GEM

Geotechnical Environmental Materials Testing

Geotechnical Investigation

Proposed UDOT Maintenance Shed

Approximately 5350 West 200 South Street

Hurricane, Washington County, Utah

Prepared For:

Sargent Design Group
36 North 300 West Street
Cedar City, Utah 84720

October 28, 2008

Report Number: RG0903

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Subject: Proposed UDOT Maintenance Shed
Approximately 5350 West 200 South Street
Hurricane, Washington County, Utah

Enclosed is our geotechnical investigation report for the subject building to be constructed at the subject site in Hurricane, Utah.

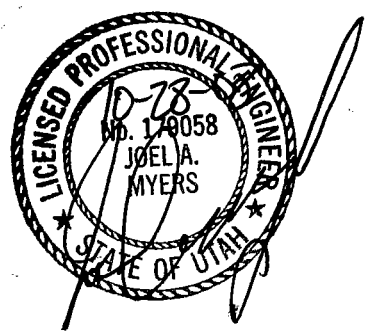
The report details our field exploration and laboratory testing program and presents our analysis, opinions and recommendations for the proposed project.

Moderately collapsible/compressible soils were encountered which will need to be overexcavated and recompacted as outlined in this report.

We appreciate this opportunity to be of service on this phase of the project and look forward to being of service as the project progresses. If you have any questions, please contact this office at your convenience.

Sincerely,
GEM Engineering, Inc.

Joel A. Myers, P.E.
President



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Appendix A

1.0 INTRODUCTION

1.1 General

This report presents the results of a geotechnical investigation performed for the proposed UDOT Maintenance Shed at approximately 5350 West 200 South Street in Hurricane, Washington County, Utah. The study was conducted in accordance with the client's authorization.

The purposes of this investigation were to: (1) evaluate the general site geologic conditions and identify potential geotechnical hazards to the proposed structures; (2) evaluate the general nature and engineering properties of the subsurface soils at the site; and (3) provide recommendations and opinions regarding general site grading and the design and construction of foundations, concrete slabs-on-grade and asphaltic concrete pavements. The investigation included a site reconnaissance, subsurface exploration representative soil sampling, laboratory testing, engineering analyses and preparation of this report.

The recommendations contained in this report are subject to the limitations presented in the "Limitations" section of the report. We recommend that all individuals reading this report read the limitations section of this document.

1.1 Project Description

We understand that a single-story or two-story maintenance building will be constructed at the location described in Hurricane, Utah. Structural loads are expected to be moderate.

The proposed site plan on Plate 1 shows the approximate property boundaries with respect to the approximate boring locations.

2.0 FIELD EXPLORATION

The subsurface soil conditions were explored by boring 6 exploratory holes to depths of approximately 5 to 30 feet below the existing site grade. The approximate locations of these explorations are shown on Plate 1. Soils and subsurface conditions encountered in the explorations were classified, logged, and recorded at the time of exploration by our field geologist. The results of the explorations are presented on the enclosed Plates 2 through 7. A key to soil symbols and terms is found on Plate 8.

3.0 LABORATORY TESTING

Representative soil samples from the exploration were tested in the laboratory for solubility, Atterberg limits, maximum density, and consolidation behavior. Results are presented on Plates 9 through 13.

4.0 SITE CONDITIONS

4.1 Surface Conditions

The site is located at approximately 5350 West 200 South Street in Hurricane, Washington County, Utah, as shown on Plate 1. At the time of our investigation it was vacant and surrounded by vacant land and a few existing structures. The surface slopes to the southeast.

4.1 Subsurface Conditions

Based on the exploration performed for this investigation, the on-site soils generally consisted of stiff to very stiff or medium dense sandy clay, clayey gravel, or silty, clayey sand extending to a depth of approximately 1 to 2 feet below existing grade. This material was underlain by very stiff to very hard or medium dense to very dense sandy clay, silty sand, clay-silt, clayey gravel, and silty, clayey sand extending to the bottoms of the bore holes.

Groundwater was not encountered during the exploration. The soils were in a slightly moist to moist condition throughout the depths explored.

The encountered subsurface conditions are described in detail on the enclosed boring logs, Plates 2 through 7. Due to the nature and depositional characteristics of the native soils, care should be taken in extrapolating subsurface conditions beyond or interpolating them between the exploration locations.

The laboratory test results indicated that the on-site soils exhibited a low to moderate degree of solubility, a low to moderate plasticity, and a moderate collapse potential.

5.0 ENGINEERING ANALYSIS AND RECOMMENDATIONS

5.1 General

Based on our investigation there are loose, soft and/or collapsible soils located at the site which will require stabilization and/or overexcavation prior to the placement of structural fill. However, it is our opinion that the subject site is suitable for the proposed construction provided that the recommendations contained in this report are followed.

The following sections of this report present our recommendations to reduce the potential for structural damage. They contain specific opinions and recommendations concerning construction considerations, site preparation and grading, structural fill, foundation design, retaining walls, concrete slabs-on-grade, soil corrosion, moisture protection, and structural pavement sections.

One of the most critical recommendations to follow in order to reduce potential for structural damage is to set the finished floor slab elevations high enough to facilitate proper drainage away from the structure.

5.2 Construction Considerations

5.2.1 Foundation Systems

After overexcavation and recompaction are completed, the structures can be supported by conventional strip and/or spread footings founded on properly placed and compacted structural fill.

5.3 Earthwork

5.3.1 Site Preparation and Grading

Within the areas to be graded, existing vegetation, loose soils, and debris should be removed and hauled off the site. Any undocumented fill soils and soft, loose,

collapsible and/or disturbed native soils should also be excavated to expose competent, dense or medium-dense native soils.

