CMT TECHNICAL SERVICES

ENGINEERING •GEOTECHNICAL •ENVIRONMENTAL (ESA I & II) • MATERIALS TESTING •SPECIAL INSPECTIONS • ORGANIC CHEMISTRY • PAVEMENT DESIGN •GEOLOGY

GEOTECHNICAL ENGINEERING STUDY

40th Street Washout Repair

7039 North 40th Street
Paradise Valley, Arizona 85253

CMT PROJECT NO. 301624

FOR:
Town of Paradise Valley
6401 East Lincoln Drive
Paradise Valley, Arizona 85253

December 17, 2025

CMT TECHNICAL SERVICES

December 17, 2025

Mr. Juan Gonzalez, Jr., Associate Engineer for Hillside Development
Town of Paradise Valley
6401 East Lincoln Drive
Paradise Valley, Arizona 85253

Subject: Geotechnical Engineering Study
40th Street Washout Repair
7039 North 40th Street
Paradise Valley, Arizona 85253
CMT Project No. 301624

Mr. Gonzalez:

Submitted herewith is the report of our geotechnical engineering study for the subject site. This report contains the results of our findings and an engineering interpretation of the results with respect to the available project characteristics.

On November 5, 2025, a CMT Technical Services (CMT) geotechnical engineer was on-site to observe the conditions of the slope on the east side of North 40th Street. Soil samples were obtained during the visit and subsequently transported to our laboratory for further testing and observation.

This report presents detailed discussions of design and construction criteria for mitigation of future erosion due to rain events at this site.

We appreciate the opportunity to work with you at this stage of the project. CMT offers a full range of Geotechnical Engineering, Geological, Material Testing, Special Inspection services, and Phase I and II Environmental Site Assessments. With offices throughout Arizona, Colorado, Idaho, Texas, and Utah, our staff is capable of efficiently serving your project needs. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at 602-241-1097.

Sincerely,
CMT Technical Services

REGISTERED PROFESSIONAL ENGINEER (Civil)
CERTIFICATE NO. 66758
HERBERT K. MAGLEBY
DATE SIGNED 12/17/2025
ARIZONA U.S.A.
Expires 6/30/2027

H. Kent Magleby, P.E.
Arizona Regional Engineering Manager

Reviewed by:

Registered Professional Engineer (Civil)
CERTIFICATE NO. 49104
HANK BELLISTON
DATE SIGNED 12-17-25
ARIZONA U.S.A.
Expires 03-31-27

Hank Belliston, M.S., P.E., M. ASCE
Senior Geotechnical Engineer

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1.0 INTRODUCTION

1.1 General

CMT Technical Services (CMT) was retained to provide geotechnical recommendations for washout repairs. The site is located at 7039 North 40th Street in Paradise Valley, Arizona, as shown in the **Vicinity Map** below.

VICINITY MAP

1.2 Objectives, Scope, and Authorization

The objectives and scope of our study were planned in discussions between Mr. Juan Gonzalez, Jr., Associate Engineer / Hillside Development for the Town of Paradise Valley, and Mr. H. Kent Magleby of CMT. In general, the objectives of this report are to recommend appropriate economical washout repair that will prevent reoccurrence specifically:

- Embankment material, placement, and compaction
- Slope reinforcement and erosion control
- Construction procedures

In accomplishing these objectives, our scope of work has included performing a field exploration, which consisted of a site inspection, collecting samples of existing slope material, laboratory testing the field samples, and conducting an office program, which consisted of correlating available data, performing engineering analyses, and preparing this summary report. This scope of work was authorized via an On-Call Services Agreement under Task Order # 1.

1.3 Description of Proposed Construction

Proposed repairs include tree removal and/or trimming, clearing and grubbing, excavation, embankment construction, slope reinforcement, and erosion control. We anticipate that the repairs will likely be constructed using conventional excavation and compaction equipment such as backhoes, excavators, loaders, plate compactors, and rollers.

Pavement and concrete appurtenance repairs if any will match existing. A site grading plan was not available at the time of this report, but we project that maximum cuts and fills may be on order of 20 to 30 feet.

1.4 Executive Summary

The most significant geotechnical and construction aspects regarding the repair work include the following:

- Existing utilities and irrigation systems are present and will need to be removed, repaired, replaced or abandoned
- Existing medium-sized trees will need to be removed and/or trimmed
- Existing slope material that does not contain organics may be processed and reused for embankment construction
- Erosion control measures include rock armor and geotextiles
- Over-steepened slopes will require reinforcement
- Groundwater is not expected to impact construction; however, significant surface water is expected

2.0 FIELD EXPLORATION

On November 5, 2025, a site inspection of the washout areas was conducted, and samples of existing slope materials were taken. The field exploration was performed by an experienced geotechnical engineer.

The soils encountered were classified in the field based upon visual and textural examination in general accordance with ASTM[1] D-2488. These field classifications were supplemented by subsequent examination and testing in our laboratory.

Unless instructed otherwise, all samples that remain after testing will be preserved in our lab for a minimum of 90 days after the date of this report.

