NATIONAL NUCLEAR REGULATOR (NNR)
NATIONAL NUCLEAR REGULATOR HEAD OFFICE BUILDING

PROVISION OF STRUCTURAL ENGINEERING SERVICES: CONDITIONAL ASSESSMENT OF THE EXISTING HEAD OFFICE BUILDING LOCATED AT: 420 WITCH-HAZEL AVE, ECO-PARK ESTATE, CENTURION
0157

PRELIMINARY VISUAL ASSESSMENT REPORT

SEPTEMBER 2021

DOCUMENT CONTROL SHEET

PROJECT DETAILS

Project Title	**NATIONAL NUCLEAR REGULATOR (NNR)** **NATIONAL NUCLEAR REGULATOR HEAD OFFICE BUILDING** **PROVISION OF STRUCTURAL ENGINEERING SERVICES:** **CONDITIONAL ASSESSMENT OF THE EXISTING HEAD OFFICE BUILDING**
Report Title	**PRELIMINARY VISUAL ASSESSMENT REPORT**
Reference	**200/418**
Date	**2021.09.14**

CONTENTS

Appendices:

1. INTRODUCTION

The National Nuclear Regulator head office building is located at 420 Witch-Hazel Avenue, Eco-Park Estate, Centurion (see Figure 1 for site plan).

Figure 1: Site locality of the National Nuclear Regulator building.

1. SCOPE OF WORKS

The Scope of Works entails the following:

a. Comment on the overall integrity and robustness of the building.
b. Identify any possible structural defects that may be observed on the existing building.
c. Ensure that the building and the building surrounds are structurally safe and sound.
d. Comment on the possible cause/s of any structural defects on the existing building.
e. Provide acceptable engineering solutions for the repair/s of any structural defects identified.

2. SITE INVESTIGATION

The information contained within this report has been obtained through an 'on-site' visual investigation undertaken on 2021.08.31.

3. STRUCTURAL VISUAL OBSERVATIONS

Note: Only 'typical photographs' of common structural defects have been incorporated within this report.

3.1 The existing building appears to be a reinforced concrete framed structure with masonry and glass infill panels. The existing roof structure comprises structural steel roof trusses with metal roof sheeting. The existing rainwater downpipes are constructed within the existing reinforced concrete columns, from roof level down to ground level.

3.2 EXTERIOR FACADE OF THE BUILDING

a. Minor cracks were observed within the marmolite finish on the existing wall surfaces at various locations.
b. Plaster cracks were also observed at various locations of the building.
c. Stormwater run-off from the rainwater gutters at roof level, is causing water seepage/ damage to the existing reinforced concrete columns.
d. Access could not be gained to the roof area and therefore no comment could be made/given regarding the condition of the existing roof sheeting and rainwater gutters.
e. Stormwater grid inlet and manholes at ground level were found to be blocked with silt and debris.
f. Water damage to the fire escape staircase was observed.
g. Mild corrosion of the existing structural steel members at the fire escape staircase was observed.
h. Moderate corrosion to a structural steel baseplate was observed by the fire escape staircase.
i. The existing surface bed slab at basement level was found to have minor cracks.
j. Water damage and structural cracking to the internal walls of the transformer room was observed.

