

325 Deansgate

MCC Planning Condition 12
discharge – structural
engineering strategy

Issue P01

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Document History

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09/02/2023	P01	For planning condition discharge	AC	AK

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1 Introduction

1.1 Purpose

The purpose of this report is to provide preliminary structural design strategy for the new hotel development at 325 Deansgate to support the discharge of a pre-commencement planning condition 12 by the Manchester City Council (MCC), as per planning application ref 125804/FO/2019.

Condition 12 wording states the following:

“Prior to the commencement of the development, detailed structural designs / surveys shall be submitted for approval in writing by the City Council, as Local Planning Authority, in order to determine the effects of the proposal on the structure of the Viaduct. This shall include, the detailed design (including the results of any structural surveys) and the proposed structure monitoring regime during the development construction.

The approved strategy shall be adhered to throughout the development.”

The structural proposals presented in this report are indicative and are subject to further design development and refinement in the later design stages, but the general structural design principles affecting the discharge of Condition 12 are envisaged to remain as outlined in this report.

1.2 Building description

The proposed development is situated on Deansgate in Manchester City Centre on a site bound by Deansgate to the west, Trafford Street to the north, Century Street to the east and the Grade II listed Deansgate Castlefield Viaduct to the south. The site extends into two of the viaduct arches.

The proposed development is a ground plus 21 storey building, accommodating hotel units and commercial and leisure floorspace associated with the aparthotel. The development also comprises of two stand-alone units extending into viaduct arches located to the south of the site.

The structure will comprise of a composite steel frame which oversails an existing Grade II listed viaduct, the Castlefield Viaduct which forms the southern boundary of the development site.



Figure 1. 325 Deansgate cantilever rendered image

2 Building structure

2.1 Superstructure

The main building superstructure is to be a composite steel frame, with the composite profiled metal deck floors spanning between the steel beams. The grid of secondary and primary beams is supported by steel columns running continuously through the entire height of the building without any intermediate transfer structures and land on reinforced concrete foundations on the ground level. Steel beams are typically concealed within the ceiling zone or within the thickness of partitions between the hotel accommodation units to suit the architectural intent. To reduce the ceiling depth, web openings will be cut in the steel beam to allow routing of the building M&E services. Steel columns are typically concealed within partitions and placed behind the cladding piers to minimise the impact on building elevation.

Stability of the structure is provided by stiff RC cores, which receives the lateral loads at every floor through the rigid diaphragm action of the floors.

Cantilevering part of the building is supported by diagonal steel ties working in tension and sending the vertical load back into the first line of columns landing on the ground, and horizontal load into the core through the floor ties.

2.2 Substructure

It is proposed that the building substructure will comprise of a piled RC raft foundation. This is driven by existing site constraints, as well as large vertical and horizontal superstructure reaction forces associated with the scale of the building and the additional overturning effects caused by the substantial cantilever structure.

Piles are proposed to be positioned on a regular grid with additional piles located close to column positions and shear core where required. Piles are envisaged to be 600-750 mm diameter rotary bored piles socketed into the bedrock. Final pile design and layout is subject to the results and recommendations of the ground investigation report to be produced during the RIBA Stage 3 design period. Piles shall be designed to resist tension if uplift is found to occur. The potential location for uplift has been identified as the back face of the shear core adjacent the Deansgate Tavern.

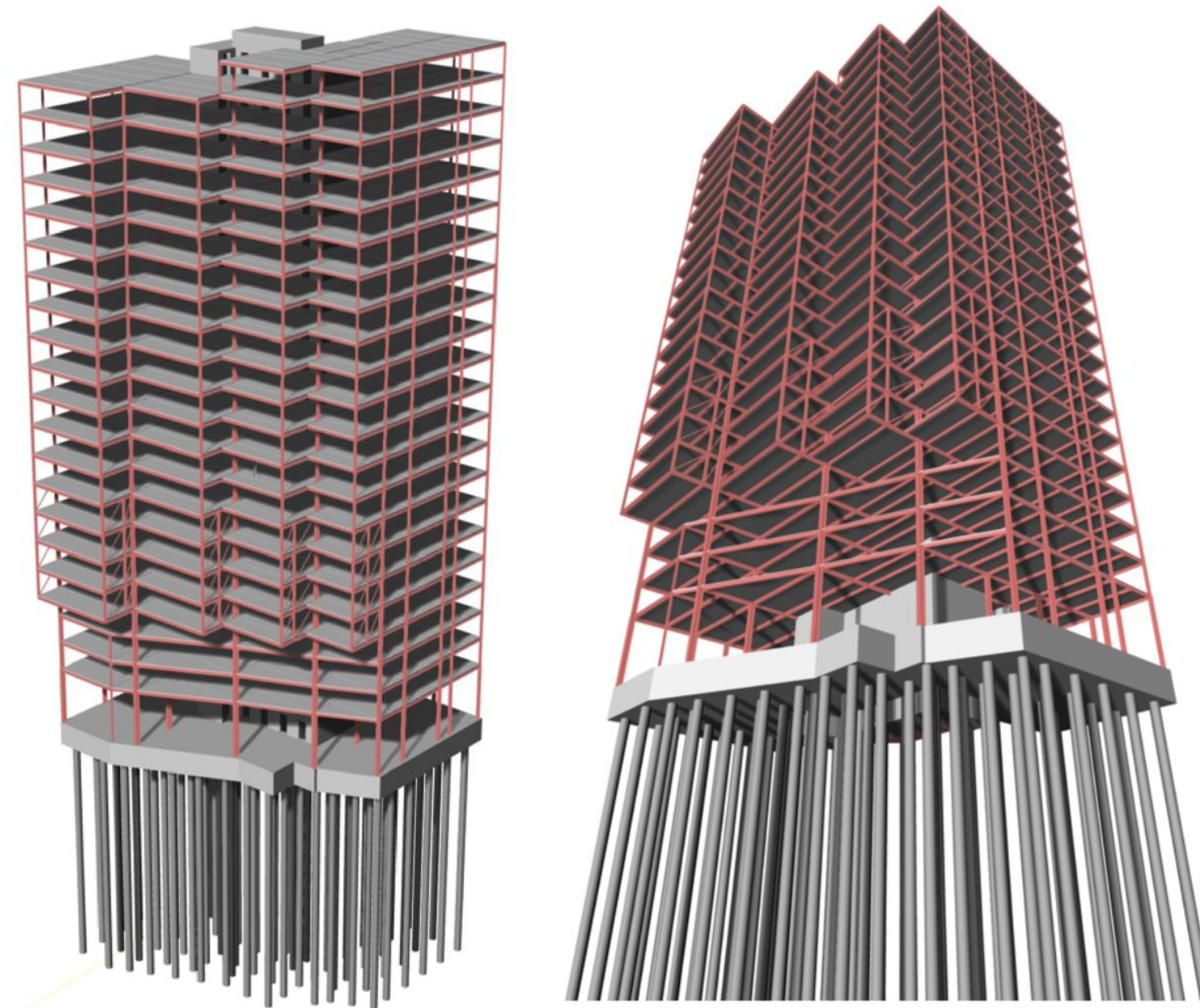


Figure 2. Structural frame 3D visual

2.3 Adjacent viaduct structure

The southern boundary of the site is defined by and existing grade II listed Castlefield Viaduct, formed of brick arches. The cantilevering part of the building oversails the viaduct without any structural support from the existing viaduct structure.

