Appendix C
Laboratory Data
Sample Description: Clayey Sand

<table>
<thead>
<tr>
<th>Location</th>
<th>Sample No.</th>
<th>Depth (ft)</th>
<th>Dry Density (pcf)</th>
<th>Initial Moisture Content (%)</th>
<th>Final Moisture Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGC-2</td>
<td>R-2</td>
<td>5</td>
<td>116.2</td>
<td>12.2</td>
<td>14.6</td>
</tr>
</tbody>
</table>

Project Number: 10132-01
Date: May-12
South Shores Church
<table>
<thead>
<tr>
<th>Location:</th>
<th>Sample No.:</th>
<th>Depth (ft)</th>
<th>Dry Density (pcf)</th>
<th>Initial Moisture Content (%)</th>
<th>Final Moisture Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LGC-2</td>
<td>R-4</td>
<td>10</td>
<td>110.5</td>
<td>13.8</td>
<td>12.8</td>
</tr>
</tbody>
</table>

Sample Description: Clayey Sand
DIRECT SHEAR TEST DIAGRAM

Boring No.  BN-3  Depth  20-21 feet
Soil Description  Silty SAND w/ir. of clay + 5% cement by wt.
Undisturbed/Remolded  Remolded to 90%
Moisture Content, %  15.9% after test
Dry Density, pcf  122.2% after test
Saturation, %  113.4% after test
Shearing Rate  0.023°/min.

NORMAL STRESS (ksf)

<table>
<thead>
<tr>
<th></th>
<th>Peak</th>
<th>Ultimate</th>
<th>Reshear</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cohesion (ksf)</td>
<td>2190</td>
<td>480</td>
<td></td>
</tr>
<tr>
<td>Friction Angle</td>
<td>43</td>
<td>34</td>
<td></td>
</tr>
</tbody>
</table>

Remarks:

EARTH SCIENCE CONSULTANTS

Project Name: SOUTH SHORES CHURCH
Date: May 2007
Project No: 6375-04.1  Figure No: C-1
DIRECT SHEAR TEST DIAGRAM

Boring No. BA-4 Depth 32.5'
Soil Description Sandy Silt with Clay
Undisturbed/Remolded Remolded to 105.5 D.D.

NORMAL STRESS (ksf)

Moisture Content, %
Dry Density, pcf
Saturation, %
Shearing Rate

Cohesion (ksf)
Friction Angle

Remarks:

▲ Peak ○ Ultimate □ Resesh 0.20 24

EARTH SCIENCE CONSULTANTS

Project Name: South Shores Church
Date: June 2007
Project No: 6375-04.1
Figure No: 1
DIRECT SHEAR TEST DIAGRAM

Boring No. BA-4 Depth 32.5'
Soil Description
Undisturbed/Remolded Sandy Silt with Clay Remolded to 105.5 D.D.

Moisture Content, %
Dry Density, pcf
Saturation, %
Shearing Rate

19.9% after test
105.7% after test
90.5% after test
.028"/min.

Cohesion (ksf) 0.15 0.15
Friction Angle 26 26
Remarks: 

EARTH SCIENCE CONSULTANTS

Project Name: South Shores Church
Date: June 2007
Project No: 6375-04.1 Figure No: 2
DIRECT SHEAR TEST DIAGRAM

Boring No. BA-4
Depth 72.5' - 73.5'

Soil Description
Silty SAND

Undisturbed/Remolded
Remolded to 90% reshear

Moisture Content, %

Dry Density, pcf

Saturation, %

Shearing Rate

NORMAL STRESS (ksf)

Peak
Ultimate
Reshear

Cohesion (ksf)
0.10

Friction Angle
31

Remarks:

EARTH SCIENCE CONSULTANTS

Project Name: South Shores Church
Date: June 2007
Project No: 6375-04.1
Figure No: 3
Boring No. BA-4 Depth 72.5' - 73.5'

Soil Description Silty SAND

Undisturbed/Remolded Remolded to 90%

Moisture Content, % 18.5% after test

Dry Density, pcf 108.2% after test

Saturation, % 89.7% after test

Shearing Rate 0.028"/min.

NORMAL STRESS (ksf)

Cohesion (ksf) 210 0.05

Friction Angle 36 32

Remarks:

Project Name: South Shores Church
Date: June 2007
Project No: 6375-04.1
Figure No: 4
DIRECT SHEAR TEST DIAGRAM

Shear Strength (ksf)

Boring No.  BN-3  Depth  20 and 21 feet
Silly Sand w/Gravel and tr. of Clay
Undisturbed/Remolded  Remolded

Moisture Content, %  15.8% after test
Dry Density, pcf  122.2% after test
Saturation, %  112.6% after test
Shearing Rate  .023\(^{\prime}\)/min.

