T.I.N. ENGINEERING COMPANY

Geotechnical • Structural • Environmental

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File No.: 232725
September 9, 2023

PDDG
554 - 2nd Street
Hermosa Beach, California 90254

SUBJECT: Soil Investigation and Report for Proposed Two-Story Residential Development with Basement at 554 - 2nd Street, Hermosa Beach, California

Dear Sir:

In accordance with the authorization by your authorization, we have completed this subject investigation for the proposed two-story residential building development with basement at the subject site. The work was performed within the terms of your authorization using the degree of care and skill ordinarily exercised under similar circumstances by geotechnical engineers practicing in this locality, and in accordance with generally accepted foundation engineering procedures. The investigation included excavation of two test trenches, specific field soil logging and sampling, laboratory soil sample tests, and engineering analyses summarized herein. In the opinion of the undersigned, the accompanying report has been substantiated by the available field and laboratory data, and presents the design information you requested.

Introduction

This investigation was made for the purpose of obtaining information on the subsurface soil condition at the subject site on which to base conclusions and recommendations for suitable grading and foundation designs for the proposed residential building development at the subject property. It is our understanding that the proposed structure is to consist of a two-story, light wood frame, residential building construction. Basement is proposed as well. Basement retaining walls will be required. Over-excavation, approximately up to 10 feet high, is to be expected for the construction of the proposed basement retaining walls. Shoring should be required.

The existing residential building is to be demolished.

The vicinity map of the subject site is shown on Plate 1. The site plan is shown on Plate 2.

This report is not intended as a bidding document, and any contractors reviewing this report should draw their own conclusions regarding required construction quantities and procedures.

Field and Laboratory Investigation

On June 26, 2023, two exploratory test trenches were excavated at the locations shown on Plate 2. The earth materials encountered in the exploratory were logged by us as shown in the attached Trench Logs presented on Plates 3.1 and 3.2. Representative samples of the earth materials encountered were obtained as appropriate. Intact samples were obtained by carefully driving a hand-sampler loaded with thin walled tubes by hand into the trench bottom. Bulk samples were obtained from the trench castings. Samples were returned to our laboratory for determination of their in-situ moisture content and density, classification, direct shear, consolidation and other appropriate testing.

The results of the in-situ moisture and density tests are summarized on the attached Plate 4. Plots of direct shear test data are presented on the attached Plate 5. Plots of the consolidation test data are presented on the attached Plate 6. See the attached Appendix A for specific information on testing methods.

Location and Site Conditions

The subject site is located on the southerly side of 2nd Street, approximately 500 feet northwestterly from the intersection of Pacific Coast Highway and Herondo Street within the City of Hermosa Beach of the Los Angeles County. The subject site consists of a level pad at an elevation of approximately up to 7 feet above the street level. It is presently occupied by one-story residential building with an attached garage. The subject site is surrounded by similarly developed residential properties to the east, west, and south. Drainage is chiefly by sheet flow to the street.

Earth Materials

The site earth materials encountered in the exploratory trenches were assumed to be representative of those throughout the area of proposed development. Variations in depth, thickness of strata, and the type of earth materials expected may occur. The design and construction procedures should take this into account. Modification of plans may be required during project construction.

Topsoil and Older Dune Sand

Topsoil, approximately 1.5 feet deep, was encountered in the exploratory trenches. The encountered topsoil consisted of a gray, dry to slightly moist, soft to moderately soft, cohesionless sand with abundant rootlets. Below the topsoil, older dune sand was encountered. The older dune sand, encountered at the depth of approximately 1.5 feet to the depths of the trenches explored consisted of a light brown, slightly moist, dense, fine to medium grained, cohesionless sand.

Groundwater

No groundwater was encountered, nor were any springs or seeps observed during the course of this investigation. However, it should be noted that fluctuations in the level of the ground water may occur due to variations in rainfall, temperature, and other factors not evident at the time of our study.

Conclusions and Recommendations

General

Based upon our evaluation of the site and soil conditions, the foregoing data and information, the following conclusions and recommendations are made. Construction of the proposed residential development with basement is feasible from the standpoint of geotechnical engineering practice at the subject site, provided all recommendations and conditions made herein are incorporated into all design. The thickness of earth materials and the depths to foundation stratum indicated in this report are based on the data obtained from the exploratory trenches. The actual thickness of earth materials and depths to foundation stratum between the exploratory trenches may vary from that indicated herein. The design and construction procedures should take this into account.

1. The foundations of the proposed residential building should be founded on spread footings penetrating into firm older dune sand as specified below. The depth to firm older dune sand at the subject site is estimated to be approximately 1.5 feet below the existing grade, although it may be deeper.

2. The basement is to be constructed underneath the proposed residential building. Temporary excavations, approximately up to 10 feet high, will be required for the construction of the basement retaining walls. Temporary shoring may be required. The temporary shoring should be designed by the project structural engineers

3. The on-site soil is considered to be non-expansive. The proposed basement retaining wall may be designed with a non-expansive soil condition. For the design of the basement retaining wall with a non-expansive soil condition see Section “Retaining and Basement Walls” below.

4. The foundation trenches of the proposed residential building should be re-moistened prior to pouring of concrete.

5. A sump pump should be required to be installed in the basement area.

Spread Footing Foundations

Spread footings founded into firm older dune sand may be used for the support of the proposed residential building and basement retaining walls. The following design criteria for new foundation are considered appropriate:

Allowable Bearing Capacity……2,000 psf

Minimum Embedment below Lowest Adjacent Grade
and into firm Older Dune Sand

One-Story and Retaining Wall……...12 inches
Two-Story ……..18 inches

Minimum Width of Spread Foundation:

One-Story ……..…….15 inches
Two-Story ……..18 inches

All continuous footings should be reinforced with a minimum of two #4 steel bars, one placed near the top, and one placed near the bottom of the footings.

Lateral Design

Resistance to lateral loading may be provided by friction acting at the base of foundations and by passive earth pressure within firm older dune sand. An allowable coefficient of friction of 0.35 may be used with the dead load forces.

For spread footings in firm older dune sand the allowable passive earth pressure may be computed as an equivalent fluid having a density of 400 pounds per square foot per foot with a maximum earth pressure of 4,000 pounds per square foot.

When combining the passive and friction values for calculating the lateral resistance, the passive component shall be reduced by one third.

The vertical and lateral bearing values indicated above are for the total of dead and all frequently applied live loads and may be increased by one-third for short duration loading which includes the effects of wind or seismic forces.

