

| JOB | 23072/51 Lamb's Conduit Street | DATE Feb-24 | PAGE 1.1 |
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| TITLE | Introduction | BY MC | CHECKED RD |

INTRODUCTION

These calculations are for the strengthening of part of the floor structure of flat 2,located on the second floor of 51 Lamb's Conduit Street.

The existing construction is a listed four-storey terraced house with load bearing masonry walls and timber floors. This note has been drafted following MHA's site visit on the 9th of January 2024. During the visit MHA viewed a limited amount of investigations to define the existing floor structure, with a particular focus on the living room and bedroom areas.

The existing timber joists are spanning parallel to Lamb's Conduit Steet, and trimmed by a bressummer along the stairs' edge. The central masony wall parallel to the facades is loadbearing and half brick thick. The existing floors was mostly covered with 18mm chipboards, with only limited areas still featuring the original timber boards.

The living room floor was found to slope towards the bressummer, with an approximate maximum defection of 50mm. The bedroom floor slopes towards the central partition and the central pier of the front façade. The maximum deflection measured was approximately 40mm.

None of the floor timber elements, joists and bressummer, meet in full the current design standards. The living room joists deflect excessively, but are sufficient for strength. The existing bressummer and bedroom joists are calculated to be overstressed and to deflect excessively. These conclusions were based on the assumption of timber being of C16 grade, which is conservative for the historic timber in good condition.

The proposed scope of the works is to strengthen the bressummer and bedroom joists to reduce the stresses to acceptable levels. Whilst the works will stiffen the floor, it will not meet full compliance in service(i.e. deflection and vibration).

REFERENCE TO STANDARDS:

BS EN 1991 EC0 : Actions on Structures BS EN 1995 EC5: Design of Timber Structures BS EN 1995 EC3: Design of Steel Structures



