



**COSMIC TECHNICAL SERVICES LLC**

**Date: 23<sup>RD</sup> - January - 2021**

**Report No. CTS-GSSI-21-130**

# **Report on Concrete Scanning using Ground Penetration Radar by Structural Scanner for As built Structural Details on Ground Floor Slab for Building a Mezzanine Floor on the Ground Floor Slab**

**Project: ATOLYE Office, Emirates Tower - Dubai - UAE**

**Client : KPS, DAMAC Business Tower, 12A, Dubai - UAE**

**Prepared by : Cosmic Technical Services LLC, Dubai - UAE**

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## **1. BACK GROUND AND OBJECTIVES OF THE SURVEY:**

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The investigated site (**Ground Floor level, Emirates Tower, Sheikh Zayed Road, Dubai - UAE**) is located within the boundary of Dubai City -U.A.E. According to the information received from the client, it is required to perform Scanning Concert – Ground Penetration Radar to find out location of beam, precast slab & solid slab for support columns for mezzanine floor on the ground floor slab and to clear and to avoid damage of Rebars inside the slab during 150 mm deep drilling for column fixing.

## **2. FIELD SURVEY**

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### **2.1 Equipment**

Scanning Ground Penetration Radar (SC-GPR) was performed on 20<sup>th</sup> & 21<sup>st</sup> January-2021, at the selected areas on the ground floor level slab by the client utilizing the Digital Control Unit (GSSI structure Scanner, made in USA), Fig. (2.1)



Figure 2.1 The system of GSSI-Structural Scanner



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## **2.2. GPR -Principle:**

GPR works by sending a tiny pulse of energy into a material and recording the strength and the time required for the return of any reflected signal. A series of pulses over a single area make up what is called a scan. Reflections are produced whenever the energy pulse enters the material with different electrical conduction properties or dielectric permittivity from the material it left. The strength, or amplitude, of the reflection is determined by the contrast in the dielectric constants and conductivities of the two materials. This means that a pulse which moves from dry sand (dielectric of 5) to wet sand (dielectric of 30) will produce a very strong reflection, while moving from dry sand (5) to limestone (7) will produce a relatively weak reflection.

While some of the GPR energy pulse is reflected to the antenna, energy also keeps traveling through the material until it either dissipates (attenuates) or the GPR control unit has closed its time window. The rate of signal attenuation varies widely and is dependent on the properties of the material through which the pulse is passing.

## **2.3 SC-GPR - Data Collection:**

The field work (SC-GPR) was performed according to the following typical procedures:

1. Initially, the system GSSI structure Scanner was set-up and operated in accordance with the manufactures instructions.
2. When the setup was ready and power supply to the instrument is switched on, another internal setup such as project type, scanning purpose, depth window, and dielectric constant of the concrete type.
3. After completion, the instrument set up the test will be ready to start, by pushing the function Key under Run/Setup to begin collecting a profile of data, and at the end of the profile, the Run/Setup key is pushed and held down, to stop data collection.
4. The profile will be saved and can be viewed by the field Engineer utilizing playback mode.

5. Collect the data for each profile as a separate file, without resetting the gains or do anything to cause the system to re-initialize the gains.

### **3. DATA ANALYSIS AND PROCESSING**

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A primary goal of GPR data processing and analysis is to extract information from the collected GPR signals and to presented in a meaningful form or clear image for the subsurface conditions. In most cases the information, collected with GPR, will be transferred for processing utilizing appropriate software, to remove the strong clutter bands from rails and produce clear image for the subsurface conditions. For this project ***COSMIC TECHNICAL SERVICES LLC, DUBAI*** utilized RADAN 7 from the United States of America (USA). The software built in the system allows our geophysical engineer/expert to process and analysis the acquired data directly.




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#### **4. CALIBRATION CERTIFICATE OF STRUCTURESCAN MINI -XT**



دکوتینانت (ش.ذ.م.م)


### **CALIBRATION CERTIFICATE**

**Certificate No:-** 68/20  
**Product Type:-** StructureScan XT  
**Serial No:-** 0489

Categ+A1:G26ory	Parameter	Min	Max	Measurement	Unit	Result
Use Test Procedure	Y-12-257			489		
Mini Type:	StructureScan MiniXT					
Firmware Revisions	Serial Number	0	9999	489	Functional	PASS
	Program Version	1.4.5	1.4.5	1.4.5	Functional	PASS
	Radar Version	3.0.0.73	3.0.0.73	3.0.0.73	Functional	PASS
	Antenna Version	2.0.5.7	2.0.5.7	2.0.5.7	Functional	PASS
	Boot Version	2.0.1.0	2.0.1.0	2.0.1.0	Functional	PASS
Shipping Configuration	Use T-11-403 MiniXT Licensing Tool					
	Date and Time Correct		Functional	PASS	Functional	PASS
	Time Zone	-5	-4	-4	GMT	PASS
	System Name	489	489	489	Functional	PASS
	License Type	CE	MAX	MAX	Functional	PASS
	Language Setting	English	English	ENGLISH	Functional	PASS
	Battery Removed		Functional	PASS	Functional	PASS
	Clean and No Scratches		Minor	PASS	Functional	PASS
	MiniXT Splash Screen		Functional	PASS	Functional	PASS
	Product Labels		Functional	PASS	Functional	PASS
OVERALL	PASS			14		
	FAIL			0		
	INCOMPLETE			0		
	RESULT			14		PASS
OnPassPromoteToPN	FGSSMINXT					
testVer	6/21/2018 1/29/2020 13:26					

**Specification No:-** Test Version 6/18  
**Date of Service:-** 29<sup>th</sup> January 2020  
**Re-Service** 12 Months  
**due:-** 28<sup>th</sup> January 2021

Signature



**Nishil Kumar, Service Engineer**

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## 5. RESULTS AND CONCLUSION

### 5.1 Image of Beams & Slab Layout of Ground Floor Level

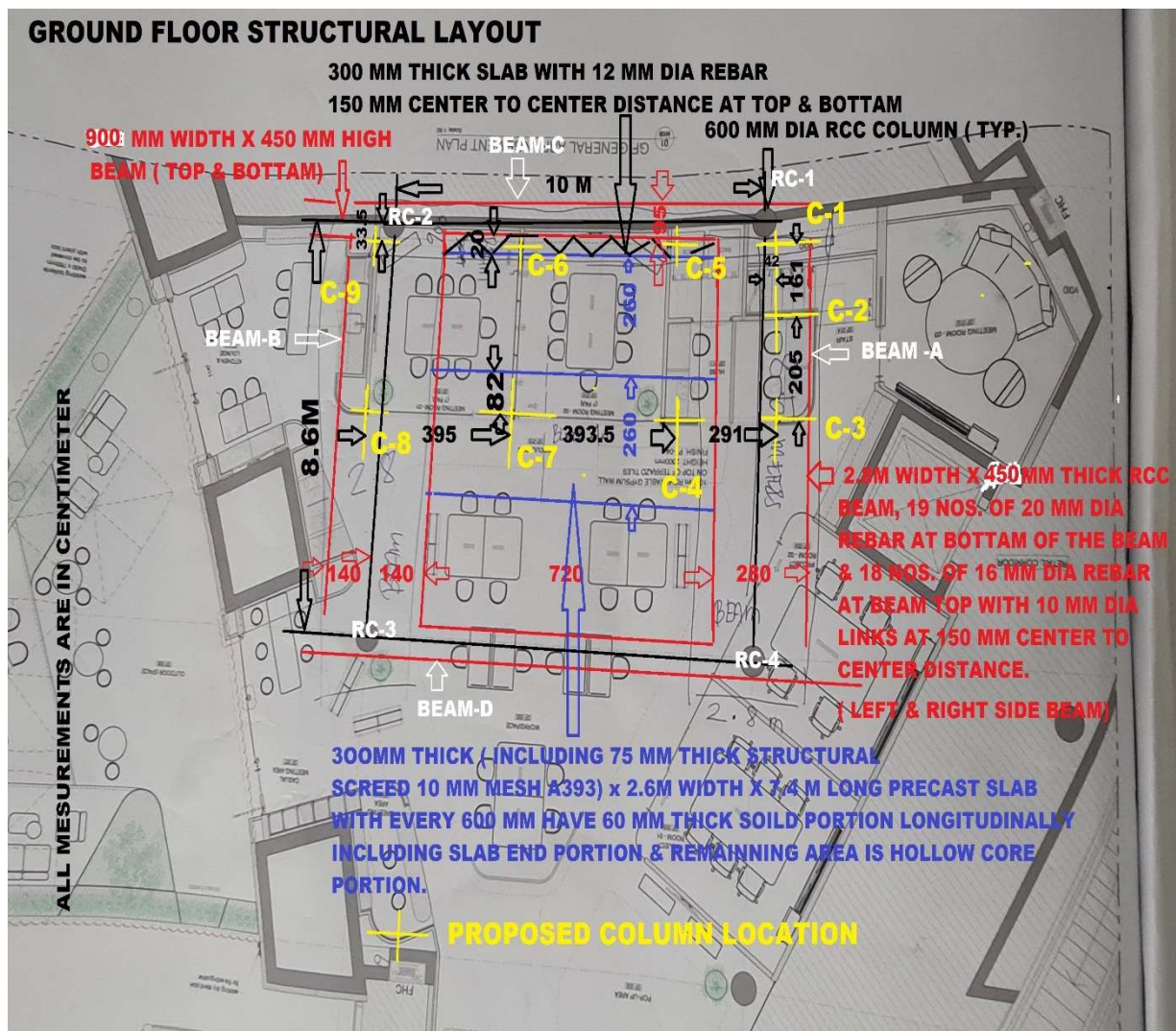


Figure 5.1: Beams, Precast Slab, Solid Slab & Proposed column locations layout of Ground floor level