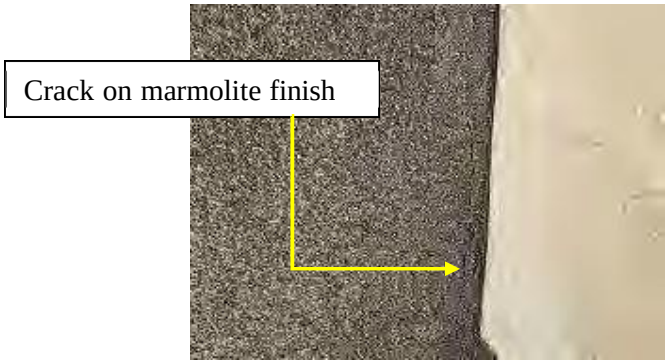

Figure 2: Showing minor crack of the existing marmolite finish

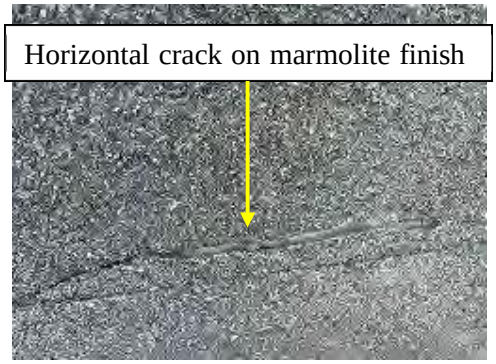

Figure 3: Showing minor cracking of the existing marmolite finish

Figure 4: Showing minor cracking of the existing marmolite finish

Figure 5: Showing plaster crack on the existing external wall

Figure 6: Showing plaster cracks on the existing external wall.

Figure 7: Showing plaster crack on the existing external wall.

Figure 8: Showing plaster crack on the existing external wall

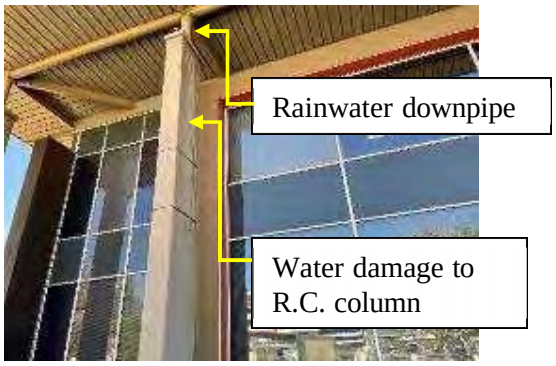

Figure 9: Showing the rainwater downpipe cast into R.C. column and water damage to the concrete column

Figure 10: Showing rainwater downpipe grid inlets

Figure 11: Showing water damage to the existing R.C. column

Figure 12: Showing stormwater manhole blocked with silt and debris

Figure 13: Showing existing stormwater grid inlets

Figure 14: Showing water damage to the existing fire escape staircase

Figure 15: Showing water damage to the fire escape staircase

Figure 16: Showing corroded structural steel baseplate

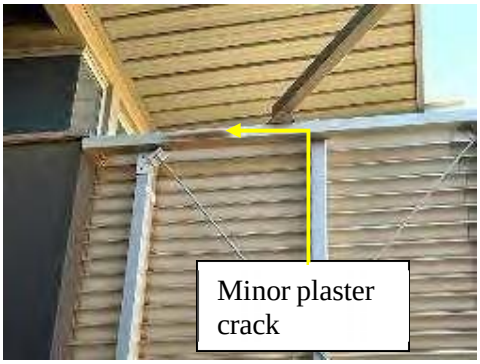

Figure 17: Showing corroded structural steel member

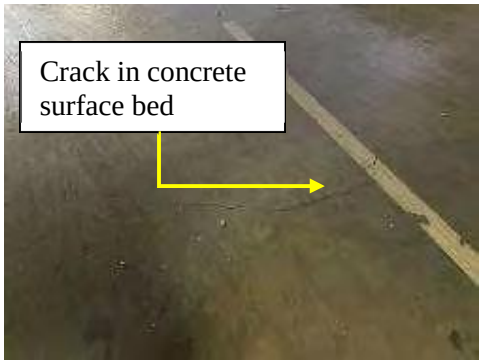

Figure 18: Showing cracking of the existing concrete surface bed slab at basement level

Figure 19: Showing damage to existing concrete surface bed slab at basement level

