



California Testing & Inspections

Material Testing & Geotechnical Laboratory

www.Caltestinspection.com Tel:213-748-4900

1515 Compton Av

Los Angeles, CA 90021

**MAXIMUM INDEX DENSITY AND UNIT WEIGHT**

**ASTM D 4253**

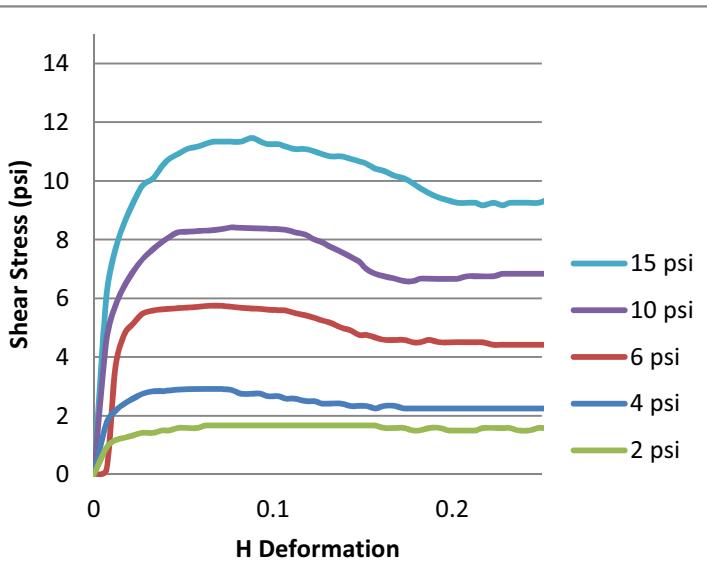
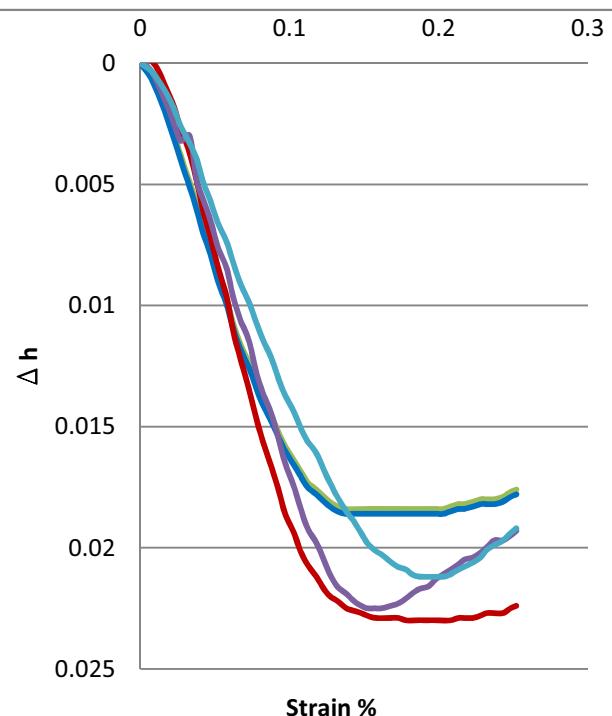
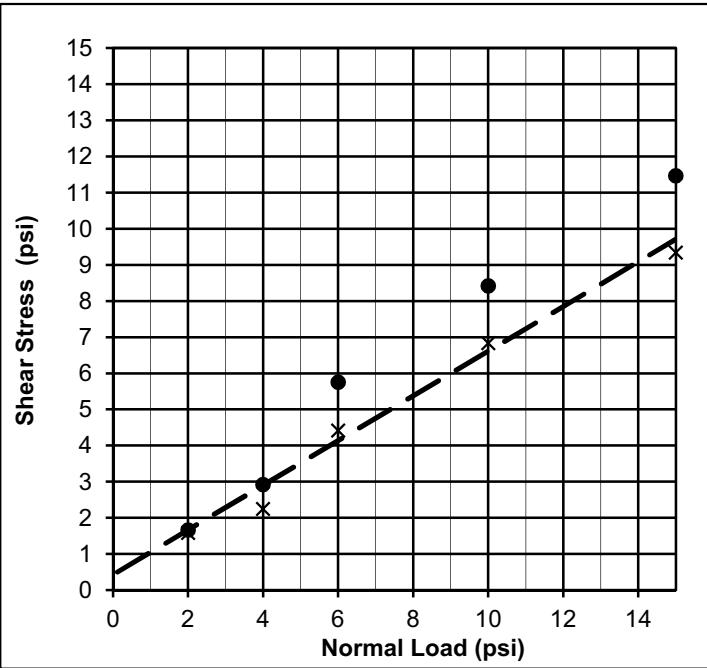
LAB SAMPLE #	SAMPLE LOCATION	SAMPLE DESCRIPTION	$\gamma_{\min}$ pcf	$\gamma_{\max}$ pcf	D <sub>d</sub> (30%) pcf
2844	Soil Direct #90	Light yellowish fine poorly graded sand (SP)	82.6	95.2	86.04
2845	Soil Direct "Minus 30"	Light yellowish fine poorly graded sand (SP)	84.8	94.7	87.57
2846	Black Lab "GRC-1"	Pale Yellowish medium to fine poorly graded sand (SP)	96.7	106.2	99.37
2847	Black Lab "Best 110"	Seashell Yellowish fine poorly graded sand (SP)	80.8	89.8	83.32
2848	Black Lab "Wedron 730"	White very fine poorly graded sand (SP)	92.8	102.0	95.42
2849	Black Lab "BLC 110 (Rounded)"	Ivory White fine poorly graded sand (SP)	90.8	94.9	91.97

Test Method: 1A

Mold used: Standard 0.10 cf

Amplitude: 0.013" Double Amplitude of Vertical Vibration

Frequency: 60 HZ



$\gamma_{\text{min}}$	82.6 pcf
$\gamma_{\text{max}}$	95.2 pcf
$\gamma_{30\%}$	86.0 pcf

TEST PERFORMED DRY

INITIAL CONDITIONS	A	B	C	D	E
WET DENSITY-PCF	86	86.1	86	86.1	86.1
MOISTURE CONT. %	0%	0%	0%	0%	0%
DRY DENSITY-PCF	86.0	86.1	86.0	86.1	86.1
SATURATION %	0%	0%	0%	0%	0%

FINAL CONDITIONS	A	B	C	D	E
WET DENSITY-PCF	86	86.1	86	86.1	86.1
MOISTURE CONT. %	0%	0%	0%	0%	0%
DRY DENSITY-PCF	86.0	86.1	86.0	86.1	86.1
SATURATION %	0%	0%	0%	0%	0%

Description	Symbol	Boring Number	Condition remolded	Shear Strength	Cohesion (psi)	Friction Angle	Soil Type
Fine Poorly graded Sand	●	2844	30% Max	Peak	0.4	37	SP
Fine Poorly graded Sand	- - X - -	2844	30% Max	Ultimate	0.3	32	SP



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#### ASTM D 3080 DIRECT SHEAR TEST RESULTS

NASA-JPL

Sample Location: Soil Direct #90  
CA

PROJECT NO.

150115

DATE

1/2015

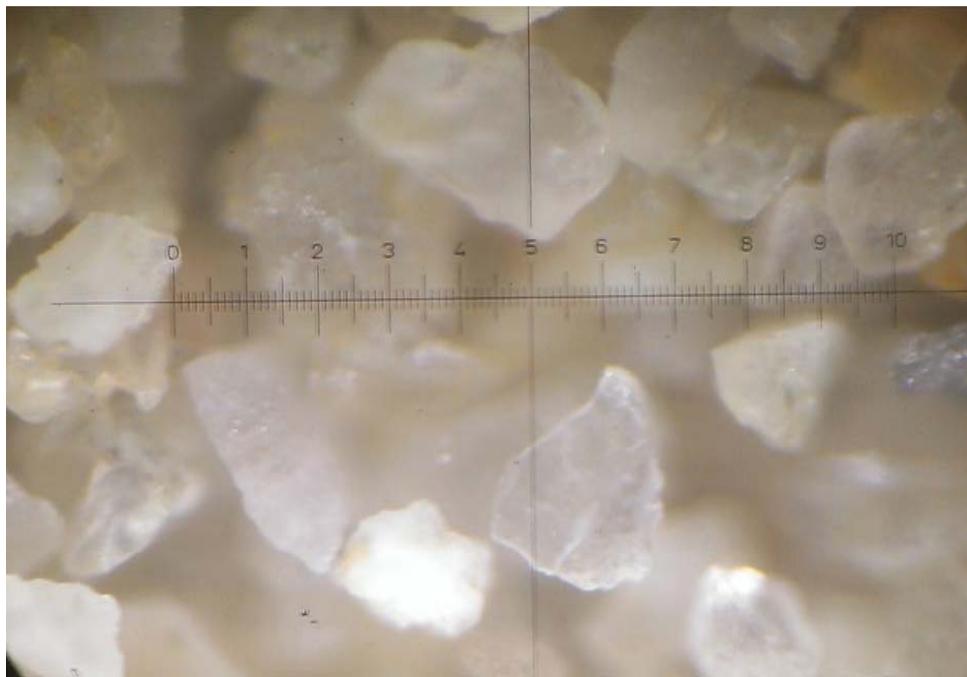
SAMPLE #

2844

# TEST DATA

Title: NASA-JPL  
 Sample Location: Soil Direct #90  
 CA  
 Project No. 150115  
 Boring No.: 2844  
 Depth (ft.):  
 Soil Type: SP  
 Description Fine Poorly graded Sand  
 Date: 1/27/2015  
 Figure No.: 1

