COMMISSION OF ARCHITECTURAL REVIEW
APPLICATION FOR CERTIFICATE OF APPROPRIATENESS

PROPERTY (location of work)

Address 211 N Foushee Street

Historic district Broad Street

Date/time rec'd 1/26/2018 @ 10:44
Rec'd by: MCH
Application #: COA-029600-2018
Hearing date: 2/27/18

APPLICANT INFORMATION

Name Melissa Harreld

Phone 8048920310

Company Cellco Partnership dba Verizon Wireless

Email mharreld@nbcllc.com

Mailing Address 4435 Waterfront Dr., Ste. 100,
Glen Allen, VA 23060

Applicant Type: ☐ Owner ■ Agent
☐ Lessee ☐ Architect ☐ Contractor
Other (please specify): _____

OWNER INFORMATION (if different from above)

Name Attn: Lennox B Turnbull

Company Shockoprops, LLC

Mailing Address 15 Robin Road
Richmond, VA 23226

Phone

Email

PROJECT INFORMATION

Review Type: ☐ Conceptual Review ■ Final Review

Project Type: ■ Alteration ☐ Demolition ☐ New Construction (Conceptual Review Required)

Project Description: (attach additional sheets if needed)
Please see attached narrative

ACKNOWLEDGEMENT OF RESPONSIBILITY

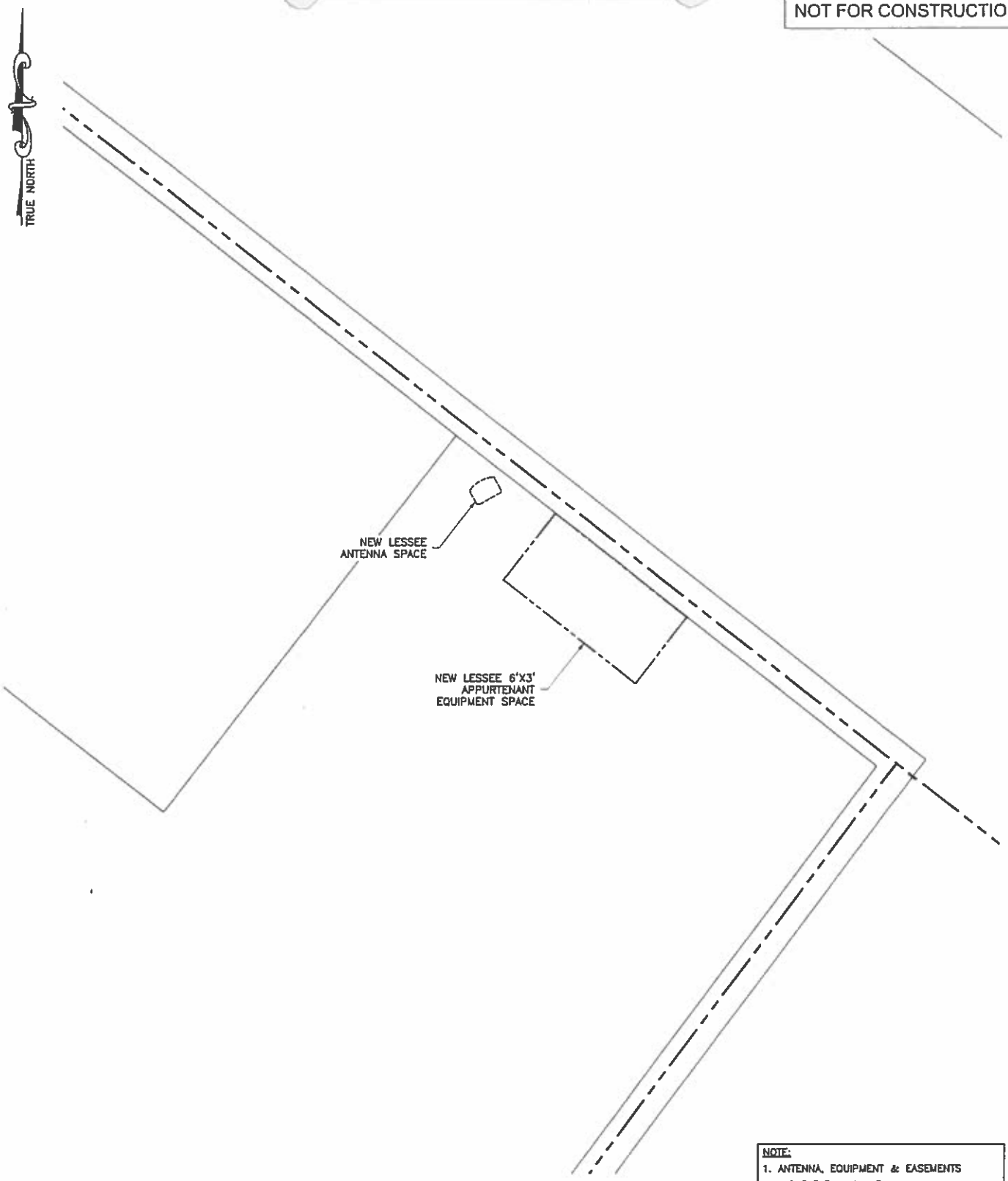
Compliance: If granted, you agree to comply with all conditions of the COA. Revisions to approved work require staff review and may require a new application and CAR approval. Failure to comply with the COA may result in project delays or legal action. The COA is valid for one (1) year and may be extended for an additional year, upon written request.

Requirements: A complete application includes all applicable information requested on checklists to provide a complete and accurate description of existing and proposed conditions. Preliminary review meeting or site visit with staff may be necessary to process the application. Owner contact information and signature is required. Late or incomplete applications will not be considered.

Zoning Requirements: Prior to CAR review, it is the responsibility of the applicant to determine if zoning approval is required and application materials should be prepared in compliance with zoning.

Signature of Owner _____ Date 1/15/18

NOT FOR CONSTRUCTION



ROOFTOP LEASE PLAN

NOTE:
1. ANTENNA, EQUIPMENT & EASEMENTS SUBJECT TO CHANGE
2. EXACT UTILITIES ROUTE TO BE DETERMINED DURING TRANSPORT SITE WALK

NB+C™
TOTALLY COMMITTED.
NB+C ENGINEERING SERVICES, LLC.
4433 WATERFRONT DRIVE, SUITE 100
GLEN ALLEN, VA 23060

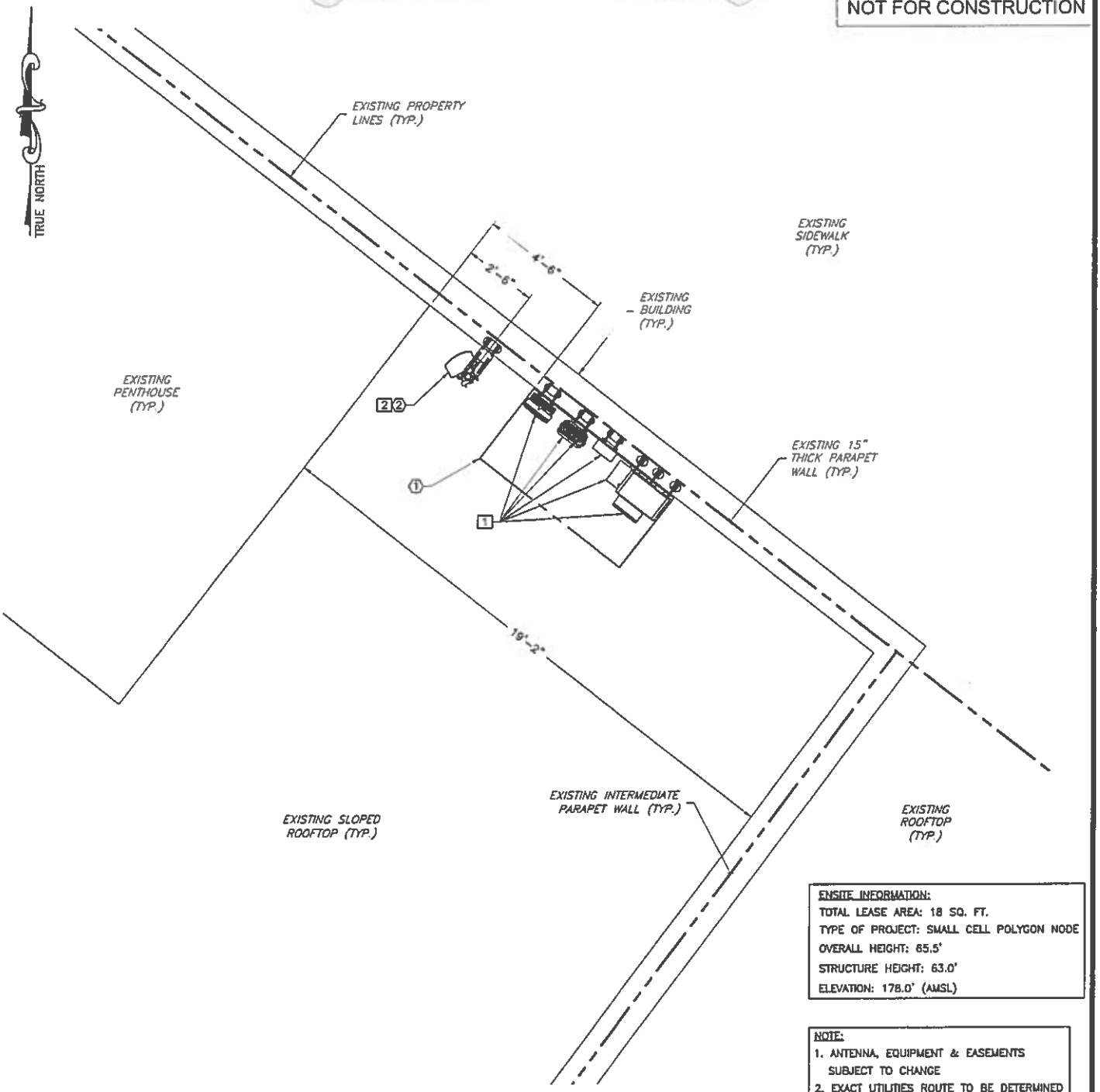
GRACE STREET N027
VERIZON WIRELESS
211 N FOUSHEE STREET
RICHMOND, VA 23220
CITY OF RICHMOND

