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16. Abstract This report summarizes small pullout test results conducted as a part of TxDOT Project 5-4829 to assess the performance of a newly developed small pullout box as well as the associated K_{SGI} model. The parameter K_{SGI} quantifies the stiffness of the soil-reinforcement interface under low displacements, which makes it suitable for evaluating the performance of geosynthetic products in base-reinforced pavements. Seven different types of geosynthetics, including six biaxial geogrids and one geotextile, were tested with three different soil types. Results of each test are summarized in two-page laboratory report format.		
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Experimental Results on Soil-Geosynthetic Interaction Stiffness

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G.H. Roodi

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Report Date:	February 2012
Project:	5-4829-01
Project Title:	Pilot Implementation to Quantify the Benefits of Using Geosynthetics for Unbound Base Courses
Sponsoring Agency:	Texas Department of Transportation
Performing Agency:	Center for Transportation Research at The University of Texas at Austin

Project performed in cooperation with the Texas Department of Transportation and the Federal Highway Administration.

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Disclaimers

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Chapter 1. Introduction

This report contains the results of small pullout tests conducted to characterize the Soil-Geosynthetic Interaction Stiffness through August 31, 2011. The tests were conducted at the Geosynthetics Laboratory at The University of Texas Austin. The main parameter obtained from these tests is the coefficient of soil-geosynthetic interaction, K_{SGI}. The parameter K_{SGI} quantifies the stiffness of the soil-reinforcement interface under low displacements, which makes it suitable for evaluation of the performance of geosynthetic products used in base-reinforced pavements.

Some of the geosynthetic products used in the small pullout testing program correspond to those used in the experimental sections of a companion field monitoring program (road FM2). Other geosynthetic products were also tested as part of the scope of this testing program. Table 1.1 summarizes the various products used in this experimental program.

Table 1.1: Geosynthetic products used in the experimental program

Manufacturer and product name	Name used in this report	Used in FM2?
Tensar Biaxial Geogrid BX1100	GG PP1	Yes
Tencate-Mirafi Biaxial Geogrid BasXgrid11	GG PET	Yes
Tencate-Mirafi Woven Geotextile Geolon HP570	GT	Yes
Tensar Biaxial Geogrid BX1200	GG PP2	No
Huesker Biaxial Geogrid Fornit20	GG PP3	No
Tenax Biaxial Geogrid MS110 (1 Layer)	GG PP4	No
Tenax Biaxial Geogrid MS220 (2 Layers)	GG PP4x2	No

Some of the tests summarized in this report were conducted with the objective of conducting preliminary evaluation of various options for selection of a standard soil and representative confining pressure. These soils and confinements could eventually be considered in TxDOT specifications. For evaluation of the soil, sand and two different gravel soils were used. The sand is the Monterey #30 Sand, which has a uniform soil particle size distribution. The gravel soils were sieved to different uniform particle sizes. Sieved Aggregate 1 (SAggr) involves soil particles passing Sieve #3/8 and retained on Sieve #1/4. Sieved Aggregate 2 (SAggr2) involves soil particles passing Sieve #1/4 and retained on Sieve #4. The soil particle size distribution curves of these soils are shown in Figure 1.1. Two confining pressures were used in tests conducted using Monterey Sand (3 and 5 psi). All the tests with the aggregates were performed using a 3 psi confining pressure.

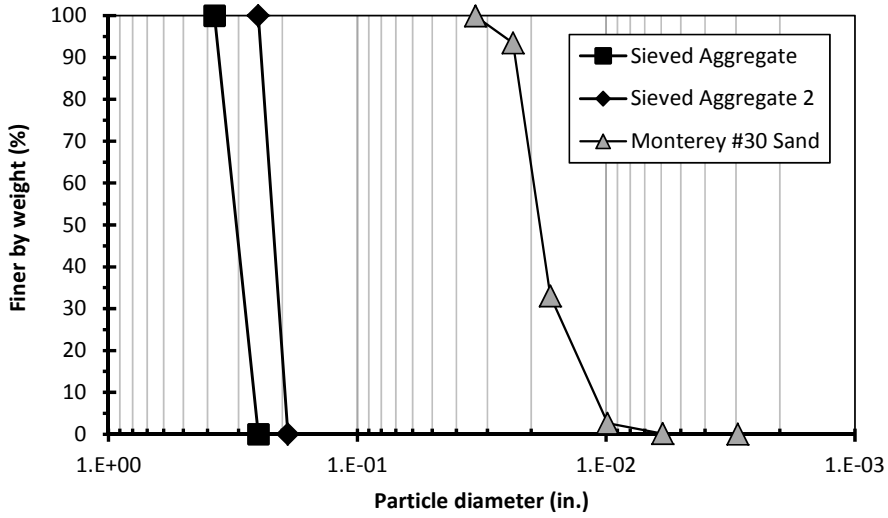

Figure 1.1: Soil particle size distribution curves of the soil used in the small pullout testing matrix

Chapter 2. Scope of the Testing Program

The first test series of the testing program was conducted using Monterey #30 Sand and geosynthetic samples testing in both the Machine- and Cross-machine directions (MD and CD). Confining pressures of 3 and 5 psi were used. The K_{SGI} values obtained from the tests in the CM direction under 3 psi confinement are considered as a possible baseline case for evaluation of the performance of the geosynthetics. In addition, some of the tests were repeated to assess the repeatability of the results. Tables 2.1 and 2.2 list the small pullout tests conducted using Monterey #30 Sand under confining pressures of 3 and 5 psi as of August 31, 2011.

Table 2.1: Summary of small pullout tests conducted using Monterey #30 Sand under confining pressure of 3 psi

Soil Type	Testing Direction	Confining Pressure (psi)	Geosynthetic	Test No.	K_{SGI} Value $(kN/m)^2/mm$
Sand	CD	3	GG PP1	1	35
			GG PP2	2	55
				3	36
			GG PP3	4	107
				5	97
			GG PET	6	40
				7	48
				8	46
			GG PP4	9	16
				10	22
			GG PP4x2	11	25
				12	36
			GT	13	83
				14	64
	MD	3	GG PP1	15	52
			GG PP2	16	62
				17	55
			GG PP3	18	25
				19	24
				20	22
			GG PET	21	45
				22	59
			GG PP4	23	15
				24	18
			GG PP4x2	25	46
				26	41
			GT	27	57
				28	45
				29	43
				30	32

Table 2.2: Summary of small pullout test conducted using Monterey Sand #30 under confining pressure of 5 psi

Soil Type	Testing Direction	Confining Pressure (psi)	Geosynthetic	Test No.	K_{SGI} Value $(kN/m)^2/mm$
Sand	CD	5	GG PP1	1	46
				2	76
			GG PP2	3	--
			GG PP3	4	142
				5	--
			GG PET	6	63
			GG PP4	7	20
				8	23
			GG PP4x2	9	32
				10	39
			GT	11	55
	MD	5	GG PP3	12	32
				13	26
			GG PET	14	73
			GG PP4	15	30
				16	27
			GG PP4x2	17	57
				18	54
				19	46
			GT	20	60

The second soil material used in the testing program corresponds to "Sieved Aggregate 1," which is a uniform gravel with particle sizes between 1/4 and 3/8 in (6.4 to 9.5 mm). This soil is categorized as GP according to the Unified Soil Classification System (USCS), and as A-1 according to AASHTO classification system. Small pullout tests were conducted using Sieved Aggregate 1 under confining pressure of 3 psi in Machine- and Cross-machine directions. Table 2.3 lists the tests conducted with Sieved Aggregate 1 as of August 31, 2011.

Table 2.3: Small pullout test conducted with Sieved Aggregate 1 under confining pressure of 3 psi

Soil Type	Testing Direction	Confining Pressure (psi)	Geosynthetic	Test No.	K_{SGI} Value $(kN/m)^2/mm$
Sieved Aggregate 1	CD	3	GG PP1	1	25
				2	30
			GG PP2	3	8
				4	8
			GG PP3	5	73
				6	149
			GG PET	7	35
				8	13
				9	19
			GG PP4	10	24
				11	36
			GT	12	69
				13	47
				14	58
				15	9
	MD	3	GG PP2	16	6
			GG PP3	17	4
				18	7
				19	24
			GG PET	20	37
			GG PP4	21	15
				22	48
			GT	23	33
				24	--

In addition to Sieved Aggregate 1, a second, finer aggregate referred to herein as "Sieved Aggregate 2" was also used in this experimental testing program. While finer than Sieved Aggregate 1, Sieved Aggregate 2 still falls into the GP class in the USCS method of classification, and into group A-1 in the AASHTO classification system. The particle sizes of Sieved Aggregate 2 range 0.2 and 1/4 in (4.75 and 6.4 mm). Small pullout tests were conducted with Sieved Aggregate 2 under confining pressure of 3 psi in the Machine and Cross-machine directions. Table 2.4 summarizes the small pullout tests conducted with Sieved Aggregate 2.

Table 2.4: Small pullout test conducted with Sieved Aggregate 2 under confining pressure of 3 psi

Soil Type	Testing Direction	Confining Pressure (psi)	Geosynthetic	Test No.	K_{SGI} Value $(kN/m)^2/mm$
Sieved Aggregate 2	CD	3	GG PP1	1	32
			GG PP2	2	44
			GG PP3	3	93
				4	103
			GG PET	5	26
				6	29
				7	39
			GG PP4	8	13
			GG PP4x2	9	41
				10	50
				11	30
				12	39
	MD	3	GG PP3	13	20
				14	25
				15	20
				16	25
				17	19
				18	20
				19	27
				20	26

Chapter 3. Experimental Data Obtained in the Testing Program

Experimental data obtained in the testing program are presented in Appendix A. The data is provided in the format of two-page Laboratory Reports. The first page of each laboratory report includes general characteristics of the test along with information on the ultimate pullout force. Specifically, the general description of the test in the first page of each laboratory report includes the following:

- Geosynthetic type
- Dimensions of geosynthetic specimen
- Soil description
- Position of the linear variable displacement transducers (LVDTs)

The second page of each laboratory report summarizes the actual data in two graphs. The first graph provides the changes in front pullout force versus displacement of each one of the five LVDTs. This graph provides the main information of the pullout test for calculation of K_{SGI}. Using the procedure described in TxDOT Project Repot 5-4829-01, the second graph of the Laboratory Report can be generated using information from the front pullout force versus displacement graphs. This second graph provides the relationship between *the square of the unit tensile force at the location of LVDTs 2, 3, and 4* (F^2) versus *displacements recorded at these locations (Δ)* in the range of 0.004 to 0.04 in (0.1 to 1 mm). Consistent with the framework for determination of K_{SGI}, F^2 is expected to be a linear function of Δ. Accordingly, the parameter K_{SGI} is the slope of F^2-Δ line. The K_{SGI} value adopted as the main reference is obtained using data collected from LVDT 3, which is located in the middle of the geosynthetic specimen. However, the Laboratory Reports in Appendix A provide the parameter K_{SGI}, as calculated using LVDTs 2, 3, and 4. The values of K_{SGI} obtained using LVDTs 2 and 4 can serve as references should problems arise with the data collected using LVDT 3.

Chapter 4. Discussion and Preliminary Observations

The sources of variability in the stiffness results were evaluated. Various possible sources were discussed with TxDOT engineers to identify approaches for implementation in the tests to be conducted after September 1, 2011. Specifically, it was found that use of Sieved Aggregate 1 did not lead to repeatable results. This was due to the small opening size of the front wall of the box compared to the size of the particles. As the geosynthetic is pulled out of the box through the front opening, the particles get jammed (Figure 4.1a). Consequently, the force required for pulling out the geosynthetic specimen increases as the jammed particles come to act as a grip, with the unconfined portion of the specimen loaded as in a tensile strength test. This is illustrated by the shape of the pullout curve in Figure 4.1a. The sudden drop of the pullout load occurred when the unconfined portion of the geosynthetic ruptured in tension. Accordingly, Sieved Aggregate 2, which has smaller particle sizes, was recommended for testing in the subsequent the testing program (Figure 4.1b). The shape of the pullout test plot shown in Figure 4.1b is consistent with that expected for this type of test, with the pullout load reaching a maximum value and then remaining constant.

Another possible source for the variability of the results was identified as the possible sliding at the junctions of knitted geogrids with weak junction strength, especially in the case of GG PP3. Depending on the form of attaching the tell-tales to the geogrid, this slippage may not be captured by the displacement readings. Specimens of this product were exhumed and analyzed after the testing and it was noticed that some of the knitted junctions do not maintain their integrity during the test as shown in Figure 4.2. This might explain the high K_{SGI} values obtained for this product (Table 2.4). With the junction slippage, the longitudinal ribs move in the pullout direction while the transverse ribs may remain stationary, thus leading to erroneously small displacement readings. Since part of the calculation of the K_{SGI} depends on the displacement data, stationary junctions lead to a false increase of stiffness.

Additionally, the weak junctions of the GG PP3 CD may be the source of the comparatively high variability on the results of this product. That is, GG PP3 CD would be more sensitive to variations on the confining pressure and to uneven gripping of the geosynthetic specimen than the other geogrids with higher junction strength. Variations on the confining pressure are intrinsic to the precision of the analog air pressure gauge used in the current small pullout test setup, which utilizes 3 psi of confining pressure. These variations at 3 psi may be on the limit of the junction strength of the GG PP3 CD but be insignificant for the other geogrids with higher junction strength. This can also be the case for the potential uneven gripping of the geosynthetic due to the clamping system of the test (Figure 4.3).

An assessment was conducted regarding the impact of having excessively tightened the screws of the rod in an attempt to prevent slippage of the specimen in the grip during the test. If both screws are tightened with excessive but even torque, the rod tends to bend in the center, leading to a looser grip of the geosynthetic at the center in relation to the edges (Figure 4.4a). Consequently, uneven pullout of the specimen would occur, leading to erroneous displacement readings at the center of the specimen. The same problem may happen if excessive uneven torque is applied to the screws of the rod. However, the location of the looser grip of the geosynthetic would change and be closer to the screw with higher torque applied (Figure 4.4b). This would also lead to uneven pullout of the specimen and could be an explanation for the uneven edges of the GG PP3 CD after a pullout test as shown in Figure 4.2. Both situations could compromise the repeatability of the test results.

(a)

(b)

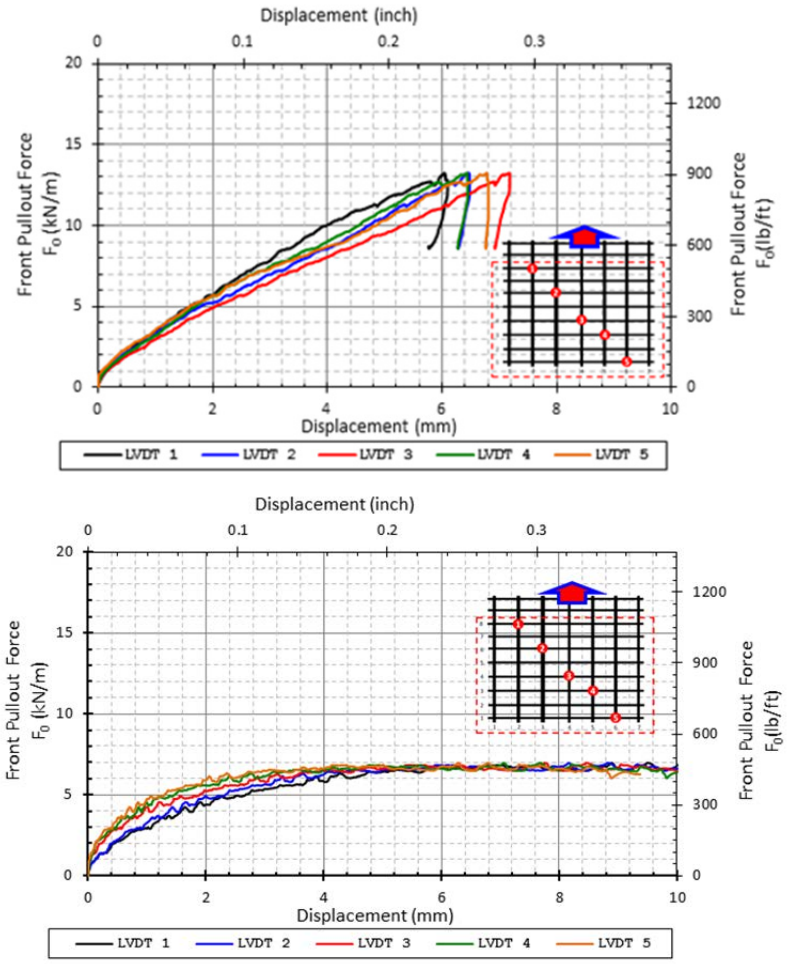

Figure 4.1: Results of small pullout tests with GG PP2 CD in (a) Sieved Aggregate 1 (particles jammed at box frontal opening) and (b) Sieved Aggregate 2

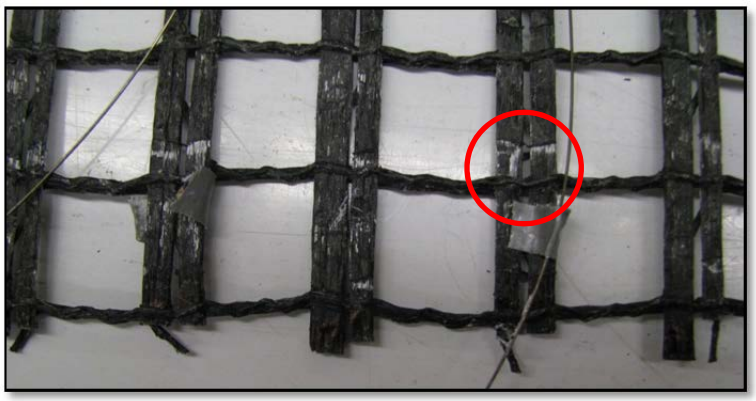

Figure 4.2: Exhumed GG PP3 CD after a small pullout test with Sieved Aggregate 2 conducted to pullout failure showing slippage at the junctions
Note the uneven edges of the longitudinal ribs that were aligned before the test.

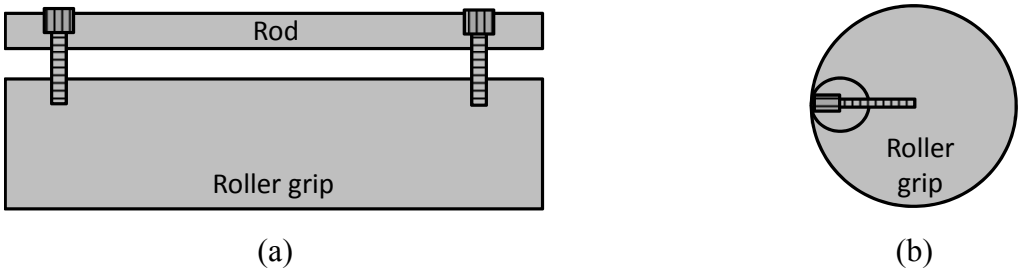

Figure 4.3: Geosynthetic specimen clamping system of the small pullout test setup composed by the roller grip and the gripping rod: (a) Plan view. (b) Cross-section.

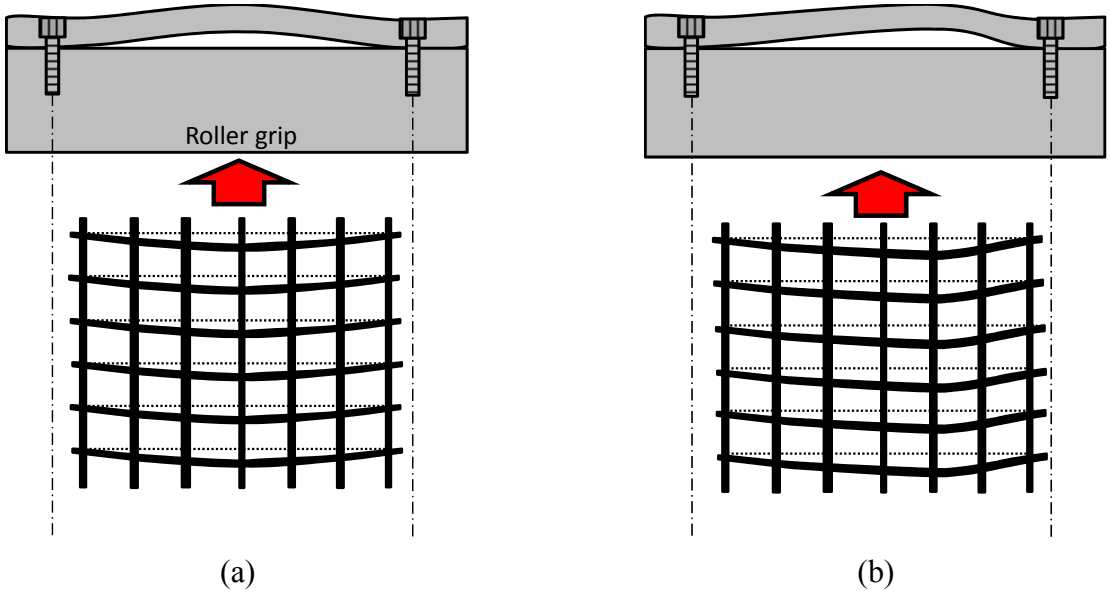

Figure 4.4: Potential issues with geosynthetic clamping system (exaggerated illustrations): (a) Excessive equal torque on the screws of the rod leading to looser grip at the center of geosynthetic specimen and uneven pullout of the specimen. (b) Excessive uneven torque on the screws of the rod leading to looser grip closer to the side with higher torque and uneven pullout of the specimen

These issues were discussed in a series of meetings with TxDOT engineers. Following are the recommendations for incorporation into future tests:

- Spray-paint white the GG PP3 CD specimens that will be used to investigate the magnitude of the junction sliding as well as the distribution of sliding among different junctions.
- Conduct tests until a displacement of only 1mm is reached (as recorded by LVDT3) to investigate the significance of the sliding in the displacement range of interest. (K_{SGI} values are calculated within 1mm of displacement.)
- Assess the benefit of using an alternative procedure to attach the tell-tales to the geogrid using an epoxy resin. In these procedures, the tell-tales would be attached to the longitudinal ribs and not to the junction.

- Use a torque wrench to minimize uneven gripping of geosynthetic specimens on the clamping system.
- Use a digital air pressure gauge with higher precision than the current analog gauge used in the small pullout test setup to minimize variations on the confining pressure.
- Establish a data smoothing procedure and evaluate the use of the data from LVDTs 2, 3, and 4 together to obtain only one regression value for reporting the K_{SGI} value of products tested. Then, an analysis of the variability of the results will be performed.

It should be noted that due to the variability of the geosynthetic product properties and soil properties, some degree of variability is expected in the results of the testing program. Accordingly, variability of relevant soil and geosynthetic properties could be addressed. Furthermore, it is recommended that a statistical procedure be established to address the repeatability issue of the testing results, and to identify the minimum number of tests required.

Appendix A

Laboratory Reports: Soil-Geosynthetic Interaction Stiffness

As described in Chapters 2 and 3 of this report, the results of the small pullout tests are presented in the form of Laboratory Reports. This data is grouped in the following test series:

- Sand – CD – 3psi
- Sand – MD – 3psi

- Sand – CD – 5psi
- Sand – MD – 5psi

- Sieved Aggregate 1 – CD – 3psi
- Sieved Aggregate 1 – MD – 3psi

- Sieved Aggregate 2 – CD – 3psi
- Sieved Aggregate 2 – MD – 3psi

Within each test series, test results are arranged according to the geosynthetic type in the following order:

- Tensar Biaxial Geogrid BX1100 (GG PP1)
- Tensar Biaxial Geogrid BX1200 (GG PP2)
- Huesker Biaxial Geogrid Fornit20 (GG PP3)
- Mirafi Biaxial Geogrid BasXgrid11 (GG PET)
- Tenax Biaxial Geogrid 1 Layer MS110 (GG PP4)
- Tenax Biaxial Geogrid 2 Layers MS220 (GG PP4x2)
- Mirafi Geotextile HP570 (GT)

Small Pullout Test

Sand – CD – 3psi

Results of the tests up to 8/31/2011

The University of Texas at Austin

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/4/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 05 GG PP1 CD sand 3psi 2008-11-04**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1100**	**CD**	**PP (Polypropylene)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**275**	**248**	**0.068**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.47 %**	**1.47 %**	**1.498 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.47 %**		**1.498 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**591**
Max Pullout Force	F_{max}	**kN/m**	**9.6**
Max Shear Stress	τ_{max}	**kN/m^2**	**19.3**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.028**
2	**-0.108**
3	**-0.149**
4	**-0.191**
5	**-0.232**

Comments:

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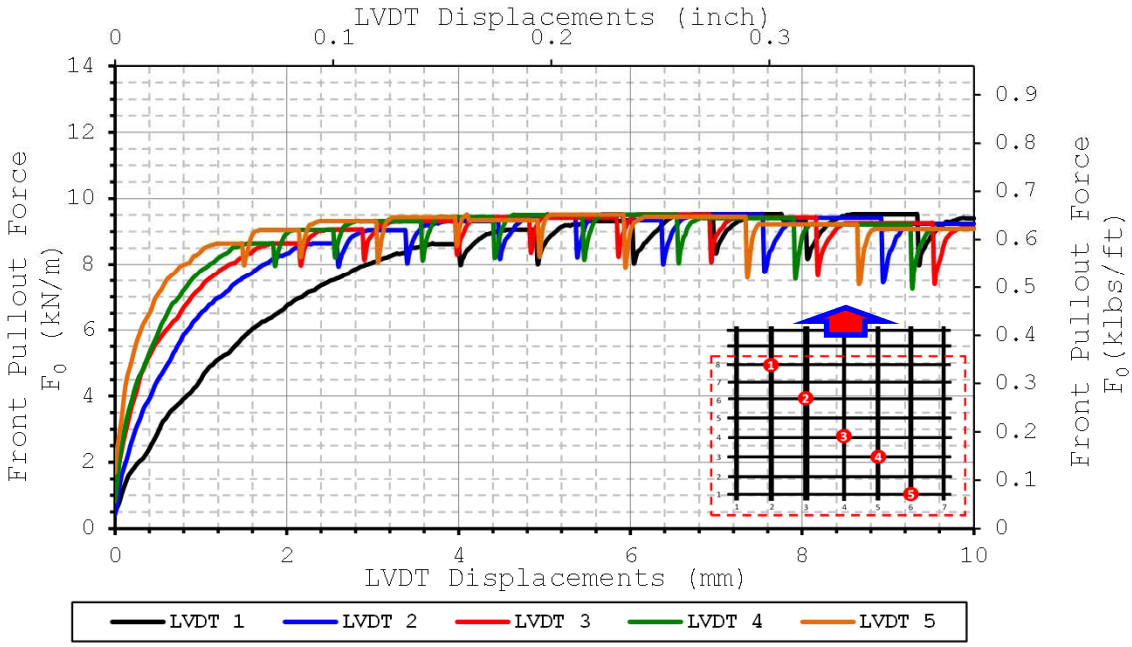
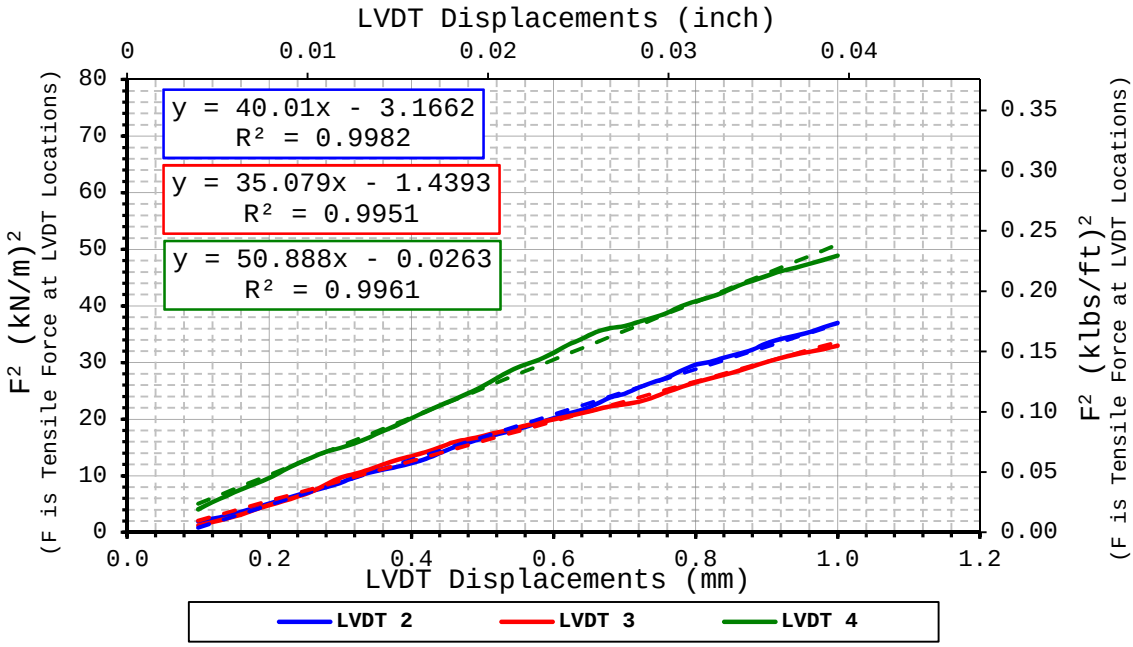
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 40 $(kN/m)^2/mm$

K_{SGI-3} = 35 $(kN/m)^2/mm$

K_{SGI-2} = 51 $(kN/m)^2/mm$

Comments:

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SMALL PULLOUT TEST

Date test conducted	**3/23/2010**
Done by	**Julio Ferreira**
Data file name	**Test 105 GG PP2 CD sand 3psi 2010-03-23**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Tensar Biaxial GG BX1200**	**CD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**10**	**282**	**248**	**0.070**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**1.50 %**	**1.56 %**	**1.532 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.61 %**		**1.532 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**639**
Max Pullout Force	F_{max}	**kN/m**	**10.1**
Max Shear Stress	τ_{max}	**kN/m^2**	**20.3**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.010**
2	**-0.098**
3	**-0.142**
4	**-0.186**
5	**-0.230**

Comments:

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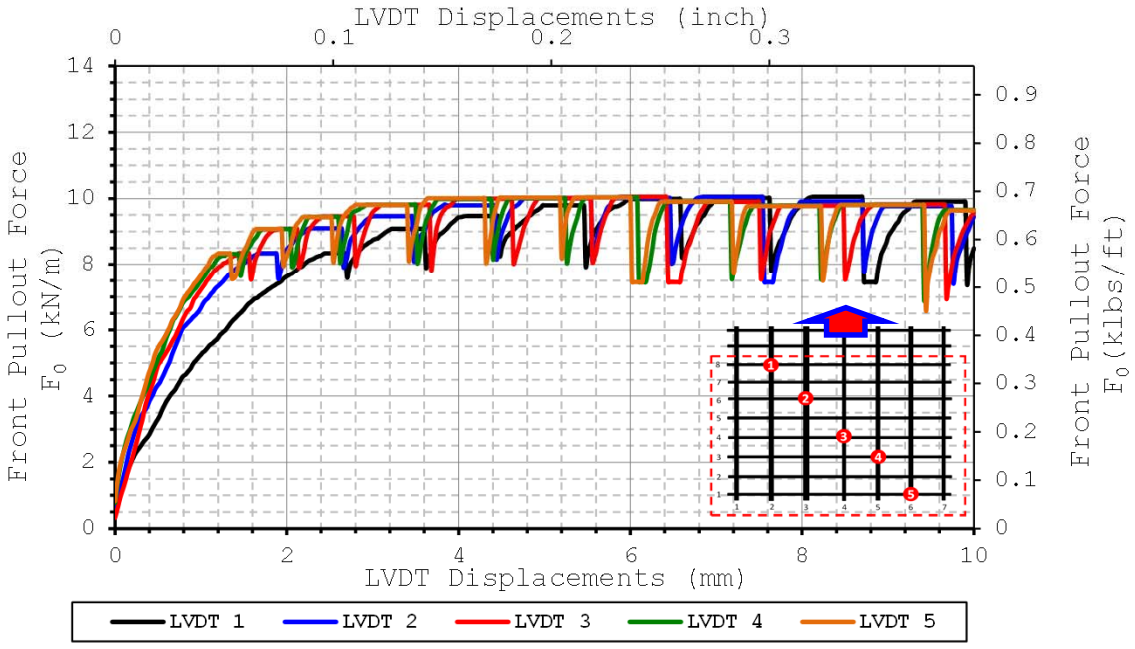
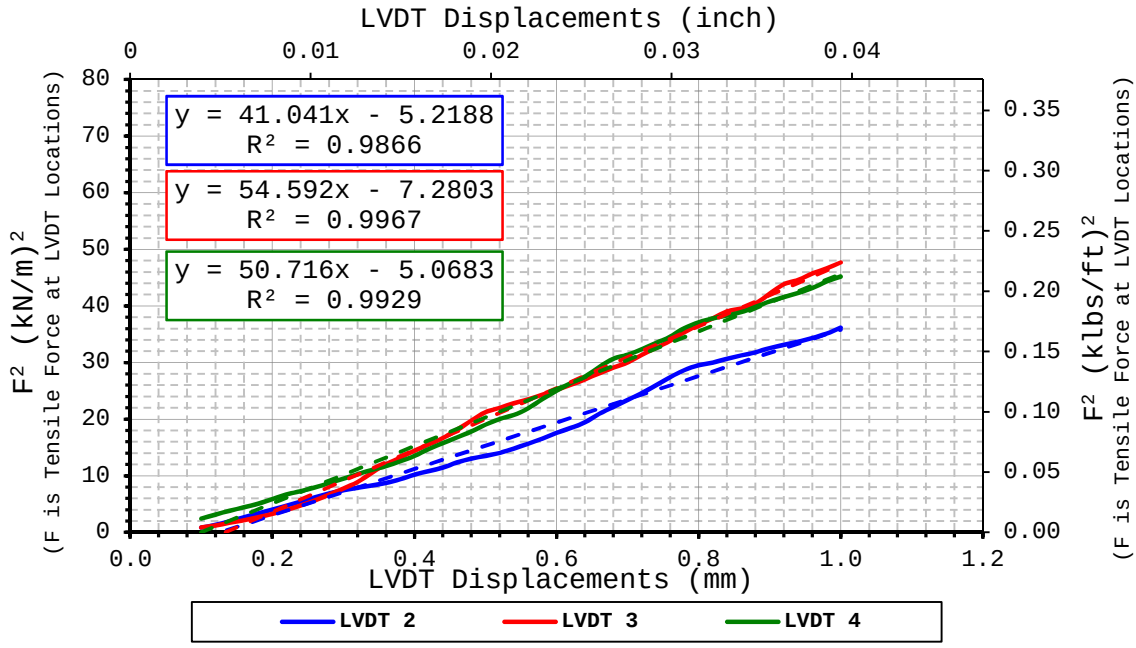
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 41 $(kN/m)^2/mm$

K_{SGI-3} = 55 $(kN/m)^2/mm$

K_{SGI-2} = 51 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**5/6/2011**
Done by	**Julio Ferreira**
Data file name	**Test 105 GG PP2 CD sand 3psi 2011-05-06**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Tensar Biaxial GG BX1200**	**CD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**9**	**263**	**248**	**0.065**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**2.00 %**	**2.00 %**	**1.538 g/cm^3**
Bottom Layer	**Monterey sand 30**	**2.00 %**		**1.538 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**526**
Max Pullout Force	F_{max}	**kN/m**	**8.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**17.9**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.015**
2	**#VALUE!**
3	**#VALUE!**
4	**-0.092**
5	**-0.208**

Comments:

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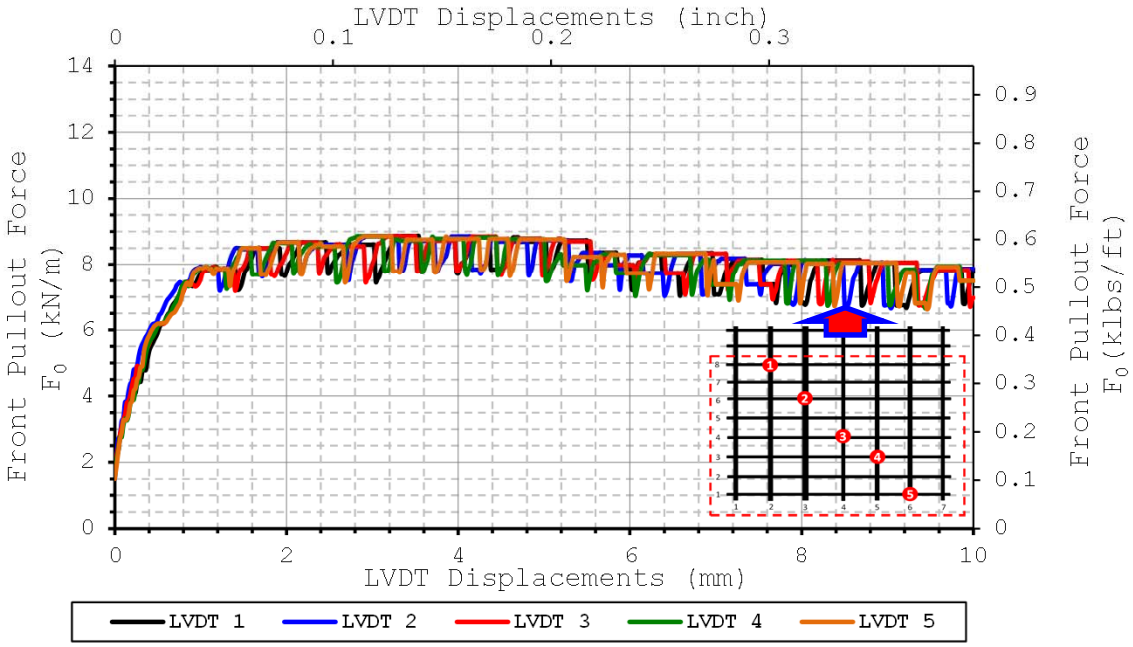
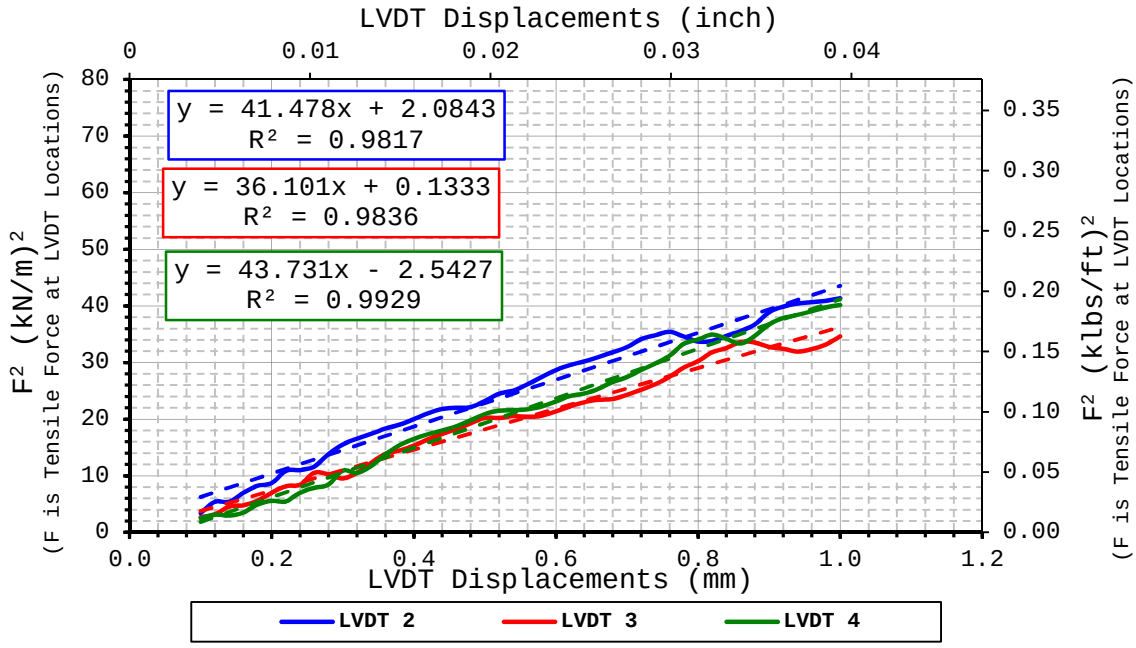
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	41	(kN/m)^2/mm
K_{SGI-3} =	**36**	**(kN/m)^2/mm**
K_{SGI-2} =	44	(kN/m)^2/mm

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**2/2/2010**
Done by	**Eddie**
Data file name	**Test 202 GG PP3 CD sand 3psi 2010-02-0**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	13	**211**	**248**	**0.052**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.60 %**	**1.60 %**	**1.378 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.60 %**		**1.378 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**602**
Max Pullout Force	F_{max}	**kN/m**	**12.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**25.6**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.006**
2	**-0.073**
3	**-0.107**
4	**-0.141**
5	**-0.226**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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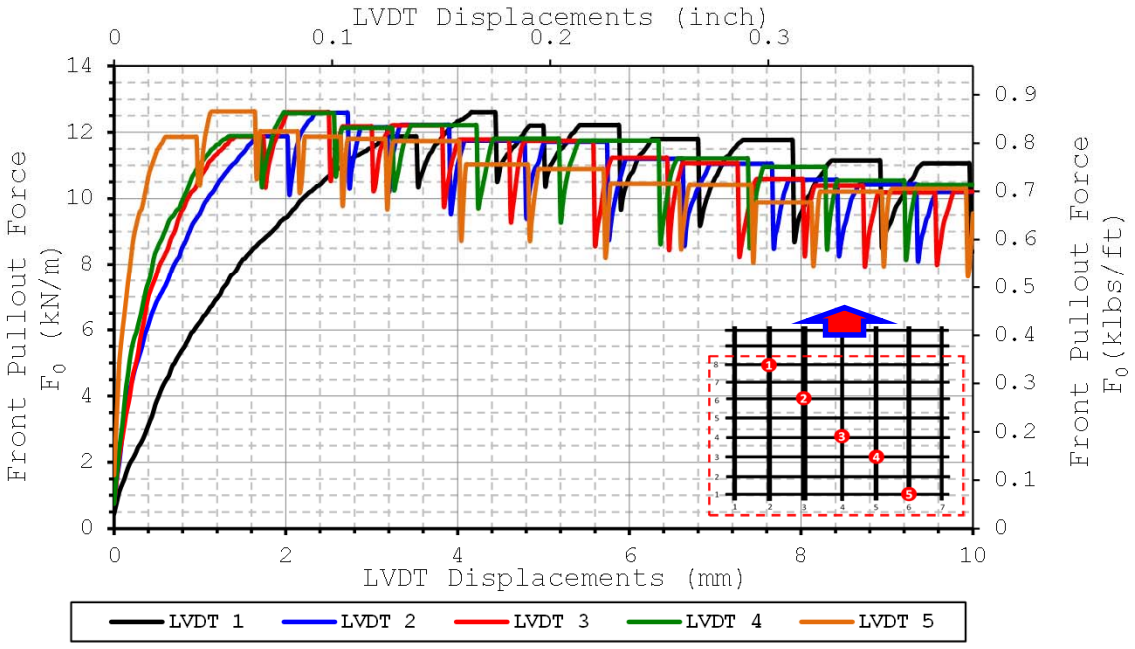
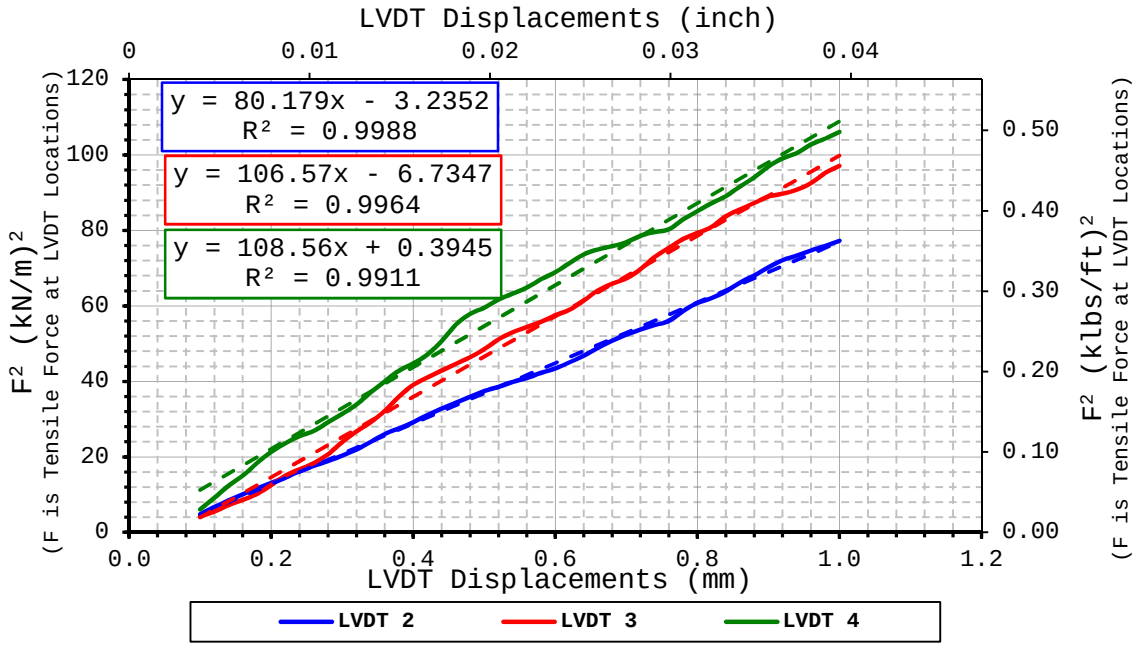
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 80 $(kN/m)^2/mm$

K_{SGI-3} = 107 $(kN/m)^2/mm$

K_{SGI-2} = 109 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**2/3/2010**
Done by	**Julio Ferreira**
Data file name	**Test 202 GG PP3 CD sand 3psi 2010-02-0**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	13	**211**	**248**	**0.052**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**%**	**0.00 %**	**1.511 g/cm^3**
Bottom Layer	**Monterey sand 30**	**0.00 %**		**1.511 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**660**
Max Pullout Force	F_{max}	**kN/m**	**13.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**28.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.007**
2	**-0.075**
3	**-0.108**
4	**-0.141**
5	**-0.226**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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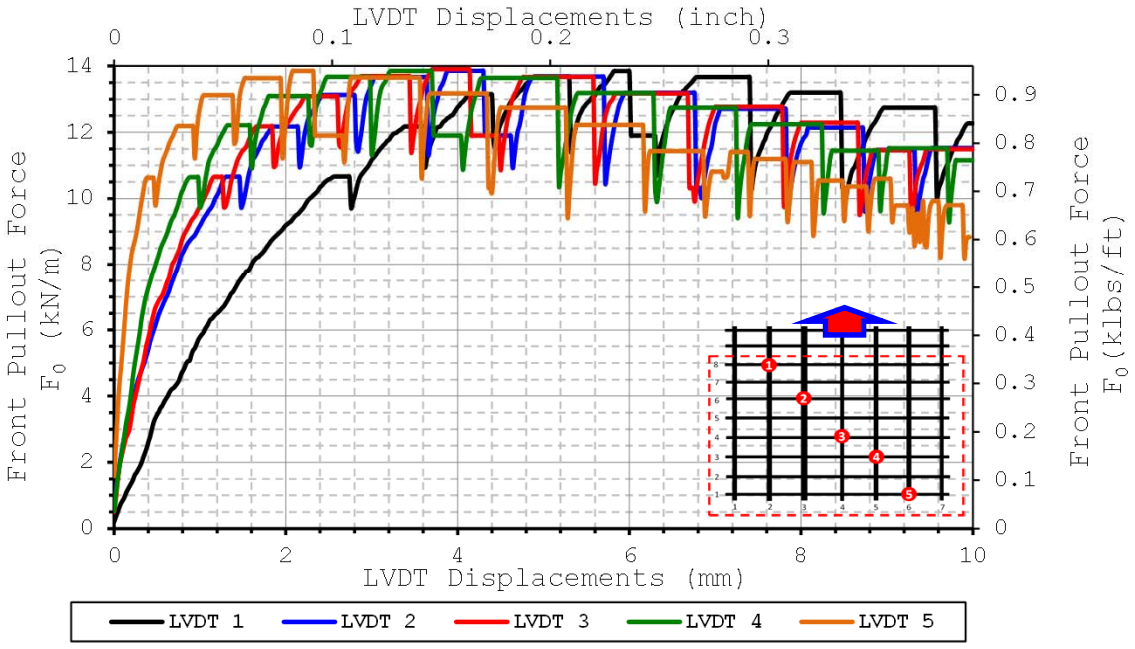
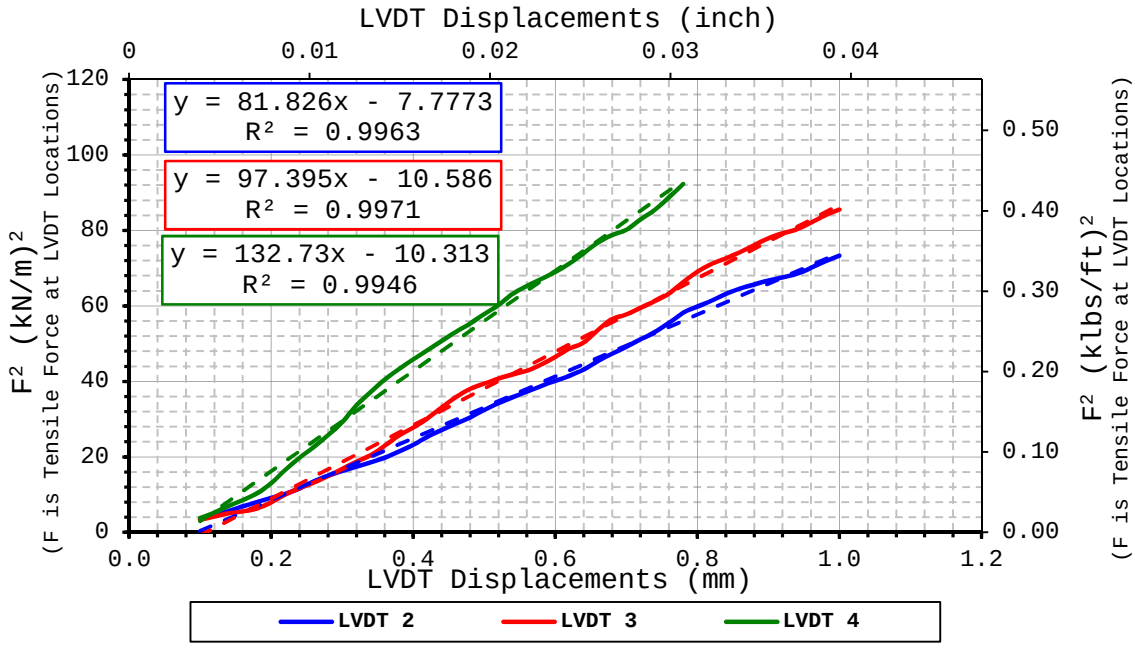
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 82 $(kN/m)^2/mm$

K_{SGI-3} = 97 $(kN/m)^2/mm$

K_{SGI-2} = 133 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**12/17/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 11 GG PET CD sand 3psi 2008-12-17**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Mirafi BasXgrid 11**	**CD**	**PET (Polyester)**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**9**	**294**	**248**	**0.073**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**2.43 %**	**2.25 %**	**1.523 g/cm^3**
Bottom Layer	**Monterey sand 30**	**2.07 %**		**1.523 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**642**
Max Pullout Force	F_{max}	**kN/m**	**9.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**19.6**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.014**
2	**-0.097**
3	**-0.125**
4	**-0.153**
5	**-0.237**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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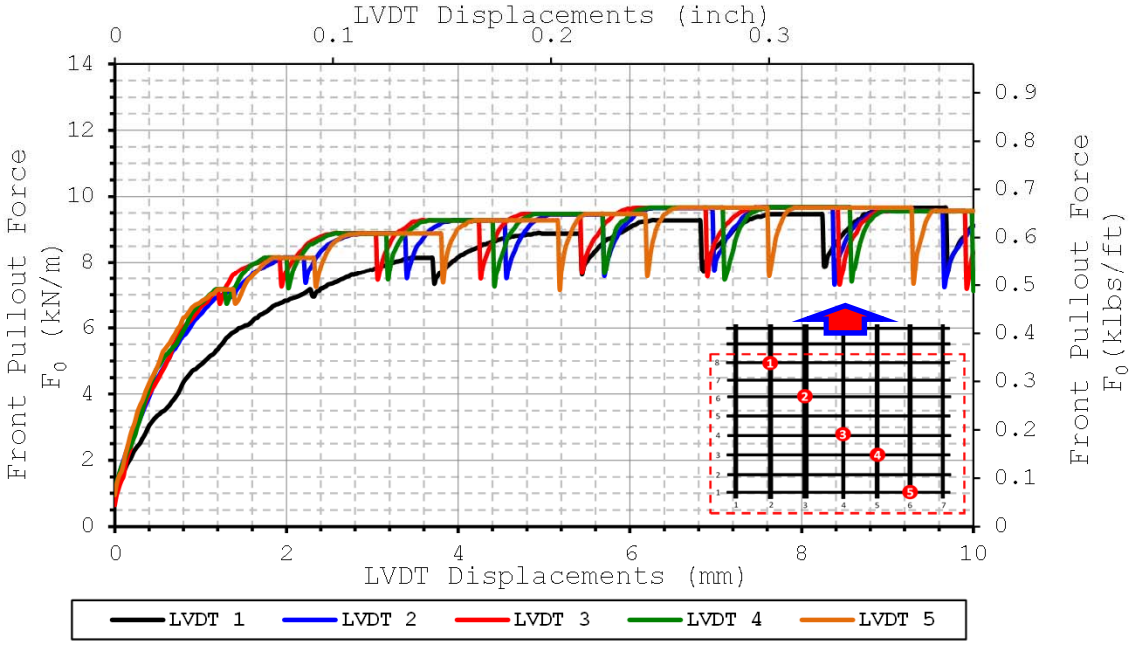
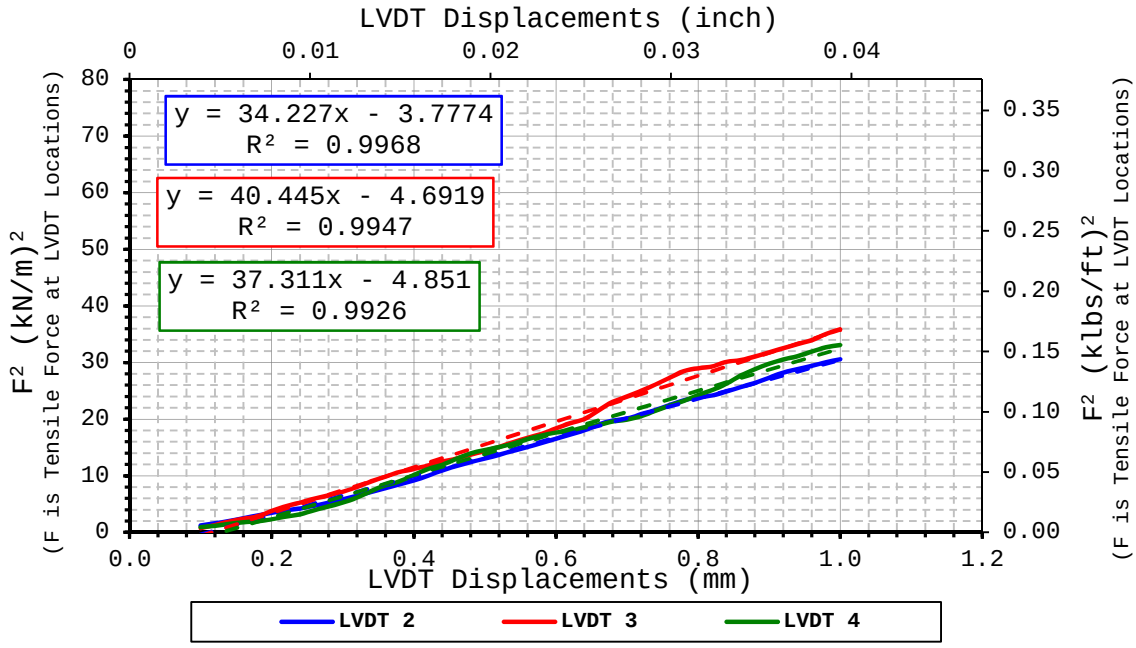
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 34 $(kN/m)^2/mm$

K_{SGI-3} = 40 $(kN/m)^2/mm$

K_{SGI-2} = 37 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**12/19/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 11 GG PET CD sand 3psi 2008-12-19**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi BasXgrid 11**	**CD**	**PET (Polyester)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	9	**294**	**248**	**0.073**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**2.43 %**	**2.25 %**	**1.535 g/cm^3**
Bottom Layer	**Monterey sand 30**	**2.07 %**		**1.535 g/cm^3**

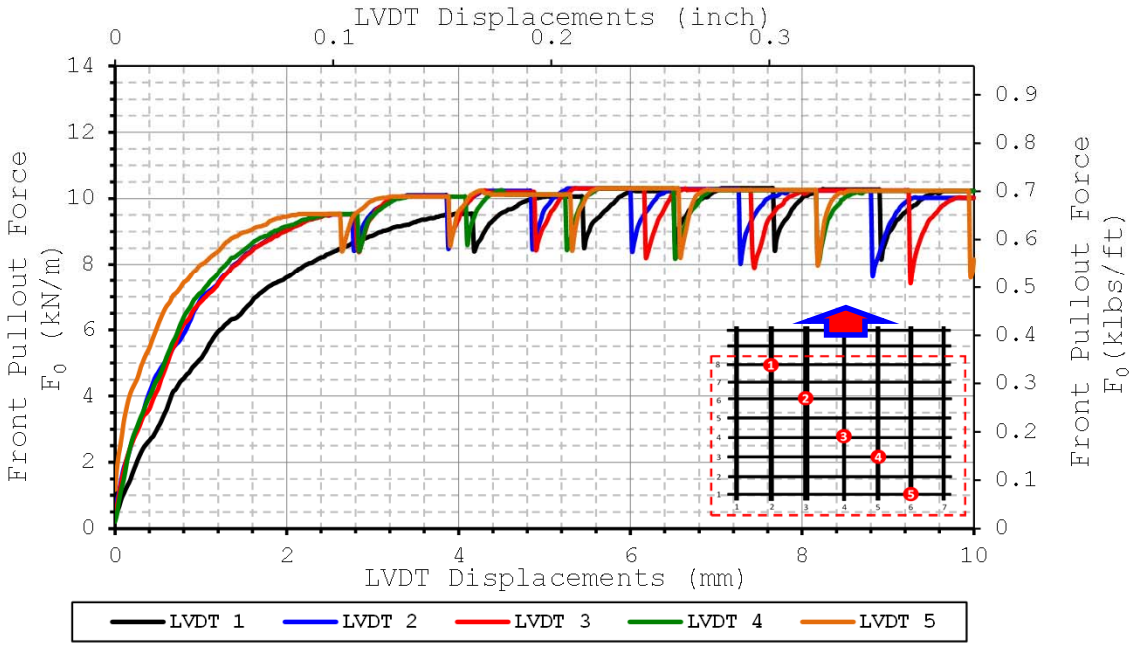
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**684**
Max Pullout Force	F_{max}	**kN/m**	**10.3**
Max Shear Stress	τ_{max}	**kN/m^2**	**20.8**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.011**
2	**-0.095**
3	**-0.125**
4	**-0.157**
5	**-0.241**

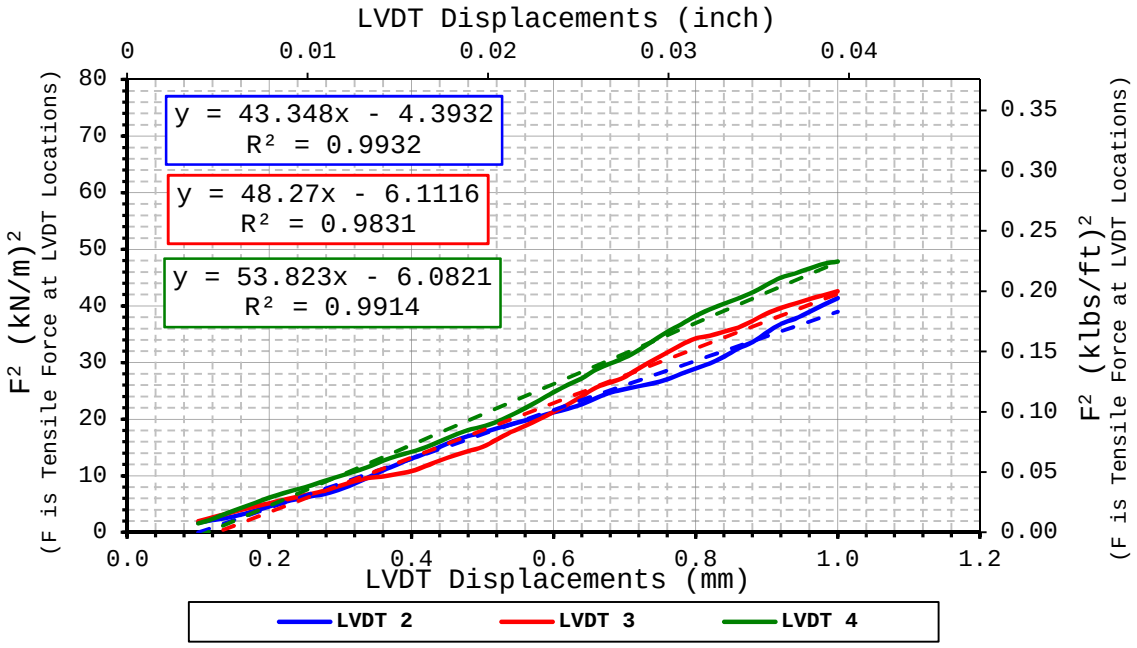
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 43 $(kN/m)^2/mm$

K_{SGI-3} = 48 $(kN/m)^2/mm$

K_{SGI-2} = 54 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**1/16/2009**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 11 GG PET CD sand 3psi 2009-01-16**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi BasXgrid 11**	**CD**	**PET (Polyester)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	8	**294**	**248**	**0.073**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**2.43 %**	**2.25 %**	**1.511 g/cm^3**
Bottom Layer	**Monterey sand 30**	**2.07 %**		**1.511 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**663**
Max Pullout Force	F_{max}	**kN/m**	**10.0**
Max Shear Stress	τ_{max}	**kN/m^2**	**20.2**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.023**
2	**-0.107**
3	**-0.135**
4	**-0.163**
5	**-0.245**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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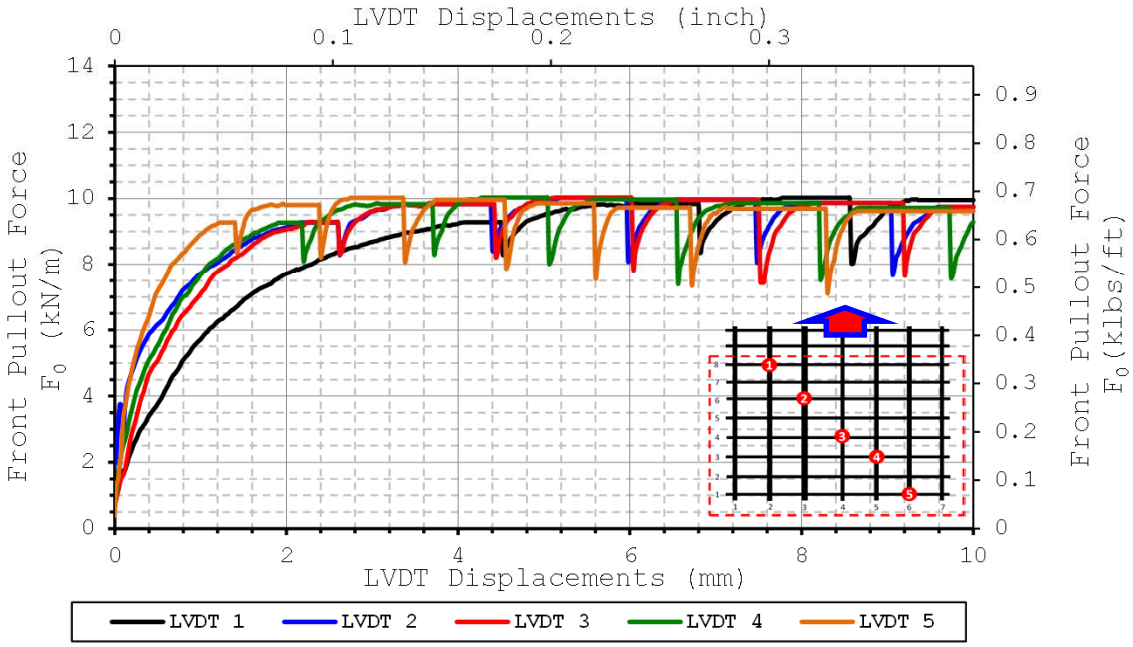
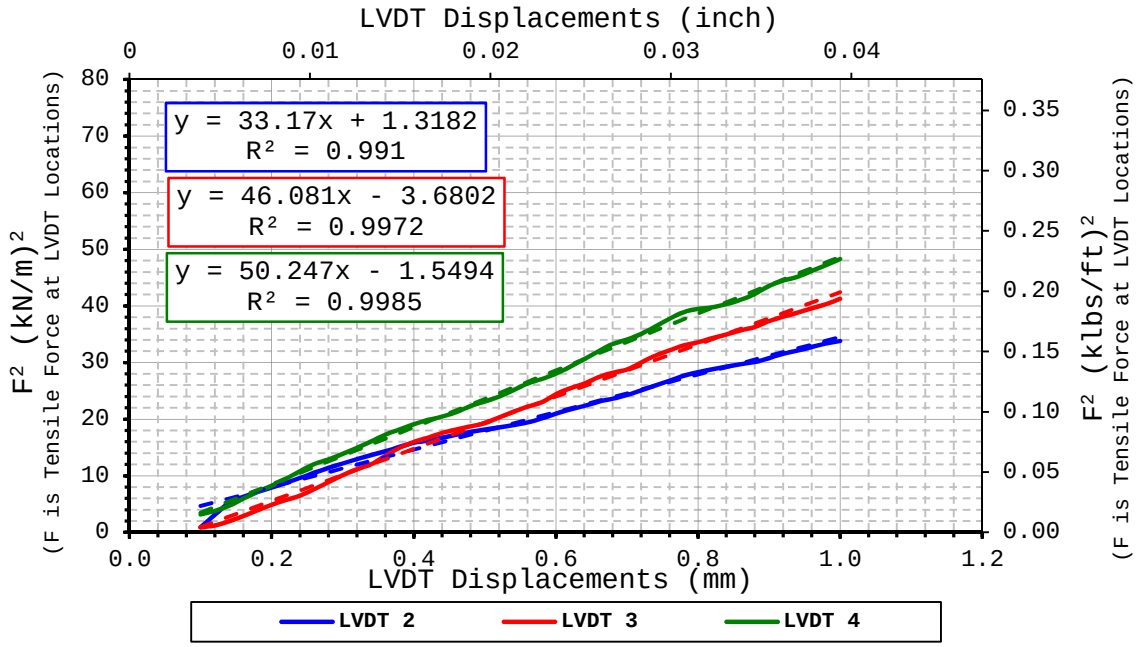
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 33 $(kN/m)^2/mm$

