



Harborne Building Consultancy  
Structural Surveys and Designs

# **SPECIFIC STRUCTURAL REPORT**

By

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**Prepared for**

**Clients**

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## ENGINEERS REPORT

### INTRODUCTION

I have been asked by my clients to comment upon structural movement within the loft space, cracking and movement to the gable wall and general structural distortions to the building. This follows concerns expressed by the building survey report.

My report has been prepared specifically in connection with structural movement to this property relating to the roof structure, gable wall and general distortions throughout the building. It does not deal with the general condition of the building, decorations, services, damp, timber, rot or infestation etc, except where these matters are considered to be relevant to any structural damage.

All directions are given as if viewing the house from the front elevation, front window bay and entrance porch.

### DESCRIPTION OF PROPERTY

The property is a semi detached house built circa 1935. The house has a pitched and hipped roof. The load bearing walls of the house are of solid brickwork. To the left hand side of the property there is a wooden garage. In the rear left hand corner of the plot an outside WC and coal shed have been enclosed by the pitched roof. The drainage system of the property is via the gable elevation running towards the rear of the property. A storm gully at the front of the house discharges towards the front garden and possibly a soakaway.



FIGURE 1

Photograph of the front elevation of the property, entrance porch and two storey window bay.

### SITE TOPOGRAPHY

The site, upon which the house was built, slopes moderately from the front to the rear of the plot.

## ENGINEERS REPORT

### OBSERVATIONS / DESCRIPTION OF THE DAMAGE

The following is an abbreviated description of the damage. The photographs included in this section of the report illustrate this damage.



**FIGURE 2**

Photograph of the rear elevation of the property and left hand outbuildings exit door.

### EXTERNALLY

#### Front Elevation:

- The front elevation of the property at the party wall area is out of vertical by between 10-20mm in 1.2m.
- The front left hand corner of the house is out of vertical by 10mm in 1.2m at ground level and then substantially out of vertical by between 50-60mm in 1.2m at roof eaves level.
- There is some severe sagging to the roof tiles in the central area of the property.
- There is a moderate slope to the roof ridge tiles away from the party wall.

#### Rear Elevation:

- The rear elevation of the property at the party wall area is out of vertical by 10mm in 1.2m at ground level and then by 20mm in 1.2m at roof eaves level.
- The rear elevation at the rear left hand corner of the house is out of vertical by 15mm in 1.2m at ground level and then by 40mm in 1.2m at roof eaves level.
- There is a significant bowing to the rear elevation of the house in the central area of the property at roof eaves level.
- The central area of the house is out of vertical by 10mm in 1.2m at ground level and then by between 20-30mm in 1.2m at roof eaves level.
- There is severe sag to the roof tiles of the property in the central area of the loft space and against the party wall. See Figure 6 and recommendations.
- There is a moderate slope to the roof ridge tiles away from the party wall.

## ENGINEERS REPORT

### Gable Elevation:

- The front left hand corner of the gable wall is out of vertical by 10mm in 1.2m.
- There is a diagonal crack to the front left hand corner at low level measuring 1mm in width approximately 8 brick courses long.
- The central area of the gable wall is significantly out of vertical by some 30mm in 1.2m at ground level.
- The rear left hand corner of the gable wall is out of vertical by 20mm in 1.2m at ground level.
- There has been significant re-pointing to the gable wall above the landing window and below the landing window.
- Cracks have also been re-filled directly above the pantry window. These cracks were approx. 10mm in width.
- There are diagonal cracks 1-2mm in width below the pantry window approximately 12 courses in length.

## INTERNALLY

### Hallway:

- The gable elevation of the hallway is significantly out of vertical by 25mm in 1.2m.
- The ceiling of the hallway at the stairs entrance area is significantly out of level by between 30-40mm in 1.2m.

## First Floor

### Landing:

- The gable wall of the landing is out of vertical by between 20-30mm in 1.2m.
- There is evidence of a large diagonal crack below the landing window having been re-filled.
- The landing stairs are out of level.
- The bathroom door frame is out of square by 20mm.
- The front left hand bedroom door frame is out of square by 25mm.