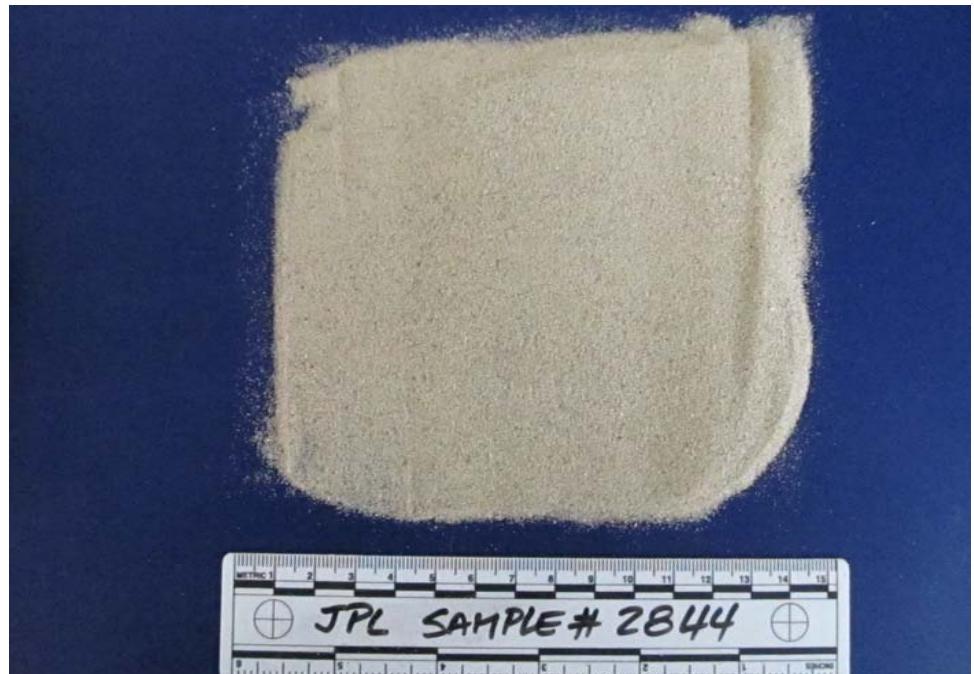
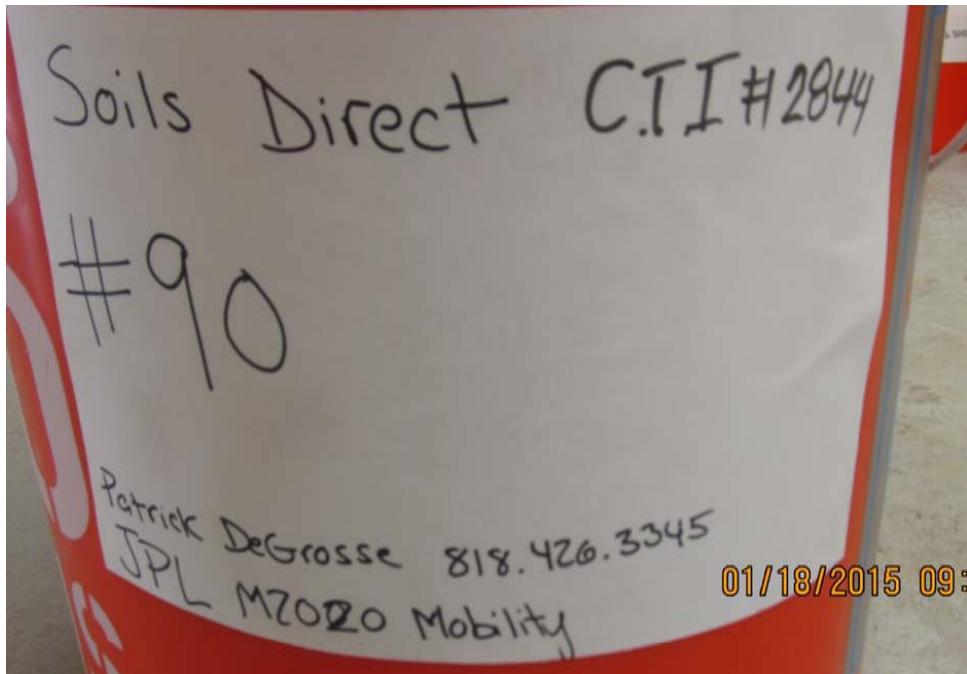
Peak cohesion (psi)	0.4	Ult. cohesion (psi)	0.3	Residual cohesion (psi)
Peak phi (degrees)	37	Ult. phi (degrees)	32	Residual phi (degrees)
<b>ACTUAL DATA POINTS</b>				
Normal Stress (psi)	Peak Shear Stress (psi)	Ultimate Shear Stress (psi)	Residual Shear Stress (psi)	Normal Stress (psi)
2	1.67	1.58		
4	2.92	2.25		
6	5.75	4.42		
10	8.42	6.83		
15	11.46	9.33		
				<b>Line Data Points</b>
<b>Data from graph</b>				
Peak phi (deg)	0.764925373	=	37	
Ult. phi (deg)	0.618625622	=	32	
Res. phi (deg)		=	0	

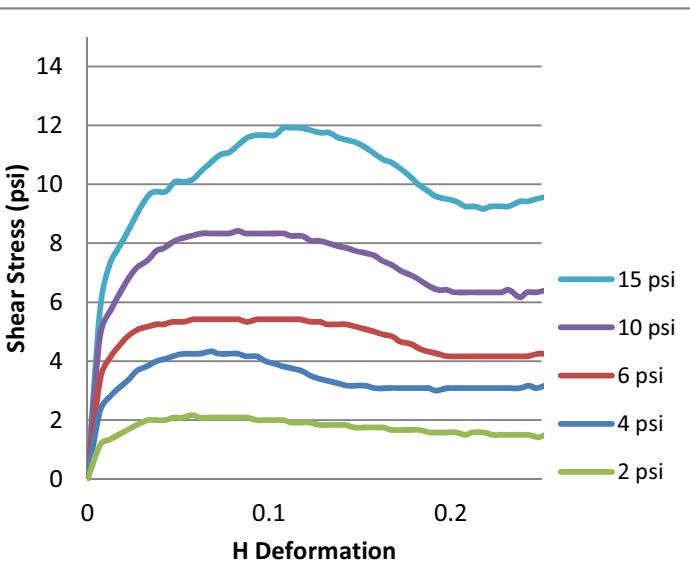
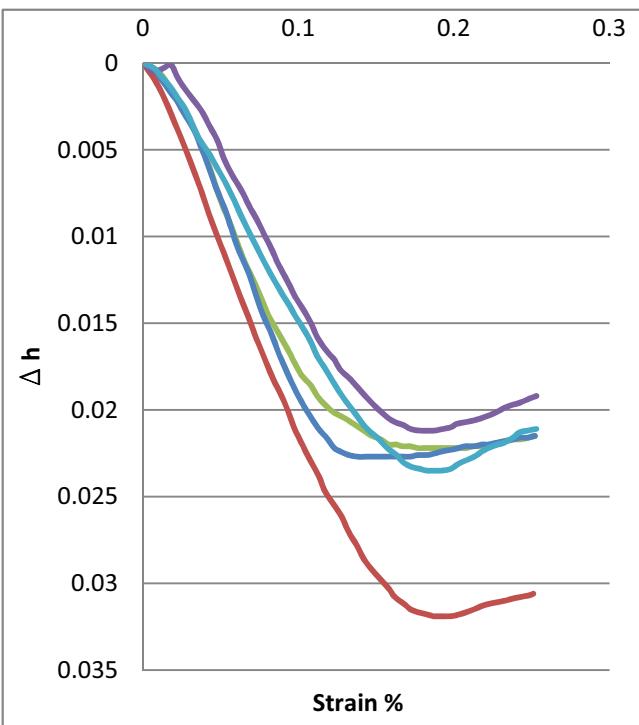
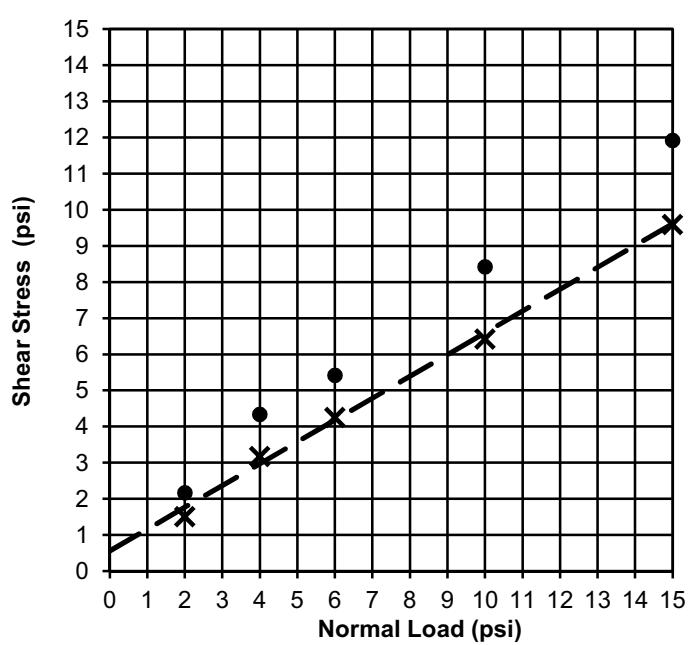


Sample #: 2844  
Sample Location: Soil Direct #90  
Description = Poorly Graded Sand  
Pass# 200: N/T  
Petrographic structure:N/T  
Moisture: N/T  
Color = Light Yellowish  
Classification: SP  
Obs: Fine Sand  
Tests Requested:

ASTM D4254  
Dmin: 82.6 pcf  
Dmax: 95.2 pcf  
D(30%) : 86.0 pcf

ASTM D3080  
Cohesion: 0.3 psi (Ultimate)  
Cohesion: 0.4 psi (Peak)  
Friction Angle: 32° (Ultimate)  
Friction Angle: 37° (Peak)





$\gamma$ min	84.8 pcf
$\gamma$ max	94.7 pcf
$\gamma$ 30%	87.6 pcf

TEST PERFORMED DRY

INITIAL CONDITIONS	A	B	C	D	E
WET DENSITY-PCF	87.6	87.6	87.6	87.6	87.6
MOISTURE CONT. %	0%	0%	0%	0%	0%
DRY DENSITY-PCF	87.6	87.6	87.6	87.6	87.6
SATURATION %	0%	0%	0%	0%	0%

FINAL CONDITIONS	A	B	C	D	E
WET DENSITY-PCF	87.6	87.6	87.6	87.6	87.6
MOISTURE CONT. %	0%	0%	0%	0%	0%
DRY DENSITY-PCF	87.6	87.6	87.6	87.6	87.6
SATURATION %	0%	0%	0%	0%	0%

Description	Symbol	Boring Number	Condition remolded	Shear Strength	Cohesion (psi)	Friction Angle	Soil Type
Fine Poorly graded Sand	—●—	2845	30% Max	Peak	1.0	36	SP
Fine Poorly graded Sand	—X—	2845	30% Max	Ultimate	0.5	31	SP



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#### ASTM D 3080 DIRECT SHEAR TEST RESULTS

NASA-JPL  
Sample Location: Soil Direct "Minus #30"  
CA

PROJECT NO.

