Porter, Karen

From: Remway Design - Jason Wilson <jason@remwaydesign.co.uk>
Sent: 05 June 2015 11:04
To: _planningadvice
Cc: Bellamy, Kate
Subject: H03-0397-15 Haylett Lodge, MAin Road,Hop Pole
Attachments: Structural Calcs for Garage slab.pdf; Structural Drg for Garage slab.pdf; 2484 - Planning Amendment Form 05.06.pdf

Please find attached additional drawing for above application.

Many thanks,

Best Regards,

Jason Wilson

Remway Design Ltd **t:** 01775 768 921 **m**: 07815 112 058

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STRUCTURAL CALCULATIONS

FOR

PROPOSED GARAGE RAFT FOUNDATION

AT

HAYLETT LODGE,
HOP POLE,
DEEPING ST NICHOLAS
LINCOLNSHIRE.

FOR

MRS L SPOONCER
C/O
REMWAY DESIGN LTD

JOB NO.
JC/15/04/2413

DOCUMENT REF;- JC 15/04/2413-SC

CALCS BY;-
JLH
APRIL 2015

INTERNAL CHECKS BY;-
J.C.ELLINGTON BSc. CEng, MIStructE, FRSA, MInstD.
APRIL 2015

CALCULATION STATUS
BUILDING REGULATION APPROVAL

Directors
J L Hicks BEng(Hons) MSc.
J C Ellington BSc. CEng MIStructE FRSA MInstD

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Registered Office 75 High Street Boston Lincolnshire. PE21 8SX
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The Institution of Structural Engineers

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General Structural Notes	GSN1-GSN3

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Structural Calculations

Job	Proposed Garage Raft Foundation at Haylett Lodge, Hop Pole, Deeping St Nicholas.
Job No.	JC/15/04/2413
Client	Mrs L Spooncer
Architect	Remway Design Ltd

Design Codes*

BS648	Scheduling of Weights of Materials.
BS6399	Loadings For Buildings.
BS5268	Design of Structural Timber.
BS5950	Use of Structural Steelwork.
BS5628	Use of Masonry.
BS8110	Structural Use of Concrete.
EN 1991	Eurocode 1: Actions on Structures.
EN 1992	Eurocode 2: Design of Concrete Structures.
EN 1993	Eurocode 3: Design of Steel Structures.
EN 1994	Eurocode 4: Design of Composite Structures.
EN 1995	Eurocode 5: Design of Timber Structures.
EN 1996	Eurocode 6: Design of Masonry Structures.
EN 1997	Eurocode 7: Geotechnical Design.

*During the transition of British Standards and Eurocode Standards, JC Consultancy Ltd will carry out designs using both references. Calculations included within this calculation package will be those that provide a conservative design approach, and as such may be a combination of both British Standards and Eurocode Standards.

Existing Info Design check based on visual observations made during site visit by JC Consultancy Ltd Engineer in May 2015 and Drawings provided by the Architect in April 2015.

Design Brief Proposed Raft Foundation requires various structural support and design checks

JC Consultancy Limited has been asked to provide design on the following items;-

1) Reinforced Concrete Slab (Acting as Raft Foundation)

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Design Philosophy

1)
Proposed foundation / slab system for proposed Garage designed as a raft foundation system.

In order to prevent disruption to the roots of adjacent trees, the raft will be designed as a shallow flat slab with minimal sub-base.

The raft foundation has been designed using reduced allowable ground bearing capacities of 50kN/m² for a conservative approach.

Scope of Works.

Only the Items discussed within the Design Brief and Design Philosophy, and listed in the contents have been considered as part of this calculation package.

Any further items, outside the Scope of works , should be carried out in accordance with Architects / Suppliers / Contractors specifications and Local Authority recommendations.

The information within these calculations satisfies the structural requirements of Part A of The Building Act 1984 under which the Building Regulations 2000 and Building (Approved Inspectors etc) Regulations 2000 have been made only. These calculations are not for any other purposes. It is the clients (or clients agent) responsibility to ensure that all proposed works are permitted under the Town and Country Planning Act 1990, the Planning (Listed Buildings and Conservation Areas) Act 1990, the Party Wall etc Act 1996 or any other required consents prior to commencing the works.

The design and detail drawings should be forwarded to the Local Authority Arboriculturist for comments and approval prior to commencement of works on site.

Any steel to steel connection, timber to steel or timber to timber connection design shown in this calculation package is indicative only. All connection design remains the responsibility of the contractor / fabricator, and should be designed to accommodate loadings which will be provided by JC Consultancy Limited upon request. The contractor / fabricator should provide proposals of connection details to JC Consultancy Limited prior to fabrication / installation to enable JC Consultancy Limited to comment and approve.

PLEASE NOTE;-

All calculations have been prepared for Building Regulation Approval purposes only.

Further structural input may be required following commencement of works on site. The contractor should request further details from JC Consultancy Limited if required.

The client has not employed JC Consultancy Limited to carry out a site or ground investigation. Therefore any Foundations and Floor slabs designed by JC Consultancy Limited are based on assumptions only. All Foundations and Floor Slabs should be constructed using the recommendations of Local Authority Building Control in order to suit the ground conditions that are encountered during the excavations.

It is the contractors responsibility to obtain accurate on site dimensions of the existing and/or proposed structure prior to ordering / purchasing / installing any materials including structural steelwork, timber, concrete and masonry. Any conflicting information shown or implied shall be referred to JC Consultancy Limited for further clarification.

FOR FURTHER NOTES REFER TO 'GENERAL STRUCTURAL NOTES' LOCATED AT THE REAR OF THIS CALCULATION PACKAGE.

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GENERAL STRUCTURAL LOADINGS –

TIMBER ROOF LOADINGS

TYPICAL PITCHED ROOF;- (Pitch 35°) + Loft Space	Live Load (R)	0.60 kN/m²
	Finishes	0.55 kN/m²
	Battens	0.02 kN/m²
	Felt	0.02 kN/m²
	Rafters	0.06 kN/m²
	Σ DL Slope	0.65 kN/m²
	1/Cos 35° x 0.65	0.80 kN/m²
TYPICAL CEILING LOADINGS;-	Live Load (R)	0.25 kN/m²
	Deck	0.05 kN/m²
	Joists / Binders	0.04 kN/m²
	Insulation	0.01 kN/m²
	Plasterboard	0.12 kN/m²
	Skim & Finish	0.03 kN/m²
	Σ DL Plan	0.25 kN/m²
TYPICAL PITCHED ROOF;- (Pitch 35°) Vaulted Roof	Live Load (R)	0.60 kN/m²
	Finishes	0.55 kN/m²
	Battens	0.02 kN/m²
	Felt	0.02 kN/m²
	Rafters	0.06 kN/m²
	Insulation	0.02 kN/m²
	Plasterboard	0.12 kN/m²
	Skim & Finish	0.03 kN/m²
	Σ DL Slope	0.82 kN/m²
	1/Cos 35° x 0.82	1.00 kN/m²
TYPICAL FLAT ROOF;-	Live Load (R)	0.75 kN/m²
	Finishes	0.30 kN/m²
	Insulation	0.10 kN/m²
	Deck & Build Up	0.20 kN/m²
	Joists	0.10 kN/m²
	Plasterboard	0.12 kN/m²
	Skim & Finish	0.03 kN/m²
	Σ DL Plan	0.85 kN/m²

