STAGE E REPORT

CHRIST CHURCH PRIMARY SCHOOL

Client: London Diocesan Board for Schools

Report Reference: SE1131 / E / 241214 / A

Date: December 2014

Iesis Special Structures
45 Moorfields
London
EC2Y 9AE

iesis
Special Structures

Contents

1.0 Brief and Scope

This report has been produced to accompany the Stage E drawing issue and specification, this report has been produced to summarise the proposed structural scheme and its design principles.

This report has been produced for the London Diocesan Board for Schools for Christ Church Primary School. The report aims to review the architectural proposals produced by SCABAL Architects for the site and discuss the structural implications of these as well as suggesting proposals for how the architectural intentions can be realised.

The report will therefore contain a brief description of the existing building construction, an explanation of the current architectural proposals and a discussion of the structural implications and proposals. The report also describes the key input data and describes the criteria to be adhered to during the detailed design stage and includes an appraisal of the site constraints, the substructure design and the superstructure design.

The focus of this report is limited to the structural aspects of the existing building and the structural design elements of the new proposals. A detailed review and commentary of other aspects of the building is outside of the scope of this report.

Fig 1 – Photograph of existing school building

1.1 Available Information

The comments presented within this report are based on the information available to Iesis Special Structures, which has been summarised below, in addition to information gathered from inspections of the site.

The main items referred to within this report have been listed below for clarity:

- Architectural existing building general arrangement drawings and elevations produced by SCABAL dated August 2014
- Architectural proposed general arrangement drawings and elevations produced by SCABAL dated August 2014
- Building topographical survey produced by Glen Survey Ltd. dated June 2013

2.0 The Site

2.1. Site Description

The school is located in the London Borough of Camden in the area of Hampstead. The site is bounded to the North by Christchurch Hill and to the West by a public footpath which is at an elevated level to the site. To the East and South of the site are existing blocks of flats up to five storeys in height which are primarily clad in masonry.

The site generally falls from West to East and along the Western boundary of the site a retaining wall exists forming the aforementioned high level footpath.

2.2. Existing Buildings

The school buildings were originally built circa 1855 and were granted Grade II listed status in 1974. Various small alterations were carried out to the existing buildings in the 20th century, but the exterior of the buildings remain largely as the original.

The buildings are principally formed as load bearing masonry structures with yellow stock bricks and stonework features. The roof and floor structures are principally in timber with timber roof trusses forming the pitched roof profiles.

A plan of the existing building has been included in Appendix A and shows the principal areas of the existing buildings.

2.3. Geotechnical Information

No site specific geotechnical or environmental investigations have been carried out for the site to date, however a series of trial pits is proposed on site to establish the existing foundation details of various key supporting walls. A full description of the ground conditions is therefore not possible at this stage, however based on experience of previous projects in the area and general geological data we would anticipate the ground to be made up of a shallow depth of made ground overlying London Clay