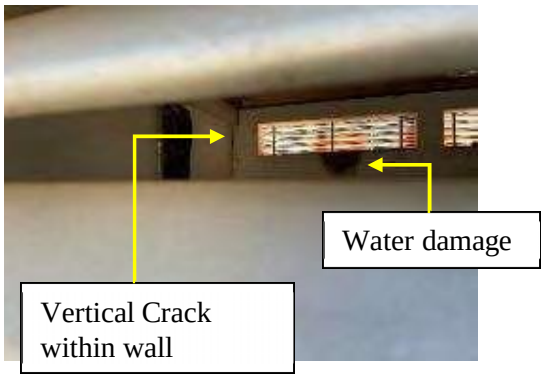

Figure 20: Showing water damage and structural cracking to the internal walls in the transformer room

3.3 INTERIOR OF THE BUILDING

a. Minor plaster cracks were observed on various sections of the existing masonry walls.
b. Water seepage/damage to the existing walls in the office space was observed.
c. There is a leaking/damaged rainwater downpipe discharging stormwater into the existing office on the first floor.
d. It appears that many offices are currently utilized as storage spaces and/or filing rooms.

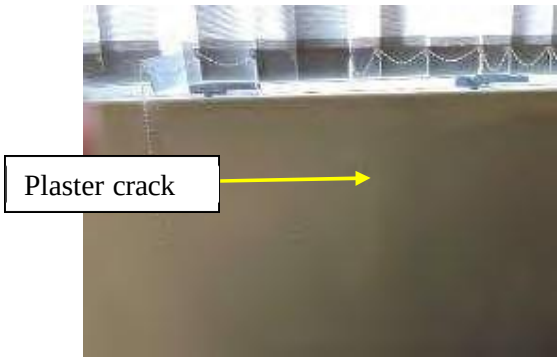

Figure 21: Showing minor plaster crack on the existing wall

Figure 22: Showing minor plaster crack on the existing wall

Figure 23: Showing minor plaster crack on the existing wall

Figure 24: Showing moderate plaster crack on the existing wall

Figure 25: Showing minor horizontal plaster crack on the existing wall

Figure 26: Showing water damage to the existing internal office wall

Figure 27: Showing water damage to existing internal office walls

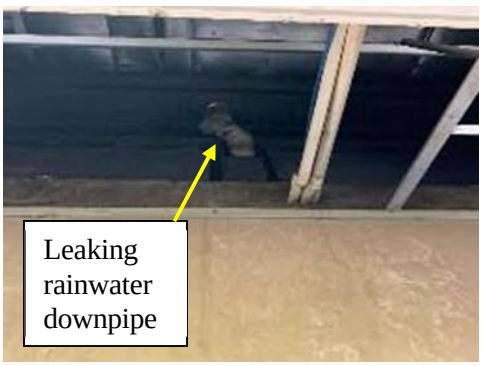

Figure 28: Showing leaking/damaged rainwater downpipe

Figure 29: Showing existing office being utilized as a filing room/storage

3.4 ARCHITECTURAL

a. Cracked/damaged and/or missing floor tiles at various locations was observed.
b. It appears that the finish on the existing concrete elements are now spalling and now showing signs of cracking.
c. Water damage and cracks to the existing ceiling boards was observed.