Between levels 00 to 04, the new building envelope interfaces with the existing brick arch structure without any intervention to the structure of the viaduct. There is no structural connection proposed between the proposed new building and the viaduct. Some preliminary above ground interface details produced by SimpsonHaugh Architects can be found in Appendix B.

2.4 Interface with viaduct foundations

It is expected that the existing viaduct is supported by brick spread footings that may project into the site of the proposed development. Further site investigations are expected in order to locate the extent and depth of the existing foundations. The 2m deep trial pits dug out at the boundary line near the existing viaduct has not located any foundation step-outs, which suggests the foundations are either deeper or have no projections into the proposed development site. Trial pit locations are shown in Figure 3.

The following actions in the design of the building foundations are taken to ensure zero impact on the foundations of the existing brick viaduct from the new building:

- Piled foundations socketed into the rockbed will transfer the vertical forces through end bearing directly into the underlying rockbed below the existing viaduct foundations, without applying any vertical or surcharge load on the viaduct or its substructure.
- The line of piles closest to the boundary will be offset from the edge of existing foundations by an appropriate clearance distance (assumed 1 meter).
- ‘Soft’ joint comprising of compressible material will be placed below the portion of the RC raft projecting beyond the first line of piles closest to the viaduct foundations, to ensure the raft is not loading the ground adjacent to the viaduct.
- ‘Soft’ joint comprising of compressible material will be placed along the vertical face of the RC raft near the existing viaduct to ensure horizontal forces are not transferred into the viaduct foundations. Piled foundations will be designed to resist the horizontal forces instead of relying on a passive soil resistance against the raft.

Refer to Figure 4 and Appendix A.

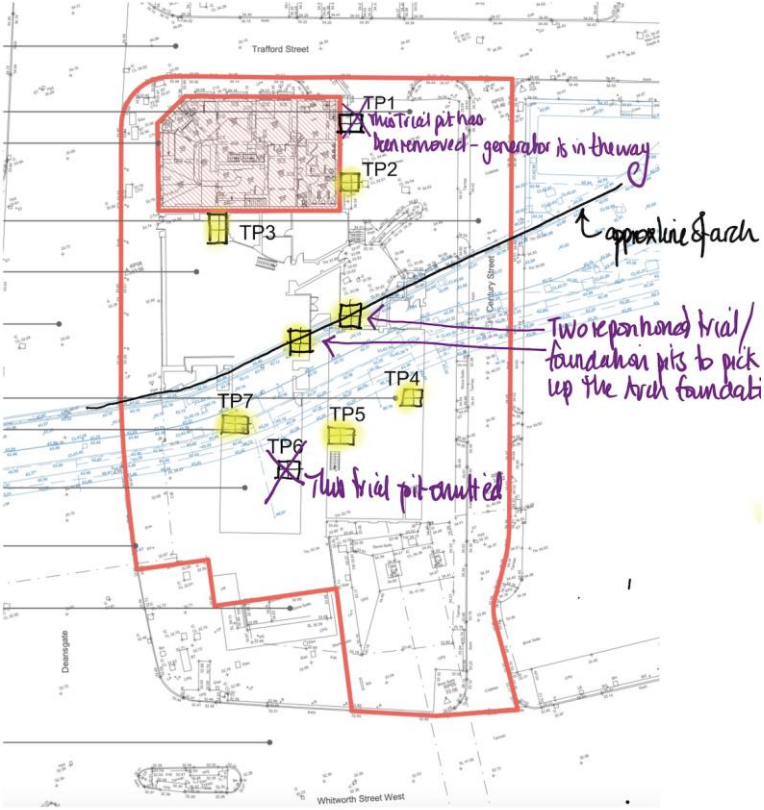


Figure 3. Trial pit locations, including 2no. trial pits along the viaduct elevation