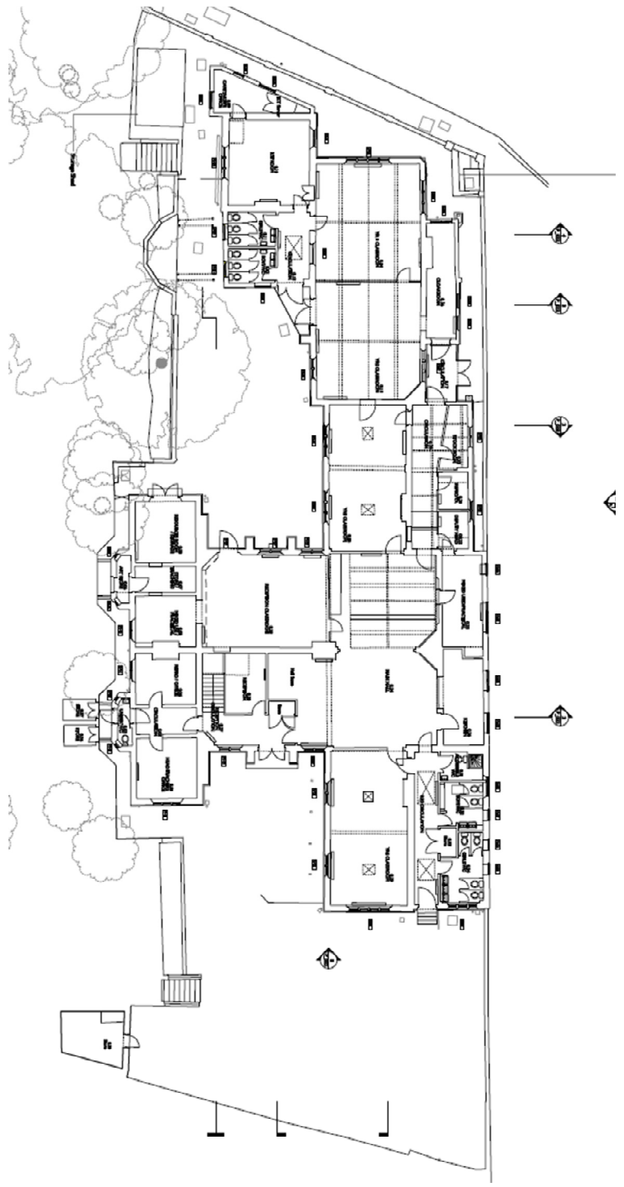

Fig 2 – Existing plan of site by SCABAL Architects

3.0 Architectural Proposals

The architectural proposals for the refurbishment of the existing buildings can be separated in to several areas for the purposes of discussion. These are the South Wing, Central Block, North Wing, main hall block and kitchen, and the external works. Each of the areas has therefore been discussed separately in the following paragraphs.

3.1 South Wing

The main focus of the refurbishment work is in the South Wing of the existing building with the addition of a new mezzanine floor being incorporated within the existing building envelope. As part of the works for this new mezzanine floor the existing roof trusses will require alteration in order to provide sufficient headroom to the new floor level. New doorways will also be required through the existing masonry wall and chimney stack. These alterations are shown on SCABAL drawing 537-P150 and 537-P151.

In addition to the above a new staircase is required within the South Wing in order to access the mezzanine level. This will involve the removal of a section of the existing floor structure.

Alterations are also proposed to the existing windows in this area of the building including the upward extension of one of the windows and the lowering of the structural opening in two others.

3.2 Central Block

The proposals for the central block are limited to the removal of several sections of existing load bearing masonry walls in order to improve the existing internal layouts.
It is also proposed to transform two of the existing windows in to doorways one with access to the North playground. The locations of these are shown in Appendix A.

3.3 North Wing

The refurbishment of the North wing is limited to the removal of non-structural timber stud walls and the widening of an existing doorway within one of the load bearing masonry walls. This is indicated on the drawings included with Appendix A.

3.4 Main Hall Block and Kitchen

There are no significant refurbishment works proposed with the Main Hall or Kitchen area.

3.5 External Works

The most notable element of the proposed external works on the site is the removal of the existing porch link and its replacement with a new canopy structure, which would be installed in the area around the Northern playground. This is to be adjacent to the building but will be supported independently.

In addition to the above it is proposed that a single section of the boundary wall is removed in order to provide a new access on to the site.

Fig 3 – Impression of proposed external canopy by SCABAL Architects

4.0 Structural Design Proposals

This section of the report will discuss the impact of the various architectural proposals and summarise the intended structural design solutions and options. In order to do this the principal elements of the refurbishment have been itemised in the sections below and discussed individually.

4.1 Alteration to Roof Trusses within South Wing

As discussed in section 3.1 of this report to allow for the installation of the new mezzanine floor the existing roof trusses in the South Wing need to be modified to provide sufficient headroom to the new floor level.

