

SIMPKINS KENNY LTD

CONSULTING CIVIL AND STRUCTURAL ENGINEERS

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Structural Calculations Proposed Alterations & Extensions

@

Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ.
(Design of Underpinning, RC Semi-Raft Foundations & Local Masonry Repairs to Existing Superstructure).

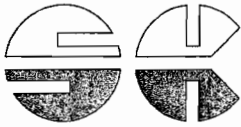
Prepared for: **Mr D & Mrs B Dransfield**
Wellsgate
Back Street
Alkborough
North Lincolnshire
DN15 9JN

Date: **July 2011**

Job No: **11 : 076**

Revision: **0**

DEVELOPMENT CONTROL SECTION	
10 AUG 2011	
DATE RECEIVED	
Referred to	



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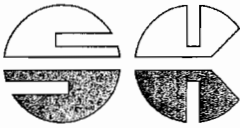
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Calculation Sheet

Client: Mr D & Mrs B Dransfield.	Sheet No: 01.
Project: Proposed Alterations & Extensions @ Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ. Design of underpinning, RC Semi-Raft Foundations & Masonry Repairs.	Job No: 11:076
	Date: July 2011
Prepared by: A.J.S.	Checked by: JK
Revision	0

Reference	Comments
<p><u>DESIGN BRIEF :</u></p> <p>PROPOSED ALTERATIONS & EXTENSIONS TO HILLCREST, BACK STREET ALKBOROUGH AS SHOWN ON ARCHITECTS M/R. JOHN WHITTAKER DRAWINGS REF:</p> <p>DD/10/1/1 REV B : SURVEY AS EXISTING. DD/10/1/2 REV D : GENERAL ARRANGEMENT AS PROPOSED. DD/10/1/3 REV F : ELEVATIONS & SECTIONS AS PROPOSED.</p> <p>THE EXISTING PROPERTY (CIRCA 1800'S) HAS EXTREMELY SHALLOW FOUNDATION FORMATION LEVEL AND IN ORDER TO ENSURE FUTURE STABILITY A SCHEME OF TRADITIONAL UNDERPINNING BAYS HAS BEEN ADOPTED AS INDICATED ON SIMPKINS KENNY DWT REF 11:076:001 REV 0. ADDITIONALLY, TO MINIMISE THE DEPTH OF PROPOSED FOUNDATION EXCAVATION TRENCHES FOR THE NEW EXTENSIONS ABUTTING THE END GABLE WALLS (THE EXISTING NEIGHBOURING BOUNDARY WALL / PROPERTY WOULD POTENTIALLY HAVE BEEN WITHIN A 45° DISPERSION ZONE) A SYSTEM OF SEMI-RAFT TYPE FOUNDATIONS HAS BEEN ADOPTED. FURTHERMORE A LIGHTLY REINFORCED FLOOR SLAB HAS ALSO BEEN INTRODUCED TO THE EXISTING CENTRAL SECTION OF THE BUILDING AND THIS IS TO BE EFFECTIVELY TIED IN TO THE NEW DOWNED UNDERPINNING BAYS WITH H10 LINKS. THIS WILL PROVIDE LOCAL CONTINUITY BETWEEN THE NEW AND OLDER SECTION OF THE PROPERTY.</p> <p>R.C. DESIGN TO BS 8110</p> <p>MASONRY DESIGN TO BS 5628-1 : 2005</p> <p>STEELWORK DESIGN TO B.S 5950-1 : 2000.</p>	



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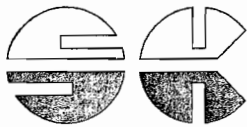
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Calculation Sheet

Client: Mr D & Mrs B Dransfield.	Sheet No: 02
Project: Proposed Alterations & Extensions @ Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ. Design of underpinning, RC Semi-Raft Foundations & Masonry Repairs.	Job No: 11:076
	Date: July 2011
Prepared by: A.J.S.	Checked by: JK
Revision	0

