.93561e-011

Summation of Vertical Forces: 9.96181e-011

Summation of Moments: 6.78119e-009

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.36469e-011

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 1.228 Side Force Inclination: -16.45

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	486.63	313.50	268.5	268.5	234.5
2	494.70	303.88	473.9	403.7	311.7
3	502.77	294.25	825.0	154.1	169.3
4	510.84	284.62	909.7	608.5	428.4
5	518.92	274.99	1013.2	1013.2	659.2
6	526.99	265.37	1199.3	1199.3	765.4
7	535.25	255.51	1552.4	960.4	629.1
8	543.70	245.43	1920.0	699.1	480.1
9	552.15	235.36	1779.7	1779.7	1096.3
10	560.60	225.28	1974.6	1974.6	1207.4
11	569.05	215.20	2337.4	1725.8	1065.6
12	577.50	205.12	2705.0	1464.4	916.5
13	582.15	199.58	3176.8	3176.8	467.2
14	587.07	199.25	4944.1	4944.1	618.2
15	596.06	199.58	4770.9	4770.9	603.4
16	605.06	199.91	4597.6	4597.6	588.6
17	615.64	200.06	4329.7	4329.7	565.7
18	627.81	200.03	4124.0	4124.0	548.1
19	639.98	199.99	3918.3	3918.3	530.6
20	652.14	199.96	3712.5	3712.5	513.0
21	664.23	199.70	3462.2	3462.2	491.6
22	676.22	199.22	3284.6	3284.6	476.4
23	688.22	198.75	3107.1	3107.1	461.2
24	700.22	198.27	2929.5	2929.5	446.1
25	712.21	197.79	2752.0	2752.0	430.9
26	724.21	197.31	2574.4	2574.4	415.7
27	736.55	197.15	2434.7	2434.7	403.8
28	749.23	197.31	2208.7	2208.7	384.5
29	761.90	197.48	1982.2	1982.2	363.4
30	774.58	197.64	1748.9	1748.9	320.6
31	787.26	197.80	1515.7	1515.7	277.9
32	799.94	197.97	1282.5	1282.5	235.1
33	811.65	198.20	1071.9	1071.9	196.5
34	822.39	198.51	864.7	864.7	158.5
35	833.14	198.82	657.6	657.6	120.6
36	843.88	199.13	450.5	450.5	82.6
37	854.62	199.44	243.4	243.4	44.6
38	861.49	199.64	69.9	69.9	12.8

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 59

* Final Results for Side Forces and Stresses Between Slices *

* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----						
Slice		Side	Y-Coord. of	Fraction	Sigma	Sigma
No.	X-Right	Force	Side Force	of	at	at
			Location	Height	Top	Bottom
1	490.66	721	312.31	0.242	-25.2	117.8
2	498.74	2855	304.51	0.249	-63.2	313.5
3	506.81	9712	295.72	0.218	-223.2	869.6
4	514.88	15238	289.75	0.278	-135.8	953.2
5	522.95	19860	284.21	0.329	-12.9	905.1
6	531.02	25458	277.94	0.350	50.2	933.5
7	539.48	36229	269.15	0.328	-18.8	1240.0
8	547.93	52175	259.79	0.302	-145.6	1705.2
9	556.38	61218	253.87	0.330	-17.9	1661.7
10	564.83	71330	247.50	0.346	68.0	1670.5
11	573.28	86506	239.55	0.342	49.9	1880.3
12	581.73	106857	230.74	0.329	-29.6	2228.0
13	582.57	109761	229.67	0.326	-52.0	2292.9
14	591.56	102241	229.15	0.328	-33.5	2197.5
15	600.56	94920	228.68	0.331	-12.1	2097.8
16	609.56	87798	228.25	0.335	12.6	1993.1
17	621.73	80778	226.95	0.336	18.2	1919.8
18	633.89	73974	225.66	0.338	25.2	1843.4
19	646.06	67385	224.41	0.340	34.3	1762.9
20	658.23	61013	223.18	0.342	46.0	1677.4
21	670.22	56590	221.33	0.340	32.1	1653.7
22	682.22	52269	219.47	0.337	16.1	1630.9
23	694.22	48049	217.60	0.333	-2.4	1609.2
24	706.21	43931	215.70	0.328	-23.8	1588.8
25	718.21	39913	213.79	0.323	-49.0	1570.2
26	730.21	35997	211.84	0.316	-78.7	1553.6
27	742.89	30246	210.54	0.314	-81.2	1448.5
28	755.57	24789	209.29	0.313	-77.4	1327.2
29	768.24	19649	208.15	0.315	-62.8	1182.4
30	780.92	15114	207.00	0.317	-48.9	1039.0
31	793.60	11183	205.83	0.319	-36.6	898.2
32	806.28	7858	204.62	0.321	-28.0	762.8
33	817.02	5311	203.77	0.326	-14.2	626.9
34	827.77	3257	202.92	0.334	0.4	489.9
35	838.51	1695	202.06	0.348	16.4	350.7
36	849.25	625	201.19	0.383	36.2	204.9
37	859.99	46	200.08	0.448	28.2	53.8
38	863.00	-0	199.68	0.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: A-A' Case: CH2M Analysis

Unit Weight Average Effective Average Total Average FINAL

Fixed Grid Coordinates

x	y
400	700
700	700
700	900
400	900

Circle Entrance

x	y
469.9252	231.8924
Tangent	

Search Grid Subdivisions

25 10

Crack Depth

10

Seismic Acceleration

0.13

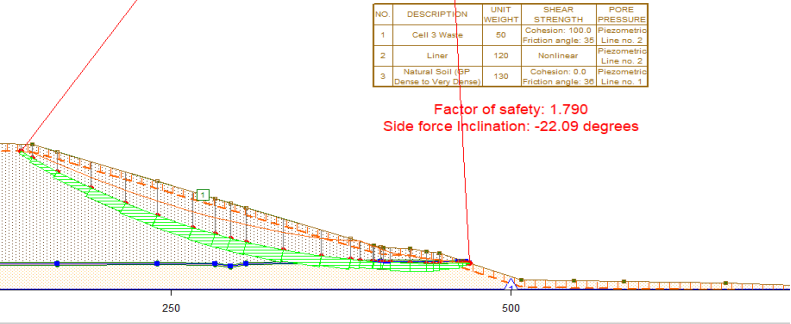
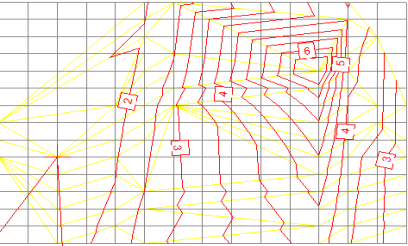
Minimum Weight

5000

Results

		Circle Center		Radius	
Circles Attempted	Circles Completed	x	y	540.215	
225	73	442.86	771.43		

Factor of Safety	Errors
1.79	



Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular

Filename: 20221125 Section A-A' Seismic Circular_input (wilson).docx

UTEXAS4 Input File

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English units

Heading follows -

MSB CELL 3

Profile line data follow -

1 1 Cell 3 Surface

0.000000	333.976600
147.552900	330.139000
399.183500	246.250400
406.121800	244.712800
426.040100	244.023100
437.832500	241.284800
447.582100	240.087400
464.4	233.9

2 2 Liner

0	232.1156
166.0471	232.1156
239.5212	232.1992
282.3832	231.8095
293.5372	230.1338
305.1905	232.1918
381.9526	233.8086
404.5544	234.1568
464.4	233.9
469.925200	231.892400

3 3 Native Surface

0.000000	230.115600
166.047100	230.115600
239.521200	230.199200
282.383200	229.809500
293.537200	228.133800
305.190500	230.191800
381.952600	231.808600
404.554400	232.156800
469.925200	231.892400
507.465300	218.060500
546.288900	216.988100
583.471700	216.402500
657.991300	215.510800
741.835000	212.295700
814.990400	214.257600
864.122100	231.583000
886.536400	237.805100
945.522300	256.707600

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular

Filename: 20221125 Section A-A' Seismic Circular_input (wilson).docx

UTEXAS4 Input File

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969.897400	262.128400
978.535600	263.868000
999.028400	264.021200

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0	35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0.0	0.0
2000	450.2
5000	765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0	36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000	210.000000
1000.000000	210.000000

2 62.40 Piezometric line 2

0	231.1156
166.0471	231.1156
239.5212	231.1992
282.3832	230.8095
293.5372	229.1338
305.1905	231.1918
381.9526	232.8086
404.5544	233.1568
464	232.9

ANALYSIS/computation data follow

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular

Filename: 20221125 Section A-A' Seismic Circular_input (wilson).docx

UTEXAS4 Input File

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Circle Search 2

15	15
400.000000	700.000000
700.000000	700.000000
700.000000	900.000000
400.000000	900.000000
	25
	10

Point

469.925200	231.892400

MINimum weight follows:

5000

ITERation limit follows:

100

crack

10 d

SEismic

0.13

GRaphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

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Stability\Section A-A'\MSB Section A-A' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 3 Surface

Point	X	Y
1	0.00	333.98
2	147.55	330.14
3	399.18	246.25
4	406.12	244.71
5	426.04	244.02
6	437.83	241.28
7	447.58	240.09
8	464.40	233.90

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	232.12
2	166.05	232.12
3	239.52	232.20
4	282.38	231.81
5	293.54	230.13
6	305.19	232.19
7	381.95	233.81
8	404.55	234.16
9	464.40	233.90
10	469.93	231.89

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	230.12
2	166.05	230.12
3	239.52	230.20
4	282.38	229.81
5	293.54	228.13
6	305.19	230.19
7	381.95	231.81
8	404.55	232.16
9	469.93	231.89
10	507.47	218.06
11	546.29	216.99
12	583.47	216.40
13	657.99	215.51
14	741.84	212.30
15	814.99	214.26
16	864.12	231.58
17	886.54	237.81
18	945.52	256.71

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

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19	969.90	262.13
20	978.54	263.87
21	999.03	264.02

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----
-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----
-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----
-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	210.00
2	1000.00	210.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	231.12
2	166.05	231.12
3	239.52	231.20
4	282.38	230.81
5	293.54	229.13
6	305.19	231.19
7	381.95	232.81
8	404.55	233.16
9	464.00	232.90

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

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Stability\Section A-A'\MSB Section A-A' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Search will be conducted using a fixed grid.

Number of Points Across Grid: 15

Number of Points Up Grid: 15

Grid Corner

Number	X	Y
1	400.00	700.00
2	700.00	700.00
3	700.00	900.00
4	400.00	900.00

----- Control Parameters for Finding "Critical" Radius -----Initial

number of subdivisions between maximum and minimum

radius for finding a critical radius/radii: 25

Minimum radius increment for terminating subdivision of radii: 10.000

The following criteria will be used for determining

the maximum and minimum radii:

Point circles pass through - X: 469.93 Y: 231.89

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 10.000

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

-----The

following represent default values or values that were previously defined:

Subtended angle for slice subdivision: 3.00(degrees)

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Search will be continued after the initial mode to find a most critical circle.

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Radii for each grid point will be sorted in the order of increasing radius.

Critical circles for grid points will be output in the order of increasing factor of safety.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

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Stability\Section A-A'\MSB Section A-A' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	333.98
2	147.55	330.14
3	166.05	323.97
4	239.52	299.48
5	282.38	285.19
6	293.54	281.47
7	305.19	277.59
8	381.95	251.99
9	399.18	246.25
10	404.55	245.06
11	406.12	244.71
12	426.04	244.02
13	437.83	241.28
14	447.58	240.09
15	464.40	233.90
16	469.93	231.89
17	507.47	218.06
18	546.29	216.99
19	583.47	216.40
20	657.99	215.51
21	741.84	212.30
22	814.99	214.26
23	864.12	231.58
24	886.54	237.81
25	945.52	256.71
26	969.90	262.13
27	978.54	263.87
28	999.03	264.02

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

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Stability\Section A-A'\MSB Section A-A' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 38

* FINAL SUMMARY OF COMPUTATIONS WITH FIXED-GRID *

Number of circles attempted: 225

Number of circles for which F calculated: 40

Circle with Lowest Factor of Safety:

 X coordinate for center: 442.86

 Y coordinate for center: 785.71

 Radius of circle: 554.483

Factor of safety: 1.794

Side force inclination: -22.16

Time Required for Computations: 1.0 seconds

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	141.46	320.30					
	144.51	318.35	3613	1	100.0	35.00	0.0
	147.55	316.41					
2	156.80	310.84	14996	1	100.0	35.00	0.0
	166.05	305.27					
3	178.81	298.35	27265	1	100.0	35.00	0.0
	191.57	291.44					
4	204.68	285.20	33934	1	100.0	35.00	0.0
	217.78	278.97					
5	228.65	274.41	31181	1	100.0	35.00	0.0
	239.52	269.86					
6	253.16	264.89	40969	1	100.0	35.00	0.0
	266.80	259.92					
7	274.59	257.44	23647	1	100.0	35.00	0.0
	282.38	254.96					
8	287.96	253.34	16727	1	100.0	35.00	0.0
	293.54	251.72					
9	299.36	250.15	17115	1	100.0	35.00	0.0
	305.19	248.59					
10	319.34	245.36	38926	1	100.0	35.00	0.0
	333.49	242.12					
11	347.79	239.63	33961	1	100.0	35.00	0.0
	362.09	237.15					
12	372.02	235.87	19307	1	100.0	35.00	0.0
	381.95	234.59					
13	385.19	234.25	5403	1	100.0	35.00	0.0
	388.44	233.91					
14	393.18	233.48	7341	2	NONLINEAR ENVELOPE		0.0
	397.93	233.05					
15	398.56	233.00	939	2	NONLINEAR ENVELOPE		3.7
	399.18	232.95					
16	401.87	232.75	3976	2	NONLINEAR ENVELOPE		22.5
	404.55	232.56					
17	405.34	232.50	1152	2	NONLINEAR ENVELOPE		40.6
	406.12	232.45					
18	408.72	232.29	3871	2	NONLINEAR ENVELOPE		53.0
	411.31	232.13					
19	418.68	231.81	11587	3	0.0	36.00	0.0
	426.04	231.49					
20	431.94	231.37	8936	3	0.0	36.00	0.0
	437.83	231.25					
21	440.34	231.24	3455	3	0.0	36.00	0.0
	442.86	231.23					
22	445.22	231.24	3100	3	0.0	36.00	0.0
	447.58	231.25					

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

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23	455.79	231.44	7566	3	0.0	36.00	0.0
	464.00	231.63					
24	464.20	231.64	111	3	0.0	36.00	0.0
	464.40	231.65					
25	467.16	231.77	753	3	0.0	36.00	0.0
	469.93	231.89					

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

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Stability\Section A-A'\MSB Section A-A' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS

Slices			Y for				
No.	X	Seismic	Seismic	Normal	Shear	X	Y
		Force	Force	Force	Force		
1	144.51	470	324.29	0	0	144.51	330.22
2	156.80	1949	318.95	0	0	156.80	327.06
3	178.81	3544	309.04	0	0	178.81	319.72
4	204.68	4411	298.15	0	0	204.68	311.09
5	228.65	4054	288.76	0	0	228.65	303.10
6	253.16	5326	279.91	0	0	253.16	294.93
7	274.59	3074	272.62	0	0	274.59	287.79
8	287.96	2174	268.33	0	0	287.96	283.33
9	299.36	2225	264.84	0	0	299.36	279.53
10	319.34	5060	259.11	0	0	319.34	272.87
11	347.79	4415	251.51	0	0	347.79	263.38
12	372.02	2510	245.59	0	0	372.02	255.31
13	385.19	702	242.58	0	0	385.19	250.91
14	393.18	954	240.54	0	0	393.18	248.25
15	398.56	122	239.12	0	0	398.56	246.46
16	401.87	517	238.46	0	0	401.87	245.66
17	405.34	150	237.85	0	0	405.34	244.89
18	408.72	503	237.55	0	0	408.72	244.62
19	418.68	1506	236.98	0	0	418.68	244.28
20	431.94	1162	235.90	0	0	431.94	242.65
21	440.34	449	235.08	0	0	440.34	240.98
22	445.22	403	234.83	0	0	445.22	240.38
23	455.79	984	233.63	0	0	455.79	237.07
24	464.20	14	232.78	0	0	464.20	233.97
25	467.16	98	232.33	0	0	467.16	232.90

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 47

 * Information for the Iterative Solution for the Factor of *
 * Safety and Side Force Inclination by Spencer's Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 4

Allowable moment imbalance for convergence: 1045

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iter- ation	1	3.00000	-17.1887	-5.911e+004	2.015e+007	
First-order corrections to F and Theta					-2.0467	3.1279
Reduced values - Deltas were too large					-0.5000	0.7641
2	2.50000	-16.4246	-4.182e+004	1.432e+007		
First-order corrections to F and Theta					-1.0033	6.2890
Reduced values - Deltas were too large					-0.4570	2.8648
3	2.04296	-13.5598	-1.884e+004	6.724e+006		
First-order corrections to F and Theta					0.4629	-777.1387
Reduced values - Deltas were too large					0.0017	-2.8648
4	2.04467	-16.4246	-1.878e+004	6.692e+006		
First-order corrections to F and Theta					-0.2597	-53.0031
Reduced values - Deltas were too large					-0.0140	-2.8648
5	2.03063	-19.2894	-1.776e+004	6.304e+006		
First-order corrections to F and Theta					-0.2686	-11.5864
Reduced values - Deltas were too large					-0.0664	-2.8648
6	1.96421	-22.1542	-1.313e+004	4.607e+006		
First-order corrections to F and Theta					-0.1872	-0.0273
Second-order corrections to F and Theta					-0.1715	-0.0056
7	1.79269	-22.1598	1.116e+002	-3.935e+004		
First-order corrections to F and Theta					0.0013	0.0020
Second-order corrections to F and Theta					0.0013	0.0020
8	1.79400	-22.1578	-6.953e-005	2.507e-002		
First-order corrections to F and Theta					-0.0000	-0.0000

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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Stability\Section A-A'\MSB Section A-A' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 1.54721e-011

Summation of Vertical Forces: 3.45608e-011

Summation of Moments: -3.82715e-009

Mohr Coulomb Shear Force/Shear Strength Check Summation: 1.60725e-011

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

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Stability\Section A-A'\MSB Section A-A' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 1.794 Side Force Inclination: -22.16

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	144.51	318.35	406.6	406.6	214.4
2	156.80	310.84	572.9	572.9	279.3
3	178.81	298.35	788.7	788.7	363.6
4	204.68	285.20	1001.3	1001.3	446.6
5	228.65	274.41	1155.4	1155.4	506.7
6	253.16	264.89	1259.2	1259.2	547.2
7	274.59	257.44	1316.6	1316.6	569.6
8	287.96	253.34	1329.5	1329.5	574.7
9	299.36	250.15	1326.1	1326.1	573.3
10	319.34	245.36	1282.7	1282.7	556.4
11	347.79	239.63	1160.9	1160.9	508.9
12	372.02	235.87	991.8	991.8	442.8
13	385.19	234.25	872.0	872.0	396.1
14	393.18	233.48	734.9	734.9	92.2
15	398.56	233.00	713.3	709.5	89.0
16	401.87	232.75	708.3	685.9	86.1
17	405.34	232.50	704.7	664.1	83.3
18	408.72	232.29	717.4	664.4	83.4
19	418.68	231.81	855.8	855.8	346.6
20	431.94	231.37	843.2	843.2	341.5
21	440.34	231.24	776.4	776.4	314.4
22	445.22	231.24	747.3	747.3	302.6
23	455.79	231.44	534.8	534.8	216.6
24	464.20	231.64	326.8	326.8	132.4
25	467.16	231.77	161.5	161.5	65.4

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Circular Failure

Filename: 20221125 Section A-A' Seismic - Circular_output (wilson).docx

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Name of input data file:

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MSB CELL 3

TABLE NO. 59

 * Final Results for Side Forces and Stresses Between Slices *
 * (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----						
Slice		Side	Y-Coord. of	Fraction	Sigma	Sigma
No.	X-Right	Force	Side Force	of	at	at
			Location	Height	Top	Bottom
1	147.55	804	320.86	0.324	-3.1	111.5
2	166.05	4222	312.31	0.376	53.8	364.2
3	191.57	9805	301.10	0.402	155.6	600.4
4	217.78	15416	290.58	0.418	262.4	766.3
5	239.52	19261	282.64	0.432	355.1	849.4
6	266.80	22403	273.68	0.452	483.3	879.0
7	282.38	23194	269.06	0.466	567.4	853.9
8	293.54	23279	265.98	0.479	635.0	814.2
9	305.19	22939	262.97	0.496	715.0	750.5
10	333.49	20361	256.64	0.558	975.3	473.7
11	362.09	15655	251.97	0.690	1446.7	-96.2
12	381.95	11608	250.35	0.906	2121.1	-885.9
13	388.44	10232	250.32	Above	2489.4	-1299.3
14	397.93	10995	246.08	0.957	2798.4	-1302.5
15	399.18	11084	245.54	0.947	2841.0	-1296.9
16	404.55	11447	243.26	0.856	2659.4	-963.7
17	406.12	11549	242.61	0.828	2589.5	-845.2
18	411.31	11873	240.48	0.673	1808.2	-35.1
19	426.04	8581	237.64	0.491	598.8	669.1
20	437.83	5699	235.79	0.452	375.4	677.1
21	442.86	4497	235.10	0.410	202.9	679.9
22	447.58	3372	234.60	0.379	97.8	609.2
23	464.00	374	232.69	0.436	88.2	198.7
24	464.40	327	232.72	0.474	113.2	155.7
25	469.93	0	231.89	0.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: B-B' Case: CH2M Analysis

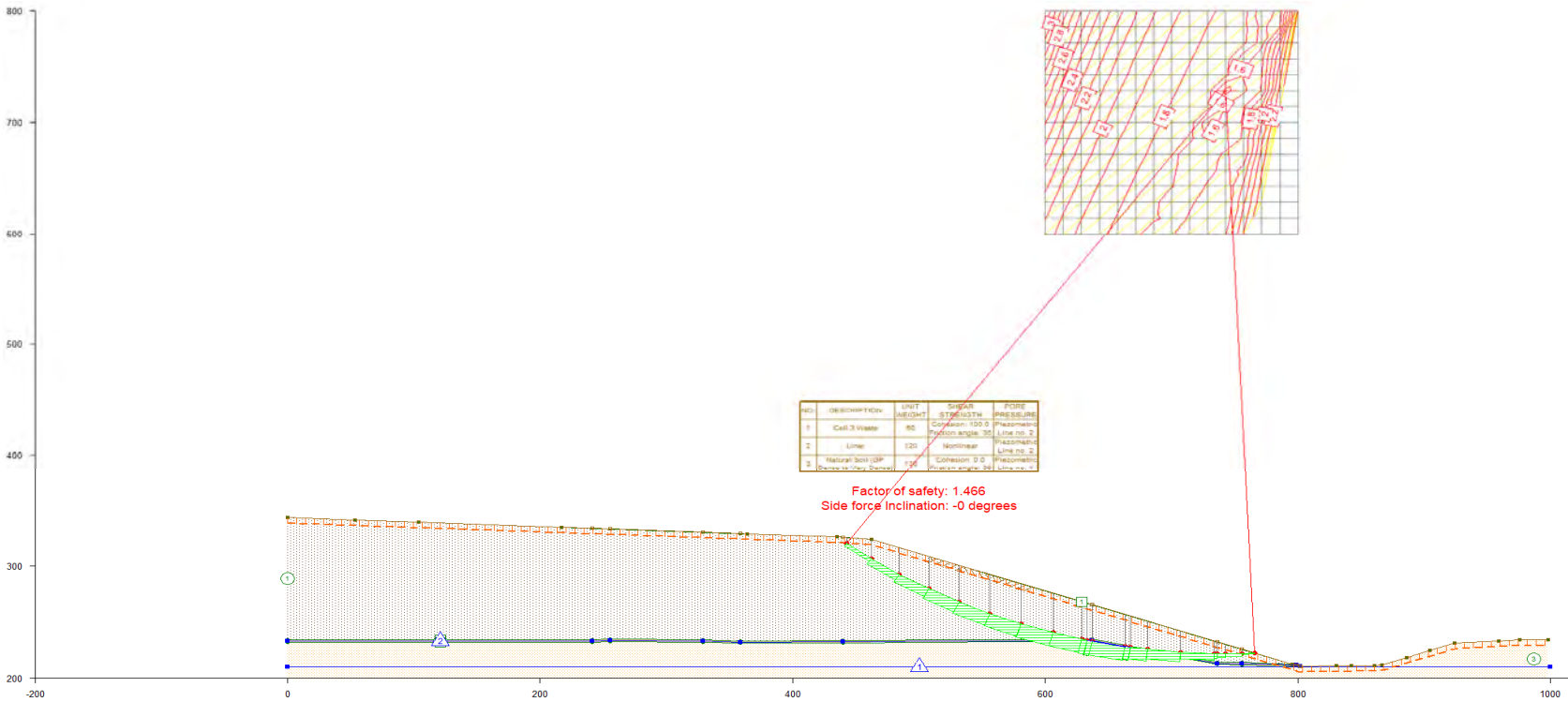
Unit Weight Average Effective Average Total Average FINAL

Fixed Grid Coordinates

x	y		x	y	Adjustments
	600	600	435.2507	325.7232	
	800	600	Tangent		
	800	800	Search Grid Subdivisions		
	600	800			
			25	10	
			Crack Depth		
			5		
			Seismic Acceleration		
		0.13			
		Minimum Weight			
		5000			

Results

		Circle Center		Radius	
Circles Attempted	Circles Completed	x	y	506.861	
225	201	742.86	728.57		
Factor of Safety		Errors			
1.466					



Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section B-B' Seismic-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 1 of 3

English units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 4 Surface
0 342.9925

53.3791 340.9508

103.5224 338.8839

216.9023 334.482

364.0891 328.5808

435.2507 325.7232

462.0904 323.8434

795.7461 212.2843

2 2 Liner

0 233.9687

241.3595 233.9687

255.373 234.532

329.1175 233.9445

358.7087 232.8241

439.6647 233.2931

636.9606 234.73

736.2644 213.9188

755.9227 213.778

795.7461 212.2843

798.737 211.2843

801.7278 210.2843

3 3 Native Surface

0 231.9687

241.3595 231.9687

255.373 232.532

329.1175 231.9445

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section B-B' Seismic-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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358.7087 230.8241

439.6647 231.2931

636.9606 232.73

736.2644 211.9188

755.9227 211.778

801.7278 210.2843

830.3544 210.7192

842.2722 210.9911

860.5027 210.9911

866.5411 211.812

886.081 218.0902

904.7485 224.5428

924.0266 230.9082

958.7877 233.0943

975.4239 234.0329

998.3779 233.9295

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0.0

0.0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Piezometric Line

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section B-B' Seismic-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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```
1
Piezometric line data follow -
  1      62.40 Piezometric line 1
                0.000000      210.000000
                1000.000000      210.000000
  2      62.40 Piezometric line 2
```

0 232.9687

241.3595 232.9687

255.373 233.532

329.1175 232.9445

358.7087 231.8241

439.6647 232.2931

636.9606 233.73

736.2644 212.9188

755.9227 212.778

798.737 211.2843

801.7278 210.2843

ANALYSIS/computation data follow

Circle Search 2

