

Structural Engineering Report on
Terrace Wall
Chartwell
Westerham
TN16 1PS

Job No. 1668

November 2021

Produced for
The National Trust

Prepared by
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Project Title: Terrace Wall

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Record of Issue

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1 Introduction

1.1 Project Overview

Adrian Cox Associates were appointed to monitor walls on the Chartwell Estate in 2015. We inspected 15 walls including the Terrace Wall, part of wall 2. A key plan is attached in Appendix A. It was noted that this wall exhibited historic movement and this report outlines proposed remedial work.

1.2 Methodology

We recently inspected the wall on 24 November 2021. Our drawing 1289 / 3 P2 issued in 2016 has been replaced by updated and renumbered drawings in Appendix A.

1.3 Limitations and Conventions

ACA's usual limitations apply. The sole purpose of the inspection was to report on the items noted above. Parts of the structure which were covered have not been inspected. Absence of comment on any part of the structure should not be taken as implying structural integrity. All dimensions are approximate. All dimensions are in mm unless noted otherwise. Drawings are approximate only. Compass orientation is used where appropriate when a north point is included on the plans. Left and right are used on the basis that the building is viewed from the front.

2 Existing Structure

2.1 Background

The wall was approximately 340mm thick and 600mm high along the edge of the Terrace. The relationship to the house is shown in figures 1 and 2. On the east side facing the soft landscaped planting bed, a height of 1m was noted with a concrete footing 240mm deep and projecting by 70mm. Material has migrated down the slope to the east creating a void below the outer section of footing. The section of wall under review was divided into 3 bays between Piers 58, 59, 60 and 61.



Figure 1



Figure 2

2.2 Observation & Interpretation

Drawing 1668 / 2 shows the layout of the Terrace wall. The section under review is between Piers 58 and 61. The results of the inspection on 24 November 2021 are summarised in Section M-M. The two bays between Piers 59 and 61 were acceptably level. Alongside Pier 58, a 65mm drop was noted over a distance of just 900mm. There was a further 32mm drop over the next 1.8m, see figures 3 and 4. This indicates settlement of the Terrace wall with respect to the major 5m high retaining wall at right angles forming the southern edge of the terrace.

It is likely that the material behind this significant structure was excavated in part during building of this wall. The wall and settlement of the resulting made ground may have contributed to the localised settlement of the wall.

A significant crack visible in figure 5 was also noted.



Figure 3



Figure 4



Figure 5

3 Remedial Works

3.1 Proposed Stabilisation

Differential settlement between the 5m high wall and the Terrace Wall has resulted in localised cracking at the interface leading to cracks close to Pier 58 and midway between Piers 58 and 59. Additionally there is concern regarding the stability of the wall as a whole. The evidence suggests that lack of support by the foundations behind the major wall due to historic settlement of fill. Additionally, loss of material locally below the footing due to the slope has contributed to the movement.

The proposed remedial solution comprises casting short lengths of reinforced concrete cross beam below the existing wall. With projecting reinforcement each side. Two reinforced concrete beams can then be cast, one on each side, below ground level, as a single pour. The cross beams will support the existing wall. The resulting beams will span between a pocket in the major retaining wall and Pier 60, being two bays to the North.

The crack in the lower section of wall should be pointed up to prevent water ingress and frost damage.

3.2 Embankment Stabilisation

It is recommended that the soil be retained on the sloping planting bed by a combination of coir matting with stakes and appropriate planting. The planting should be selected by the Garden Team to maximise root action and slope stabilisation.

4 Conclusions

Adrian Cox Associates have monitored the Chartwell Terrace wall since 2015. Evidence of differential settlement has been noted, with cracks in the masonry particularly at the junction with the major retaining wall at Pier 58.

Close inspection during this period and our most recent inspection on 24 November 2021 confirmed that the movement has mainly resulted in distortion of the wall close to the pier. This is probably due to settlement of made ground behind the large retaining wall placed during construction coupled with migration of material down the steep slope from the planter to the East.

The proposed remedial work comprises forming a ladder arrangement on plan of reinforced concrete beams cast each side of the wall below ground level with short interconnecting cross beams to provide support to the wall. This is proposed for the two bays closest to Pier 58 with the beam extended into a pocket of the major retaining wall.

Embankment stabilisation can be improved by the use of coir matting and appropriately selected planting for which the assistance of the Garden Team will be required.

5 Appendix A – ACA Drawings

Structural Masonry

- M1 All load bearing masonry and workmanship to be in accordance with BS 5628.
- M2 All bricks to have a minimum compressive strength to BS 3921 of 48.5 N/mm² below dpc (if any) or less than 500 above ground and 48.5 N/mm² above dpc (if any) or greater than 500 above ground unless noted otherwise. Below dpc (if any) or less than 500 above ground bricks to be class F2 to BS EN 771-1.
- M3 NOT USED
- M4 NOT USED
- M5 NOT USED
- M6 All mortar unless otherwise noted to be as follows. For normal building season operations lime putty mortars to be used for all external masonry, unless specified otherwise to give additional structural strength or rapid strength gain. For non-exposed work or work carried out in winter where drying out is inhibited 1 part English hydraulic lime (Singleton Birch) NHL 3.5 should be used with 3 parts of sharp sand, with no more than 10-15% passing the 300 micron sieve. Where lime putty mortar is excluded on the drawings for new masonry, mortar above dpc to be class (iii) 1:5 to 6 (cement : sand with plasticiser). Mortar below dpc to be class (ii) 1:3 (sulphate resisting cement : sand).
- M7 NOT USED
- M8 NOT USED
- M9 NOT USED
- M10 NOT USED
- M11 NOT USED
- M12 NOT USED
- M13 NOT USED
- M14 All loose material above padstones to be removed and voids filled as noted on the drawings. If dry packed mortar, this to be 1 : 3 (cement : sharp sand) with earth damp consistency.
- M15 All Rawl resin anchors to be installed in existing masonry to be load tested by a Rawl Ltd. technical advisor to confirm the load carrying capacity of anchors in shear and tension. (www.rawlplug.com)
- M16 NOT USED
- M17 NOT USED
- M18 Cold weather : Mortar must not be less than 5°C. Do not lay mortar against frozen surfaces. Protect mortar from frost.
- M19 NOT USED
- M20 NOT USED