Reference		Comments
	<u>DESIGN LOADING ASSESSMENT :</u>	
(A)	<u>PITCHED ROOF :</u> (Approx 40° pitch).	
	CONCRETE TILES : 60 kg/m ² BATTENS, FELT & INSULATION : 7 TIMBER TRUSSES : 16 12.5mm PLASTERBOARD & SKIM : 20 $\Sigma \frac{103 * 9.81 * 10^{-3}}$	
	TOTAL DEAD LOAD (SLOPE) = 1.0 KN/m ²	
	TOTAL DEAD LOAD (PLAN) = $\frac{1.0}{\cos 40^\circ} = 1.31 \text{ KN/m}^2$	
	TOTAL LIVE LOAD = 0.60 KN/m ² (SNOW)	
(B)	<u>TIMBER FIRST FLOOR :</u> (DOMESTIC)	
	24 'T&G' OR SIMILAR : 15 kg/m ² TIMBER FLOOR JOISTS : 12 12.5mm PLASTERBOARD & SKIM : 20 SUB PARTITION ALLOWANCE : 50 $\Sigma \frac{97 * 9.81 * 10^{-3}}$	
	TOTAL DEAD LOAD = 0.95 KN/m ²	
	TOTAL LIVE LOAD = 1.50 KN/m ²	
(C)	<u>NEW EXTERNAL CAVITY WALL :</u>	
	102.5 BRICKWORK : 220 100 BLOCKWORK : 160 12.5 PLASTER : 20 $\Sigma \frac{400 * 9.81 * 10^{-3}}$	
	TOTAL DEAD LOAD = 4.0 KN/m ²	
(D)	$\gamma_{\text{STONE}} = 22 \text{ KN/m}^3$, $\gamma_{\text{CONC}} = 24 \text{ KN/m}^3$	



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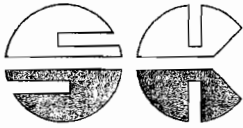
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Calculation Sheet

Client: Mr D & Mrs B Dransfield.	Sheet No: 03.
Project: Proposed Alterations & Extensions @ Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ. Design of underpinning, RC Semi-Raft Foundations & Masonry Repairs.	Job No: 11:076
	Date: July 2011
Prepared by: A.J.S.	Checked by: JK
Revision	0

Reference	Comments
	<p><u>CONSIDER DESIGN OF R.C. SEMI-RAFT FOUNDATIONS.</u></p> <p>CONSERVATIVELY CONSIDER TWO STOREY EXTENSION ADJACENT TO 'FRONT' WESTERN GABLE. CONSERVATIVELY FOR PURPOSES OF DESIGN ASSUME NEW RAFT EDGE THICKENING THEORETICALLY SPANS 3.0m "SOFT SPOT."</p> <p><u>TYPICAL EDGE THICKENING DETAIL :</u></p> <p>CONCRETE GRADE RC35 MIN COVER TO REINFORCEMENT = 40mm.</p>



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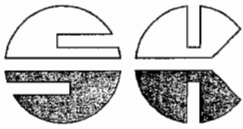
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Calculation Sheet

Client: Mr D & Mrs B Dransfield.	Sheet No: 04.
Project: Proposed Alterations & Extensions @ Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ. Design of underpinning, RC Semi-Raft Foundations & Masonry Repairs.	Job No: 11:076 Date: July 2011
Prepared by: A.J.S.	Checked by: JK Revision: 0

Reference	Comments
<u>DESIGN LOADINGS:</u>	
(i) PITCHED ROOF (O.A. SPAN \approx 4.75m) $UDL_D = 1.31 * \frac{4.75}{2} = 3.11 \text{ kN/m} * 1.40 = 4.36 \text{ kN/m (ULT)}$ $UDL_L = 0.60 * \frac{4.75}{2} = 1.43 \text{ kN/m} * 1.60 = 2.28 \text{ kN/m (ULT)}$	
(ii) TIMBER FIRST FLOOR $UDL_D = 0.95 * \frac{4.15}{2} = 1.97 \text{ kN/m} * 1.40 = 2.76 \text{ kN/m (ULT)}$ $UDL_L = 1.50 * \frac{4.15}{2} = 3.11 \text{ kN/m} * 1.60 = 4.98 \text{ kN/m (ULT)}$	
(iii) SELF WT CAVITY WALL, MAX HT \approx 3.75m $UDL_D = 4.0 * 3.75 = 15.0 \text{ kN/m} * 1.40 = 21.0 \text{ kN/m (ULT)}$	
(iv) R.I. EDGE STRIP $UDL_D = ((0.6 * 0.525) - (0.3 * 0.375)) * 24 = 4.86 \text{ kN/m} * 1.40 = 6.80 \text{ kN/m (ULT)}$	
$\Sigma \underline{29.48 \text{ kN/m (SERVICE)}}$	$\Sigma \underline{42.18 \text{ kN/m (ULT)}}$
CHECK BEARING PRESSURE TO U/S. EDGE STRIP. ASSUME PERMISSIBLE G.B.P. (SERVICE) = 75 kN/m^2	SUBJECT TO CONFIRMATION ON SITE WITH L.A. BUILDING CONTROL OFFICER.
$\therefore \text{ACTUAL G.B.P. (SERVICE)} = \frac{P}{A} = \frac{29.48}{0.6 * 1.0} = 49.13 \text{ kN/m}^2 < 75 \text{ kN/m}^2$ $\therefore \text{SATISFACTORY}$	
CONSIDER R.I. DESIGN OF EDGE STRIP TO SPAN 3.0m THEORETICAL 'SOFT SPOT'	
$\therefore \text{BM MAX (ULT)} = \frac{wl^2}{8} = \frac{42.18 * 3.0^2}{8} = 47.45 \text{ kNm (ULT)}$	
EFFECTIVE DEPTH 'd' \approx 525 - 40 - 10 = 475mm	
$\therefore k = \frac{M}{bd^2fw} = \frac{47.45 * 10^6}{600 * 475^2 * 35} = 0.01$	