[1] American Society for Testing and Materials

3.0 LABORATORY TESTING

Soils samples were subjected to various laboratory tests to assess pertinent engineering properties, as follows:

- Moisture Content, ASTM D-2216, percent moisture representative of field conditions
- Atterberg Limits, ASTM D-4318, plasticity and workability
- Gradation Analysis, ASTM D-1140/C-117, grain size analysis
- Moisture Density, AASHTO T 99, maximum unit weight and optimum moisture

Laboratory test results are presented in the following **Lab Summary Table**:

LAB SUMMARY TABLE

Location	DEPTH (feet)	SOIL CLASS	SAMPLE TYPE	MOISTURE CONTENT(%)	T-99 Density (pcf)	GRADATION			ATTERBERG LIMITS		
						GRAV.	SAND	FINES	LL	PL	PI
Slope	Surface	GP-GC	Bulk	1.4	126.3	51	41	8.0	26	23	3
Slope	3	GP-GC	Bulk	2.2	128.2	52	40	8.1	NV	NP	NP

4.0 SITE CONDITIONS

4.1 Surface Conditions

Overall, the shoulder slopes with washouts slope at approximately 1.5:1 (horizontal : vertical), North 40th Street at the top of the washouts has a 2.5% grade to the North towards the North Clearwater Parkway Intersection. There is a drainage channel at the base of the shoulder slope sloping North to South (see **Vicinity Map** in **Section 1.1** above).

4.2 Subsurface Soils

The washouts exposed subsurface soils more than 4 ft deep. There are natural soils, consisting of clayey gravel with cobbles and boulders to the maximum washout depths of about 6 ft feet.

The natural soils were dry to moist, light brown to brown, and estimated to be dense to very dense.

4.3 Groundwater

There is no groundwater present in the exposed shoulder slopes, at the bottom of the washouts, or in the drainage channel at the base of shoulder slopes.

4.4 Site Suburface Variations

Based on the results of the exploration and our experience, variations in the continuity and nature of subsurface conditions should be anticipated. Due to the heterogeneous characteristics of natural soils, care should be taken in interpolating or extrapolating subsurface conditions beyond the exploratory location.

5.0 PRELIMINARY SITE PREPARATION AND GRADING

5.1 General

All deleterious materials should be stripped from the site prior to commencement of construction activities. This includes loose and disturbed soils, topsoil, vegetation, roots, etc. When stripping and grubbing, topsoil should be distinguished by the apparent organic content and not solely by color. Existing buried utilities should be completely removed.

The site earthwork should be observed by a CMT geotechnical engineer or their representative to assess that suitable natural soils have been exposed and any deleterious materials, loose and/or disturbed soils have been removed. CMT should also observe and test the scarification, moisture-conditioning, and re-compaction of the site soils as well as placement of any structural fill.

5.2 Temporary Excavations

Groundwater was not encountered at the time of our field exploration and thus is not anticipated to affect excavations.

Temporary construction excavations should be no steeper than one- and one-half horizontal to one vertical (1.5H:1V).

To reduce disturbance of the natural soils during excavation, smooth-edged buckets/blades may be utilized.

All excavations should be made following OSHA safety guidelines. Excavations must be inspected periodically by qualified personnel. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated.

5.3 Fill Material

The following are our recommendations for the fill we anticipate will be used at this site:

FILL MATERIAL TYPE	DESCRIPTION | RECOMMENDED SPECIFICATION
Structural Fill	Placed for shoulder slope embankment, below structures, flatwork, and pavement. Material shall meet the requirements of Arizona Department of Transportation (ADOT) Structure Backfill (Section 203).

The on-site soil may be suitable for use as structural fill; however, it will need processing to meet the specified requirements.

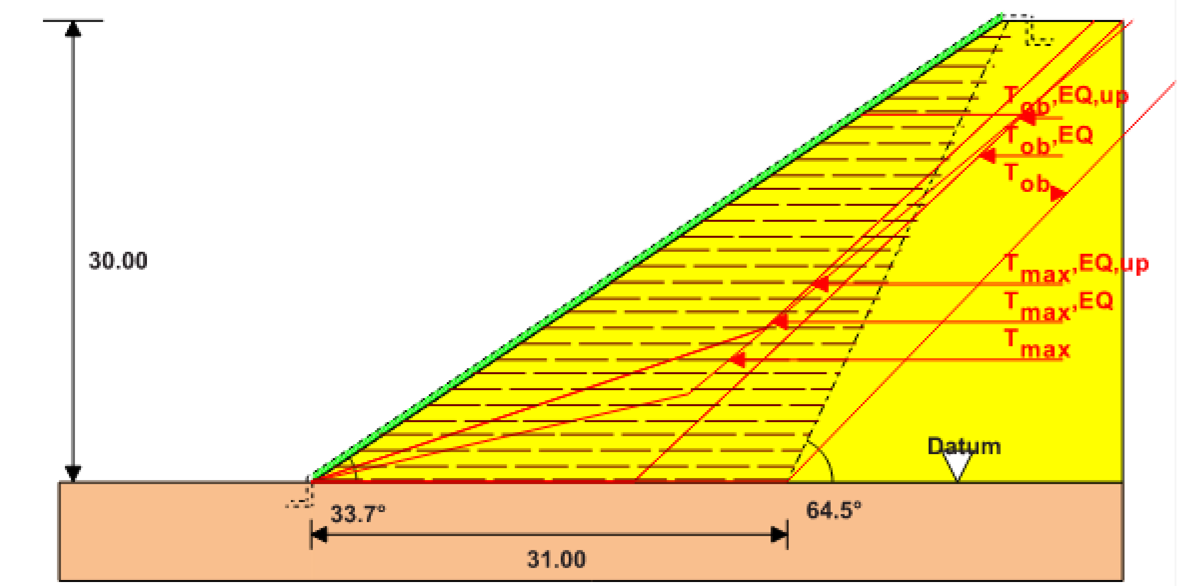
All imported fill material should be approved by a CMT geotechnical engineer prior to placement.