K_{SGI-3} = 46 $(kN/m)^2/mm$

K_{SGI-2} = 50 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**3/5/2010**
Done by	**Julio Ferreira**
Data file name	**Test 206 GG PP4 CD sand 3psi 2010-03-0**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	6	**287**	**248**	**0.071**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.62 %**	**1.65 %**	**1.522 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.67 %**		**1.522 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**434**
Max Pullout Force	F_{max}	**kN/m**	**6.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**13.6**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.016**
2	**-0.066**
3	**-0.114**
4	**-0.163**
5	**-0.212**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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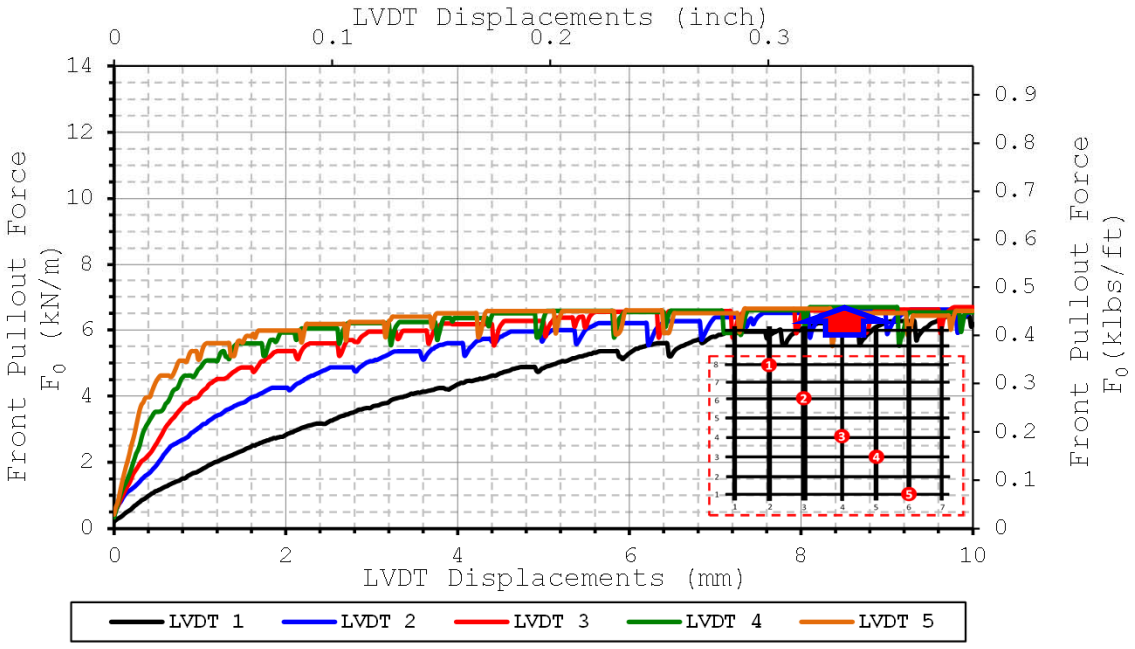
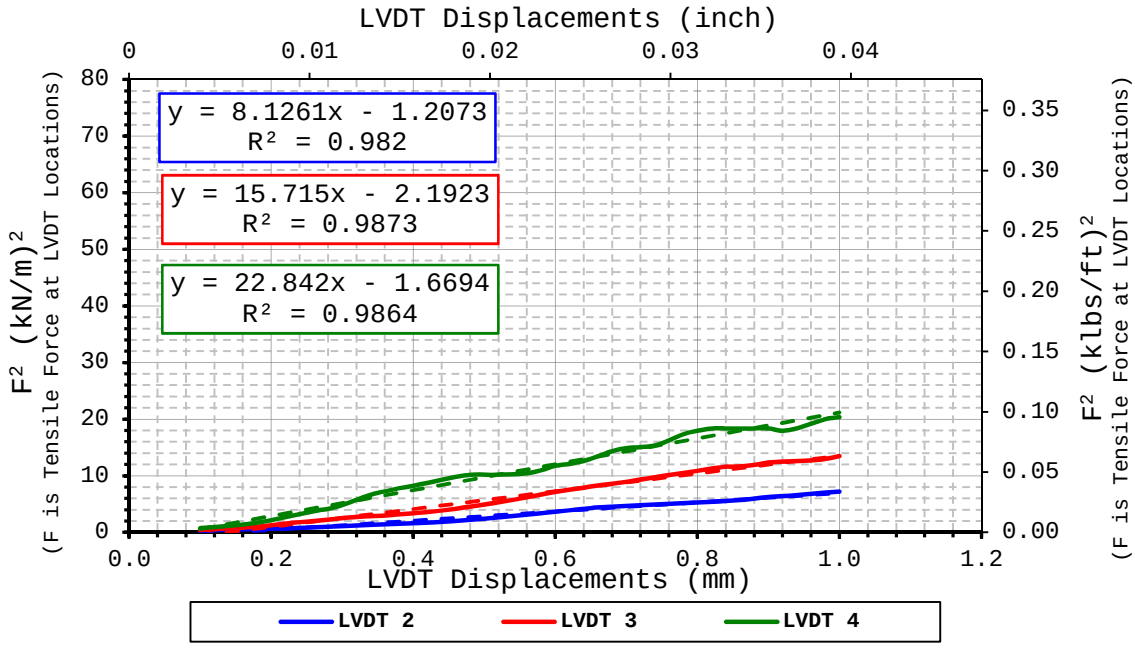
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	8	$(kN/m)^2/mm$	
K_{SGI-3} =	16	$(kN/m)^2/mm$	
K_{SGI-2} =	23	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**3/9/2010**
Done by	**Julio Ferreira**
Data file name	**Test 206 GG PP4 CD sand 3psi 2010-03-0**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	6	**287**	**248**	**0.071**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.51 %**	**1.52 %**	**1.523 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.54 %**		**1.523 g/cm^3**

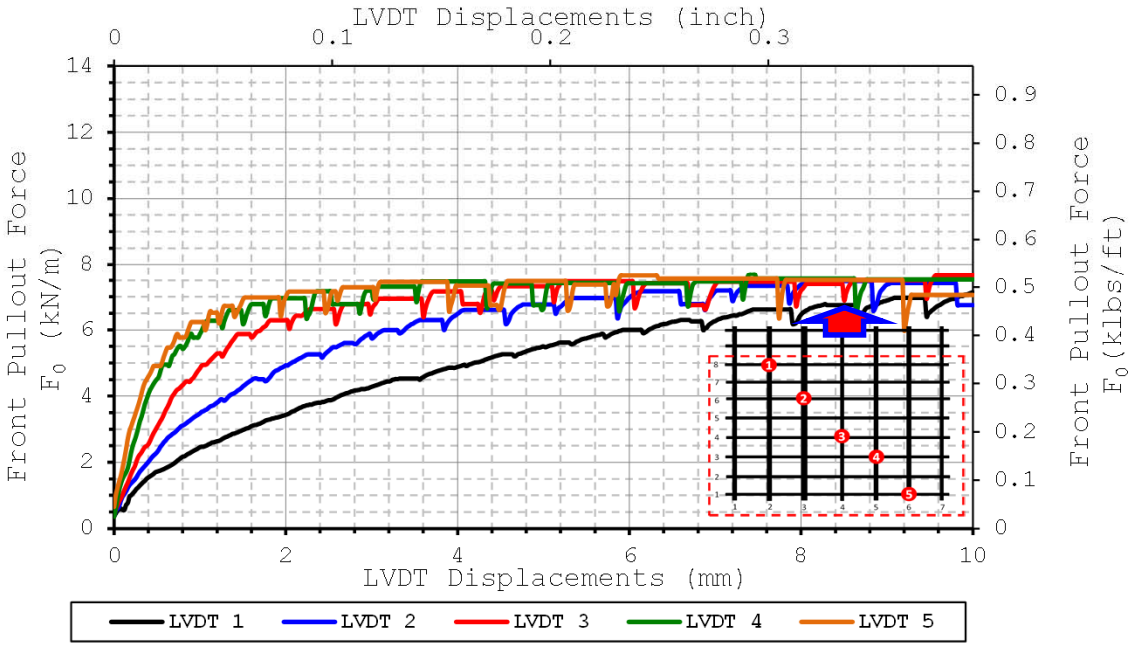
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**499**
Max Pullout Force	F_{max}	**kN/m**	**7.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**15.6**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.020**
2	**-0.072**
3	**-0.124**
4	**-0.176**
5	**-0.228**

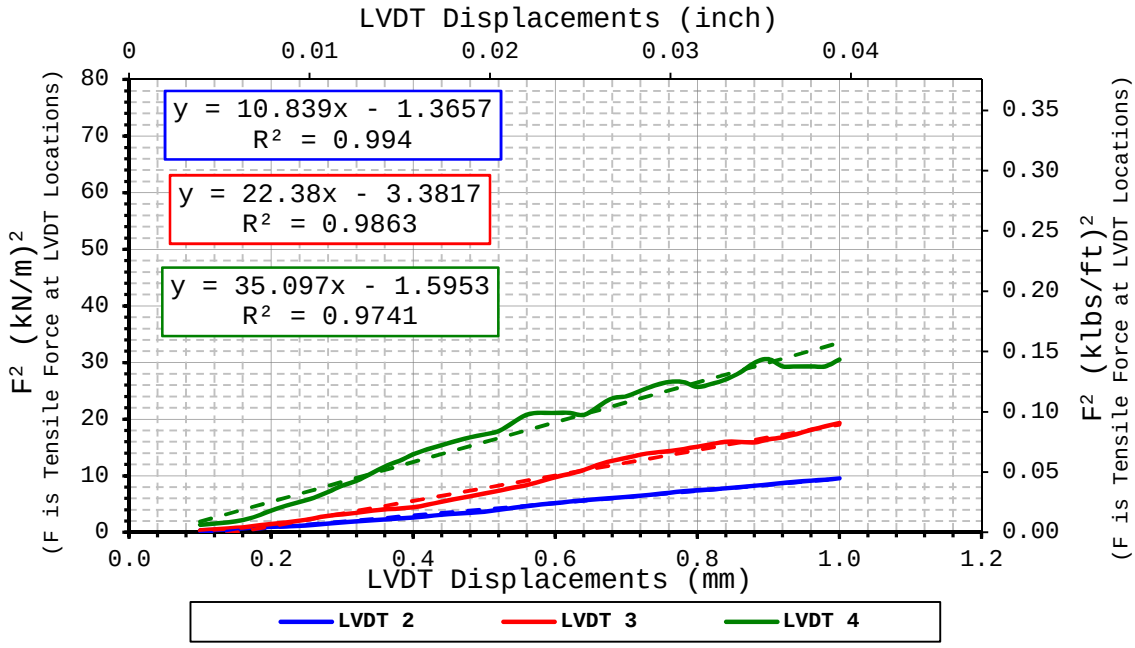
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	11	$(kN/m)^2/mm$	
K_{SGI-3} =	22	$(kN/m)^2/mm$	
K_{SGI-2} =	35	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**3/31/2010**
Done by	**Julio Ferreira**
Data file name	**Test 210 GG PP4x2 CD sand 3psi 2010-03-**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	12	**296**	**248**	**0.073**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.47 %**	**1.48 %**	**1.533 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.50 %**		**1.533 g/cm^3**

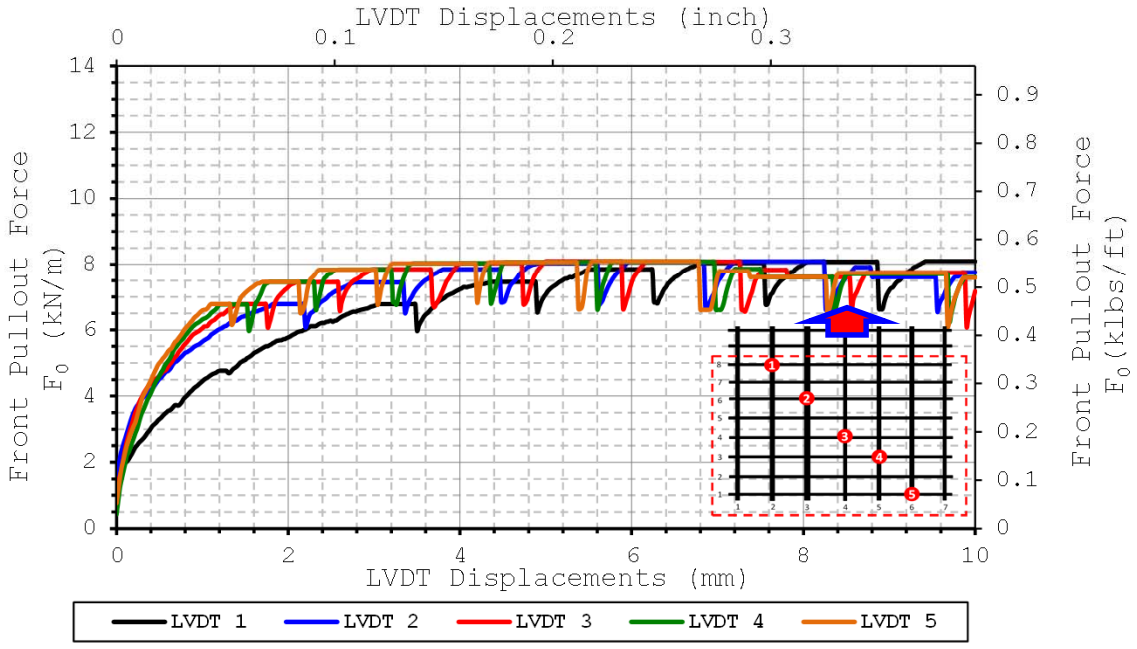
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**541**
Max Pullout Force	F_{max}	**kN/m**	**8.1**
Max Shear Stress	τ_{max}	**kN/m^2**	**16.4**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.026**
2	**-0.078**
3	**-0.129**
4	**-0.180**
5	**-0.229**

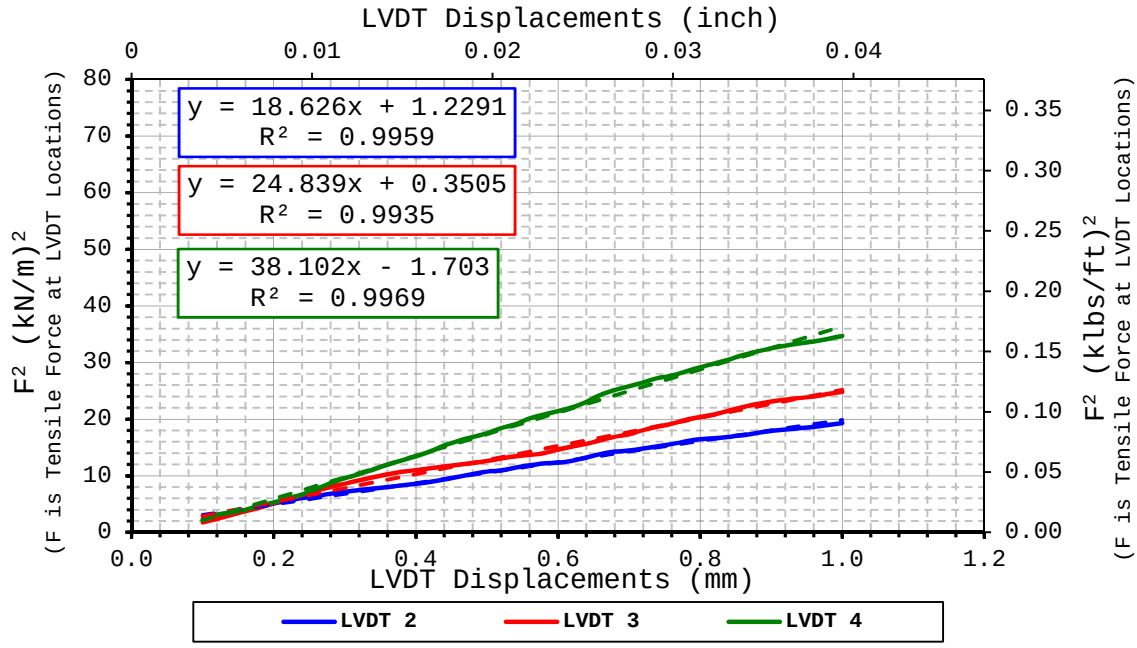
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 19 $(kN/m)^2/mm$

K_{SGI-3} = 25 $(kN/m)^2/mm$

K_{SGI-2} = 38 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**4/1/2010**
Done by	**Julio Ferreira**
Data file name	**Test 210 GG PP4x2 CD sand 3psi 2010-04**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	12	**296**	**248**	**0.073**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.43 %**	**1.44 %**	**1.406 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.45 %**		**1.406 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**631**
Max Pullout Force	F_{max}	**kN/m**	**9.5**
Max Shear Stress	τ_{max}	**kN/m^2**	**19.1**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.015**
2	**-0.068**
3	**-0.120**
4	**-0.170**
5	**-0.220**

Comments:

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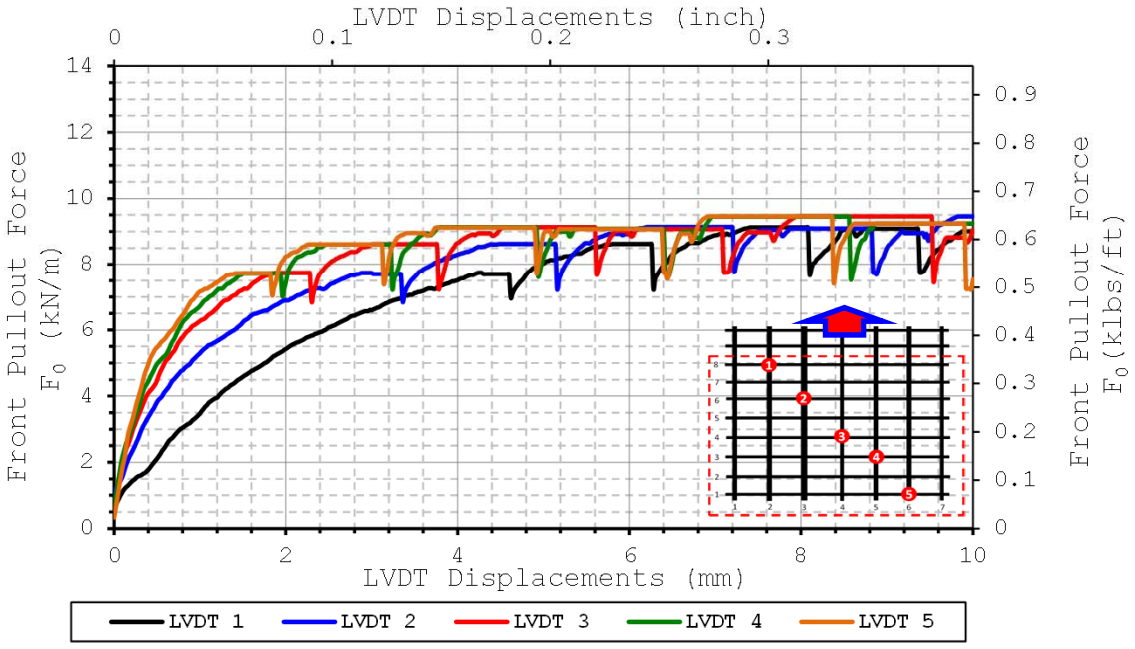
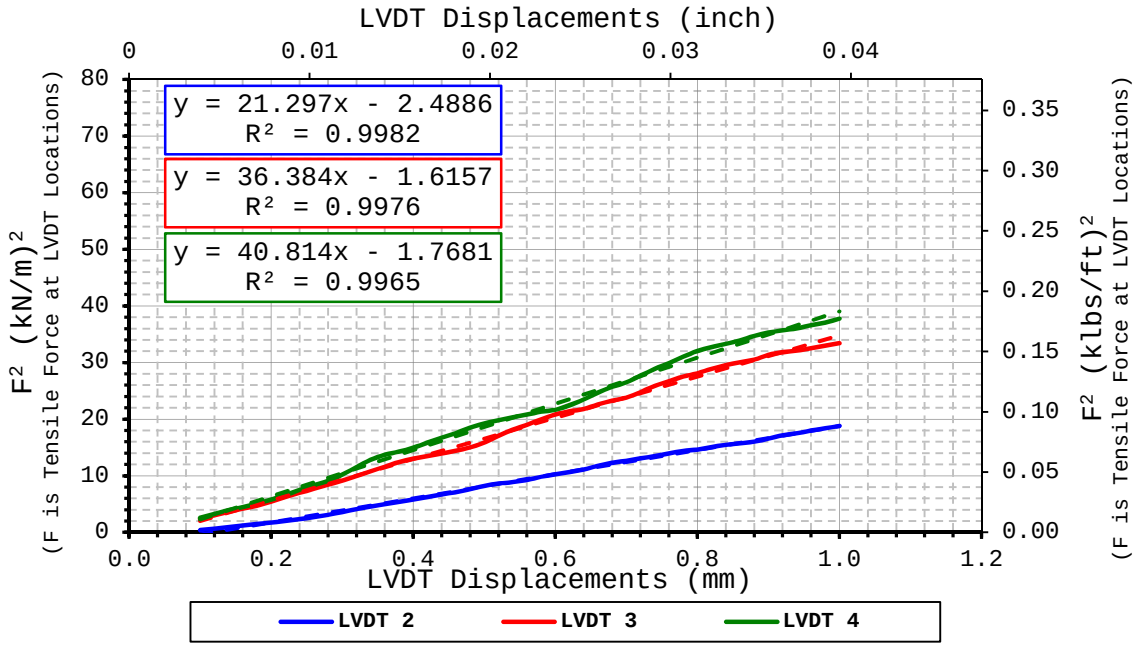
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 21 $(kN/m)^2/mm$

K_{SGI-3} = 36 $(kN/m)^2/mm$

K_{SGI-2} = 41 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**10/17/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 17 GT CD sand 3psi 2008-10-17**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geotextile**	**Mirafi Geolon HP 570**	**CD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**---**	**276**	**248**	**0.068**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**2.00 %**	**2.00 %**	**1.532 g/cm^3**
Bottom Layer	**Monterey sand 30**	**2.00 %**		**1.532 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**592**
Max Pullout Force	F_{max}	**kN/m**	**9.5**
Max Shear Stress	τ_{max}	**kN/m^2**	**19.2**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.022**
2	**-0.089**
3	**-0.123**
4	**-0.156**
5	**-0.223**

Comments:

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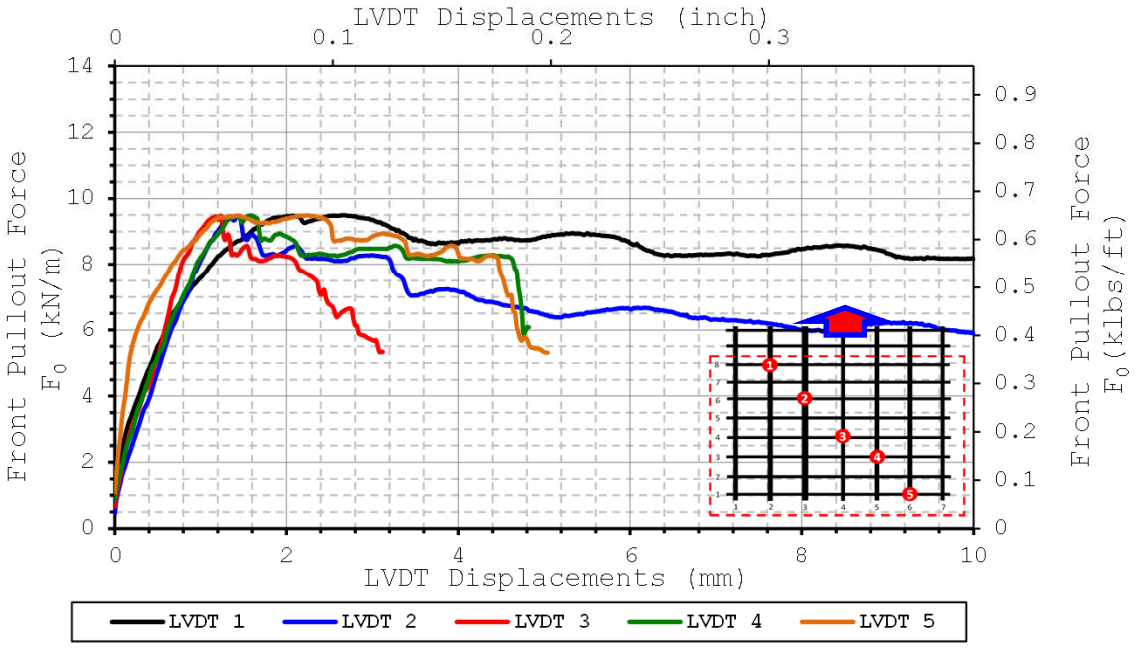
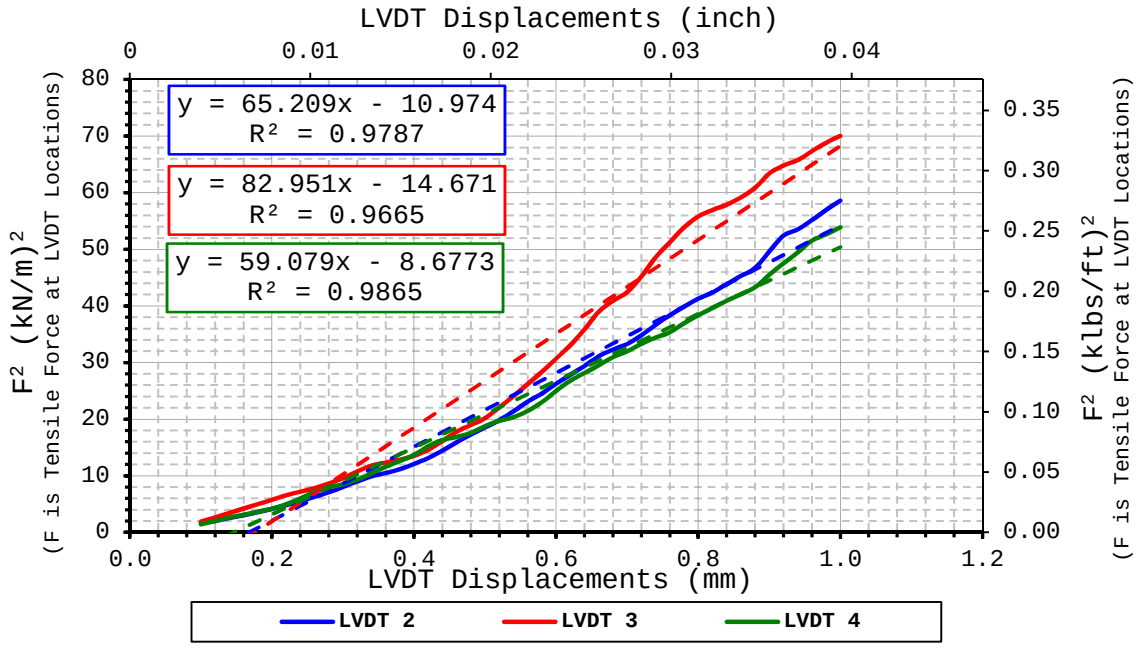
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 65 $(kN/m)^2/mm$

K_{SGI-3} = 83 $(kN/m)^2/mm$

K_{SGI-2} = 59 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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SMALL PULLOUT TEST

Date test conducted	**12/5/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 17 GT CD sand 3psi 2008-12-05**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Geolon HP 570**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**276**	**248**	**0.068**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.13 %**	**1.13 %**	**1.545 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.13 %**		**1.545 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**589**
Max Pullout Force	F_{max}	**kN/m**	**9.5**
Max Shear Stress	τ_{max}	**kN/m^2**	**19.2**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.004**
2	**-0.044**
3	**-0.099**
4	**-0.141**
5	**-0.212**

Comments:

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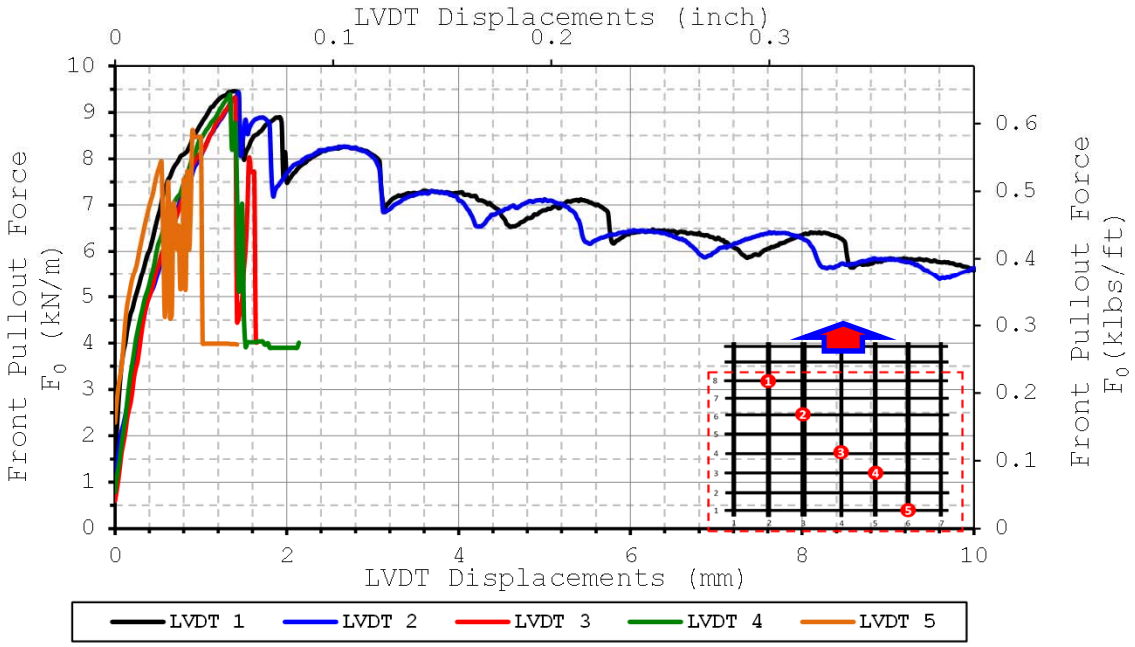
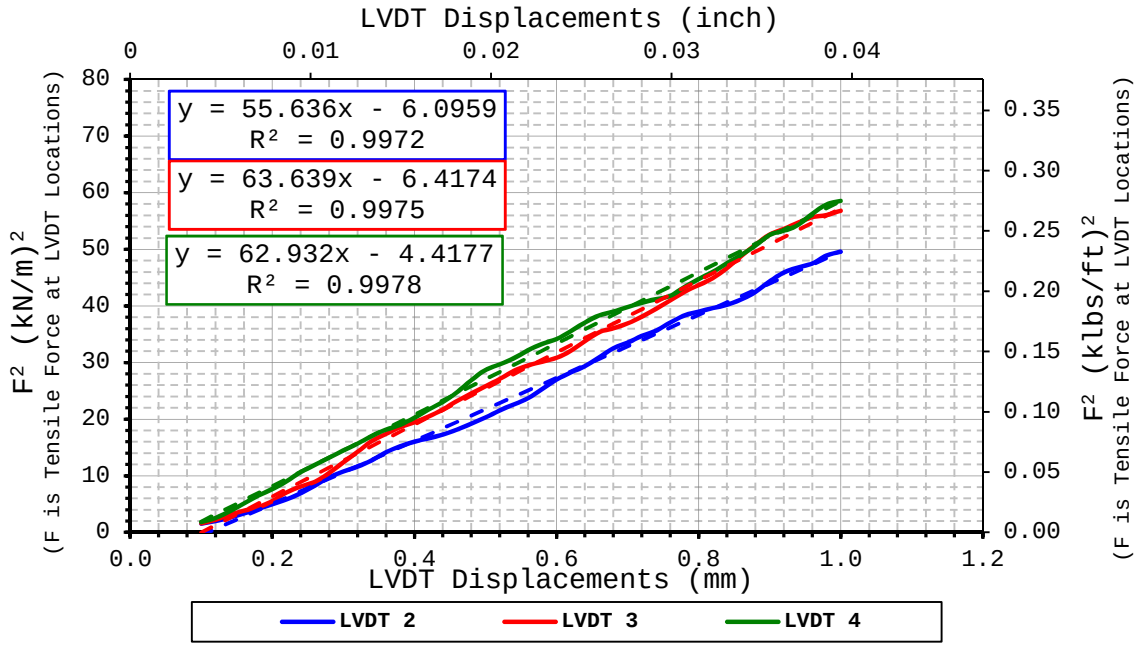
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	56	$(kN/m)^2/mm$	
K_{SGI-3} =	64	$(kN/m)^2/mm$	
K_{SGI-2} =	63	$(kN/m)^2/mm$	

Comments:

Small Pullout Test

Sand – MD – 3psi

Results of the tests up to 8/31/2011

The University of Texas at Austin

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**12/18/2008**
Done by	**Julio Ferreira**
Data file name	**Test 02 GG PP1 MD sand 3psi 2008-12-18**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1100**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	7	**263**	**248**	**0.065**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**2.43 %**	**2.25 %**	**1.526 g/cm^3**
Bottom Layer	**Monterey sand 30**	**2.08 %**		**1.526 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**601**
Max Pullout Force	F_{max}	**kN/m**	**10.2**
Max Shear Stress	τ_{max}	**kN/m^2**	**20.5**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.033**
2	**-0.088**
3	**-0.146**
4	**-0.171**
5	**-0.230**

Comments:

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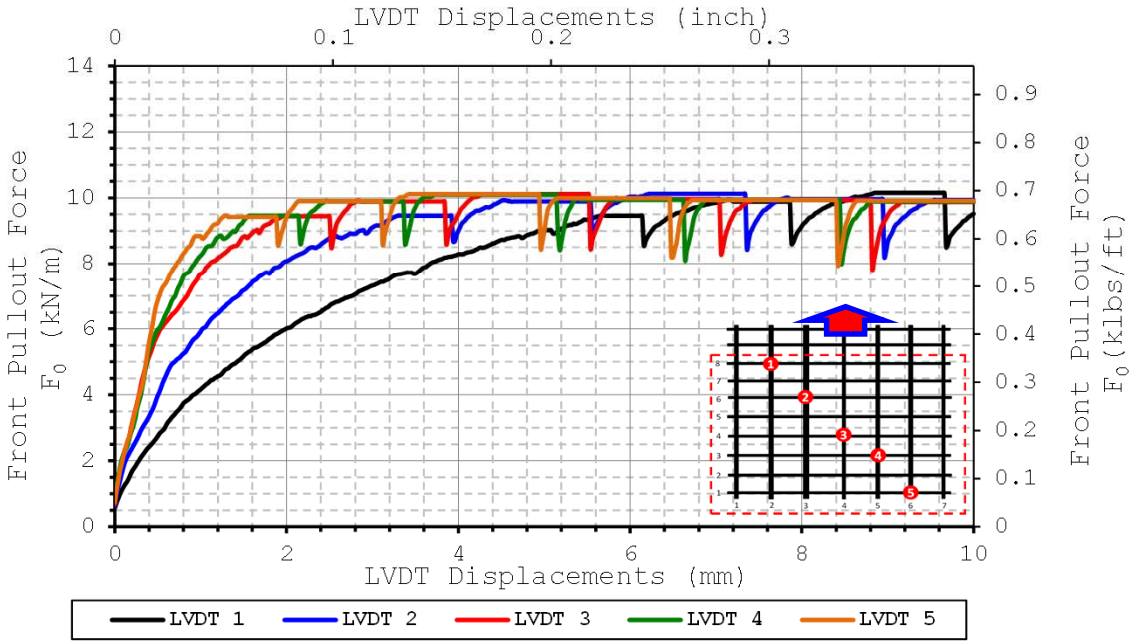
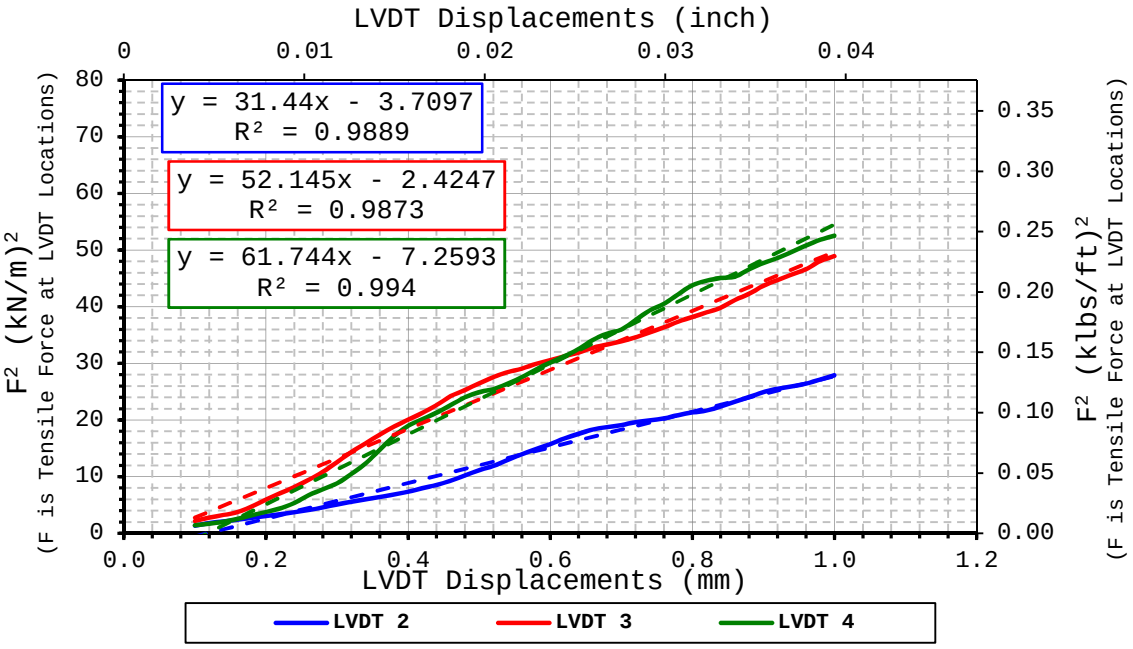
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 31 $(kN/m)^2/mm$

K_{SGI-3} = 52 $(kN/m)^2/mm$

K_{SGI-4} = 62 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**4/17/2009**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 102 GG PP2 MD sand 3psi 2009-04-17**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1200**	**MD**	**PP (Polypropylene)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	7	**263**	**248**	**0.065**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.97 %**	**1.86 %**	**1.532 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.75 %**		**1.532 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**647**
Max Pullout Force	F_{max}	**kN/m**	**10.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**22.1**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.017**
2	**-0.078**
3	**-0.138**
4	**-0.169**
5	**-0.229**

Comments:

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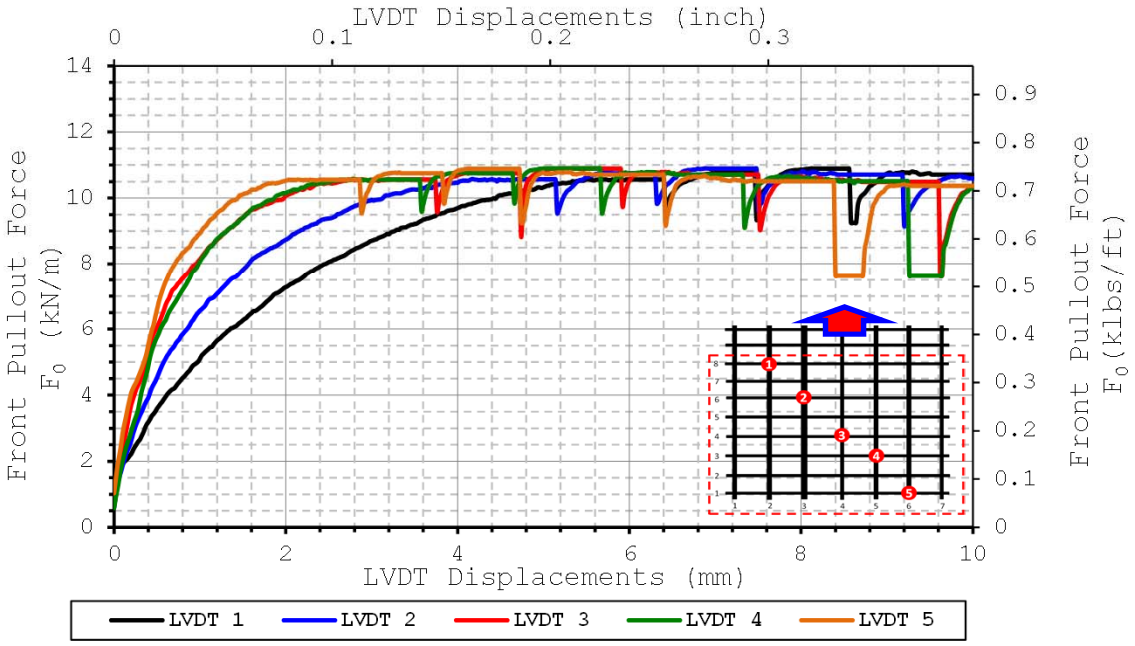
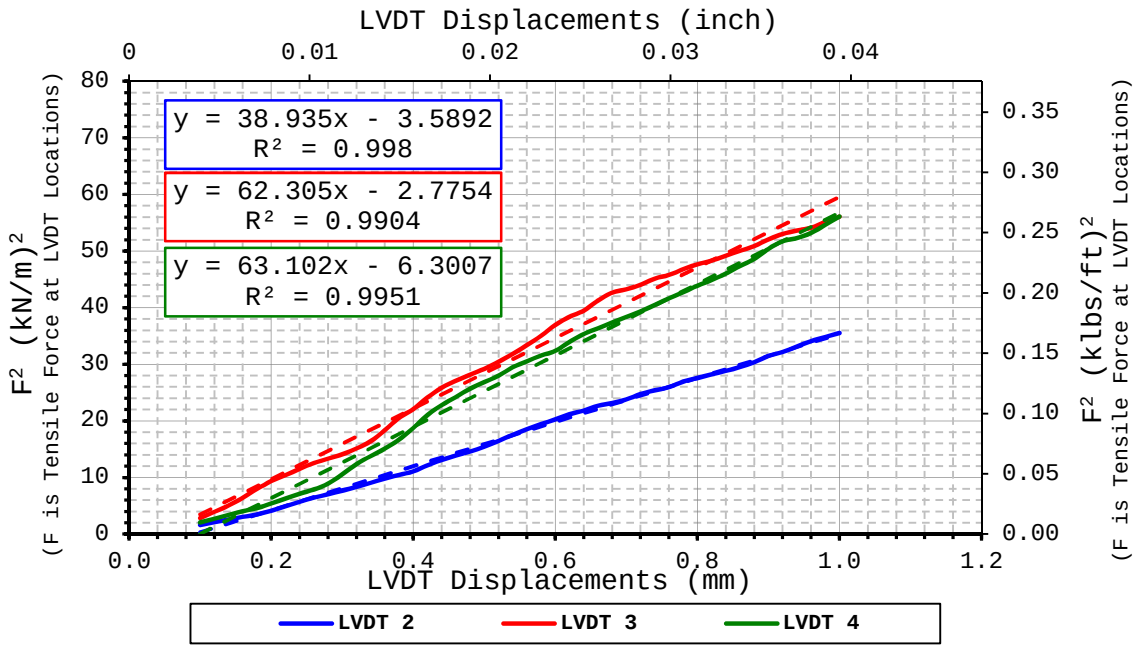
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 39 $(kN/m)^2/mm$

K_{SGI-3} = 62 $(kN/m)^2/mm$

K_{SGI-4} = 63 $(kN/m)^2/mm$

Comments:

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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**5/20/2010**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 102 GG PP2 MD sand 3psi 2010-05-20**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1200**	**MD**	**PP (Polypropylene)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	7	**263**	**248**	**0.065**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.43 %**	**1.45 %**	**1.551 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.48 %**		**1.551 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**543**
Max Pullout Force	F_{max}	**kN/m**	**9.2**
Max Shear Stress	τ_{max}	**kN/m^2**	**18.5**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.017**
2	**-0.078**
3	**-0.138**
4	**-0.169**
5	**-0.229**

Comments:

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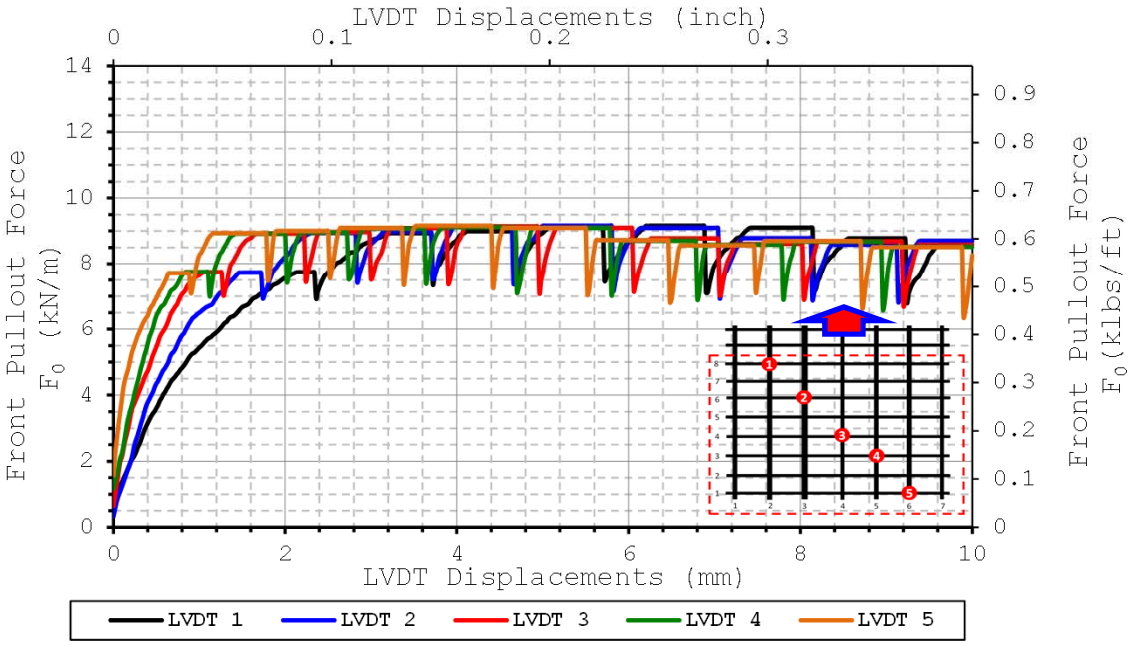
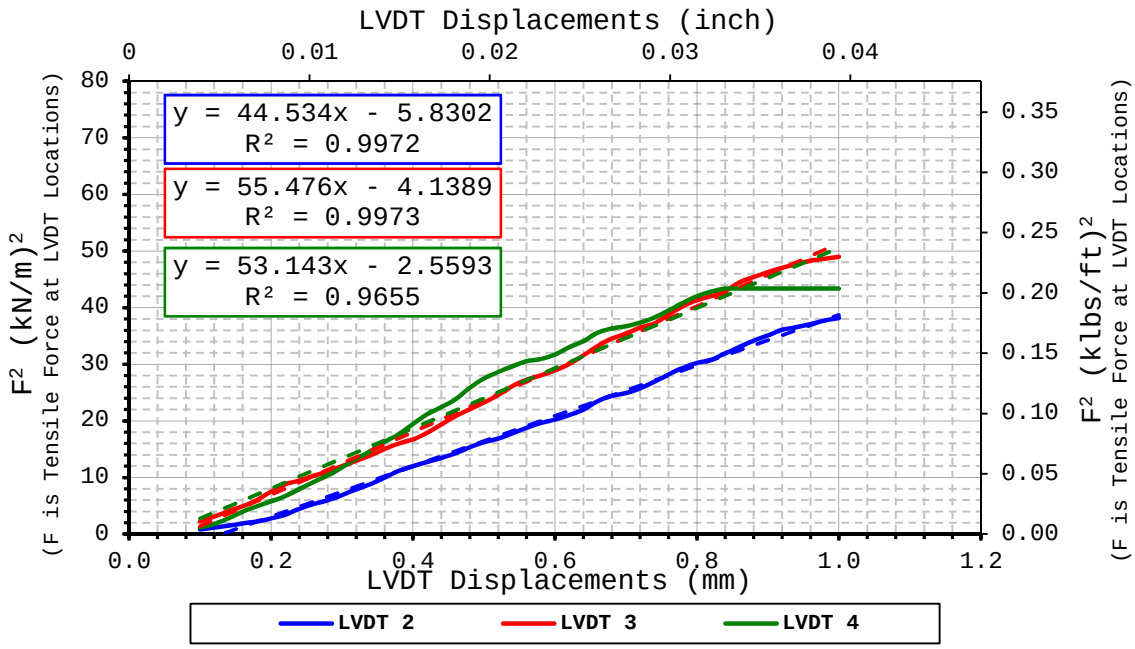
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 45 $(kN/m)^2/mm$

K_{SGI-3} = 55 $(kN/m)^2/mm$

K_{SGI-4} = 53 $(kN/m)^2/mm$

Comments:

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SMALL PULLOUT TEST

Date test conducted	**1/19/2010**
Done by	**Julio Ferreira**
Data file name	**Test 200 GG PP3 MD sand 3psi 2010-01-19**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.11 %**	**1.08 %**	**1.534 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.06 %**		**1.534 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**626**
Max Pullout Force	F_{max}	**kN/m**	**7.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**15.4**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.014**
2	**-0.058**
3	**-0.102**
4	**-0.145**
5	**-0.231**

Comments:

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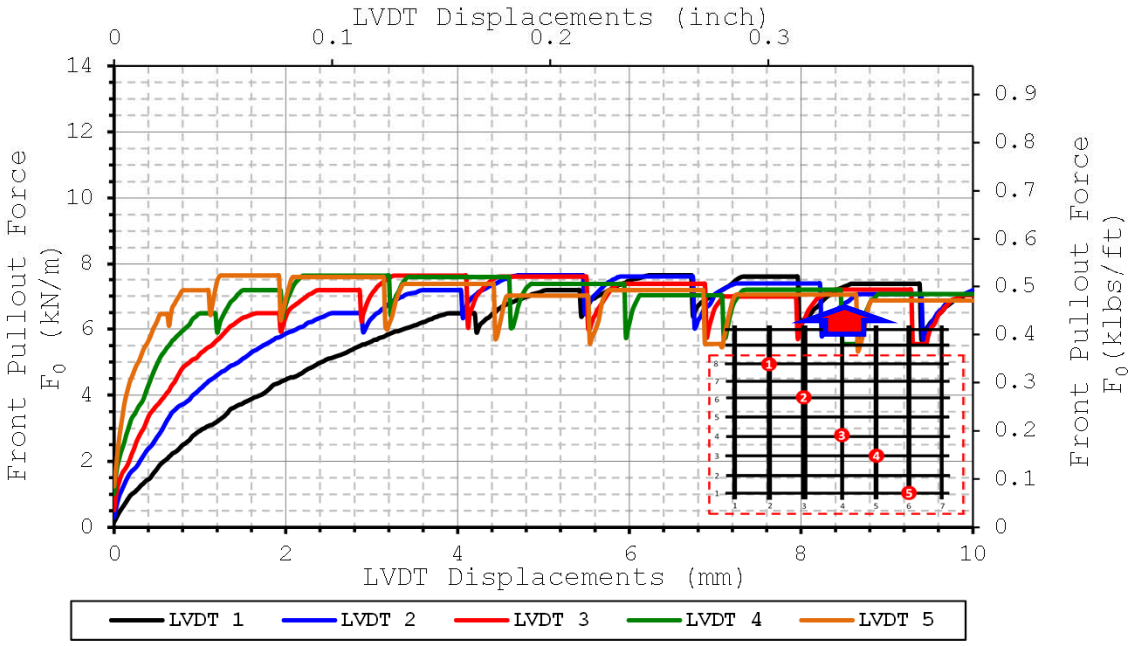
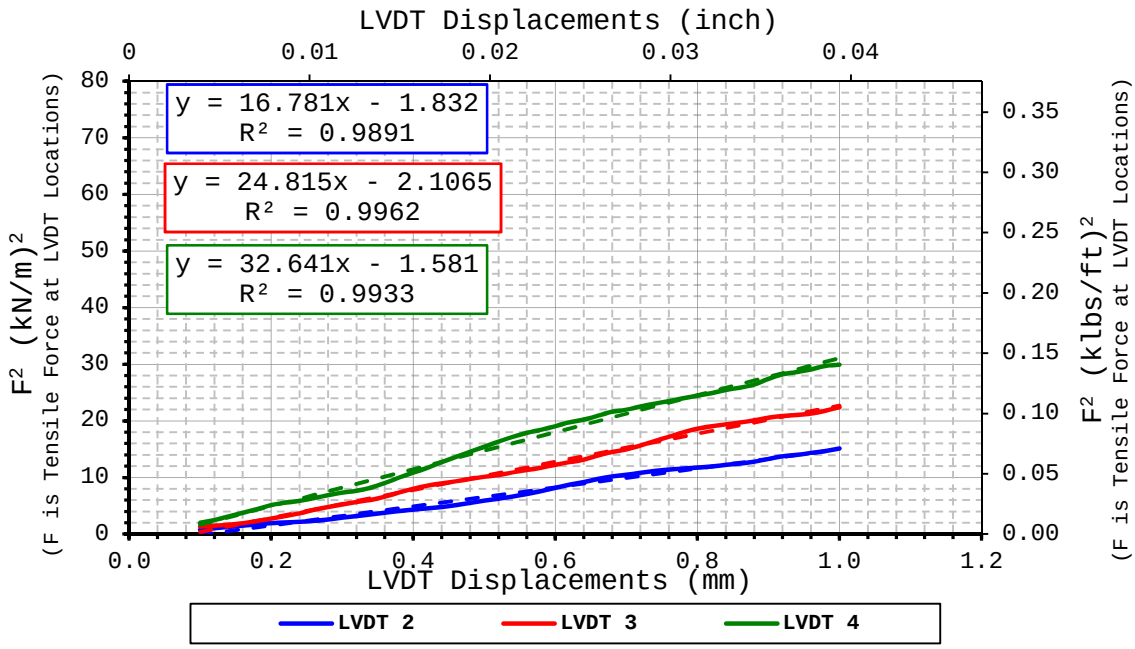
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 17 $(kN/m)^2/mm$

K_{SGI-3} = 25 $(kN/m)^2/mm$

K_{SGI-4} = 33 $(kN/m)^2/mm$

Comments:

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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**1/20/2010**
Done by	**Eddie**
Data file name	**Test 200 GG PP3 MD sand 3psi 2010-01-20**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.84 %**	**1.78 %**	**1.533 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.72 %**		**1.533 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**620**
Max Pullout Force	F_{max}	**kN/m**	**7.6**
Max Shear Stress	τ_{max}	**kN/m^2**	**15.3**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.013**
2	**-0.058**
3	**-0.100**
4	**-0.143**
5	**-0.230**

Comments:

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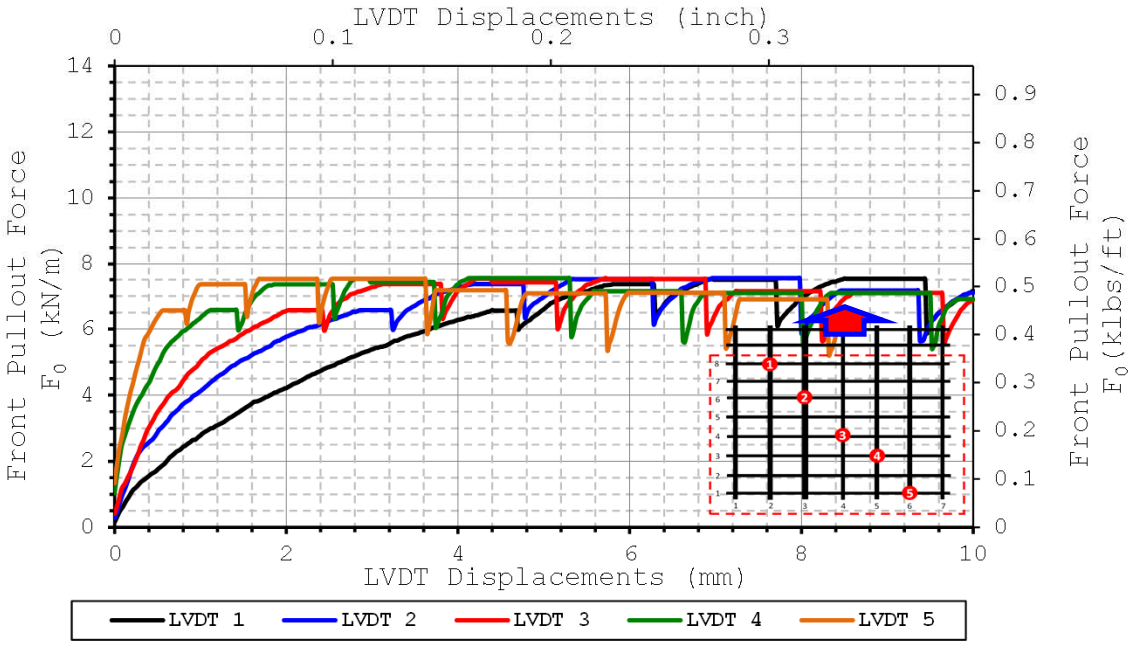
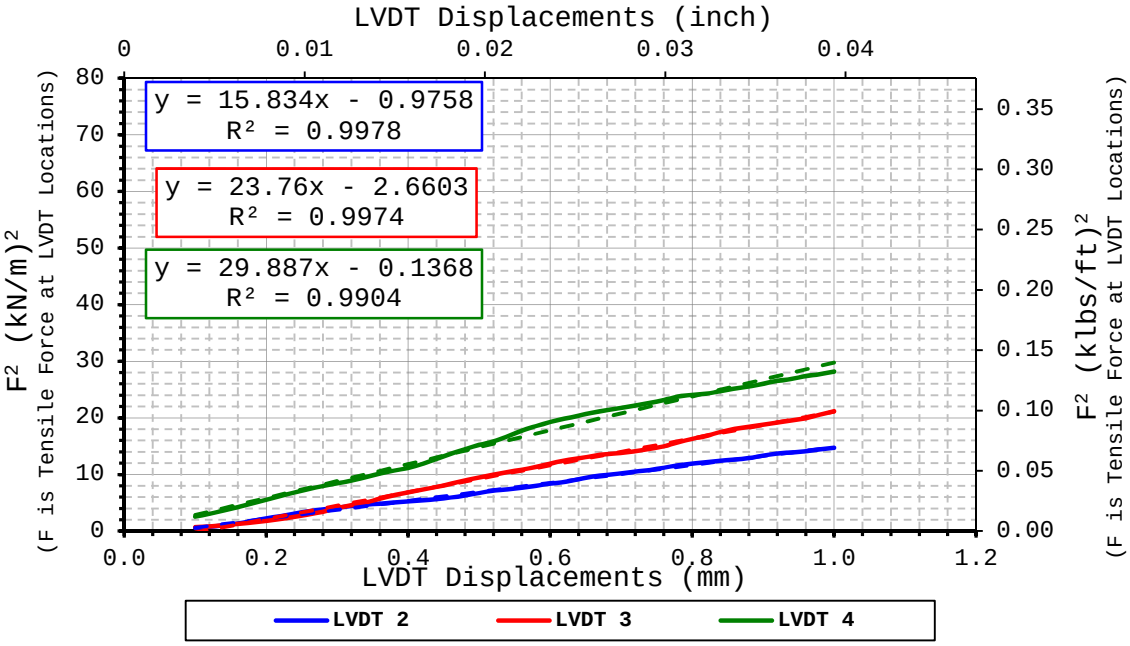
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 16 $(kN/m)^2/mm$

K_{SGI-3} = 24 $(kN/m)^2/mm$

K_{SGI-4} = 30 $(kN/m)^2/mm$

Comments:

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SMALL PULLOUT TEST

Date test conducted	**1/21/2010**
Done by	**Eddie**
Data file name	**Test 200 GG PP3 MD sand 3psi 2010-01-21**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.84 %**	**1.78 %**	**1.533 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.72 %**		**1.533 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**634**
Max Pullout Force	F_{max}	**kN/m**	**7.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**15.6**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.011**
2	**-0.057**
3	**-0.100**
4	**-0.145**
5	**-0.233**

Comments:

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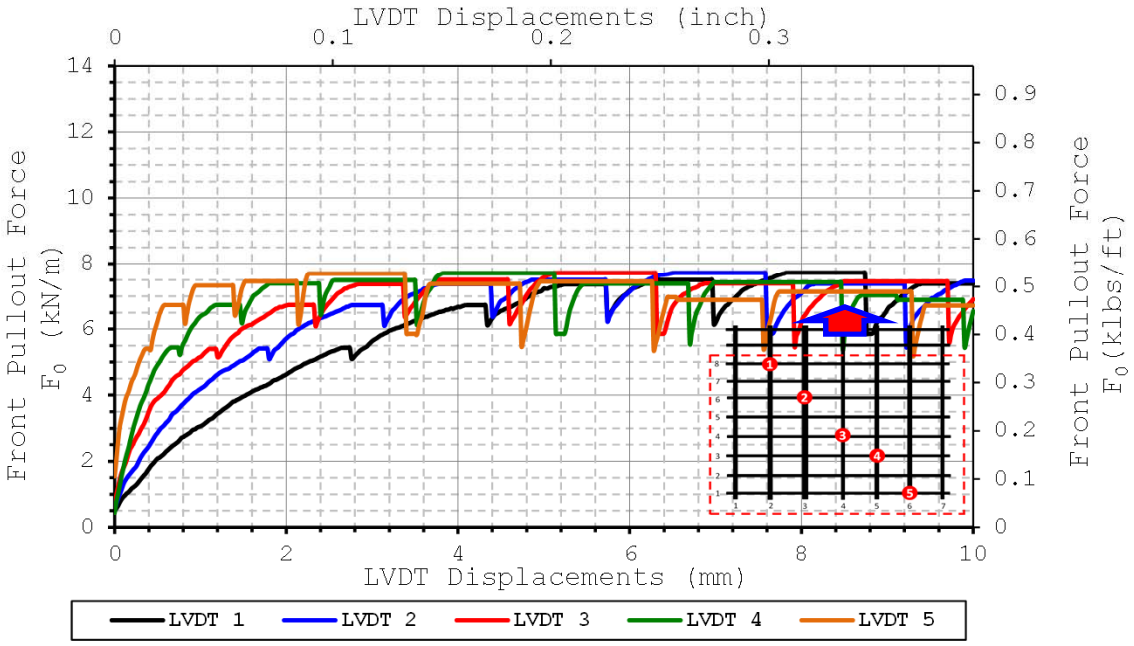
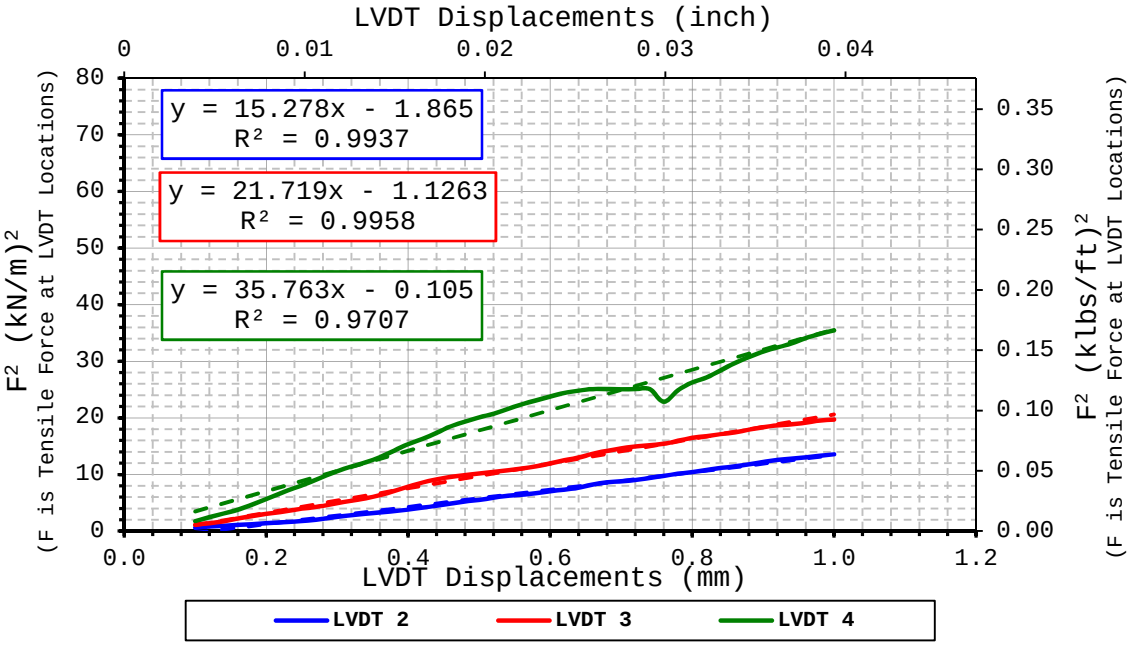
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 15 $(kN/m)^2/mm$

K_{SGI-3} = 22 $(kN/m)^2/mm$

K_{SGI-4} = 36 $(kN/m)^2/mm$

Comments:

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SMALL PULLOUT TEST

Date test conducted	**12/17/2008**
Done by	**Julio Ferreira**
Data file name	**Test 08 GG PET MD sand 3psi 2008-12-17**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi Biaxial GG BasXgrid 11**	**MD**	**PET (Polyester)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	11	**270**	**248**	**0.067**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.11 %**	**1.08 %**	**1.532 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.06 %**		**1.532 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**626**
Max Pullout Force	F_{max}	**kN/m**	**10.3**
Max Shear Stress	τ_{max}	**kN/m^2**	**20.8**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.027**
2	**-0.095**
3	**-0.129**
4	**-0.160**
5	**-0.225**

Comments:

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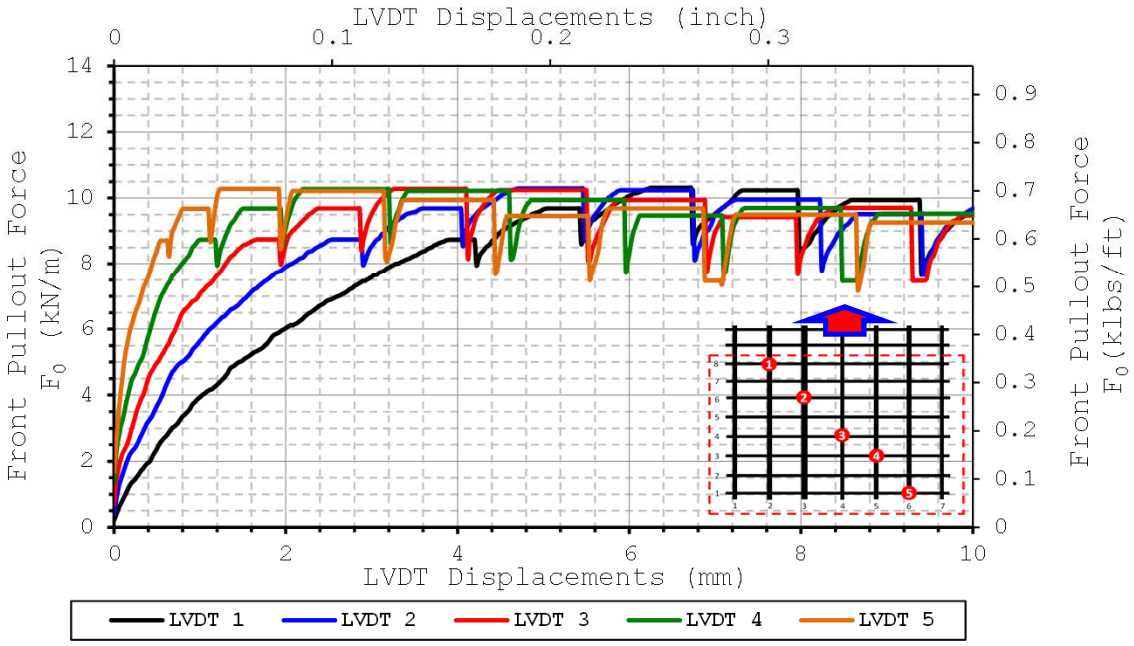
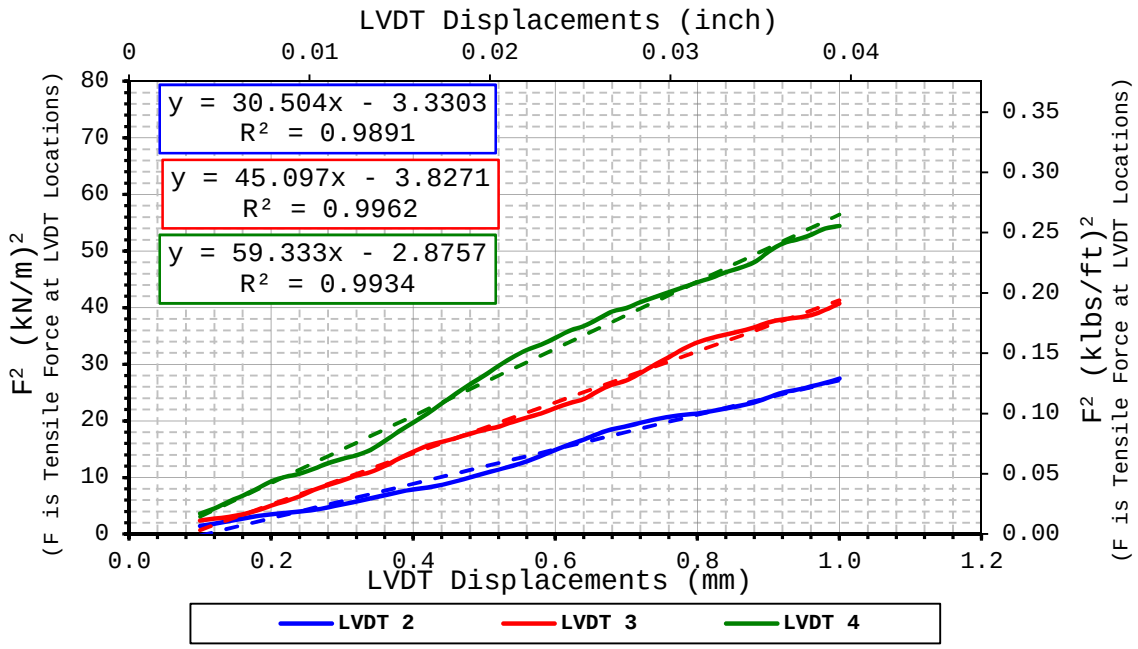
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 31 $(kN/m)^2/mm$

K_{SGI-3} = 45 $(kN/m)^2/mm$

K_{SGI-4} = 59 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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SMALL PULLOUT TEST

Date test conducted	**7/30/2009**
Done by	**Julio Ferreira**
Data file name	**Test 08 GG PET MD sand 3psi 2009-07-30**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi Biaxial GG BasXgrid 11**	**MD**	**PET (Polyester)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**270**	**248**	**0.067**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.33 %**	**1.41 %**	**1.525 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.48 %**		**1.525 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**648**
Max Pullout Force	F_{max}	**kN/m**	**10.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**21.5**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.031**
2	**-0.096**
3	**-0.131**
4	**-0.164**
5	**-0.231**

Comments:

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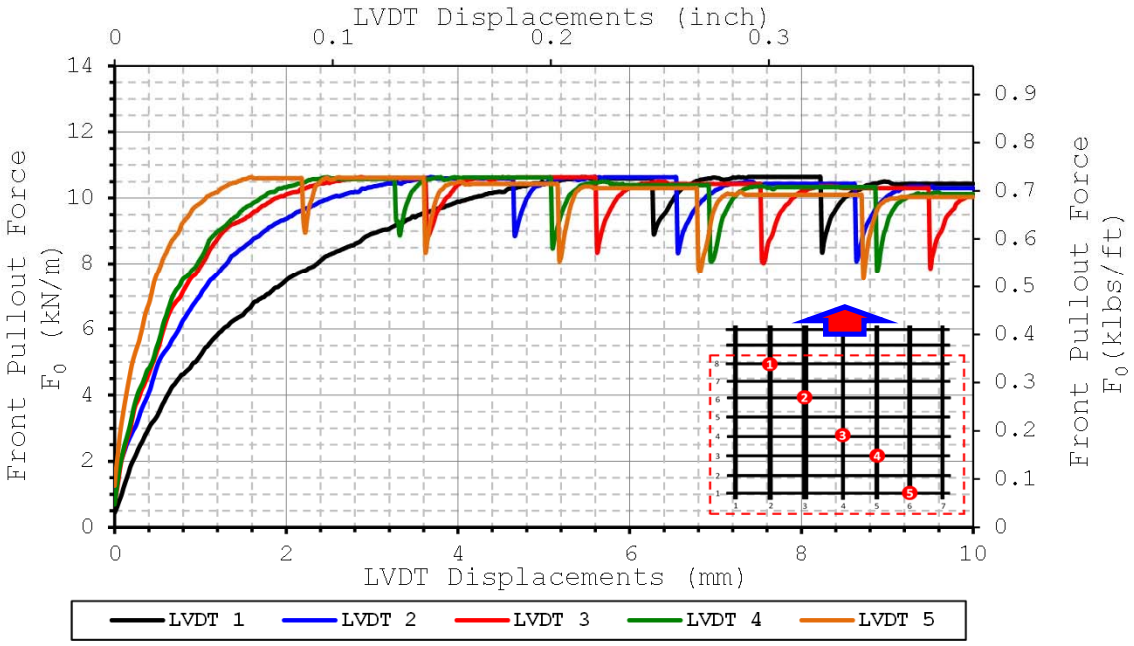
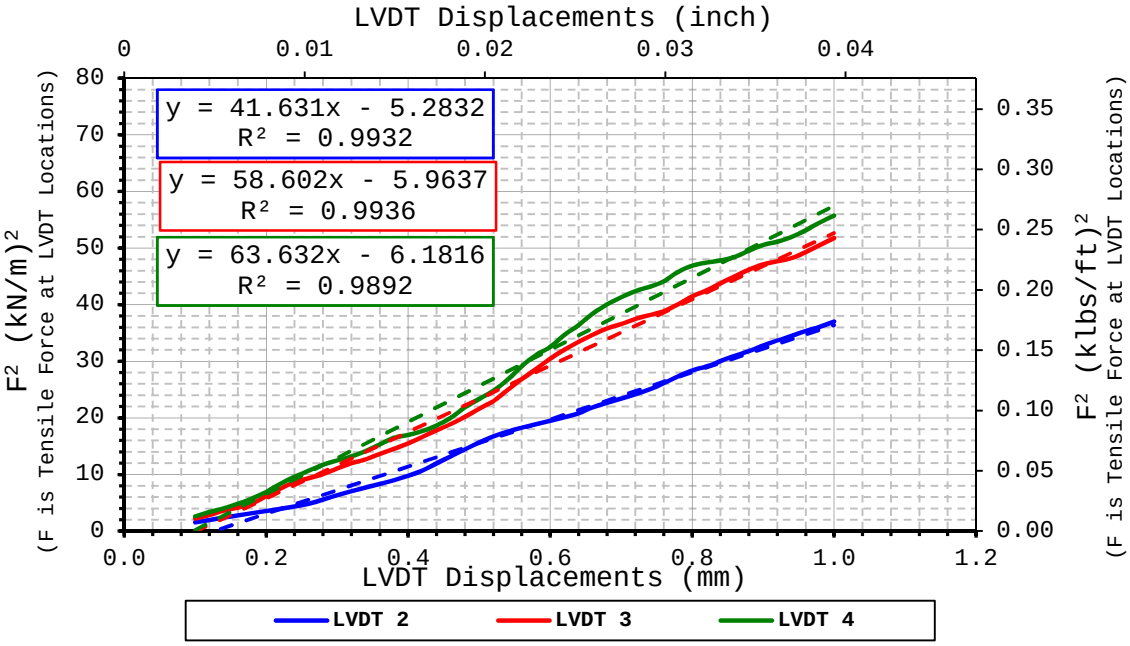
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 42 $(kN/m)^2/mm$

K_{SGI-3} = 59 $(kN/m)^2/mm$

K_{SGI-4} = 64 $(kN/m)^2/mm$

Comments:

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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**2/16/2010**
Done by	**Julio Ferreira**
Data file name	**Test 204 GG PP4 CD sand 3psi 2010-02-16**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	6	**255**	**248**	**0.063**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**%**	**0.00 %**	**1.578 g/cm^3**
Bottom Layer	**Monterey sand 30**	**0.00 %**		**1.578 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**408**
Max Pullout Force	F_{max}	**kN/m**	**7.1**
Max Shear Stress	τ_{max}	**kN/m^2**	**14.4**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.011**
2	**-0.056**
3	**-0.102**
4	**-0.146**
5	**-0.236**

Comments:

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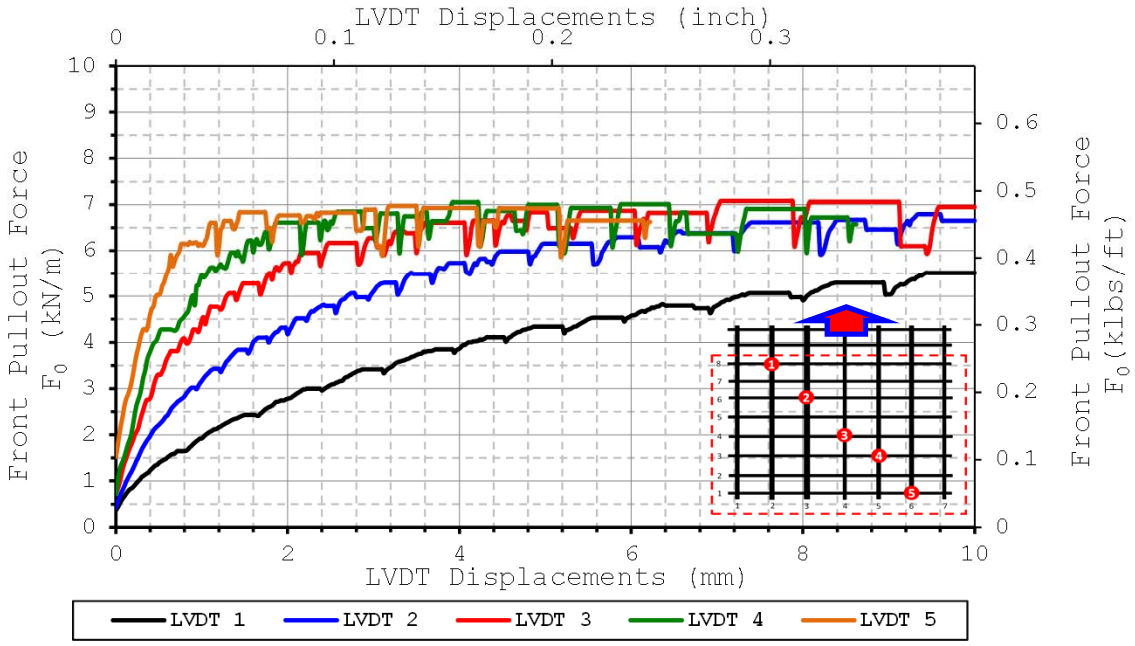
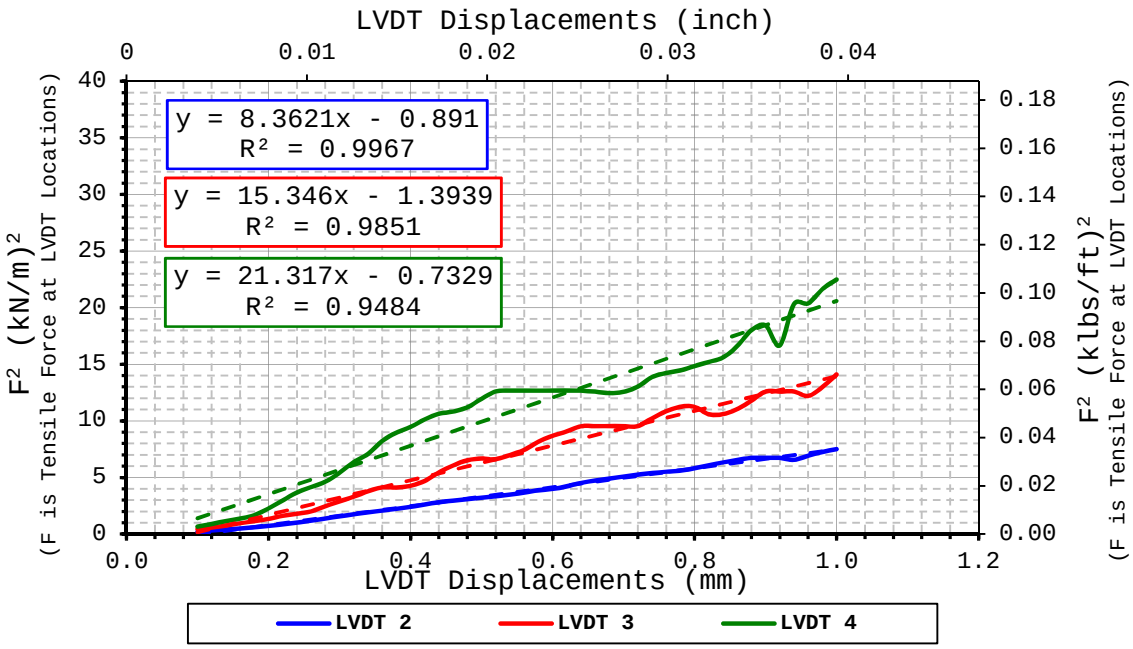
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 8 $(kN/m)^2/mm$

K_{SGI-3} = 15 $(kN/m)^2/mm$

K_{SGI-4} = 21 $(kN/m)^2/mm$

Comments:

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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**2/19/2010**
Done by	**Julio Ferreira**
Data file name	**Test 204 GG PP4 CD sand 3psi 2010-02-19**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	6	**255**	**248**	**0.063**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.43 %**	**1.45 %**	**1.542 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.47 %**		**1.542 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**451**
Max Pullout Force	F_{max}	**kN/m**	**7.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**15.9**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.008**
2	**-0.055**
3	**-0.101**
4	**-0.147**
5	**-0.237**

Comments:

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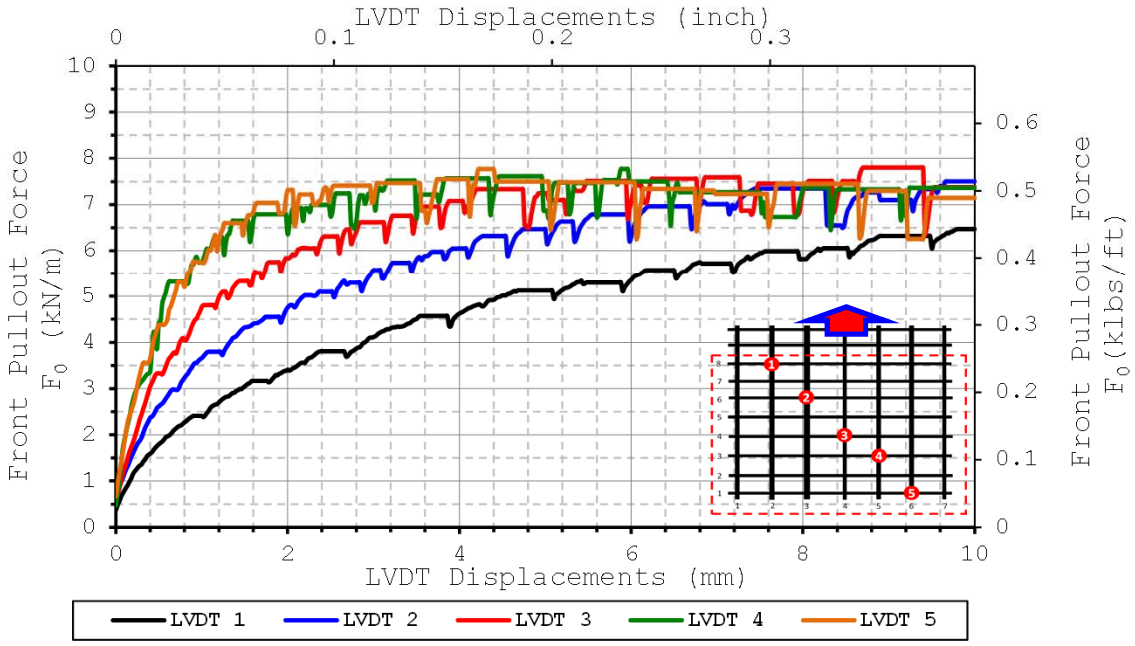
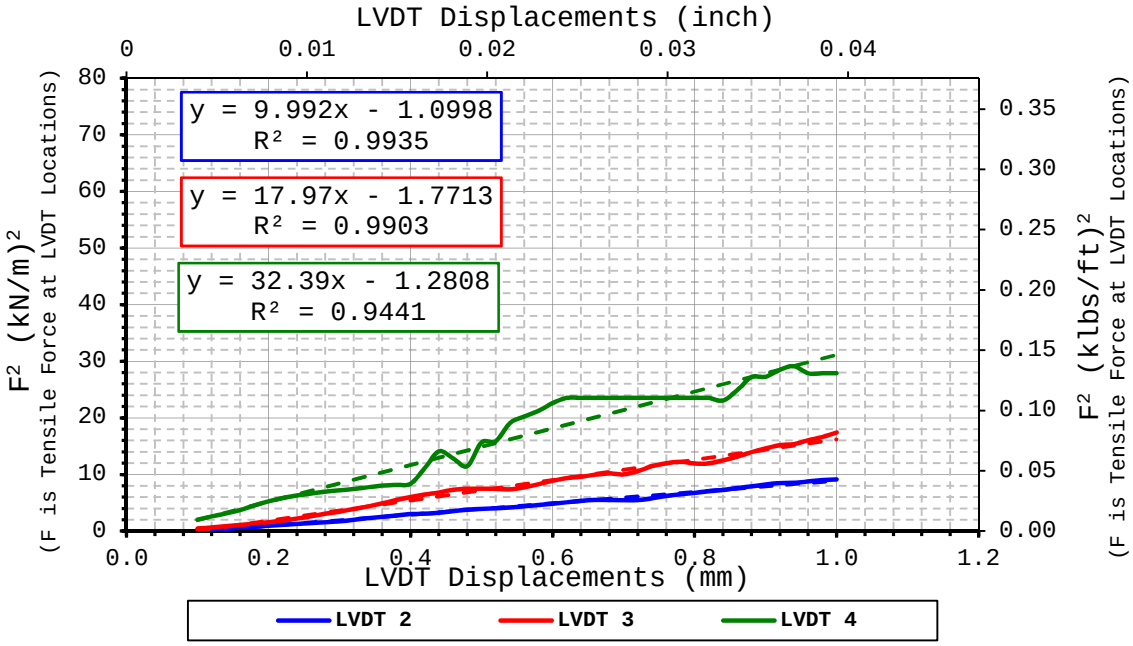
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 10 $(kN/m)^2/mm$

K_{SGI-3} = 18 $(kN/m)^2/mm$

K_{SGI-4} = 32 $(kN/m)^2/mm$

Comments:

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SMALL PULLOUT TEST

Date test conducted	**4/7/2010**
Done by	**Julio Ferreira**
Data file name	**Test 208 GG PP4x2 CD sand 3psi 2010-04**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**260**	**248**	**0.064**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.41 %**	**1.45 %**	**1.533 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.48 %**		**1.533 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**566**
Max Pullout Force	F_{max}	**kN/m**	**9.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**19.5**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.003**
2	**-0.091**
3	**-0.133**
4	**-0.177**
5	**-0.222**

Comments:

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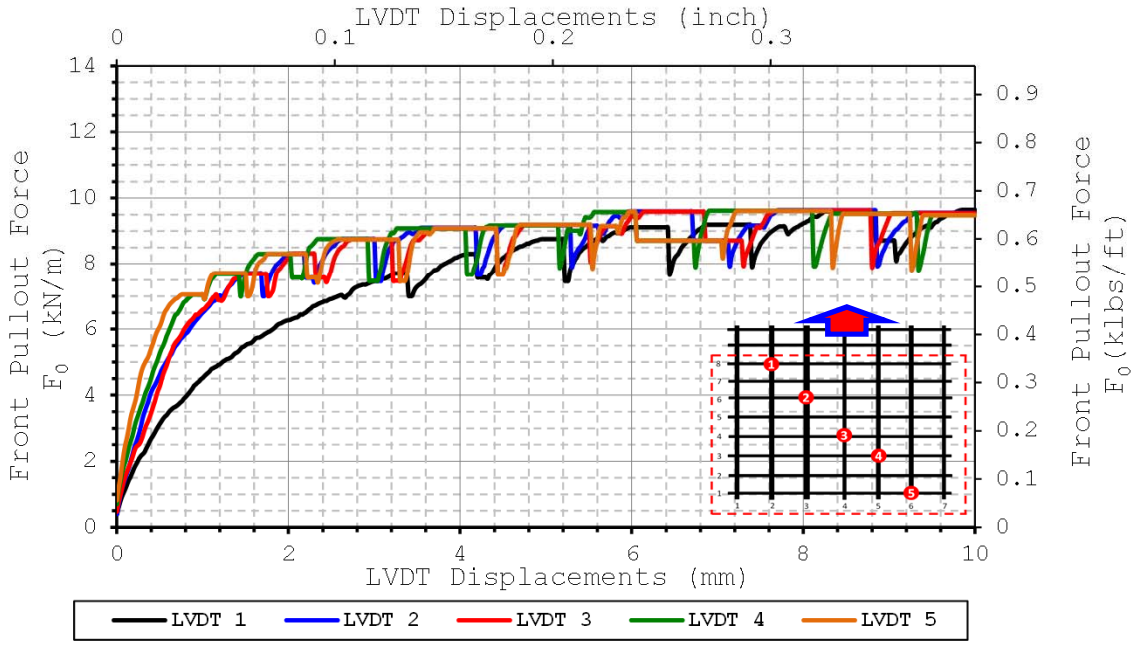
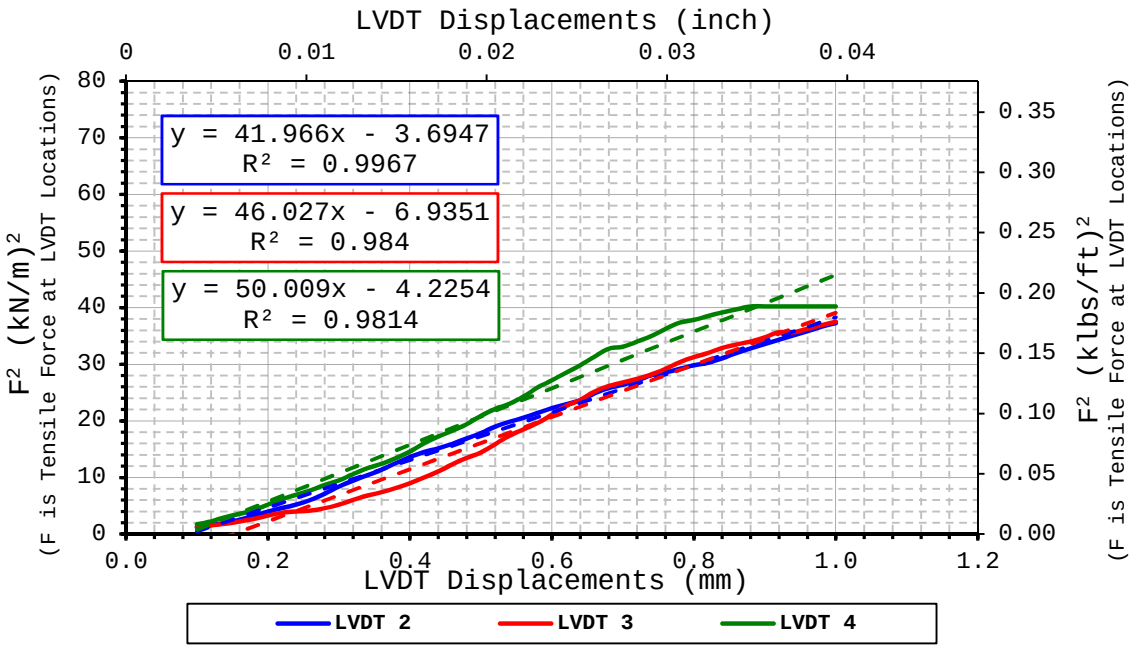
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 42 $(kN/m)^2/mm$

K_{SGI-3} = 46 $(kN/m)^2/mm$

K_{SGI-4} = 50 $(kN/m)^2/mm$

Comments:

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Department of Civil, Evironmental and Architectural Engineering
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SMALL PULLOUT TEST

Date test conducted	**4/11/2010**
Done by	**Julio Ferreira**
Data file name	**Test 208 GG PP4x2 CD sand 3psi 2010-04-**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**260**	**248**	**0.064**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.60 %**	**1.58 %**	**1.518 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.57 %**		**1.518 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**559**
Max Pullout Force	F_{max}	**kN/m**	**9.6**
Max Shear Stress	τ_{max}	**kN/m^2**	**19.3**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.010**
2	**-0.098**
3	**-0.143**
4	**-0.187**
5	**-0.233**

Comments:

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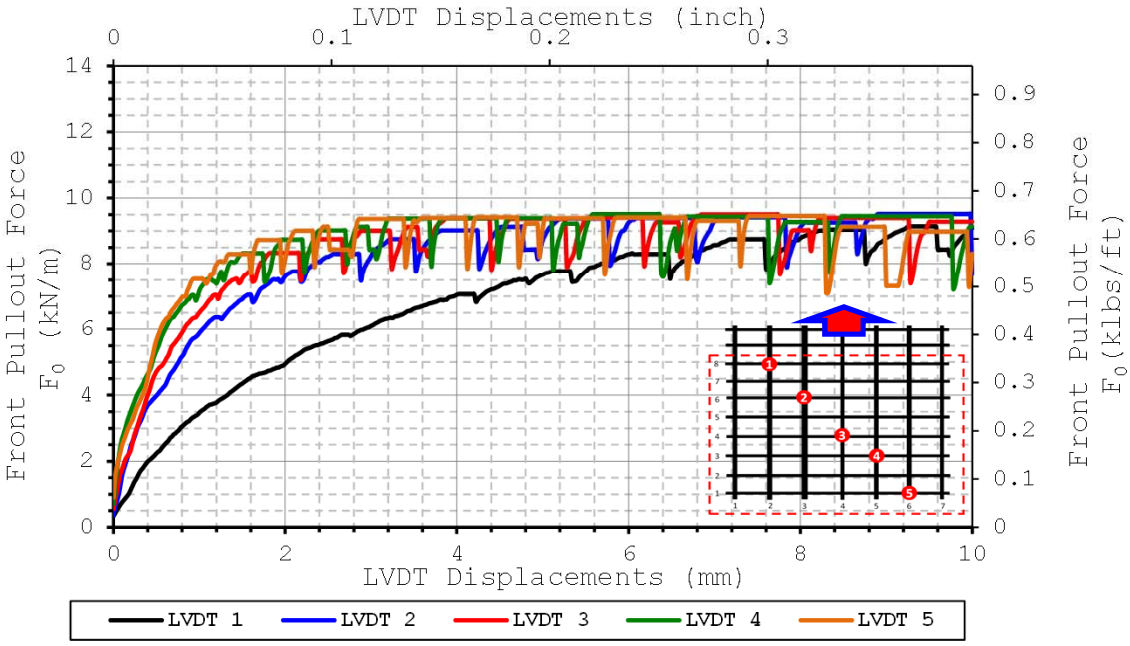
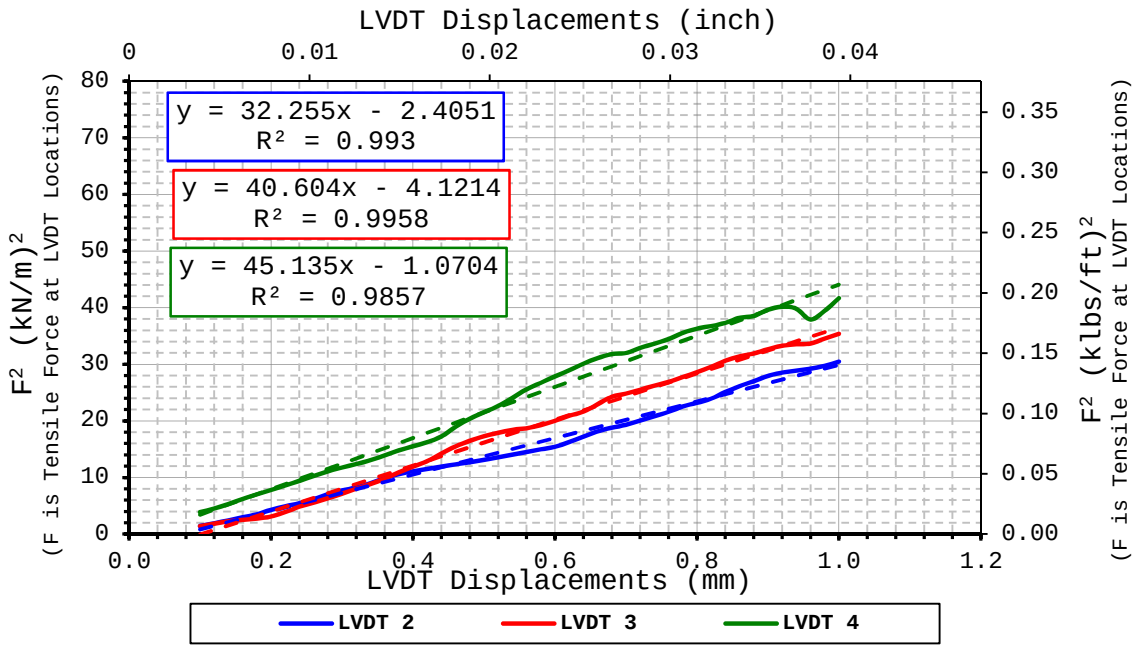
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 32 $(kN/m)^2/mm$

K_{SGI-3} = 41 $(kN/m)^2/mm$

K_{SGI-4} = 45 $(kN/m)^2/mm$

Comments:

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SMALL PULLOUT TEST

Date test conducted	**9/29/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 14 (R3) GT MD sand 3psi 2008-09-29**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Geolon HP 570**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**285**	**248**	**0.071**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.13 %**	**1.13 %**	**1.542 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.13 %**		**1.542 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**616**
Max Pullout Force	F_{max}	**kN/m**	**9.6**
Max Shear Stress	τ_{max}	**kN/m^2**	**19.4**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.050**
2	**-0.087**
3	**-0.123**
4	**-0.157**
5	**-0.229**

Comments:

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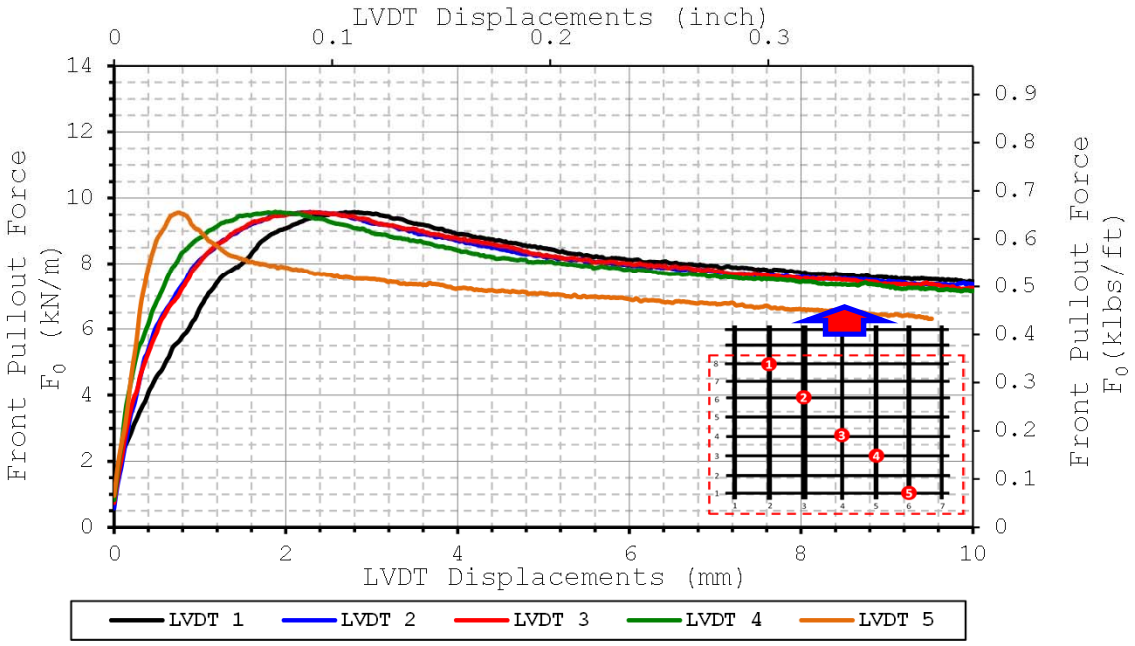
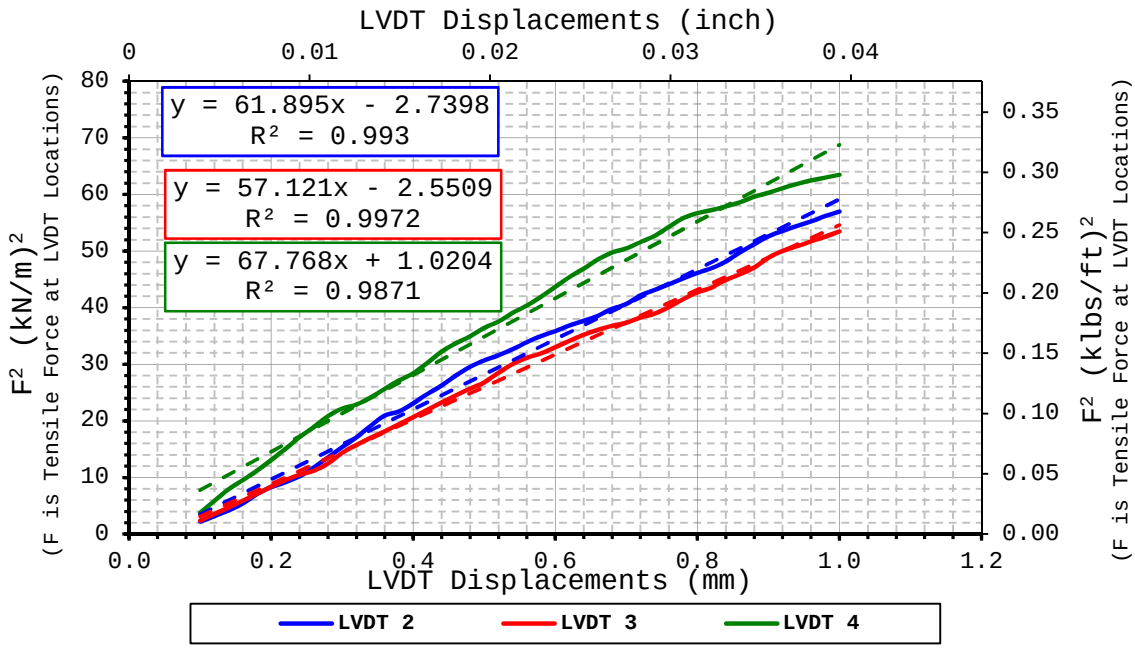
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 62 $(kN/m)^2/mm$

K_{SGI-3} = 57 $(kN/m)^2/mm$

K_{SGI-4} = 68 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**10/18/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 14 (R4) GT MD sand 3psi 2008-10-18**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Geolon HP 570**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**285**	**248**	**0.071**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.13 %**	**1.13 %**	**1.545 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.13 %**		**1.545 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**574**
Max Pullout Force	F_{max}	**kN/m**	**9.0**
Max Shear Stress	τ_{max}	**kN/m^2**	**18.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.248**
2	**-0.248**
3	**-0.248**
4	**-0.248**
5	**-0.248**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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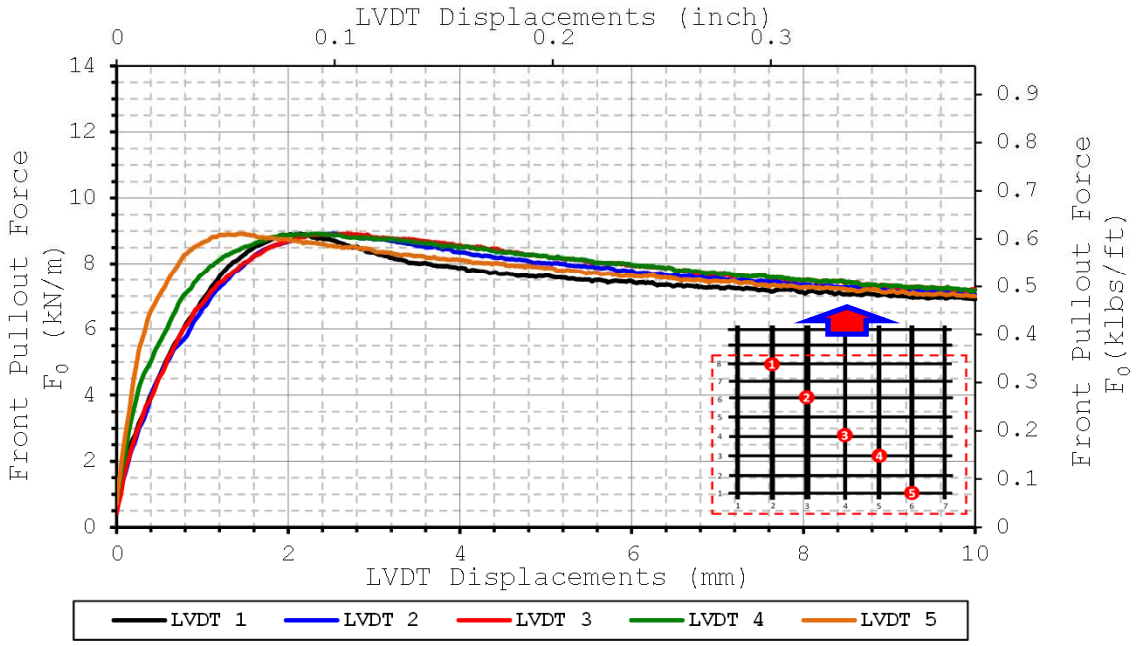
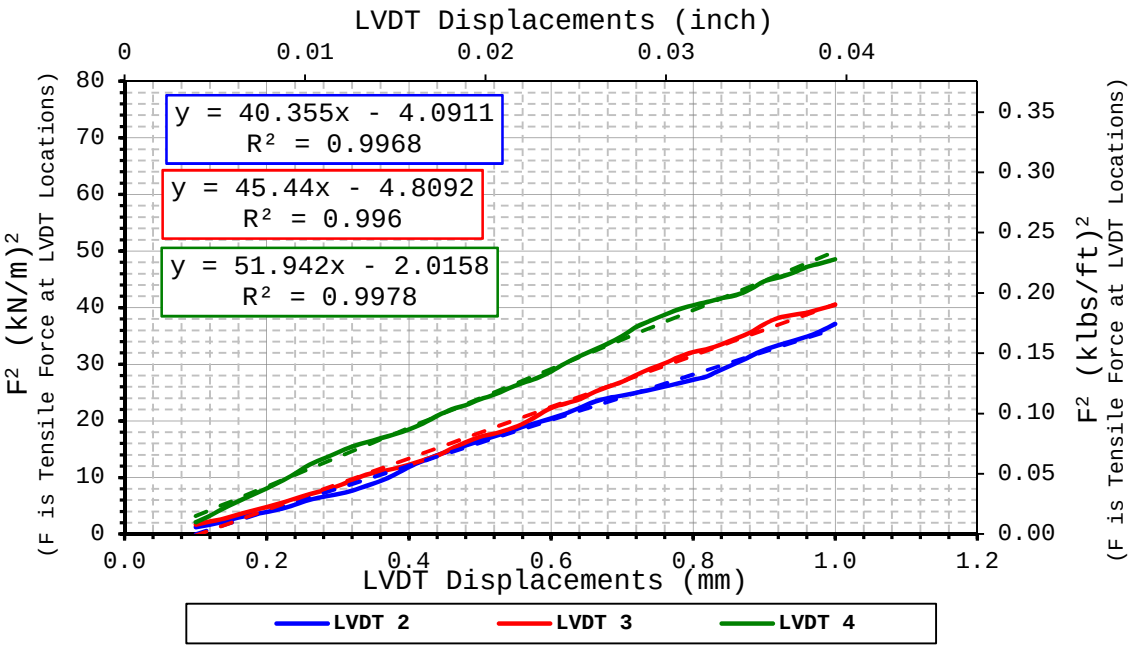
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 40 $(kN/m)^2/mm$

K_{SGI-3} = 45 $(kN/m)^2/mm$

K_{SGI-4} = 52 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/15/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 14 GT MD sand 3psi 2008-11-15**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Geolon HP 570**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**285**	**248**	**0.071**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.13 %**	**1.13 %**	**1.570 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.13 %**		**1.570 g/cm^3**

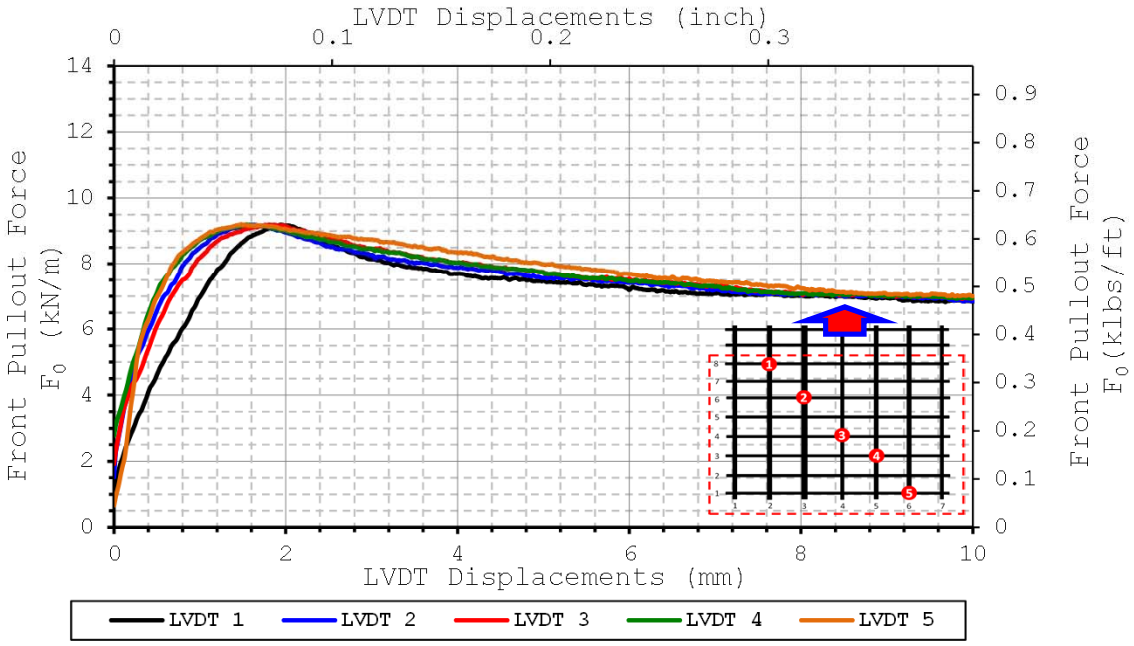
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**593**
Max Pullout Force	F_{max}	**kN/m**	**9.3**
Max Shear Stress	τ_{max}	**kN/m^2**	**18.7**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.021**
2	**-0.106**
3	**-0.135**
4	**-0.164**
5	**-0.225**

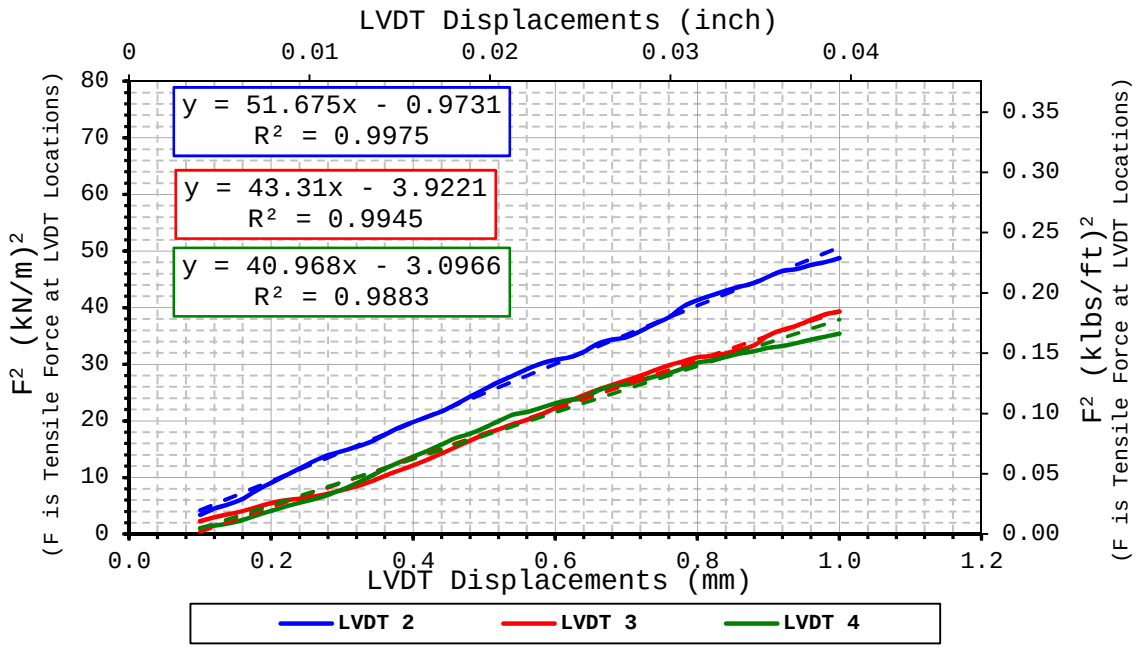
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 52 $(kN/m)^2/mm$

K_{SGI-3} = 43 $(kN/m)^2/mm$

K_{SGI-4} = 41 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/25/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 14 GT MD sand 3psi 2008-11-25**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Biaxial GT Geolon HP570**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**280**	**248**	**0.069**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.13 %**	**1.13 %**	**1.538 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.13 %**		**1.538 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**548**
Max Pullout Force	F_{max}	**kN/m**	**8.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**17.5**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.008**
2	**-0.049**
3	**-0.103**
4	**-0.143**
5	**-0.217**

Comments:

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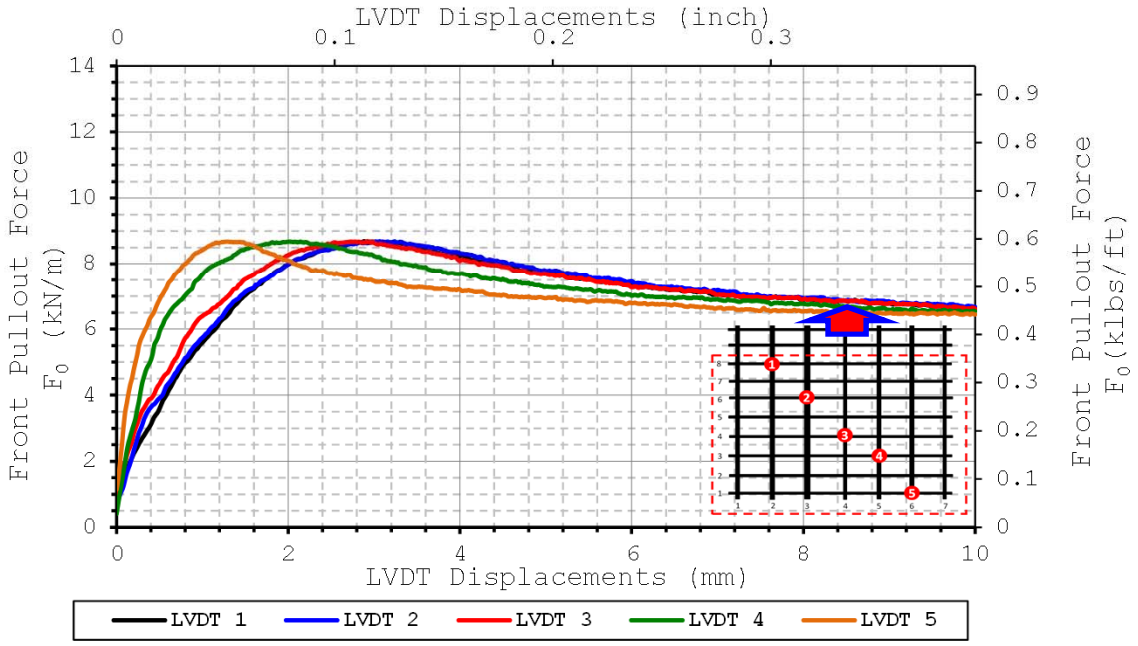
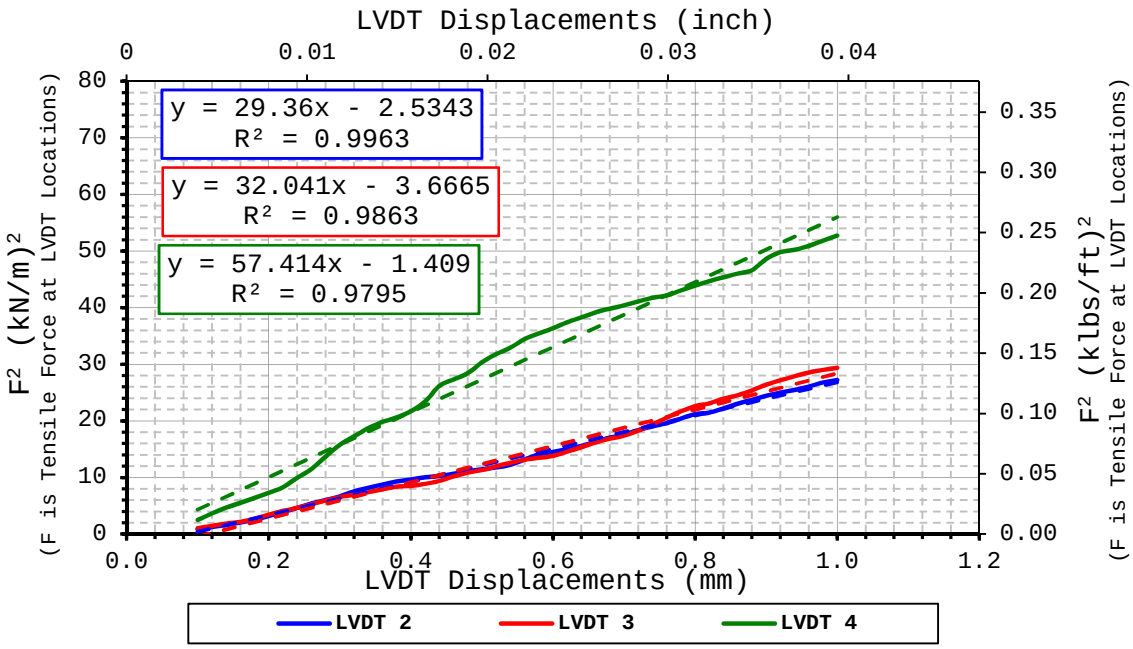
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 29 $(kN/m)^2/mm$

K_{SGI-3} = 32 $(kN/m)^2/mm$

K_{SGI-4} = 57 $(kN/m)^2/mm$

Comments:

Small Pullout Test

Sand – CD – 5psi

Results of the tests up to 8/31/2011

The University of Texas at Austin

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**5/20/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 06 GG PP CD sand 5psi 2008-05-20**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1100**	**CD**	**PP (Polypropylene)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**275**	**248**	**0.068**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.43 %**	**1.45 %**	**1.476 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.48 %**		**1.476 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**664**
Max Pullout Force	F_{max}	**kN/m**	**10.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**21.6**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.026**
2	**-0.104**
3	**-0.144**
4	**-0.184**
5	**-0.224**

Comments:

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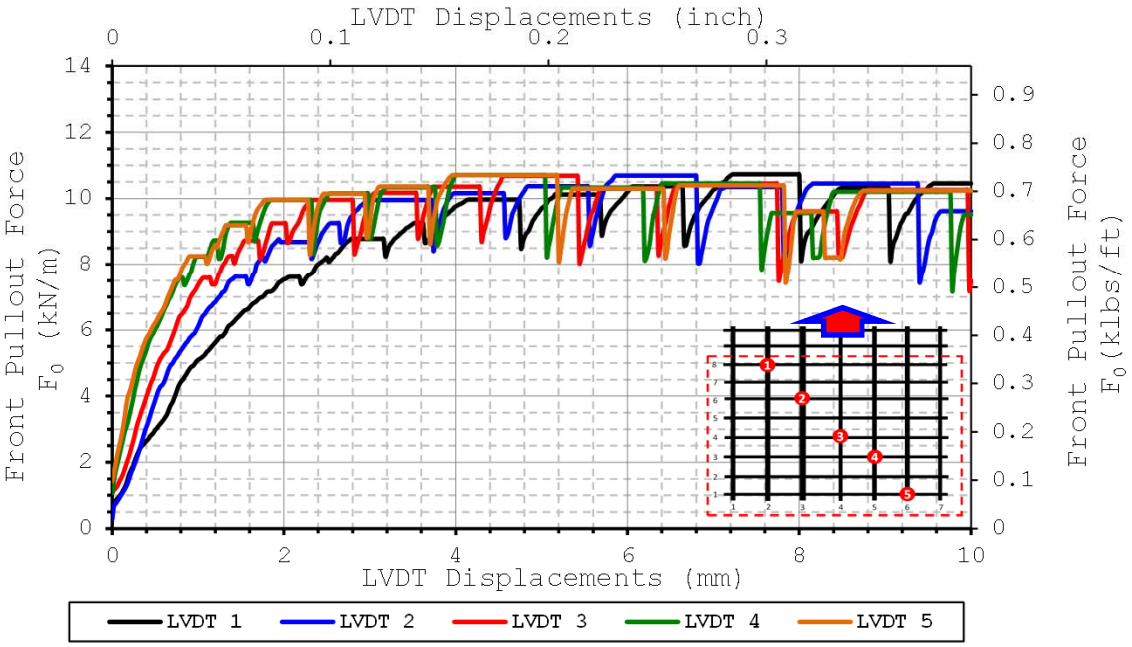
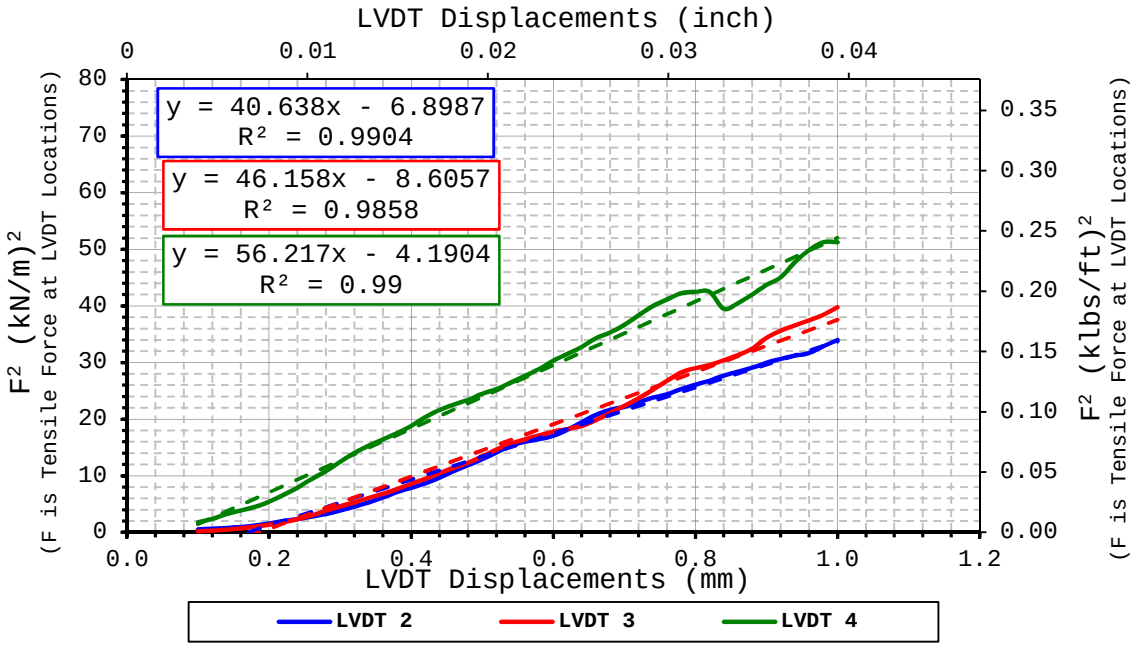
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 41 $(kN/m)^2/mm$

K_{SGI-3} = 46 $(kN/m)^2/mm$

K_{SGI-2} = 56 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/3/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 06 GG PP CD sand 5psi 2008-11-03**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Tensar Biaxial GG BX1100**	**CD**	**PP (Polypropylene)**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**10**	**275**	**248**	**0.068**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**1.47 %**	**1.47 %**	**1.516 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.47 %**		**1.516 g/cm^3**

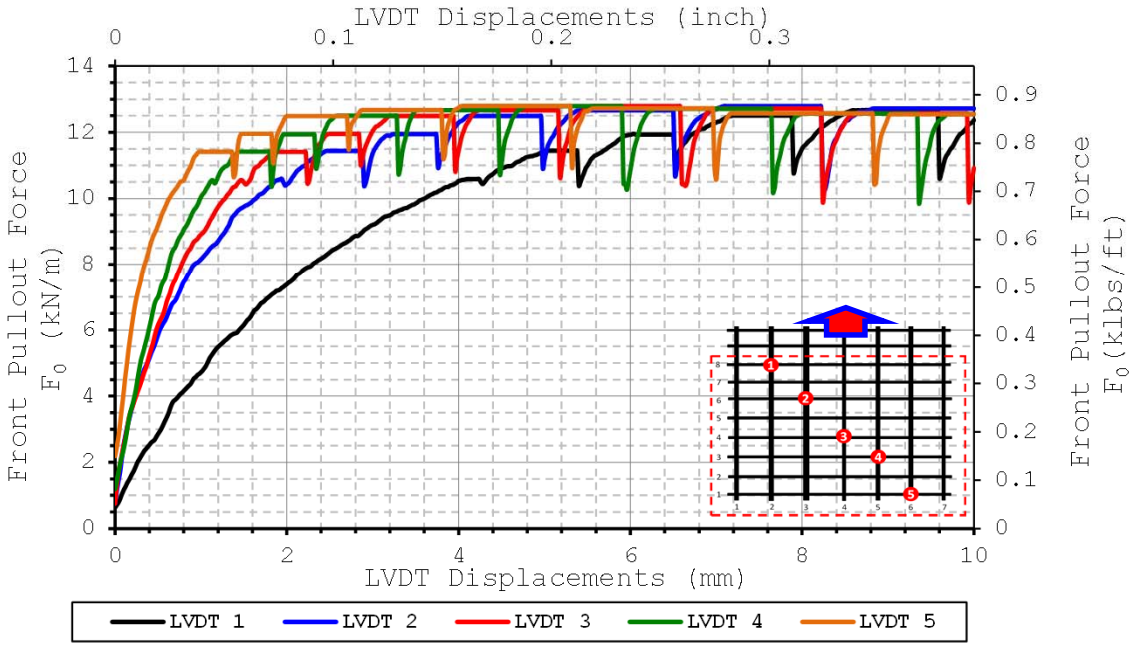
RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**794**
Max Pullout Force	F_{max}	**kN/m**	**12.8**
Max Shear Stress	τ_{max}	**kN/m^2**	**25.9**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.027**
2	**-0.108**
3	**-0.147**
4	**-0.189**
5	**-0.230**

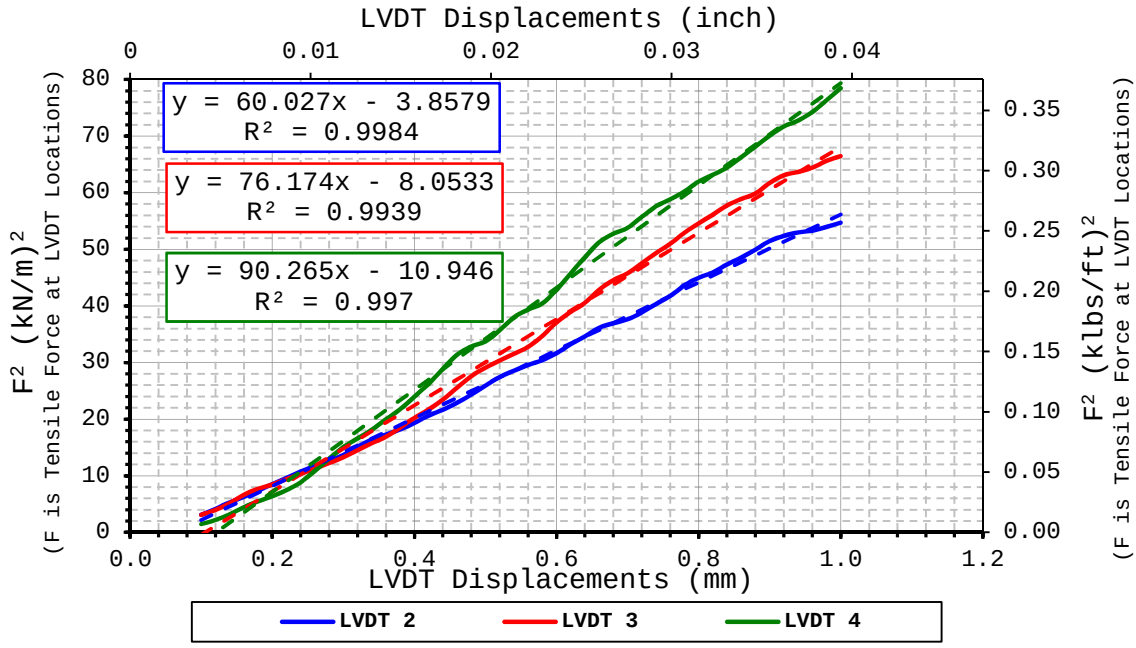
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 60 $(kN/m)^2/mm$

K_{SGI-3} = 76 $(kN/m)^2/mm$

K_{SGI-2} = 90 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**5/19/2010**
Done by	**Julio Ferreira**
Data file name	**Test 106 GG PP2 CD sand 5psi 2010-05-19**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1200**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	9	**275**	**248**	**0.068**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.50 %**	**1.50 %**	**1.467 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.50 %**		**1.467 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**794**
Max Pullout Force	F_{max}	**kN/m**	**12.8**
Max Shear Stress	τ_{max}	**kN/m^2**	**25.9**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.050**
2	**-0.120**
3	**-0.156**
4	**-0.193**
5	**-0.230**

Comments:

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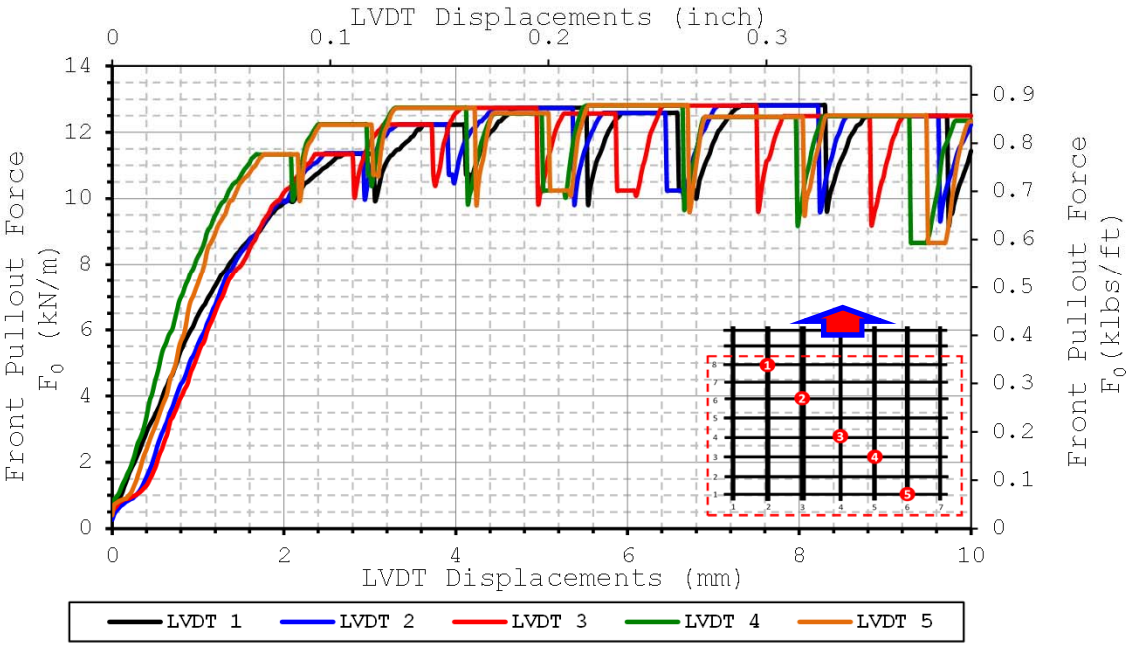
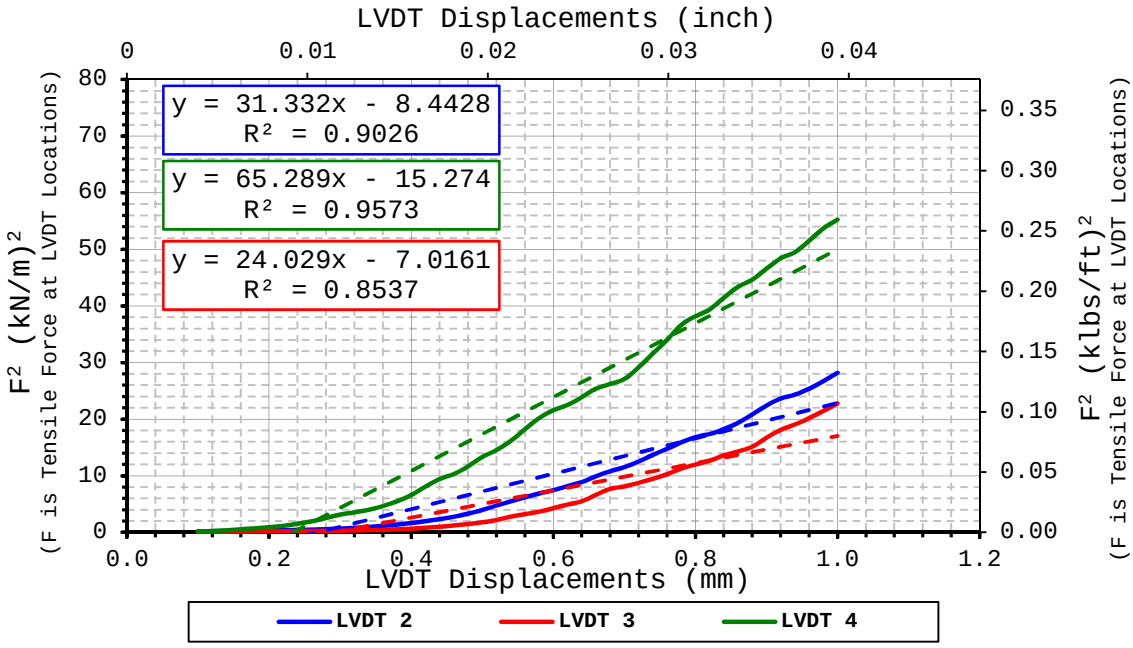
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 31 $(kN/m)^2/mm$

