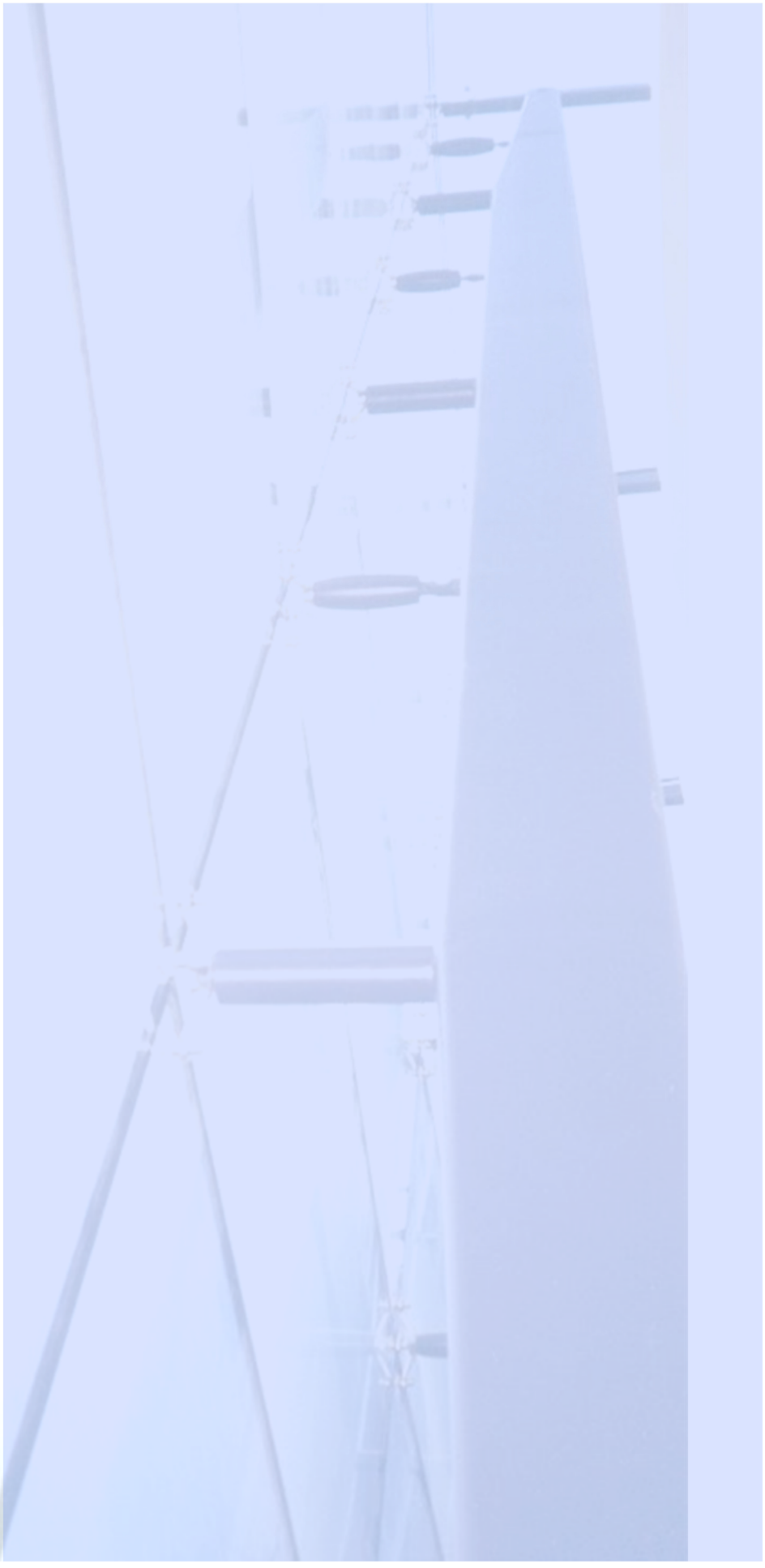


$(dp)^2$

1890-PS-DP2-A180-RP-XX-9050

Sheep Sculptures

Penistone

Structural Calculation Submission

Part A – Building Regulations

DP Squared Ltd

Second Floor
4 Albert Street
Hebden Bridge
HX7 8AH

01422 846693 :T

Part A Building Regulations Submission

For

Sheep Sculptures, Penistone

For

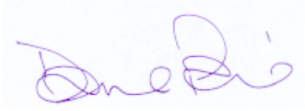
Michael Disley

April 2022.

Ref : 1890-PS-DP2-A180-RP-XX-9050

Report Prepared by D.Paine

B.Eng C.Eng MICE



Rev	Date	By	Comment
P01	April 2022	DEP	First Issue

Part A Building Regulations Submission

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1. Introduction

This document is a summary of the foundation design for a series of Sheep Sculptures by Michael Disley to be placed in and around Penistone.