### Front Left Hand Bedroom:

- The front elevation of the small bedroom is out of vertical by 10mm in 1.2m.
- The gable elevation of the small bedroom is out of vertical by 15mm in 1.2m.
- The front elevation of the small bedroom has moved laterally away from the floor boards of this room by between 15-20mm. See Figure 5 and recommendations.
- The gable wall within the small room has moved laterally significantly away from the room floorboards by between 30-40mm. See Figure 4 and recommendations.
- The suspended timber floor of the small room slopes to the front left hand corner of the room by between 10-15mm in 1.2m.

### Front & Rear Right Hand Bedrooms:

- There is evidence of distortions to both the right hand bedrooms.
- The front and rear elevations to both right hand bedrooms show moderate lateral movement within both rooms to the elevations at roof eaves level.

### Loft Space (accessed via landing):

- There are cracks to the party wall measuring between 10-20mm in width immediately to the rear of the front chimney stack. See Figure 8 and recommendations.
- There is a diagonal crack immediately to the rear of the front chimney breast. See Figure 9 and recommendations.
- There is severe twisting to the gable elevation roof purlin. See Figure 10 and recommendations.
- There is moderate twisting and a substantial crack to the front roof purlin. See Figure 11 and recommendations.
- All the roof purlins are very poorly supported throughout the entire loft space area. See recommendations.

**ENGINEERS REPORT**



**FIGURE 3**

Photograph of lateral movement to the front and gable elevations of the front left hand corner bedroom.



**FIGURE 4**

Outward lateral movement of the gable elevation of the front left hand bedroom away from the bedroom floor boards.

**ENGINEERS REPORT**



**FIGURE 5**

Lateral outward movement of the front elevation of the front left hand bedroom away from the bedroom floorboards.



**FIGURE 6**

Severe sagging to the roof structure of the house looking from the rear elevation.

## ENGINEERS REPORT



**FIGURE 7**

Diagonal cracking to the gable wall at low level in its central area.



**FIGURE 8**

Severe vertical crack to brickwork of the party wall of the loft space immediately to the rear of the front chimney breast. The front chimney breast is leaning in a forward direction.



**FIGURE 9**  
Diagonal cracking to the party wall immediately to the rear of the front chimney breast.



**FIGURE 10**  
Severe twisting to the gable elevation roof purlin.





**FIGURE 11**

Twisting and substantial cracking to the front elevation roof purlin showing poor vertical supports to that structure.

**CATEGORY**

It is common practice to categorise the structural significance of the damage in accordance with the classification given in Table 1 of Digest 251 produced by the Building Research Establishment<sup>1</sup>. In this instance, the damage falls into Category 2-4.

Category 0	"aesthetic damage"	< 0.1mm
Category 1	"aesthetic damage"	0.1 - 1mm
Category 2	"aesthetic damage"	>1 but < 5mm
Category 3	"serviceability damage"	>5 but < 15mm
Category 4	"serviceability damage"	>15 but < 25mm
Category 5	"stability damage"	>25 mm

**Extract from Table 1, B.R.E. Digest 251**  
Classification of damage based on crack widths.  
Note: Actual categorisation can vary due to 'local' effects

**DRAINS**

A drainage survey at this property was completed by Birmingham Drain Services Limited on 13<sup>th</sup> December 2012. That report makes recommendations for substantial drainage repairs. It is essential that drainage repairs are completed prior to any building repairs.

<sup>1</sup> Building Research Establishment, Garston, Watford. Tel: 01923.674040

## **ENGINEERS REPORT**

### **DISCUSSION / CAUSE OF DAMAGE**

A building survey report was produced by Allcott Associates on 27<sup>th</sup> November 2012. That report makes recommendations regarding roof strengthening works and masonry reinforcement repairs to the gable elevation. That report also suspects drainage defects are causing some slight subsidence to the gable wall. My client became concerned following the survey findings and employed a drainage contractor to survey the drainage system. The drainage report was completed on 13<sup>th</sup> December 2012 and shows significant defects to the foul and storm sewer. My clients suspected subsidence was occurring to the gable elevation and I was first contacted on 5<sup>th</sup> February 2013 and asked to quote for producing a specific structural report. I was appointed on 11<sup>th</sup> February 2013 and carried out my inspection on 12<sup>th</sup> February 2013.