K_{SGI-3} = 24 $(kN/m)^2/mm$

K_{SGI-2} = 65 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**2/6/2010**
Done by	**Julio Ferreira**
Data file name	**Test 203 GG PP3 CD sand 5psi 2010-02-0**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Huesker Biaxial GG Fornit20**	**CD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**13**	**211**	**248**	**0.052**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**1.31 %**	**1.28 %**	**1.505 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.25 %**		**1.505 g/cm^3**

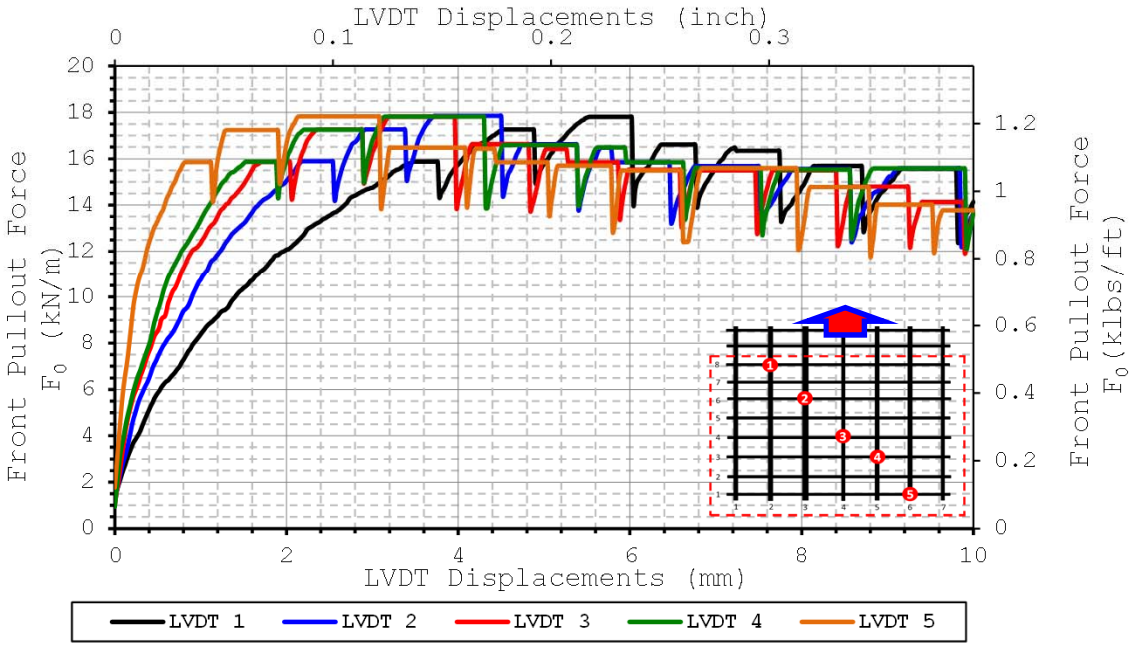
RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**848**
Max Pullout Force	F_{max}	**kN/m**	**17.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**36.1**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.008**
2	**-0.076**
3	**-0.109**
4	**-0.142**
5	**-0.226**

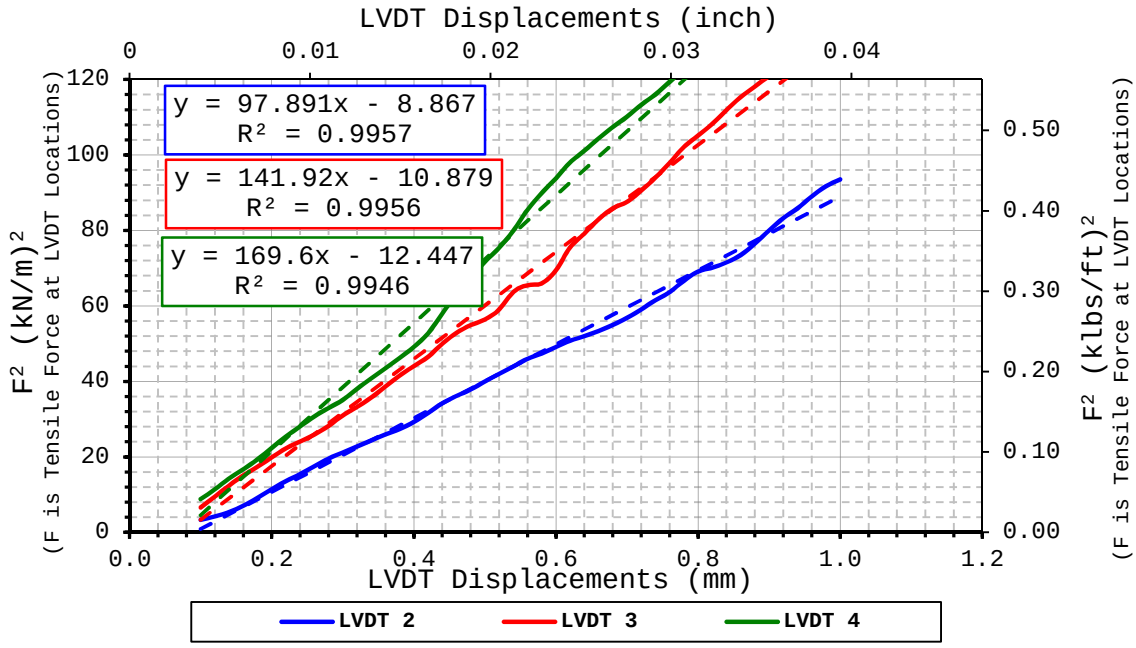
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 98 $(kN/m)^2/mm$

K_{SGI-3} = 142 $(kN/m)^2/mm$

K_{SGI-2} = 170 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**2/11/2010**
Done by	**Julio Ferreira**
Data file name	**Test 203 GG PP3 CD sand 5psi 2010-02-11**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	13	**211**	**248**	**0.052**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.11 %**	**1.10 %**	**1.490 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.09 %**		**1.490 g/cm^3**

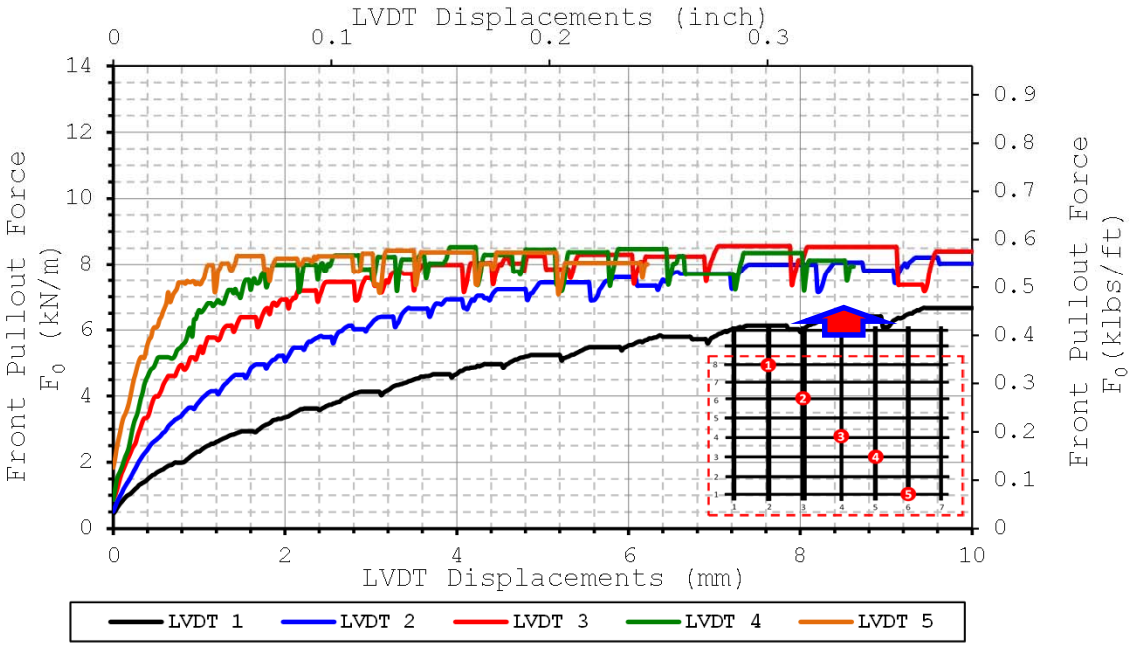
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**408**
Max Pullout Force	F_{max}	**kN/m**	**8.6**
Max Shear Stress	τ_{max}	**kN/m^2**	**17.4**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**26**
Coefficient of Interaction	C_i		**0.81**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.007**
2	**-0.074**
3	**-0.107**
4	**-0.141**
5	**-0.224**

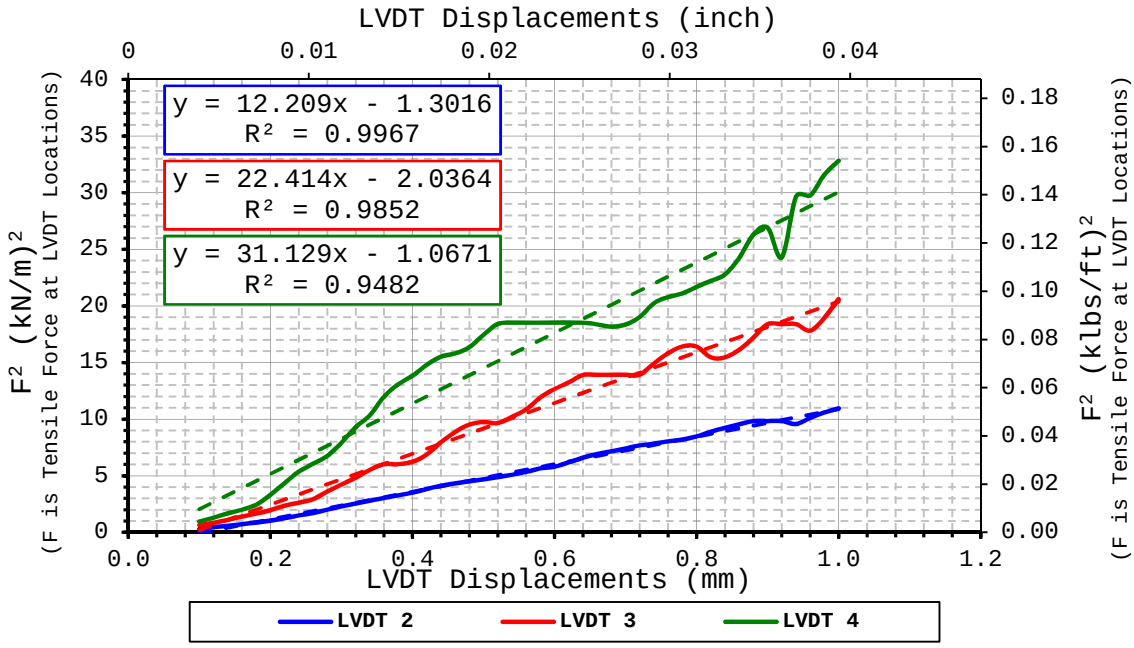
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 12 $(kN/m)^2/mm$

K_{SGI-3} = 22 $(kN/m)^2/mm$

K_{SGI-2} = 31 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**1/15/2009**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 12 GG PET CD sand 5psi 2009-01-15**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Mirafi BasXgrid 11**	**CD**	**PET (Polyester)**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**9**	**294**	**248**	**0.073**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**1.90 %**	**1.90 %**	**1.520 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.90 %**		**1.520 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**906**
Max Pullout Force	F_{max}	**kN/m**	**13.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**27.6**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.022**
2	**-0.106**
3	**-0.133**
4	**-0.161**
5	**-0.242**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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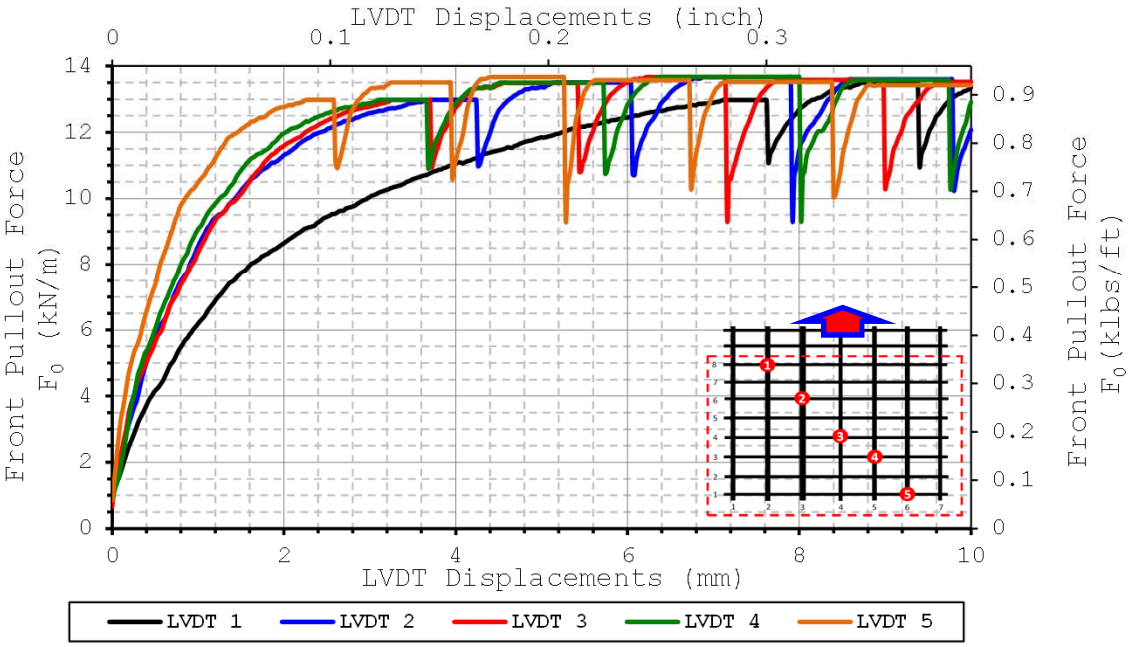
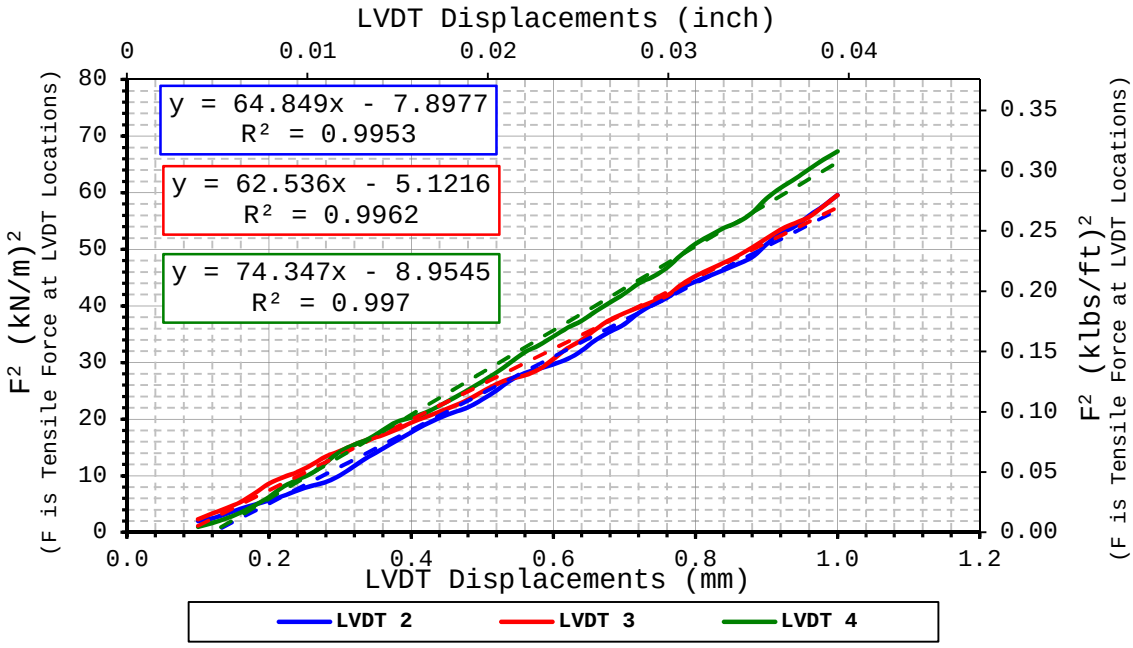
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 65 $(kN/m)^2/mm$

K_{SGI-3} =	63	$(kN/m)^2/mm$

K_{SGI-2} = 74 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**3/24/2010**
Done by	**Julio Ferreira**
Data file name	**Test 207 GG PP4 CD sand 5psi 2010-03-24**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Tenax Biaxial GG MS110**	**CD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**6**	**287**	**248**	**0.071**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**1.59 %**	**1.58 %**	**1.531 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.56 %**		**1.531 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**557**
Max Pullout Force	F_{max}	**kN/m**	**8.6**
Max Shear Stress	τ_{max}	**kN/m^2**	**17.4**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**26**
Coefficient of Interaction	C_i		**0.81**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.001**
2	**-0.054**
3	**-0.108**
4	**-0.160**
5	**-0.212**

Comments:

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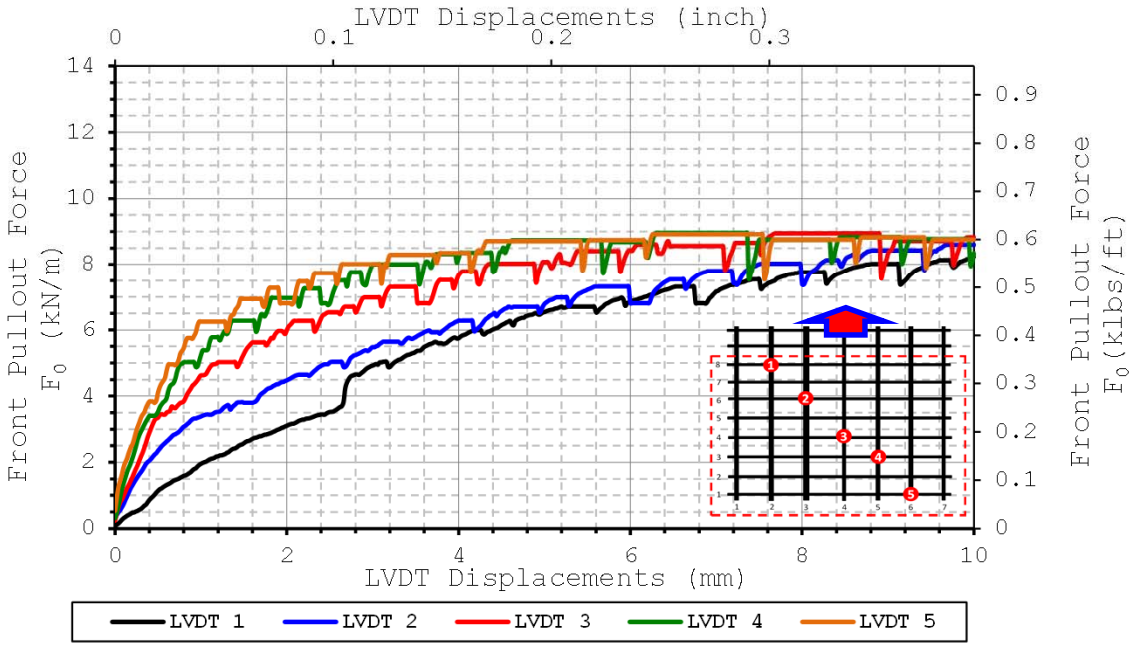
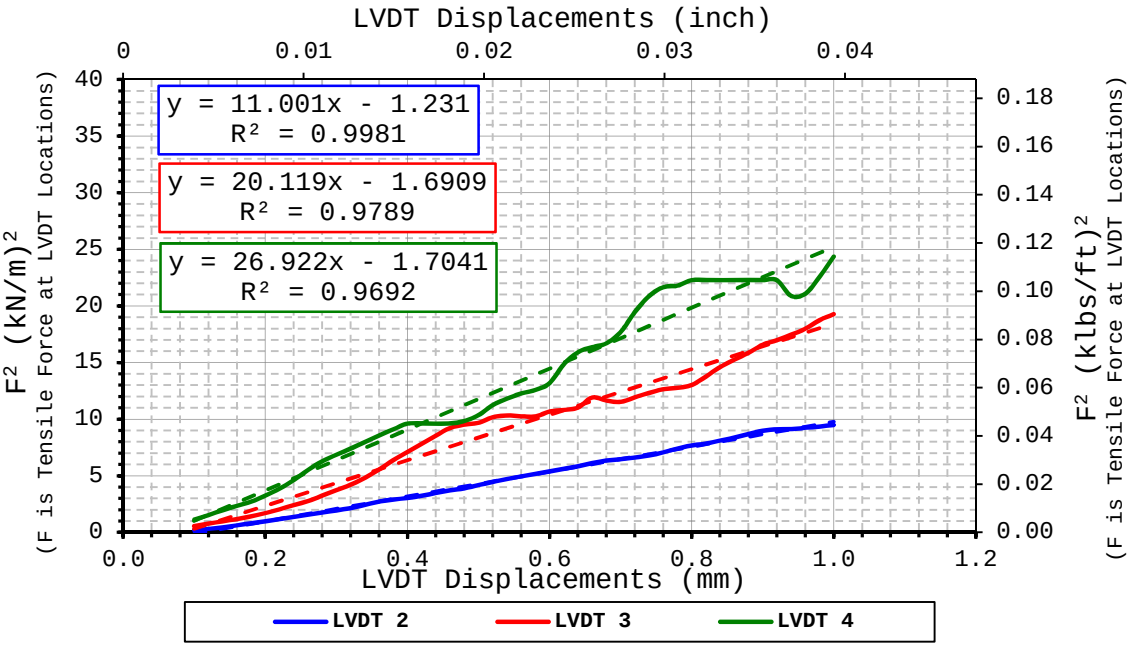
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 11 $(kN/m)^2/mm$

K_{SGI-3} = 20 $(kN/m)^2/mm$

K_{SGI-2} = 27 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**3/30/2010**
Done by	**Julio Ferreira**
Data file name	**Test 207 GG PP4 CD sand 5psi 2010-03-30**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	6	**287**	**248**	**0.071**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.55 %**	**1.51 %**	**1.515 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.48 %**		**1.515 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**530**
Max Pullout Force	F_{max}	**kN/m**	**8.2**
Max Shear Stress	τ_{max}	**kN/m^2**	**16.6**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**25**
Coefficient of Interaction	C_i		**0.77**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.013**
2	**-0.066**
3	**-0.119**
4	**-0.172**
5	**-0.224**

Comments:

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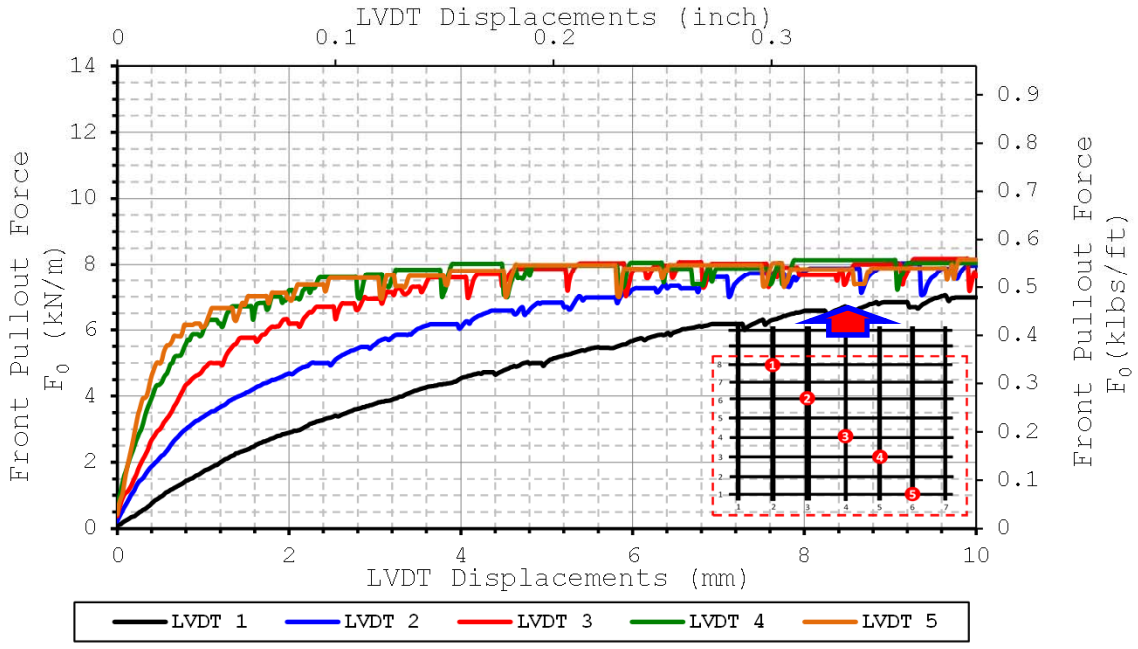
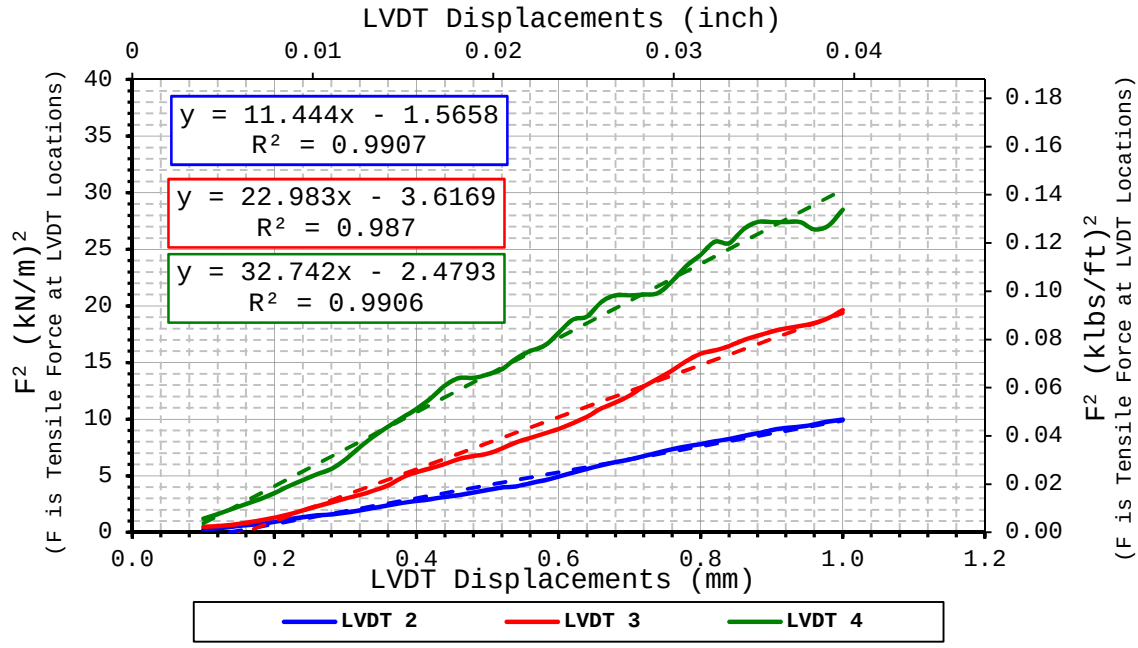
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	11	$(kN/m)^2/mm$
K_{SGI-3} =	23	$(kN/m)^2/mm$
K_{SGI-2} =	33	$(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**4/4/2010**
Done by	**Julio Ferreira**
Data file name	**Test 211 GG PP4x2 CD sand 5psi 2010-04**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Tenax Biaxial GG MS220**	**CD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**12**	**296**	**248**	**0.073**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**1.60 %**	**1.60 %**	**1.531 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.60 %**		**1.531 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**761**
Max Pullout Force	F_{max}	**kN/m**	**11.4**
Max Shear Stress	τ_{max}	**kN/m^2**	**23.1**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.063**
2	**-0.111**
3	**-0.162**
4	**-0.213**
5	**-0.219**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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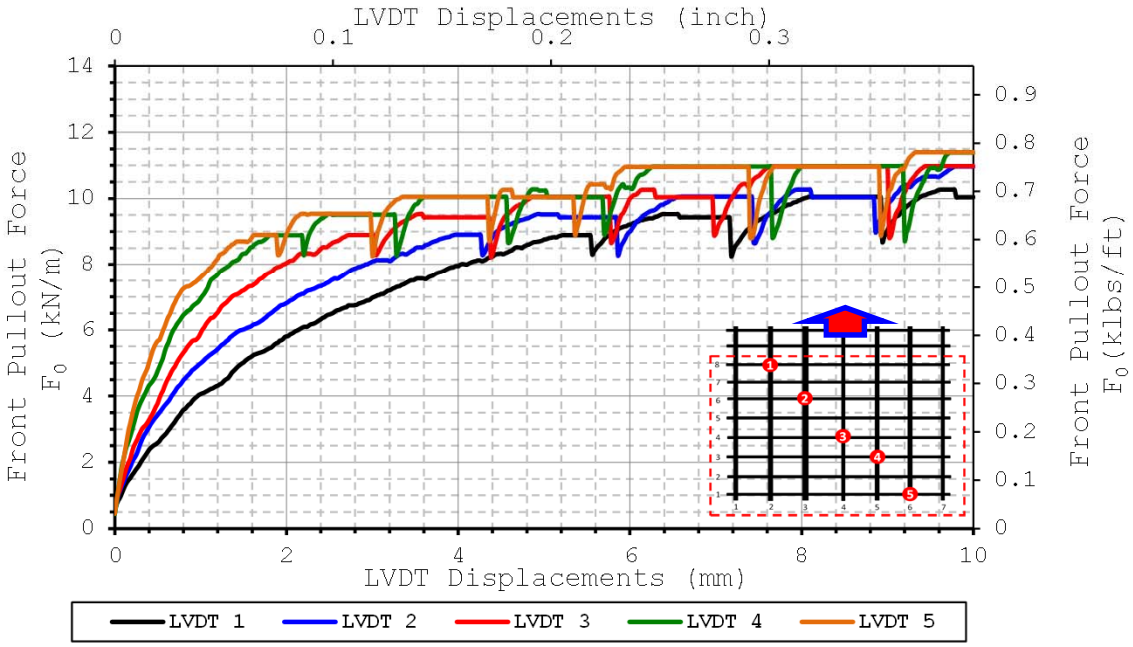
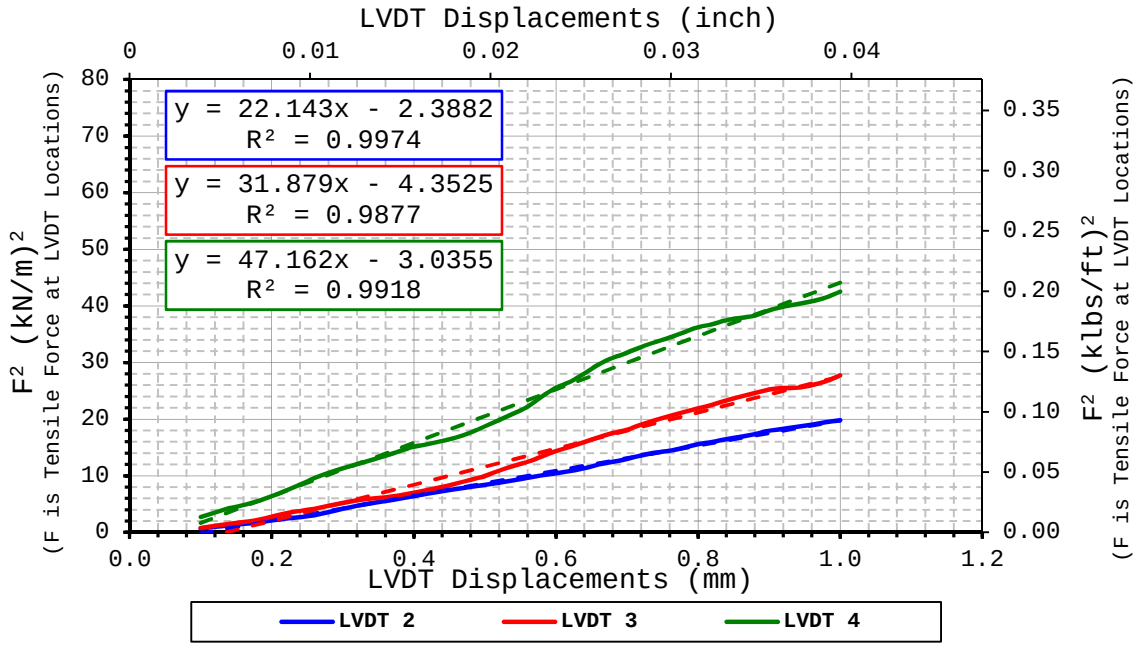
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	22	$(kN/m)^2/mm$	
K_{SGI-3} =	**32**	**$(kN/m)^2/mm$**	
K_{SGI-2} =	47	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**4/4/2010**
Done by	**Julio Ferreira**
Data file name	**Test 211 GG PP4x2 CD sand 5psi 2010-04**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Tenax Biaxial GG MS220**	**CD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**12**	**296**	**248**	**0.073**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**1.60 %**	**1.60 %**	**1.531 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.60 %**		**1.531 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**765**
Max Pullout Force	F_{max}	**kN/m**	**11.5**
Max Shear Stress	τ_{max}	**kN/m^2**	**23.2**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.021**
2	**-0.071**
3	**-0.123**
4	**-0.175**
5	**-0.226**

Comments:

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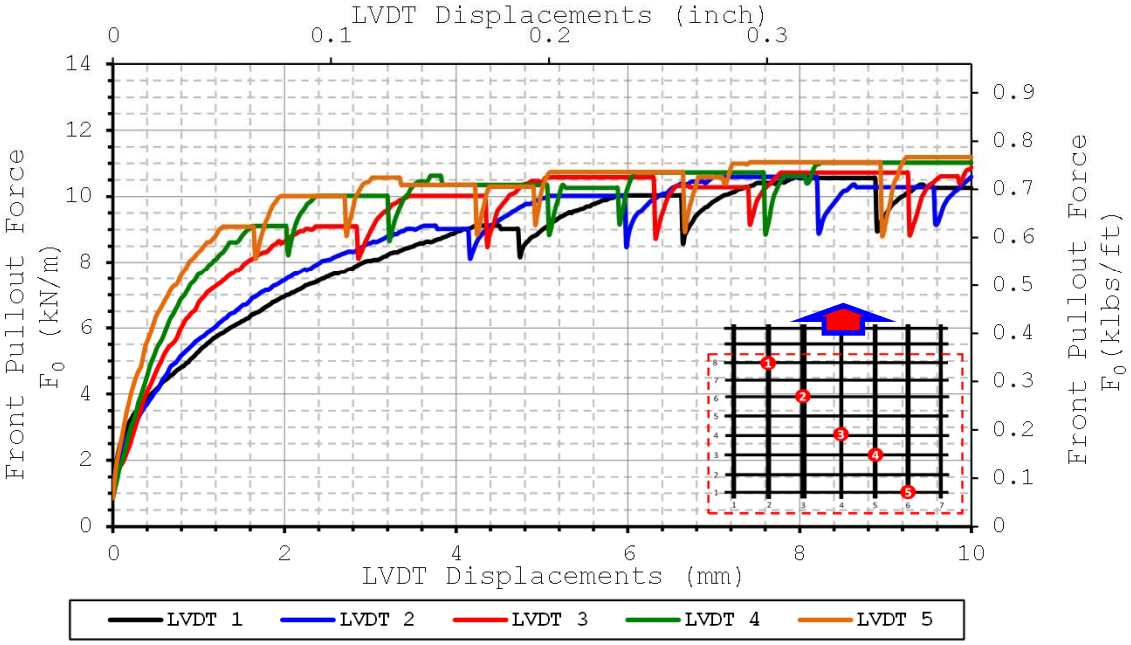
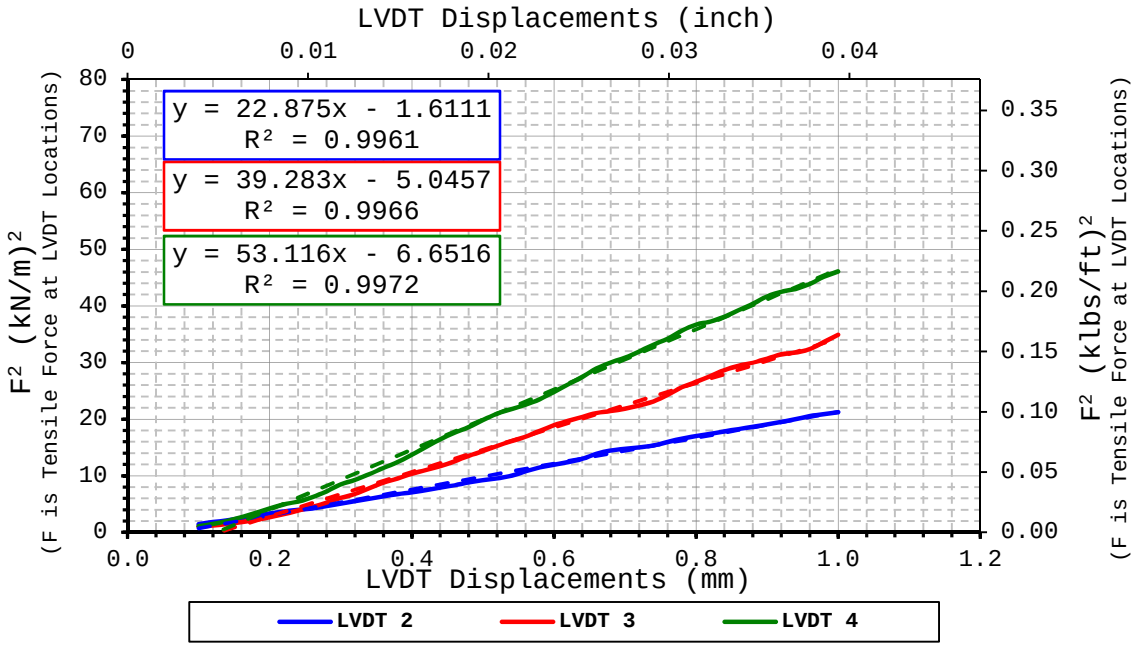
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 23 $(kN/m)^2/mm$

K_{SGI-3} = 39 $(kN/m)^2/mm$

K_{SGI-2} = 53 $(kN/m)^2/mm$

Comments:

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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**12/16/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 18 GT CD sand 5psi 2008-12-16**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Geolon HP 570**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**277**	**248**	**0.069**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.26 %**	**1.26 %**	**1.541 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.26 %**		**1.541 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**741**
Max Pullout Force	F_{max}	**kN/m**	**11.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**24.0**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.009**
2	**-0.082**
3	**-0.116**
4	**-0.153**
5	**-0.232**

Comments:

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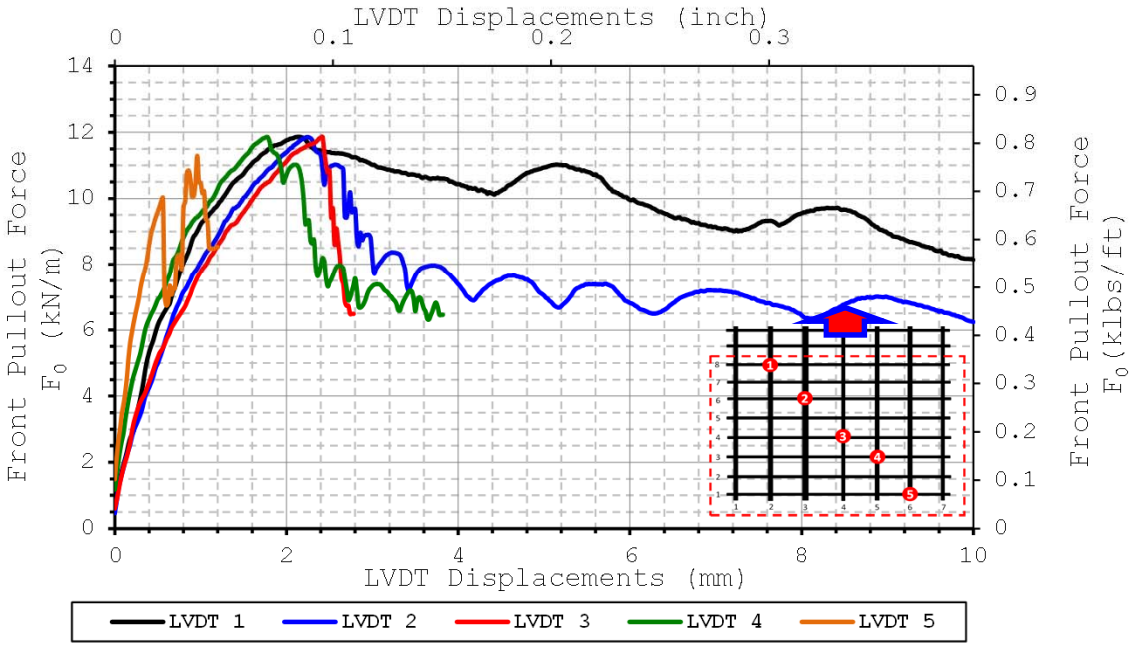
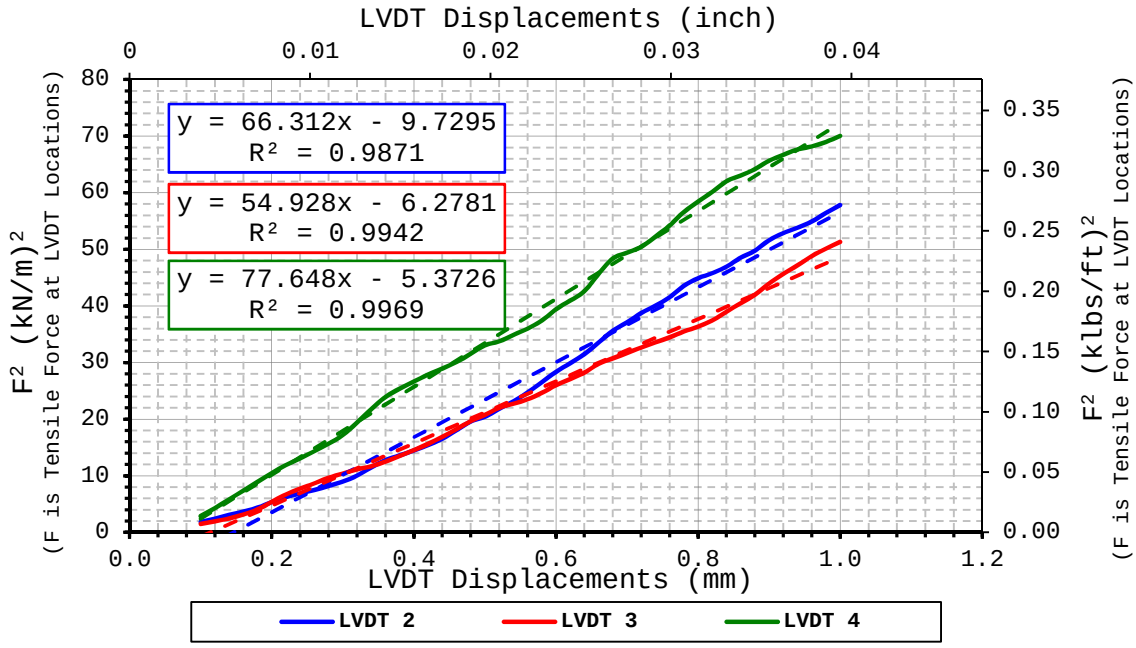
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 66 $(kN/m)^2/mm$

K_{SGI-3} = 55 $(kN/m)^2/mm$

K_{SGI-2} = 78 $(kN/m)^2/mm$

Comments:

Small Pullout Test

Sand – MD – 5psi

Results of the tests up to 8/31/2011

The University of Texas at Austin

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**1/27/2010**
Done by	**Eddie**
Data file name	**Test 201 GG PP3 MD sand 5psi 2010-01-27**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**17**	**364**	**248**	**0.090**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**1.54 %**	**1.56 %**	**1.514 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.59 %**		**1.514 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**788**
Max Pullout Force	F_{max}	**kN/m**	**9.6**
Max Shear Stress	τ_{max}	**kN/m^2**	**19.4**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**29**
Coefficient of Interaction	C_i		**0.90**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.013**
2	**-0.057**
3	**-0.103**
4	**-0.144**
5	**-0.233**

Comments:

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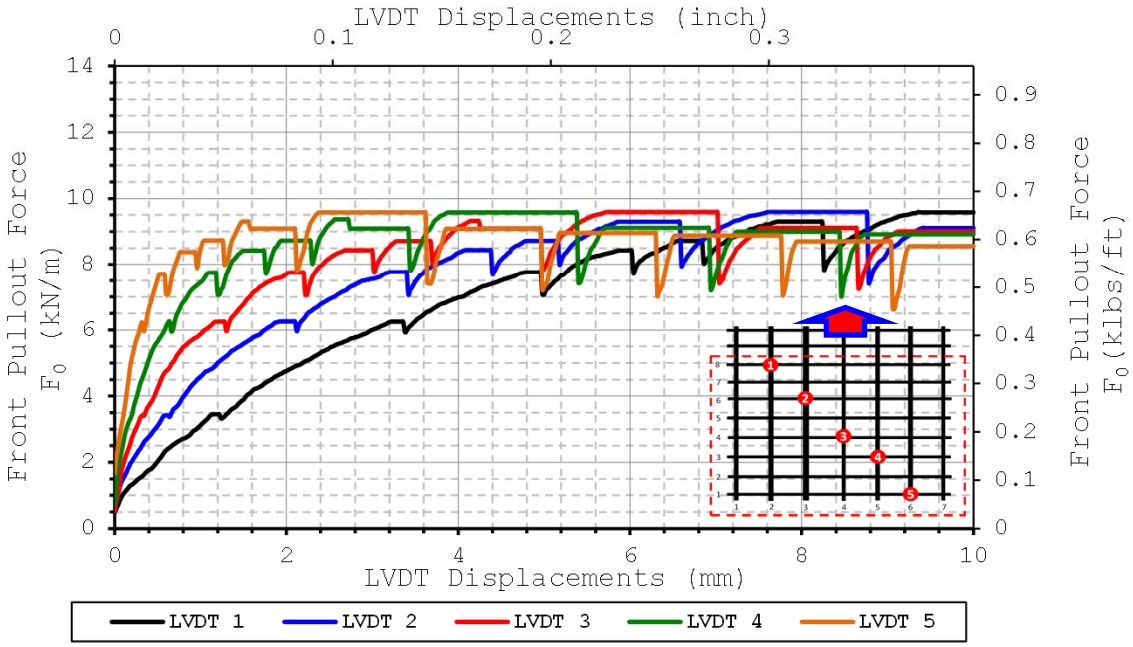
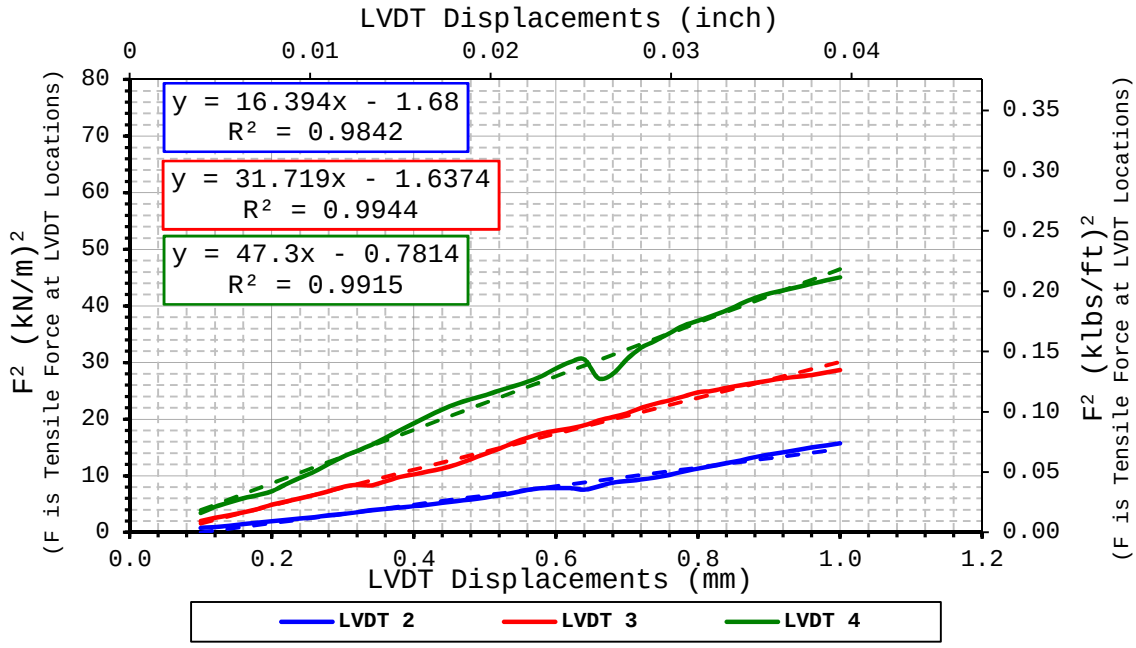
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 16 $(kN/m)^2/mm$

K_{SGI-3} = 32 $(kN/m)^2/mm$

K_{SGI-2} = 47 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**1/28/2010**
Done by	**Eddie**
Data file name	**Test 201 GG PP3 MD sand 5psi 2010-01-28**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**17**	**364**	**248**	**0.090**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Monterey sand 30**	**1.33 %**	**1.38 %**	**1.534 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.43 %**		**1.534 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**767**
Max Pullout Force	F_{max}	**kN/m**	**9.4**
Max Shear Stress	τ_{max}	**kN/m^2**	**18.9**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**28**
Coefficient of Interaction	C_i		**0.88**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.014**
2	**-0.055**
3	**-0.097**
4	**-0.140**
5	**-0.232**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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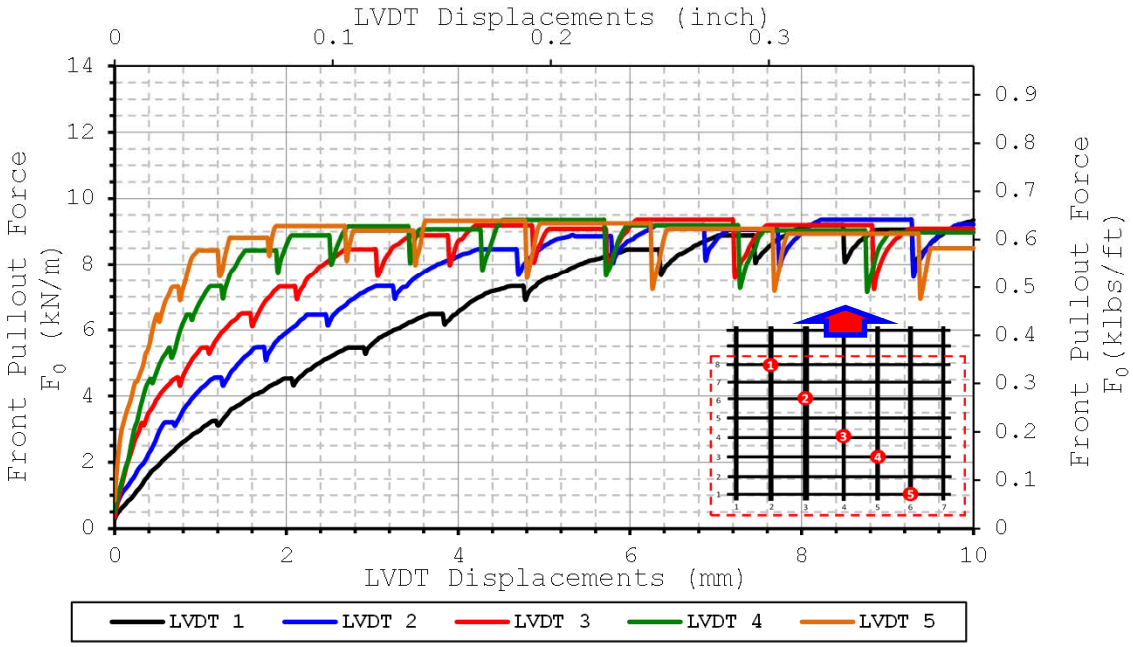
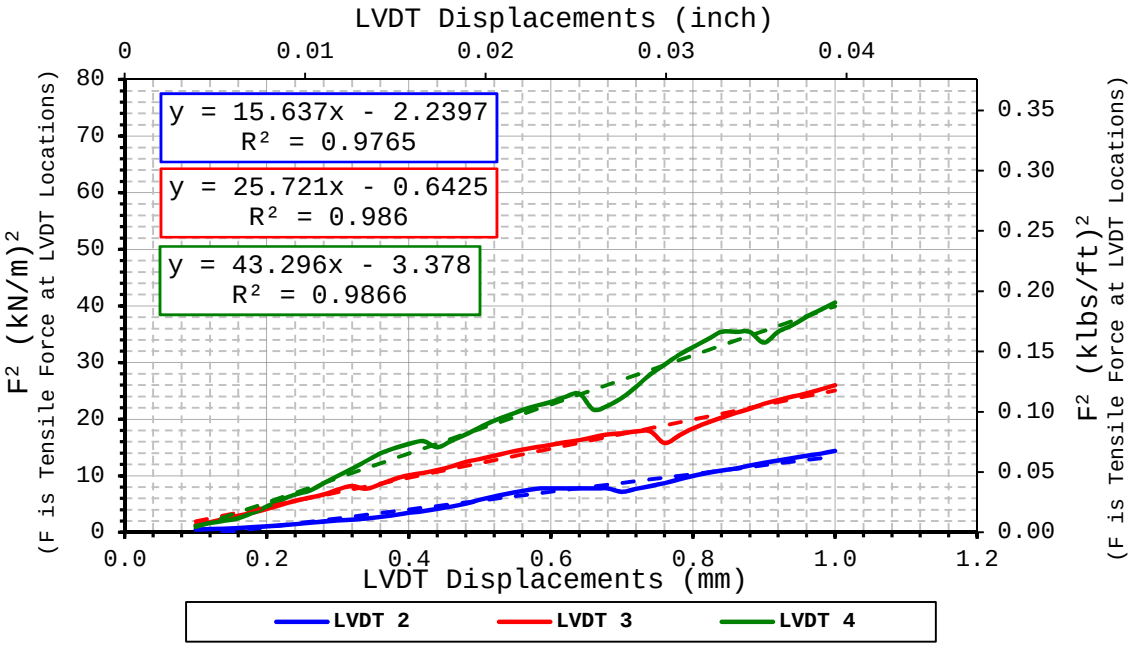
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 16 $(kN/m)^2/mm$

K_{SGI-3} = 26 $(kN/m)^2/mm$

K_{SGI-2} = 43 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**2/27/2010**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 09 GG PET MD sand 5psi 2010-02-27**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi BasXgrid 11**	**MD**	**PET (Polyester)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**270**	**248**	**0.067**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.07 %**	**1.03 %**	**1.487 g/cm^3**
Bottom Layer	**Monterey sand 30**	**0.99 %**		**1.487 g/cm^3**

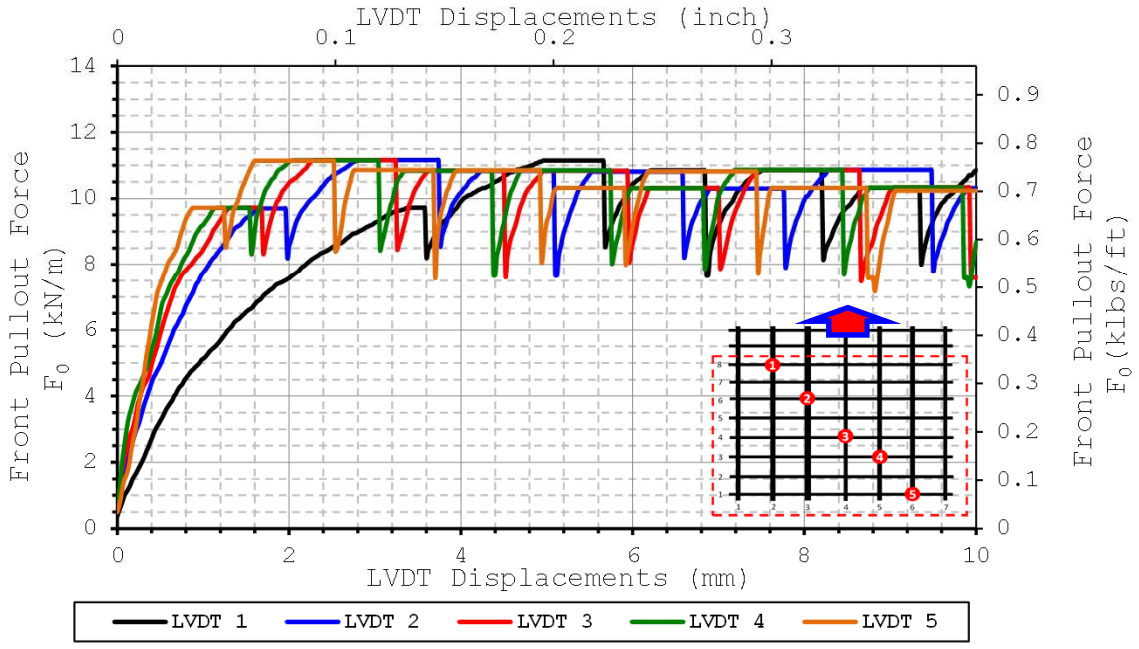
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**680**
Max Pullout Force	F_{max}	**kN/m**	**11.2**
Max Shear Stress	τ_{max}	**kN/m^2**	**22.6**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.029**
2	**-0.098**
3	**-0.131**
4	**-0.164**
5	**-0.233**

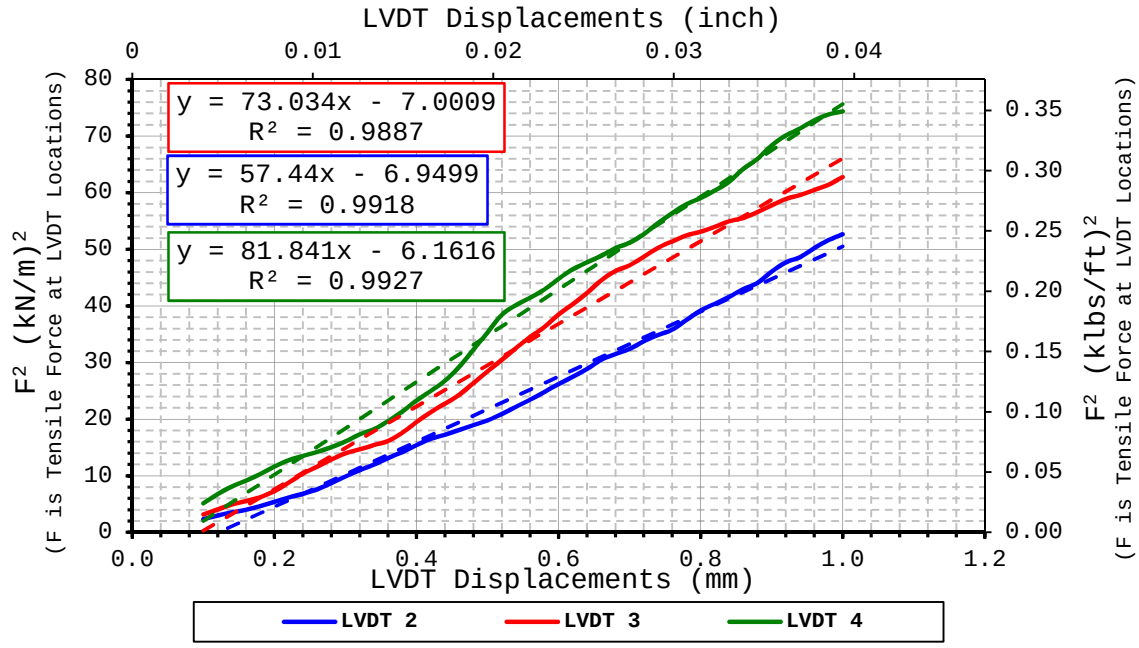
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	57	(kN/m)^2/mm	
K_{SGI-3} =	**73**	**(kN/m)^2/mm**	
K_{SGI-2} =	82	(kN/m)^2/mm	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**2/17/2010**
Done by	**Julio Ferreira**
Data file name	**Test 205 GG PP4 MD sand 5psi 2010-02-17**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	6	**255**	**248**	**0.063**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**%**	**0.00 %**	**1.551 g/cm^3**
Bottom Layer	**Monterey sand 30**	**0.00 %**		**1.551 g/cm^3**

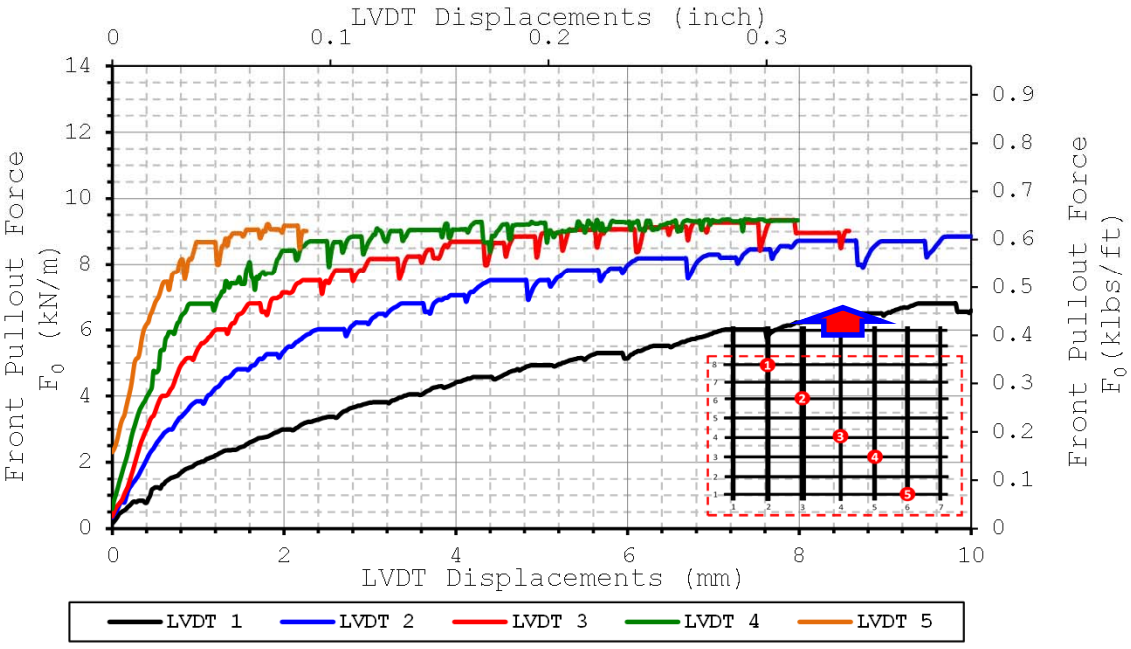
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**515**
Max Pullout Force	F_{max}	**kN/m**	**9.0**
Max Shear Stress	τ_{max}	**kN/m^2**	**18.1**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**27**
Coefficient of Interaction	C_i		**0.84**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.006**
2	**-0.052**
3	**-0.097**
4	**-0.143**
5	**-0.233**

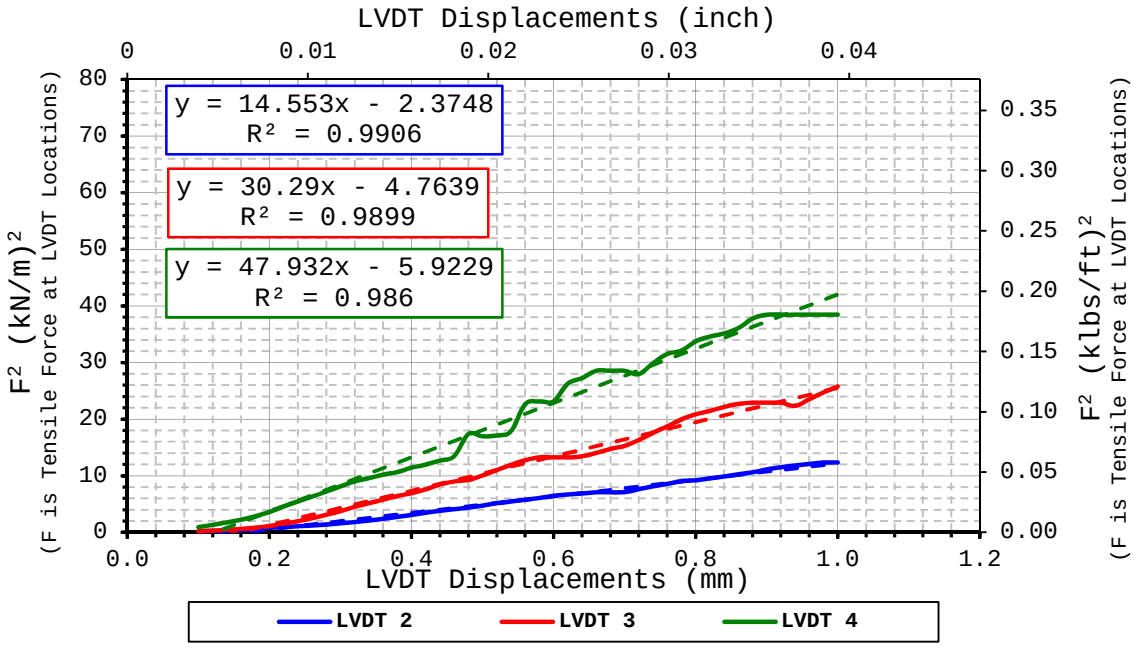
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	15	(kN/m)^2/mm	
K_{SGI-3} =	**30**	**(kN/m)^2/mm**	
K_{SGI-2} =	48	(kN/m)^2/mm	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**2/21/2010**
Done by	**Julio Ferreira**
Data file name	**Test 205 GG PP4 MD sand 5psi 2010-02-21**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	6	**255**	**248**	**0.063**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**%**	**0.00 %**	**1.551 g/cm^3**
Bottom Layer	**Monterey sand 30**	**0.00 %**		**1.551 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**522**
Max Pullout Force	F_{max}	**kN/m**	**9.1**
Max Shear Stress	τ_{max}	**kN/m^2**	**18.4**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**28**
Coefficient of Interaction	C_i		**0.85**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.014**
2	**-0.058**
3	**-0.103**
4	**-0.147**
5	**-0.236**