Seismic Coefficients

Older dune sand was encountered at the subject site. The foundations of the proposed residential building are to be founded into firm older dune sand. Based upon the 2022 CBC,

ASCE7-22 is adopted for the calculations of the seismic coefficients for the designs of the proposed structures at the subject site as below:

- Site Latitude = 33.855841, Longitude = -118.393066
- Site Class: D
- Spectral Acceleration for Short Periods, $S_S = 2.15$
- Spectral Acceleration for a 1-Second Period, $S_1 = 0.83$
- Maximum Spectral Acceleration for Short Periods, $S_{MS} = 2.16$
- Maximum Spectral Acceleration for a 1-Second Period, $S_{M1} = 1.80$
- Design Spectral Acceleration at Short Periods, $S_{DS} = 2/3\ S_{MS} = 1.44$
- Design Spectral Acceleration at 1-Second Period, $S_{D1} = 2/3\ S_{M1} = 1.20$
- Seismic Design Category : E

Retaining and Basement Walls

Freestanding walls should be designed for static earth pressure as shown in Plate 7.1. Where retaining walls exceed 6 feet in retained height, the walls should be designed with the dynamic seismic lateral earth pressures based on the Building Code requirements plus the static lateral earth pressures. Based upon $S_{DS}/2.5$ by the County requirement, the seismic earth pressures used for the design of the retaining wall should be designed with an equivalent fluid pressure as calculated in Plate 7.3. For allowable bearing values see "Spread Footing Foundations." For resistance of lateral loads see "Lateral Design."

Basement wall or similar walls retaining earth where the top of the wall is restricted from deflecting outward under the lateral earth pressure, such as by a concrete floor slab, should be considered as non-freestanding walls. The wall should be considered as being supported by the foundation and the upper floor slabs with those elements being designed to support the earth pressures. The earth pressure may be computed as equivalent to a fluid weighing trapezoidal pressure block as shown in the attached Plate 7.2. The Engineer or Architect should indicate where the wall may be backfilled.

Wall should be backfilled with on-site soil materials, compacted as described under "Grading", or with uniform crushed rock vibrated into place, and provided with backfill subdrains. If the wall is backfilled with the latter, the upper two feet should be backfilled with an impermeable layer of compacted earth. The subdrains should consist of 4-inch minimum diameter perforated pipe placed within filter material 3 to 5 inches vertically above the earth, 12 inches horizontally to any soil and 2 inches clear of any masonry or concrete surface. The filter material should consist of ¾ inch crushed rock. The base of the filter material should be two feet wide, or the width of the area to be backfilled whichever is less, placed up against the stem of the wall and a one-foot thickness continued up along the stem of the wall to within 24 inches of the finish grade surface. The invert of the perforated pipe should be at least 12 inches below finished basement floor slab elevation. Perforated pipe should slope at least one percent, preferably two percent to daylight, with perforations pointing down and out to the side. Open head joints in concrete block are often inadequate

as grout flow may seal them off. The 4-inch perforated pipe, encased in at least one cubic foot of ¾" crushed rock for the subdrain system behind walls, should be wrapped with geo-textile filter cloth.

Where penetration of moisture or water through basement wall is undesirable, the designer should take appropriate measures. As a minimum the designer should give consideration to treatment of the backfill side of the wall with a bituminous coating for resistance to penetration of water vapor. Troweled mortar coats, particularly for masonry surfaces, may be required to level irregular wall surfaces before application of bituminous coatings. In more critical applications, particularly where there may be a hydrostatic head of water, a bituminous membrane or similar system should be considered. All concrete and masonry should be of durable materials and carefully constructed to obtain a watertight member.

Foundation Settlement

Settlement of foundation is expected to occur on initial application of loading. The settlement is expected to be ¼ to ¾ inch, depending upon final loads. Differential settlement is not expected to exceed 1/3 inch for a horizontal distance of 30 feet.

Temporary Construction Excavations

Excavations will be required for the proposed construction. The excavation is expected to expose on-site older dune sand soil which is not suitable for vertical excavations over four feet. Portions of excavations over four feet should be trimmed to a 2:1 slope gradient. All excavations should be stabilized within 30 days of initial excavation. Water should not be allowed to pond on top of the excavation nor to flow toward it. No vehicular surcharge should be allowed within five feet of the top of cut.

All safety provisions of Cal OSHA and other related statutory agencies should be adhered to, especially as related to support of adjacent structures.

Temporary shoring should be designed for an active equivalent fluid pressure of 30 pounds per cubic foot.

Temporary excavations during the raining season are subject to potential hazards, such as caving, floods, erosion, raveling of the cuts and concentrated drainage. The potential damage from these hazards can be greatly reduced by maintenance of cuts and drainage facilities and erosion controls in the surrounding areas of the cuts. It is the responsibility of the owner or the project contractors to maintain the excavated areas and to improve any deficiencies found during the raining season.

Slabs On-Grade

The on-site soils are classified to be non-expansive. Slabs should be cast over a minimum of two inches of vibrated sand or miscellaneous base material placed on firm subgrade soil. The subgrade soil should be proof-rolled to remove any soft spots prior to covering of sand bedding and vapor barrier. Slabs should be reinforced with a minimum of #4 rebars at 24 inches on center each way. Slabs which will be provided with a floor covering should be protected by a polyethylene plastic vapor barrier. The barrier should be covered with a minimum two-inch layer of clean sand or miscellaneous base material to prevent punctures and aid in the concrete cure.

A minimum 4 inch concrete slab should be designed for interior and exterior concrete slabs.

As is typical in reinforced concrete construction, cracking of concrete can occur and is a common process. Reinforcement and crack control joints are intended to minimize this risk. In addition, irregularities of new slabs are common. A completed slab is generally not perfectly level and not free of some type of cracking.

Grading

The General Earthwork Specifications, Appendix B, should be used in preparation of the grading plans and job specifications where engineered fills are used and constitute our definition of an engineered fill. We should review all documents prior to submission for statutory permits or contracting in order to ascertain that the intents of our recommendations are conveyed.

Drainage Control

Control of soil moisture is essential for the long term performance of improvements. All roof and surface drainage should be conducted away from the development in engineered non-erosive devices to a safe point of discharge and to the street.

Slabs and planted areas immediately adjacent to the dwelling or appurtenant structures should slope a minimum of 5% away from said structures, measured perpendicular to the face of the wall, to mitigate pooling of water. All other slabs and planted areas should be sloped a minimum of 2% to drain to a safe point of collection. All roof drainage should be collected in eave gutters that discharge directly into engineered non-erosive drainage devices. All joints in slab and swales should be maintained sealed with an appropriate joint compound.

Drainage devices shall be provided as specified by the Building Code and Grading Ordinances.