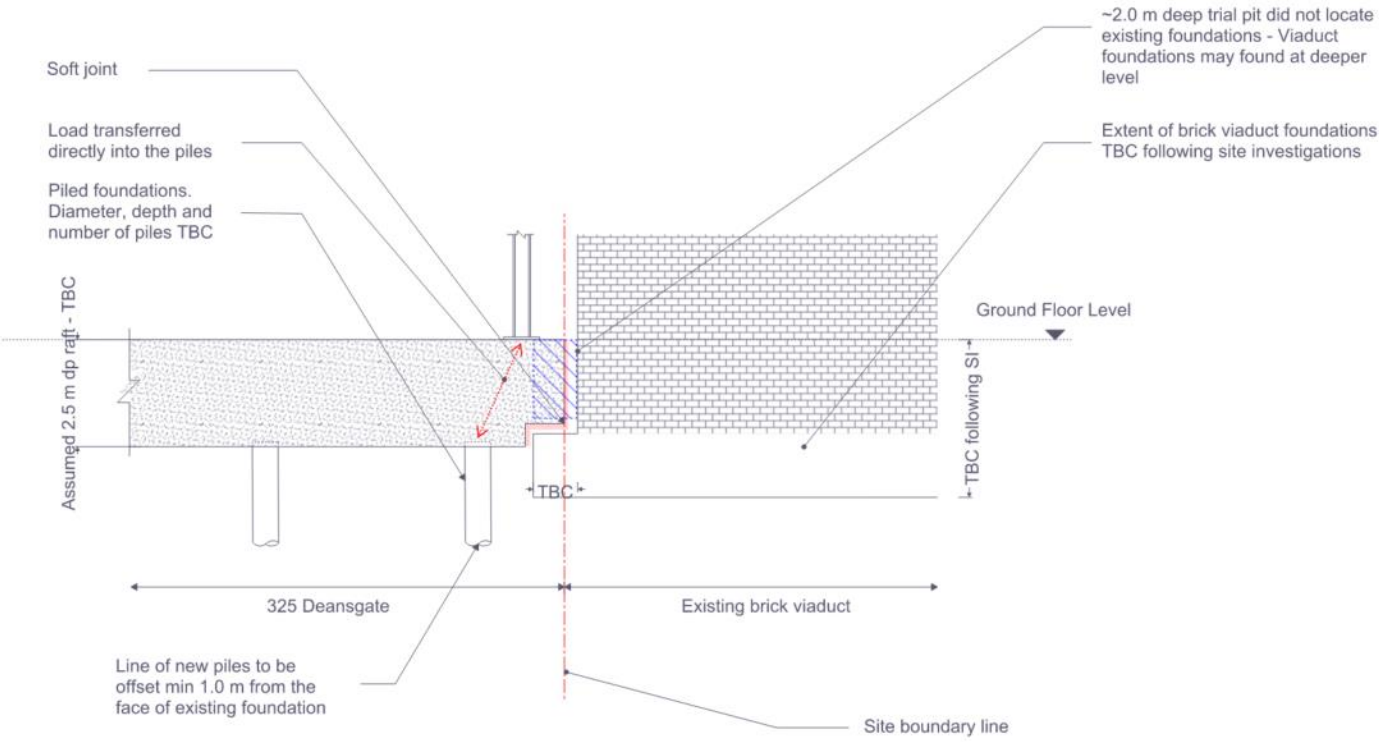


Figure 4. Proposed interface detail between proposed development and existing viaduct foundations

3 Movement monitoring proposals

This section of the report provides the requisite information for the 3-dimensional monitoring of vertical and horizontal movement of the existing viaduct arch structure along the southern boundary of the 325 Deansgate site.

3.1 Monitoring Survey Points

A suggested arrangement of movement monitoring targets is indicated in Figure 5 and Appendix C of this report. The Contractor is to establish an agreed number and location of survey points and record initial positions to enable monitoring of:

- 3-dimensional movements: in accordance with trigger points as identified.
- Crack widths: >1mm

Before commencement of excavation, establish and record initial positions to enable monitoring of the adjacent viaduct structure. Ensure datum for monitoring is on a solid structure away from building works and is not at risk of seasonal movement or damage from construction works.

3.2 Location of Monitoring Targets

The monitoring targets are to be located along the northern elevation of the brick arched viaduct structure, facing the direction of the proposed development site. The monitoring targets are to be located above ground level in pairs at 5m horizontal centres with an approximate vertical spacing of 3m, to allow for 3-dimensional movement monitoring to the full extent of the affected areas. In addition, monitoring targets are to be placed to the underside of the brick arches, spaced horizontally at approximately 5 m centres.

It is expected that the existing building on site will be demolished and arches stripped out from finishes prior to placing the monitoring targets. The targets are not to be obstructed and should be always accessible for monitoring during the construction works.

3.3 Timing & Frequency of Monitoring

The proposed frequency of monitoring is as follows:

- The initial readings taken prior to work commencing on site should be stable and consistent. Inconsistencies should first be checked by repeating readings and checking the surveying instrumentation & method. The contractor should report on causes of all inconsistencies in readings and calibrate his monitoring equipment according to good practice.
- During underpinning, piling and substructure works: full set of 3-D readings to be taken every week, for the duration of this period of work.
- A weekly information pack to be issued to Eckersley O'Callaghan within 24 hrs of readings being carried out.
- Post substructure works: readings to be taken monthly, for 3 months on completion of structural interventions (i.e. during the fit-out stage).

3.4 Method of Monitoring

The method of monitoring should comply with the requirements of CIRIA Publication C579. This includes consideration of accuracy of readings, location of site, position of fixed datum not affected by the works on site and weather conditions.

The contractor is to submit a detailed method statement of the proposed monitoring regime, including types of targets and monitoring equipment.

The contractor is expected to review monitoring results immediately after readings are taken and report any excessive and unexpected movements to the engineer. Results of monitoring are to be issued to Eckersley O'Callaghan within 24 hours of readings being taken.

The monitoring report is to include all previous monitoring records referenced according to the dates and times at which the readings were taken. These should be presented in graphical and tabular format.