5.4 Fill Placement and Compaction

The various types of compaction equipment available have their limitations as to the maximum lift thickness that can be compacted. For example, hand operated equipment is limited to lifts of about 4 inches and most "trench compactors" have a maximum, consistent compaction depth of about 6 inches. Large rollers, depending on soil and moisture conditions, can achieve compaction at 8 to 12 inches. The full thickness of each lift should be compacted to at least 95% of the maximum dry density as determined by ASTM D-698 (or AASHTO[2] T-99). For best compaction results, we recommend that the moisture content for structural fill/backfill be within 2% of optimum. Field density tests should be performed on each lift to verify that proper compaction is being achieved.

5.5 Fill Reinforcement

Below is a schematic drawing of a reinforced slope design using Tensar+ software and Tensar UX1500 Geogrid.

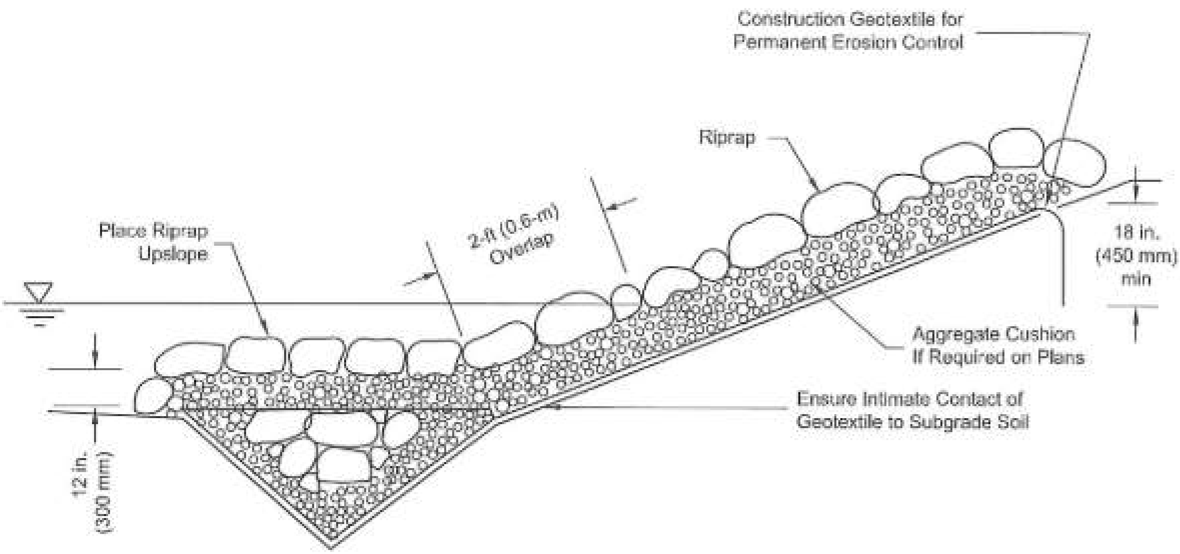


The outside slope is similar to the existing shoulder slope at 1.5H:1V. Geogrid is placed below each 1' layer of structural fill with length starting at 31' at the bottom of the fill and reducing by 1' for each subsequent layer to 2' in length 29' above the base Datum. The design includes earthquake and traffic surcharge loading. A detailed report on the slope design is included in the Appendix.

[2] American Association of State Highway and Transportation Officials

5.6 Slope Erosion Control

The new slope surface shall be protected with permanent erosion control geotextile meeting the requirements for AASHTO M288-24 underlying riprap rock armor meeting the requirements of Maricopa Association of Governments (MAG) Section 703 D_{50} Size 8". Geotextile installation and anchoring shall be per AASHTO M288-24 X1.4. Below is a detail for permanent erosion control geotextile installation and a photo of placed rock riprap armor in the vicinity of the washouts.



5.7 Utility Trenches

For the bedding zone around utilities, we recommend utilizing sand bedding fill material that meets current APWA[3] requirements.

All utility trench backfill material shall meet structural fill requirements and be placed at the same density requirements established for structural fill in the previous section.

6.0 QUALITY CONTROL

We recommend that CMT be retained as part of a comprehensive quality control testing and observation program. With CMT on-site we can help facilitate the implementation of our recommendations and address, in a timely manner, any subsurface conditions encountered which vary from those described in this report. Without such a program CMT cannot be responsible for the application of our recommendations to subsurface conditions which may vary from those described herein. This program may include, but not necessarily be limited to, the following:

6.1 Field Observations

Observations should be completed during all phases of construction such as site preparation, slope excavation, structural fill placement and any concrete placement.

6.2 Fill Compaction

Compaction testing by CMT is required for all slope fill materials. Maximum Dry Density (Standard Proctor, AASHTO T-99) tests should be requested by the contractor immediately after delivery of any fill materials. The maximum density information should then be used for field density tests on each lift as necessary to ensure that the required compaction is being achieved.

6.3 Excavations

All excavation procedures and processes should be observed by a geotechnical engineer from CMT or their representative. In addition, for the recommendations in this report to be valid, all backfill and structural fill placed in trenches and all pavements should be density tested by CMT. We recommend that freshly mixed concrete be tested by CMT in accordance with ASTM designations.

[3] American Public Works Association

7.0 LIMITATIONS

The recommendations provided herein were developed by evaluating the information obtained from the subsurface exploration and soils encountered therein. Soil and ground water conditions may differ from conditions encountered at the actual exploration locations. The nature and extent of any variation in the explorations may not become evident until during construction. If variations do appear, it may become necessary to re-evaluate the recommendations of this report after we have observed the variation.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices.

We appreciate the opportunity to be of service to you on this project. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at (602) 241-1097. To schedule materials testing, please call (602) 509-5464.