The existing timber trusses are formed as a simple A frame with a timber tie beam at the base of the truss. It is the lowest horizontal tie member of this arrangement which causes issues with the proposed new layout. In order to allow for the removal of this horizontal tie member it is proposed that new raking steel ties are introduced in the formation shown on Iesis drawing SE1131-201. These new steel members are envisaged as being hot rolled steel hollow sections as indicated on the drawing however other sections could be considered to suit the desired aesthetic.

Initial structural modelling of this adjusted roof truss formation indicates anticipated movements of around 2mm at each end of the truss which is considered to be within acceptable limits.

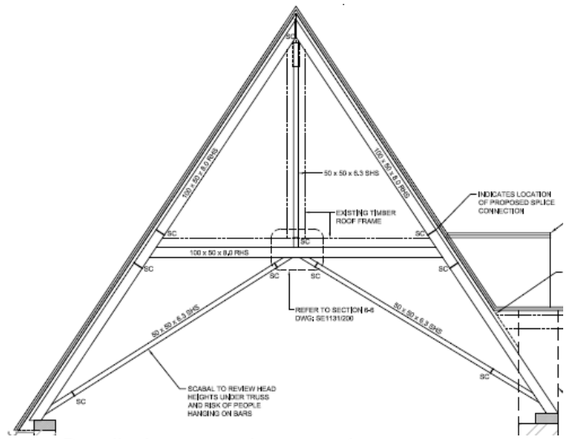

Fig 4 – Detail of proposed new roof truss

In order to avoid the need for temporary works to the roof structure it is intended that the new steel trusses are installed prior to the removal of the existing horizontal timber tie section. This is indicated within the proposed construction sequence noted on drawing SE1131-111.

4.2 Construction of Mezzanine floor within South Wing

It is intended that the construction of the new mezzanine floor will be in the form of timber floor joists spanning between steel universal beam sections that will be supported at each end by the existing masonry walls. It is envisaged that the new steel beams will be built in to pockets on pad stones carefully formed in the existing masonry walls.

The steel floor beams will be located either side of the existing window locations to allow the fixing in the existing walls and to allow the formation of the proposed chamfered floor construction adjacent to the existing windows. The timber floor joists will then span between the steel beams supported on joist hangers fixed to the steels.

4.3 Formation of New Doorways within South Wing

The formation of the new doorways through the existing masonry wall and chimney stack within the South Wing will require substantial temporary works. It is envisaged that a temporary tower will be required to support needle beams that will restrain the existing chimney stack and support the masonry walls above the level of the new openings. Consideration should however be given to taking down the chimney stack entirely and rebuilding it to avoid the need for these extensive temporary works. This proposal would need to be agreed with English Heritage as it would need to form part of the listed building consent.

Following the installation of the temporary needle beams and frame it will be possible to create the new opening in the wall and put in place a series of new precast concrete lintels which will support the chimney stack above. These lintels will be supported one one side by a new masonry pier that will be tied in to the existing masonry wall and supported on a steel beam at mezzanine level. As soon as these lintels have been installed the temporary support frame and needle beams can be removed and any holes created in the masonry sympathetically repaired. These proposals have been indicatively shown in Iesis drawings SE1131-111 and SE1131-202.

4.4 Formation of New Staircase within South Wing

The formation of this new staircase will require a new void to be created in the first floor structure. This will require the introduction of a new steel beam to trim the opening and support the existing floor joists. The stairs themselves are envisaged to be of steel construction with the half landing supported either on new steel posts or tied in to the existing masonry walls.

4.5 Formation of New Openings in Load Bearing Masonry Walls

The formation of new openings within the load bearing masonry walls will also require temporary works. The existing floor and roof structure will need to be propped during the works and it may be necessary to utilise temporary steel needle beams above the proposed openings. It is likely however that the new supporting box frames can be installed to each side of the proposed new opening in sequence in order to limit the amount of temporary works required. The final temporary works design and details will need to be confirmed by the temporary works engineer.

The nature of the structural support for the new opening will depend on the size of the proposed opening, the thickness of the existing wall and the details of the existing foundations. The current proposed lintel and steel box frame details are indicated on drawing SE1131-204, however these will need to be confirmed following further site investigation to establish the existing foundation details.