150115

DATE

1/2015

SAMPLE #

2845

# TEST DATA

Title: NASA-JPL  
 Sample Location: Soil Direct "Minus #30"  
 CA  
 Project No. 150115 Peak  
 Boring No.: 2845 Ultimate  
 Depth (ft.): Residual  
 Soil Type: SP  
 Description Fine Poorly graded Sand  
 Date: 1/15  
 Figure No.: 2

Peak cohesion (psi)	1.0	Ult. cohesion (psi)	0.5	Residual cohesion (psi)
Peak phi (degrees)	36	Ult. phi (degrees)	31	Residual phi (degrees)

ACTUAL DATA POINTS				LINE DATA POINTS			
Normal Stress (psi)	Peak Shear Stress (psi)	Ultimate Shear Stress (psi)	Residual Shear Stress (psi)	Normal Stress (psi)	Peak Shear Stress (psi)	Ultimate Shear Stress (psi)	Residual Shear Stress (psi)
2	2.17	1.50					
4	4.33	3.17					
6	5.42	4.25					
10	8.42	6.42					
15	11.92	9.58					

**Data from graph**

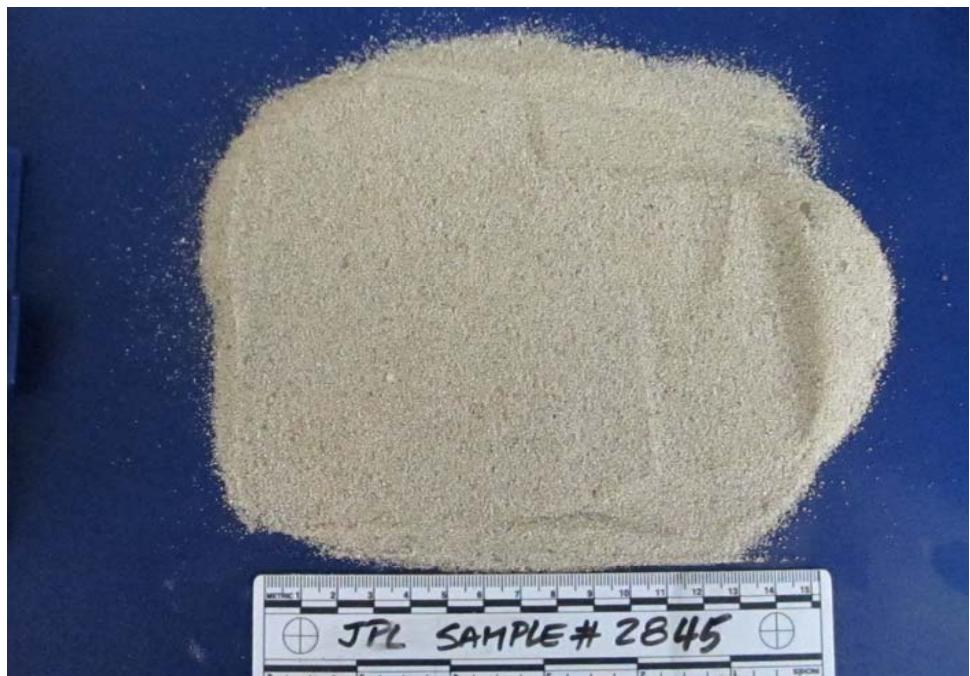
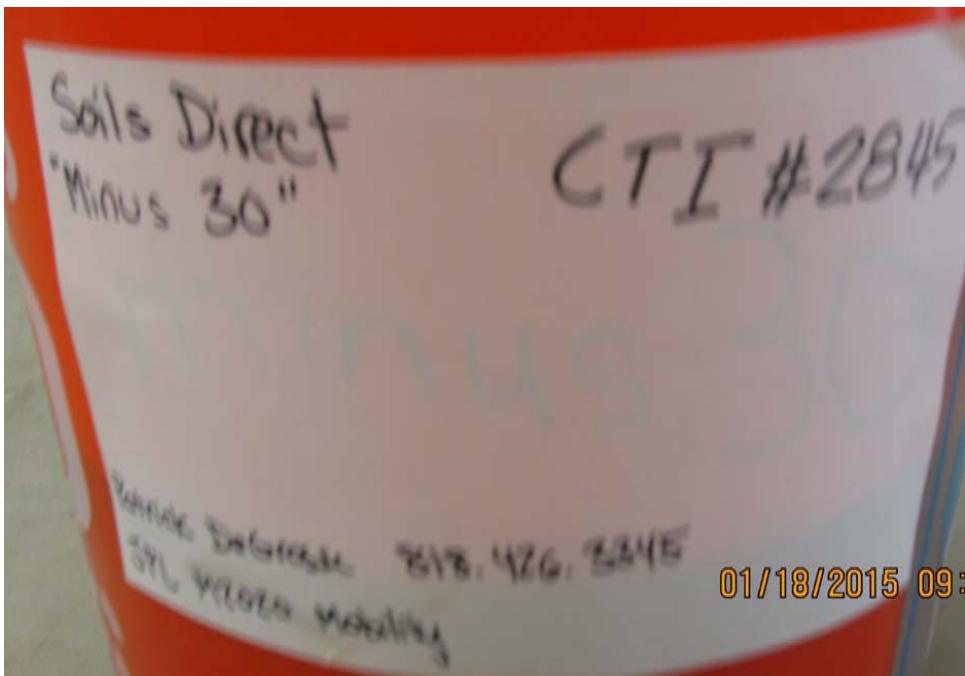
Peak phi (deg)	0.731654229	=	36
Ult. phi (deg)	0.603544776	=	31
Res. phi (deg)		=	0

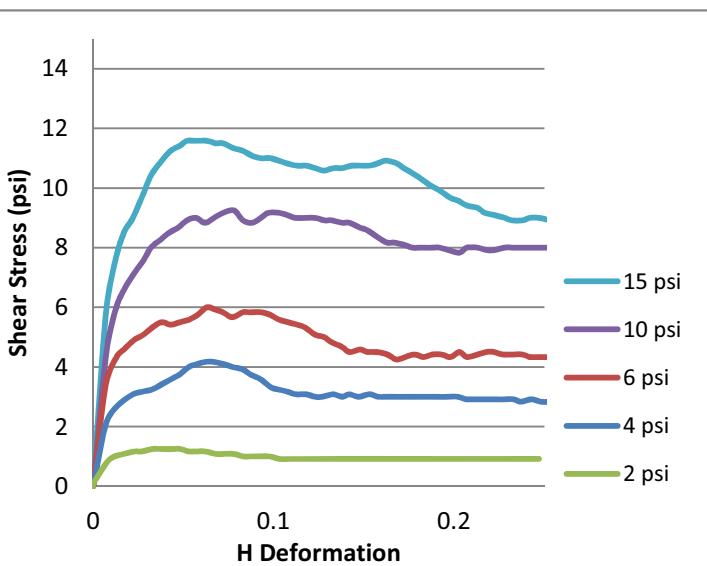
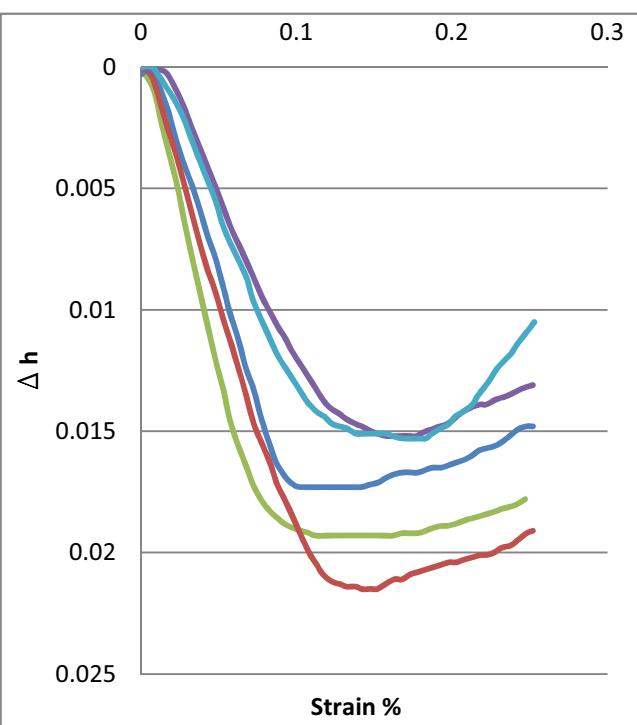
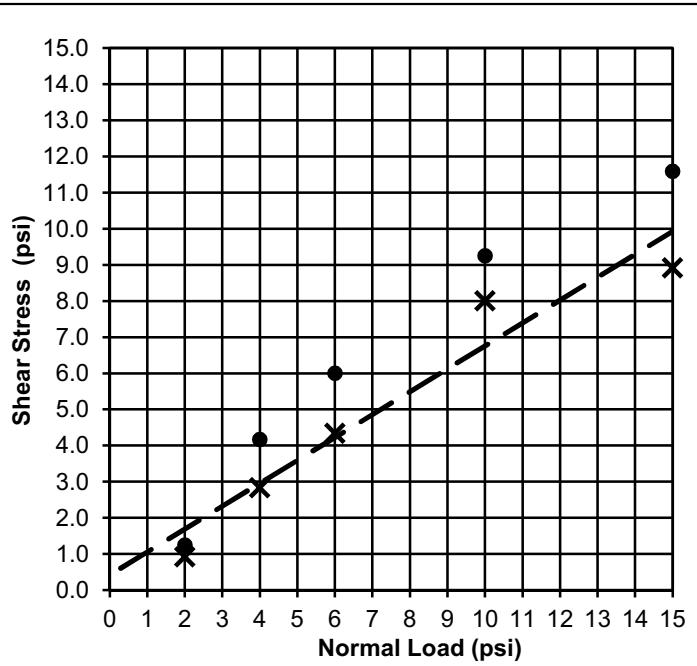