```
  15    15
 600.000000 600.000000
 800.000000 600.000000
 800.000000 800.000000
 600.000000 800.000000
                25    10
```

Point

435.2507 325.7232

MINimum weight follows:

5000

ITERation limit follows:

100

crack

5 d

SEismic

0.13

Procedure

Corps of Engineers

0

GRAPHICS output file

COMPUTE

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

Filename: 20221125 Section B-B' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Cross-Section: B-B'

Case: Seismic - Circular Failure

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Name of input data file:

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B-B'\MSB Section B-B' - Seismic.input-utexas

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

Filename: 20221125 Section B-B' Seismic - Circular_output (wilson).docx

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B-B'\MSB Section B-B' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

----- Profile Line No. 1 - Material Type (Number): 1 -----

Description: Cell 4 Surface

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	364.09	328.58
6	435.25	325.72
7	462.09	323.84
8	795.75	212.28

----- Profile Line No. 2 - Material Type (Number): 2 -----

Description: Liner

Point	X	Y
1	0.00	233.97
2	241.36	233.97
3	255.37	234.53
4	329.12	233.94
5	358.71	232.82
6	439.66	233.29
7	636.96	234.73
8	736.26	213.92
9	755.92	213.78
10	795.75	212.28
11	798.74	211.28
12	801.73	210.28

----- Profile Line No. 3 - Material Type (Number): 3 -----

Description: Native Surface

Point	X	Y
1	0.00	231.97
2	241.36	231.97

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

Filename: 20221125 Section B-B' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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3	255.37	232.53
4	329.12	231.94
5	358.71	230.82
6	439.66	231.29
7	636.96	232.73
8	736.26	211.92
9	755.92	211.78
10	801.73	210.28
11	830.35	210.72
12	842.27	210.99
13	860.50	210.99
14	866.54	211.81
15	886.08	218.09
16	904.75	224.54
17	924.03	230.91
18	958.79	233.09
19	975.42	234.03
20	998.38	233.93

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- DATA FOR MATERIAL NUMBER 1 -----

Description: Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 2 -----

Description: Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----
Point Normal Stress Shear Stress

1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 3 -----

Description: Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

Filename: 20221125 Section B-B' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

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B-B'\MSB Section B-B' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- Piezometric Line Number 1 -----

Description: Piezometric line 1
Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	210.00
2	1000.00	210.00

----- Piezometric Line Number 2 -----

Description: Piezometric line 2
Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	232.97
2	241.36	232.97
3	255.37	233.53
4	329.12	232.94
5	358.71	231.82
6	439.66	232.29
7	636.96	233.73
8	736.26	212.92
9	755.92	212.78
10	798.74	211.28
11	801.73	210.28

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Search will be conducted using a fixed grid.

Number of Points Across Grid: 15

Number of Points Up Grid: 15

Grid Corner

Number	X	Y
1	600.00	600.00
2	800.00	600.00
3	800.00	800.00
4	600.00	800.00

----- Control Parameters for Finding "Critical" Radius -----

Initial number of subdivisions between maximum and minimum
radius for finding a critical radius/radii: 25

Minimum radius increment for terminating subdivision of radii: 10.000

The following criteria will be used for determining
the maximum and minimum radii:

Point circles pass through - X: 435.25 Y: 325.72

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 5.000

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 0.00

The following represent default values or values that were previously defined:

Subtended angle for slice subdivision: 3.00(degrees)

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Search will be continued after the initial mode to find a most critical circle.

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Radii for each grid point will be sorted in the order of increasing radius.

Critical circles for grid points will be output in the order of increasing factor of safety.

Standard sign convention used for direction of shear stress on shear surface.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

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Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

Filename: 20221125 Section B-B' Seismic - Circular_output (wilson).docx

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Name of input data file:

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B-B'\MSB Section B-B' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	241.36	333.50
6	255.37	332.94
7	329.12	329.98
8	358.71	328.80
9	364.09	328.58
10	435.25	325.72
11	439.66	325.41
12	462.09	323.84
13	636.96	265.37
14	736.26	232.17
15	755.92	225.60
16	795.75	212.28
17	798.74	211.28
18	801.73	210.28
19	830.35	210.72
20	842.27	210.99
21	860.50	210.99
22	866.54	211.81
23	886.08	218.09
24	904.75	224.54
25	924.03	230.91
26	958.79	233.09
27	975.42	234.03
28	998.38	233.93

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Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

Filename: 20221125 Section B-B' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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MSB CELL 3

TABLE NO. 38

* FINAL SUMMARY OF COMPUTATIONS WITH FIXED-GRID *

Number of circles attempted: 225

Number of circles for which F calculated: 201

Circle with Lowest Factor of Safety:

 X coordinate for center: 742.86

 Y coordinate for center: 728.57

 Radius of circle: 506.861

Factor of safety: 1.466

Side force inclination: -0.00

Time Required for Computations: 1.0 seconds

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

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MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	442.61 452.35 462.09	320.21 313.39 306.58	10843	1	100.0	35.00	0.0
2	473.33 484.56	299.52 292.46	23107	1	100.0	35.00	0.0
3	496.15 507.74	286.00 279.54	30657	1	100.0	35.00	0.0
4	519.65 531.56	273.70 267.85	36808	1	100.0	35.00	0.0
5	543.76 555.96	262.64 257.42	41358	1	100.0	35.00	0.0
6	568.42 580.88	252.86 248.29	44141	1	100.0	35.00	0.0
7	593.56 606.24	244.38 240.47	45020	1	100.0	35.00	0.0
8	617.60 628.96	237.57 234.67	38955	1	100.0	35.00	0.0
9	631.11 633.25	234.19 233.70	7253	2	NONLINEAR ENVELOPE		0.0
10	635.11 636.96	233.30 232.90	6433	2	NONLINEAR ENVELOPE		26.0
11	650.00 663.05	230.46 228.03	42645	2	NONLINEAR ENVELOPE		33.2
12	665.16 667.27	227.71 227.38	6297	2	NONLINEAR ENVELOPE		7.2
13	674.15 681.02	226.44 225.50	18701	2	NONLINEAR ENVELOPE		0.0
14	694.23 707.44	224.22 222.95	29061	1	100.0	35.00	0.0
15	720.69 733.95	222.37 221.79	19897	1	100.0	35.00	0.0
16	735.11 736.26	221.77 221.75	1251	1	100.0	35.00	0.0
17	739.56 742.86	221.73 221.71	3078	1	100.0	35.00	0.0
18	749.39 755.92	221.79 221.88	3913	1	100.0	35.00	0.0
19	760.95 765.98	222.06 222.24	935	1	100.0	35.00	0.0

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

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No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

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MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS							
Slices No.	X	Seismic Force	Y for Seismic Force	Normal Force	Shear Force	X	Y
1	452.35	1410	318.96	0	0	452.35	324.53
2	473.33	3004	309.80	0	0	473.33	320.09
3	496.15	3985	299.23	0	0	496.15	312.46
4	519.65	4785	289.15	0	0	519.65	304.60
5	543.76	5377	279.59	0	0	543.76	296.54
6	568.42	5738	270.57	0	0	568.42	288.29
7	593.56	5853	262.13	0	0	593.56	279.89
8	617.60	5064	254.71	0	0	617.60	271.85
9	631.11	943	250.42	0	0	631.11	267.33
10	635.11	836	248.75	0	0	635.11	266.00
11	650.00	5544	244.79	0	0	650.00	261.01
12	665.16	819	241.12	0	0	665.16	255.95
13	674.15	2431	239.35	0	0	674.15	252.94
14	694.23	3778	235.22	0	0	694.23	246.23
15	720.69	2587	229.87	0	0	720.69	237.38
16	735.11	163	227.17	0	0	735.11	232.56
17	739.56	400	226.40	0	0	739.56	231.07
18	749.39	509	224.79	0	0	749.39	227.78
19	760.95	122	222.99	0	0	760.95	223.92

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

Filename: 20221125 Section B-B' Seismic - Circular_output (wilson).docx

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Name of input data file:

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 4

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	8.845e+004	-2.924
Reduced value - Delta was too large			-0.500
2	2.50000	7.056e+004	-1.666
Reduced value - Delta was too large			-0.500
3	2.00000	4.464e+004	-0.703
Reduced value - Delta was too large			-0.500
4	1.50000	3.681e+003	-0.035
5	1.46518	-7.619e+001	0.001
6	1.46588	-3.132e-002	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

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B-B'\MSB Section B-B' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 2.76401e-011

Summation of Vertical Forces: 2.87628e-011

Mohr Coulomb Shear Force/Shear Strength Check Summation: 3.37958e-002

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

Filename: 20221125 Section B-B' Seismic - Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *
* (Results are for the critical shear surface in the case of a search.) *

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PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 1.466 Side Force Inclination: -0.00

----- VALUES AT CENTER OF BASE OF SLICE -----					
Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	452.35	313.39	381.4	381.4	250.4
2	473.33	299.52	758.0	758.0	430.3
3	496.15	286.00	1014.5	1014.5	552.8
4	519.65	273.70	1224.6	1224.6	653.2
5	543.76	262.64	1383.4	1383.4	729.0
6	568.42	252.86	1486.4	1486.4	778.2
7	593.56	244.38	1529.1	1529.1	798.6
8	617.60	237.57	1512.2	1512.2	790.5
9	631.11	234.19	1635.5	1635.5	251.1
10	635.11	233.30	1678.8	1652.7	253.8
11	650.00	230.46	1590.2	1556.9	239.1
12	665.16	227.71	1455.6	1448.4	222.4
13	674.15	226.44	1332.2	1332.2	204.6
14	694.23	224.22	1045.5	1045.5	567.6
15	720.69	222.37	732.2	732.2	418.0
16	735.11	221.77	534.5	534.5	323.5
17	739.56	221.73	465.0	465.0	290.4
18	749.39	221.79	302.2	302.2	212.6
19	760.95	222.06	97.1	97.1	114.6

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Circular Failure

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B-B'\MSB Section B-B' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 60

* Final Results for Side Forces Between Slices *
* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Slice No.	X-Right	Resultant Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	462.09	1730	-0.00	1730	-0
2	484.56	5765	-0.00	5765	-0
3	507.74	10046	-0.00	10046	-0
4	531.56	13585	-0.00	13585	-0
5	555.96	15597	-0.00	15597	-0
6	580.88	15526	-0.00	15526	-0
7	606.24	13083	-0.00	13083	-0
8	628.96	8947	-0.00	8947	-0
9	633.25	10398	-0.00	10398	-0
10	636.96	11647	-0.00	11647	-0
11	663.05	18687	-0.00	18687	-0
12	667.27	19520	-0.00	19520	-0
13	681.02	21645	-0.00	21645	-0
14	707.44	13092	-0.00	13092	-0
15	733.95	5448	-0.00	5448	-0
16	736.26	4879	-0.00	4879	-0
17	742.86	3385	-0.00	3385	-0
18	755.92	1066	-0.00	1066	-0
19	765.98	-0	-0.00	-0	0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: C-C' Case: CH2M Analysis

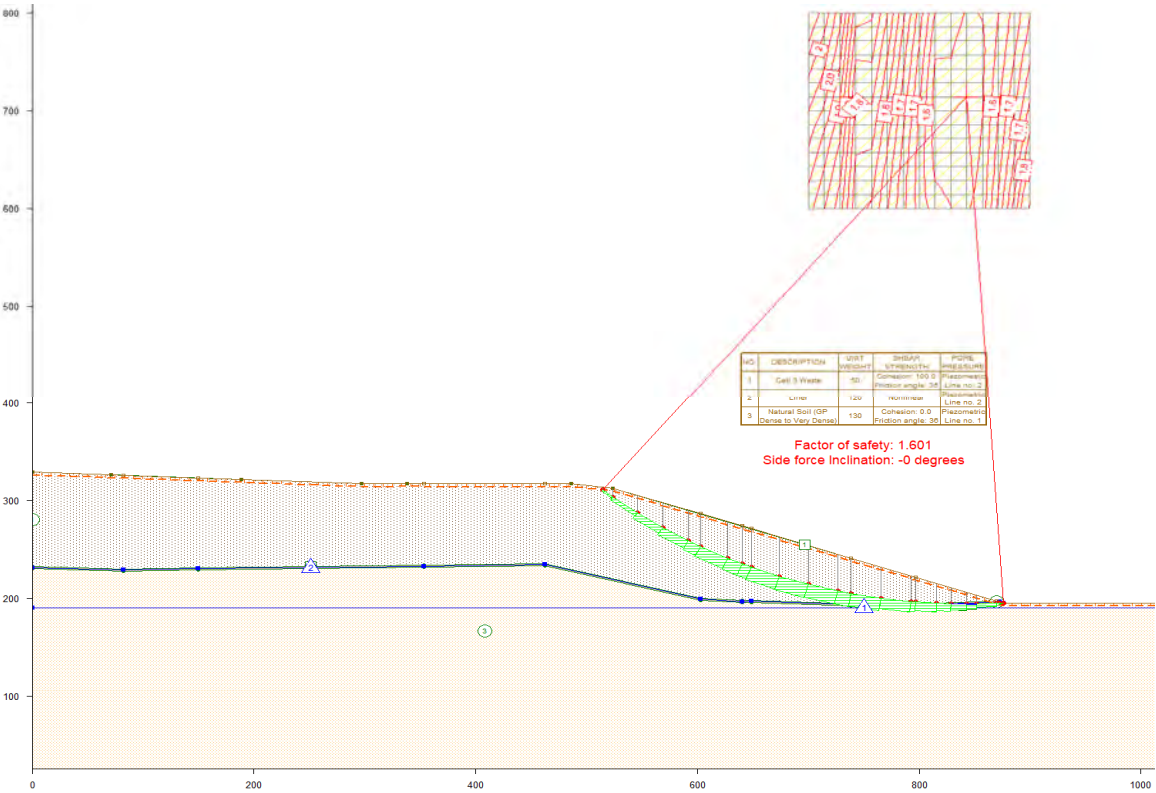
Unit Weight Average Effective Average Total Average FINAL

Fixed Grid Coordinates

x	y		x	y	Adjustments
	700	600	875.9111	195.1749	
	900	600	Tangent		
	900	800	Search Grid Subdivisions		
	700	800			
			25	10	
			Crack Depth		
			5		
			Seismic Acceleration		
			0.13		
		Minimum Weight			
		5000			

Results

		Circle Center		Radius	
Circles Attempted	Circles Completed	x	y	520.162	
225	225	842.86	714.29		
Factor of Safety	Errors				
1.601					



Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section C-C' Seismic-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 1 of 3

English units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 5 Surface
0 328.8926

71.051 326.0616

188.5248 321.3252

296.7885 317.0329

337.8051 317.0858

486.3848 316.9548

523.8643 312.6729

869.918712 197.1749

2 2 Liner

0 232.1147

82.3776 229.8661

149.6914 230.9902

353.4471 233.6161

462.8547 235.1779

602.9616 199.777

640.4418 197.3469

648.5372 197.872

738.6968 194.1687

796.7718 193.9902

869.918712 197.1749

875.9111 195.1749

3 3 Native Surface

0 230.1147

82.3776 227.8661

149.6914 228.9902

353.4471 231.6161

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section C-C' Seismic-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 2 of 3

462.8547 233.1779

602.9616 197.777

640.4418 195.3469

648.5372 195.872

738.6968 192.1687

796.7718 191.9902

875.9111 195.1749

1500 195.2685

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0.0

0.0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000

190.000000

1500.000000

190.000000

2 62.40 Piezometric line 2

0 231.1147

82.3776 228.8661

149.6914 229.9902

353.4471 232.6161

462.8547 234.1779

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section C-C' Seismic-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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602.9616 198.777

640.4418 196.3469

648.5372 196.872

738.6968 193.1687

796.7718 192.9902

872.914906 196.1749

875.9111 195.1749

ANALYSIS/computation data follow

Circle Search 2

15 15

700.000000 600.000000

900.000000 600.000000

900.000000 800.000000

700.000000 800.000000

25 10

Point

875.9111 195.1749

MINimum weight follows:

5000

ITERation limit follows:

100

crack

3 d

SEIsmic

0.13

Procedure

Corps of Engineers

0

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

Filename: 20221125 Section C-C' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

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UTEXAS4 Output File

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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

----- Profile Line No. 1 - Material Type (Number): 1 -----

Description: Cell 5 Surface

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	188.52	321.33
4	296.79	317.03
5	337.81	317.09
6	486.38	316.95
7	523.86	312.67
8	869.92	197.17

----- Profile Line No. 2 - Material Type (Number): 2 -----

Description: Liner

Point	X	Y
1	0.00	232.11
2	82.38	229.87
3	149.69	230.99
4	353.45	233.62
5	462.85	235.18
6	602.96	199.78
7	640.44	197.35
8	648.54	197.87
9	738.70	194.17
10	796.77	193.99
11	869.92	197.17
12	875.91	195.17

----- Profile Line No. 3 - Material Type (Number): 3 -----

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

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Description: Native Surface

Point	X	Y
1	0.00	230.11
2	82.38	227.87
3	149.69	228.99
4	353.45	231.62
5	462.85	233.18
6	602.96	197.78
7	640.44	195.35
8	648.54	195.87
9	738.70	192.17
10	796.77	191.99
11	875.91	195.17
12	1500.00	195.27

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- DATA FOR MATERIAL NUMBER 1 -----

Description: Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 2 -----

Description: Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 3 -----

Description: Natural Soil (GP Dense to Very Dense)

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

Filename: 20221125 Section C-C' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

Page 5 of 17

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- Piezometric Line Number 1 -----

Description: Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

----- Piezometric Line Number 2 -----

Description: Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	231.11
2	82.38	228.87
3	149.69	229.99
4	353.45	232.62
5	462.85	234.18
6	602.96	198.78
7	640.44	196.35
8	648.54	196.87
9	738.70	193.17
10	796.77	192.99
11	872.91	196.17
12	875.91	195.17

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

Filename: 20221125 Section C-C' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section C-C'\MSB Section C-C' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Search will be conducted using a fixed grid.

Number of Points Across Grid: 15

Number of Points Up Grid: 15

Grid Corner

Number	X	Y
1	700.00	600.00
2	900.00	600.00
3	900.00	800.00
4	700.00	800.00

----- Control Parameters for Finding "Critical" Radius -----

Initial number of subdivisions between maximum and minimum
radius for finding a critical radius/radii: 25

Minimum radius increment for terminating subdivision of radii: 10.000

The following criteria will be used for determining
the maximum and minimum radii:

Point circles pass through - X: 875.91 Y: 195.17

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 3.000

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 0.00

The following represent default values or values that were previously defined:

Subtended angle for slice subdivision: 3.00(degrees)

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

Filename: 20221125 Section C-C' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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Search will be continued after the initial mode to find a most critical circle.
No restrictions exist on the lateral extent of the search.
No shear surfaces other than the most critical will be saved for display later.
Neither slope face was explicitly designated for analysis.
Radii for each grid point will be sorted in the order of increasing radius.
Critical circles for grid points will be output in the order of increasing factor of safety.
Standard sign convention used for direction of shear stress on shear surface.
Force imbalance: 1.000000e-005 (fraction of total weight)
Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)
Initial trial factor of safety: 3.000
Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

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Name of input data file:

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	82.38	325.60
4	149.69	322.89
5	188.52	321.33
6	296.79	317.03
7	337.81	317.09
8	353.45	317.07
9	462.85	316.98
10	486.38	316.95
11	523.86	312.67
12	602.96	286.27
13	640.44	273.76
14	648.54	271.06
15	738.70	240.97
16	796.77	221.59
17	869.92	197.17
18	875.91	195.17
19	1500.00	195.27

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Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

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MSB CELL 3

TABLE NO. 38

* FINAL SUMMARY OF COMPUTATIONS WITH FIXED-GRID *

Number of circles attempted: 225

Number of circles for which F calculated: 225

Circle with Lowest Factor of Safety:

X coordinate for center: 842.86

Y coordinate for center: 714.29

Radius of circle: 520.162

Factor of safety: 1.601

Side force inclination: -0.00

Time Required for Computations: 0.0 seconds

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

Filename: 20221125 Section C-C' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
	514.67	310.72					
1	519.27	307.07	2816	1	100.0	35.00	0.0
	523.86	303.42					
2	534.83	295.35	14984	1	100.0	35.00	0.0
	545.80	287.29					
3	557.18	279.81	24742	1	100.0	35.00	0.0
	568.56	272.33					
4	580.31	265.45	33359	1	100.0	35.00	0.0
	592.07	258.58					
5	597.51	255.66	17669	1	100.0	35.00	0.0
	602.96	252.75					
6	615.20	246.78	43340	1	100.0	35.00	0.0
	627.45	240.82					
7	633.94	237.97	24667	1	100.0	35.00	0.0
	640.44	235.12					
8	644.49	233.45	15770	1	100.0	35.00	0.0
	648.54	231.78					
9	661.30	227.03	50750	1	100.0	35.00	0.0
	674.06	222.27					
10	687.05	218.19	51982	1	100.0	35.00	0.0
	700.04	214.11					
11	713.22	210.72	51101	1	100.0	35.00	0.0
	726.41	207.33					
12	732.55	205.99	22749	1	100.0	35.00	0.0
	738.70	204.66					
13	752.10	202.28	45871	1	100.0	35.00	0.0
	765.51	199.91					
14	779.02	198.23	39562	1	100.0	35.00	0.0
	792.54	196.56					
15	794.65	196.37	5489	1	100.0	35.00	0.0
	796.77	196.17					
16	806.33	195.50	21898	1	100.0	35.00	0.0

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

Filename: 20221125 Section C-C' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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	815.90	194.82					
17	822.23	194.57	12200	2	NONLINEAR ENVELOPE		0.0
	828.57	194.32					
18	835.71	194.22	11733	2	NONLINEAR ENVELOPE		24.8
	842.86	194.12					
19	847.24	194.16	5882	2	NONLINEAR ENVELOPE		58.7
	851.62	194.20					
20	860.77	194.51	8138	3		0.0 36.00	0.0
	869.92	194.83					
21	871.42	194.91	637	3		0.0 36.00	0.0
	872.91	194.99					
22	874.41	195.08	213	3		0.0 36.00	0.0
	875.91	195.17					

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

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Name of input data file:

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MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS							
Slices			Y for				
No.	X	Seismic Force	Seismic Force	Normal Force	Shear Force	X	Y
1	519.27	366	310.13	0	0	519.27	313.20
2	534.83	1948	302.18	0	0	534.83	309.01
3	557.18	3217	290.68	0	0	557.18	301.55
4	580.31	4337	279.64	0	0	580.31	293.83
5	597.51	2297	271.88	0	0	597.51	288.09
6	615.20	5634	264.49	0	0	615.20	282.19
7	633.94	3207	256.95	0	0	633.94	275.93
8	644.49	2050	252.93	0	0	644.49	272.41
9	661.30	6597	246.92	0	0	661.30	266.80
10	687.05	6758	238.20	0	0	687.05	258.21
11	713.22	6643	230.10	0	0	713.22	249.47
12	732.55	2957	224.51	0	0	732.55	243.02
13	752.10	5963	219.39	0	0	752.10	236.50
14	779.02	5143	212.87	0	0	779.02	227.51
15	794.65	714	209.33	0	0	794.65	222.29
16	806.33	2847	206.95	0	0	806.33	218.40
17	822.23	1586	203.49	0	0	822.23	213.09
18	835.71	1525	200.60	0	0	835.71	208.59
19	847.24	765	198.55	0	0	847.24	204.74
20	860.77	1058	196.75	0	0	860.77	200.23
21	871.42	83	195.79	0	0	871.42	196.67
22	874.41	28	195.38	0	0	874.41	195.67

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

Filename: 20221125 Section C-C' Seismic - Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 5

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	9.987e+004	-2.466
Reduced value - Delta was too large			-0.500
2	2.50000	7.592e+004	-1.340
Reduced value - Delta was too large			-0.500
3	2.00000	4.126e+004	-0.486
4	1.51359	-1.151e+004	0.083
5	1.59653	-5.241e+002	0.004
6	1.60067	-1.188e+000	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

Filename: 20221125 Section C-C' Seismic - Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 2.48264e-011

Summation of Vertical Forces: 5.36886e-011

Mohr Coulomb Shear Force/Shear Strength Check Summation: 1.27249e+000

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

Filename: 20221125 Section C-C' Seismic - Circular_output (wilson).docx

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *
* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 1.601 Side Force Inclination: -0.00

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	519.27	307.07	190.5	190.5	145.8
2	534.83	295.35	482.0	482.0	273.3
3	557.18	279.81	812.6	812.6	417.9
4	580.31	265.45	1100.9	1100.9	544.1
5	597.51	255.66	1287.0	1287.0	625.5
6	615.20	246.78	1434.2	1434.2	689.9
7	633.94	237.97	1569.5	1569.5	749.0
8	644.49	233.45	1628.4	1628.4	774.8
9	661.30	227.03	1690.0	1690.0	801.8
10	687.05	218.19	1741.8	1741.8	824.4
11	713.22	210.72	1727.1	1727.1	818.0
12	732.55	205.99	1678.6	1678.6	796.8
13	752.10	202.28	1577.3	1577.3	752.5
14	779.02	198.23	1381.4	1381.4	666.7
15	794.65	196.37	1240.1	1240.1	605.0
16	806.33	195.50	1106.6	1106.6	546.5
17	822.23	194.57	957.5	957.5	134.7
18	835.71	194.22	819.4	794.7	111.8
19	847.24	194.16	671.8	613.1	86.2
20	860.77	194.51	451.8	451.8	205.1
21	871.42	194.91	218.0	218.0	99.0
22	874.41	195.08	73.3	73.3	33.3

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Circular Failure

Filename: 20221125 Section C-C' Seismic - Circular_output (wilson).docx

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Name of input data file:

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MSB CELL 3

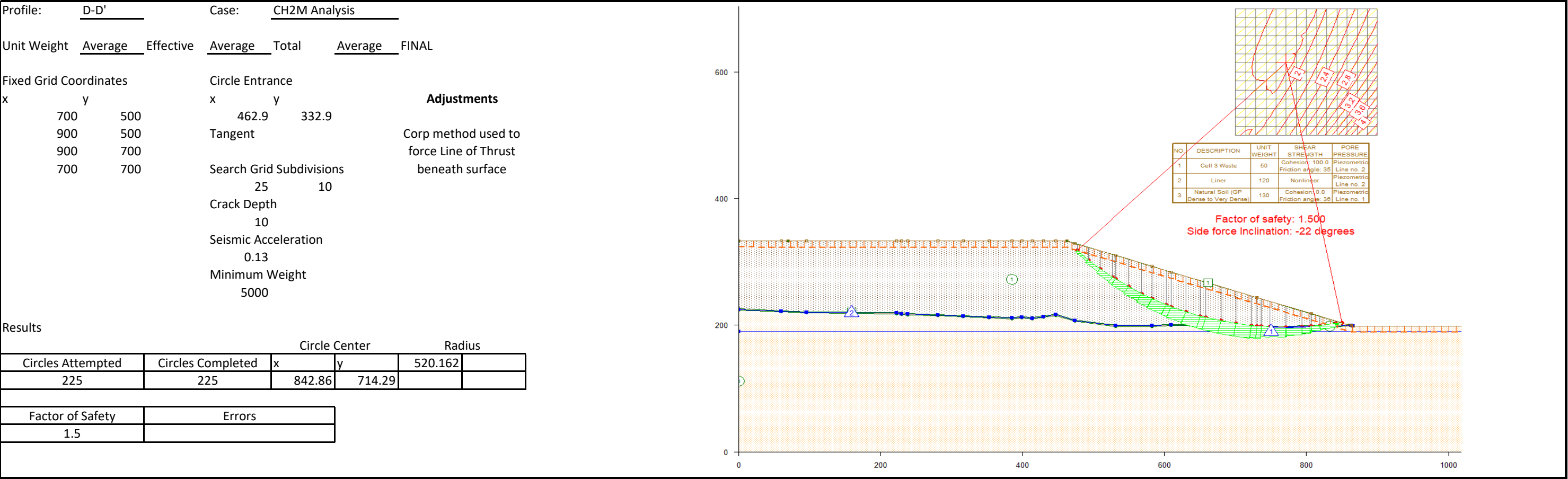
TABLE NO. 60

* Final Results for Side Forces Between Slices *
* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Slice No.	X-Right	Resultant Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	523.86	417	-0.00	417	-0
2	545.80	4144	-0.00	4144	-0
3	568.56	10008	-0.00	10008	-0
4	592.07	16693	-0.00	16693	-0
5	602.96	19677	-0.00	19677	-0
6	627.45	25520	-0.00	25520	-0
7	640.44	27938	-0.00	27938	-0
8	648.54	29155	-0.00	29155	-0
9	674.06	31362	-0.00	31362	-0
10	700.04	30914	-0.00	30914	-0
11	726.41	27710	-0.00	27710	-0
12	738.70	25353	-0.00	25353	-0
13	765.51	18637	-0.00	18637	-0
14	792.54	10378	-0.00	10378	-0
15	796.77	9019	-0.00	9019	-0
16	815.90	2903	-0.00	2903	-0
17	828.57	3265	-0.00	3265	-0
18	842.86	3354	-0.00	3354	-0
19	851.62	3313	-0.00	3313	-0
20	869.92	334	-0.00	334	-0
21	872.91	84	-0.00	84	-0
22	875.91	-1	-0.00	-1	0

Read end-of-file on input while looking for another command word.
End of input data assumed - normal termination.



Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section D-D' Seismic-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 1 of 4

English units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 5 Surface

0 333.4446

70.2135 332.8662

462.9171 332.8662

859.9918497 200.6787

2 2 Liner

0 225.941

60.295 222.8622

96.3755 221.4547

222.67 219.9925

229.574 218.9521

238.2127 218.2238

281.1197 216.7649

317.0974 215.141

353.4706 213.1896

385.299 212.1641

399.5351 213.1354

414.0331 211.9903

429.8377 214.4455

446.6344 217.3867

474.0832 208.2405

531.0248 200.0882

582.5672 200.0792

609.5593 201.0805

658.2285 200.9409

730.2071 198.071

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section D-D' Seismic-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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806.2818 199.0468

859.9918497 200.6787

862.9957248 199.6787

865.9996 198.6787

3 3 Native Surface

0 223.941

60.295 220.8622

96.3755 219.4547

222.67 217.9925

229.574 216.9521

238.2127 216.2238

281.1197 214.7649

317.0974 213.141

353.4706 211.1896

385.299 210.1641

399.5351 211.1354

414.0331 209.9903

429.8377 212.4455

446.6344 215.3867

474.0832 206.2405

531.0248 198.0882

582.5672 198.0792

609.5593 199.0805

658.2285 198.9409

730.2071 196.071

806.2818 197.0468

865.9996 198.6787

1500 199.105

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0.0

0.0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000

190.000000

1500.000000

190.000000

2 62.40 Piezometric line 2

0 224.941

60.295 221.8622

96.3755 220.4547

222.67 218.9925

229.574 217.9521

238.2127 217.2238

281.1197 215.7649

317.0974 214.141

353.4706 212.1896

385.299 211.1641

399.5351 212.1354

414.0331 210.9903

429.8377 213.4455

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section D-D' Seismic-Circular-Residual_input (wilson).docx

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446.6344 216.3867

474.0832 207.2405

531.0248 199.0882

582.5672 199.0792

609.5593 200.0805

658.2285 199.9409

730.2071 197.071

806.2818 198.0468

862.9957248 199.6787

865.9996 198.6787

ANALYSIS/computation data follow

Circle Search 2

15 15

700.000000 500.000000

900.000000 500.000000

900.000000 700.000000

700.000000 700.000000

25 10

Point

462.9171 332.8662

MINimum weight follows:

5000

ITERation limit follows:

100

crack

10 d

SEIsmic

0.13

Procedure

Corps of Engineers

22

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic - Circular Failure

Filename: 20221125 Section D-D' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic - Circular Failure

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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

----- Profile Line No. 1 - Material Type (Number): 1 -----

Description: Cell 5 Surface

Point	X	Y
1	0.00	333.44
2	70.21	332.87
3	462.92	332.87
4	859.99	200.68

----- Profile Line No. 2 - Material Type (Number): 2 -----

Description: Liner

Point	X	Y
1	0.00	225.94
2	60.30	222.86
3	96.38	221.45
4	222.67	219.99
5	229.57	218.95
6	238.21	218.22
7	281.12	216.76
8	317.10	215.14
9	353.47	213.19
10	385.30	212.16
11	399.54	213.14
12	414.03	211.99
13	429.84	214.45
14	446.63	217.39
15	474.08	208.24
16	531.02	200.09
17	582.57	200.08
18	609.56	201.08
19	658.23	200.94

Matanuska-Susinta, AK Landfill

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20	730.21	198.07
21	806.28	199.05
22	859.99	200.68
23	863.00	199.68
24	866.00	198.68

----- Profile Line No. 3 - Material Type (Number): 3 -----

Description: Native Surface

Point	X	Y
1	0.00	223.94
2	60.30	220.86
3	96.38	219.45
4	222.67	217.99
5	229.57	216.95
6	238.21	216.22
7	281.12	214.76
8	317.10	213.14
9	353.47	211.19
10	385.30	210.16
11	399.54	211.14
12	414.03	209.99
13	429.84	212.45
14	446.63	215.39
15	474.08	206.24
16	531.02	198.09
17	582.57	198.08
18	609.56	199.08
19	658.23	198.94
20	730.21	196.07
21	806.28	197.05
22	866.00	198.68
23	1500.00	199.10

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Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- DATA FOR MATERIAL NUMBER 1 -----

Description: Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 2 -----

Description: Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 3 -----

Description: Natural Soil (GP Dense to Very Dense)

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Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- Piezometric Line Number 1 -----

Description: Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

----- Piezometric Line Number 2 -----

Description: Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	224.94
2	60.30	221.86
3	96.38	220.45
4	222.67	218.99
5	229.57	217.95
6	238.21	217.22
7	281.12	215.76
8	317.10	214.14
9	353.47	212.19
10	385.30	211.16
11	399.54	212.14
12	414.03	210.99
13	429.84	213.45
14	446.63	216.39
15	474.08	207.24
16	531.02	199.09
17	582.57	199.08
18	609.56	200.08
19	658.23	199.94

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Cross-Section: D-D'

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20	730.21	197.07
21	806.28	198.05
22	863.00	199.68
23	866.00	198.68

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Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Search will be conducted using a fixed grid.

Number of Points Across Grid: 15

Number of Points Up Grid: 15

Grid Corner

Number	X	Y
1	700.00	500.00
2	900.00	500.00
3	900.00	700.00
4	700.00	700.00

----- Control Parameters for Finding "Critical" Radius -----

Initial number of subdivisions between maximum and minimum
radius for finding a critical radius/radii: 25

Minimum radius increment for terminating subdivision of radii: 10.000

The following criteria will be used for determining
the maximum and minimum radii:

Point circles pass through - X: 462.92 Y: 332.87

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 10.000

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 22.00

The following represent default values or values that were previously defined:

Subtended angle for slice subdivision: 3.00(degrees)

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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Search will be continued after the initial mode to find a most critical circle.
No restrictions exist on the lateral extent of the search.
No shear surfaces other than the most critical will be saved for display later.
Neither slope face was explicitly designated for analysis.
Radii for each grid point will be sorted in the order of increasing radius.
Critical circles for grid points will be output in the order of increasing factor of safety.
Standard sign convention used for direction of shear stress on shear surface.
Force imbalance: 1.000000e-005 (fraction of total weight)
Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)
Initial trial factor of safety: 3.000
Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	333.44
2	60.30	332.95
3	70.21	332.87
4	96.38	332.87
5	222.67	332.87
6	229.57	332.87
7	238.21	332.87
8	281.12	332.87
9	317.10	332.87
10	353.47	332.87
11	385.30	332.87
12	399.54	332.87
13	414.03	332.87
14	429.84	332.87
15	446.63	332.87
16	462.92	332.87
17	474.08	329.15
18	531.02	310.19
19	582.57	293.03
20	609.56	284.05
21	658.23	267.85
22	730.21	243.88
23	806.28	218.56
24	859.99	200.68
25	863.00	199.68
26	866.00	198.68
27	1500.00	199.10

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MSB CELL 3

TABLE NO. 38

* FINAL SUMMARY OF COMPUTATIONS WITH FIXED-GRID *

Number of circles attempted: 225

Number of circles for which F calculated: 225

Circle with Lowest Factor of Safety:

X coordinate for center: 771.43

Y coordinate for center: 614.29

Radius of circle: 417.584

Factor of safety: 1.500

Side force inclination: -22.00

Time Required for Computations: 1.0 seconds

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MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	476.98	318.18	11810	1	100.0	35.00	0.0
	484.93	310.68					
	492.88	303.18					
2	501.21	296.10	20008	1	100.0	35.00	0.0
	509.54	289.03					
3	518.23	282.40	27856	1	100.0	35.00	0.0
	526.92	275.77					
4	528.97	274.31	7497	1	100.0	35.00	0.0
	531.02	272.84					
5	540.12	266.79	36741	1	100.0	35.00	0.0
	549.22	260.73					
6	558.63	255.16	43114	1	100.0	35.00	0.0
	568.03	249.59					
7	575.30	245.72	36145	1	100.0	35.00	0.0
	582.57	241.85					
8	592.44	237.16	51927	1	100.0	35.00	0.0
	602.32	232.48					
9	605.94	230.91	19675	1	100.0	35.00	0.0
	609.56	229.35					
10	619.74	225.38	56296	1	100.0	35.00	0.0
	629.93	221.41					
11	640.30	217.97	57949	1	100.0	35.00	0.0
	650.68	214.54					
12	654.46	213.44	21001	1	100.0	35.00	0.0
	658.23	212.34					
13	668.82	209.65	57925	1	100.0	35.00	0.0
	679.42	206.96					
14	690.14	204.84	56168	1	100.0	35.00	0.0
	700.86	202.71					
15	711.68	201.14	52912	1	100.0	35.00	0.0
	722.50	199.58					
16	726.35	199.16	17728	1	100.0	35.00	0.0

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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	730.21	198.74					
17	733.42	198.45	14270	1	100.0	35.00	0.0
	736.64	198.15					
18	742.76	197.73	26134	2	NONLINEAR ENVELOPE		0.0
	748.89	197.31					
19	759.82	197.01	42662	2	NONLINEAR ENVELOPE		27.7
	770.74	196.70					
20	771.09	196.70	1243	2	NONLINEAR ENVELOPE		55.7
	771.43	196.70					
21	782.36	196.99	34955	2	NONLINEAR ENVELOPE		46.9
	793.28	197.27					
22	798.97	197.65	14311	2	NONLINEAR ENVELOPE		18.9
	804.66	198.03					
23	805.47	198.09	1793	2	NONLINEAR ENVELOPE		0.0
	806.28	198.16					
24	812.72	198.80	11737	2	NONLINEAR ENVELOPE		0.0
	819.15	199.44					
25	829.97	200.97	10499	1	100.0	35.00	0.0
	840.80	202.50					
26	845.25	203.30	1016	1	100.0	35.00	0.0
	849.70	204.10					

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 44

 * Seismic Forces and Forces Due to Distributed Loads for *
 * Individual Slices for Conventional Computations or the *
 * First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS							
Slices			Y for				
No.	X	Seismic Force	Seismic Force	Normal Force	Shear Force	X	Y
1	484.93	1535	318.11	0	0	484.93	325.54
2	501.21	2601	308.11	0	0	501.21	320.12
3	518.23	3621	298.42	0	0	518.23	314.45
4	528.97	975	292.59	0	0	528.97	310.88
5	540.12	4776	286.98	0	0	540.12	307.16
6	558.63	5605	278.08	0	0	558.63	301.00
7	575.30	4699	270.59	0	0	575.30	295.45
8	592.44	6750	263.46	0	0	592.44	289.75
9	605.94	2558	258.08	0	0	605.94	285.25
10	619.74	7318	253.02	0	0	619.74	280.66
11	640.30	7533	245.89	0	0	640.30	273.81
12	654.46	2730	241.27	0	0	654.46	269.10
13	668.82	7530	236.99	0	0	668.82	264.32
14	690.14	7302	231.03	0	0	690.14	257.22
15	711.68	6879	225.60	0	0	711.68	250.05
16	726.35	2305	222.16	0	0	726.35	245.17
17	733.42	1855	220.63	0	0	733.42	242.81
18	742.76	3397	218.38	0	0	742.76	239.70
19	759.82	5546	214.60	0	0	759.82	234.03
20	771.09	162	212.33	0	0	771.09	230.28
21	782.36	4544	210.69	0	0	782.36	226.52
22	798.97	1860	208.52	0	0	798.97	220.99
23	805.47	233	207.87	0	0	805.47	218.83
24	812.72	1526	207.31	0	0	812.72	216.42
25	829.97	1365	205.82	0	0	829.97	210.67
26	845.25	132	204.44	0	0	845.25	205.59

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Trial No. 1 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 7

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	1.547e+005	-3.049
Reduced value - Delta was too large			-0.500
2	2.50000	1.241e+005	-1.690
Reduced value - Delta was too large			-0.500
3	2.00000	7.801e+004	-0.673
Reduced value - Delta was too large			-0.500
4	1.50000	-4.262e+001	0.000
5	1.50020	-6.015e-003	0.000

After trial 1 the following changes were computed for the nonlinear strength envelopes:

Maximum change in shear strength: 0.000 (percent)
Strengths from nonlinear envelope have converged.
Final computations will be performed next.

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 7

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	1.547e+005	-3.049
Reduced value - Delta was too large			-0.500
2	2.50000	1.241e+005	-1.690
Reduced value - Delta was too large			-0.500
3	2.00000	7.801e+004	-0.673
Reduced value - Delta was too large			-0.500
4	1.50000	-4.262e+001	0.000
5	1.50020	-6.015e-003	0.000

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MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 7.05143e-011

Summation of Vertical Forces: 9.53833e-011

Mohr Coulomb Shear Force/Shear Strength Check Summation: 5.67222e-003

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic - Circular Failure

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *
* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 1.500 Side Force Inclination: -22.00

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear Stress
			Normal Stress	Normal Stress	
1	484.93	310.68	408.9	408.9	257.5
2	501.21	296.10	714.4	714.4	400.1
3	518.23	282.40	1012.7	1012.7	539.3
4	528.97	274.31	1195.1	1195.1	624.4
5	540.12	266.79	1362.5	1362.5	702.6
6	558.63	255.16	1626.7	1626.7	825.9
7	575.30	245.72	1841.6	1841.6	926.2
8	592.44	237.16	2030.2	2030.2	1014.2
9	605.94	230.91	2166.6	2166.6	1077.9
10	619.74	225.38	2275.9	2275.9	1128.9
11	640.30	217.97	2410.3	2410.3	1191.7
12	654.46	213.44	2481.8	2481.8	1225.0
13	668.82	209.65	2518.7	2518.7	1242.2
14	690.14	204.84	2535.3	2535.3	1250.0
15	711.68	201.14	2490.3	2490.3	1229.0
16	726.35	199.16	2427.5	2427.5	1199.7
17	733.42	198.45	2382.3	2382.3	1178.6
18	742.76	197.73	2066.2	2066.2	304.7
19	759.82	197.01	1935.6	1907.8	286.3
20	771.09	196.70	1822.4	1766.6	265.1
21	782.36	196.99	1635.3	1588.3	238.3
22	798.97	197.65	1319.2	1300.3	195.1
23	805.47	198.09	1168.8	1168.8	175.4
24	812.72	198.80	977.1	977.1	146.6
25	829.97	200.97	720.7	720.7	403.1
26	845.25	203.30	224.5	224.5	171.4

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic - Circular Failure

Filename: 20221125 Section D-D' Seismic - Circular_output (wilson).docx

UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section D-D'\MSB Section D-D' - Seismic.input-utexas

MSB CELL 3

TABLE NO. 60

* Final Results for Side Forces Between Slices *
* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Slice No.	X-Right	Resultant Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	492.88	3857	-22.00	3576	-1445
2	509.54	10375	-22.00	9620	-3887
3	526.92	18654	-22.00	17296	-6988
4	531.02	20713	-22.00	19205	-7759
5	549.22	29875	-22.00	27700	-11191
6	568.03	38719	-22.00	35900	-14504
7	582.57	44630	-22.00	41380	-16719
8	602.32	50831	-22.00	47130	-19042
9	609.56	52476	-22.00	48655	-19658
10	629.93	55069	-22.00	51059	-20629
11	650.68	54370	-22.00	50411	-20368
12	658.23	53239	-22.00	49363	-19944
13	679.42	47566	-22.00	44102	-17819
14	700.86	38173	-22.00	35393	-14300
15	722.50	25316	-22.00	23472	-9483
16	730.21	20021	-22.00	18563	-7500
17	736.64	15355	-22.00	14237	-5752
18	748.89	16872	-22.00	15644	-6321
19	770.74	17376	-22.00	16111	-6509
20	771.43	17356	-22.00	16092	-6502
21	793.28	15630	-22.00	14492	-5855
22	804.66	14173	-22.00	13141	-5309
23	806.28	13950	-22.00	12934	-5226
24	819.15	12212	-22.00	11323	-4575
25	840.80	1891	-22.00	1754	-708
26	849.70	-0	-22.00	-0	0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: A-A' Case: CH2M Analysis

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates Shifting Points

x y 10

10 330.8 5

166 231.1

239.52 231.2 fixed

282.38 230.81 fixed

293.54 229.13 fixed

305.19 231.19 fixed

381.95 232.81 fixed

404.55 233.16 fixed

467.12 232.9 fixed

Adjustments

Corp method used to
force Line of Thrust
beneath surface

Crack Depth

17

Seismic Acceleration

0.13

Minimum Weight

5000

Results

Noncircular Shear Surface

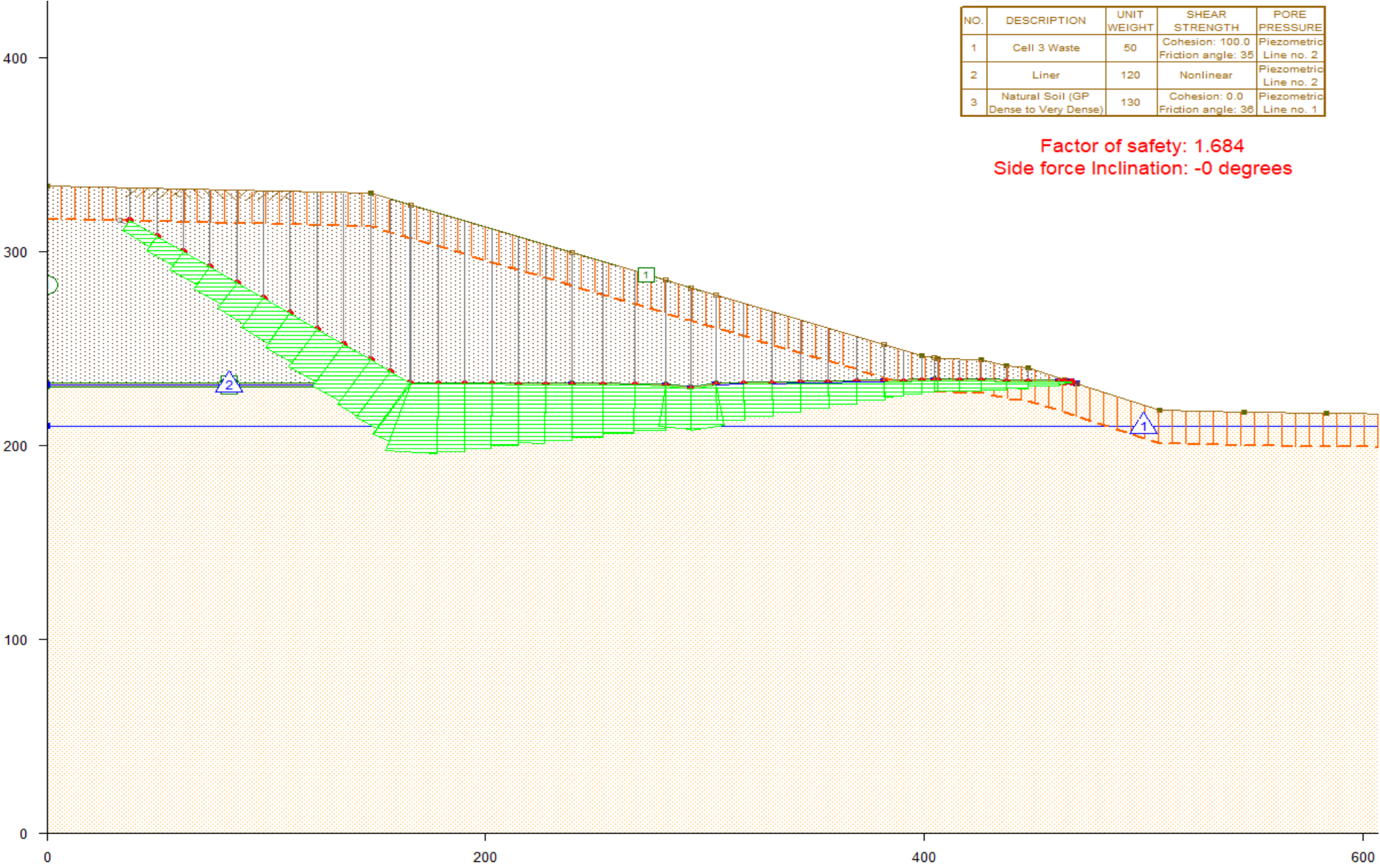
42.97	315.86
166.24	231.84
239.52	231.2
282.38	230.81
293.54	229.13
305.19	231.19
381.95	232.81
404.55	233.16
467.15	232.9

Factor of Safety

1.684

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Cell 3 Waste	50	Cohesion: 100.0 Friction angle: 35	Piezometric Line no. 2
2	Liner	120	Nonlinear	Piezometric Line no. 2
3	Natural Soil (GP Dense to Very Dense)	130	Cohesion: 0.0 Friction angle: 36	Piezometric Line no. 1

Factor of safety: 1.684
Side force Inclination: -0 degrees



Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section A-A' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 1 of 4

English units

HEAding follows -MSB

CELL 3

PROfile line data follow -

1 1 Cell 3 Surface

0.000000	333.976600
147.552900	330.139000
399.183500	246.250400
406.121800	244.712800
426.040100	244.023100
437.832500	241.284800
447.582100	240.087400

464.4 233.9

2 2 Liner

0 232.1156

166.0471 232.1156

239.5212 232.1992

282.3832 231.8095

293.5372 230.1338

305.1905 232.1918

381.9526 233.8086

404.5544 234.1568

464.4 233.9

469.925200 231.892400

3 3 Native Surface

0.000000	230.115600
166.047100	230.115600
239.521200	230.199200
282.383200	229.809500
293.537200	228.133800
305.190500	230.191800
381.952600	231.808600
404.554400	232.156800
469.925200	231.892400

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section A-A' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 2 of 4

507.465300	218.060500
546.288900	216.988100
583.471700	216.402500
657.991300	215.510800
741.835000	212.295700
814.990400	214.257600
864.122100	231.583000
886.536400	237.805100
945.522300	256.707600
969.897400	262.128400
978.535600	263.868000
999.028400	264.021200

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0 35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0.0 0.0

700 454.6

4200 1942.8

5000 2183.7

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0 36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000 210.000000

1000.000000 210.000000

2 62.40 Piezometric line 2

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section A-A' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 3 of 4

0 231.1156

166.0471 231.1156

239.5212 231.1992

282.3832 230.8095

293.5372 229.1338

305.1905 231.1918

381.9526 232.8086

404.5544 233.1568

461.6819 232.9

467.1180884 232.9123734

469.925200 231.892400

ANALYSIS/computation data follow

Noncircular Search 2

10 330.8

166 231.1

239.5212 231.1992 fixed

282.3832 230.8095 fixed

293.5372 229.1338 fixed

305.1905 231.1918 fixed

381.9526 232.8086 fixed

404.5544 233.1568 fixed

461.6819 232.9 fixed

467.1180884 232.9123734 fixed

10 5

MINIMUM weight follows:

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section A-A' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 4 of 4

5000
ITERation limit follows:
100
crack
17 d
Procedure
Corps of Engineers
0
SEismic
0.13
GRAphics output file
COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

Page 1 of 22

TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

Page 2 of 22

UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Time and date of run: Wed Nov 16 06:41:13 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to
weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

Page 3 of 22

UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Name of input data file:

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Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 5 Surface

Point	X	Y
1	0.00	333.44
2	70.21	333.27
3	462.92	332.87
4	859.99	200.68

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	225.94
2	60.30	222.86
3	96.38	221.45
4	222.67	219.99
5	229.57	218.95
6	238.21	218.22
7	281.12	216.76
8	317.10	215.14
9	353.47	213.19
10	385.30	212.16
11	399.54	213.14
12	414.03	211.99
13	429.84	214.45
14	446.63	217.39
15	474.08	208.24
16	531.02	200.09
17	582.57	200.08
18	609.56	201.08
19	658.23	200.94
20	730.21	198.07
21	806.28	199.05
22	859.99	200.68
23	863.00	199.68
24	866.00	198.68

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Native Surface

Point	X	Y
1	0.00	223.94
2	60.30	220.86
3	96.38	219.45
4	222.67	217.99
5	229.57	216.95
6	238.21	216.22
7	281.12	214.76
8	317.10	213.14
9	353.47	211.19
10	385.30	210.16
11	399.54	211.14
12	414.03	209.99
13	429.84	212.45
14	446.63	215.39
15	474.08	206.24
16	531.02	198.09
17	582.57	198.08
18	609.56	199.08
19	658.23	198.94
20	730.21	196.07
21	806.28	197.05
22	866.00	198.68
23	1500.00	199.10

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Time and date of run: Wed Nov 16 06:41:13 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----

-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures calculated by interpolation of
specified values of pore water pressure.

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----

-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	700.0	454.6
3	4200.0	1942.8
4	5000.0	2183.7

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----

-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

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Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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Time and date of run: Wed Nov 16 06:41:13 2022

Name of input data file:

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Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	224.94
2	60.30	221.86
3	96.38	220.45
4	222.67	218.99
5	229.57	217.95
6	238.21	217.22
7	281.12	215.76
8	317.10	214.14
9	353.47	212.19
10	385.30	211.16
11	399.54	212.14
12	414.03	210.99
13	429.84	213.45
14	446.63	216.39
15	474.08	207.24
16	531.02	199.09
17	582.57	199.08
18	609.56	200.08
19	658.23	199.94
20	730.21	197.07
21	806.28	198.05
22	863.00	199.68
23	866.00	198.68

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Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Time and date of run: Wed Nov 16 06:41:13 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 8

* NEW INTERPOLATION DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Input Point	Assigned Point			Variable	Material Type
No.	No.	X	Y		
1	1	350.00	332.98	0.0 Pore Pressure	1
2	2	400.00	332.93	0.0 Pore Pressure	1
3	3	450.00	332.88	0.0 Pore Pressure	1
4	4	462.92	332.87	0.0 Pore Pressure	1
5	5	500.00	320.52	0.0 Pore Pressure	1
6	6	550.00	303.88	0.0 Pore Pressure	1
7	7	600.00	287.23	0.0 Pore Pressure	1
8	8	650.00	270.59	0.0 Pore Pressure	1
9	9	700.00	253.94	0.0 Pore Pressure	1
10	10	750.00	237.30	0.0 Pore Pressure	1
11	11	800.00	220.65	0.0 Pore Pressure	1
12	12	859.99	200.68	0.0 Pore Pressure	1
13	13	350.00	225.00	0.0 Pore Pressure	1
14	14	400.00	225.00	0.0 Pore Pressure	1
15	15	450.00	225.00	0.0 Pore Pressure	1
16	16	500.00	225.00	0.0 Pore Pressure	1
17	17	550.00	225.00	0.0 Pore Pressure	1
18	18	600.00	225.00	0.0 Pore Pressure	1
19	19	650.00	225.00	0.0 Pore Pressure	1
20	20	675.00	225.00	0.0 Pore Pressure	1
21	21	711.93	225.00	0.0 Pore Pressure	1
22	22	750.00	225.00	0.0 Pore Pressure	1
23	23	775.00	225.00	0.0 Pore Pressure	1
24	24	350.00	225.00	0.0 Pore Pressure	1
25	25	400.00	205.00	1248.0 Pore Pressure	1
26	26	450.00	205.00	1248.0 Pore Pressure	1
27	27	500.00	205.00	1248.0 Pore Pressure	1
28	28	550.00	205.00	1248.0 Pore Pressure	1
29	29	600.00	205.00	1248.0 Pore Pressure	1
30	30	650.00	205.00	1248.0 Pore Pressure	1
31	31	700.00	205.00	1248.0 Pore Pressure	1
32	32	750.00	205.00	1248.0 Pore Pressure	1
33	33	772.01	205.00	1248.0 Pore Pressure	1
34	34	773.00	205.00	0.0 Pore Pressure	1
35	35	800.00	205.00	0.0 Pore Pressure	1
36	36	350.00	224.50	0.0 Pore Pressure	1
37	37	400.00	204.50	0.0 Pore Pressure	1
38	38	450.00	204.50	0.0 Pore Pressure	1
39	39	500.00	204.50	0.0 Pore Pressure	1
40	40	550.00	204.50	0.0 Pore Pressure	1

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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41	41	600.00	204.50	0.0 Pore Pressure	1
42	42	650.00	204.50	0.0 Pore Pressure	1
43	43	700.00	204.50	0.0 Pore Pressure	1
44	44	750.00	204.50	0.0 Pore Pressure	1
45	45	800.00	204.50	0.0 Pore Pressure	1
46	46	350.00	265.00	0.0 Pore Pressure	1
47	47	400.00	265.00	0.0 Pore Pressure	1
48	48	450.00	265.00	0.0 Pore Pressure	1
49	49	500.00	265.00	0.0 Pore Pressure	1
50	50	550.00	265.00	0.0 Pore Pressure	1
51	51	591.78	265.00	0.0 Pore Pressure	1
52	52	600.00	265.00	0.0 Pore Pressure	1
53	53	650.00	265.00	0.0 Pore Pressure	1
54	54	350.00	245.00	1248.0 Pore Pressure	1
55	55	400.00	245.00	1248.0 Pore Pressure	1
56	56	450.00	245.00	1248.0 Pore Pressure	1
57	57	500.00	245.00	1248.0 Pore Pressure	1
58	58	550.00	245.00	1248.0 Pore Pressure	1
59	59	600.00	245.00	1248.0 Pore Pressure	1
60	60	651.86	245.00	1248.0 Pore Pressure	1
61	61	652.00	245.00	0.0 Pore Pressure	1
62	62	350.00	244.50	0.0 Pore Pressure	1
63	63	400.00	244.50	0.0 Pore Pressure	1
64	64	450.00	244.50	0.0 Pore Pressure	1
65	65	500.00	244.50	0.0 Pore Pressure	1
66	66	550.00	244.50	0.0 Pore Pressure	1
67	67	600.00	244.50	0.0 Pore Pressure	1
68	68	650.00	244.50	0.0 Pore Pressure	1
69	69	350.00	305.00	0.0 Pore Pressure	1
70	70	400.00	305.00	0.0 Pore Pressure	1
71	71	450.00	305.00	0.0 Pore Pressure	1
72	72	471.62	305.00	0.0 Pore Pressure	1
73	73	500.00	305.00	0.0 Pore Pressure	1
74	74	531.70	305.00	0.0 Pore Pressure	1
75	75	350.00	285.00	1248.0 Pore Pressure	1
76	76	400.00	285.00	1248.0 Pore Pressure	1
77	77	450.00	285.00	1248.0 Pore Pressure	1
78	78	471.62	285.00	1248.0 Pore Pressure	1
79	79	500.00	285.00	1248.0 Pore Pressure	1
80	80	531.70	285.00	1248.0 Pore Pressure	1
81	81	532.00	285.00	0.0 Pore Pressure	1
82	82	600.00	285.00	0.0 Pore Pressure	1
83	83	350.00	284.50	0.0 Pore Pressure	1
84	84	400.00	284.50	0.0 Pore Pressure	1
85	85	450.00	284.50	0.0 Pore Pressure	1
86	86	471.62	284.50	0.0 Pore Pressure	1
87	87	500.00	284.50	0.0 Pore Pressure	1
88	88	531.70	284.50	0.0 Pore Pressure	1
89	89	532.00	284.50	0.0 Pore Pressure	1
90	90	550.00	284.50	0.0 Pore Pressure	1
91	91	600.00	284.50	0.0 Pore Pressure	1

Number of new interpolation points read: 91

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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Number of old interpolation points retained: 0

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	462.92	332.87	angle to be computed - moveable
2	582.57	200.08	angle to be computed - moveable
3	609.56	200.08	- fixed
4	658.23	199.94	- fixed
5	730.21	197.07	- fixed
6	806.28	198.05	- fixed
7	863.00	199.68	- fixed
8	866.00	198.68	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 8.000

-----The

following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Seismic coefficient: 0.000

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Procedure of Analysis: Spencer

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Minimum (most negative) side force inclination allowed in Spencer's procedure:

-10.00

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	333.44
2	60.30	333.29
3	70.21	333.27
4	96.38	333.24
5	222.67	333.11
6	229.57	333.10
7	238.21	333.10
8	281.12	333.05
9	317.10	333.02
10	353.47	332.98
11	385.30	332.95
12	399.54	332.93
13	414.03	332.92
14	429.84	332.90
15	446.63	332.88
16	462.92	332.87
17	474.08	329.15
18	531.02	310.19
19	582.57	293.03
20	609.56	284.05
21	658.23	267.85
22	730.21	243.88
23	806.28	218.56
24	859.99	200.68
25	863.00	199.68
26	866.00	198.68
27	1500.00	199.10

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 453.73 Y: 324.88

X: 592.96 Y: 217.15

X: 609.56 Y: 200.08

X: 658.23 Y: 199.94

X: 730.21 Y: 197.07

X: 806.28 Y: 198.05

X: 863.00 Y: 199.68

Minimum factor of safety: 2.102

Side force inclination: -17.15

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 4

Total number of shear surfaces attempted: 20

Total number of shear surfaces for which the factor of safety
was successfully calculated: 18

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	2.1638	5	4
2	10.0000	2	10.000	2.1024	10	8
3	10.0000	2	3.972	2.1024	15	13
4	5.0000	1	5.000	2.1024	20	18

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
	453.73	324.88					
1	458.32	321.32	5305	1	100.0	35.00	0.0
	462.92	317.77					
2	468.50	313.45	9804	1	100.0	35.00	0.0
	474.08	309.13					
3	478.83	305.46	10493	1	100.0	35.00	0.0
	483.57	301.78					
4	488.32	298.11	12478	1	100.0	35.00	429.7
	493.06	294.44					
5	497.81	290.77	14463	1	100.0	35.00	887.9
	502.55	287.10					
6	507.30	283.43	16449	1	100.0	35.00	0.0
	512.04	279.76					
7	516.79	276.08	18434	1	100.0	35.00	0.0
	521.53	272.41					
8	526.28	268.74	20419	1	100.0	35.00	0.0
	531.02	265.07					
9	536.18	261.08	24429	1	100.0	35.00	244.5
	541.33	257.09					
10	546.49	253.11	26771	1	100.0	35.00	742.2
	551.64	249.12					
11	556.80	245.13	29113	1	100.0	35.00	1239.9
	561.95	241.14					
12	567.10	237.15	31456	1	100.0	35.00	0.0
	572.26	233.17					
13	577.41	229.18	33798	1	100.0	35.00	0.0
	582.57	225.19					
14	587.76	221.17	36442	1	100.0	35.00	239.1
	592.96	217.15					
15	596.87	213.12	29424	1	100.0	35.00	741.1
	600.79	209.10					
16	604.71	205.07	31555	1	100.0	35.00	1243.5
	608.62	201.05					
17	609.09	200.56	3959	2	NONLINEAR ENVELOPE		0.0
	609.56	200.08					

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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18	615.64	200.06	50713	2	NONLINEAR ENVELOPE	0.0
	621.73	200.05				
19	627.81	200.03	48270	2	NONLINEAR ENVELOPE	0.0
	633.89	200.01				
20	639.98	199.99	45827	2	NONLINEAR ENVELOPE	0.0
	646.06	199.98				
21	652.14	199.96	43385	2	NONLINEAR ENVELOPE	0.0
	658.23	199.94				
22	664.23	199.70	40517	2	NONLINEAR ENVELOPE	0.0
	670.22	199.46				
23	676.22	199.22	38408	2	NONLINEAR ENVELOPE	0.0
	682.22	198.98				
24	688.22	198.75	36299	2	NONLINEAR ENVELOPE	0.0
	694.22	198.51				
25	700.22	198.27	34191	2	NONLINEAR ENVELOPE	0.0
	706.21	198.03				
26	712.21	197.79	32082	2	NONLINEAR ENVELOPE	0.0
	718.21	197.55				
27	724.21	197.31	29974	2	NONLINEAR ENVELOPE	0.0
	730.21	197.07				
28	736.55	197.15	29176	2	NONLINEAR ENVELOPE	0.0
	742.89	197.23				
29	749.23	197.31	26397	2	NONLINEAR ENVELOPE	0.0
	755.57	197.40				
30	761.90	197.48	23618	2	NONLINEAR ENVELOPE	0.0
	768.24	197.56				
31	774.58	197.64	20839	2	NONLINEAR ENVELOPE	0.0
	780.92	197.72				
32	787.26	197.80	18060	2	NONLINEAR ENVELOPE	0.0
	793.60	197.88				
33	799.94	197.97	15281	2	NONLINEAR ENVELOPE	0.0
	806.28	198.05				
34	813.00	198.24	13091	2	NONLINEAR ENVELOPE	0.0
	819.71	198.43				
35	826.42	198.63	9851	2	NONLINEAR ENVELOPE	0.0
	833.14	198.82				
36	839.85	199.01	6611	2	NONLINEAR ENVELOPE	0.0
	846.56	199.21				
37	853.28	199.40	3371	2	NONLINEAR ENVELOPE	0.0
	859.99	199.59				
38	861.49	199.64	196	2	NONLINEAR ENVELOPE	0.0
	863.00	199.68				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 44

