

Below Ground Drainage Surface Water Design

Project: New Dwelling

Site: 23a Crimsworth Ave
Chorlton
M16 0EB

Client: Mr J O'Hare

Contractor:

Architect:

Date: August 2021

Job Ref: 21-4678

Prepared by: MR

Checked by: JH

Revisions:

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Construction (Design & Management) Regulations 2015.

Under the C(D&M) Regs the designer's responsibility is limited to the reasonably foreseeable risks to persons involved in the construction, maintenance and repair of a structure from hazards that arise from the design. Therefore, this DRA only assesses the possible hazards that may arise from the specific structural design at this stage of the project. Should any alterations to the structure be carried out without the knowledge of the designer then no responsibility can be attributed.

It is the Contractors responsibility to use this document for the construction and future maintenance of the building as designed at this stage. This is not a Method Statement.

Under the C(D&M) Regulations 2015 it is the clients responsibility to ensure that every person designing the structure and every contractor who has been or may be appointed to work on the project is promptly provided with sufficient pre-construction information to ensure so far as is reasonably practicable the health and safety of all persons engaged in the construction work, liable to be affected by the way in which it is carried out, and who will use the structure in future.

Designers Risk Analysis.

Considerations to be given are:

During initial construction.

Noise and vibrations. Not only consider the effects these may have on workers but also neighbours.

Contamination. Where ground may be contaminated may need to consider substructure works that do not allow leaching through surface etc.

Falls from height, generally over 2m. These include around edges of deep excavations, upper floor and roof edges.

Collapse of the structure under both temporary and permanent imposed loads.

Handling of structural elements. Consideration must be given to the weight of elements specified and whether mechanical handling is feasible. Otherwise consider splicing beams and columns etc or the use of lightweight masonry if acceptable.

Fire. Although on site welding may be necessary, using this near combustible materials is not wise.

Long term.

Falls from height, generally over 2m. Consideration should be given for the future maintenance of the building such as ladder restraint to upper walls.

Collapse of the structure under the permanent imposed loads. The structural elements should be clearly marked on the drawings.

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Hazard ref	Hazard Source	Risk Category	Preventative/Control Measures	Residual Risk
1	Manual handling	MEDIUM	Use lighter sections/material where possible and keep lengths to minimum. Where necessary allow for splicing longer, heavier sections and provide details	LOW
2	Competence	HIGH	Consideration to be given during design of persons undertaking building works. Where complicated structural works are to be carried then suitable design information is to be produced and risks highlighted	MEDIUM
3	Structural stability of building	HIGH	Design is to consider the temporary (during works) and permanent stability of the building Unless we have been instructed to provide the temporary works design, it is the contractors responsibility to design all temporary works to facilitate the structural alterations. Any element where risk is possible to be highlighted in our design information	MEDIUM
4	Noise/vibration	MEDIUM	The design is to consider the effects of any recommended works on the workforce and/or neighbours.	LOW
5	Working at height	MEDIUM	Risks to be advised on design information The design is to consider any unnecessary height issues such as foundation/excavation depths and working overhead. Ultimately, this is the contractors' responsibility to provide all temporary support and platforms	LOW

Risk Category/Residual Risk

Low No further action required	Medium Risk to be highlighted to contractor/end user	High Action required within design to mitigate risk
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Standard documents.

Documents used:

Building Regulation Approved Documents	Part A	Structure
	Part B	Fire
	Part C	Site Preparation
	Part H	Drainage
British Codes of Practice	BS8110 Part 1	Concrete
	BS5950 Part 1	Steel
	BS5628 Part	Unreinforced masonry
	BS5977	Lintel design
	BS5268 Part	Timber
	BS6399 Parts	Dead & Imposed loads
Euro Codes	EC1	Actions on structures
	EC2	Concrete design
	EC3	Steel Design
	EC5	Timber design
	EC6	Masonry design
NHBC Standards 2019	Chapter 4.2	Building near Trees

Standard Construction Notes.

These calculations have been produced for the sole purpose of obtaining Building Regulations Approval for the structural elements of the proposed scheme as per our terms of instruction. These calculations are based on the structural alterations required and either as shown on the Architects' drawings or in the design brief. These calculations should be read in conjunction with such information. Due care and attention has been given in the production of these calculations, however, it is the Contractors' responsibility to advise STL of any discrepancies prior to commencing on site.

Any dimensions shown in these calculations are purely for design purposes only and must not be used for ordering lengths of members. All measurements must be taken on site and lengths of required bearings added.

Unless specifically stated, STL have not undertaken any ground investigations or survey of the existing structure and the suitability of such is presumed to be structurally sound for the purpose of these calculations. All supporting walls are presumed to have suitable foundations and it is the Contractors' responsibility to ensure such before creating new load paths. These calculations do not constitute a structural appraisal of the building, and it is the Clients responsibility to employ an experienced Contractor who has full knowledge and understanding of current building practice.