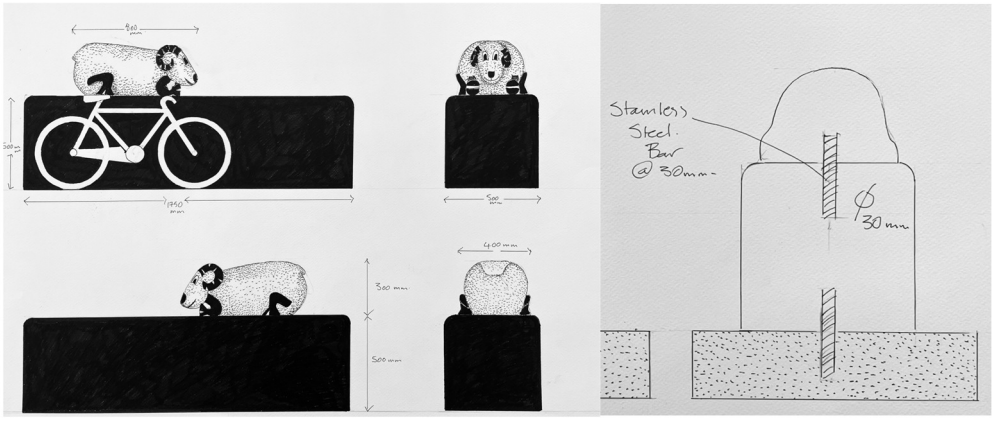
Some of the larger pieces may be placed directly on to the hard landscape and may not require a foundation but will require some lateral restraint.

2. Calculations

2.1 Long Benches (various types)

The approximate dimensions are 1500mm long x 500mm wide x 500mm high

The sheep sculpture needs to be anchored to the top of the bench.



Assume that a 1.5kN load can be applied to the top of the sheep, lever arm to top of bench = 300mm

Overturning Moment = (1.5 x 1.5(Factor of Safety)) x 0.3 = 0.675kNm.

The lever arm for the two fixings = 200mm

Tension in fixing = 0.675 / 0.2 / 2 = 1.68kN (Adopt 20mm diameter Resin Fixings)

Check Overturning on the base

Self-weight of base = 1.75 x 0.5 x 0.5 x 28 = 12.25kN, Equivalent bearing pressure = 14kPa, therefore suitable for placing on hard landscaping.

Apply an overturning force of 1.5kN at 1.1m above the base, Overturning Moment = 1.65kNm

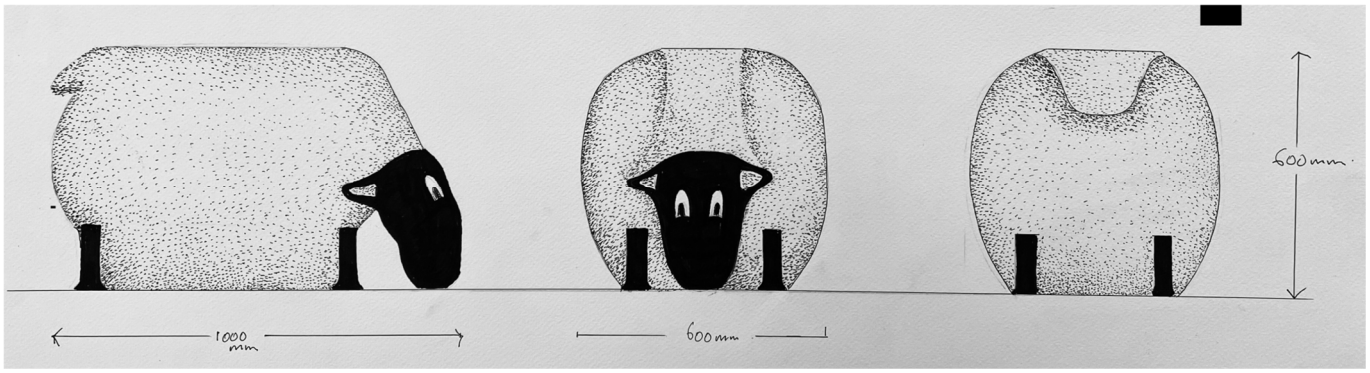
Restoring Moment of base = 12.25 x 0.25 = 3,0kNm

Factor of safety = 3 / 1.65 = 1.86 > 1.5 therefore okay.

Where the benches are to be located on soft landscaping provide a 200mm deep RC base on 150mm compacted Type 1 sub-base.