Plan Reviews

Final development plans should be reviewed by this office to ascertain that the general intents of the recommendations of this report have been incorporated into the plans. Additional structures not analyzed during this investigation should be reviewed by a representative of this office.

On-Site Construction Reviews

On-site construction reviews of all grading, drainage, and foundation work should be performed by a field representative of this office to ascertain compliance with the recommendations of this report. Final grading and/or construction should be observed and a written observation form or report issued by this office stating that the work meets the recommendations of this report. The stages at which our on-site construction reviews are to be performed should include, but are not necessarily limited to, the following stages of work:

1. Observation of footing excavations prior to placement of form boards or reinforcing steel.

2. Observation of temporary excavations and of the installation of a shoring system.

3. As called for in Appendix B for on-site construction reviews and testing of all grading work and of compacted earth backfilling behind the basement retaining walls.

4. During proof rolling of subgrade soil before placement of base material or reinforcing steel, and again following the placement of base material prior to placing reinforcing.

5. Observation of installation of subdrain perforated pipes before covering with gravel or filter material, and again after placing the filter material over perforated pipes before covering with backfill.

6. Observation of installation of drainage structures and completion of all work.

All work and materials should comply with the latest applicable specifications of the City of Hermosa Beach.

Permits

Design and construction should be carried out under applicable conditions and permits of the City of Hermosa Beach Building Code and other concerned statutory authorities.

Remark

The conclusions and recommendations submitted in this report are based in part upon the data obtained from two exploratory test trenches excavated by this office and site observations during the field exploration operations. The nature and extent of variations between the trenches may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report. No warranty is made nor should any be construed that deep-seated soil or geological weaknesses may not exist below the depths explored. This office shall be notified if any unusual conditions differing from that disclosed by this report are encountered during construction.

In the event of any change in the assumed nature, or design of the proposed project as planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed by this office and the conclusions of this report modified or verified in writing.

This report is issued with the understanding that it is the responsibility of the owner, or of their representative to insure that the information and recommendations contained herein are called to the attention of the architect and engineers for the project and incorporated into the plan, and that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

This report has been prepared for the exclusive use of the client and authorized agents, and in accordance with generally accepted soil and foundation engineering practices. No other warranties either expressed or implied are made as to the professional advice provided under the terms of this agreement and included in the report.

It is recommended that this office be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design specifications. As a condition for use of this report the above described “Plan Reviews” and “On-Site Construction Reviews” are to be performed. (If this office is not accorded the privilege of making the recommended reviews, we can assume no responsibility for misinterpretation of their recommendations).

The statements contained in this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or to the works of man, on this or adjacent properties. In addition, if changes in applicable or appropriate standards occur, whether they result from legislation or the broadening of knowledge, the conclusions of this report could be invalidated, wholly or partially, by changes outside of our control.

Thank you for this opportunity to be of service. If you have any questions regarding this report, please contact the undersigned at the letterhead location.

Very truly yours,

T.I.N. ENGINEERING COMPANY

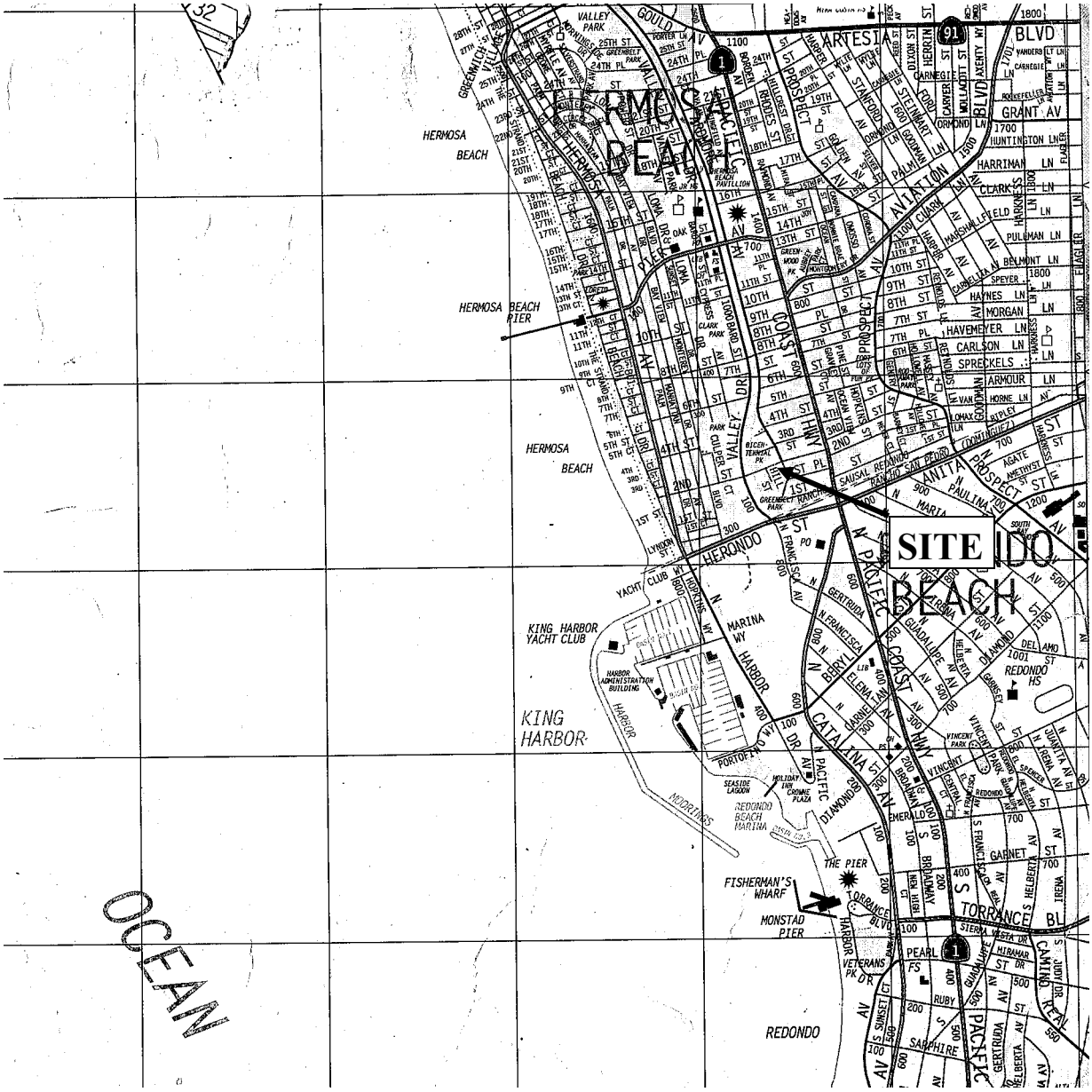
Tony S. C. Lee, M.S., P.E.
Project Engineer