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FLOOR LOADINGS

TYPICAL TIMBER SUSPENDED FLOOR;-	Live Load (F) – Res'l	1.50 kN/m²
	Live Load (F) – Off'e	2.50 kN/m²
	Live Load (F) – Clas	3.00 kN/m²
	Live Load (F) – Shop	4.00 kN/m²
	Finishes	0.02 kN/m²
	Deck	0.15 kN/m²
	Joists	0.06 kN/m²
	Insulation	0.02 kN/m²
	Plasterboard	0.12 kN/m²
	Skim & Finish	0.03 kN/m²
	Σ DL Plan	0.40 kN/m²
	Partition Allow	0.35 kN/m²
	Σ DL Plan + Part	0.75 kN/m²
TYPICAL BEAM & BLOCK SUSPENDED FLOOR;-	Live Load (F)	1.50 kN/m²
	Live Load (Garage)	2.50 kN/m²
	Live Load (F) – Off'e	2.50 kN/m²
	Live Load (F) – Clas	3.00 kN/m²
	Live Load (F) – Shop	4.00 kN/m²
	Finishes	0.02 kN/m²
	Screed	1.80 kN/m²
	Insulation	0.05 kN/m²
	Beam & Block	2.15 kN/m²
	Σ DL Plan	4.02 kN/m²
	Partition Allow	0.35 kN/m²
	Σ DL Plan + Part	4.37 kN/m²
TYPICAL SOLID CONCRETE SUSPENDED FLOOR;-	Live Load (F)	1.50 kN/m²
	Live Load (Garage)	2.50 kN/m²
	Live Load (F) – Off'e	2.50 kN/m²
	Live Load (F) – Clas	3.00 kN/m²
	Live Load (F) – Shop	4.00 kN/m²
	Finishes	0.02 kN/m²
	Screed	1.80 kN/m²
	Insulation	0.05 kN/m²
	150 R/C Slab	3.60 kN/m²
	Σ DL Plan	5.47 kN/m²
	Partition Allow	0.35 kN/m²
	Σ DL Plan + Part	5.82 kN/m²

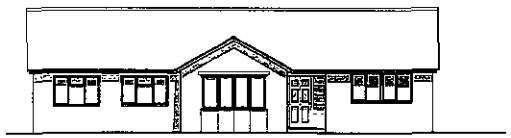
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WALL LOADINGS

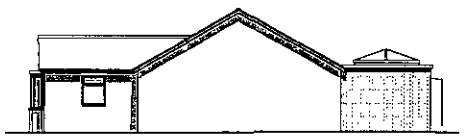
MASONRY WALL;-	330 mm Thk	6.30 kN/m²
	215 mm Thk	4.20 kN/m²
	102.5 mm Thk	2.10 kN/m²
BLOCKWORK WALL;-	215 mm Thk	2.70 kN/m²
	140 mm Thk	1.75 kN/m²
	100 mm Thk	1.25 kN/m²
	Plaster & Finish	0.13 kN/m²
PARTITIONS;-	Plastered 102.5 Brick	2.60 kN/m²
	Plastered 100 Block	2.00 kN/m²
	Timber Studwork	0.35 kN/m²

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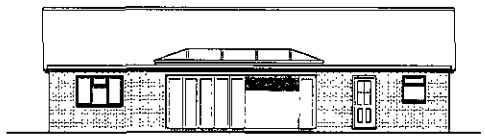
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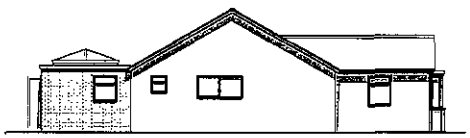
01 - Front Elevation
1 : 100



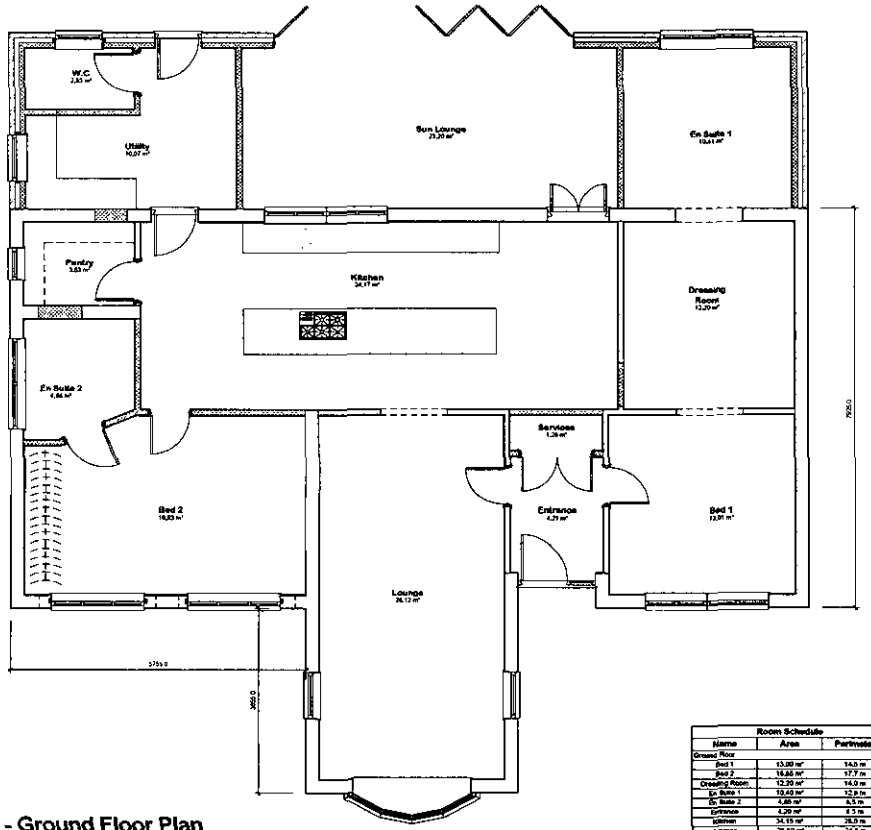
02 - Right Flank
1 : 100



03 - Rear Elevation
1 : 100

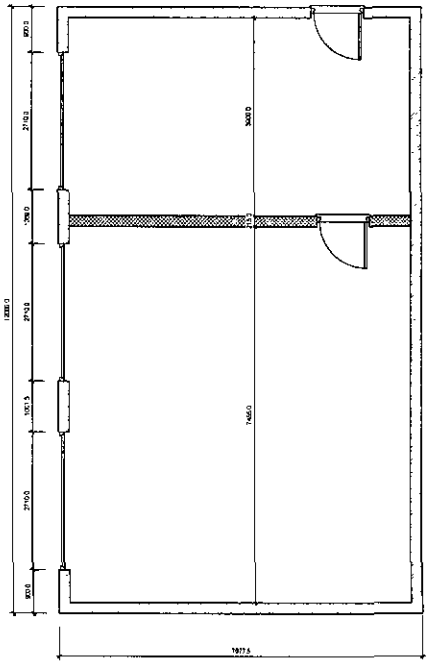


04 - Left Flank
1 : 100

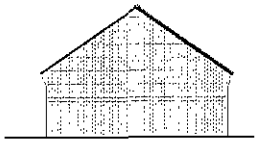


01 - Ground Floor Plan
1 : 50

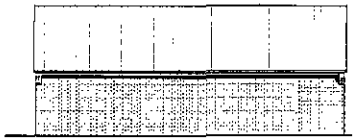
Room Schedule		
Name	Area	Perimeter
Ground floor		
Bed 1	13.00 m²	14.0 m
Bed 2	16.85 m²	17.7 m
Dressing Room	12.20 m²	14.0 m
En Suite 1	10.42 m²	12.9 m
En Suite 2	4.86 m²	8.5 m
Entrance	4.29 m²	8.5 m
Kitchen	34.19 m²	26.9 m
Lounge	26.19 m²	21.9 m
Pantry	3.56 m²	7.6 m
Services	1.25 m²	3.9 m
Sun Lounge	25.39 m²	21.0 m
Utility	10.05 m²	14.8 m
W.C	2.55 m²	6.9 m
Ground floor 13	184.29 m²	178.4 m
Grand total: 13	184.29 m²	178.4 m