Figure 30: Showing delamination of the tiled skirting on the existing wall

Figure 31: Showing damage to the exterior tiling

Figure 32: Showing minor spalling on the finish of the existing

Figure 33: Showing minor spalling on the finish of the existing

Figure 34: Showing water damage to existing ceiling boards

Figure 35: Showing cracked/damaged ceiling boards

4. FINDINGS AND RECOMMENDATIONS

a. Our visual structural assessment of the existing building concludes that in our opinion, the existing building is structurally sound with minor structural repairs to be undertaken.
b. All plaster cracks and masonry cracks appear to be due to general deterioration and lack of regular maintenance. All plaster and masonry cracks must be repaired in accordance with the structural repair specification in ***Annexure: A***
c. Cracks within the marmolite finish appear to be due to general deterioration and lack of regular maintenance. These cracks on the marmolite finish are to be repaired by a specialist marmolite installer.
d. The corrosion to the structural steel members is to be repaired in accordance to our structural specification as detailed in ***Annexure: B***
e. Cracks in the existing concrete surface bed slab in the basement must be repaired as per the repair specification in ***Annexure: C***
f. Concrete spalling at various locations should be repaired as per the repair specification in ***Annexure: D***
g. Masonry walls located within the transformer have water damage due to water ingress from the screens above. The vertical crack is to be repaired as per the repair specification in ***Annexure: E***
h. The rainwater downpipes within the R.C columns appear to be blocked and/or damaged. We recommend that the existing rainwater downpipes be high pressure cleaned and a CCTV camera investigation be undertaken to determine the integrity of the existing rainwater downpipes.
i. Existing stormwater reticulation, including all existing manholes, be high pressure cleaned.
j. There are many existing office areas being used for storage and/or filing rooms. As per the structural design code, **SANS 10160-2:2011 Self Weight and Imposed Loads (Table 1 – Category B1)**, we assume that the existing slabs were designed for a live load of 2.5 kN/m^2 (250 kg/m^2) of which is for 'office areas for general use'. The current storage areas appear to have a stack height of approximately 3m which would make the live load requirement 7.5 kN/m^2 as per the live loading requirements of **Category B5 (SANS 10160-2:2011)**. This current loading situation, is in our opinion, in excess (more than 3 times) of the assumed designed live load of the existing slab and therefore could result in excess deflection and possible severe cracking of the existing slab. We strongly recommend that the stack height used in these storage areas be reduced to maximum 1m heights to maintain the overall structural integrity of the existing slab.

Table 1 — Imposed loads on floors, balconies and stairs in buildings

1	2	3	4	5	6
Category	**Specific use**	**Sub-category**	**Example**	q_k kN/m²	Q_k kN
A	Areas for domestic and residential activities	A1	All rooms in a dwelling unit and a dwelling house, including corridors and lobbies	1,5	1,5
		A2	Bedrooms, wards, dormitories, private bathrooms and toilets in hospitals, hotels, hostels and other institutional residential occupancies	2,0	1,5
		A3	Stairs and escape routes in residential occupancies for example, serving hospitals, hotels, hostels and other institutional residential occupancies	3,0	1,5
		A4	Balconies accessible to domestic and residential occupancy areas	4,0	3,0
B[a]	Public areas (not susceptible to crowding)	B1	Office areas for general use	2,5	4,5
		B2	Public libraries, excluding stack areas	3,0	4,5
		B3	Kitchens, communal bathrooms and toilets in educational buildings, hotels, office buildings and other institutional occupancies	3,0	5,0
		B4	Light laboratories, operating theatres, X-ray rooms	3,0	5,0
		B5	Filing and office storage areas and stack areas in libraries and archives	2,5 per metre stack height, but ≥ 5,0	5,0
NOTE 1 Depending on their anticipated uses, areas likely to be categorised as C2, C3 or C4 may be categorised as C5 by decision of the client or the relevant authority.					
NOTE 2 See 9.3.2 for storage or industrial activity.					
NOTE 3 The concentrated load, Q_k, is applied over an area of 0,1 m × 0,1 m					
NOTE 4 See 9.3.1.9 for loads due to movable partition for categories B and C.					
[a] Escape routes for categories B and D shall be designed according to category C5.					

Figure 36: Showing an excerpt from the SANS 10160-2:2011 design guidelines and code (Table 1)

k. All damaged ceiling boards to be removed and replace with new. All to match existing on site.
l. All damaged and cracked tiles are to be removed and replaced. All to match existing on site.
m. All internal walls to be prepared to receive two coats of paint.