We also recommend that Building Regulation Approval is obtained for any structural works. The design calculations should be provided as part of any such approval, however STL take no responsibility applying for such approval unless specifically instructed. Additional fees may be charged for such work in addition to Building Control Fees.

All attempts have been made to simplify the design of any supports and reduce the risks and hazards associated with the implementation of such. It is the contractor's responsibility to ensure that he is satisfied with the scheme and design and install all the necessary temporary support of the existing structure and ensure the safety of all persons involved in the construction and secure the site.

Where we have not been asked to undertake any ground investigations we cannot advise on the required foundations for the new project. Therefore, all new foundations are to be of adequate width and taken down to a suitable depth to be confirmed on site with the Engineer or Building Inspector. Where posts or piers are specified then we will provide approximate pad foundation sizes based upon presumed safe bearing capacities of the substrata. These will need to be confirmed on site. Should specialist foundations be required then STL are more than happy to design these but at extra cost. Where new foundations pass over existing or new drain runs they should be taken down below the invert level of the drains and pre cast concrete lintels used to span over.

All steel specified in these calculations is to be of minimum grade S275 to Standard British sections to BS5950. All steelwork is to be protected from corrosion by standard 2 coats of zinc rich primer and being touched up on site as necessary. Where steel is in external exposed conditions, then we recommend shot blasting and hot dip galvanising plus the use of cavity trays etc where applicable. All bearings for beams supporting the structure over new openings should be a minimum of 100mm, sat on 440x100x215mm deep C35 concrete padstones built into the new/existing masonry walls. Where increased bearing is required these will be specified in the calculations/drawings. All steel to steel connections are to be made with M16 Grade 8.8 bolts minimum or 6mm full penetration fillet welds all round.

All lintels are to be installed in accordance with the manufacturers' recommendations, with a minimum bearing of 150mm unless specified otherwise.

All new load bearing masonry should be of minimum 7N/mm² block or 10N/mm² brickwork bed in class iii mortar to BS5628 unless advised otherwise in the calculations.

All new timber sections are to be of structural graded timber as specified in the calculations to BS5268. All timber delivered to site should be marked with the grade and this should be checked with the calculations for compatibility. All timber should be kept covered, off the ground and out of the elements. Any special timber trusses or floor joists should be stored in accordance with the manufacturer's instructions.

It should be noted that any structural works to the existing building fabric may cause some damage to adjacent plastered/decorated areas and this should be taken into consideration with respect to any redecoration costs.

Where any of the structure is built into or adjacent a Party Wall Structure, you have a legal requirement under the Party Wall etc Act 1996, to notify the owner such structure before undertaking any work. We recommend that a condition survey is undertaken of the affected area as any damage that may occur during the work is your responsibility to correct. Sometime disputes can arise and you will need the services of a Party Wall Surveyor.

Below Ground Drainage Design

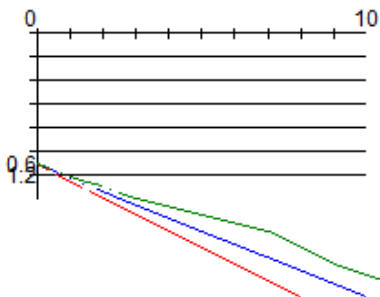
Percolation Test Results

Soakaway design - Soil infiltration rate calculation to BRE Digest 365

Trial pit reference	-	TP01
Length of pit	L	= 0.6 m
Breadth of pit	B	= 0.6 m
Depth of pit	D	= 1.2 m
Depth of water at start of test	WL	= 0.6 m

Test data

Time Vs Water depth plot



	Test 1		Test 2		Test 3	
Step	Time (minutes)	Water depth (m)	Time (minutes)	Water depth (m)	Time (minutes)	Water depth (m)
1	0	0.6	0	0.6	0	0.6
2	2	0.75	2.5	0.75	3	0.75
3	4	0.9	5	0.9	7	0.9
4	6	1.05	7.5	1.05	9	1.05
5	8	1.2	10	1.2	12	1.2