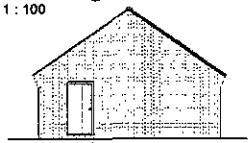
05 - Garage Floor Plan
1 : 50



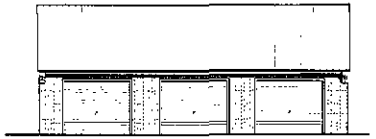
05 - Garage Front
1 : 100



06 - Garage Right Flank
1 : 100



07 - Garage Rear
1 : 100



08 - Garage Left Flank
1 : 100

PLANNING ISSUE

Due to areas of the structure being covered, unexposed or otherwise inaccessible the notes / specifications of existing materials are subject to confirmation of site work this includes to expose the relevant areas of construction.

GENERAL CONDITIONS
Contractors are responsible for checking all dimensions on site when work commences and before ordering any materials.Any discrepancies should be brought to the attention of the Client/ Re-committed action before commencing further.
All materials not specified to be of a standard suitable for the work proposed and be fit for purpose,All work to be in accordance with good building practice and all necessary BS codes for Workmanship on Building titles.

Client
Mr & Mrs Spooncer

Site
Haylett Lodge
Hop Pole
Deeping St Nicholas

Dwg Title
Proposed Plans

remway

Date	Contract No	Dwg No
19.12.14	2485	003 B

"Trialkopt" The Ramparts Spalding PE11 1AP Tel 01775 765 921

COMMENT	CALCULATION	OUTPUT

GARAGE RAFT FOUNDATION ;-

LOADINGS ;- (REAR ELEVATION)

(FROM ROOF)

(LL) = 0.85 x (7.00/2) = 2.98 kN/m

(DL) = 1.20 x (7.00/2) = 4.20 kN/m

(FROM WALL)

(DL) = 4.20 x 2.80 = 11.76 kN/m

ΣL = 2.98 kN/m

ΣD = 15.96 kN/m

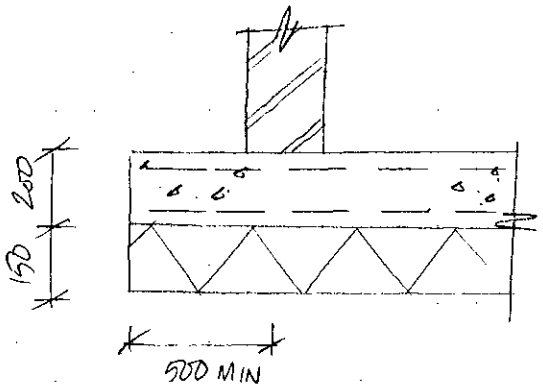
LOADINGS ;- (GABLE ELEVATION) + (PARTITION)

(FROM WALL) ;-

(DL) = 4.20 x 4.00 = 16.80 kN/m

LOADINGS ;- (GARAGE FLOOR)

(LL) = 2.50 kN/m²

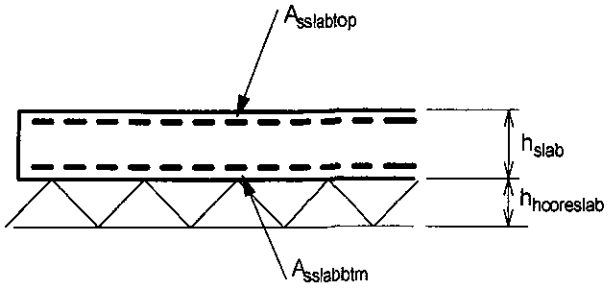


CHECK SLAB OVER HARDCORE

j c consultancy consulting structural & civil engineers JC Consultancy Limited info@jcconsultancyltd.com	Project Garage at Haylett Lodge, Hop Pole, Deeping St Nicholas				Job no. JC 2413	
	Calcs for Garage Slab - Acting as Raft Foundation				Start page no./Revision 11	
	Calcs by JH	Calcs date May 2015	Checked by JCE	Checked date May 2015	Approved by CN	Approved date May 2015

RAFT FOUNDATION DESIGN (BS8110 : PART 1 : 1997)

Tedds calculation version 1.0.09



Soil and raft definition

Soil definition

Allowable bearing pressure	q_{allow} = **50.0** kN/m^2
Number of types of soil forming sub-soil	**One type only**
Soil density	**Firm to loose**
Depth of hardcore beneath slab	$h_{hcoreslab}$ = **150** mm (Dispersal allowed for bearing pressure check)
Density of hardcore	γ_{hcore} = **20.0** kN/m^3
Basic assumed diameter of local depression	$\phi_{depbasic}$ = **2000**mm
Diameter under slab modified for hardcore	$\phi_{depslab} = \phi_{depbasic} - h_{hcoreslab}$ = **1850** mm

Raft slab definition

Max dimension/max dimension between joints	l_{max} = **12.000** m
Slab thickness	h_{slab} = **180** mm
Concrete strength	f_{cu} = **35** N/mm^2
Poissons ratio of concrete	ν = **0.2**
Slab mesh reinforcement strength	f_{yslab} = **500** N/mm^2
Partial safety factor for steel reinforcement	γ_s = **1.15**
From C&CA document 'Concrete ground floors' Table 5	
Minimum mesh required in top for shrinkage	**A142**
Actual mesh provided in top	**A252 ($A_{sslabtop}$ = 252 mm^2/m)**
Mesh provided in bottom	**A252 ($A_{sslabbtm}$ = 252 mm^2/m)**
Top mesh bar diameter	$\phi_{slabtop}$ = **8** mm
Bottom mesh bar diameter	$\phi_{slabbtm}$ = **8** mm
Cover to top reinforcement	c_{top} = **20** mm
Cover to bottom reinforcement	c_{btm} = **35** mm
Average effective depth of top reinforcement	$d_{tslabav} = h_{slab} - c_{top} - \phi_{slabtop}$ = **152** mm
Average effective depth of bottom reinforcement	$d_{bslabav} = h_{slab} - c_{btm} - \phi_{slabbtm}$ = **137** mm
Overall average effective depth	$d_{slabav} = (d_{tslabav} + d_{bslabav})/2$ = **145** mm
Minimum effective depth of top reinforcement	$d_{tslabmin} = d_{tslabav} - \phi_{slabtop}/2$ = **148** mm
Minimum effective depth of bottom reinforcement	$d_{bslabmin} = d_{bslabav} - \phi_{slabbtm}/2$ = **133** mm

Slab edge reinforcement

Mesh provided in top	**A252 ($A_{sedgetop}$ = 252 mm^2/m)**

Mesh provided in bottom — **A252 ($A_{sedgebtm}$ = 252 mm²/m)**

Internal slab design checks

Basic loading

Slab self weight — $w_{slab} = 24\ kN/m^3 \times h_{slab} = \mathbf{4.3}\ kN/m^2$