5. CONCLUSION

a. We strongly advise that all the recommended remedial works be carried out by a competent person (i.e.: NHBRC Registered Building Contractor), all in accordance with the specifications, details and supervision of a Professional Structural Engineer.

6. COST ESTIMATES

Measurements should be done where quantity is not available.

Item	Description	Unit	Qty	Rate	Amount
a.	Plaster crack repairs	m	150		
b.	Marmolite repairs	m²			
c.	Structural steel repairs	Sum			
d.	Repairs to crack in transformer room	Sum			
e.	Repairs to concrete surface bed	Sum			
f.	Concrete spalling repairs	m²	100		
g.	High pressure clean + CCTV	Sum			
h.	High pressure clean stormwater infrastructure	Sum			
i.	Replace ceiling boards	m²	50		
j.	Replace damage tiles	m²	50		
	Painting of internal walls				

End of Report .

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ANNEXURE: A

GENERAL PLASTER REPAIRS & BRICKWORK/BLOCKWORK STITCHING REPAIRS SPECIFICATIONS

GENERAL PLASTER 'CRACK' REPAIRS:

1. RECOMMENDATIONS & SPECIFICATIONS:

ALL PLASTER 'CRACKING' MUST BE REPAIRED AS SPECIFIED BELOW. THE CONTRACTOR IS ALSO REQUIRED TO DETERMINE IF ANY CRACKS IN THE PLASTER HAVE BEEN TRANSFERRED TO THE BLOCKWORK/BRICKWORK. (CONTRACTOR IS REQUIRED TO CUT 100mm LONG x 20mm WIDE INSPECTION SLOT). IF A CRACK HAS TRANSFERRED TO THE BLOCKWORK/BRICKWORK, THEN IT NEEDS TO BE REPAIRED AS SET OUT IN THE SPECIFICATION FOR BLOCKWORK/BRICKWORK 'STITCHING'.

1.1 SPECIFICATION FOR GENERAL 'PLASTER' REPAIR:

BREAK OUT AND REMOVE DAMAGED PLASTER TO 50mm INTO SOUND PLASTER. CLEAN WALL AND APPLY 'SIKA PLASTERSTIK' OR EQUALLY APPROVED BONDING AGENT TO MANUFACTURER'S SPECIFICATIONS. RE-PLASTER WALL AND PAINT TO ARCHITECTS SPECIFICATIONS.

1.2 SPECIFICATION FOR PLASTER REPAIR 'CRACKING':

RAKE OUT CRACK 6mm x 6mm DEEP. CLEAN OUT ALL DEBRIS/LOOSE MATERIAL. FILL WITH ACRYLIC FILLER - 'SIKACRYL' OR EQUALLY APPROVED TO MANUFACTURERS SPECIFICATIONS. PAINT TO ARCHITECTS SPECIFICATIONS.

1.3 SPECIFICATION FOR BLOCKWORK/BRICKWORK 'STITCHING' REPAIR:

" RAKE OUT CRACK. REMOVE ALL DEBRIS/LOOSE MATERIAL.
" STITCH CRACK IN BLOCKWORK/BRICKWORK WITH R8 REINFORCING RODS.
" R8 REINFORCING RODS ARE TO BE 300mm LONG WITH 50mm BENDS AT BOTH ENDS - TOTAL LENGTH = 400mm.
" R8 REINFORCING RODS ARE TO BE EPOXY GROUTED WITH 'PROSTRUCT 617 GENERAL PURPOSE EPOXY ADHESIVE' OR EQUALLY APPROVED AT 250mm CENTRES, AND GROUTED INTO (10mm DEEP) SLOTS CUT INTO BLOCKWORK/BRICKWORK AND WITH (60mm DEEP) 10mm DIA. DRILL HOLES AT EACH END TO ACCOMMODATE THE BENDS OF THE REINFORCING RODS.
" ALL SLOTS AND DRILL HOLES TO BE COMPLETELY FILLED WITH EPOXY ADHESIVE.
" ALL SLOTS TO BE CUT PERPENDICULAR TO THE CRACK IN THE BLOCKWORK/BRICKWORK.
" EPOXY ADHESIVE APPLICATION TO BE AS PER MANUFACTURERS' SPECIFICATIONS.
" APPLY 'SIKA PLASTERSTIK' (OR EQUALLY APPROVED) AND RE-PLASTER WALL, HOWEVER IF LARGE AREAS OF PLASTER HAS BEEN REMOVED, 450mm WIDE 'CHICKEN WIRE MESH' MUST BE 'TACKED ON' OVER THE CRACKED AREA PRIOR TO RE-PLASTERING.
" RE-PAINT PLASTER TO ARCHITECTS SPECIFICATIONS.