It is not unusual for external walls (particularly gable walls) to suffer structural movement and damage due to outward/ lateral movement of the gable wall. Such movement occurs as a result of inadequate lateral restraint to the wall. External walls rely upon the internal structure of the building to provide lateral-stability and prevent buckling of the wall and this can only effectively be achieved if the floors, ceilings, roof and/or internal or return walls are positively connected to the external walls. Quite often this is not the case and this is especially so when the floor joists and the ceiling joists span parallel to the external wall and then offer no effective restraint.

Outward movement of external walls can be initiated by one or a combination of thermal expansion, wind suction and excessive vertical loading but these forces are only significant in cases where the external wall is inadequately restrained laterally. In cases where there is inadequate lateral restraint to an external wall the wall tends to move outwards slowly over a long period of time and this movement usually remains progressive and will eventually result in the wall becoming unstable. In this case the severity of the bowing to the gable elevation means substantial stabilisation measures will be required. In the section below I am recommending that some Bow ties and Cem ties are introduced to stabilise that elevation. Furthermore there is some moderate bowing to the front elevation and Bow ties will also be required to stabilise that wall.

Within the loft space of that property there is evidence of substantial roof spread having caused damage to the party wall in its central area. The roof purlins are very poorly supported and have twisted significantly. In the section below I will be recommending that some seven vertical supports are added to the front, rear and gable elevation purlins. Triangulation members should also be introduced to the front, rear and gable elevations of the loft space tying the roof rafters to the ceiling joists. The substantial cracking to the party wall within the loft space area should be repaired with a masonry beam.

I concur with the building surveyor's findings that the gable elevation of the property is suffering from historic and ongoing subsidence problems. The cause of the subsidence appears to be defective drains washing away fines from below the property's foundation. Drain repairs need to be completed as per the drainage survey recommendations. Masonry reinforcement type of repairs should then be completed to the elevation externally and internally.

### **INSURANCE**

The owners of this property should contact their buildings insurers and submit a subsidence claim. A subsidence claim will be subject to a £1000 policy excess. Furthermore the drainage defects of this property would normally be covered under the "Accidental Damage to Underground Services" clause of the buildings insurance policy. The Accidental Damage claim would normally be subject to £100 policy excess.

### **RECOMMENDATIONS/ CONCLUSION**

In order to stabilise the gable elevation of this property it is normal practice to introduce galvanised steel lateral restraint straps to stabilise the deflected wall. These straps are normally 30mm x 5mm in section and are screwed to the floor joists, the ceiling joists and the rafters and bolted to the wall. The straps are usually spaced at not more than 1.0m centres and in some cases are also fitted to intersecting walls. In the latter case they are again usually spaced at not more than 1.0m centres, measured vertically. However due to the severity of the bowing to the gable elevation of this house I am recommending that Bow and Cem ties are introduced to stabilise that elevation. The front elevation of the property is bowing moderately and both ties will be required to stabilise that elevation.

## **ENGINEERS REPORT**

It is important that the drainage repairs recommended along the gable elevation of this property are completed. Once drainage repairs are carried out building repairs to the gable wall should comprise masonry reinforcement of the cracks present at both ground level and first floor levels.

Within the loft space of the property substantial roof strengthening works are required. Some seven vertical supports are required to the front, gable and rear roof purlins. Triangulation members are needed to the front, gable and rear of the loft space tying the roof rafters to the ceiling joists. The large cracks present to the party wall should be strengthened with a masonry beam.

In conclusion this house is suffering from substantial bowing of the gable elevation due to a lack of lateral restraint of that wall. The house is suffering from a severe degree of roof spread and a moderate degree of subsidence. I have made recommendations in my report above for some roof strengthening works to be carried out. The gable elevation and front elevation of the house need to be repaired with bow ties and cem ties. A masonry beam is recommended to the party wall within the loft space. Masonry reinforcement repairs are required to the gable elevation of the house at both first floor and ground floor levels. The drainage repairs as per recommendations from the drainage contractor should be completed prior to implementing any building works.

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