SUBMITTALS		
REV	DATE	BY
0	09/06/17	TD

SHEET 2

SITE INFORMATION
SITE VISIT BY: DET
DATE: 08/30/17
GOOGLE EARTH
LAT (NAD 83): 37° 32' 43.53"
LONG (NAD 83): -77° 26' 31.04"

NOT FOR CONSTRUCTION



EQUIPMENT PLAN

ENSITE INFORMATION:
TOTAL LEASE AREA: 18 SQ. FT.
TYPE OF PROJECT: SMALL CELL POLYGON NODE
OVERALL HEIGHT: 65.5'
STRUCTURE HEIGHT: 63.0'
ELEVATION: 178.0' (AMSL)

NOTE:
1. ANTENNA, EQUIPMENT & EASEMENTS SUBJECT TO CHANGE
2. EXACT UTILITIES ROUTE TO BE DETERMINED DURING TRANSPORT SITE WALK

CONSTRUCTION NOTES

[1] NEW LESSEE EQUIPMENT MOUNTED TO BRICK PARAPET WALL
[2] NEW LESSEE ANTENNA MOUNTED TO BRICK PARAPET WALL (PAINTED TO MATCH)

LEASE NOTES

(1) NEW LESSEE 6'X3' APPURTENANT EQUIPMENT SPACE
(2) NEW LESSEE ANTENNA SPACE

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SHEET 3

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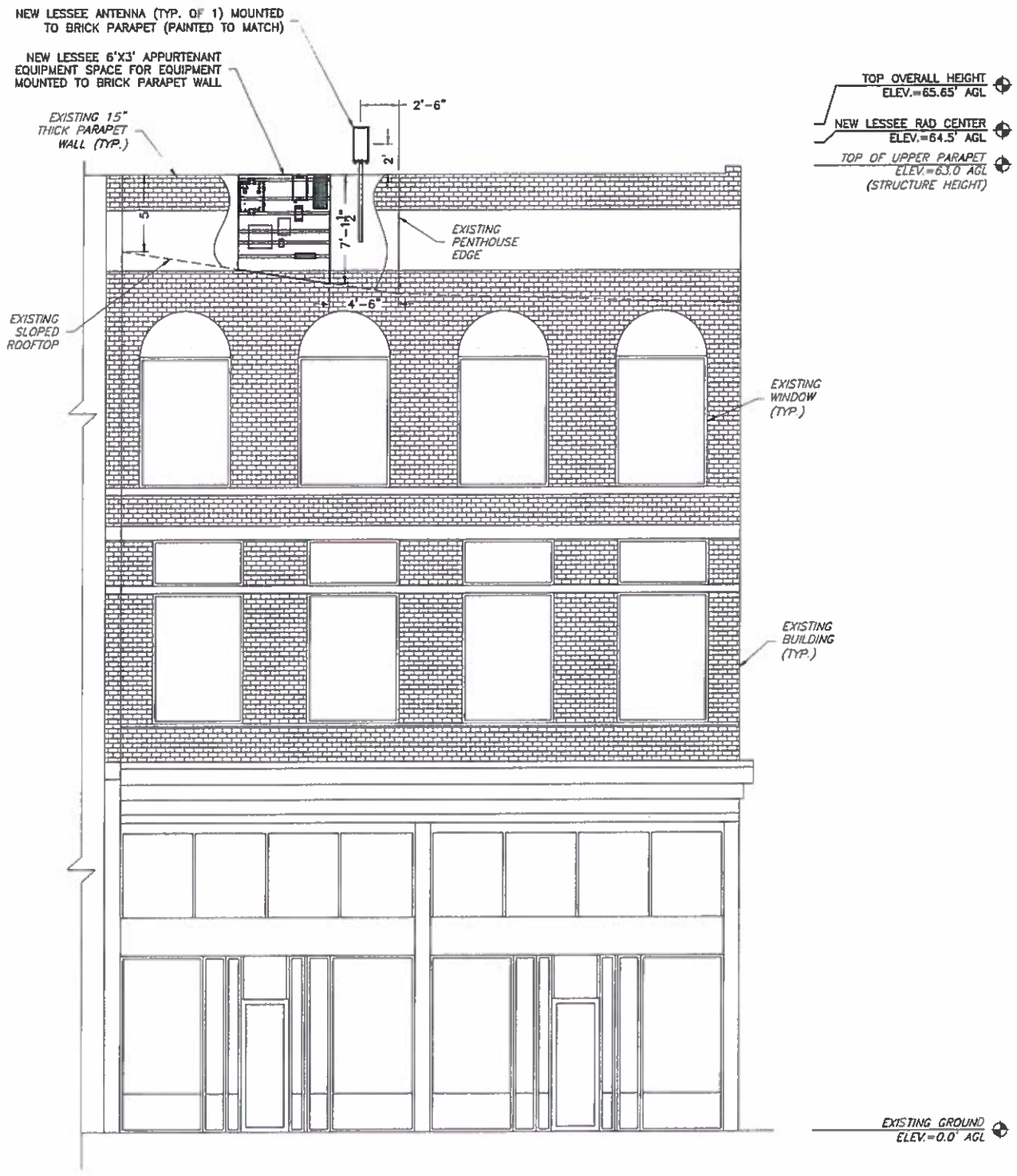

ELEVATION

NOTE:
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LONG (NAD 83): -77° 26' 31.04"

4435 Waterfront Drive
Suite 100
Glen Allen, VA 23060
www.networkbuilding.com

Joshua Son
Planning and Preservation Division
Department of Planning and Development Review
City Hall, Room 510
900 East Broad Street
Richmond, Virginia 23219

January 25, 2017

RE: COMMISSION OF ARCHITECTURAL REVIEW
VERIZON WIRELESS
GRACE STREET N027
211 N FOUSHEE STREET

Dear Mr. Son:

Enclosed you will find the following materials to support the Certificate of Appropriateness application filed on behalf of the applicant, Cellco Partnership d/b/a Verizon Wireless, with respect to their proposed colocation of an antenna on an existing building located at 211 Foushee Street.

- Twelve (12) sets of 8.5 x 11" plans, drawn to scale, showing the proposed improvements;
- Twelve (12) copies of the Project narrative
- Twelve (12) copies of Structural Analysis
- Twelve (12) copies of photo simulations

If you have any questions or require any additional information, please contact me at any time. Thank you in advance for your consideration of this matter.