REV	DESCRIPTION	BY	DATE	PRELIMINARY
P1	PRELIMINARY	S.A.	2021.09.14	

PROJECT	DETAILS	DATE	REVISION
NATIONAL NUCLEAR REGULATOR: CONDITIONAL ASSESSMENT OF EXISTING HEAD OFFICE BUILDING	GENERAL PLASTER REPAIRS & BRICKWORK/BLOCKWORK STITCHING REPAIRS SPECIFICATIONS	2021.09.14	P1
		PROJECT No. 200/418	SKETCH No. SK 01

ANNEXURE: B

GENERAL CORRODED STRUCTURAL STEEL REPAIRS SPECIFICATION

Repairs to Corroded Structural Steelwork Elements:

1. Existing steelwork to be mechanically wire-brushed to remove all rust and paint.
2. Sections of steelwork which are badly corroded must be cut and removed. New steelwork is to be installed to match. existing and must be welded with minimum 6mm continuous fillet weld to the existing structure.
   Note: The structure must be propped prior to the removal of the existing corroded steelwork.
3. Apply one full coat of Sigma Zinc 160 @ 60 - 80µm (or equally approved). Allow adequate drying time depending on temperature.
4. Apply one full coat of Sigma Sigmacover 410 @ 125 - 150µm (or equally approved) to entire area. Allow overnight to dry.
5. Stripe coat all edges, welds, nuts and bolts with Sigma Sigmacover 410 (or equally approved) (we recommend a different colour to verify stripe coat has been done).
6. Apply two full coats of Sigma Sigmadur 550 @ 50 - 60µm (or equally approved) to entire area. Allow overnight drying between coats.
7. All paint colours to Architects specification.

NB: All products are to be applied as per manufacturer's (Sigma Coatings - or equally approved) instructions specifications.

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P1	PRELIMINARY	S.A.	2021.09.14	

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NATIONAL NUCLEAR REGULATOR: CONDITIONAL ASSESSMENT OF EXISTING HEAD OFFICE BUILDING	GENERAL CORRODED STRUCTURAL STEEL REPAIRS SPECIFICATION	2021.09.14	P1
		PROJECT No. 200/418	SKETCH No. SK 02

ANNEXURE: C

REPAIRS TO EXISTING CONCRETE SURFACE BED SLAB:

Surface Preparation :

" Remove all loose, unsound concrete from the areas to be repaired.
" Cut out around the areas to be repaired to a minimum depth of 10mm to avoid feather edging.
" High pressure water blast the prepared areas to remove any contaminants.
" Ensure that the substrate onto which the repaired concrete is to be applied is sound and free from loose material.
" If reinforcing is exposed & shows signs of corrosion, the reinforcing shall be opened up by breaking out the concrete to a depth of 20mm below the reinforcing and 50mm beyond the corroded length of the reinforcing.
" Any exposed steel must be mechanically cleaned and coated with 1 coat of 'Prostruct 688' Zinc Rich Primer (or equally approved) @ 4m²/lt.
" Removal of badly corroded reinforcement and its replacement - All to engineers' instructions on site.