Appendix

Field Bulk Sample Test Reports

CMT TECHNICAL SERVICES

Soils & Aggregates Summary

Client:	Town Of Paradise Valley		
Project Name:	40th Street Wash Out	**CMT Project No.:**	301624
Project Location:	40th Street	**Moisture/Density Lab No.:**	162107
Material:	Clayey Gravel with Cobbles & Boulders	**Sieve anaylis Lab No.:**	162109
Material Source:	Shoulder Slope @ Surface	**Plasticity Index Lab No.:**	162110
Sample Location:	85' S. of N. Clearwater Pkwy Wash Out on E. Shoulder	**Report Date:**	12/15/2025
Sample Date:	12/12/2025	**Specification:**	

Sieve Analysis / Gradation		
Test Method:	***AASHTO T27***	
Screen Size	***% Passing***	***Specification***
3"	96	
2 1/2"	93	
2"	87	
1 1/2"	84	
1"	80	
3/4"	79	
1/2"	73	
3/8"	69	
1/4"	61	
#4	49	
#8	44	
#10	38	
#16	30	
#30	22	
#40	18	
#50	15	
#100	12	
#200	8.0	

Determining pH & Minimum Resistivity of Soils & Aggregates		
Test Method:		
	Value	***Spec.***
pH:		
pH:		
pH:		
Resistivity:		

Moisture / Density Relations		
Test Method: ***AASHTO T99 - Method D***		
Maximum Dry Density:	126.3	(pcf)
Optimum Moisture:	9.0	(%)

Note: Value is Uncorrected. Correct in the field.

Plasticity Index of Soils		
Test Method: ***AAHTO T89 & T90***		***Spec.***
Liquid Limit:	26	
Plastic Limit:	23	
Plasticity Index:	3	

Note: NV = No Value NP = Non-Plastic

Specific Gravity (SG) and Absorption of Coarse Aggregate		
Test Method:		***Spec.***
Bulk Specific Gravity:		
SSD Specific Gravity:		
App. Specific Gravity:		
Absorption (%):		

Specific Gravity (SG) and Absorption of Fine Aggregate		
Test Method:		***Spec.***
Bulk Specific Gravity:		
SSD Specific Gravity:		
App. Specific Gravity:		
Absorption (%):		

Totatl Evaporable Moisture Content		
Test Method: ***AASHTO T255***		***Spec.***
Moisture Content %	1.4	

* Large Stones & Boulders Present

CMT TECHNICAL SERVICES

Soils & Aggregates Summary

Client: Town Of Paradise Valley
Project Name: 40th Street Wash Out
Project Location: 40th Street
Material: Clayey Gravel with Cobbles & Boulders
Material Source: Shoulder Slope Wash Out
Sample Location: 85' S. of Clearwater Pkwy Wash Out on E. Shoulder, 3' Below SRF
Sample Date: 12/12/2025

CMT Project No.: 301624
Moisture/Density Lab No.: 162111
Sieve anaylis Lab No.: 162113
Plasticity Index Lab No.: 162114
Report Date: 12/15/2025
Specification:

Sieve Analysis / Gradation		
Test Method:	**AASHTO T27**	
Screen Size	**% Passing**	**Specification**
3"	96	
2 1/2"	94	
2"	88	
1 1/2"	84	
1"	79	
3/4"	75	
1/2"	67	
3/8"	66	
1/4"	61	
#4	48	
#8	41	
#10	32	
#16	28	
#30	25	
#40	20	
#50	18	
#100	15	
#200	8.1	

Determining pH & Minimum Resistivity of Soils & Aggregates		
Test Method:		
	Value	**Spec.**
pH:		
pH:		
pH:		
Resistivity:		

Moisture / Density Relations		
Test Method:	**AASHTO T99 - Method D**	
Maximum Dry Density:	128.2	(pcf)
Optimum Moisture:	8.4	(%)

Note: Value is Uncorrected. Correct in the field.

Plasticity Index of Soils		
Test Method: AAHTO T89 & T90		**Spec.**
Liquid Limit:	NV	
Plastic Limit:	NP	
Plasticity Index:	NP	

Note: NV = No Value NP = Non-Plastic

Specific Gravity (SG) and Absorption of Coarse Aggregate		
Test Method:		**Spec.**
Bulk Specific Gravity:		
SSD Specific Gravity:		
App. Specific Gravity:		
Absorption (%):		

Specific Gravity (SG) and Absorption of Fine Aggregate		
Test Method:		**Spec.**
Bulk Specific Gravity:		
SSD Specific Gravity:		
App. Specific Gravity:		
Absorption (%):		

Totatl Evaporable Moisture Content		
Test Method: AASHTO T255		**Spec.**
Moisture Content %	2.2	

* Large Stones & Boulders Present

2921 North 30th Avenue, Phoenix, Arizona 85017 - Phone: (602) 241-1097 - Web: cmttechnicalservices.com

Slope Reinforcement Design

Tensar

Calculations in accordance with: Tensar 2-Part Wedge Slope Design (seismic loading)

Tensar software output
TensarSoilÈ Version 2.17.9

Client:	**Town of Paradise Valley**
Project:	**40th Street Washouts**

Tensar
Structural Systems

SierraSlopeÈ Slope Retention System

IMPORTANT NOTES (Final Design)

(1) This Tensar Software Output has been prepared by a Tensar affiliate or by LICENSEE to enable the application of Tensar Geogrids to be evaluated.The calculations are derived from a standardized software program which generally follows HA68/94 methodologies and which has been modified to incorporate certain properties of TensarÈ products.