Based upon soil types and laboratory consolidation tests, the required depth of overexcavation is as follows: A minimum of 2 feet below the bottom of footing elevation or 2 feet below the existing site grade, whichever is greater. Overexcavations should extend laterally at least 5 feet beyond the edge of footing on each side or to a distance equal to the depth of overexcavation, whichever is greater. In some circumstances, after review of the excavation, GEM Engineering may approve a width of lateral overexcavation less than 5 feet but in no case shall this width be less than the required depth of overexcavation.

Slabs-on-grade, exterior concrete flatwork, and pavements should be supported by a zone of properly placed and compacted structural fill. Overexcavations on the order of 12 inches below the supportive gravel layer or 12 inches below the existing site grade, whichever is greater, are required. As an alternative to the above, 6 inches of Type 1 pit run gravel can be substituted for the 12 inches of recompacted native soils. Excavations shall extend laterally at least 2 feet beyond exterior flatwork and pavement areas.

If loose soft or pumping soils are encountered at the bottom of the overexcavations, stabilization and/or additional overexcavation will be required prior to the placement of structural fill. Overexcavations may be terminated if competent, medium-dense granular soils are encountered. A GEM Engineering representative should observe excavation and determine if it is acceptable to terminate the excavation or reduce the overexcavation depth.

The majority of the on-site soils, free of organics and debris, should be suitable for reuse as structural fill, although approximately 5 to 10% shrinkage can be expected.

Following excavation of the unsuitable soils as described above, a representative of this office should observe the excavation bottoms prior to the continuance of grading to verify that unsuitable materials have been removed and that competent soils have been exposed. The native soils exposed after overexcavation should be scarified to a depth of 6 inches, brought to within 2 percent of the optimum moisture content for granular soils and slightly above optimum for fine-grained soils, and compacted to at least 90 percent of the maximum dry density as determined by ASTM D-1557. The site should then be brought to the proper grade with structural fill as described in the Structural Fill section.

Subgrade materials supporting slabs-on-grade, exterior concrete flatwork, and pavements should be kept moist and not be allowed to dry out and crack. If the subgrade has been disturbed or dried out prior to placement of aggregate base, the exposed soils should be moisture-conditioned and recompacted as outlined in the Structural Fill section of this report.

We recommend that a GEM Engineering representative be allowed to review the grading plans when prepared to evaluate their compatibility with the recommendations of this report.

5.3.2 Excavations

The majority of the soils encountered in our explorations should be readily excavatable with conventional earthwork equipment. It is also possible that soft pumping soils may be encountered. Pumping soils will need to be stabilized prior to placing of structural fill. Safety of construction personnel is the responsibility of the Contractor.

5.3.3 Material Volume Changes

There will be shrinkage losses when excavating and compacting the on-site soils. An estimated average shrinkage factor of 5 to 10 percent is applicable for the loose to medium-dense near-surface native soils. A subsidence factor of 0.1 feet

should be used in all areas where the surficial soils are scarified and recompacted to a depth of 6 inches.

5.3.4 Structural Fill

All fill placed for the support of slabs-on-grade, exterior concrete flatwork, and pavements should be structural fill. Structural fill may consist of approved excavated on-site soils or imported fill materials. Structural fill should have a swell potential less than 4 percent under a 60 psf surcharge, have a solubility of less than 3 percent, be free of organics, salts, or inert materials larger than 4 inches nominal size, and be similar in gradation to the on-site soils.

Structural fill should be placed in maximum eight-inch loose lifts and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer. Soils in compacted fills should be compacted to at least 90 percent of the maximum dry density as determined by ASTM-D1557 for fine grained soils and 95 percent for granular soils. The moisture content should be within 2 percent of optimum for granular soils and at least 2 percent above optimum for fine-grained soils. Any imported fill materials should be approved prior to importing. Also, prior to placing any fill, the excavations should be observed by a GEM Engineering representative to observe that unsuitable materials have been removed.

5.4 Foundations

5.4.1 Conventional Foundations

General: Conventional shallow foundations consisting of strip and/or spread footings can be utilized for the support of the proposed building provided that overexcavation is completed in accordance with the requirements and recommendations of this report as described in the Earthwork section.

For frost protection the bottom of exterior conventional spread and strip footings shall be at least 12 inches below the lowest adjacent final compacted subgrade.

Foundations for structures constructed on soils, prepared in accordance with the recommendations and requirements of this report, may be designed for an allowable net bearing pressure of 1000 psf. This bearing pressure may be increased by one-third for load combinations containing seismic or wind loads.

The net allowable bearing pressure can be increased to 2000 psf if pit run gravel is utilized beneath the structure instead of the native soils. The pit run gravel must have a maximum dry density of at least 135 pcf utilizing ASTM D1557. The pit run gravel must also meet all of the requirements contained in the Structural Fill section of this report.

Prior to constructing the foundations, the footing excavations should be observed by a GEM Engineering representative to confirm that the soil preparation has been completed in accordance with the requirements and recommendations of this report.

Seismicity: The soil meets the 2006 International Building Code (IBC) requirements for a site class D. The seismic design category for the 2006 International Residential Code (IRC) is D_1.

Settlement: Foundations established in accordance with the recommendations and requirements of this report are estimated to subject to 1 ½" or less of settlement if the soils beneath the overexcavation do not become moistened. Estimated differential settlement could be on the order of ½ the total settlement.

Lateral Earth Pressures: The following lateral earth pressure equivalent fluid densities shall be used in the design of the structure.

Properly Compacted On-Site Soils	
Active pressure	41 pcf
At rest pressure	56 pcf
Passive pressure	208 pcf

When passive pressure is used for resistance to lateral loads the top one foot of soil should be neglected. The maximum allowable passive pressure for lateral load resistance should not exceed 1,600 psf.

A seismic lateral earth pressure coefficient (k_h) of 0.12 may be used for the analysis and design of the retaining walls and basement walls resisting soil loads.

