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STRUCTURAL REPORT

3 Two Gates, Slaithwaite – Roof Timbers Report – Rev A

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Date: 21.07.2021

1.0 INTRODUCTION

Alan Wood & Partners was appointed by Mr K. Ryall (herein referred to as the client) to carry out a Structural Condition Report on the condition of the roof of the property know as Number 3, Two Gates, Holme Lane, Slaithwaite.

It is understood that the owner is doing roofing works to the property and wants to understand what repairs are required to the roof structure.

The Property is Grade II Listed. The list statement for the property reads as follows:

"No 3 late C18. No 4 early C19. Two houses. Hammer stone. Quoins to No 3. Stone slate roof. Ashlar chimney to western end. 2 chimneys with square string course and water tabling. 2 storeys. South elevation: No 3: Ground floor; Two 3-light stone mullioned windows (recessed). One 2-light stone mullioned window (recessed). First floor; Three 3-light stone mullioned windows. No 4: Ground floor; One doorway with stone surrounds and tie-stones (blocked). One doorway with stone surrounds to porch. One 3-light stone mullioned window. One 4-light stone mullioned window. First floor; One lO-light stone mullioned window (4 lights blocked). East elevation: Ground floor; Barn doorway and one doorway with stone surrounds and tie-stones and modern windows to extension. First floor; One 2-light stone mullioned window. North elevation: No 3: Ground floor; One doorway and one small window with stone surrounds. First floor; One window with stone surround. No 4. Ground floor; One modern window. First floor; One modern window. One 2-light stone mullioned window. West elevation: No 30. One small window to gable apex with stone surround. Lean-to extension at western end with concrete roof. Single storey porch extension with monopitch stone slated roof at eastern end. Extension to rear of No 3 probably originally a barn."

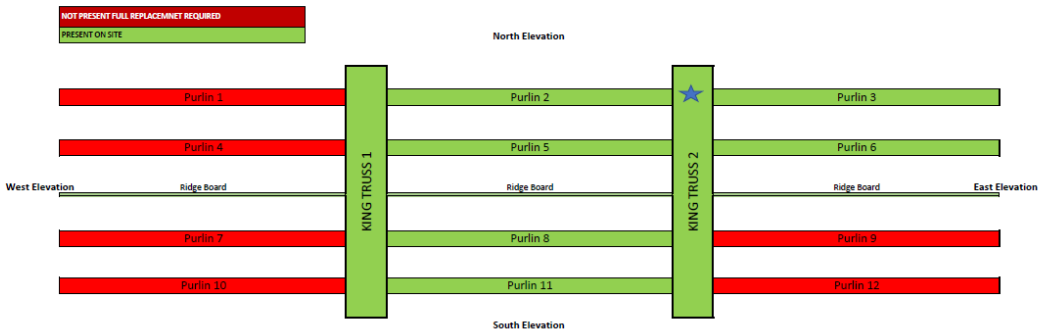
Due to the age and nature of the roof a specialist timber survey, incorporating micro-drilling techniques has been commissioned and carried out by Decadet Timber Frame Surveys and this report has been made available to Alan Wood and Partners.

No site attendance has been carried out by Alan Wood and Partners and all observations are based upon a desk top exercise.

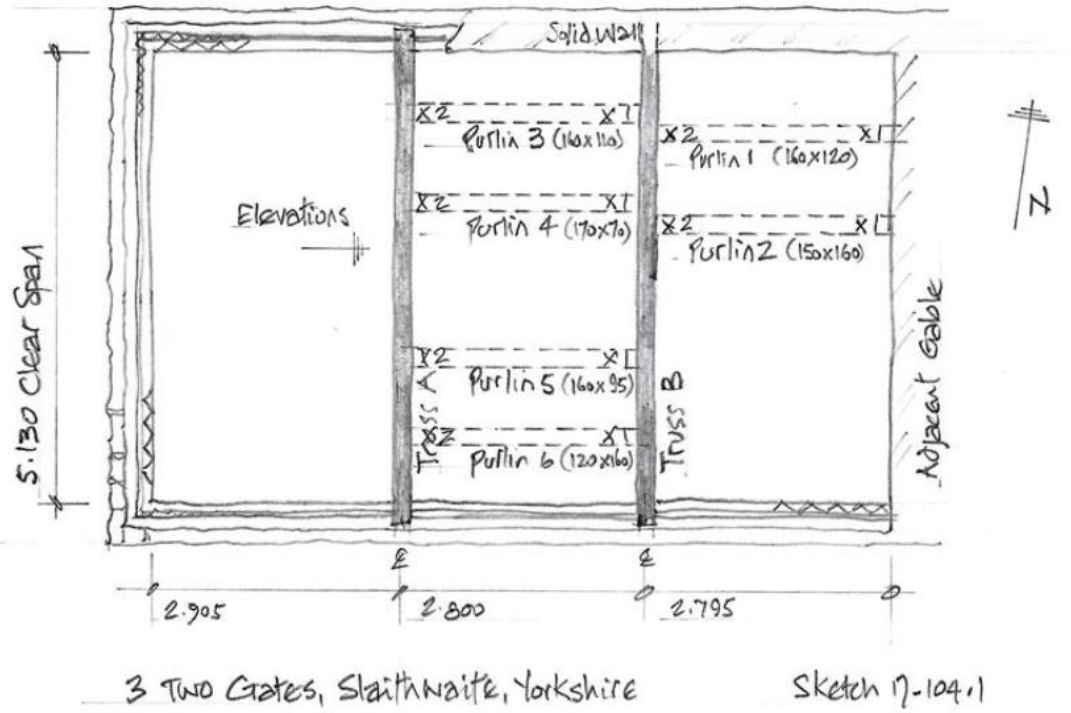
This report should be read in conjunction with the Decadet Timber Frame Surveys report and the recommendations from both reports adopted.