(2) Any mechanically-stabilized earth structure involves various engineering, design, material, construction and end-use considerations.Many of these are site specific, such as (but not limited to) terrain and grading, watertable, the nature and strength of the foundation and backfill soils, compaction of the backfill, surface and subsurface water control and drainage, the presence of utilities and other elements in or around the structure, use of proper equipment and construction practices during installation, neighboring construction activity, load factors, other environmental factors and the like. This printout provides certain limited information to a final design, and does not itself constitute a design or plan suitable for actual construction. A final engineered design and plan, with drawings and installation details and requirements, signed and sealed by a registered professional engineer, is required prior to construction.

(3) This printout, and any final design and plan, includes certain assumptions regarding onsite conditions which must be verified by others at the site both before and during construction. Adherence thereto by the owner and those other contractors specifically engaged to be onsite for assessment and testing, construction, supervision, quality control and other assistance is required for the proper installation, safety and performance of the structure (Tensar does not provide such onsite services except and to the extent specifically engaged and compensated for doing so under a written contract signed by Tensar).

Method of analysis	The Tensar 2-part Wedge Slope Design Method is based on the 2-part wedge calculation procedure described in Advice Note HA68/94 "Design Methods for the Reinforcement of Highway Slopes by Reinforced Soil and Soil Nailing Techniques" (Design Manual for Roads and Bridges, Volume 4, Section 1, Part 4, now withdrawn). Partial material factors are applied to the soil strength and the resistance provided by the geogrid reinforcement.

Reference	CMT Projecte No.: 301624	**Date**	Dec 16 2025	**Page**	1 of 12

Design analysis prepared by
CMT Technical Services
Telephone: **(602) 241-1097**
Fax: **NA**
E-mail: **kent.magleby@cmttechnicalservices.com**
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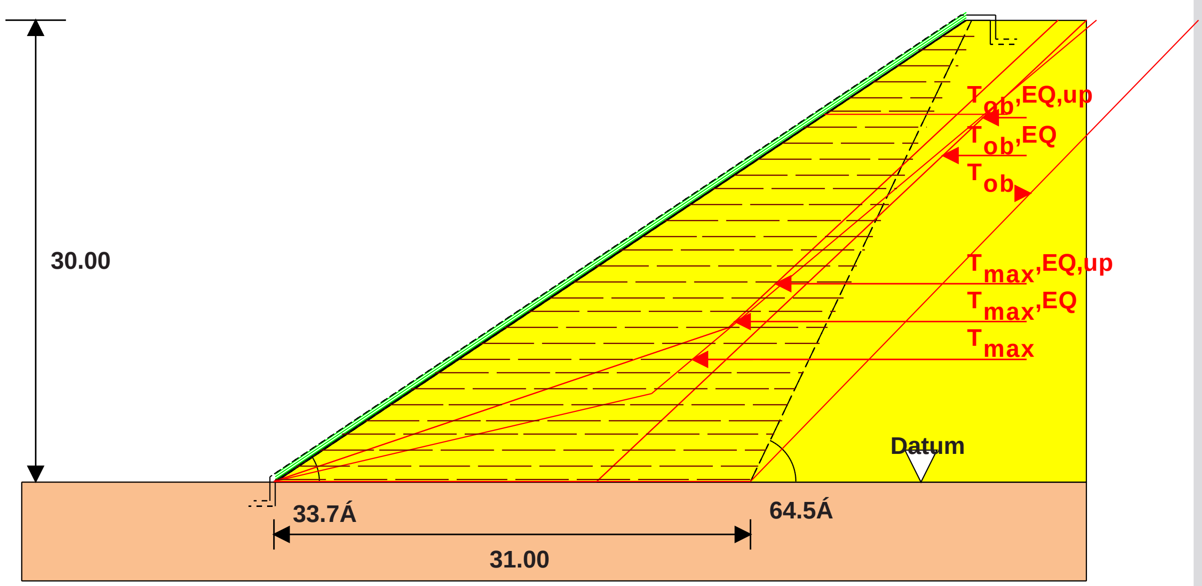
Phoenix
2921 North 30th Avenue
Phoenix, Arizona 85017

Designer
Designer

Input data and Section **Project:** **40th Street Washouts**



Tensar Structural Systems **SierraSlopeÈ Slope Retention System**

Seismic loading case | All dimensions in feet | Scale 1:150

Fill/foundation properties
Design soil strength parameters are peak values

Soil zone	Drained/ undrained	c' (lb/ftƚ)	◖' (Á)	ɔbulk (lb/ftį)
Reinforced fill	Drained	0	30.0	138.0
Retained fill	Drained	0	30.0	138.0
Foundation soil	Assumed to be competent			

Seismic design data
g = acceleration due to gravity

Input	External mechanisms	Internal mechanisms
A_h = 0.05g	k_h(ext) = 0.025g	k_h(int) = 0.07g
A_v = 0.02g	k_v(ext) = 0.01g	k_v(int) = 0.029g

Proportion of dynamic increment of earth pressure used in seismic calculations: 0.5

Vertical accelerations may act either downwards or upwards

Surcharges

No	Load acts from x (ft)	To x (ft)	Load (lb/ftļ)	Live load/Dead load
1	10.00	300.00	250	Dead load

x coordinates are measured from the top of the reinforced fill block.

