APPENDIX C

ADDITIONAL CALCULATIONS
Input:

Foundation:

- **Pier Shape:** Square
- **d:** 2.50 ft - length of side of pier
- **L:** 2.67 ft - pier length
- **l:** 0.00 ft - pier extension above grade
- **B:** 6.00 ft - width of pad
- **t:** 3.00 ft - thickness of pad
- **γ₁:** 106.00 pcf - effective unit weight of soil
- **φ₁:** 30.00 deg - friction angle of soil layer
- **γ₂:** 150.00 pcf - unit weight of concrete
- **φ₂:** deg - friction angle of soil layer
- **γ₃:** pcf - effective unit weight of soil
- **φ₃:** deg - friction angle of soil layer
- **γ₄:** pcf - effective unit weight of soil
- **φ₄:** deg - friction angle of soil layer
- **γ₅:** pcf - effective unit weight of soil
- **φ₅:** deg - friction angle of soil layer
- **t₁:** 2.67 ft - thickness of soil layer (from t/pad)
- **t₂:** ft - thickness of soil layer
- **t₃:** ft - thickness of soil layer
- **t₄:** ft - thickness of soil layer
- **t₅:** ft - thickness of soil layer
- **φ₄:** deg - friction angle of soil layer
- **qₜ₅:** 17.53 ksf - ultimate end bearing capacity
- **fs:** 0.00 ksf - ultimate skin friction on sides of pad
- **μ:** 0.40 - friction factor along base of foundation
- **Fₜ₅:** 318 psf - ultimate lateral resistance per foot
- **Dₜ:** 99.00 ft - depth to water table

Soil:

- **qₚ₃:** 3.20 ksf
- **qₚ₅:** 10.52 ksf

Bearing Capacity:

- **qₚ₆:** 10.52 ksf
- **qₚ₅:** 17.53 ksf

Foundation is Adequate in Bearing 30.4%

Lateral Capacity:

- **V:** 1.35 kip
- **Vₚ₅:** 51.13 kip

Foundation is Adequate in Lateral 2.6%
Concrete pad:
- $f'_{c}: \ 3000.00$ psi - concrete compressive strength
- $f_{y}: \ 60.00$ ksi - yield strength of reinforcing steel
- cover: \ 3.00 in - clear cover to reinforcement
- R/F: \ 6 - bar size for flexural reinforcement
- Qty. of R/F: \ 5 - quantity of reinforcing bars
- $A_{s}: \ 2.2$ in$^2$ - quantity of reinforcing bars
- $\alpha: \ 40.00$ - 40 for interior columns
- $\beta: \ 1.00$ - ratio of long side to short side (pier)
- $\beta: \ 0.85$ - concrete strength ratio
- $\varepsilon_{c}: \ 0.003$ - maximum concrete strain (typically 0.003)
- $\phi: \ 0.75$ - strength reduction factor for shear per ACI318
- $\phi: \ 0.9$ - strength reduction factor for flexure per ACI318

Shear Capacity:
- $V_{u}: \ 28.53$ kip - ultimate punching shear
- $\phi V_{c}: \ 1319.50$ kip - punching shear resistance
- $V_{f}: \ 28.53$ kip - ultimate one-way shear
- $\phi V_{f}: \ 190.77$ kip - one-way shear resistance

Flexural Capacity:
- $M_{max}: \ 29.13$ kip-ft
- $\phi M_{n}: \ 308.29$ kip-ft

Foundation is Adequate in Flexure \ 9.4%
Deadman Anchor Analysis: C - Proposed Inner

Project Name: Cumorah Hill  
Job #: # 50108.12262  
Client: Central Communications  
Analysis by: JRM  
Checked by: AMA  
Code: TIA - G

Anchor Block is Adequate for Uplift 72.4%  
Anchor Block is Adequate for Lateral 79.2%  
Anchor Shaft is Adequate 61.5%

Loads

<table>
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<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>U_{max}</td>
<td>26.57 kips - maximum uplift reaction</td>
</tr>
<tr>
<td>H_{max}</td>
<td>35.07 kips - maximum horizontal reaction</td>
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Capacity

<table>
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<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>U_{all}</td>
<td>36.71 kips - allowable uplift</td>
</tr>
<tr>
<td>H_{all}</td>
<td>44.31 kips - allowable horizontal</td>
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</tbody>
</table>