Sample #: 2845  
Sample Location: Soil Direct  
"Minus 30"  
Description = Poorly Graded Sand  
Pass# 200: N/T  
Petrographic structure:N/T  
Moisture: N/T  
Color = Light Yellowish  
Classification: SP  
Obs: Fine Sand  
Tests Requested:

ASTM D4254  
Dmin: 84.8 pcf  
Dmax: 94.7 pcf  
D(30%): 87.6 pcf

ASTM D3080  
Cohesion: 0.5 psi (Ultimate)  
Cohesion: 1.0 psi (Peak)  
Friction Angle: 31° (Ultimate)  
Friction Angle: 36° (Peak)





$\gamma$ min	96.7 pcf
$\gamma$ max	106 pcf
$\gamma$ 30%	99.4 pcf

TEST PERFORMED DRY

INITIAL CONDITIONS	A	B	C	D	E
WET DENSITY-PCF	99.4	99.4	99.4	99.4	99.4
MOISTURE CONT. %	0%	0%	0%	0%	0%
DRY DENSITY-PCF	99.4	99.4	99.4	99.4	99.4
SATURATION %	0%	0%	0%	0%	0%

FINAL CONDITIONS	A	B	C	D	E
WET DENSITY-PCF	99.4	99.4	99.4	99.4	99.4
MOISTURE CONT. %	0%	0%	0%	0%	0%
DRY DENSITY-PCF	99.4	99.4	99.4	99.4	99.4
SATURATION %	0%	0%	0%	0%	0%

Description	Symbol	Boring Number	Condition remolded	Shear Strength	Cohesion (psi)	Friction Angle	Soil Type
Medium to Fine Poorly graded Sand	—●—	2846	30% Max	Peak	0.7	38	SP
Medium to Fine Poorly graded Sand	- - X - -	2846	30% Max	Ultimate	0.3	32	SP



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#### ASTM D 3080 DIRECT SHEAR TEST RESULTS

NASA-JPL  
Sample Location: Black Lab GRC-1  
CA

PROJECT NO.

150115

DATE

1/27/2015

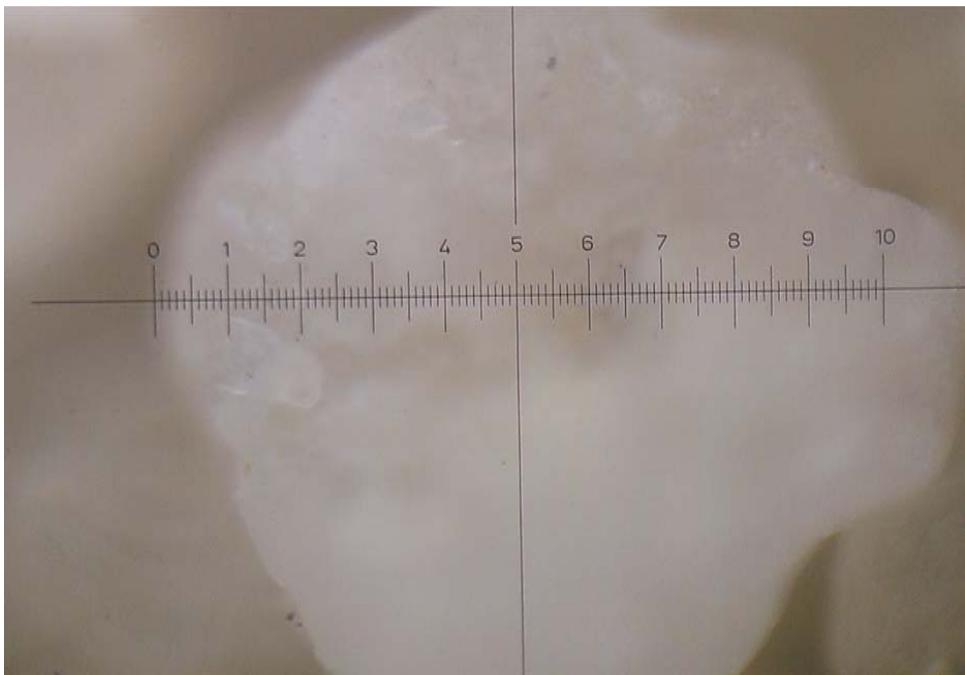
SAMPLE #

2846

# TEST DATA

Title: NASA-JPL  
 Sample Location: Black Lab GRC-1  
 CA  
 Project No. 150115 Peak  
 Boring No.: 2846 Ultimate  
 Depth (ft.): Residual  
 Soil Type: SP  
 Description Medium to Fine Poorly graded Sand  
 Date: 1/27/2015  
 Figure No.: 2

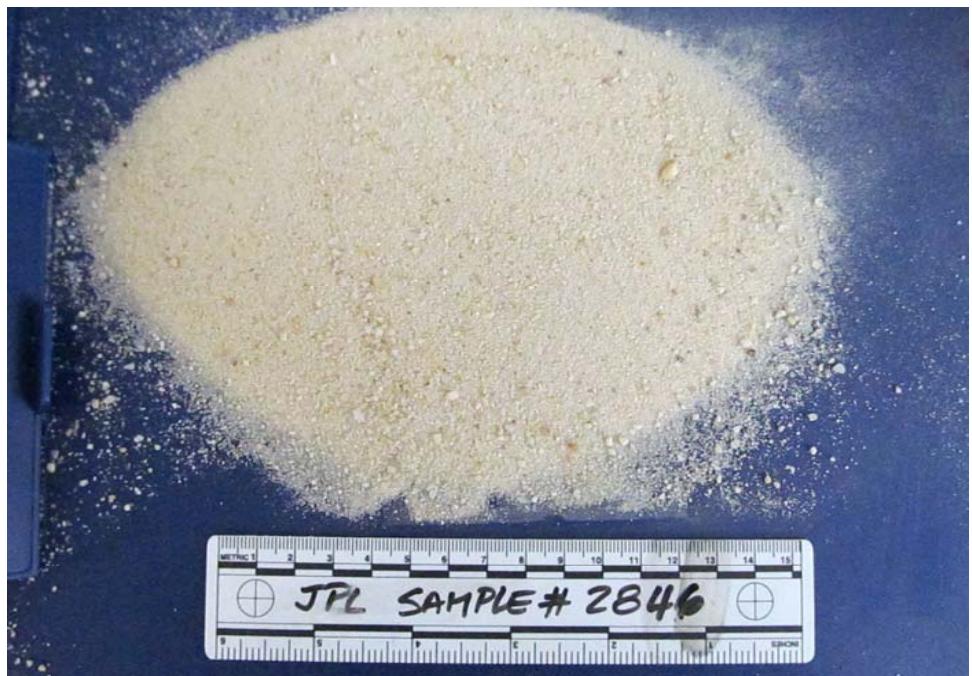
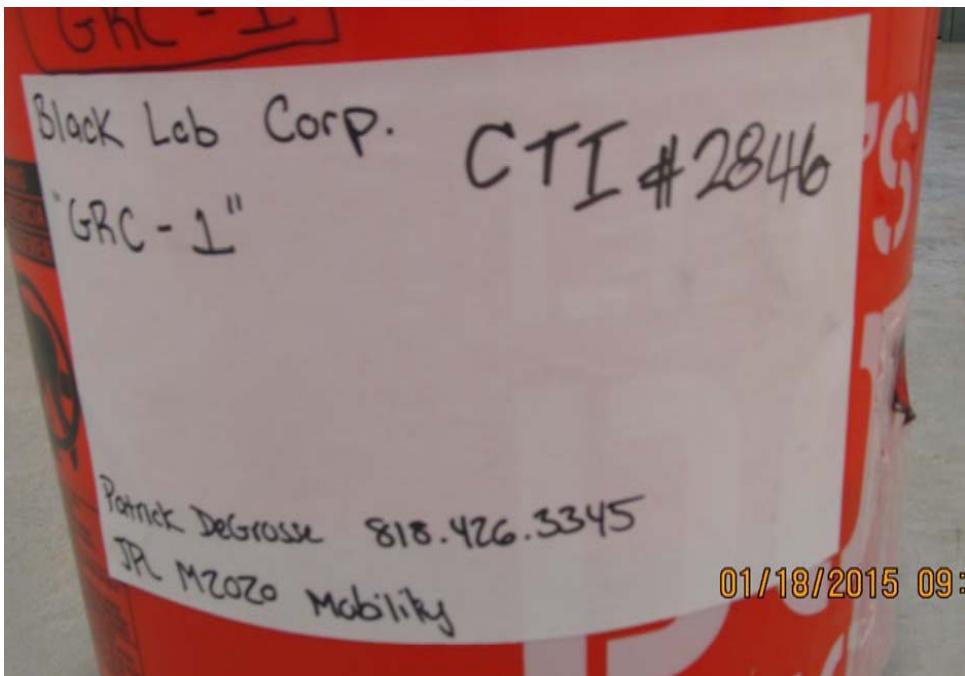
Peak cohesion (psi)	0.7	Ult. cohesion (psi)	0.3	Residual cohesion (psi)
Peak phi (degrees)	38	Ult. phi (degrees)	32	Residual phi (degrees)
<b>ACTUAL DATA POINTS</b>				
Normal Stress (psi)	Peak Shear Stress (psi)	Ultimate Shear Stress (psi)	Residual Shear Stress (psi)	Normal Stress (psi)
2	1.25	0.92		
4	4.17	2.83		
6	6.00	4.33		
10	9.25	8.00		
15	11.58	8.92		
				<b>Line Data Points</b>
<b>Data from graph</b>				
Peak phi (deg)	0.772077114	=	38	
Ult. phi (deg)	0.633550995	=	32	
Res. phi (deg)		=	0	