2.0 OBSERVATIONS

The roof layout as provided by the client is as below:



This is confirmed by the sketch layout produced by David Brooks of Decadet:



The numbering sequence differs across the two plans and therefore the Decadet report refers to purlins by different numbers and the Trusses have gain a letter designation rather than a numeric reference.
As the original client plan includes the missing purlins this numbering system will be adopted and then linked to the Decadet reporting.

Purlins 1, 4, 7, 9, 10 & 12 are missing and therefore will require replacement. Sizing of these replacements is as per the supporting calculations in the appendices.

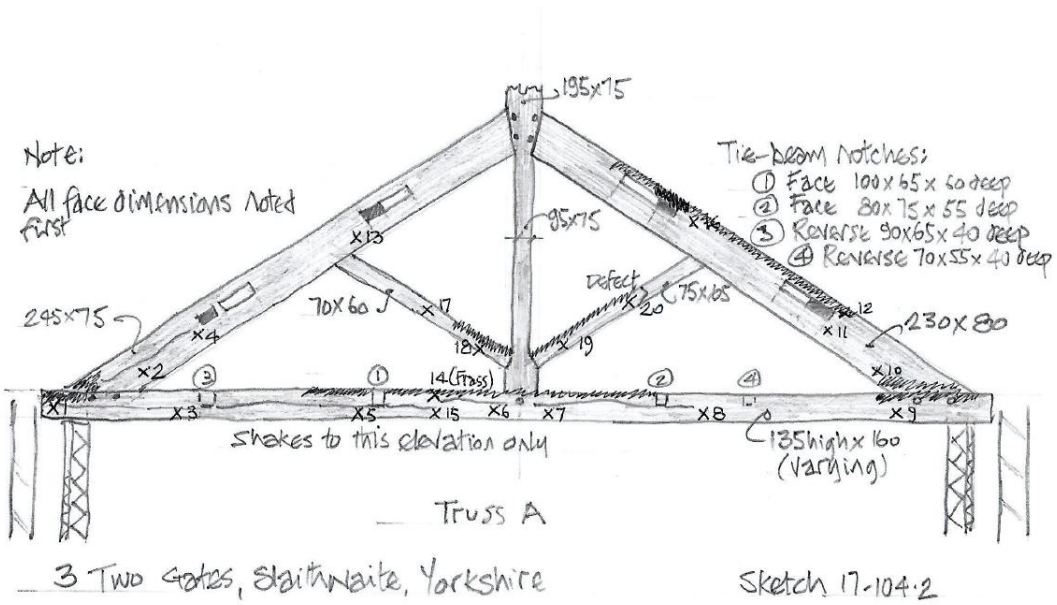
The remaining purlins are generally sound with some surface deterioration. Taking the shallower section sizes – e.g. Purlin 11 (6) and reducing the depth further from 120mm to 100mm, by calculation this section is adequate in stress states. It would deflect further than is allowable by current standards, but this is not a failure state and is considered acceptable for retention.

The original report found that the same applied when checking Purlin 5 (4) by calculation. This is a very slender purlin by comparison but deeper. As some deterioration of the upper face is noted the depth for calculation has

been reduced to 160mm. This section too passes in stress but deflects excessively by modern standards.