Foundation Input

Guy Path: C  
Anchor Ring: Proposed Inner  
W_b: 4.00 ft - width of anchor block  
L_b: 9.00 ft - length of anchor block  
T_b: 4.00 ft - thickness of anchor block  
d: 2.00 ft - depth from t/ grade to t/ anchor block  
b: 6.00 ft - depth from t/ grade to b/ anchor block

Ultimate Soil Properties

D_w: 99.00 ft - depth from t/ grade to water table

<table>
<thead>
<tr>
<th>Layer</th>
<th>Begin (ft)</th>
<th>End (ft)</th>
<th>Friction Angle (deg)</th>
<th>C (psi)</th>
<th>γ (pcf)</th>
<th>f_s (psf)</th>
<th>μ</th>
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</thead>
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<td>1</td>
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<td>1.00</td>
<td>30.00</td>
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<td>0.36</td>
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<td>6.00</td>
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<td>113.00</td>
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Analysis Criteria

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<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Decision</th>
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</thead>
<tbody>
<tr>
<td>F_{s,sides}</td>
<td>3.35</td>
<td>Yes</td>
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<tr>
<td>F_{s,front}</td>
<td>6.24</td>
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<tr>
<td>F_{s,back}</td>
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<td>No</td>
</tr>
<tr>
<td>F_{s,front}</td>
<td>6.24</td>
<td>Yes</td>
</tr>
<tr>
<td>F_{s,back}</td>
<td>0.00</td>
<td>No</td>
</tr>
<tr>
<td>F_⊥ \cdot f_s</td>
<td>6.07</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Geotechnical Firm: Tower Engineering Professionals  
Report: 50108.1905  
Date: 7/9/2014  
Notes: Frost Depth: 0'  
Boring B-2
Deadman Anchor Analysis: B - Outer

Project Name: Cumorah Hill
Job #: # 50108.12262
Client: Central Communications
Analysis by: JRM
Checked by: AMA
Code: TIA - G

Anchor Block is Adequate for Uplift 49.8%
Anchor Block is Adequate for Lateral 52.2%
Anchor Shaft is Adequate 93.8%

Loads

\[ U_{\text{max}} = 23.99 \text{ kips - maximum uplift reaction} \]
\[ H_{\text{max}} = 22.87 \text{ kips - maximum horizontal reaction} \]

Capacity

\[ U_{\text{all}} = 48.21 \text{ kips - allowable uplift} \]
\[ H_{\text{all}} = 43.86 \text{ kips - allowable horizontal} \]

Foundation Input

Guy Path: B
Anchor Ring: Outer

\[ W_b = 4.50 \text{ ft - width of anchor block} \]
\[ L_b = 12.50 \text{ ft - length of anchor block} \]
\[ T_b = 2.25 \text{ ft - thickness of anchor block} \]
\[ d = 3.17 \text{ ft - depth from t/ grade to t/ anchor block} \]
\[ b = 5.42 \text{ ft - depth from t/ grade to b/ anchor block} \]

Ultimate Soil Properties

\[ D_w = 99.00 \text{ ft - depth from t/ grade to water table} \]

Geotechnical Firm: Tower Engineering Professionals
Report: 50108.19050
Date: 7/9/2014
Notes: Frost Depth: 0" Boring B-4

<table>
<thead>
<tr>
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<td>106.00</td>
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<td>2</td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

Analysis Criteria

Uplift:
\[ F_s_{\text{sides}} = 2.80 \text{ Yes} \]
\[ F_s_{\text{front}} = 5.37 \text{ Yes} \]
\[ F_s_{\text{back}} = 0.00 \text{ No} \]

Horizontal:
\[ F_s_{\text{sides}} = 2.67 \text{ Yes} \]
\[ F_s_{\text{top}} = 0.00 \text{ No} \]
\[ F_s_{\text{bottom}} = 0.00 \text{ No} \]
\[ F_\perp \cdot f_\perp = 13.58 \text{ Yes} \]
June 04, 2014

Mr. Lawrence Wilson
Columbia County
263 NW Lake City Avenue
Lake City, FL 32055
(386) 623-3616

Subject: Foundation Mapping Report

Client Designation: Columbia County Site Name: Cumorah Hill
Columbia County Site Number: Unknown

Engineering Firm Designation: TEP Project Number: 50108-19050

Site Data: Near 1077 SW Cumorah Hill Street
Fort White, Columbia County, FL 32038
Latitude N 29° 57' 15.0", Longitude W 82° 39' 36.9"
300 Foot – Guyed Tower

Dear Mr. Wilson,

Tower Engineering Professionals (TEP) is pleased to submit this “Foundation Mapping Report” to Columbia County for the above referenced site. The onsite investigation was performed by Chris Thompson and Trevor Kamm of Tower Engineering Professionals, Inc. during the June 03, 2014 site visit.

