



Report on survey findings and structure analysis of the listed chimney at Brock Barracks.

TA CENTRE, BROCK BARRACKS

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Contents

Introduction and purpose	2
Findings	2-3
Conclusions	4
Appendix A – Figures	5-7
Appendix B – Structural calculations	8-9
Appendix C – Draft drawing of chimney	10

Introduction and purpose

WHP received a request to survey the listed chimney structure located in Brock Barracks in order to assess its structural integrity and suitability for the proposed mounted telecoms equipment at its top hat. To action on that request a team of two structural engineers, Grant Duffield and Evangelos Karkanevatos, secured site access for one day and surveyed the tower by taking site photos, making observations and taking measurements in order to analyse the tower.

The purpose of this report is multifaceted and involves presenting the findings of the survey and subsequently using those findings to make assumptions and analyse the structure. The telecoms equipment have already been installed but are dormant until the validity of this report proving the chimney tower is safe has been approved.

Findings

The survey was carried out on dry and sunny weather with the listed chimney located in the North-East corner of the compound (Figure 1). Around the chimney temporary scaffolding has been installed and is used to ascend and inspect the tower (Figure 2).

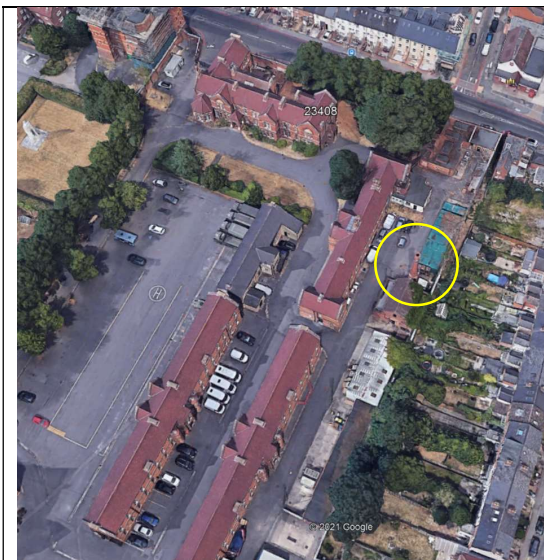


Fig. 1 Aerial view of the compound, chimney in yellow circle.

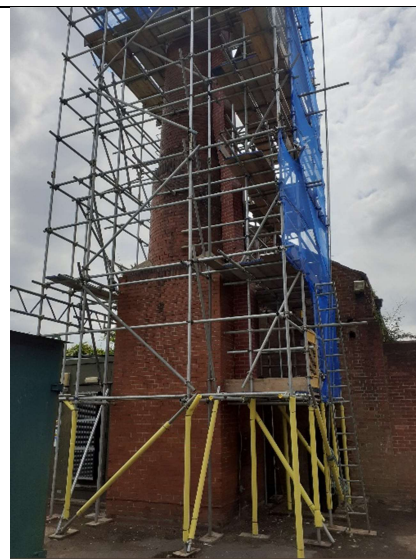


Fig. 2 View of the listed chimney with engulfing scaffolding

The historical chimney is a stand-alone masonry structure with an adjacent cabinet slab to the east side and a masonry depo building to the south side. The chimney is comprised of two main parts on elevation. A lower rectangular box with a furnace hatch (Fig. 3) and the upper tapered circular part whose top hat is used for the telecoms equipment. The upper circle sits on the lower rectangular part (Fig. 4). After acquiring precise measurements of the tower's dimensions a draft elevation drawing is presented in Appendix C.

Throughout the upper part of the chimney run the feeder cables boxed into a camouflaged vertical cable tray and cover which sets off from the nearby cabinet and ends up to the telecoms equipment at the very top (Fig. 5). The painted trench is anchored onto the chimney using mechanical (friction) bolts. Existing U-bars are also present on the other side of the upper part used as climbing steps in the

contemporary days of the building (Fig. 7). An existing ventilation pipe just above the lower part of the historical chimney was used to transfer heat from the internal furnace to the adjacent building which remains in place (Fig.6). All telecoms equipment are bolted with resin anchored bolts and steel plates at the top hat appropriately painted to preserve the aesthetics of the listed building (Figures 7,8).