```
*****
* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations.                *
* (Information is for the critical shear surface in the    *
* case of an automatic search.)                             *
*****
```

There are no seismic forces or forces due to distributed loads
for the current shear surface

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of *

* Safety and Side Force Inclination by Spencer's Procedure *

Trial No. 1 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Allowable moment imbalance for convergence: 5905

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iter- ation	of Safety					
1	3.00000	-17.1887	-7.364e+004	2.938e+007		
First-order corrections to F and Theta					-1.2729	-0.0250
Reduced values - Deltas were too large					-0.5000	-0.0098
2	2.50000	-17.1985	-3.897e+004	1.554e+007		
First-order corrections to F and Theta					-0.8410	22.9727
Reduced values - Deltas were too large					-0.1049	2.8648
3	2.39512	-14.3337	-3.379e+004	1.360e+007		
First-order corrections to F and Theta					0.0837	-30.2774
Reduced values - Deltas were too large					0.0079	-2.8648
4	2.40304	-17.1985	-3.058e+004	1.220e+007		
First-order corrections to F and Theta					-0.3421	0.1323
Second-order corrections to F and Theta					-0.3026	0.0307
5	2.10042	-17.1678	4.927e+002	-1.954e+005		
First-order corrections to F and Theta					0.0042	-0.0028
Second-order corrections to F and Theta					0.0042	-0.0029
6	2.10466	-17.1707	-2.000e-003	7.696e-001		
First-order corrections to F and Theta					-0.0000	0.0000

After trial 1 the following changes were computed for the nonlinear
strength envelopes:

Maximum change in shear strength: -1.588 (percent)

Maximum change occurred for slice 18

Normal stress where max. change occurred: 4462.89

Old strength at this slice: 2054.58

New strength at this slice: 2021.96

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of *

* Safety and Side Force Inclination by Spencer's Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Allowable moment imbalance for convergence: 5905

	Trial Factor	Trial Side Force Inclination (degrees)	Force Imbalance (lbs.)	Moment Imbalance (ft.-lbs.)	Delta-F	Delta Theta (degrees)
Iter- ation	1	3.00000	-17.1887	-7.371e+004	2.941e+007	
First-order corrections to F and Theta					-1.2760	-0.0403
Reduced values - Deltas were too large					-0.5000	-0.0158
2	2.50000	-17.2045	-3.910e+004	1.559e+007		
First-order corrections to F and Theta					0.6922	-72.8355
Reduced values - Deltas were too large					0.0272	-2.8648
3	2.52723	-20.0693	-3.754e+004	1.490e+007		
First-order corrections to F and Theta					-0.9938	32.9316
Reduced values - Deltas were too large					-0.0865	2.8648
4	2.44078	-17.2045	-3.407e+004	1.358e+007		
First-order corrections to F and Theta					-0.3978	0.3959
Second-order corrections to F and Theta					-0.3444	0.0567
5	2.09641	-17.1479	6.885e+002	-2.722e+005		
First-order corrections to F and Theta					0.0059	-0.0061
Second-order corrections to F and Theta					0.0059	-0.0062
6	2.10235	-17.1541	-5.491e-003	2.070e+000		
First-order corrections to F and Theta					-0.0000	0.0000

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 55

* Check of Computations by Spencer's Procedure (Results are for the *
* critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 1.02318e-010

Summation of Vertical Forces: 6.23288e-011

Summation of Moments: 5.60831e-008

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.41158e-011

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

SPENCER'S PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY

Factor of Safety: 2.102 Side Force Inclination: -17.15

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear Stress
			Normal Stress	Normal Stress	
1	458.32	321.32	398.5	398.5	180.3
2	468.50	313.45	614.1	614.1	252.1
3	478.83	305.46	777.4	777.4	306.5
4	488.32	298.11	975.3	545.5	229.3
5	497.81	290.77	1176.3	288.4	143.6
6	507.30	283.43	1227.7	1227.7	456.5
7	516.79	276.08	1377.8	1377.8	506.5
8	526.28	268.74	1527.9	1527.9	556.4
9	536.18	261.08	1711.6	1467.1	536.2
10	546.49	253.11	1930.0	1187.7	443.2
11	556.80	245.13	2148.3	908.4	350.1
12	567.10	237.15	2173.5	2173.5	771.5
13	577.41	229.18	2336.6	2336.6	825.8
14	587.76	221.17	2526.8	2287.7	809.5
15	596.87	213.12	2505.3	1764.2	635.1
16	604.71	205.07	2757.5	1513.9	551.8
17	609.09	200.56	2846.0	2846.0	650.3
18	615.64	200.06	4458.0	4458.0	961.1
19	627.81	200.03	4248.2	4248.2	931.0
20	639.98	199.99	4035.3	4035.3	890.8
21	652.14	199.96	3821.5	3821.5	847.5
22	664.23	199.70	3546.6	3546.6	792.0
23	676.22	199.22	3363.1	3363.1	754.9
24	688.22	198.75	3179.7	3179.7	717.7
25	700.22	198.27	2996.2	2996.2	680.6
26	712.21	197.79	2812.7	2812.7	643.5
27	724.21	197.31	2629.2	2629.2	606.4
28	736.55	197.15	2497.4	2497.4	579.7
29	749.23	197.31	2261.9	2261.9	532.1
30	761.90	197.48	2026.5	2026.5	484.5
31	774.58	197.64	1791.1	1791.1	436.9
32	787.26	197.80	1555.7	1555.7	389.3
33	799.94	197.97	1320.3	1320.3	341.7
34	813.00	198.24	1083.7	1083.7	293.8

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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35	826.42	198.63	822.3	822.3	241.0
36	839.85	199.01	555.1	555.1	171.5
37	853.28	199.40	283.0	283.0	87.4
38	861.49	199.64	73.5	73.5	22.7

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section D-D'\MSB Section D-D' - Non Circular.input-utexas

MSB CELL 3

TABLE NO. 59

 * Final Results for Side Forces and Stresses Between Slices *
 * (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----						
Slice		Y-Coord. of	Fraction	Sigma	Sigma	
No.	X-Right	Side Force	of Height	at Top	at Bottom	
1	462.92	1231	319.90	0.141	-89.7	245.5
2	474.08	3838	313.24	0.206	-140.5	506.8
3	483.57	6768	307.58	0.239	-150.8	685.1
4	493.06	11986	301.16	0.237	-233.6	1040.5
5	502.55	19599	294.77	0.235	-337.8	1487.7
6	512.04	24500	289.86	0.275	-223.1	1496.9
7	521.53	30058	284.66	0.299	-144.3	1547.4
8	531.02	36273	279.25	0.314	-87.9	1624.1
9	541.33	44776	272.92	0.319	-75.9	1798.7
10	551.64	56105	266.06	0.312	-123.6	2101.4
11	561.95	70261	258.98	0.304	-203.8	2489.0
12	572.26	80082	253.32	0.318	-108.7	2526.3
13	582.57	90677	247.50	0.329	-34.3	2588.5
14	592.96	103136	241.31	0.334	1.7	2719.7
15	600.79	119041	235.28	0.336	25.9	2895.5
16	608.62	137754	228.93	0.335	12.5	3147.3
17	609.56	139990	228.19	0.335	13.3	3172.8
18	621.73	127915	226.91	0.336	24.3	3033.1
19	633.89	116215	225.67	0.338	40.1	2884.6
20	646.06	105019	224.45	0.340	58.4	2732.1
21	658.23	94367	223.25	0.343	78.9	2576.8
22	670.22	86199	221.60	0.344	80.5	2477.8
23	682.22	78405	219.94	0.344	80.4	2381.0
24	694.22	70986	218.26	0.344	78.1	2286.9
25	706.21	63940	216.55	0.344	73.0	2196.4
26	718.21	57269	214.82	0.343	64.1	2110.5
27	730.21	50972	213.05	0.341	50.1	2030.6
28	742.89	42854	211.78	0.343	54.8	1875.3
29	755.57	35407	210.50	0.344	58.5	1720.0
30	768.24	28633	209.20	0.346	60.7	1564.8
31	780.92	22531	207.89	0.347	60.9	1409.7
32	793.60	17100	206.55	0.348	58.4	1254.2
33	806.28	12342	205.19	0.348	52.2	1097.6
34	819.71	7774	203.92	0.350	48.5	900.4
35	833.14	4055	202.73	0.362	61.2	656.4
36	846.56	1421	201.62	0.407	100.8	356.2

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section A-A' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

Page 22 of 22

37	859.99	78	200.10	0.467	54.8	82.4
38	863.00	-0	199.68	0.000	0.0	0.0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: B-B' Case: CH2M Analysis

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates Shifting Points

x y 10

364.09 328.58 5

439.66 232.29

636.96 233.73 fixed

736.26 212.92 fixed

755.92 212.78 fixed

798.74 211.28 fixed

801.73 210.28 fixed

Adjustments

Corp method used to
force Line of Thrust
beneath surface

Crack Depth

10

Seismic Acceleration

0.13

Minimum Weight

5000

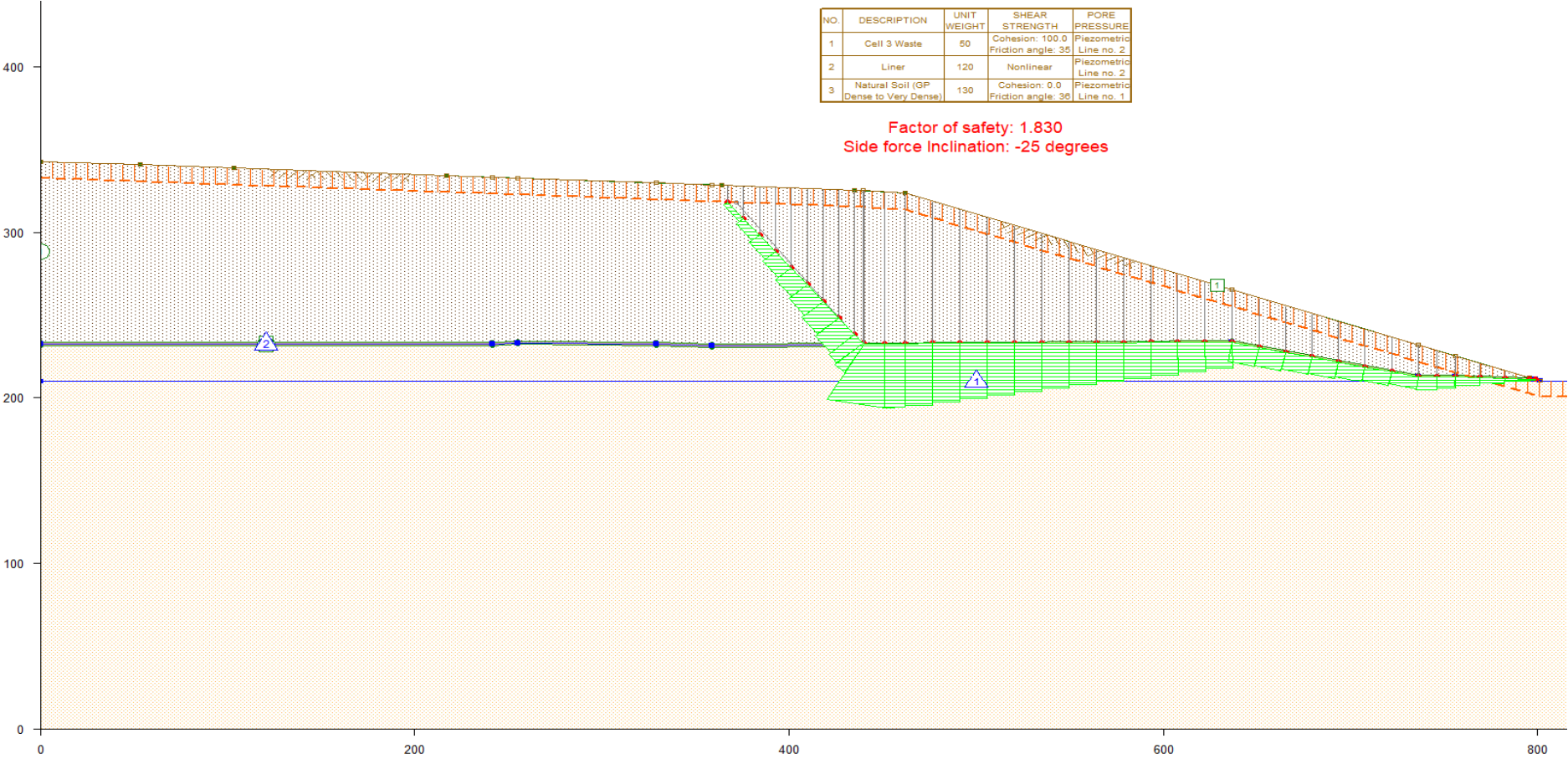
Results

Noncircular Shear Surface

366.81	318.47
440.19	233.16
636.96	233.73
736.26	212.92
755.92	212.78
798.74	211.28

Factor of Safety

1.83



Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section B-B' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 1 of 4

English units

Heading follows -MSB

CELL 3

Profile line data follow -

1 1 Cell 4 Surface

0 342.9925

53.3791 340.9508

103.5224 338.8839

216.9023 334.482

364.0891 328.5808

435.2507 325.7232

462.0904 323.8434

795.7461 212.2843

2 2 Liner

0 233.9687

241.3595 233.9687

255.373 234.532

329.1175 233.9445

358.7087 232.8241

439.6647 233.2931

636.9606 234.73

736.2644 213.9188

755.9227 213.778

795.7461 212.2843

798.737 211.2843

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section B-B' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 2 of 4

801.7278 210.2843

3 3 Native Surface

0 231.9687

241.3595 231.9687

255.373 232.532

329.1175 231.9445

358.7087 230.8241

439.6647 231.2931

636.9606 232.73

736.2644 211.9188

755.9227 211.778

801.7278 210.2843

830.3544 210.7192

842.2722 210.9911

860.5027 210.9911

866.5411 211.812

886.081 218.0902

904.7485 224.5428

924.0266 230.9082

958.7877 233.0943

975.4239 234.0329

998.3779 233.9295

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section B-B' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 3 of 4

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0.0

0.0

700 454.6

4200 1942.8

5000 2183.7

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000

210.000000

1000.000000

210.000000

2 62.40 Piezometric line 2

0 232.9687

241.3595 232.9687

255.373 233.532

329.1175 232.9445

358.7087 231.8241

439.6647 232.2931

636.9606 233.73

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section B-B' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 4 of 4

736.2644 212.9188

755.9227 212.778

798.737 211.2843

801.7278 210.2843

ANALYSIS/computation data follow
Noncircular Search 2

364.0891 328.5808

439.6647 232.2931

636.9606 233.73 Fixed

736.2644 212.9188 Fixed

755.9227 212.778 Fixed

798.737 211.2843 Fixed

801.7278 210.2843 Fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

10 d

Procedure

Corps of Engineers

25

Seismic

0.13

GRAPHICS output file

COMPUTE

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

Page 1 of 20

TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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UTEXAS4 S/N:10001 - Version: 4.1.2.0 - Latest Revision: 7/29/2020

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Name of input data file:

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Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to
weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 4 Surface

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	364.09	328.58
6	435.25	325.72
7	462.09	323.84
8	795.75	212.28

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	233.97
2	241.36	233.97
3	255.37	234.53
4	329.12	233.94
5	358.71	232.82
6	439.66	233.29
7	636.96	234.73
8	736.26	213.92
9	755.92	213.78
10	795.75	212.28
11	798.74	211.28
12	801.73	210.28

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	231.97
2	241.36	231.97
3	255.37	232.53
4	329.12	231.94
5	358.71	230.82
6	439.66	231.29

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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7	636.96	232.73
8	736.26	211.92
9	755.92	211.78
10	801.73	210.28
11	830.35	210.72
12	842.27	210.99
13	860.50	210.99
14	866.54	211.81
15	886.08	218.09
16	904.75	224.54
17	924.03	230.91
18	958.79	233.09
19	975.42	234.03
20	998.38	233.93

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----

-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----

-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	700.0	454.6
3	4200.0	1942.8
4	5000.0	2183.7

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----

-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

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Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----
-Description:
Piezometric line 1
Unit weight of fluid (water): 62.4
Point X Y
1 0.00 210.00
2 1000.00 210.00

Piezometric Line Number 2 -----
-Description:
Piezometric line 2
Unit weight of fluid (water): 62.4
Point X Y
1 0.00 232.97
2 241.36 232.97
3 255.37 233.53
4 329.12 232.94
5 358.71 231.82
6 439.66 232.29
7 636.96 233.73
8 736.26 212.92
9 755.92 212.78
10 798.74 211.28
11 801.73 210.28

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	364.09	328.58	angle to be computed - moveable
2	439.66	232.29	angle to be computed - moveable
3	636.96	233.73	- fixed
4	736.26	212.92	- fixed
5	755.92	212.78	- fixed
6	798.74	211.28	- fixed
7	801.73	210.28	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 10.000

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 25.00

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

-----The

following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	241.36	333.50
6	255.37	332.94
7	329.12	329.98
8	358.71	328.80
9	364.09	328.58
10	435.25	325.72
11	439.66	325.41
12	462.09	323.84
13	636.96	265.37
14	736.26	232.17
15	755.92	225.60
16	795.75	212.28
17	798.74	211.28
18	801.73	210.28
19	830.35	210.72
20	842.27	210.99
21	860.50	210.99
22	866.54	211.81
23	886.08	218.09
24	904.75	224.54
25	924.03	230.91
26	958.79	233.09
27	975.42	234.03
28	998.38	233.93

Left end point on noncircular shear surface adjusted to:

X: 372.19, Y: 318.26

Adjustment was made to put end point at bottom of crack.

Right end point on noncircular shear surface adjusted to:

X: 798.74, Y: 211.28

Adjustment was made to put end point on the slope.

Right end point deleted after adjustment because it was same as adjacent point.

Noncircular Shear Surface Points After End Point Adjustment

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	372.19	318.26	angle to be computed - moveable

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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2	439.66	232.29	angle to be computed - moveable
3	636.96	233.73	- fixed
4	736.26	212.92	- fixed
5	755.92	212.78	- fixed
6	798.74	211.28	- fixed

Computed crack depth: 10.00

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

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Name of input data file:

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Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 367.20 Y: 318.46

X: 440.04 Y: 232.89

X: 636.96 Y: 233.73

X: 736.26 Y: 212.92

X: 755.92 Y: 212.78

X: 798.74 Y: 211.28

Minimum factor of safety: 1.830

Side force inclination: -25.00

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 3

Total number of shear surfaces attempted: 15

Total number of shear surfaces for which the factor of safety
was successfully calculated: 14

Pass	Shift Distance	Pt. Moved	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	2	2.458	1.8578	5	4
2	5.0000	1	5.000	1.8304	10	9
3	5.0000	1	5.000	1.8304	15	14

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

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Time and date of run: Wed Nov 16 06:41:13 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope
Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas
MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *
* Information for Individual Slices for Conventional *
* Computations or First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
	367.20	318.46					
1	371.45	313.46	6306	1	100.0	35.00	0.0
	375.70	308.46					
2	379.96	303.47	10410	1	100.0	35.00	0.0
	384.21	298.47					
3	388.46	293.48	14515	1	100.0	35.00	0.0
	392.72	288.48					
4	396.97	283.49	18619	1	100.0	35.00	0.0
	401.22	278.49					
5	405.48	273.49	22723	1	100.0	35.00	0.0
	409.73	268.50					
6	413.98	263.50	26828	1	100.0	35.00	0.0
	418.24	258.51					
7	422.49	253.51	30932	1	100.0	35.00	0.0
	426.74	248.51					
8	431.00	243.52	35037	1	100.0	35.00	0.0
	435.25	238.52					
9	437.46	235.93	19783	1	100.0	35.00	0.0
	439.66	233.34					
10	439.68	233.32	177	1	100.0	35.00	0.0
	439.70	233.29					
11	439.87	233.09	1580	2	NONLINEAR	ENVELOPE	0.0
	440.04	232.89					
12	445.56	232.92	51077	2	NONLINEAR	ENVELOPE	0.0
	451.07	232.94					
13	456.58	232.96	50652	2	NONLINEAR	ENVELOPE	0.0
	462.09	232.99					
14	469.38	233.02	64905	2	NONLINEAR	ENVELOPE	0.0
	476.66	233.05					
15	483.95	233.08	61355	2	NONLINEAR	ENVELOPE	0.0
	491.24	233.11					
16	498.52	233.14	57805	2	NONLINEAR	ENVELOPE	0.0
	505.81	233.17					
17	513.09	233.20	54255	2	NONLINEAR	ENVELOPE	0.0
	520.38	233.23					

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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18	527.67	233.27	50704	2	NONLINEAR ENVELOPE	0.0
	534.95	233.30				
19	542.24	233.33	47154	2	NONLINEAR ENVELOPE	0.0
	549.53	233.36				
20	556.81	233.39	43604	2	NONLINEAR ENVELOPE	0.0
	564.10	233.42				
21	571.38	233.45	40054	2	NONLINEAR ENVELOPE	0.0
	578.67	233.48				
22	585.96	233.51	36503	2	NONLINEAR ENVELOPE	0.0
	593.24	233.54				
23	600.53	233.58	32953	2	NONLINEAR ENVELOPE	0.0
	607.82	233.61				
24	615.10	233.64	29403	2	NONLINEAR ENVELOPE	0.0
	622.39	233.67				
25	629.67	233.70	25852	2	NONLINEAR ENVELOPE	0.0
	636.96	233.73				
26	644.05	232.24	22811	2	NONLINEAR ENVELOPE	0.0
	651.15	230.76				
27	658.24	229.27	21556	2	NONLINEAR ENVELOPE	0.0
	665.33	227.78				
28	672.43	226.30	20300	2	NONLINEAR ENVELOPE	0.0
	679.52	224.81				
29	686.61	223.32	19044	2	NONLINEAR ENVELOPE	0.0
	693.71	221.84				
30	700.80	220.35	17789	2	NONLINEAR ENVELOPE	0.0
	707.89	218.86				
31	714.99	217.38	16533	2	NONLINEAR ENVELOPE	0.0
	722.08	215.89				
32	729.17	214.41	15278	2	NONLINEAR ENVELOPE	0.0
	736.26	212.92				
33	741.18	212.88	9360	2	NONLINEAR ENVELOPE	0.0
	746.09	212.85				
34	751.01	212.81	7779	2	NONLINEAR ENVELOPE	0.0
	755.92	212.78				
35	762.56	212.55	8104	2	NONLINEAR ENVELOPE	0.0
	769.20	212.31				
36	775.83	212.08	5433	2	NONLINEAR ENVELOPE	0.0
	782.47	211.85				
37	789.11	211.62	2762	2	NONLINEAR ENVELOPE	0.0
	795.75	211.39				
38	797.24	211.34	161	2	NONLINEAR ENVELOPE	0.0
	798.74	211.28				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS

Slices No.	Y for		Normal Force	Shear Force		
	X	Seismic Force			X	Y
1	371.45	820	320.87	0	0	371.45 328.29
2	379.96	1353	315.71	0	0	379.96 327.94
3	388.46	1887	310.54	0	0	388.46 327.60
4	396.97	2420	305.37	0	0	396.97 327.26
5	405.48	2954	300.21	0	0	405.48 326.92
6	413.98	3488	295.04	0	0	413.98 326.58
7	422.49	4021	289.87	0	0	422.49 326.24
8	431.00	4555	284.71	0	0	431.00 325.89
9	437.46	2572	280.75	0	0	437.46 325.57
10	439.68	23	279.36	0	0	439.68 325.41
11	439.87	205	279.11	0	0	439.87 325.40
12	445.56	6640	278.67	0	0	445.56 325.00
13	456.58	6585	278.28	0	0	456.58 324.23
14	469.38	8438	276.87	0	0	469.38 321.41
15	483.95	7976	274.44	0	0	483.95 316.53
16	498.52	7515	272.00	0	0	498.52 311.66
17	513.09	7053	269.57	0	0	513.09 306.79
18	527.67	6592	267.13	0	0	527.67 301.92
19	542.24	6130	264.70	0	0	542.24 297.05
20	556.81	5668	262.27	0	0	556.81 292.17
21	571.38	5207	259.83	0	0	571.38 287.30
22	585.96	4745	257.40	0	0	585.96 282.43
23	600.53	4284	254.97	0	0	600.53 277.56
24	615.10	3822	252.54	0	0	615.10 272.68
25	629.67	3361	250.12	0	0	629.67 267.81
26	644.05	2965	246.98	0	0	644.05 263.00
27	658.24	2802	243.12	0	0	658.24 258.26
28	672.43	2639	239.27	0	0	672.43 253.52
29	686.61	2476	235.41	0	0	686.61 248.77
30	700.80	2313	231.56	0	0	700.80 244.03
31	714.99	2149	227.70	0	0	714.99 239.29
32	729.17	1986	223.85	0	0	729.17 234.54
33	741.18	1217	221.09	0	0	741.18 230.53

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

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34	751.01	1011	219.43	0	0	751.01	227.24
35	762.56	1053	217.41	0	0	762.56	223.38
36	775.83	706	215.03	0	0	775.83	218.94
37	789.11	359	212.76	0	0	789.11	214.50
38	797.24	21	211.56	0	0	797.24	211.78

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	1.258e+005	-1.954
Reduced value - Delta was too large			-0.500
2	2.50000	8.697e+004	-0.927
Reduced value - Delta was too large			-0.500
3	2.00000	2.780e+004	-0.186
4	1.81384	-3.015e+003	0.016
5	1.83027	-2.863e+001	0.000
6	1.83043	-2.631e-003	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

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Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 1.50770e-010

Summation of Vertical Forces: 1.66011e-010

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.29814e-003

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

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Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas
MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *

* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 1.830 Side Force Inclination: -25.00

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total	Effective	Shear
			Normal Stress	Normal Stress	
1	371.45	313.46	361.6	361.6	193.0
2	379.96	303.47	610.8	610.8	288.3
3	388.46	293.48	860.1	860.1	383.6
4	396.97	283.49	1109.3	1109.3	479.0
5	405.48	273.49	1358.5	1358.5	574.3
6	413.98	263.50	1607.7	1607.7	669.6
7	422.49	253.51	1857.0	1857.0	765.0
8	431.00	243.52	2106.2	2106.2	860.3
9	437.46	235.93	2293.7	2293.7	932.1
10	439.68	233.32	2357.2	2357.2	956.4
11	439.87	233.09	2504.4	2504.4	667.5
12	445.56	232.92	4917.5	4917.5	1179.4
13	456.58	232.96	4878.1	4878.1	1173.0
14	469.38	233.02	4734.1	4734.1	1149.3
15	483.95	233.08	4485.5	4485.5	1108.4
16	498.52	233.14	4237.0	4237.0	1067.5
17	513.09	233.20	3980.8	3980.8	1010.5
18	527.67	233.27	3723.2	3723.2	950.6
19	542.24	233.33	3465.7	3465.7	890.8
20	556.81	233.39	3208.2	3208.2	831.0
21	571.38	233.45	2950.7	2950.7	771.2
22	585.96	233.51	2693.2	2693.2	711.4
23	600.53	233.58	2435.7	2435.7	651.5
24	615.10	233.64	2178.1	2178.1	591.7
25	629.67	233.70	1920.6	1920.6	531.9
26	644.05	232.24	1476.3	1476.3	428.7
27	658.24	229.27	1396.2	1396.2	410.1
28	672.43	226.30	1316.1	1316.1	391.5
29	686.61	223.32	1236.0	1236.0	372.9
30	700.80	220.35	1155.9	1155.9	354.3
31	714.99	217.38	1075.8	1075.8	335.7
32	729.17	214.41	995.7	995.7	317.1
33	741.18	212.88	1041.5	1041.5	327.7

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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34	751.01	212.81	873.1	873.1	288.6
35	762.56	212.55	664.3	664.3	235.7
36	775.83	212.08	445.4	445.4	158.0
37	789.11	211.62	226.4	226.4	80.3
38	797.24	211.34	58.5	58.5	20.7

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

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Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas
MSB CELL 3

TABLE NO. 60

* Final Results for Side Forces Between Slices *

* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

		Resultant			
Slice No.	X-Right	Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	375.70	3080	-25.00	2791	-1302
2	384.21	8601	-25.00	7795	-3635
3	392.72	16564	-25.00	15012	-7000
4	401.22	26968	-25.00	24442	-11397
5	409.73	39814	-25.00	36084	-16826
6	418.24	55101	-25.00	49939	-23287
7	426.74	72830	-25.00	66006	-30779
8	435.25	93000	-25.00	84287	-39304
9	439.66	104420	-25.00	94637	-44130
10	439.70	104522	-25.00	94729	-44173
11	440.04	105605	-25.00	95710	-44631
12	451.07	98332	-25.00	89119	-41557
13	462.09	91079	-25.00	82546	-38492
14	476.66	81586	-25.00	73942	-34480
15	491.24	72259	-25.00	65489	-30538
16	505.81	63097	-25.00	57185	-26666
17	520.38	54359	-25.00	49266	-22973
18	534.95	46092	-25.00	41774	-19479
19	549.53	38295	-25.00	34707	-16184
20	564.10	30969	-25.00	28067	-13088
21	578.67	24112	-25.00	21853	-10190
22	593.24	17726	-25.00	16065	-7491
23	607.82	11810	-25.00	10704	-4991
24	622.39	6365	-25.00	5768	-2690
25	636.96	1389	-25.00	1259	-587
26	651.15	2794	-25.00	2532	-1181
27	665.33	4047	-25.00	3668	-1710
28	679.52	5148	-25.00	4666	-2176
29	693.71	6098	-25.00	5527	-2577
30	707.89	6896	-25.00	6250	-2915
31	722.08	7543	-25.00	6836	-3188
32	736.26	8038	-25.00	7285	-3397
33	746.09	5907	-25.00	5354	-2497
34	755.92	3962	-25.00	3590	-1674
35	769.20	2011	-25.00	1823	-850
36	782.47	704	-25.00	638	-297

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section B-B' Seismic - Non-Circular - Peak_output (wilson).docx

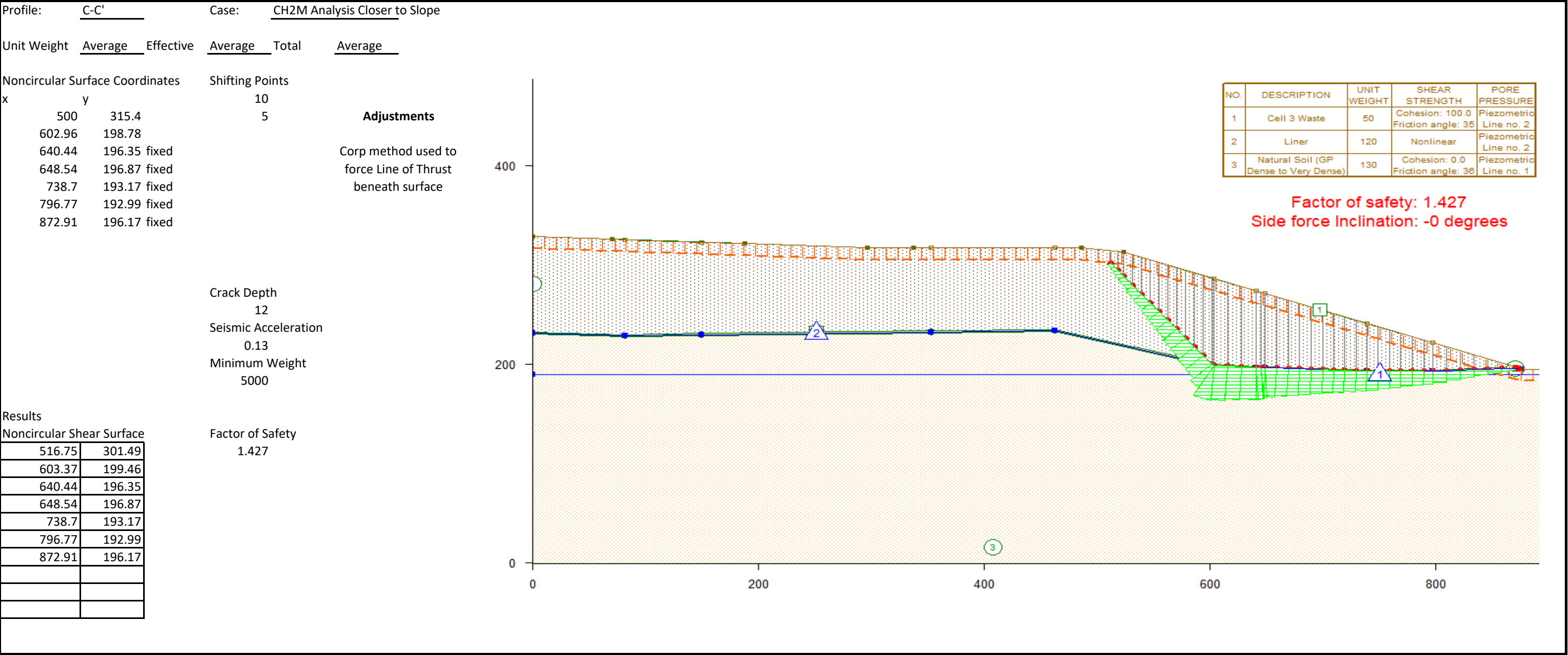
UTEXAS4 Output File

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37	795.75	39	-25.00	35	-16
38	798.74	-0	-25.00	-0	0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.



Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section C-C' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 1 of 4

English units

Heading follows -MSB

CELL 3

Profile line data follow -

1 1 Cell 5 Surface

0 328.8926

71.051 326.0616

188.5248 321.3252

296.7885 317.0329

337.8051 317.0858

486.3848 316.9548

523.8643 312.6729

869.918712 197.1749

2 2 Liner

0 232.1147

82.3776 229.8661

149.6914 230.9902

353.4471 233.6161

462.8547 235.1779

602.9616 199.777

640.4418 197.3469

648.5372 197.872

738.6968 194.1687

796.7718 193.9902

869.918712 197.1749

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section C-C' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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875.9111 195.1749

3 3 Native Surface

0 230.1147

82.3776 227.8661

149.6914 228.9902

353.4471 231.6161

462.8547 233.1779

602.9616 197.777

640.4418 195.3469

648.5372 195.872

738.6968 192.1687

796.7718 191.9902

875.9111 195.1749

1500 195.2685

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0.0

0.0

700 454.6

4200 1942.8

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section C-C' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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5000 2183.7

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000

190.000000

1500.000000

190.000000

2 62.40 Piezometric line 2

0 231.1147

82.3776 228.8661

149.6914 229.9902

353.4471 232.6161

462.8547 234.1779

602.9616 198.777

640.4418 196.3469

648.5372 196.872

738.6968 193.1687

796.7718 192.9902

872.914906 196.1749

875.9111 195.1749

ANALYSIS/computation data follow

Noncircular Search 2

500 315.4

602.96 198.78

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section C-C' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 4 of 4

640.44 196.35 fixed

648.54 196.87 fixed

738.7 193.17 fixed

796.77 192.99 fixed

872.914906 196.1749 fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

12 d

Procedure

Corps of Engineers

0

Seismic

0.13

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section C-C' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section C-C' Seismic - Non-Circular - Peak_output (wilson).docx

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TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to
weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----
-----Description:

Cell 5 Surface

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	188.52	321.33
4	296.79	317.03
5	337.81	317.09
6	486.38	316.95
7	523.86	312.67
8	869.92	197.17

Profile Line No. 2 - Material Type (Number): 2 -----
-----Description:

Liner

Point	X	Y
1	0.00	232.11