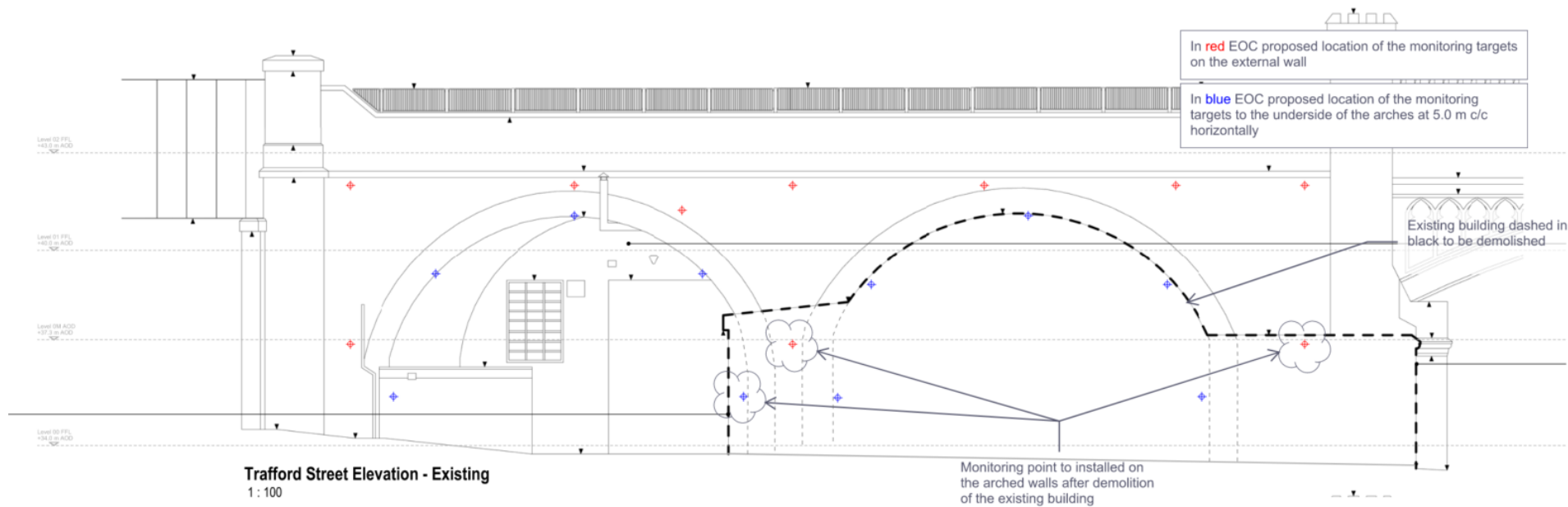
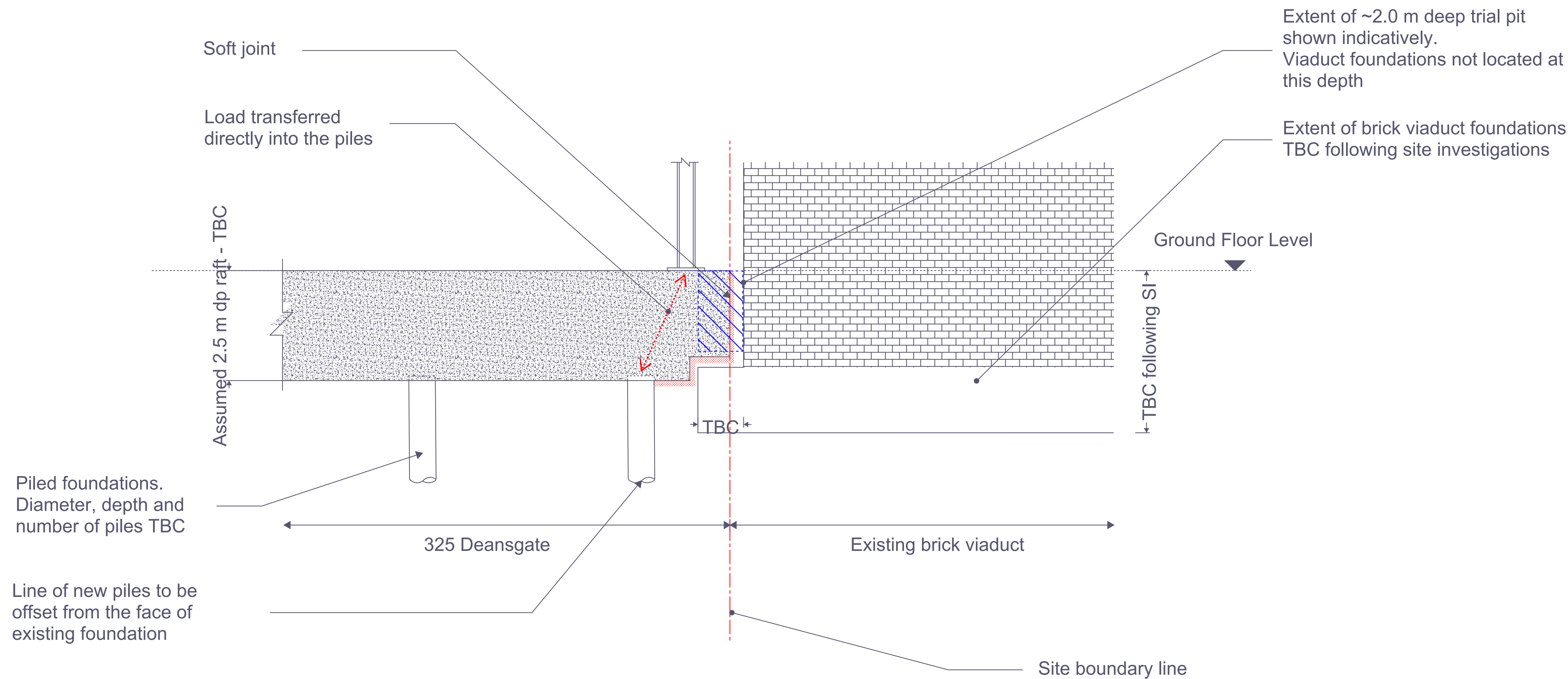