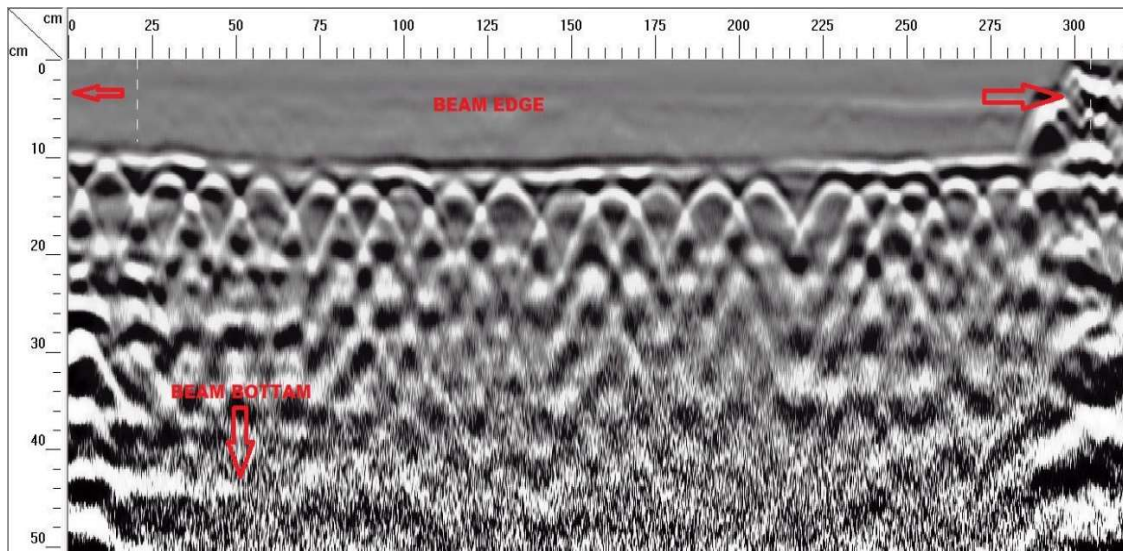
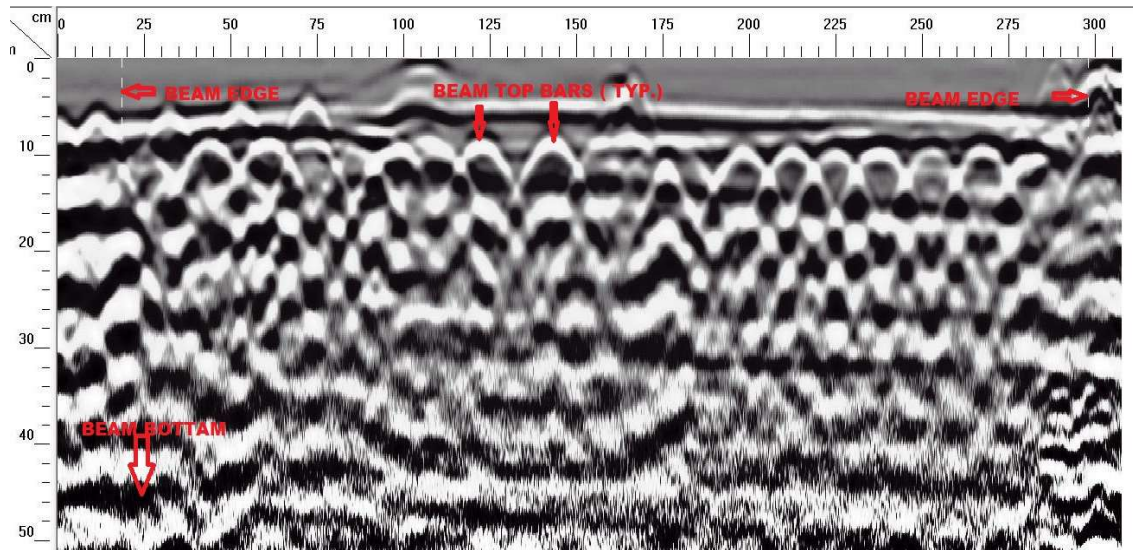


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## **5.2 GPR Images of Beam Top**



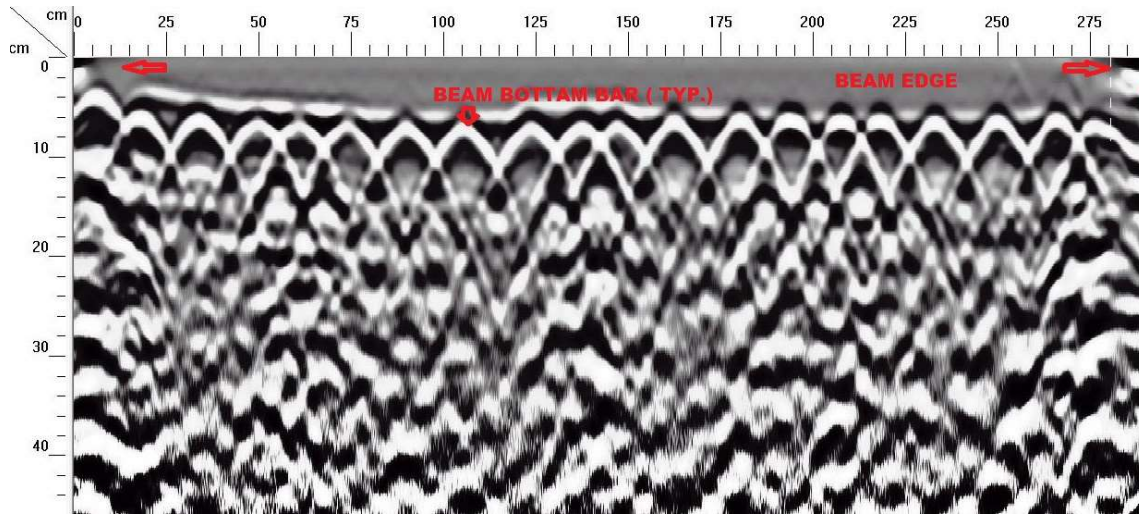
**5.2: layout of ground floor beam top images**



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### **5.3 GPR Images of beam bottom**



**Figure 5.3: GPR Image of beam bottom**



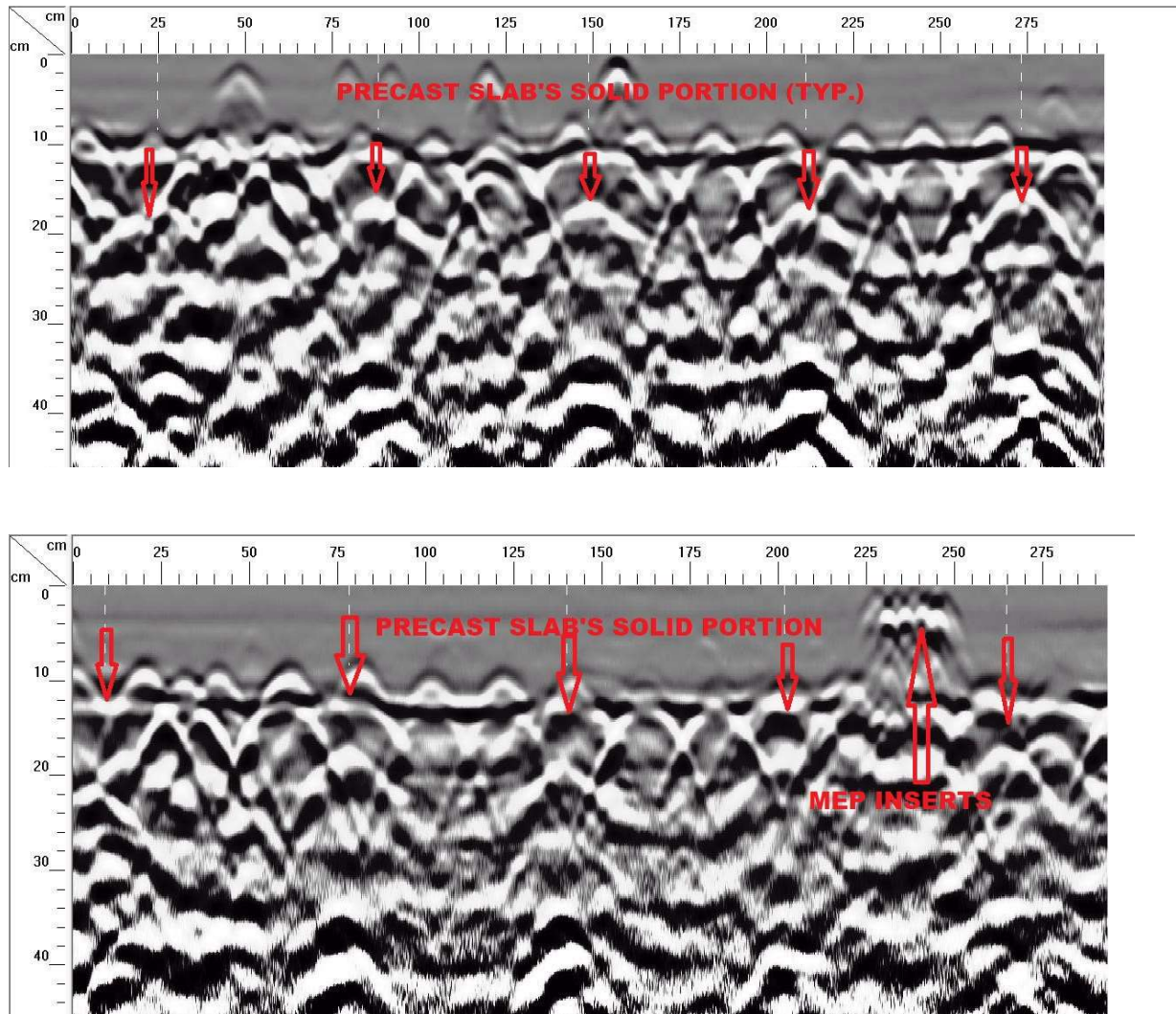


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### **5.4 GPR Images From Precast Slab's Top**



**Figure 5.4: GPR Images From Top of the Precast Slab**

### 5.5 GPR Images From Precast Slab's Bottom

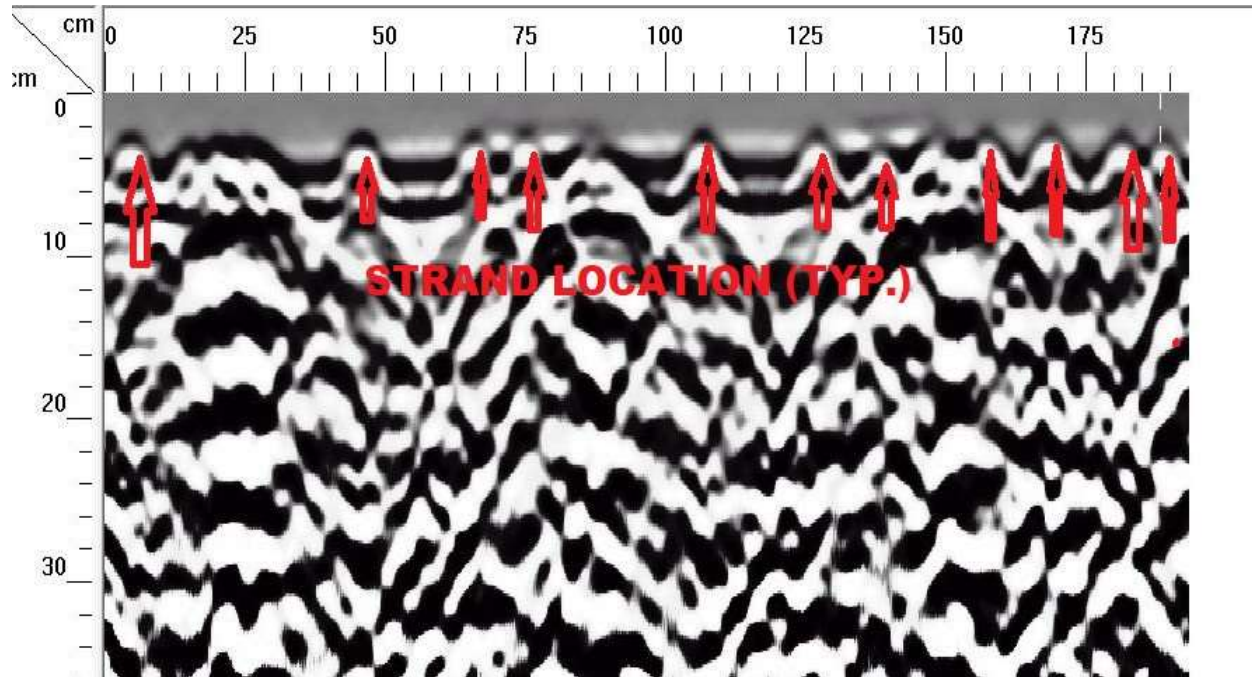


Figure 5.5: Precast slab's Strand location at slab bottom level



## **5.6 Findings and Interpretations**

Based on the results of SC-GPR survey, the five locations of the proposed columns ( C-1,C-2,C-3,C-8 & C-9 See Figure 5.1) are on 2.8 m width x 450 mm x 8.6 m span length beam ( Beam-A & Beam-B ). The beam is supported by the 600 mm dia. RCC Columns. The four 600 mm dia. circular columns with sides 2.8m x 0.450m deep beam ( Beam-A & Beam- B) and the other has sides of 900 mm width x 450 mm depth beam( Beam-C & Beam-D, See Figure 5-1). For the 2.8m x 0.450m deep (Beam-A), we found 19 nos. of 20 dia. rebar at the bottom of the beam & 18 nos. of 16 mm dia. rebar at top of the beam with 100 – 150 mm center to center distance spacing links.