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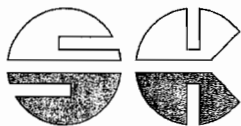
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Calculation Sheet

Client: Mr D & Mrs B Dransfield.	Sheet No: 05.
Project: Proposed Alterations & Extensions @ Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ. Design of underpinning, RC Semi-Raft Foundations & Masonry Repairs.	Job No: 11:076
	Date: July 2011
Prepared by: A.J.S.	Checked by: JK
Revision	0

Reference	Comments
$\therefore Z = 0.94 d = 446.5 \text{ mm.}$ $\therefore A_s (\text{REQ'D}) = \frac{M}{0.95 f_y Z} = \frac{47.45 * 10^6}{0.95 * 460 * 446.5} = 244 \text{ mm}^2$ <p>CHECK $A_s (\text{MIN}) = 0.13 \% A_c = \frac{0.13 * ((1600 * 525) - (300 * 375))}{100}$</p> $\therefore A_s (\text{MIN}) = 264 \text{ mm}^2 \quad \therefore A_s (\text{MIN}) \text{ CONTROLS.}$ <p>$A_s (\text{PROV}) \Rightarrow$ 500 WIDE STRIP B508 MESH (MIN 5 H8 BARS) PLUS 2 H12</p> $\therefore A_s (\text{PROV}) = 252 + 226 = 478 \text{ mm}^2 > 264 \text{ mm}^2 \quad \therefore \text{SATISFACTORY}$ <p><u>CHECK SHEAR.</u></p> <p>MAX SHEAR FORCE = $42.18 * 3.0 = 63.27 \text{ kN (ULT)}$</p> $\frac{100 A_c}{bd} = \frac{100 * 478}{300 * 475} = 0.34 \%$ $\therefore V_c \approx 0.42 \text{ N/mm}^2$ $\therefore v = \frac{V}{bd} = \frac{63.27 * 10^3}{300 * 475} = 0.44 \text{ N/mm}^2$ <p>MINIMUM LINKS PROVIDES $V_c + 0.40 \text{ N/mm}^2 \quad \therefore \text{SATISFACTORY}$</p> <p>$\therefore$ PROVIDE MINIMUM LINKS SUCH THAT :-</p> $\frac{A_{sv}}{sv} \geq \frac{0.4 bv}{0.95 f_{yv}}$ <p>TRY H10 LINKS @ MAX 300mm GRS (2 LEGS)</p> <p>NOTE:- $0.75 d = 356.25 \text{ mm} > 300 \text{ mm} \quad \therefore \text{LINK SPACING SATISFACTORY}$</p> $\therefore \frac{A_{sv}}{sv} = \frac{157}{300} = 0.523$	



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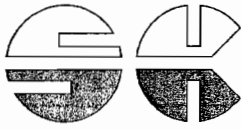
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Calculation Sheet

Client: Mr D & Mrs B Dransfield.	Sheet No: <i>40.</i>
Project: Proposed Alterations & Extensions @ Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ. Design of underpinning, RC Semi-Raft Foundations & Masonry Repairs.	Job No: 11:076
	Date: July 2011
Prepared by: A.J.S.	Checked by: JK
Revision	0