Concrete

- RC1 All strengths for concrete are for cube strengths.
- RC2 Reinforced concrete to be designated mix RC40 from an approved ready mix supplier. Cover to reinforcement to be 40mm unless noted otherwise.
- RC3 Concrete to be designed to meet requirements of Design Sulphate Class DS-1 (to BRE Special Digest 1).
- RC4 The materials and workmanship for concrete works to be in accordance with BS 8110 : part 1 except as stated above.
- RC5 Quality assurance of reinforcement :
Standards : Reinforcement to BS 4449, BS 4482, BS 4483 or BS 6744.
Cutting & bending to BS 8666
Source of reinforcement : Companies holding valid certificates of approval for product conformity issued by the UK Certification Authority for Reinforcing Steels (CARES).
- RC6 All structural concrete to be cast against formwork or on 50mm blinding concrete.
- RC7 Cold weather : Concrete must not be less than 5°C. Do not lay concrete against frozen surfaces. Protect concrete from frost.
- RC8 NOT USED
- RC9 Unformed Surfaces : The concrete shall be levelled and screeded to produce a uniform surface. No further work shall be applied to the surface.
- RC10 Mesh to be lapped by 300 minimum. Laps to be staggered to give a maximum of 3 layers of mesh. Loose bar reinforcement to have 40 x bar diameter minimum lap unless noted otherwise.

General Notes

- G1 This drawing is copyright and should not be reproduced without approval.
- G2 This drawing is to be read in conjunction with all relevant architects, services engineers and structural engineers drawings and specifications. Any discrepancy between specifications to be referred to Design Team for clarification.
- G3 Dimensions denoted (*) are to be confirmed by the architect.
- G4 All dimensions are in millimetres unless noted otherwise.
- G5 All levels are in metres unless noted otherwise and relate to ground floor level (GFL).
- G6 Do not scale from drawings.
- G7 All dimensions are to be confirmed on site by contractor before commencement of works any deviations found are to be reported to the engineer / architect.
- G8 NOT USED
- G9 NOT USED
- G10 Materials specified must be used in accordance with manufacturers' recommendations and the COSHH regulations if any hazardous materials are uncovered during demolition, appropriate safety precautions shall be taken and the architect shall be notified immediately.
- G11 Refer alternative materials to engineer for approval prior to construction.
- G12 NOT USED
- G13 NOT USED
- G14 Temporary support is to be the responsibility of the contractor at all times.
- G16 Measures to control noise and dust and to ensure safe working conditions shall be the responsibility of the contractor and shall be agreed with the contract administrator.

Foundations

- F1 The foundations have been designed using a safe bearing pressure of 100kN/m². Footings to be central under walls unless noted otherwise and to be founded a minimum depth of 1000mm below ground level unless noted otherwise on the drawings. Depth in any case to be as approved by the Building Control Officer.
- F2 NOT USED
- F3 All reinforced concrete to be cast against formwork or on 50mm blinding concrete.
- F4 The materials and workmanship for concrete works to be in accordance with BS 8110 part 1 except as stated above.
- F5 Cold Weather : Concrete must be not less than 5°C. Protect concrete from frost.
- F6 NOT USED
- F7 Concrete footings to be cast to 150 below ground level unless noted otherwise.
- F8 NOT USED

Construction, Design and Management

- DM1 Adrian Cox Associates' role on this project is that of a designer as defined by the construction design and management regulations. The role of Principal Designer is fulfilled by the Client or their appointed Consultant.
- DM2 Adrian Cox Associates have as reasonably practicable considered their design for foreseeable hazards and associated risks unique to this project as identified in the pre-construction information.
- DM3 The hazards and associated risks identified in the health and safety plan should not be considered as the only potential hazards and the contractors shall assess these and any other hazards they foresee relating to the project and carry out their own risk assessments.
- DM4 The contractor's normal health and safety obligations apply.