Best Regards,

Melissa Harreld
Zoning Manager
NB+C, LLC
(P) 804-892-0310
mharreld@nbcllc.com

VERIZON WIRELESS
PROJECT NARRATIVE

The applicant, Cellco Partnership d/b/a Verizon Wireless (hereinafter "VZW"), is licensed by the Federal Communications Commission ("FCC") to provide state-of-the-art wireless communications services within the City of Richmond. The proposed colocation on an existing building located at 211 N. Foushee St. will assist in the enhancement of VZW's existing wireless network in the Richmond area. Specifically, per the attached site plan, VZW proposes the following modifications:

- Collocate an antenna on the roof of an existing building at 211 N Foushee Street, painted to match the building materials
- Equipment to be inside parapet wall, invisible from street level

The subject property is a 3-story mixed-use building, approximately 63' in height, located on a parcel that is zoned B-4, Business. In accordance with Sec. 114-692.4.b.3 which addresses installations using an alternative support structure, the installation does not exceed the 5' maximum protrusion above the mounting structure; the equipment is proposed to be located on the inside of the parapet wall so as not to be visible and the antenna will be painted to look as though it is part of the structure. The height of the building and the existing streetscape also help to camouflage the antenna. Included with this application is a photo simulation of the proposed design which is only visible from one angle across all traffic lanes on Broad Street.

The building has been evaluated to ensure that the installation will be structurally sound. That evaluation is found in the attached structural evaluation letter stamped by Trent Snarr, PE and dated January 3, 2018. A building and electrical permit will also be required to ensure that the installation complies with all state and local laws.

Along with reviews by the city for building permits, electrical permits, and architectural review, these installations must be reviewed by the State Historic Preservation Office (SHPO). In the case of Grace Street N027, the SHPO review found no adverse effect.

CONCLUSION

In conclusion, we would ask that the commission, support the installation as currently proposed. This proposal achieves the goals of keeping the design in harmony with the surrounding buildings, is visibly unobtrusive and offers maximum RF propagation.


Foushee St
200
Foushee St
Broad St

NB+C Engineering Services

Proposed Equipment Installation on Rooftop

Prepared for Verizon Wireless – Network Node Project

SITE INFORMATION

Address	211 N Foushee Street, Richmond, VA 23220, City of Richmond Lat: 37° 32’ 43.53”, Long: -77° 26’ 31.04”
Verizon Wireless Site Name	Grace Street N027
NB+C Project Number	02632
Date	January 3, 2018

Analysis Results: Passing

4435 Waterfront Drive | Suite 100 | Glen Allen, VA | 23060 | 804.548.4079

TABLE OF CONTENTS

1.0 INTRODUCTION

The existing structure is a 62.5' tall commercial building located in the City of Richmond, VA.

Verizon has proposed to install one (1) Commscope-Andrew HBXX-6513DS-A2M panel antenna mounted on the existing brick parapet wall using one (1) set of Site Pro 1 (P/N SP250) wall mounts at an approximate antenna centerline elevation of 64.5'. Additionally, Verizon has also proposed to install one (1) Charles Industries CUBE-SC1041NAN3 equipment cabinet, one (1) ALU RRH4x30-B25, one (1) ALU RHH4x45 and one (1) Commscope CBC1921Y-DS-2X on the proposed P1000 unistrut mounted to the existing rooftop parapet wall. A structural analysis was performed to see if the new loads are safely supported by the existing roof and to verify if the structure is in compliance with the applicable codes and standards. Information we have received and used for this analysis includes:

- Site Walk Notes and Photos prepared by **NB+C ES** (Project # 02632) personnel dated January 2, 2018
- Construction Drawings prepared by **NB+C ES** (Project # 02632) dated December 27, 2017
- RF Data Sheet provided by Verizon

2.0 APPURTENANCES LOADING

As per the information provided to us, the following Table 1 shows the proposed equipment loading.

Table 1 – Proposed Antenna and Equipment Information

Center Line Elevation	Type of Mounts	Antenna Model/ Equipment Cabinet	Carrier	Feed Line (in)
64.5'	(1) Site Pro 1 (P/N SP250) with 2.375" SCH 40 Pipe	(1) Commscope-Andrew HBXX-6513DS-A2M (27.4"x12"x6.5", 17.4lbs.)	Verizon	(2) 1/2
60.0' ±	(4) P1000 Unistrut Mount	(1) ALU RRH4x30-B25 (21.4"x12.0"x7.2", 51.0 lbs.)		-
		(1) ALU RRH4x45-AWS (26.6"x12.0"x6.8", 64.0 lbs.)		
		(1) Commscope CBC1921Y-DS-2X (7.6"x7.6"x5.5", 16.5 lbs.)		
		(1) Charles Industries CUBE-SC1041NAN3 (23.4"x19.4"x10.8", 91.0 lbs.)		

3.0 ASSUMPTIONS

This report is based on the theoretical capacity of the existing building structural elements and is not an assessment of the overall suitability of the existing Structure or its components for any particular use other than specified here in this report:

- This report makes no warranties, expressed and/or implied, and disclaims any liability arising from material, fabrication and erection of the existing Structure or proposed sled, and any other existing or proposed components or appurtenances.
- All existing structural elements are assumed to be in place and in good condition as evident by site audit photos and visual site observations, and were previously designed and constructed in accordance with applicable codes and standards.
- Contractor to verify existing site conditions including the existing roof framing prior to fabrication and construction. In the event the existing building conditions are different than the assumptions made in this report, this has to be brought to the structural engineer's attention before proceeding any further with bidding, fabrication and/or erection.
- All antennas and equipment are conservatively assumed to be normal to the wind for all load combinations considered.

4.0 APPLICABLE CODES AND STANDARDS

The existing structure was analyzed/designed per the provisions of following applicable codes and standards:

- *The Virginia Uniform Statewide Building Code, Incorporating 2012 International Building Code*
- *ANSI/TIA-222-G – Structural Standards for Antenna Supporting Structures and Antennas w/ Addendums 1 and 2*
- *Minimum Design Loads for Buildings and Other Structures ASCE/SEI 7-10*
- *Specification for Structural Steel Buildings ANSI/AISC 360-05, AISC 13th Edition*

5.0 ANALYSIS

Design Loads:

- ASCE 7-10, Peak wind gust: 115 mph
- Occupancy Category: II
- Exposure: B
- Ground Snow Load: 25 psf

Load Combinations:

- D+Lr or S
- 0.6D+0.6W

- D+0.7E
- 0.6D+W
- 0.6D+0.7E

6.0 CONCLUSIONS & RECOMMENDATIONS

Based on the performed analysis of this structure for applied gravity and lateral loads, the proposed antenna wall mount connection is determined to have **adequate** structural capacity and will be stressed at 13.6% of its capacity. Equipment with the gravity and lateral loads, and the proposed wall mount connection is determined to have **adequate** structural capacity and will be stressed at 18% of its capacity to support the proposed Verizon Wireless telecommunication equipment and is in compliance with building codes and standards listed in this report. We have determined the multi-wythe solid brick parapet walls supporting the proposed antenna and equipment loads to be **adequate** by inspection and can support the proposed installation without any structural modification to the structure.

The results in Appendix B of the report shows that the additional forces imparted to the existing structure due to the proposed telecommunications antenna and equipment are within acceptable limits considering the overall configuration of the existing support structure. The proposed antenna mount, RRHs, and equipment cabinet will be connected to the wall using at least four (4) 1/2"ø Hilti HAS threaded rods at each unistrut (top, middle and bottom), with a drilled hole diameter of 11/16". Use an embedment depth of 3-3/4" for the rod in HILTI HIT-HY 70 epoxy.

The conclusions reached by NB+C ES in this report are only applicable for the previously mentioned existing structural members supporting the Verizon Wireless telecommunication antennas and equipment. Any deterioration or damage to the penthouse wall and the parapet wall or localized damage or distress to the structure should be documented and reported to the engineer of record and repaired by the contractor prior to the installation of the proposed equipment. Further, no structural qualification is made or implied by this report for existing structural members not supporting the Verizon equipment. Should you have any questions or require additional information, please feel free to contact us.