Lateral Load Resistance: Horizontal loads acting on foundations will be resisted by friction acting at the base of foundations and/or passive earth pressures acting against the side of footings and concrete walls. If design makes use of passive earth pressures, it is important that a GEM Engineering representative be present during backfill placement.

The friction force acting along the base of footings founded on suitable foundation soils may be calculated using a coefficient of friction of 0.36.

Lateral loads acting on buried utility lines may be resisted by thrust blocks reacting against undisturbed dative soil or properly placed and compacted structural fill. The passive lateral earth pressure equivalent fluid density and coefficient of friction, previously listed, may be used for thrust block design.

5.5 Concrete Slabs-On-Grade

Satisfactory support for concrete slabs-on-grade and exterior concrete flatwork may be provided by a 6 inch layer of compacted gravel overlying properly placed and compacted structural fill as recommended in the Site Grading section of this report. The layer of

compacted gravel may consist of roadbase or pit-run gravel with a 2-inch maximum particle size and not more than 12% fines passing the No. 200 sieve. The gravel layer should be compacted to at least 95% of the maximum dry density as determined by ASTM D1557

All concrete slabs should be designed to minimize cracking as a result of shrinkage. Reinforcement shall requirements shall be provided by the Structural Engineer. Reinforcement should be installed at the mid-height of the slab unless directed otherwise by the Structural Engineer.

Special precautions must be taken during the placement and curing of all concrete slabs. Excessive slump (high water-cement ratio) of the concrete and/or improper curing procedures used during either hot or cold weather conditions could lead to excessive shrinkage, cracking or curling in the slabs. We recommend that all concrete placement and curing operations be performed in accordance with the American Concrete Institute (ACI) Manual.

5.6 Soil Corrosion

Based on similar studies performed in the area, the on-site soils contain salts in sufficient concentration to be considered corrosive to both concrete and metal. Therefore, all concrete in contact with the on-site soils and used in stemwalls should contain Type V or equivalent sulfate-resistant cement, and should be placed with a maximum four inch slump. Special protection to buried metal pipes and water lines should be considered for long term performance of these underground utilities. Consideration should be given to cathodic protection of buried metal pipes, or to the use of PVC pipe where permitted by local building codes.

5.7 Moisture Protection and Drainage

It is imperative that precautions are taken during and after construction to eliminate, or at least minimize, wetting of foundation soils. Drainage and grading shall be constructed in accordance with the requirements of section R401.3 of the 2006 International Residential

Code (IRC). Positive drainage shall be established away from the exterior walls of the structure. The required minimum slope is five percent (5%) in landscape areas and two percent (2%) in pavement areas, for a minimum distance of 10 feet from the structure. Roof runoff and other sources of moisture should not be allowed to infiltrate the soils in the vicinity of, or upslope from, the structure. Outlets to roof drains should be constructed to drain through the curb and gutter to the street. No roof moisture should infiltrate the soils beneath the foundations.

All utility trenches leading into the structures should be backfilled with compacted non-pervious fill. Special care should be taken during installation of sub floor sewer and water lines to reduce the possibility of future subsurface saturation.

Landscape watering adjacent to the structure should be eliminated. As an additional protection a concrete slab could be placed around the structure to facilitate drainage away from the structure as described above. Any planters adjacent to the structure should have sealed bottoms. It is recommended that desert landscaping techniques be utilized.

5.8 Asphaltic Concrete Pavements

Asphaltic concrete pavement sections were developed for non-dedicated areas. In developing our recommendations, we have assumed that: (1) a minimum of 8 inches of Type 1 gravel (3-inch minus pit run) will be provided beneath the pavement section; (2) a Traffic Index value of 6.5 for automobile and truck traffic and parking areas is appropriate; and (3) an R-value of 35 is representative of recompacted native soils. The following table presents the minimum recommended structural pavement sections:

Asphaltic Concrete Pavements

Traffic Condition	Assumed Traffic Index (T.I.)	Asphalt Thickness (in)	Road Base Thickness (in)	Compacted Type 1 Gravel (in)
Moderate Traffic/Parking	6.5	3	9	8

Asphalt and aggregate base material should conform to local requirements. All base material should be compacted to at least (95%) of the maximum dry density (ASTM D-1557). Asphalt should be compacted to minimum of (97%) of the Marshall maximum density. Asphaltic concrete and base materials should be tested prior to delivery to the site and during placement to determine conformance with the project specifications.

It is important that parking area grades be set to provide positive drainage to suitable drainage structures. A desirable slope for drainage in paved areas is two percent.

6.0 CLOSURE

6.1 Limitations

The recommendations contained in this report are based on the field explorations, laboratory tests, and our understanding of the proposed construction. The subsurface data used in the preparation of this report were obtained from the explorations made during this investigation. It is possible that variations in the soil and groundwater conditions could exist elsewhere on the site. The nature and extent of variations may not be evident until construction occurs. If any conditions are encountered at the site which are different from those described in this report, GEM Engineering should be immediately notified so that we may make any necessary revisions to recommendations contained in this report. In addition, if the scope of the proposed construction changes from that described in this report, GEM Engineering should likewise be notified.

This report was prepared in accordance with the generally accepted standard of practice at the time the report was written. No warranty, express or implied, is made. It is the Client's responsibility to see that all parties to the project, including the Designer, Contractor, Subcontractors, etc., are made aware of this report in its entirety. The use of information contained in this report for bidding purposes should be done at the Contractor's option and risk. GEM Engineering will not accept the responsibility for damage caused by the uncontrolled action of water at the site.