The other two columns are ( C-6 & C-5) proposed on 300 mm thick solid slab with 12mm dia. rebar spacing at a distance of 150 mm in both directions, top and bottom. The long side is parallelly connected to the 900 mm width x 450 mm thick beam and the short side is supported by the 600 mm dia. RCC columns.

The C-7 & C-4 columns location are on 300 mm thick precast slab including 75 mm thick structural screed with A393 welded mesh. The precast size is 2.6m width x 300 mm thick x 7.4 m long and is placed on the nib of the 2.8 m width beam ( Beam -A & Beam- B). The scanning from the top of the slab shows that, at every 600 mm a 60 mm thick solid portion and remaining area is hollow. Due to the restriction, the below floor scanning concert was not done.



### 5.7 Image on Column Location-1

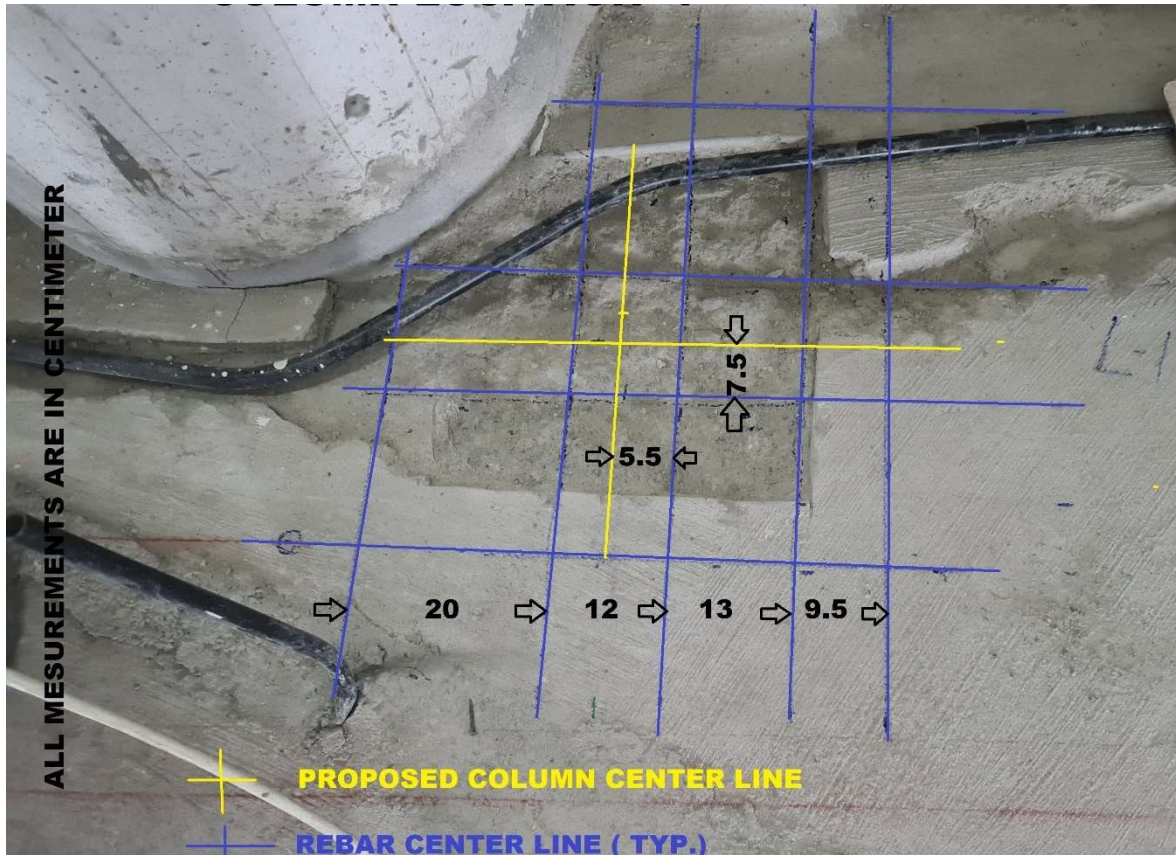
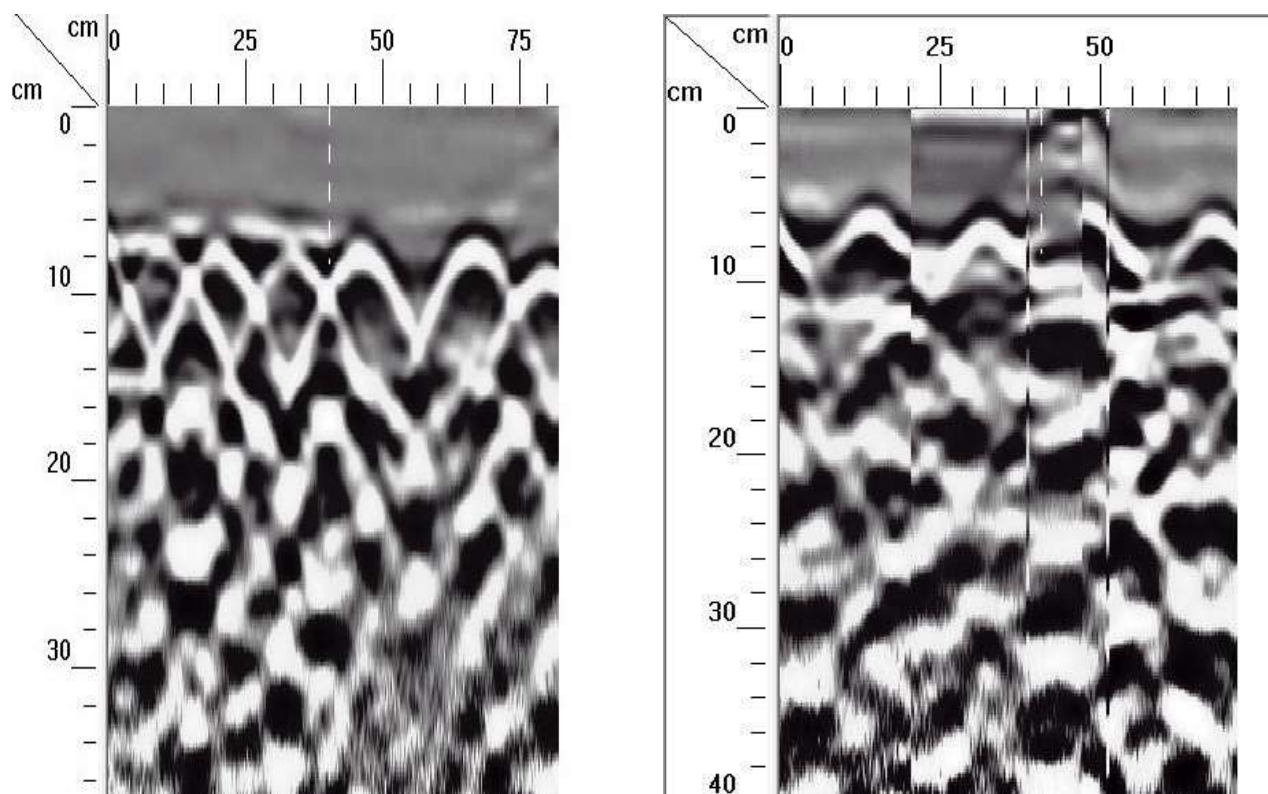


Figure 5.6: Rebar & Proposed column location -1 Layout



### **5.8 GPR Images on Column Location-1**



**Figure 5.7: GPR Images of Column location -1**



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## **5.9 Recommendations and Suggestions**

Based on the results of SC-GPR survey, the proposed column location -1 on the 2.8m width x 450 mm beam ( Beam-A) is very near to the 600 mm dia. circular column. The column location is 420 mm from the center of the beam-A towards right side & 335 mm from the column center line ( Column RC-1 & RC-2 ) downwards ( See Figure 5.1). The rebar center line and proposed column center line is physically marked on the floor ( See Figure 5.6). From the center of the rebar, 25 mm plus half of the dia. of the hole will be safe drilling location in all directions. However this subject to structural Engineers approval for final drilling location.