NORMAL STRESS (ksf)

\[ \Delta \text{ Peak} = 1.0 \]
\[ \circ \text{ Ultimate} = 0.5 \]
\[ \square \text{ Reshear} = 30 \]

Cohesion (ksf)
Friction Angle
Remarks:

EARTH SCIENCE CONSULTANTS

Project Name: South Shores Church
Date: February 2008
Project No: 6375-04.1  Figure No: A-3
**DIRECT SHEAR TEST DIAGRAM**

**SHEAR STRENGTH (ksf)**

**NORMAL STRESS (ksf)**

<table>
<thead>
<tr>
<th>Boring No.</th>
<th>BN-6</th>
<th>Depth</th>
<th>31 feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Description</td>
<td>Clayey Siltstone bed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undisturbed/Remolded</td>
<td>Undisturbed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture Content, %</td>
<td>16.9% after test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Density, pcf</td>
<td>115.4% after test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturation, %</td>
<td>99.2 after test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shearing Rate</td>
<td>.022°/min.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohesion (ksf)</td>
<td>▲ Peak</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Friction Angle</td>
<td>270c</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks:</td>
<td>19</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EARTH SCIENCE CONSULTANTS

Project Name: South Shores Church
Date: February 2008
Project No: 6375-04.1 Figure No: A-7
- peak shear strength
- strength at 1/4" displacement

Normal Pressure (psf) vs. Shear Strength (psf)

Strain Rate: 0.025 in. / min.

**Sample** | **Type** | **Description** | **Dry Density (pcf)** | **Water Content (%)**
--- | --- | --- | --- | ---
BB-1/4 | Undisturbed | San Onofre Formation: Sandy Siltstone w. Gravel | 125.5 | 7.4

<table>
<thead>
<tr>
<th>Normal Pressure (psf)</th>
<th>Peak Shear Strength (psf)</th>
<th>Ultimate Shear Strength (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>1480</td>
<td>1430</td>
</tr>
<tr>
<td>2000</td>
<td>2470</td>
<td>2470</td>
</tr>
<tr>
<td>3000</td>
<td>3730</td>
<td>3730</td>
</tr>
<tr>
<td>C = 400 psf</td>
<td>C = 400 psf</td>
<td></td>
</tr>
<tr>
<td>( \phi = 46 \text{ deg.} )</td>
<td>( \phi = 46 \text{ deg.} )</td>
<td></td>
</tr>
</tbody>
</table>
### Shear Strength Analysis

**Sample:** S-1/3  
**Type:** Undisturbed  
San Onofre Formation: Sandy Siltstone w. Gravel

<table>
<thead>
<tr>
<th>Normal Pressure (psf)</th>
<th>Peak Shear Strength (psf)</th>
<th>Ultimate Shear Strength (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>970</td>
<td>870</td>
</tr>
<tr>
<td>2000</td>
<td>1770</td>
<td>1770</td>
</tr>
<tr>
<td>3000</td>
<td>2040</td>
<td>2040</td>
</tr>
<tr>
<td></td>
<td>C = 300 psf</td>
<td>C = 300 psf</td>
</tr>
<tr>
<td></td>
<td>$\phi = 30,\text{deg.}$</td>
<td>$\phi = 30,\text{deg.}$</td>
</tr>
</tbody>
</table>

**Normal Pressure (psf):**
- 0 to 4000

**Shear Strength (psf):**
- 0 to 4000

**Description:**
- *peak shear strength*
- *strength at 1/4" displacement*

**Strain Rate:** 0.025 in. / min.

**Dry Density (pcf):** 126.7
**Water Content (%):** 14.5

---

**AGRA**

Joo No. 8-212-107500 - March 20, 2000
**Sample**: R-2-3A  
**Type**: Undisturbed  
**Description**: Landslide Material: Diatomaceous Siltstone  

<table>
<thead>
<tr>
<th>Normal Pressure (psf)</th>
<th>Peak Shear Strength (psf)</th>
<th>Ultimate Shear Strength (psf)</th>
<th>Residual Shear Strength (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>2300</td>
<td>1970</td>
<td>1500</td>
</tr>
<tr>
<td>4000</td>
<td>5390</td>
<td>4370</td>
<td>3410</td>
</tr>
<tr>
<td>6000</td>
<td>5270</td>
<td>4950</td>
<td>4710</td>
</tr>
</tbody>
</table>

- C = 800 psf  
- $\phi = 36.5$ deg.
Sample | Type       | Description                  | Dry Density (pcf) | Water Content (%) |
--------|------------|------------------------------|-------------------|-------------------|
R-2/13A | Undisturbed| Monterey Formation:          | 105.6             | 23.3              |
         |            | Fine sandy Siltstone         |                   |                   |