6.2 Additional Services

The recommendations made in this report are based on the assumption that an adequate program of tests and observations will be made during the construction to verify compliance with the recommendations. These tests and observations should include, but not necessarily be limited to, the following:

- Observations and testing during site preparation, earthwork and structural fill placement

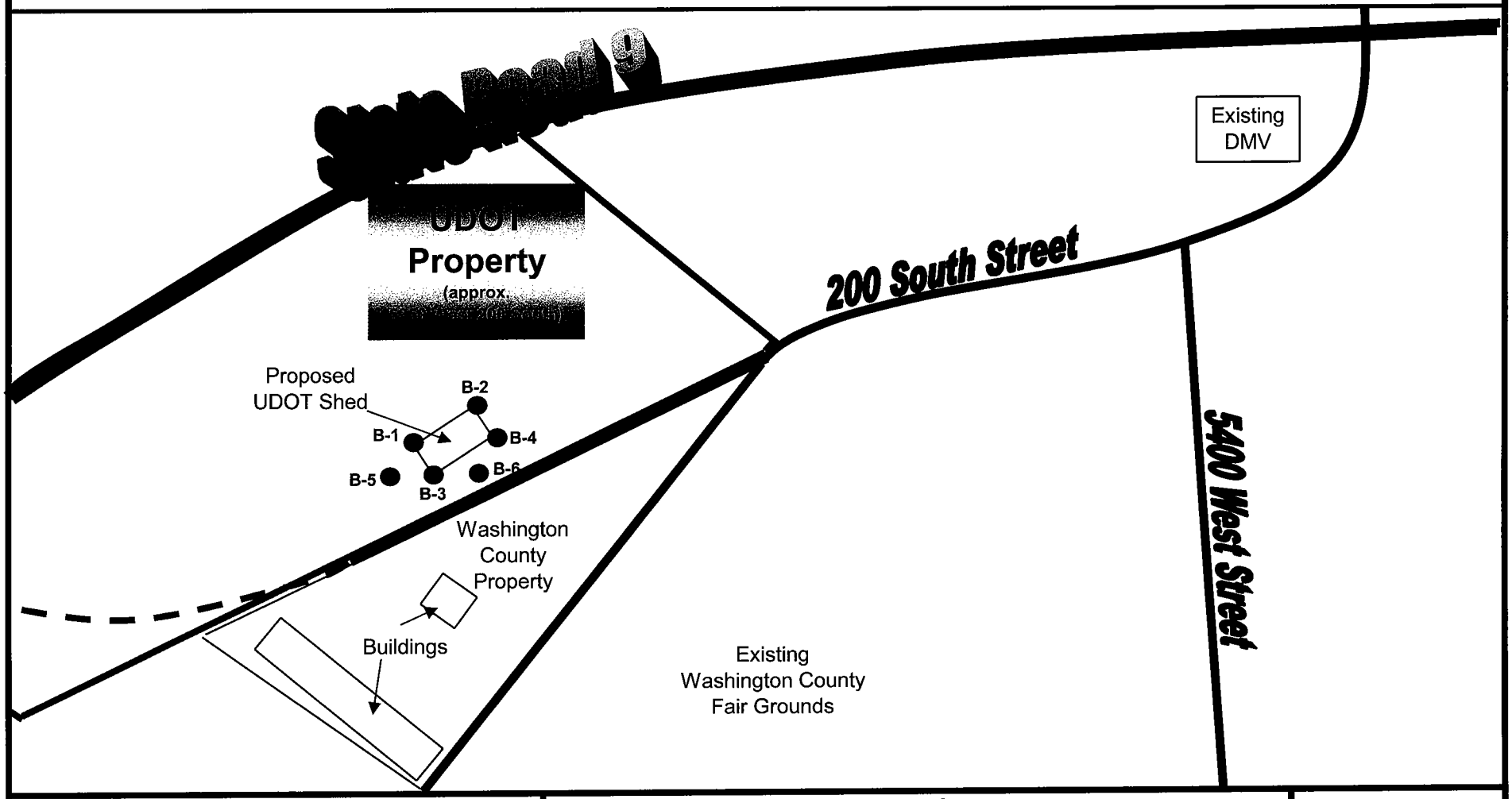
- Observations of footing excavations
- Consultation as may be required during construction

We also recommend that project plans and specifications be reviewed by us to verify compatibility with our conclusions and recommendations. Additional information concerning the scope and cost of these services can be obtained from our office.

Key
● - Approximate Boring Location

Site Plan

North ↑ Not to Scale



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Site Plan

Proposed UDOT Maintenance Shed,
Approximately 5350 West 200 South,
Hurricane, Washington County, Utah

Plate
1

Date Excavated: 10/1/2008 | Elev: Not Measured

Location: see plate 1

BORING NO. B-1

Rammer Weight:

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0							(CL) - Sandy Clay with Gravel.	Slightly Moist to Moist	Stiff to Very Stiff
							- Light Gray		
	5.1	87.7	110	AT			- some gravel observed.		Hard
							- selenite gypsum observed.		
5									
	9.3	121.3	145	SOL C			- claystone materisl.		
							- abundant selenite gypsum observed up to 1/4" thick.		
							- Dark Brown		
				SOL AT					
10							Refusal @ 10 feet.		
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▨ = Bulk Sample; ☒ = No Recovery

Notes:
- No groundwater encountered.

Project:

Proposed UDOT Maintenance Shed,
Approximately 5350 West 200 South,
Hurricane, Washington County, Utah

GEM ENGINEERING, INC.

Plate: 2

Date Excavated: 10/2/2008 | Elev: Not Measured

Location: see plate 1

BORING NO. B-2

Rammer Weight:

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0							(CL) - Sandy Clay.	Slightly Moist	Stiff to Very Stiff
							- Brown		
				SOL AT			- some gravel observed.		Hard
	6.6	105.1	110	SOL AT			- selenite gypsum observed.		
5			300				- claystone materisl.		
							- abundant selenite gypsum observed up to 1/4" thick.		
							- Brown		
			300						
10							Refusal @ 10 feet.		
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

+ Sample Type: ■ = Drive Sample; ▨ = Bulk Sample; ⊠ = No Recovery

Notes:
- No groundwater encountered.