### 5.10 Image on Column Location-2

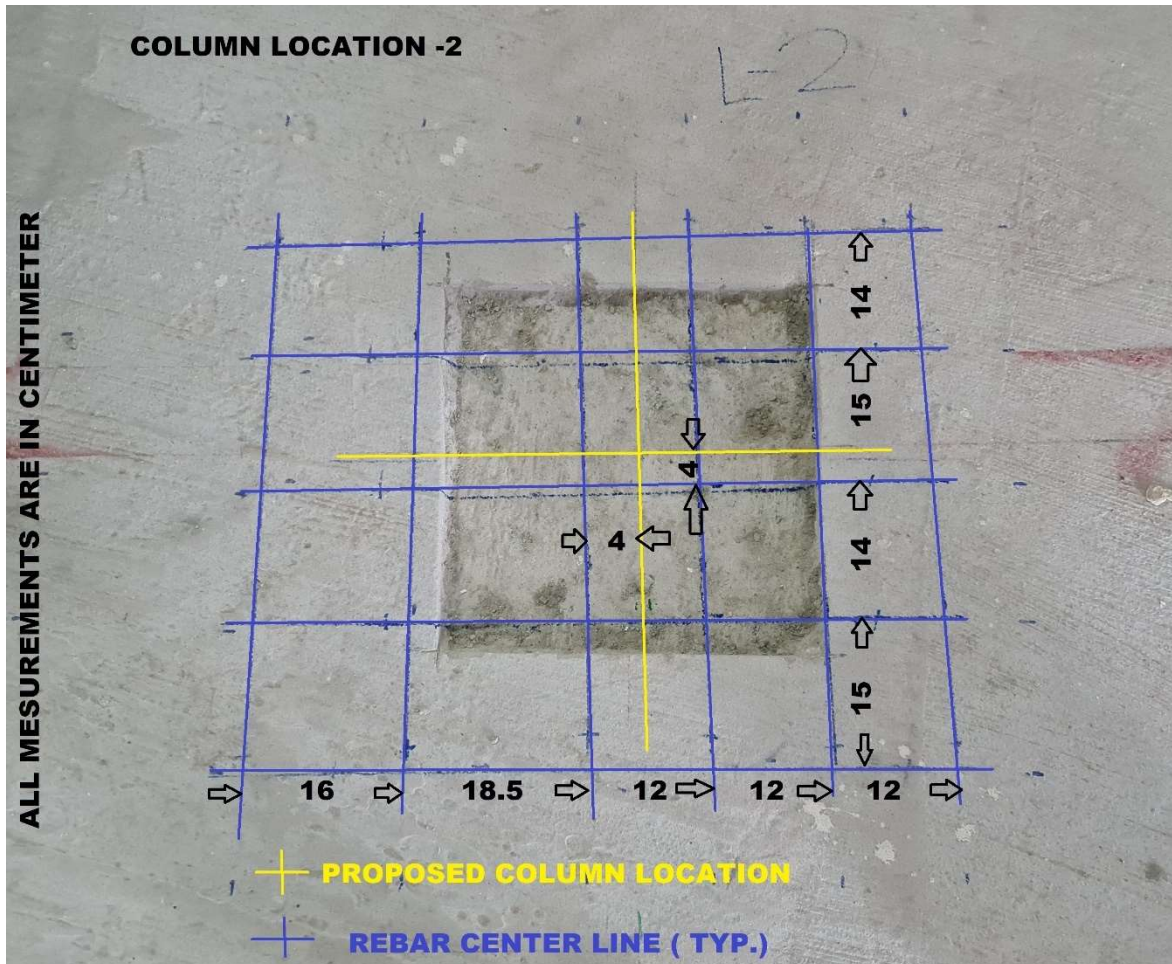
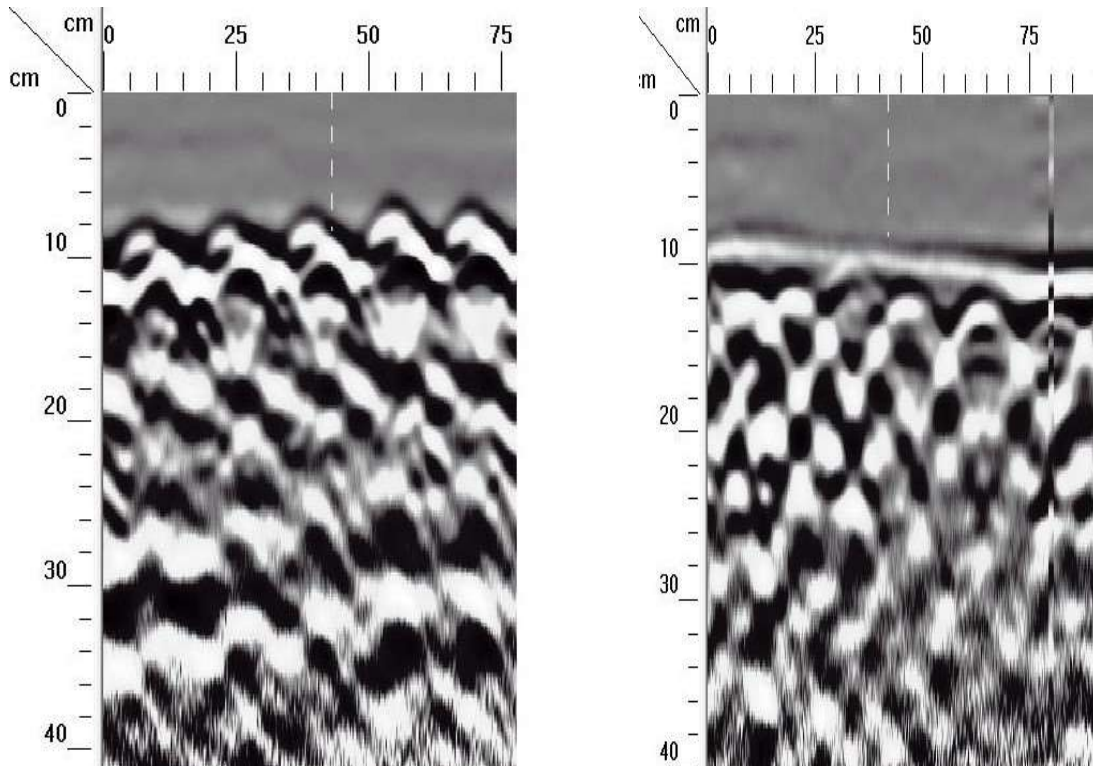


Figure 5.8: Rebar & Proposed column location -2 Layout

### **5.11 GPR Images on Column Location-2**



**Figure 5.9 : GPR Images of Column location -2**



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### **5.12 Recommendations and Suggestions**

Based on the results of SC-GPR survey, the proposed column location -2 on the 2.8m width x 450 mm beam ( Beam-A). The column location is 420 mm from the center of the beam towards right side & 1945 mm from the column center line downwards (Column RC-1 & RC-2 See Figure 5.1). The rebar center line and proposed column center line is physically marked on the floor ( See Figure 5.8). From the center of the rebar, 25 mm plus half of the dia. of the hole will be safe drilling location in all directions. However this subject to structural Engineers approval for final drilling location.



### 5.13 Image on Column Location-3

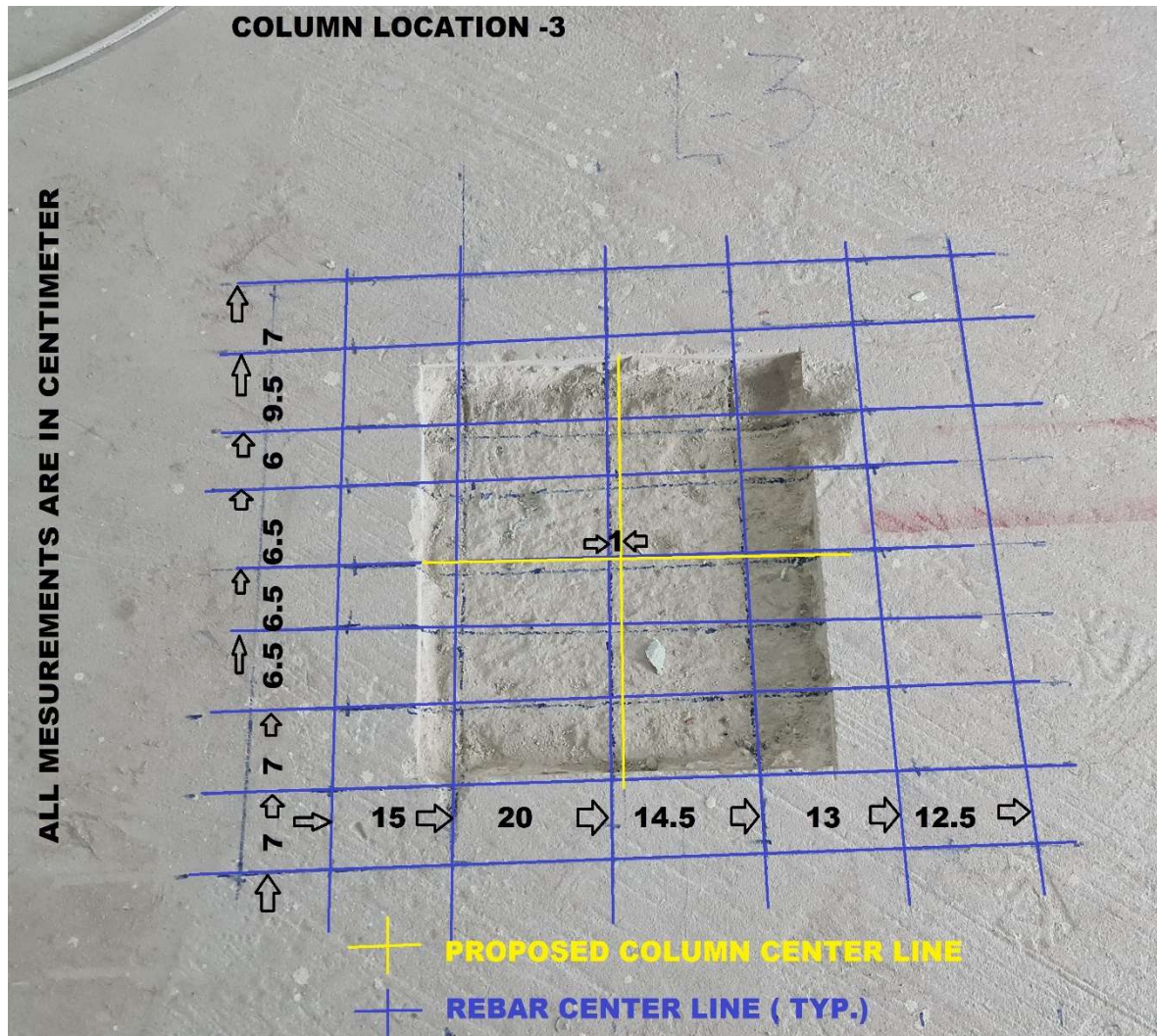
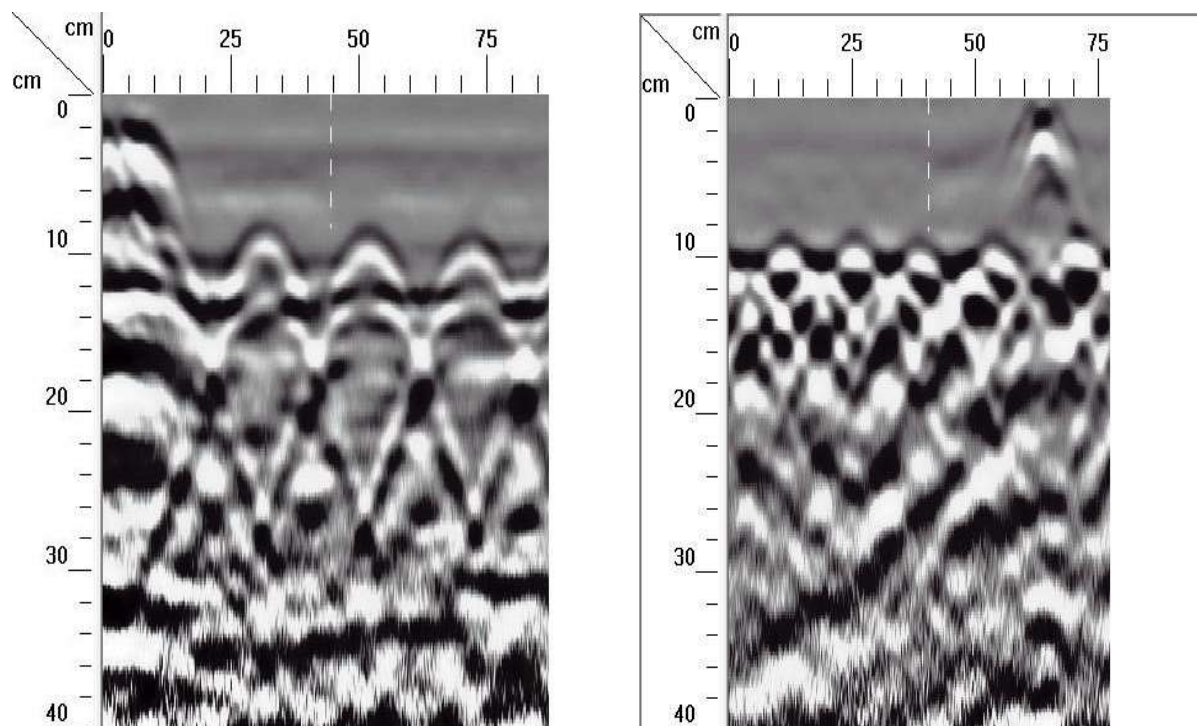