<table>
<thead>
<tr>
<th>Normal Pressure (psf)</th>
<th>Peak Shear Strength (psf)</th>
<th>Ultimate Shear Strength (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>1070</td>
<td>750</td>
</tr>
<tr>
<td>2000</td>
<td>2440</td>
<td>2100</td>
</tr>
<tr>
<td>3000</td>
<td>2970</td>
<td>2970</td>
</tr>
<tr>
<td>C = 200 psf</td>
<td>C = 100 psf</td>
<td></td>
</tr>
<tr>
<td>( \phi = 43 , \text{deg.} )</td>
<td>( \phi = 41 , \text{deg.} )</td>
<td></td>
</tr>
</tbody>
</table>

Normal Pressure: 0.0121 in. / min.
### Normal Pressure vs. Shear Strength

- **Peak Shear Strength**
- **Strength at 1/4" Displacement**

<table>
<thead>
<tr>
<th>Normal Pressure (psf)</th>
<th>Peak Shear Strength (psf)</th>
<th>Ultimate Shear Strength (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>970</td>
<td>820</td>
</tr>
<tr>
<td>2000</td>
<td>1480</td>
<td>1410</td>
</tr>
<tr>
<td>3000</td>
<td>1960</td>
<td>1960</td>
</tr>
<tr>
<td></td>
<td>C = 200 psf</td>
<td>C = 200 psf</td>
</tr>
<tr>
<td></td>
<td>φ = 30 deg.</td>
<td>φ = 30 deg.</td>
</tr>
</tbody>
</table>

### Sample Details
- **Sample**: R-3/1
- **Type**: Undisturbed
- **Description**: Fill Material: Sandy Silt
- **Dry Density (psf)**: 109.7
- **Water Content (%)**: 18.1

Strain Rate: 0.025 in. / min.
Sample | Type  | Description                  | Dry Density (pcf) | Water Content (%) |
--------|-------|------------------------------|-------------------|-------------------|
R-3/10A | Undisturbed | Monterey Formation: Siltstone | 73.7              | 41.2              |

<table>
<thead>
<tr>
<th>Normal Pressure (psf)</th>
<th>Peak Shear Strength (psf)</th>
<th>Ultimate Shear Strength (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>1450</td>
<td>1210</td>
</tr>
<tr>
<td>4000</td>
<td>2930</td>
<td>2440</td>
</tr>
<tr>
<td>6000</td>
<td>4580</td>
<td>3310</td>
</tr>
<tr>
<td>C = 0 psf</td>
<td>C = 0 psf</td>
<td></td>
</tr>
<tr>
<td>φ = 36.5 deg.</td>
<td>φ = 30 deg.</td>
<td></td>
</tr>
<tr>
<td>Sample</td>
<td>Type</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>R-4/1</td>
<td>Undisturbed</td>
<td>Fill Material: Silty Clay w. Siltstone Frgmts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Normal Pressure (psf)</th>
<th>Peak Shear Strength (psf)</th>
<th>Ultimate Shear Strength (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>990</td>
<td>970</td>
</tr>
<tr>
<td>2000</td>
<td>1380</td>
<td>1330</td>
</tr>
<tr>
<td>3000</td>
<td>2090</td>
<td>2090</td>
</tr>
<tr>
<td></td>
<td>C = 400 psf</td>
<td>C = 400 psf</td>
</tr>
<tr>
<td></td>
<td>φ = 28 deg.</td>
<td>φ = 28 deg.</td>
</tr>
</tbody>
</table>
**Peak shear strength**  * strength at 1/4" displacement  * residual shear strength

Normal Pressure (psf)

<table>
<thead>
<tr>
<th>Normal Pressure (psf)</th>
<th>Peak Shear Strength (psf)</th>
<th>Ultimate Shear Strength (psf)</th>
<th>Residual Shear Strength (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>2320</td>
<td>1370</td>
<td>580</td>
</tr>
<tr>
<td>4000</td>
<td>4160</td>
<td>1820</td>
<td>460</td>
</tr>
<tr>
<td>6000</td>
<td>4580</td>
<td>3640</td>
<td>2540</td>
</tr>
<tr>
<td>C = 1200 psf</td>
<td>C = 400 psf</td>
<td>C = 0 psf</td>
<td></td>
</tr>
<tr>
<td>θ = 29 deg</td>
<td>θ = 20 deg</td>
<td>θ = 16 deg</td>
<td></td>
</tr>
</tbody>
</table>

Sample: R-4/11A  
Type: Undisturbed  
Description: Monterey Formation: Siltstone  
Dry Density (pcf): 75.5  
Water Content (%): 40.3  
Strain Rate: 0.0025 in. / min.
Geotechnical Evaluation and Slope Stabilization Design for Environmental Impact Report Purposes, for Proposed New Structures at the South Shores Church, City of Dana Point, California

Volume II

Prepared For:

Mr. GG Kohlhagan
South Shores Church
32712 Crown Valley Parkway
Dana Point, CA 92629

Dated: May 22, 2013

Project No. 10132-01