PRELIMINARY

P1	30.11.21	JB	Preliminary
Rev	Date	Drawn	Amendment



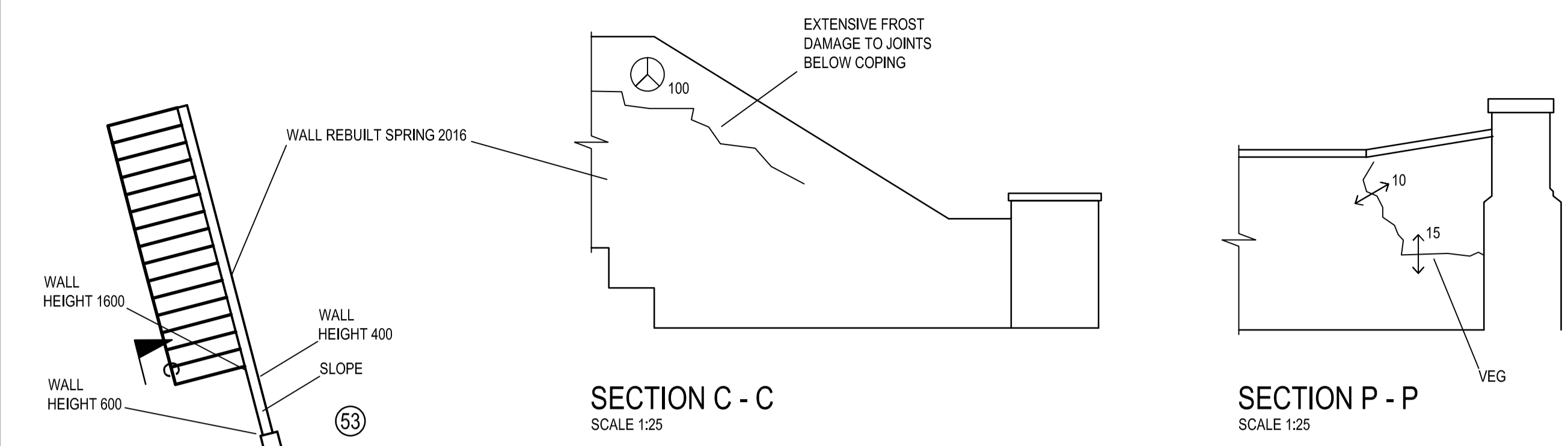
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Job	Chartwell Wall Terrace Mapleton Road Westerham TN16 1PS
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Description	Notes for Drawings
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Scale	NTS
Drawn	JB
Checked	
Date	Nov 2021
Drg No	1668 / 1 P1

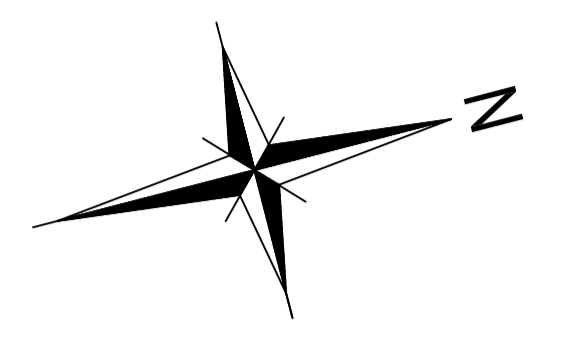


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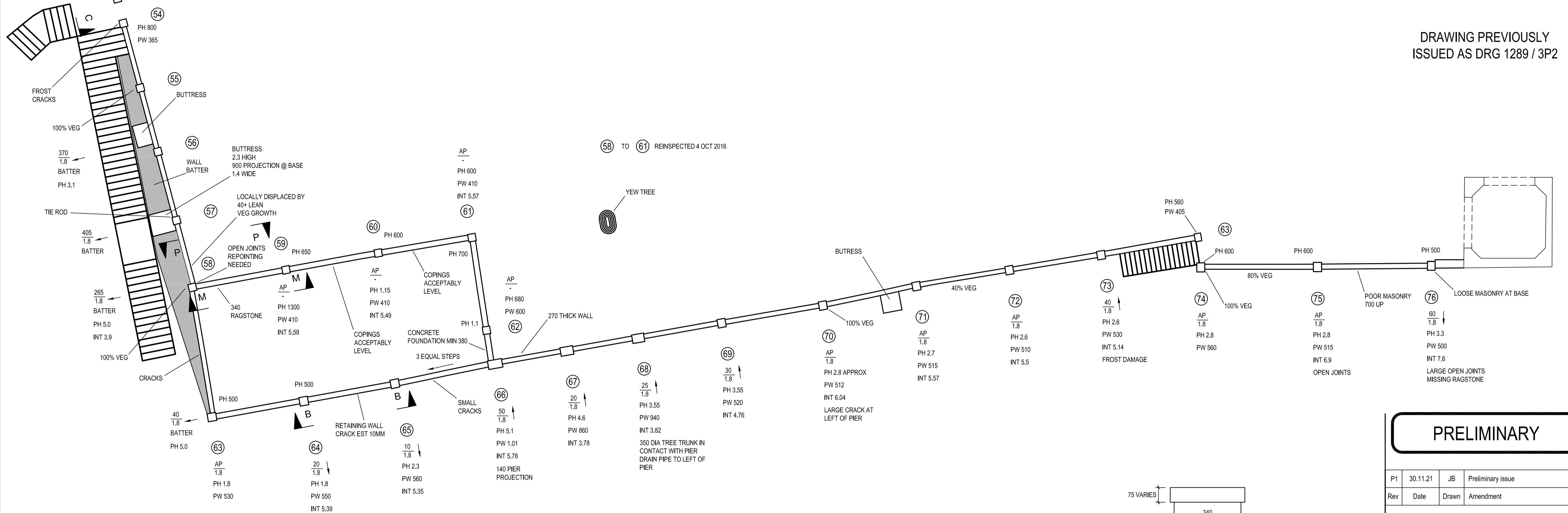
- 135 / 1.8 ↑ = PIER / WALL LEAN DISTANCE & DIRECTION HEIGHT OF MEASUREMENT
- PH 2.6 = PIER HEIGHT
- PW 480 = PIER WIDTH
- INT 4.7 = WALL LENGTH PIER TO PIER INTERNAL DIMENSION IN ORDER (53) TO (76)
- AP = ACCEPTABLY PLUMB
- (66) = PIER NUMBER