Figure 5. Proposed monitoring target points

Appendix A – Substructure interface

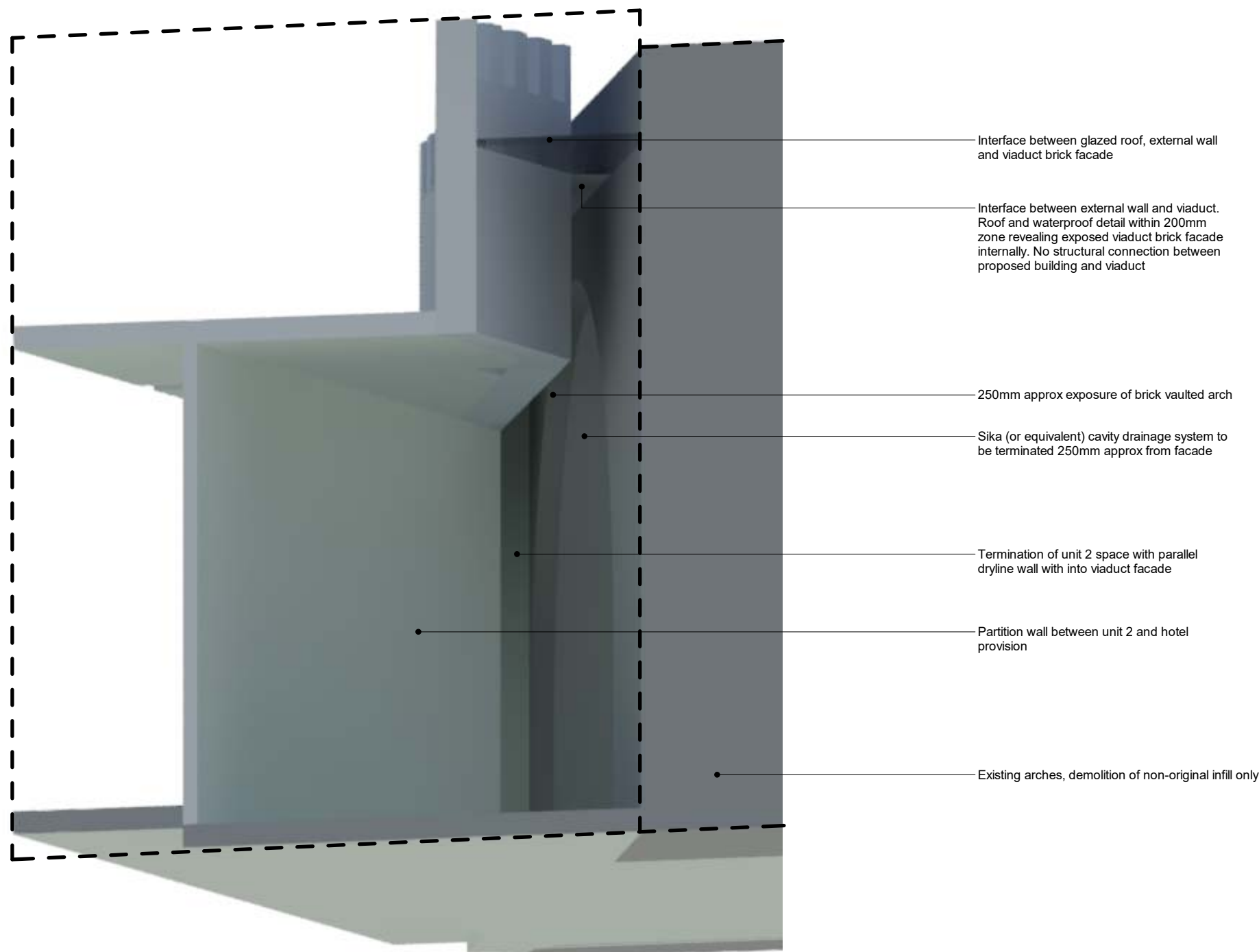


Section 1-1

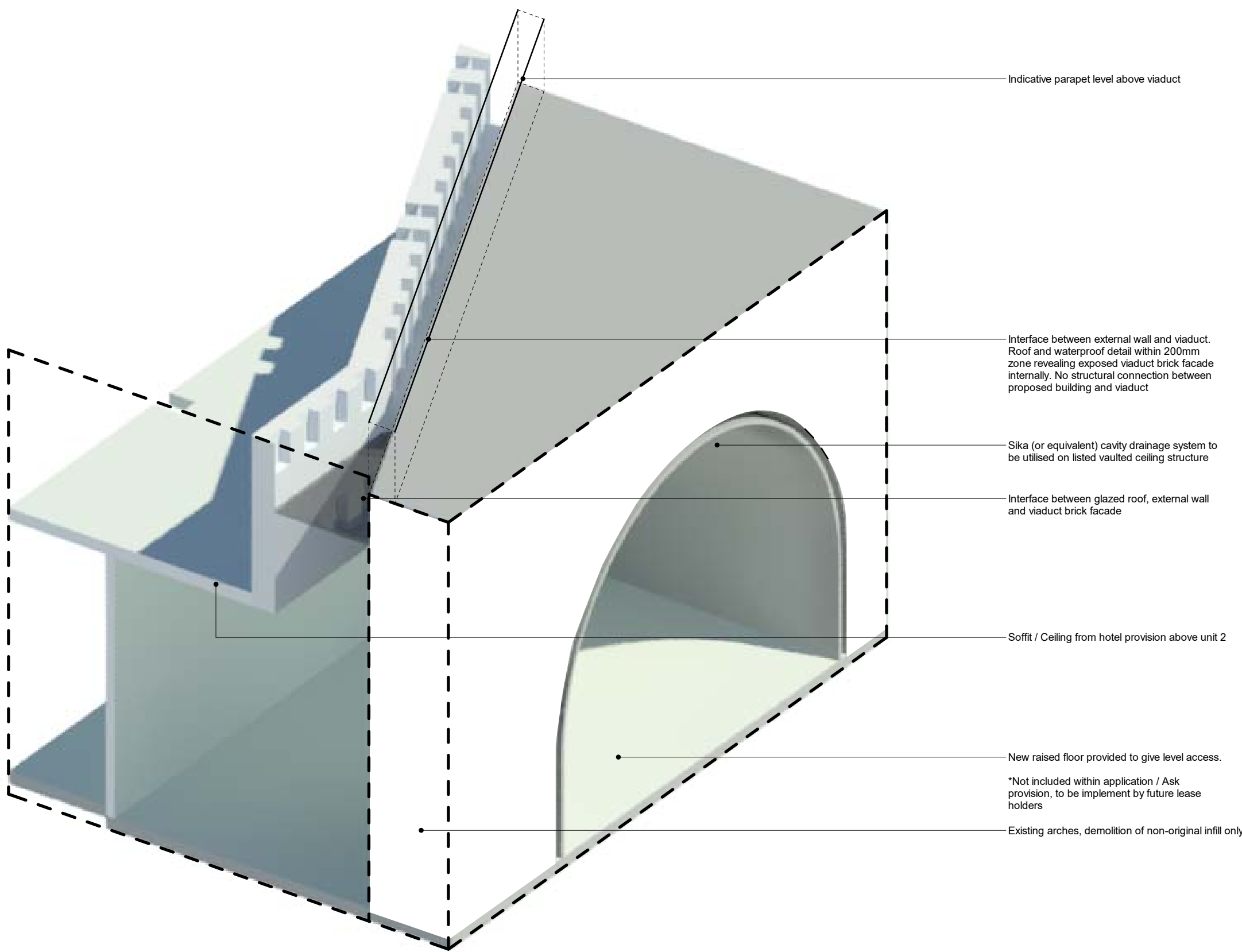


GF Key Plan

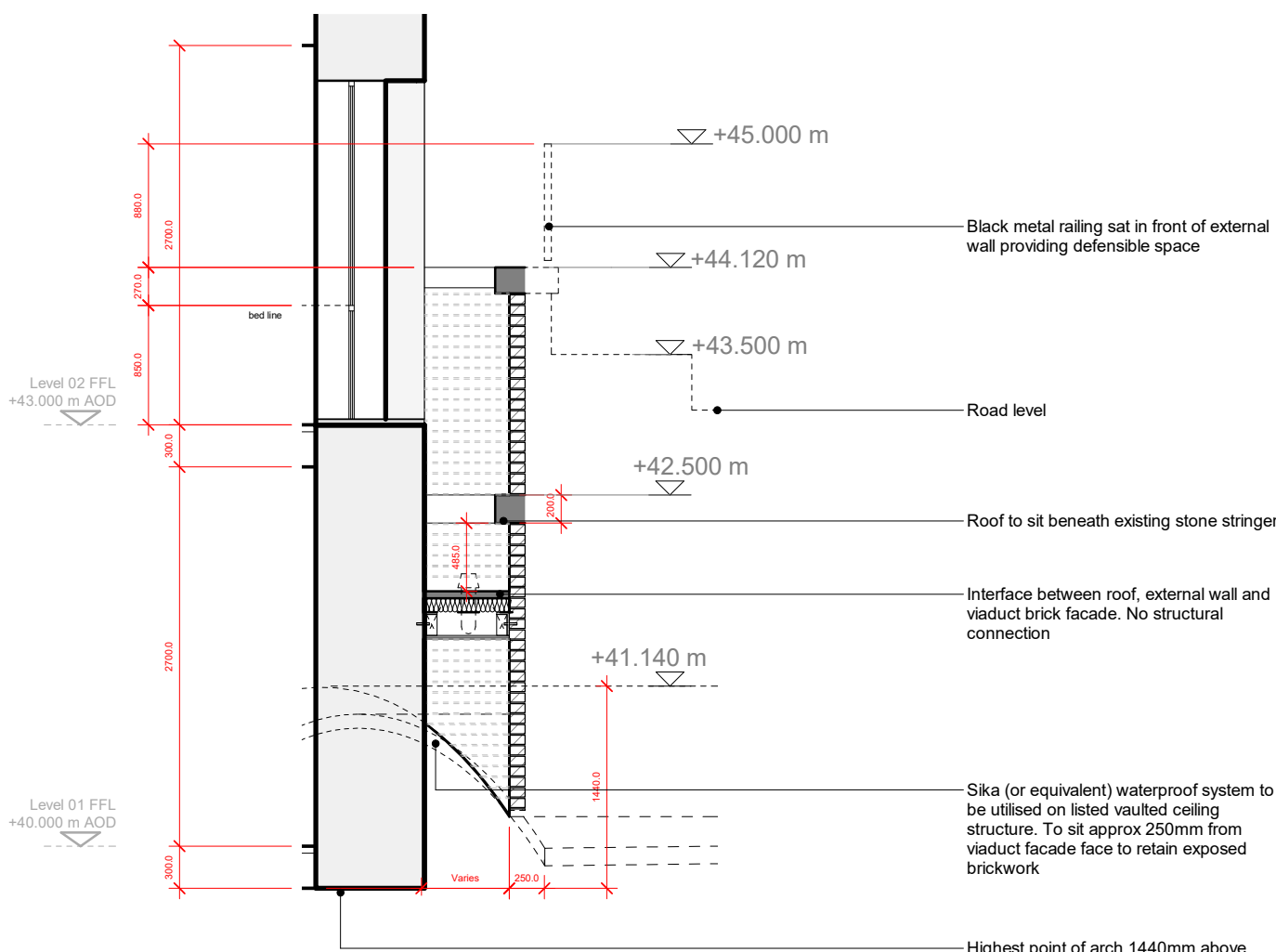
Appendix B – Above ground interface details