Reference		Comments
	$\therefore \frac{0.4 b_v}{0.95 f_{yv}} = \frac{0.4 * 300}{0.95 * 460} = 0.275 < 0.523 \therefore \text{SATISFACTORY}$ <p style="text-align: right;"><i>USE MINIMUM LINKS</i></p> <div style="border: 1px solid black; border-radius: 50%; padding: 10px; width: fit-content; margin: 10px auto;"> <p>\therefore PROVIDE SINGLE LAYER B503 MESH (BTM) WITH 2 N^o H12 BARS TOP & BOTTOM COMPLETE WITH H10 LINKS @ MAX 300mm CRS THROUGHOUT, MIN COVER 40mm.</p> </div> <p><u>CONSIDER DESIGN OF FLOOR SLAB.</u></p> <p>By INSPECTION PROVIDE MINIMUM ANTI-CRACK MESH TO (TOP OF SLAB</p> $\therefore A_s(\text{MIN}) = 0.13\% A_c = \frac{0.13 * 1000 * 150}{100} = 195 \text{mm}^2/\text{m}$ <p>\therefore PROVIDE SINGLE LAYER A252 MESH TOP MIN COVER 25mm</p> <div style="border: 1px solid black; border-radius: 50%; padding: 10px; width: fit-content; margin: 10px auto;"> <p>\therefore PROVIDE SINGLE LAYER A252 MESH (TOP) MIN COVER 25mm</p> </div>	



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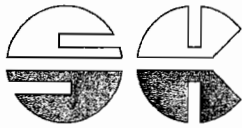
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Calculation Sheet

Client: Mr D & Mrs B Dransfield.	Sheet No: 07
Project: Proposed Alterations & Extensions @ Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ. Design of underpinning, RC Semi-Raft Foundations & Masonry Repairs.	Job No: 11:076
	Date: July 2011
Prepared by: A.J.S.	Checked by: JK
Revision	0

Reference	Comments
	<p>CONSIDER DESIGN OF 'TRADITIONAL' UNDERPINNING BAYS.</p> <p>IN ORDER TO PROVIDE A MORE ROBUST & HOMOGENOUS STRUCTURE THE UNDERPINNING BAYS ARE TO BE INTERLINKED WITH THE INTERNAL REINFORCED FLOOR SLABS AND THE ADJACENT SEMI RAFT TYPE FOUNDATIONS TO THE EXTENSIONS.</p> <p>EXISTING STONE / BK WALLING.</p> <p>1 LAYER A252 MESH (TOP)</p> <p>SCREEDS 75</p> <p>INSULATION 100</p> <p>150</p> <p>2x H12 LACED BARS</p> <p>H10 LINKS @ 250mm CRS</p> <p>RC 35 CONCRETE</p> <p>4 H16 DOWEL BARS</p> <p>750mm</p> <p>450mm</p> <p>100mm</p> <p>200 = 370 = 100</p> <p>1150mm</p> <p>75 New STRAIN GLASS DRY PACK (Combetex 100) O.S.A.</p> <p>75</p>
	<p><u>TYPICAL UNDERPINNING BAY SECTION</u></p>



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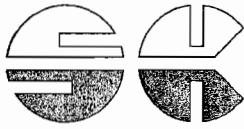
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Calculation Sheet

Client: Mr D & Mrs B Dransfield.	Sheet No: 48.
Project: Proposed Alterations & Extensions @ Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ. Design of underpinning, RC Semi-Raft Foundations & Masonry Repairs.	Job No: 11:076
	Date: July 2011
Prepared by: A.J.S.	Checked by: JK
Revision	0

Reference	Comments
	<u>CONSIDER GROUND BEARING PRESSURE TO U/S. OF UNDERPINNING BAY.</u>
	CONSERVATIVELY TAKE EXT WALL AS 450mm THK SOLID STONE.
	DESIGN LOADINGS:
(i) EXTERNAL STONE WALL 450mm THK., MAX HT 3.75	
$\therefore UDL_D = 22 * 0.45 * 3.75 = 37.13 \text{ kN/m (SERVICE)}$	
(ii) TIMBER FIRST FLOOR	
$\therefore UDL_D = 0.95 * 4.15 / 2 = 1.97 \text{ kN/m}$	
$\therefore UDL_L = 1.50 * 4.15 / 2 = 3.11 \text{ kN/m}$	
(iii) PITCHED ROOF (O.A. SPAN $\approx 4.75 \text{m}$)	
$\therefore UDL_D = 1.31 * 4.75 / 2 = 3.11 \text{ kN/m}$	
$\therefore UDL_L = 0.60 * 4.75 / 2 = 1.43 \text{ kN/m}$	
(iv) R.C. BAY 450 THK. (TAKE EFFECTIVE WIDTH AS 750mm, CONSERVATIVELY)	
$\therefore UDL_D = 0.75 * 0.45 * 24 = 8.1 \text{ kN/m}$	
$\Sigma 54.85 \text{ kN/m (SERVICE)}$	
$\therefore G.B.P. (SERVICE) = \frac{P}{A} = \frac{54.85}{0.75 * 1.0} = 73.13 \text{ kN/m}^2 < 75 \text{ kN/m}^2$	\therefore SATISFACTORY
	NOTE:- GENEROUS LOADINGS ADOPTED ⊕ OVERBURDEN REMOVAL IGNORED \therefore OBVIOUSLY SATISFACTORY.
	<u>\therefore USE TRADITIONAL UNDERPINNING BAY / SERVICE AS DETAILED ON SIMPKINS KENNY DEG 11:076:0001</u>