Calculation

Maximum effective storage depth

$$D_e = D - WL = 0.6 \text{ m}$$

Volume outflow, V_{p75-25}

$$V = L * B * 0.5 * D_e = 0.11 \text{ m}^3$$

Mean outflow surface area, a_{p50}

$$a = L * D_e + B * D_e + L * B = 1.08 \text{ m}^2$$

25% effective depth

$$D_{e25} = WL + 0.25 * D_e = 0.75 \text{ m}$$

75% effective depth

$$D_{e75} = WL + 0.75 * D_e = 1.05 \text{ m}$$

Time taken for mean outflow, t_{p75-25}

$$t_1 = 4 \text{ min.}$$

Soil infiltration rate

$$f_1 = V / (a * t_1) = 0.00042 \text{ m/s}$$

Time taken for mean outflow, t_{p75-25}

$$t_2 = 5 \text{ min.}$$

Soil infiltration rate

$$f_2 = V / (a * t_2) = 0.00033 \text{ m/s}$$

Time taken for mean outflow, t_{p75-25}

$$t_3 = 6 \text{ min.}$$

Soil infiltration rate

$$f_3 = V / (a * t_3) = 0.00028 \text{ m/s}$$

Average soil infiltration rate

$$f = (f_1 + f_2 + f_3) / 3 = 0.00034 \text{ m/s}$$

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Design of soil Infiltration system

Check run off conditions for 1:2, 1:30 and 1:100 year storms:

1:2 year

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.03

Design rainfall intensity

Location of catchment area; Manchester
 Impermeable area drained to the system; $A = 100.0 \text{ m}^2$
 Return period; Period = 2 yr
 Ratio 60 min to 2 day rainfall of 5 yr return period; $r = 0.360$
 5-year return period rainfall of 60 minutes duration; $M5_{60\text{min}} = 18.0 \text{ mm}$
 Increase of rainfall intensity due to global warming; $p_{\text{climate}} = 40 \%$

Soakaway / infiltration trench details

Soakaway type; Rectangular
 Minimum depth of pit (below incoming invert); $d = 500 \text{ mm}$
 Width of pit; $w = 1000 \text{ mm}$
 Length of pit; $l = 1750 \text{ mm}$
 Percentage free volume; $V_{\text{free}} = 95 \%$
 Soil infiltration rate; $f = 340 \times 10^{-6} \text{ m/s}$
 Wetted area of pit 50% full; $a_{s50} = l \times d + w \times d = 1374896 \text{ mm}^2$

Table equations

Inflow (cl.3.3.1); $I = M2 \times A$
 Outflow (cl.3.3.2); $O = a_{s50} \times f \times D$
 Storage (cl.3.3.3); $S = I - O$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	2 year rainfall, M2 (mm)	Inflow (m ³)	Outflow (m ³)	Storage required (m ³)
5;	0.36;	9.1;	0.79;	7.2;	0.72;	0.14;	0.58
10;	0.51;	12.9;	0.80;	10.2;	1.02;	0.28;	0.74
15;	0.62;	15.6;	0.80;	12.5;	1.25;	0.42;	0.83
30;	0.79;	19.9;	0.81;	16.1;	1.61;	0.84;	0.77
60;	1.00;	25.2;	0.82;	20.7;	2.07;	1.68;	0.38
120;	1.22;	30.7;	0.83;	25.5;	2.55;	3.37;	0.00
240;	1.48;	37.3;	0.84;	31.2;	3.12;	6.73;	0.00
360;	1.67;	42.1;	0.84;	35.4;	3.54;	10.10;	0.00
600;	1.90;	47.9;	0.85;	40.6;	4.06;	16.83;	0.00
1440;	2.42;	61.0;	0.86;	52.4;	5.24;	40.39;	0.00

Required storage volume; $S_{\text{req}} = 0.83 \text{ m}^3$

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Soakaway storage volume;

$$S_{act} = l \times d \times w \times V_{free} = 0.83 \text{ m}^3$$

PASS - Soakaway storage volume

Time for emptying soakaway to half volume;

$$t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f); = 14\text{min } 48\text{s}$$

PASS - Soakaway discharge time less than or equal to 24 hours

1:30 year

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.03

Design rainfall intensity

Location of catchment area;

Manchester

Impermeable area drained to the system;

$$A = 100.0 \text{ m}^2$$

Return period;

Period = 30 yr

Ratio 60 min to 2 day rainfall of 5 yr return period;

$$r = 0.360$$

5-year return period rainfall of 60 minutes duration;

$$M5_{60\text{min}} = 18.0 \text{ mm}$$

Increase of rainfall intensity due to global warming;

$$p_{climate} = 40 \%$$

Soakaway / infiltration trench details

Soakaway type;

