

By:	SC	Date:	12-Feb-20	Sheet:	1 of 10
Chk'd by:	AC	Project No.:	VF23408	Revision:	B
Project:	TA Centre Brock Barracks Oxford Rd, Reading Berkshire RG30 1HW				

mono[#]

Structural Calculations
for
Telecommunication Installation at
TA Centre
Brock Barracks
Oxford Rd, Reading
Berkshire RG30 1HW

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Project: TA Centre Brock Barracks Oxford Rd, Reading Berkshire RG30 1HW		

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Introduction

It is proposed to upgrade a telecoms installation at the above site, by replacing existing 3no. antennas with 6 no. new units on new wall mounted poles and wall brackets fixed to the brick masonry chimney. It is also proposed to install a 0.3m transmission dish on a separate pole mount at 11.5m AGL onto the chimney masonry.

Existing Site

The existing structure is a masonry chimney circa 15m tall, tapering in diameter from bottom to top, in 3 no. separate sections. The new antennas will be installed at the upper section below the capping, and the 0.3m dish on the section below.

Conclusions

The proposed wall poles are adequate for the proposed antennas and dish. The calculations indicate the resin anchor fixings will be within design limits under applied wind and dead loads, however insitu pullout tests should be carried out to confirm this as part of the Mono build process. The 76.1 x 5.0 CHS support poles are adequate for the applied loads. No information regarding the structural makeup of the masonry chimney was available at the time of this report, however it is deemed reasonable to assume that there will be no undue stress due to the relatively small additional wind loads. A full dimensional and structural survey is recommended to confirm stability of structure as noted above, and local masonry condition survey at proposed fixing points .

References

BS6399 part 2	Wind loads
BS 5950 part1 -	Structural use of steelwork in building
BS 8110 part 1 -	Structural use of concrete
BS 5628 part 1 -	Code of practice for use of masonry
BS 6399 part 1 - 1996	Loading for buildings: Code of practice for dead and imposed
BS 6399 part 3 - 1988	Loading for buildings: Code of practice for imposed roof load
The forces used in steel design in the proceeding calculations are ultimate forces based on the following load combinations;	
Dead and imposed	1.4 x dead plus 1.6 x imposed
Dead plus wind	0.9 x dead plus 1.4 x wind
Dead imposed and wind	1.2 x (dead plus imposed plus wind)

CALCULATION SHEET

Sheet 4 of 10 Sheets

Client

CTIL

Subject

TA Centre

Date

Aug-19

Calculated By
SCChecked By
AC

Approved By

Site Ref

Job Number

VF 23408

WIND LOAD

Location: TA Centre, Brock Barracks, Oxford Road, Reading, Berkshire RG30 1HW

NGR ref: 469375E 173680N

Site Altitude $h_s = 40$ mClosest distance to sea $d_s = 75$ kmHeight of Building $h = 15$ mBasic Wind Speed $v_b = 20$ m/sAltitude Factor $s_a = 1 + 0.001 \times h_s = 1.040$ Directional Factor $s_d = 1.0$ Seasonal Factor $s_r = 1.0$ Probability Factor $s_p = 1.0$ Site Wind Speed $v_s = v_b \times s_a \times s_d \times s_p = 20.80$ m/sTerrain & Building Factor $s_b = 1.74$ (Table 4, $H_e = 15$ m, 75 km to sea)Effective Wind Speed $v_e = v_s \times s_b = 36.19$ m/sDynamic Pressure $q_s = 0.613 \times v_e^2 \times 10^{-3} = 0.80$ kN/m²

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Client

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TA CENTRE

Date

AUGUST 2019

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SC

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AC

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VF 23408

Job Number

Antennas:

Huawei AOC4518R8U06

Dimensions: 2099 x 449 x 196 mm weight = 43 KG

Ericsson AAU 6488

Dimensions: 810 x 420 x 200 mm weight = 60 KG.

From inspection, the Huawei antenna will be more onerous in terms of overall loading, so calculations will be based only on this antenna.

WIND LOADS:

Worst case assume wind acting on front face.

$$\text{Wind on antenna } P_{\text{ANT}} = \underset{\delta_1}{1.4} \times \underset{\delta_2}{1.6} \times \underset{\delta_3}{0.8} \times 2.1 \times 0.45 = 1.7 \text{ KN}$$

$$\text{Wind on pole } P_{\text{pole}} = 1.4 \times 1.6 \times 0.8 \times 2.5 \times 0.076 = 0.34 \text{ KN}$$

$$\delta_1 = \text{FOS}$$

$$\delta_2 = \text{shape factor}$$

$$\delta_3 = 1$$

Due to the relatively small loads applied, from inspection the 76.1 x 5.0 CHS will be adequate and only the fixings back to the brick masonry will be considered.

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CALCULATION SHEET

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Client

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TA CENTRE

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VF 23408

Job Number

LOADING DEAD WIND

Support pole 22.5 KG 0.34 KN
2.5m 76.3x5.0 CHS = 0.22 KN

Antenna 0.4 KN 1.7 KN

Wall brackets 0.3 KN /

Moment at Wall Plate (Wind Only)

Antenna = $1.7 \times 0.31 = 0.53 \text{ KNm}$
Pole = $0.34 \times 0.16 = 0.05 \text{ KNm}$

Total = 0.58 KNm

Applied moment per bracket

= $\frac{0.58}{2} = 0.29 \text{ KNm}$

Resulting tensile load per bolt

= $\frac{0.29}{2 \times 0.25} = 0.58 \text{ KN}$

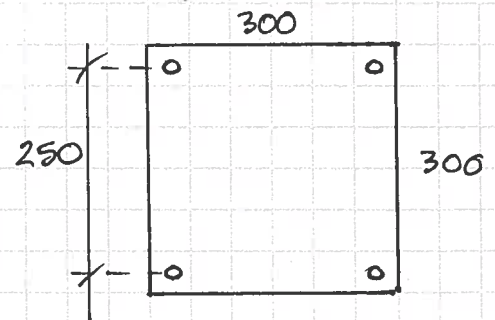
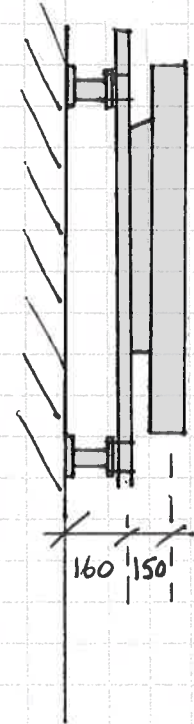
Moment at Wall Plate (Dead Load)

Antenna = $1.4 \times 0.4 \times 0.31 = 0.17 \text{ KNm}$

Pole = $1.4 \times 0.22 \times 0.16 = 0.05 \text{ KNm}$

Wall brackets = $1.4 \times 0.3 \times 0.08 = 0.03 \text{ KNm}$

Total = 0.25 KNm



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Job Number

Applied moment per bracket

$$= \frac{0.25}{2} = 0.125 \text{ KNm}$$

$$\text{Tensile load per bolt} = \frac{0.125}{2 \times 0.25} = 0.25 \text{ KN}$$

$$\text{Maximum pullout on bolts} = 0.58 + 0.25 = 0.83 \text{ KN}$$

Recommended load on M12 resin bolts in masonry minimum 80mm embedment can be taken as 2.5KN from Hilti tables.

$$2.5 > 0.83 \Rightarrow \text{BOLTS OK.}$$

Check Support Pole

Assume wind load on pole and antenna acts as a point load midspan

$$P = 2.04 \text{ KN}$$

$$M_{\max} = \frac{wl}{4} = \frac{2.04 \times 2.15}{4} = 1.1 \text{ KNm}$$

$$\text{For } 76.1 \times 5.0 \text{ CHS } M_c = 7.9 \text{ KNm} > 1.1$$

$\Rightarrow$ SECTION OK IN BENDING

Deflection assumed by inspection to be negligible.

CALCULATION SHEET

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Client

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FEB' 2020

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VF 23408

Job Number

0.3m TRANSMISSION DISH

q previously calculated as 0.8 kN/m^2 .

Dish will be supported off 1.0m long 76.1 x 5.0 CHS pole fixed to the masonry with 2 No 300 x 300 x 10 mm thick plates, and 4 No M12 resin anchor bolts, see page 6.

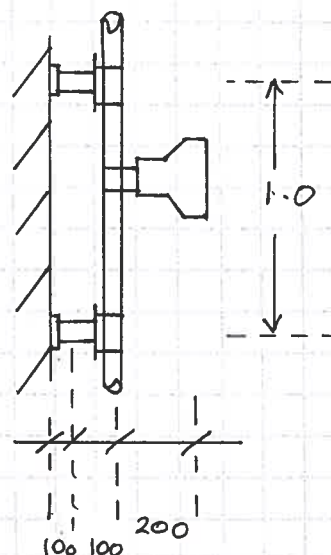
Wind Loads:

$$P_{\text{dish}} = 1.4 \times 1.2 \times 0.8 \times \frac{\pi \times 0.3^2}{4} = 0.1 \text{ kN}$$

$$P_{\text{pole}} = 1.4 \times 1.6 \times 0.8 \times 1.0 \times 0.076 = 0.14 \text{ kN}$$

LOADING SUMMARY:

LOAD	DEAD	WIND
Support pole 1.0 76.5 x 5.0 CHS	9 KG = 0.09 kN	0.14 kN
Dish	10 KG = 0.11 kN	0.1 kN
Wall brackets	0.3 kN	—



Moment at Wall Plate (Wind Only)

$$M_{\text{dish}} = 0.1 \times 0.4 = 0.04 \text{ kNm}$$

$$M_{\text{pole}} = 0.14 \times 0.2 = 0.03 \text{ kNm}$$

$$\text{Total} = 0.07 \text{ kNm}$$

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VF 23408

Job Number

Applied moment per bracket

$$= \frac{0.07}{2} = 0.035 \text{ KNm}$$

Resulting tensile load per bolt

$$= \frac{0.035}{2 \times 0.25} = 0.07 \text{ KN}$$

Moment at wall plate (Dead Load)

$$\text{Dish} = 1.4 \times 0.1 \times 0.4 = 0.06 \text{ KNm}$$

$$\text{Pole} = 1.4 \times 0.09 \times 0.2 = 0.03 \text{ KNm}$$

$$\text{Brackets} = 1.4 \times 0.3 \times 0.1 = 0.04 \text{ KNm}$$

$$\text{Total} = 0.13 \text{ KNm}$$

Applied moment per bracket

$$= \frac{0.13}{2} = 0.065 \text{ KNm}$$

Resultant tensile load per bolt

$$= \frac{0.065}{2 \times 0.25} = 0.13 \text{ KN}$$

$$\text{Max pullout on bolts} = 0.07 + 0.13 = 0.2 \text{ KN}$$

As per page 7, $2.5 > 0.2 \Rightarrow$ BOLTS OK.



CALCULATION SHEET

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Job Number

Check Support pole:

Assume wind loads act as midspan point load:

$$P = 0.24 \text{ kN}$$

$$M_{\max} = \frac{WL}{4} = 0.06 \text{ kNm} < 7.9 \text{ kNm} \Rightarrow \text{SECTION OK IN BENDING}$$

From inspection pole deflection will be within design limits.

Amendment

Amendment By/Date

Checked By/Date

Approved By/Date

Details

N.C.R	E: 469375	N: 173680
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CONCESSION REQUIRED

STEELWORK NOTES

1. ALL STEELWORK FABRICATION AND ERECTION SHALL COMPLY WITH THE "NATIONAL STEELWORK SPECIFICATION"

2. STRUCTURAL STEEL TO BE GRADE S275 MILD STEEL TO BS EN10025 AND BS5950

3. ALL WELDS TO BE MINIMUM 6
CONTINUOUS FILLET UNLESS OTHERWISE
NOTED.

4. BOLTS TO BE GRADE 8.8 TO BS4190 MINIMUM SIZE M16 UNLESS STATED OTHERWISE. ALL BOLTS SHALL BE SPUN GALVANISED FINISH IN ACCORDANCE WITH BS7371.

5. ALL STEELWORK TO BE GALVANISED TO BS729. MINOR SITE ERECTION DAMAGE TO BE MADE GOOD WITH GALVAFOID OR SIMILAR APPROVED ALTERNATIVE.

6. ALL RESIN FIXINGS TO BE TYPICALLY HILTI HIT HY150 RESIN INJECTION MORTAR WITH HAS-T ANCHOR RODS c/w LOCK NUTS, NEOPRENE TOP-HAT WASHERS AND CAPS.

REV	MODIFICATION	BY	CH	DATE
A	Issued for Construction	DAF	JIP	31.07.19

EMERSON

mono #

MONO CONSULTANTS, LIMITED
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CORNERSTONE - BEACON

Cell Name	Op1	
TA CENTRE	A	
Cell ID No		
CTRL	TEF	VF
126942	N/A	023408
Site Address / Contact Details		

BROCK BARRACKS
OXFORD ROAD
READING, BERKSHIRE
RG30 1HW

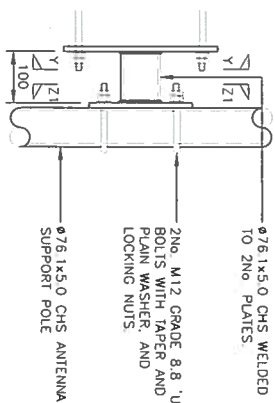
WALL MOUNTED SUPPORT POLE CONSTRUCTION	Purpose of Issue
--	----------------------------------

Drawing Number	605	A
Surveyed By	Original Sheet Size	Pack Issue
JTP	A3	
Drawn	Date	Checked
DAF	31.07.19	JTP
		Date
		31.07.19
		A

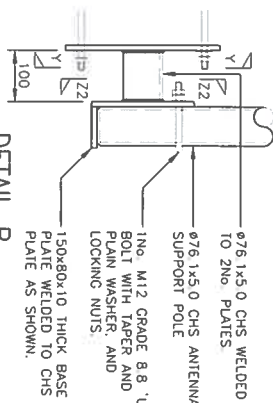
ELECTRICAL NOTE.
PROPOSED EQUIPMENT AND ALL
ADDITIONAL EXTRANEOUS STEELWORK
TO BE BONDED TO THE EXISTING LPS

IMPORTANT NOTE:

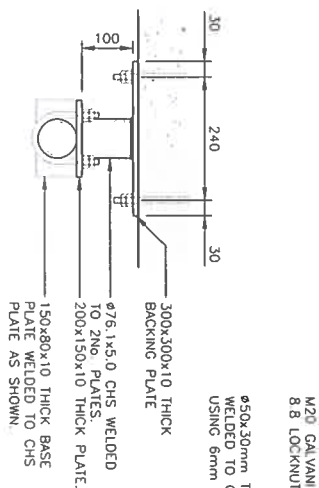
ALL STEELWORK TO CONFORM TO
AND BE STAMPED WITH CE MARK



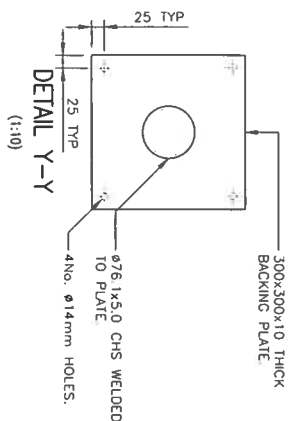
DETAIL A
(1:10)



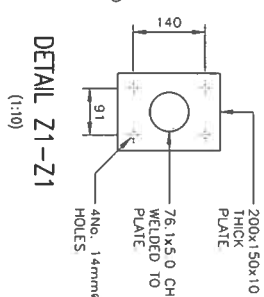
DETAIL
(1:10)



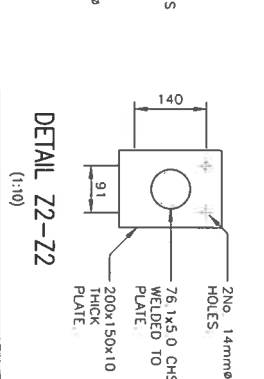
DETAIL X-X
(1:10)



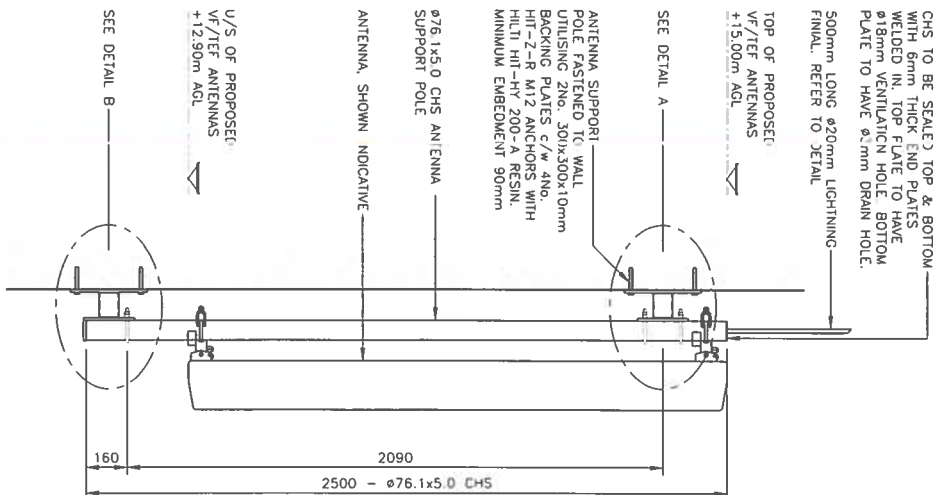
DETAIL Y-Y
(1:10)



DETAIL Z1-Z1
(1:10)



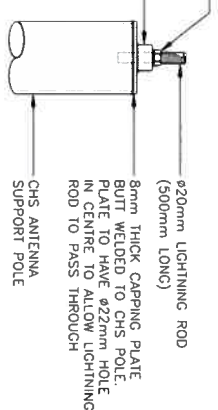
DETAIL Z2-Z2
(1:10)



SECTION (1:20)

IMPORTANT NOTES:
AN IN-SITU PULL-OUT TEST IS TO BE CARRIED OUT ON ALL PROPOSED RESIN ANCHORS. THE PROPOSED RESIN ANCHORS ARE TO BE TESTED TO MIN. 2%N. TEST IN STRICT ACCORDANCE WITH MANUFACTURERS PRINTED INSTRUCTIONS. ANY PROBLEMS ARE TO BE REPORTED TO ENGINEER PRIOR TO INSTALLATION OF POLE CONCRETE CLASS ASSUMED TO BE CRACKED CONCRETE C20/25.

TYP. LIGHTNING FINIAL DETAIL



AOC4518R8v06

D8X-2x(690-960)/1427-2690/2x(1695-2200)/2x(2490-2690)/2300-3800-8x65-

15.5i/15.5i/17.5i/17i/17i/17i/17i/17i-8xM-R

EasyRET 2L5H FDD/2.3-3.8GHz 8T8R TDD Antenna with 8 Integrated RCUs - 2.0m



5G NR Electrical Properties

Radiation parameters	Frequency range (MHz)		2300 - 3800 (p1)	
			2300 - 2690	3300 - 3800
	Single column beam	Gain (dBi)	/	15.7
		Horizontal 3dB beam width (°)	/	70
		Front to back ratio (dB)	/	≥ 25
		Cross polar ratio (0°) (dB)	/	15
		Vertical 3dB beam width (°)	/	5.5
		Side lobe suppression for first side lobe above main beam (dB)	/	≥ 15
	NR Broadcast beam (PBCH/PSCH/SSCH with HUAWEI gNodeB)	Gain (dBi)	/	20.8
		Horizontal 3dB beam width (°)	/	65
Front to back ratio (dB)		/	25	
Vertical 3dB beam width (°)		/	5.5	
Side lobe suppression for first side lobe above main beam (dB)		/	≥ 15	
NR Service beam	0°direct beam gain (dBi)	/	21.1	
	0°direction beam horizontal 3dB beam width (°)	/	20	
	0°direction beam front to back ratio (dB)	/	30	
	0°direction beam cross polar ratio (0°) (dB)	/	19	

Notes:

1. The 5G NR broadcast beam is the envelope of SSB(synchronization signal block) sweeping beams and the gain is the maximum gain of SSB sweeping beams.
2. Downlink broadcast beam gain values and pattern files can only be used for broadcast channel coverage prediction.
3. Downlink and uplink budgets need to be calculated based on the gain of single column beam and the correct Tx/Rx number.

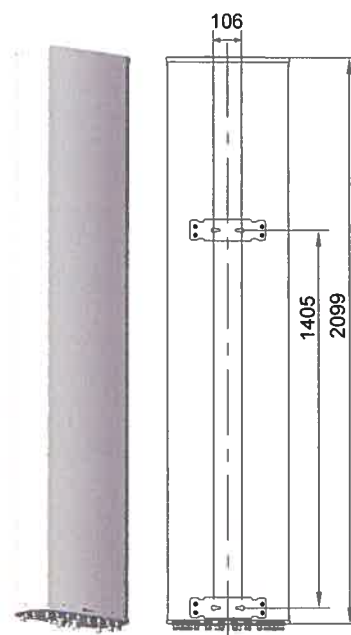
Mechanical Properties

Distance between TDD columns (mm)	59
Antenna dimensions (H x W x D) (mm)	2099 x 449 x 196
Packing dimensions (H x W x D) (mm)	2360 x 535 x 240
Antenna weight (kg)	43.0
Clamps weight (kg)	5.8 (2 units)
Antenna packing weight (kg)	54.9 (Included clamps)
Mast diameter supported (mm)	50 - 115
Radome material	GFRPP
Radome colour	Light grey
Operational temperature (°C)	-40 .. +65
Wind load (N)*	Frontal: 615 (at 150 km/h) Lateral: 375 (at 150 km/h) Maximum: 810 (at 150 km/h)
Max. operational wind speed (km/h)	200
Survival wind speed (km/h)	250
Connector	14 x 4.3-10 Female 1 x MQ4 Male + 1 x MQ5 Male
Connector position	Bottom

*Parameters and values based on *BASTA Passive Antenna Whitepaper V10.1 Rev1.8* (24 May 2018), and may be changed following the final version.

Accessories

Item	Model	Description	Weight	Units per antenna
Downtilt kit	ASMDT0F01	Mechanical downtilt: 0 - 12 °	3.1 kg	1 (Separate packing)



AIR 6488 B42EU

— Frequency band:	3420-3600 or 3410-3600MHz
— Maximum Output Power:	200W
— IBW:	100 MHz
— Interface:	3 x 10.3 Gbps eCPRI
— Weight:	~60 kg (to be confirmed)
— Dimensions:	400x810x200mm
— Volume:	~65 litres
— Cooling:	Passive
— IP Class:	IP65
— 256QAM DL/64QAM UL:	Yes
— Power Consumption:	850W typ. 1180 max. load
— Installation type:	Pole / wall mounted
— Availability:	Nov 2018



Prelimina