TSCL:ir

Enclosures:

Vicinity Map	Plate 1
Site Plan	Plate 2
Test Trench Logs	Plates 3.1 - 3.2
Moisture Density Test Results	Plate 4
Direct Shear Test Results	Plate 5
Consolidation Test Results	Plate 6
Design of Free-Standing Wall	Plate 7.1
Design of Non-Freestanding Wall	Plate 7.2
Peak Ground Acceleration Map	Plate 7.3
Exploration and Laboratory Testing	Appendix A
General Grading	Appendix B

Distribution: Client (3)



VICINITY MAP

SOURCE: The Thomas Guide, 1996
Sheet No. 762, Los Angeles County

N

SCALE 1" = 2,400'

JOB NO.: 232725	**DATE:** September 9, 2023	**PLATE** 1

SITE: PDDG
554 2nd Street, Hermosa Beach, California

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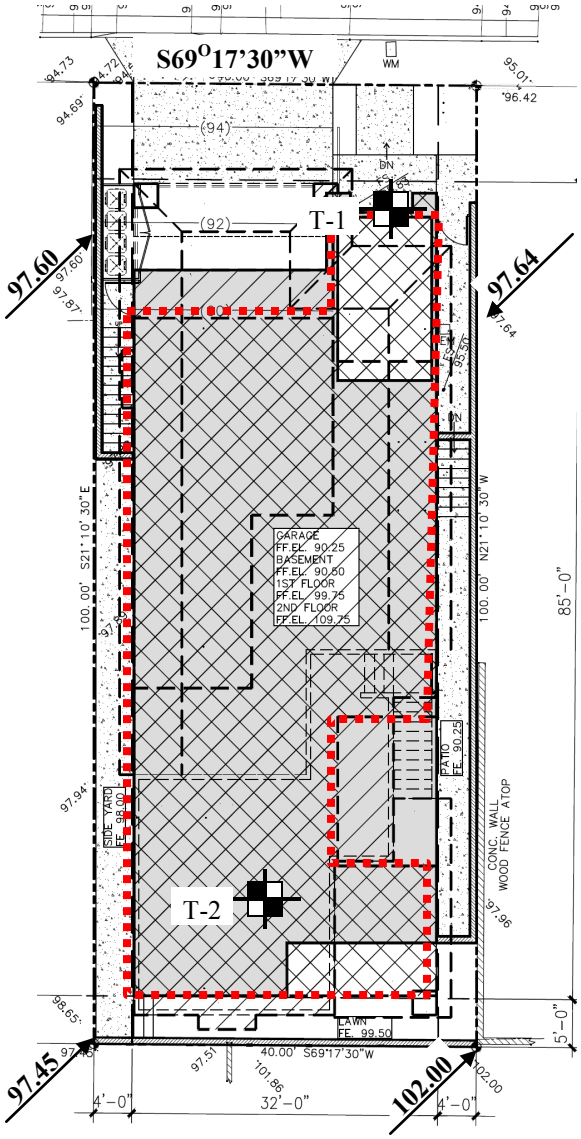
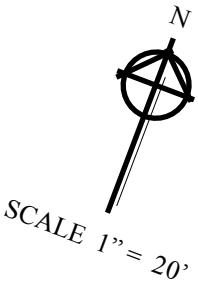
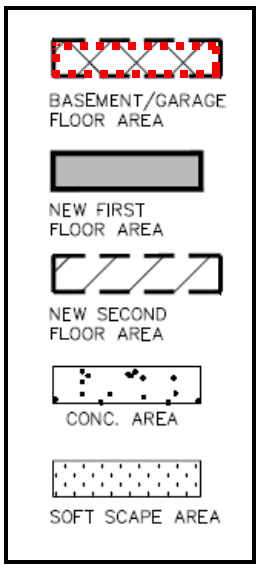
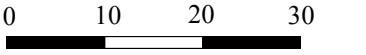
2ND STREET









LEGEND

EXPLORATORY TEST TRENCH T- 1

T-1

EXISTING SITE PLAN

JOB No. : 232725	**DATE:** September 9, 2023	**P L A T E** 2

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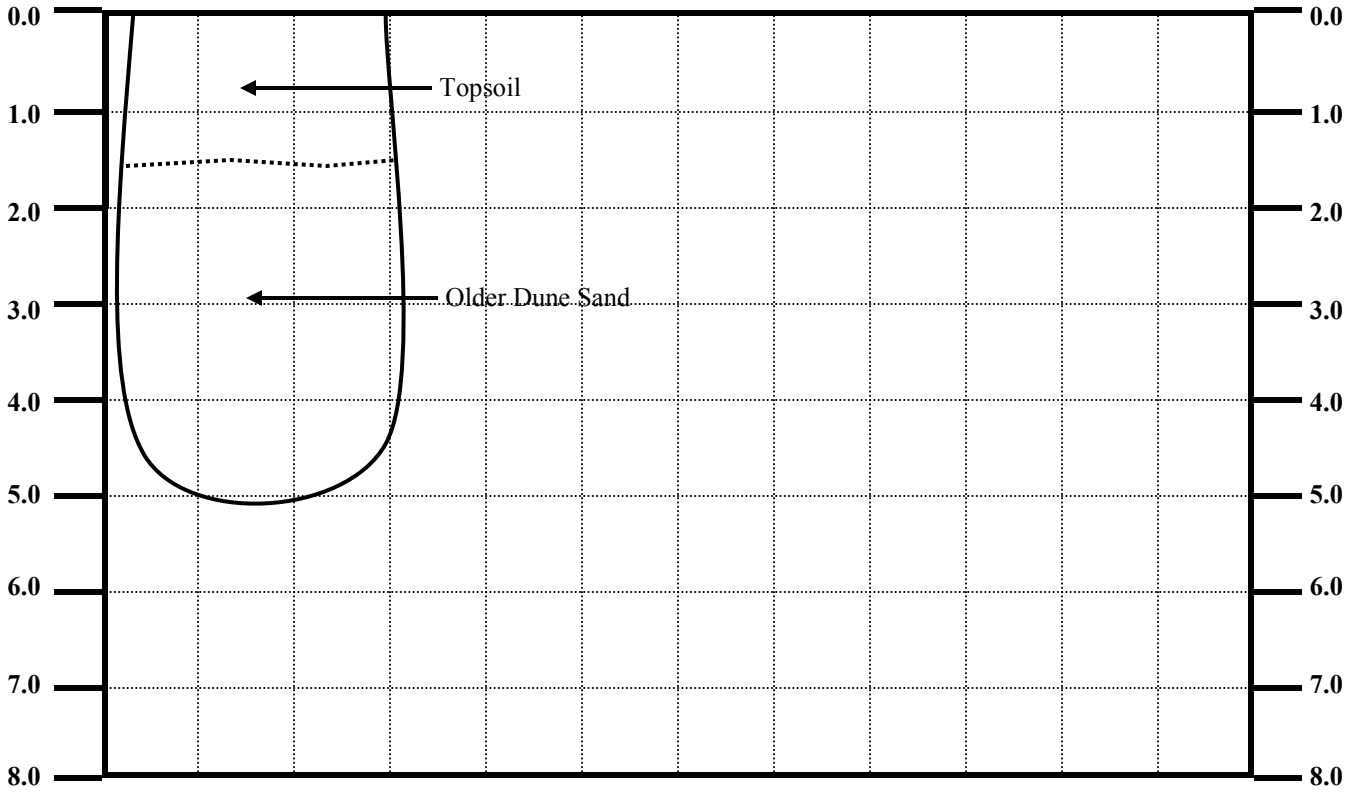
TEST TRENCH T-1 LOGS