2	82.38	229.87
3	149.69	230.99
4	353.45	233.62
5	462.85	235.18
6	602.96	199.78
7	640.44	197.35
8	648.54	197.87
9	738.70	194.17
10	796.77	193.99
11	869.92	197.17
12	875.91	195.17

Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	230.11
2	82.38	227.87
3	149.69	228.99
4	353.45	231.62
5	462.85	233.18
6	602.96	197.78

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7	640.44	195.35
8	648.54	195.87
9	738.70	192.17
10	796.77	191.99
11	875.91	195.17
12	1500.00	195.27

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----
-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 2 -----
-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	700.0	454.6
3	4200.0	1942.8
4	5000.0	2183.7

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----
-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

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Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----
Description: Piezometric line 1
Unit weight of fluid (water): 62.4
Point X Y
1 0.00 190.00
2 1500.00 190.00

Piezometric Line Number 2 -----
-Description:
Piezometric line 2
Unit weight of fluid (water): 62.4
Point X Y
1 0.00 231.11
2 82.38 228.87
3 149.69 229.99
4 353.45 232.62
5 462.85 234.18
6 602.96 198.78
7 640.44 196.35
8 648.54 196.87
9 738.70 193.17
10 796.77 192.99
11 872.91 196.17
12 875.91 195.17

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	500.00	315.40	angle to be computed - moveable
2	602.96	198.78	angle to be computed - moveable
3	640.44	196.35	- fixed
4	648.54	196.87	- fixed
5	738.70	193.17	- fixed
6	796.77	192.99	- fixed
7	872.91	196.17	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 12.000

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 0.00

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

-----The

following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	82.38	325.60
4	149.69	322.89
5	188.52	321.33
6	296.79	317.03
7	337.81	317.09
8	353.45	317.07
9	462.85	316.98
10	486.38	316.95
11	523.86	312.67
12	602.96	286.27
13	640.44	273.76
14	648.54	271.06
15	738.70	240.97
16	796.77	221.59
17	869.92	197.17
18	875.91	195.17
19	1500.00	195.27

Left end point on noncircular shear surface adjusted to:

X: 511.78, Y: 302.05

Adjustment was made to put end point at bottom of crack.

Noncircular Shear Surface Points After End Point Adjustment

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	511.78	302.05	angle to be computed - moveable
2	602.96	198.78	angle to be computed - moveable
3	640.44	196.35	- fixed
4	648.54	196.87	- fixed
5	738.70	193.17	- fixed
6	796.77	192.99	- fixed
7	872.91	196.17	- fixed

Computed crack depth: 12.00

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 511.78 Y: 302.05

X: 602.96 Y: 198.78

X: 640.44 Y: 196.35

X: 648.54 Y: 196.87

X: 738.70 Y: 193.17

X: 796.77 Y: 192.99

X: 872.91 Y: 196.17

Minimum factor of safety: 1.427

Side force inclination: -0.00

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 2

Total number of shear surfaces attempted: 10

Total number of shear surfaces for which the factor of safety
was successfully calculated: 10

Pass	Shift Distance	Max. Dist. Pt. Moved	Minimum F	n Tried	n Computed
1	10.0000	1 10.000	1.4273	5	5
2	5.0000	1 5.000	1.4273	10	10

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *
* Information for Individual Slices for Conventional *
* Computations or First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
	511.78	302.05					
1	514.80	298.63	4553	1	100.0	35.00	0.0
	517.82	295.21					
2	520.84	291.79	6411	1	100.0	35.00	0.0
	523.86	288.37					
3	527.76	283.95	10688	1	100.0	35.00	0.0
	531.66	279.54					
4	535.56	275.12	13116	1	100.0	35.00	0.0
	539.46	270.71					
5	543.35	266.29	15544	1	100.0	35.00	0.0
	547.25	261.88					
6	551.15	257.46	17972	1	100.0	35.00	0.0
	555.05	253.05					
7	558.95	248.63	20400	1	100.0	35.00	0.0
	562.85	244.22					
8	566.74	239.80	22827	1	100.0	35.00	0.0
	570.64	235.39					
9	574.54	230.97	25255	1	100.0	35.00	0.0
	578.44	226.56					
10	582.34	222.14	27683	1	100.0	35.00	0.0
	586.23	217.72					
11	590.13	213.31	30111	1	100.0	35.00	0.0
	594.03	208.89					
12	597.93	204.48	32539	1	100.0	35.00	0.0
	601.83	200.06					
13	602.39	199.42	4972	2	NONLINEAR ENVELOPE		0.0
	602.96	198.78					
14	602.96	198.78	7	2	NONLINEAR ENVELOPE		0.0
	602.96	198.78					
15	609.21	198.37	54475	2	NONLINEAR ENVELOPE		0.0
	615.45	197.97					
16	621.70	197.56	52376	2	NONLINEAR ENVELOPE		0.0
	627.95	197.16					
17	634.19	196.75	50278	2	NONLINEAR ENVELOPE		0.0
	640.44	196.35					

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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18	640.44	196.35	7	2	NONLINEAR ENVELOPE	0.0
	640.44	196.35				
19	642.85	196.50	18781	2	NONLINEAR ENVELOPE	0.0
	645.27	196.66				
20	646.90	196.76	12468	2	NONLINEAR ENVELOPE	0.1
	648.54	196.87				
21	648.54	196.87	11	2	NONLINEAR ENVELOPE	0.1
	648.54	196.87				
22	653.66	196.66	37969	2	NONLINEAR ENVELOPE	0.1
	658.79	196.45				
23	663.91	196.24	36432	2	NONLINEAR ENVELOPE	0.1
	669.04	196.03				
24	674.16	195.82	34894	2	NONLINEAR ENVELOPE	0.1
	679.29	195.61				
25	684.41	195.40	33356	2	NONLINEAR ENVELOPE	0.0
	689.54	195.19				
26	694.66	194.98	31819	2	NONLINEAR ENVELOPE	0.0
	699.79	194.77				
27	704.65	194.57	28779	2	NONLINEAR ENVELOPE	0.0
	709.51	194.37				
28	714.38	194.17	27393	2	NONLINEAR ENVELOPE	0.0
	719.24	193.97				
29	724.10	193.77	26008	2	NONLINEAR ENVELOPE	0.0
	728.97	193.57				
30	733.83	193.37	24623	2	NONLINEAR ENVELOPE	0.0
	738.70	193.17				
31	738.70	193.17	8	2	NONLINEAR ENVELOPE	0.0
	738.70	193.17				
32	743.72	193.15	23861	2	NONLINEAR ENVELOPE	0.0
	748.74	193.14				
33	753.76	193.12	22196	2	NONLINEAR ENVELOPE	0.0
	758.78	193.11				
34	763.80	193.09	20530	2	NONLINEAR ENVELOPE	0.0
	768.82	193.08				
35	773.84	193.06	18864	2	NONLINEAR ENVELOPE	0.0
	778.86	193.05				
36	783.87	193.03	17198	2	NONLINEAR ENVELOPE	0.0
	788.89	193.01				
37	792.83	193.00	12327	2	NONLINEAR ENVELOPE	0.0
	796.77	192.99				
38	796.77	192.99	3	2	NONLINEAR ENVELOPE	0.0
	796.77	192.99				
39	802.87	193.25	16899	2	NONLINEAR ENVELOPE	0.0
	808.96	193.50				
40	815.06	193.75	14126	2	NONLINEAR ENVELOPE	0.0
	821.15	194.01				
41	827.25	194.26	11353	2	NONLINEAR ENVELOPE	0.0
	833.35	194.52				
42	839.44	194.77	8579	2	NONLINEAR ENVELOPE	0.0
	845.54	195.03				
43	851.63	195.28	5806	2	NONLINEAR ENVELOPE	0.0
	857.73	195.54				

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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44	863.82	195.79	3033	2	NONLINEAR ENVELOPE	0.0
	869.92	196.05				
45	871.42	196.11	202	2	NONLINEAR ENVELOPE	0.0
	872.91	196.17				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS

Slices No.	Y for		Normal Force	Shear Force		
	X	Seismic Force			X	Y
1	514.80	592	306.17	0	0	514.80 313.71
2	520.84	833	302.40	0	0	520.84 313.02
3	527.76	1389	297.66	0	0	527.76 311.37
4	535.56	1705	291.95	0	0	535.56 308.77
5	543.35	2021	286.23	0	0	543.35 306.17
6	551.15	2336	280.51	0	0	551.15 303.57
7	558.95	2652	274.80	0	0	558.95 300.96
8	566.74	2968	269.08	0	0	566.74 298.36
9	574.54	3283	263.37	0	0	574.54 295.76
10	582.34	3599	257.65	0	0	582.34 293.16
11	590.13	3914	251.93	0	0	590.13 290.56
12	597.93	4230	246.22	0	0	597.93 287.95
13	602.39	646	242.60	0	0	602.39 286.46
14	602.96	1	241.85	0	0	602.96 286.27
15	609.21	7082	240.60	0	0	609.21 284.19
16	621.70	6809	238.11	0	0	621.70 280.02
17	634.19	6536	235.63	0	0	634.19 275.85
18	640.44	1	234.38	0	0	640.44 273.76
19	642.85	2442	234.05	0	0	642.85 272.96
20	646.90	1621	233.51	0	0	646.90 271.61
21	648.54	1	233.29	0	0	648.54 271.06
22	653.66	4936	232.33	0	0	653.66 269.35
23	663.91	4736	230.41	0	0	663.91 265.93
24	674.16	4536	228.49	0	0	674.16 262.51
25	684.41	4336	226.57	0	0	684.41 259.09
26	694.66	4136	224.65	0	0	694.66 255.67
27	704.65	3741	222.78	0	0	704.65 252.33
28	714.38	3561	220.96	0	0	714.38 249.09
29	724.10	3381	219.14	0	0	724.10 245.84
30	733.83	3201	217.32	0	0	733.83 242.59
31	738.70	1	216.41	0	0	738.70 240.97
32	743.72	3102	215.56	0	0	743.72 239.29
33	753.76	2885	213.87	0	0	753.76 235.94

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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34	763.80	2669	212.18	0	0	763.80	232.59
35	773.84	2452	210.50	0	0	773.84	229.24
36	783.87	2236	208.81	0	0	783.87	225.89
37	792.83	1602	207.31	0	0	792.83	222.90
38	796.77	0	206.65	0	0	796.77	221.59
39	802.87	2197	205.75	0	0	802.87	219.55
40	815.06	1836	203.98	0	0	815.06	215.48
41	827.25	1476	202.20	0	0	827.25	211.42
42	839.44	1115	200.45	0	0	839.44	207.35
43	851.63	755	198.73	0	0	851.63	203.28
44	863.82	394	197.14	0	0	863.82	199.21
45	871.42	26	196.39	0	0	871.42	196.67

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Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	1.873e+005	-3.029
Reduced value - Delta was too large			-0.500
2	2.50000	1.508e+005	-1.756
Reduced value - Delta was too large			-0.500
3	2.00000	9.843e+004	-0.770
Reduced value - Delta was too large			-0.500
4	1.50000	1.611e+004	-0.076
5	1.42413	-7.477e+002	0.003
6	1.42734	-1.473e+000	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section C-C' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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Stability\Section C-C'\MSB Section C-C' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 1.40924e-010

Summation of Vertical Forces: 1.05832e-010

Mohr Coulomb Shear Force/Shear Strength Check Summation: 1.49205e+000

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section C-C' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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Stability\Section C-C'\MSB Section C-C' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *
* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 1.427 Side Force Inclination: -0.00

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	514.80	298.63	433.5	433.5	282.7
2	520.84	291.79	631.3	631.3	379.7
3	527.76	283.95	830.2	830.2	477.3
4	535.56	275.12	1030.4	1030.4	575.5
5	543.35	266.29	1230.6	1230.6	673.8
6	551.15	257.46	1430.8	1430.8	772.0
7	558.95	248.63	1631.0	1631.0	870.2
8	566.74	239.80	1831.2	1831.2	968.4
9	574.54	230.97	2031.4	2031.4	1066.6
10	582.34	222.14	2231.5	2231.5	1164.8
11	590.13	213.31	2431.7	2431.7	1263.0
12	597.93	204.48	2631.9	2631.9	1361.2
13	602.39	199.42	3187.1	3187.1	1059.4
14	602.96	198.78	4354.1	4354.1	1393.7
15	609.21	198.37	4271.3	4271.3	1376.2
16	621.70	197.56	4106.1	4106.1	1333.2
17	634.19	196.75	3941.3	3941.3	1284.1
18	640.44	196.35	4024.5	4024.5	1308.9
19	642.85	196.50	3975.7	3975.7	1294.3
20	646.90	196.76	3893.8	3893.7	1269.9
21	648.54	196.87	3860.6	3860.5	1260.0
22	653.66	196.66	3655.5	3655.4	1198.9
23	663.91	196.24	3507.3	3507.2	1154.7
24	674.16	195.82	3359.1	3359.0	1110.6
25	684.41	195.40	3210.8	3210.8	1066.5
26	694.66	194.98	3062.6	3062.6	1022.3
27	704.65	194.57	2918.2	2918.2	979.3
28	714.38	194.17	2777.5	2777.5	937.4
29	724.10	193.77	2636.8	2636.8	895.5
30	733.83	193.37	2496.1	2496.1	853.6
31	738.70	193.17	2425.8	2425.8	832.6
32	743.72	193.15	2374.4	2374.4	817.3
33	753.76	193.12	2208.6	2208.6	767.9

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section C-C' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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34	763.80	193.09	2042.8	2042.8	718.5
35	773.84	193.06	1877.0	1877.0	669.1
36	783.87	193.03	1711.2	1711.2	619.7
37	792.83	193.00	1563.3	1563.3	575.7
38	796.77	192.99	1523.5	1523.5	563.8
39	802.87	193.25	1408.3	1408.3	529.5
40	815.06	193.75	1178.0	1178.0	460.9
41	827.25	194.26	947.6	947.6	392.3
42	839.44	194.77	717.3	717.3	323.6
43	851.63	195.28	485.5	485.5	220.9
44	863.82	195.79	253.6	253.6	115.4
45	871.42	196.11	68.8	68.8	31.3

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section C-C' Seismic - Non-Circular - Peak_output (wilson).docx

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Stability\Section C-C'\MSB Section C-C' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 60

* Final Results for Side Forces Between Slices *

* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Resultant					
Slice No.	X-Right	Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	517.82	1850	-0.00	1850	-0
2	523.86	4709	-0.00	4709	-0
3	531.66	9708	-0.00	9708	-0
4	539.46	16025	-0.00	16025	-0
5	547.25	23660	-0.00	23660	-0
6	555.05	32613	-0.00	32613	-0
7	562.85	42883	-0.00	42883	-0
8	570.64	54471	-0.00	54471	-0
9	578.44	67377	-0.00	67377	-0
10	586.23	81601	-0.00	81601	-0
11	594.03	97142	-0.00	97142	-0
12	601.83	114002	-0.00	114002	-0
13	602.96	117539	-0.00	117539	-0
14	602.96	117538	-0.00	117538	-0
15	615.45	110887	-0.00	110887	-0
16	627.95	104367	-0.00	104367	-0
17	640.44	98054	-0.00	98054	-0
18	640.44	98052	-0.00	98052	-0
19	645.27	93017	-0.00	93017	-0
20	648.54	89667	-0.00	89667	-0
21	648.54	89665	-0.00	89665	-0
22	658.79	83851	-0.00	83851	-0
23	669.04	78227	-0.00	78227	-0
24	679.29	72793	-0.00	72793	-0
25	689.54	67550	-0.00	67550	-0
26	699.79	62497	-0.00	62497	-0
27	709.51	57877	-0.00	57877	-0
28	719.24	53428	-0.00	53428	-0
29	728.97	49151	-0.00	49151	-0
30	738.70	45045	-0.00	45045	-0
31	738.70	45044	-0.00	45044	-0
32	748.74	40015	-0.00	40015	-0
33	758.78	35260	-0.00	35260	-0
34	768.82	30780	-0.00	30780	-0
35	778.86	26573	-0.00	26573	-0
36	788.89	22641	-0.00	22641	-0

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section C-C' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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37	796.77	19748	-0.00	19748	-0
38	796.77	19747	-0.00	19747	-0
39	808.96	14771	-0.00	14771	-0
40	821.15	10388	-0.00	10388	-0
41	833.35	6598	-0.00	6598	-0
42	845.54	3402	-0.00	3402	-0
43	857.73	1216	-0.00	1216	-0
44	869.92	75	-0.00	75	-0
45	872.91	-1	-0.00	-1	0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: D-D' Case: CH2M Analysis

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates Shifting Points

x	y	
467	332.87	5
582.57	199.08	
609.56	200.08	fixed
658.23	199.94	fixed
730.21	197.07	fixed
806.28	198.05	fixed
863	199.68	fixed
866	198.68	fixed

Adjustments

Corp method used to
force Line of Thrust
beneath surface

Crack Depth

15

Seismic Acceleration

0.13

Minimum Weight

5000

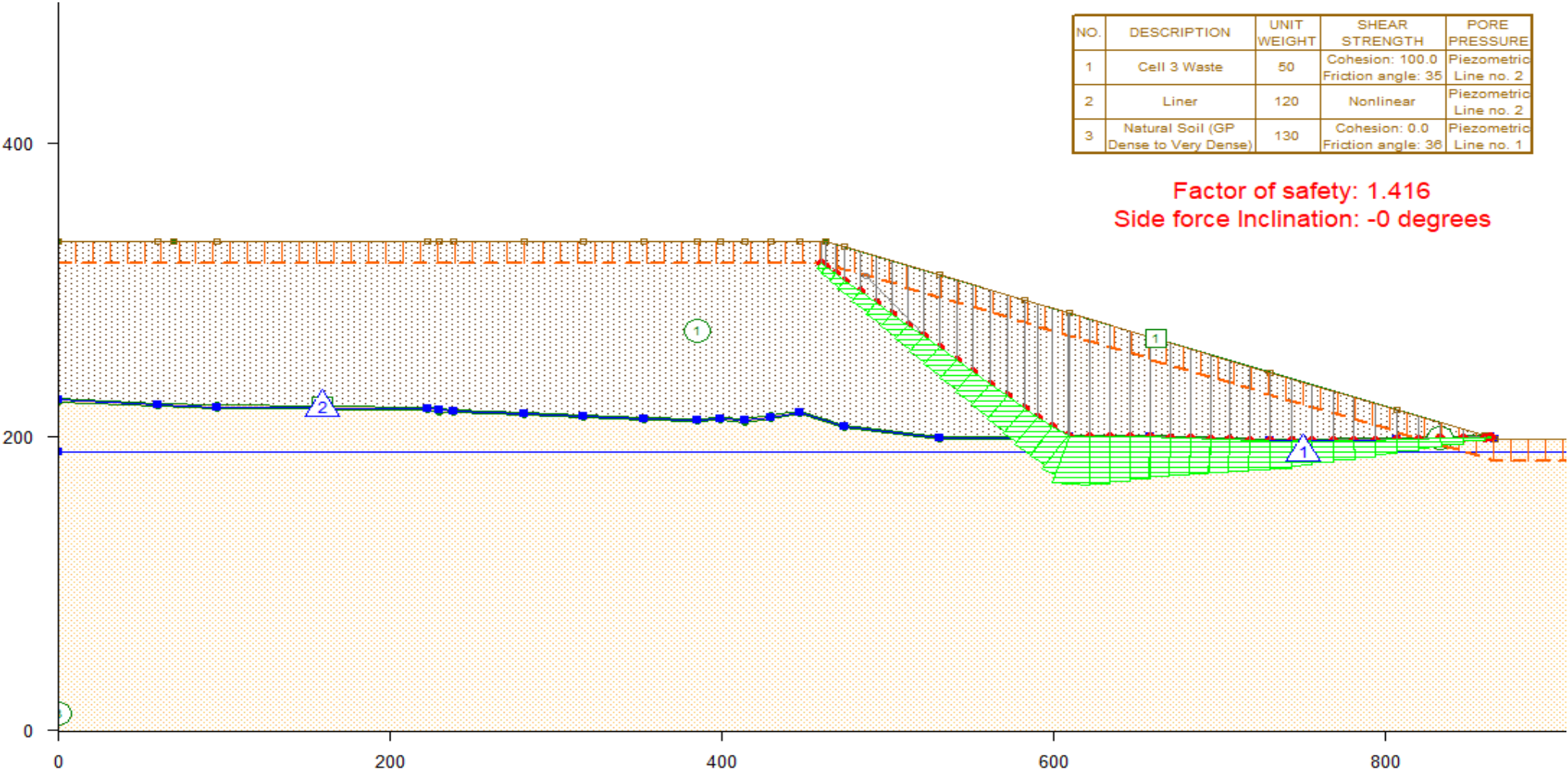
Results

Noncircular Shear Surface

491.58	308.32
583.06	199.95
609.56	200.08
658.23	199.94
730.21	197.07
806.28	198.05
863	199.68

Factor of Safety

1.416



Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section D-D' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 1 of 5

English units

Heading follows -MSB

CELL 3

Profile line data follow -

1 1 Cell 5 Surface

0 332.8662

70.2135 332.8662

462.9171 332.8662

859.9918497 200.6787

2 2 Liner

0 225.941

60.295 222.8622

96.3755 221.4547

222.67 219.9925

229.574 218.9521

238.2127 218.2238

281.1197 216.7649

317.0974 215.141

353.4706 213.1896

385.299 212.1641

399.5351 213.1354

414.0331 211.9903

429.8377 214.4455

446.6344 217.3867

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section D-D' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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474.0832 208.2405

531.0248 200.0882

582.5672 200.0792

609.5593 201.0805

658.2285 200.9409

730.2071 198.071

806.2818 199.0468

859.9918497 200.6787

862.9957248 199.6787

865.9996 198.6787

3 3 Native Surface

0 223.941

60.295 220.8622

96.3755 219.4547

222.67 217.9925

229.574 216.9521

238.2127 216.2238

281.1197 214.7649

317.0974 213.141

353.4706 211.1896

385.299 210.1641

399.5351 211.1354

414.0331 209.9903

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section D-D' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

Page 3 of 5

429.8377 212.4455

446.6344 215.3867

474.0832 206.2405

531.0248 198.0882

582.5672 198.0792

609.5593 199.0805

658.2285 198.9409

730.2071 196.071

806.2818 197.0468

865.9996 198.6787

1500 199.105

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0.0

0.0

700 454.6

4200 1942.8

5000 2183.7

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section D-D' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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	0.0	36.0
Piezometric Line		
1		
PIEzometric line data follow -		
1	62.40	Piezometric line 1
	0.000000	190.000000
	1500.000000	190.000000
2	62.40	Piezometric line 2
0	224.941	
60.295	221.8622	
96.3755	220.4547	
222.67	218.9925	
229.574	217.9521	
238.2127	217.2238	
281.1197	215.7649	
317.0974	214.141	
353.4706	212.1896	
385.299	211.1641	
399.5351	212.1354	
414.0331	210.9903	
429.8377	213.4455	
446.6344	216.3867	
474.0832	207.2405	
531.0248	199.0882	
582.5672	199.0792	
609.5593	200.0805	

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic - Non-Circular Failure - Liner Strength

Filename: 20221125 Section D-D' Seismic-Non-Circular-Peak_input (wilson)

UTEXAS4 Input File

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658.2285 199.9409

730.2071 197.071

806.2818 198.0468

862.9957248 199.6787

865.9996 198.6787

ANALYSIS/computation data follow

Noncircular Search 2

467 332.8662

582.5672 199.0792

609.5593 200.0805 Fixed

658.2285 199.9409 Fixed

730.2071 197.071 Fixed

806.2818 198.0468 Fixed

862.9957248 199.6787 Fixed

865.9996 198.6787 Fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

15 d

Procedure

Corps of Engineers

0

Seismic

0.13

GRAPHICS output file

COMPUTE

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

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Stability\Section D-D'\MSB Section D-D' - Non Circular - Seismic -
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TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to
weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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Stability\Section D-D'\MSB Section D-D' - Non Circular - Seismic -
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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

Profile Line No. 1 - Material Type (Number): 1 -----

-----Description:

Cell 5 Surface

Point	X	Y
1	0.00	332.87
2	70.21	332.87
3	462.92	332.87
4	859.99	200.68

Profile Line No. 2 - Material Type (Number): 2 -----

-----Description:

Liner

Point	X	Y
1	0.00	225.94
2	60.30	222.86
3	96.38	221.45
4	222.67	219.99
5	229.57	218.95
6	238.21	218.22
7	281.12	216.76
8	317.10	215.14
9	353.47	213.19
10	385.30	212.16
11	399.54	213.14
12	414.03	211.99
13	429.84	214.45
14	446.63	217.39
15	474.08	208.24
16	531.02	200.09
17	582.57	200.08
18	609.56	201.08
19	658.23	200.94
20	730.21	198.07
21	806.28	199.05
22	859.99	200.68
23	863.00	199.68
24	866.00	198.68

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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Profile Line No. 3 - Material Type (Number): 3 -----
-----Description:

Native Surface

Point	X	Y
1	0.00	223.94
2	60.30	220.86
3	96.38	219.45
4	222.67	217.99
5	229.57	216.95
6	238.21	216.22
7	281.12	214.76
8	317.10	213.14
9	353.47	211.19
10	385.30	210.16
11	399.54	211.14
12	414.03	209.99
13	429.84	212.45
14	446.63	215.39
15	474.08	206.24
16	531.02	198.09
17	582.57	198.08
18	609.56	199.08
19	658.23	198.94
20	730.21	196.07
21	806.28	197.05
22	866.00	198.68
23	1500.00	199.10

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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Stability\Section D-D'\MSB Section D-D' - Non Circular - Seismic -
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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

DATA FOR MATERIAL NUMBER 1 -----

-----Description:

Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 2 -----

-----Description:

Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	700.0	454.6
3	4200.0	1942.8
4	5000.0	2183.7

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

DATA FOR MATERIAL NUMBER 3 -----

-----Description:

Natural Soil (GP Dense to Very Dense)

Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section D-D' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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Stability\Section D-D'\MSB Section D-D' - Non Circular - Seismic -
Corps.input-utexas

MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

Piezometric Line Number 1 -----

-Description:

Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

Piezometric Line Number 2 -----

-Description:

Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	224.94
2	60.30	221.86
3	96.38	220.45
4	222.67	218.99
5	229.57	217.95
6	238.21	217.22
7	281.12	215.76
8	317.10	214.14
9	353.47	212.19
10	385.30	211.16
11	399.54	212.14
12	414.03	210.99
13	429.84	213.45
14	446.63	216.39
15	474.08	207.24
16	531.02	199.09
17	582.57	199.08
18	609.56	200.08
19	658.23	199.94
20	730.21	197.07
21	806.28	198.05
22	863.00	199.68
23	866.00	198.68

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	467.00	332.87	angle to be computed - moveable
2	582.57	199.08	angle to be computed - moveable
3	609.56	200.08	- fixed
4	658.23	199.94	- fixed
5	730.21	197.07	- fixed
6	806.28	198.05	- fixed
7	863.00	199.68	- fixed
8	866.00	198.68	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 15.000

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 0.00

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

-----The

following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	332.87
2	60.30	332.87
3	70.21	332.87
4	96.38	332.87
5	222.67	332.87
6	229.57	332.87
7	238.21	332.87
8	281.12	332.87
9	317.10	332.87
10	353.47	332.87
11	385.30	332.87
12	399.54	332.87
13	414.03	332.87
14	429.84	332.87
15	446.63	332.87
16	462.92	332.87
17	474.08	329.15
18	531.02	310.19
19	582.57	293.03
20	609.56	284.05
21	658.23	267.85
22	730.21	243.88
23	806.28	218.56
24	859.99	200.68
25	863.00	199.68
26	866.00	198.68
27	1500.00	199.10

Left end point on noncircular shear surface adjusted to:

X: 486.84, Y: 309.90

Adjustment was made to put end point at bottom of crack.

Right end point on noncircular shear surface adjusted to:

X: 863.00, Y: 199.68

Adjustment was made to put end point on the slope.

Right end point deleted after adjustment because it was same as adjacent point.

Noncircular Shear Surface Points After End Point Adjustment

Coordinates of points on shear surface which are to be shifted

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 459.79 Y: 317.87

X: 590.35 Y: 213.29

X: 609.56 Y: 200.08

X: 658.23 Y: 199.94

X: 730.21 Y: 197.07

X: 806.28 Y: 198.05

X: 863.00 Y: 199.68

Minimum factor of safety: 1.416

Side force inclination: -0.00

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 4

Total number of shear surfaces attempted: 20

Total number of shear surfaces for which the factor of safety
was successfully calculated: 20

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	1.4360	5	5
2	10.0000	1	10.000	1.4214	10	10
3	10.0000	2	3.990	1.4158	15	15
4	5.0000	1	5.000	1.4157	20	20

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 43

* Coordinate, Weight, Strength and Pore Water Pressure *
* Information for Individual Slices for Conventional *
* Computations or First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
	459.79	317.87					
1	461.35	316.61	2539	1	100.0	35.00	0.0
	462.92	315.36					
2	465.71	313.13	5251	1	100.0	35.00	0.0
	468.50	310.89					
3	471.29	308.66	5980	1	100.0	35.00	0.0
	474.08	306.42					
4	478.83	302.62	11840	1	100.0	35.00	0.0
	483.57	298.82					
5	488.32	295.02	13947	1	100.0	35.00	0.0
	493.06	291.22					
6	497.81	287.42	16055	1	100.0	35.00	0.0
	502.55	283.61					
7	507.30	279.81	18163	1	100.0	35.00	0.0
	512.04	276.01					
8	516.79	272.21	20271	1	100.0	35.00	0.0
	521.53	268.41					
9	526.28	264.61	22379	1	100.0	35.00	0.0
	531.02	260.81					
10	536.18	256.68	26697	1	100.0	35.00	0.0
	541.33	252.55					
11	546.49	248.42	29184	1	100.0	35.00	0.0
	551.64	244.30					
12	556.80	240.17	31671	1	100.0	35.00	0.0
	561.95	236.04					
13	567.10	231.91	34158	1	100.0	35.00	0.0
	572.26	227.78					
14	577.41	223.65	36645	1	100.0	35.00	0.0
	582.57	219.52					
15	586.46	216.41	29330	1	100.0	35.00	0.0
	590.35	213.29					
16	594.81	210.22	35087	1	100.0	35.00	0.0
	599.27	207.16					
17	603.72	204.09	36496	1	100.0	35.00	0.0

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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	608.18	201.03				
18	608.87	200.55	5824	2	NONLINEAR ENVELOPE	0.0
	609.56	200.08				
19	615.64	200.06	50713	2	NONLINEAR ENVELOPE	0.0
	621.73	200.05				
20	627.81	200.03	48270	2	NONLINEAR ENVELOPE	0.0
	633.89	200.01				
21	639.98	199.99	45827	2	NONLINEAR ENVELOPE	0.0
	646.06	199.98				
22	652.14	199.96	43385	2	NONLINEAR ENVELOPE	0.0
	658.23	199.94				
23	664.23	199.70	40517	2	NONLINEAR ENVELOPE	0.0
	670.22	199.46				
24	676.22	199.22	38408	2	NONLINEAR ENVELOPE	0.0
	682.22	198.98				
25	688.22	198.75	36299	2	NONLINEAR ENVELOPE	0.0
	694.22	198.51				
26	700.22	198.27	34191	2	NONLINEAR ENVELOPE	0.0
	706.21	198.03				
27	712.21	197.79	32082	2	NONLINEAR ENVELOPE	0.0
	718.21	197.55				
28	724.21	197.31	29974	2	NONLINEAR ENVELOPE	0.0
	730.21	197.07				
29	736.55	197.15	29176	2	NONLINEAR ENVELOPE	0.0
	742.89	197.23				
30	749.23	197.31	26397	2	NONLINEAR ENVELOPE	0.0
	755.57	197.40				
31	761.90	197.48	23618	2	NONLINEAR ENVELOPE	0.0
	768.24	197.56				
32	774.58	197.64	20839	2	NONLINEAR ENVELOPE	0.0
	780.92	197.72				
33	787.26	197.80	18060	2	NONLINEAR ENVELOPE	0.0
	793.60	197.88				
34	799.94	197.97	15281	2	NONLINEAR ENVELOPE	0.0
	806.28	198.05				
35	813.00	198.24	13091	2	NONLINEAR ENVELOPE	0.0
	819.71	198.43				
36	826.42	198.63	9851	2	NONLINEAR ENVELOPE	0.0
	833.14	198.82				
37	839.85	199.01	6611	2	NONLINEAR ENVELOPE	0.0
	846.56	199.21				
38	853.28	199.40	3371	2	NONLINEAR ENVELOPE	0.0
	859.99	199.59				
39	861.49	199.64	196	2	NONLINEAR ENVELOPE	0.0
	863.00	199.68				

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 44

* Seismic Forces and Forces Due to Distributed Loads for *
* Individual Slices for Conventional Computations or the *
* First Stage of Multi-Stage Computations. *
* (Information is for the critical shear surface in the *
* case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS

Slices No.	Y for		Normal Force	Shear Force		
	X	Seismic Force			X	Y
1	461.35	330	324.74	0	0	461.35 332.87
2	465.71	683	322.53	0	0	465.71 331.94
3	471.29	777	319.37	0	0	471.29 330.08
4	478.83	1539	315.09	0	0	478.83 327.57
5	488.32	1813	309.71	0	0	488.32 324.41
6	497.81	2087	304.33	0	0	497.81 321.25
7	507.30	2361	298.95	0	0	507.30 318.09
8	516.79	2635	293.57	0	0	516.79 314.93
9	526.28	2909	288.19	0	0	526.28 311.77
10	536.18	3471	282.58	0	0	536.18 308.48
11	546.49	3794	276.73	0	0	546.49 305.05
12	556.80	4117	270.89	0	0	556.80 301.61
13	567.10	4441	265.05	0	0	567.10 298.18
14	577.41	4764	259.20	0	0	577.41 294.75
15	586.46	3813	254.07	0	0	586.46 291.74
16	594.81	4561	249.59	0	0	594.81 288.96
17	603.72	4745	245.04	0	0	603.72 285.99
18	608.87	757	242.07	0	0	608.87 284.28
19	615.64	6593	240.36	0	0	615.64 282.02