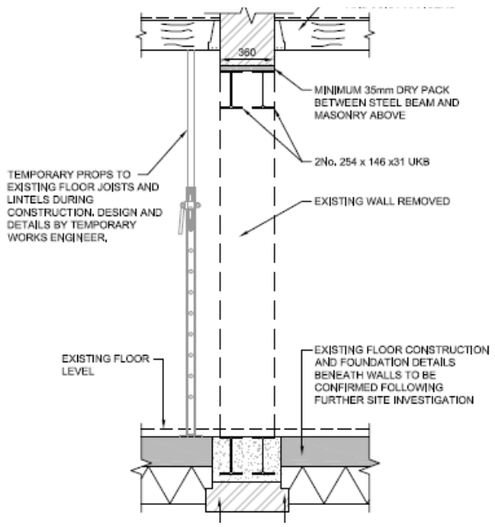

Fig 5 – Typical box frame detail

4.6 Alterations to Existing Windows

In essence the proposed alterations to the existing windows will either involve the lifting of the window head level or the lowering of the cill level. Where the cill level is lowered the stonework and masonry beneath the window will be carefully removed and a new opening formed as indicated on the architects details without the need for any major temporary works.

Where the window head level is being raised temporary needle beams will need to be installed in the same manner as those discussed in section 4.5 of this report. When the temporary support has been installed a new lintel can be introduced and the existing stone window façade can be carefully dismantled and re constructed at the higher level as per the architects proposed details. A stonework specialist will however need to be employed to advise on the proposed construction details and on the connection of the various existing stonework elements as well as the most suitable sequence of works. For more information refer to the architects drawings and details.

4.7 Installation of New Canopy Structure to North Playground

The proposed new canopy structure is to be constructed directly adjacent to the existing building as indicated on SCABAL drawing 537-P220. The structure itself will however be entirely structurally independent with separate foundations constructed adjacent to the existing building. A new cantilevered steel frame will then be installed on the new foundation supporting a glazed roof structure as per the architects proposed details.

The steel frame is envisaged as being formed in back to back 150x75x15 Unequal Angle Sections bolted together with fully welded connections to the main curved structural column and cantilever beam arrangement. Lateral tee sections will then be bolted to the primary cantilever steels as indicated on the proposed details.

The foundation details for the canopy will need to be confirmed following further investigation on site to establish the existing wall foundation detail. This may impact on both the depth and detail of the proposed new canopy foundations.

5.0 Additional Investigations and Ongoing Design Risks

This section of the report is intended to highlight any ongoing design risks and any additional investigations required in order to complete the design. These have all been summarised in the below points:

- Trial pits required on site to uncover the depth and extents of the existing foundations to the external walls in the area of the proposed new canopy. This will allow the informed design and detailing of the foundations to the new canopy structure.
- Intrusive site investigations required on site to determine the existing floor construction and wall foundations for the existing internal walls where new openings are proposed. This will allow the informed design and detailing of the new steel box frame structures.
- If there is a proposal to take down and rebuild the existing South Wing chimney this will need to be confirmed as part of Listed Buildings Consent.
- A stonework specialist will be required to confirm the preferred connection and construction details for the alterations to the existing stone window frames and adjustment to transom levels.
- A full measured survey will need to be carried out within the existing roof space of the South Wing prior to going in to manufacture of any elements in order to confirm the dimensions and details of the existing trusses, roof profile and chimney details.
- Additional trial pits will be required to confirm the details of the existing retaining walls at the front of the existing residential units.

6.0 Design Criteria

6.1 Floor Loading

6.1.1 Floor Loading

The following loadings will apply:

New Mezzanine Floor			
Dead Load (kN/m2)		**Imposed Load (kN/m2)**	
Timber joists and steel beams self-weight	1.0	Class room	3.0
Services and ceiling	0.5	Partitions	1.0
Total	**1.50**	**Total**	**3.0**

6.1.2 Wind Loading

Wind load is to be derived from BS 6399 Pt2.