0.0’ - 1.5’ Topsoil - gray, dry to slightly moist, soft to moderately soft, cohesionless sand (SP) with abundant rootlets.

1.5’ - 5.0’ Older Dune Sand - light brown, slightly moist, dense, fine to medium grained, cohesionless sand (SP).

(No groundwater encountered. No caving encountered.)



Trench No. T - 1 Length: 2.0’ Width: 2.0’ Depth: 5.0’

THE LOG OF SUBSURFACE CONDITIONS HEREON APPLIES ONLY AT THE SPECIFIC LOCATION AND THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

LOGGING DATE: 06/26/2023

DATE: September 9, 2023

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P L A T E 3.1

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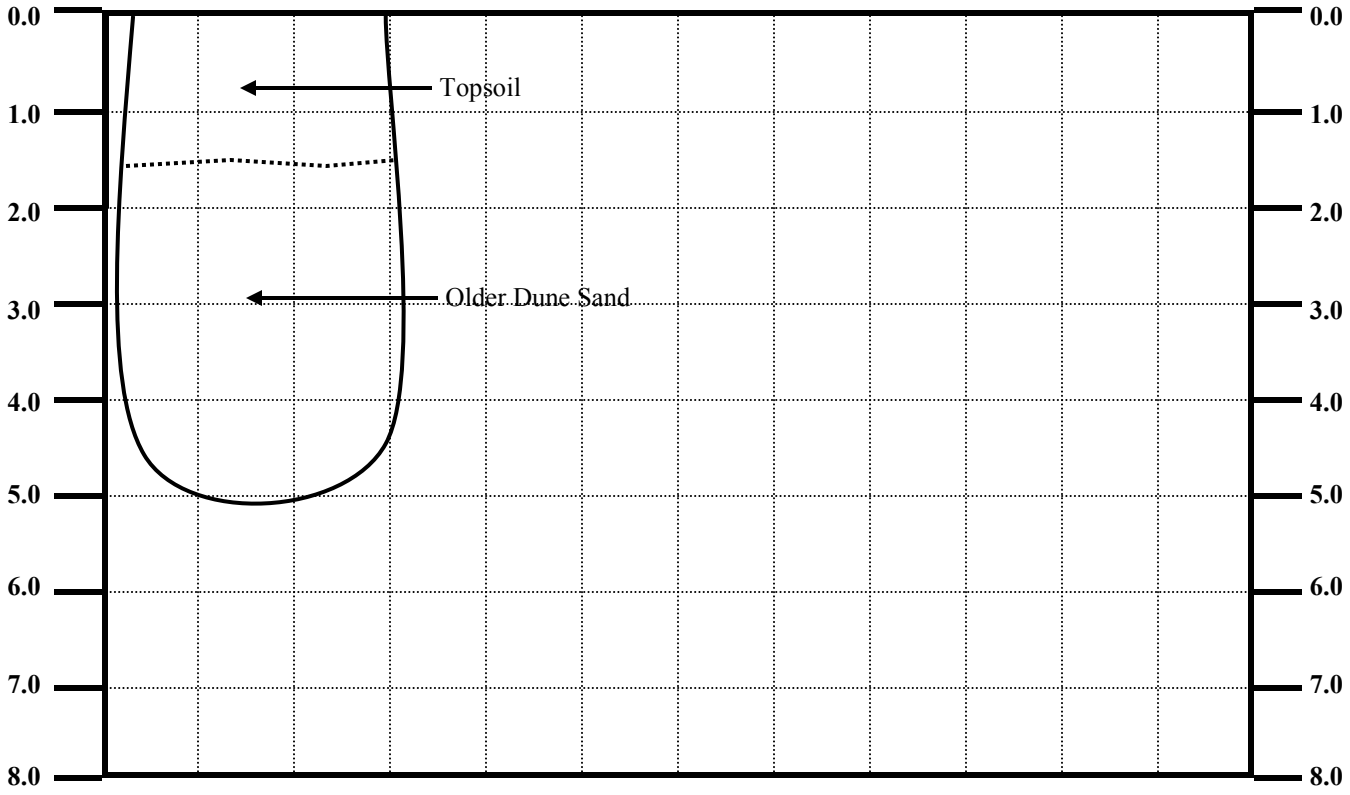
TEST TRENCH T-2 LOGS

0.0’ - 1.5’ Topsoil - gray, dry to slightly moist, soft to moderately soft, cohesionless sand (SP) with abundant rootlets.

1.5’ - 5.0’ Older Dune Sand - light brown, slightly moist, dense, fine to medium grained, cohesionless sand (SP).

(No groundwater encountered. No caving encountered.)