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|-------|--------------------------------|--|----------------|
| TITLE | Load Allowance | bad Allowance BY MC | |
| | | Typical Floor | [KN/m2] |
| | | | G Q |
| | | Laminated floor with soundproof layer | 0.15 |
| | | Timber joists + plywood + Insulation | 0.30 |
| | | Ceiling and Services | 0.25 |
| | | Imposed | 1.50 |
| | | ТОТ | 0.70 1.50 |
| | | Original partition | [KN/m2] G Q |
| | | Lath and plaster on both sides | 0.70 |
| | | Studs and diagonals | 0.10 |
| | | Services | 0.05 |
| | | | |
| | | тот | 0.85 |
| | | New partition | [KN/m2] |
| | | | G Q |
| | | Plasterboard and skim on both sides | 0.30 |
| | | Studs and ply | 0.15 |
| | | Services | 0.05 |
| | | ТОТ | 0.50 |
| | | Stairs | [KN/m2] |
| | | | G Q |
| | | Timber treads, rises and stringers | 0.30 |
| | | Ceiling and Services | 0.20 |
| | | language | 2.00 |
| | | imposed | 3.00 |
| | | тот | 0.50 3.00 |
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| | PAGE 4.1 | eb-24 | DATE F | | | Conduit Street | JOB 23072/51 Lamb's |
|----------------------------|------------------------------------|-----------------------|---|--|---|---|--|
| | CHECKED RI | 1C | BY M | | | eck | TITLE Existing Floor Ch |
| | 95x63 @ 400 c/c | om Joists - C16 1 | Check Living Roc | | | | |
| 4.25 m 0.6 [/] | Span = L = Class 1: k def = | o factor for Service | Creep | 0.30 0.10 | combination $\psi 2 =$ ad combination = | loads in long term o loads in vibration lo | Partial factor for Imposed Partial factor for Imposed |
| 0.001/01/ | | | | . . | | | |
| 0.88 KN/m 1 16 KN/n | Instantaneous = | SLS 1080 SLS | Line Load | Spacing 0.40 m | L0a0 0.70 KN/m2 | Dead I oad = G = | |
| 0.34 KN/n | SLS Vibration = | 020 | 0.6 KN/m | 0.10111 | 1.50 KN/m2 | e Load Roof = Q = | Variabl |
| 1.28 KN/n | ULS load = | | | | | | |
| 3.9E+07 mm [,] | I = BD ³ /12 = | 195 mm | Depth joist = D= | | | | |
| 4.0E+05 mm3 | W = BD ² /6 = | 63 mm | eadth Joist = B = | В | | | |
| 8400 N/mm: | lulus = Emean = | Elasticity mod | | | | | |
| 10.83 N/mm2 | = fmd = | x Kcrit = 1.0 | x Kdep = 1.0 | x Ksys = 1.1 | x γmat = 1.3 | x Kmod = 0.8 | Bending Resistance = fmk = 16 |
| 2.17 N/mm2 | = fvd = | x Kcr = 1.00 | | x Ksys = 1.1 | x γmat = 1.3 | x Kmod = 0.8 | Shear Resistance = fvk = 3.2 |
| 11.43 mm < | neous] x L^4 / EI = | 34 x [SLS instantai | taneous = δ1 = 5/38 | Deflection insta | | Deflection | |
| 12.76 mm CHECKEI | δmax = L/333 = | on instantaneous = | Maximum deflectio | | | | |
| 4.32 KNn | Ird = W x fmd = | Ν | | | | ending Moment | E |
| > 2.89 KNn | S load) x $L^2 / 8 =$ | Muls = (UL | | | | | |
| CHECKED | | | | | | Shoor | |
| 4.5 KM | d = A x fvd /1.5 = | Vro | x 63 mm tenon | 50 mm | Assuming | Snear | |
| > | | | | | | | |
| 2.72 KN | JLS 10ad) x L/2 = | vuis = (L | | | | | |
| | Notes: | | | | | | |
| | II depth blocking ity performance. | continuous line of fu | e existing joists. A c at midspan to impro | will be laid over th I also be provided | new 18m plywood wi | A | |
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|-------------|--|------------------------|------------------------|-------------------|-----------------------|----------------------|--------------------------------|-------------------|
| TITLE | Existing Floor Che | eck | | | BY N | IC | CHECKED | RD |
| | | | | | | Check Bressume | er - C16 200x200 | |
| | Partial factor for Imposed | loads in long term o | combination $\psi 2 =$ | 0.30 | | | Span = L = | 5.00 m |
| | Partial factor for Imposed loads in vibration load combination = | | | 0.10 | Creep | factor for Service | e Class 1: k def = | 0.60 |
| | | | Load | Spacing | *Line Load | SLS load | instantaneous = | 7.23 KN/m |
| | | Dead Load = G = | 0.70 KN/m2 | 2.13 m | 4.0 KN/m | SLS | load long term = | 10.22 KN/m |
| | Variable | e Load Roof = Q = | 1.50 KN/m2 | | 3.2 KN/m | * | ¹ SLS Vibration = | 1.36 KN/m |
| | | | | | | | ULS load = | 10.23 KN/m |
| *3m x 0.8 | 5KN/m2 = 2.55KN/m addec | d for partition above | | Dauthin | | 000 | | |
| * Partition | n not considered in vibratior | n | | Depth br | essummer = D= | 200 mm | $I = BD^{2}/12 =$ | 1.3E+08 mm4 |
| | | | | Breadin br | essummer = B = | 200 mm | VV = BD /6 = | 1.3E+06 mm3 |
| | | | | | | Elasticity mod | dulus = Emean = | 8400 N/mm2 |
| Bending | gResistance = fmk = 16 | x Kmod = 0.8 | x γmat = 1.3 | x Ksys = 1.0 | x Kdep = 1.0 | x Kcrit = 1.0 | = fmd = | 9.85 N/mm2 |
| Shear | Resistance = fvk = 3.2 | x Kmod = 0.8 | x γmat = 1.3 | x Ksys = 1.0 | | x Kcr = 0.67 | = fvd = | 1.32 N/mm2 |