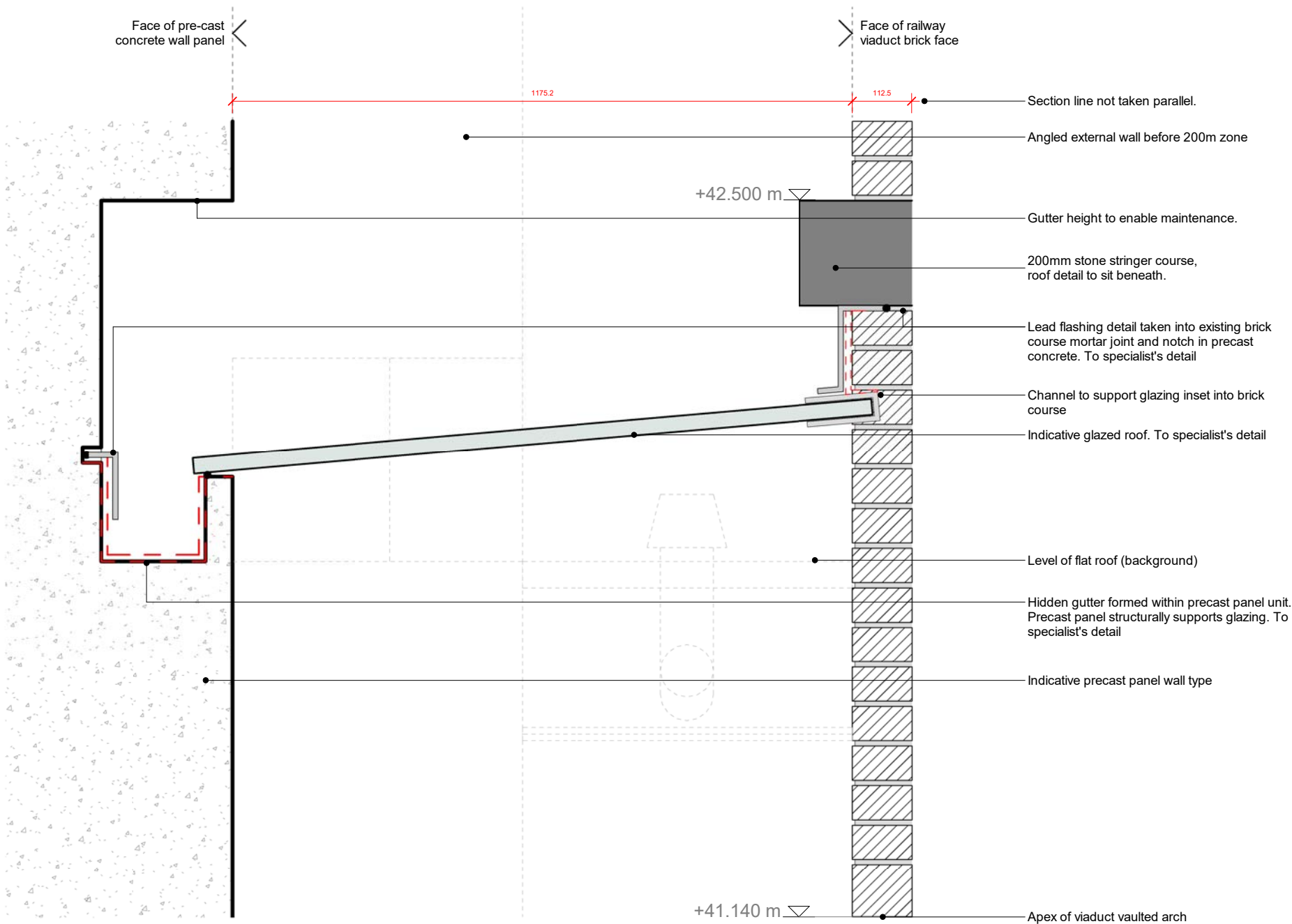


Section lines take through arch walls to highlight indicative interface details between proposed and viaduct