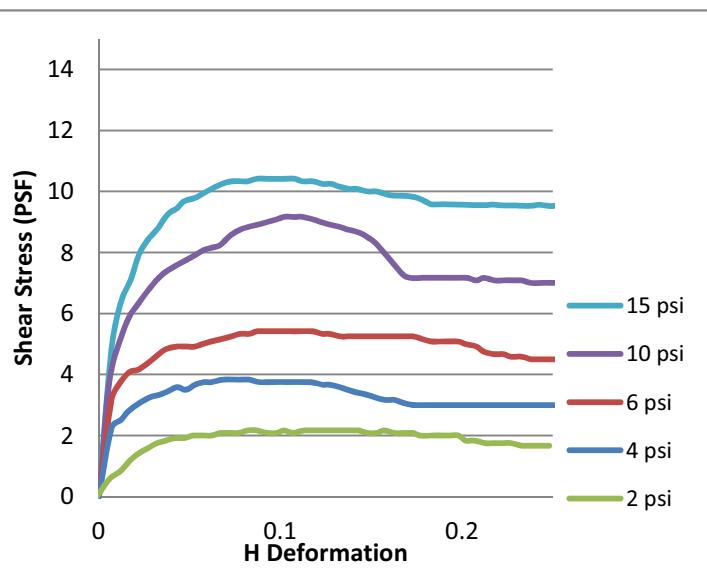
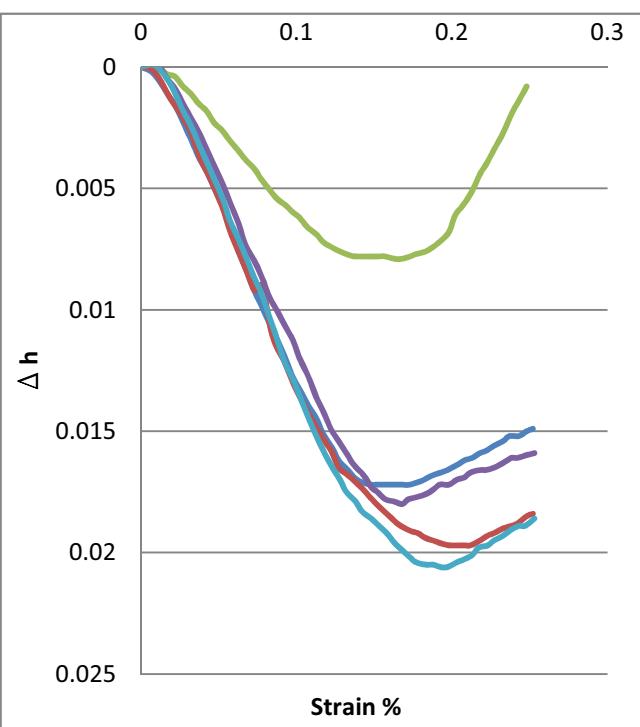
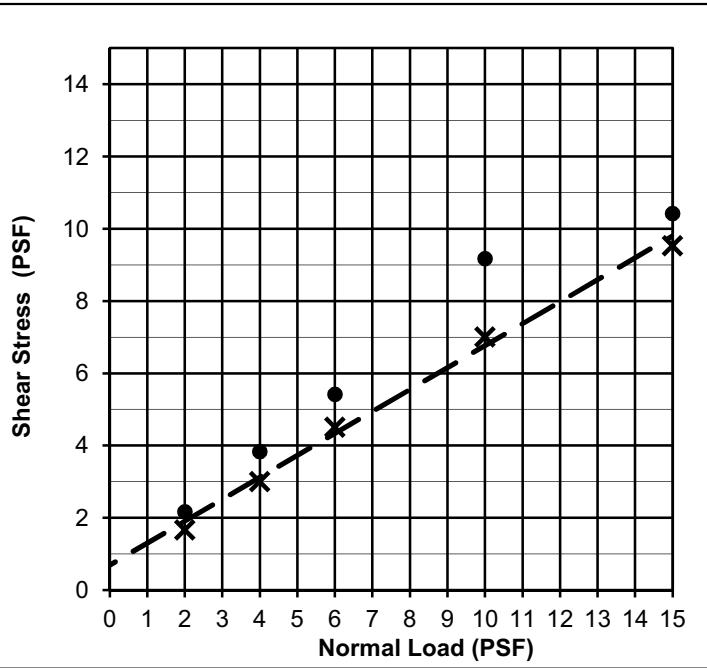


Sample #: 2846  
Sample Location: Black Lab "GRC-1"  
Description = Poorly Graded Sand  
Pass# 200: N/T  
Petrographic structure:N/T  
Moisture: N/T  
Color = Pale Yellowish  
Classification: SP  
Obs: Medium to Fine Sand  
Tests Requested:

ASTM D4254  
Dmin: 96.7 pcf  
Dmax: 106.2 pcf  
D(30%) 99.4 pcf

ASTM D3080  
Cohesion: 0.3 psi (Ultimate)  
Cohesion: 0.7 psi (Peak)  
Friction Angle: 32° (Ultimate)  
Friction Angle: 38° (Peak)





INITIAL CONDITIONS	A	B	C	D	E
WET DENSITY-PCF	83.3	83.3	83.3	83.3	83.3
MOISTURE CONT. %	0%	0%	0%	0%	0%
DRY DENSITY-PCF	83.3	83.3	83.3	83.3	83.3
SATURATION %	0%	0%	0%	0%	0%
FINAL CONDITIONS	A	B	C	D	E
WET DENSITY-PCF	83.3	83.3	83.3	83.3	83.3
MOISTURE CONT. %	0%	0%	0%	0%	0%
DRY DENSITY-PCF	83.3	83.3	83.3	83.3	83.3
SATURATION %	0%	0%	0%	0%	0%

Description	Symbol	Boring Number	Condition remolded	Shear Strength	Cohesion (psi)	Friction Angle	Soil Type
Fine Poorly graded Sand	—●—	2847	30% Max	Peak	1.3	33	SP
Fine Poorly graded Sand	- - X - -	2847	30% Max	Ultimate	0.6	31	SP



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#### ASTM D 3080 DIRECT SHEAR TEST RESULTS

NASA-JPL  
Sample Location: Black Lab Best 110  
CA

PROJECT NO.

150115

DATE

1/27/2015

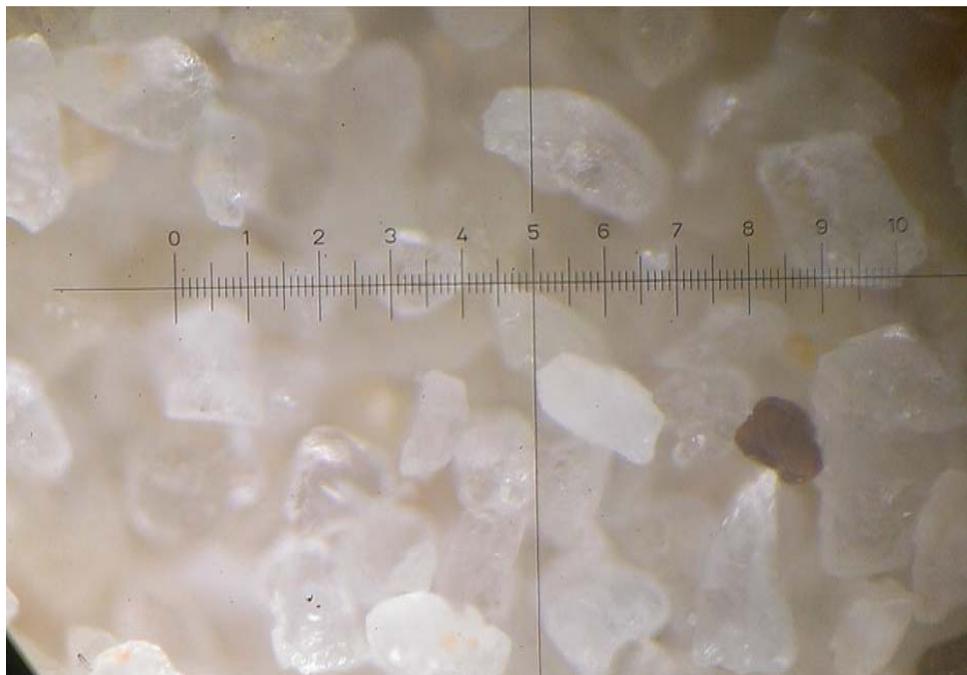
SAMPLE #

2847

# TEST DATA

Title: NASA-JPL  
 Sample Location: Black Lab Best 110  
 CA  
 Project No. 150115  
 Boring No.: 2847  
 Depth (ft.):  
 Soil Type: SP  
 Description Fine Poorly graded Sand  
 Date: 1/27/2015  
 Figure No.: 2