Hardcore — $w_{hcoreslab} = \gamma_{hcore} \times h_{hcoreslab} = \mathbf{3.0}\ kN/m^2$

Applied loading

Uniformly distributed dead load — $w_{Dudl} = \mathbf{0.0}\ kN/m^2$

Uniformly distributed live load — $w_{Ludl} = \mathbf{2.5}\ kN/m^2$

Slab load number 1

Load type — **Line load**

Dead load — $w_{D1} = \mathbf{16.8}\ kN/m$

Live load — $w_{L1} = \mathbf{0.0}\ kN/m$

Ultimate load — $w_{ult1} = 1.4 \times w_{D1} + 1.6 \times w_{L1} = \mathbf{23.5}\ kN/m$

Line load width — $b_1 = \mathbf{215}\ mm$

Internal slab bearing pressure check

Total uniform load at formation level — $w_{udl} = w_{slab} + w_{hcoreslab} + w_{Dudl} + w_{Ludl} = \mathbf{9.8}\ kN/m^2$

Bearing pressure beneath load number 1

Net bearing pressure available to resist line load — $q_{net} = q_{allow} - w_{udl} = \mathbf{40.2}\ kN/m^2$

Net 'ultimate' bearing pressure available — $q_{netult} = q_{net} \times w_{ult1}/(w_{D1} + w_{L1}) = \mathbf{56.3}\ kN/m^2$

Loaded width required at formation — $l_{req1} = w_{ult1}/q_{netult} = \mathbf{0.418}\ m$

Effective loaded width at u/side slab — $l_{eff1} = \max(b_1, l_{req1} - 2 \times h_{hcoreslab} \times \tan(30)) = \mathbf{0.245}\ m$

Effective net ult bearing pressure at u/side slab — $q_{netulteff} = q_{netult} \times l_{req1}/l_{eff1} = \mathbf{96.0}\ kN/m^2$

Cantilever bending moment — $M_{cant1} = q_{netulteff} \times [(l_{eff1} - b_1)/2]^2/2 = \mathbf{0.0}\ kNm/m$

Reinforcement required in bottom

Maximum cantilever moment — $M_{cantmax} = \mathbf{0.0}\ kNm/m$

K factor — $K_{slabbp} = M_{cantmax}/(f_{cu} \times d_{bslabmin}^2) = \mathbf{0.000}$

Lever arm — $z_{slabbp} = d_{bslabmin} \times \min(0.95, 0.5 + \sqrt{(0.25 - K_{slabbp}/0.9)}) = \mathbf{126.3}\ mm$

Area of steel required — $A_{sslabbpreq} = M_{cantmax}/((1.0/\gamma_s) \times f_{yslab} \times z_{slabbp}) = \mathbf{0}\ mm^2/m$

PASS - $A_{sslabbpreq}$ <= $A_{sslabbtm}$ - Area of reinforcement provided to distribute the load is adequate

The allowable bearing pressure will not be exceeded

Internal slab bending and shear check

Applied bending moments

Span of slab — $l_{slab} = \phi_{depslab} + d_{tslabav} = \mathbf{2002}\ mm$

Ultimate self weight udl — $w_{swult} = 1.4 \times w_{slab} = \mathbf{6.0}\ kN/m^2$

Self weight moment at centre — $M_{csw} = w_{swult} \times l_{slab}^2 \times (1 + \nu) / 64 = \mathbf{0.5}\ kNm/m$

Self weight moment at edge — $M_{esw} = w_{swult} \times l_{slab}^2 / 32 = \mathbf{0.8}\ kNm/m$

Self weight shear force at edge — $V_{sw} = w_{swult} \times l_{slab} / 4 = \mathbf{3.0}\ kN/m$

Moments due to applied uniformly distributed loads

Ultimate applied udl — $w_{udlult} = 1.4 \times w_{Dudl} + 1.6 \times w_{Ludl} = \mathbf{4.0}\ kN/m^2$

Moment at centre — $M_{cudl} = w_{udlult} \times l_{slab}^2 \times (1 + \nu) / 64 = \mathbf{0.3}\ kNm/m$

Moment at edge — $M_{eudl} = w_{udlult} \times l_{slab}^2 / 32 = \mathbf{0.5}\ kNm/m$

Shear force at edge — $V_{udl} = w_{udlult} \times l_{slab} / 4 = \mathbf{2.0}\ kN/m$

Moment due to load number 1

Approximate equivalent udl	$w_{udl1} = w_{ult1}/(2 \times 0.3 \times l_{slab})$ = **19.6** kN/m²
Moment at centre	$M_{c1} = w_{udl1} \times l_{slab}^2 \times (1 + \nu) / 64$ = **1.5** kNm/m
Moment at edge	$M_{e1} = w_{udl1} \times l_{slab}^2 / 32$ = **2.5** kNm/m
Shear force at edge	$V_1 = w_{udl1} \times l_{slab} / 4$ = **9.8** kN/m

Resultant moments and shears

Total moment at edge	$M_{\Sigma e}$ = **3.7** kNm/m
Total moment at centre	$M_{\Sigma c}$ = **2.2** kNm/m
Total shear force	V_Σ = **14.8** kN/m

Reinforcement required in top

K factor	$K_{slabtop} = M_{\Sigma e}/(f_{cu} \times d_{tslabav}^2)$ = **0.005**
Lever arm	$z_{slabtop} = d_{tslabav} \times \min(0.95, 0.5 + \sqrt{(0.25 - K_{slabtop}/0.9)})$ = **144.4** mm
Area of steel required for bending	$A_{sslabtopbend} = M_{\Sigma e}/((1.0/\gamma_s) \times f_{yslab} \times z_{slabtop})$ = **59** mm²/m
Minimum area of steel required	$A_{sslabmin} = 0.0013 \times h_{slab}$ = **234** mm²/m
Area of steel required	$A_{sslabtopreq} = \max(A_{sslabtopbend}, A_{sslabmin})$ = **234** mm²/m

PASS - $A_{sslabtopreq}$ <= $A_{sslabtop}$ - Area of reinforcement provided in top to span local depressions is adequate

Reinforcement required in bottom

K factor	$K_{slabbtm} = M_{\Sigma c}/(f_{cu} \times d_{bslabav}^2)$ = **0.003**
Lever arm	$z_{slabbtm} = d_{bslabav} \times \min(0.95, 0.5 + \sqrt{(0.25 - K_{slabbtm}/0.9)})$ = **130.1** mm
Area of steel required for bending	$A_{sslabbtmbend} = M_{\Sigma c}/((1.0/\gamma_s) \times f_{yslab} \times z_{slabbtm})$ = **39** mm²/m
Area of steel required	$A_{sslabbtmreq} = \max(A_{sslabbtmbend}, A_{sslabmin})$ = **234** mm²/m

PASS - $A_{sslabbtmreq}$ <= $A_{sslabbtm}$ - Area of reinforcement provided in bottom to span local depressions is adequate

Shear check

Applied shear stress	$v = V_\Sigma/d_{tslabmin}$ = **0.100** N/mm²
Tension steel ratio	$\rho = 100 \times A_{sslabtop}/d_{tslabmin}$ = **0.170**
From BS8110-1:1997 - Table 3.8	
Design concrete shear strength	v_c = **0.502** N/mm²