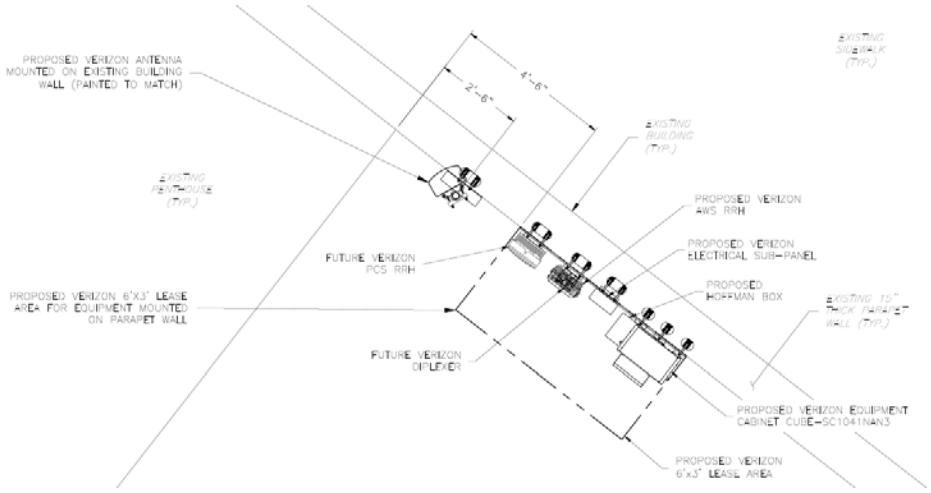
NB+C Engineering Services, LLC

Prepared by: Erik Bowers, PE

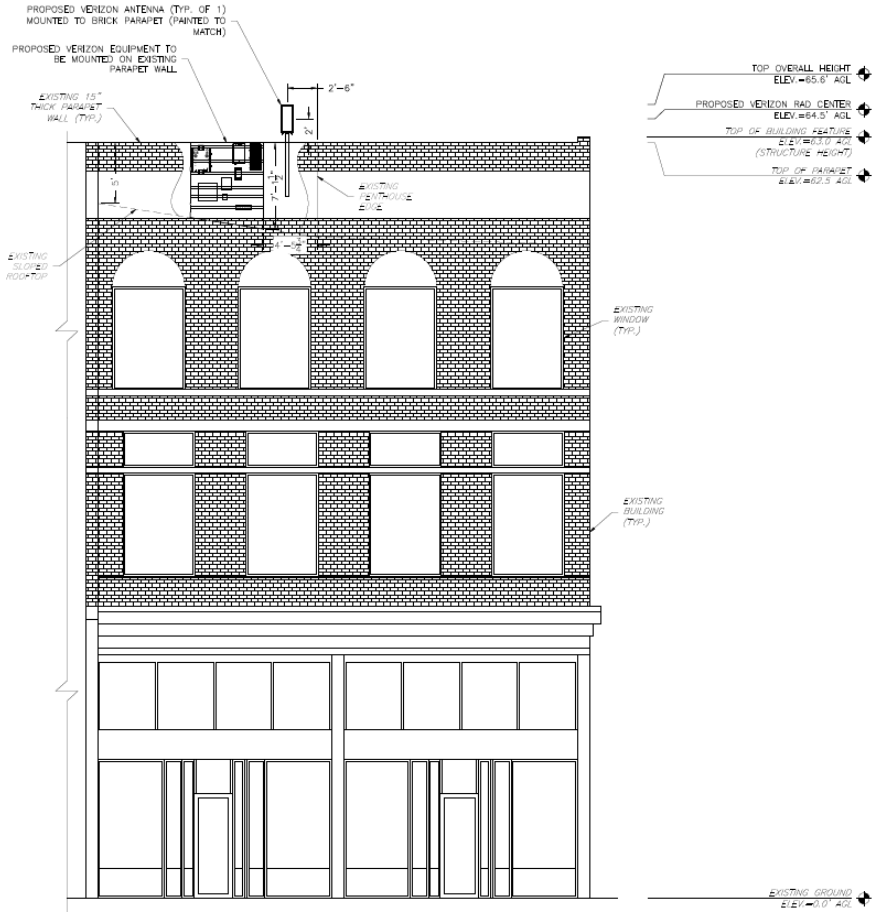
Respectfully submitted by:

Trent Snarr, P.E.
Engineering Manager - South
VA PE License No. 49978

APPENDIX A
PROPOSED PLAN AND ELEVATION LAYOUT



PLAN



ELEVATION

APPENDIX B
CALCULATIONS

Antenna Mast Structural Analysis:

Site Information:

Site Name: Grace Street N027
Address: 211 N Foushee Street, Richmond, VA 23220, City of Richmond

Wind Loads on Antennas Per IBC 2012

		ASCE/SEI 7-10 Reference
Location:	Richmond, VA	
Occupancy Category:	II	Table 1.5-1, pg. 2
Exposure:	$Exp := "B"$	Section 26.7.3, pg 251
Topographic Factor:	$K_{zt} := 1.0$	Section 28.8.2, pg 254
Wind Directional Factor:	$K_d := 0.95$	Table 26.6-1, pg 250
Gust Response Factor:	$G := .85$	Section 26.9.1, Pg. 254
Basic Wind Speed (mph):	$V := 115$	Figure 26.5-1 A-C, pgs 247-249
Equipment Mid Height AGL (ft):	$h := 64.5$ ft	
Velocity Pressure Coefficient:	$z_g := \begin{cases} 1200 & \text{if } Exp = "B" \\ 900 & \text{if } Exp = "C" \\ 700 & \text{if } Exp = "D" \end{cases} = 1200$	Table 26.9-1, pg 256
	$\alpha := \begin{cases} 7 & \text{if } Exp = "B" \\ 9.5 & \text{if } Exp = "C" \\ 11.5 & \text{if } Exp = "D" \end{cases} = 7$	
	$K_z := 2.01 \cdot \left(\frac{h}{z_g}\right)^{\frac{2}{\alpha}} = 0.872$	Table 27.3-1, Pg. 261
Velocity Pressure (psf):	$q_z := 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V^2 psf$	Equation 27.3-1, Pg. 260
	$q_z = 28.04 \cdot psf$	

Proposed Andrew HBXX-6513DS-A2M w/ Site Pro 1 #SP250 Antenna Mount

Mast Dimensions

Pipe Diameter:

PipeD :=

"
1Ø
1.5Ø
2Ø
2.5Ø

Diameter

$h_{mast} := 96in$

$d_{out} = 2.375 \cdot in$ Mast diameter IN

$d_{in} = 2.067 \cdot in$ Mast diameter OUT

$Mmast_{plf} = 3.653 \cdot \frac{lbf}{ft}$ Mast weight per foot

$M_{mast} := Mmast_{plf} \cdot h_{mast}$

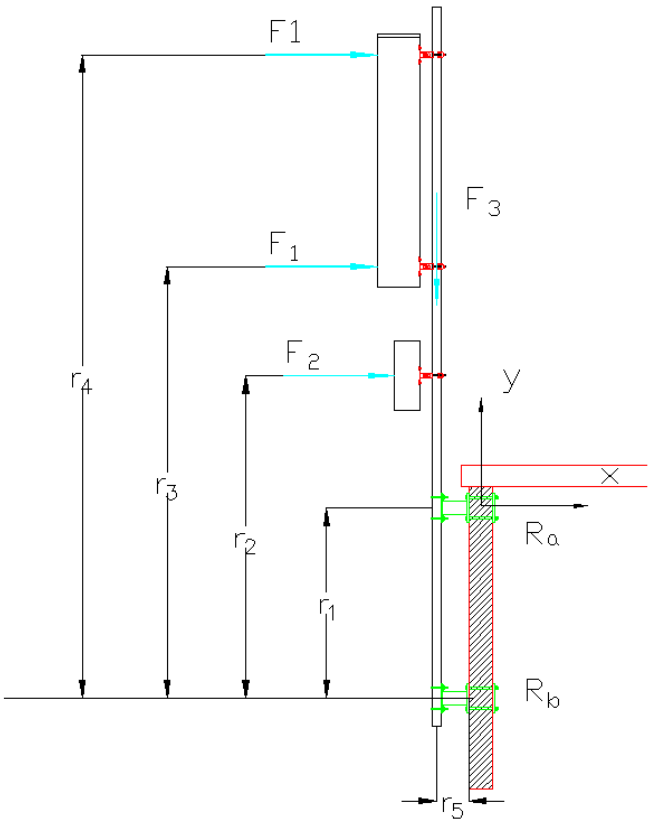
$M_{mast} = 29.2 \cdot lbf$ Mast total weight

Antenna Dimensions

	Andrew HBXX-6513DS-A2M:	MAST:
Antenna height	$h_1 := 27.4in$	$h_3 := h_{mast} = 96 \cdot in$
Antenna width	$w_1 := 12in$	$w_3 := d_{out} = 2.375 \cdot in$
Antenna depth	$d_1 := 6.5in$	$d_3 := d_{out} = 2.375 \cdot in$
Antenna weight	$m_{ant} := 17.4lbf$	$M_{mast} = 29.2 \cdot lbf$
Wind area front	$A_{1f} := h_1 \cdot w_1$	$A_{3f} := h_3 \cdot w_3$
Wind area side	$A_{1s} := h_1 \cdot d_1$	$A_{3s} := h_3 \cdot d_3$
Aspect ratio	$Aspect_{1x} := \frac{h_1}{w_1} = 2.3$	$Aspect_{3x} := \frac{h_3}{w_3} = 40.4$
	$Aspect_{1z} := \frac{h_1}{d_1} = 4.2$	$Aspect_{3z} := \frac{h_3}{d_3} = 40.4$
Force Coeff front	$C_{f1x} = 1.32$	$C_{f3x} := 1.2$
Force Coeff side	$C_{f1z} = 1.35$	$C_{f3z} := 1.2$