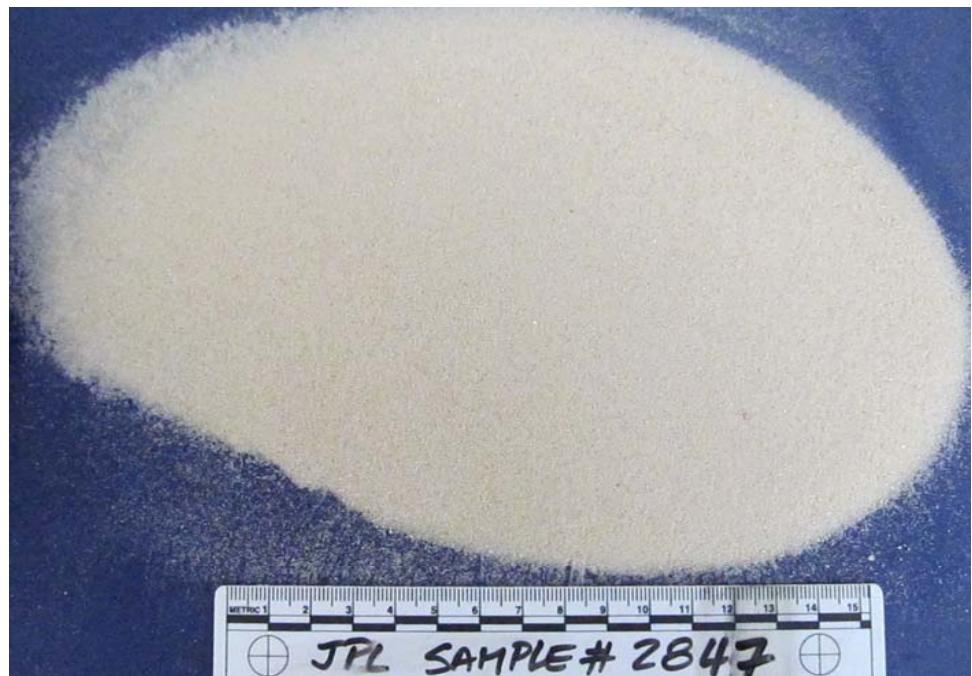
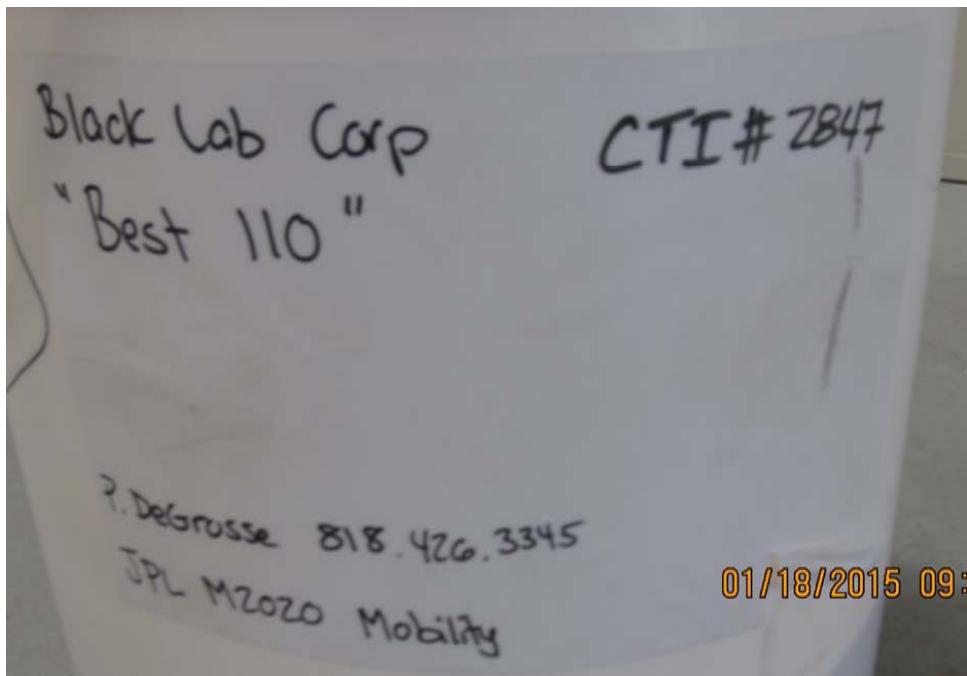
Peak cohesion (psi)	1.3	Ult. cohesion (psi)	0.6	Residual cohesion (psi)
Peak phi (degrees)	33	Ult. phi (degrees)	31	Residual phi (degrees)
<b>ACTUAL DATA POINTS</b>				
Normal Stress (psi)	Peak Shear Stress (psi)	Ultimate Shear Stress (psi)	Residual Shear Stress (psi)	Normal Stress (psi)
2	2.17	1.67		
4	3.83	3.00		
6	5.42	4.50		
10	9.17	7.00		
15	10.42	9.53		
				<b>Data from graph</b>
				Peak phi (deg) 0.659359453 = 33
				Ult. phi (deg) 0.607379768 = 31
				Res. phi (deg) = 0

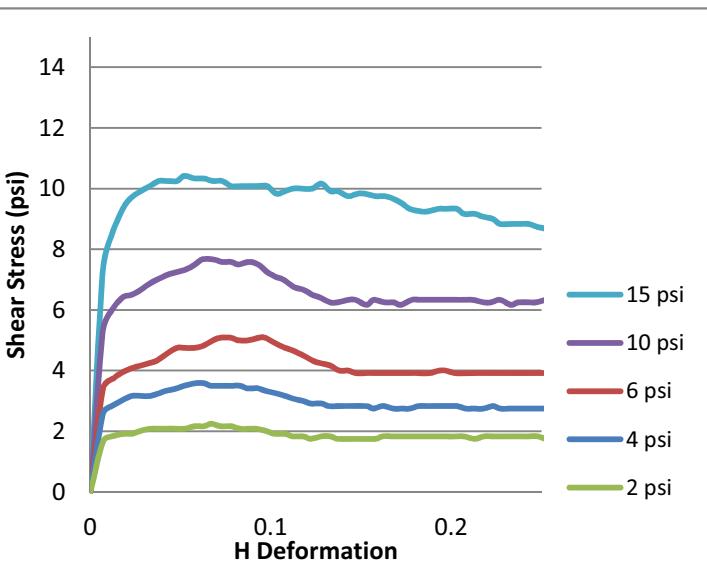
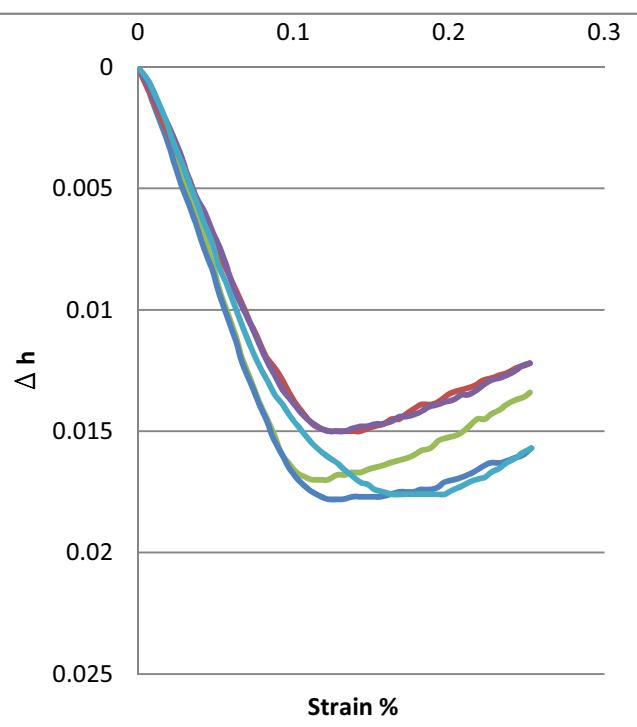
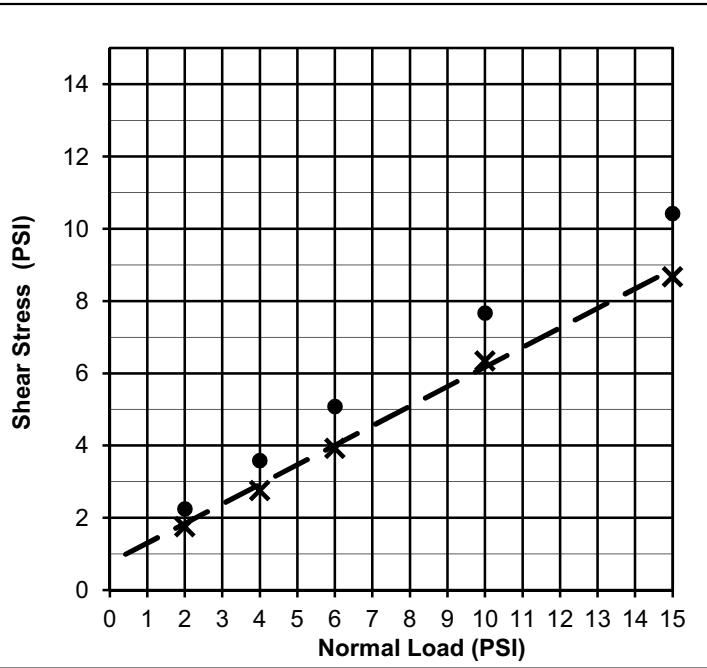


Sample #: 2847  
Sample Location: Black Lab "Best 110"  
Description = Fine Poorly Graded Sand  
Pass# 200: N/T  
Petrographic structure:N/T  
Moisture: N/T  
Color = Seashell Yellowish  
Classification: SP  
Obs: Fine Sand  
Tests Requested:

ASTM D4254  
Dmin: 80.8 pcf  
Dmax: 89.8 pcf  
D(30%): 83.3 pcf

ASTM D3080  
Cohesion: 0.3psi (Ultimate)  
Cohesion: 1.3 psi (Peak)  
Friction Angle: 31° (Ultimate)  
Friction Angle: 33° (Peak)





Description	Symbol	Boring Number	Condition remolded	Shear Strength	Cohesion (psi)	Friction Angle	Soil Type
Very Fine Poorly graded Sand	—●—	2848	30% Max	Peak	1.1	32	SP
Very Fine Poorly graded Sand	- - X - -	2848	30% Max	Ultimate	0.7	28	SP



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#### ASTM D 3080 DIRECT SHEAR TEST RESULTS

NASA-JPL  
Sample Location: Black Lab Wedron 730  
CA

PROJECT NO.