PASS - $v <= v_c$ - Shear capacity of the slab is adequate

Internal slab deflection check

Basic allowable span to depth ratio	$Ratio_{basic}$ = **26.0**
Moment factor	$M_{factor} = M_{\Sigma c}/d_{bslabav}^2$ = **0.119** N/mm²
Steel service stress	$f_s = 2/3 \times f_{yslab} \times A_{sslabbtmbend}/A_{sslabbtm}$ = **52.047** N/mm²
Modification factor	$MF_{slab} = \min(2.0, 0.55 + [(477N/mm^2 - f_s)/(120 \times (0.9N/mm^2 + M_{factor}))])$
	MF_{slab} = **2.000**
Modified allowable span to depth ratio	$Ratio_{allow} = Ratio_{basic} \times MF_{slab}$ = **52.000**
Actual span to depth ratio	$Ratio_{actual} = l_{slab}/ d_{bslabav}$ = **14.613**

PASS - $Ratio_{actual}$ <= $Ratio_{allow}$ - Slab span to depth ratio is adequate

Slab edge design checks

Basic loading

Hardcore	$w_{hcoreslab} = \gamma_{hcore} \times h_{hcoreslab}$ = **3.0** kN/m²
Slab self weight	w_{slab} = 24 kN/m³ × h_{slab} = **4.3** kN/m²

Edge load number 1

Load type	**Longitudinal line load**
Dead load	w_{Dedge1} = **16.0** kN/m
Live load	w_{Ledge1} = **3.0** kN/m
Ultimate load	$w_{ultedge1} = 1.4 \times w_{Dedge1} + 1.6 \times w_{Ledge1}$ = **27.2** kN/m

Longitudinal line load width — b_{edge1} = **215** mm

Centroid of load from outside face of raft — x_{edge1} = **500** mm

Slab edge bearing pressure check

Total uniform load at formation level — $w_{udledge} = w_{Dudl} + w_{Ludl} + w_{slab} + w_{hcoreslab}$ = **9.8** kN/m²

Centroid of longitudinal and equivalent line loads from outside face of raft

Load x distance for edge load 1 — $Moment_1 = w_{ultedge1} \times x_{edge1}$ = **13.6** kN

Sum of ultimate longitud'l and equivalent line loads — ΣUDL = **27.2** kN/m

Sum of load x distances — $\Sigma Moment$ = **13.6** kN

Centroid of loads — $x_{bar} = \Sigma Moment/\Sigma UDL$ = **500** mm

Initially assume no moment transferred into slab due to load/reaction eccentricity

Sum of unfactored longitud'l and eff'tive line loads — $\Sigma UDLsls$ = **19.0** kN/m

Allowable bearing width — $b_{allow} = 2 \times x_{bar} + 2 \times h_{hcoreslab} \times \tan(30)$ = **1173** mm

Bearing pressure due to line/point loads — $q_{linepoint} = \Sigma UDLsls / b_{allow}$ = **16.2** kN/m²

Total applied bearing pressure — $q_{edge} = q_{linepoint} + w_{udledge}$ = **26.0** kN/m²

PASS - q_{edge} <= q_{allow} - Allowable bearing pressure is not exceeded

Slab edge bending check

Considering a 1.0m width of slab

Divider for moments due to udl's — β_{udl} = **10.0**

Applied bending moments

Span of slab — $l_{edge} = \phi_{depslab} + d_{tslabmin}$ = **1998** mm

Ultimate self weight udl — $w_{edgeult} = 1.4 \times w_{slab}$ = **6.0** kN/m²

Self weight bending moment — $M_{edgesw} = w_{edgeult} \times l_{edge}^2/10$ = **2.4** kNm/m

Self weight shear force — $V_{edgesw} = w_{edgeult} \times l_{edge}/2$ = **6.0** kN/m

Moments due to applied uniformly distributed loads

Ultimate udl — $w_{edgeudl} = w_{udlult}$ = **4.0** kN/m²

Bending moment — $M_{edgeudl} = w_{edgeudl} \times l_{edge}^2/\beta_{udl}$ = **1.6** kNm/m

Shear force — $V_{edgeudl} = w_{edgeudl} \times l_{edge}/2$ = **4.0** kN/m

Moment and shear due to load number 1

Effective slab width — $b_{eff1} = \min(x_{edge1}, b_{edge1}/2 + 0.3 \times l_{edge}) + b_{edge1}/2 + 0.3 \times l_{edge}$ = **1207** mm

Bending moment — $M_{edge1} = w_{ultedge1} \times l_{edge}^2/(\beta_{udl} \times b_{eff1})$ = **9.0** kNm/m

Shear force — $V_{edge1} = w_{ultedge1} \times l_{edge}/(2 \times b_{eff1})$ = **22.5** kN/m

Resultant moments and shears

Total moment (hogging and sagging) — $M_{\Sigma edge}$ = **13.0** kNm/m

Maximum shear force — $V_{\Sigma edge}$ = **32.6** kN/m

Reinforcement required in top

K factor — $K_{edgetop} = M_{\Sigma edge}/(f_{cu} \times d_{tslabmin}^2)$ = **0.017**

Lever arm — $z_{edgetop} = d_{tslabmin} \times \min(0.95, 0.5 + \sqrt{(0.25 - K_{edgetop}/0.9)})$ = **141** mm

Area of steel required for bending — $A_{sedgetopbend} = M_{\Sigma edge}/((1.0/\gamma_s) \times f_{yslab} \times z_{edgetop})$ = **213** mm²/m

Area of steel required — $A_{sedgetopreq} = \max(A_{sedgetopbend}, A_{sslabmin})$ = **234** mm²/m

PASS - $A_{sedgetopreq}$ <= $A_{sedgetop}$ - Area of reinforcement provided in top of slab is adequate

Reinforcement required in bottom

K factor — $K_{edgebtm} = M_{\Sigma edge}/(f_{cu} \times d_{bslabmin}^2)$ = **0.021**

Lever arm — $z_{edgebtm} = d_{bslabmin} \times \min(0.95, 0.5 + \sqrt{(0.25 - K_{edgebtm}/0.9)})$ = **126** mm

Area of steel required for bending — $A_{sedgebtmbend} = M_{\Sigma edge}/((1.0/\gamma_s) \times f_{yslab} \times z_{edgebtm})$ = **237** mm²/m

Area of steel required $A_{sedgebtmreq} = \max(A_{sedgebtmbend}, A_{sslabmin}) = \mathbf{237}$ mm²/m

PASS - $A_{sedgebtmreq}$ <= $A_{sedgebtm}$ - Area of reinforcement provided in bottom of slab is adequate

Applied shear stress $v_{edge} = V_{\Sigma edge} \times 1.0m/(1000mm \times d_{tslabmin}) = \mathbf{0.220}$ N/mm²

Tension steel ratio $\rho_{edge} = 100 \times A_{sedgetop} \times 1.0m/(1000mm \times d_{tslabmin}) = \mathbf{0.170}$

From BS8110-1:1997 - Table 3.8

Design concrete shear strength $v_{cedge} = \mathbf{0.502}$ N/mm²

PASS - v_{edge} <= v_{cedge} - Shear capacity of the slab is not exceeded

Slab edge deflection check

Basic allowable span to depth ratio $Ratio_{basicedge} = \mathbf{26.0}$

Moment factor $M_{factoredge} = M_{\Sigma edge}/d_{bslabmin}^2 = \mathbf{0.735}$ N/mm²

Steel service stress $f_{sedge} = 2/3 \times f_{yslab} \times A_{sedgebtmbend}/A_{sedgebtm} = \mathbf{313.214}$ N/mm²