2.2 Seats (various types)

The approximate dimensions are 1000mm long x 600mm wide x 600mm high



Assume that a 1.5kN load can be applied to the top of the sheep, lever arm to top of seat = 600mm

Overturning Moment = 1.5 x 0.6 = 0.9kNm.

The lever arm for the fixings = 200mm

Tension in fixing = 0.9 / 0.2 / 2 = 2.25kN (Adopt 20mm diameter Resin Fixings)

Check Overturning on the base

Self-weight of base = 1.0 x 0.6 x 0.6 x 28 = 10kN,

Equivalent bearing pressure = 10 / 1 / 0.6 = 17kPa, therefore suitable for placing on hard landscaping.

Apply an overturning force of 1.5kN at 1.1m above the base, Overturning Moment = 1.65kNm

Restoring Moment of base = 12.25 x 0.25 = 3,0kNm (Conservative)

Factor of safety = 3 / 1.65 = 1.86 > 1.5 therefore okay.

Where the benches are to be located on soft landscaping provide a 200mm deep RC base on 150mm compacted Type 1 sub-base.

2.3 Individual Sculptures

Individual Sculptures are typically 1200x 450 x 450, self-weight = 1.2 x 0.45 x 0.45 x 28 = 6.8kN

Apply an overturning force of 1.5kN at 1.1m above the base, Overturning Moment = 1.65kNm

Restoring Moment of base = 6.8 x 0.25 = 1.7kNm

Connect a concrete base to increase the resistance, 0.6 x 0.6 x 0.3 x 24 x 0.3 = 0.78kNm

Factor of safety = (1.7+0.78) / 1.65 = 1.5 therefore okay. Note that the stone section sizes are conservative, so the actual FOS will be slightly larger.

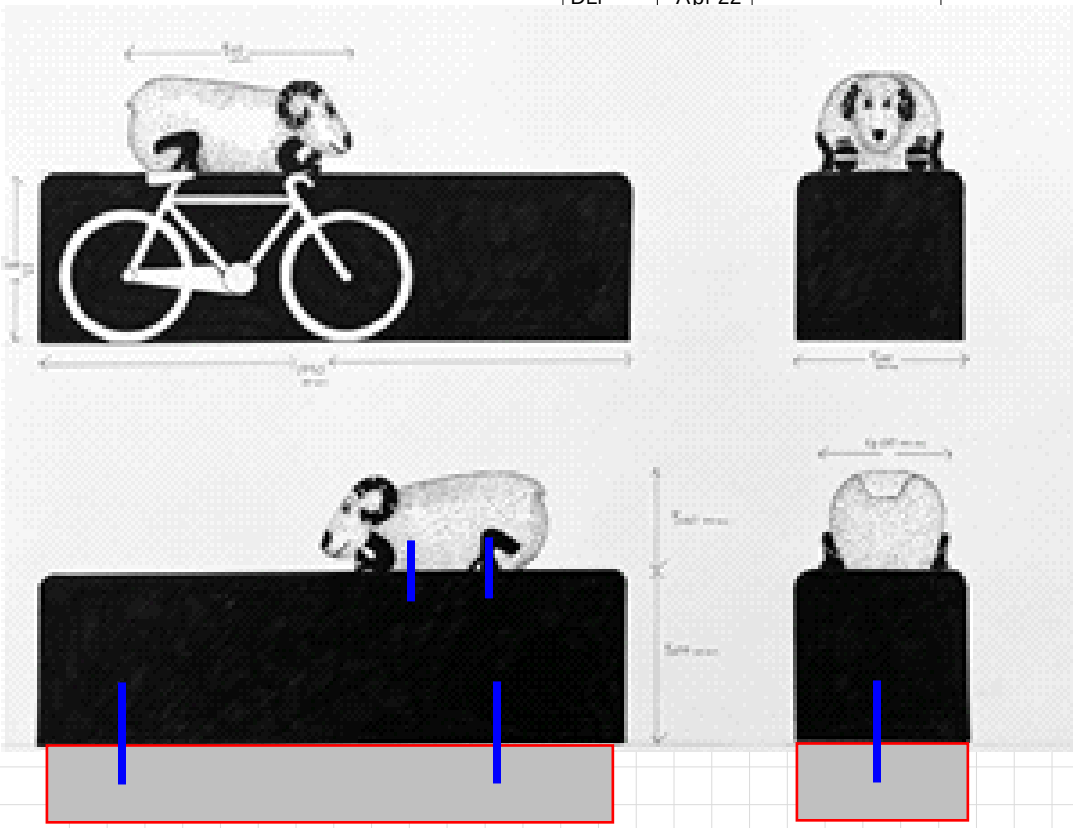
Provide a 600x600x300mm deep base under each sculpture

Provide a 20mm diameter bar in the centre of the sculpture, connecting the base and stone.