Figure 5.10: Rebar & Proposed column location -3 Layout



### **5.14 GPR Images on Column Location-3**



**Figure 5.11 : GPR Images of Column location -3**



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### **5.15 Recommendations and Suggestions**

Based on the results of SC-GPR survey, the proposed column location -3 on the 2.8m width x 450 mm beam ( Beam- A). The column location is 420 mm from the center of the beam towards right side & 3995 mm from the column center line downwards ( See Figure 5.1). The rebar center line and proposed column center line is physically marked on the floor ( See Figure 5.10). From the center of the rebar, 25 mm plus half of the dia. of the hole will be safe drilling location in all directions. However this subject to structural Engineers approval for final drilling location.

#### 5.16 Image on Column Location-4

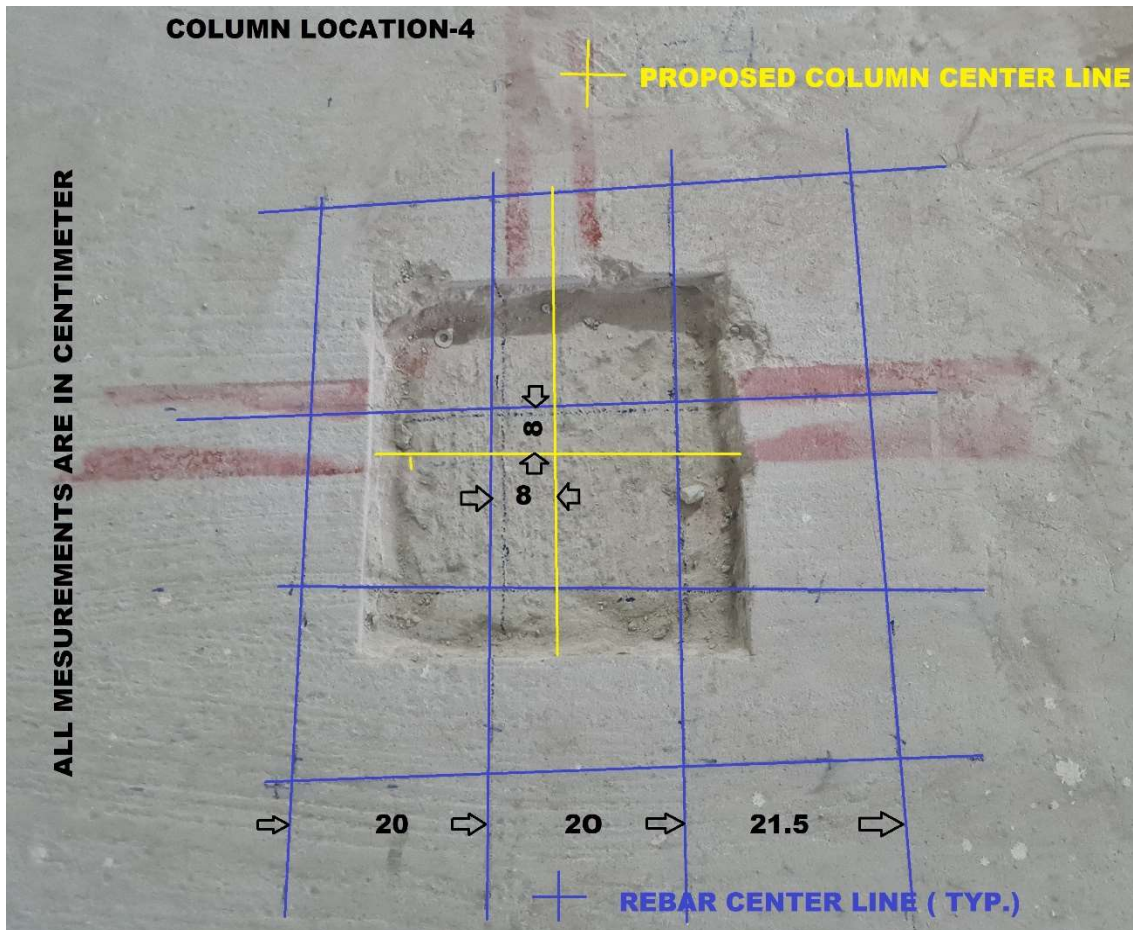
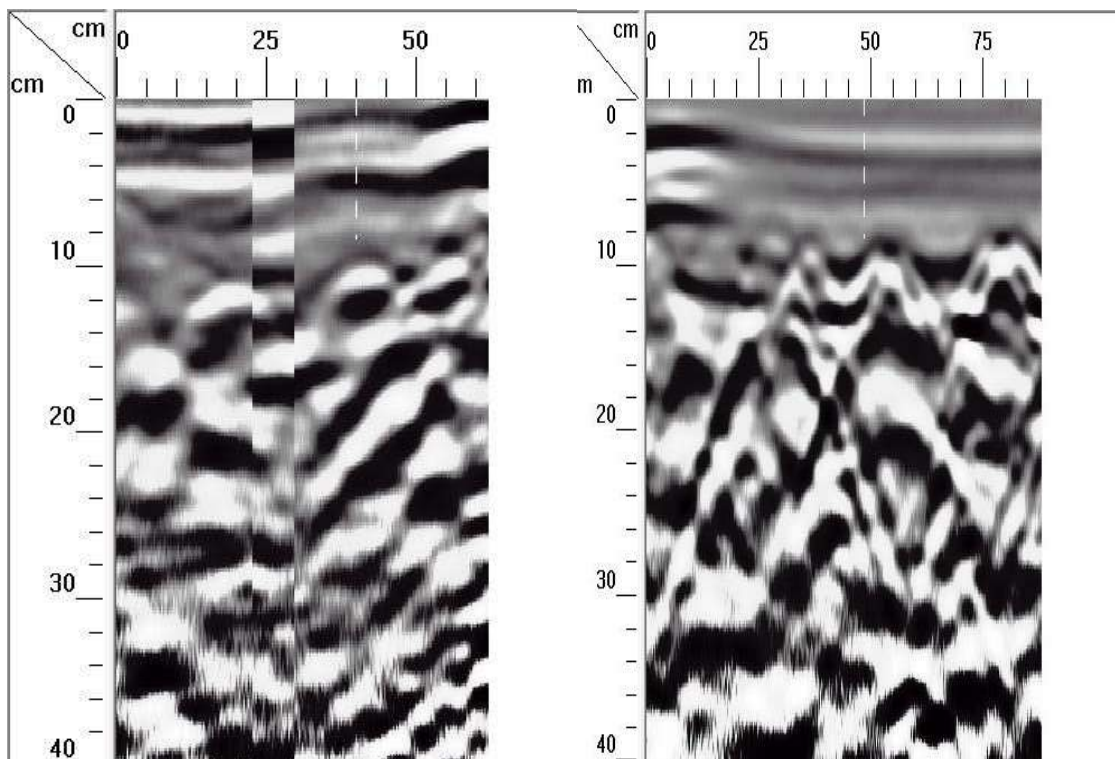


Figure 5.12: Rebar & Proposed column location -4 Layout

### **5.17 GPR Images on Column Location-4**



**Figure 5.13: GPR Images of Column location -4**



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### **5.18 Recommendations and Suggestions**

Based on the results of SC-GPR survey, the proposed column location -4 on the 2.6m width x 300 mm thick precast slab. The column location is 2490 mm from the center of the beam (Beam-A) towards left side & 3995 mm from the RC-1 & RC-2 center line downwards ( See Figure 5.1). The rebar center line and proposed column center line is physically marked on the floor ( See Figure 5.12). From the center of the rebar, 25 mm plus half of the dia. of the hole will be safe drilling location in all directions. However this subject to structural Engineers approval for final drilling location.