20	627.81	6275	238.32	0	0	627.81 277.97
21	639.98	5958	236.28	0	0	639.98 273.92
22	652.14	5640	234.24	0	0	652.14 269.87
23	664.23	5267	232.10	0	0	664.23 265.85
24	676.22	4993	229.87	0	0	676.22 261.86
25	688.22	4719	227.63	0	0	688.22 257.86
26	700.22	4445	225.40	0	0	700.22 253.87
27	712.21	4171	223.16	0	0	712.21 249.87
28	724.21	3897	220.93	0	0	724.21 245.88
29	736.55	3793	218.80	0	0	736.55 241.77
30	749.23	3432	216.77	0	0	749.23 237.55
31	761.90	3070	214.75	0	0	761.90 233.33
32	774.58	2709	212.73	0	0	774.58 229.11

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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33	787.26	2348	210.71	0	0	787.26	224.89
34	799.94	1987	208.69	0	0	799.94	220.67
35	813.00	1702	206.66	0	0	813.00	216.32
36	826.42	1281	204.64	0	0	826.42	211.85
37	839.85	859	202.65	0	0	839.85	207.38
38	853.28	438	200.79	0	0	853.28	202.91
39	861.49	25	199.91	0	0	861.49	200.18

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	2.063e+005	-3.090
Reduced value - Delta was too large			-0.500
2	2.50000	1.669e+005	-1.793
Reduced value - Delta was too large			-0.500
3	2.00000	1.101e+005	-0.792
Reduced value - Delta was too large			-0.500
4	1.50000	2.049e+004	-0.089
5	1.41134	-1.118e+003	0.004
6	1.41569	-2.992e+000	0.000
7	1.41571	-2.155e-005	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 1.19996e-010

Summation of Vertical Forces: 8.59757e-011

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.24854e-005

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *
* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 1.416 Side Force Inclination: -0.00

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	461.35	316.61	541.5	541.5	338.5
2	465.71	313.13	633.1	633.1	383.8
3	471.29	308.66	726.7	726.7	430.1
4	478.83	302.62	853.0	853.0	492.5
5	488.32	295.02	1012.1	1012.1	571.2
6	497.81	287.42	1171.2	1171.2	649.9
7	507.30	279.81	1330.3	1330.3	728.6
8	516.79	272.21	1489.4	1489.4	807.3
9	526.28	264.61	1648.5	1648.5	886.0
10	536.18	256.68	1814.4	1814.4	968.0
11	546.49	248.42	1987.2	1987.2	1053.5
12	556.80	240.17	2160.0	2160.0	1139.0
13	567.10	231.91	2332.8	2332.8	1224.4
14	577.41	223.65	2505.6	2505.6	1309.9
15	586.46	216.41	2657.3	2657.3	1384.9
16	594.81	210.22	2901.3	2901.3	1505.6
17	603.72	204.09	3019.3	3019.3	1564.0
18	608.87	200.55	3435.4	3435.4	1142.7
19	615.64	200.06	4164.1	4164.1	1361.5
20	627.81	200.03	3963.5	3963.5	1301.3
21	639.98	199.99	3762.9	3762.9	1241.0
22	652.14	199.96	3562.3	3562.3	1180.8
23	664.23	199.70	3333.1	3333.1	1111.9
24	676.22	199.22	3159.4	3159.4	1059.8
25	688.22	198.75	2985.7	2985.7	1007.6
26	700.22	198.27	2812.0	2812.0	955.4
27	712.21	197.79	2638.3	2638.3	903.3
28	724.21	197.31	2464.6	2464.6	851.1
29	736.55	197.15	2311.4	2311.4	805.1
30	749.23	197.31	2091.4	2091.4	739.0
31	761.90	197.48	1871.4	1871.4	672.9
32	774.58	197.64	1651.3	1651.3	606.8

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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33	787.26	197.80	1431.3	1431.3	540.8
34	799.94	197.97	1211.3	1211.3	474.7
35	813.00	198.24	986.7	986.7	407.2
36	826.42	198.63	743.3	743.3	334.1
37	839.85	199.01	498.9	498.9	228.9
38	853.28	199.40	254.4	254.4	116.7
39	861.49	199.64	66.1	66.1	30.3

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 60

* Final Results for Side Forces Between Slices *

* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

		Resultant			
Slice		Side	Side Force	Horizontal	Vertical
No.	X-Right	Force	Inclination	Side Force	Side Force
1	462.92	628	-0.00	628	-0
2	468.50	1999	-0.00	1999	-0
3	474.08	3625	-0.00	3625	-0
4	483.57	6974	-0.00	6974	-0
5	493.06	11060	-0.00	11060	-0
6	502.55	15882	-0.00	15882	-0
7	512.04	21441	-0.00	21441	-0
8	521.53	27737	-0.00	27737	-0
9	531.02	34769	-0.00	34769	-0
10	541.33	43242	-0.00	43242	-0
11	551.64	52584	-0.00	52584	-0
12	561.95	62795	-0.00	62795	-0
13	572.26	73875	-0.00	73875	-0
14	582.57	85825	-0.00	85825	-0
15	590.35	95428	-0.00	95428	-0
16	599.27	104352	-0.00	104352	-0
17	608.18	113664	-0.00	113664	-0
18	609.56	116104	-0.00	116104	-0
19	621.73	106276	-0.00	106276	-0
20	633.89	96856	-0.00	96856	-0
21	646.06	87845	-0.00	87845	-0
22	658.23	79242	-0.00	79242	-0
23	670.22	72764	-0.00	72764	-0
24	682.22	66555	-0.00	66555	-0
25	694.22	60614	-0.00	60614	-0
26	706.21	54942	-0.00	54942	-0
27	718.21	49539	-0.00	49539	-0
28	730.21	44404	-0.00	44404	-0
29	742.89	37613	-0.00	37613	-0
30	755.57	31335	-0.00	31335	-0
31	768.24	25569	-0.00	25569	-0
32	780.92	20315	-0.00	20315	-0
33	793.60	15574	-0.00	15574	-0
34	806.28	11345	-0.00	11345	-0
35	819.71	7198	-0.00	7198	-0

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

Filename: 20221128 Section D-D' Seismic - Non-Circular - Peak_output (wilson).docx

UTEXAS4 Output File

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36	833.14	3705	-0.00	3705	-0
37	846.56	1298	-0.00	1298	-0
38	859.99	71	-0.00	71	-0
39	863.00	-0	-0.00	-0	0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: A-A' Case: CH2M Analysis

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates Shifting Points

x	y	10	5	Adjustments
10	330.8			
166	231.1			
239.52	231.2	fixed		Corp method used to
282.38	230.81	fixed		force Line of Thrust
293.54	229.13	fixed		beneath surface
305.19	231.19	fixed		
381.95	232.81	fixed		
404.55	233.16	fixed		
461.68	232.9	fixed		
467.12	232.91	fixed		

Crack Depth
17
Seismic Acceleration
0.13
Minimum Weight
5000

Results

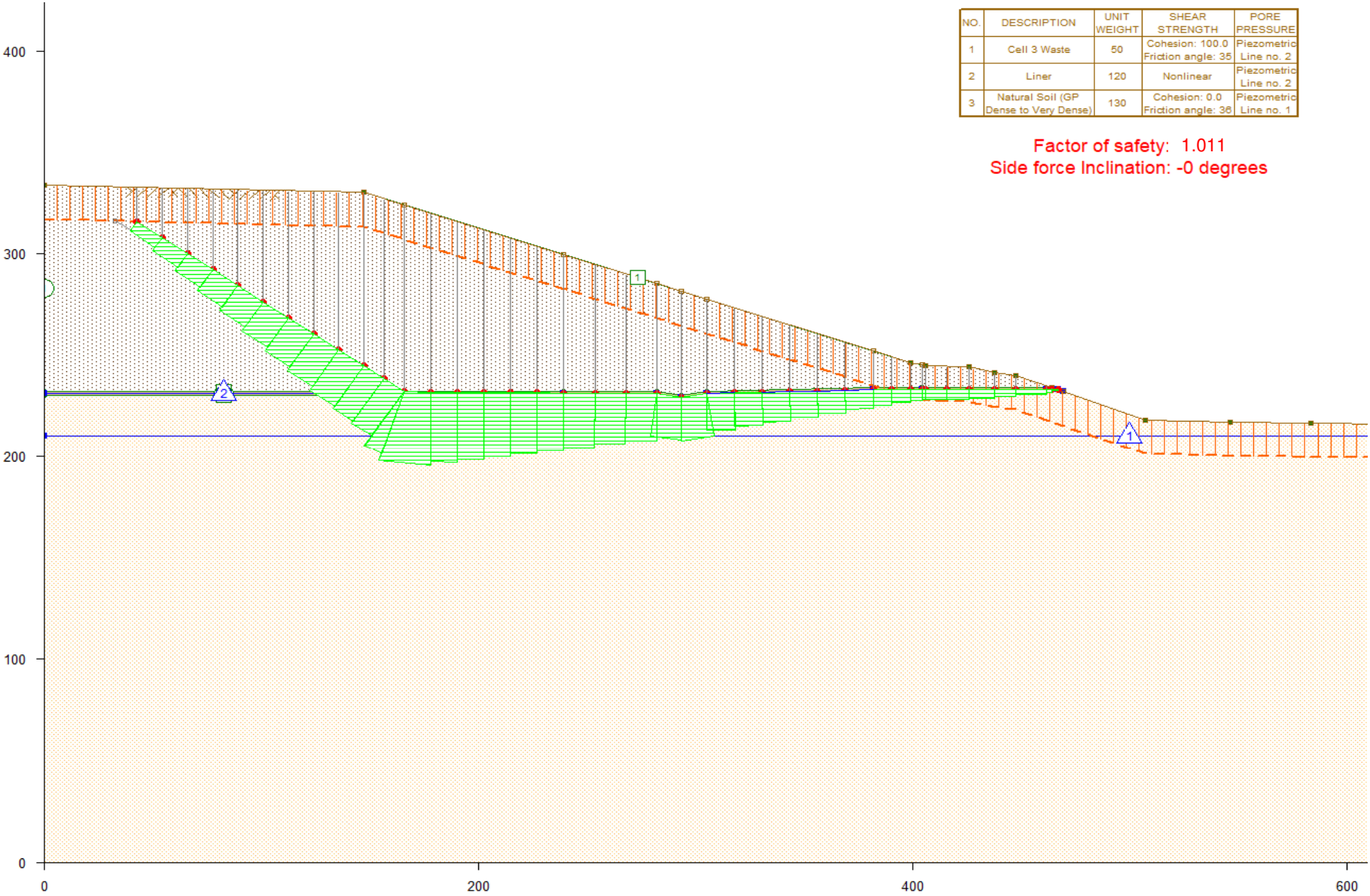
Noncircular Shear Surface

47.97	315.73
166.29	231.99
239.52	231.2
282.38	230.81
293.54	229.13
305.19	231.19
381.95	232.81
404.55	233.16
461.68	232.9
467.12	232.91

Factor of Safety
1.011

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	Cell 3 Waste	50	Cohesion: 100.0 Friction angle: 35	Piezometric Line no. 2
2	Liner	120	Nonlinear	Piezometric Line no. 2
3	Natural Soil (GP Dense to Very Dense)	130	Cohesion: 0.0 Friction angle: 36	Piezometric Line no. 1

Factor of safety: 1.011
Side force Inclination: -0 degrees



Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section A-A' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 1 of 3

English units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 3 Surface

0.000000	333.976600
147.552900	330.139000
399.183500	246.250400
406.121800	244.712800
426.040100	244.023100
437.832500	241.284800
447.582100	240.087400

464.4 233.9

2 2 Liner

0 232.1156

166.0471 232.1156

239.5212 232.1992

282.3832 231.8095

293.5372 230.1338

305.1905 232.1918

381.9526 233.8086

404.5544 234.1568

464.4 233.9

469.925200 231.892400

3 3 Native Surface

0.000000	230.115600
166.047100	230.115600
239.521200	230.199200
282.383200	229.809500
293.537200	228.133800
305.190500	230.191800
381.952600	231.808600
404.554400	232.156800
469.925200	231.892400
507.465300	218.060500
546.288900	216.988100
583.471700	216.402500
657.991300	215.510800
741.835000	212.295700
814.990400	214.257600
864.122100	231.583000
886.536400	237.805100
945.522300	256.707600
969.897400	262.128400
978.535600	263.868000

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section A-A' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 2 of 3

999.028400 264.021200

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0 35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0 0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0 36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000 210.000000

1000.000000 210.000000

2 62.40 Piezometric line 2

0 231.1156

166.0471 231.1156

239.5212 231.1992

282.3832 230.8095

293.5372 229.1338

305.1905 231.1918

381.9526 232.8086

404.5544 233.1568

461.6819 232.9

467.1180884 232.9123734

469.925200 231.892400

ANALysis/computation data follow

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section A-A' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 3 of 3

Noncircular Search 2

10 330.8

166 231.1

239.5212 231.1992 fixed

282.3832 230.8095 fixed

293.5372 229.1338 fixed

305.1905 231.1918 fixed

381.9526 232.8086 fixed

404.5544 233.1568 fixed

461.6819 232.9 fixed

467.1180884 232.9123734 fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

17 d

Procedure

Corps of Engineers

0

SEismic

0.13

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section A-A'\MSB Section A-A' - Non Circular - Seismic.input-utexas

TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

----- Profile Line No. 1 - Material Type (Number): 1 -----

Description: Cell 3 Surface

Point	X	Y
1	0.00	333.98
2	147.55	330.14
3	399.18	246.25
4	406.12	244.71
5	426.04	244.02
6	437.83	241.28
7	447.58	240.09
8	464.40	233.90

----- Profile Line No. 2 - Material Type (Number): 2 -----

Description: Liner

Point	X	Y
1	0.00	232.12
2	166.05	232.12
3	239.52	232.20
4	282.38	231.81
5	293.54	230.13
6	305.19	232.19
7	381.95	233.81
8	404.55	234.16
9	464.40	233.90
10	469.93	231.89

----- Profile Line No. 3 - Material Type (Number): 3 -----

Description: Native Surface

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Point	X	Y
1	0.00	230.12
2	166.05	230.12
3	239.52	230.20
4	282.38	229.81
5	293.54	228.13
6	305.19	230.19
7	381.95	231.81
8	404.55	232.16
9	469.93	231.89
10	507.47	218.06
11	546.29	216.99
12	583.47	216.40
13	657.99	215.51
14	741.84	212.30
15	814.99	214.26
16	864.12	231.58
17	886.54	237.81
18	945.52	256.71
19	969.90	262.13
20	978.54	263.87
21	999.03	264.02

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- DATA FOR MATERIAL NUMBER 1 -----

Description: Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 2 -----

Description: Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 3 -----

Description: Natural Soil (GP Dense to Very Dense)

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- Piezometric Line Number 1 -----

Description: Piezometric line 1
Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	210.00
2	1000.00	210.00

----- Piezometric Line Number 2 -----

Description: Piezometric line 2
Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	231.12
2	166.05	231.12
3	239.52	231.20
4	282.38	230.81
5	293.54	229.13
6	305.19	231.19
7	381.95	232.81
8	404.55	233.16
9	461.68	232.90
10	467.12	232.91
11	469.93	231.89

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	10.00	330.80	angle to be computed - moveable
2	166.00	231.10	angle to be computed - moveable
3	239.52	231.20	- fixed
4	282.38	230.81	- fixed
5	293.54	229.13	- fixed
6	305.19	231.19	- fixed
7	381.95	232.81	- fixed
8	404.55	233.16	- fixed
9	461.68	232.90	- fixed
10	467.12	232.91	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 17.000

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 0.00

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

The following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	333.98
2	147.55	330.14
3	166.05	323.97
4	239.52	299.48
5	282.38	285.19
6	293.54	281.47
7	305.19	277.59
8	381.95	251.99
9	399.18	246.25
10	404.55	245.06
11	406.12	244.71
12	426.04	244.02
13	437.83	241.28
14	447.58	240.09
15	464.40	233.90
16	469.93	231.89
17	507.47	218.06
18	546.29	216.99
19	583.47	216.40
20	657.99	215.51
21	741.84	212.30
22	814.99	214.26
23	864.12	231.58
24	886.54	237.81
25	945.52	256.71
26	969.90	262.13
27	978.54	263.87
28	999.03	264.02

Left end point on noncircular shear surface adjusted to:

X: 32.97, Y: 316.12

Adjustment was made to put end point at bottom of crack.

Noncircular Shear Surface Points After End Point Adjustment

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	32.97	316.12	angle to be computed - moveable
2	166.00	231.10	angle to be computed - moveable
3	239.52	231.20	- fixed
4	282.38	230.81	- fixed
5	293.54	229.13	- fixed
6	305.19	231.19	- fixed
7	381.95	232.81	- fixed
8	404.55	233.16	- fixed
9	461.68	232.90	- fixed
10	467.12	232.91	- fixed

Computed crack depth: 17.00

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section A-A'\MSB Section A-A' - Non Circular - Seismic.input-utexas

MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X:	47.97	Y:	315.73
X:	166.29	Y:	231.99
X:	239.52	Y:	231.20
X:	282.38	Y:	230.81
X:	293.54	Y:	229.13
X:	305.19	Y:	231.19
X:	381.95	Y:	232.81
X:	404.55	Y:	233.16
X:	461.68	Y:	232.90
X:	467.12	Y:	232.91

Minimum factor of safety: 1.011

Side force inclination: -0.00

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 5

Total number of shear surfaces attempted: 25

Total number of shear surfaces for which the factor of safety
was successfully calculated: 25

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	1.0553	5	5
2	5.0000	1	5.000	1.0409	10	10
3	5.0000	1	5.000	1.0261	15	15
4	5.0000	1	5.000	1.0112	20	20
5	5.0000	1	5.000	1.0112	25	25

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

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MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
	47.97	315.73					
1	53.50	311.81	11492	1	100.0	35.00	0.0
	59.03	307.90					
2	64.56	303.98	15665	1	100.0	35.00	0.0
	70.10	300.07					
3	75.63	296.15	19838	1	100.0	35.00	0.0
	81.16	292.24					
4	86.69	288.32	24011	1	100.0	35.00	0.0
	92.23	284.41					
5	97.76	280.49	28184	1	100.0	35.00	0.0
	103.29	276.58					
6	108.82	272.66	32357	1	100.0	35.00	0.0
	114.36	268.75					
7	119.89	264.83	36530	1	100.0	35.00	0.0
	125.42	260.92					
8	130.96	257.00	40703	1	100.0	35.00	0.0
	136.49	253.09					
9	142.02	249.17	44877	1	100.0	35.00	0.0
	147.55	245.25					
10	152.18	241.98	40047	1	100.0	35.00	0.0
	156.80	238.71					
11	161.42	235.44	41647	1	100.0	35.00	0.0
	166.05	232.17					
12	166.08	232.14	333	1	100.0	35.00	0.0
	166.12	232.12					
13	166.21	232.05	806	2	NONLINEAR ENVELOPE		0.0
	166.29	231.99					
14	172.40	231.93	55046	2	NONLINEAR ENVELOPE		0.0
	178.50	231.86					
15	184.60	231.79	52768	2	NONLINEAR ENVELOPE		0.0
	190.70	231.73					
16	196.81	231.66	50491	2	NONLINEAR ENVELOPE		0.0

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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	202.91	231.60				
17	209.01	231.53	48213	2	NONLINEAR ENVELOPE	0.0
	215.11	231.46				
18	221.21	231.40	45936	2	NONLINEAR ENVELOPE	0.0
	227.32	231.33				
19	233.42	231.27	43658	2	NONLINEAR ENVELOPE	0.0
	239.52	231.20				
20	244.88	231.15	36402	2	NONLINEAR ENVELOPE	0.0
	250.24	231.10				
21	255.59	231.05	34540	2	NONLINEAR ENVELOPE	0.0
	260.95	231.00				
22	266.31	230.96	32678	2	NONLINEAR ENVELOPE	0.0
	271.67	230.91				
23	277.03	230.86	30816	2	NONLINEAR ENVELOPE	0.0
	282.38	230.81				
24	287.96	229.97	30539	2	NONLINEAR ENVELOPE	0.0
	293.54	229.13				
25	299.36	230.16	29579	2	NONLINEAR ENVELOPE	0.0
	305.19	231.19				
26	311.59	231.33	29123	2	NONLINEAR ENVELOPE	0.0
	317.98	231.46				
27	324.38	231.60	26222	2	NONLINEAR ENVELOPE	0.0
	330.78	231.73				
28	337.17	231.87	23321	2	NONLINEAR ENVELOPE	0.0
	343.57	232.00				
29	349.97	232.13	20421	2	NONLINEAR ENVELOPE	0.0
	356.37	232.27				
30	362.76	232.40	17520	2	NONLINEAR ENVELOPE	0.0
	369.16	232.54				
31	375.56	232.67	14619	2	NONLINEAR ENVELOPE	0.0
	381.95	232.81				
32	386.26	232.87	8221	2	NONLINEAR ENVELOPE	0.0
	390.57	232.94				
33	394.88	233.01	6926	2	NONLINEAR ENVELOPE	0.0
	399.18	233.07				
34	401.87	233.12	3743	2	NONLINEAR ENVELOPE	0.0
	404.55	233.16				
35	405.34	233.15	1029	2	NONLINEAR ENVELOPE	0.0
	406.12	233.15				
36	411.10	233.13	6381	2	NONLINEAR ENVELOPE	0.0
	416.08	233.10				
37	421.06	233.08	6233	2	NONLINEAR ENVELOPE	0.0
	426.04	233.06				
38	431.94	233.03	6502	2	NONLINEAR ENVELOPE	0.0
	437.83	233.01				
39	442.71	232.99	4442	2	NONLINEAR ENVELOPE	0.0
	447.58	232.96				
40	454.63	232.93	4213	2	NONLINEAR ENVELOPE	0.0
	461.68	232.90				
41	463.04	232.90	394	2	NONLINEAR ENVELOPE	0.0
	464.40	232.91				
42	465.76	232.91	162	2	NONLINEAR ENVELOPE	0.0

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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467.12 232.91

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 44

 * Seismic Forces and Forces Due to Distributed Loads for *
 * Individual Slices for Conventional Computations or the *
 * First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS							
Slices			Y for				
No.	X	Seismic Force	Seismic Force	Normal Force	Shear Force	X	Y
1	53.50	1494	322.20	0	0	53.50	332.59
2	64.56	2036	318.14	0	0	64.56	332.30
3	75.63	2579	314.08	0	0	75.63	332.01
4	86.69	3121	310.02	0	0	86.69	331.72
5	97.76	3664	305.96	0	0	97.76	331.43
6	108.82	4206	301.90	0	0	108.82	331.15
7	119.89	4749	297.84	0	0	119.89	330.86
8	130.96	5291	293.79	0	0	130.96	330.57
9	142.02	5834	289.73	0	0	142.02	330.28
10	152.18	5206	285.29	0	0	152.18	328.60
11	161.42	5414	280.48	0	0	161.42	325.51
12	166.08	43	278.05	0	0	166.08	323.96
13	166.21	105	277.94	0	0	166.21	323.92
14	172.40	7156	276.75	0	0	172.40	321.86
15	184.60	6860	274.55	0	0	184.60	317.79
16	196.81	6564	272.35	0	0	196.81	313.72
17	209.01	6268	270.15	0	0	209.01	309.65
18	221.21	5972	267.96	0	0	221.21	305.58
19	233.42	5676	265.76	0	0	233.42	301.51
20	244.88	4732	263.75	0	0	244.88	297.69
21	255.59	4490	261.91	0	0	255.59	294.12
22	266.31	4248	260.08	0	0	266.31	290.55
23	277.03	4006	258.25	0	0	277.03	286.98
24	287.96	3970	255.98	0	0	287.96	283.33
25	299.36	3845	254.18	0	0	299.36	279.53
26	311.59	3786	252.73	0	0	311.59	275.45
27	324.38	3409	250.73	0	0	324.38	271.19
28	337.17	3032	248.74	0	0	337.17	266.92
29	349.97	2655	246.75	0	0	349.97	262.66

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

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30	362.76	2278	244.76	0	0	362.76	258.39
31	375.56	1900	242.77	0	0	375.56	254.13
32	386.26	1069	241.10	0	0	386.26	250.56
33	394.88	900	239.75	0	0	394.88	247.69
34	401.87	487	238.81	0	0	401.87	245.66
35	405.34	134	238.45	0	0	405.34	244.89
36	411.10	830	238.26	0	0	411.10	244.54
37	421.06	810	238.07	0	0	421.06	244.20
38	431.94	845	237.29	0	0	431.94	242.65
39	442.71	577	236.32	0	0	442.71	240.69
40	454.63	548	234.79	0	0	454.63	237.49
41	463.04	51	233.53	0	0	463.04	234.40
42	465.76	21	233.16	0	0	465.76	233.41

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Trial No. 1 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	2.221e+005	-5.019
Reduced value - Delta was too large			-0.500
2	2.50000	1.960e+005	-3.196
Reduced value - Delta was too large			-0.500
3	2.00000	1.587e+005	-1.748
Reduced value - Delta was too large			-0.500
4	1.50000	1.006e+005	-0.677
Reduced value - Delta was too large			-0.500
5	1.00000	-3.228e+003	0.011
6	1.01109	-2.879e+001	0.000
7	1.01119	-2.329e-003	0.000

After trial 1 the following changes were computed for the nonlinear strength envelopes:

Maximum change in shear strength: -0.000 (percent)

Maximum change occurred for slice 24

Normal stress where max. change occurred: 2660.73

Old strength at this slice: 519.53

New strength at this slice: 519.53

Strengths from nonlinear envelope have converged.

Final computations will be performed next.

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	2.221e+005	-5.019
Reduced value - Delta was too large			-0.500
2	2.50000	1.960e+005	-3.196
Reduced value - Delta was too large			-0.500
3	2.00000	1.587e+005	-1.748
Reduced value - Delta was too large			-0.500
4	1.50000	1.006e+005	-0.677
Reduced value - Delta was too large			-0.500
5	1.00000	-3.228e+003	0.011
6	1.01109	-2.879e+001	0.000
7	1.01119	-2.329e-003	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

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MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 4.89422e-011

Summation of Vertical Forces: 8.26503e-011

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.61464e-003

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *
* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 1.011 Side Force Inclination: -0.00

----- VALUES AT CENTER OF BASE OF SLICE -----					
Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	53.50	311.81	650.0	650.0	549.0
2	64.56	303.98	903.1	903.1	724.3
3	75.63	296.15	1156.3	1156.3	899.6
4	86.69	288.32	1409.4	1409.4	1074.8
5	97.76	280.49	1662.5	1662.5	1250.1
6	108.82	272.66	1915.6	1915.6	1425.3
7	119.89	264.83	2168.7	2168.7	1600.6
8	130.96	257.00	2421.8	2421.8	1775.9
9	142.02	249.17	2674.9	2674.9	1951.1
10	152.18	241.98	2859.5	2859.5	2079.0
11	161.42	235.44	2975.7	2975.7	2159.4
12	166.08	232.14	3034.2	3034.2	2199.9
13	166.21	232.05	4126.4	4126.4	665.9
14	172.40	231.93	4502.7	4502.7	704.9
15	184.60	231.79	4316.3	4316.3	685.6
16	196.81	231.66	4129.9	4129.9	666.2
17	209.01	231.53	3943.5	3943.5	646.9
18	221.21	231.40	3757.1	3757.1	627.6
19	233.42	231.27	3570.7	3570.7	608.2
20	244.88	231.15	3391.7	3391.7	589.6
21	255.59	231.05	3218.2	3218.2	571.6
22	266.31	230.96	3044.6	3044.6	553.6
23	277.03	230.86	2871.0	2871.0	535.6
24	287.96	229.97	2660.7	2660.7	513.8
25	299.36	230.16	2628.4	2628.4	510.4
26	311.59	231.33	2286.3	2286.3	474.9
27	324.38	231.60	2059.1	2059.1	451.4
28	337.17	231.87	1831.5	1831.5	407.7

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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29	349.97	232.13	1603.7	1603.7	357.0
30	362.76	232.40	1375.9	1375.9	306.3
31	375.56	232.67	1148.1	1148.1	255.6
32	386.26	232.87	957.5	957.5	213.1
33	394.88	233.01	806.7	806.7	179.6
34	401.87	233.12	699.4	699.4	155.7
35	405.34	233.15	656.0	656.0	146.0
36	411.10	233.13	640.1	640.1	142.5
37	421.06	233.08	625.3	625.3	139.2
38	431.94	233.03	550.9	550.9	122.6
39	442.71	232.99	455.1	455.1	101.3
40	454.63	232.93	298.5	298.5	66.5
41	463.04	232.90	145.1	145.1	32.3
42	465.76	232.91	59.7	59.7	13.3

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 60

 * Final Results for Side Forces Between Slices *
 * (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Slice No.	Resultant				
	X-Right	Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	59.03	509	-0.00	509	-0
2	70.10	1603	-0.00	1603	-0
3	81.16	3283	-0.00	3283	-0
4	92.23	5547	-0.00	5547	-0
5	103.29	8396	-0.00	8396	-0
6	114.36	11831	-0.00	11831	-0
7	125.42	15851	-0.00	15851	-0
8	136.49	20455	-0.00	20455	-0
9	147.55	25645	-0.00	25645	-0
10	156.80	30339	-0.00	30339	-0
11	166.05	35257	-0.00	35257	-0
12	166.12	35297	-0.00	35297	-0
13	166.29	35797	-0.00	35797	-0
14	178.50	34944	-0.00	34944	-0
15	190.70	34007	-0.00	34007	-0
16	202.91	32985	-0.00	32985	-0
17	215.11	31879	-0.00	31879	-0
18	227.32	30688	-0.00	30688	-0
19	239.52	29412	-0.00	29412	-0
20	250.24	28156	-0.00	28156	-0
21	260.95	26835	-0.00	26835	-0
22	271.67	25447	-0.00	25447	-0
23	282.38	23994	-0.00	23994	-0
24	293.54	26692	-0.00	26692	-0
25	305.19	19179	-0.00	19179	-0
26	317.98	16273	-0.00	16273	-0
27	330.78	13353	-0.00	13353	-0
28	343.57	10675	-0.00	10675	-0
29	356.37	8330	-0.00	8330	-0
30	369.16	6319	-0.00	6319	-0
31	381.95	4640	-0.00	4640	-0

Matanuska-Susinta, AK Landfill

Cross-Section: A-A'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section A-A' Seismic – Non-Circular - Residual_output (wilson).docx

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32	390.57	3746	-0.00	3746	-0
33	399.18	2992	-0.00	2992	-0
34	404.55	2584	-0.00	2584	-0
35	406.12	2494	-0.00	2494	-0
36	416.08	1933	-0.00	1933	-0
37	426.04	1385	-0.00	1385	-0
38	437.83	814	-0.00	814	-0
39	447.58	423	-0.00	423	-0
40	461.68	53	-0.00	53	-0
41	464.40	15	-0.00	15	-0
42	467.12	-0	-0.00	-0	0

Read end-of-file on input while looking for another command word.
End of input data assumed - normal termination.

Profile: B-B' Case: CH2M Analysis

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates Shifting Points

x y 10

364.09 328.58
439.66 232.29
636.96 233.73 fixed
736.26 212.92 fixed
755.92 212.78 fixed
798.74 211.28 fixed
801.73 210.28 fixed

Adjustments

Corp method used to
force Line of Thrust
beneath surface

Increased liner
strength to avoid
negative side forces

Crack Depth

10

Seismic Acceleration

0.13

Minimum Weight

5000

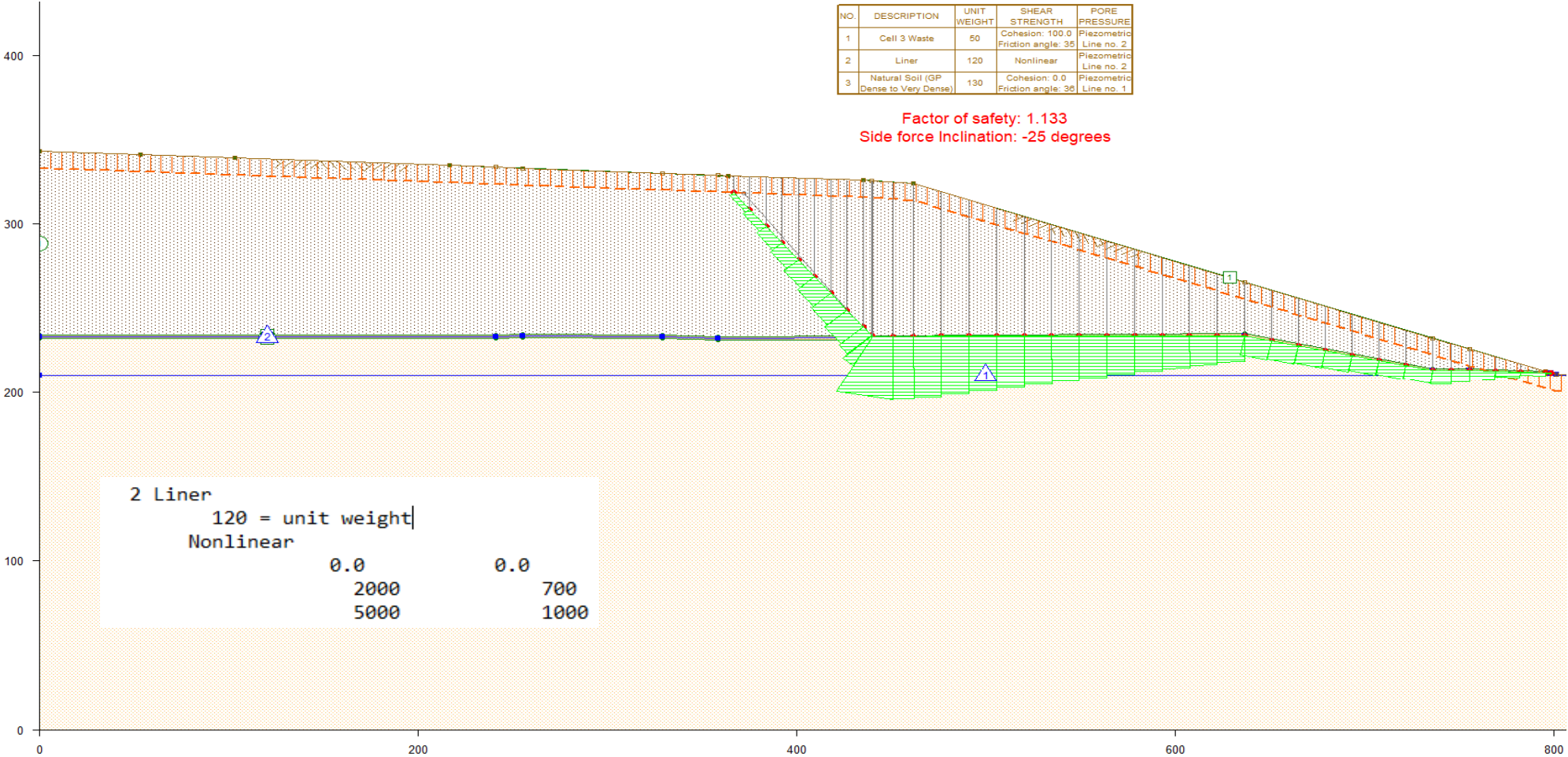
Results

Noncircular Shear Surface

366.81	318.47
440.19	233.16
636.96	233.73
736.26	212.92
755.92	212.78
798.74	211.28

Factor of Safety

1.133



Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section B-B' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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English units

HEAding follows -MSB

CELL 3

PR0file line data follow -

1 1 Cell 4 Surface

0 342.9925

53.3791 340.9508

103.5224 338.8839

216.9023 334.482

364.0891 328.5808

435.2507 325.7232

462.0904 323.8434

795.7461 212.2843

2 2 Liner

0 233.9687

241.3595 233.9687

255.373 234.532

329.1175 233.9445

358.7087 232.8241

439.6647 233.2931

636.9606 234.73

736.2644 213.9188

755.9227 213.778

795.7461 212.2843

798.737 211.2843

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section B-B' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 2 of 4

801.7278 210.2843

3 3 Native Surface

0 231.9687

241.3595 231.9687

255.373 232.532

329.1175 231.9445

358.7087 230.8241

439.6647 231.2931

636.9606 232.73

736.2644 211.9188

755.9227 211.778

801.7278 210.2843

830.3544 210.7192

842.2722 210.9911

860.5027 210.9911

866.5411 211.812

886.081 218.0902

904.7485 224.5428

924.0266 230.9082

958.7877 233.0943

975.4239 234.0329

998.3779 233.9295

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section B-B' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 3 of 4

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0.0

0

2000 700

5000 1000

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000

210.000000

1000.000000

210.000000

2 62.40 Piezometric line 2

0 232.9687

241.3595 232.9687

255.373 233.532

329.1175 232.9445

358.7087 231.8241

439.6647 232.2931

636.9606 233.73

736.2644 212.9188

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section B-B' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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755.9227 212.778

798.737 211.2843

801.7278 210.2843

ANALYSIS/computation data follow

Noncircular Search 2

364.0891 328.5808

439.6647 232.2931

636.9606 233.73 Fixed

736.2644 212.9188 Fixed

755.9227 212.778 Fixed

798.737 211.2843 Fixed

801.7278 210.2843 Fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

10 d

Procedure

Corps of Engineers

25

Seismic

0.13

GRAPHICS output file

COMPUTE

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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Name of input data file:

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TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

----- Profile Line No. 1 - Material Type (Number): 1 -----

Description: Cell 4 Surface

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	364.09	328.58
6	435.25	325.72
7	462.09	323.84
8	795.75	212.28

----- Profile Line No. 2 - Material Type (Number): 2 -----

Description: Liner

Point	X	Y
1	0.00	233.97
2	241.36	233.97
3	255.37	234.53
4	329.12	233.94
5	358.71	232.82
6	439.66	233.29
7	636.96	234.73
8	736.26	213.92
9	755.92	213.78
10	795.75	212.28
11	798.74	211.28
12	801.73	210.28

----- Profile Line No. 3 - Material Type (Number): 3 -----

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Description: Native Surface