Project:

Proposed UDOT Maintenance Shed,
Approximately 5350 West 200 South,
Hurricane, Washington County, Utah

GEM ENGINEERING, INC.

Plate: 3

Date Excavated: 10/3/2008 | Elev: Not Measured

Location: see plate 1

BORING NO. B-3a

Rammer Weight:

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0							(CL) - Sandy Clay. - Light Red Brown	Slightly Moist	Stiff
							- friable claystone.		Very Stiff
							- selenite gypsum observed.		
				SOL AT					
							- Light Gray Brown		
5									
			109	SOL C			- Green Brown		Very Hard
			200	SOL AT			- some gypsum observed.		
10									
							- Green Gray		
			130	AT, C			- abundant selenite gypsum observed.		
15									
							- Dark Green Brown		
							- Green Gray		Very Stiff
			18	SOL					
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▨ = Bulk Sample; ☒ = No Recovery

Notes:
- No groundwater encountered.
- Air rotary rig and bits used to obtain depth.

Project:

Proposed UDOT Maintenance Shed,
Approximately 5350 West 200 South,
Hurricane, Washington County, Utah

GEM ENGINEERING, INC.

Plate: 4a

Date Excavated: 10/3/2008 | Elev: Not Measured

Location: see plate 1

BORING NO. B-3b

Rammer Weight:

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
20							(CL) - Sandy Clay.		Very Stiff
							- selenite gypsum observed.		
							(CL-ML) - Clay-Silt.		
				SOL AT			- friable claystone.		
							- unreliable blow counts, after several tries, due to cuttings		
25							falling into hole.		
							- Light Gray		
30							Bottom @ 30 feet.		
35									
40									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▨ = Bulk Sample; ☒ = No Recovery

Notes:
- No groundwater encountered.
- Air rotary rig and bits used to obtain depth.

Project:

Proposed UDOT Maintenance Shed,
Approximately 5350 West 200 South,
Hurricane, Washington County, Utah

GEM ENGINEERING, INC.

Plate: 4b

Date Excavated: 10/1/2008 | Elev: Not Measured

Location: see plate 1

BORING NO. B-4

Rammer Weight:

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0							(CL) - Sandy Clay. - Light Gray - Undocumented fill. Clay and basalt mix.	Slightly Moist	Stiff to Very Stiff
						SM	(SM) - Silty Sand with some Clay.		Dense
	4.1	118.9	150	SOL AT,C					
5			110	SOL AT			(CL-ML) - Clay-Silt. - Brown		Hard
			150						
10							Refusal @ 10 feet.		
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▨ = Bulk Sample; ⊠ = No Recovery

Notes:
- No groundwater encountered.

Project:

Proposed UDOT Maintenance Shed,
Approximately 5350 West 200 South,
Hurricane, Washington County, Utah

GEM ENGINEERING, INC.

Plate: 5

Date Excavated: 10/3/2008 | Elev: Not Measured

Location: see plate 1

BORING NO. B-5

Rammer Weight:

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0							(GC) - Clayey Gravel. Undocumented fill.	Slightly Moist	Medium Dense
						SM SC	(SM-SC) - Silty, Clayey, Sand.		Dense
	5.7	106.3	50	SOL AT			- selenite gypsum crystals observed within layer.		
							(SC) - Clayey Sand.		Very Dense
	5.6	97.1	150	SOL AT			- Light Brown		
5							Bottom @ 5 feet.		
10									
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type:
- ■ = Drive Sample
- ▨ = Bulk Sample
- ☒ = No Recovery

Notes:
- No groundwater encountered.

Project:

Proposed UDOT Maintenance Shed,
Approximately 5350 West 200 South,
Hurricane, Washington County, Utah

GEM ENGINEERING, INC.

Plate: 6

Date Excavated: 10/3/2008 | Elev: Not Measured

Location: see plate 1

BORING NO. B-6

Rammer Weight:

Depth (ft.)	Field Moisture %	Dry Density (pcf)	BLOW COUNT	Other Tests *	Samples	SYMBOL +	SOIL DESCRIPTION	MOISTURE	CONSISTENCY
0						SM SC	(SM-SC) - Silty, Clayey, Sand.	Slightly Moist	Medium Dense
				SOL AT			- Light Gray		Medium Dense to Dense
							(CL-ML) - Clay-Silt with Sand.	Moist	Very Stiff
	15.3	105.3	24	SOL AT,C			- Brown		
5							Bottom @ 5 feet.		
10									
15									
20									

* Other Tests: C = Consolidation, AT = Atterberg, S = Shear, G = G. Size, E = Expansion, SOL = Solubility, DS = Direction Shear

\+ Sample Type: ■ = Drive Sample; ▨ = Bulk Sample; ☒ = No Recovery

Notes:
- No groundwater encountered.

Project:

Proposed UDOT Maintenance Shed,
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Hurricane, Washington County, Utah

GEM ENGINEERING, INC.

Plate: 7

THE UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			Group	Symbol	TYPICAL NAMES
COARSE GRAINED SOILS More than 50% of material is larger than the No. 200 sieve.	**GRAVELS** More than 50 % of coarse part is larger than the No. 4 sieve.	**CLEAN GRAVELS** Little or no fines	GW		Well graded gravels, gravel sand mixtures, little or no fines
			GP		Poorly graded gravels/gravel sand mixtures
		GRAVELS WITH FINES Appreciable amount of fines	GM		Silty gravels, gravel-sand-silt mixtures
			GC		Clayey gravels, gravel-clay-sand mixtures
	SANDS More than 50 % of coarse part is smaller than the No. 4 sieve.	**CLEAN SANDS** Little or no fines	SW		Well graded sands, gravely sands, little or no fines
			SP		Poorly graded sands or gravely sands, little or no fines
		SANDS WITH FINES Appreciable amount of fines	SM		Silty sands, sand-silt mixtures
			SC		Clayey sands, sand clay mixtures
FINE GRAINED SOILS More than 50% of material is smaller than the No. 200 sieve.	**SILTS AND CLAYS** Liquid limit less than 50		ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with low plasticity
			CL-ML		Inorganic clay-silt mixture and very fine sand, silty or clayey fine sands or clayey silts with low plasticity.
			CL		Inorganic clays of low to medium plasticity, gravely Claus, 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 sandy or silty soils, elastic silts
			CH		Inorganic clays of high plasticity, fat clays
			OH		Organic clays or medium to high plasticity, organic silts
	HIGHLY ORGANIC SOILS		PT		Peat and other highly organic silts