KEY TO CRACK NOTATION

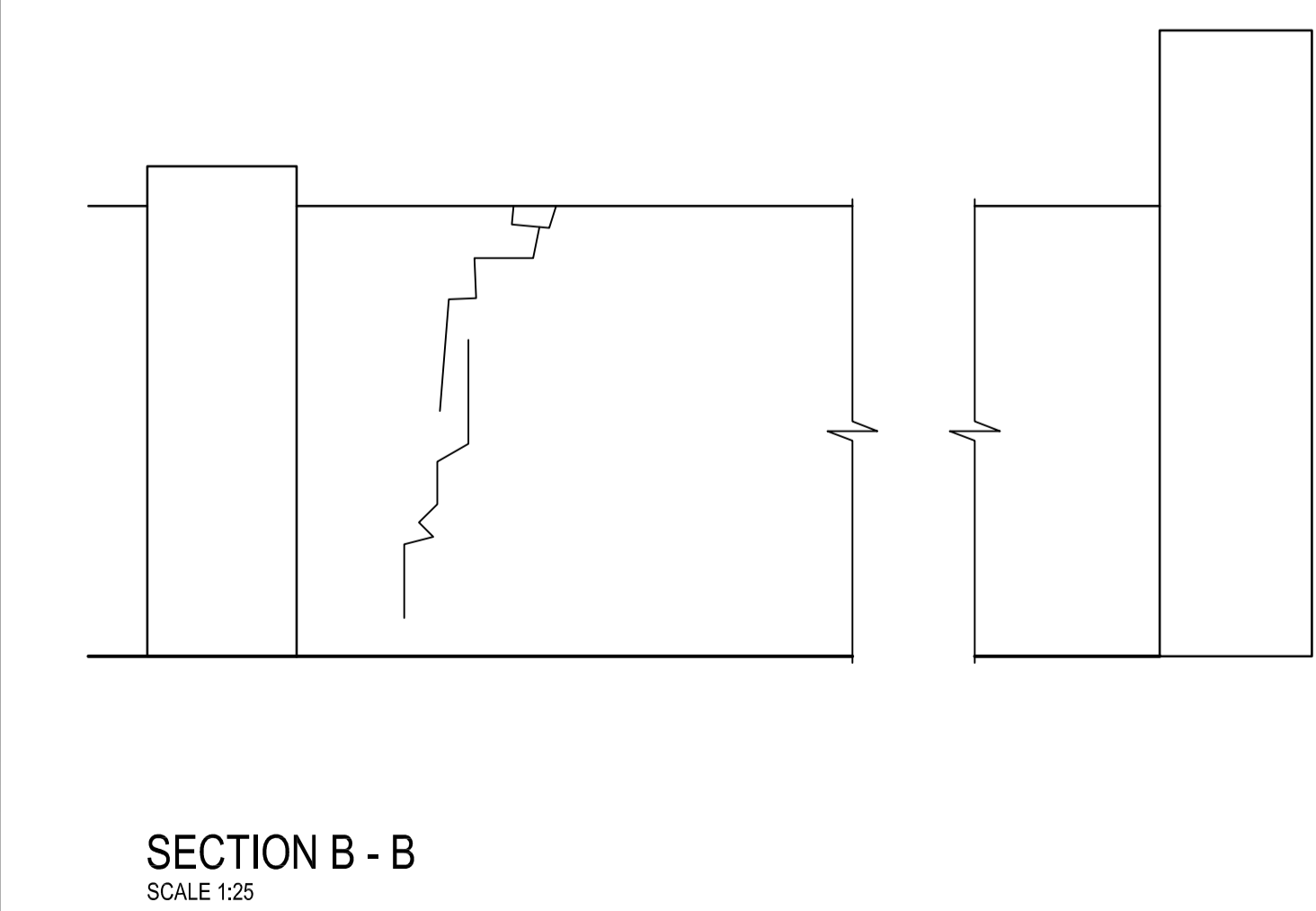
- ↔ 2 = WIDTH OF CRACK IN mm AND DIRECTION OF DISPLACEMENT
- ↓ = SHEAR DISPLACEMENT
- ⊕ = DISPLACEMENT INTO PLANE OF PAPER (TAIL OF DART)
- ⊙ = DISPLACEMENT OUT OF PLANE OF PAPER (HEAD OF DART)