Trench No. T - 2 Length: 2.0’ Width: 2.0’ Depth: 5.0’

THE LOG OF SUBSURFACE CONDITIONS HEREON APPLIES ONLY AT THE SPECIFIC LOCATION AND THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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DATE: September 9, 2023

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P L A T E 3.2

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MOISTURE-DENSITY RESULTS OF LABORATORY TEST

Trench No.	Depth (ft)	Moisture Content (% dry wt.)	Dry Density (puff)	Comment
T-1	**5.0**	**3.2**	**95.7**	**Older Dune Sand**
T-2	**5.0**	**3.3**	**91.3**	**Older Dune Sand**

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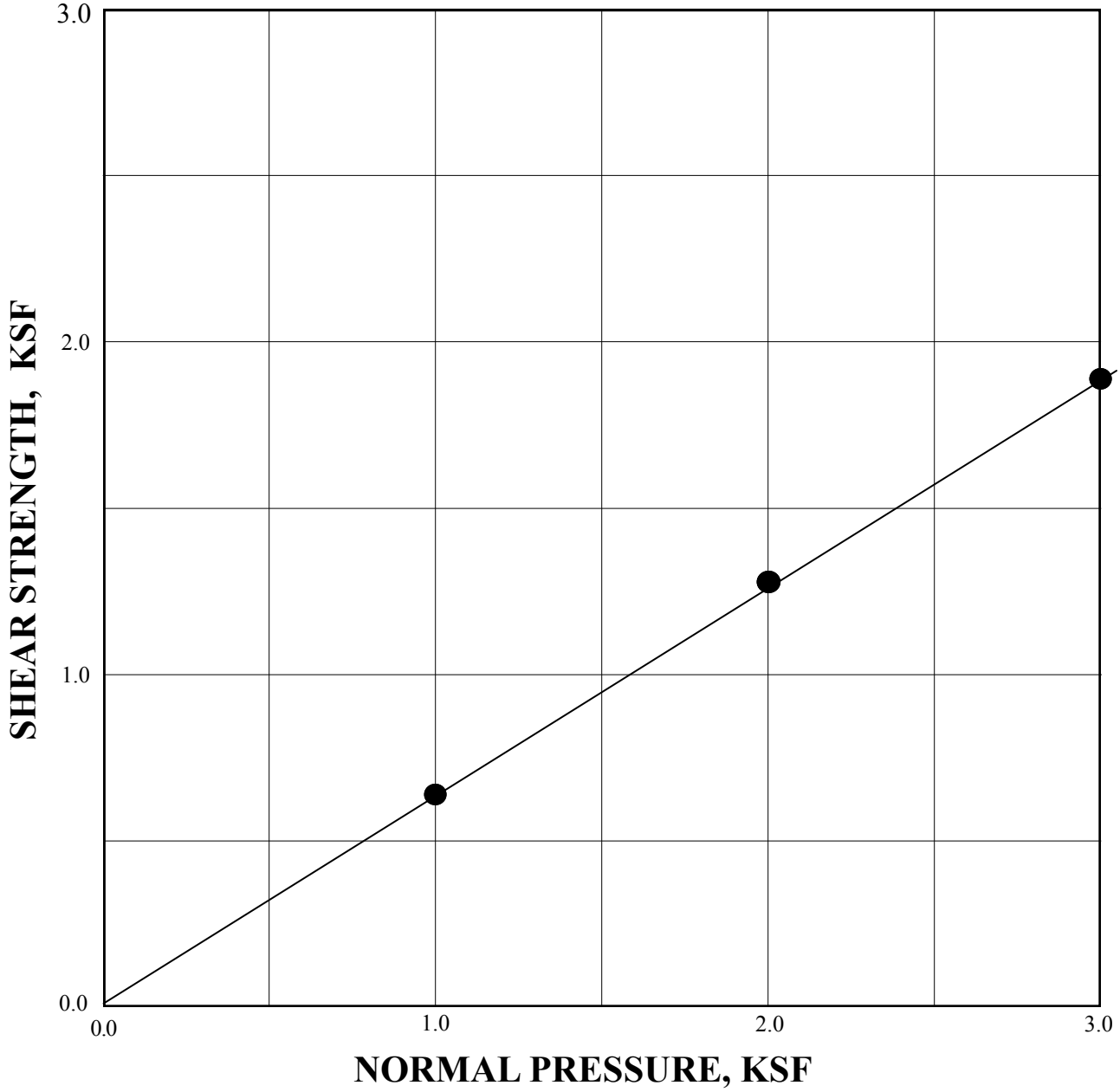
SYMBOL	SOIL SAMPLE	LOCATION	DEPTH (ft)	Ø	C (psf)
●	Older Dune Sand – Cohesionless Sand,	T - 1	5.0	32°	15



PLOT OF DIRECT SHEAR TEST DATA	**JOB NO:** 232725
SITE: PDDG 554 2nd Street, Hermosa Beach, California	**DATE:** September 9, 2023
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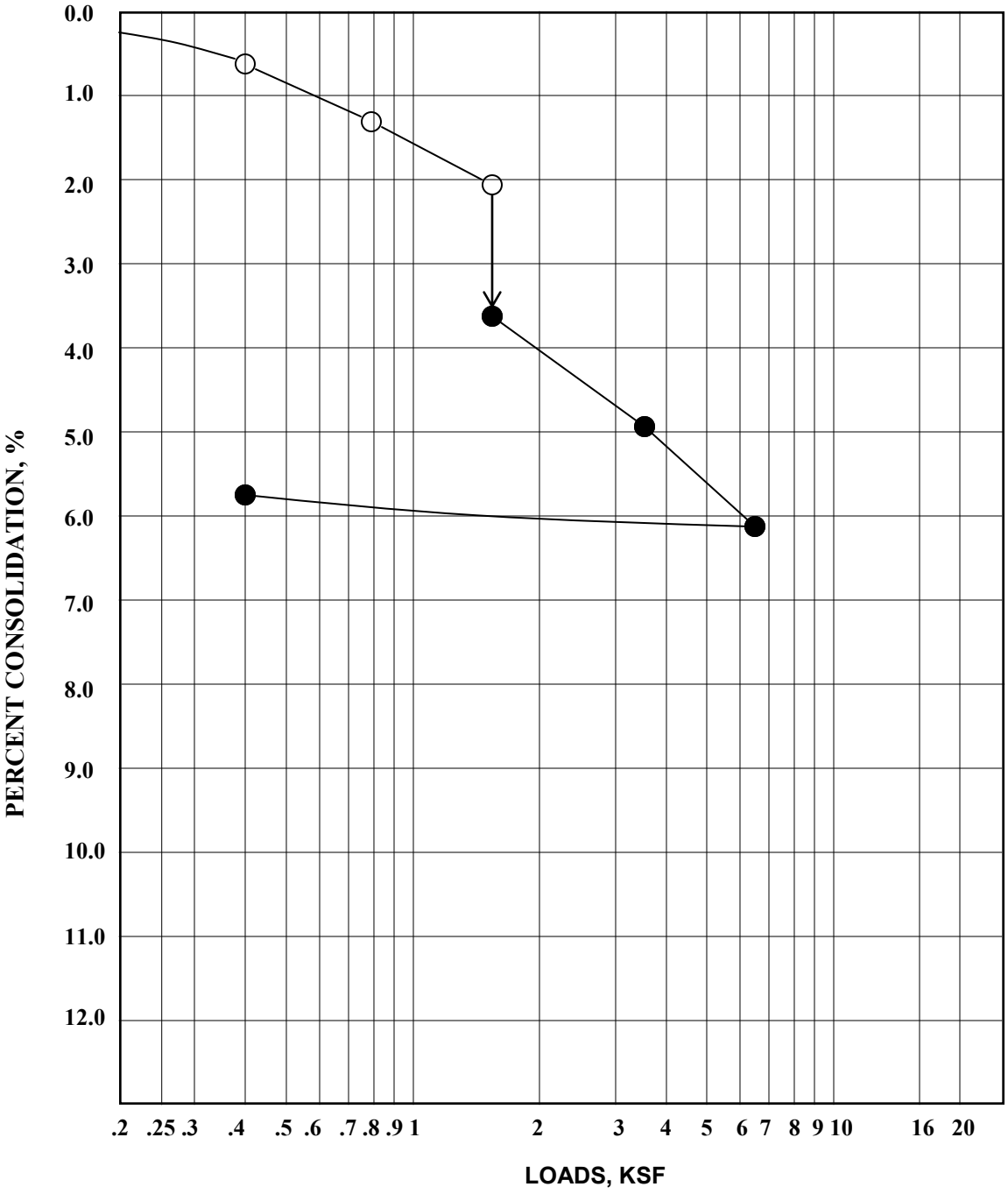