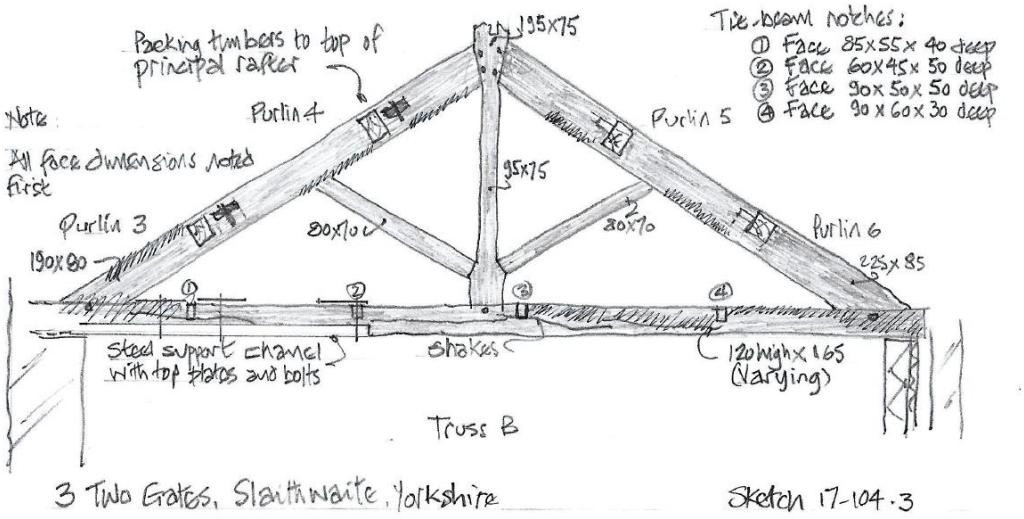
The client has provided additional dimensional information following original issuing of the report which demonstrates that in places Purlins 4 and 5 are 30mm and 35mm wide respectively. As a result the calculations have been updated and the sections fail significantly. It is acknowledged that the worst case stresses may not conincide with the most depleted sectional area, but it is similarly noted that the degree of failure is too great to ignore. As such the sections should be replaced with new timbers as per the new purlin design.

The remaining existing purlin sections sit dimensionally between the original 2 checks and as such by inspection will perform in the same way and will be acceptable for retention.



The tie beam to Truss 1/A was found to have deteriorated generally, this along with the number of shakes present and the notches in the top face reducing available section makes it likely that this section is no longer performing adequately.

Truss 1/A was found to be generally out of plumb.



The tie beam to Truss 2/B was found to be in poor condition with previous attempts to strengthen with steel plating, large shakes and general deterioration of the section. The tie beam can no longer be said to performing adequtely.

Truss 2/B was found to be generally out of plumb.

4.0 CONCLUSIONS

It is recommended that the rafters be replaced with 50x175mm deep rafters at 600 centres in minimum C16 Grade timber.

The existing purlins, as per the statements within observations and the supporting calculations can be retained, with the exception of purlins 4 and 5.

The missing purlins, along with purlins 4 and 5 should be replaced with new members sized 100x175mm deep in minimum D40 Grade Oak, appropriately treated.

The lower tie beam of Truss 1/A should be replaced with an equal sized timber in minimum D40 Oak.

Truss 1/A should be brought back to plumb by means of suitable packing to allow it to perform adequately.

As with Truss 1/A the lower tie beam of Truss 2/B should be replaced with an equal sized timber in minimum D40 Oak.

Truss 2/B should be brought back to plumb by means of suitable packing to allow it to perform adequately.

The recommendations of the Decadet report to install a steel support shoe to the ends of Purlins 3/1 and 6/2 should be adopted. This equally applies to the new purlins to prevent effects of damp transferring from the walls into the timbers.

The recommendation to treat the timbers to prevent further beetle infestation found within the Decadet report should be followed.

APPENDIX
SUPPORTING TIMBER CALCULATIONS

Alan Wood & Partners

■ **Hull Office** 01482 442138
■ **Lincoln Office** 01522 300210
■ **Scarborough Office** 01723 865484
■ **Sheffield Office** 01142 440077
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Project		Job No.	Sheet No.	Revision
	No. 3 Two Gates	45688	A2	A
Part of Structure	**Purlin 5 (4) - remeasure**	**Date**	**Calc. by**	**Rev. Date**
		09.07.21	JMB	21.07.21

Plan span	2.80	m	Roof pitch	37.5	degrees
Dead load	1.6	kN/sqm	Imposed load	0.6	kN/sqm

Member size	160	x	30	mm deep
Supported width of load	1300	mm		

Grade stress flexure	12.5	N/sqmm
Grade stress shear	2	
E	10800	N/sqmm
G (=E/16)	675	N/sqmm

K2 (service class)	1.00	K7 (depth)	1.29
K3 (duration)	1.00	K8 (load sharing)	1.10
K6 (form)	1.00		

Calculations are carried out per member

w	2.80	kN/m	Z	2.40E+04	mm3
M	2.74	kNm	I	3.60E+05	mm4
			A	4.80E+03	mm2

Bending

Applied flexural stress	**114.1**	**N/sqmm**		
		Allowable stress	17.7	N/sqmm
				CHECK

Reaction

Reaction each end	2.8	kN	DL	1.1 kN	LL

Shear

Shear each end	3.1	kN		
Shear stress	**#DIV/0!**	**N/sqmm**		
		Allowable stress	2.20	N/sqmm
				#DIV/0!