Project:

Proposed UDOT Maintenance Shed,
Approximately 5350 West 200 South,
Hurricane, Washington County, Utah

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Table # 1: Solubility Analysis

Sample Location	Soil Classification / Description	Percent Soluble by Weight
B-1 @ 6′	Sandy Clay	1.076
B-1 @ 9′	Sandy Clay	1.000
B-2 @ 3′	Sandy Clay	1.086
B-2 @ 4′	Sandy Clay	1.055
B-3 @ 4′	Sandy Clay	< 1
B-3 @ 7′	Sandy Clay	< 1
B-3 @ 10′	Sandy Clay	1.817
B-3 @ 20′	Sandy Clay	< 1
B-3 @ 24′	Silt-Clay	< 1
B-4 @ 4′	Silty Sand	1.819
B-4 @ 7′	Silt-Clay	< 1
B-5 @ 3′	Silty Clayey Sand	1.564
B-5 @ 5′	Clayey Sand	1.457
B-6 @ 2′	Silty Clayey Sand	1.110
B-6 @ 5′	Silt-Clay	2.713

Table # 2 Atterberg Limits

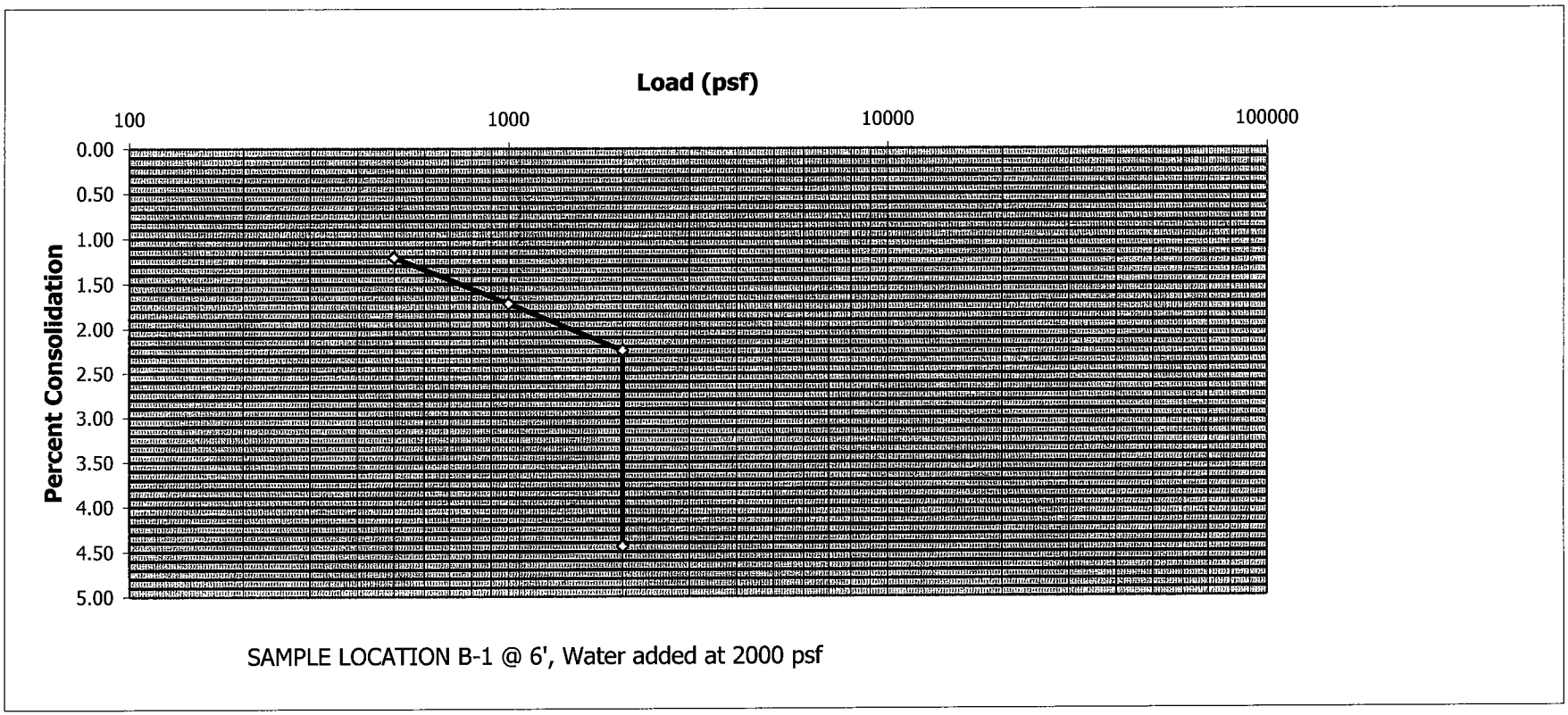
Sample Location	UCS Type	Percent Passing # 4 Sieve	Percent Passing # 10 Sieve	Percent Passing # 40 Sieve	Percent Passing # 200 Sieve	Liquid Limit	Plastic Limit	Plasticity Index
B-1 @ 3′	CL	77.7	70.7	64.0	57.8	24	14	10
B-1 @ 9′	CL	99.4	97.9	81.8	59.0	21	13	8
B-2 @ 3′	CL	92.0	85.1	76.0	69.6	25	16	9
B-2 @ 4′	CL	84.3	79.0	73.2	62.1	25	16	10
B-3 @ 4′	CL	96.6	87.9	67.5	56.4	24	15	9
B-3 @ 10′	CL	98.2	83.4	69.1	53.7	28	16	13
B-3 @ 15′	CL	96.3	88.8	78.4	64.3	24	16	8
B-3 @ 24′	CL-ML	100	100	79.1	57.7	22	15	7
B-4 @ 4′	SM	75.4	53.8	37.4	31.0	--	--	Non-Plastic
B-4 @ 7′	CL-ML	94.8	77.7	58.8	51.8	23	19	4
B-5 @ 3′	SM-SC	64.4	50.0	34.4	26.6	22	17	5
B-5 @ 5′	SC	73.3	59.5	39.1	33.7	23	13	10
B-6 @ 2′	SM-SC	79.6	58.3	35.1	25.9	18	14	4
B-6 @ 5′	CL-ML	100	100	99.7	84.4	20	16	5

