Structural Report

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Sidestrand Hall School, Sidestrand – Full Planning Application for demolition and rebuilding of chimney, including replacement of existing steel supports

Document information

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1.0 Introduction

1.1 Overview

The following report appraises the current structural condition of the centrally located high level chimney, and provides recommendations as necessary based on the findings.

1.2 Initial Inspection

During refurbishment works to the hall roof, scaffold access was available to the areas surrounding the chimney. On close inspection, it became evident that the masonry chimney is suffering from significant structural cracking, and the existing steel bracing to the chimney is extensively corroded.

This raised significant concern in relation to the current and long-term structural integrity and safety of the chimney.

▲ *Cracking to chimney structure*

▲ *Corroded steel supports*

2.0 Structural Appraisal

2.1 Remedial Design Options

Various options for remedial works have been explored, including undertaking repairs to the chimney in-situ.

This would involve installation of a masonry reinforcement system to areas of cracked masonry and repointing in conjunction with localised brick repairs. With this option, the external steel supports would need to be replaced due to the extent of corrosion. Due to the inherent risk of instability to the chimney whilst steel bracing is removed, repairs would need to be undertaken in sections, in conjunction with a complex temporary support system that allows access to the chimney to carry out repairs.

In addition, the replacement steel bracing could be installed to match the existing framing arrangement but would need to facilitate segmental installation from the top down, requiring a complex integration with temporary support to provide temporary support whilst simultaneously installing the permanent bracing frame.

The preferred option would be to carefully demolish all external sides of the chimney to the existing plant room flat roof level, and rebuild the chimney structure in the same position, strengthening & re-stitching the damaged masonry as it is re-built. This would remove the need for any cracking repairs to the external facing brickwork. The steelwork could then be removed fully at the same time, allowing full access for repairs and final replacement in full sections to match existing.

The existing chimney isn't currently lined, so by rebuilding the structure there is scope to install a flue liner which would be good practice. This would aid in protecting the masonry material, and if any cracks were to form in the future, it could help to prevent against possible carbon monoxide leaks.

Although the chimney will be rebuilt to address the cracking issue, external steel bracing would still be required to provide structural integrity & support to the chimney to ensure Building Regulations Part A – Structure compliance. This will follow the same principal as is currently installed in terms of steel section details and design. The steelwork will however be powder coated to help prevent against future corrosion.

2.2 External Bracing Assessment

There are no records of the structural design and detailing of the existing steel bracing available.

Our intuition suggests that at some point in the last 30 - 40 years, a structural assessment was undertaken by a builder or structural engineer due to concerns over the stability of the chimney, and the steel bracing present today is the result of this assessment.

Reference Section 2D Building Regulations Part A – Structure, a chimney should not project more than 4 times its width above the roof, i.e. circa 4.0m in this situation. Current / proposed projection is approximately 5.5 x width if considering projection above eaves level only. However, this assumes connection into the 1st Floor walls below eaves provides full lateral restraint, which is difficult to prove with any confidence, as the masonry at this level is interrupted by window openings and a stairwell void.

Assuming the masonry below eaves level does not provide partial or full lateral restraint to the chimney, the H / W ratio increases to approximately 8, i.e. considerably beyond the limitations stipulated in Building Regulations Part A – Structure, section 2D.

We have assessed the structural stability of the chimney in accordance with BS5628 (Structural Use of Masonry) & BS6399 (Wind Loading). Considering the chimney as a vertical cantilevered masonry column with no steel bracing, and applying the extreme wind pressures that are likely to occur due to the harsh environmental locality, our calculations show that the chimney is at risk of failure due to excessive flexural stresses. The actual failure ratio (Overturning Moment / Resistance Moment) is in the order of 6 – 7.

In addition to the above, there is significant visible evidence of structural cracking damage, both internally and externally to the walls that adjoin the chimney and form the external chimney walls respectively. This cracking is most likely evidence of damage that occurred to the chimney and adjoining masonry superstructure prior to the steel bracing being added, probably instigating the decision to provide steel bracing in the first place due to concerns over safety.

Therefore, from a structural safety perspective, and in accordance with Building Regulations Part A – Structure compliance requirements, the chimney must be provided with additional support and it is therefore our recommendation that the existing steel bracing is retained, albeit as a like for like replacement steel frame due to the significant corrosion to the existing steelwork.