Point	X	Y
1	0.00	231.97
2	241.36	231.97
3	255.37	232.53
4	329.12	231.94
5	358.71	230.82
6	439.66	231.29
7	636.96	232.73
8	736.26	211.92
9	755.92	211.78
10	801.73	210.28
11	830.35	210.72
12	842.27	210.99
13	860.50	210.99
14	866.54	211.81
15	886.08	218.09
16	904.75	224.54
17	924.03	230.91
18	958.79	233.09
19	975.42	234.03
20	998.38	233.93

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- DATA FOR MATERIAL NUMBER 1 -----

Description: Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 2 -----

Description: Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	700.0
3	5000.0	1000.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 3 -----

Description: Natural Soil (GP Dense to Very Dense)

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- Piezometric Line Number 1 -----

Description: Piezometric line 1
Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	210.00
2	1000.00	210.00

----- Piezometric Line Number 2 -----

Description: Piezometric line 2
Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	232.97
2	241.36	232.97
3	255.37	233.53
4	329.12	232.94
5	358.71	231.82
6	439.66	232.29
7	636.96	233.73
8	736.26	212.92
9	755.92	212.78
10	798.74	211.28
11	801.73	210.28

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	364.09	328.58	angle to be computed - moveable
2	439.66	232.29	angle to be computed - moveable
3	636.96	233.73	- fixed
4	736.26	212.92	- fixed
5	755.92	212.78	- fixed
6	798.74	211.28	- fixed
7	801.73	210.28	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 10.000

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 25.00

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

The following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Force imbalance: 1.000000e-005 (fraction of total weight)

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	342.99
2	53.38	340.95
3	103.52	338.88
4	216.90	334.48
5	241.36	333.50
6	255.37	332.94
7	329.12	329.98
8	358.71	328.80
9	364.09	328.58
10	435.25	325.72
11	439.66	325.41
12	462.09	323.84
13	636.96	265.37
14	736.26	232.17
15	755.92	225.60
16	795.75	212.28
17	798.74	211.28
18	801.73	210.28
19	830.35	210.72
20	842.27	210.99
21	860.50	210.99
22	866.54	211.81
23	886.08	218.09
24	904.75	224.54
25	924.03	230.91
26	958.79	233.09
27	975.42	234.03
28	998.38	233.93

Left end point on noncircular shear surface adjusted to:

X: 372.19, Y: 318.26

Adjustment was made to put end point at bottom of crack.

Right end point on noncircular shear surface adjusted to:

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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X: 798.74, Y: 211.28

Adjustment was made to put end point on the slope.

Right end point deleted after adjustment because it was same as adjacent point.

Noncircular Shear Surface Points After End Point Adjustment

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	372.19	318.26	angle to be computed - moveable
2	439.66	232.29	angle to be computed - moveable
3	636.96	233.73	- fixed
4	736.26	212.92	- fixed
5	755.92	212.78	- fixed
6	798.74	211.28	- fixed

Computed crack depth: 10.00

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X: 366.81 Y: 318.47

X: 440.19 Y: 233.16

X: 636.96 Y: 233.73

X: 736.26 Y: 212.92

X: 755.92 Y: 212.78

X: 798.74 Y: 211.28

Minimum factor of safety: 1.133

Side force inclination: -25.00

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 5

Total number of shear surfaces attempted: 25

Total number of shear surfaces for which the factor of safety was successfully calculated: 25

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	1.1375	5	5
2	5.0000	1	5.000	1.1347	10	10
3	5.0000	1	1.147	1.1336	15	15
4	5.0000	1	0.760	1.1327	20	20
5	5.0000	1	0.689	1.1327	25	25

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	366.81	318.47					
	371.09	313.50	6331	1	100.0	35.00	0.0
	375.37	308.53					
2	379.64	303.55	10439	1	100.0	35.00	0.0
	383.92	298.58					
3	388.20	293.61	14547	1	100.0	35.00	0.0
	392.48	288.63					
4	396.75	283.66	18654	1	100.0	35.00	0.0
	401.03	278.69					
5	405.31	273.71	22762	1	100.0	35.00	0.0
	409.59	268.74					
6	413.86	263.77	26869	1	100.0	35.00	0.0
	418.14	258.79					
7	422.42	253.82	30977	1	100.0	35.00	0.0
	426.70	248.85					
8	430.97	243.87	35085	1	100.0	35.00	0.0
	435.25	238.90					
9	437.46	236.33	19694	1	100.0	35.00	0.0
	439.66	233.77					
10	439.87	233.53	1865	1	100.0	35.00	0.0
	440.07	233.30					
11	440.13	233.23	534	2	NONLINEAR	ENVELOPE	0.0
	440.19	233.16					
12	445.66	233.18	50401	2	NONLINEAR	ENVELOPE	0.0
	451.14	233.19					
13	456.61	233.21	50000	2	NONLINEAR	ENVELOPE	0.0
	462.09	233.22					
14	469.38	233.25	64506	2	NONLINEAR	ENVELOPE	0.0
	476.66	233.27					
15	483.95	233.29	60990	2	NONLINEAR	ENVELOPE	0.0
	491.24	233.31					
16	498.52	233.33	57475	2	NONLINEAR	ENVELOPE	0.0

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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	505.81	233.35				
17	513.09	233.37	53959	2	NONLINEAR ENVELOPE	0.0
	520.38	233.39				
18	527.67	233.41	50444	2	NONLINEAR ENVELOPE	0.0
	534.95	233.44				
19	542.24	233.46	46928	2	NONLINEAR ENVELOPE	0.0
	549.53	233.48				
20	556.81	233.50	43413	2	NONLINEAR ENVELOPE	0.0
	564.10	233.52				
21	571.38	233.54	39897	2	NONLINEAR ENVELOPE	0.0
	578.67	233.56				
22	585.96	233.58	36382	2	NONLINEAR ENVELOPE	0.0
	593.24	233.60				
23	600.53	233.62	32866	2	NONLINEAR ENVELOPE	0.0
	607.82	233.65				
24	615.10	233.67	29351	2	NONLINEAR ENVELOPE	0.0
	622.39	233.69				
25	629.67	233.71	25835	2	NONLINEAR ENVELOPE	0.0
	636.96	233.73				
26	644.05	232.24	22811	2	NONLINEAR ENVELOPE	0.0
	651.15	230.76				
27	658.24	229.27	21556	2	NONLINEAR ENVELOPE	0.0
	665.33	227.78				
28	672.43	226.30	20300	2	NONLINEAR ENVELOPE	0.0
	679.52	224.81				
29	686.61	223.32	19044	2	NONLINEAR ENVELOPE	0.0
	693.71	221.84				
30	700.80	220.35	17789	2	NONLINEAR ENVELOPE	0.0
	707.89	218.86				
31	714.99	217.38	16533	2	NONLINEAR ENVELOPE	0.0
	722.08	215.89				
32	729.17	214.41	15278	2	NONLINEAR ENVELOPE	0.0
	736.26	212.92				
33	741.18	212.88	9360	2	NONLINEAR ENVELOPE	0.0
	746.09	212.85				
34	751.01	212.81	7779	2	NONLINEAR ENVELOPE	0.0
	755.92	212.78				
35	762.56	212.55	8104	2	NONLINEAR ENVELOPE	0.0
	769.20	212.31				
36	775.83	212.08	5433	2	NONLINEAR ENVELOPE	0.0
	782.47	211.85				
37	789.11	211.62	2762	2	NONLINEAR ENVELOPE	0.0
	795.75	211.39				
38	797.24	211.34	161	2	NONLINEAR ENVELOPE	0.0
	798.74	211.28				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 44

 * Seismic Forces and Forces Due to Distributed Loads for *
 * Individual Slices for Conventional Computations or the *
 * First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS							
Slices			Y for				
No.	X	Seismic Force	Seismic Force	Normal Force	Shear Force	X	Y
1	371.09	823	320.90	0	0	371.09	328.30
2	379.64	1357	315.75	0	0	379.64	327.96
3	388.20	1891	310.61	0	0	388.20	327.61
4	396.75	2425	305.46	0	0	396.75	327.27
5	405.31	2959	300.32	0	0	405.31	326.93
6	413.86	3493	295.17	0	0	413.86	326.58
7	422.42	4027	290.03	0	0	422.42	326.24
8	430.97	4561	284.88	0	0	430.97	325.89
9	437.46	2560	280.95	0	0	437.46	325.57
10	439.87	243	279.47	0	0	439.87	325.40
11	440.13	69	279.26	0	0	440.13	325.38
12	445.66	6552	278.97	0	0	445.66	324.99
13	456.61	6500	278.57	0	0	456.61	324.23
14	469.38	8386	277.14	0	0	469.38	321.41
15	483.95	7929	274.68	0	0	483.95	316.53
16	498.52	7472	272.23	0	0	498.52	311.66
17	513.09	7015	269.77	0	0	513.09	306.79
18	527.67	6558	267.31	0	0	527.67	301.92
19	542.24	6101	264.85	0	0	542.24	297.05
20	556.81	5644	262.39	0	0	556.81	292.17
21	571.38	5187	259.94	0	0	571.38	287.30
22	585.96	4730	257.48	0	0	585.96	282.43
23	600.53	4273	255.03	0	0	600.53	277.56
24	615.10	3816	252.58	0	0	615.10	272.68
25	629.67	3359	250.13	0	0	629.67	267.81
26	644.05	2965	246.98	0	0	644.05	263.00
27	658.24	2802	243.12	0	0	658.24	258.26
28	672.43	2639	239.27	0	0	672.43	253.52
29	686.61	2476	235.41	0	0	686.61	248.77

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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30	700.80	2313	231.56	0	0	700.80	244.03
31	714.99	2149	227.70	0	0	714.99	239.29
32	729.17	1986	223.85	0	0	729.17	234.54
33	741.18	1217	221.09	0	0	741.18	230.53
34	751.01	1011	219.43	0	0	751.01	227.24
35	762.56	1053	217.41	0	0	762.56	223.38
36	775.83	706	215.03	0	0	775.83	218.94
37	789.11	359	212.76	0	0	789.11	214.50
38	797.24	21	211.56	0	0	797.24	211.78

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

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Name of input data file:

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Trial No. 1 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	1.929e+005	-4.846
Reduced value - Delta was too large			-0.500
2	2.50000	1.691e+005	-2.969
Reduced value - Delta was too large			-0.500
3	2.00000	1.337e+005	-1.515
Reduced value - Delta was too large			-0.500
4	1.50000	7.517e+004	-0.484
5	1.01590	-3.519e+004	0.105
6	1.12081	-3.274e+003	0.012
7	1.13268	-3.399e+001	0.000
8	1.13280	-3.738e-003	0.000

After trial 1 the following changes were computed for the nonlinear strength envelopes:

Maximum change in shear strength: -13.488 (percent)

Maximum change occurred for slice 11

Normal stress where max. change occurred: 2465.59

Old strength at this slice: 862.96

New strength at this slice: 746.56

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Trial No. 2 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	1.930e+005	-4.847
Reduced value - Delta was too large			-0.500
2	2.50000	1.692e+005	-2.970
Reduced value - Delta was too large			-0.500
3	2.00000	1.337e+005	-1.515
Reduced value - Delta was too large			-0.500
4	1.50000	7.519e+004	-0.484
5	1.01577	-3.521e+004	0.105
6	1.12073	-3.278e+003	0.012
7	1.13261	-3.407e+001	0.000
8	1.13273	-3.756e-003	0.000

After trial 2 the following changes were computed for the nonlinear strength envelopes:

Maximum change in shear strength: -0.000 (percent)

Maximum change occurred for slice 15

Normal stress where max. change occurred: 4323.60

Old strength at this slice: 932.36

New strength at this slice: 932.36

Strengths from nonlinear envelope have converged.

Final computations will be performed next.

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

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Name of input data file:

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 10

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	1.930e+005	-4.847
Reduced value - Delta was too large			-0.500
2	2.50000	1.692e+005	-2.970
Reduced value - Delta was too large			-0.500
3	2.00000	1.337e+005	-1.515
Reduced value - Delta was too large			-0.500
4	1.50000	7.519e+004	-0.484
5	1.01577	-3.521e+004	0.105
6	1.12073	-3.278e+003	0.012
7	1.13261	-3.407e+001	0.000
8	1.13273	-3.756e-003	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 8.98837e-011

Summation of Vertical Forces: 1.34150e-010

Mohr Coulomb Shear Force/Shear Strength Check Summation: 3.54056e-003

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

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Name of input data file:

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *
* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 1.133 Side Force Inclination: -25.00

----- VALUES AT CENTER OF BASE OF SLICE -----

Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	371.09	313.50	321.3	321.3	286.9
2	379.64	303.55	549.9	549.9	428.2
3	388.20	293.61	778.6	778.6	569.6
4	396.75	283.66	1007.2	1007.2	710.9
5	405.31	273.71	1235.9	1235.9	852.2
6	413.86	263.77	1464.5	1464.5	993.6
7	422.42	253.82	1693.2	1693.2	1134.9
8	430.97	243.87	1921.8	1921.8	1276.3
9	437.46	236.33	2093.6	2093.6	1382.4
10	439.87	233.53	2156.3	2156.3	1421.2
11	440.13	233.23	2510.2	2510.2	663.0
12	445.66	233.18	4732.5	4732.5	859.2
13	456.61	233.21	4696.7	4696.7	856.0
14	469.38	233.25	4560.3	4560.3	844.0
15	483.95	233.29	4323.6	4323.6	823.1
16	498.52	233.33	4086.9	4086.9	802.2
17	513.09	233.37	3850.1	3850.1	781.3
18	527.67	233.41	3613.4	3613.4	760.4
19	542.24	233.46	3376.6	3376.6	739.5
20	556.81	233.50	3139.9	3139.9	718.6
21	571.38	233.54	2903.1	2903.1	697.7
22	585.96	233.58	2666.4	2666.4	676.8
23	600.53	233.62	2429.7	2429.7	655.9
24	615.10	233.67	2192.9	2192.9	635.0
25	629.67	233.71	1950.8	1950.8	602.8
26	644.05	232.24	1483.2	1483.2	458.3
27	658.24	229.27	1401.6	1401.6	433.1
28	672.43	226.30	1319.9	1319.9	407.8

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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29	686.61	223.32	1238.3	1238.3	382.6
30	700.80	220.35	1156.7	1156.7	357.4
31	714.99	217.38	1075.0	1075.0	332.2
32	729.17	214.41	993.4	993.4	306.9
33	741.18	212.88	1038.4	1038.4	320.9
34	751.01	212.81	863.1	863.1	266.7
35	762.56	212.55	649.5	649.5	200.7
36	775.83	212.08	435.4	435.4	134.5
37	789.11	211.62	221.4	221.4	68.4
38	797.24	211.34	57.2	57.2	17.7

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section B-B'\MSB Section B-B' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 60

 * Final Results for Side Forces Between Slices *
 * (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Slice No.	Resultant				
	X-Right	Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	375.37	1726	-25.00	1564	-729
2	383.92	5216	-25.00	4728	-2205
3	392.48	10471	-25.00	9490	-4425
4	401.03	17490	-25.00	15852	-7392
5	409.59	26274	-25.00	23812	-11104
6	418.14	36822	-25.00	33372	-15562
7	426.70	49134	-25.00	44531	-20765
8	435.25	63211	-25.00	57288	-26714
9	439.66	71158	-25.00	64491	-30072
10	440.07	71912	-25.00	65174	-30391
11	440.19	72276	-25.00	65505	-30545
12	451.14	68958	-25.00	62497	-29143
13	462.09	65621	-25.00	59473	-27733
14	476.66	61091	-25.00	55367	-25818
15	491.24	56404	-25.00	51119	-23837
16	505.81	51560	-25.00	46729	-21790
17	520.38	46558	-25.00	42196	-19676
18	534.95	41399	-25.00	37520	-17496
19	549.53	36083	-25.00	32702	-15249
20	564.10	30610	-25.00	27742	-12936
21	578.67	24979	-25.00	22639	-10557
22	593.24	19192	-25.00	17393	-8111
23	607.82	13247	-25.00	12006	-5598
24	622.39	7145	-25.00	6475	-3019
25	636.96	1068	-25.00	967	-451
26	651.15	2031	-25.00	1841	-859
27	665.33	2942	-25.00	2667	-1243
28	679.52	3800	-25.00	3444	-1606
29	693.71	4605	-25.00	4173	-1946
30	707.89	5357	-25.00	4855	-2264
31	722.08	6055	-25.00	5488	-2559

Matanuska-Susinta, AK Landfill

Cross-Section: B-B'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section B-B' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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32	736.26	6701	-25.00	6073	-2832
33	746.09	4644	-25.00	4209	-1963
34	755.92	2935	-25.00	2660	-1240
35	769.20	1490	-25.00	1350	-630
36	782.47	521	-25.00	472	-220
37	795.75	29	-25.00	26	-12
38	798.74	-0	-25.00	-0	0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.

Profile: C-C' Case: CH2M Analysis

Unit Weight Average Effective Average Total Average

Noncircular Surface Coordinates Shifting Points

x y 10

400 317.03 5

462.85 235.18

602.96 198.78 fixed

640.44 196.35 fixed

648.54 196.87 fixed

738.7 193.17 fixed

796.77 192.99 fixed

872.91 196.17 fixed

Adjustments

Corp method used to
force Line of Thrust
beneath surface

Increased liner
strength to avoid
negative side forces

Crack Depth

12

Seismic Acceleration

0.13

Minimum Weight

5000

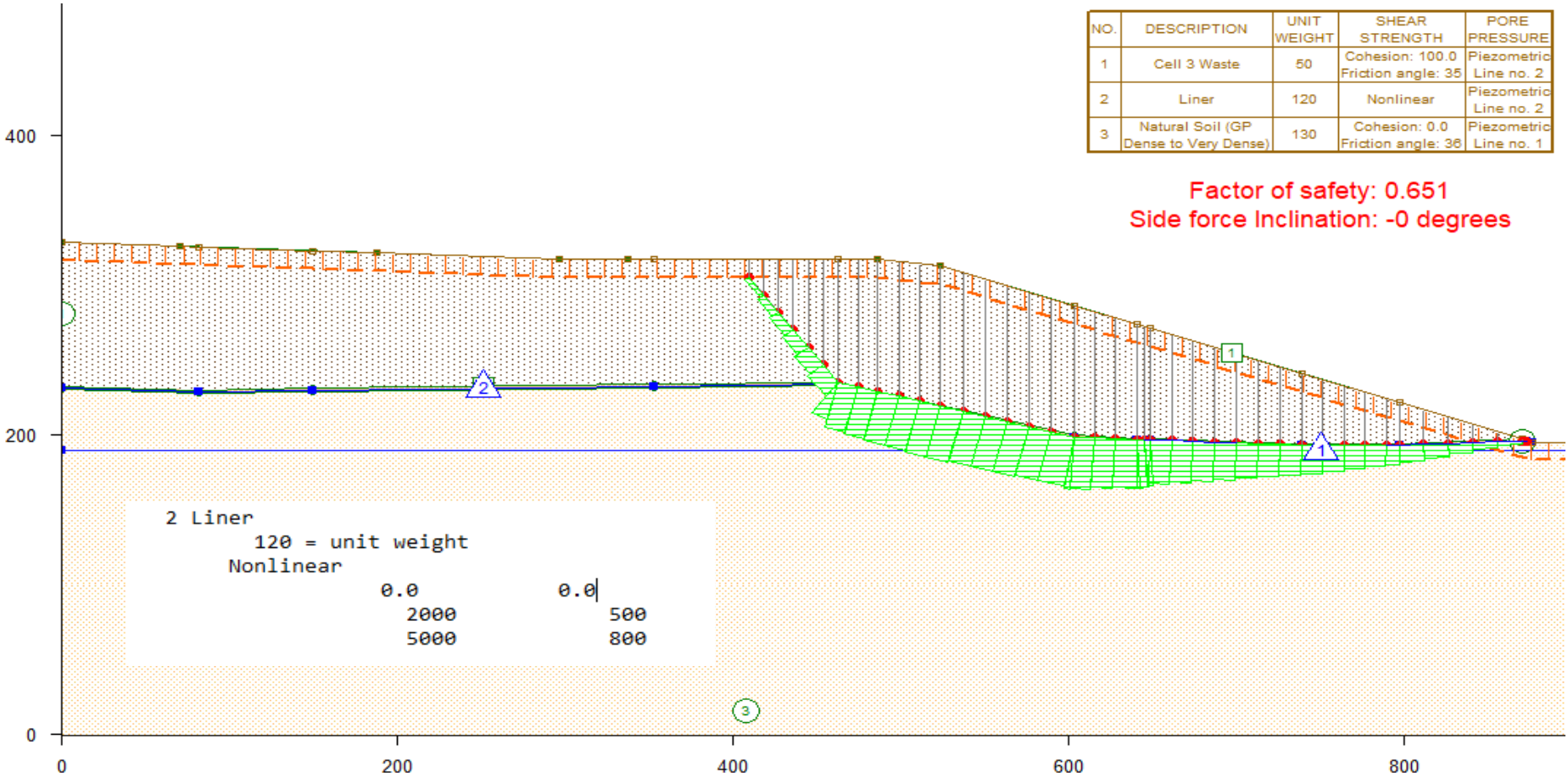
Results

Noncircular Shear Surface

409.22	305.02
462.85	235.18
602.96	198.78
640.44	196.35
648.54	196.87
738.7	193.17
796.77	192.99
872.91	196.17

Factor of Safety

0.651



Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section C-C' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 1 of 4

English units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 5 Surface

0 328.8926

71.051 326.0616

188.5248 321.3252

296.7885 317.0329

337.8051 317.0858

486.3848 316.9548

523.8643 312.6729

869.918712 197.1749

2 2 Liner

0 232.1147

82.3776 229.8661

149.6914 230.9902

353.4471 233.6161

462.8547 235.1779

602.9616 199.777

640.4418 197.3469

648.5372 197.872

738.6968 194.1687

796.7718 193.9902

869.918712 197.1749

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section C-C' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 2 of 4

875.9111 195.1749

3 3 Native Surface

0 230.1147

82.3776 227.8661

149.6914 228.9902

353.4471 231.6161

462.8547 233.1779

602.9616 197.777

640.4418 195.3469

648.5372 195.872

738.6968 192.1687

796.7718 191.9902

875.9111 195.1749

1500 195.2685

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0.0

0.0

2000 500

5000 800

Piezometric Line

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section C-C' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 3 of 4

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Piezometric Line

1

PIEzometric line data follow -

1 62.40 Piezometric line 1

0.000000

190.000000

1500.000000

190.000000

2 62.40 Piezometric line 2

0 231.1147

82.3776 228.8661

149.6914 229.9902

353.4471 232.6161

462.8547 234.1779

602.9616 198.777

640.4418 196.3469

648.5372 196.872

738.6968 193.1687

796.7718 192.9902

872.914906 196.1749

875.9111 195.1749

ANALYSIS/computation data follow

Noncircular Search 2

400 317.03

462.8547 234.1779

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section C-C' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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602.96 198.78 fixed

640.44 196.35 fixed

648.54 196.87 fixed

738.7 193.17 fixed

796.77 192.99 fixed

872.914906 196.1749 fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

12 d

Procedure

Corps of Engineers

0

Seismic

0.13

GRAphics output file

COMpute

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section C-C' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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* BEEN VERIFIED BY INDEPENDENT ANALYSES, EXPERIMENTAL DATA *
* OR FIELD EXPERIENCE. THE USER SHOULD UNDERSTAND THE ALGORITHMS *
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Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section C-C' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Time and date of run: Thu Nov 17 12:45:47 2022

Name of input data file:

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TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

----- Profile Line No. 1 - Material Type (Number): 1 -----

Description: Cell 5 Surface

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	188.52	321.33
4	296.79	317.03
5	337.81	317.09
6	486.38	316.95
7	523.86	312.67
8	869.92	197.17

----- Profile Line No. 2 - Material Type (Number): 2 -----

Description: Liner

Point	X	Y
1	0.00	232.11
2	82.38	229.87
3	149.69	230.99
4	353.45	233.62
5	462.85	235.18
6	602.96	199.78
7	640.44	197.35
8	648.54	197.87
9	738.70	194.17
10	796.77	193.99
11	869.92	197.17
12	875.91	195.17

----- Profile Line No. 3 - Material Type (Number): 3 -----

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Description: Native Surface

Point	X	Y
1	0.00	230.11
2	82.38	227.87
3	149.69	228.99
4	353.45	231.62
5	462.85	233.18
6	602.96	197.78
7	640.44	195.35
8	648.54	195.87
9	738.70	192.17
10	796.77	191.99
11	875.91	195.17
12	1500.00	195.27

Matanuska-Susinta, AK Landfill

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- DATA FOR MATERIAL NUMBER 1 -----

Description: Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 2 -----

Description: Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	500.0
3	5000.0	800.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 3 -----

Description: Natural Soil (GP Dense to Very Dense)

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Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- Piezometric Line Number 1 -----

Description: Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

----- Piezometric Line Number 2 -----

Description: Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	231.11
2	82.38	228.87
3	149.69	229.99
4	353.45	232.62
5	462.85	234.18
6	602.96	198.78
7	640.44	196.35
8	648.54	196.87
9	738.70	193.17
10	796.77	192.99
11	872.91	196.17
12	875.91	195.17

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	400.00	317.03	angle to be computed - moveable
2	462.85	234.18	angle to be computed - moveable
3	602.96	198.78	- fixed
4	640.44	196.35	- fixed
5	648.54	196.87	- fixed
6	738.70	193.17	- fixed
7	796.77	192.99	- fixed
8	872.91	196.17	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 12.000

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 0.00

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

The following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

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Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

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TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	328.89
2	71.05	326.06
3	82.38	325.60
4	149.69	322.89
5	188.52	321.33
6	296.79	317.03
7	337.81	317.09
8	353.45	317.07
9	462.85	316.98
10	486.38	316.95
11	523.86	312.67
12	602.96	286.27
13	640.44	273.76
14	648.54	271.06
15	738.70	240.97
16	796.77	221.59
17	869.92	197.17
18	875.91	195.17
19	1500.00	195.27

Left end point on noncircular shear surface adjusted to:

X: 409.11, Y: 305.02

Adjustment was made to put end point at bottom of crack.

Noncircular Shear Surface Points After End Point Adjustment

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	409.11	305.02	angle to be computed - moveable
2	462.85	234.18	angle to be computed - moveable
3	602.96	198.78	- fixed
4	640.44	196.35	- fixed
5	648.54	196.87	- fixed

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6	738.70	193.17	- fixed
7	796.77	192.99	- fixed
8	872.91	196.17	- fixed

Computed crack depth: 12.00

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Cross-Section: C-C'

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TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X:	429.11	Y:	305.01
X:	463.52	Y:	235.00
X:	602.96	Y:	198.78
X:	640.44	Y:	196.35
X:	648.54	Y:	196.87
X:	738.70	Y:	193.17
X:	796.77	Y:	192.99
X:	872.91	Y:	196.17

Minimum factor of safety: 0.639

Side force inclination: -0.00

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 5

Total number of shear surfaces attempted: 25

Total number of shear surfaces for which the factor of safety

was successfully calculated: 25

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	0.6424	5	5
2	10.0000	1	10.000	0.6424	10	10
3	5.0000	1	5.000	0.6401	15	15
4	5.0000	1	5.000	0.6392	20	20
5	5.0000	1	0.776	0.6392	25	25

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TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	429.11	305.01					
	431.92	299.28	4983	1	100.0	35.00	0.0
	434.73	293.56					
2	437.55	287.84	8198	1	100.0	35.00	0.0
	440.36	282.12					
3	443.17	276.40	11414	1	100.0	35.00	0.0
	445.98	270.68					
4	448.79	264.96	14630	1	100.0	35.00	0.0
	451.61	259.24					
5	454.42	253.52	17846	1	100.0	35.00	0.0
	457.23	247.80					
6	460.04	242.08	21062	1	100.0	35.00	0.0
	462.85	236.36					
7	463.19	235.69	2701	1	100.0	35.00	0.0
	463.52	235.01					
8	463.52	235.00	22	2	NONLINEAR ENVELOPE		0.0
	463.52	235.00					
9	469.24	233.51	47735	2	NONLINEAR ENVELOPE		0.0
	474.95	232.03					
10	480.67	230.55	49491	2	NONLINEAR ENVELOPE		0.0
	486.38	229.06					
11	492.63	227.44	55660	2	NONLINEAR ENVELOPE		0.0
	498.88	225.82					
12	505.12	224.19	56873	2	NONLINEAR ENVELOPE		0.0
	511.37	222.57					
13	517.62	220.95	58086	2	NONLINEAR ENVELOPE		0.0
	523.86	219.33					
14	530.46	217.61	61653	2	NONLINEAR ENVELOPE		0.0
	537.05	215.90					
15	543.64	214.19	61096	2	NONLINEAR ENVELOPE		0.0
	550.23	212.48					
16	556.82	210.76	60539	2	NONLINEAR ENVELOPE		0.0

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	563.41	209.05				
17	570.00	207.34	59983	2	NONLINEAR ENVELOPE	0.0
	576.59	205.63				
18	583.19	203.92	59426	2	NONLINEAR ENVELOPE	0.0
	589.78	202.20				
19	596.37	200.49	58869	2	NONLINEAR ENVELOPE	0.0
	602.96	198.78				
20	602.96	198.78	7	2	NONLINEAR ENVELOPE	0.0
	602.96	198.78				
21	609.21	198.37	54475	2	NONLINEAR ENVELOPE	0.0
	615.45	197.97				
22	621.70	197.56	52376	2	NONLINEAR ENVELOPE	0.0
	627.95	197.16				
23	634.19	196.75	50278	2	NONLINEAR ENVELOPE	0.0
	640.44	196.35				
24	640.44	196.35	7	2	NONLINEAR ENVELOPE	0.0
	640.44	196.35				
25	642.85	196.50	18781	2	NONLINEAR ENVELOPE	0.0
	645.27	196.66				
26	646.90	196.76	12468	2	NONLINEAR ENVELOPE	0.1
	648.54	196.87				
27	648.54	196.87	11	2	NONLINEAR ENVELOPE	0.1
	648.54	196.87				
28	654.95	196.61	47222	2	NONLINEAR ENVELOPE	0.1
	661.35	196.34				
29	667.76	196.08	44819	2	NONLINEAR ENVELOPE	0.1
	674.16	195.82				
30	680.57	195.56	42416	2	NONLINEAR ENVELOPE	0.0
	686.97	195.29				
31	693.38	195.03	40014	2	NONLINEAR ENVELOPE	0.0
	699.79	194.77				
32	706.27	194.50	38064	2	NONLINEAR ENVELOPE	0.0
	712.76	194.23				
33	719.24	193.97	35601	2	NONLINEAR ENVELOPE	0.0
	725.73	193.70				
34	732.21	193.44	33138	2	NONLINEAR ENVELOPE	0.0
	738.70	193.17				
35	738.70	193.17	8	2	NONLINEAR ENVELOPE	0.0
	738.70	193.17				
36	744.97	193.15	29567	2	NONLINEAR ENVELOPE	0.0
	751.25	193.13				
37	757.52	193.11	26964	2	NONLINEAR ENVELOPE	0.0
	763.80	193.09				
38	770.07	193.07	24360	2	NONLINEAR ENVELOPE	0.0
	776.35	193.05				
39	782.62	193.03	21757	2	NONLINEAR ENVELOPE	0.0
	788.89	193.01				
40	792.83	193.00	12327	2	NONLINEAR ENVELOPE	0.0
	796.77	192.99				
41	796.77	192.99	3	2	NONLINEAR ENVELOPE	0.0
	796.77	192.99				
42	804.09	193.30	19946	2	NONLINEAR ENVELOPE	0.0

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	811.40	193.60				
43	818.72	193.91	15953	2	NONLINEAR ENVELOPE	0.0
	826.03	194.21				
44	833.35	194.52	11959	2	NONLINEAR ENVELOPE	0.0
	840.66	194.83				
45	847.97	195.13	7966	2	NONLINEAR ENVELOPE	0.0
	855.29	195.44				
46	862.60	195.74	3972	2	NONLINEAR ENVELOPE	0.0
	869.92	196.05				
47	871.42	196.11	202	2	NONLINEAR ENVELOPE	0.0
	872.91	196.17				

No water in crack.

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MSB CELL 3

TABLE NO. 44

 * Seismic Forces and Forces Due to Distributed Loads for *
 * Individual Slices for Conventional Computations or the *
 * First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS							
Slices			Y for				
No.	X	Seismic Force	Seismic Force	Normal Force	Shear Force	X	Y
1	431.92	648	308.14	0	0	431.92	317.00
2	437.55	1066	302.42	0	0	437.55	317.00
3	443.17	1484	296.70	0	0	443.17	316.99
4	448.79	1902	290.98	0	0	448.79	316.99
5	454.42	2320	285.25	0	0	454.42	316.98
6	460.04	2738	279.53	0	0	460.04	316.98
7	463.19	351	276.33	0	0	463.19	316.98
8	463.52	3	275.99	0	0	463.52	316.97
9	469.24	6206	275.21	0	0	469.24	316.97
10	480.67	6434	273.66	0	0	480.67	316.96
11	492.63	7236	271.69	0	0	492.63	316.24
12	505.12	7393	269.29	0	0	505.12	314.81
13	517.62	7551	266.90	0	0	517.62	313.39
14	530.46	8015	263.71	0	0	530.46	310.47
15	543.64	7942	259.73	0	0	543.64	306.07
16	556.82	7870	255.76	0	0	556.82	301.67
17	570.00	7798	251.78	0	0	570.00	297.27