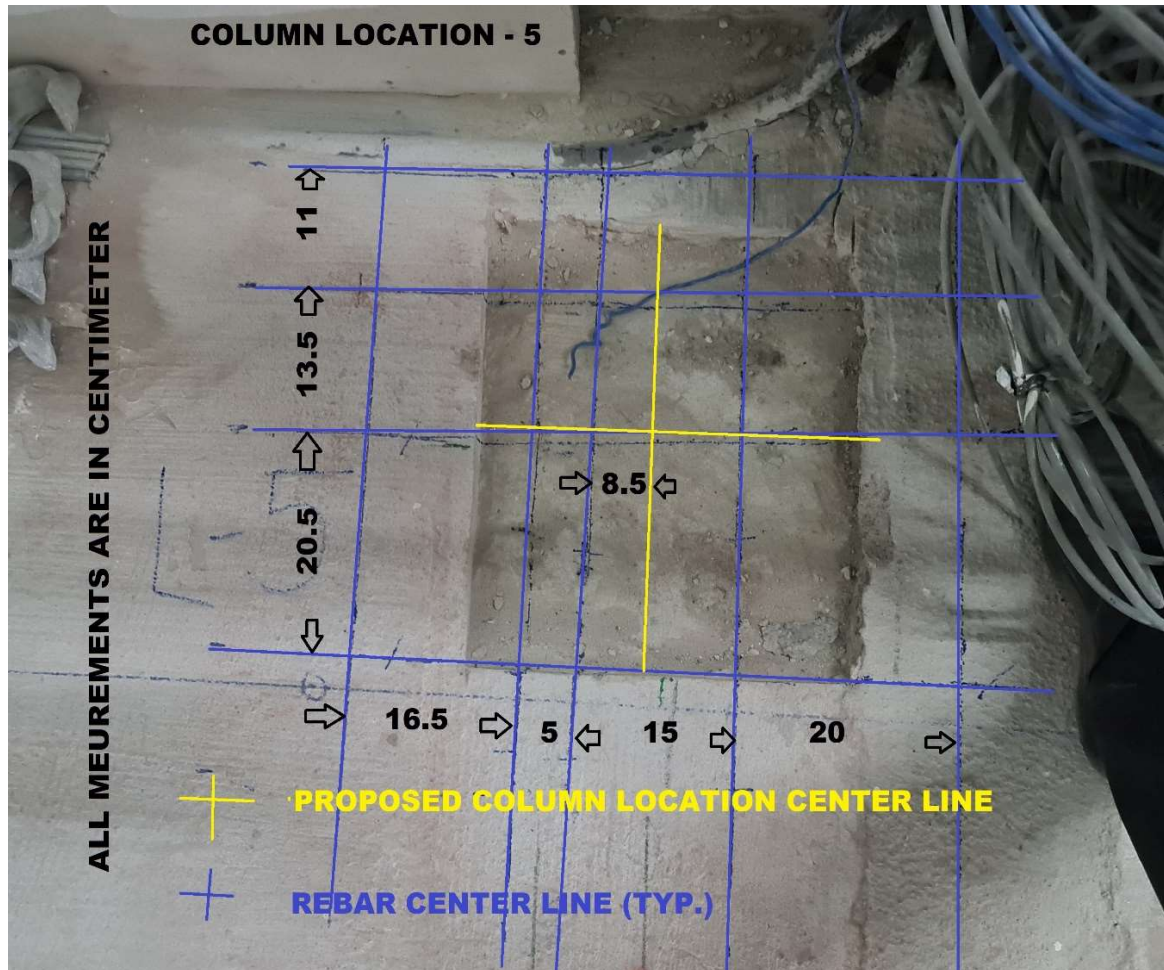


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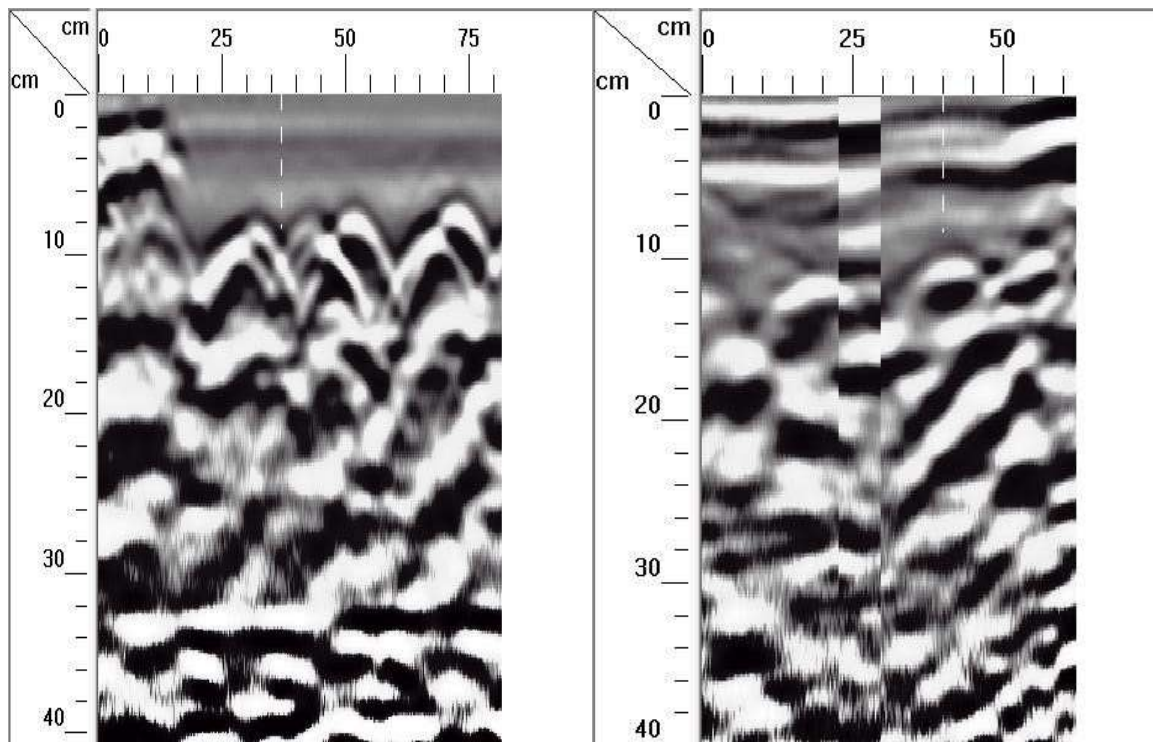
### 5.19 Image on Column Location-5



**Figure 5.14: Rebar & Proposed column location -5 Layout**



## 5.20 GPR Images on Column Location-5



**Figure 5.15: GPR Images of Column location -5**



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### **5.21 Recommendations and Suggestions**

Based on the results of SC-GPR survey, the proposed column location -5 on the 300 mm thick solid slab ( Parallel to column RC-1 & RC-2. The column location is 2490 mm from the center of the beam (Beam-A) towards left side & 335 mm from the RC-1 & RC-2 center line downwards ( See Figure 5.1). The rebar center line and proposed column center line is physically marked on the floor ( See Figure 5.14). From the center of the rebar, 25 mm plus half of the dia. of the hole will be safe drilling location in all directions. However this subject to structural Engineers approval for final drilling location.



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## 5.22 Image on Column Location-6

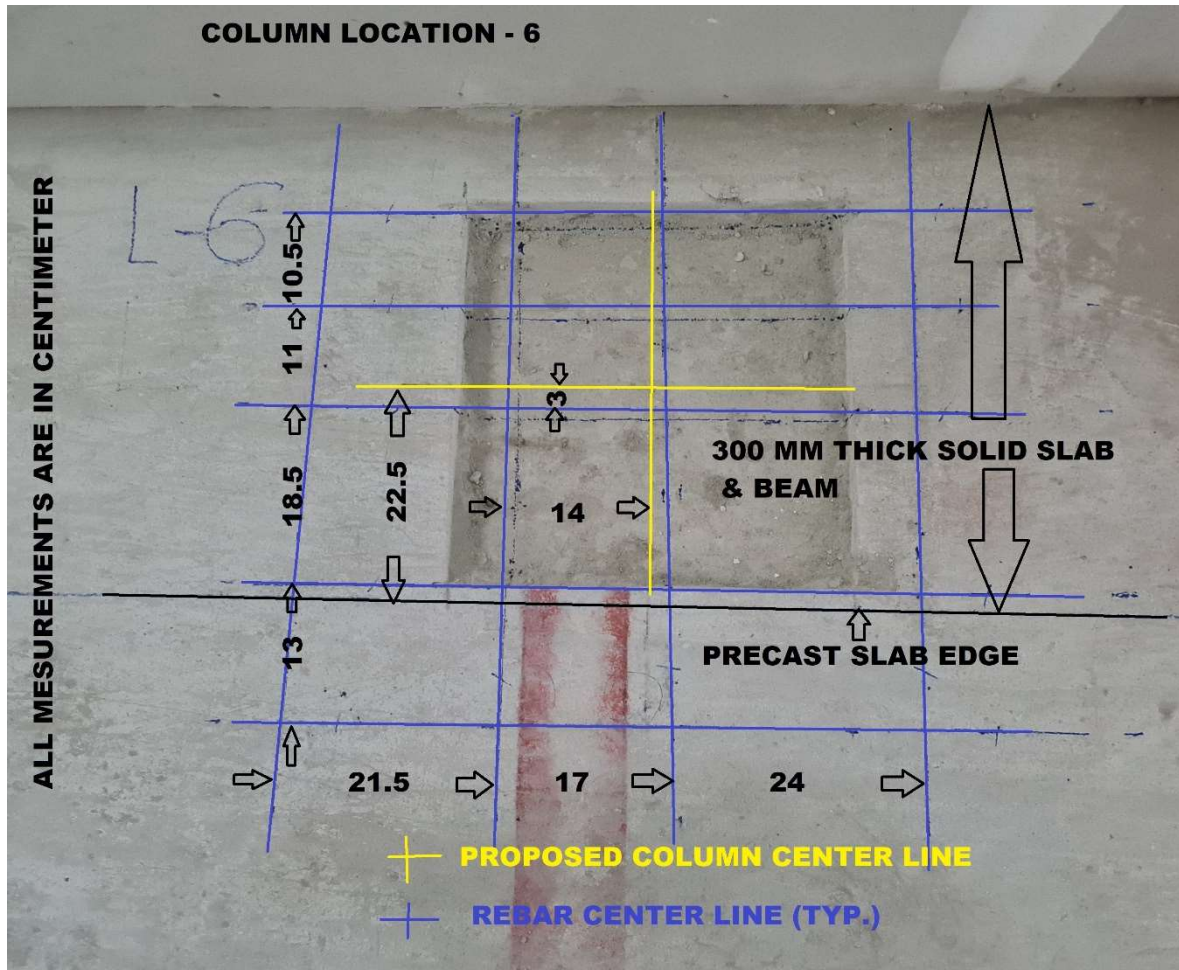
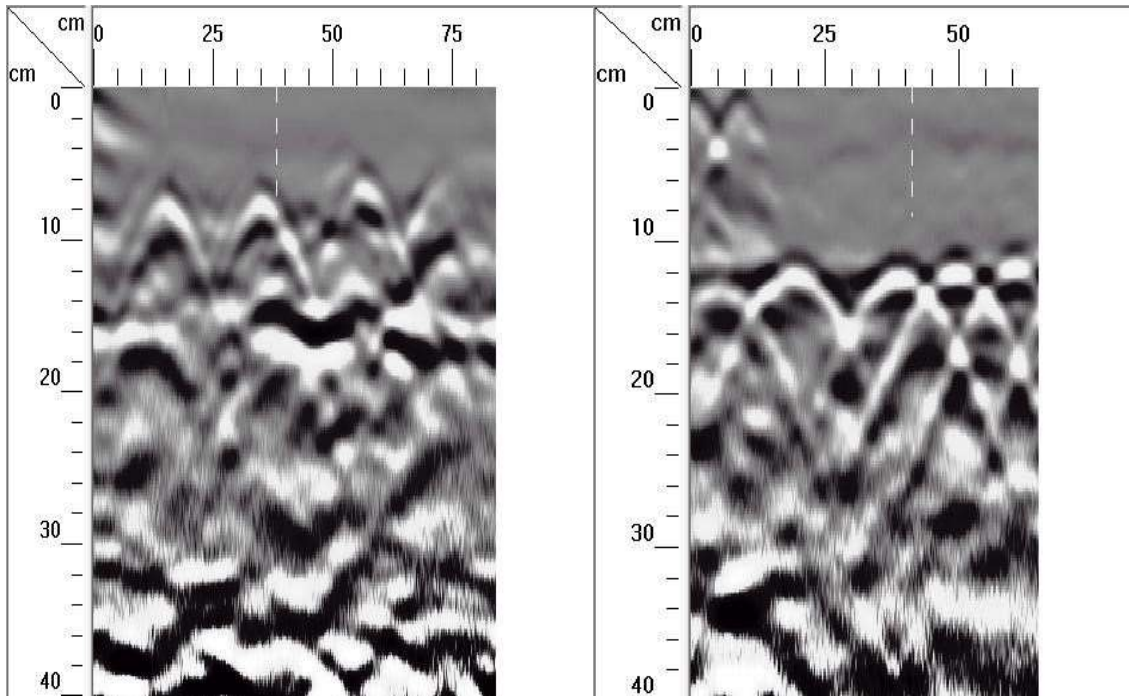


Figure 5.16: Rebar & Proposed column location -6 Layout

### **5.23 GPR Images on Column Location-6**



**Figure 5.17: GPR Images of Column location -6**



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## **5.24 Recommendations and Suggestions**

Based on the results of SC-GPR survey, the proposed column location -6 on the 300 mm thick solid slab ( Parallel to column RC-1 & RC-2. The column location is 3950 mm from the center of the beam (Beam-B) towards right side & 335 mm from the RC-1 & RC-2 center line downwards ( See Figure 5.1). The rebar center line and proposed column center line is physically marked on the floor ( See Figure 5.16). From the center of the rebar, 25 mm plus half of the dia. of the hole will be safe drilling location in all directions. However this subject to structural Engineers approval for final drilling location.