Comments:

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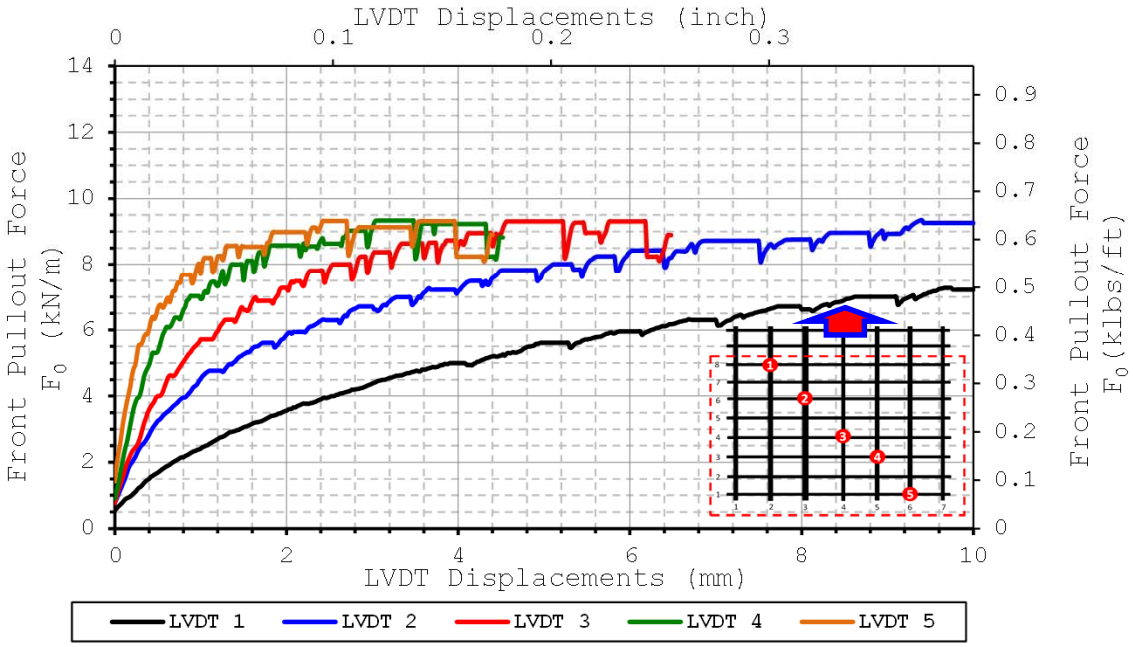
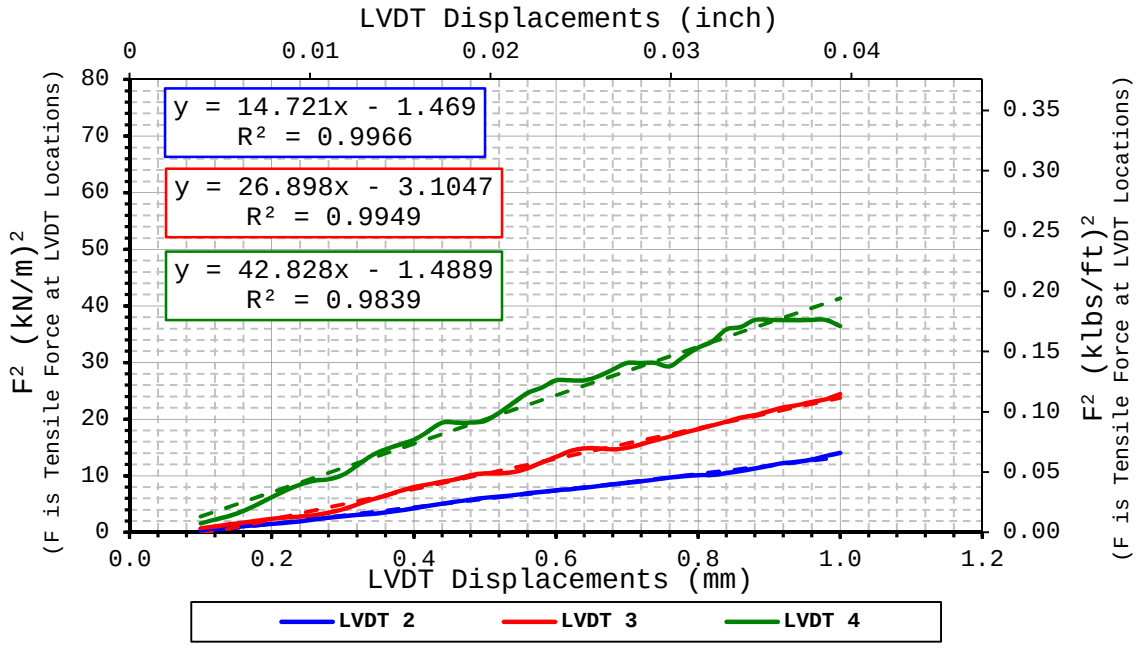
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 15 $(kN/m)^2/mm$

K_{SGI-3} = 27 $(kN/m)^2/mm$

K_{SGI-2} = 43 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**4/18/2010**
Done by	**Julio Ferreira**
Data file name	**Test 209 GG PP4x2 MD sand 5psi 2010-04-1**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**260**	**248**	**0.064**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**0.00 %**	**0.75 %**	**1.533 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.49 %**		**1.533 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**611**
Max Pullout Force	F_{max}	**kN/m**	**10.4**
Max Shear Stress	τ_{max}	**kN/m^2**	**21.1**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**31**
Coefficient of Interaction	C_i		**0.98**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.003**
2	**-0.094**
3	**-0.140**
4	**-0.185**
5	**-0.231**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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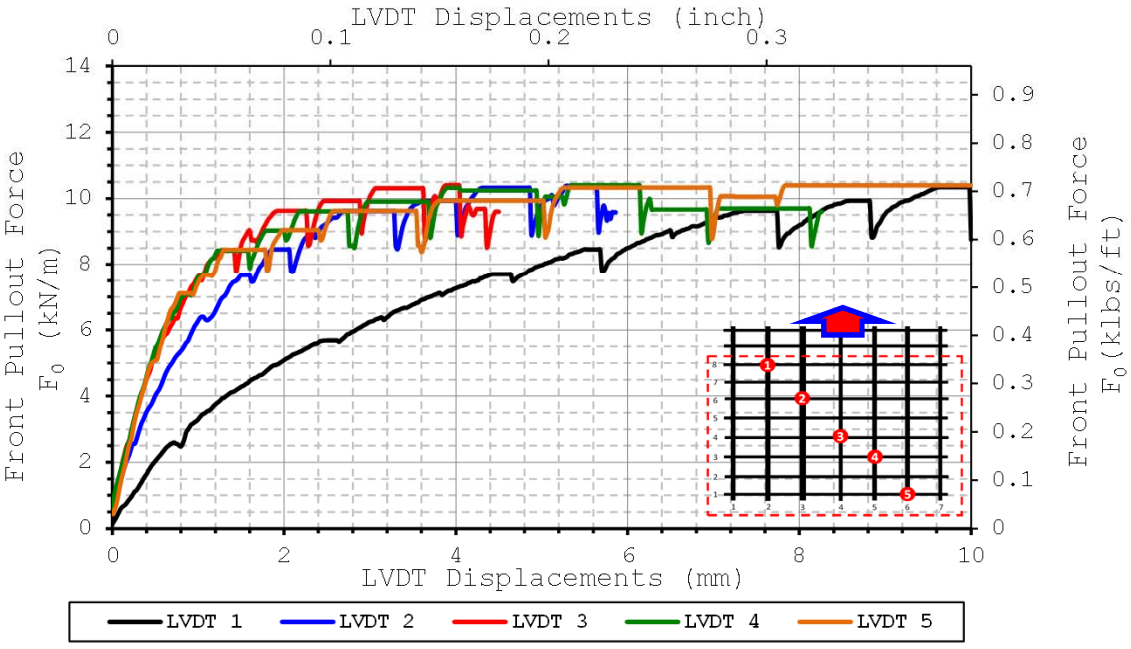
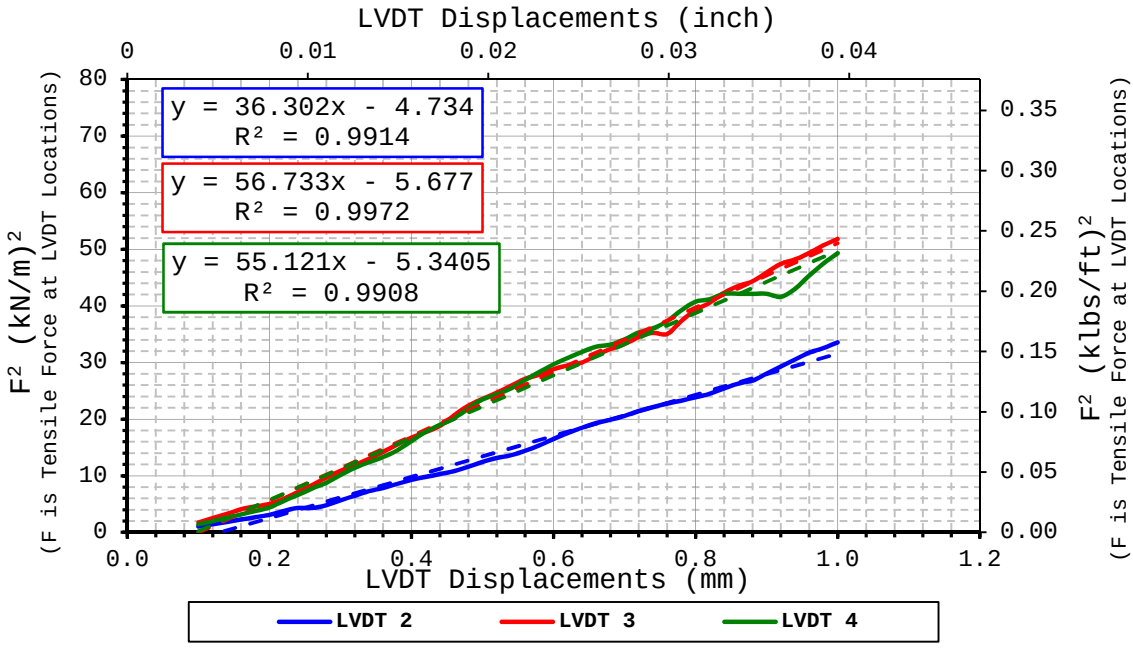
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 36 $(kN/m)^2/mm$

K_{SGI-3} = 57 $(kN/m)^2/mm$

K_{SGI-2} = 55 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**5/2/2010**
Done by	**Julio Ferreira**
Data file name	**Test 209 GG PP4x2 MD sand 5psi 2010-05**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**260**	**248**	**0.064**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.60 %**	**1.60 %**	**1.509 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.60 %**		**1.509 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**678**
Max Pullout Force	F_{max}	**kN/m**	**11.6**
Max Shear Stress	τ_{max}	**kN/m^2**	**23.4**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.017**
2	**-0.102**
3	**-0.146**
4	**-0.189**
5	**-0.231**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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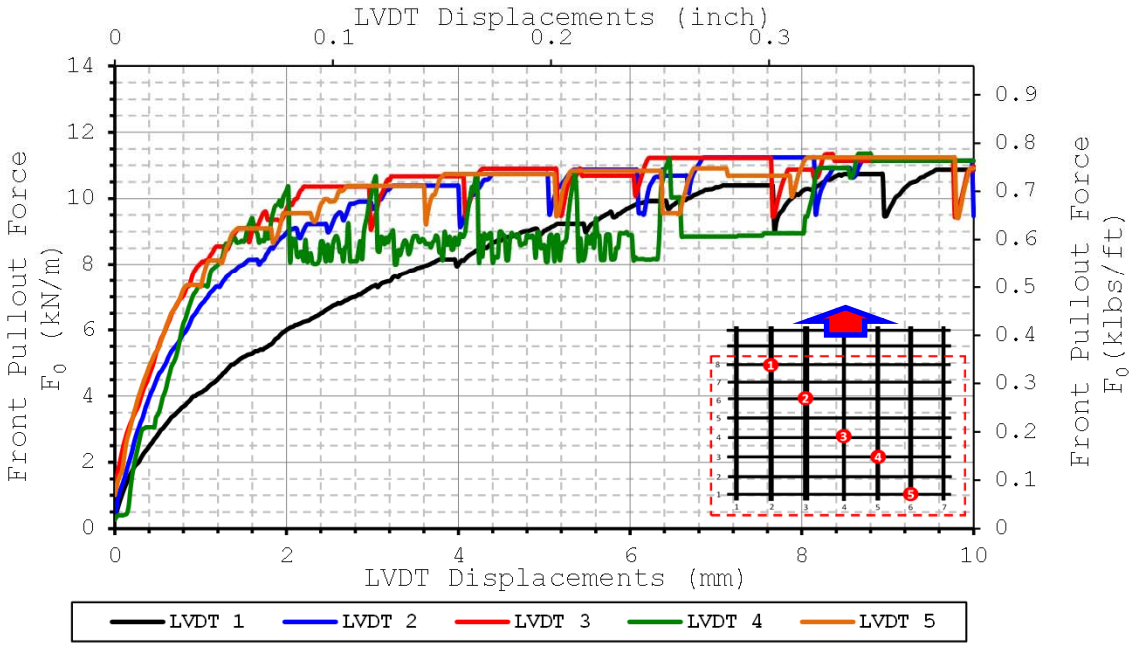
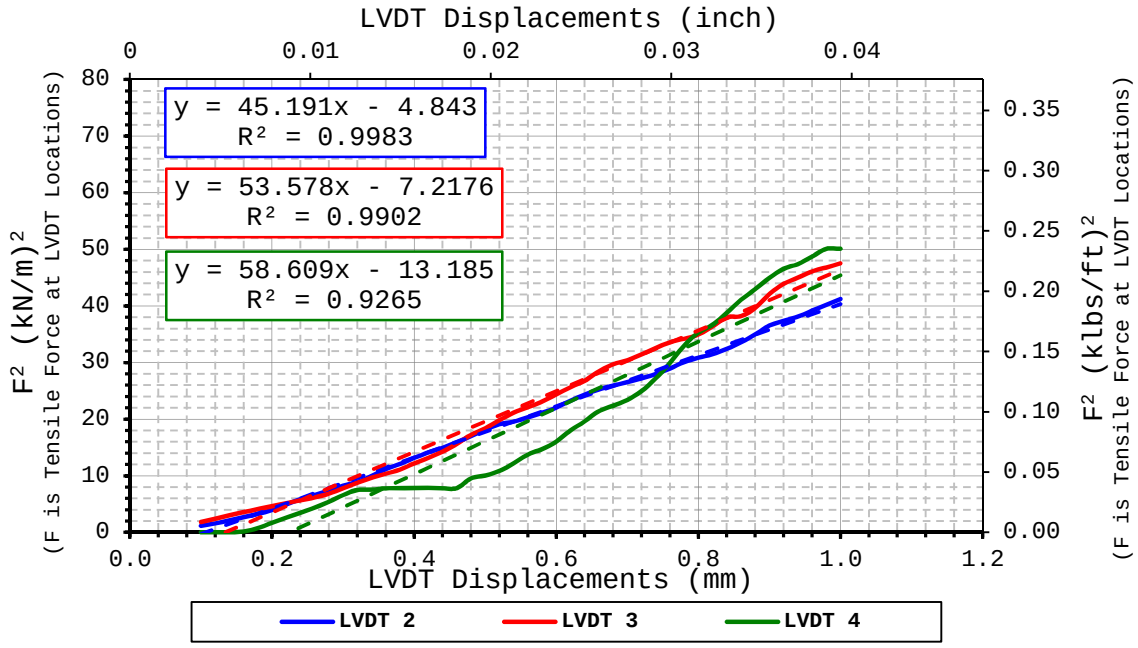
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 45 $(kN/m)^2/mm$

K_{SGI-3} = 54 $(kN/m)^2/mm$

K_{SGI-2} = 59 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**5/4/2010**
Done by	**Julio Ferreira**
Data file name	**Test 209 GG PP4x2 MD sand 5psi 2010-05**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**260**	**248**	**0.064**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**1.60 %**	**1.60 %**	**1.522 g/cm^3**
Bottom Layer	**Monterey sand 30**	**1.60 %**		**1.522 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**608**
Max Pullout Force	F_{max}	**kN/m**	**10.4**
Max Shear Stress	τ_{max}	**kN/m^2**	**21.0**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**31**
Coefficient of Interaction	C_i		**0.97**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.001**
2	**-0.094**
3	**-0.140**
4	**-0.184**
5	**-0.230**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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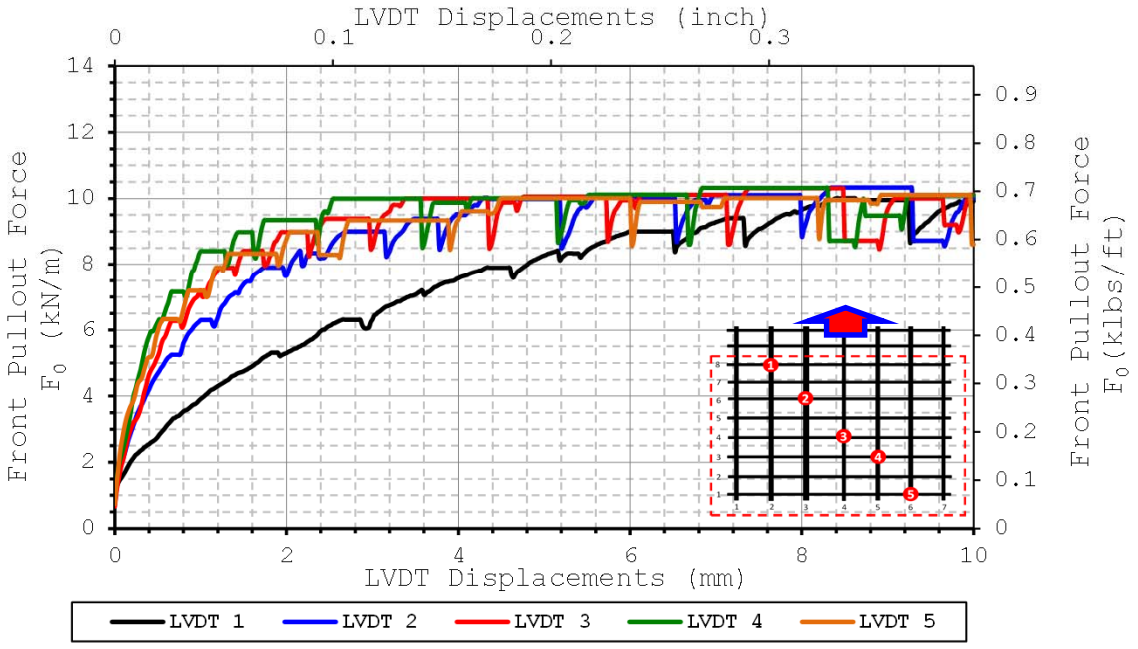
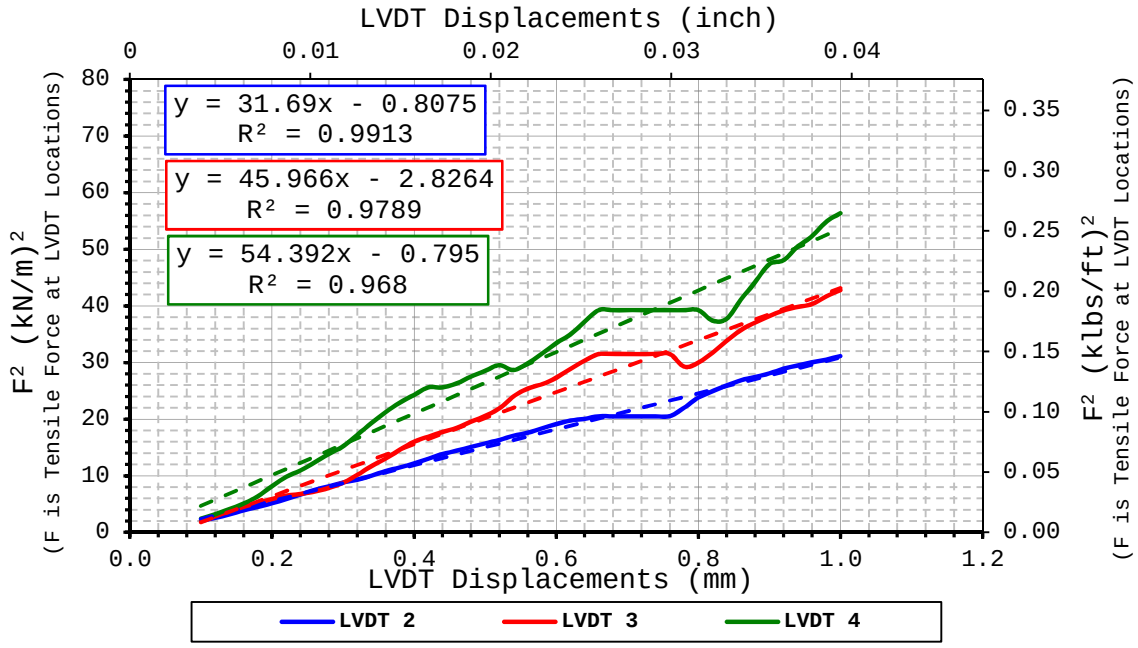
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 32 $(kN/m)^2/mm$

K_{SGI-3} = 46 $(kN/m)^2/mm$

K_{SGI-2} = 54 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**10/6/2008**
Done by	**Edward Wong / Julio Ferreira**
Data file name	**Test 15 GT MD sand 5psi 2008-10-06**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Geolon HP 570**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**280**	**248**	**0.069**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Monterey sand 30**	**2.04 %**	**2.04 %**	**1.530 g/cm^3**
Bottom Layer	**Monterey sand 30**	**2.04 %**		**1.530 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**742**
Max Pullout Force	F_{max}	**kN/m**	**11.8**
Max Shear Stress	τ_{max}	**kN/m^2**	**23.8**
Confining Pressure	σ	**kN/m^2**	**35**
Friction Angle of Top Layer Soil	ϕ	**degrees**	**32**
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	**32**
Interface Angle	δ	**degrees**	**32**
Coefficient of Interaction	C_i		**1.00**

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.024**
2	**-0.076**
3	**-0.114**
4	**-0.149**
5	**-0.226**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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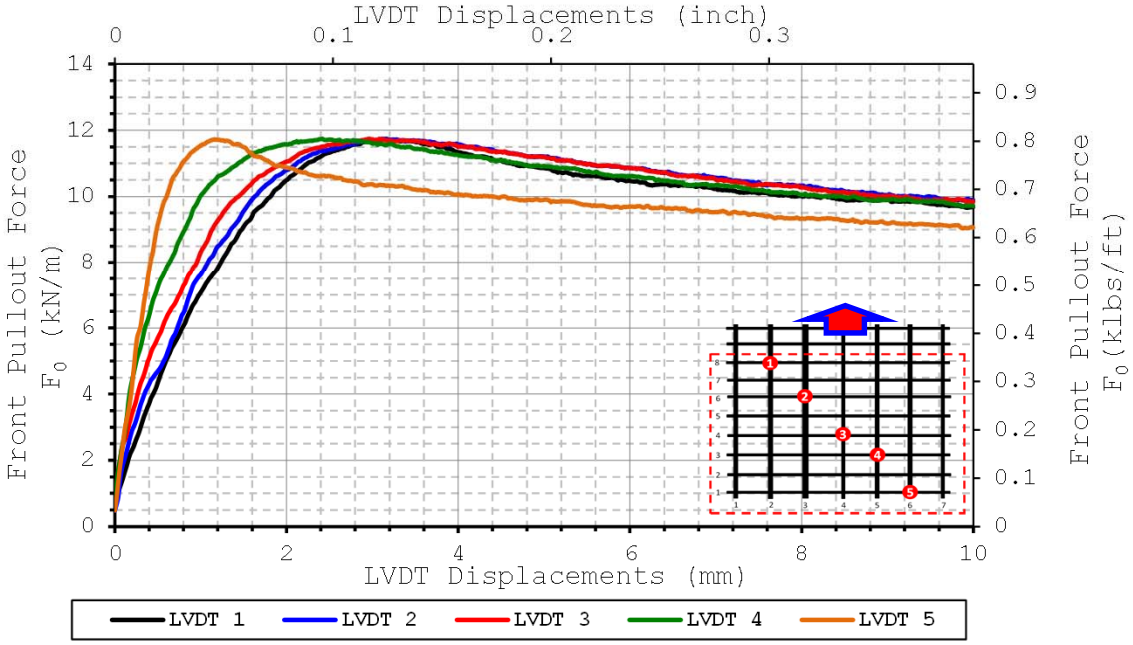
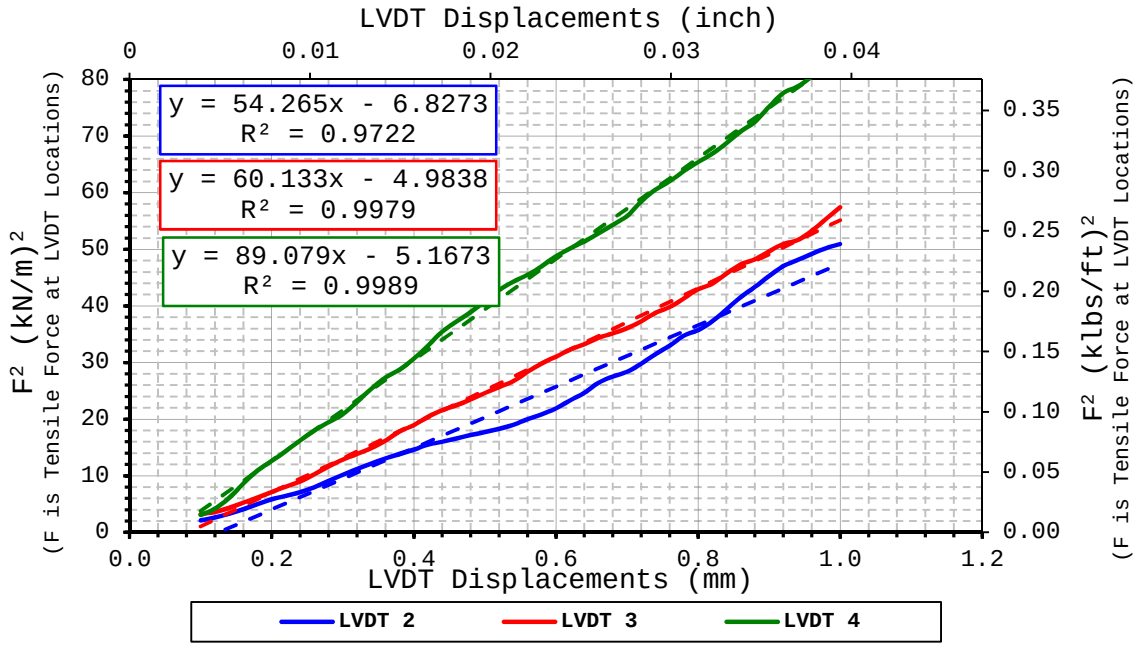
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 54 $(kN/m)^2/mm$

K_{SGI-3} = 60 $(kN/m)^2/mm$

K_{SGI-2} = 89 $(kN/m)^2/mm$

Comments:

Small Pullout Test

Sieved Aggregate 1 – CD – 3psi

Results of the tests up to 8/31/2011

The University of Texas at Austin

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**12/1/2010**
Done by	**Julio Ferreira**
Data file name	**Test 302 GG PP 1 CD SAggr 3psi 2010-12-01**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Tensar Biaxial GG BX1100**	**CD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**10**	**275**	**248**	**0.068**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.596 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.596 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**915**
Max Pullout Force	F_{max}	**kN/m**	**14.8**
Max Shear Stress	τ_{max}	**kN/m^2**	**29.8**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.008**
2	**-0.049**
3	**-0.090**
4	**-0.130**
5	**-0.210**

Comments:

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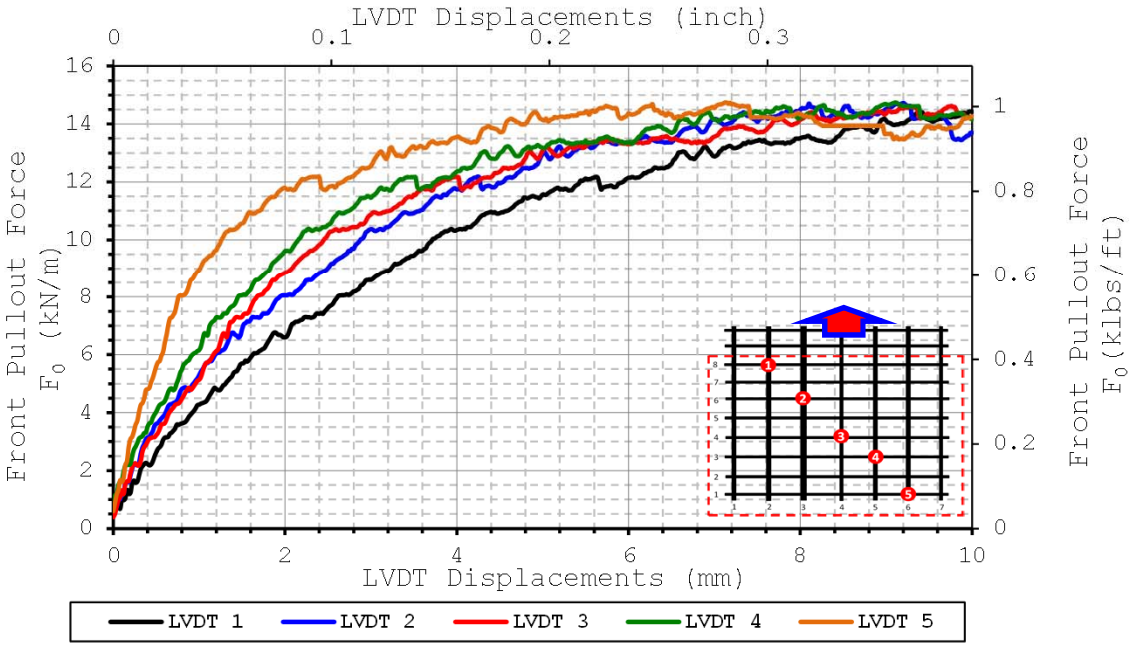
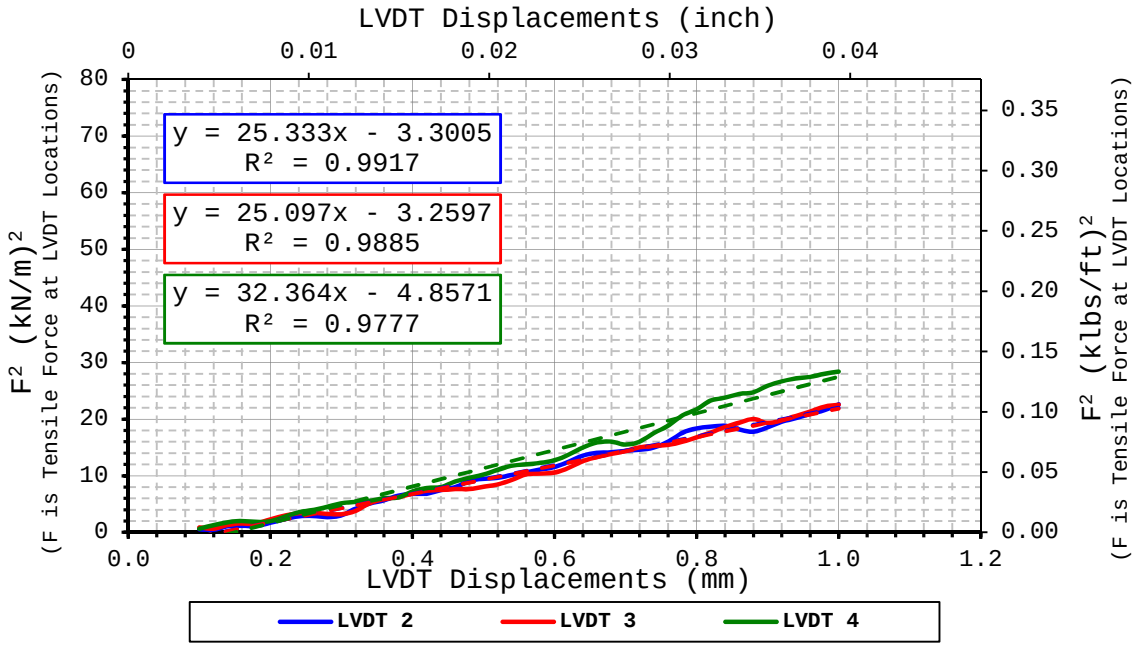
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	25	$(kN/m)^2/mm$	
K_{SGI-3} =	25	$(kN/m)^2/mm$	
K_{SGI-2} =	32	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**12/2/2010**
Done by	**Julio Ferreira**
Data file name	**Test 302 GG PP 1 CD SAggr 3psi 2010-12-02**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1100**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**275**	**248**	**0.068**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.604 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.604 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**940**
Max Pullout Force	F_{max}	**kN/m**	**15.2**
Max Shear Stress	τ_{max}	**kN/m^2**	**30.7**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.011**
2	**-0.051**
3	**-0.092**
4	**-0.132**
5	**-0.212**

Comments:

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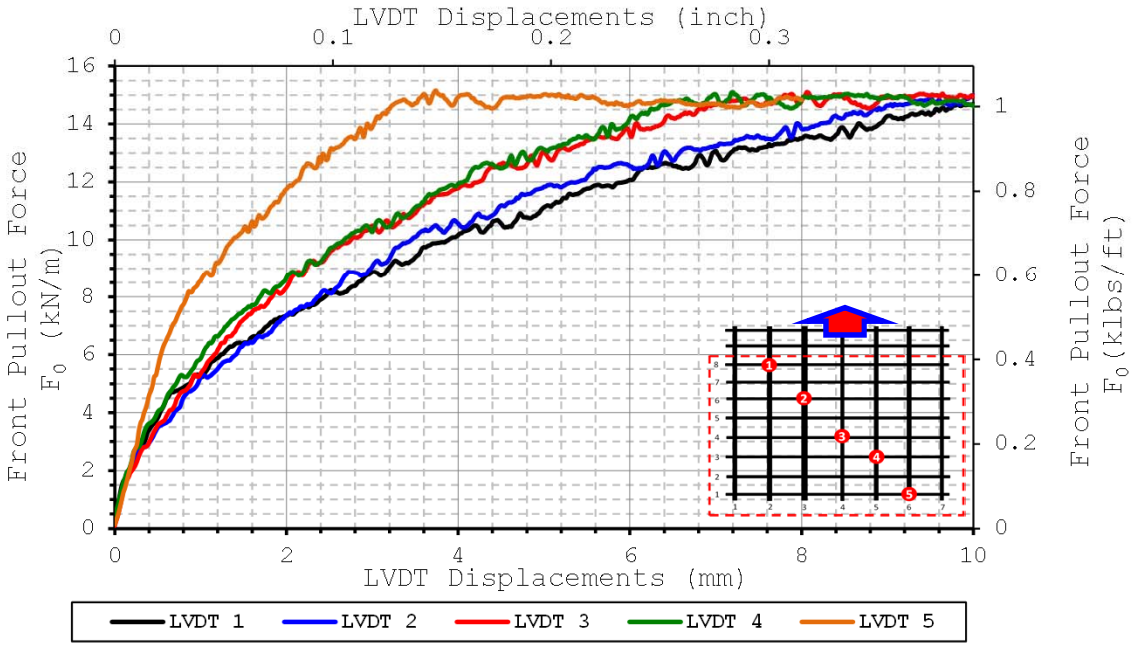
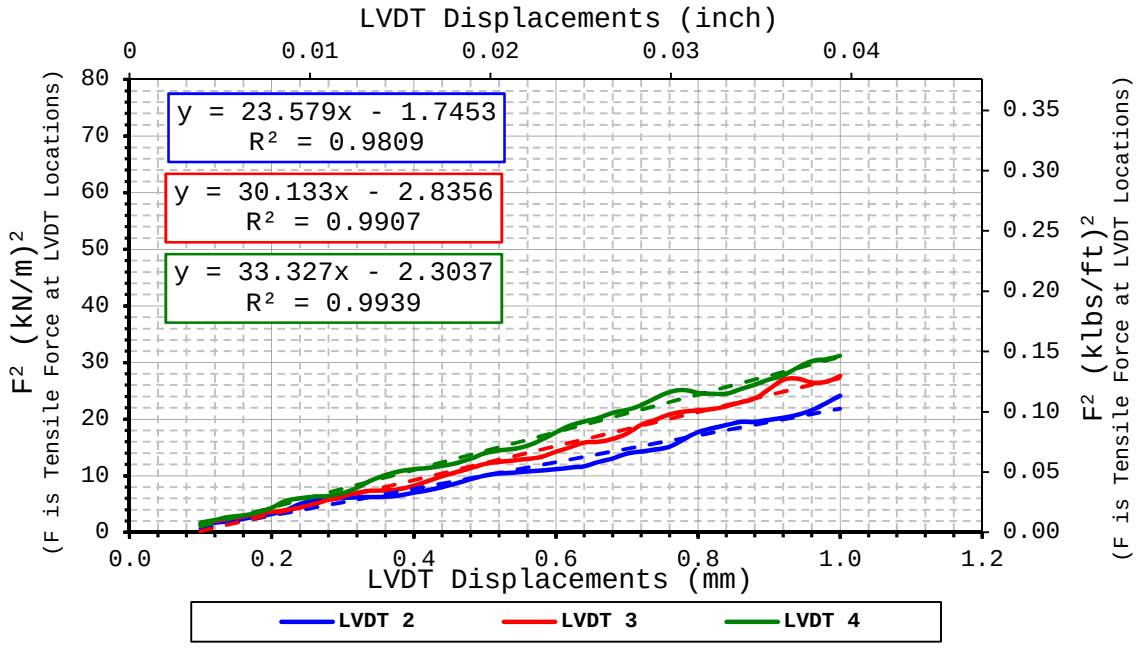
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	24	$(kN/m)^2/mm$	
K_{SGI-3} =	30	$(kN/m)^2/mm$	
K_{SGI-2} =	33	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**7/28/2010**
Done by	**Julio Ferreira**
Data file name	**Test 332 GG PP2 CD SAggr 3psi 2010-07-28**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1200**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	9	**248**	**248**	**0.062**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.622 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.622 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**792**
Max Pullout Force	F_{max}	**kN/m**	**14.2**
Max Shear Stress	τ_{max}	**kN/m^2**	**28.7**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.018**
2	**-0.093**
3	**-0.132**
4	**-0.170**
5	**-0.209**

Comments:

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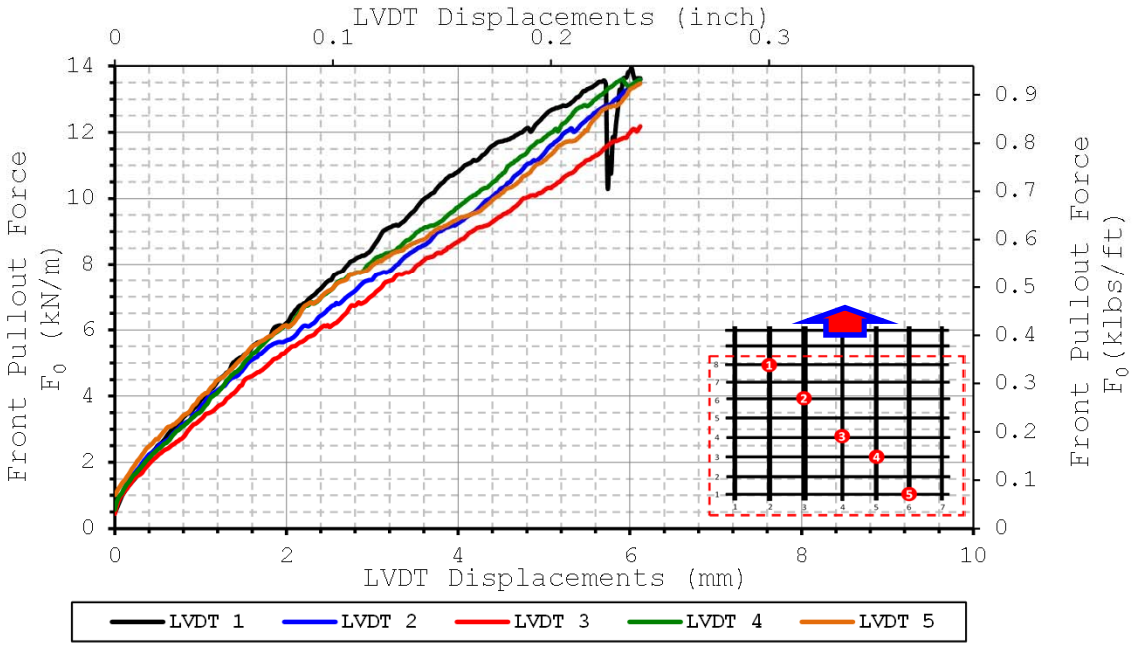
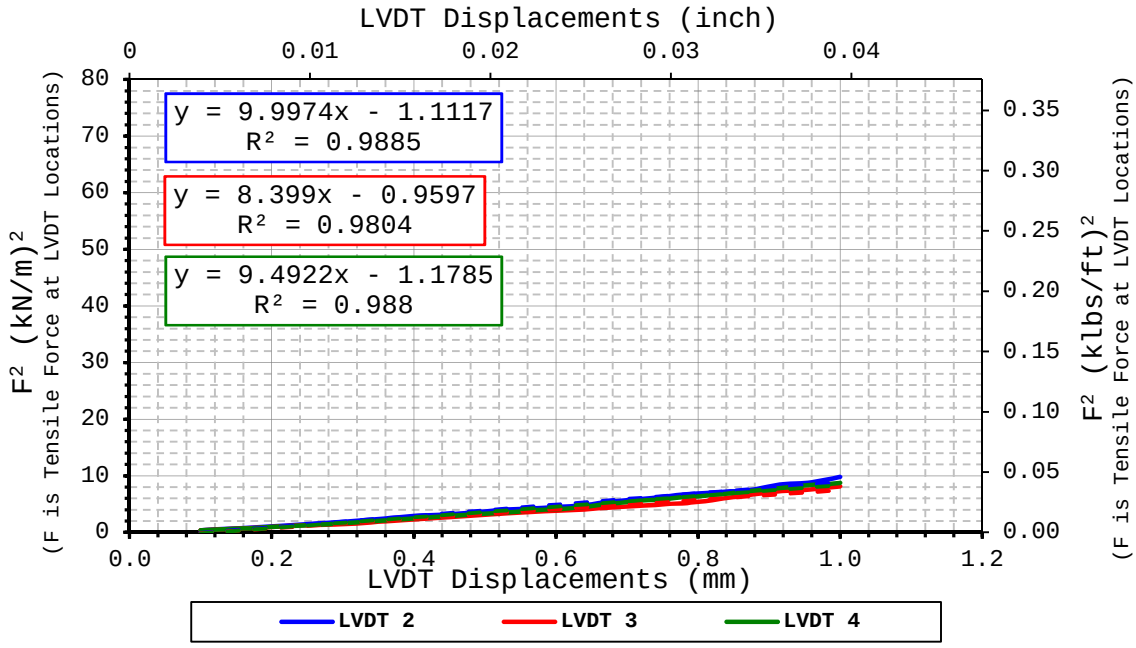
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	10	$(kN/m)^2/mm$	
K_{SGI-3} =	8	$(kN/m)^2/mm$	
K_{SGI-2} =	9	$(kN/m)^2/mm$	

Comments:

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SMALL PULLOUT TEST

Date test conducted	**7/30/2010**
Done by	**Julio Ferreira**
Data file name	**Test 332 GG PP2 CD SAggr 3psi 2010-07-30**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1200**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	9	**248**	**248**	**0.062**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.596 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.596 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**1253**
Max Pullout Force	F_{max}	**kN/m**	**22.5**
Max Shear Stress	τ_{max}	**kN/m^2**	**45.3**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.010**
2	**-0.092**
3	**-0.132**
4	**-0.172**
5	**-0.211**

Comments:

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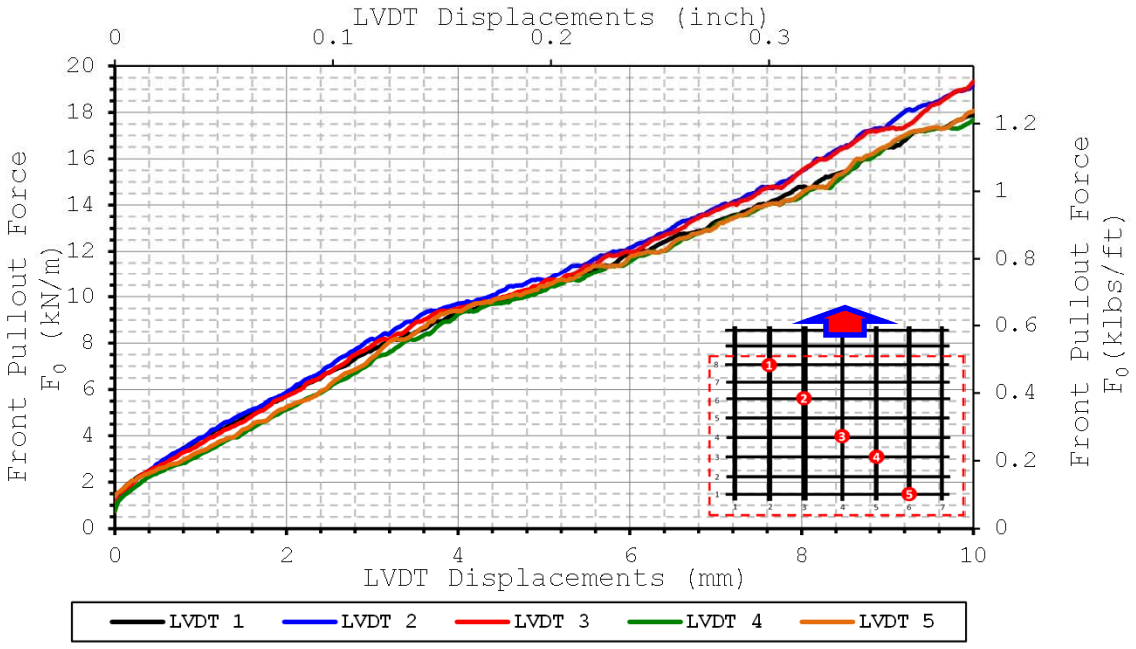
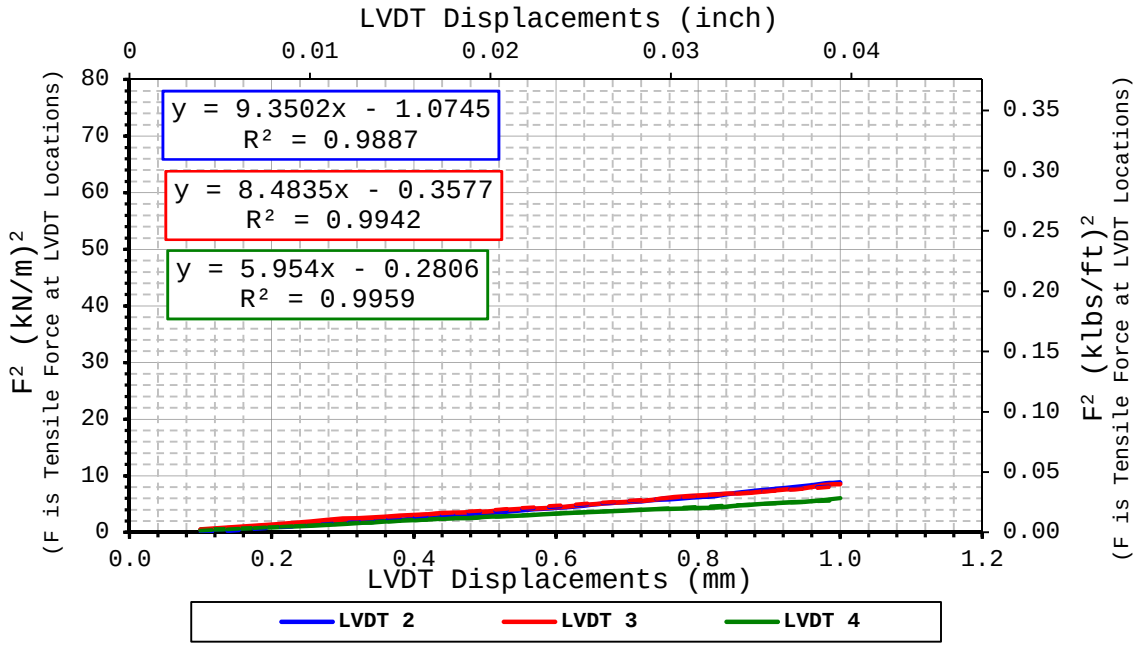
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	9	$(kN/m)^2/mm$	
K_{SGI-3} =	8	$(kN/m)^2/mm$	
K_{SGI-2} =	6	$(kN/m)^2/mm$	

Comments:

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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**7/29/2010**
Done by	**Julio Ferreira**
Data file name	**Test 342 GG PP3 CD SAggr 3psi 2010-07-29**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	13	**211**	**248**	**0.052**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**919**
Max Pullout Force	F_{max}	**kN/m**	**19.4**
Max Shear Stress	τ_{max}	**kN/m^2**	**39.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**0.001**
2	**-0.049**
3	**-0.083**
4	**-0.118**
5	**-0.202**

Comments:

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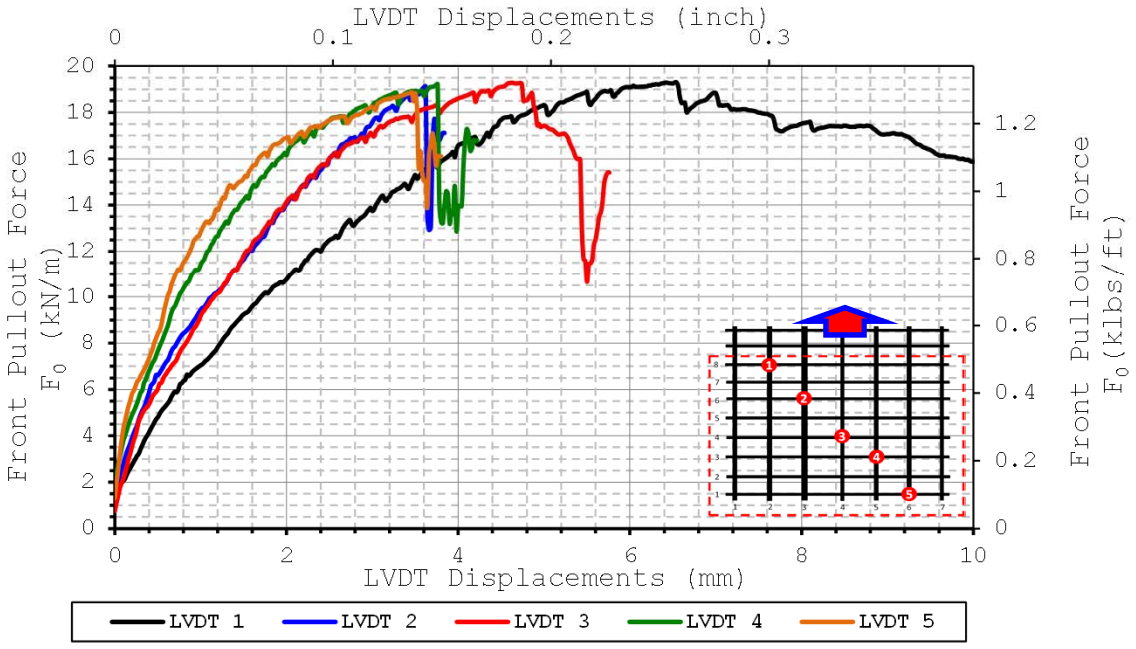
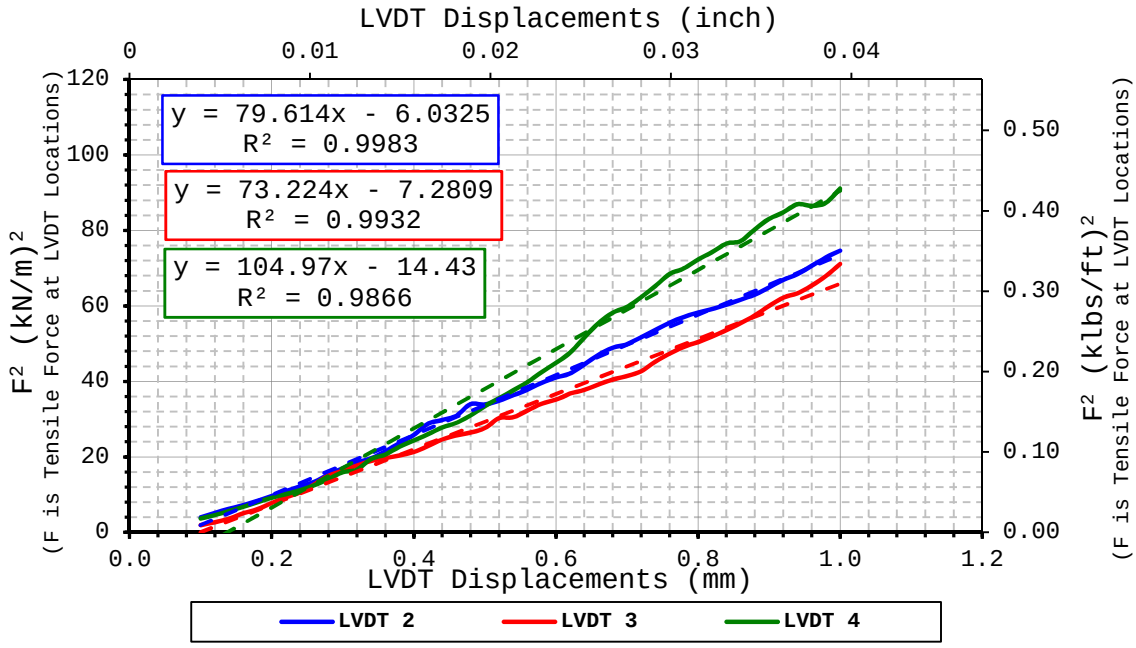
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	80	$(kN/m)^2/mm$	
K_{SGI-3} =	73	$(kN/m)^2/mm$	
K_{SGI-2} =	105	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**3/23/2011**
Done by	**Julio Ferreira**
Data file name	**Test 342 GG PP3 CD SAggr 3psi 2011-03-23**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	13	**211**	**248**	**0.052**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.596 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.596 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**997**
Max Pullout Force	F_{max}	**kN/m**	**21.0**
Max Shear Stress	τ_{max}	**kN/m^2**	**42.4**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.001**
2	**-0.051**
3	**-0.085**
4	**-0.119**
5	**-0.203**

Comments:

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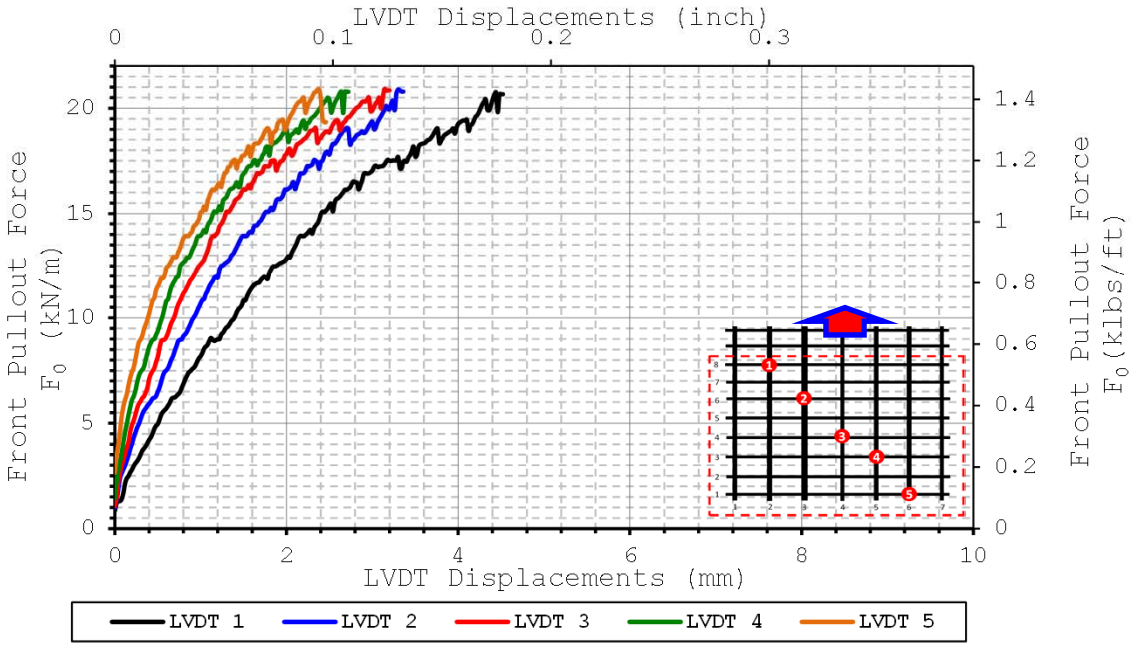
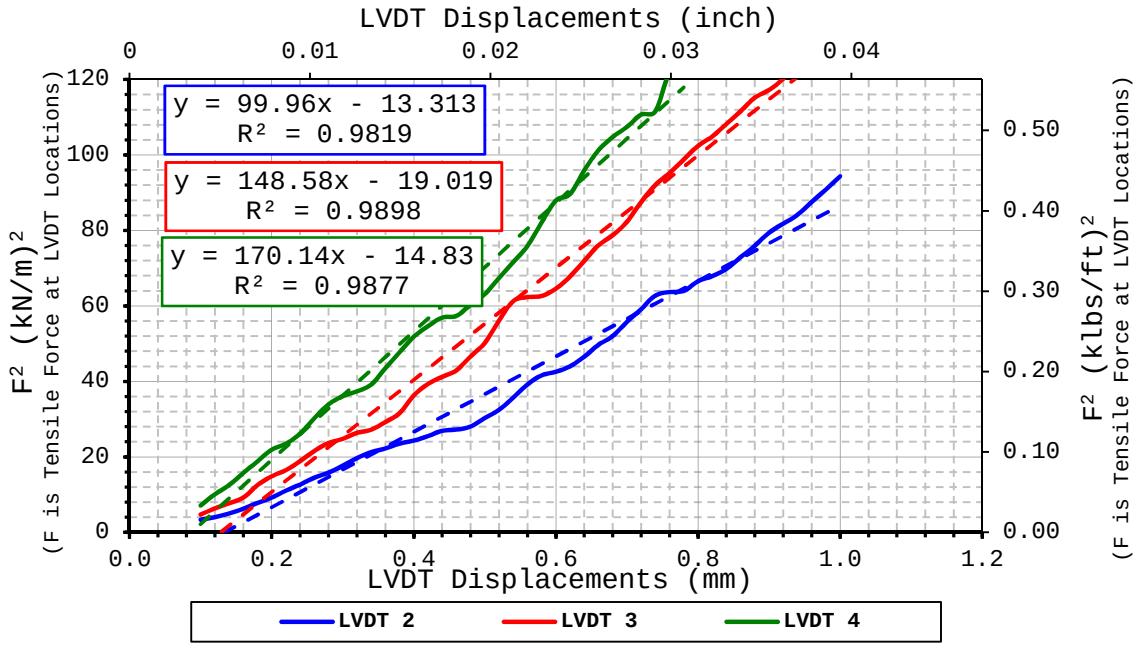
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	100	$(kN/m)^2/mm$	
K_{SGI-3} =	149	$(kN/m)^2/mm$	
K_{SGI-2} =	170	$(kN/m)^2/mm$	

Comments:

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SMALL PULLOUT TEST

Date test conducted	**7/29/2010**
Done by	**Julio Ferreira**
Data file name	**Test 312 GG PET CD SAggr 3psi 2010-07-29**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi Biaxial GG BasXgrid 11**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	8	**261**	**248**	**0.065**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.564 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.564 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**1085**
Max Pullout Force	F_{max}	**kN/m**	**18.5**
Max Shear Stress	τ_{max}	**kN/m^2**	**37.3**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.011**
2	**-0.067**
3	**-0.123**
4	**-0.153**
5	**-0.209**

Comments:

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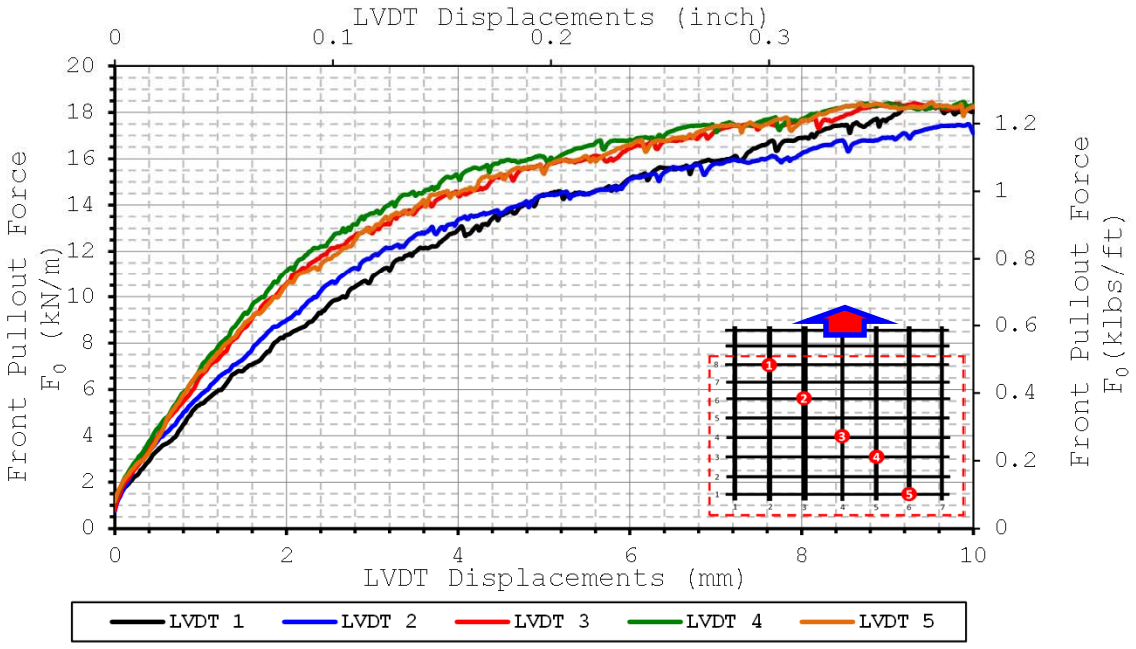
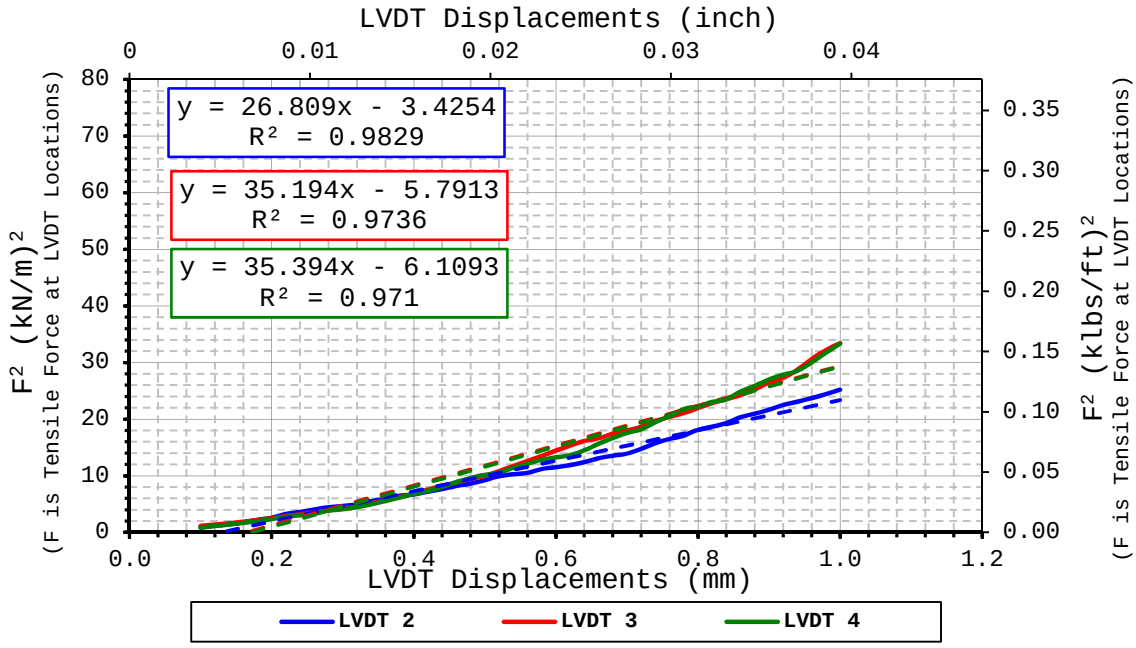
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	27	$(kN/m)^2/mm$	
K_{SGI-3} =	35	$(kN/m)^2/mm$	
K_{SGI-2} =	35	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**10/22/2010**
Done by	**Julio Ferreira**
Data file name	**Test 312 GG PET CD SAggr 3psi 2010-10-22**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi Biaxial GG BasXgrid 11**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	8	**261**	**248**	**0.065**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.609 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.609 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**1009**
Max Pullout Force	F_{max}	**kN/m**	**17.2**
Max Shear Stress	τ_{max}	**kN/m^2**	**34.7**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.010**
2	**-0.066**
3	**-0.094**
4	**-0.150**
5	**-0.205**

Comments:

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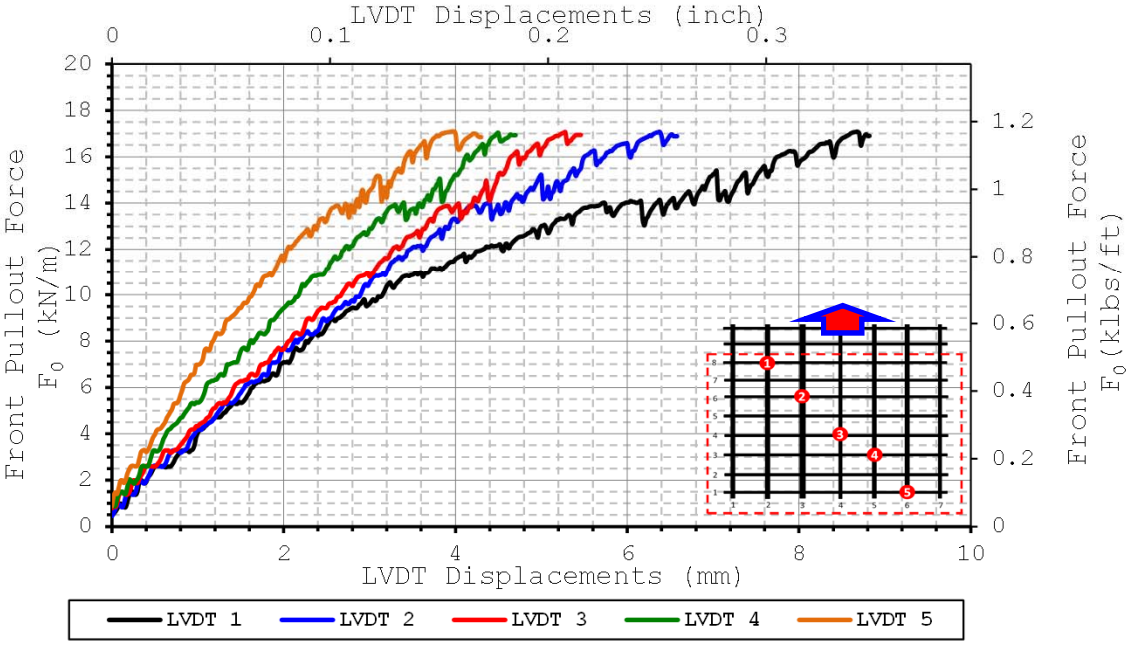
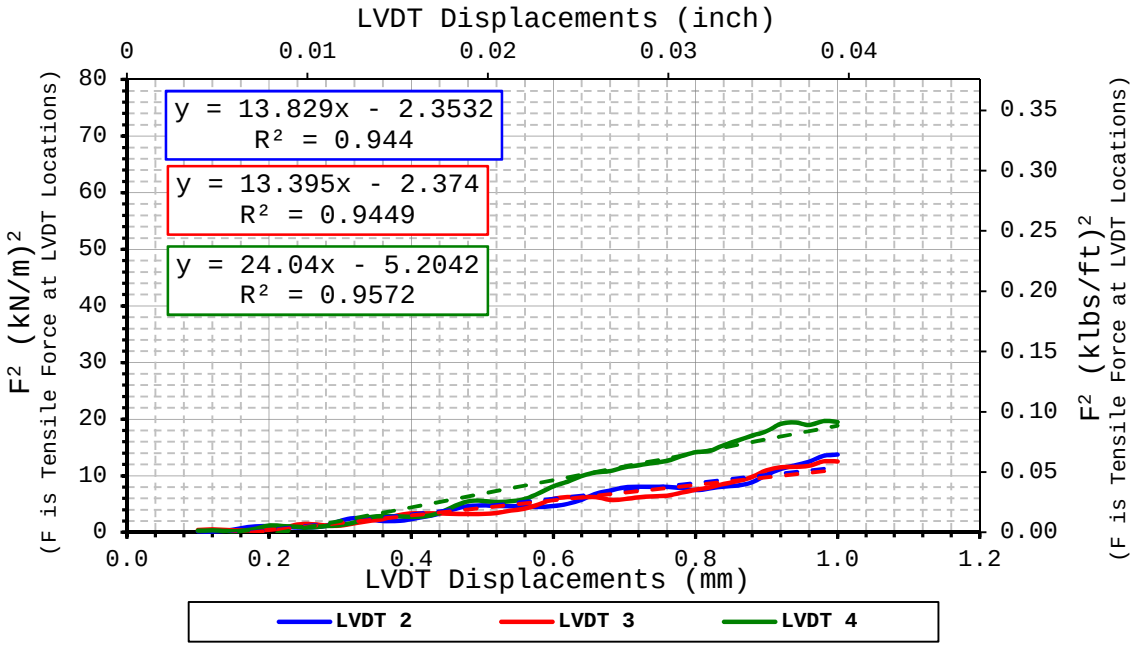
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	14	$(kN/m)^2/mm$	
K_{SGI-3} =	13	$(kN/m)^2/mm$	
K_{SGI-2} =	24	$(kN/m)^2/mm$	

Comments:

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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**4/2/2011**
Done by	**Julio Ferreira**
Data file name	**Test 312 GG PET CD SAggr 3psi 2011-04-02**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi Biaxial GG BasXgrid 11**	**CD**	**PET (Polyester)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	8	**273**	**248**	**0.068**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.609 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.609 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**1082**
Max Pullout Force	F_{max}	**kN/m**	**17.6**
Max Shear Stress	τ_{max}	**kN/m^2**	**35.5**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.025**
2	**-0.082**
3	**-0.139**
4	**-0.168**
5	**-0.223**

Comments:

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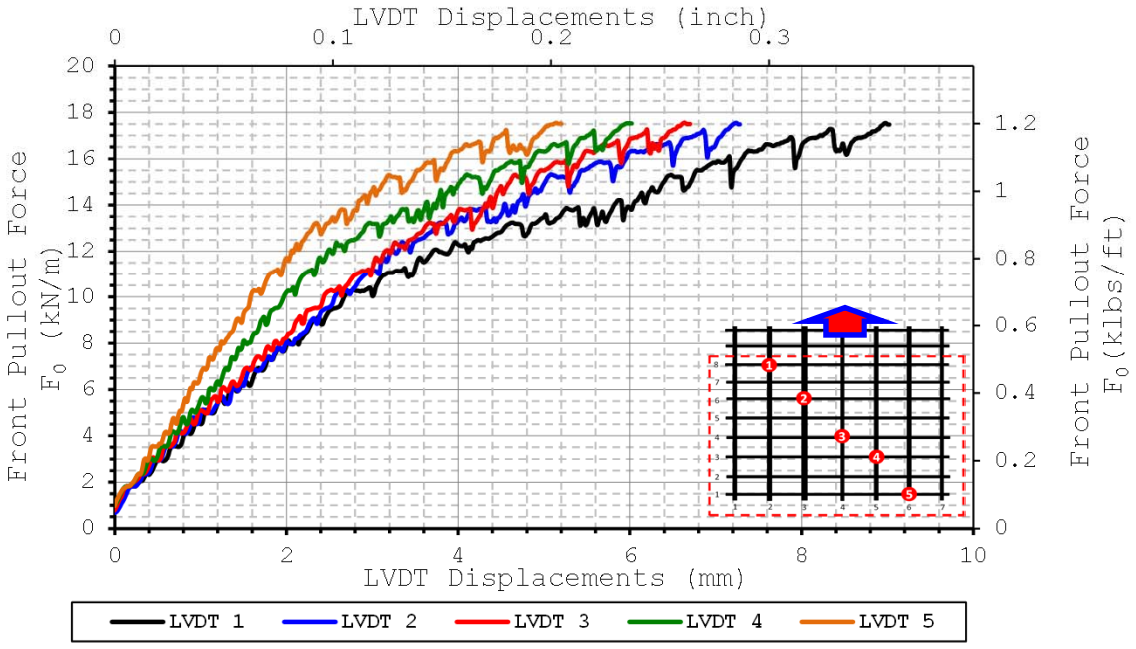
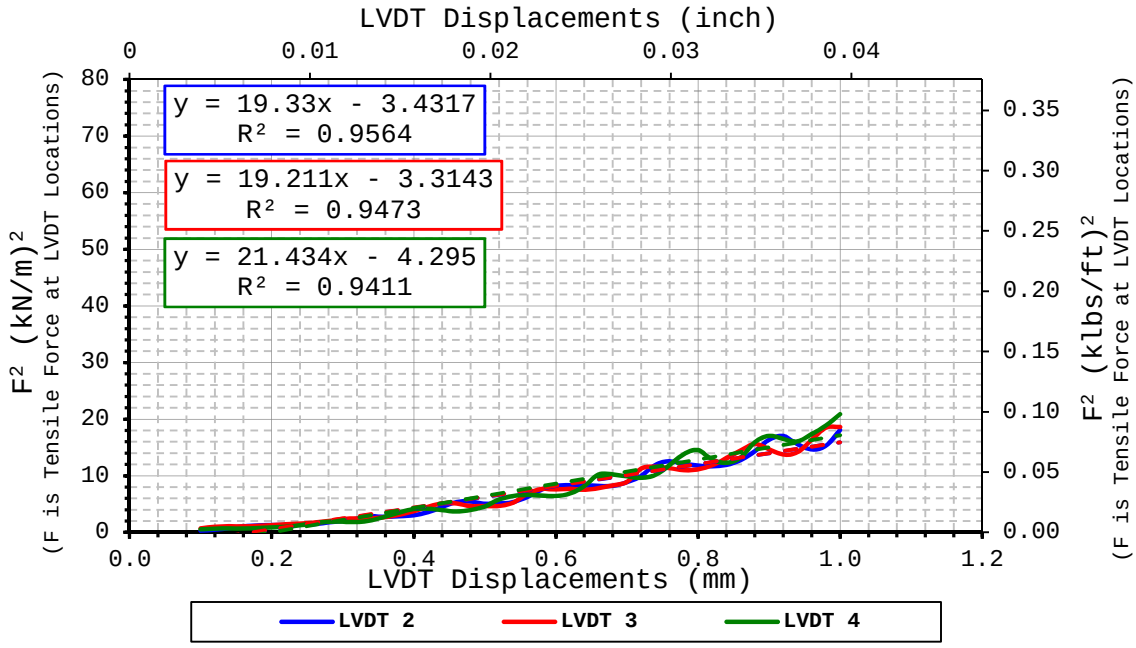
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	19	$(kN/m)^2/mm$	
K_{SGI-3} =	19	$(kN/m)^2/mm$	
K_{SGI-2} =	21	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/23/2010**
Done by	**Julio Ferreira**
Data file name	**Test 352 GG PP4 CD SAggr 3psi 2010-11-23**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	7	**287**	**248**	**0.071**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**g/cm^3**

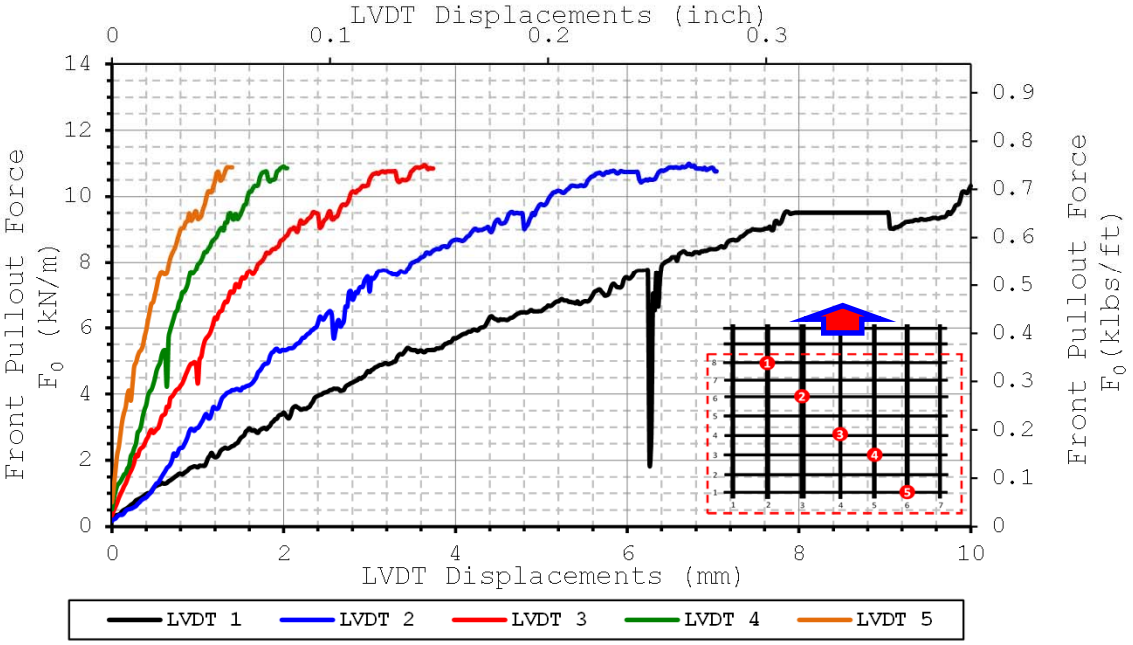
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**716**
Max Pullout Force	F_{max}	**kN/m**	**11.1**
Max Shear Stress	τ_{max}	**kN/m^2**	**22.4**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.228**
2	**-0.228**
3	**-0.228**
4	**-0.228**
5	**-0.228**

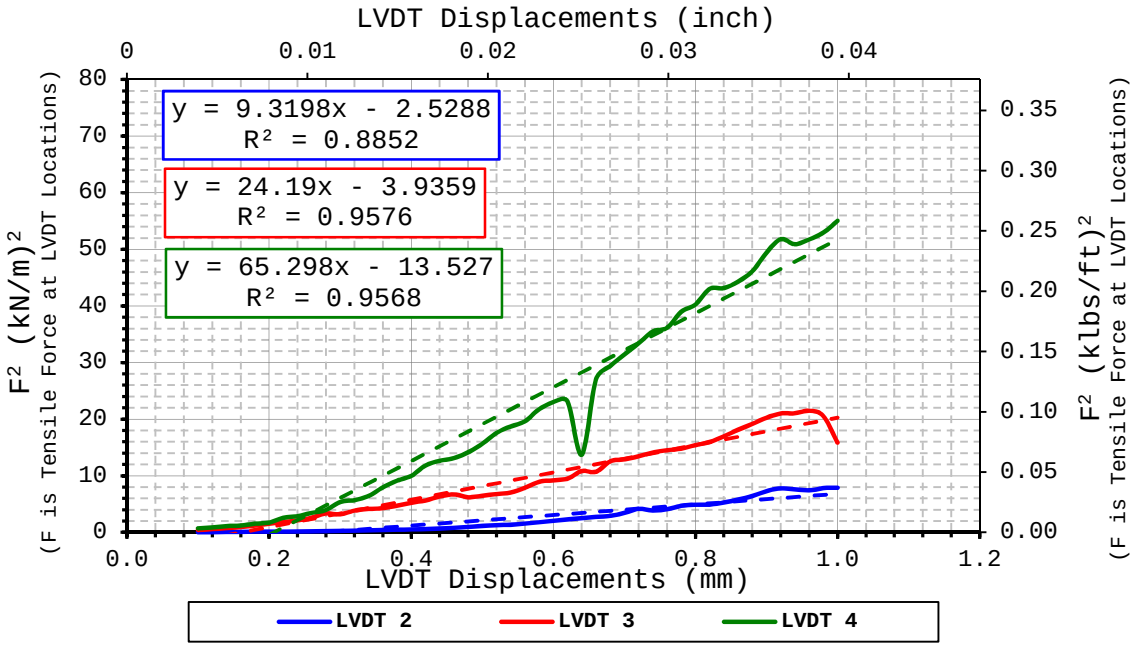
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	9	$(kN/m)^2/mm$	
K_{SGI-3} =	24	$(kN/m)^2/mm$	
K_{SGI-2} =	65	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/29/2010**
Done by	**Julio Ferreira**
Data file name	**Test 352 GG PP4 CD SAggr 3psi 2010-11-29**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	7	**287**	**248**	**0.071**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.600 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.600 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**675**
Max Pullout Force	F_{max}	**kN/m**	**10.5**
Max Shear Stress	τ_{max}	**kN/m^2**	**21.1**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.003**
2	**-0.053**
3	**-0.105**
4	**-0.158**
5	**-0.209**

Comments:

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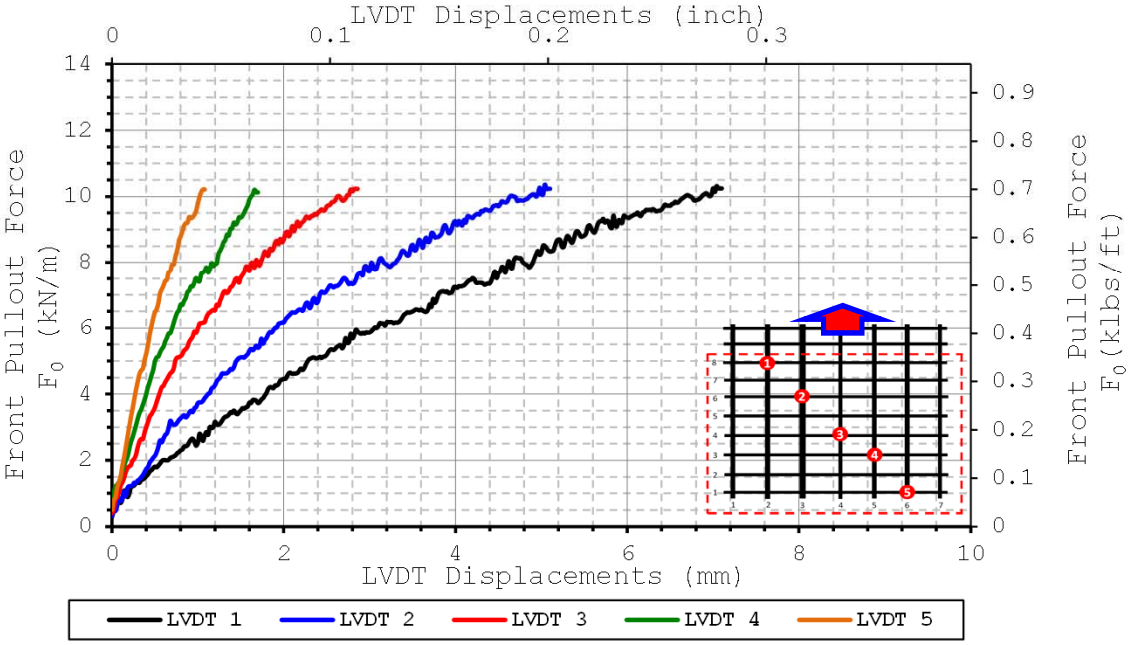
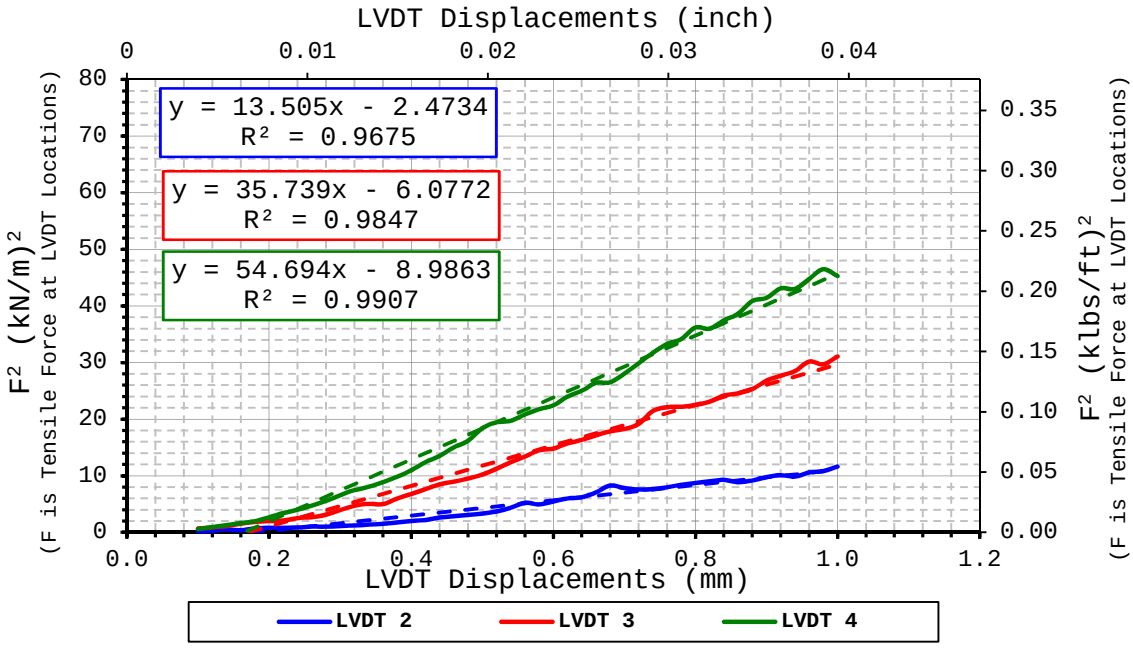
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	14	$(kN/m)^2/mm$
K_{SGI-3} =	36	$(kN/m)^2/mm$
K_{SGI-2} =	55	$(kN/m)^2/mm$

Comments:

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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/9/2010**
Done by	**Julio Ferreira**
Data file name	**Test 322 GT CD SAggr 3psi 2010-11-09**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Biaxial GT Geolon HP570**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**285**	**248**	**0.071**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**1020**
Max Pullout Force	F_{max}	**kN/m**	**15.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**32.1**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.002**
2	**-0.076**
3	**-0.121**
4	**-0.162**
5	**-0.208**

Comments:

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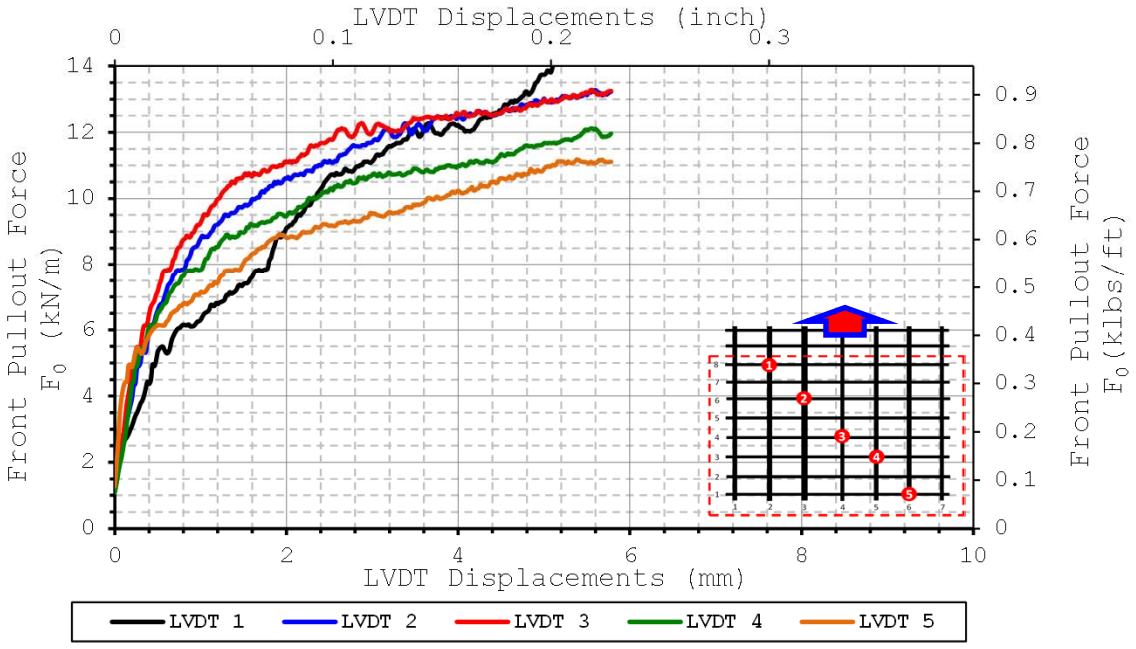
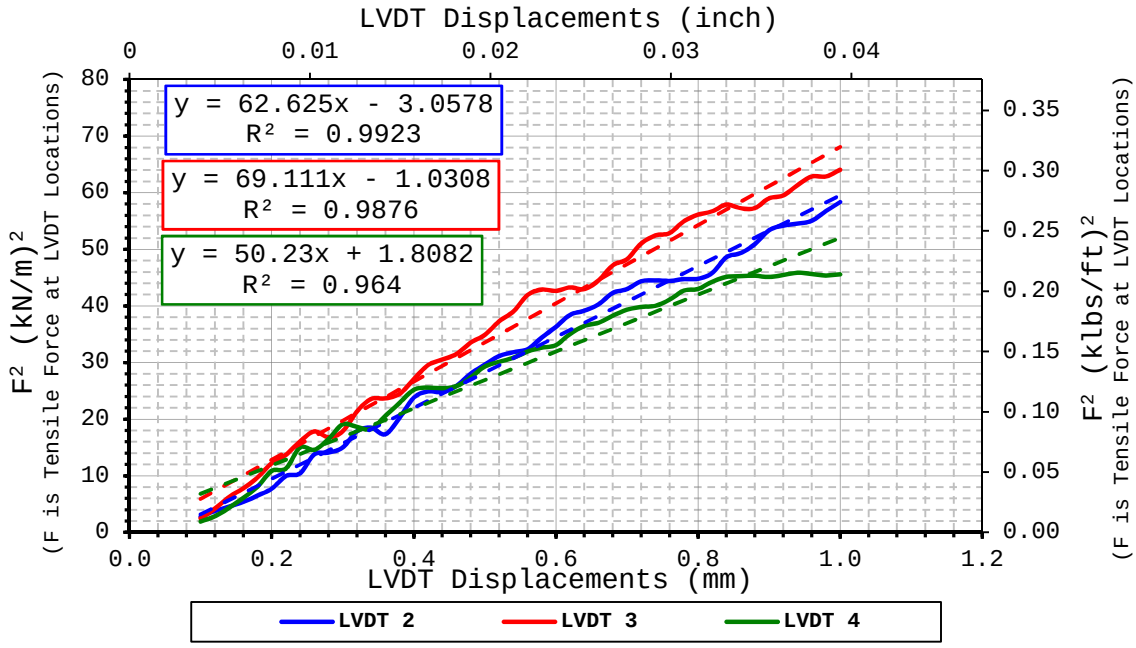
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 63 $(kN/m)^2/mm$

K_{SGI-3} = 69 $(kN/m)^2/mm$

K_{SGI-2} = 50 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/11/2010**
Done by	**Julio Ferreira**
Data file name	**Test 322 GT CD SAggr 3psi 2010-11-11**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Biaxial GT Geolon HP570**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**279**	**248**	**0.069**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**654**
Max Pullout Force	F_{max}	**kN/m**	**10.4**
Max Shear Stress	τ_{max}	**kN/m^2**	**21.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.014**
2	**-0.086**
3	**-0.127**
4	**-0.159**
5	**-0.210**

Comments:

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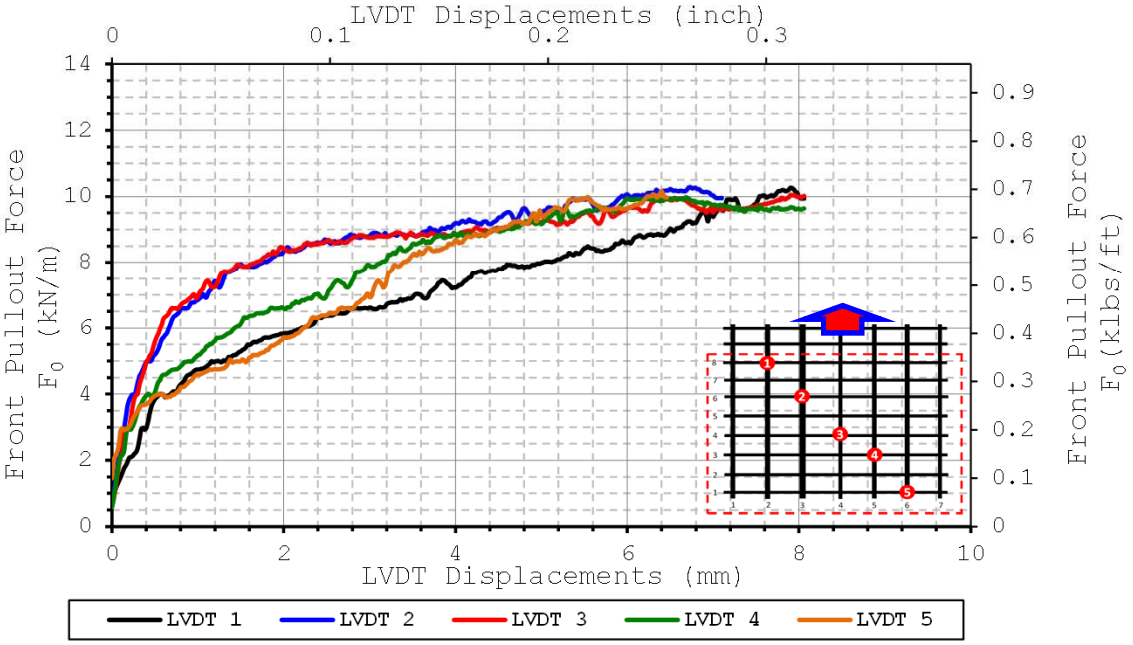
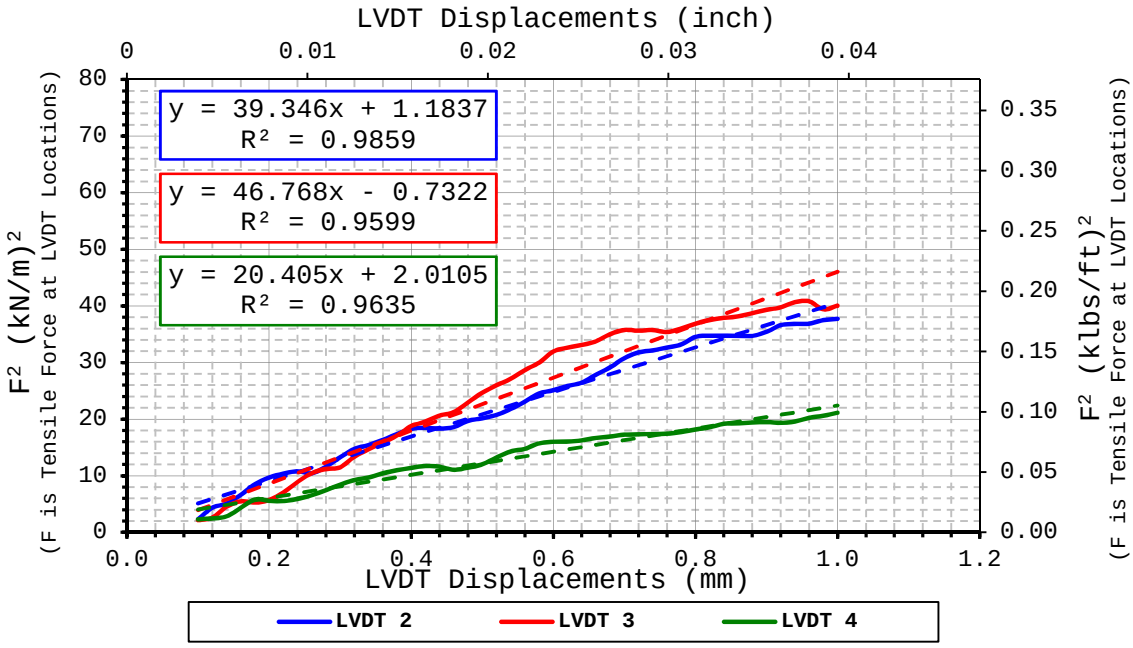
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	39	$(kN/m)^2/mm$	
K_{SGI-3} =	47	$(kN/m)^2/mm$	
K_{SGI-2} =	20	$(kN/m)^2/mm$	

Comments:

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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/12/2010**
Done by	**Julio Ferreira**
Data file name	**Test 322 GT CD SAggr 3psi 2010-11-12**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Biaxial GT Geolon HP570**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**283**	**248**	**0.070**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**765**
Max Pullout Force	F_{max}	**kN/m**	**12.0**
Max Shear Stress	τ_{max}	**kN/m^2**	**24.2**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.037**
2	**-0.108**
3	**-0.152**
4	**-0.204**
5	**-0.228**

Comments:

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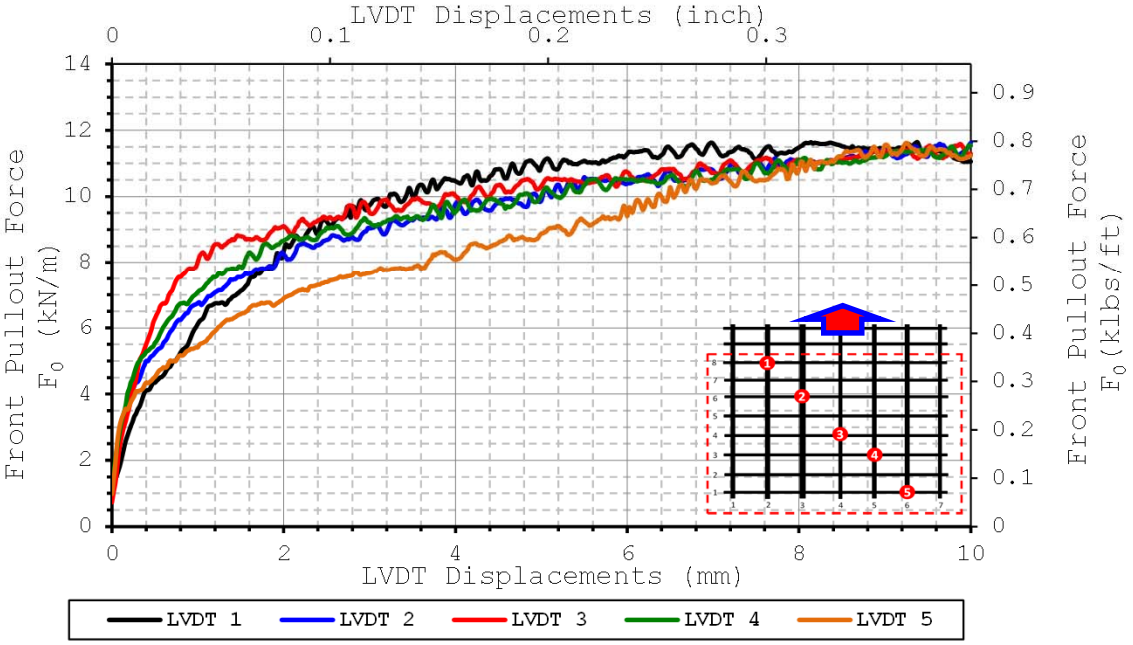
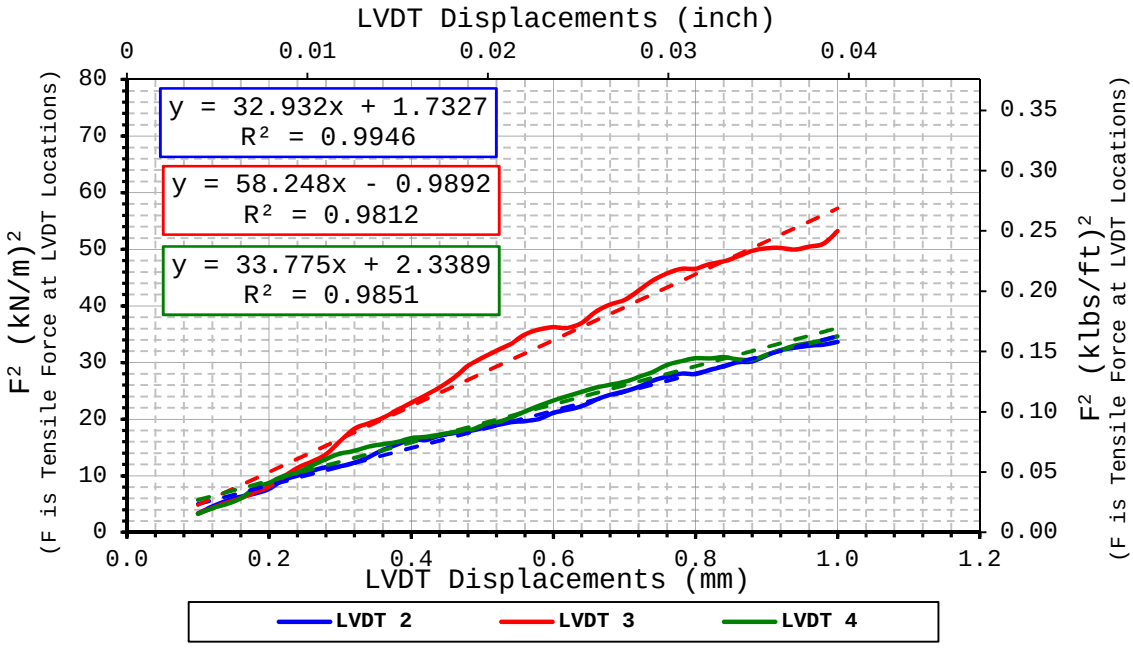
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	33	$(kN/m)^2/mm$	
K_{SGI-3} =	58	$(kN/m)^2/mm$	
K_{SGI-2} =	34	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/12/2010**
Done by	**Julio Ferreira**
Data file name	**Test 322 GT CD SAggr 3psi 2010-11-12**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi Biaxial GT Geolon HP570**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	0	**283**	**248**	**0.070**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.618 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.618 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**427**
Max Pullout Force	F_{max}	**kN/m**	**6.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**13.5**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**0.003**
2	**-0.068**
3	**-0.108**
4	**-0.152**
5	**-0.204**

Comments:

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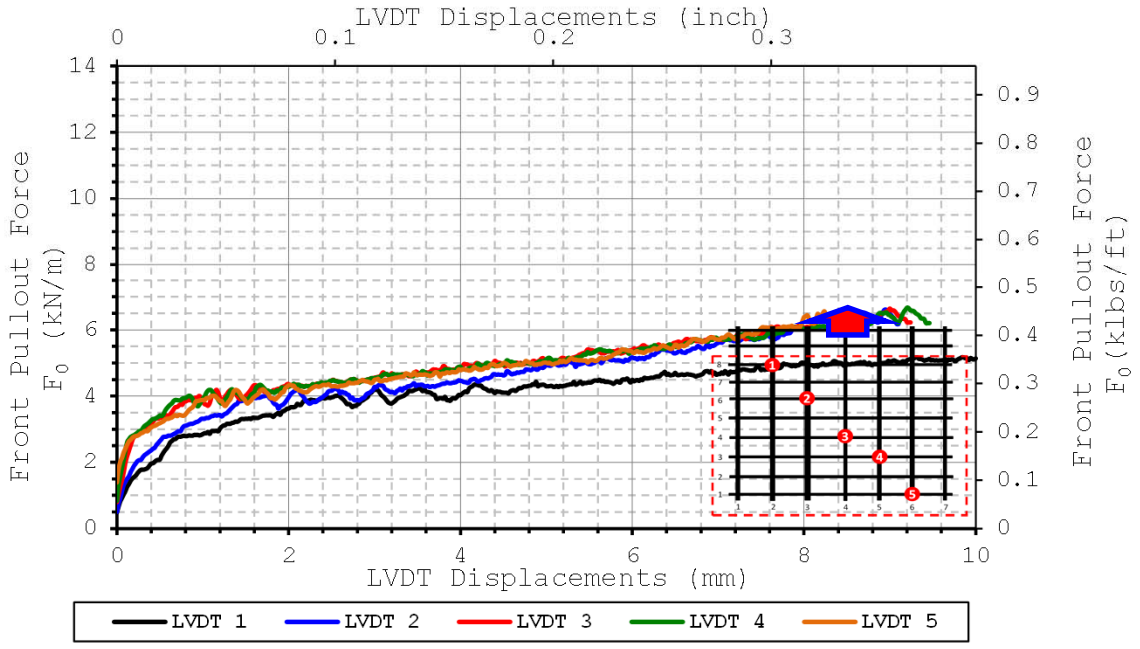
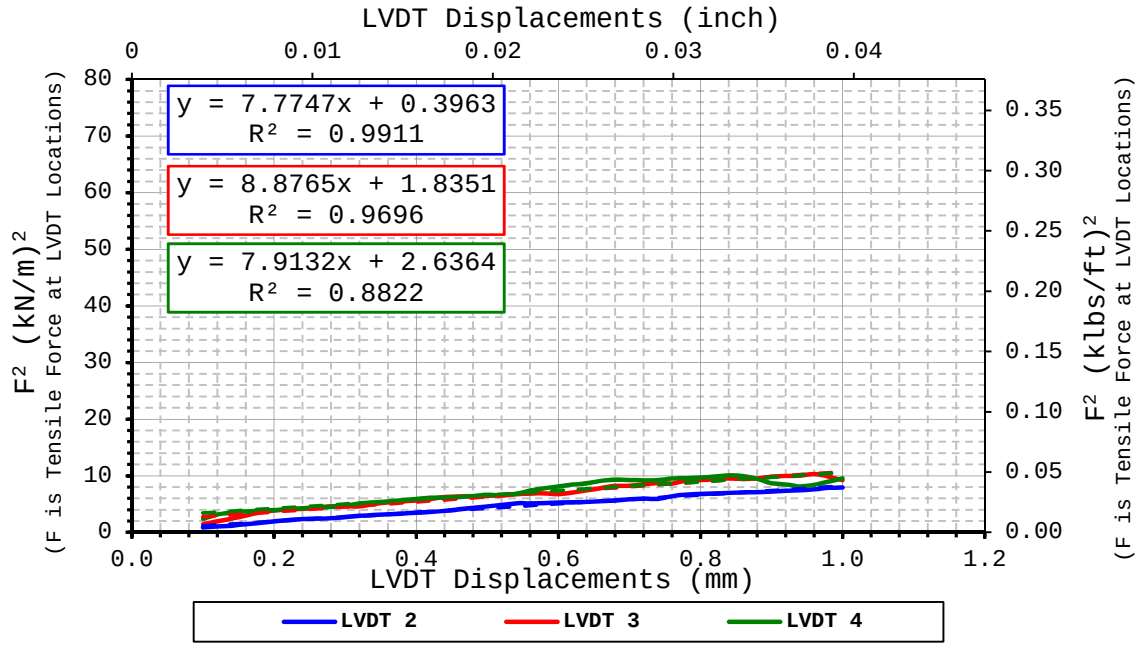
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	8	$(kN/m)^2/mm$	
K_{SGI-3} =	9	$(kN/m)^2/mm$	
K_{SGI-2} =	8	$(kN/m)^2/mm$	

Comments:

Small Pullout Test

Sieved Aggregate 1 – MD – 3psi

Results of the tests up to 8/31/2011

The University of Texas at Austin

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
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SMALL PULLOUT TEST

Date test conducted	**10/29/2010**
Done by	**Julio Ferreira**
Data file name	**Test 330 GG PP2 MD SAggr 3psi 2010-10-29**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1200**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	0	**263**	**248**	**0.065**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.618 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.618 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**1065**
Max Pullout Force	F_{max}	**kN/m**	**18.0**
Max Shear Stress	τ_{max}	**kN/m^2**	**36.3**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.008**
2	**-0.027**
3	**-0.059**
4	**-0.117**
5	**-0.209**

Comments:

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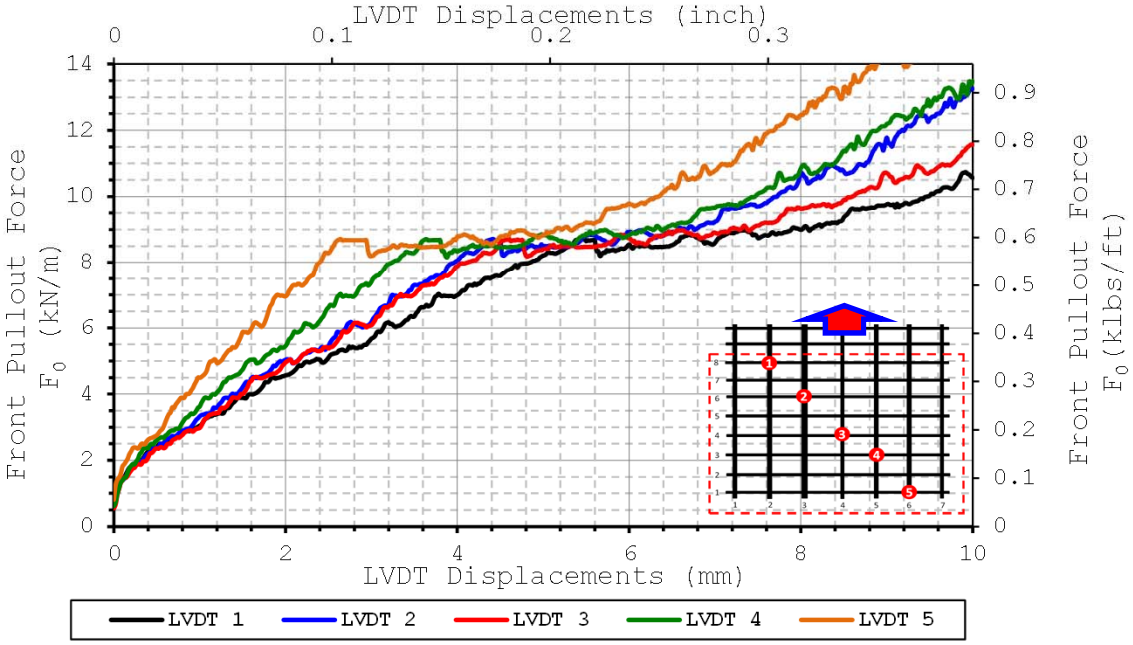
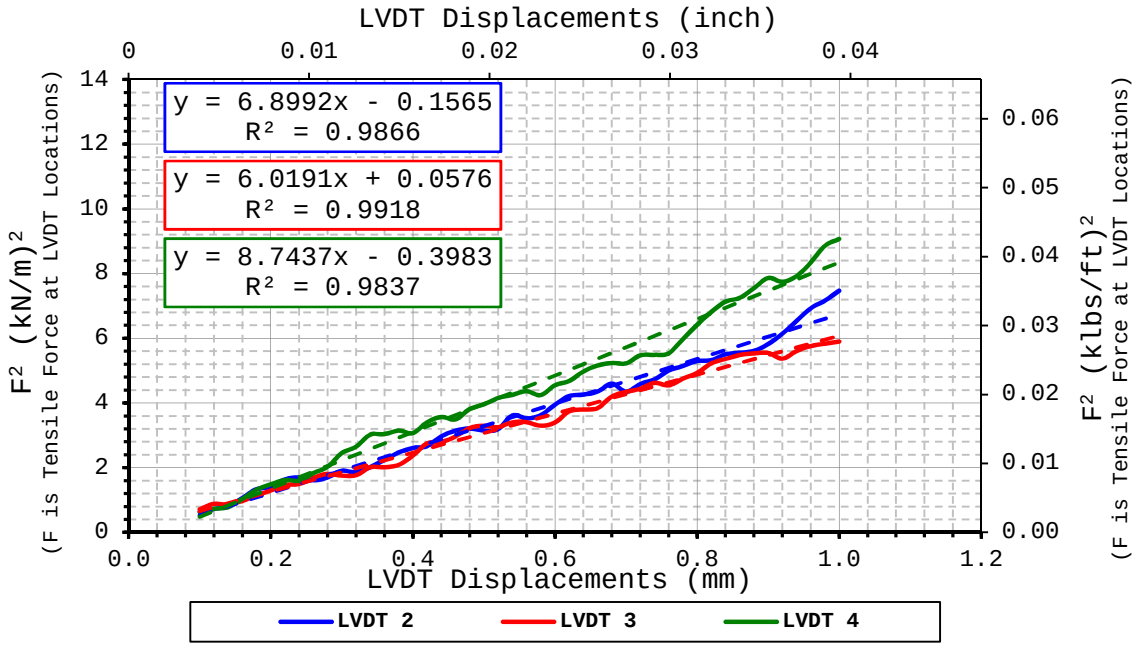
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	7	$(kN/m)^2/mm$	
K_{SGI-3} =	**6**	**$(kN/m)^2/mm$**	
K_{SGI-2} =	9	$(kN/m)^2/mm$	

Comments:

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SMALL PULLOUT TEST

Date test conducted	**7/23/2010**
Done by	**Julio Ferreira**
Data file name	**Test 340 GG PP3 MD SAggr 3psi 2010-07-23**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**17**	**364**	**248**	**0.090**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.600 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.600 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**1012**
Max Pullout Force	F_{max}	**kN/m**	**12.4**
Max Shear Stress	τ_{max}	**kN/m^2**	**24.9**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.013**
2	**-0.057**
3	**-0.100**
4	**-0.145**
5	**-0.233**

Comments:

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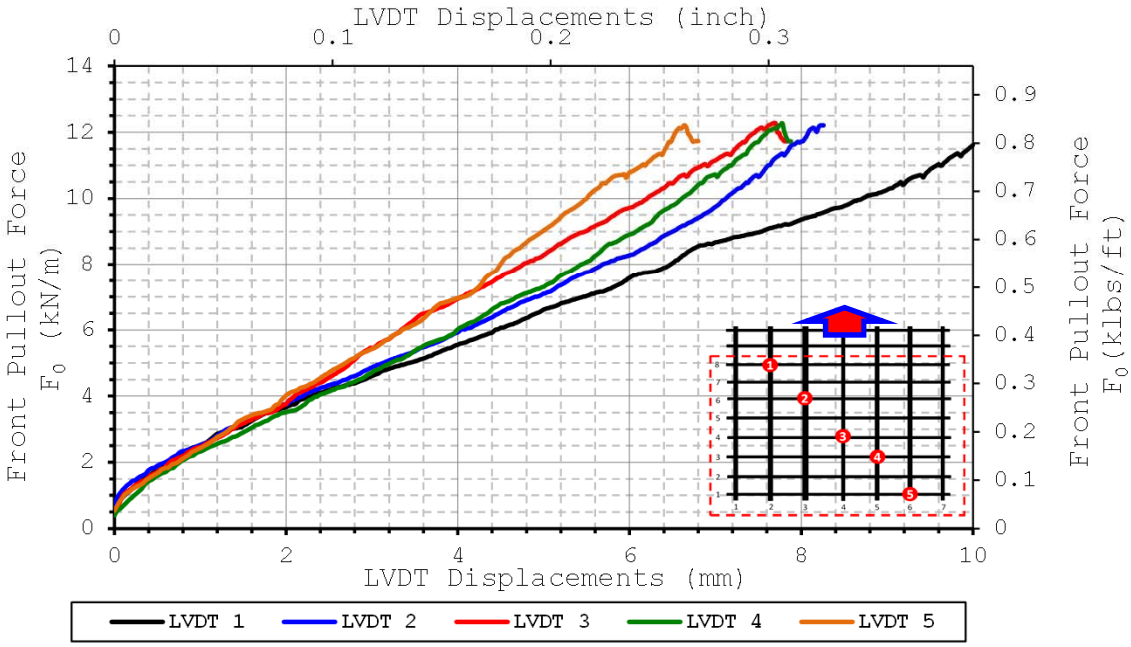
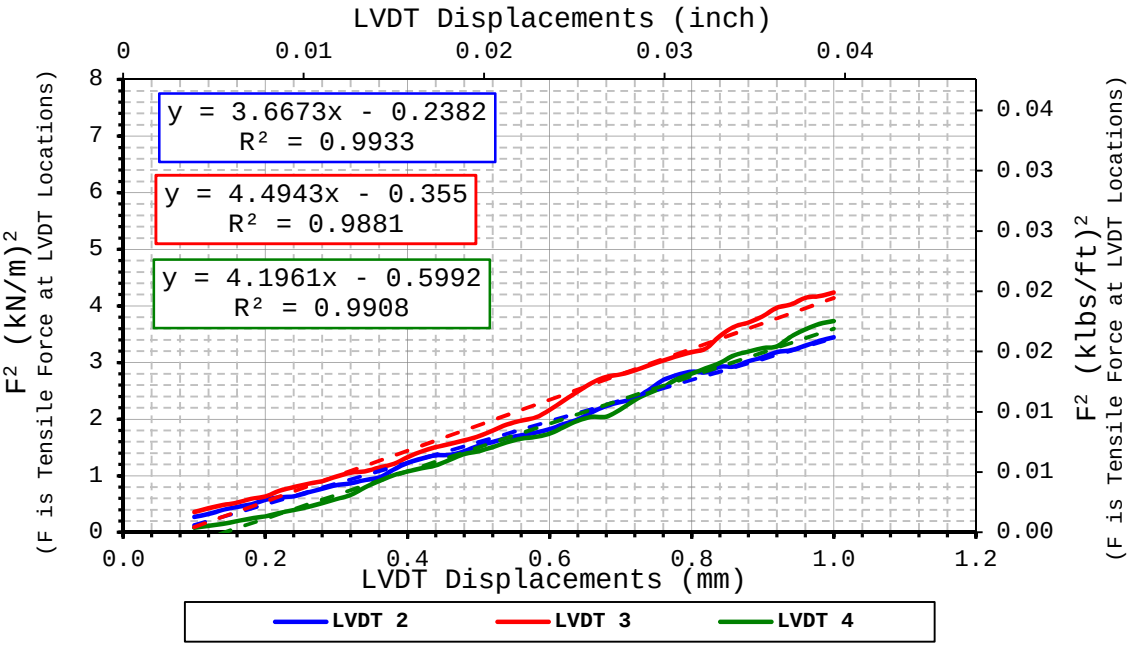
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 4 $(kN/m)^2/mm$

K_{SGI-3} =	4	$(kN/m)^2/mm$

K_{SGI-2} = 4 $(kN/m)^2/mm$

Comments:

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SMALL PULLOUT TEST

Date test conducted	**7/24/2010**
Done by	**Julio Ferreira**
Data file name	**Test 340 GG PP3 MD SAggr 3psi 2010-07-24**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.600 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.600 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**1103**
Max Pullout Force	F_{max}	**kN/m**	**13.5**
Max Shear Stress	τ_{max}	**kN/m^2**	**27.2**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.019**
2	**-0.062**
3	**-0.105**
4	**-0.148**
5	**-0.233**

Comments:

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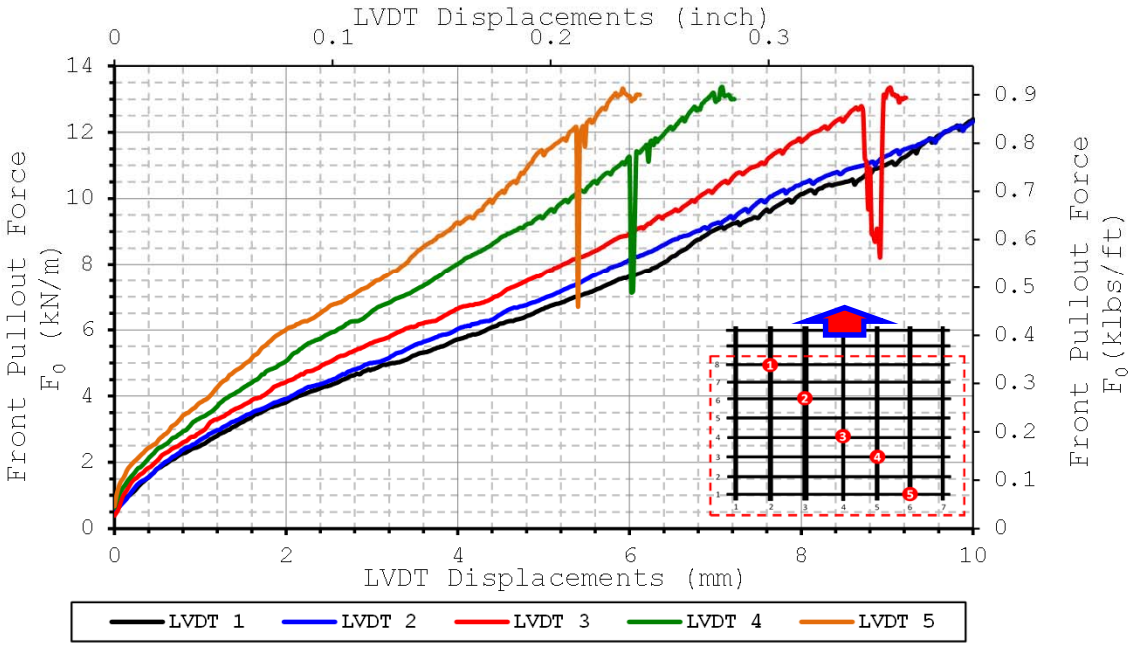
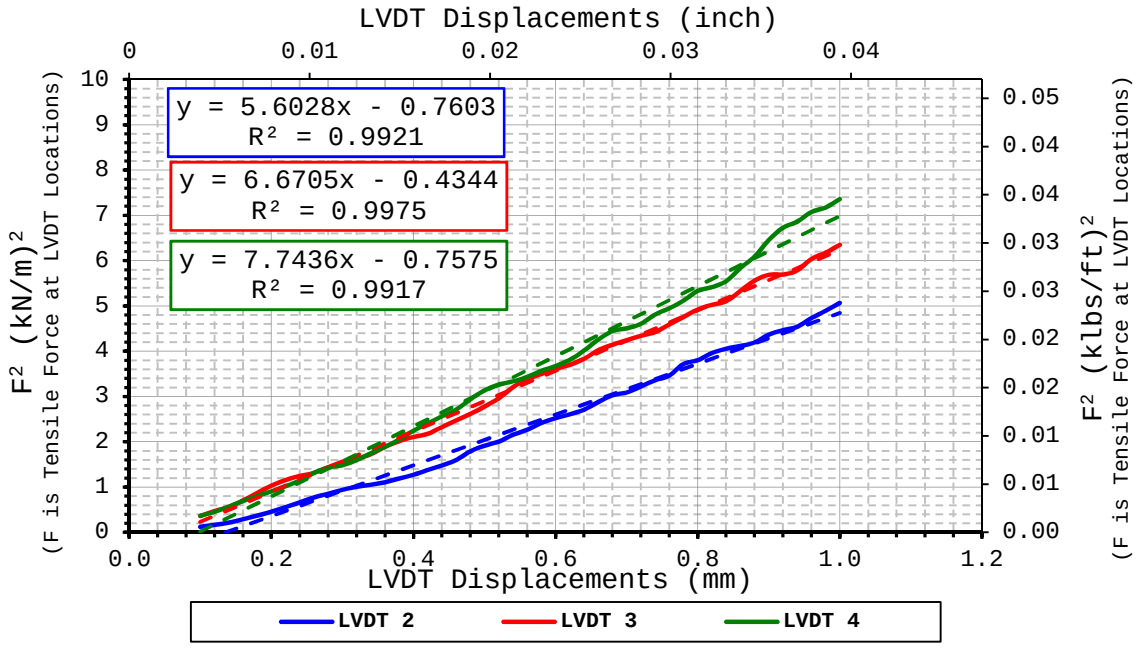
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	6	$(kN/m)^2/mm$
K_{SGI-3} =	7	$(kN/m)^2/mm$
K_{SGI-2} =	8	$(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**4/26/2011**
Done by	**Julio Ferreira**
Data file name	**Test 340 GG PP3 MD SAggr 3psi 2010-07-24**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**17**	**364**	**248**	**0.090**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.604 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.604 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**649**
Max Pullout Force	F_{max}	**kN/m**	**7.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**16.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.026**
2	**-0.047**
3	**-0.090**
4	**-0.133**
5	**-0.218**

Comments:

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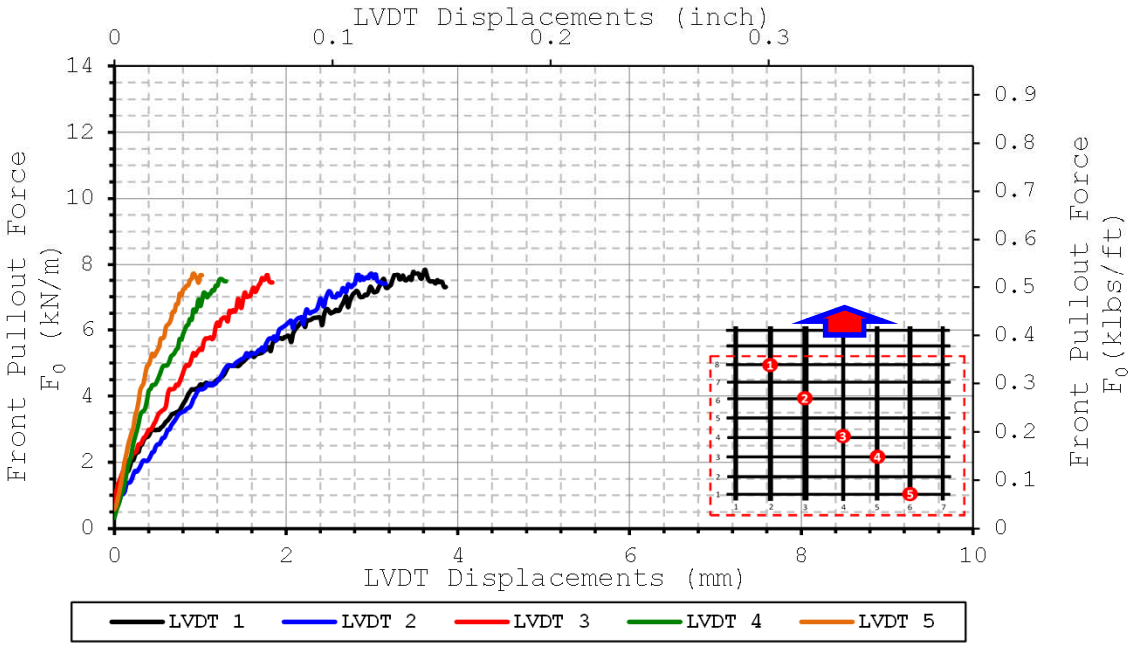
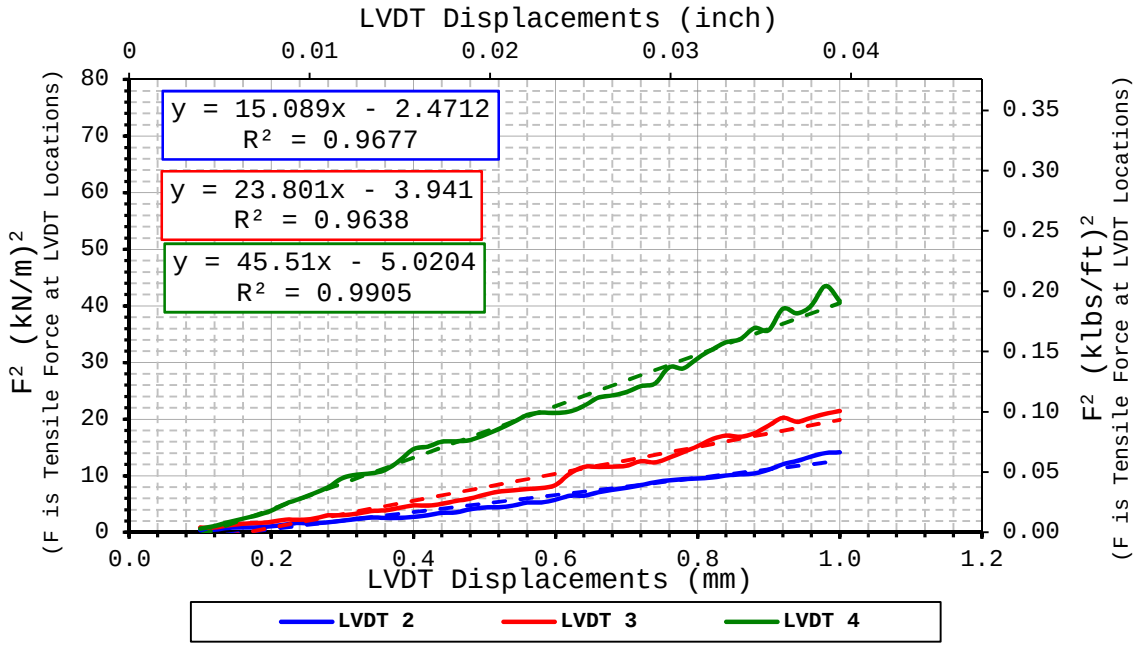
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 15 $(kN/m)^2/mm$

K_{SGI-3} = 24 $(kN/m)^2/mm$

K_{SGI-2} = 46 $(kN/m)^2/mm$

Comments:

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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**10/26/2010**
Done by	**Julio Ferreira**
Data file name	**Test 310 GG PET MD SAggr 3psi 2010-10-26**

	Type	Manufacter & Model	Direction Pulled	Polymer
GEOSYNTHETIC Information	**Geogrid**	**Mirafi Biaxial GG BasXgrid 11**	**MD**	**PET (Polyester)**

	# Ribs Pulled	Equivalent Width (W) mm	Embedded Length (L) mm	Area (A) m^2
SPECIMEN Dimensions	**10**	**270**	**248**	**0.067**

SOIL Information	Soil Type	Water Content	Average Water Content	Dry Density (ρ_d)
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.596 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.596 g/cm^3**

RESULTS		Units	Values
Max Pullout Load	P_{max}	**lbs**	**1270**
Max Pullout Force	F_{max}	**kN/m**	**20.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**42.2**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.012**
2	**-0.080**
3	**-0.111**
4	**-0.145**
5	**-0.212**

Comments:

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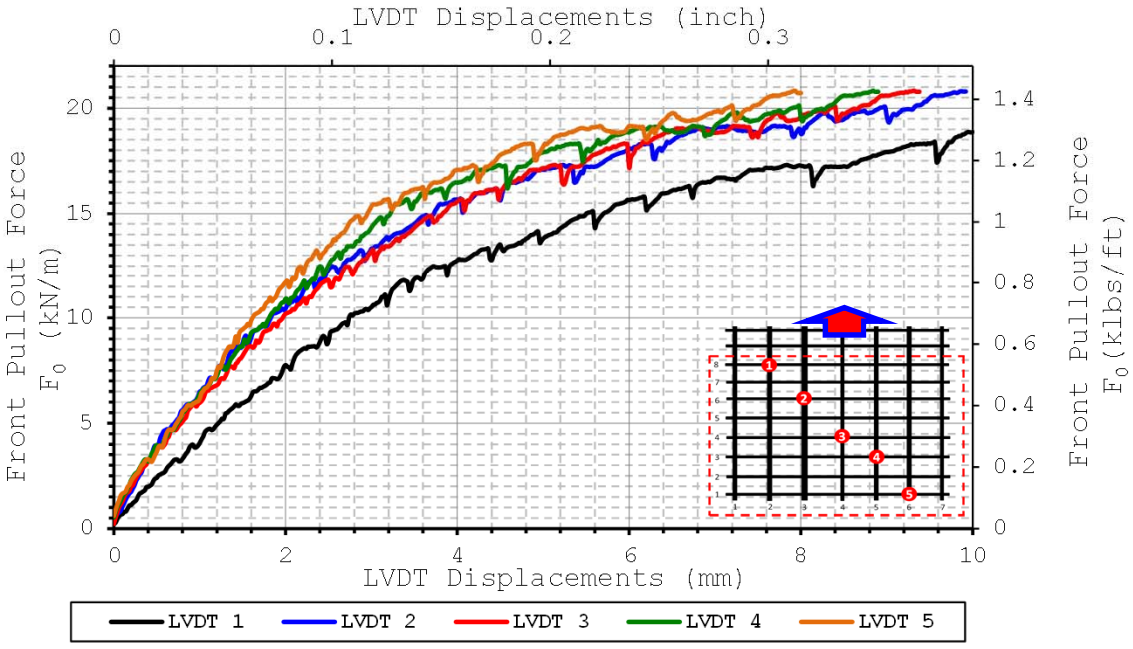
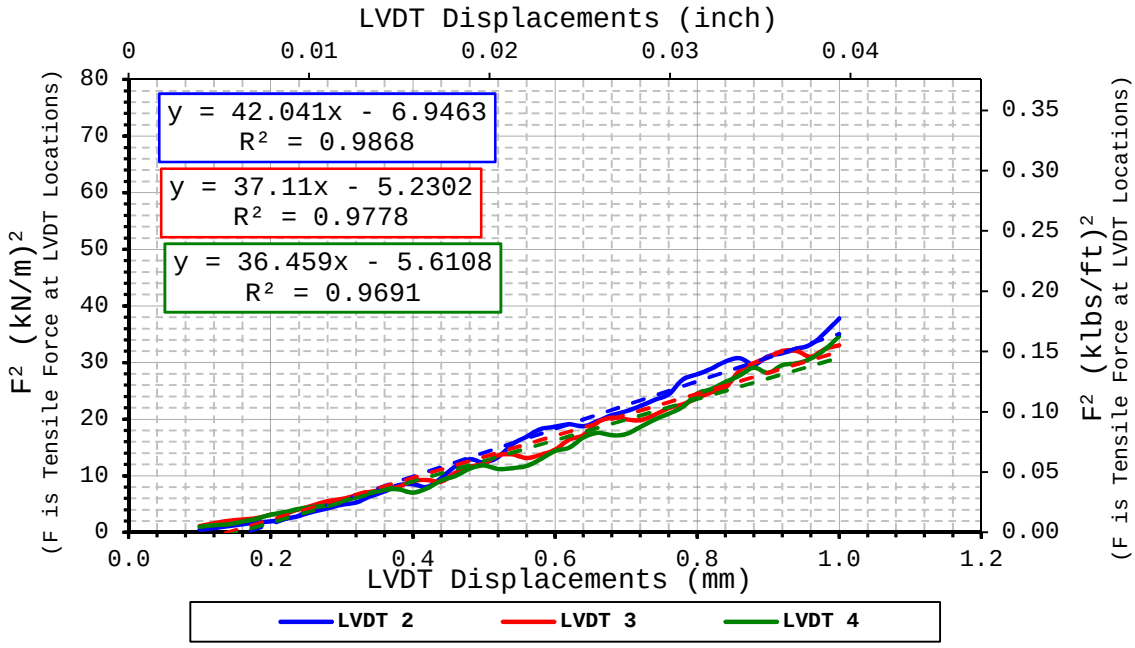
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	42	(kN/m)^2/mm	
K_{SGI-3} =	**37**	**(kN/m)^2/mm**	
K_{SGI-2} =	36	(kN/m)^2/mm	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/2/2010**
Done by	**Julio Ferreira**
Data file name	**Test 350 GG PP4 MD SAggr 3psi 2010-11-02**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	6	**255**	**248**	**0.063**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.596 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.596 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**604**
Max Pullout Force	F_{max}	**kN/m**	**10.5**
Max Shear Stress	τ_{max}	**kN/m^2**	**21.2**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.014**
2	**-0.059**
3	**-0.104**
4	**-0.148**
5	**-0.192**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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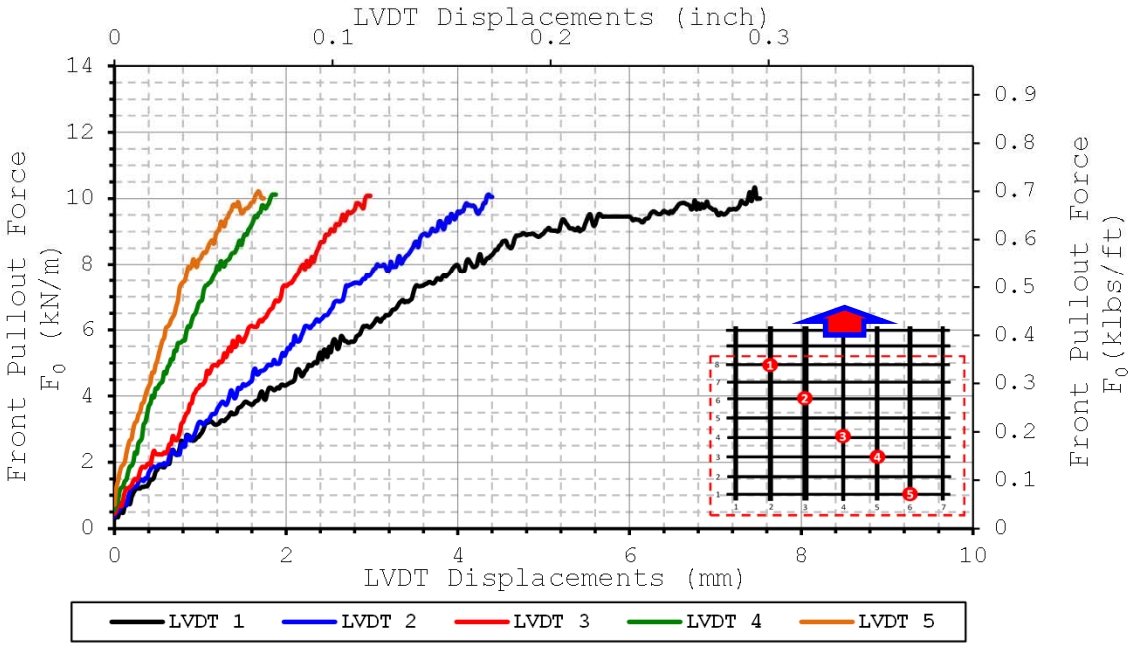
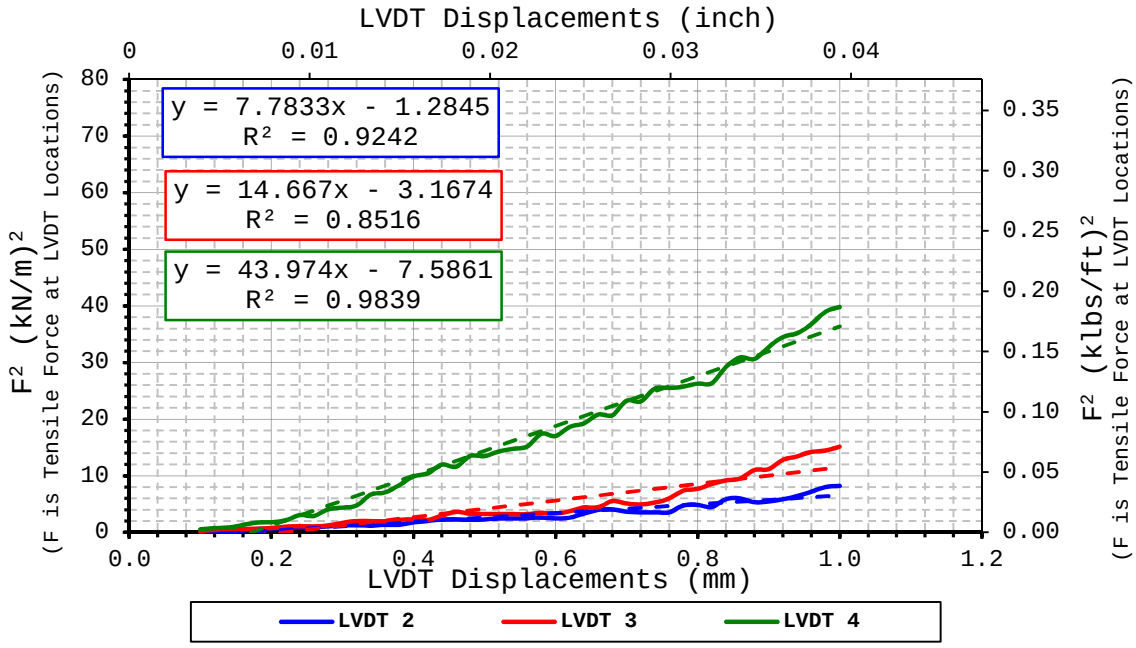
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 8 (kN/m)^2/mm

K_{SGI-3} =	15	(kN/m)^2/mm

K_{SGI-2} = 44 (kN/m)^2/mm

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/19/2010**
Done by	**Julio Ferreira**
Data file name	**Test 350 GG PP4 MD SAggr 3psi 2010-11-19**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS110**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	6	**255**	**248**	**0.063**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.591 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.591 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**656**
Max Pullout Force	F_{max}	**kN/m**	**11.4**
Max Shear Stress	τ_{max}	**kN/m^2**	**23.1**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.009**
2	**-0.055**
3	**-0.100**
4	**-0.148**
5	**-0.194**

Comments:

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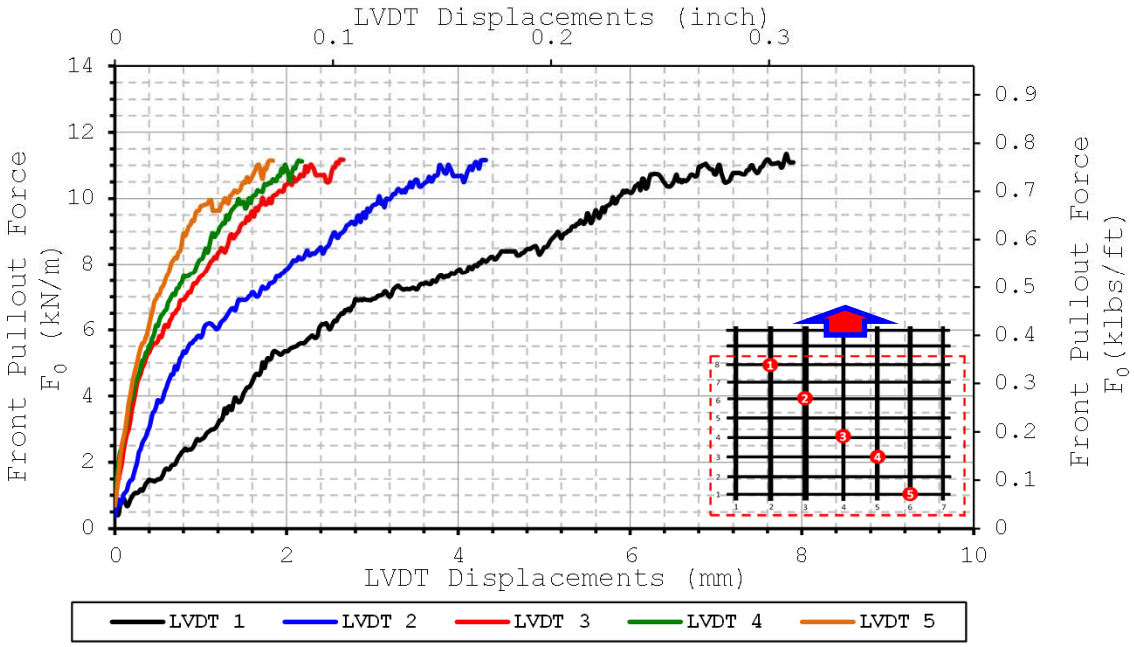
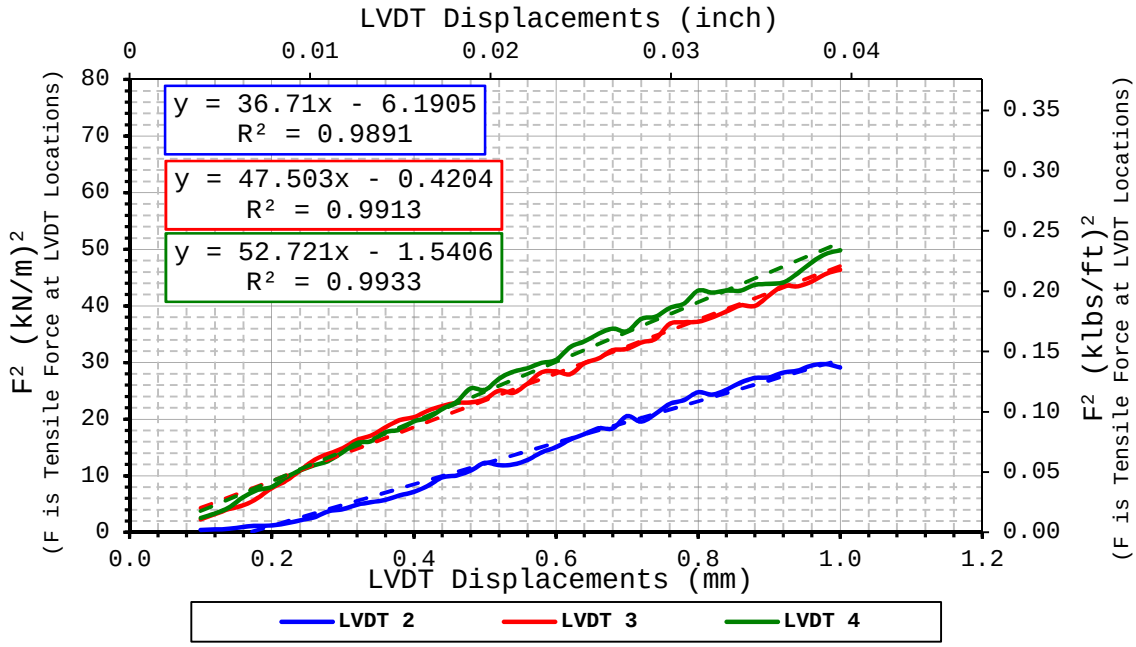
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	37	$(kN/m)^2/mm$	
K_{SGI-3} =	**48**	**$(kN/m)^2/mm$**	
K_{SGI-2} =	53	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/16/2010**
Done by	**Julio Ferreira**
Data file name	**Test 320 GT MD SAggr 3psi 2010-11-16**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Biaxial GT Geolon HP570**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**280**	**248**	**0.069**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**438**
Max Pullout Force	F_{max}	**kN/m**	**7.0**
Max Shear Stress	τ_{max}	**kN/m^2**	**14.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.006**
2	**-0.078**
3	**-0.114**
4	**-0.154**
5	**-0.207**

Comments:

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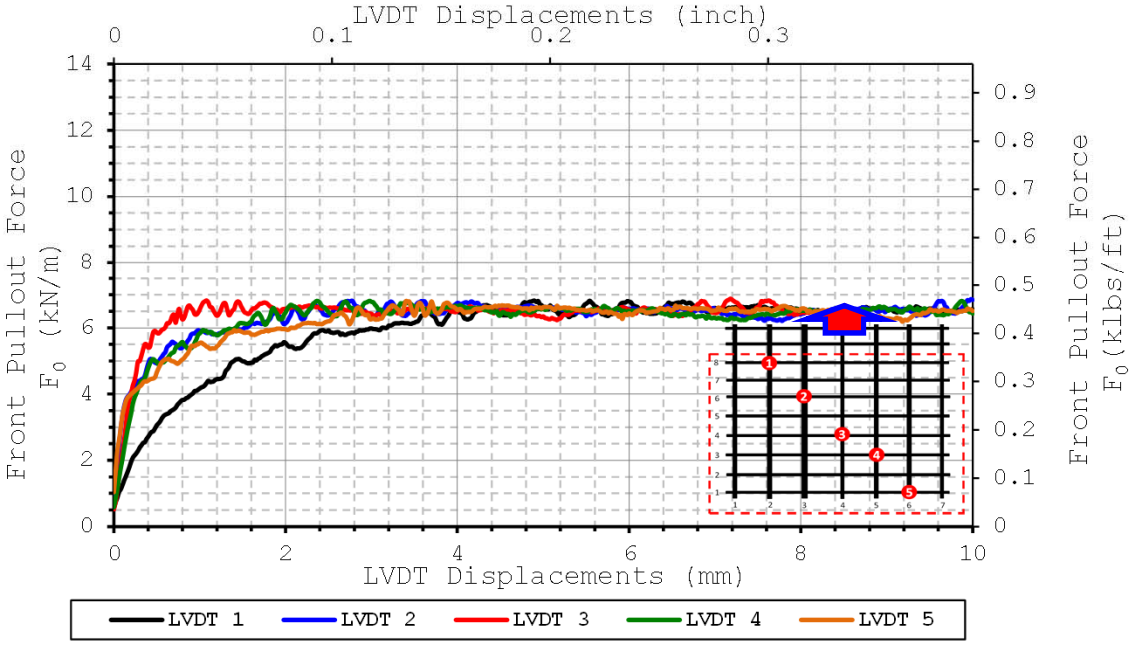
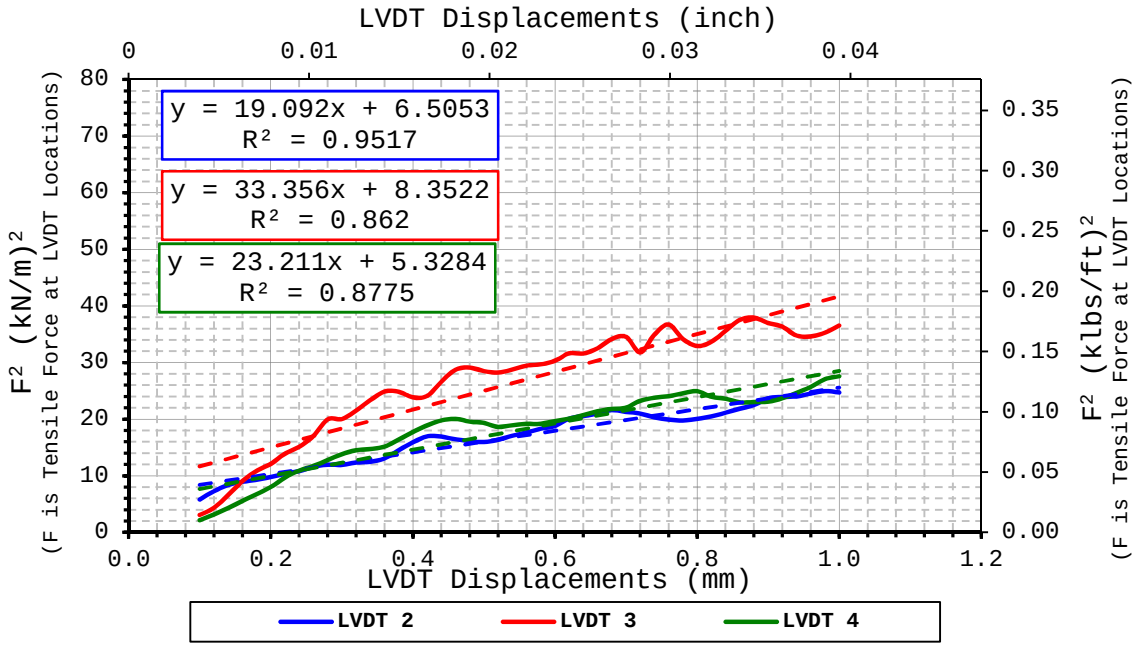
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 19 $(kN/m)^2/mm$

K_{SGI-3} = 33 $(kN/m)^2/mm$

K_{SGI-2} = 23 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**11/18/2010**
Done by	**Julio Ferreira**
Data file name	**Test 320 GT MD SAggr 3psi 2010-11-18**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geotextile	**Mirafi Biaxial GT Geolon HP570**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	---	**279**	**248**	**0.069**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 1**	**0.00 %**	**0.00 %**	**1.613 g/cm^3**
Bottom Layer	**Sieved Aggregate 1**	**0.00 %**		**1.613 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**188**
Max Pullout Force	F_{max}	**kN/m**	**3.0**
Max Shear Stress	τ_{max}	**kN/m^2**	**6.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**0.000**
2	**-0.078**
3	**-0.113**
4	**-0.144**
5	**-0.203**

Comments:

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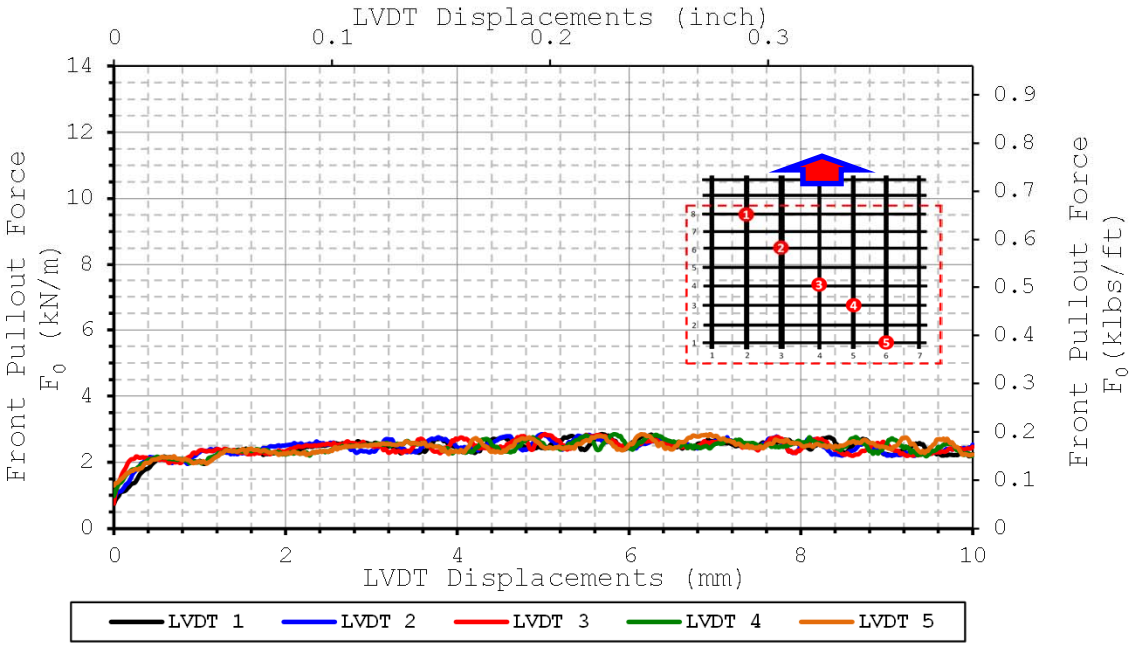
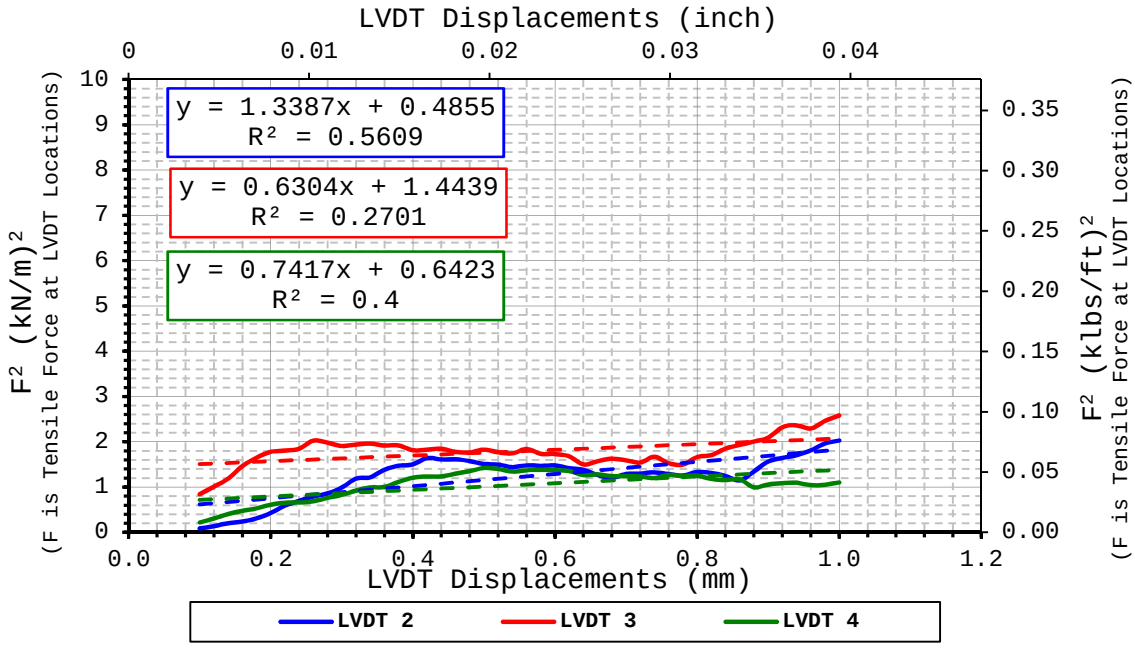
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 1 $(kN/m)^2/mm$

K_{SGI-3} =	1	$(kN/m)^2/mm$

K_{SGI-2} = 1 $(kN/m)^2/mm$

Comments:

Small Pullout Test

Sieved Aggregate 2 – CD – 3psi

Results of the tests up to 8/31/2011

The University of Texas at Austin

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/4/2011**
Done by	**Julio Ferreira**
Data file name	**Test 302b GG PP1 CD SAggr2 3psi 2011-08**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1100**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	10	**275**	**248**	**0.068**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.498 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.498 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**703**
Max Pullout Force	F_{max}	**kN/m**	**11.4**
Max Shear Stress	τ_{max}	**kN/m^2**	**22.9**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.019**
2	**-0.060**
3	**-0.100**
4	**-0.141**
5	**-0.238**

Comments:

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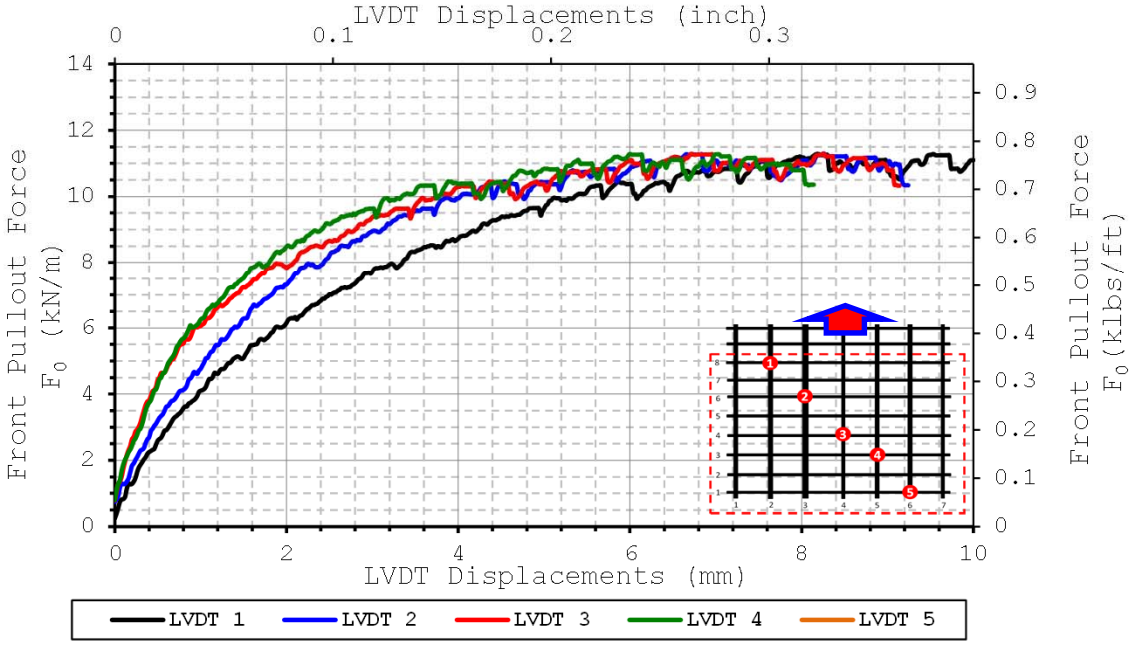
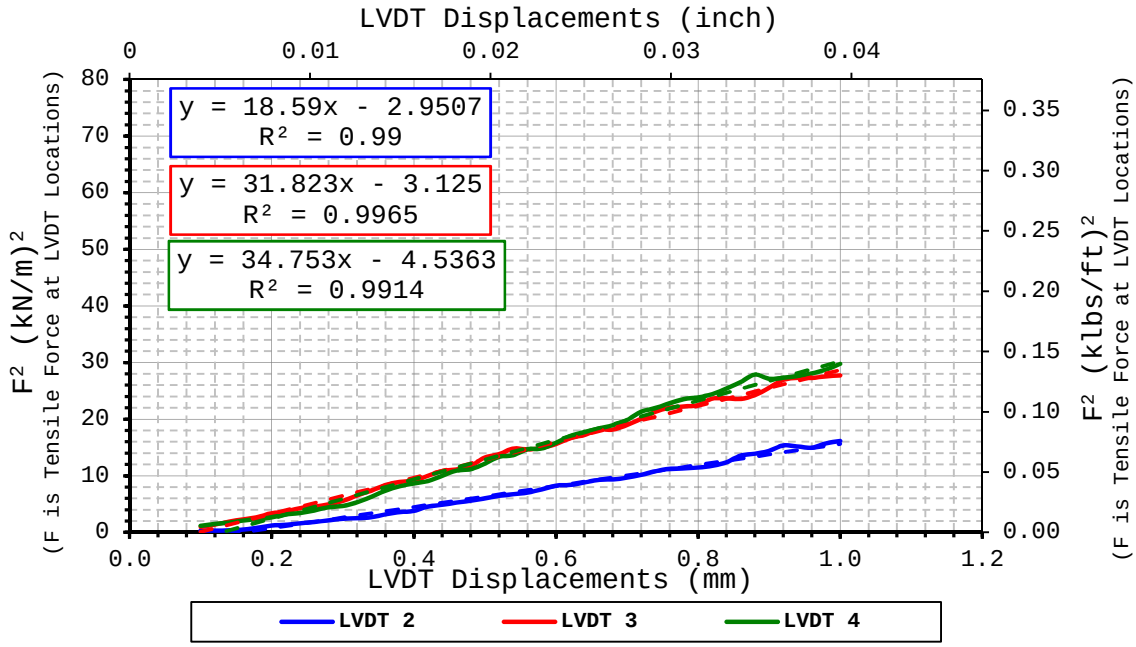
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	19	$(kN/m)^2/mm$	
K_{SGI-3} =	**32**	**$(kN/m)^2/mm$**	
K_{SGI-2} =	35	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/3/2011**
Done by	**Julio Ferreira**
Data file name	**Test 332b GG PP2 CD SAggr2 3psi 2011-08**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tensar Biaxial GG BX1200**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	9	**265**	**248**	**0.066**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.427 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.427 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**769**
Max Pullout Force	F_{max}	**kN/m**	**12.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**26.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.036**
2	**-0.074**
3	**-0.112**
4	**-0.149**
5	**-0.222**

Comments:

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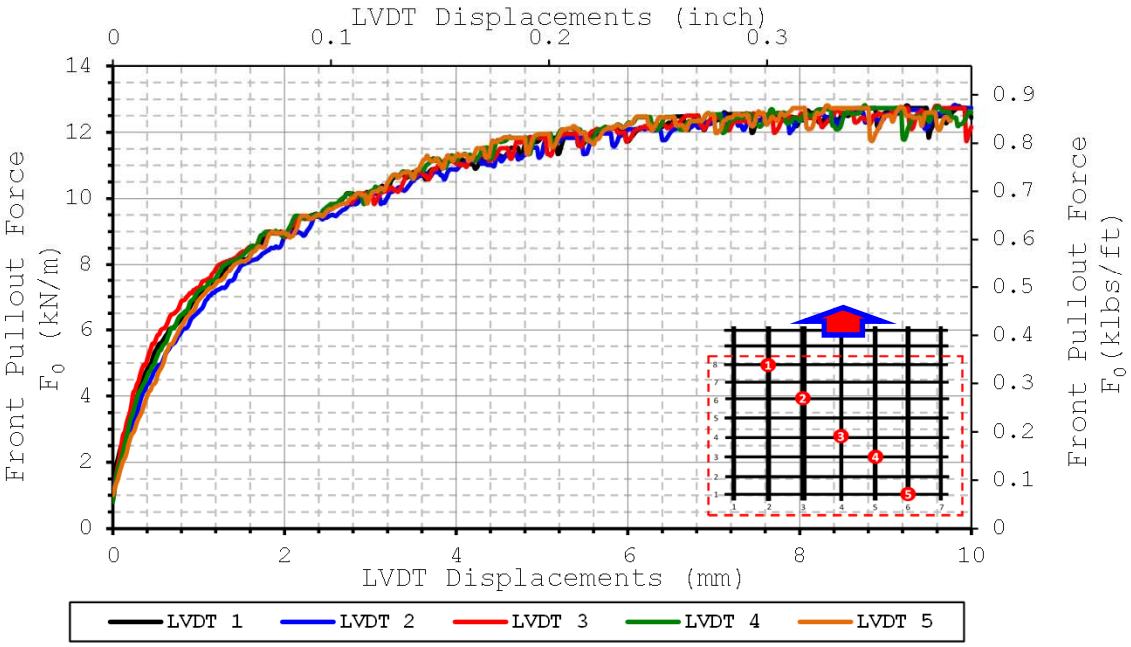
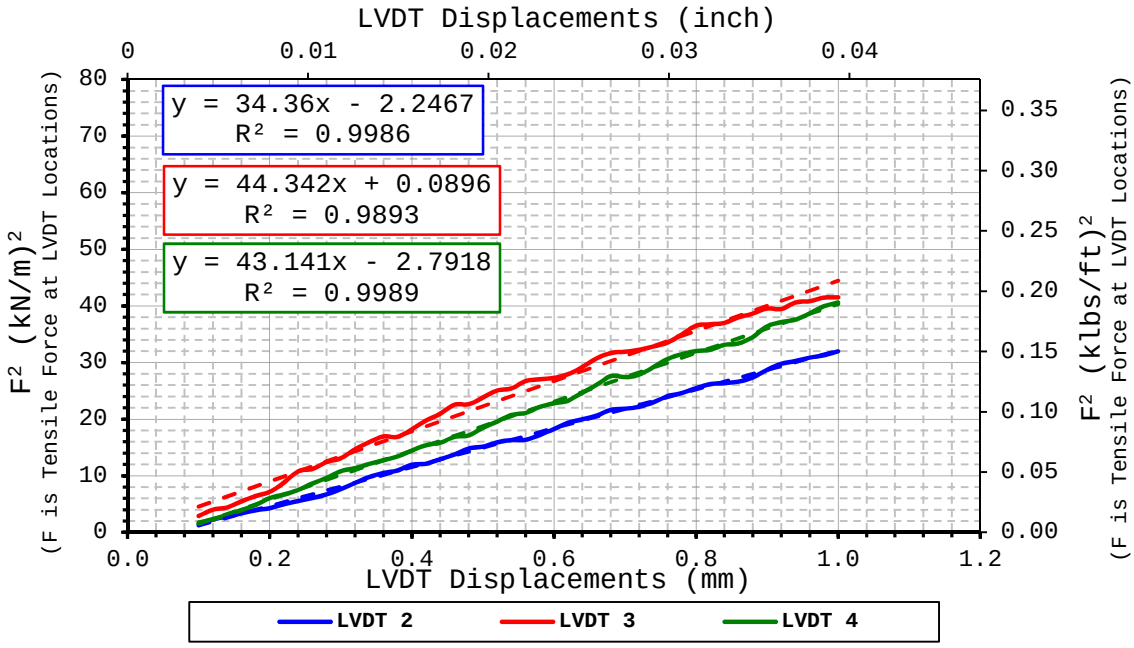
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 34 $(kN/m)^2/mm$

K_{SGI-3} = 44 $(kN/m)^2/mm$

K_{SGI-2} = 43 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/6/2011**
Done by	**Julio Ferreira**
Data file name	**Test 342b GG PP3 CD SAggr2 3psi 2011-08**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	13	**211**	**248**	**0.052**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.507 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.507 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**807**
Max Pullout Force	F_{max}	**kN/m**	**17.0**
Max Shear Stress	τ_{max}	**kN/m^2**	**34.3**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.015**
2	**-0.066**
3	**-0.099**
4	**-0.131**
5	**-0.238**

Comments:

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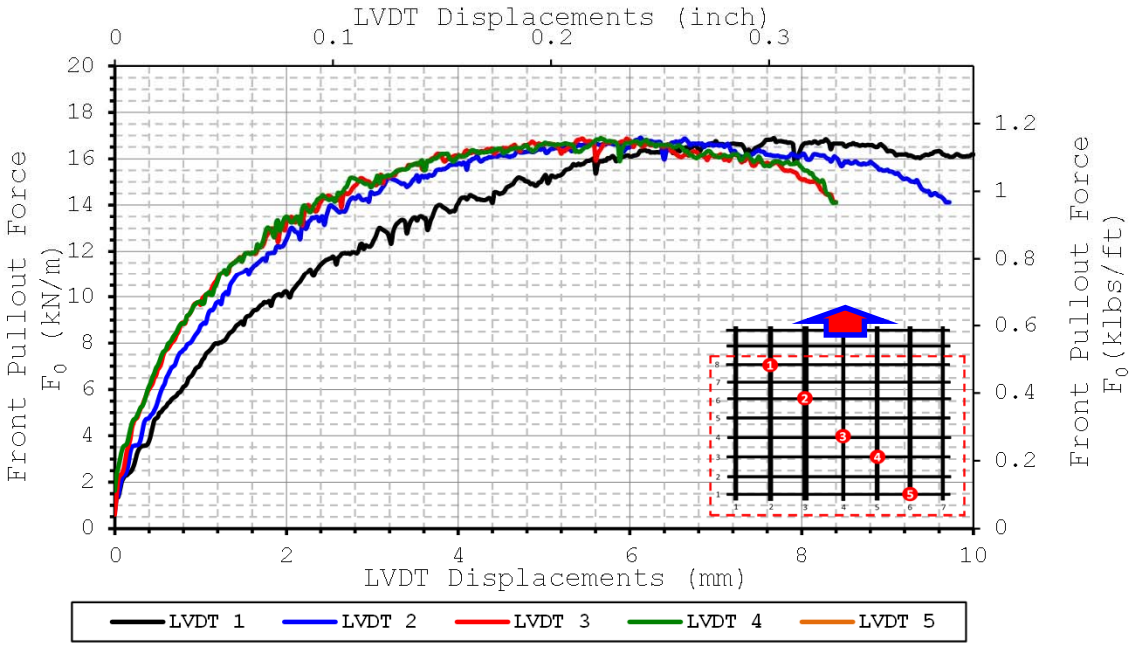
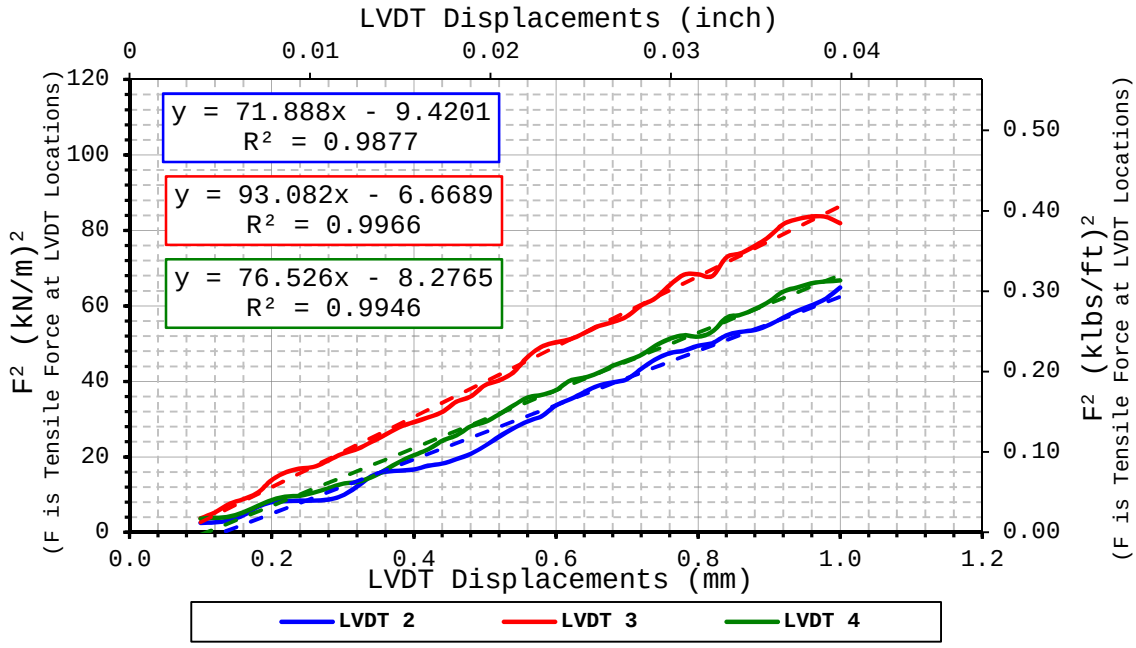
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 72 $(kN/m)^2/mm$

K_{SGI-3} = 93 $(kN/m)^2/mm$

K_{SGI-2} = 77 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/31/2011**
Done by	**Julio Ferreira**
Data file name	**Test 342b GG PP3 CD SAggr2 3psi 2011-08**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	13	**211**	**248**	**0.052**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**792**
Max Pullout Force	F_{max}	**kN/m**	**16.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**33.7**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.010**
2	**-0.061**
3	**-0.095**
4	**-0.129**
5	**-0.213**

Comments:

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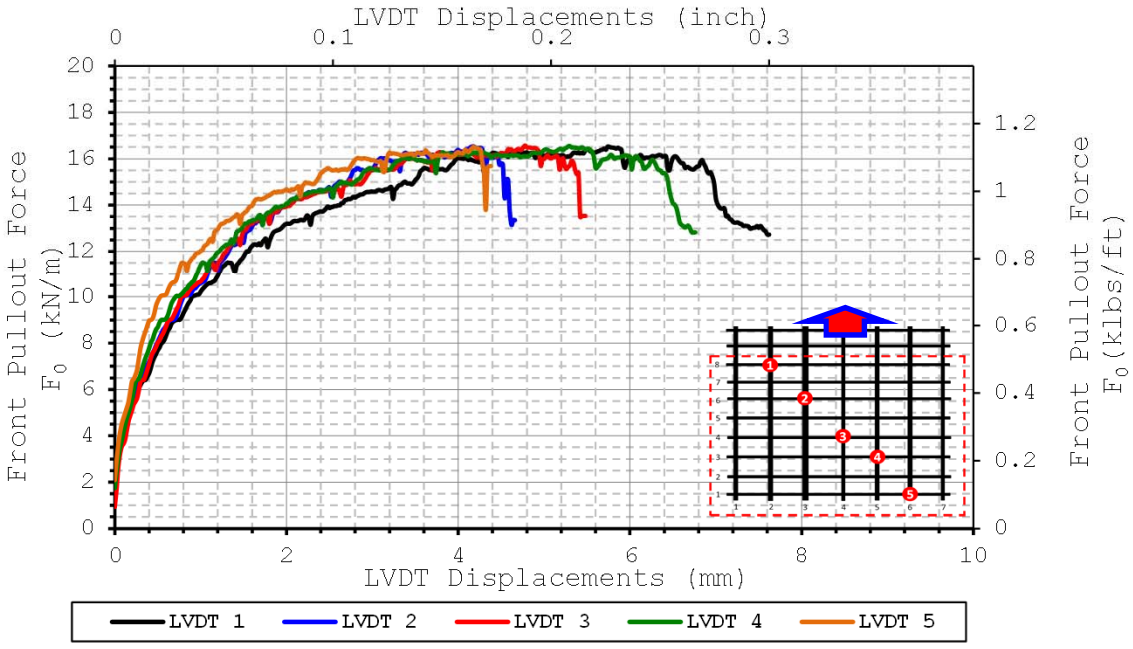
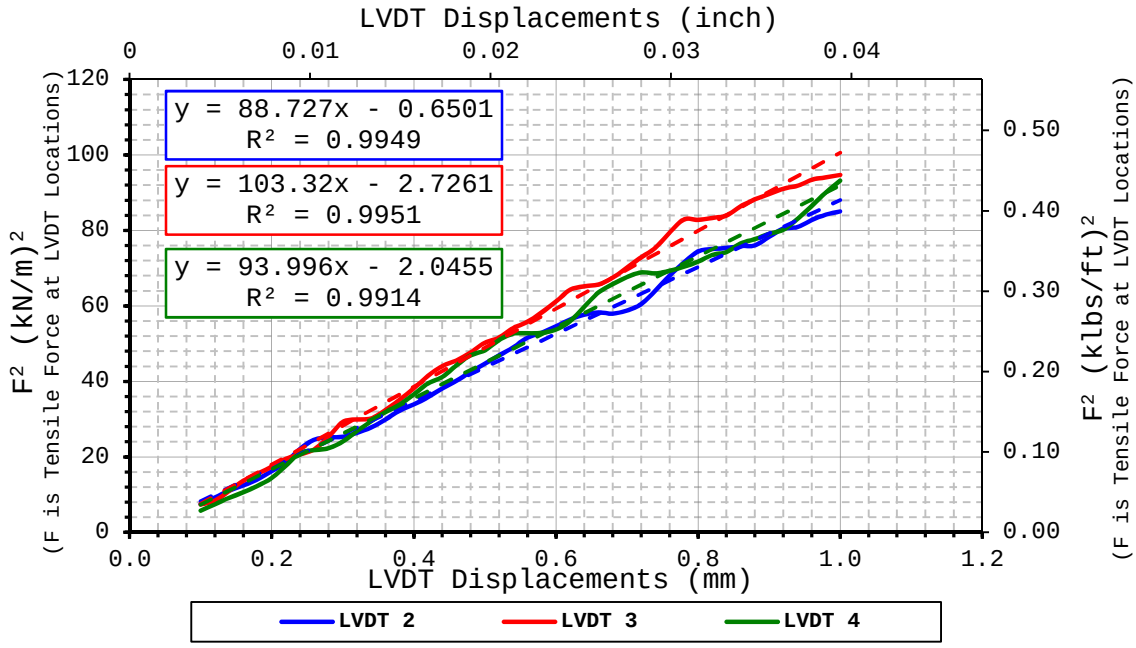
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 89 $(kN/m)^2/mm$

K_{SGI-3} = 103 $(kN/m)^2/mm$

K_{SGI-2} = 94 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**7/22/2011**
Done by	**Julio Ferreira**
Data file name	**Test 312b GG PET CD SAggr2 3psi 2011-07**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi Biaxial GG BasXgrid 11**	**CD**	**PET (Polyester)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	8	**261**	**248**	**0.065**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.516 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.516 g/cm^3**

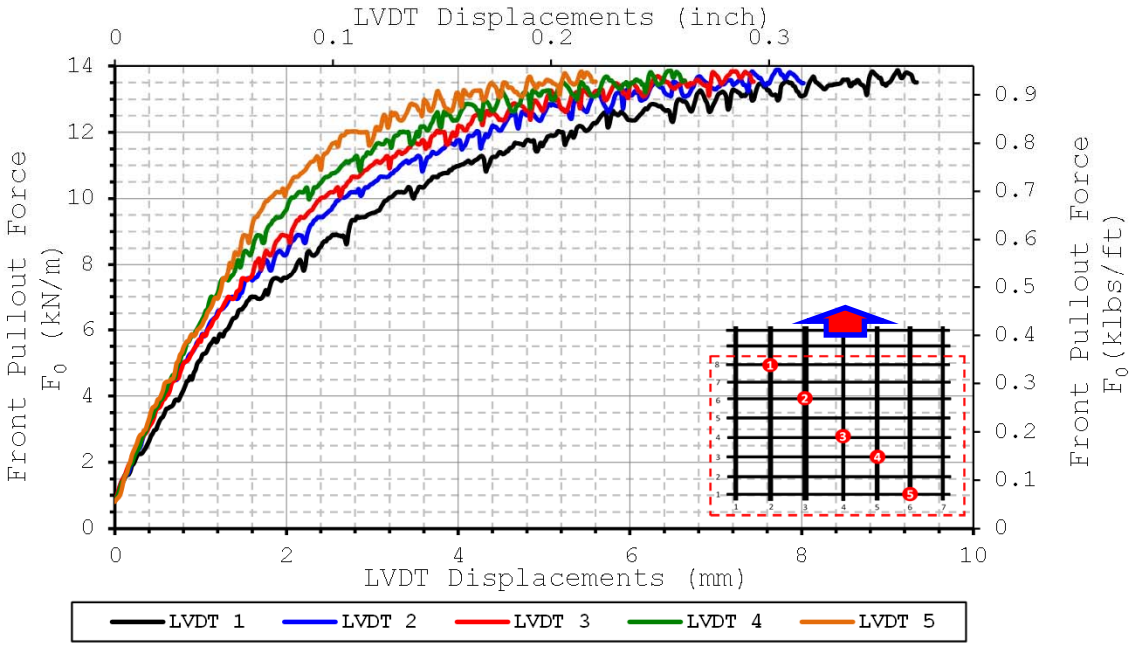
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**817**
Max Pullout Force	F_{max}	**kN/m**	**13.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**28.1**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.027**
2	**-0.083**
3	**-0.111**
4	**-0.167**
5	**-0.223**

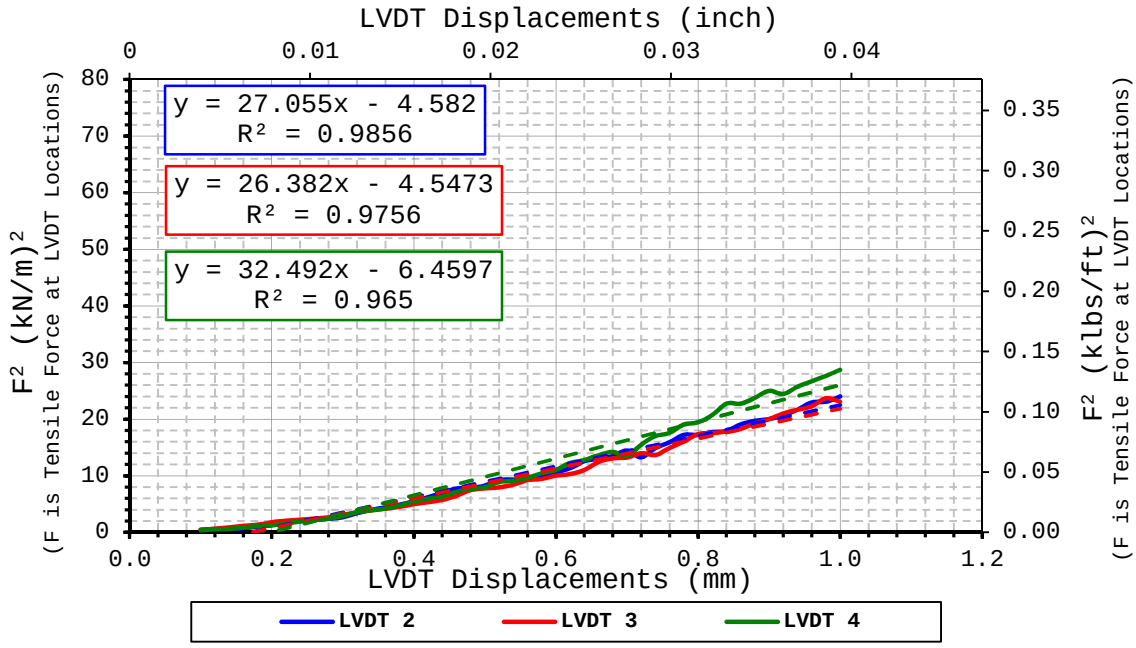
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 27 $(kN/m)^2/mm$

K_{SGI-3} =	26	$(kN/m)^2/mm$

K_{SGI-2} = 32 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**7/25/2011**
Done by	**Julio Ferreira**
Data file name	**Test 312b GG PET CD SAggr2 3psi 2011-07**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi Biaxial GG BasXgrid 11**	**CD**	**PET (Polyester)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	8	**261**	**248**	**0.065**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.493 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.493 g/cm^3**

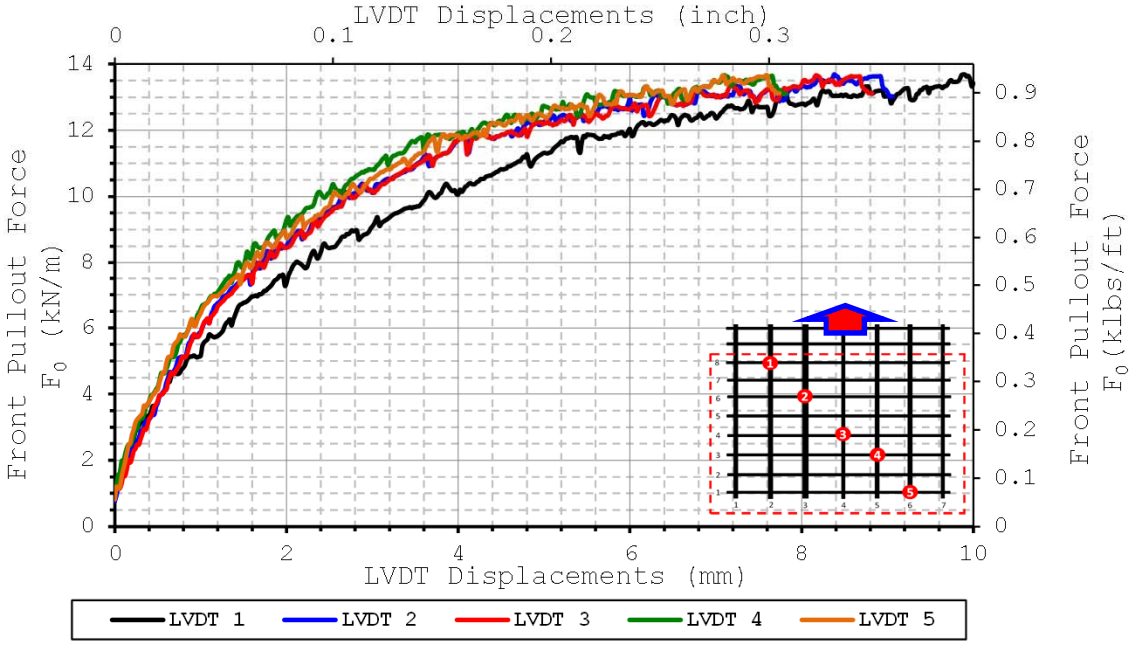
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**807**
Max Pullout Force	F_{max}	**kN/m**	**13.7**
Max Shear Stress	τ_{max}	**kN/m^2**	**27.7**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.030**
2	**-0.086**
3	**-0.113**
4	**-0.169**
5	**-0.225**

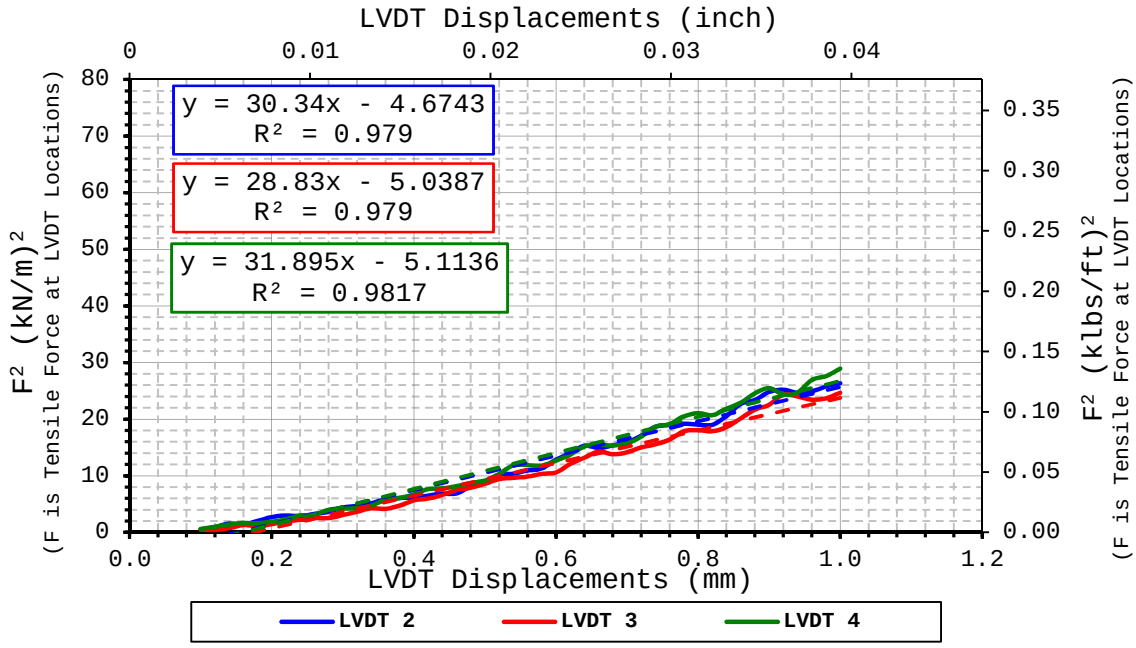
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	30	$(kN/m)^2/mm$
K_{SGI-3} =	**29**	**$(kN/m)^2/mm$**
K_{SGI-2} =	32	$(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**7/26/2011**
Done by	**Julio Ferreira**
Data file name	**Test 312b GG PET CD SAggr2 3psi 2011-07**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi Biaxial GG BasXgrid 11**	**CD**	**PET (Polyester)**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	8	**261**	**248**	**0.065**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.458 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.458 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**712**
Max Pullout Force	F_{max}	**kN/m**	**12.1**
Max Shear Stress	τ_{max}	**kN/m^2**	**24.5**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.027**
2	**-0.083**
3	**-0.111**
4	**-0.167**
5	**-0.224**

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
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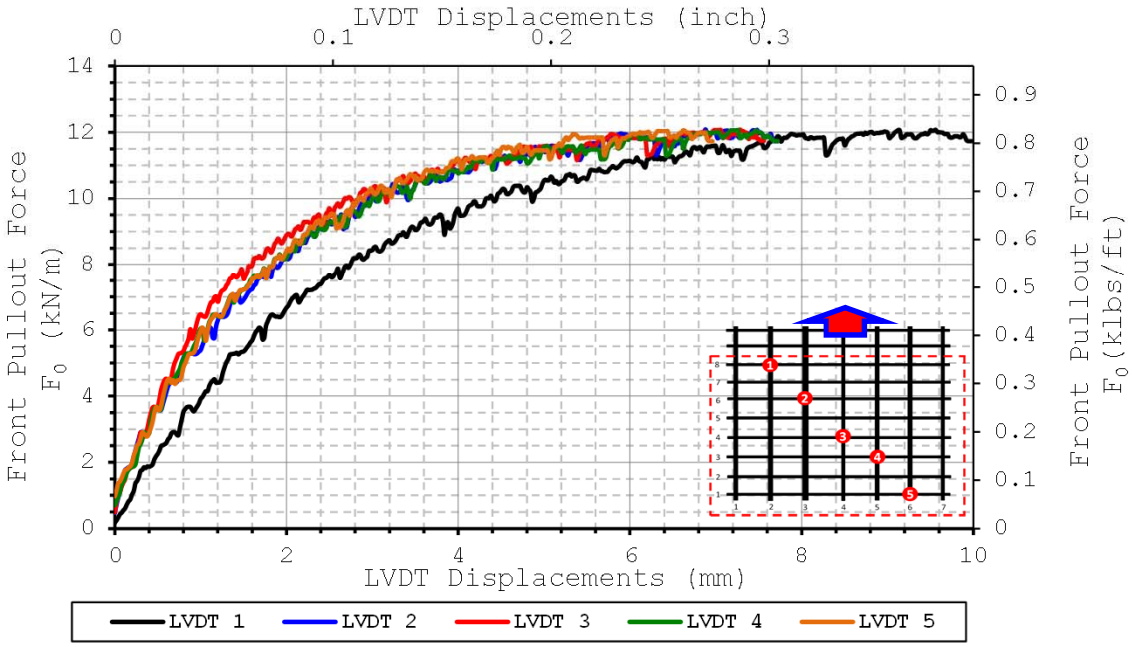
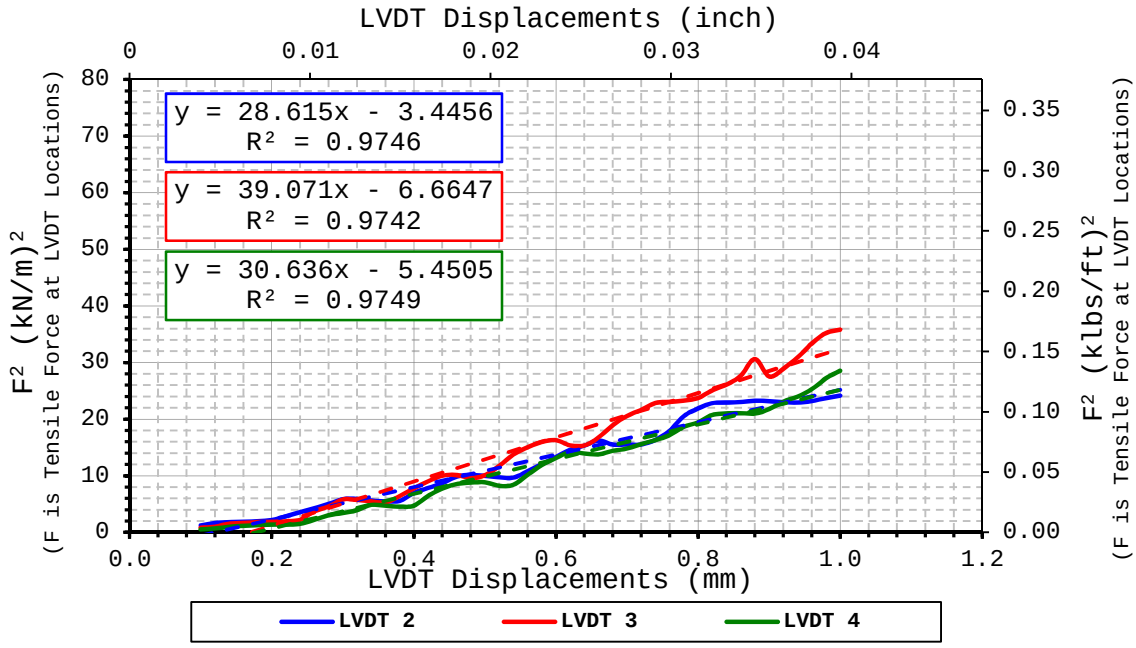
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 29 $(kN/m)^2/mm$

K_{SGI-3} = 39 $(kN/m)^2/mm$

K_{SGI-2} = 31 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**7/29/2011**
Done by	**Julio Ferreira**
Data file name	**Test 352b GG PP4 CD SAggr2 3psi 2011-07**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Mirafi Biaxial GG BasXgrid 11**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	7	**335**	**248**	**0.083**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**g/cm^3**

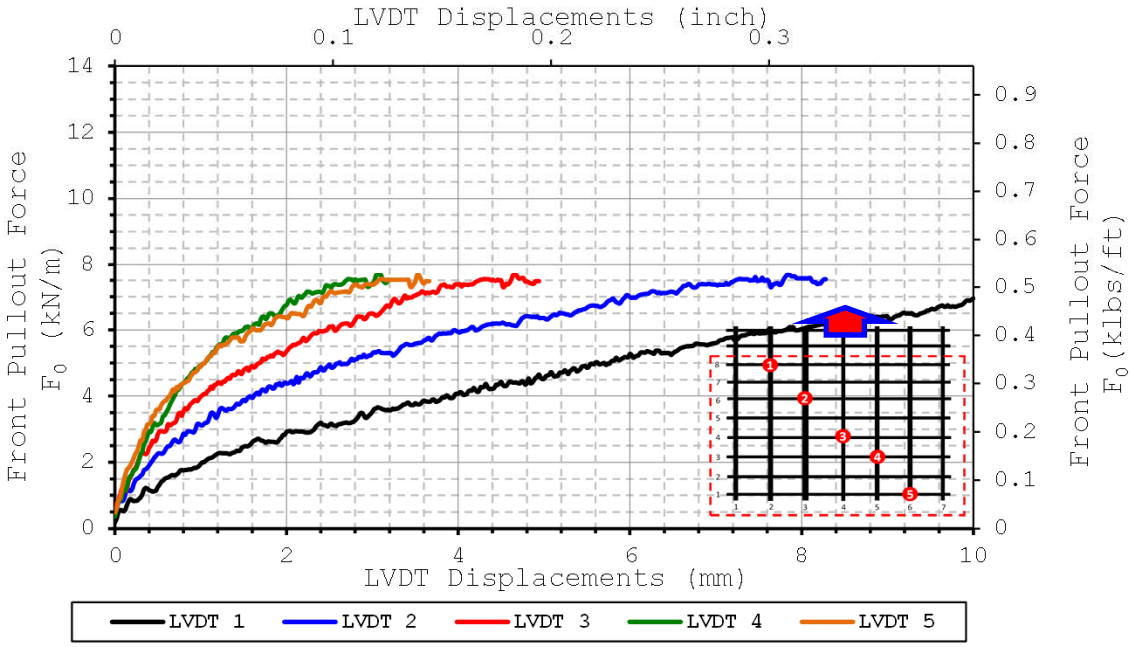
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**585**
Max Pullout Force	F_{max}	**kN/m**	**7.8**
Max Shear Stress	τ_{max}	**kN/m^2**	**15.7**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.238**
2	**-0.238**
3	**-0.238**
4	**-0.238**
5	**-0.238**

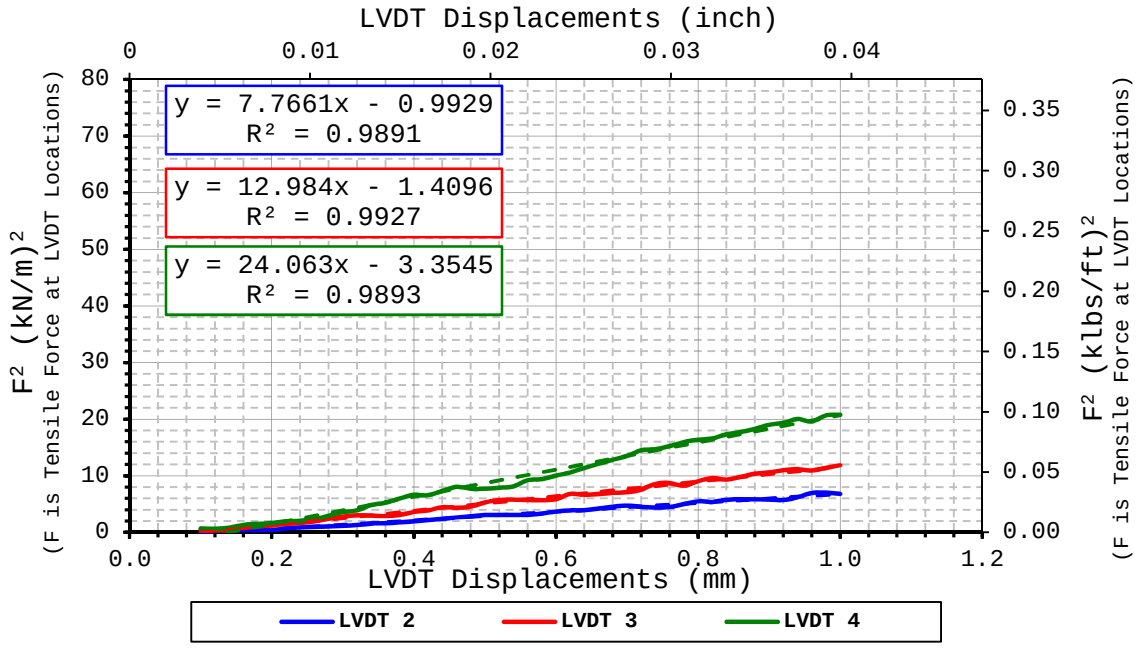
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 8 (kN/m)^2/mm