18	583.19	7725	247.81	0	0	583.19	292.87
19	596.37	7653	243.83	0	0	596.37	288.47
20	602.96	1	241.85	0	0	602.96	286.27
21	609.21	7082	240.60	0	0	609.21	284.19
22	621.70	6809	238.11	0	0	621.70	280.02
23	634.19	6536	235.63	0	0	634.19	275.85
24	640.44	1	234.38	0	0	640.44	273.76
25	642.85	2442	234.05	0	0	642.85	272.96
26	646.90	1621	233.51	0	0	646.90	271.61
27	648.54	1	233.29	0	0	648.54	271.06
28	654.95	6139	232.09	0	0	654.95	268.92
29	667.76	5826	229.69	0	0	667.76	264.65

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30	680.57	5514	227.29	0	0	680.57	260.37
31	693.38	5202	224.89	0	0	693.38	256.10
32	706.27	4948	222.48	0	0	706.27	251.79
33	719.24	4628	220.05	0	0	719.24	247.46
34	732.21	4308	217.62	0	0	732.21	243.14
35	738.70	1	216.41	0	0	738.70	240.97
36	744.97	3844	215.35	0	0	744.97	238.88
37	757.52	3505	213.24	0	0	757.52	234.69
38	770.07	3167	211.13	0	0	770.07	230.50
39	782.62	2828	209.02	0	0	782.62	226.31
40	792.83	1602	207.31	0	0	792.83	222.90
41	796.77	0	206.65	0	0	796.77	221.59
42	804.09	2593	205.58	0	0	804.09	219.15
43	818.72	2074	203.44	0	0	818.72	214.26
44	833.35	1555	201.32	0	0	833.35	209.38
45	847.97	1036	199.24	0	0	847.97	204.50
46	862.60	516	197.28	0	0	862.60	199.62
47	871.42	26	196.39	0	0	871.42	196.67

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Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section C-C'\MSB Section C-C' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Trial No. 1 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 14

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	3.714e+005	-8.742
Reduced value - Delta was too large			-0.500
2	2.50000	3.465e+005	-5.928
Reduced value - Delta was too large			-0.500
3	2.00000	3.111e+005	-3.609
Reduced value - Delta was too large			-0.500
4	1.50000	2.558e+005	-1.801
Reduced value - Delta was too large			-0.500
5	1.00000	1.549e+005	-0.536
Reduced value - Delta was too large			-0.500
6	0.50000	-1.119e+005	0.111
7	0.61111	-1.881e+004	0.027
8	0.63804	-7.223e+002	0.001
9	0.63916	-1.145e+000	0.000

After trial 1 the following changes were computed for the nonlinear strength envelopes:

Maximum change in shear strength: -7.430 (percent)

Maximum change occurred for slice 8

Normal stress where max. change occurred: 2282.68

Old strength at this slice: 570.67

New strength at this slice: 528.27

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section C-C' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Trial No. 2 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 14

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	3.714e+005	-8.743
Reduced value - Delta was too large			-0.500
2	2.50000	3.465e+005	-5.928
Reduced value - Delta was too large			-0.500
3	2.00000	3.111e+005	-3.609
Reduced value - Delta was too large			-0.500
4	1.50000	2.558e+005	-1.801
Reduced value - Delta was too large			-0.500
5	1.00000	1.549e+005	-0.536
Reduced value - Delta was too large			-0.500
6	0.50000	-1.119e+005	0.111
7	0.61111	-1.881e+004	0.027
8	0.63804	-7.223e+002	0.001
9	0.63916	-1.145e+000	0.000

After trial 2 the following changes were computed for the nonlinear strength envelopes:

Maximum change in shear strength: 0.000 (percent)

Maximum change occurred for slice 32

Normal stress where max. change occurred: 2896.76

Old strength at this slice: 589.68

New strength at this slice: 589.68

Strengths from nonlinear envelope have converged.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section C-C' Seismic – Non-Circular - Residual_output (wilson).docx

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Final computations will be performed next.

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 14

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	3.714e+005	-8.743
Reduced value - Delta was too large			-0.500
2	2.50000	3.465e+005	-5.928
Reduced value - Delta was too large			-0.500
3	2.00000	3.111e+005	-3.609
Reduced value - Delta was too large			-0.500
4	1.50000	2.558e+005	-1.801
Reduced value - Delta was too large			-0.500
5	1.00000	1.549e+005	-0.536
Reduced value - Delta was too large			-0.500
6	0.50000	-1.119e+005	0.111
7	0.61111	-1.881e+004	0.027
8	0.63804	-7.223e+002	0.001
9	0.63916	-1.145e+000	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section C-C' Seismic – Non-Circular - Residual_output (wilson).docx

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MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 1.75637e-010

Summation of Vertical Forces: 1.32228e-010

Mohr Coulomb Shear Force/Shear Strength Check Summation: 1.20387e+000

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section C-C' Seismic – Non-Circular - Residual_output (wilson).docx

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *
* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 0.639 Side Force Inclination: -0.00

----- VALUES AT CENTER OF BASE OF SLICE -----					
Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	431.92	299.28	175.8	175.8	349.1
2	437.55	287.84	352.9	352.9	543.1
3	443.17	276.40	530.0	530.0	737.1
4	448.79	264.96	707.2	707.2	931.1
5	454.42	253.52	884.3	884.3	1125.2
6	460.04	242.08	1061.4	1061.4	1319.2
7	463.19	235.69	1160.4	1160.4	1427.7
8	463.52	235.00	2385.0	2385.0	842.5
9	469.24	233.51	3896.0	3896.0	1078.9
10	480.67	230.55	4043.6	4043.6	1102.0
11	492.63	227.44	4164.1	4164.1	1120.9
12	505.12	224.19	4257.4	4257.4	1135.5
13	517.62	220.95	4350.7	4350.7	1150.1
14	530.46	217.61	4377.0	4377.0	1154.2
15	543.64	214.19	4336.4	4336.4	1147.8
16	556.82	210.76	4295.9	4295.9	1141.5
17	570.00	207.34	4255.3	4255.3	1135.1
18	583.19	203.92	4214.7	4214.7	1128.8
19	596.37	200.49	4174.1	4174.1	1122.4
20	602.96	198.78	4369.7	4369.7	1153.0
21	609.21	198.37	4286.6	4286.6	1140.0
22	621.70	197.56	4120.3	4120.3	1114.0
23	634.19	196.75	3954.0	3954.0	1088.0
24	640.44	196.35	4010.9	4010.9	1096.9
25	642.85	196.50	3962.5	3962.5	1089.3
26	646.90	196.76	3881.4	3881.3	1076.6
27	648.54	196.87	3848.5	3848.4	1071.5
28	654.95	196.61	3643.3	3643.2	1039.4

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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UTEXAS4 Output File

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29	667.76	196.08	3456.9	3456.9	1010.2
30	680.57	195.56	3270.6	3270.6	981.1
31	693.38	195.03	3084.3	3084.2	951.9
32	706.27	194.50	2896.8	2896.8	922.6
33	719.24	193.97	2708.1	2708.1	893.1
34	732.21	193.44	2519.4	2519.4	863.5
35	738.70	193.17	2425.1	2425.1	848.8
36	744.97	193.15	2353.6	2353.6	837.6
37	757.52	193.11	2146.3	2146.3	805.2
38	770.07	193.07	1939.0	1939.0	758.4
39	782.62	193.03	1731.8	1731.8	677.4
40	792.83	193.00	1563.2	1563.2	611.4
41	796.77	192.99	1524.9	1524.9	596.4
42	804.09	193.30	1386.1	1386.1	542.2
43	818.72	193.91	1108.6	1108.6	433.6
44	833.35	194.52	831.1	831.1	325.1
45	847.97	195.13	553.6	553.6	216.5
46	862.60	195.74	276.0	276.0	108.0
47	871.42	196.11	68.6	68.6	26.8

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

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Name of input data file:

Z:\Clients\ENS\MatSuBorough\141712_LFEng2022\Design\GeoTech\Working\Dsgn\Slope Stability\Section C-C'\MSB Section C-C' - Non Circular - Seismic - Corp.input-utexas

MSB CELL 3

TABLE NO. 60

* Final Results for Side Forces Between Slices *
* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Slice No.	Resultant				
	X-Right	Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	434.73	696	-0.00	696	-0
2	440.36	2745	-0.00	2745	-0
3	445.98	6147	-0.00	6147	-0
4	451.61	10902	-0.00	10902	-0
5	457.23	17010	-0.00	17010	-0
6	462.85	24472	-0.00	24472	-0
7	463.52	25442	-0.00	25442	-0
8	463.52	25467	-0.00	25467	-0
9	474.95	30907	-0.00	30907	-0
10	486.38	36751	-0.00	36751	-0
11	498.88	43497	-0.00	43497	-0
12	511.37	50521	-0.00	50521	-0
13	523.86	57823	-0.00	57823	-0
14	537.05	65611	-0.00	65611	-0
15	550.23	73271	-0.00	73271	-0
16	563.41	80804	-0.00	80804	-0
17	576.59	88209	-0.00	88209	-0
18	589.78	95486	-0.00	95486	-0
19	602.96	102636	-0.00	102636	-0
20	602.96	102635	-0.00	102635	-0
21	615.45	98947	-0.00	98947	-0
22	627.95	95176	-0.00	95176	-0
23	640.44	91323	-0.00	91323	-0
24	640.44	91321	-0.00	91321	-0
25	645.27	87279	-0.00	87279	-0
26	648.54	84564	-0.00	84564	-0
27	648.54	84562	-0.00	84562	-0
28	661.35	79301	-0.00	79301	-0
29	674.16	74002	-0.00	74002	-0
30	686.97	68667	-0.00	68667	-0
31	699.79	63296	-0.00	63296	-0

Matanuska-Susinta, AK Landfill

Cross-Section: C-C'

Case: Seismic – Non-Circular Failure

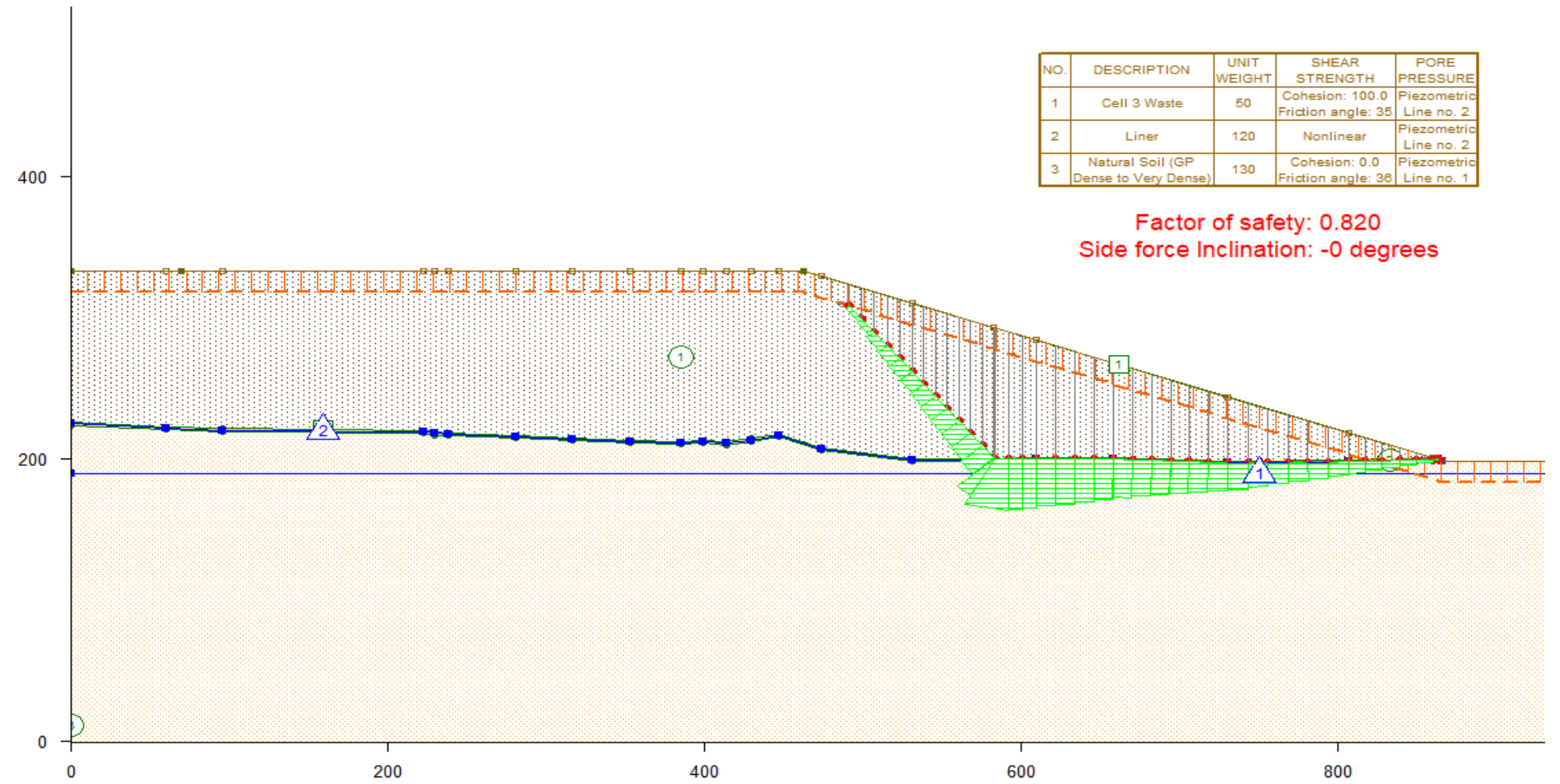
Filename: 20221125 Section C-C' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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32	712.76	57819	-0.00	57819	-0
33	725.73	52306	-0.00	52306	-0
34	738.70	46754	-0.00	46754	-0
35	738.70	46753	-0.00	46753	-0
36	751.25	40177	-0.00	40177	-0
37	763.80	33662	-0.00	33662	-0
38	776.35	27388	-0.00	27388	-0
39	788.89	21784	-0.00	21784	-0
40	796.77	18609	-0.00	18609	-0
41	796.77	18608	-0.00	18608	-0
42	811.40	12422	-0.00	12422	-0
43	826.03	7474	-0.00	7474	-0
44	840.66	3764	-0.00	3764	-0
45	855.29	1294	-0.00	1294	-0
46	869.92	62	-0.00	62	-0
47	872.91	-1	-0.00	-1	0

Read end-of-file on input while looking for another command word.
End of input data assumed - normal termination.



Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section D-D' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 1 of 5

English units

HEADING follows -MSB

CELL 3

PROFILE line data follow -

1 1 Cell 5 Surface

0 332.8662

70.2135 332.8662

462.9171 332.8662

859.9918497 200.6787

2 2 Liner

0 225.941

60.295 222.8622

96.3755 221.4547

222.67 219.9925

229.574 218.9521

238.2127 218.2238

281.1197 216.7649

317.0974 215.141

353.4706 213.1896

385.299 212.1641

399.5351 213.1354

414.0331 211.9903

429.8377 214.4455

446.6344 217.3867

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section D-D' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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474.0832 208.2405

531.0248 200.0882

582.5672 200.0792

609.5593 201.0805

658.2285 200.9409

730.2071 198.071

806.2818 199.0468

859.9918497 200.6787

862.9957248 199.6787

865.9996 198.6787

3 3 Native Surface

0 223.941

60.295 220.8622

96.3755 219.4547

222.67 217.9925

229.574 216.9521

238.2127 216.2238

281.1197 214.7649

317.0974 213.141

353.4706 211.1896

385.299 210.1641

399.5351 211.1354

414.0331 209.9903

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section D-D' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

Page 3 of 5

429.8377 212.4455

446.6344 215.3867

474.0832 206.2405

531.0248 198.0882

582.5672 198.0792

609.5593 199.0805

658.2285 198.9409

730.2071 196.071

806.2818 197.0468

865.9996 198.6787

1500 199.105

MATerial property data follow -

1 Cell 3 Waste

50.00 = unit weight

Conventional

100.0

35.0

Piezometric Line

2

2 Liner

120 = unit weight

Nonlinear

0 0

2000 450.2

5000 765

Piezometric Line

2

3 Natural Soil (GP Dense to Very Dense)

130.00 = unit weight

Conventional

0.0

36.0

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section D-D' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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Piezometric Line

1

PIEzometric line data follow -

1	62.40	Piezometric line 1	
		0.000000	190.000000
		1500.000000	190.000000
2	62.40	Piezometric line 2	

0 224.941

60.295 221.8622

96.3755 220.4547

222.67 218.9925

229.574 217.9521

238.2127 217.2238

281.1197 215.7649

317.0974 214.141

353.4706 212.1896

385.299 211.1641

399.5351 212.1354

414.0331 210.9903

429.8377 213.4455

446.6344 216.3867

474.0832 207.2405

531.0248 199.0882

582.5672 199.0792

609.5593 200.0805

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Non-Circular Failure – Seismic Loading – Residual Liner Strength

Filename: 20221125 Section D-D' Seismic-Non-Circular-Residual_input (wilson).docx

UTEXAS4 Input File

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658.2285 199.9409

730.2071 197.071

806.2818 198.0468

862.9957248 199.6787

865.9996 198.6787

ANALYSIS/computation data follow
Noncircular Search 2

467 332.8662

582.5672 199.0792

609.5593 200.0805 Fixed

658.2285 199.9409 Fixed

730.2071 197.071 Fixed

806.2818 198.0468 Fixed

862.9957248 199.6787 Fixed

865.9996 198.6787 Fixed

10 5

MINimum weight follows:

5000

ITERation limit follows:

100

crack

15 d

Procedure

Corps of Engineers

0

Seismic

0.13

GRAPHICS output file

COMPUTE

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section D-D' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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TABLE NO. 1

COMPUTER PROGRAM DESIGNATION: UTEXAS4

Originally Coded By Stephen G. Wright

Version No. 4.1.2.0 - Last Revision Date: 7/29/2020

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Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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Name of input data file:

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TABLE NO. 2

* NEW UNITS DATA *

English units (feet, pounds) will be used.

Number of decimals for coordinates in output: 2

Number of decimals for forces in output: 0

Number of decimals for stresses in output: 1

Number of decimals for unit weights in output: 1

Number of decimals for angles in output: 2

Default unit weight of fluid: 62.4

Default maximum allowable force imbalance (fraction of total weight): 1.00000e-005

Default maximum allowable moment for computations (fraction of moment due to weight): 1.00000e-005

Default minimum allowable weight for computations: 1.00000e+002

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

Filename: 20221125 Section D-D' Seismic – Non-Circular - Residual_output (wilson).docx

UTEXAS4 Output File

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Name of input data file:

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MSB CELL 3

TABLE NO. 3

* NEW PROFILE LINE DATA *

----- Profile Line No. 1 - Material Type (Number): 1 -----

Description: Cell 5 Surface

Point	X	Y
1	0.00	332.87
2	70.21	332.87
3	462.92	332.87
4	859.99	200.68

----- Profile Line No. 2 - Material Type (Number): 2 -----

Description: Liner

Point	X	Y
1	0.00	225.94
2	60.30	222.86
3	96.38	221.45
4	222.67	219.99
5	229.57	218.95
6	238.21	218.22
7	281.12	216.76
8	317.10	215.14
9	353.47	213.19
10	385.30	212.16
11	399.54	213.14
12	414.03	211.99
13	429.84	214.45
14	446.63	217.39
15	474.08	208.24
16	531.02	200.09
17	582.57	200.08
18	609.56	201.08
19	658.23	200.94

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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20	730.21	198.07
21	806.28	199.05
22	859.99	200.68
23	863.00	199.68
24	866.00	198.68

----- Profile Line No. 3 - Material Type (Number): 3 -----

Description: Native Surface

Point	X	Y
1	0.00	223.94
2	60.30	220.86
3	96.38	219.45
4	222.67	217.99
5	229.57	216.95
6	238.21	216.22
7	281.12	214.76
8	317.10	213.14
9	353.47	211.19
10	385.30	210.16
11	399.54	211.14
12	414.03	209.99
13	429.84	212.45
14	446.63	215.39
15	474.08	206.24
16	531.02	198.09
17	582.57	198.08
18	609.56	199.08
19	658.23	198.94
20	730.21	196.07
21	806.28	197.05
22	866.00	198.68
23	1500.00	199.10

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 4

* NEW MATERIAL PROPERTY DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- DATA FOR MATERIAL NUMBER 1 -----

Description: Cell 3 Waste

Constant unit weight of soil (material): 50.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 100.0

Friction angle - - - - - 35.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 2 -----

Description: Liner

Constant unit weight of soil (material): 120.0

---- NONLINEAR SHEAR STRENGTH ENVELOPE ----

Point	Normal Stress	Shear Stress
1	0.0	0.0
2	2000.0	450.2
3	5000.0	765.0

Pore water pressures are defined by a piezometric line.

Piezometric line number: 2

Negative pore water pressures are NOT allowed - set to zero.

----- DATA FOR MATERIAL NUMBER 3 -----

Description: Natural Soil (GP Dense to Very Dense)

Matanuska-Susinta, AK Landfill

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Constant unit weight of soil (material): 130.0

CONVENTIONAL (ISOTROPIC) SHEAR STRENGTHS

Cohesion - - - - - 0.0

Friction angle - - - - - 36.00 (degrees)

Pore water pressures are defined by a piezometric line.

Piezometric line number: 1

Negative pore water pressures are NOT allowed - set to zero.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 6

* NEW PIEZOMETRIC LINE DATA - CONVENTIONAL/FIRST-STAGE COMPUTATIONS *

----- Piezometric Line Number 1 -----

Description: Piezometric line 1

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	190.00
2	1500.00	190.00

----- Piezometric Line Number 2 -----

Description: Piezometric line 2

Unit weight of fluid (water): 62.4

Point	X	Y
1	0.00	224.94
2	60.30	221.86
3	96.38	220.45
4	222.67	218.99
5	229.57	217.95
6	238.21	217.22
7	281.12	215.76
8	317.10	214.14
9	353.47	212.19
10	385.30	211.16
11	399.54	212.14
12	414.03	210.99
13	429.84	213.45
14	446.63	216.39
15	474.08	207.24
16	531.02	199.09
17	582.57	199.08
18	609.56	200.08
19	658.23	199.94

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Cross-Section: D-D'

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20	730.21	197.07
21	806.28	198.05
22	863.00	199.68
23	866.00	198.68

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Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 16

* NEW ANALYSIS/COMPUTATION DATA *

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	467.00	332.87	angle to be computed - moveable
2	582.57	199.08	angle to be computed - moveable
3	609.56	200.08	- fixed
4	658.23	199.94	- fixed
5	730.21	197.07	- fixed
6	806.28	198.05	- fixed
7	863.00	199.68	- fixed
8	866.00	198.68	- fixed

Initial distance for shifting points on shear surface = 10.000

Final distance for shifting points on shear surface = 5.000

Maximum steepness permitted for toe of shear surface = 50.00

Minimum weight required for computations to be performed: 5000

Iteration limit: 100

Depth of crack: 15.000

Procedure of Analysis: Corps of Engineers' Modified Swedish

Specified side force inclination: 0.00

Seismic coefficient: 0.130

Seismic force acts at center of gravity.

The following represent default values or values that were previously defined:

Maximum increment for slice subdivision: 30

There is no water in a crack.

Conventional (single-stage) computations will be performed.

Unit weight of water (or other fluid) in crack: 62.4

Automatic search output will be in long form.

Maximum number of passes for noncircular search: 50

No restrictions exist on the lateral extent of the search.

No shear surfaces other than the most critical will be saved for display later.

Neither slope face was explicitly designated for analysis.

Standard sign convention used for direction of shear stress on shear surface.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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Force imbalance: 1.000000e-005 (fraction of total weight)

Moment imbalance: 1.000000e-005 (fraction of moment due to total weight)

Initial trial factor of safety: 3.000

Initial trial side force inclination: 17.189 (degrees)

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 26

* NEW, COMPUTED SLOPE GEOMETRY DATA *

These slope geometry were generated from the Profile Lines.

Point	X	Y
1	0.00	332.87
2	60.30	332.87
3	70.21	332.87
4	96.38	332.87
5	222.67	332.87
6	229.57	332.87
7	238.21	332.87
8	281.12	332.87
9	317.10	332.87
10	353.47	332.87
11	385.30	332.87
12	399.54	332.87
13	414.03	332.87
14	429.84	332.87
15	446.63	332.87
16	462.92	332.87
17	474.08	329.15
18	531.02	310.19
19	582.57	293.03
20	609.56	284.05
21	658.23	267.85
22	730.21	243.88
23	806.28	218.56
24	859.99	200.68
25	863.00	199.68
26	866.00	198.68
27	1500.00	199.10

Left end point on noncircular shear surface adjusted to:

X: 486.84, Y: 309.90

Adjustment was made to put end point at bottom of crack.

Right end point on noncircular shear surface adjusted to:

X: 863.00, Y: 199.68

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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Adjustment was made to put end point on the slope.

Right end point deleted after adjustment because it was same as adjacent point.

Noncircular Shear Surface Points After End Point Adjustment

Coordinates of points on shear surface which are to be shifted

Point	X	Y	Shift Angle
1	486.84	309.90	angle to be computed - moveable
2	582.57	199.08	angle to be computed - moveable
3	609.56	200.08	- fixed
4	658.23	199.94	- fixed
5	730.21	197.07	- fixed
6	806.28	198.05	- fixed
7	863.00	199.68	- fixed

Computed crack depth: 15.00

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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TABLE NO. 41

* Critical Noncircular Shear Surface *

***** CRITICAL NONCIRCULAR SHEAR SURFACE *****

X:	491.58	Y:	308.32
X:	583.06	Y:	199.95
X:	609.56	Y:	200.08
X:	658.23	Y:	199.94
X:	730.21	Y:	197.07
X:	806.28	Y:	198.05
X:	863.00	Y:	199.68

Minimum factor of safety: 0.820

Side force inclination: -0.00

Time required to find most critical surface: 0.0 seconds

Number of passes required to find most critical surface: 3

Total number of shear surfaces attempted: 15

Total number of shear surfaces for which the factor of safety
was successfully calculated: 15

Pass	Shift Distance	Pt.	Max. Dist. Moved	Minimum F	n Tried	n Computed
1	10.0000	1	10.000	0.8236	5	5
2	5.0000	1	5.000	0.8200	10	10
3	5.0000	1	5.000	0.8200	15	15

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 43

 * Coordinate, Weight, Strength and Pore Water Pressure *
 * Information for Individual Slices for Conventional *
 * Computations or First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

Slice No.	X	Y	Slice Weight	Matl. No.	Cohesion	Friction Angle	Pore Pressure
1	491.58	308.32					
	495.52	303.65	7242	1	100.0	35.00	0.0
	499.47	298.98					
2	503.41	294.30	9893	1	100.0	35.00	0.0
	507.36	289.63					
3	511.30	284.96	12544	1	100.0	35.00	0.0
	515.25	280.29					
4	519.19	275.61	15194	1	100.0	35.00	0.0
	523.14	270.94					
5	527.08	266.27	17845	1	100.0	35.00	0.0
	531.02	261.59					
6	534.71	257.23	19047	1	100.0	35.00	0.0
	538.39	252.87					
7	542.07	248.51	21356	1	100.0	35.00	0.0
	545.75	244.15					
8	549.43	239.78	23665	1	100.0	35.00	0.0
	553.11	235.42					
9	556.80	231.06	25975	1	100.0	35.00	0.0
	560.48	226.70					
10	564.16	222.34	28284	1	100.0	35.00	0.0
	567.84	217.98					
11	571.52	213.61	30593	1	100.0	35.00	0.0
	575.20	209.25					
12	578.89	204.89	32902	1	100.0	35.00	0.0
	582.57	200.53					
13	582.75	200.31	1708	1	100.0	35.00	0.0
	582.94	200.09					
14	583.00	200.02	557	2	NONLINEAR ENVELOPE		0.0
	583.06	199.95					
15	587.47	199.97	40565	2	NONLINEAR ENVELOPE		0.0
	591.89	199.99					
16	596.31	200.02	39423	2	NONLINEAR ENVELOPE		0.0

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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	600.72	200.04				
17	605.14	200.06	38281	2	NONLINEAR ENVELOPE	0.0
	609.56	200.08				
18	615.64	200.06	50713	2	NONLINEAR ENVELOPE	0.0
	621.73	200.05				
19	627.81	200.03	48270	2	NONLINEAR ENVELOPE	0.0
	633.89	200.01				
20	639.98	199.99	45827	2	NONLINEAR ENVELOPE	0.0
	646.06	199.98				
21	652.14	199.96	43385	2	NONLINEAR ENVELOPE	0.0
	658.23	199.94				
22	664.23	199.70	40517	2	NONLINEAR ENVELOPE	0.0
	670.22	199.46				
23	676.22	199.22	38408	2	NONLINEAR ENVELOPE	0.0
	682.22	198.98				
24	688.22	198.75	36299	2	NONLINEAR ENVELOPE	0.0
	694.22	198.51				
25	700.22	198.27	34191	2	NONLINEAR ENVELOPE	0.0
	706.21	198.03				
26	712.21	197.79	32082	2	NONLINEAR ENVELOPE	0.0
	718.21	197.55				
27	724.21	197.31	29974	2	NONLINEAR ENVELOPE	0.0
	730.21	197.07				
28	736.55	197.15	29176	2	NONLINEAR ENVELOPE	0.0
	742.89	197.23				
29	749.23	197.31	26397	2	NONLINEAR ENVELOPE	0.0
	755.57	197.40				
30	761.90	197.48	23618	2	NONLINEAR ENVELOPE	0.0
	768.24	197.56				
31	774.58	197.64	20839	2	NONLINEAR ENVELOPE	0.0
	780.92	197.72				
32	787.26	197.80	18060	2	NONLINEAR ENVELOPE	0.0
	793.60	197.88				
33	799.94	197.97	15281	2	NONLINEAR ENVELOPE	0.0
	806.28	198.05				
34	811.65	198.20	10732	2	NONLINEAR ENVELOPE	0.0
	817.02	198.36				
35	822.39	198.51	8658	2	NONLINEAR ENVELOPE	0.0
	827.77	198.66				
36	833.14	198.82	6585	2	NONLINEAR ENVELOPE	0.0
	838.51	198.97				
37	843.88	199.13	4511	2	NONLINEAR ENVELOPE	0.0
	849.25	199.28				
38	854.62	199.44	2437	2	NONLINEAR ENVELOPE	0.0
	859.99	199.59				
39	861.49	199.64	196	2	NONLINEAR ENVELOPE	0.0
	863.00	199.68				

No water in crack.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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TABLE NO. 44

 * Seismic Forces and Forces Due to Distributed Loads for *
 * Individual Slices for Conventional Computations or the *
 * First Stage of Multi-Stage Computations. *
 * (Information is for the critical shear surface in the *
 * case of an automatic search.) *

FORCES DUE TO DISTRIBUTED LOADS							
Slices			Y for				
No.	X	Seismic Force	Seismic Force	Normal Force	Shear Force	X	Y
1	495.52	941	312.83	0	0	495.52	322.01
2	503.41	1286	306.84	0	0	503.41	319.38
3	511.30	1631	300.86	0	0	511.30	316.76
4	519.19	1975	294.87	0	0	519.19	314.13
5	527.08	2320	288.89	0	0	527.08	311.51
6	534.71	2476	283.10	0	0	534.71	308.97
7	542.07	2776	277.51	0	0	542.07	306.52
8	549.43	3077	271.92	0	0	549.43	304.06
9	556.80	3377	266.34	0	0	556.80	301.61
10	564.16	3677	260.75	0	0	564.16	299.16
11	571.52	3977	255.16	0	0	571.52	296.71
12	578.89	4277	249.58	0	0	578.89	294.26
13	582.75	222	246.64	0	0	582.75	292.97
14	583.00	72	246.41	0	0	583.00	292.89
15	587.47	5273	245.49	0	0	587.47	291.40
16	596.31	5125	243.84	0	0	596.31	288.46
17	605.14	4976	242.20	0	0	605.14	285.52
18	615.64	6593	240.36	0	0	615.64	282.02
19	627.81	6275	238.32	0	0	627.81	277.97
20	639.98	5958	236.28	0	0	639.98	273.92
21	652.14	5640	234.24	0	0	652.14	269.87
22	664.23	5267	232.10	0	0	664.23	265.85
23	676.22	4993	229.87	0	0	676.22	261.86
24	688.22	4719	227.63	0	0	688.22	257.86
25	700.22	4445	225.40	0	0	700.22	253.87
26	712.21	4171	223.16	0	0	712.21	249.87
27	724.21	3897	220.93	0	0	724.21	245.88
28	736.55	3793	218.80	0	0	736.55	241.77
29	749.23	3432	216.77	0	0	749.23	237.55

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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30	761.90	3070	214.75	0	0	761.90	233.33
31	774.58	2709	212.73	0	0	774.58	229.11
32	787.26	2348	210.71	0	0	787.26	224.89
33	799.94	1987	208.69	0	0	799.94	220.67
34	811.65	1395	206.87	0	0	811.65	216.77
35	822.39	1126	205.24	0	0	822.39	213.19
36	833.14	856	203.64	0	0	833.14	209.62
37	843.88	586	202.07	0	0	843.88	206.04
38	854.62	317	200.63	0	0	854.62	202.47
39	861.49	25	199.91	0	0	861.49	200.18

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Trial No. 1 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	2.629e+005	-5.995