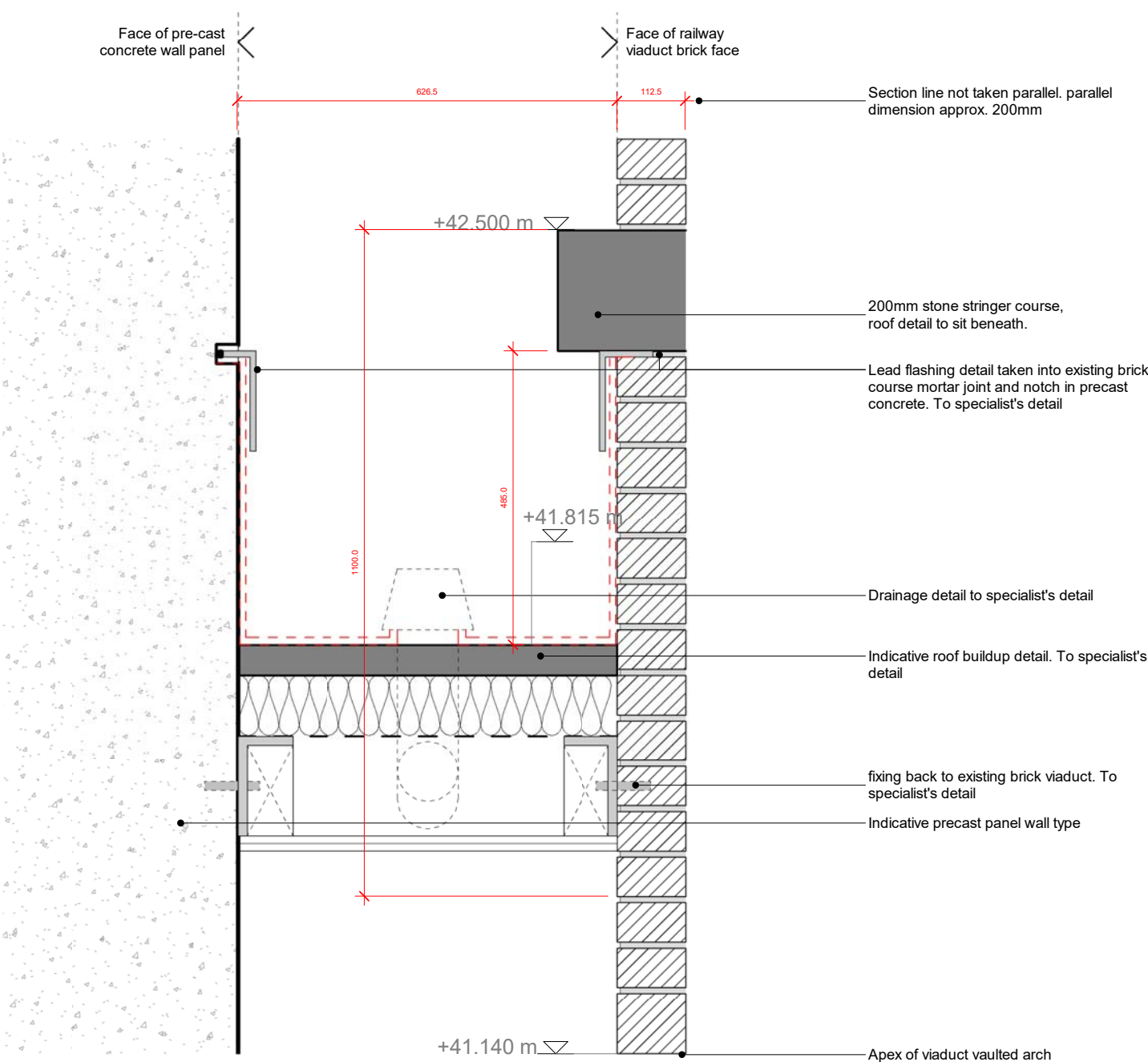


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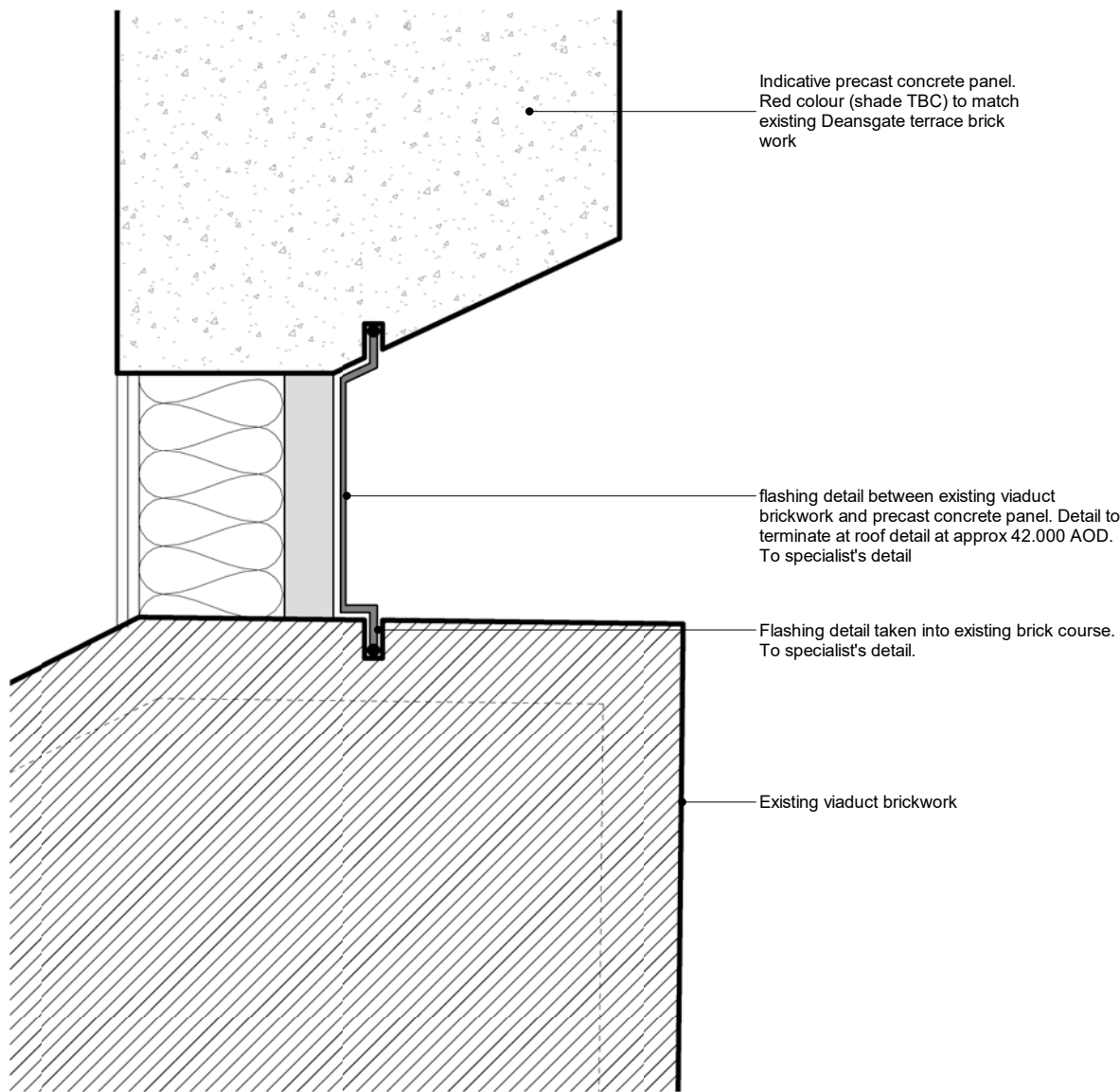