Modification factor $MF_{edge}=\min(2.0,0.55+[(477N/mm^2-f_{sedge})/(120\times(0.9N/mm^2+M_{factoredge}))])$

$MF_{edge} = \mathbf{1.385}$

Modified allowable span to depth ratio $Ratio_{allowedge} = Ratio_{basicedge} \times MF_{edge} = \mathbf{36.000}$

Actual span to depth ratio $Ratio_{actualedge} = l_{edge}/ d_{tslabmin} = \mathbf{13.500}$

PASS - $Ratio_{actualedge}$ <= $Ratio_{allowedge}$ - Slab span to depth ratio is adequate

Corner design checks

Basic loading

Corner bearing pressure check

Total uniform load at formation level $w_{udlcorner} = w_{Dudl} + w_{Ludl} + w_{slab} + w_{hcoreslab} = \mathbf{9.8}$ kN/m²

PASS - $w_{udlcorner}$ <= q_{allow} - Applied bearing pressure is less than allowable

Slab corner bending check

Cantilever span of slab at corner $l_{corner} = \phi_{depslab}/\sqrt{(2)} + d_{tslabav}/2 = \mathbf{1384}$ mm

Moment and shear due to self weight

Considering triangular loading

Maximum ultimate self weight udl $w_{swult} = 1.4 \times w_{slab} \times \phi_{depslab}/\sqrt{(2)} = \mathbf{7.9}$ kN/m

Self weight bending moment $M_{cornersw} = w_{swult} \times l_{corner}^2/(6 \times \phi_{depslab}/\sqrt{(2)}) = \mathbf{1.9}$ kNm/m

Self weight shear force $V_{cornersw} = w_{swult} \times l_{corner}/(2 \times \phi_{depslab}/\sqrt{(2)}) = \mathbf{4.2}$ kN/m

Moment and shear due to udls

Maximum ultimate udl $w_{cornerudl} = ((1.4\times w_{Dudl})+(1.6\times w_{Ludl})) \times \phi_{depslab}/\sqrt{(2)} = \mathbf{5.2}$ kN/m

Bending moment $M_{cornerudl} = w_{cornerudl} \times l_{corner}^2/(6 \times \phi_{depslab}/\sqrt{(2)}) = \mathbf{1.3}$ kNm/m

Shear force $V_{cornerudl} = w_{cornerudl} \times l_{corner}/(2 \times \phi_{depslab}/\sqrt{(2)}) = \mathbf{2.8}$ kN/m

Resultant moments and shears

Total design moment $M_{\Sigma corner} = M_{cornersw} + M_{cornerudl} = \mathbf{3.2}$ kNm/m

Total design shear force $V_{\Sigma corner} = V_{cornersw} + V_{cornerudl} = \mathbf{7.0}$ kN/m

Reinforcement required in top of slab at corners

K factor $K_{corner} = M_{\Sigma corner}/(f_{cu} \times d_{tslabmin}^2) = \mathbf{0.004}$

Lever arm $z_{corner} = d_{tslabmin} \times \min(0.95, 0.5 + \sqrt{(0.25 - K_{corner}/0.9)}) = \mathbf{141}$ mm

Area of steel required for bending $A_{scornerbend} = M_{\Sigma corner}/((1.0/\gamma_s) \times f_{yslab} \times z_{corner}) = \mathbf{52}$ mm²/m

Area of steel required $A_{scorner} = \max(A_{scornerbend}, A_{sslabmin}) = \mathbf{234}$ mm²/m

PASS - $A_{scorner}$ <= $A_{sedgetop}$ - Area of reinforcement provided in top of slab at corners is adequate

Applied shear stress $v_{corner} = V_{\Sigma corner}/d_{tslabmin} = \mathbf{0.047}$ N/mm²

Tension steel ratio $\rho_{corner} = 100 \times A_{sedgetop}/d_{tslabmin} = \mathbf{0.170}$

From BS8110-1:1997 - Table 3.8

Design concrete shear strength — $v_{ccorner}$ = **0.502** N/mm²

Pass - v_{corner} <= $v_{ccorner}$ - Shear capacity of the slab is not exceeded

Slab corner deflection check

Basic allowable span to depth ratio — $Ratio_{basiccorner}$ = **7.0**

Moment factor — $M_{factorcorner} = M_{\Sigma corner}/d_{tslabmin}^2$ = **0.146** N/mm²

Steel service stress — $f_{scorner} = 2/3 \times f_{yslab} \times A_{scornerbend}/A_{sedgetop}$ = **69.425** N/mm²

Modification factor — $MF_{corner}=\min(2.0,0.55+[(477N/mm^2-f_{scorner})/(120\times(0.9N/mm^2+M_{factorcorner}))])$

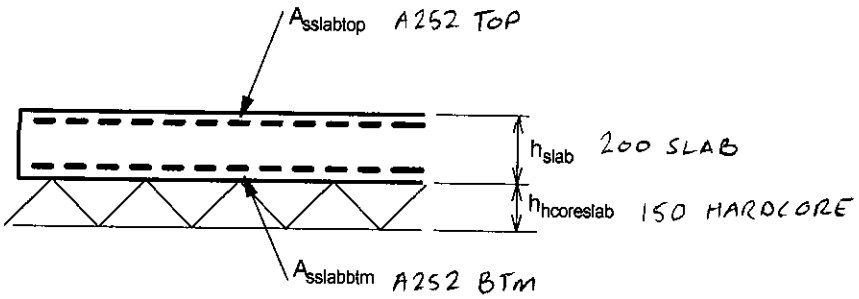
MF_{corner} = **2.000**

Modified allowable span to depth ratio — $Ratio_{allowcorner} = Ratio_{basiccorner} \times MF_{corner}$ = **14.000**

Actual span to depth ratio — $Ratio_{actualcorner} = l_{corner}/ d_{tslabmin}$ = **9.352**

PASS - $Ratio_{actualcorner}$ <= $Ratio_{allowcorner}$ - Slab span to depth ratio is adequate

∴ 180MM THK SLAB OK. FOR CONSERVATIVE APPROACH INCREASE THICKNESS TO 200MM.