LOAD - CONSOLIDATION CURVE

SAMPLE LOCATION : Older Dune Sand – Cohesionless Sand, T – 2 @ 5.0'
WATER ADDED: ↓

JOB NO. : 232725	**DATE:** September 9, 2023	**P L A T E** 6

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DESIGN OF FREESTANDING WALL

WITH NON-EXPANSION SOIL CONDITION

Surface Slope of Retained Material * Horizontal to Vertical	Equivalent Fluid Weight $lbs/ft^2/ft$
Level	**30**
5 TO 1	**32**
4 TO 1	**35**
3 TO 1	**38**
2 TO 1	**43**
1 ½ TO 1	**55**
1 TO 1	**80**

*** Where the surface slope of the retained earth varies, the design slope shall be obtained by connecting a line from the top of the wall to the highest point on the slope whose limits are within the horizontal distance from the stem equal to the stem height of the wall.**

JOB No. : 232725	**DATE:** September 9, 2023	**P L A T E** 7.1

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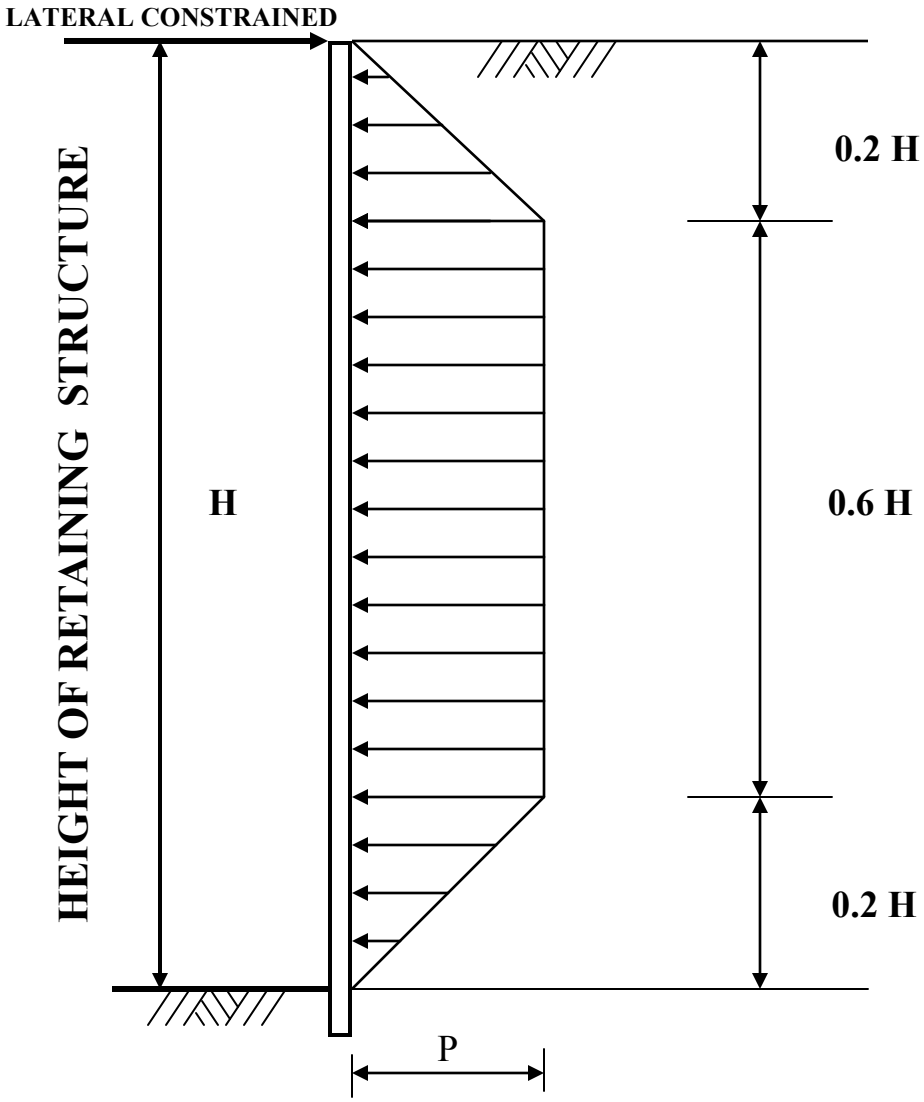
LATERAL DESIGN
FOR
NON-FREESTANDING RETAINING WALL
WITH NON-EXPANSIVE SOIL CONDITION



P = 25 H psf/ft FOR NON-FREESTANDING WALL DESIGN

JOB No. : 232725	**DATE:** September 9, 2023	**P L A T E** 7.2

SITE: PDDG
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CALCULATIONS OF SEISMIC EARTH PRES-

ACCORDING PAGE 7.2 - 78 OF NAVAL DESIGN MANUAL 7.02

$P_{AE} = \frac{1}{2} \gamma H^2 K_A$ (STATIC) + $\frac{3}{8} \gamma H^2 K_H$ (SEISMIC)

$= \frac{1}{2} \gamma_{E.F.P.} H^2$ (STATIC)+ $\frac{1}{2} (\frac{3}{4} \gamma K_H) H^2$ (SEISMIC)

IN WHICH K_H = HORIZONTAL ACCELERATION IN "g"s

= $S_{DS}/2.5$, PGA (S_{DS} = 1.44, See Section "Seismic Coefficients" of this report.)