150115

DATE

1/27/2015

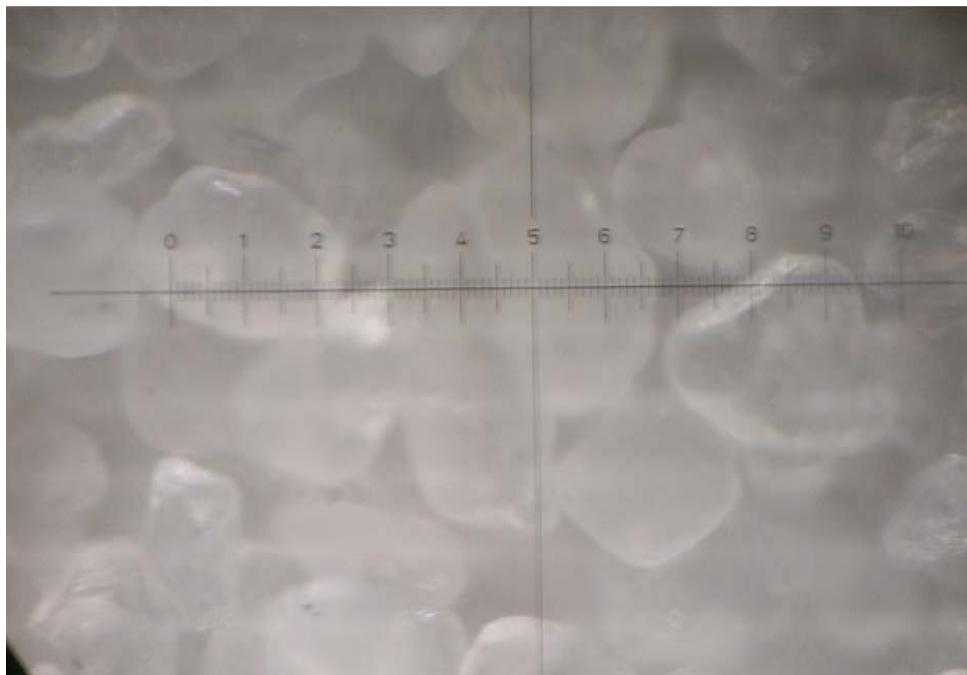
SAMPLE #

2848

## TEST DATA

Title: NASA-JPL  
 Sample Location: Black Lab Wedron 730  
 CA  
 Project No. 150115  
 Boring No.: 2848  
 Depth (ft.):  
 Soil Type: SP  
 Description Very Fine Poorly graded Sand  
 Date: 1/27/2015  
 Figure No.: 2

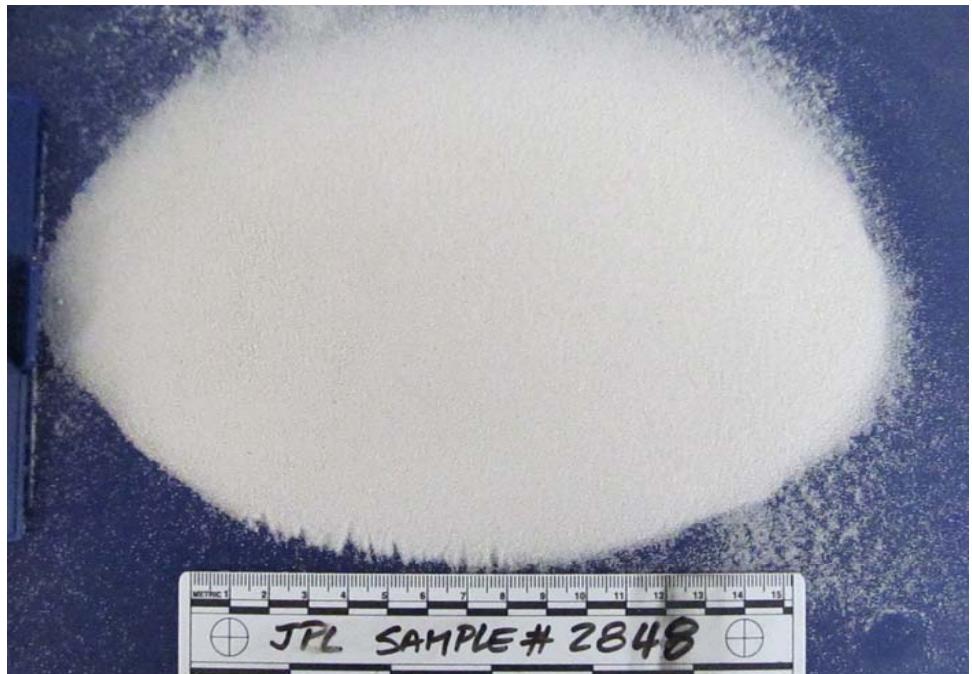
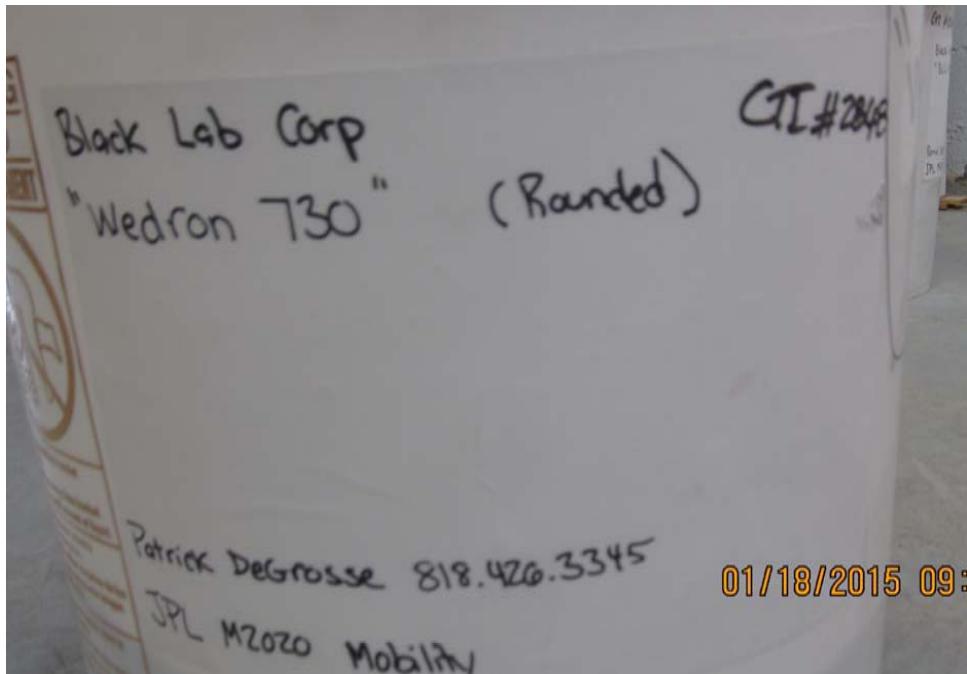
Peak cohesion (psi)	1.1	Ult. cohesion (psi)	0.7	Residual cohesion (psi)
Peak phi (degrees)	32	Ult. phi (degrees)	28	Residual phi (degrees)
<b>ACTUAL DATA POINTS</b>				
Normal Stress (psi)	Peak Shear Stress (psi)	Ultimate Shear Stress (psi)	Residual Shear Stress (psi)	Normal Stress (psi)
2	2.25	1.75		
4	3.58	2.75		
6	5.08	3.92		
10	7.67	6.33		
15	10.42	8.67		
				<b>Line Data Points</b>
<b>Data from graph</b>				
Peak phi (deg)	0.631063433	=	32	
Ult. phi (deg)	0.541511194	=	28	
Res. phi (deg)		=	0	