Rectangular

Minimum depth of pit (below incoming invert);

$$d = 500 \text{ mm}$$

Width of pit;

$$w = 1000 \text{ mm}$$

Length of pit;

$$l = 3560 \text{ mm}$$

Percentage free volume;

$$V_{free} = 95 \%$$

Soil infiltration rate;

$$f = 340 \times 10^{-6} \text{ m/s}$$

Wetted area of pit 50% full;

$$a_{s50} = l \times d + w \times d = 2279868 \text{ mm}^2$$

Table equations

Inflow (cl.3.3.1);

$$I = M30 \times A$$

Outflow (cl.3.3.2);

$$O = a_{s50} \times f \times D$$

Storage (cl.3.3.3);

$$S = I - O$$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	30 year rainfall, M30 (mm)	Inflow (m ³)	Outflow (m ³)	Storage required (m ³)
5;	0.36;	9.1;	1.48;	13.4;	1.34;	0.23;	1.11
10;	0.51;	12.9;	1.51;	19.4;	1.94;	0.47;	1.48
15;	0.62;	15.6;	1.53;	23.9;	2.39;	0.70;	1.69
30;	0.79;	19.9;	1.54;	30.7;	3.07;	1.40;	1.68
60;	1.00;	25.2;	1.53;	38.6;	3.86;	2.79;	1.07
120;	1.22;	30.7;	1.51;	46.4;	4.64;	5.58;	0.00
240;	1.48;	37.3;	1.48;	55.2;	5.52;	11.16;	0.00

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Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	30 year rainfall, M30 (mm)	Inflow (m ³)	Outflow (m ³)	Storage required (m ³)
360;	1.67;	42.1;	1.46;	61.3;	6.13;	16.74;	0.00
600;	1.90;	47.9;	1.43;	68.5;	6.85;	27.91;	0.00
1440;	2.42;	61.0;	1.39;	84.5;	8.45;	66.97;	0.00

Required storage volume;

$$S_{req} = 1.69 \text{ m}^3$$

Soakaway storage volume;

$$S_{act} = l \times d \times w \times V_{free} = 1.69 \text{ m}^3$$

PASS - Soakaway storage volume

Time for emptying soakaway to half volume;

$$t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f) = 18\text{min } 11\text{s}$$

PASS - Soakaway discharge time less than or equal to 24 hours

1:100 year

SOAKAWAY DESIGN

In accordance with BRE Digest 365 - Soakaway design

Tedds calculation version 2.0.03

Design rainfall intensity

Location of catchment area;

Manchester

Impermeable area drained to the system;

$$A = 100.0 \text{ m}^2$$

Return period;

Period = 100 yr

Ratio 60 min to 2 day rainfall of 5 yr return period;

$$r = 0.360$$

5-year return period rainfall of 60 minutes duration;

$$M5_{60\text{min}} = 18.0 \text{ mm}$$

Increase of rainfall intensity due to global warming;

$$p_{climate} = 40 \%$$

Soakaway / infiltration trench details

Soakaway type;

Rectangular

Minimum depth of pit (below incoming invert);

$$d = 500 \text{ mm}$$

Width of pit;

$$w = 1500 \text{ mm}$$

Length of pit;

$$l = 3516 \text{ mm}$$

Percentage free volume;

$$V_{free} = 95 \%$$

Soil infiltration rate;

$$f = 340 \times 10^{-6} \text{ m/s}$$

Wetted area of pit 50% full;

$$a_{s50} = l \times d + w \times d = 2507908 \text{ mm}^2$$

Table equations

Inflow (cl.3.3.1);

$$I = M100 \times A$$

Outflow (cl.3.3.2);

$$O = a_{s50} \times f \times D$$

Storage (cl.3.3.3);

$$S = I - O$$

Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m ³)	Outflow (m ³)	Storage required (m ³)
5;	0.36;	9.1;	1.89;	17.1;	1.71;	0.26;	1.46

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Duration, D (min)	Growth factor Z1	M5 rainfalls (mm)	Growth factor Z2	100 year rainfall, M100 (mm)	Inflow (m ³)	Outflow (m ³)	Storage required (m ³)
10;	0.51;	12.9;	1.96;	25.1;	2.51;	0.51;	2.00
15;	0.62;	15.6;	1.99;	31.2;	3.12;	0.77;	2.35
30;	0.79;	19.9;	2.03;	40.4;	4.04;	1.53;	2.51
60;	1.00;	25.2;	2.01;	50.6;	5.06;	3.07;	1.99
120;	1.22;	30.7;	1.96;	60.4;	6.04;	6.14;	0.00
240;	1.48;	37.3;	1.91;	71.3;	7.13;	12.28;	0.00
360;	1.67;	42.1;	1.87;	78.8;	7.88;	18.42;	0.00
600;	1.90;	47.9;	1.83;	87.5;	8.75;	30.70;	0.00
1440;	2.42;	61.0;	1.74;	105.8;	10.58;	73.67;	0.00

Required storage volume;

$$S_{req} = 2.51 \text{ m}^3$$

Soakaway storage volume;

$$S_{act} = l \times d \times w \times V_{free} = 2.51 \text{ m}^3$$

PASS - Soakaway storage volume

Time for emptying soakaway to half volume;

$$t_{s50} = S_{req} \times 0.5 / (a_{s50} \times f); = 24\text{min } 32\text{s}$$

PASS - Soakaway discharge time less than or equal to 24 hours

Therefore,

PROVIDE 2.5m³ STORAGE