| | | Deflection | | Deflection instar | ntaneous = δ1 = 5/38 | 34 x [SLS instanta | neous] x L ⁴ / EI = | 52.50 mm |
| | | | | | Maximum deflection | on instantaneous = | - δmax = 1 /333 = | > 14 00 mm |
| | | | | | | Shiniotantanoodo | EXC | ESSIVE DEFLECTION |
| | | | | | | | | |
| | В | ending Moment | | | | | | |
| | | | | | | Ν | /Ird = W x fmd = | 13.13 KNm |
| | | | | | | Mule = (III | $S \log d x l^{2} / 8 =$ | < 31.97 KNm |
| | | | | | | 1013 - (01 | 10 10du) x E 70 - | OVERSTRESSED |
| | | Shear | | | | | | |
| | | | | | | Vre | d = A x fvd /1.5 = | 35.2 KN |
| | | | | | | | | > |
| | | | | | | Vuls = (L | JLS load) x L/2 = | 25.58 KN |
| | | Vibration | | | | | | CHECKED |
| | | VIDIATION | | | | Ν | lean frequency = | 5.7 Hz |
| | | | | | | | | < |
| | | | | | | | Min frequency = | 8.0 Hz |
| | | | | | | | | LOW FREQUENCY |
| | | | | | | | | |
| | | | | | | | Notes: | |
| | | 1. It is likely that t | he bressummer is | formed from hard | wood, and would stil | II be over-stressed | d by around 20%. | |
| | | - | | | | | | |
| | 2. The bre | ssummer requires | strengthening to co | mply wih strength | requirements, i.e. to | o be checked in be | ending and shear. | |
| | | | | | 0 | vt a action for all | athoning details | |
| | | | | | Seene | XI SECILON IOF S(FE) | igu ier in ig detalls. | |
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| JOB | DB 23072/51 Lamb's Conduit Street | | | DATE Fe | DATE Feb-24 | | 4.3 | |
|--------------|-----------------------------------|-------------------------|------------------------|--------------------|------------------------|--------------------|--------------------------------|-------------------|
| TITLE | Existing Floor Cl | neck | | | BY M | C | CHECKED | RD |
| | | | | | Joists B | 3edroom - C16 1 | 95x63 @ 400 c/c | |
| Parti | al factor for Imposer | d loads in long term ‹ | combination $\psi 2 =$ | 0.30 | | | Span = L = | 6.50 m |
| Parti | al factor for Imposed | l loads in vibration lo | ad combination = | 0.10 | Creep | factor for Service | Class 1: k def = | 0.60 |
| | | | Load | Spacing | Line Load | SLS load | d instantaneous = | 0.88 KN/m |
| | | Dead Load = G = | 0.70 KN/m2 | 0.40 m | 0.3 KN/m | SLS | load long term = | 1.16 KN/m |
| | Variab | le Load Roof = Q = | 1.50 KN/m2 | | 0.6 KN/m | | SLS Vibration = | 0.34 KN/m |
| | | | | | | | ULS load = | 1.28 KN/m |
| | | | Load | | | | 2 | |
| | | Partition load = | 0.60 KN | | Depth joist = D= | 195 mm | $I = BD^{3}/12 =$ | 3.9E+07 mm4 |
| | | | | B | readth Joist = B = | 63 mm | $W = BD^{2}/6 =$ | 4.0E+05 mm3 |
| | | | | | | Elasticity mo | dulus = Emean = | 8400 N/mm2 |
| Bending Resi | stance = fmk = 16 | x Kmod = 0.8 | x γmat = 1.3 | x Ksys = 1.1 | x Kdep = 1.0 | x Kcrit = 1.0 | = fmd = | 10.83 N/mm2 |
| Shear Resis | stance = fvk = 3.2 | x Kmod = 0.8 | x γmat = 1.3 | x Ksys = 1.1 | - | x Kcr = 0.67 | = fvd = | 1.45 N/mm2 |
| | | Deflection | | Deflection insta | ntaneous = δ1 = 5/384 | 4 x [SLS instanta | neous] x L ⁴ / EI = | 62.55 mm |
| | | | | | Marine un deflectio | | ∑ | > 14.00 mm |
| | | | | | Maximum dellecito | in Instantaneous - | • omax = ∟/333 – EXC | |
| | | | | | | | | ESSIVE DEFILO HOM |
| | , | Bending Moment | | | | | | |
| | | - | | | | Ν | ۸rd = W x fmd = | 4.32 KNm < |
| | | | Increase | d by point load -> | | Muls = (U | LS load) x L^2 /8 = | 8.00 KNm |
| | | | | | | | , | OVERSTRESSED |
| | | Shear | | | | | | |
| | | | | | | Vr | d = A x fvd /1.5 = | 11.9 KN |
| | | | Increase | hv noint load -> | | Vuls = (I | II.S load) x L/2 = | - 4 65 KN |
| | | | | u by point road | | | | CHECKED |
| | | Vibration | | | | | | |
| E plywood | = 8100 | D | Plywood Thk = | 18.0 mm | Kstrut = | 0.97 | El,b = | 7.9E+10 mm4 |
| E ceiling | j = 2000 | 0 Pl | asterboard Thk = | 0.0 mm | | | Kdist = | 0.30 |
| | | | | Scheme = | Simply Supported | | L eq = | 6500 |
| | | | | Type of joists = | Solid Timber | | K amp = | 1.05 |
| | | | Continuc | ous blocking line? | Yes | | | |
| | | | | | | | winst,q = | 5.5 mm > |
| | | | | | | | a = | 1.06 mm |
| | | | | | | | | LOW FREQUENCY |
| | | | | | | _ | - | |
| | | | | | | N | lean frequency = | 3.7 Hz |
| | | | | | | | Min frequency = | \$ 80Hz |
| | | | | | | | WITT II Equency | I OW FREQUENCY |
| | | | | | | | | LOWINLOCLICE |
| | | | | | | | Notes: | |
| | 1. A new 18m ply | wood and two contir | uous lines of full de | epth blocking will | be provided to impro | ove the serviceabi | lity performance. | |
| | | | | | 2. Every joist will be | doubled with a 19 | 5x47C24 timber. | |
| | | | | | | | | |