6.2 Building Tolerances

Unless specified otherwise, tolerances will (where applicable) be within the limits given in BS 5606, Tables 1 and 2.

6.3 Fire Resistance

The structure will be designed for 60 minute fire resistance period unless specifically stated by fire engineering consultant.

6.4 Vertical Deflection of Mezzanine Floor

The mezzanine floor will be designed to the following deflection criteria.

Area	**Total Deflection limit**		**Live Load + Creep**	
	Deflection/span	Max mm	Deflection/span	Max mm
Steel Beams	Span/250	-	Span/360	-

6.5 Vibration of Horizontal Elements

The vertical vibration of horizontal elements will be limited for floors generally to 5HZ

7.0 Materials

The following materials will be used:-

7.1 Steelwork

All steelwork will be grade:

S275 JR Internal Steelwork
S275 J0 External Steelwork

7.2 Masonry

All blockwork masonry to be minimum 7.3N/mm² block to be built in type 3 mortar unless noted otherwise.

In areas of repair to existing masonry type (iv) mortar should be utilised.

8.0 General Construction Notes

8.1 Steelwork

- All steelwork to be fabricated and erected in accordance with BS5950.
- Welds to be minimum 6mm fillet weld.
- All bolts to be grade 8.8, min 2 No M20 in any connection.
- Fire protection to Architects details.
- All steelwork below ground to be concrete encased.
- Galvanised finish to all external steelwork:
  Blast clean to BS7079
  Preparation Grade Sa2
  Hot dipped galvanising to BS729 min. 610g/m².
- Basic finish to internal hidden steelwork:
  Blast clean to BS7079
  Preparation Grade Sa2
  Apply 2 pack zinc phosphate, M10 epoxy
- Finish to internal exposed steelwork:
  Blast clean to BS7079
  Preparation Sa2.5
  Apply 2 pack zinc phosphate, M10 acrylic top coat to Architects Requirements.
- Intumescent coating to steelwork:
  Blast clean to BS7079
  Preparation grade Sa2.5
  Apply 2 pack zinc phosphate, M10 epoxy, intumescent, fire resistance 1 hour.

8.2 Masonry

- All mortar to be class (iii) with sulphate resisting cement below ground unless in areas of repair to existing masonry where type (iv) mortar should be utilised as per section 7.2.
- Brickwork below ground to be class F2
- Movement joints in masonry walls to be 15mm wide with compressible filler and debonded ties at 450 vertical centres. Ties to inner leaf to be a maximum of 225mm from either side of joint.
- All lintels to be propped during construction and installed to the manufacturer's details.

8.3 Timber

- Structural timber to be strength class C16 in accordance with BS5268.
- No drilling or notching of timber permitted without the Engineers approval.
- Allow for solid timber strutting at joist support and mid span.
- Floors and roofs to be strapped to walls using 1200mm x 30mm x 5mm straps at maximum 2m c/c, straps to extend over a minimum of 3 joists and solid timber noggins to be provided between joists.

9.0 References

The following will be used in the structural design:

BS 6399 Pt 1	Loading on Buildings; code of practice for Dead and Imposed Loads
BS 6399 Pt 2	Loading on Buildings; code of practice for wind loads
BS 6399 Pt 3	Loading on Buildings; code of practice for snow loads
BS 8004	Code of practice for foundations
BS 648	Schedule of weights of Building Materials
BS 8110 Pt 1	Structural use of concrete; code of practice for design and construction
BS 8110 Pt 2	Structural use of concrete; code of practice for special circumstances
BS 5950 Pt 1	Structural use of steelwork in Building; code of practice for design in simple and continuous construction: Hot Rolled sections
BS 5628	Code of Practice for use of masonry
BS 6472 Pt 1	Guide to evaluation of human exposure to vibration in buildings

iesis
Special Structures

APPENDIX C

Existing Below Ground Drainage Sketch Layout from CCTV Survey

iesis
Special Structures