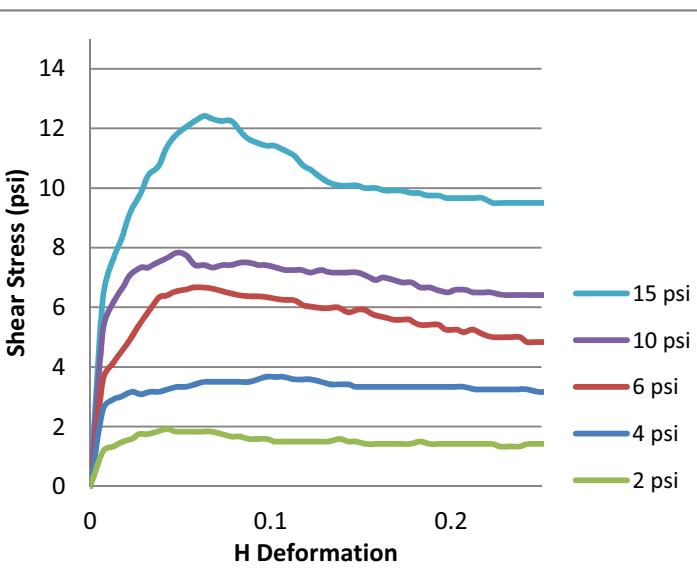
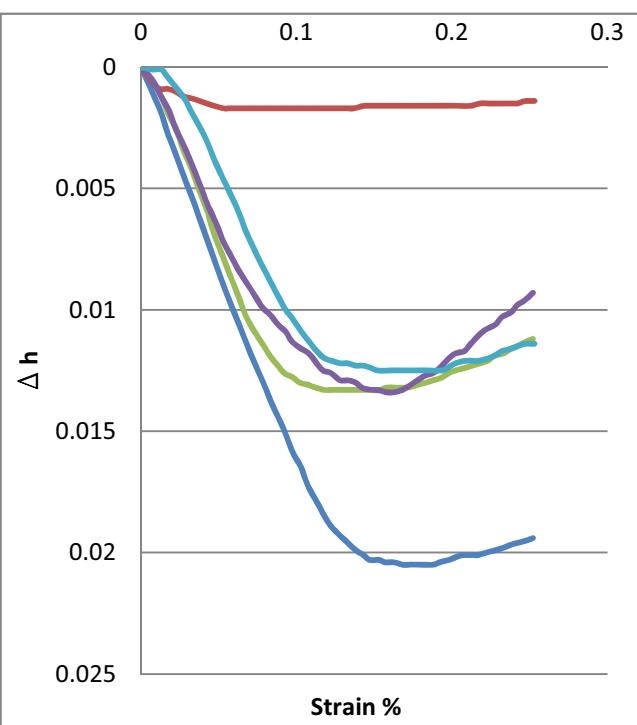
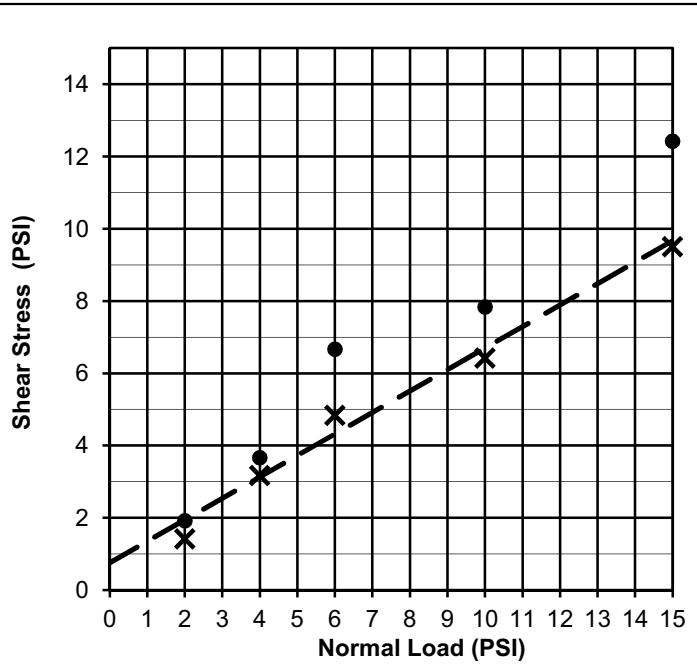


Sample #: 2848  
Sample Location: Black Lab "Wedron 730"  
Description = Very Fine Poorly Graded Sand  
Pass# 200: N/T  
Petrographic structure:N/T  
Moisture: N/T  
Color = White  
Classification: SP  
Obs: Very Fine Sand  
Tests Requested:

ASTM D4254  
Dmin: 92.8 pcf  
Dmax: 102.0 pcf  
D(30%): 95.42 pcf

ASTM D3080  
Cohesion: 0.7 psi (Ultimate)  
Cohesion: 1.1 psi (Peak)  
Friction Angle: 28° (Ultimate)  
Friction Angle: 32° (Peak)





$\gamma$ min	90.8 pcf
$\gamma$ max	94.9 pcf
$\gamma$ 30%	92.0 pcf

TEST PERFORMED DRY

INITIAL CONDITIONS	A	B	C	D	E
WET DENSITY-PCF	92	92	92	92	92
MOISTURE CONT. %	0%	0%	0%	0%	0%
DRY DENSITY-PCF	92.0	92.0	92.0	92.0	92.0
SATURATION %	0%	0%	0%	0%	0%

FINAL CONDITIONS	A	B	C	D	E
WET DENSITY-PCF	92	92	92	92	92
MOISTURE CONT. %	0%	0%	0%	0%	0%
DRY DENSITY-PCF	92.0	92.0	92.0	92.0	92.0
SATURATION %	0%	0%	0%	0%	0%

Description	Symbol	Boring Number	Condition remolded	Shear Strength	Cohesion (psi)	Friction Angle	Soil Type
Fine Poorly graded Sand	—●—	2849	30% Max	Peak	0.8	38	SP
Fine Poorly graded Sand	- - X - -	2849	30% Max	Ultimate	0.7	31	SP



California Testing & Inspections  
Material Testing & Geotechnical Laboratory  
[www.Caltestinspection.com](http://www.Caltestinspection.com) Tel:213-748-4900  
1515 Compton Av  
Los Angeles, CA 90021

#### ASTM D 3080 DIRECT SHEAR TEST RESULTS

NASA-JPL  
Sample Location: Black Lab BLC 110 (Rounded)  
CA

PROJECT NO.

150115

DATE

1/27/2015

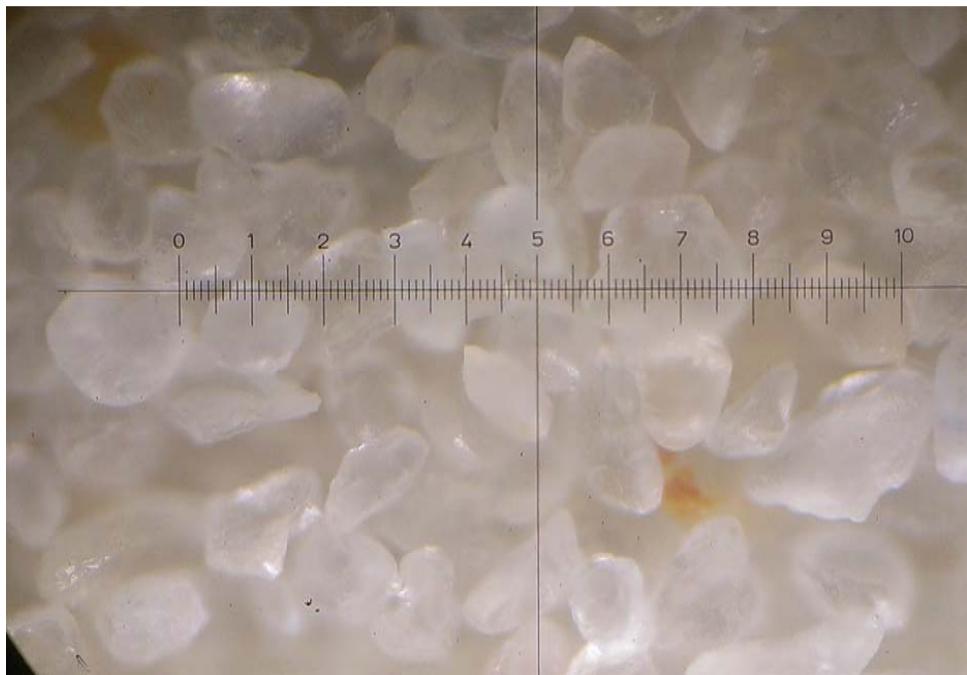
SAMPLE #

2849

# TEST DATA

Title: NASA-JPL  
 Sample Location: Black Lab BLC 110 (Rounded)  
 CA  
 Project No. 150115 Peak  
 Boring No.: 2849 Ultimate  
 Depth (ft.): Residual  
 Soil Type: SP  
 Description Fine Poorly graded Sand  
 Date: 1/27/2015  
 Figure No.: 6

Peak cohesion (psi)	0.8	Ult. cohesion (psi)	0.7	Residual cohesion (psi)
Peak phi (degrees)	38	Ult. phi (degrees)	31	Residual phi (degrees)
<b>ACTUAL DATA POINTS</b>				
Normal Stress (psi)	Peak Shear Stress (psi)	Ultimate Shear Stress (psi)	Residual Shear Stress (psi)	Normal Stress (psi)
2	1.92	1.42		
4	3.67	3.17		
6	6.67	4.83		
10	7.83	6.42		
15	12.42	9.50		
				<b>Data from graph</b>
				Peak phi (deg) 0.770366915 = 38
				Ult. phi (deg) 0.594216418 = 31
				Res. phi (deg) = 0



Sample #: 2849  
Sample Location: Black Lab "BLC 110 (Rounded)"  
Description = Fine Poorly Graded Sand  
Pass# 200: N/T  
Petrographic structure:N/T  
Moisture: N/T  
Color = Ivory White  
Classification: SP  
Obs: Fine Sand  
Tests Requested:

ASTM D4254  
Dmin: 90.8 pcf  
Dmax: 94.9 pcf  
D(30%): 92.0 pcf

ASTM D3080  
Cohesion: 0.7 psi (Ultimate)  
Cohesion: 0.8 psi (Peak)  
Friction Angle: 31° (Ultimate)  
Friction Angle: 38° (Peak)