Tolerances :

" If loose material exceeds more than 20mm thick, the entire concrete surface bed slab is to be demolished and re-cast.

Priming :

" Pre-dampen prepared surface with water as described below.

Repair Material:

" Thoroughly wet the surface of the concrete within the repair area with water.
" Drain excess water.
" Mix 'Prostruct 617' Wet to Dry Epoxy Grout (or equally approved) as per detailed instructions and re-screed the surface bed slab.
" Repaired areas must be wet cured for a minimum of 3 days once shutters have been stripped.

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P1	PRELIMINARY	S.A.	2021.09.14	

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		PROJECT No. 200/418	SKETCH No. SK 03

National Nuclear Regulator

ANNEXURE: D

CONCRETE SPALLING REPAIRS FOR REPAIRS UP TO 30mm THICK

SURFACE PREPARATION :

" REMOVE ALL LOOSE, UNSOUND CONCRETE FROM THE AREAS TO BE REPAIRED.
" CUT OUT AROUND THE AREAS TO BE REPAIRED TO A MINIMUM DEPTH OF 10mm TO AVOID FEATHER EDGING. "
HIGH PRESSURE WATER BLAST THE PREPARED AREAS TO REMOVE ANY CONTAMINANTS.
" ENSURE THAT THE SUBSTRATE ONTO WHICH THE REPAIR MORTAR IS TO BE APPLIED IS SOUND AND FREE FROM LOOSE MATERIAL.
" IF REINFORCING IS EXPOSED & SHOWS SIGNS OF CORROSION, THE REINFORCING SHALL BE OPENED UP BY BREAKING OUT THE CONCRETE TO A DEPTH OF 20mm BELOW THE REINFORCING AND 50mm BEYOND THE CORRODED LENGTH OF THE REINFORCING.
" ANY EXPOSED STEEL MUST BE MECHANICALLY CLEANED AND COATED WITH 1 COAT OF PRO-STRUCT 688 : ZINC RICH PRIMER @ 4m²/LT (OR EQUALLY APPROVED).
" REMOVAL OF BADLY CORRODED REINFORCEMENT AND ITS REPLACEMENT-ALL TO ENGINEERS INSTRUCTIONS ON SITE.

PRIMING :

" PRE-DAMPEN PREPARED SURFACE WITH WATER.
" DO NOT ALLOW TO DRY OUT PRIOR TO THE APPLICATION OF THE PRO-STRUCT 528VO-MC1 : STRUCTURAL CONCRETE (OR EQUALLY APPROVED).

REPAIR MORTAR :

" APPLY PRO-STRUCT 528VO-MC1 : STRUCTURAL CONCRETE (OR EQUALLY APPROVED) INTO THE PRE-SATURATED SURFACE.
" COVERAGE WILL BE APPROXIMATELY 1.4m² @ 10mm THICK PER 25KG BAG OF PRO-STRUCT 528VO-MC1.
" ENSURE COMPLETE SUBSTRATE CONTACT AND MAXIMUM COMPACTION.
" CURE THE REPAIRS BY KEEPING THEM DAMP FOR 24 HOURS AFTER THE INITIAL SET HAS TAKEN PLACE.

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P1	PRELIMINARY	S.A.	2021.09.14	

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		PROJECT No. 200/418	SKETCH No. SK 04