Plate: 9

Set Value
0.1635

Consolidation Test Data

Load	Displacement	Calculated %
500	0.1756	1.21
1000	0.1807	1.72
2000	0.1860	2.25
2000	0.2079	4.44



Project:

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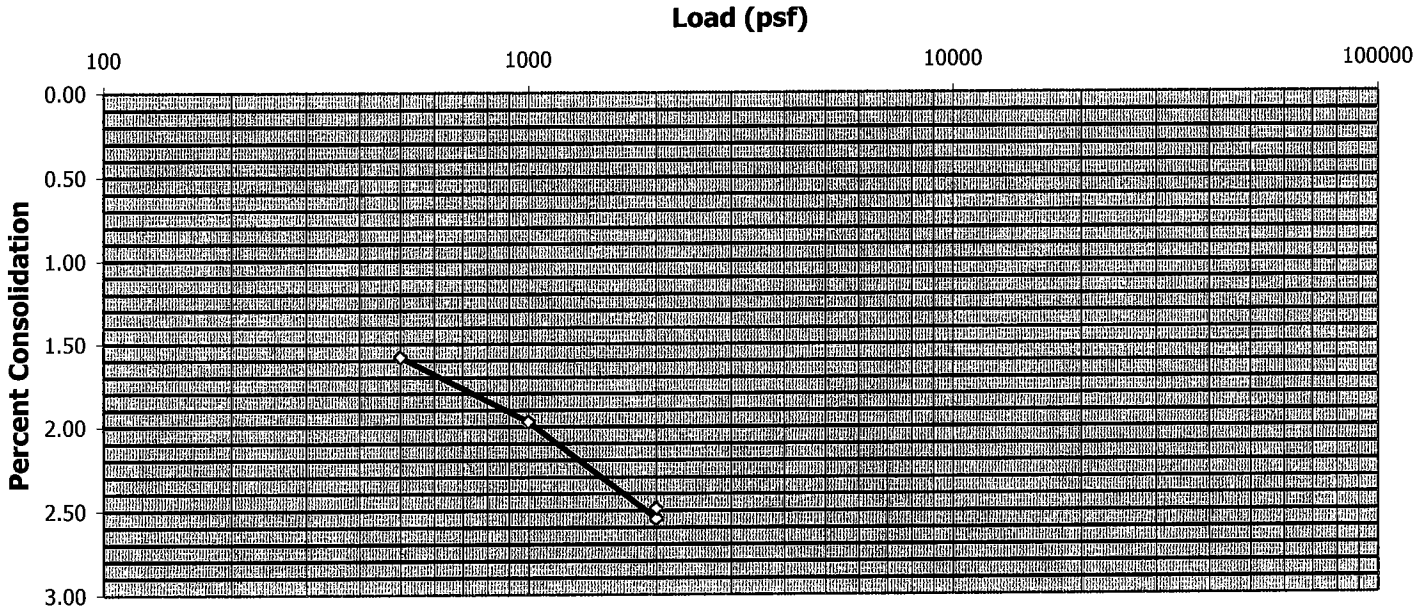
GEM ENGINEERING, INC.

Plate: 10

Set Value
0.1459

Consolidation Test Data

Load	Displacement	Calculated %
500	0.1617	1.58
1000	0.1656	1.97
2000	0.1714	2.55
2000	0.1708	2.49