Figure 29.5-1, Pg. 312

Geometry:



r1 := 3ft
r2 := 0ft
r3 := 6ft
r4 := 8ft
r5 := 0.42ft Stand-off

Wind Loads:

Antenna:

$W_{x1} := q_z \cdot G \cdot C_{f1x} \cdot A_{1f}$

$W_{x1} = 71.9 \cdot lbf$

$W_{z1} := q_z \cdot G \cdot C_{f1z} \cdot A_{1s}$

$W_{z1} = 39.9 \cdot lbf$

Mast:

$W_{x2} := q_z \cdot G \cdot C_{f3x} \cdot A_{3f}$

$W_{x2} = 45.3 \cdot lbf$

$W_{z2} := q_z \cdot G \cdot C_{f1z} \cdot A_{3s}$

$W_{z2} = 51.1 \cdot lbf$

Equation 29.5-1, Pg. 308

Reactions: X-dir

$$F_{1x} := \frac{W_{x1}}{2} = 36 \cdot lbf$$

$$F_{2x} := \frac{W_{x2}}{2} = 22.6 \cdot lbf$$

$$F_{3x} := 0 = 0 \cdot lbf$$

$$R_{ax} := \frac{F_{1x} \cdot r4 + F_{1x} \cdot r3 + F_{2x} \cdot r2 + F_{3x} \cdot \frac{h_{mast}}{2}}{r1}$$

Sum of the moments about point b

$$\boxed{R_{ax} = 167.8 \cdot lbf}$$

$$R_{bx} := 2F_{1x} + F_{2x} - R_{ax}$$

$$\boxed{R_{bx} = -73.2 \cdot lbf}$$

Reactions: Z-dir

$$F_{1z} := \frac{W_{z1}}{2} = 20 \cdot lbf$$

$$F_{2z} := \frac{W_{z2}}{2} = 25.5 \cdot lbf$$

$$F_{3z} := 0 = 0 \cdot lbf$$

$$R_{az} := \frac{F_{1z} \cdot r4 + F_{1z} \cdot r3 + F_{2z} \cdot r2 + F_{3z} \cdot \frac{h_{mast}}{2}}{r1}$$

Sum of the moments about point b

$$\boxed{R_{az} = 93.1 \cdot lbf}$$

$$R_{bz} := 2F_{1z} + F_{2z} - R_{az}$$

$$\boxed{R_{bz} = -27.7 \cdot lbf}$$

Reactions: Due to Gravity Loads:

$$m_{mount} := 20.11 lbf$$

$$Mass_{total} := m_{ant} + M_{mast} + m_{mount}$$

$$F_{3z} := Mass_{total} = 66.7 \cdot lbf$$

$$R_{b1} := \frac{F_{3z} \cdot r5}{r1}$$

$$\boxed{R_{b1} = 9.3 \cdot lbf}$$

Couple applied at a and b

$$R_{a1} := -R_{b1}$$

$$\boxed{R_{a1} = -9.3 \cdot lbf}$$

Mast Bending Moments:

$Mx_{max} := |R_{bx} \cdot r1| + |R_{b1} \cdot r1|$ Additional Moment due to gravity loads applied

$Mx_{max} = 247.8 \cdot ft \cdot lbf$

$Mz_{max} := |R_{bz} \cdot r1| + |R_{b1} \cdot r1|$

$Mz_{max} = 111 \cdot ft \cdot lbf$

MAST BENDING FAILURE CHECK

$E := 29000ksi$

$F_y := 35ksi$

$Z := \frac{d_{out}^3 - d_{in}^3}{6}$

$I_m := \pi \cdot \frac{\left(d_{out}^4 - d_{in}^4\right)}{64}$

$Z = 0.761 \cdot in^3$

$I_m = 0.666 \cdot in^4$

$t_{ratio} := \frac{d_{out}}{d_{out} - d_{in}}$ Check if Local Buckling needs to be considered. AISC 2005 Specification for Structural Steel Buildings Table B4.1

$t_{ratio} = 7.7$

$t_{limit} := .07 \cdot \frac{E}{F_y}$ $t_{ratio} < t_{limit}$ therefore buckling need not be considered. AISC 2005 Specification for Structural Steel Buildings Table B4.1

$t_{limit} = 58$

$M_{allow} := Z \cdot \frac{F_y}{1.67} = 1.329 \times 10^3 \cdot lbf \cdot ft$ Nominal Flexure Strength AISC 2005 Specifications for Structural Steel Buildings F8-1

$Mx_{max} = 247.8 \cdot ft \cdot lbf$

$Mz_{max} = 111 \cdot ft \cdot lbf$

$Check_1 = \text{"GOOD"}$ $\%Capacity := \frac{\max\left(Mx_{max}, Mz_{max}\right)}{M_{allow}} = 18.644 \cdot \%$

MAST DEFLECTION CHECK:

Deflection calculated by assuming a cantilever beam with equivalent load at end to generate M_{max}

$$F_e := \frac{Mx_{max}}{h_{mast}}$$

$F_e = 31 \cdot lbf$

$L_1 := r4 - r1$

$L_1 = 5 \cdot ft$

$$\Delta := \frac{F_e \cdot L_1^{\,3}}{3 \cdot E \cdot I_m} \qquad \Delta_{allow} := .015 h_{mast}$$

$\Delta_{allow} = 1.44 \cdot in$

$\Delta = 0.115 \cdot in$

$Check_2 = \text{"GOOD"}$ $\qquad$ $\%Capacity := \frac{\Delta}{\Delta_{allow}} = 8.021 \cdot \%$

BOLT CONNECTION CHECK (EPOXY):

1/2" diameter Hilti HY-70 bolts with 3-3/4" embedment:

The existing installation will be less strong than the proposed installation thus, analyzing the existing conditions is adequate.

$F_{T.allow} := 915lbf$

$F_{V.allow} := 1740lbf$ Hilti 3.2.6 Table 12

Max Load on Anchors

$$F_{Tx} := \max\left(\left|R_{ax}\right| + \left|R_{a1}\right|, \left|R_{bx}\right| + \left|R_{b1}\right|\right)$$

$$F_{Vy} := \frac{Mass_{total}}{2}$$

$$F_{Vz} := \max\left(\left|R_{az}\right| + \left|R_{a1}\right|, \left|R_{bz}\right| + \left|R_{b1}\right|\right)$$

$$Inter := \frac{\frac{F_{Tx}}{2}}{F_{T.allow}} + \frac{\frac{F_{Vy}}{2}}{F_{V.allow}} + \frac{\frac{F_{Vz}}{2}}{F_{V.allow}} = 13.583 \cdot \%$$

$Check_3 = \text{"GOOD"}$

BOLT CONNECTION CHECK (BOLT):

Diameter of Bolts: diameter := "

- 1/2Ø
- 5/8Ø
- 3/4Ø
- 7/8Ø

Diameter

Calculations:

Number of Bolts: $n := 2$

Surface Area of Bolt: $A_{bolt} := \frac{\pi \cdot d_{bolt}^2}{4} = 0.196 \cdot in^2$

Factor of Safety: $\Omega := 2$ Steel Construction Manual 13th Edition 16.1

Tensile Stress: $F_u := 120ksi$

Nominal Tensile Strength: $F_{nt} := 0.75 \cdot F_u$ $F_{nt} = 90 \cdot ksi$

Nominal Shear Strength: $F_{nv} := 0.45 \cdot F_u$ $F_{nv} = 54 \cdot ksi$

Allowable Tensile Strength: $\Omega F_{nt} := \frac{F_{nt} \cdot A_{bolt}}{\Omega}$ $\Omega F_{nt} = 8.836 \cdot kip$

Allowable Shear Strength: $\Omega F_{nv} := \frac{F_{nv} \cdot A_{bolt}}{\Omega}$ $\Omega F_{nv} = 5.301 \cdot kip$

Bolt Capacity Check:

Tensile Force Applied Per Bolt: $T_{applied} := \frac{F_{Tx}}{n} = 88.573 \cdot lbf$

Shear Force Applied Per Bolt: $V_{applied} := \frac{\max(F_{Vy}, F_{Vz})}{n} = 51.226 \cdot lbf$

% Capacity in Tension: $\%Capacity := \frac{T_{applied}}{\Omega F_{nt}} = 1.002 \cdot \%$ **Okay**

% Capacity in Shear: $\%Capacity := \frac{V_{applied}}{\Omega F_{nv}} = 0.966 \cdot \%$ **Okay**

Parapet Wall Check:

The parapet wall was determined adequate by inspection.

Therefore, the proposed pipe mount w/ Site Pro 1 #SP250 antenna mount connecting to the existing parapet wall are adequate for the proposed installation and the proposed Verizon equipment can be installed as intended. Please see the construction drawings prepared by NB+C ES for further details.

Proposed Wall-Mounted Equipment

Antenna Dimensions

Cube-SC1041NAN3 Equipment Cabinet:

Antenna height $h_1 := 26in$

Antenna width $w_1 := 19.4in$

Antenna depth $d_1 := 10.8in$

Antenna weight $m_{ant} := 91lbf$

Wind area front $A_{1f} := h_1 \cdot w_1$

Wind area side $A_{1s} := h_1 \cdot d_1$

Aspect ratio $Aspect_{1x} := \frac{h_1}{w_1} = 1.3$

$Aspect_{1z} := \frac{h_1}{d_1} = 2.4$

Force Coeff front $C_{f1x} = 1.31$

Force Coeff side $C_{f1z} = 1.32$

Figure 29.5-1, Pg. 312

Diplexer Dimensions

Diplexer CBC1921Y-DS-2X:

Antenna height $h_4 := 12.5in$

Antenna width $w_4 := 7.6in$

Antenna depth $d_4 := 5.5in$

Antenna weight $m_{dipx} := 16.5lbf$

Wind area front $A_{4f} := h_4 \cdot w_4$

Wind area side $A_{4s} := h_4 \cdot d_4$

Aspect ratio $Aspect_{4x} := \frac{h_4}{w_4} = 1.6$

$Aspect_{4z} := \frac{h_4}{d_4} = 2.3$

Force Coeff front $C_{f4x} = 1.31$

Force Coeff side $C_{f4z} = 1.32$

Figure 29.5-1, Pg. 312

RRH 4x30 Dimensions

PCS RRH4x30-B25:

Antenna height $h_5 := 21.4in$

Antenna width $w_5 := 12.0in$

Antenna depth $d_5 := 7.2in$

Antenna weight $m_{rrh430} := 51lbf$

Wind area front $A_{5f} := h_5 \cdot w_5$

Wind area side $A_{5s} := h_5 \cdot d_5$

Aspect ratio $Aspect_{5x} := \frac{h_5}{w_5} = 1.8$

$Aspect_{5z} := \frac{h_5}{d_5} = 3$

Force Coeff front $C_{f5x} = 1.31$

Force Coeff side $C_{f5z} = 1.33$

Figure 29.5-1, Pg. 312

RRH 4x45 Dimensions

AWS RRH4x45:

Antenna height $h_6 := 26.0in$

Antenna width $w_6 := 11.4in$

Antenna depth $d_6 := 5.9in$

Antenna weight $m_{rrh445} := 51lbf$

Wind area front $A_{6f} := h_5 \cdot w_5$

Wind area side $A_{6s} := h_5 \cdot d_5$

Aspect ratio $Aspect_{6x} := \frac{h_6}{w_6} = 2.3$

$Aspect_{6z} := \frac{h_6}{d_6} = 4.4$

Force Coeff front $C_{f6x} = 1.32$

Force Coeff side $C_{f6z} = 1.36$

Figure 29.5-1, Pg. 312

Wind Loads:

Antenna:

$W_{x1} := q_z \cdot G \cdot C_{f1x} \cdot A_{1f}$ Equation 29.5-1, Pg. 308

$W_{x1} = 109 \cdot lbf$

$W_{z1} := q_z \cdot G \cdot C_{f1z} \cdot A_{1s}$

$W_{z1} = 61.5 \cdot lbf$

Diplexer:

$W_{x4} := q_z \cdot G \cdot C_{f4x} \cdot A_{4f}$ Equation 29.5-1, Pg. 308

$W_{x4} = 20.5 \cdot lbf$

$W_{z4} := q_z \cdot G \cdot C_{f4z} \cdot A_{4s}$

$W_{z4} = 15 \cdot lbf$

RRH 4x30:

$W_{x5} := q_z \cdot G \cdot C_{f5x} \cdot A_{5f}$ Equation 29.5-1, Pg. 308

$W_{x5} = 55.8 \cdot lbf$

$W_{z5} := q_z \cdot G \cdot C_{f5z} \cdot A_{5s}$

$W_{z5} = 34 \cdot lbf$

RRH 4x45:

$W_{x6} := q_z \cdot G \cdot C_{f6x} \cdot A_{6f}$ Equation 29.5-1, Pg. 308

$W_{x6} = 56.2 \cdot lbf$

$W_{z6} := q_z \cdot G \cdot C_{f6z} \cdot A_{6s}$

$W_{z6} = 34.6 \cdot lbf$

Equipment Loads:

$W_{equip} := m_{ant} + m_{dipx} + m_{rrh430} + m_{rrh445}$

$W_{equip} = 209.5 \cdot lbf$

BOLT CONNECTION CHECK (EPOXY):

1/2" diameter Hilti HY-70 bolts with 3-3/4" embedment:

The existing installation will be less strong than the proposed installation thus, analyzing the existing conditions is adequate.

$F_{T.allow} := 915lbf$

$F_{V.allow} := 1740lbf$ Hilti 3.2.6 Table 12

Max Load on Anchors

$F_{Tx} := W_{x1} + W_{x4} + W_{x5} + W_{x6}$

$F_{Vy} := \frac{W_{equip}}{4} = 52.375 \cdot lbf$

$F_{Vz} := W_{z1} + W_{z4} + W_{z5} + W_{z6}$

$Inter := \frac{\frac{F_{Tx}}{4}}{F_{T.allow}} + \frac{\frac{F_{Vy}}{2}}{F_{V.allow}} + \frac{\frac{F_{Vz}}{4}}{F_{V.allow}} = 10.189 \cdot \%$

$Check_3 = "GOOD"$

BOLT CONNECTION CHECK (BOLT):

Diameter of Bolts: diameter :=

"
1/2Ø
5/8Ø
3/4Ø
7/8Ø

Diameter

Calculations:

Number of Bolts: $n := 4$

Surface Area of Bolt: $A_{bolt} := \frac{\pi \cdot d_{bolt}^2}{4} = 0.196 \cdot in^2$

Factor of Safety: $\Omega := 2$ Steel Construction Manual 13th Edition 16.1

Tensile Stress: $F_u := 120ksi$

Nominal Tensile Strength: $F_{nt} := 0.75 \cdot F_u$ $F_{nt} = 90 \cdot ksi$

Nominal Shear Strength: $F_{nv} := 0.45 \cdot F_u$ $F_{nv} = 54 \cdot ksi$

Allowable Tensile Strength: $\Omega F_{nt} := \frac{F_{nt} \cdot A_{bolt}}{\Omega}$ $\Omega F_{nt} = 8.836 \cdot kip$

Allowable Shear Strength: $\Omega F_{nv} := \frac{F_{nv} \cdot A_{bolt}}{\Omega}$ $\Omega F_{nv} = 5.301 \cdot kip$

Bolt Capacity Check:

Tensile Force Applied Per Bolt: $T_{applied} := \frac{F_{Tx}}{n} = 60.381 \cdot lbf$

Shear Force Applied Per Bolt: $V_{applied} := \frac{\max(F_{Vy}, F_{Vz})}{n} = 36.286 \cdot lbf$

% Capacity in Tension: $\%Capacity := \frac{T_{applied}}{\Omega F_{nt}} = 0.683 \cdot \%$ **Okay**

% Capacity in Shear: $\%Capacity := \frac{V_{applied}}{\Omega F_{nv}} = 0.684 \cdot \%$ **Okay**

Parapet Wall Check:

The parapet wall was determined adequate by inspection.

Therefore, the proposed Hilti HIT-HY 70 Epoxy w/ (4) threaded rods connecting to the existing brick wall are adequate for the proposed installation and the proposed Verizon equipment can be installed as intended. Please see the construction drawings prepared by NB+C ES for further details.