JOB 23072/51 Lamb's Conduit Street DATE Feb-24 PAGE 5.1 TITLE BY MC CHECKED RD Proposed Floor Strengthening Strengthening Bressummer - PFC 200x 90 + Bressummer Span = L = 5.00 m Floor Load Load T. width *Line Load Dead Load = G = 0.70 KN/m2 2.13 m 1.5 KN/m SLS load = 4.68 KN/m Variable Load = Q = 1.50 KN/m2 3.2 KN/m ULS load = 6.79 KN/m Line Load Partition Load Load Height Dead Load = G = 0.85 KN/m2 3.00 m 2.55 KN/m SLS load = 2.55 KN/m ULS load = 3.44 KN/m Stairs I oad T. width line load Dead I oad = G = 0.50 KN/m2 0.60 m 0.30 KN/m SLS load = 2.10 KN/m Variable Load = Q = 3.00 KN/m2 1.80 KN/m ULS load = 3.11 KN/m Point Load Landing Load T. area Dead Load = G = 0.50 KN/m2 0.66 m2 0.33 KN SLS load = 2.31 KN Variable Load = Q = 3.00 KN/m2 1.98 KN ULS load = 3.42 KN The strengthening beam is designed to take the bending moment for the whole load currently on the bressummer SI S 2,31 KN 2.31 KN 7.23 KN/m 7.23 KN/ 1.05 m 2.90 m 1.05 m 23.42 KN 23.42 KN ULS 3|42 KN 3|42 KN 10.23 KN/m 10.23 KN/m 1 | 1 | 1 | 1 | 1 | 1 | 1.05 m 2.90 m 1.05 m 33.50 KN 33.50 KN Full Bending Moment (only on PFC) C1 factor for equivalent moment from SCI P360 1.13 Mrd for Le = 5.00m = From Blue Book 44.10 KNm * Assuming no torsional restraint by the floor and plywood > Muls : 43.55 KNm CHECKED Shear (resisted by bressummer) Shear Resistance = fvk = 3.2x Kmod = 0.8x vmat = 1.3 x Ksys = 1.0 x Kcr = 0.67 = fvd = 1.32 N/mm2 Vrd = DB x fvd /1.5 = Depth bressummer = D= 200 mm Breadth bressummer = B = 200 mm 35.2 KN Vuls = ULS Reaction Bressummer and PFC = 33.50 KN The PFC will bear into the masonry wall and wil be encased in concrete