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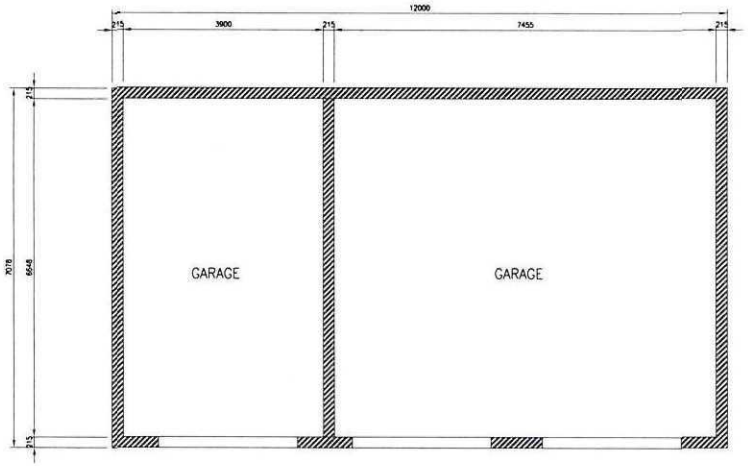
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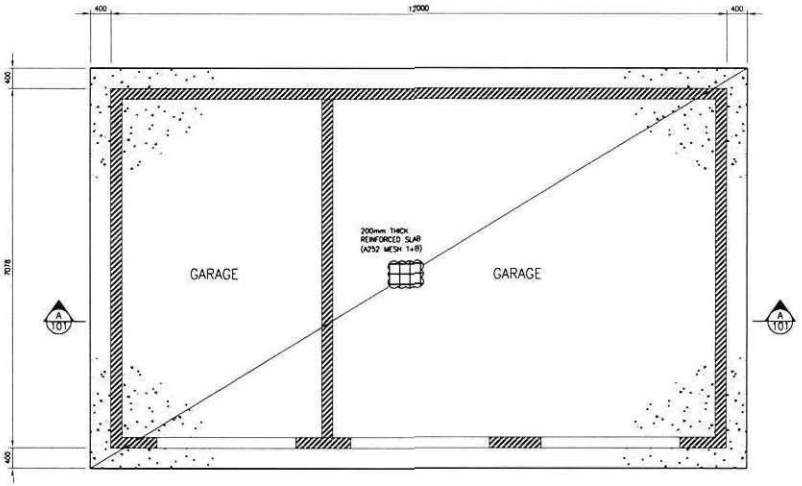
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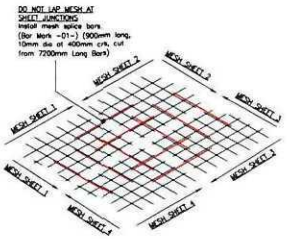
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WALL G.A (1:50)
AS PER ARCHITECTS LAYOUT

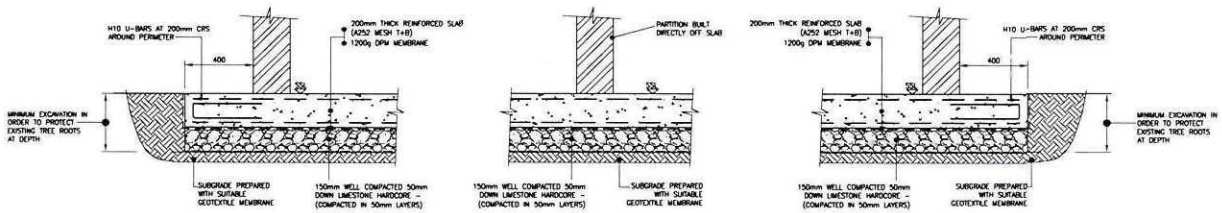


R/C RAFT G.A (1:50)



MESH INTERSECTION DETAIL (N.T.S)

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TYPICAL PERIMETER SECTION A-A (1:15)

This drawing and associated calculations should be forwarded to the Local Authority Arboriculturist for comments and approval prior to commencement of works on site.

Rev.	Date.	Drwn.	Chkd.	Description
-	MAY 15	JLH	JCE	ISSUED TO CLIENT / ARCHITECT FOR INFO. & COMMENTS - NOT FOR CONSTRUCTION.

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Contract
PROPOSED GARAGE
HAYLETT LODGE
HOP POLE, LINCOLNSHIRE.

Drg Title
PROPOSED R/C RAFT FOUNDATION
G.A AND DETAILS - GARAGE

Drawn	Checked	Date	Scales
JLH	JCE	MAY 2015	VARIES - SEE PLAN

Job Ref	Drawing Ref	Rev.
JC/15/04/2413	2413-101	-

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All dimensions are in mm unless noted otherwise. All dimensions, details, components and assemblies shall be verified by the contractor prior to construction, manufacture or supply.

All materials, construction and details shown or implied by these calculations must comply with current British standards, codes of practice, planning / building regulations, H & SE legislation and clients particular specifications.

The information within these calculations satisfies the structural requirements of Part A of The Building Act 1984 under which the Building Regulations 2000 and Building (Approved Inspectors etc) Regulations 2000 have been made only. These calculations are not for any other purposes. It is the clients (or clients agent) responsibility to ensure that all proposed works are permitted under the Town and Country Planning Act 1990, the Planning (Listed Buildings and Conservation Areas) Act 1990, the Party Wall etc Act 1996 or any other required consents prior to commencing the works.

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Opening up works may have been carried out in isolated areas only by JC Consultancy Ltd, therefore some information within these feasibility details may be based on interpretation and assumptions. The contractor should investigate and confirm all existing detail. Any discrepancies should be reported to the engineer for comment prior to carrying out the works.

It is the contractors responsibility to obtain accurate on site dimensions of the existing and/or proposed structure prior to ordering / purchasing / installing any materials including structural steelwork, timber, concrete and masonry. Any conflicting information shown or implied shall be referred to JC Consultancy Ltd for further clarification.

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GENERAL STRUCTURAL NOTES – CONCRETE

Foundations and Floor Slabs may not have been designed by JC Consultancy Ltd, and should be constructed in accordance with the Architects requirements and the recommendations of Local Authority Building Control in order to suit the ground conditions that are encountered during the excavations.

Unless a detailed Site Investigation Report is made available, conservative assumptions will be made in design. Allowable Ground Bearing Pressures have been limited to 100kN/m², and must be verified on site by the contractor / LABC prior to pouring of any concrete.

It is the contractors responsibility to report any condition found on site during excavation which in any way may affect the present design, including dubious / soft ground, existing foundations and obstructions, drains, trees, roots, pits and shafts etc.. All concrete element dimensions are to be checked by the contractor prior to carrying out the structural works.

As a minimum, any foundations designed by JC Consultancy Ltd, should be constructed using designated concrete RC35, conforming to BS 8500-2 and BS EN 206-1, with 20mm maximum aggregate size and consistence class S2. Admixtures may not be used. Unless noted otherwise, any concrete in contact with the ground should include aggregates, cement content and water/cement ratios which provide protection for Sulphate Resistance.

All foundations are to be placed within undisturbed natural strata at a minimum depth of 950mm below floor level unless noted or approved otherwise.

As a minimum, any floor slabs designed by JC Consultancy Ltd, should be constructed using designated concrete RC35, conforming to BS 8500-2 and BS EN 206-1, with 20mm maximum aggregate size and consistence class S2. Admixtures may not be used.

Concrete mix specifications can vary from supplier to supplier. It is the contractor's responsibility to inform JC Consultancy Ltd of the mix specification for any proposed structural concrete in order that the engineer can confirm it suitability.

All reinforcement bar to be in accordance with BS 4461 & 4449. All reinforcement bar to be cut and bent in accordance with BS 8666. Minimum cover to loose bar reinforcement to be 50mm unless noted otherwise.

Minimum lap of all loose bars to be minimum 40xBar Diameter unless noted otherwise. Minimum lap to mesh fabric to be 300mm unless noted otherwise.

All concrete workmanship to be in accordance with recommendations set out in BS 8110. All concrete is to be fully mechanically vibrated during placing and all concrete to be adequately protected from frost action whilst placing and during curing. No Concrete is to be poured if the ambient temperature is less than 2 degrees centigrade.

Any subgrade specified to be clean, inert granular material, well graded and compacted with maximum particle size of 40mm.

A 1200g Polythene membrane is to be laid underneath all slabs unless noted otherwise. Lap joints to polythene be min 150mm.

Slabs are to be laid maximum 4.80m wide and 18.0m long unless approved by Engineer. Slabs are to be laid in strict accordance with jointing layout supplied. Unless noted otherwise a perimeter isolation joint should be provided at the junction of the slab and any steel columns or masonry walls. The joint should consist of a 20mm compressible filler board capped with proprietary sealant.