Deflection

Length on rake	3.5	m			
Bending deflection	914.1	mm			
Shear deflection	1.0	mm			
Total deflection	**915.1**	**mm**			
			Allowable deflection	10.6	mm
					CHECK

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Part of Structure	**Purlin 5 (4) - remeasure**	**Date**	**Calc. by**	**Rev. Date**
		09.07.21	JMB	21.07.21

Plan span	2.80	m	Roof pitch	37.5	degrees
Dead load	1.6	kN/sqm	Imposed load	0.6	kN/sqm

Member size	150	x	35	mm deep
Supported width of load	1300	mm		

Grade stress flexure	12.5	N/sqmm
Grade stress shear	2	
E	10800	N/sqmm
G (=E/16)	675	N/sqmm

K2 (service class)	1.00	K7 (depth)	1.27
K3 (duration)	1.00	K8 (load sharing)	1.10
K6 (form)	1.00		

Calculations are carried out per member

w	2.80	kN/m	Z	3.06E+04	mm3
M	2.74	kNm	I	5.36E+05	mm4
			A	5.25E+03	mm2

Bending

Applied flexural stress	**89.4**	**N/sqmm**		
		Allowable stress	17.4	N/sqmm

CHECK

Reaction

Reaction each end	2.8	kN	DL	1.1 kN	LL

Shear

Shear each end	3.1	kN		
Shear stress	**6.21**	**N/sqmm**		
		Allowable stress	2.20	N/sqmm

CHECK

Deflection

Length on rake	3.5	m		
Bending deflection	614.0	mm		
Shear deflection	0.9	mm		
Total deflection	**614.9**	**mm**		
		Allowable deflection	10.6	mm

CHECK

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Project		Job No.	Sheet No.	Revision
	No. 3 Two Gates	45688	A3	
Part of Structure	**New Purlins**	**Date** 09.07.21	**Calc. by** JMB	**Rev. Date**

Plan span	2.80	m	Roof pitch	37.5	degrees
Dead load	1.6	kN/sqm	Imposed load	0.6	kN/sqm

Member size	100	x	175	mm deep
Supported width of load	1300	mm		

Grade stress flexure	12.5	N/sqmm
Grade stress shear	2	
E	10800	N/sqmm
G (=E/16)	675	N/sqmm

K2 (service class)	1.00	K7 (depth)	1.06
K3 (duration)	1.00	K8 (load sharing)	1.10
K6 (form)	1.00		

Calculations are carried out per member

w	2.80	kN/m	Z	5.10E+05	mm3
M	2.74	kNm	I	4.47E+07	mm4
			A	1.75E+04	mm2

Bending

Applied flexural stress	**5.4**	**N/sqmm**		
		Allowable stress	14.6	N/sqmm
				PASS

Reaction

Reaction each end	2.8	kN	DL	1.1 kN	LL

Shear

Shear each end	3.1	kN		
Shear stress	**0.32**	**N/sqmm**		
		Allowable stress	2.20	N/sqmm
				PASS

Deflection

Length on rake	3.5	m		
Bending deflection	7.4	mm		
Shear deflection	0.3	mm		
Total deflection	**7.6**	**mm**		
		Allowable deflection	10.6	mm
				PASS

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Project	Job No.	Sheet No.	Revision
No. 3 Two Gates	45688	A4	
Part of Structure	**Date**	**Calc. by**	**Rev. Date**
New Rafters	09.07.21	JMB	

Plan span	2.80	m	Roof pitch	37.5	degrees
Dead load	1.6	kN/sqm	Imposed load	0.6	kN/sqm

Member size	50	x	175	mm deep
Supported width of load	600	mm		

Grade stress flexure	5.3	N/sqmm
Grade stress shear	0.67	
E	8800	N/sqmm
G (=E/16)	550	N/sqmm

K2 (service class)	1.00	K7 (depth)	1.06
K3 (duration)	1.00	K8 (load sharing)	1.10
K6 (form)	1.00		

Calculations are carried out per member

w	1.29	kN/m	Z	2.55E+05	mm3
M	1.26	kNm	I	2.23E+07	mm4
			A	8.75E+03	mm2

Bending

Applied flexural stress	**5.0**	**N/sqmm**		
		Allowable stress	6.2	N/sqmm
				PASS

Reaction

Reaction each end	1.3	kN	DL	0.5 kN	LL

Shear

Shear each end	1.4	kN		
Shear stress	**0.30**	**N/sqmm**		
		Allowable stress	0.74	N/sqmm
				PASS

Deflection

Length on rake	3.5	m		
Bending deflection	8.3	mm		
Shear deflection	0.3	mm		
Total deflection	**8.7**	**mm**		
		Allowable deflection	10.6	mm
				PASS