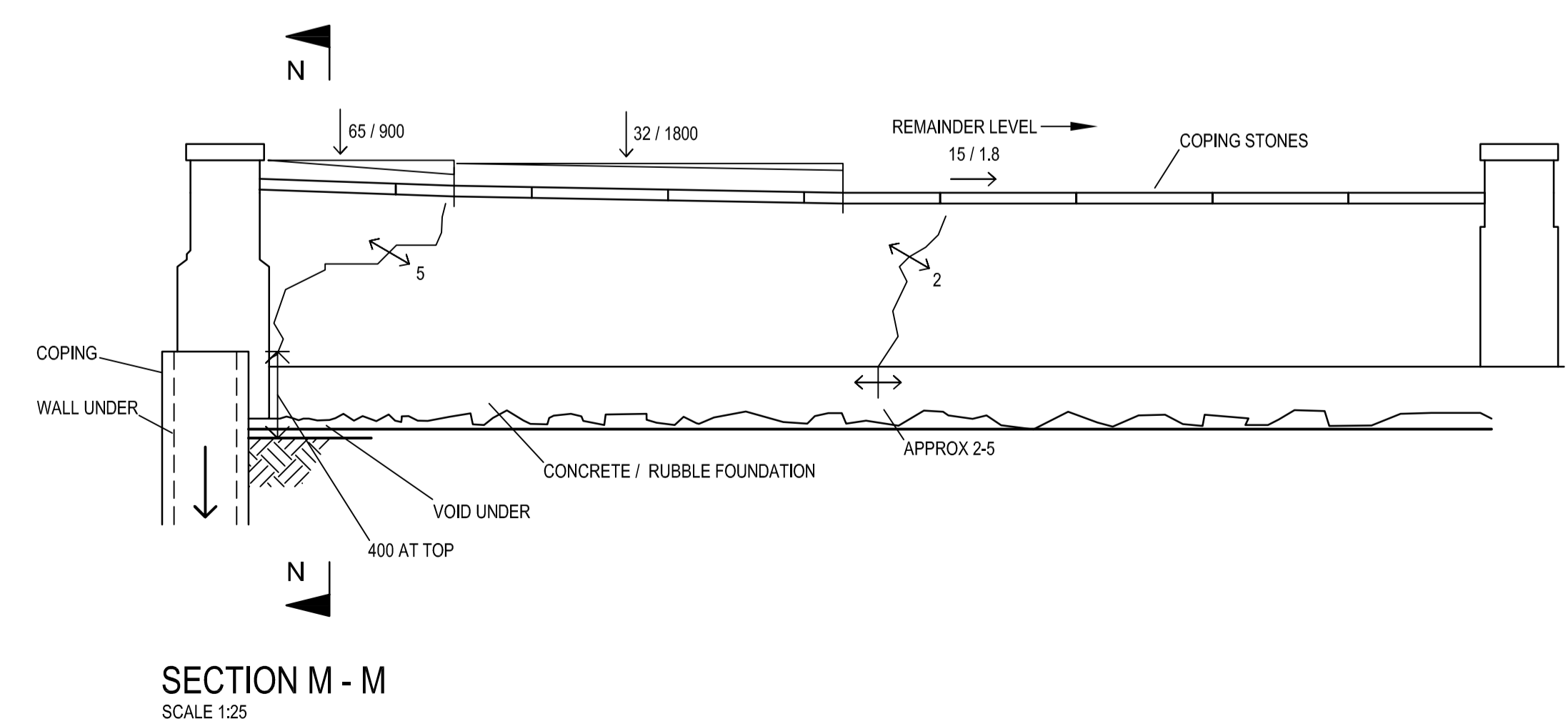
DRAWING PREVIOUSLY ISSUED AS DRG 1289 / 3P2