K_{SGI-3} = 13 (kN/m)^2/mm

K_{SGI-2} = 24 (kN/m)^2/mm

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/15/2011**
Done by	**Julio Ferreira**
Data file name	**Test 362b GG PP4x2 CD SAggr2 3psi 2011-(**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	14	**304**	**248**	**0.075**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.480 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.480 g/cm^3**

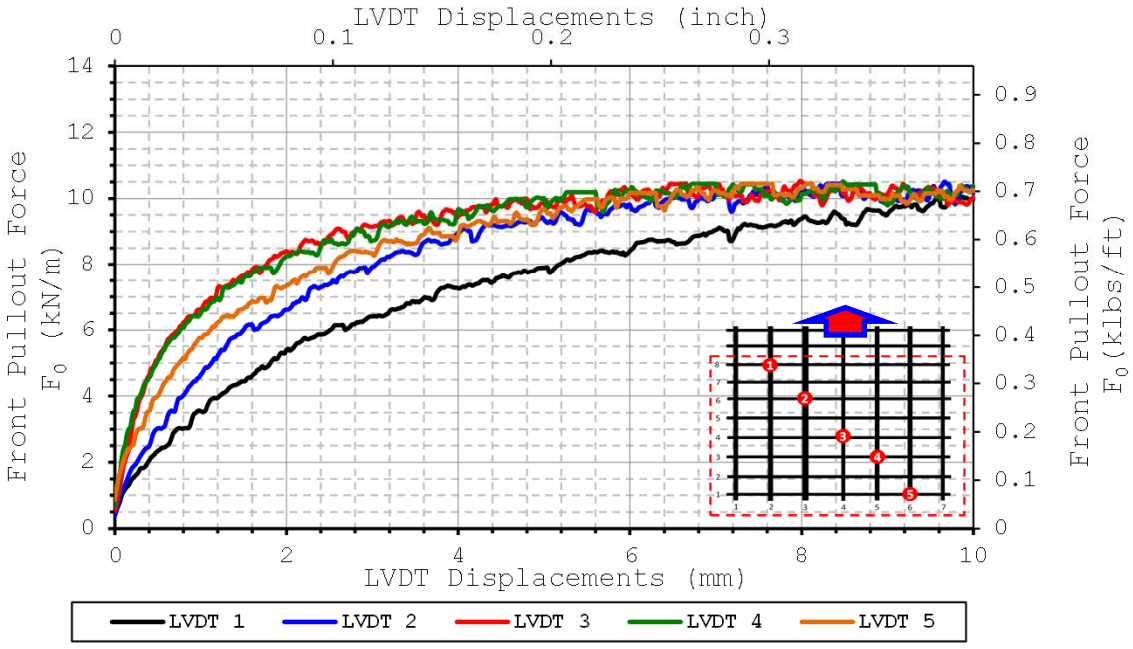
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**724**
Max Pullout Force	F_{max}	**kN/m**	**10.6**
Max Shear Stress	τ_{max}	**kN/m^2**	**21.4**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.011**
2	**-0.065**
3	**-0.119**
4	**-0.172**
5	**-0.225**

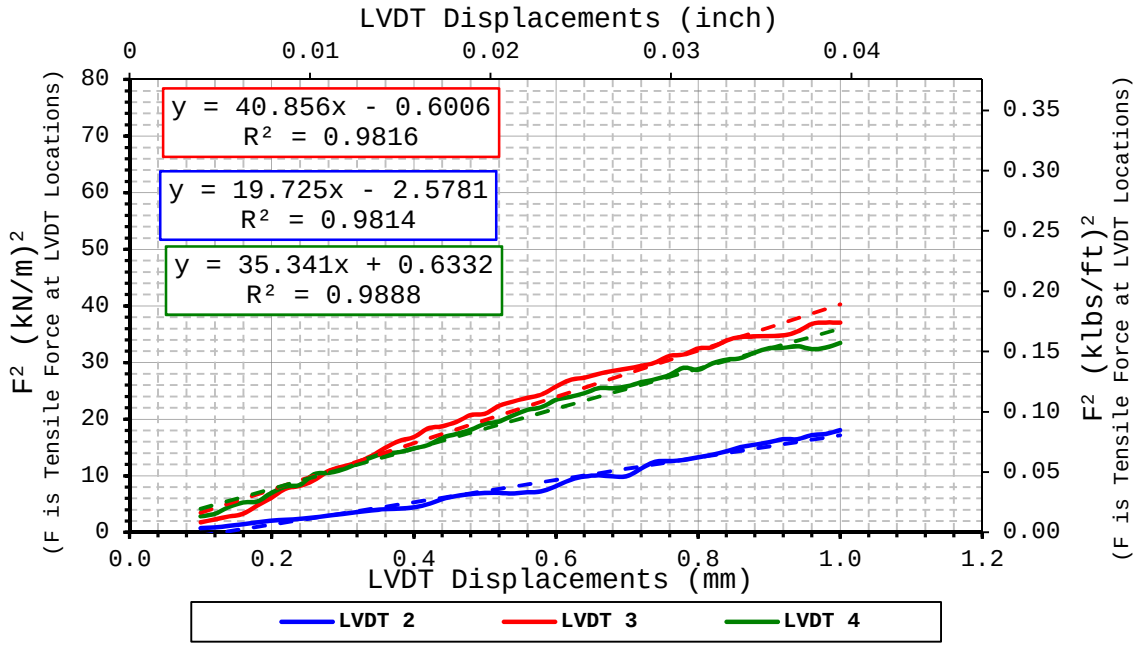
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 20 $(kN/m)^2/mm$

K_{SGI-3} = 41 $(kN/m)^2/mm$

K_{SGI-2} = 35 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/18/2011**
Done by	**Julio Ferreira**
Data file name	**Test 362b GG PP4x2 CD SAggr2 3psi 2011-**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	14	**304**	**248**	**0.075**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.489 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.489 g/cm^3**

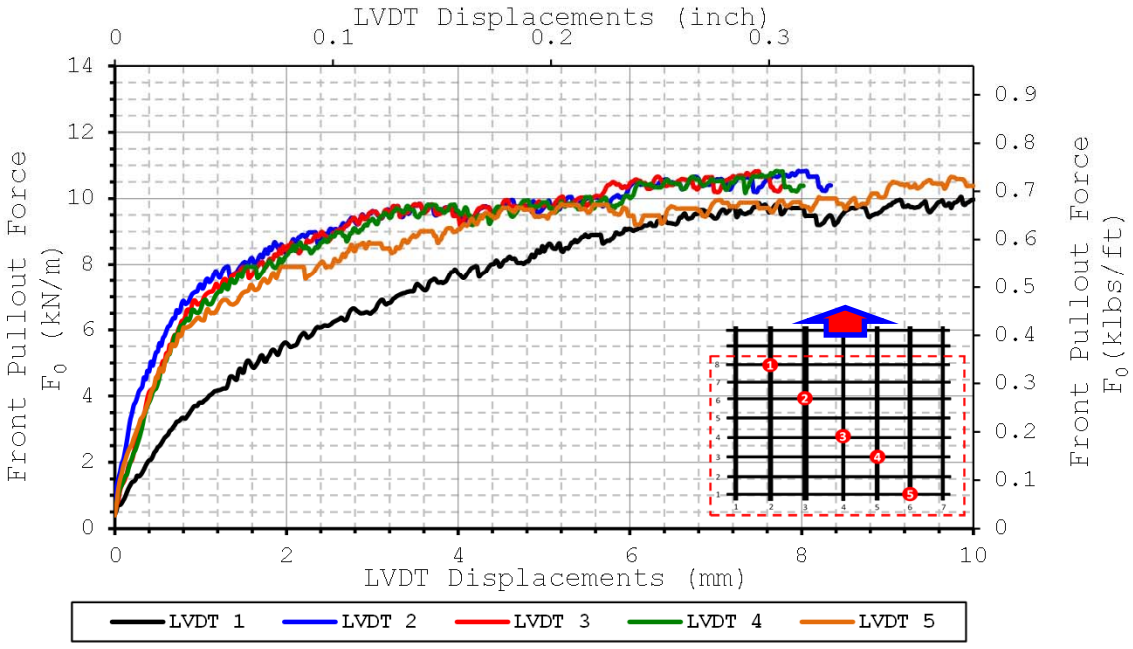
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**747**
Max Pullout Force	F_{max}	**kN/m**	**10.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**22.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.010**
2	**-0.062**
3	**-0.113**
4	**-0.166**
5	**-0.218**

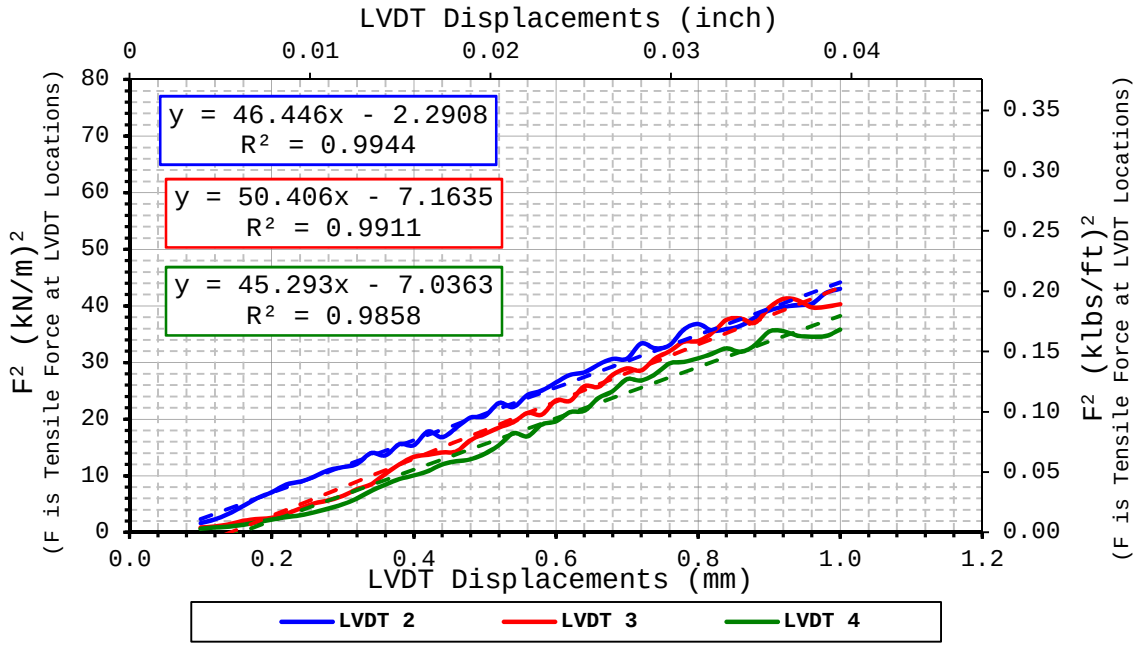
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 46 $(kN/m)^2/mm$

K_{SGI-3} = 50 $(kN/m)^2/mm$

K_{SGI-2} = 45 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/23/2011 am**
Done by	**Julio Ferreira**
Data file name	**Test 362b GG PP4x2 CD SAggr2 3psi 2011-(**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	14	**304**	**248**	**0.075**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.498 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.498 g/cm^3**

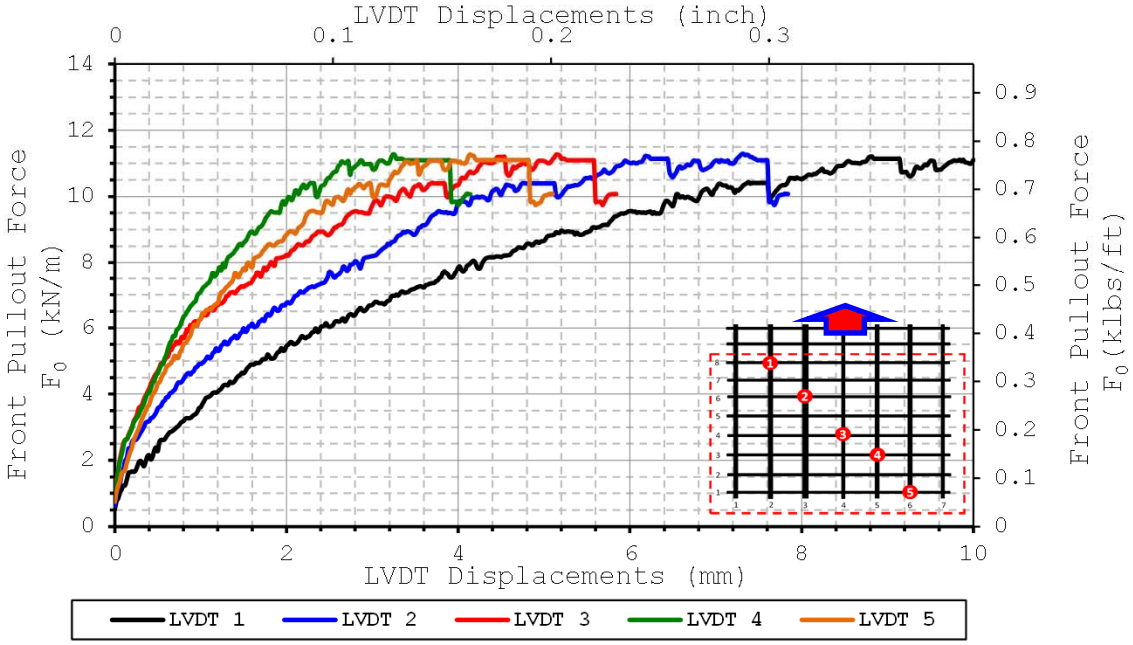
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**775**
Max Pullout Force	F_{max}	**kN/m**	**11.3**
Max Shear Stress	τ_{max}	**kN/m^2**	**22.9**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.011**
2	**-0.062**
3	**-0.115**
4	**-0.166**
5	**-0.217**

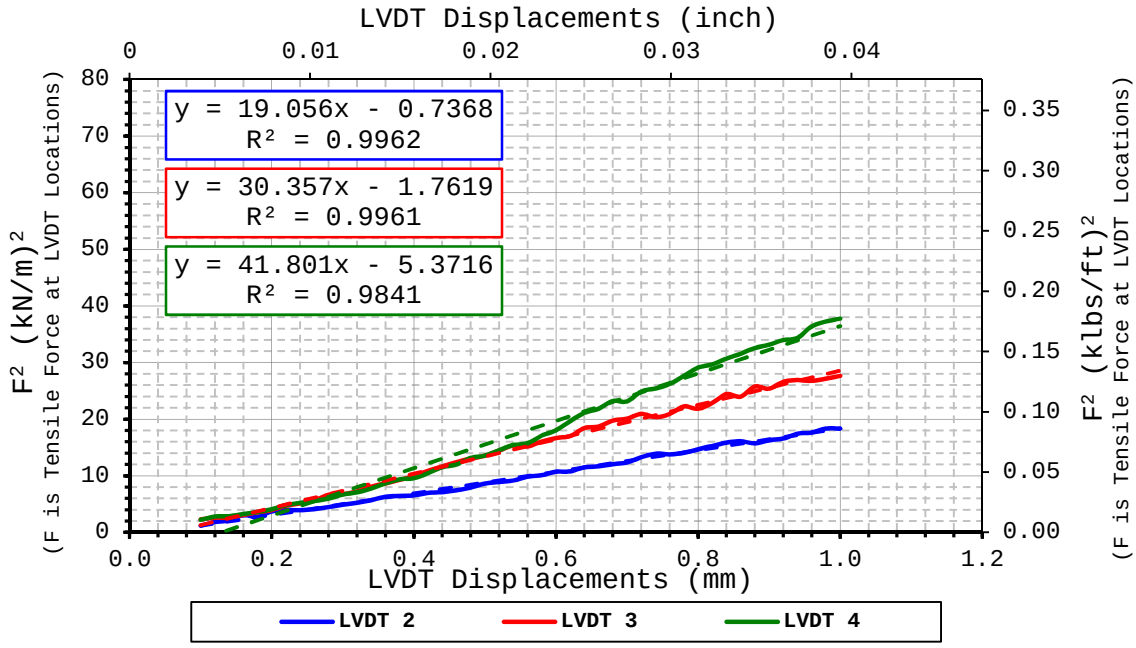
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	19	$(kN/m)^2/mm$
K_{SGI-3} =	**30**	**$(kN/m)^2/mm$**
K_{SGI-2} =	42	$(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/24/2011 pm**
Done by	**Julio Ferreira**
Data file name	**Test 362b GG PP4x2 CD SAggr2 3psi 2011-(**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Tenax Biaxial GG MS220**	**CD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	14	**304**	**248**	**0.075**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.502 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.502 g/cm^3**

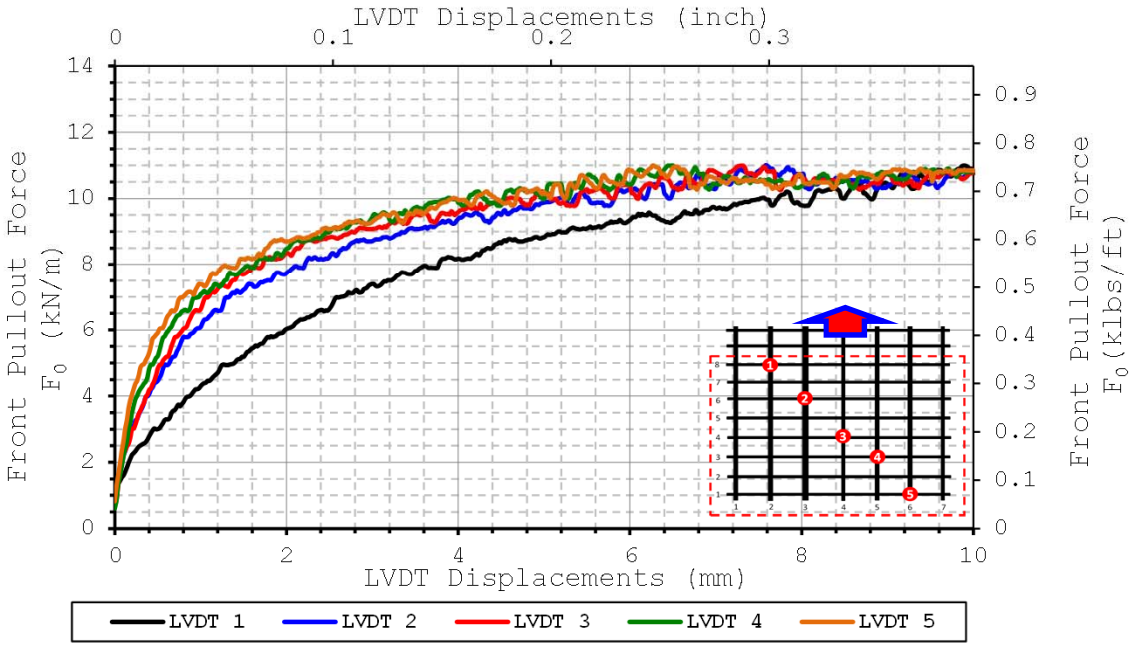
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**754**
Max Pullout Force	F_{max}	**kN/m**	**11.0**
Max Shear Stress	τ_{max}	**kN/m^2**	**22.3**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.014**
2	**-0.064**
3	**-0.116**
4	**-0.168**
5	**-0.219**

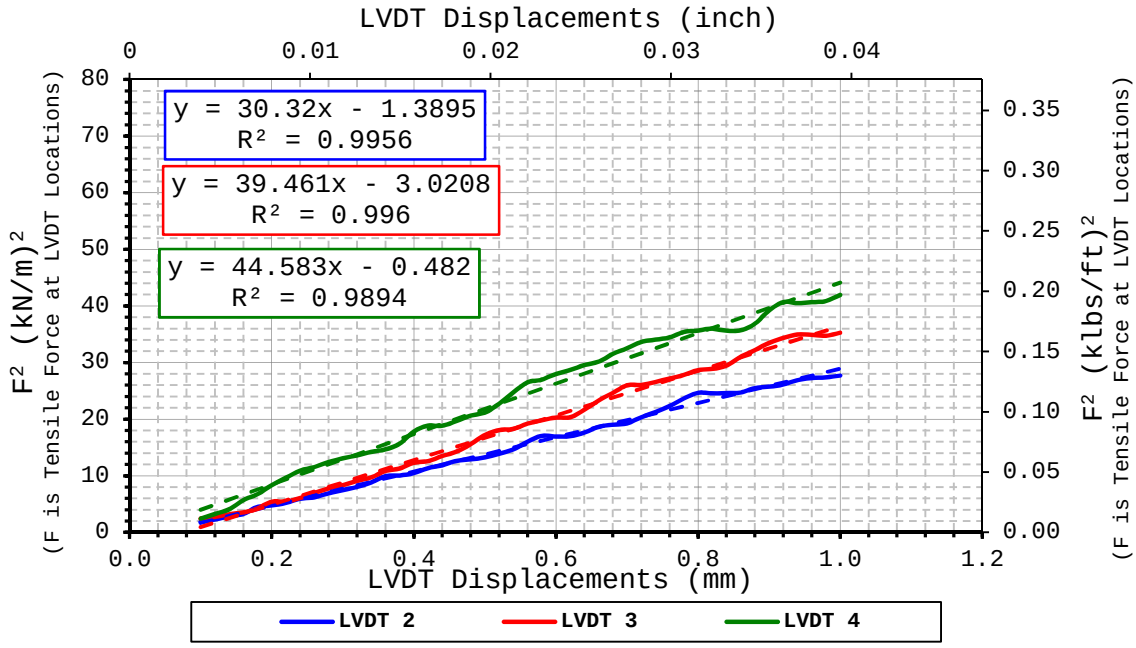
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	30	$(kN/m)^2/mm$	
K_{SGI-3} =	**39**	**$(kN/m)^2/mm$**	
K_{SGI-2} =	45	$(kN/m)^2/mm$	

Comments:

Small Pullout Test

Sieved Aggregate 2 – MD – 3psi

Results of the tests up to 8/31/2011

The University of Texas at Austin

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**7/14/2011**
Done by	**Julio Ferreira**
Data file name	**Test 340b GG PP3 MD SAggr2 3psi 2011-07-**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.529 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.529 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**756**
Max Pullout Force	F_{max}	**kN/m**	**9.2**
Max Shear Stress	τ_{max}	**kN/m^2**	**18.6**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.004**
2	**-0.048**
3	**-0.091**
4	**-0.135**
5	**-0.222**

Comments: Unwashed Aggregates were used in this test.

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Department of Civil, Evironmental and Architectural Engineering
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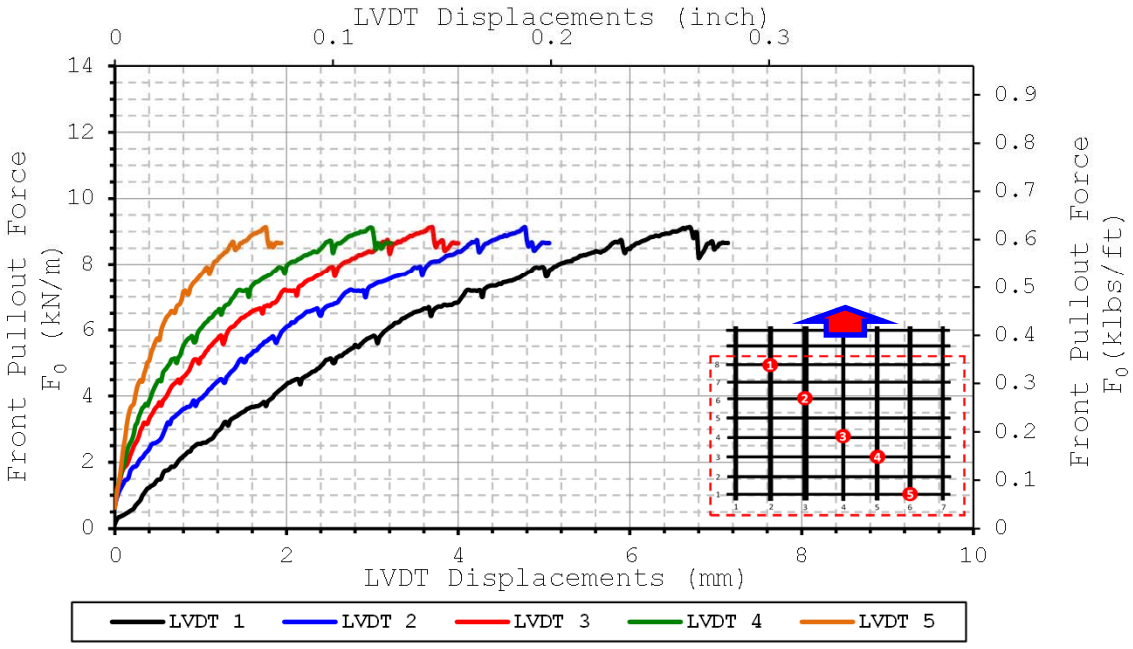
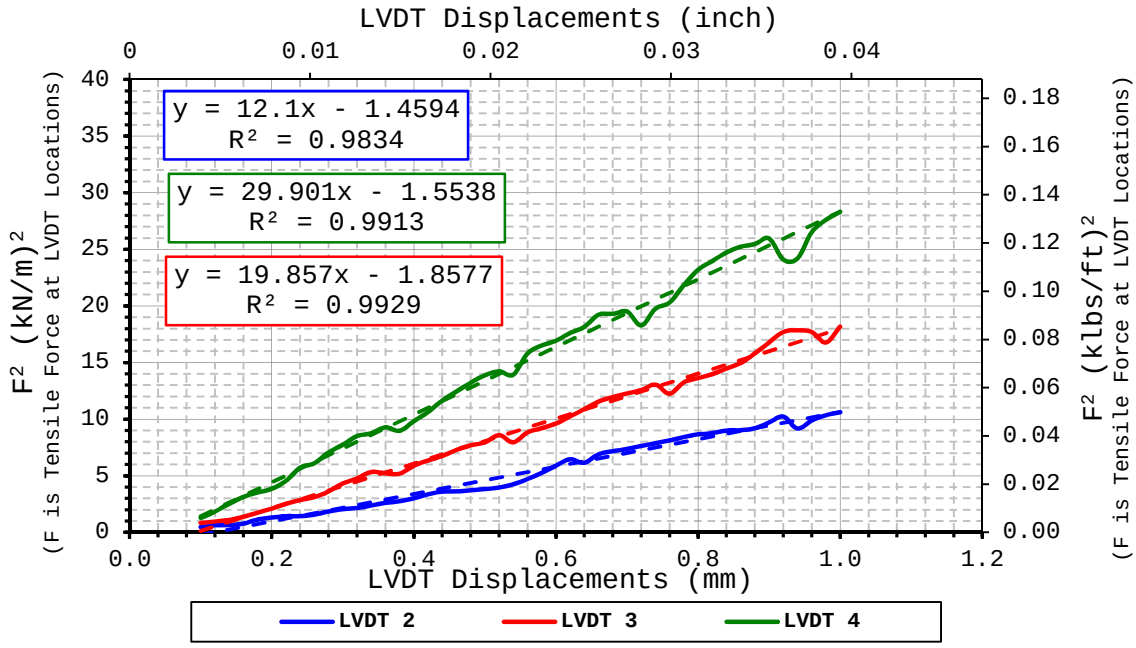
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	12	$(kN/m)^2/mm$
K_{SGI-3} =	**20**	**$(kN/m)^2/mm$**
K_{SGI-2} =	30	$(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**7/19/2011**
Done by	**Julio Ferreira**
Data file name	**Test 340b GG PP3 MD SAggr2 3psi 2011-07-**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.467 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.467 g/cm^3**

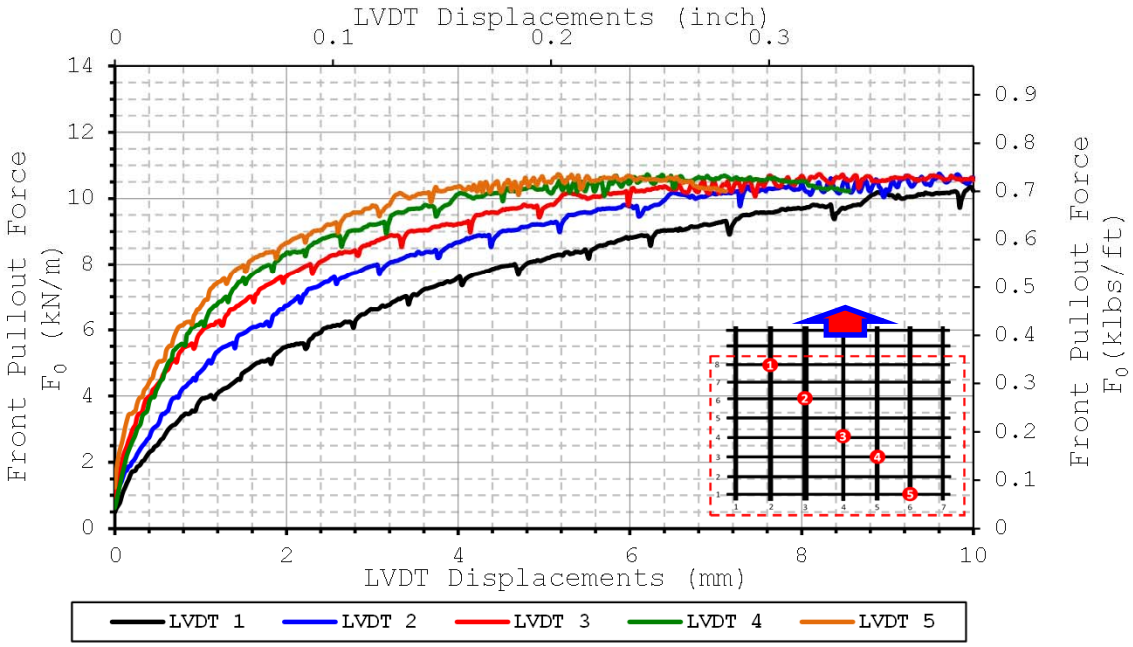
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**887**
Max Pullout Force	F_{max}	**kN/m**	**10.8**
Max Shear Stress	τ_{max}	**kN/m^2**	**21.8**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.010**
2	**-0.054**
3	**-0.097**
4	**-0.141**
5	**-0.229**

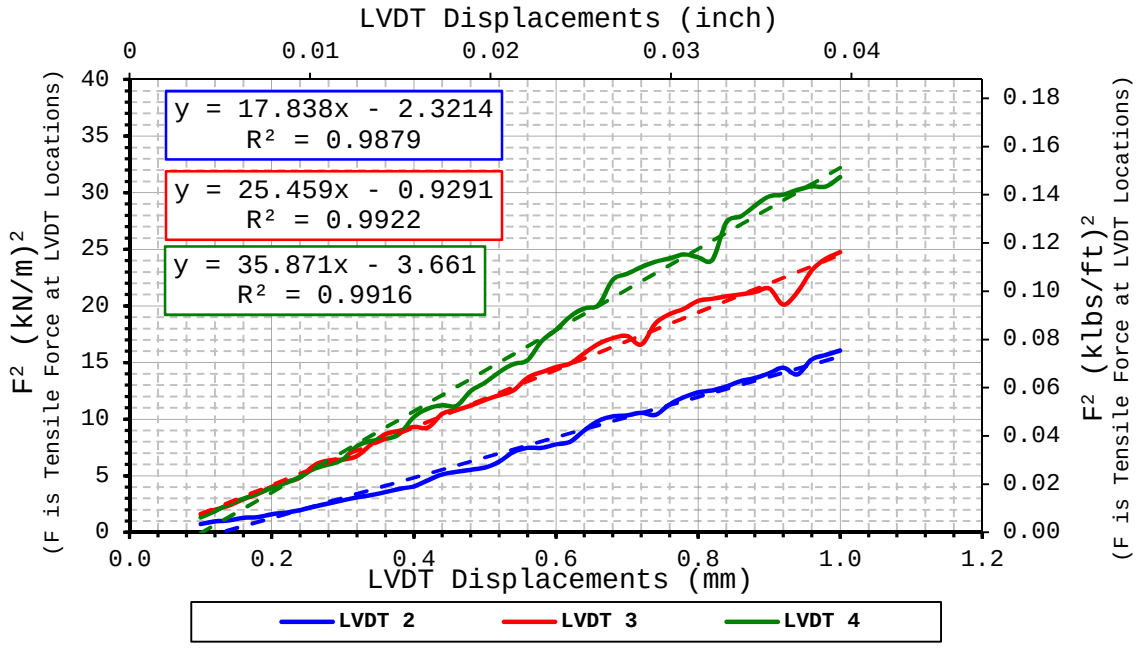
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} =	18	$(kN/m)^2/mm$	
K_{SGI-3} =	25	$(kN/m)^2/mm$	
K_{SGI-2} =	36	$(kN/m)^2/mm$	

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**7/20/2011**
Done by	**Julio Ferreira**
Data file name	**Test 340b GG PP3 MD SAggr2 3psi 2011-07-**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.471 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.471 g/cm^3**

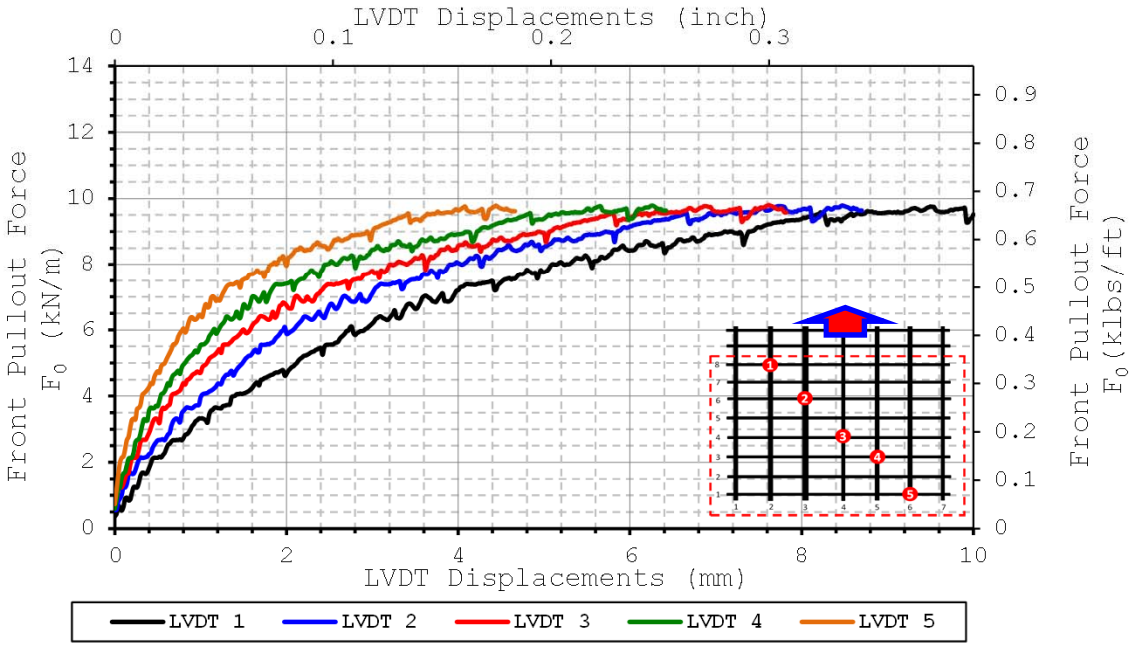
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**811**
Max Pullout Force	F_{max}	**kN/m**	**9.9**
Max Shear Stress	τ_{max}	**kN/m^2**	**20.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.012**
2	**-0.055**
3	**-0.099**
4	**-0.143**
5	**-0.229**

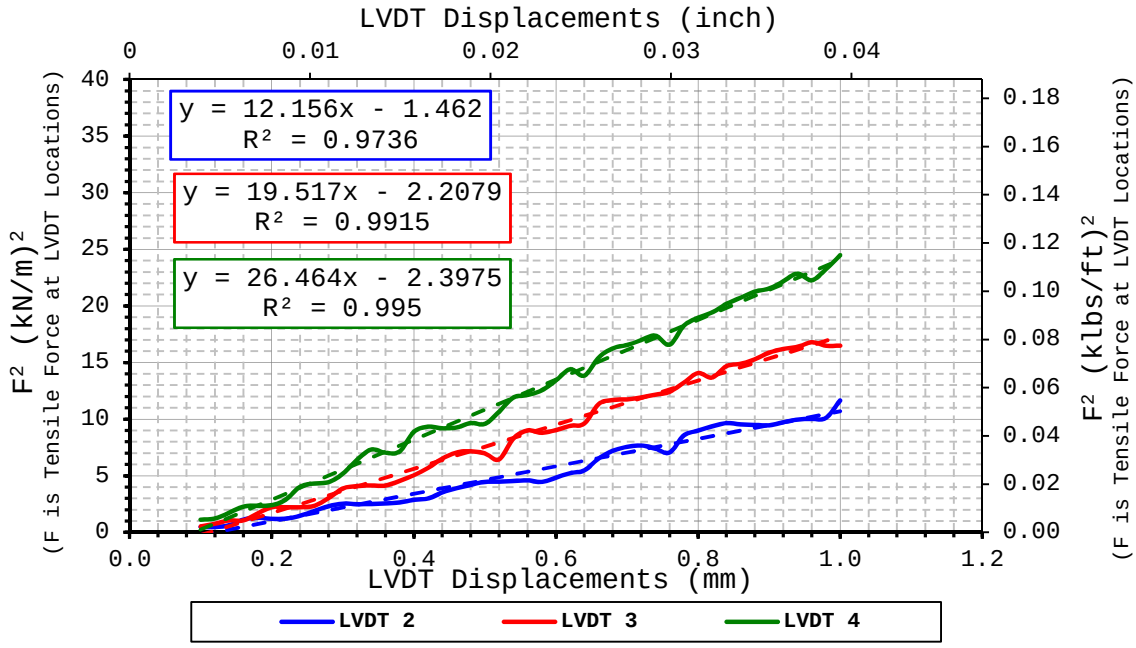
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 12 $(kN/m)^2/mm$

K_{SGI-3} = 20 $(kN/m)^2/mm$

K_{SGI-2} = 26 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**7/21/2011**
Done by	**Julio Ferreira**
Data file name	**Test 340b GG PP3 MD SAggr2 3psi 2011-0**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.547 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.547 g/cm^3**

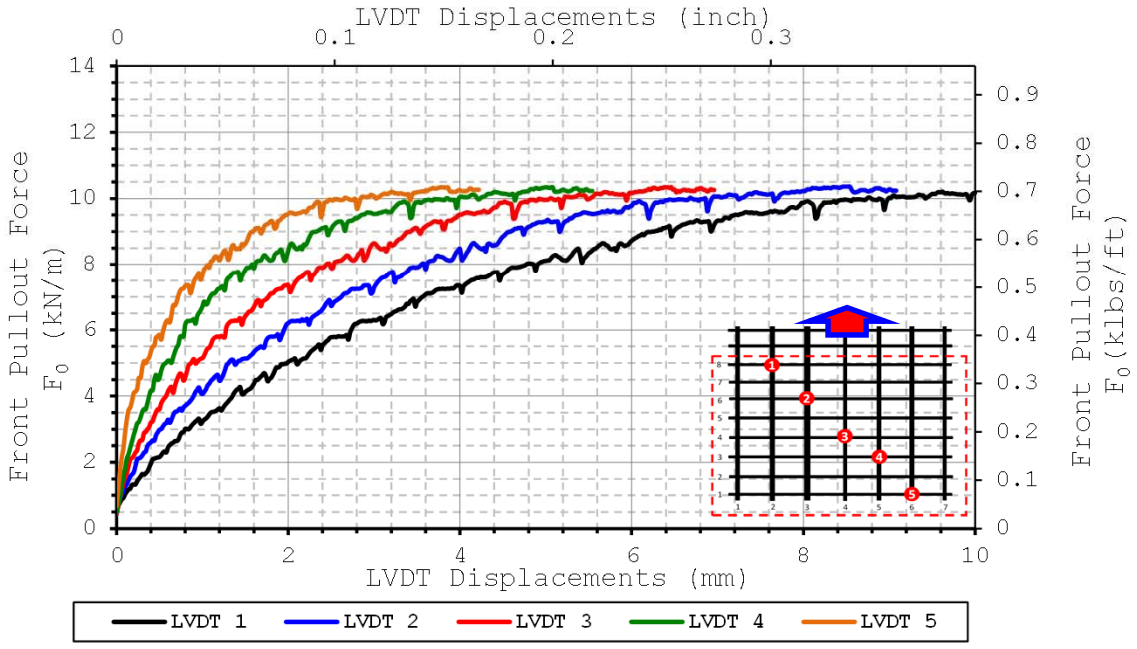
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**851**
Max Pullout Force	F_{max}	**kN/m**	**10.4**
Max Shear Stress	τ_{max}	**kN/m^2**	**21.0**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.009**
2	**-0.053**
3	**-0.096**
4	**-0.140**
5	**-0.226**

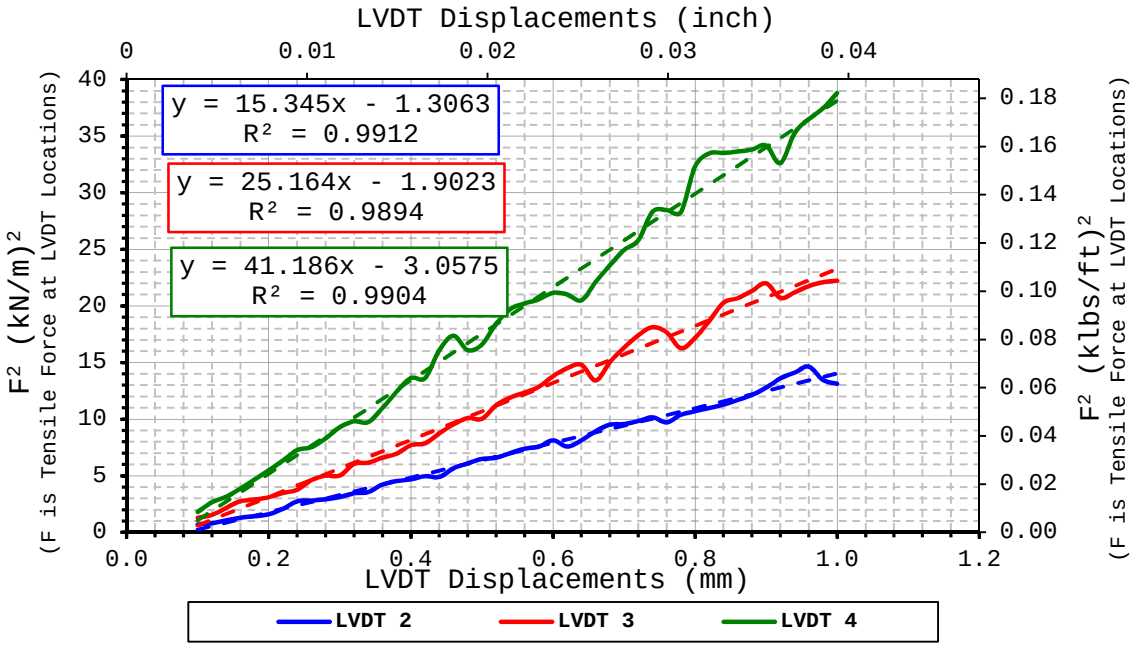
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 15 $(kN/m)^2/mm$

K_{SGI-3} = 25 $(kN/m)^2/mm$

K_{SGI-2} = 41 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/24/2011**
Done by	**Julio Ferreira**
Data file name	**Test 340b GG PP3 MD SAggr2 3psi 2011-08-**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.502 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.502 g/cm^3**

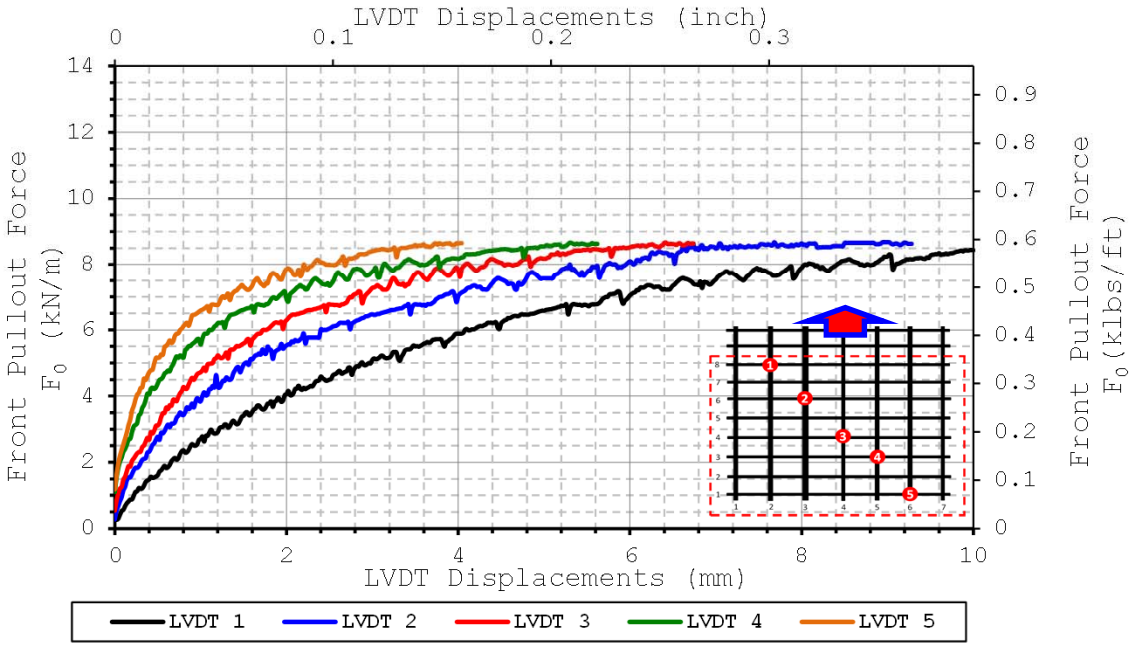
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**723**
Max Pullout Force	F_{max}	**kN/m**	**8.8**
Max Shear Stress	τ_{max}	**kN/m^2**	**17.8**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.011**
2	**-0.055**
3	**-0.098**
4	**-0.143**
5	**-0.229**

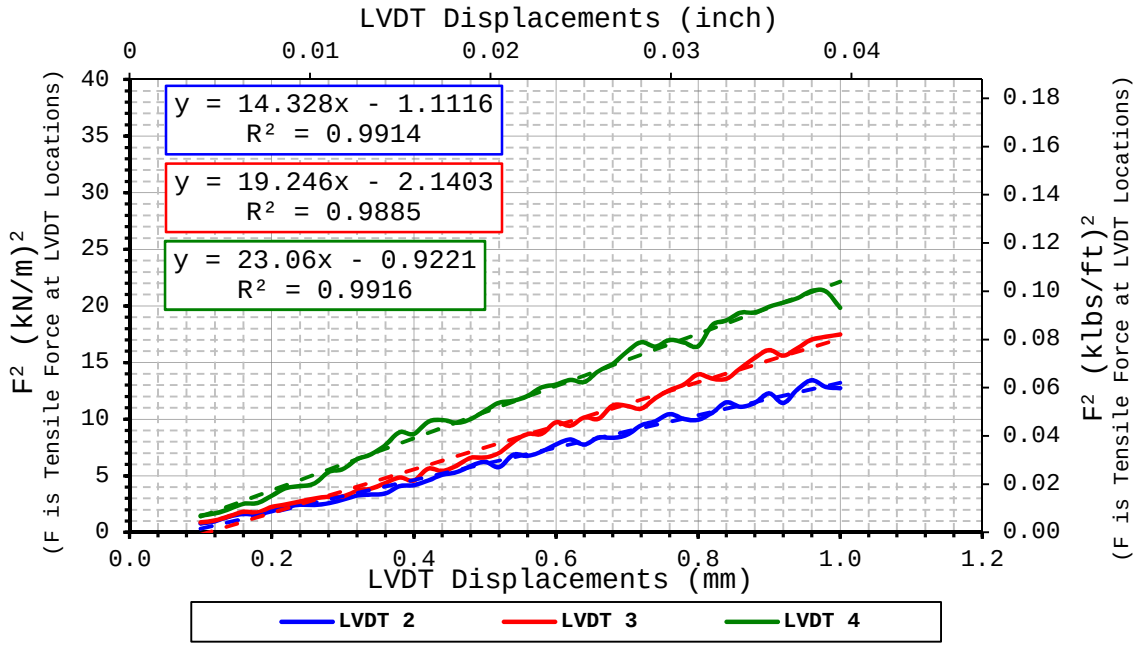
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 14 $(kN/m)^2/mm$

K_{SGI-3} = 19 $(kN/m)^2/mm$

K_{SGI-2} = 23 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/25/2011**
Done by	**Julio Ferreira**
Data file name	**Test 340b GG PP3 MD SAggr2 3psi 2011-08-**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.502 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.502 g/cm^3**

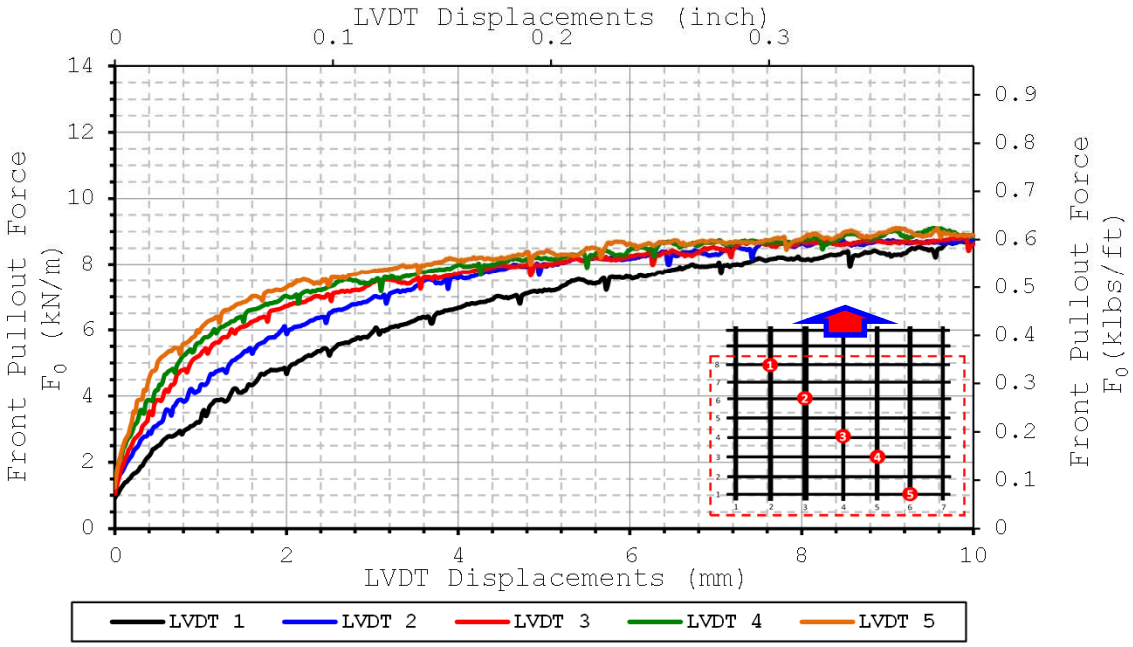
RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**754**
Max Pullout Force	F_{max}	**kN/m**	**9.2**
Max Shear Stress	τ_{max}	**kN/m^2**	**18.6**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.011**
2	**-0.054**
3	**-0.097**
4	**-0.140**
5	**-0.226**

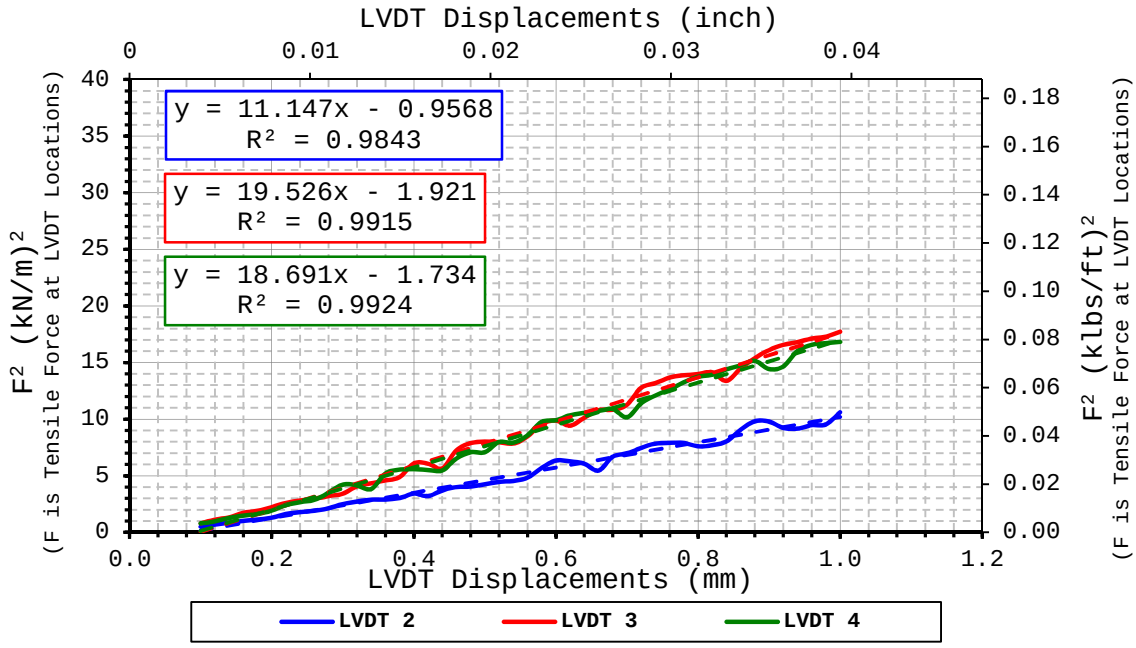
Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 11 $(kN/m)^2/mm$

K_{SGI-3} = 20 $(kN/m)^2/mm$

K_{SGI-2} = 19 $(kN/m)^2/mm$

Comments:

THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Civil, Evironmental and Architectural Engineering
Geotechnical Engineering Program - Geosynthetics and Geoenvironmental Laboratory

SMALL PULLOUT TEST

Date test conducted	**8/26/2011**
Done by	**Julio Ferreira**
Data file name	**Test 340b GG PP3 MD SAggr2 3psi 2011-08-**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.516 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.516 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**763**
Max Pullout Force	F_{max}	**kN/m**	**9.3**
Max Shear Stress	τ_{max}	**kN/m^2**	**18.8**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.015**
2	**-0.060**
3	**-0.105**
4	**-0.147**
5	**-0.233**

Comments:

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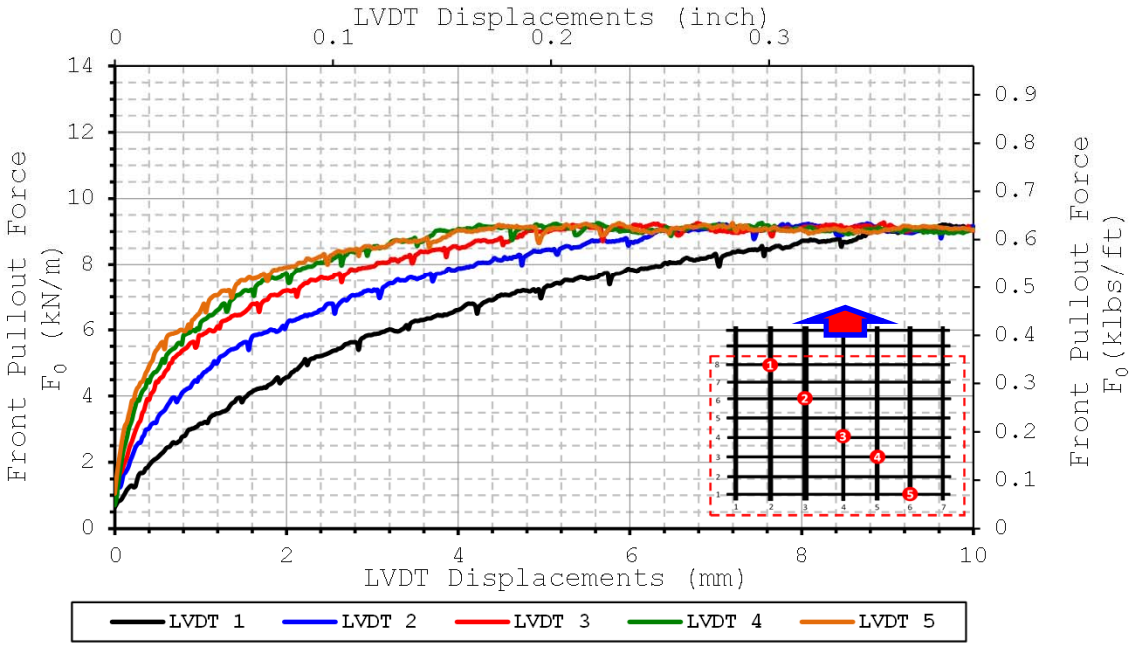
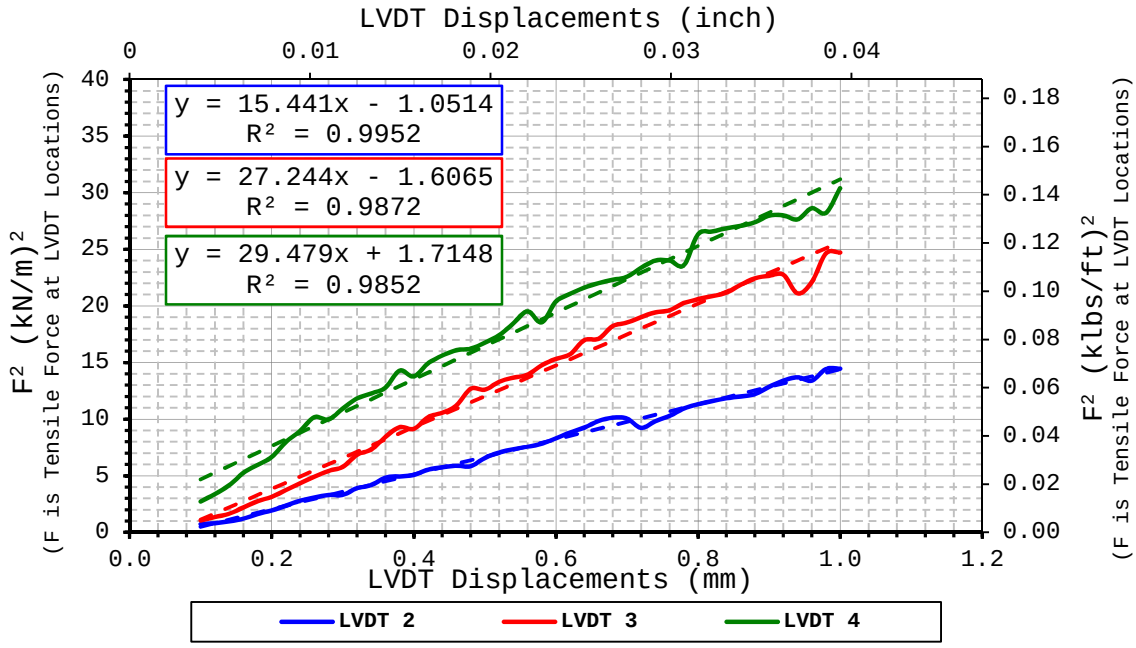
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 15 $(kN/m)^2/mm$

K_{SGI-3} = 27 $(kN/m)^2/mm$

K_{SGI-2} = 29 $(kN/m)^2/mm$

Comments:

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SMALL PULLOUT TEST

Date test conducted	**8/29/2011**
Done by	**Julio Ferreira**
Data file name	**Test 340b GG PP3 MD SAggr2 3psi 2011-08-**

GEOSYNTHETIC Information	**Type**	**Manufacter & Model**	**Direction Pulled**	**Polymer**
	Geogrid	**Huesker Biaxial GG Fornit20**	**MD**	**Polypropylene**

SPECIMEN Dimensions	**# Ribs Pulled**	**Equivalent Width (W) mm**	**Embedded Length (L) mm**	**Area (A) m^2**
	17	**364**	**248**	**0.090**

SOIL Information	**Soil Type**	**Water Content**	**Average Water Content**	**Dry Density (ρ_d)**
Top Layer	**Sieved Aggregate 2**	**0.00 %**	**0.00 %**	**1.480 g/cm^3**
Bottom Layer	**Sieved Aggregate 2**	**0.00 %**		**1.480 g/cm^3**

RESULTS		**Units**	**Values**
Max Pullout Load	P_{max}	**lbs**	**908**
Max Pullout Force	F_{max}	**kN/m**	**11.1**
Max Shear Stress	τ_{max}	**kN/m^2**	**22.4**
Confining Pressure	σ	**kN/m^2**	**21**
Friction Angle of Top Layer Soil	ϕ	**degrees**	
Friction Angle of Bottom Layer Soil	ϕ	**degrees**	
Interface Angle	δ	**degrees**	
Coefficient of Interaction	C_i		

POSITION OF LVDTs	
LVDT #	**Distance from Front Wall (m)**
1	**-0.016**
2	**-0.059**
3	**-0.103**
4	**-0.147**
5	**-0.234**

Comments:

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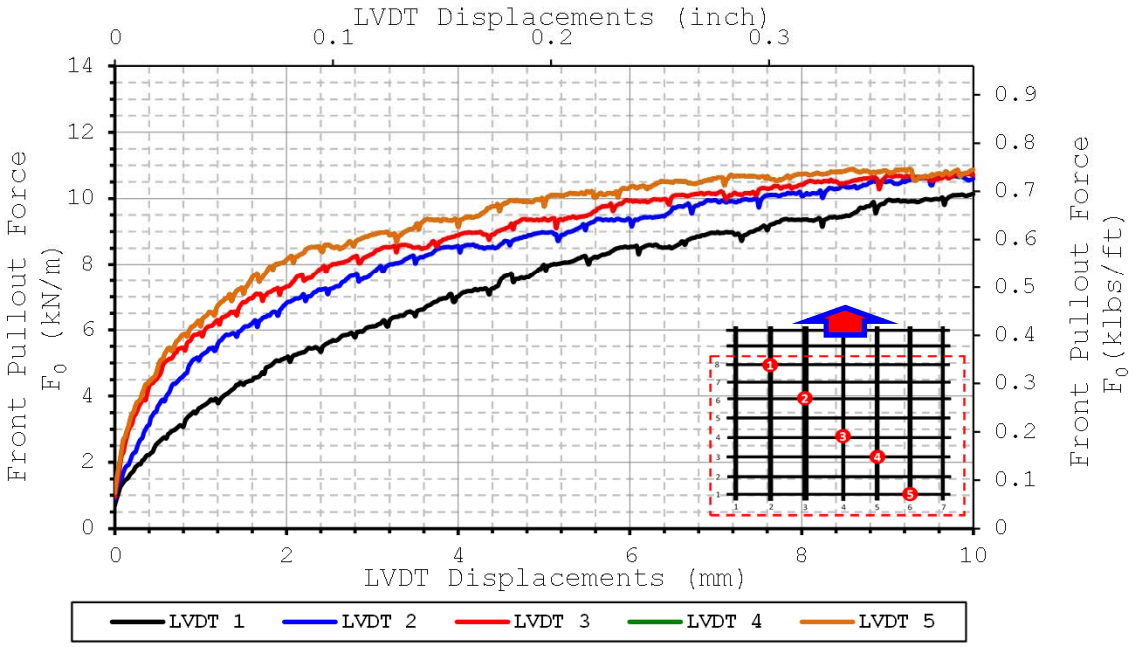
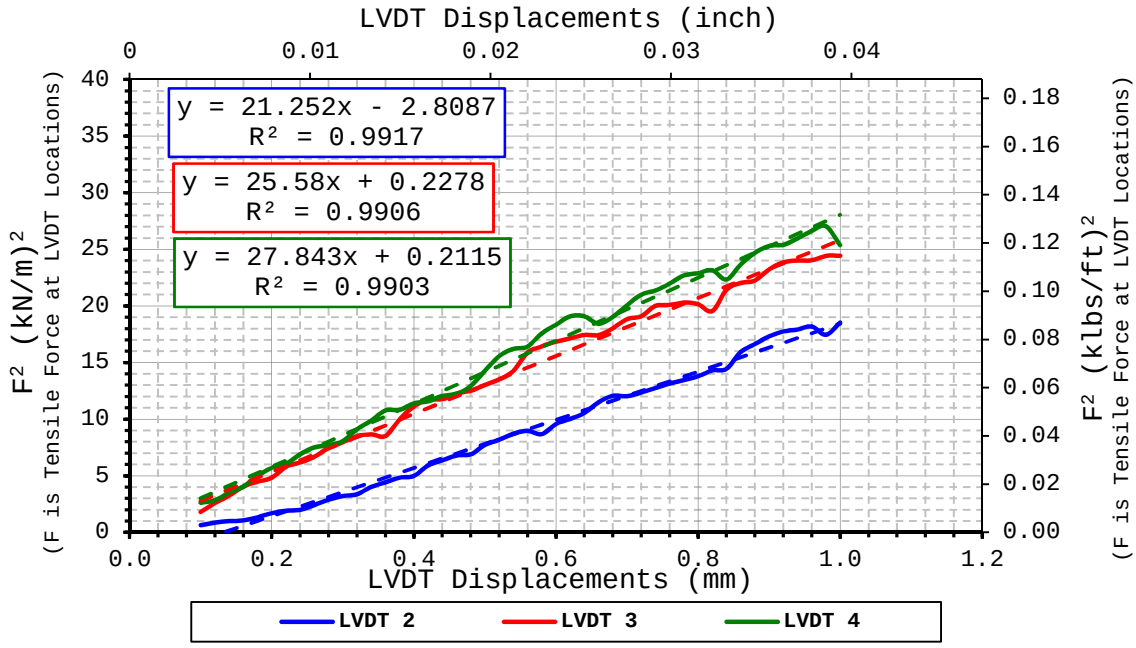
Pullout Force vs LVDT Displacement Curves



F^2 vs Displacement Curves for LVDTs 2,3,4



K_{SGI-2} = 21 $(kN/m)^2/mm$

K_{SGI-3} = 26 $(kN/m)^2/mm$

K_{SGI-2} = 28 $(kN/m)^2/mm$

Comments: