Appendix C
Results of Interface Tests

This appendix contains the results of all the interface tests performed during this investigation. Table C1 shows the organization of the figures. Symbols used in this appendix are listed and defined in the Notation (Appendix F).

<table>
<thead>
<tr>
<th>Table C1 Organization of the Figures in Appendix C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Test</td>
</tr>
<tr>
<td>Initial loading (virgin shear)</td>
</tr>
<tr>
<td>Staged shear</td>
</tr>
<tr>
<td>Unload-reload</td>
</tr>
<tr>
<td>Multi-directional stress path</td>
</tr>
</tbody>
</table>
a. Shear stress vs. interface displacement data

Figure C1. Results of initial loading tests on dense Density Sand-to-concrete interface (Sheet 1 of 4)
b. Vertical vs. horizontal interface displacement data

Figure C1. (Sheet 2 of 4)
Test T104_40
\( \sigma_n = 274 \text{ kPa} \)

Test T103_15
\( \sigma_n = 102 \text{ kPa} \)

Test T102_5
\( \sigma_n = 33 \text{ kPa} \)

Test T101_2
\( \sigma_n = 15 \text{ kPa} \)
d. Enlargement of Figure C1b

Figure C1. (Sheet 4 of 4)
Figure C2. Peak and residual shear strength envelopes for initial loading on dense Density Sand-to-concrete interface.
a. Shear stress vs. interface displacement data

Figure C3. Results of initial loading tests on medium dense Density Sand-to-concrete interface (Sheet 1 of 4)

Notes: - See Figure C3c for an expanded view in the 0 - 2.5mm displacement range
- Data on subsequent unload-reload cycles are omitted (see Figures C19 through C21)
b. Vertical vs. horizontal interface displacement data

Figure C3. (Sheet 2 of 4)
c. Enlargement of Figure C3a

Figure C3. (Sheet 3 of 4)
d. Enlargement of Figure C3b

Figure C3. (Sheet 4 of 4)
Figure C4. Peak and residual shear strength envelopes for initial loading on medium dense Density Sand-to-concrete interface.
a. Shear stress vs. interface displacement data

Figure C5. Results of initial loading tests on dense Light Castle Sand-to-concrete interface (Sheet 1 of 4)

Notes: - See Figure C5c for an expanded view in the 0 - 2.5mm displacement range
- Data on subsequent unload-reload cycles are omitted (see Figures C22 through C25)
b. Vertical vs. horizontal interface displacement data

Figure C5. (Sheet 2 of 4)
c. Enlargement of Figure C5a

Figure C5. (Sheet 3 of 4)
d. Enlargement of Figure C5b

Figure C5. (Sheet 4 of 4)
Figure C6. Peak and residual shear strength envelopes for initial loading on dense Light Castle Sand-to-concrete interface.

\[ \delta_p = 33.7^\circ \]

\[ \delta_r = 29.5^\circ \]
a. Shear stress vs. interface displacement data

Figure C7. Staged test on dense Density Sand-to-concrete interface. Specimen S105. Data on shear reversals are omitted (Continued)
b. Vertical vs. horizontal interface displacement data

Figure C7. (Concluded)
a. Shear stress vs. interface displacement data

Figure C8. Staged test on dense Density Sand-to-concrete interface. Specimen S106. Data on shear reversals are omitted (Continued)
b. Vertical vs. horizontal interface displacement data

Figure C8. (Concluded)
a. Results of all staged tests performed on specimen S101

Figure C9. Staged tests on dense Density Sand-to-concrete interface. Specimen S101 (Sheet 1 of 4)
b. Detail of shear stress-displacement response for staged shear test T101_5. Normal stress increased from 15 to 33 kPa

Figure C9. (Sheet 2 of 4)
c. Detail of shear stress-displacement response for staged shear test T101_15. Normal stress increased from 33 to 102 kPa

Figure C9. (Sheet 3 of 4)

Figure C9. (Sheet 4 of 4)
a. Results of all staged tests performed on specimen S102

Figure C10. Staged tests on dense Density Sand-to-concrete interface. Specimen S102 (Sheet 1 of 3)
b. Detail of shear stress-displacement response for staged shear test T102_15. Normal stress increased from 33 to 102 kPa

Figure C10. (Sheet 2 of 3)

Figure C10. (Sheet 3 of 3)
a. Results of all staged tests performed on specimen S103

Figure C11. Staged tests on dense Density Sand-to-concrete interface. Specimen S103 (Continued)
b. Detail of shear stress-displacement response for staged shear test T103_40. Normal stress increased from 102 to 274 kPa

Figure C11. (Concluded)
a. Detail of unload reload cycle. Inset shows data for full range of interface displacement.

Figure C12. Unload-reload test on dense Density Sand-to-concrete interface, $\sigma_n = 33$ kPa, specimen S201 (Continued)
b. Vertical vs. horizontal interface displacement data

Figure C12. (Concluded)
a. Detail of unload-reload cycle. Inset shows data for full range of interface displacement.

Figure C13. Unload-reload test on dense Density sand-to-concrete interface, $\sigma_n = 33$ kPa, specimen S202 (Continued)
b. Vertical vs. horizontal interface displacement data

Figure C13. (Concluded)
a. Detail of unload-reload cycle. Inset shows data for full range of interface displacement.

Figure C14. Unload-reload test on dense Density sand-to-concrete interface, $\sigma_n = 102$ kPa, specimen S203 (Continued)
b. Vertical vs. horizontal interface displacement data

Figure C14. (Concluded)
Figure C15. Cycle of shear reversals on dense Density Sand-to-concrete interface, $\sigma_n = 15$ kPa, specimen S101
Figure C16. Cycle of shear reversals on dense Density Sand-to-concrete interface, $\sigma_n = 33$ kPa, specimen S102.
Figure C17. Cycle of shear reversals on dense Density Sand-to-concrete interface, $\sigma_n = 102$ kPa, specimen S103
Figure C18. Cycle of shear reversals on dense Density Sand-to-concrete interface, $\sigma_n = 274$ kPa, specimen S104.
Figure C19. Shear reversal on medium dense Density Sand-to-concrete interface, $\sigma_n = 35$ kPa, specimen S302
Figure C20. Cycle of shear reversals on medium dense Density Sand-to-concrete interface, $\sigma_n = 104$ kPa, specimen S303
Figure C21. Cycle of shear reversals on medium dense Density Sand-to-concrete interface, $\sigma_n = 276$ kPa, specimen S304
Figure C22. Shear reversal on dense Light Castle Sand-to-concrete interface, $\sigma_n = 15$ kPa, specimen S401
Figure C23. Shear reversal on dense Light Castle Sand-to-concrete interface, $\sigma_n = 35$ kPa, specimen S402
Figure C24. Cycle of shear reversals on dense Light Castle Sand-to-concrete interface, $\sigma_n = 104$ kPa, specimen S403
Figure C25. Cycle of shear reversals on dense Light Castle Sand-to-concrete interface, $\sigma_n = 276$ kPa, specimen S404
a. Stress path applied during test

Figure C26. Multi-directional stress path test T204_5 on dense Density Sand-to-concrete interface (Continued)
b. Shear stress vs. interface displacement data

Figure C26. (Concluded)
Strength envelope for dense Density Sand-to-concrete interface

Figure C27. Multi-directional stress path test T205_5 on dense Density Sand-to-concrete interface (Continued)

- Stress path applied during test

Normal stress, $\sigma_n$ (kPa)

Interface shear stress, $\tau$ (kPa)
b. Shear stress vs. interface displacement data

Figure C27. (Concluded)
a. Stress path applied during test

Figure C28. Multi-directional stress path test T206_5 on dense Density Sand-to-concrete interface (Continued)
b. Shear stress vs. interface displacement data

Figure C28. (Concluded)
a. Stress path applied during test

Figure C29. Multi-directional stress path test T305_10 on medium dense Density Sand-to-concrete interface (Continued)

Strength envelope for medium dense Density Sand-to-concrete interface (see Figure C4)
b. Shear stress vs. interface displacement data

Figure C29. (Concluded)
a. Stress path applied during test
Figure C30. Multi-directional stress path test T405_10 on dense Light Castle Sand-to-concrete interface (Continued)
b. Shear stress vs. interface displacement data
Figure C30. (Concluded)