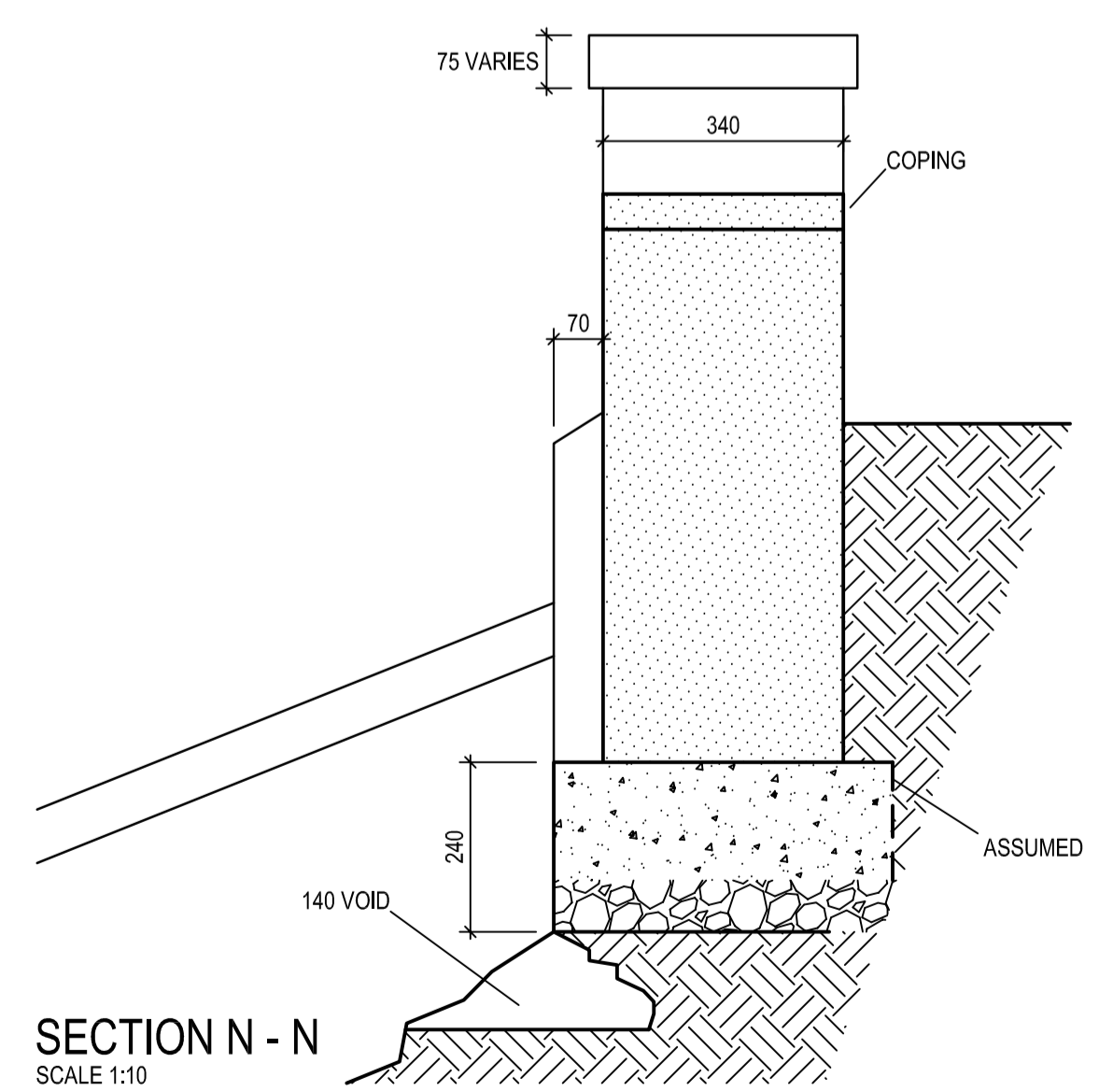
SURVEY OF WALL 2
SCALE 1:125



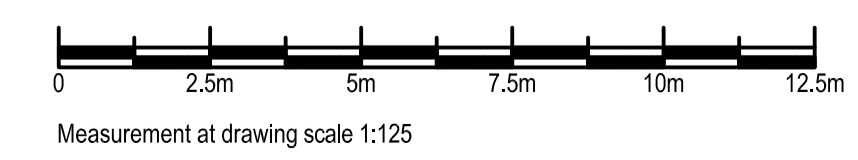
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SCALE 1:25



SECTION M - M
SCALE 1:25



SECTION N - N
SCALE 1:10



PRELIMINARY

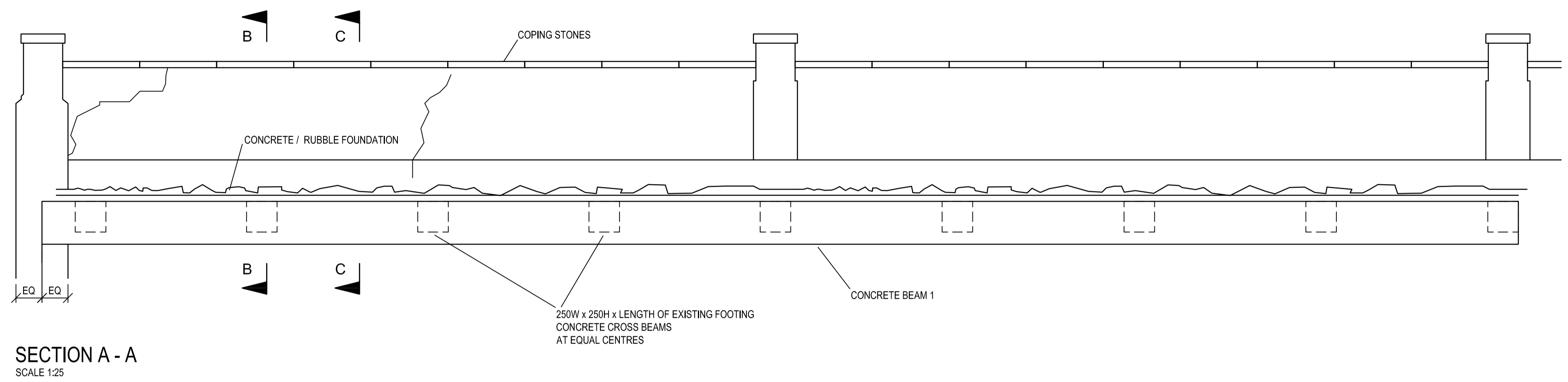
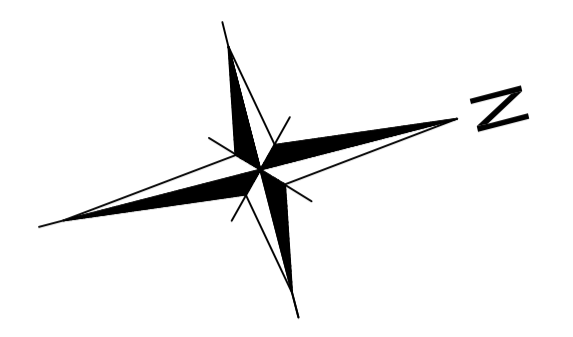
P1	30.11.21	JB	Preliminary issue
Rev	Date	Drawn	Amendment