The foundation mapping was to include location of all tower foundation(s)/anchors relative to the tower base and magnetic north, depth below grade and measurement of all external tower foundation/anchor dimensions. For self-support and guyed towers, the tower legs were named by letter according to the magnetic azimuth defined by a line from the center of tower to the leg, with the “A” leg being the leg closest to magnetic north, followed clockwise by “B” and “C”.

We at Tower Engineering Professionals, Inc. appreciate the opportunity of providing our continuing professional services to you and Columbia County. If you have any questions or need further assistance on this or any other projects please give us a call.

Sincerely,

Christopher Thompson, P.E.
Tower Engineering Professionals, Inc.
DATA COLLECTION PROCEDURES:

TEP field technicians perform all data collection by physical excavation of the foundation in question. Experienced excavators are hired and met on location by TEP field technicians who closely direct all aspects of the excavation. Non-caisson tower masts are uncovered from exposed portions outward with a minimum disturbance of the tower foundation and surrounding soil. Once the foundation is exposed, the TEP field technician will physically measure, record and photograph all relevant dimensions and foundation condition. Upon completion of recording the relevant data, the exposed foundation is covered and the site is restored as close as possible to the way it appeared prior to the excavation. Dead man anchors are uncovered by digging to the side and behind of where the anchor rod enters grade. This is done to prevent damage to the anchor rod and to minimize disturbing the soil above and in front of the anchor as much as possible. (TEP will unearth the entire anchor rod for inspection purposes upon request.) Once the edge of the dead man anchor is exposed, the TEP field technician will physically measure and record the depth below grade, thickness and length of the exposed area. The width of the dead man anchor is measured from the anchor rod to the edge. The anchor rod is assumed to be centered widthwise on the anchor foundation. Photographs of all relevant dimensions and the foundation’s condition are then taken. Upon completion of recording the relevant data, the exposed foundation is covered and the site is restored as close as possible to the way it appeared prior to the excavation. Excavation is the deemed to be the most accurate method for mapping a non-caisson foundation with the added benefit of discovering the material condition of the concrete anchor.
# Foundation Dimensions

<table>
<thead>
<tr>
<th>Tower Leg</th>
<th>Azimuth</th>
<th>Radius</th>
<th>Rel. Elev.</th>
<th>&quot;A&quot;</th>
<th>&quot;B&quot;</th>
<th>&quot;C&quot;</th>
<th>&quot;D&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;A&quot; Leg</td>
<td>35°</td>
<td>240'-6&quot;</td>
<td>-0'-6&quot;</td>
<td>9'0&quot;</td>
<td>6'-0&quot;</td>
<td>2'-9&quot;</td>
<td>2'-3&quot;</td>
</tr>
<tr>
<td>&quot;B&quot; Leg</td>
<td>155°</td>
<td>240'-6&quot;</td>
<td>+0'-6&quot;</td>
<td>12'-6&quot;</td>
<td>4'-6&quot;</td>
<td>2'-3&quot;</td>
<td>3'-2&quot;</td>
</tr>
<tr>
<td>&quot;C&quot; Leg</td>
<td>275°</td>
<td>240'-6&quot;</td>
<td>+1'-0&quot;</td>
<td>12'-0&quot;</td>
<td>5'-0&quot;</td>
<td>2'-9&quot;</td>
<td>2'-9&quot;</td>
</tr>
</tbody>
</table>

*Denotes that these foundations were not excavated due to field conditions. Anchor foundation dimensions are given based on anchors that could be mapped.*

## Anchor Foundation

**Scale:** N.T.S.

---

**Prepared By:**
Tower Engineering Professionals
5811 Memorial Hwy, Suite 204
Tampa, FL 33615
(813) 622-0111
www.tegrgroup.net

**Prepared For:**
Columbia County
263 NW Lake City Avenue
Lake City, FL 32055

**Project Information:**
Cumorah Hill
1077 SW Cumorah Hill Street
Fort White, FL 32038
(Columbia County)

**Revision:** 0

**TEP Job #:** 5016-19059

**Sheet Number:** F-3