All concrete is to be cured in accordance with Section 6 of BS8110 and to have a minimum curing period of 4 days.

Contd....

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GENERAL STRUCTURAL NOTES – PADSTONES AND LINTELS

Any padstones specified should be constructed using fully bonded Class B (Blue) Engineering bricks laid in mortar class I (1:3 Cement:sand) to the dimensions indicated, unless noted otherwise within engineers sketches / drawings.

Any concrete padstones should be cast using min C40 concrete mix or equivalent controlled hand - mix i.e (1:1.5:3 Cement : Sand : 20mm Agg)

Any drypack placed between installed steel beams and existing wall/floor structures should be rammed in semi-dry, using a (1:3 Cement:Sand) mix.

All lintels are to be installed in accordance with the manufacturers requirements. Temporary propping of lintels during construction should be carried out if stipulated by the manufacturer. End Bearings of lintels should be a minimum of 150mm unless alternative is specified by manufacturer.

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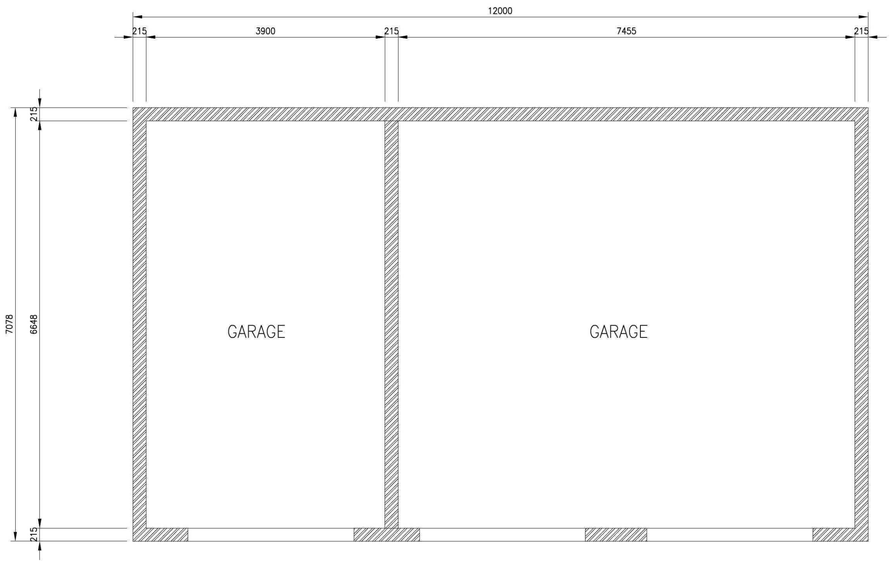
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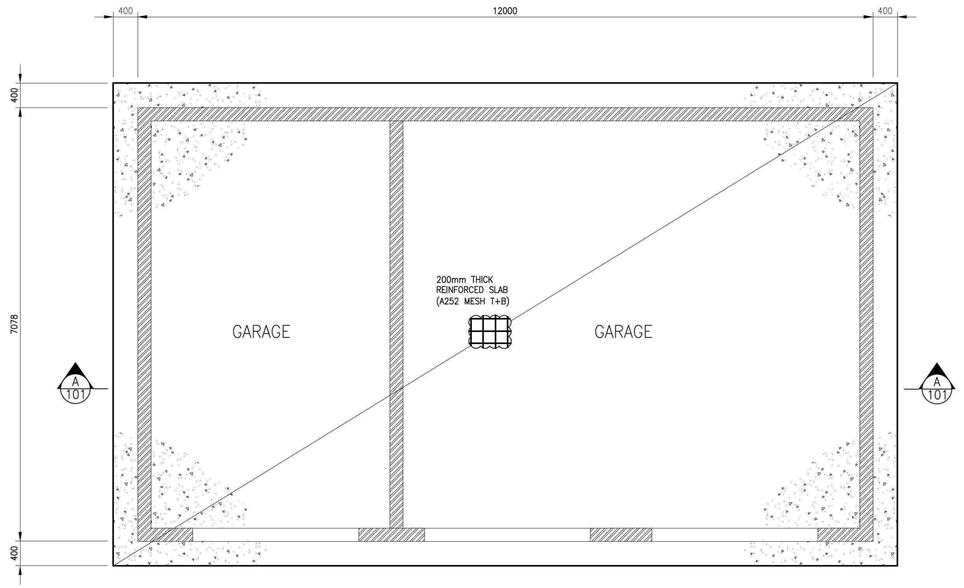
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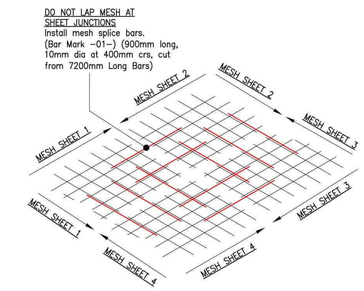
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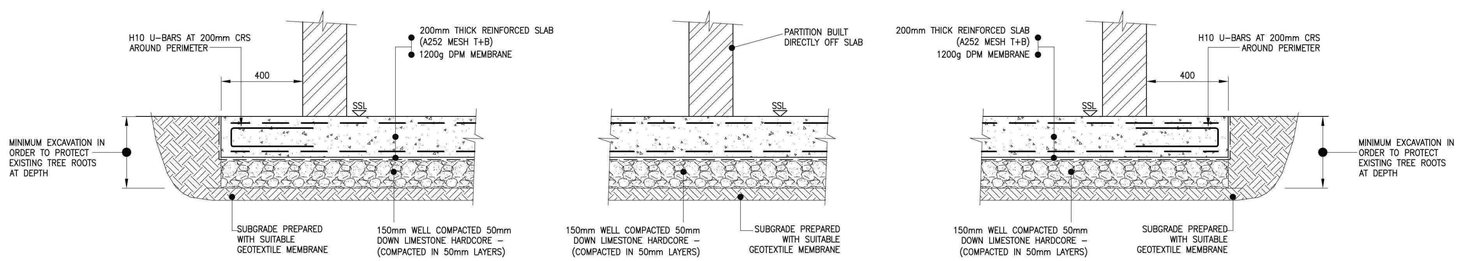
WALL G.A (1:50)
AS PER ARCHITECTS LAYOUT



R/C RAFT G.A (1:50)



MESH INTERSECTION DETAIL (N.T.S)



TYPICAL PERIMETER SECTION A–A (1:15)

This drawing and associated calculations should be forwarded to the Local Authority Arboriculturist for comments and approval prior to commencement of works on site.

ISSUED FOR INFORMATION / APPROVAL
DO NOT USE FOR CONSTRUCTION

Rev.	Date.	Drwn.	Chkd.	Description
-	MAY 15	JLH	JCE	ISSUED TO CLIENT / ARCHITECT FOR INFO. & COMMENTS - NOT FOR CONSTRUCTION.

Drawing Status
ISSUED FOR COMMENTS - NOT FOR CONSTRUCTION

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civil engineers
building engineers
conservation engineers

Client
MR & MRS SPOONCER C/O REMWAY DESIGN LIMITED

Contract
PROPOSED GARAGE
HAYLETT LODGE
HOP POLE, LINCOLNSHIRE.

Drg Title
PROPOSED R/C RAFT FOUNDATION
G.A AND DETAILS - GARAGE

Drawn	Checked	Date	Scales
JLH	JCE	MAY 2015	VARIES - SEE PLAN

Job Ref	Drawing Ref	Rev.
JC/15/04/2413	2413-101	-

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