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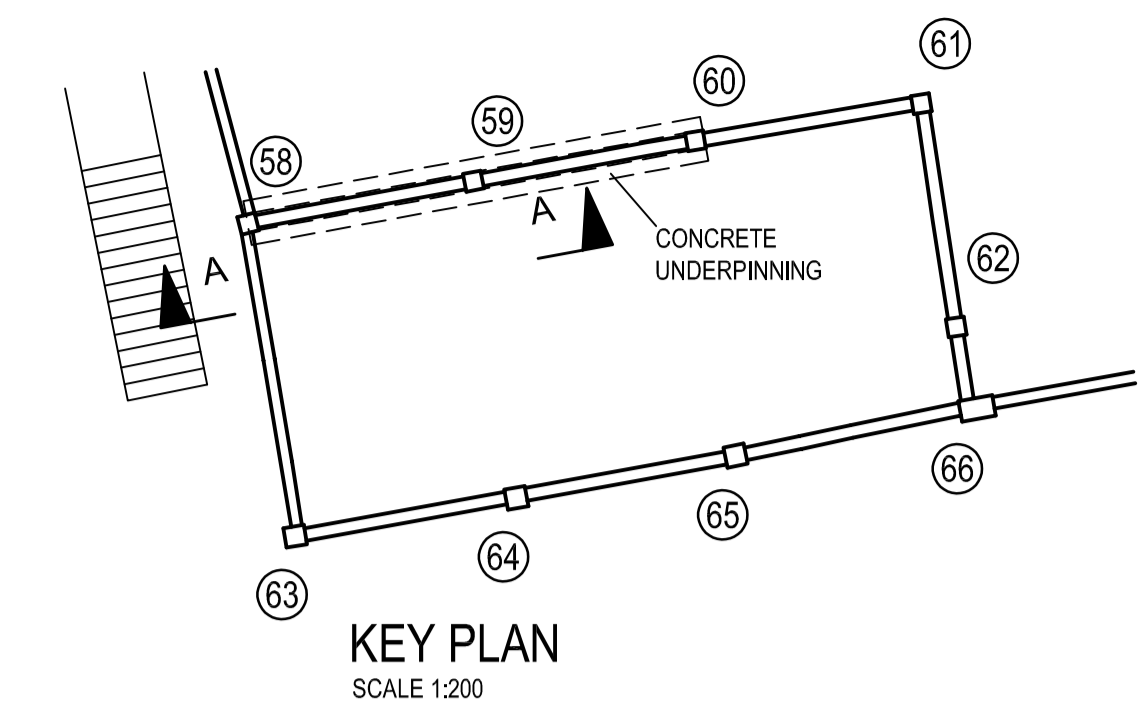
Job
Chartwell Wall Terrace
Mapleton Road
Westerham
TN16 1PS

Description
Existing Plan & Survey of Wall 2

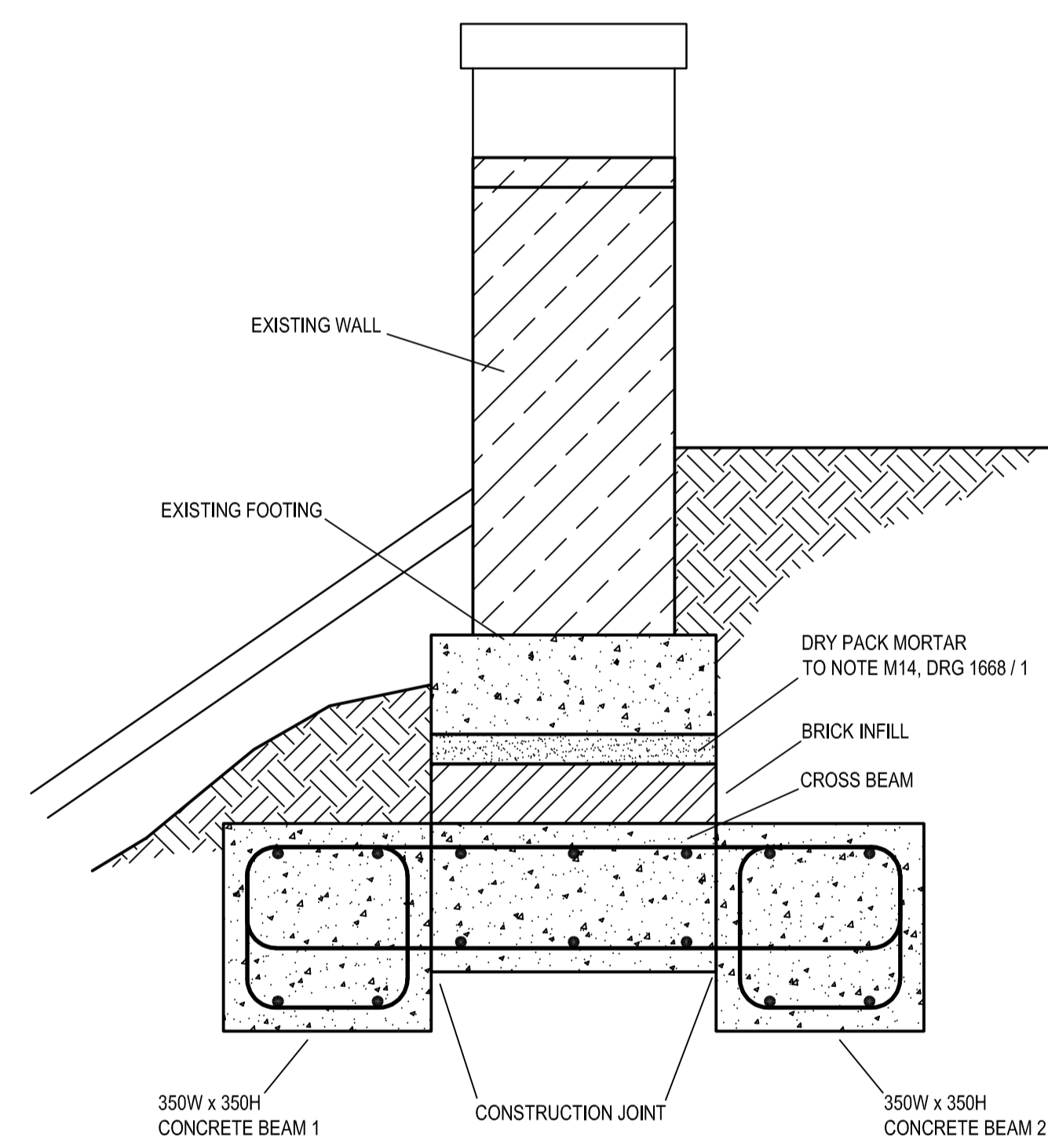
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Drawn	JB	Checked	AC
Date	Nov 2021	Dwg No	1668 / 2 P1