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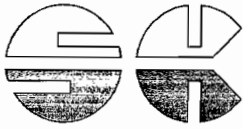
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Calculation Sheet

Client: Mr D & Mrs B Dransfield.	Sheet No: 09
Project: Proposed Alterations & Extensions @ Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ. Design of underpinning, RC Semi-Raft Foundations & Masonry Repairs.	Job No: 11:076
	Date: July 2011
Prepared by: A.J.S.	Checked by: JK
Revision	0

Reference		Comments
	<p><u>CONSIDER DESIGN OF NEW STEEL BEAM 'PURLINS'</u></p> <p>NOTE:- NEW SUPPORT BEAMS REQ'D TO EXISTING RAISED TIE ROOF SPANNING BETWEEN NEW GABLE WALLS AND INTERNAL WALLS TO STAIRWELL. (NEW DOORWAY OPENINGS FOR WINDOWS TO BE PROVIDED AND BEAMS ADDED TO ENHANCE 'ROBUSTNESS' OF EXISTING ROOF AND MINIMISE ANY POTENTIAL FOR SINKS SPREAD.</p> <p>MAX DESIGN SPAN = 4.10m</p> <p><u>DESIGN LOADING:</u></p> <p>(i) EXISTING PITCHED ROOF $UDL_D = 1.31 * (0.8 + \frac{1.5}{2}) = 2.03 \text{ kN/m} * 1.4 = 2.84 \text{ kN/m (ULT)}$ $UDL_L = 0.6 * (0.8 + \frac{1.5}{2}) = 0.93 \text{ kN/m} * 1.6 = 1.49 \text{ kN/m (ULT)}$</p> <p>(ii) SELF WT + CASING $= 0.25 \text{ kN/m} * 1.4 = 0.35 \text{ kN/m (ULT)}$ $\Sigma 3.21 \text{ kN/m (SERVICE)} \Sigma 4.68 \text{ kN/m (ULT)}$</p> <p><u>DESIGN LOADING SKETCH:</u></p> <p>$\therefore BM)_{\text{max}}(ULT) = \frac{wL^2}{8} = \frac{4.68 * 4.1^2}{8} = 9.83 \text{ kNm (ULT)}$ TRY 152 * 89 UB 16. (GR S275) BEAM FULLY RESTRAINED BY RAFTERS $\therefore M_{cx} = 33.8 \text{ kNm} > 9.83 \text{ kNm} \therefore \text{SATISFACTORY.}$</p>	



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Calculation Sheet

Client: Mr D & Mrs B Dransfield.	Sheet No: 10
Project: Proposed Alterations & Extensions @ Hillcrest, Back Street, Alkborough, North Lincolnshire, DN15 9NJ. Design of underpinning, RC Semi-Raft Foundations & Masonry Repairs.	Job No: 11:076
	Date: July 2011
Prepared by: A.J.S.	Checked by:
	Revision 0

Reference		Comments
	<p>By INSPECTION SHEAR SATISFACTORY, CHECK DEFLECTION UNDER SERVICE DEAD + LIVE LOADS.</p> <p>$\therefore \delta(\max) = \frac{5WL^3}{384EI}$ WHERE $W = 3.21 * 4.1 = 13.16 \text{ KN (D+L SERVICE)}$</p> <p>$\therefore \delta(\max) = \frac{5 * 13.16 * 10^3 * 4100^3}{384 * 205 * 10^5 * 834 * 10^4} = 6.91 \text{ mm.}$</p> <p>$\delta(\text{ALLOWABLE}) = \frac{\text{SPAN}}{360} = 11.39 \text{ mm} > 6.91 \text{ mm} \therefore \text{SATISFACTORY}$</p> <p>$\therefore$ USE 152 * 89 UB16 (Gr S275) (4 N² REQ'D)</p>	