### 5.25 Image on Column Location-7

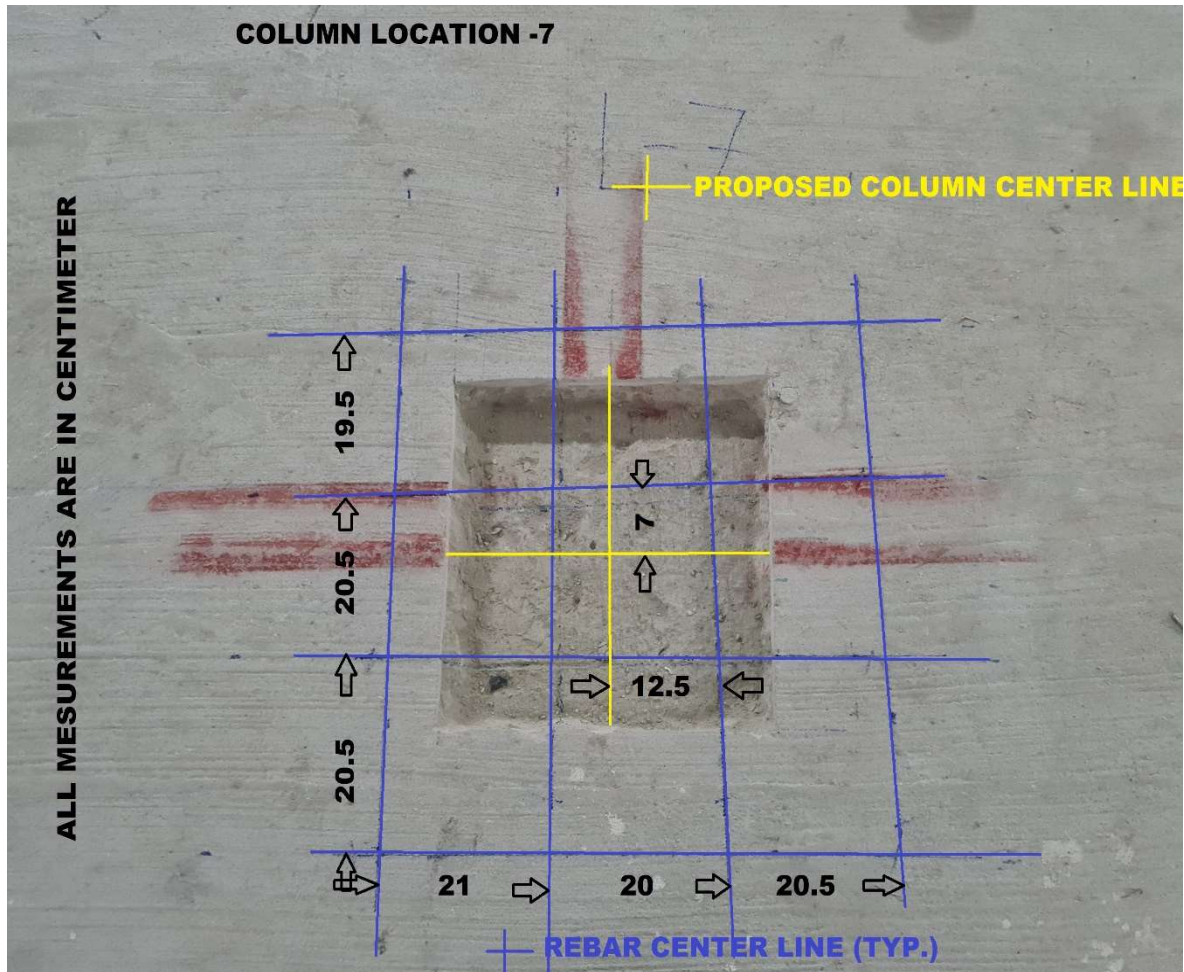


Figure 5.18: Rebar & Proposed column location -7 Layout

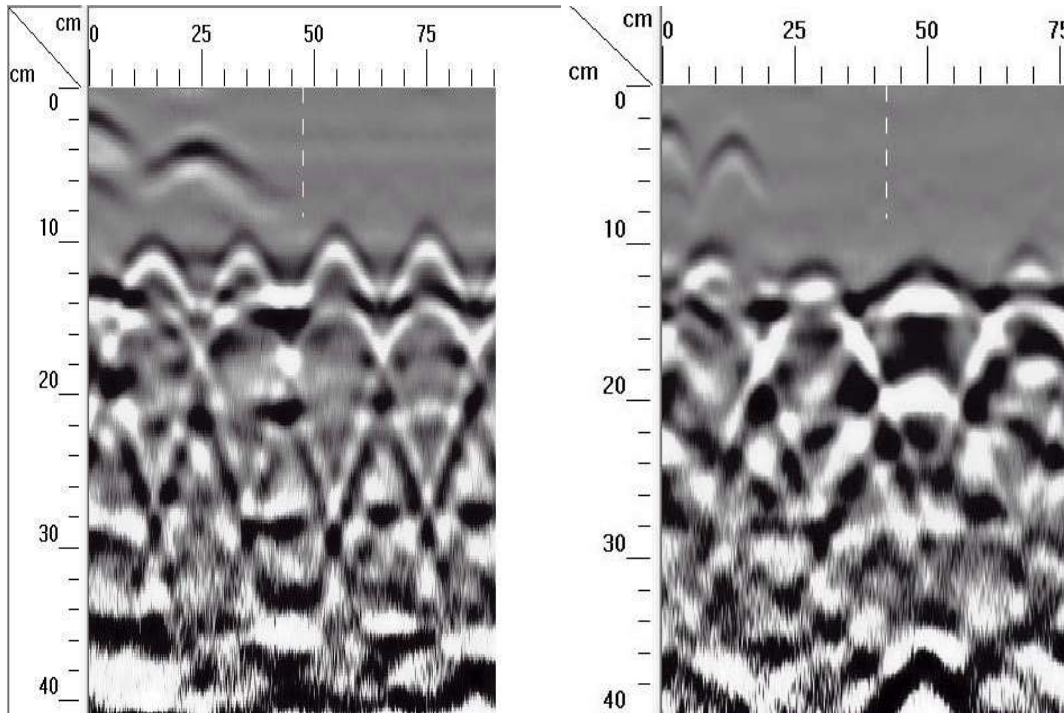




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### **5.26 GPR Images on Column Location-7**



**Figure 5.19: GPR Images of Column location -7**



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### **5.27 Recommendations and Suggestions**

Based on the results of SC-GPR survey, the proposed column location -7 on the 2.6m width x 300 mm thick precast slab. The column location is 2490 mm from the center of the beam(Beam-A) towards left side & 3950 mm from the RC-1 & RC-2 center line downwards ( See Figure 5.1). The rebar center line and proposed column center line is physically marked on the floor ( See Figure 5.18). From the center of the rebar, 25 mm plus half of the dia. of the hole will be safe drilling location in all directions. However this subject to structural Engineers approval for final drilling location.