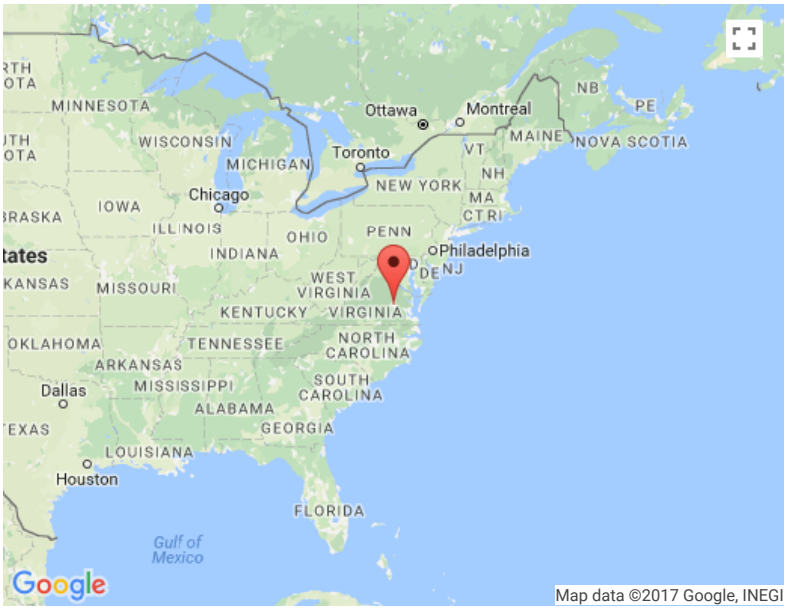
Search Results

Query Date: Wed Aug 30 2017
Latitude: 37.5406
Longitude: -77.4387

ASCE 7-10 Windspeeds (3-sec peak gust in mph*):

Risk Category I: 105
Risk Category II: 115
Risk Category III-IV: 120
MRI 10-Year:** 76
MRI 25-Year:** 84
MRI 50-Year:** 90
MRI 100-Year:** 96

ASCE 7-05 Windspeed:
90 (3-sec peak gust in mph)
ASCE 7-93 Windspeed:
73 (fastest mile in mph)



*Miles per hour
**Mean Recurrence Interval

Users should consult with local building officials to determine if there are community-specific wind speed requirements that govern.

Print your results

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NOT FOR CONSTRUCTION

UTILITY POLE INFORMATION:
OWNER: SHOCKOPROPS LLC ATTN: LENNOX B TURNBULL JR.
PARCEL ID: W0000084001
ZONING CLASS: B-4 – BUSINESS
ACREAGE: 0.135
ELEVATION: 178.0' (AMSL)

TRUE NORTH

NOTE:
1. ANTENNA, EQUIPMENT & EASEMENTS SUBJECT TO CHANGE
2. EXACT UTILITIES ROUTE TO BE DETERMINED DURING TRANSPORT SITE WALK

SITE PLAN

LEASE NOTES

1. NEW LESSEE 6'X3' APPURTENANT EQUIPMENT SPACE
2. NEW LESSEE ANTENNA SPACE

NB+C TOTALLY COMMITTED
NB+C ENGINEERING SERVICES, LLC.
4435 WATERFRONT DRIVE, SUITE 100
GLEN ALLEN, VA 23060

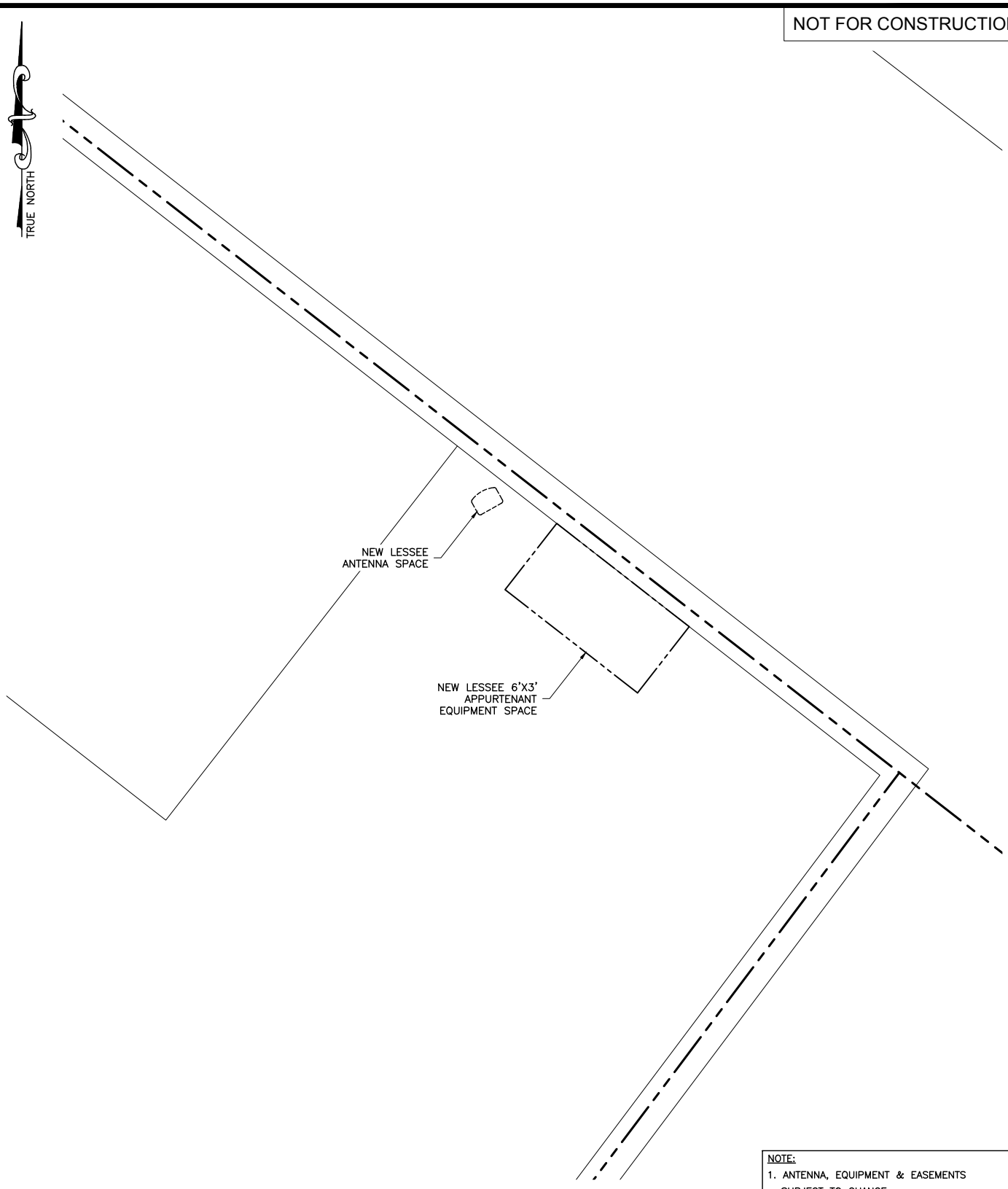
GRACE STREET N027
VERIZON WIRELESS
211 N FOUSHEE STREET
RICHMOND, VA 23220
CITY OF RICHMOND

SUBMITTALS		
REV	DATE	BY
0	09/06/17	TD

SHEET 1

SITE INFORMATION
SITE VISIT BY: DET
DATE: 08/30/17
GOOGLE EARTH
LAT (NAD 83): 37° 32' 43.53"
LONG (NAD 83): -77° 26' 31.04"

NOT FOR CONSTRUCTION



ROOFTOP LEASE PLAN

NOTE:
1. ANTENNA, EQUIPMENT & EASEMENTS SUBJECT TO CHANGE
2. EXACT UTILITIES ROUTE TO BE DETERMINED DURING TRANSPORT SITE WALK