A few findings that influence the design assumptions and methodology are presented below:

- Top of foundation level not visible from ground level. Foundation pad/strips of the historical masonry chimney are expected to be well below ground level at minimum 500 mm to not compromise the structural integrity of the nearby access staircase to the adjacent building and protect from freeze thaw cycles.
- Trees are not present in the vicinity therefore roots are not expected to adversely affect the foundations. Mass fill under ground level would mitigate the effect of past tree removals.
- Throughout the height of the structure the brick courses have a ratio of l x d x h of 215 x 60 x 65 with 10 mm of mortar in-between brick courses.
- The upper tapered part is divided into three distinct parts segregated by extruding masonry ring details (Figures 9). The assumed necessity of these rings adheres to the chimney's combustion functions, but they also act as thermal horizontal movement joints as is also evident from adjacent nearby buildings which use the same technique. It is speculated that the upper hat would engulf the atmospheric filters which would be upgraded regularly thus looking more modern than the rest of the tower (Figure 10).
- Structural integrity of the wall is deemed satisfactory with few superficial vertical cracks concentrated mainly at the top of the tower but under the hat where telecoms equipment are located (Fig. 9). This also backs up the assumption that the top hat utilized for the antennas has been regularly retrofitted due to the better condition of the bricks.
- The lower rectangular part and the first upper part have got stretcher bond type build-up with the upper two tapered parts having English bond with a sequence of 3 long sides -1 short side. Total wall thickness is 215 mm. (Fig. 11,12)
-

Assumptions

- Due to the cantilevered nature of the tower, structural rebar of mild steel is expected embedded into the walls to pick up wind loads on the tension side. The exact quantities of the reinforcement and locations within the walls are unknown.
- No concrete layer is identified within the walls.

Conclusions

Structural calculations are presented in appendix B of this report.

- On-site pull-out testing of 3.0 KN for each bolt is well within the expected 0.5 KN tensile and 0.3 KN shear stresses derived from the structural analysis. Therefore, the local wall conditions behind every bolt are adequate.
- Global upper hat structural integrity is not compromised since the overall wind caption area is not increased to a considerable degree. In order to assess the exact residual capacity of the walls a non-intrusive survey picking up any existing rebar is required.
- Total added gravity loads from the telecoms equipment are not surpassing 3 % of the existing masonry S/W therefore existing founds and underlying soil are not compromised. The structural calculations ignore the expected mass fill under the ground level to reach top of founds level, the foundation S/W and any internal layers/ equipment that cannot be inspected which further increases structural redundancy.

Appendix A



Figure 3. View from ground level. Lower rectangular part with access hatch.



Figure 4. View from first level. Interface detail between upper circle and lower rectangle.

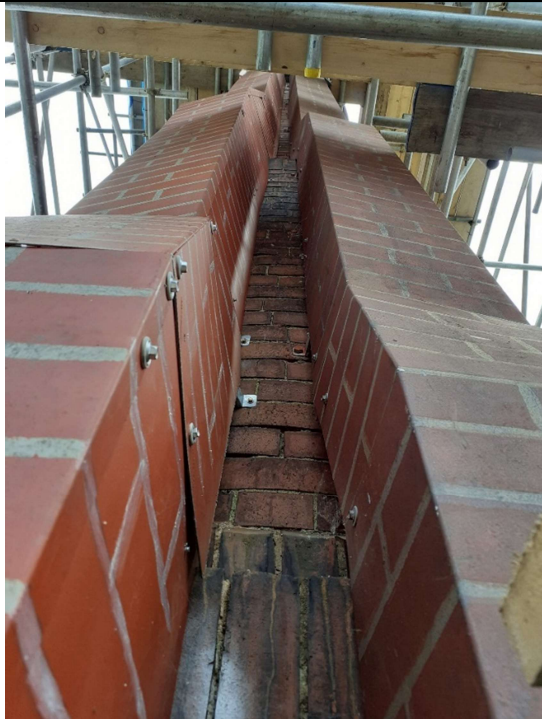


Figure 5. Boxed out vertically bundled cable feeders fixed with friction bolts to the structure.



Figure 6. View from first scaffold level. Remaining ventilation pipe (front), cabinet and cable feeders (back)



Figure 7. View from scaffolding level 4. Painted wall plates with resin anchors (front), existing U-bars acting as ladder steps (back)



Figure 8. Fixing details for proposed antenna poles at top hat.



Figure 9. Detail of segregating ring between upper parts 2 and 3. Local vertical cracks on upper part 2.