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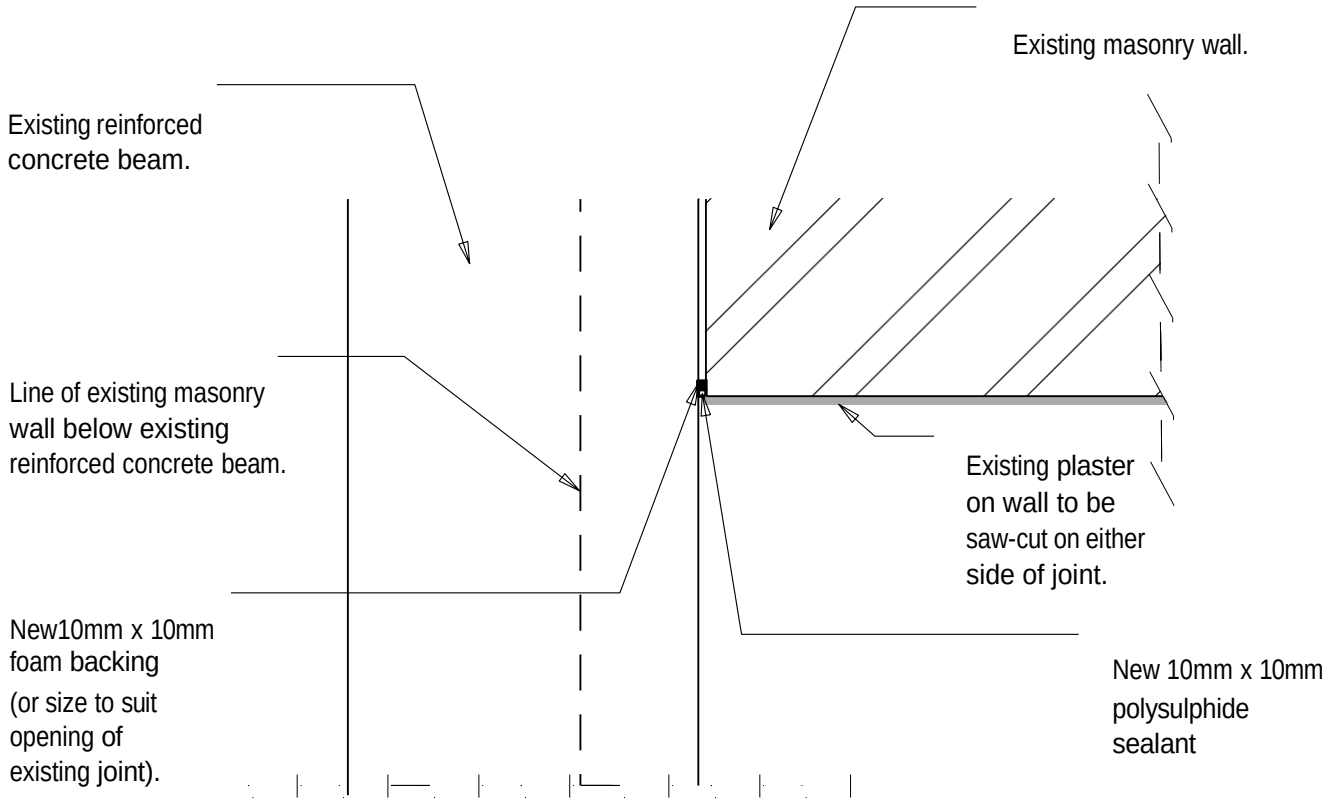
ANNEXURE: E

JOINT REPAIR BETWEEN THE EXISTING R.C. BEAM AND EXISTING MASONRY WALL



PLAN: EXISTING R.C. BEAM AND EXTERNAL MASONRY WALL

NOTE: EXISTING JOINT TO BE CLEANED OF ALL LOOSE DEBRIS APPROXIMATELY UP TO 50mm INTO JOINT. JOINT TO BE PROJECTED THROUGH THE EXISTING PLASTER.

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P1	PRELIMINARY	A.P.	2021.09.14	

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NATIONAL NUCLEAR REGULATOR: CONDITIONAL ASSESSMENT OF EXISTING HEAD OFFICE BUILDING	REPAIR SPECIFICATION FOR JOINT BETWEEN THE EXISTING R.C. BEAM AND EXTERNAL MASONRY WALLS IN THE TRANSFORMER ROOM	2021.09.14	P1
		PROJECT No. 200/418	SKETCH No. SK 05