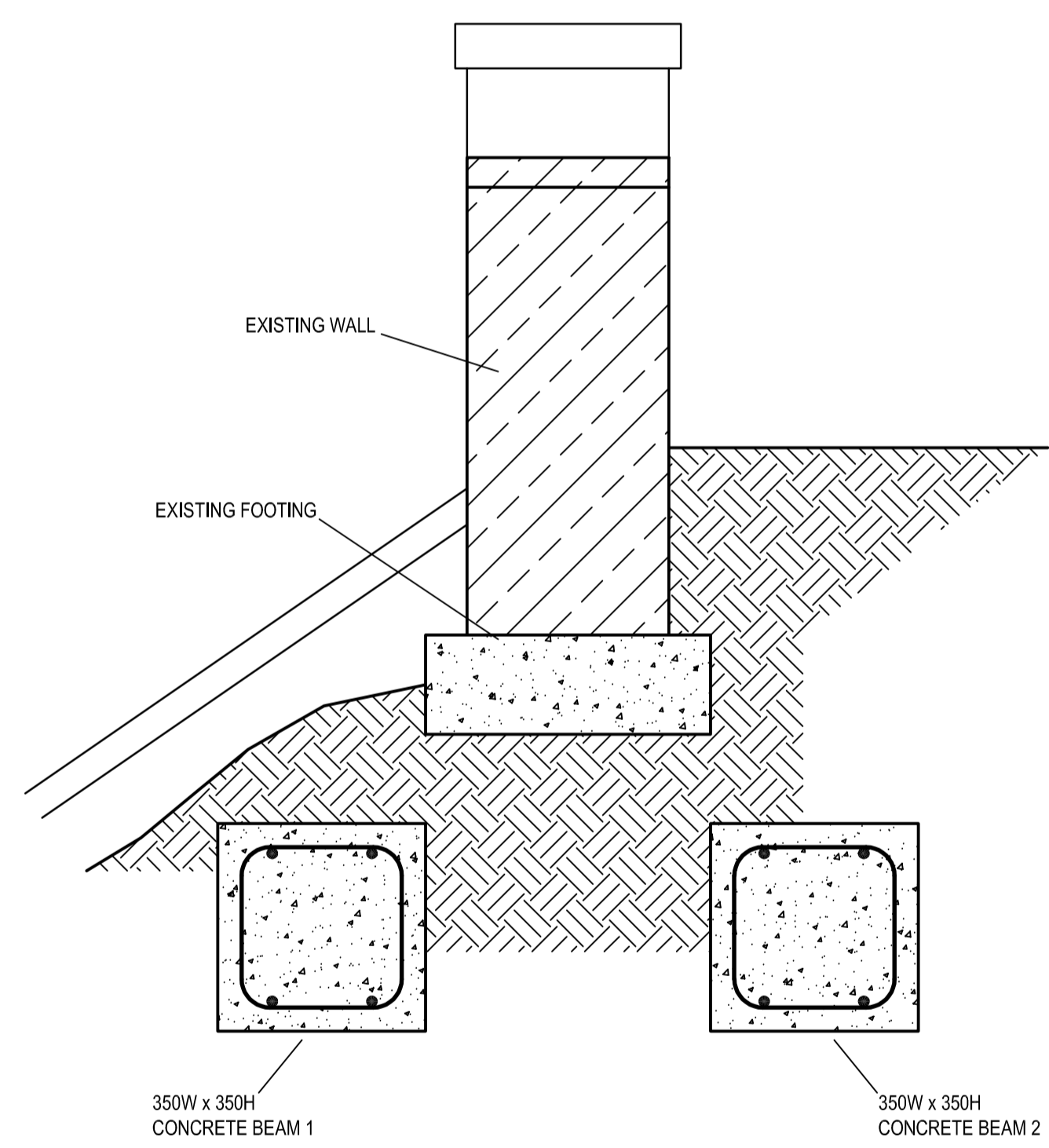
SECTION A - A
SCALE 1:25



KEY PLAN
SCALE 1:200



SECTION B - B
SCALE 1:10



SECTION C - C
SCALE 1:10

- METHOD STATEMENT FOR WALL UNDERPINNING**
1. EXCAVATE FOR CROSS BEAMS
 2. CAST CROSS BEAMS
 3. BRICK INFILL AND DRY PACK
 4. EXCAVATE AND SHUTTER FOR BEAM 1 AND 2
 5. CAST BEAM 1 AND 2
 6. ADD COIR MATTING TO RETAIN SOIL TO RAISE LEVEL CLOSE TO WALL. PLANTING TO PROMOTE ROOT GROWTH

PRELIMINARY

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Job
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Mapleton Road
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Description
Repairs to Wall 2

Scale 1:100 at A1

Drawn JB Checked

Date Nov 2021 Drg No 1668 / 3 P1