Reduced value - Delta was too large			-0.500
2	2.50000	2.373e+005	-3.978
Reduced value - Delta was too large			-0.500
3	2.00000	2.015e+005	-2.337
Reduced value - Delta was too large			-0.500
4	1.50000	1.473e+005	-1.077
Reduced value - Delta was too large			-0.500
5	1.00000	5.379e+004	-0.209
6	0.79082	-1.053e+004	0.029
7	0.81937	-2.835e+002	0.001
8	0.82018	-2.156e-001	0.000

After trial 1 the following changes were computed for the nonlinear strength envelopes:

Maximum change in shear strength: -22.948 (percent)

Maximum change occurred for slice 14

Normal stress where max. change occurred: 3507.99

Old strength at this slice: 789.65

New strength at this slice: 608.44

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Trial No. 2 with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	2.629e+005	-5.996
Reduced value - Delta was too large			-0.500
2	2.50000	2.374e+005	-3.979
Reduced value - Delta was too large			-0.500
3	2.00000	2.015e+005	-2.338
Reduced value - Delta was too large			-0.500
4	1.50000	1.473e+005	-1.077
Reduced value - Delta was too large			-0.500
5	1.00000	5.384e+004	-0.209
6	0.79060	-1.055e+004	0.029
7	0.81920	-2.848e+002	0.001
8	0.82002	-2.176e-001	0.000

After trial 2 the following changes were computed for the nonlinear strength envelopes:

Maximum change in shear strength: -0.000 (percent)

Maximum change occurred for slice 24

Normal stress where max. change occurred: 2998.87

Old strength at this slice: 555.01

New strength at this slice: 555.01

Strengths from nonlinear envelope have converged.

Final computations will be performed next.

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 47

* Information for the Iterative Solution for the Factor of Safety *
* by Force Equilibrium Procedure *

Final Trial with Nonlinear Strength Envelope

Allowable force imbalance for convergence: 9

Iteration	Trial Factor of Safety	Force Imbalance (lbs.)	Delta-F
1	3.00000	2.629e+005	-5.996
Reduced value - Delta was too large			-0.500
2	2.50000	2.374e+005	-3.979
Reduced value - Delta was too large			-0.500
3	2.00000	2.015e+005	-2.338
Reduced value - Delta was too large			-0.500
4	1.50000	1.473e+005	-1.077
Reduced value - Delta was too large			-0.500
5	1.00000	5.384e+004	-0.209
6	0.79060	-1.055e+004	0.029
7	0.81920	-2.848e+002	0.001
8	0.82002	-2.176e-001	0.000

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 57

* Check of Computations by Force Equilibrium Procedure (Results are for *
* the critical shear surface in the case of an automatic search.) *

Summation of Horizontal Forces: 7.55342e-011

Summation of Vertical Forces: 9.48432e-011

Mohr Coulomb Shear Force/Shear Strength Check Summation: 2.47382e-001

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 58

* Final Results for Stresses Along the Shear Surface *
* (Results are for the critical shear surface in the case of a search.) *

CORPS OF ENGINEERS' FORCE EQUILIBRIUM (ONLY)

PROCEDURE USED TO COMPUTE THE FACTOR OF SAFETY.

Factor of Safety: 0.820 Side Force Inclination: -0.00

----- VALUES AT CENTER OF BASE OF SLICE -----					
Slice No.	X-Center	Y-Center	Total Normal Stress	Effective Normal Stress	Shear Stress
1	495.52	303.65	384.5	384.5	450.3
2	503.41	294.30	551.6	551.6	592.9
3	511.30	284.96	718.6	718.6	735.5
4	519.19	275.61	885.6	885.6	878.2
5	527.08	266.27	1052.7	1052.7	1020.8
6	534.71	257.23	1214.1	1214.1	1158.7
7	542.07	248.51	1370.0	1370.0	1291.8
8	549.43	239.78	1525.9	1525.9	1424.9
9	556.80	231.06	1681.8	1681.8	1558.0
10	564.16	222.34	1837.7	1837.7	1691.1
11	571.52	213.61	1993.6	1993.6	1824.3
12	578.89	204.89	2149.5	2149.5	1957.4
13	582.75	200.31	2231.3	2231.3	2027.3
14	583.00	200.02	3735.1	3735.1	771.0
15	587.47	199.97	4595.9	4595.9	881.2
16	596.31	200.02	4466.6	4466.6	864.6
17	605.14	200.06	4337.2	4337.2	848.1
18	615.64	200.06	4165.6	4165.6	826.1
19	627.81	200.03	3964.9	3964.9	800.5
20	639.98	199.99	3764.2	3764.2	774.8
21	652.14	199.96	3563.5	3563.5	749.1
22	664.23	199.70	3348.6	3348.6	721.6
23	676.22	199.22	3173.7	3173.7	699.2
24	688.22	198.75	2998.9	2998.9	676.8
25	700.22	198.27	2824.0	2824.0	654.5
26	712.21	197.79	2649.1	2649.1	632.1
27	724.21	197.31	2474.2	2474.2	609.7
28	736.55	197.15	2308.6	2308.6	588.5

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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29	749.23	197.31	2089.1	2089.1	560.4
30	761.90	197.48	1869.3	1869.3	513.1
31	774.58	197.64	1649.4	1649.4	452.8
32	787.26	197.80	1429.4	1429.4	392.4
33	799.94	197.97	1209.5	1209.5	332.0
34	811.65	198.20	1007.0	1007.0	276.4
35	822.39	198.51	812.5	812.5	223.0
36	833.14	198.82	617.9	617.9	169.6
37	843.88	199.13	423.3	423.3	116.2
38	854.62	199.44	228.7	228.7	62.8
39	861.49	199.64	65.7	65.7	18.0

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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MSB CELL 3

TABLE NO. 60

* Final Results for Side Forces Between Slices *
* (Results are for the critical shear surface in the case of a search.) *

----- VALUES AT RIGHT SIDE OF SLICE -----

Slice No.	Resultant				
	X-Right	Side Force	Side Force Inclination	Horizontal Side Force	Vertical Side Force
1	499.47	983	-0.00	983	-0
2	507.36	2747	-0.00	2747	-0
3	515.25	5291	-0.00	5291	-0
4	523.14	8615	-0.00	8615	-0
5	531.02	12720	-0.00	12720	-0
6	538.39	17256	-0.00	17256	-0
7	545.75	22472	-0.00	22472	-0
8	553.11	28367	-0.00	28367	-0
9	560.48	34943	-0.00	34943	-0
10	567.84	42198	-0.00	42198	-0
11	575.20	50134	-0.00	50134	-0
12	582.57	58749	-0.00	58749	-0
13	582.94	59198	-0.00	59198	-0
14	583.06	59708	-0.00	59708	-0
15	591.89	56998	-0.00	56998	-0
16	600.72	54292	-0.00	54292	-0
17	609.56	51588	-0.00	51588	-0
18	621.73	48275	-0.00	48275	-0
19	633.89	44949	-0.00	44949	-0
20	646.06	41611	-0.00	41611	-0
21	658.23	38261	-0.00	38261	-0
22	670.22	36473	-0.00	36473	-0
23	682.22	34596	-0.00	34596	-0
24	694.22	32630	-0.00	32630	-0
25	706.21	30575	-0.00	30575	-0
26	718.21	28430	-0.00	28430	-0
27	730.21	26196	-0.00	26196	-0
28	742.89	22151	-0.00	22151	-0
29	755.57	18138	-0.00	18138	-0
30	768.24	14398	-0.00	14398	-0
31	780.92	11098	-0.00	11098	-0

Matanuska-Susinta, AK Landfill

Cross-Section: D-D'

Case: Seismic – Non-Circular Failure

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32	793.60	8238	-0.00	8238	-0
33	806.28	5819	-0.00	5819	-0
34	817.02	3933	-0.00	3933	-0
35	827.77	2412	-0.00	2412	-0
36	838.51	1255	-0.00	1255	-0
37	849.25	462	-0.00	462	-0
38	859.99	34	-0.00	34	-0
39	863.00	-0	-0.00	-0	0

Read end-of-file on input while looking for another command word.

End of input data assumed - normal termination.



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Attachment F – Makdisi and Seed Displacement

PURPOSE: DETERMINE THE DISPLACEMENT FOR NON-CIRCULAR SEISMIC C-C' USING THE PROCEDURE DEFINED BY MAKDISI + SEED.

GIVEN MAX CREST ACCELERATION ($\ddot{u}_{max}$) = ?

MAX AVERAGE ACCELERATION FOR (k_{max}) = ?

DISTANCE FROM CREST TO FAILURE SURFACE (y) = H

HEIGHT OF EMBANKMENT (H) = y

$$y/H = 1.0$$

MAX BASE ACCELERATION = $0.13g$

SOLVE

$$y/H = 1.0$$

ACCORDING TO FIGURE 9, MAKDISI + SEED:

$$k_{max}/\ddot{u}_{max} = 0.38 \leftarrow k_{max}/\ddot{u}_{max}$$

ACCORDING TO FIGURE 10, USACE 2000:

$$\ddot{u}_{max} = 0.4 \leftarrow \ddot{u}_{max}$$

$$k_{max}/\ddot{u}_{max} = 0.38$$

$$k_{max} = (0.38)(0.4)$$

$$k_{max} = 0.152 \leftarrow k_{max}$$

ACCORDING TO AN ANALYSIS PERFORMED IN UTEXAS4,
THE MAXIMUM ACCELERATION TO PRODUCE A F.S. = 1 (k_y)
IS ~~0.18g~~ 0.016

$$k_y = 0.18$$

$$k_y/k_{max} = \frac{0.016}{0.152} = \frac{0.105}{1.2} \leftarrow k_y/k_{max}$$

ACCORDING TO FIGURE 14, MAKDISI + SEED
THE DISPLACEMENT (u) IS about 100 cm

$$u = 3.3 \text{ ft} \leftarrow u$$

PURPOSE: DETERMINE THE DISPLACEMENT FOR NON-CIRCULAR D-N, SEISMIC CASE, USING PROCEDURES DEFINED BY MAKDISI + SEED.

GIVEN MAX CREST ACCELERATION ($\ddot{u}_{max}$) = ?

MAX AVERAGE ACCELERATION FOR (K_{max}) = ?

DISTANCE FROM CREST TO FAILURE SURFACE (y) = H

HEIGHT OF EMBANKMENT (H) = y

$$y/H = 1.0$$

MAX BASE ACCELERATION = $0.13g$

SOLVE

$$y/H = 1.0$$

ACCORDING TO FIGURE 9, MAKDISI + SEED:

$$K_{max}/\ddot{u}_{max} = 0.38 \leftarrow K_{max}/\ddot{u}_{max}$$

ACCORDING TO FIGURE 10, USACE 2000:

$$\ddot{u}_{max} = 0.45 \leftarrow \ddot{u}_{max}$$

$$K_{max}/\ddot{u}_{max} = 0.38$$

$$K_{max} = (0.38)(0.45)$$

$$K_{max} = 0.152 \leftarrow K_{max}$$

ACCORDING TO AN ANALYSIS PERFORMED IN UTEXAS4,
THE MAXIMUM ACCELERATION TO PRODUCE A F.S. = 1 (K_y)
IS ~~0.165~~ 0.072

$$K_y = 0.165$$

$$K_y/K_{max} = \frac{0.072}{0.152} = 0.474 \leftarrow K_y/K_{max}$$

ACCORDING TO FIGURE 14, MAKDISI + SEED
THE DISPLACEMENT (u) IS about 40 cm

$$u = 1.3 \text{ ft} \leftarrow u$$

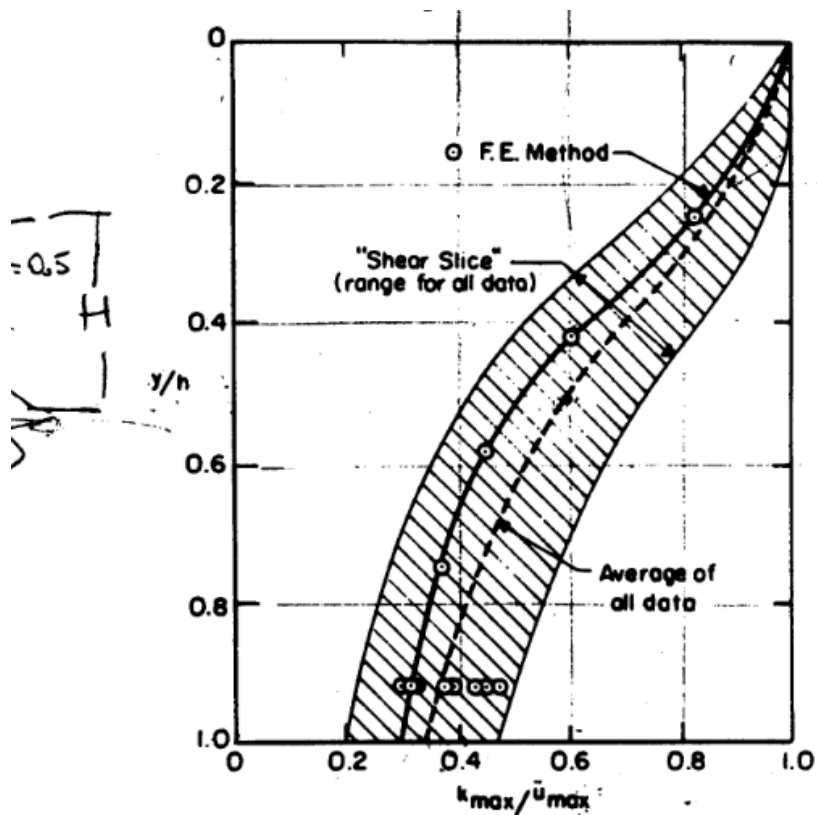


FIG. 9 VARIATION OF "MAXIMUM ACCELERATION RATIO" WITH DEPTH OF SLIDING MASS

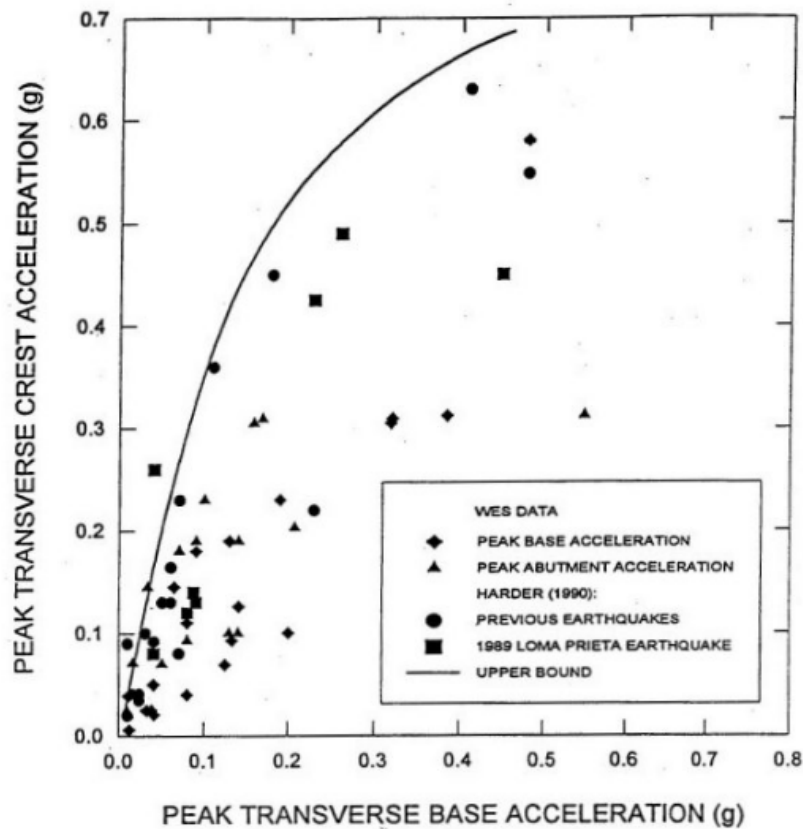


Fig. 10. Comparison of peak base and crest transverse accelerations measured at earth dams (from US Army Corps of Engineers, 2000).

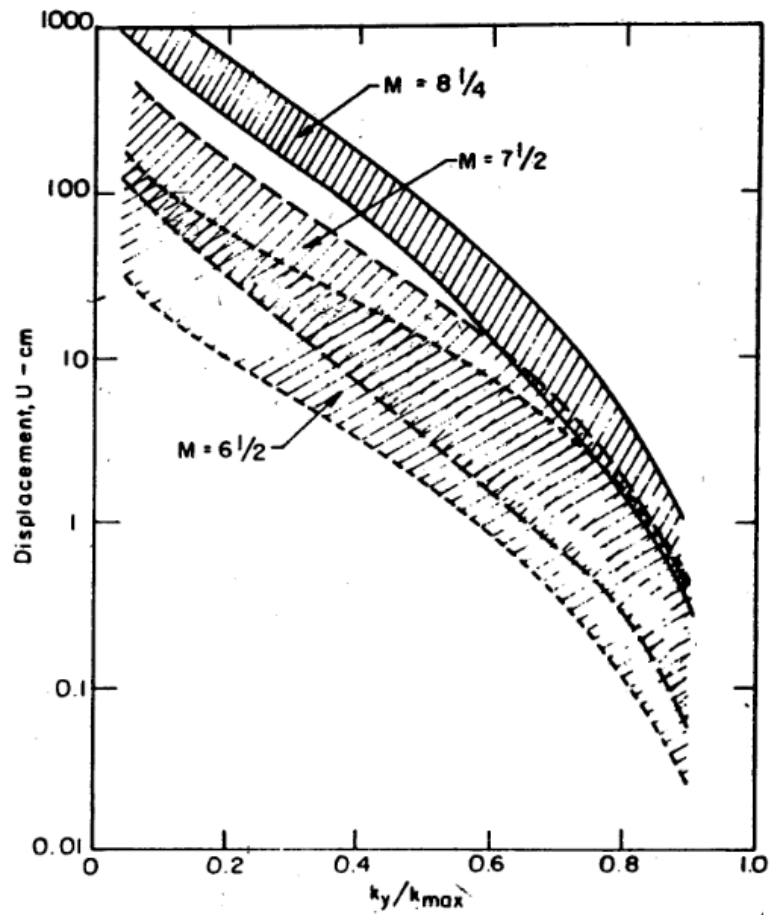


FIG. 14 VARIATION OF PERMANENT DISPLACEMENT WITH YIELD ACCELERATION - SUMMARY OF ALL DATA



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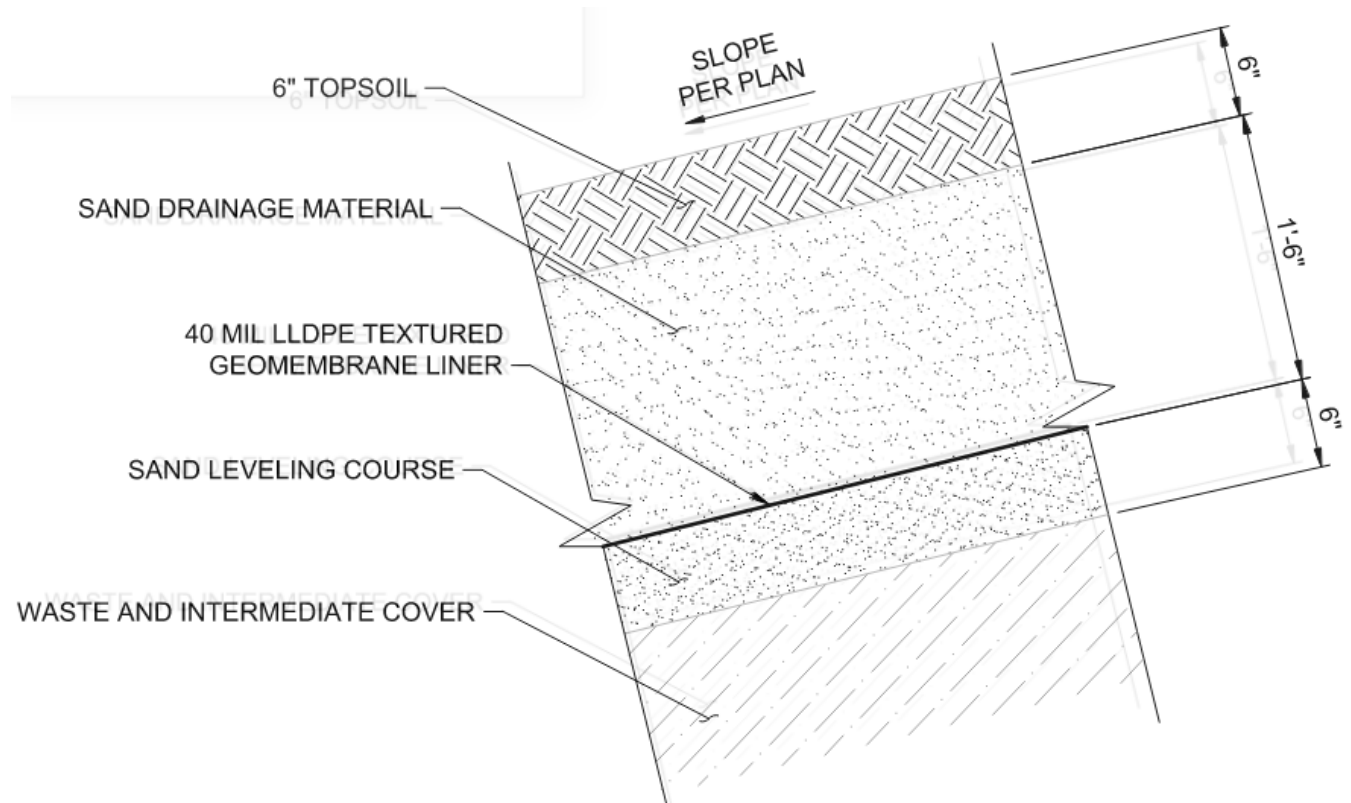
Attachment G – Cover Stability

Introduction

Previous calculations involving the mass stability of the planned MSB MSW landfill were performed as part of the permitting process.

Cover System

The cover system is made up of the following system:



Based on this system including geosynthetics, the stability will be controlled by the strength along the interfaces of the controlling geosynthetic. The following interfaces will be evaluated:

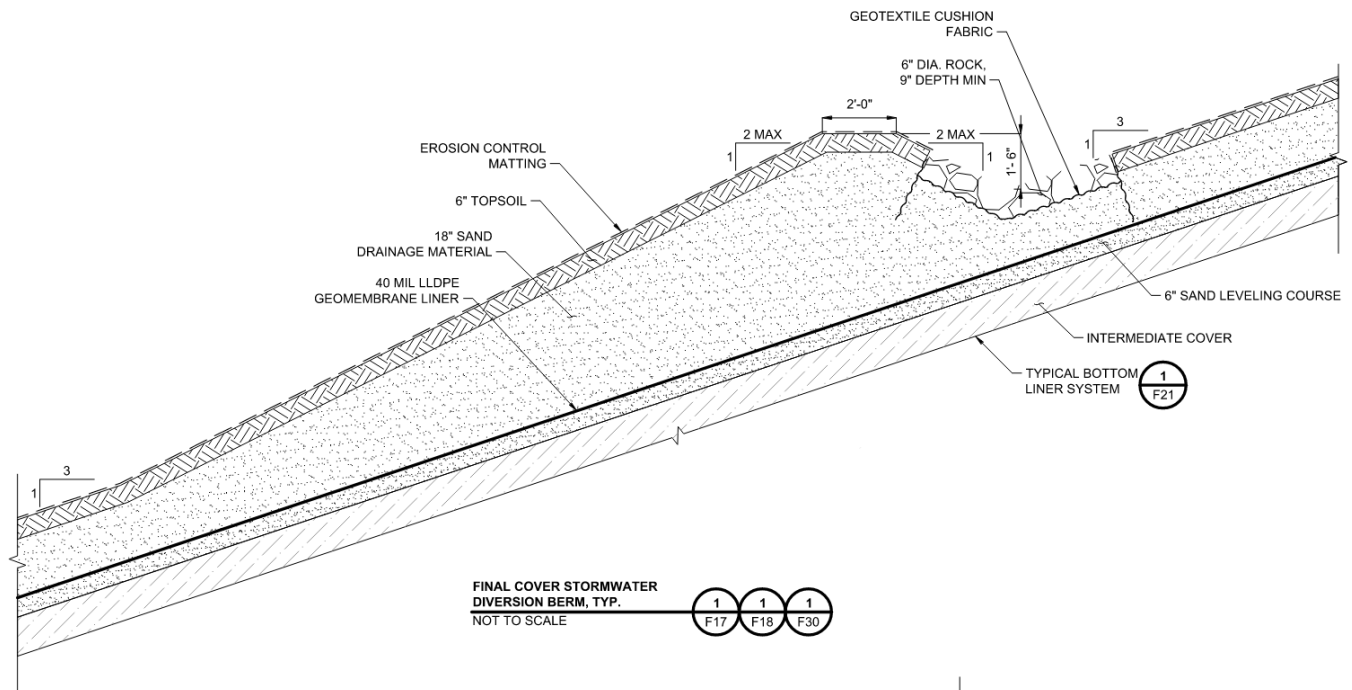
- Sand Drainage Material – LLDPE Textured Geomembrane (Interface #1)
- LLDPE Textured Geomembrane – Sand Drainage Material (Interface #2)

For the interface shear strengths of these geosynthetics interfaces, GRI Report #30 was reviewed. Based on this reference, the following interface shear strengths were used:

- Interface: $\Phi = 26$ degrees, cohesion = 160 psf [peak]; $\phi = 25$ degrees, cohesion = 160 psf [residual]

The final cover has a 3H:1V slope.

As noted, storm ditches are needed along the length of the cover system. These ditches will be spaced variously along the cover system, with a total of approximately 1-2. The ditch is made up of a triangular fill placed along the cover system that creates a 2 feet deep ditch. The interior and exterior slopes of the fill are 2H:1V. See below for storm ditch section:



Based on the use of geocomposite within the cover system and stormwater ditches as noted, it is assumed that no build-up of pore pressures within the cover system will occur.

Drawings are included in Attachment A. Interface shear strengths from GRI Report #30 are included in Attachment B.

Cover Stability

Previous calculations included evaluating the stability of the cover system by utilizing infinite slope calculations for a uniform thickness of soil. Based on the addition of the storm ditches and the driving force associated with them, further evaluations of the cover system are required.

Limit Equilibrium Method

An approach is put forth by Koerner and Daniel in *Final Covers for Solid Waste Landfills and Abandoned Dumps* that calculates the cover stability based on limit equilibrium, see below:

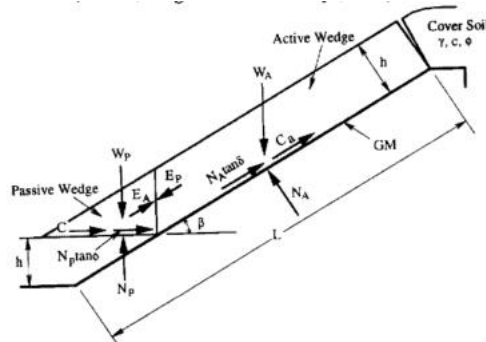


Figure 3. Limit equilibrium forces involved in a finite length slope analysis for a uniformly thick cover soil.

The symbols used in Figure 3 are defined below.

- W_A = total weight of the active wedge
- W_P = total weight of the passive wedge
- N_A = effective force normal to the failure plane of the active wedge
- N_P = effective force normal to the failure plane of the passive wedge
- γ = unit weight of the cover soil
- h = thickness of the cover soil
- L = length of slope measured along the geomembrane
- β = soil slope angle beneath the geomembrane
- ϕ = friction angle of the cover soil
- δ = interface friction angle between cover soil and geomembrane
- C_A = adhesive force between cover soil of the active wedge and the geomembrane
- c_a = adhesion between cover soil of the active wedge and the geomembrane
- C = cohesive force along the failure plane of the passive wedge
- c = cohesion of the cover soil
- E_A = interwedge force acting on the active wedge from the passive wedge
- E_P = interwedge force acting on the passive wedge from the active wedge
- FS = factor of safety against cover soil sliding on the geomembrane

Based on this method, stability along the interface of the cover system can be calculated based on the specific characteristics of the cover system.

This evaluation is meant to understand the effect of the stormwater ditches on the cover system stability. Further limit equilibrium calculation methods were considered. A further use of this approach is calculating the stability while accounting for equipment loads on the cover, see below:

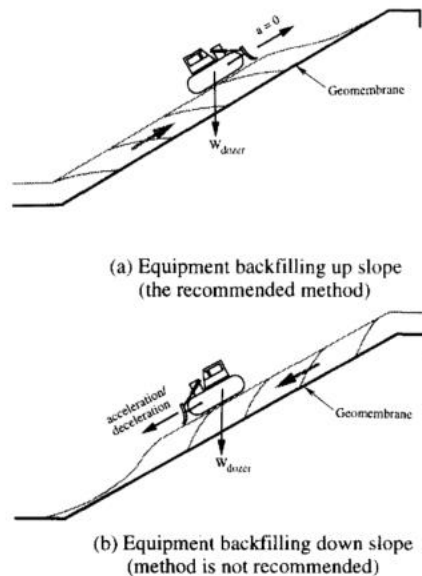


Figure 5. Construction equipment placing cover soil on slopes containing geosynthetics.

For the uphill equipment situation, the weight of the construction equipment can be included in the

calculations to understand the exact effect on the overall cover stability. The construction equipment is modeled as an additional vertical weight on the system. This same method can also be applied to stormwater ditches by modeling them as an additional vertical weight on the cover system.

The storm ditch fill volume is approximately 40 cubic feet per foot. Utilizing a unit weight of 120 pcf, the total weight of each storm ditch is approximately 4,800 pounds per foot.

A pseudo-static condition was also evaluated. The pseudo-static approach is like the approach noted previously. The addition of a seismic coefficient (C_s) is the only difference, as illustrated below. The seismic coefficient was determined using the United States Geological Survey (USGS) Uniform Hazard Tool for an event with a 2-percent probability over a 50 year time period. The corresponding seismic coefficient is 0.75 (g).

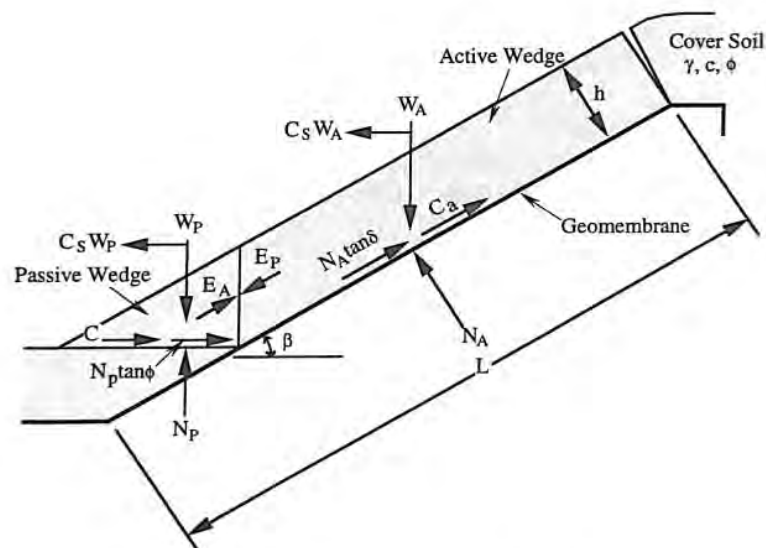


FIG. 5.20. Limit Equilibrium Forces Involved in Pseudo-Static Analysis Using Average Seismic Coefficient

Multiple slope length could be evaluated for cover stability. However, the most critical scenario of the section of slope directly beneath the stormwater ditch was the only evaluated. Static and pseudo-static conditions resulted in factors of safety of 2.9 and 0.8 respectively.

Based on the calculations, the cover system is considered stable with the addition of the stormwater ditches.

Spreadsheets showing limit equilibrium and hand calculations for one of the spreadsheets calculations are included in Attachment C.



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Attachment A – Related Drawings



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Attachment B – GRI Report #30 Excerpt



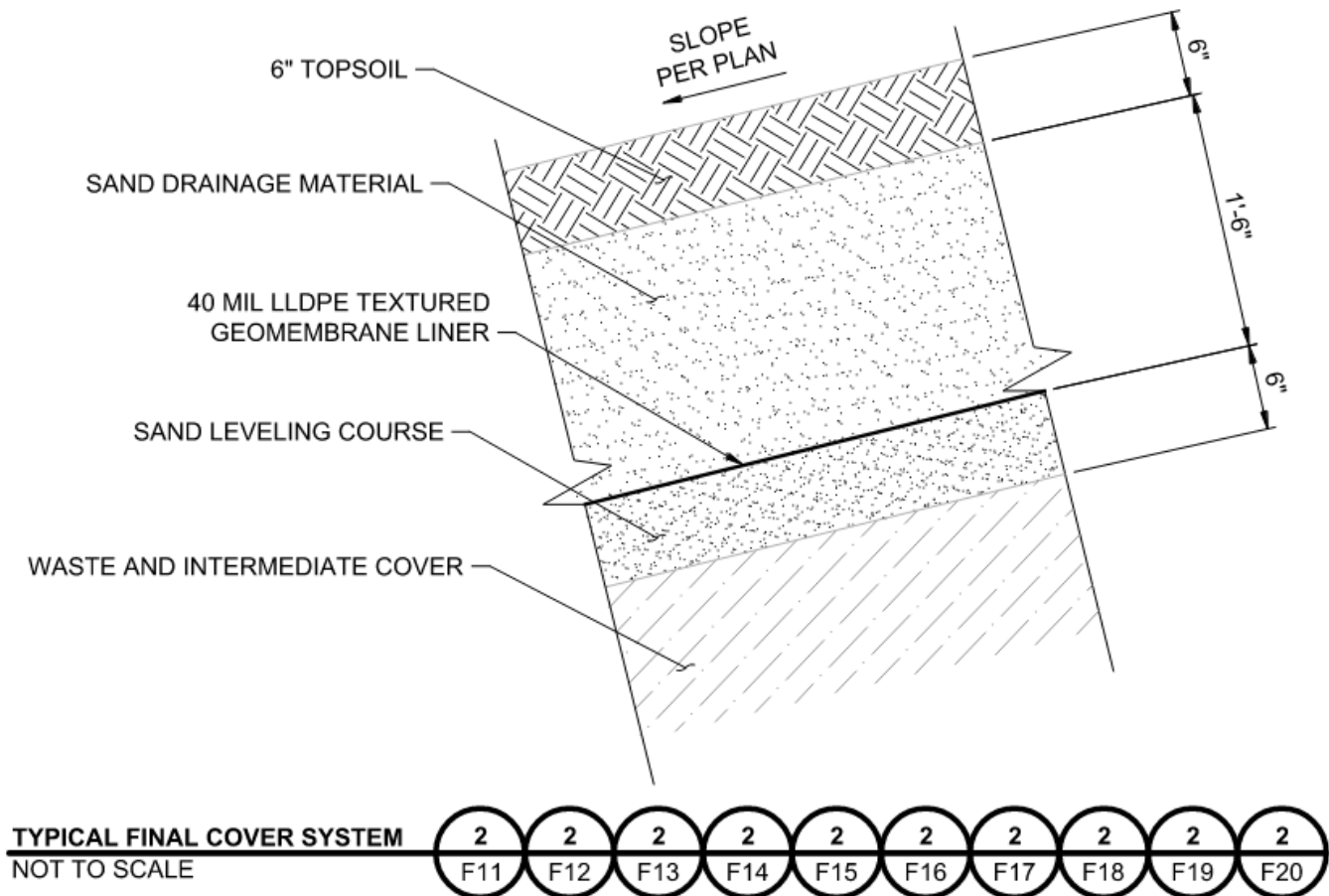
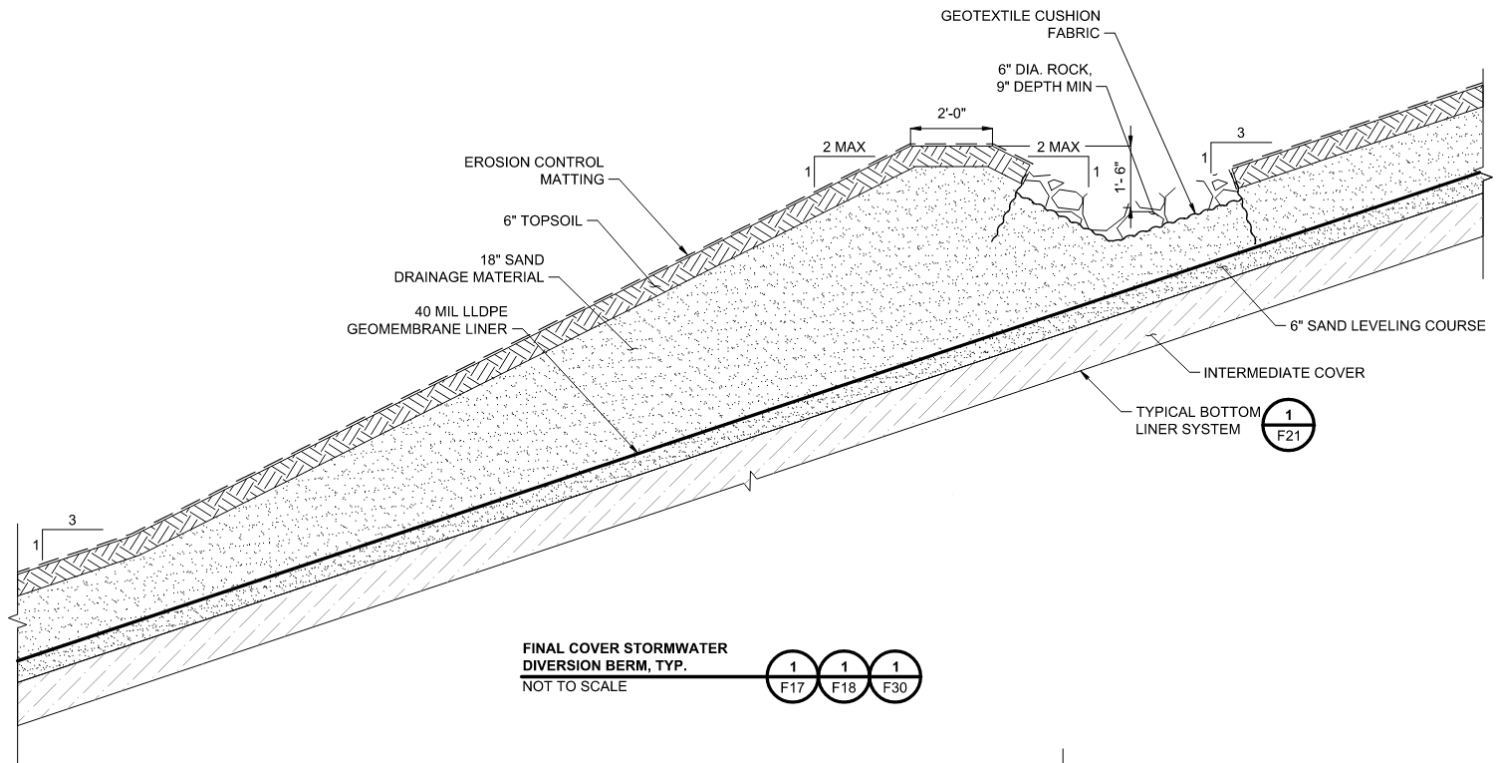
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Attachment C – Calculation Spreadsheets



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Attachment D – Example Hand Calculations



Appendix Table 1. Summary of interface shear strengths.

Interface 1*	Interface 2*	Peak Strength					Residual Strength				
		Fig. No.	δ (deg)	Ca (kPa)	Points	R ²	Fig. No.	δ (deg)	Ca (kPa)	Points	R ²
HDPE-S	Granular Soil	1a	21	0	162	0.93	1b	17	0	128	0.92
HDPE-S	Cohesive Soil										
	Saturated	1c	11	7	79	0.94	1d	11	0	59	0.95
	Unsaturated	1c	22	0	44	0.93	1d	18	0	32	0.93
HDPE-S	NW-NP GT	1e	11	0	149	0.93	1f	9	0	82	0.96
HDPE-S	Geonet	1g	11	0	196	0.90	1h	9	0	118	0.93
HDPE-S	Geocomposite	1i	15	0	36	0.97	1j	12	0	30	0.93
HDPE-T	Granular Soil	2a	34	0	251	0.98	2b	31	0	239	0.96
HDPE-T	Cohesive Soil										
	Saturated	2c	18	10	167	0.93	2d	16	0	150	0.90
	Unsaturated	2c	19	23	62	0.91	2d	22	0	35	0.93
HDPE-T	NW-NP GT	2e	25	8	254	0.96	2f	17	0	217	0.95
HDPE-T	Geonet	2g	13	0	31	0.99	2h	10	0	27	0.99
HDPE-T	Geocomposite	2i	26	0	168	0.95	2j	15	0	164	0.94
LLDPE-S	Granular Soil	3a	27	0	6	1.00	3b	24	0	9	1.00
LLDPE-S	Cohesive Soil	3c	11	12.4	12	0.94	3d	12	3.7	9	0.93
LLDPE-S	NW-NP GT	3e	10	0	23	0.63	3f	9	0	23	0.49
LLDPE-S	Geonet	3g	11	0	9	0.99	3h	10	0	9	1.00
LLDPE-T	Granular Soil	4a	26	7.7	12	0.95	4b	25	5.2	12	0.95
LLDPE-T	Cohesive Soil	4c	21	5.8	12	1.00	4d	13	7.0	9	0.98
LLDPE-T	NW-NP GT	4e	26	8.1	9	1.00	4f	17	9.5	9	0.96
LLDPE-T	Geonet	4g	15	3.6	6	0.97	4h	11	0	6	0.98
PVC-S	Granular Soil	5a	26	0.4	6	0.99	5b	19	0	6	0.99
PVC-S	Cohesive Soil	5c	22	0.9	11	0.88	5d	15	0	9	0.95
PVC-S	NW-NP GT	5e	20	0	89	0.91	5f	16	0	83	0.74
PVC-S	NW-HB GT	5g	18	0	3	1.00	5h	12	0.1	3	1.00
PVC-S	Woven GT	5i	17	0	6	0.54	5j	7	0	6	0.93
PVC-S	Geonet	5k	18	0.1	3	1.00	5l	16	0.6	3	1.00

Gamma	120
h	2
L	40
Beta	18.43
ca	160
Phi (inter)	26
c	0
Phi (soil)	32
W ditches	4800
Wa	12801.7
Na	12145.1
Ca	5387.8
Wp	800.2
C	0.0
a	1213.9
b	-3803.5
c	706.4
FS	2.9

Cover soil unit weight (pcf)

Cover soil thickness (ft)

Length of slope (ft)

Slope of cover (degrees)

Interface cohesion (psf)

Interface friction angle (deg)

Cover soil cohesion (psf)

Cover soil friction angle (deg)

Weight of stormwater ditch (lbs)

Gamma	120	
Gamma Sat	135	
Gamma dry		
h	2	
L	40	
Beta	18.43	0.321664
ca	160	
Phi (inter)	26	0.454
c	0	
Phi (soil)	32	0.559
W ditches	4800	
Wa	12801.7	
Na	12145.1	
Ca	5387.8	
Wp	800.2	
C	0.0	
Cs	0.75	
a	13321	
b	-13310.5	
c	2120.0	
FS	0.8	

Cover soil unit weight (pcf)
 Cover soil saturated unit weight (pcf)
 Cover soil dry unit weight (pcf)
 Cover soil thickness (ft)
 Length of slope (ft)
 Slope of cover (degrees)
 Interface cohesion (psf)
 Interface friction angle (deg)
 Cover soil cohesion (psf)
 Cover soil friction angle (deg)

Weight of stormwater ditch (lbs)

Seismic coefficient (USGS Online Tool)

PART 1 - STATIC CONDITION

INPUTS

COVER SOIL UNIT WEIGHT (γ) = 120 PCF

COVER SOIL THICKNESS (h) = 2 FT

LENGTH OF SLOPE (L) = 40 FT

SLOPE OF COVER (β) = 18.43°

INTERFACE COHESION (c_a) = 160 PCF

INTERFACE FRICTION ANGLE (δ) = 26°

COVER SOIL COHESION (c) = 0

COVER SOIL FRICTION ANGLE (ϕ) = 32°

ACTIVE WEDGE

WEIGHT OF STORM WATER DITCH

THE VOLUME OF THE STORM WATER BERM WAS DETERMINED ON PAGE 6

THE UNIT WEIGHT OF THE STORM FILL IS ASSUMED = 120 PCF

VOLUME OF BERM (V_B) $\approx$ 40 FT³/FT

UNIT WEIGHT OF BERM FILL (γ_B) = 120 PCF

WEIGHT OF BERM (W_B) = (V_B)(γ_B) = (40 FT³/FT)(120 PCF) = 4800 $\frac{lb}{ft}$

$$W_A = \gamma h^2 \left(\frac{L}{h} - \frac{1}{\sin(\beta)} - \frac{\tan(\beta)}{2} \right)$$

$$= (120 \text{ PCF})(2 \text{ FT})^2 \left[\frac{(40 \text{ FT})}{(2 \text{ FT})} - \frac{1}{\sin(18.43^\circ)} - \frac{\tan(18.43^\circ)}{2} \right]$$

$$= (480 \text{ lb/ft}) [20 - 3.16 - 0.166] + (4800 \text{ lb/ft})$$

$$= \underline{12803 \text{ lbs/ft}} \longleftarrow W_A$$



$$N_A = W_A \cos(\beta) = (12863 \text{ lbs/ft}) \cos(18.43^\circ)$$

$$= 12,146 \text{ lbs} \quad \leftarrow N_A$$

$$C_a = c \left(L - \frac{h}{\sin(\beta)} \right) = (160 \text{ PCF}) \left(40' - \frac{2'}{\sin(18.43^\circ)} \right)$$

$$= 5,388 \text{ lbs} \quad \leftarrow C_a$$

PASSIVE WEDGE

$$W_p = \frac{\gamma h^2}{\sin(2\beta)} = \frac{(120 \text{ PCF})(2')^2}{\sin(2 \cdot 18.43^\circ)}$$

$$= 800 \text{ lbs} \quad \leftarrow W_p$$

$$C = \frac{(c)(h)}{\sin(\beta)} = \frac{0(h)}{\sin(\beta)}$$

$$= 0 \quad \leftarrow C$$

$$a = (W_A - N_A \cos(\beta)) \cos(\beta)$$

$$= (12,803 \text{ lbs} - 12,146 \text{ lbs} (\cos(18.43^\circ))) \cos(18.43^\circ)$$

$$= 1,214 \quad \leftarrow a$$

$$b = - \left[(W_A - N_A \cos(\beta)) \sin(\beta) \tan(\delta) + (N_A \tan(\delta) + C_a) \right. \\ \left. \sin(\beta) \cos(\beta) + \sin(\beta) (C + W_p \tan(\delta)) \right]$$

$$b = - \left[(12,803 \text{ lbs} - 12,146 \text{ lbs} \cdot \cos(18.43^\circ)) \sin(18.43^\circ) \tan(32^\circ) + (-252.9) \right. \\ \left. (12,146 \text{ lbs} \cdot \tan(26^\circ) + 5,388 \text{ lbs}) \cdot \sin(18.43^\circ) \cos(18.43^\circ) + (-3392.8) \right. \\ \left. \sin(18.43^\circ) (0 + 800 \text{ lbs} \cdot \tan(32^\circ)) \right] \quad (= 158.0)$$

$$b = -3,804 \quad \leftarrow b$$



Client MATAJUSK-SUSIANA BOROUGH Page 3 of 6
Project 141712 Date 10/26/22 Made By A. Wilson
MSB LANDFILL Checked By _____
COVER STABILITY SPREADSHEET Preliminary _____ Final _____

$$\begin{aligned} C &= (N_A \tan(\delta) + C_a) \sin^2(\beta) \tan(\phi) \\ &= (12,146 \text{ lbs} \tan(26^\circ) + 5,388 \text{ lbs}) \sin^2(18.43^\circ) \tan(32^\circ) \\ &= \underline{706} \quad \leftarrow \text{C} \end{aligned}$$

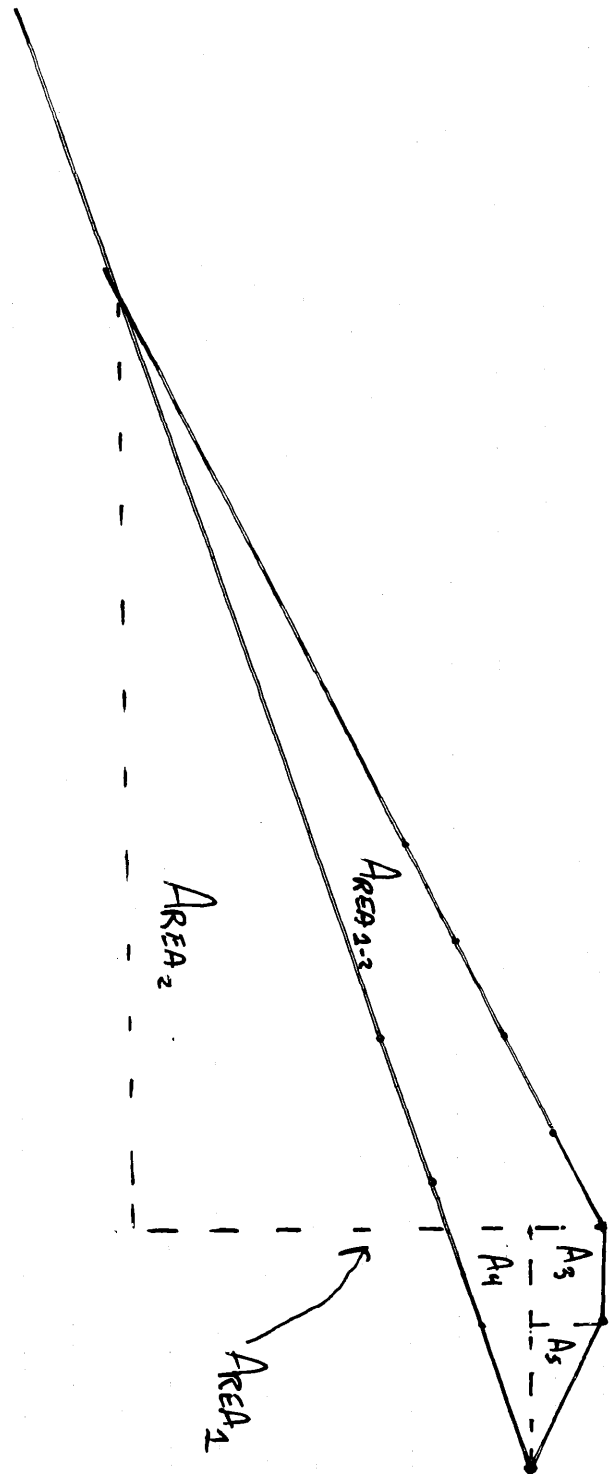
$$F.S. = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$F.S. = \frac{-(-3,804) + \sqrt{(-3,804)^2 - 4(1,214)(706)}}{2(1,214)}$$

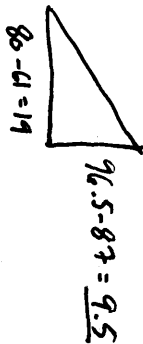
$$= \underline{2.9} \quad \leftarrow \text{F.S. STATIC}$$



Client MATANUSKA-SUSITNA BOROUGH Page 6 of 6
 Project 141712 Date 10/26/22 Made By A. Wilson
MSB LANDFILL Checked By _____
COVER STABILITY SPREADSHEET HANDC. Preliminary _____ Final _____



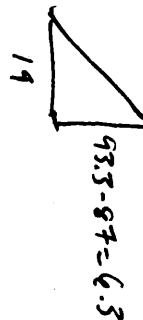
AREA 1



$$A_1 = 126.6$$

$$A_1 = 90.25$$

AREA 2



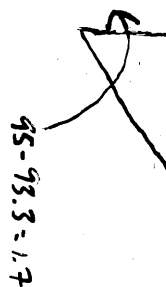
$$A_2 = 59.85$$

AREA 3



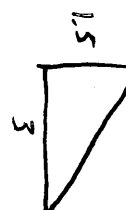
$$A_3 = 3$$

AREA 4



$$A_4 = 4.25$$

AREA 5



$$A_5 = 2.25$$

$$A_{1-2} = 90.25 - 59.85 = 30.4$$

$$\text{Area of BERM} = A_{1-2} + A_3 + A_4 + A_5$$

$$= 39.9 \text{ FT}^2$$



PART 2 - PSEUDO STATIC CONDITION

INPUTS

$$\text{AVERAGE SEISMIC COEFFICIENT } (C_s) = 0.4572 \quad 0.75g$$

$$F.S. = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

$$\begin{aligned} a &= (C_s W_A + N_A \sin(\beta)) \cos(\beta) + C_s W_p \cos(\beta) \\ &= \left[\overset{0.75g}{(0.4572)(12,803 \text{ lbs})} + (12,146 \text{ lbs}) \sin(18.45^\circ) \right] \cos(18.45^\circ) + \\ &\quad (0.27)(800 \text{ lbs}) \cos(18.45^\circ) \\ &= \overset{13,116.1}{6,922.5} + 204.9 \\ &= \overset{13321}{7543} \leftarrow a \end{aligned}$$

$$\begin{aligned} b &= - \left[\left[C_s W_A + N_A \sin(\beta) \right] \sin(\beta) \tan(\phi) + \right. \\ &\quad \left[N_A \tan(\beta) + C_u \right] \cos^2(\beta) + \\ &\quad \left[C + W_p \tan(\phi) \right] \cos(\beta) \left. \right] \\ &= - \left[\overset{0.75g}{\left[(0.4572)(12,803 \text{ lbs}) + (12,146 \text{ lbs}) \sin(18.45^\circ) \right] \sin(18.45^\circ) \tan(32^\circ)} \right. \\ &\quad \left[(12,146 \text{ lbs}) \tan(26^\circ) + 5,388 \text{ lbs} \right] \cos^2(18.45^\circ) + \\ &\quad \left[0 + (800 \text{ lbs}) \tan(32^\circ) \right] \cos(18.45^\circ) \left. \right] \\ &= - \overset{2,655.5}{[1491 + 10,181 + 474]} \\ &= \overset{-13310.5}{-12570} \leftarrow b \end{aligned}$$



$$\begin{aligned}
 C &= (N_A \tan(\delta) + C_u) \cos(\beta) \sin(\beta) \tan(\phi) \\
 &= [(12,146 \text{ lbs}) \tan(26^\circ) + 5,388] \cos(18.45^\circ) \sin(18.45^\circ) \tan(32^\circ) \\
 &= (11,312)(0.187) \\
 &= \underline{2120} \quad \leftarrow C
 \end{aligned}$$

$$\begin{aligned}
 F.S. &= \frac{-b + \sqrt{b^2 - 4ac}}{2a} \\
 F.S. &= \frac{-(-12570) + \sqrt{(-12570)^2 - 4(9543)(2120)}}{2(9543)} \\
 &= \frac{12570 + 8780}{2(9543)} \\
 &= \underline{0.81} \quad \leftarrow F.S. \text{ SEISMIC}
 \end{aligned}$$



PURPOSE: DETERMINE THE DISPLACEMENT FOR THE COVER LIVER IN A SEISMIC EVENT USING PROCEDURES DEFINED BY MAKDISI + SEED.

GIVEN MAX CREST ACCELERATION ($\ddot{u}_{max}$) = ?
MAX AVERAGE ACCELERATION FOR (k_{max}) = ?
DISTANCE FROM CREST TO FAILURE SURFACE (y) = H
HEIGHT OF EMBANKMENT (H) = y
 $y/H = 1.0$

MAX BASE ACCELERATION = $0.75g$

Solve

$$y/H = 1.0$$

ACCORDING TO FIGURE 9, MAKDISI + SEED:

$$k_{max}/\ddot{u}_{max} = 0.38 \longleftarrow k_{max}/\ddot{u}_{max}$$

ACCORDING TO FIGURE 10, USACE 2000:

$$\ddot{u}_{max} = 0.7 \longleftarrow \ddot{u}_{max}$$

$$k_{max}/\ddot{u}_{max} = 0.38$$

$$k_{max} = (0.38)(0.7)$$

$$k_{max} = 0.266 \longleftarrow k_{max}$$

ACCORDING TO AN ANALYSIS performed in the excel spreadsheets, THE MAXIMUM ACCELERATION TO PRODUCE A F.S. = 1 (k_y) IS ~~0.18g~~ 0.58

$$k_y = \frac{0.58}{0.18}$$

$$k_y/k_{max} = \frac{0.58}{0.266} = 2.18 \longleftarrow k_y/k_{max}$$

ACCORDING TO FIGURE 14, MAKDISI + SEED, THE DISPLACEMENT (u) IS less than 0.01 cm

$$u < 0.004 \text{ in} \longleftarrow u$$

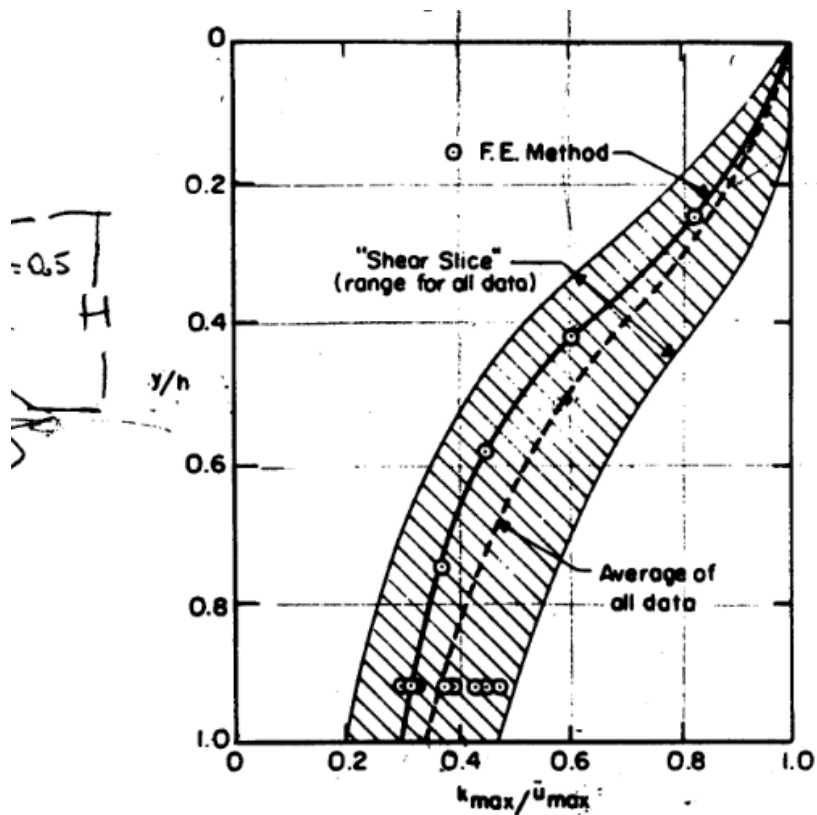


FIG. 9 VARIATION OF "MAXIMUM ACCELERATION RATIO" WITH DEPTH OF SLIDING MASS

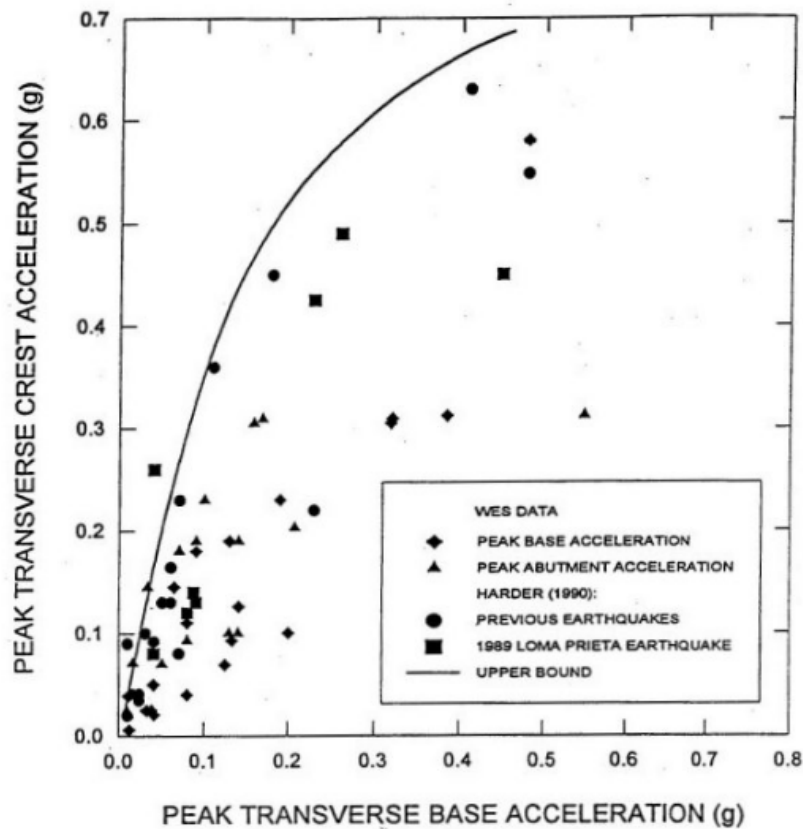


Fig. 10. Comparison of peak base and crest transverse accelerations measured at earth dams (from US Army Corps of Engineers, 2000).

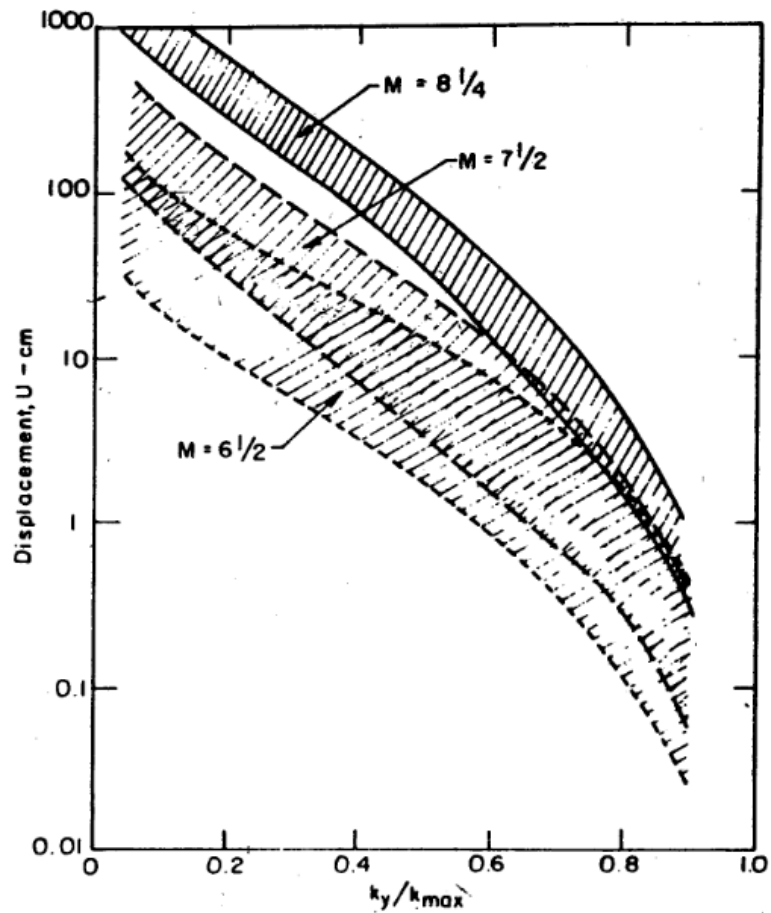
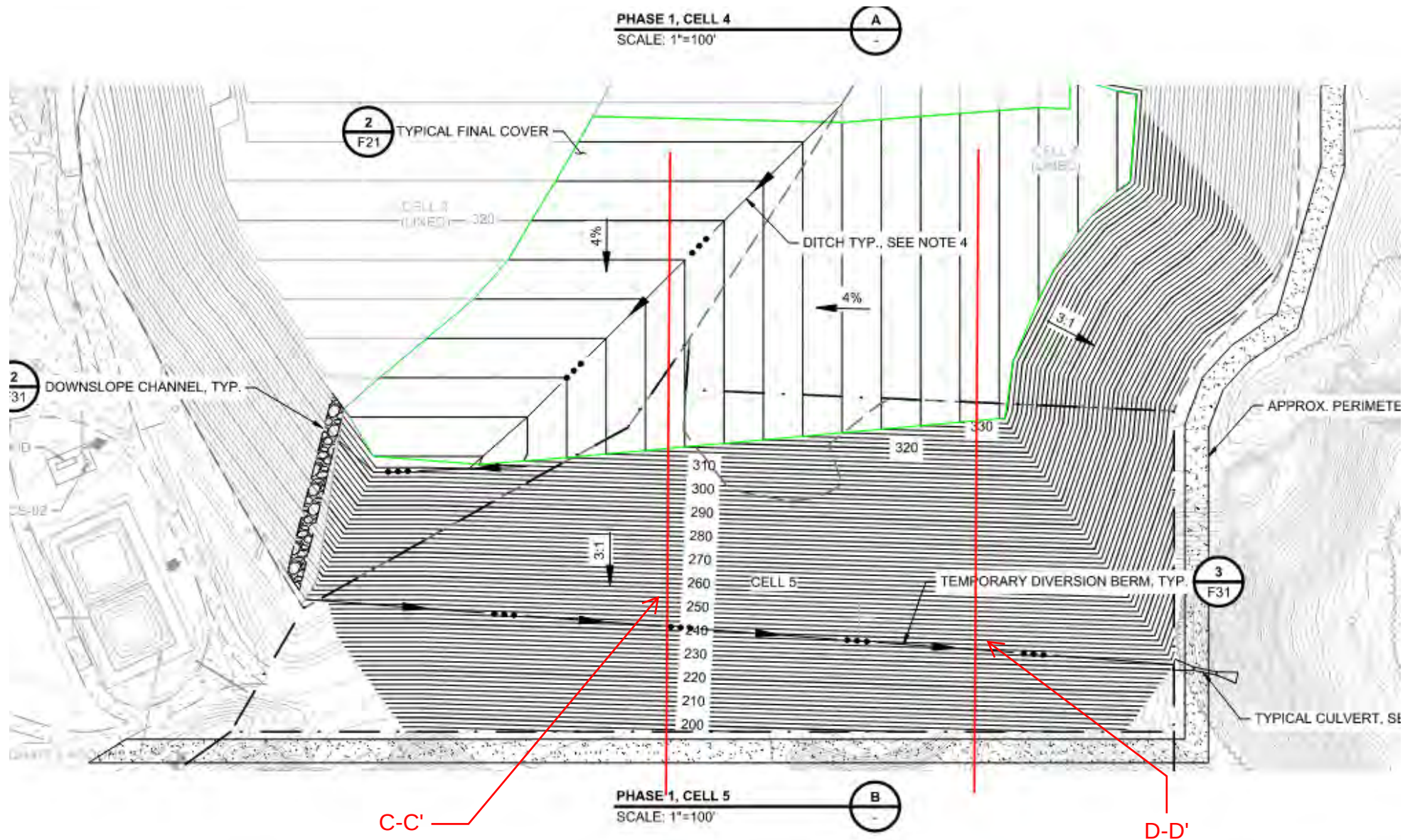


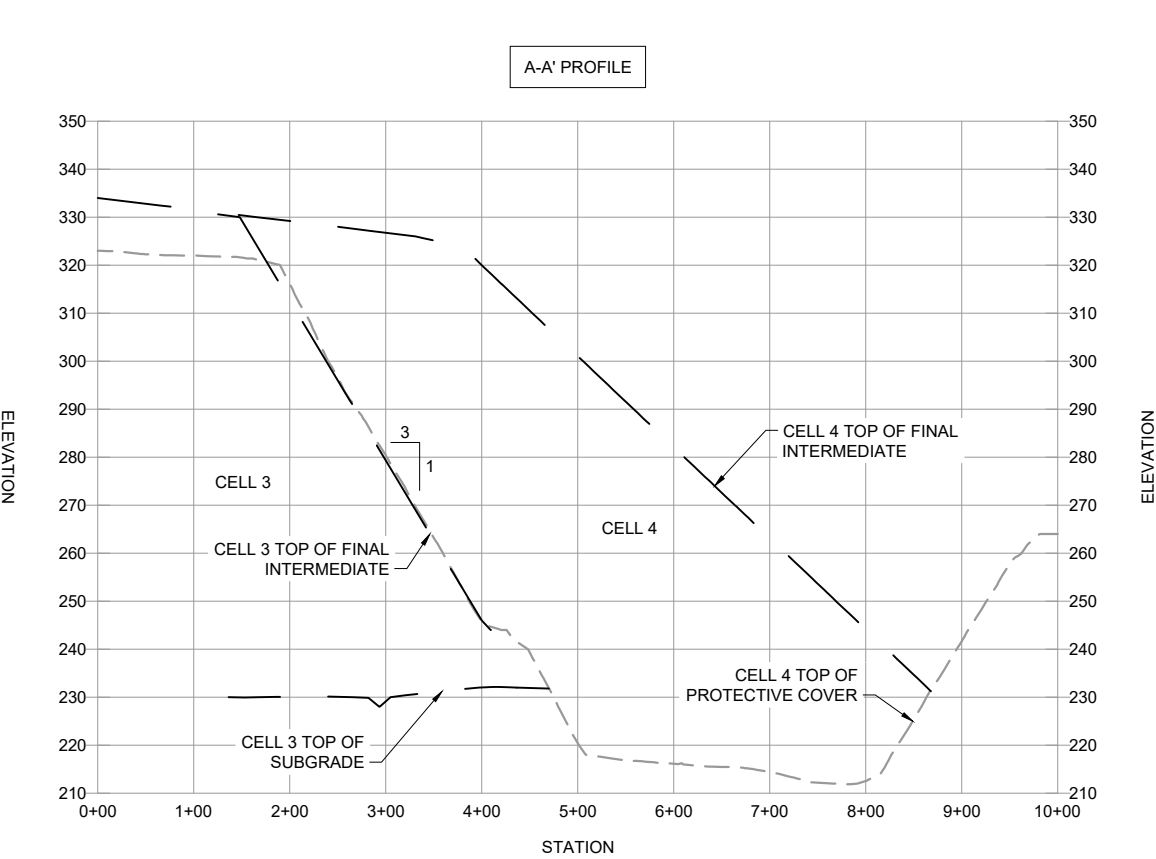
FIG. 14 VARIATION OF PERMANENT DISPLACEMENT WITH YIELD ACCELERATION - SUMMARY OF ALL DATA



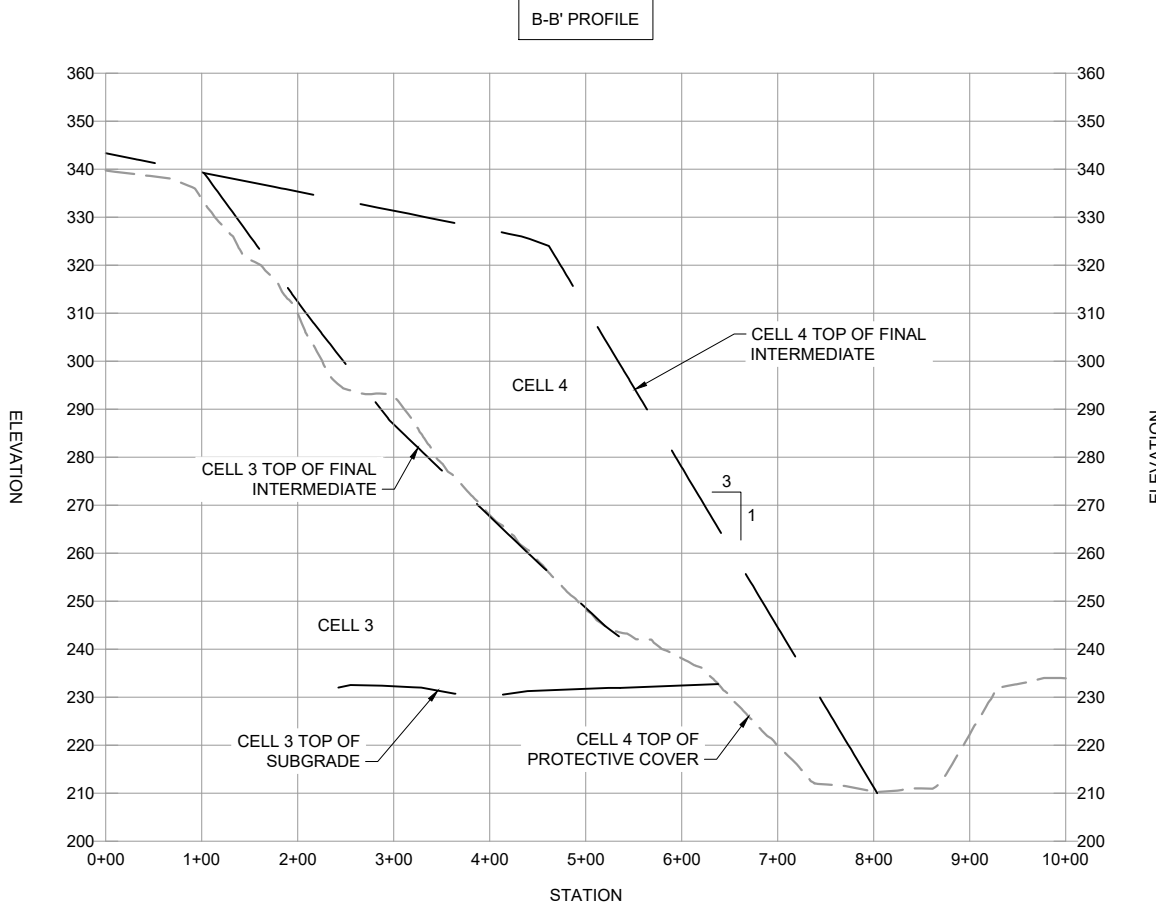




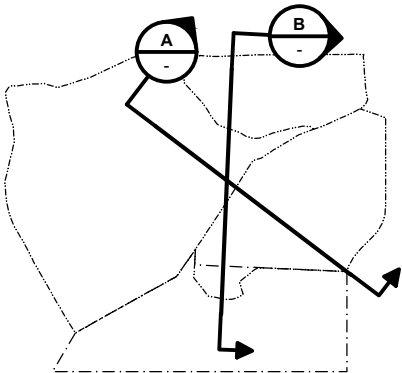
- NOTES:**
1. EXISTING SITE TOPOGRAPHY CREATED FROM DRAFT LIDAR DATA FLOWN IN THE FALL OF 2019 PROVIDED BY MSB. THE ACCURACY OF THE DATA IS NOT GUARANTEED.



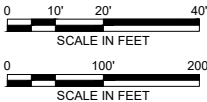
MSW CROSS SECTION
VERTICAL SCALE: 1" = 20'
HORIZONTAL SCALE: 1" = 100'



MSW CROSS SECTION
VERTICAL SCALE: 1" = 20'
HORIZONTAL SCALE: 1" = 100'



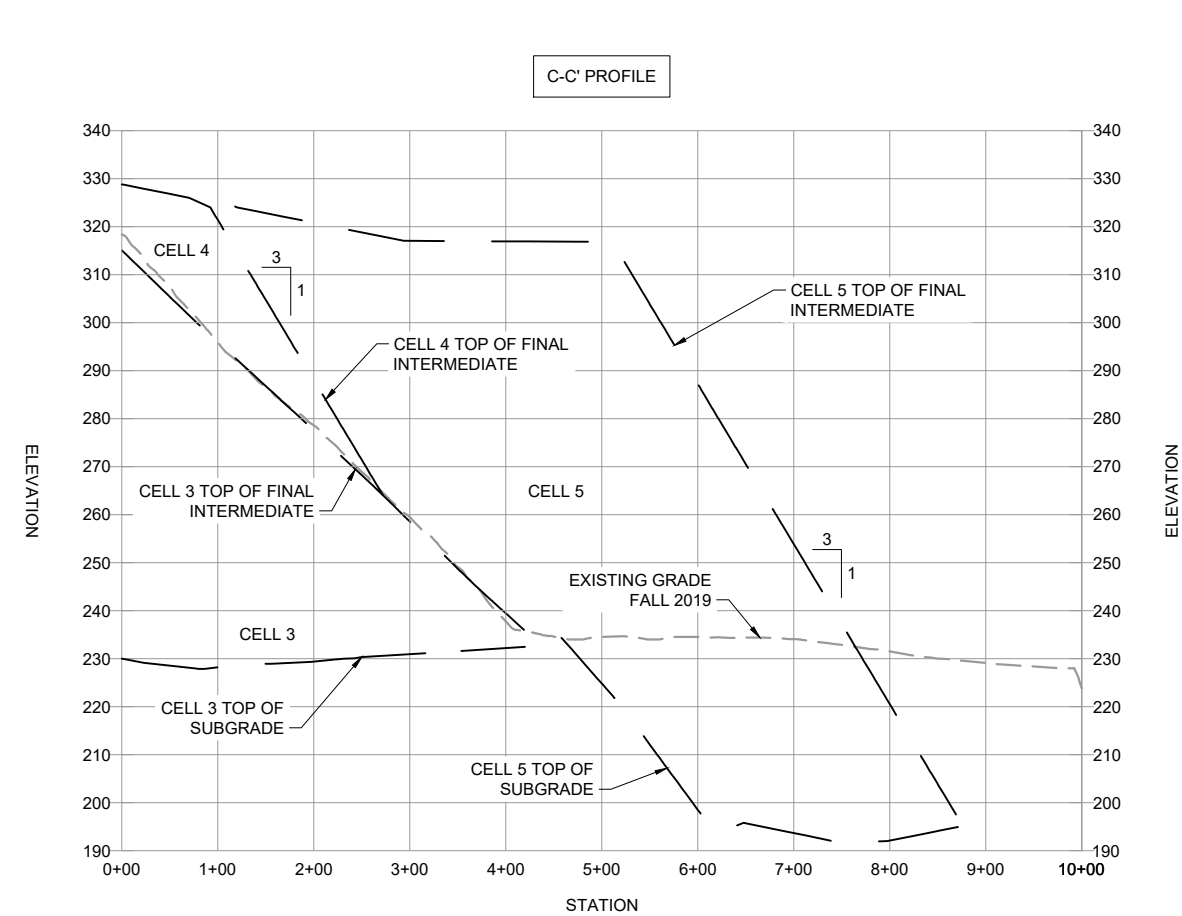
KEY MAP
SCALE: NTS



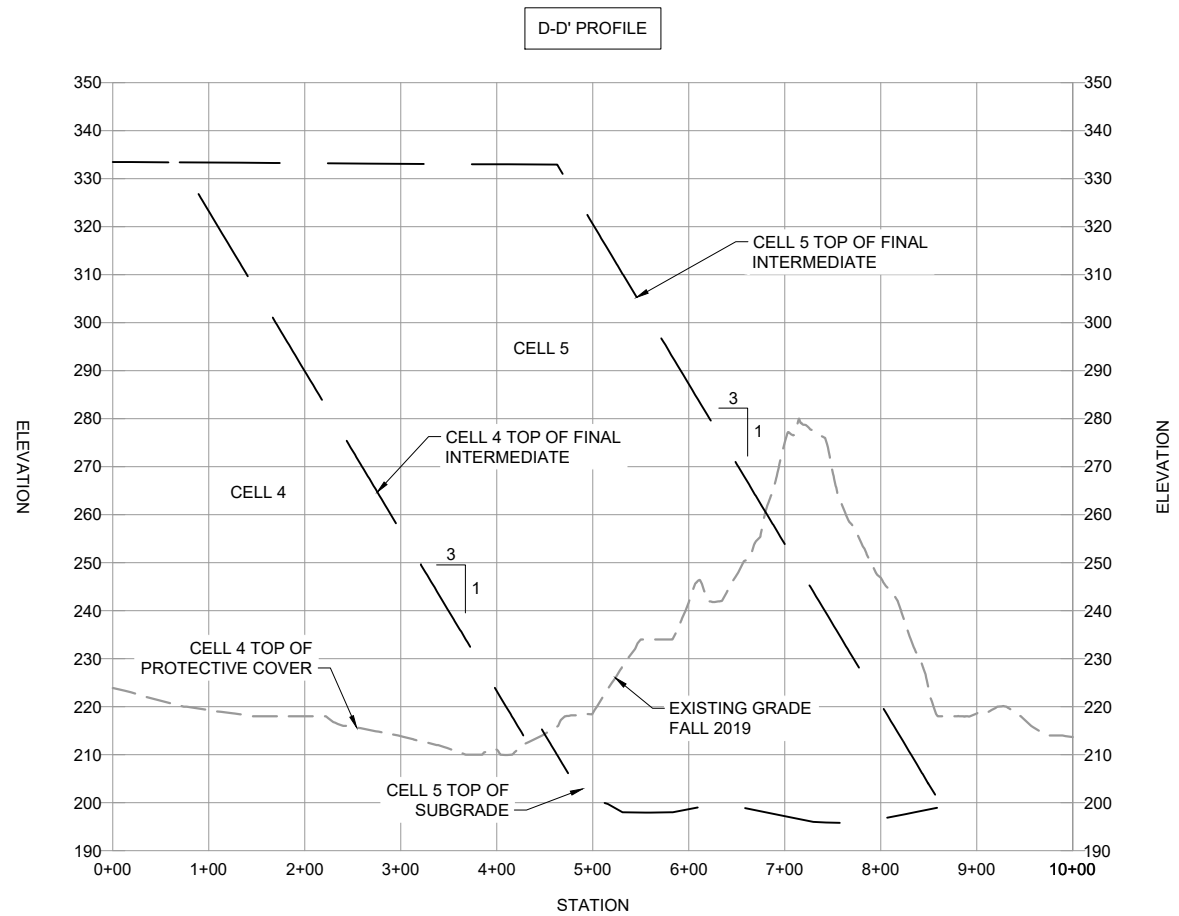
**BURNS
MCDONNELL**

Figure 1
MSB Central Landfill
Cells 3-5 Slope Stability
X-Sections

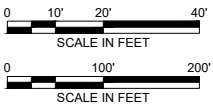
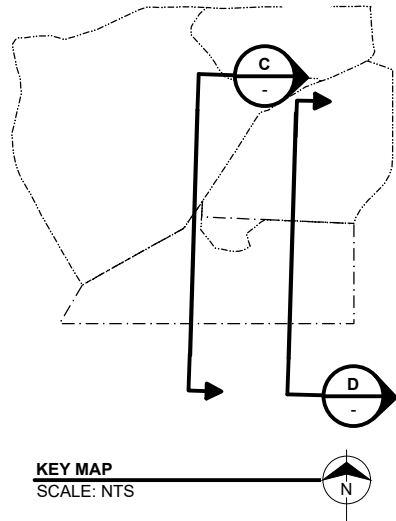
- NOTES:
1. EXISTING SITE TOPOGRAPHY CREATED FROM DRAFT LIDAR DATA FLOWN IN THE FALL OF 2019 PROVIDED BY MSB. THE ACCURACY OF THE DATA IS NOT GUARANTEED.



MSW CROSS SECTION
VERTICAL SCALE: 1" = 20'
HORIZONTAL SCALE: 1" = 100'



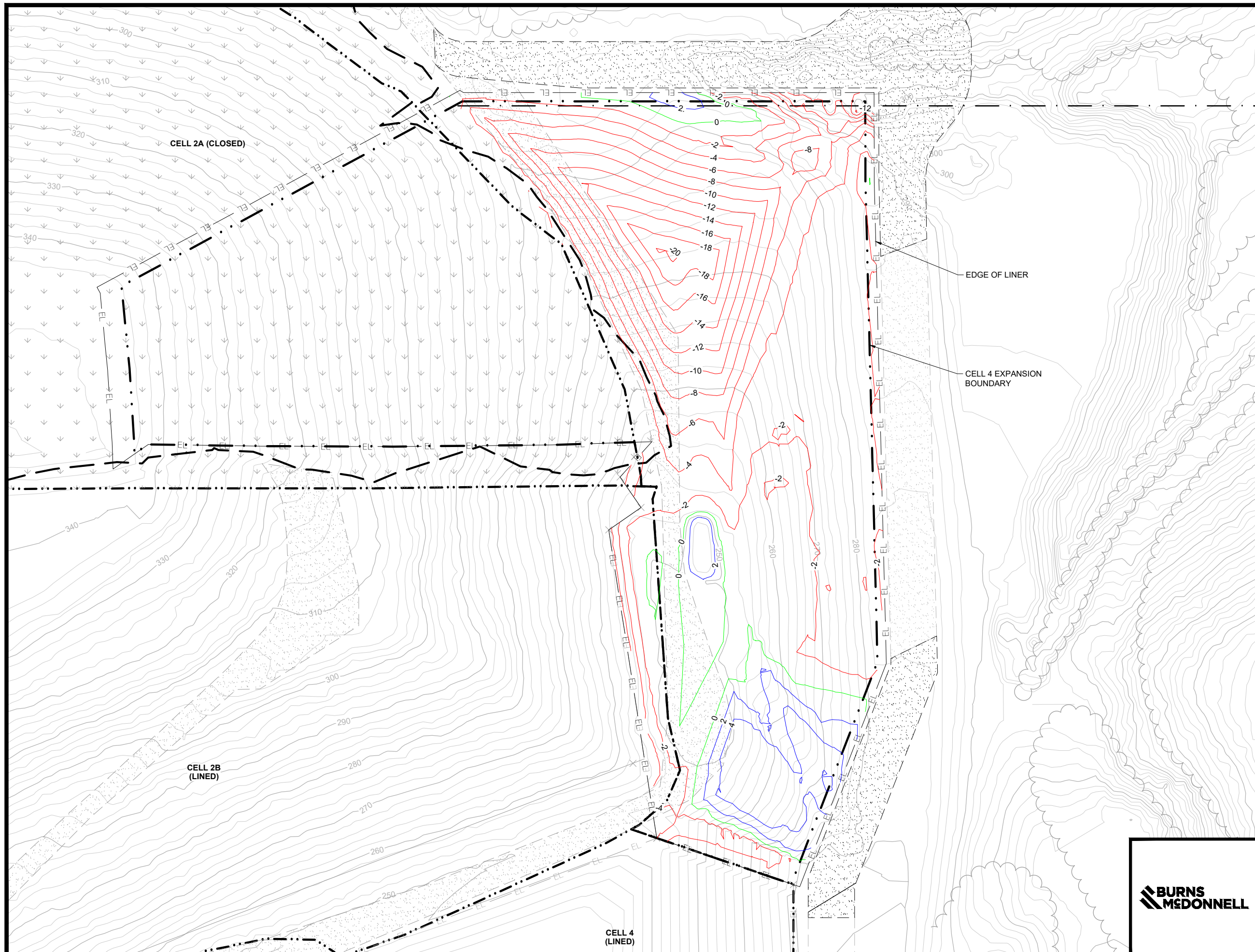
MSW CROSS SECTION
VERTICAL SCALE: 1" = 20'
HORIZONTAL SCALE: 1" = 100'



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Figure 2
MSB Central Landfill
Cells 3-5 Slope Stability
X-Sections

ATTACHMENT 6:
CELL 4 EXPANSION ISOPACH FIGURE



NOTES:

1. EXISTING SITE FEATURES SHOWN PROVIDED BY MSB.
2. EXISTING SITE TOPOGRAPHY CREATED FROM VARIOUS SURVEYS. MOST RECENT SURVEY OF THE CELL 4 EXPANSION AREA CREATED FROM DRAFT LIDAR DATA FLOWN IN THE FALL OF 2019 BY MSB, THE ACCURACY OF THE DATA IS NOT GUARANTEED.
3. CONTOUR INTERVAL IS TWO FEET.
4. ISOPACH CONTOURS SHOWN REPRESENT THE COMPARISON BETWEEN EXISTING SITE TOPOGRAPHY TO THE DESIGN TOP OF LINER GRADES.
5. ISOPACH CONTOUR INTERVAL IS TWO FEET

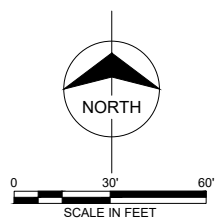
LEGEND:

- EXISTING/ORIGINAL DESIGN CONTOURS
- - - - - CELL BOUNDARY

ISOPACH:

- CUT
- FILL
- ZERO
- CY = CUBIC YARDS

APPROX. NET (CUT): 12,328 CY



**BURNS
MCDONNELL**

Figure 1
TOL VS EXISTING
CELL 4 EXPANSION
MATSU
DECEMBER 2024