= 0.576

Soil Density: γ = 110 pcf

Basement (restrained) walls with level backfill:	$\Delta P_{ae} = \frac{1}{2}\gamma H^2 (0.68\, PGA/g)$
Cantilever (unrestrained) wall with level backfill:	$\Delta P_{ae} = \frac{1}{2}\gamma H^2 (0.42\, PGA/g)$
Cantilever (unrestrained) wall with sloping backfill*:	$\Delta P_{ae} = \frac{1}{2}\gamma H^2 (0.70\, PGA/g)$

1. For Restrained Basement Walls with Level Backfill:

$\frac{1}{2} (\gamma H^2) (0.68 PGA/g) = \frac{1}{2} (\gamma H^2) (0.68 PGA/g)$

$= \frac{1}{2} (\gamma H^2)(0.68 \bullet 0.576)$

$= \frac{1}{2} (\gamma H^2)(0.39168)$

FOR SEISMIC: 43 psf/ft

2. For Unrestrained Cantilever Walls with Level Backfill:

$\frac{1}{2} (\gamma H^2) (0.42 PGA/g) = \frac{1}{2} (\gamma H^2) (0.42 PGA/g)$

$= \frac{1}{2} (\gamma H^2)(0.42 \bullet 0.576)$

$= \frac{1}{2} (\gamma H^2)(0.24192)$

FOR SEISMIC: 27 psf/ft

3. For Unrestrained Cantilever Walls with Slope Backfill:

$\frac{1}{2} (\gamma H^2) (0.70 PGA/g) = \frac{1}{2} (\gamma H^2) (0.70 PGA/g)$

$= \frac{1}{2} (\gamma H^2)(0.70 \bullet 0.576)$

$= \frac{1}{2} (\gamma H^2)(0.4032)$

FOR SEISMIC: 44 psf/ft

JOB No. : 232725	**DATE:** September 9, 2023	**P L A T E** 7.3

SITE: PDDG
554 2nd Street, Hermosa Beach, California

T.I.N. ENGINEERING COMPANY
17834 BAILEY DRIVE •TORRANCE • CALIFORNIA (310) 371-7045

APPENDIX A

EXPLORATION AND LABORATORY TESTING

Exploration

Field exploration was performed using a truck mounted drill rig, backhoe, or hand-diggers as noted in the report.

Undisturbed samples of representative soils were obtained at frequent intervals in the boring or trench excavations. In drilling boring, the samples were obtained by driving a thin walled steel sampler with successive drops of the drilling Kelly Bar. The driving energy required for one foot of penetration is shown on the boring summary sheets. Soil samples were retained in 2 ½ inch diameter and 1 inch in height brass rings. In backhoe or hand-dug trenches, undisturbed samples were obtained with thin walled tubes carefully driven by hand into the trench walls and by carving chunk samples directly from the trench walls.

Classification of Soils

All soils were visually classified in accordance with the Unified Soil Classification System per ASTM D 2487.

Moisture and Density

The moisture density information can provide a gross indication of soil consistency and delineate local variations. The information can also be used to correlate soils found on this site with soils on other sites in the general area. The dry unit weight and field moisture content were determined for selected undisturbed samples. Moisture and density were done using the ASTM D 2216 method.

Direct Shear Test

Shear tests were made with a direct shear machine of the strain control type. The shear test samples are saturated to simulate expected extreme moisture conditions. Unless indicated otherwise, tests were performed at a constant rate of shear displacement of approximately 0.002 inches per minute, under vary loads and under conditions of saturation. Samples at the indicated moisture conditions, were tested at three or more normal loads in order to determine the Coulomb shear strength parameters. ASTM D 3080 method was followed to perform all shear tests.

Consolidation Test

Soil settlement predictions under load are made on the basis of consolidation tests. The consolidation apparatus is designed to receive one-inch high rings. Loads are applied in several increments, in a geometric progression, and the resulting deformations are recorded at selected time intervals. Porous stones are placed in contact with the top and bottom of each specimen to permit addition and release of pore liquid. Samples are generally tested at increased content by adding water to determine the effect of water contacting the bearing soil. The normal load at which water is added is noted on the plate. Results are plotted on the "Load-Consolidation Curve." ASTM D 2435 method is followed during a consolidation test.

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			Group Symbols	Typical Names
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: 50% or more of coarse fraction retained on No. 4 sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands: More than 50% of coarse fraction passes No. 4 sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-silt mixtures
Fine-Grained Soils: 50% or more passes No. 200 sieve	Silts and Clays: Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays: Liquid Limit Greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

APPENDIX B

GENERAL GRADING

The following guidelines should be used in preparation of any grading plans and job specifications where engineered fills are used and retaining walls backfilled. We should review all documents prior to submittal for statutory permits or contracting in order to ascertain that the intent of our recommendations is conveyed.

1. The area to receive compacted fill shall be stripped of all vegetation, debris, existing fill, and soft or disturbed soils, The excavated areas shall be reviewed by the geotechnical engineer in the field prior to placing controlled, compacted fill.

2. The exposed grade shall then be benched, appropriately graded, scarified to a depth of six inches, moistened to optimum moisture and recompacted to 90 percent of the maximum density.

3. The excavated on-site materials are considered satisfactory for reuse in the engineered fill. Remove any organic trash or deleterious materials. Remove boulders larger than 6 inches.

4. Soil shall be spread evenly in layers not to exceed 4 inches while loose for compaction by wrackers. Add water as required. Only approved compaction equipment shall be used.

5. The fill shall be compacted to at least 90 percent of the maximum laboratory density for the material used. The maximum density shall be determined by ASTM D 1557-07.

6. Periodic on-site construction reviews and field tests shall be performed by the geotechnical engineer during grading to assist the contractor in obtaining the required degree of compaction and the proper moisture content. Where compaction is less than required, additional compactive effort should be made with adjustment of the moisture content, or the layer stripped out and replaced in thinner layer, as necessary, until a minimum of 90 percent relative compaction is obtained. The contractor shall call the soil engineer to test every two feet of vertical lift.

7. No fill soils shall be placed during unfavorable weather conditions. When work is interrupted by rains, fill operation shall not be resumed until the field tests by the soils engineer indicate that the moisture content and density of the fill are as previously specified.