SAMPLE LOCATION B-3 @ 7', Water added at 2000 psf

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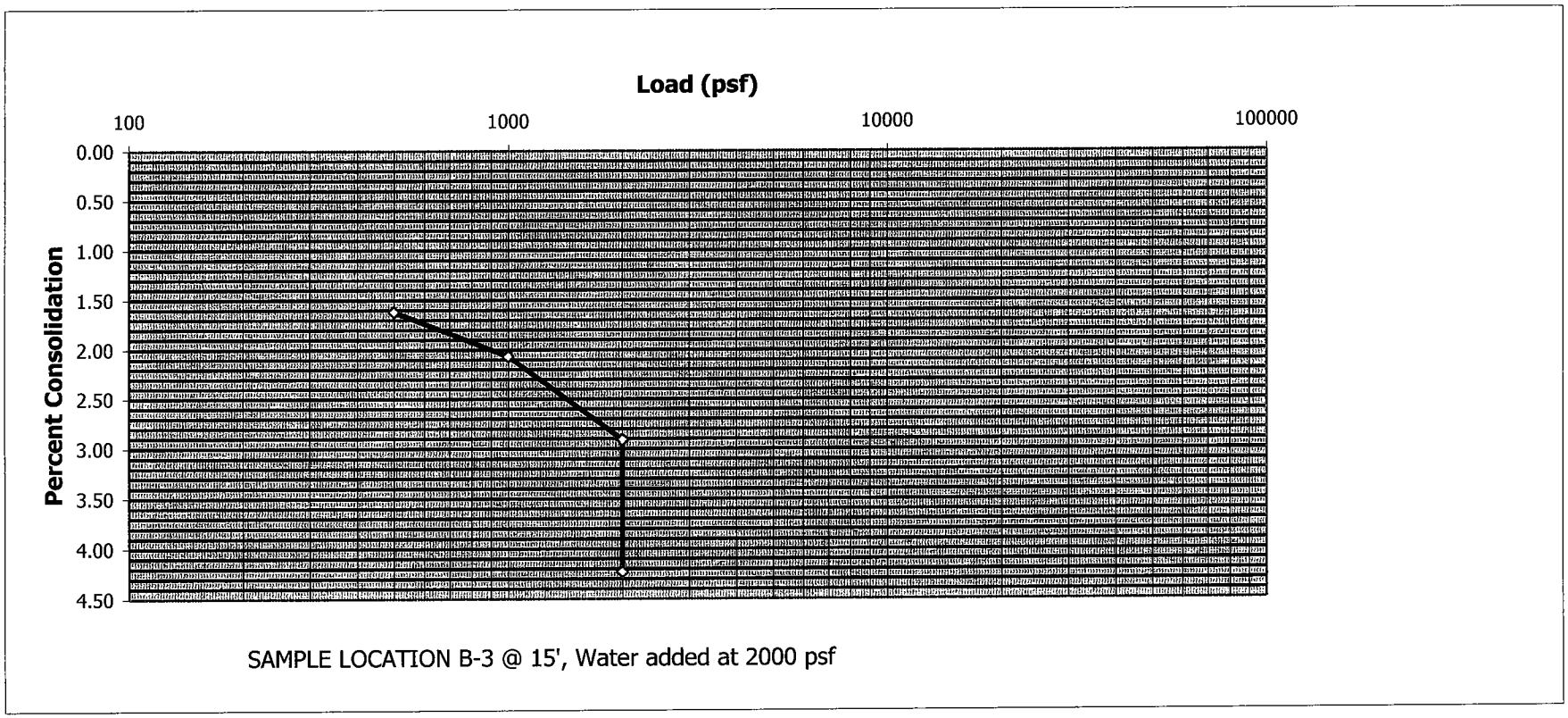
Plate: 11

Set Value
0.1285

Consolidation Test Data

Load	Displacement	Calculated %
500	0.1447	1.62
1000	0.1492	2.07
2000	0.1576	2.91
2000	0.1708	4.23



Project:

Proposed UDOT Maintenance Shed,
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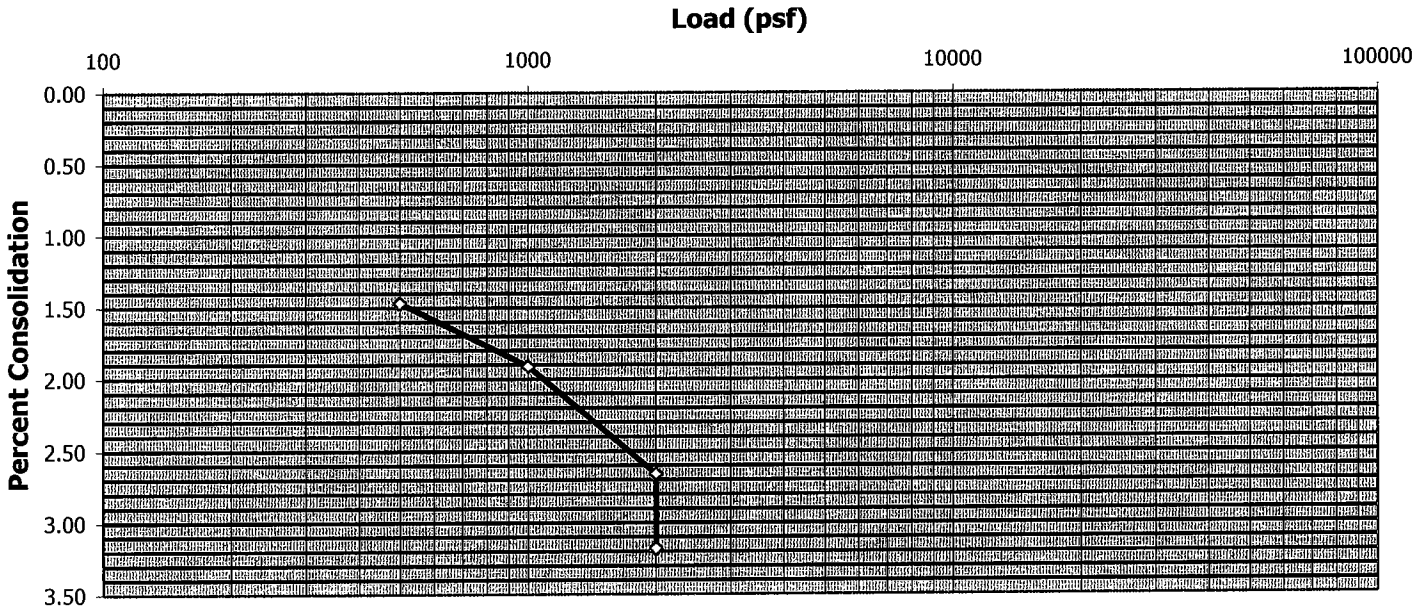
GEM ENGINEERING, INC.

Plate: 12

Set Value
0.1131

Consolidation Test Data

Load	Displacement	Calculated %
500	0.1278	1.47
1000	0.1322	1.91
2000	0.1397	2.66
2000	0.1449	3.18



SAMPLE LOCATION B-6 @ 5', Water added at 2000 psf

Project:

Proposed UDOT Maintenance Shed,
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GEM ENGINEERING, INC.

Plate: 13