Tension in bar = 1.65 / 0.3 = 5.5kN, Adopt Rawlplug RKem II Resin

3. Design Drawings

Project: Penistone Sheep	Sheet :	defined by design (dp)²
Calculation Title : Sheep with Bench	Project No.: 1890	
	DEP Apr 22	



Notes for Sculptures as Bench

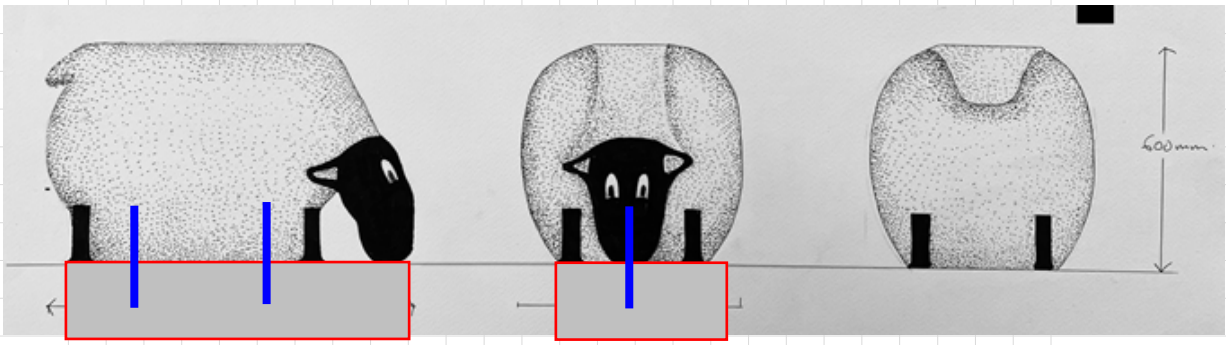
The sheep is to be fixed to the bench with 2 Resin fixings. the bench is to be fixed to a concrete base using a resin fixing.

Concrete Base to be same dimensions as the bench x 200mm deep in C32/40 concrete. No reinforcement is required

The formation level should be clean and free from any deleterious material. Any soft spots should be removed and replaced with compacted Type 1 Sub-base.

The bar is to be in Grade 316L Stainless Steel and secured with Rawlplug RKEM II Resin

Project: Penistone Sheep	Sheet :	defined by design (dp)²
Calculation Title : Sheep as seat	Project No.: 1890	
	DEP Apr 22	



Notes for Sculptures as Seat

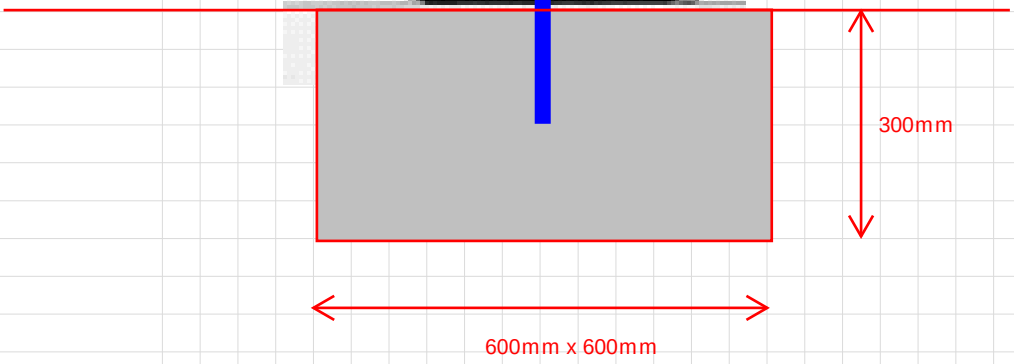
The sheep is to be fixed to the concrete base with 2 Resin fixings.

Concrete Base to be same dimensions as the seat, nominally 1m x 600mm x 200mm deep x 200mm deep in C32/40 concrete.
No reinforcement is required

The formation level should be clean and free from any deleterious material.
Any soft spots should be removed and replaced with compacted Type 1 Sub-base.

The bar is to be in Grade 316L Stainless Steel and secured with Rawlplug RKEM II Resin

Project: Penistone Sheep	Sheet :	defined by design (dp)²
Calculation Title : Individual Sculpture	Project No.: 1890	
	DEP | APR 2022	



Notes for Individual Sculptures

The stone is to be fixed to a concrete base using a resin fixing.

Concrete Base to be 600mm x 600mm x 300mm deep in C32/40 concrete.
No reinforcement is required

The formation level should be clean and free from any deleterious material.
Any soft spots should be removed and replaced with compacted Type 1 Sub-base.

The bar is to be in Grade 316L Stainless Steel and secured with Rawlplug RKEM II Resin