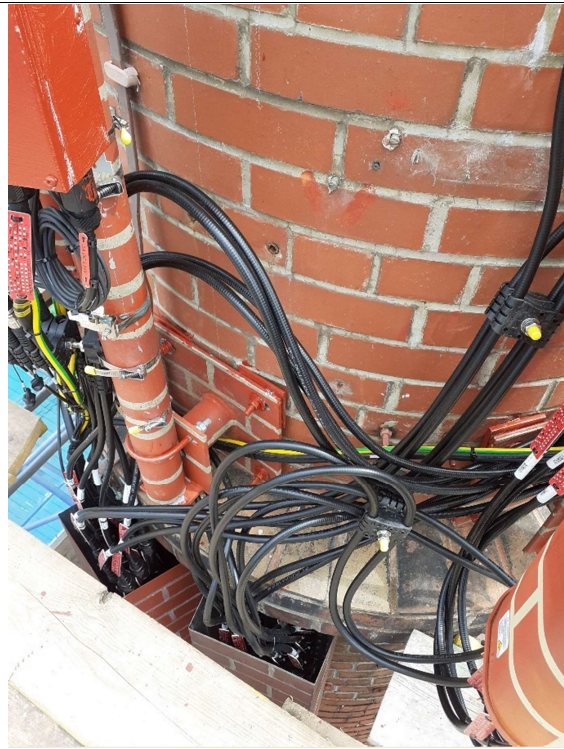


Figure 10. View of clean top hat – Segregating ring – Lower part of older construction.

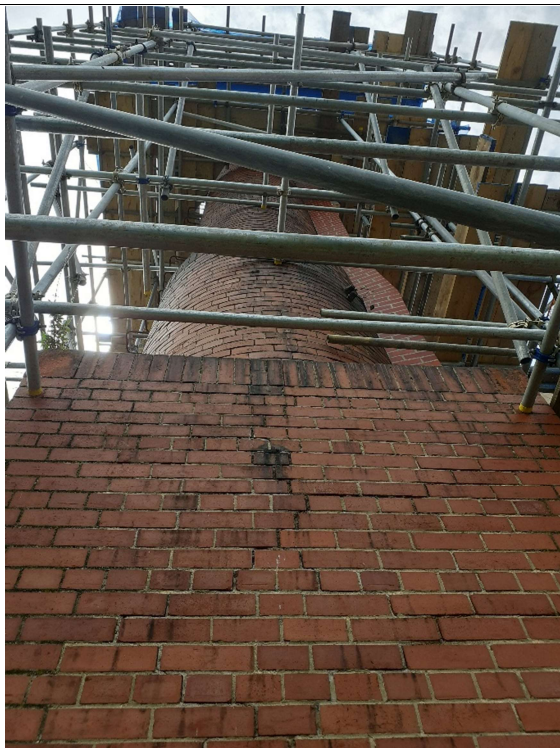
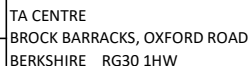


Figure 11. Lower stretcher bond build-up parts.