Water pressure data

Location	Height of water level above datum (ft)	r_u
In front of structure	No water pressures	
Within fill	No water pressures	NA

Stability results

T_{ob} mechanism gives the minimum length of the base geogrid (ft)		9.45
T_{max} mechanism gives minimum length of theoretical top grid (ft)		3.64
Two-part wedge searches starting at various heights above the datum require percentage of available geogrid strength as shown	0.0 ft 2.29 ft 4.57 ft 6.86 ft	31.9% 23.2% 20.9% 22.8%

Seismic, down

T_{ob} mechanism gives the minimum length of the base geogrid (ft)		6.4
T_{max} mechanism gives minimum length of theoretical top grid (ft)		4.02
Two-part wedge searches starting at various heights above the datum require percentage of available geogrid strength as shown	0.0 ft 2.29 ft 4.57 ft 6.86 ft	14.6% 14.8% 15.6% 15.4%

Seismic, up

T_{ob} mechanism gives the minimum length of the base geogrid (ft)		6.4
T_{max} mechanism gives minimum length of theoretical top grid (ft)		4.02
Two-part wedge searches starting at various heights above the datum require percentage of available geogrid strength as shown	0.0 ft 2.29 ft 4.57 ft 6.86 ft	14.9% 14.9% 16.2% 16.5%

Reinforcement layout
Starting and finishing levels are related to datum

Tensar Geogrid	No of layers	Starting level (ft)	Vertical spacing (ft)	Finishing level (ft)	Coverage (%)	C_i
UX1500	29	1.00	1.00	29.00	100	0.8
UX1500	1	0.00	-	-	100	0.8

Further information relevent to this Tensar Earth Retention System	Further information, specifications and bill of quantities descriptions for this Tensar Earth Retaining Structure are given in the following documents which form part of this Design Analysis	System overview Installation guide Case histories
	The current versions of these documents may be found by following the website linkto "Tensar Documentation" in the Help menu of the TensarSoilÈ program	
	For program users who do For program users who do contact your nearest Tensar representative or distributor	Tensar International Corporation Tel: +1 770 3442090 Fax: +1 770 3442089 E-mail: web@tensarcorp.com Web: www.tensarcorp.com

Detailed calculation results

The following tables provide the detailed results from the design Analysis, including geogrid design data, together with both external and internal analysis results.

Geogrid reinforcement design data

Geogrid strength is calculated following Section 2.20 but using the notation defined in US design codes and guidelines.
Strength values quoted are per metre width of geogrid, and do not take into account percentage coverage

Design temperature (ÁC)	20	**Design life (years)**	60

Maximum particle size of fill = 4"

Tensar geogrid	Ultimate strength (lb/ft)	Creep factor	Durability factor	Installation damage	FS	Design strength (lb/ft)	Sliding interaction
	T_{ult}	RF_{cr}	RF_d	RF_{id}		T_a	C_{ds}
UX1500	7811	2.54	1.1	1.25	1.3	1718	0.8

Design temperature (ÁC)	20	**Seismic**

Maximum particle size of fill = 4"

Tensar geogrid	Ultimate strength (lb/ft)	Creep factor	Durability factor	Installation damage	FS	Design strength (lb/ft)	Sliding interaction
	T_{ult}	RF_{cr}	RF_d	RF_{id}		T_a	C_{ds}
UX1500	7811	2.54	1.1	1.25	1.1	5165	0.8

Grid coordinates

Levels are measured from the datum and horizontal location is measured from the toe of the wall

Tensar geogrid	**Level**	**Left end**	**Right end**	**Length**	**Coverage**	**Pullout interaction factor C_i Ŭp**
	(ft)	**(ft)**	**(ft)**	**(ft)**	**%**	
UX1500	29.00	43.48	45.48	2.00	100.0	0.800
UX1500	28.00	41.98	44.98	3.00	100.0	0.800
UX1500	27.00	40.48	44.48	4.00	100.0	0.800
UX1500	26.00	38.99	43.99	5.00	100.0	0.800
UX1500	25.00	37.49	43.49	6.00	100.0	0.800
UX1500	24.00	35.99	42.99	7.00	100.0	0.800
UX1500	23.00	34.49	42.49	8.00	100.0	0.800
UX1500	22.00	32.99	41.99	9.00	100.0	0.800
UX1500	21.00	31.49	41.49	10.00	100.0	0.800
UX1500	20.00	29.99	40.99	11.00	100.0	0.800
UX1500	19.00	28.49	40.49	12.00	100.0	0.800
UX1500	18.00	26.99	39.99	13.00	100.0	0.800
UX1500	17.00	25.49	39.49	14.00	100.0	0.800

Tensar geogrid	Level	Left end	Right end	Length	Coverage	Pullout interaction factor C_i Ŭp
	(ft)	(ft)	(ft)	(ft)	%	
UX1500	16.00	23.99	38.99	15.00	100.0	0.800
UX1500	15.00	22.49	38.49	16.00	100.0	0.800
UX1500	14.00	20.99	37.99	17.00	100.0	0.800
UX1500	13.00	19.49	37.49	18.00	100.0	0.800
UX1500	12.00	17.99	36.99	19.00	100.0	0.800
UX1500	11.00	16.49	36.49	20.00	100.0	0.800
UX1500	10.00	14.99	35.99	21.00	100.0	0.800
UX1500	9.00	13.49	35.49	22.00	100.0	0.800
UX1500	8.00	12.00	35.00	23.00	100.0	0.800
UX1500	7.00	10.50	34.50	24.00	100.0	0.800
UX1500	6.00	9.00	34.00	25.00	100.0	0.800
UX1500	5.00	7.50	33.50	26.00	100.0	0.800
UX1500	4.00	6.00	33.00	27.00	100.0	0.800
UX1500	3.00	4.50	32.50	28.00	100.0	0.800
UX1500	2.00	3.00	32.00	29.00	100.0	0.800
UX1500	1.00	1.50	31.50	30.00	100.0	0.800
UX1500	0.00	0.00	31.00	31.00	100.0	0.800

T_{ob} and T_{max} Mechanisms

Check of two-part wedges in accordance with Section 3 of HA 68/94.