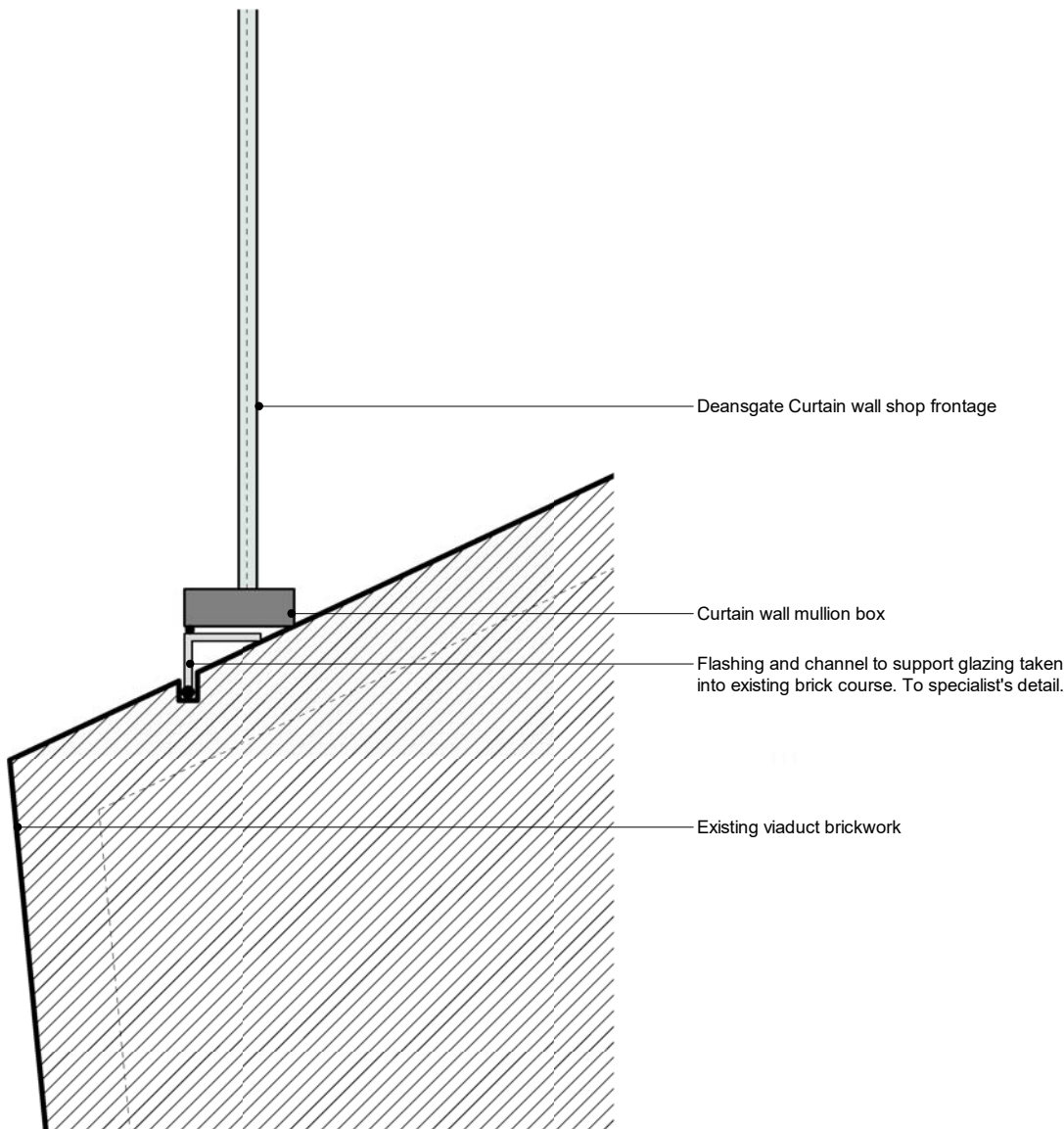
Detail 01 - Indicative Glazed Roof Detail and Interface With Viaduct
1 : 10



Detail 02 - Indicative Flat Roof detail and Interface with Viaduct
1 : 10

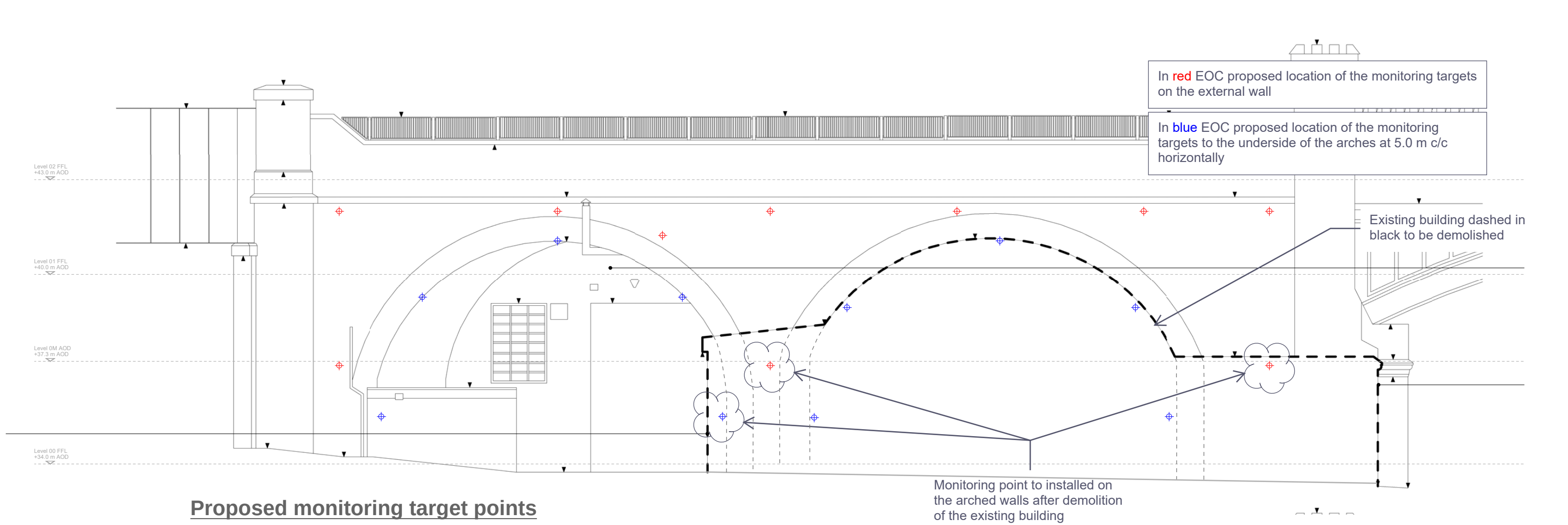


Detail 03 - Indicative External Wall and Viadut Interface
1 : 10



Detail 04 - Indicative Curtain Wall and Viadut Interface
1 : 10

Appendix C – Proposed monitoring



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Project Name		325 Deansgate			
Sketch Title		Monitoring targets on existing arched viaduct			
Project No.	22244	Sketch No.	SK230208	Date	08/02/2023
By	KJ	Checked		Scale	N/A