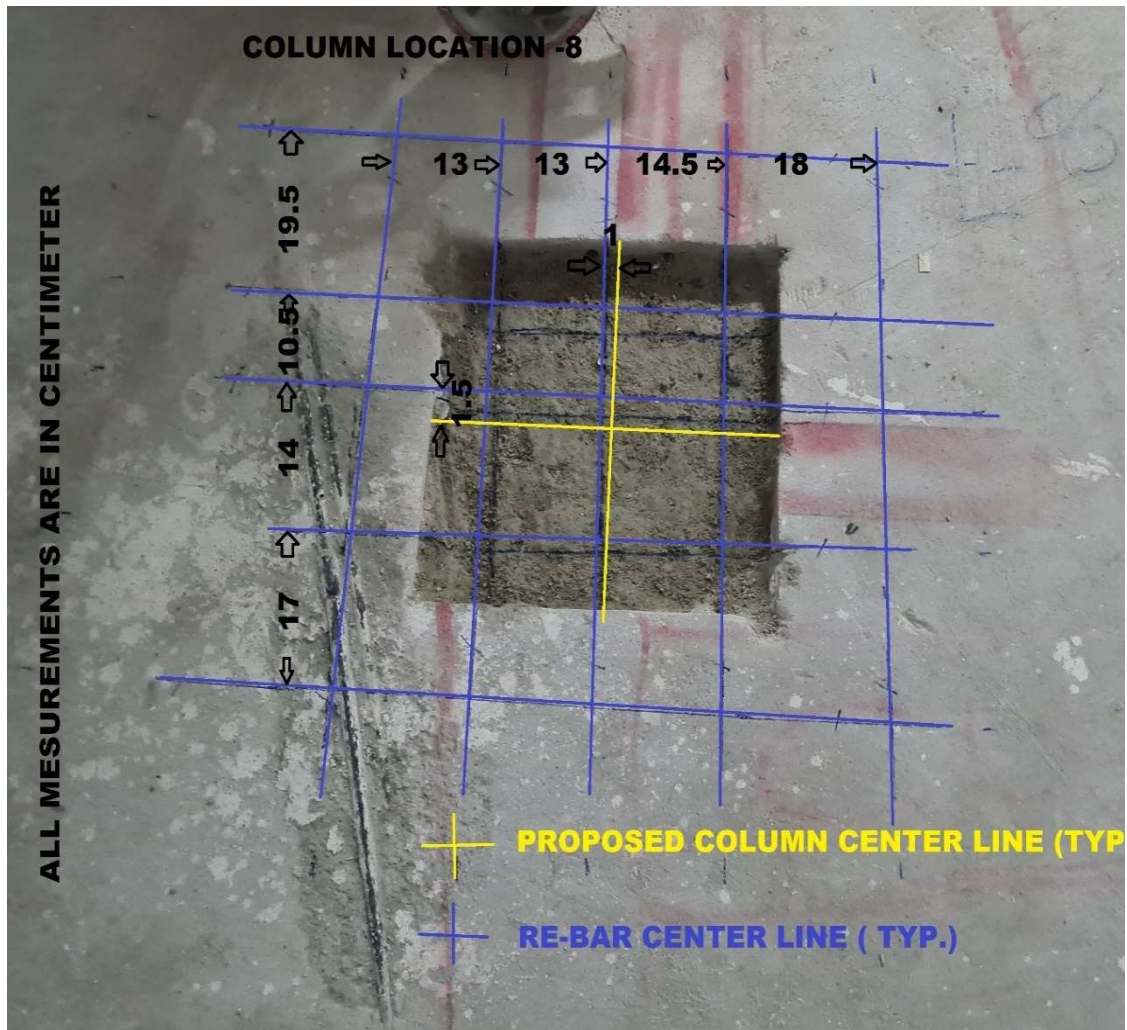


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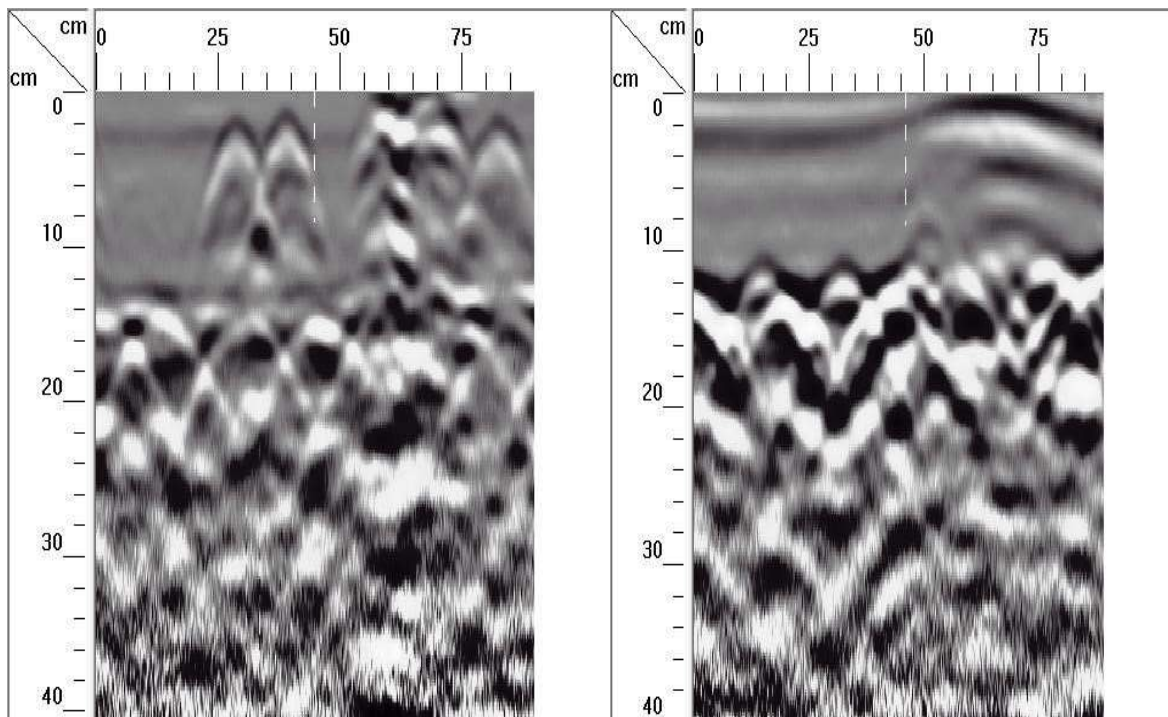
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### 5.28 Image on Column Location-8



**Figure 5.20: Rebar & Proposed column location -8 Layout**

### 5.29 GPR Images on Column Location-8



**Figure 5.21: GPR Images of Column location -8**





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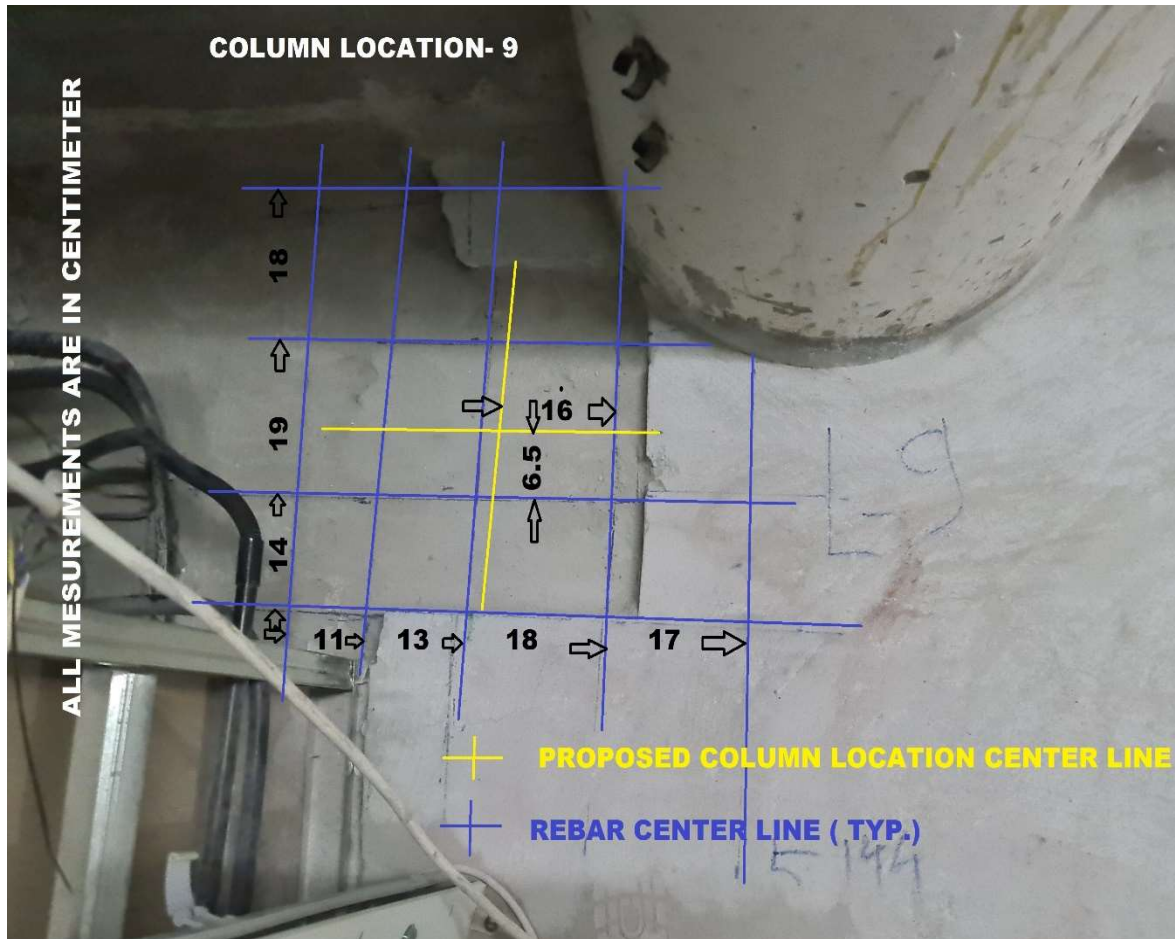
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### **5.30 Recommendations and Suggestions**

Based on the results of SC-GPR survey, the proposed column location -8 on the 2.8m width x 450 mm beam ( Beam-B) is very near to the 600 mm dia. circular column. The column location is 400 mm from the center of the column ( RC-2) towards left side & 335 mm from the column center line ( RC2 & RC-1 ) downwards ( See Figure 5.1). The rebar center line and proposed column center line is physically marked on the floor ( See Figure 5.20). From the center of the rebar, 25 mm plus half of the dia. of the hole will be safe drilling location in all directions. However this subject to structural Engineers approval for final drilling location.



### 5.31 Image on column location-9



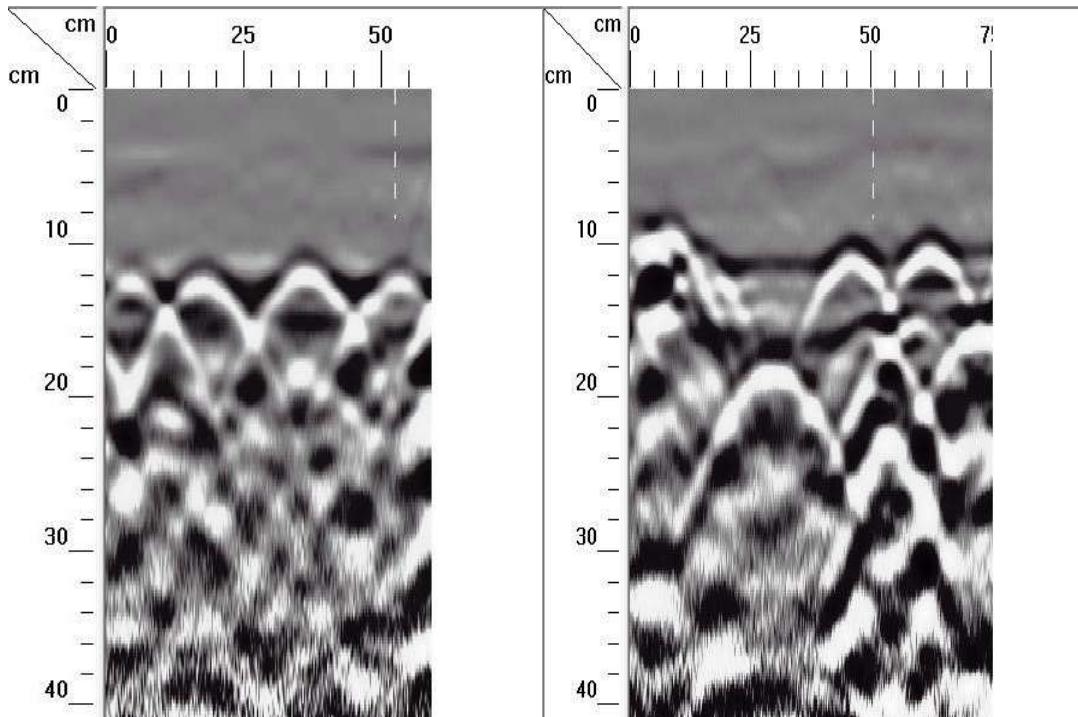
**Figure 5.22: Rebar & Proposed column location -9 Layout**



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### **5.32 GPR Images on Column Location-9**



**Figure 5.23: GPR Images of Column location -9**



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### **5.33 Recommendations and Suggestions**

Based on the results of SC-GPR survey, the proposed column location -9 on the 2.8m width x 450 mm beam ( Beam- B). The column location is 400 mm from the center of the beam towards left side & 3995 mm from the column center line ( RC-1 & RC-2 ) downwards ( See Figure 5.1). The rebar center line and proposed column center line is physically marked on the floor ( See Figure 5.22). From the center of the rebar, 25 mm plus half of the dia. of the hole will be safe drilling location in all directions. However this subject to structural Engineers approval for final drilling location.



## **6. COMPLIANCE STATEMENT**

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- The statements of fact presented in the report are correct to the best of surveyor's knowledge.
- The analysis & conclusions are limited by the observations shown by the GPR Scanner.

## **7. CONCLUSION**

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We hope that the above mentioned report meets your requirement for the safe coring works. Any clarification on the report, contact the undersigned.

Yours faithfully,



**Raj**

**Scanning Manager**

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Surveyed and Prepared by **Engineer Harisree**