Minimum base width is determined by analysis of the T_{ob} mechanism.
Length of the upper geogrid determined from anchorage length behind T_{max} mechanism.
For T_{max} the critical case without reinforcement is unlikely to be the same as the critical case with reinforcement.
Co-ordinates are measured from the toe, x horizontal and y vertical

Inter-wedge friction in relation to design soil strength ű'$_d$	**0.5**

Data	**Mechanism**	
	T_{ob}	**T_{max}**
x at base (ft)	0.00	0.00
y at base (ft)	0.00	0.00
x at wedge junction (ft)	31.00	24.57
y at wedge junction (ft)	0.00	5.71
x at top (ft)	60.15	53.51
y at top (ft)	30.00	30.00
Weight Wedge1 W_1 (lb/ft)	51335	29321
Weight Wedge2 W_2 (lb/ft)	44223	18089
Surcharge Wedge1 Q_1 (lb/ft)	1291	0
Surcharge Wedge2 Q_2 (lb/ft)	0	0
Pore water forces		
Base of wedge 1 U_1	0	0
Base of wedge 2 U_2	0	0
Inter-wedge U_{12}	0	0
External water forces (lb/ft)		
Wedge 1, vertical U_{1v}	0	0
Wedge 2, vertical U_{2v}	0	0
Wedge 1, horizontal U_{1h}	0	0
Wedge 2, horizontal U_{2h}	0	0
Cohesion forces (lb/ft)		
Wedge 1 K_1	0	0
Wedge 2 K_2	0	0
Inter-wedge K_{12}	0	0
Out of balance force (lb/ft)	0	4914

T_{ob} and T_{max} Mechanisms; Seismic conditions; Check with vertical acceleration acting downwards:
Check of two-part wedges in accordance with Section 3 of HA 68/94.
Minimum base width is determined by analysis of the T_{ob} mechanism.
Length of the upper geogrid determined from anchorage length behind T_{max} mechanism.
For T_{max} the critical case without reinforcement is unlikely to be the same as the critical case with reinforcement.
Co-ordinates are measured from the toe, x horizontal and y vertical

Inter-wedge friction in relation to design soil strength ű'$_d$		**0.5**
Data	**Mechanism**	
	T_{ob}	T_{max}
x at base (ft)	0.00	0.00
y at base (ft)	0.00	0.00
x at wedge junction (ft)	21.00	29.57
y at wedge junction (ft)	0.00	10.00
x at top (ft)	52.87	51.01
y at top (ft)	30.00	30.00
Weight Wedge1 W_1 (lb/ft)	39493	18659
Weight Wedge2 W_2 (lb/ft)	20294	19825
Surcharge Wedge1 Q_1 (lb/ft)	0	0
Surcharge Wedge2 Q_2 (lb/ft)	0	0
Pore water forces		
Base of wedge 1 U_1	0	0
Base of wedge 2 U_2	0	0
Inter-wedge U_{12}	0	0
External water forces (lb/ft)		
Wedge 1, vertical U_{1v}	0	0
Wedge 2, vertical U_{2v}	0	0
Wedge 1, horizontal U_{1h}	0	0
Wedge 2, horizontal U_{2h}	0	0
Cohesion forces (lb/ft)		
Wedge 1 K_1	0	0
Wedge 2 K_2	0	0
Inter-wedge K_{12}	0	0
Out of balance force (lb/ft)	-378	3704

T_{ob} and T_{max} Mechanisms; Seismic conditions; Check with vertical acceleration acting upwards:

Check of two-part wedges in accordance with Section 3 of HA 68/94.

Minimum base width is determined by analysis of the T_{ob} mechanism.
Length of the upper geogrid determined from anchorage length behind T_{max} mechanism.
For T_{max} the critical case without reinforcement is unlikely to be the same as the critical case with reinforcement.
Co-ordinates are measured from the toe, x horizontal and y vertical

Inter-wedge friction in relation to design soil strength ű' $_d$	**0.5**	
Data	**Mechanism**	
	T_{ob}	**T_{max}**
x at base (ft)	0.00	0.00
y at base (ft)	0.00	0.00
x at wedge junction (ft)	21.00	29.57
y at wedge junction (ft)	0.00	10.00
x at top (ft)	52.87	51.01
y at top (ft)	30.00	30.00
Weight Wedge1 W_1 (lb/ft)	39493	18659
Weight Wedge2 W_2 (lb/ft)	20294	19825
Surcharge Wedge1 Q_1 (lb/ft)	0	0
Surcharge Wedge2 Q_2 (lb/ft)	0	0
Pore water forces		
Base of wedge 1 U_1	0	0
Base of wedge 2 U_2	0	0
Inter-wedge U_{12}	0	0
External water forces (lb/ft)		
Wedge 1, vertical U_{1v}	0	0
Wedge 2, vertical U_{2v}	0	0
Wedge 1, horizontal U_{1h}	0	0
Wedge 2, horizontal U_{2h}	0	0
Cohesion forces (lb/ft)		
Wedge 1 K_1	0	0
Wedge 2 K_2	0	0
Inter-wedge K_{12}	0	0
Out of balance force (lb/ft)	-279	3704

Internal stability check

Check of two-part wedges in accordance with document HA 68/94.
Results are listed below for worst wedge at each level checked
Co-ordinates are measured from the toe, x horizontal and y vertical