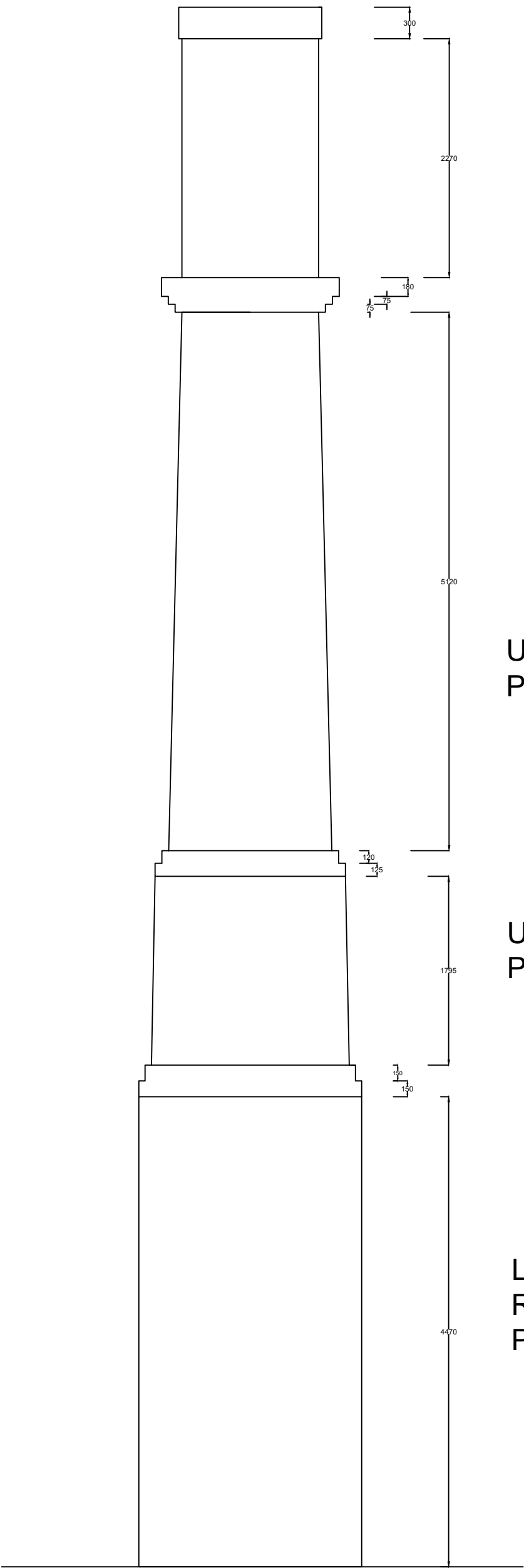


Figure 12. Upper English bond build-up parts.

 WHP Telecoms Ltd	CALCULATION SUMMARY (Version 1.0)			SHEET 1 OF 2 SHEETS	
					
Unit 16 Saxon Way Trading Estate, Saxon Way, Harmondsworth, Hillingdon UB7 0LW	CALCULATED BY:	EK	DATE: 18/06/2021	Cell ID:	23408
	APPROVED BY:	AIM	DATE: 21/06/2021	TA CENTRE BROCK BARRACKS, OXFORD ROAD BERKSHIRE RG30 1HW	
<u>WIND LOADS</u> $V_b = 20.5 \text{ m/s}$ $Alt = 40 \text{ m}$ $S_a = 1.040$ $S_d = S_s = S_p = 1.0$ $V_s = V_b \times S_a \times S_d \times S_s \times S_p = 20.5 \times 1.040 \times 1.0 \times 1.0 \times 1.0 = 21.32 \text{ m/s}$ $H_e = 15 \text{ m}$ $D_{sea} = 69 \text{ km}$ $S_b = 1.75$ $V_e = V_s \times S_b = 20.5 \text{ m/s} \times 1.75 = 35.88 \text{ m/s}$ $q_s = 0.613 \times V_e^2 = 0.613 \times 35.88^2 = 789 \text{ N/m}^2$ $q_s = 789 \text{ N/m}^2$ <u>FROM ANTENNA POLE</u> $C_p(\text{pole}) = 1.2$ CHS 76.1x5.0 Wind load $F_p = \pi \times 0.0761/2 \times 1.2 \times 789 = 113 \text{ N/m}$ $S/W = 8.77 \text{ Kg/m}$ <u>FROM HUAWEI AOC4518R8v06</u> Frontal wind load = 615 N @ 41.67 m/s $F1,F = (35.88^2 / 41.67^2) \times 615 = 456 \text{ N}$ Lateral wind load = 375 N @ 41.67 m/s $F1,L = (35.88^2 / 41.67^2) \times 375 = 278 \text{ N}$ $S/W = 54.9 \text{ Kg/ each}$ <u>FROM VF AIR 6488</u> Frontal wind load = 700 N @ 41.67 m/s $F2,F = (35.88^2 / 41.67^2) \times 615 = 519 \text{ N}$ Lateral wind load = 171 N @ 41.67 m/s $F2,L = (35.88^2 / 41.67^2) \times 375 = 127 \text{ N}$ $S/W = 60.0 \text{ Kg}$ <u>FROM Single ERS (4415worst case)</u> $C_p(\text{ERS}) = 2.0$ Dims = 340x420x150 Frontal wind load = $2.0 \times 0.34 \times 0.420 \times 789 = 225 \text{ N}$ $S/W = 20.0 \text{ Kg}$					
AMENDMENT BY:		DATE:		DETAILS:	
CHECKED BY:		DATE:			



AMENDMENT BY:	DATE:	DETAILS:
CHECKED BY:	DATE:	



UPPER TAPERED
PART 3

UPPER TAPERED
PART 2

UPPER TAPERED
PART 1

LOWER
RECTANGULAR
PART