| JOB | 23072/51 Lamb's | Conduit Street | | | DATE F | eb-24 | PAGE | 5.2 |
|----------------|--|--|--|---|---|--|--|--|
| TITLE | Proposed Floor S | trengthening | | | BY N | IC | CHECKED | RD |
| | | | S | trengthening Jo | ists Bedroom - C′ | 16 195x63 + C24 | 195x47 @ 400 c/c | |
| | Partial factor for Imposed Partial factor for Imposed | loads in long term c loads in vibration loa | combination $\psi 2 =$ ad combination = | 0.30 0.10 | Cree | o factor for Servic | Span = L = e Class 1: k def = | 6.50 m 0.60 |
| | Variable | Dead Load = G = e Load Roof = Q = | Load 0.70 KN/m2 1.50 KN/m2 | Spacing 0.40 m | Line Load 0.3 KN/m 0.6 KN/m | SLS loa SLS | ad instantaneous = S load long term = SLS Vibration = | 0.88 KN/m 1.16 KN/m 0.34 KN/m |
| | Partition load | =0.5KN/m2 x 3m > | Load (0.4m =0.60 KN | Br | Depth joist = D= eadth Joist = B = | 195 mm 63 mm | ULS load = I = BD ³ /12 = W = BD ² /6 = | 1.28 KN/m 3.9E+07 mm4 4.0E+05 mm3 |
| | Depth C24 joist = D= Breadth C24 Joist = B = | 195 mm 47 mm Elasticity modulus | I = BD ³ /12 = W = BD ² /6 = C24 = Emean = | 2.9E+07 mm4 3.0E+05 mm3 11000 N/mm2 | Equivalent C16 | Elasticity mo properties: leq = We | odulus = Emean = E _{C24} / E _{C16} x I = q = C ₂₄ / C ₁₆ x I = | 8400 N/mm2 3.8E+07 mm4 4.5E+05 mm3 |
| | | | | | ا W fina | final = I existing + I = W existing + \ | - I strengthening = N strengthening = | 7.7E+07 mm4 8.5E+05 mm4 |
| Bendir Shea | ng Resistance = fmk = 16 ar Resistance = fvk = 3.2 | x Kmod = 0.8 x Kmod = 0.8 | x γmat = 1.3 x γmat = 1.3 | x Ksys = 1.1 x Ksys = 1.1 | x Kdep = 1.0 | x Kcrit = 1.0 x Kcr = 0.67 | = fmd = = fvd = | 10.83 N/mm2 1.45 N/mm2 |
| | E | Sending Moment | | | | | Mrd = W x fmd = | 9.16 KNm |
| | | | Increased | d by point load -> | Muls | s = (ULS load) x l | _² /8 + Puls x L/4= | > 8.07 KNm CHECKED |
| | | Shear | | | | V | rd = A x fvd /1.5 = | 11.9 KN > |
| | | | Increased | d by point load -> | | Vuls = (ULS lo | ad) x L/2 + Puls = | 4.56 KN |
| | | | | 1. Each | joist is to be double | ed with a 195x47 | Notes: C24 grade timber. | |
| | 2. A new | 18m plywood will b | e laid over the exis | ting joists. A conti | nuoud line of full dep midspan to impr | oth blocking will a ove the serviceat | also be provided at bility performance. | |
| | | 3. The propos | ed works are impr | oving the perform | ance in service of th | ne floor joists, eve with latest rece | en if not complying ommended limits. | |
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