Inter-wedge friction in relation to design soil strength ŭ' d	**0.5**

Data	Wedge base level (ft)			
	0.00	7.50	15.00	22.50
x at base (ft)	0.00	11.25	22.49	33.74
y at base (ft)	0.00	7.50	15.00	22.50
x at wedge junction (ft)	34.16	38.85	40.48	43.64
y at wedge junction (ft)	6.04	15.08	19.12	26.15
x at top (ft)	58.11	52.52	50.45	47.17
y at top (ft)	30.00	30.00	30.00	30.00
Weight Wedge1 W_1 (lb/ft)	34206	12341	6551	855
Weight Wedge2 W_2 (lb/ft)	39446	20629	9775	2017
Surcharge Wedge1 Q_1 (lb/ft)	783	0	0	0
Surcharge Wedge2 Q_2 (lb/ft)	0	0	0	0
Pore water forces				
Base of wedge1 U_1	0.0	0.0	0.0	0.0
Base of wedge2 U_2	0	0	0	0
Inter-wedge U_{12}	0	0	0	0
External water forces (lb/ft)				
Wedge 1, vertical U_{1v}	0	0	0	0
Wedge 2, vertical U_{2v}	0	0	0	0
Wedge 1, horizontal U_{1h}	0	0	0	0
Wedge 2, horizontal U_{2h}	0	0	0	0
Cohesion forces (lb/ft)				
Wedge 1 K_1	0	0	0	0
Wedge 2 K_2	0	0	0	0
Inter-wedge K_{12}	0	0	0	0
Reinforcement forces (lb/ft)				
Base of wedge 1 T_1	0	0	0	17
Base of wedge 2 T_2	7684	8541	3673	1034
Inter-wedge T_{12}	21238	8018	4004	551
Grid layout adequate?	YES	YES	YES	YES

Seismic case; Check with vertical acceleration acting downwards:

Check of two-part wedges in accordance with document HA 68/94.
Results are listed below for worst wedge at each level checked
Co-ordinates are measured from the toe, x horizontal and y vertical

Inter-wedge friction in relation to design soil strength ű' $_d$	**0.5**

Data	Wedge base level (ft)			
	0.00	7.50	15.00	22.50
x at base (ft)	0.00	11.25	22.49	33.74
y at base (ft)	0.00	7.50	15.00	22.50
x at wedge junction (ft)	43.22	41.59	42.61	43.64
y at wedge junction (ft)	24.89	25.77	24.48	26.15
x at top (ft)	47.51	46.63	47.67	47.17
y at top (ft)	30.00	30.00	30.00	30.00
Weight Wedge1 W_1 (lb/ft)	1370	942	1669	855
Weight Wedge2 W_2 (lb/ft)	11745	4123	5465	2017
Surcharge Wedge1 Q_1 (lb/ft)	0	0	0	0
Surcharge Wedge2 Q_2 (lb/ft)	0	0	0	0
Pore water forces				
Base of wedge1 U_1	0.0	0.0	0.0	0.0
Base of wedge2 U_2	0	0	0	0
Inter-wedge U_{12}	0	0	0	0
External water forces (lb/ft)				
Wedge 1, vertical U_{1v}	0	0	0	0
Wedge 2, vertical U_{2v}	0	0	0	0
Wedge 1, horizontal U_{1h}	0	0	0	0
Wedge 2, horizontal U_{2h}	0	0	0	0
Cohesion forces (lb/ft)				
Wedge 1 K_1	0	0	0	0
Wedge 2 K_2	0	0	0	0
Inter-wedge K_{12}	0	0	0	0
Reinforcement forces (lb/ft)				
Base of wedge 1 T_1	78	1013	181	21
Base of wedge 2 T_2	13302	4447	4874	1186
Inter-wedge T_{12}	1022	588	1312	618
Grid layout adequate?	YES	YES	YES	YES

Seismic case; Check with vertical acceleration acting upwards:

Check of two-part wedges in accordance with document HA 68/94.
Results are listed below for worst wedge at each level checked
Co-ordinates are measured from the toe, x horizontal and y vertical

Inter-wedge friction in relation to design soil strength ű' d				**0.5**
Data	Wedge base level (ft)			
	0.00	7.50	15.00	22.50
x at base (ft)	0.00	11.25	22.49	33.74
y at base (ft)	0.00	7.50	15.00	22.50
x at wedge junction (ft)	43.22	41.59	42.61	43.64
y at wedge junction (ft)	24.89	25.77	24.48	26.15
x at top (ft)	47.51	46.63	47.67	47.17
y at top (ft)	30.00	30.00	30.00	30.00
Weight Wedge1 W_1 (lb/ft)	1370	942	1669	855
Weight Wedge2 W_2 (lb/ft)	11745	4123	5465	2017
Surcharge Wedge1 Q_1 (lb/ft)	0	0	0	0
Surcharge Wedge2 Q_2 (lb/ft)	0	0	0	0
Pore water forces				
Base of wedge1 U_1	0.0	0.0	0.0	0.0
Base of wedge2 U_2	0	0	0	0
Inter-wedge U_{12}	0	0	0	0
External water forces (lb/ft)				
Wedge 1, vertical U_{1v}	0	0	0	0
Wedge 2, vertical U_{2v}	0	0	0	0
Wedge 1, horizontal U_{1h}	0	0	0	0
Wedge 2, horizontal U_{2h}	0	0	0	0
Cohesion forces (lb/ft)				
Wedge 1 K_1	0	0	0	0
Wedge 2 K_2	0	0	0	0
Inter-wedge K_{12}	0	0	0	0
Reinforcement forces (lb/ft)				
Base of wedge 1 T_1	74	972	171	20
Base of wedge 2 T_2	12737	4337	4664	1143
Inter-wedge T_{12}	980	570	1254	599
Grid layout adequate?	YES	YES	YES	YES