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GLEN ALLEN, VA 23060

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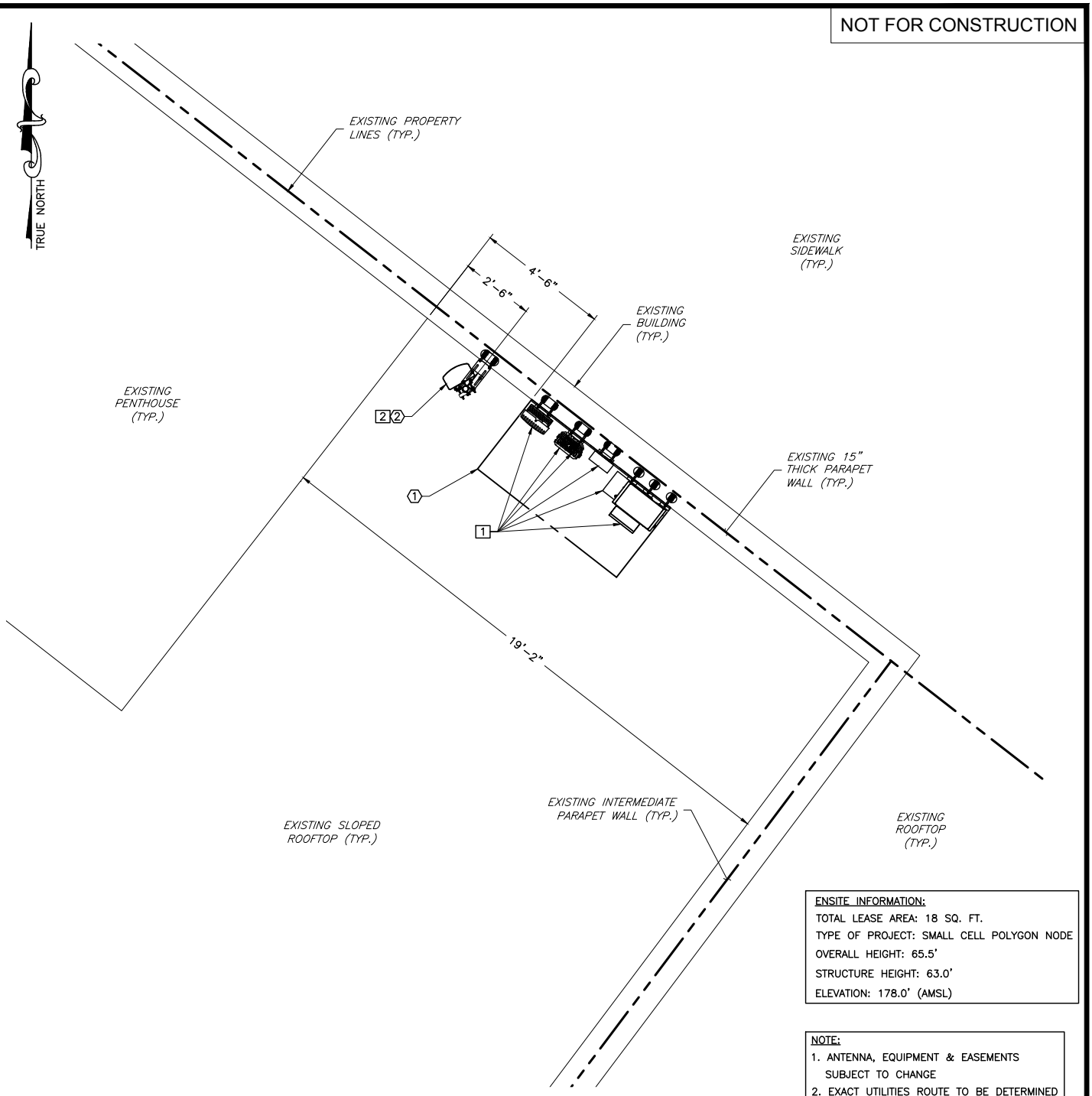
VERIZON WIRELESS
211 N FOUSHEE STREET
RICHMOND, VA 23220
CITY OF RICHMOND

SUBMITTALS		
REV	DATE	BY
0	09/06/17	TD

SHEET 2

SITE INFORMATION
SITE VISIT BY: DET
DATE: 08/30/17
GOOGLE EARTH
LAT (NAD 83): 37° 32' 43.53"
LONG (NAD 83): -77° 26' 31.04"

NOT FOR CONSTRUCTION



ENSITE INFORMATION:
TOTAL LEASE AREA: 18 SQ. FT.
TYPE OF PROJECT: SMALL CELL POLYGON NODE
OVERALL HEIGHT: 65.5'
STRUCTURE HEIGHT: 63.0'
ELEVATION: 178.0' (AMSL)

NOTE:
1. ANTENNA, EQUIPMENT & EASEMENTS SUBJECT TO CHANGE
2. EXACT UTILITIES ROUTE TO BE DETERMINED DURING TRANSPORT SITE WALK

EQUIPMENT PLAN

CONSTRUCTION NOTES

1 NEW LESSEE EQUIPMENT MOUNTED TO BRICK PARAPET WALL
2 NEW LESSEE ANTENNA MOUNTED TO BRICK PARAPET WALL (PAINTED TO MATCH)

LEASE NOTES

1 NEW LESSEE 6'X3' APPURTENANT EQUIPMENT SPACE
2 NEW LESSEE ANTENNA SPACE

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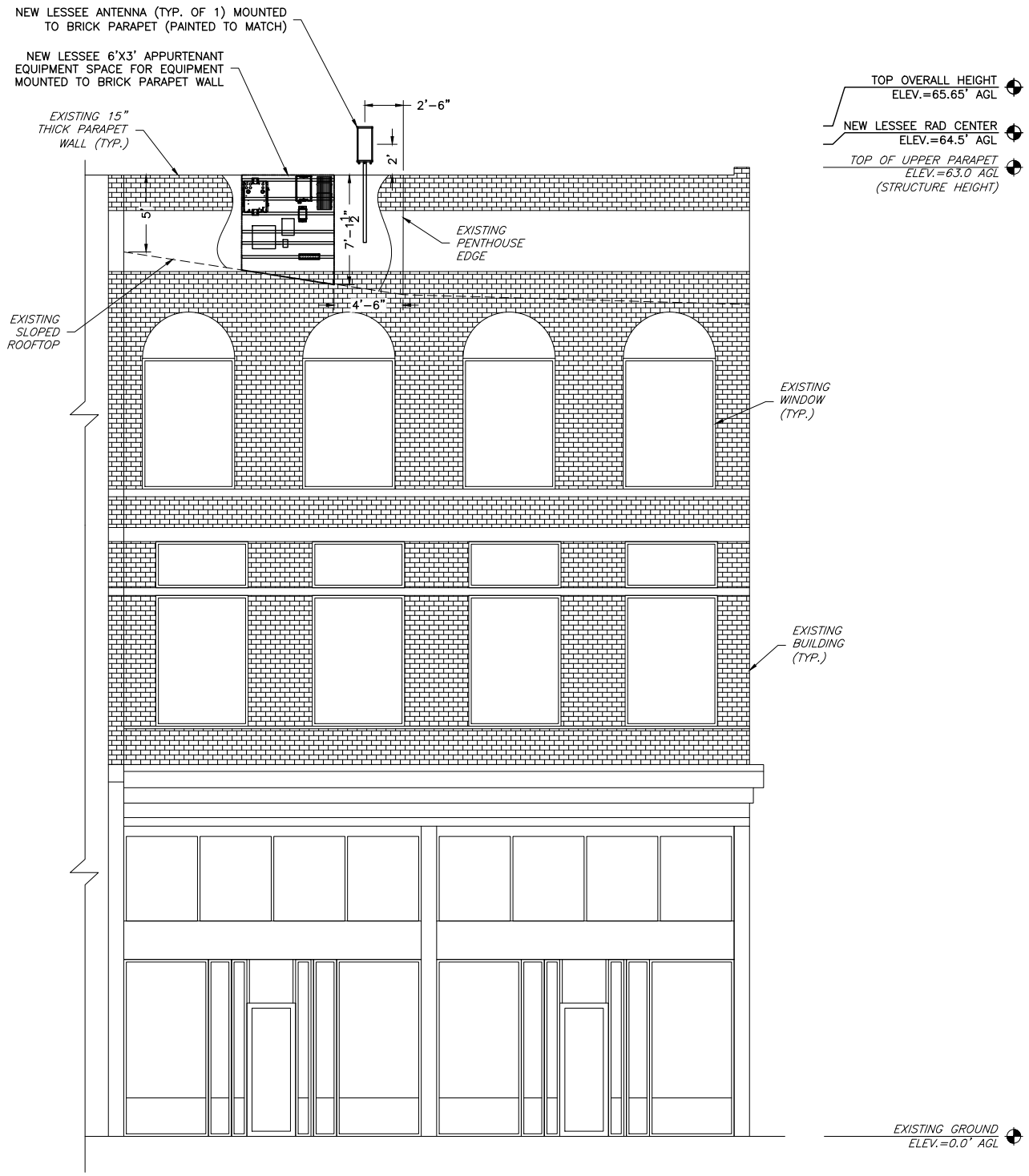
CITY OF RICHMOND

SUBMITTALS		
REV	DATE	BY
0	09/06/17	TD

SHEET 3

SITE INFORMATION
SITE VISIT BY: DET
DATE: 08/30/17
GOOGLE EARTH
LAT (NAD 83): 37° 32' 43.53"
LONG (NAD 83): -77° 26' 31.04"

NOT FOR CONSTRUCTION



ELEVATION

NOTE:
1. ANTENNA, EQUIPMENT & EASEMENTS SUBJECT TO CHANGE
2. EXACT UTILITIES ROUTE TO BE DETERMINED DURING TRANSPORT SITE WALK

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RICHMOND, VA 23220
CITY OF RICHMOND

SUBMITTALS		
REV	DATE	BY
0	09/06/17	TD

SHEET 4

SITE INFORMATION
SITE VISIT BY: DET
DATE: 08/30/17
GOOGLE EARTH
LAT (NAD 83): 37° 32' 43.53"
LONG (NAD 83): -77° 26' 31.04"