

# **Additional Technical Documents**

## **BOOK VOLUME I OF I**

### **PROJECT:**

## **REMODELATION OF THE CARIBE PLAZA OFFICE BUILDING FOR 9-1-1 FACILITIES**

URBANIZACIÓN MARIO DÁVILA CINTRÓN, BARRIO MONACILLOS, SECTOR EL CINCO RIO PIEDRAS CARRETERA  
ESTATAL PR-8838, EXTENSIÓN DE LA AVENIDA PONCE DE LEÓN # 1547 PUERTO RICO

### **OWNER:**

## **DEPARTAMENTO DE SEGURIDAD PÚBLICA- NEGOCIADO DE SISTEMA DE EMERGENCIAS 9-1-1**

235 AVE. ARTERIAL HOSTOS, CAPITAL CENTER, TORRE NORTE HATO REY, PR 00918



**GOBIERNO DE PUERTO RICO**  
DEPARTAMENTO DE SEGURIDAD PÚBLICA  
Negociado de Sistema de Emergencias 9-1-1



**BID NO.: 23J-12467**  
**JULY 19, 2023**  
**ADDENDUM 06**



## Additional Technical Documents

- GMTS - Geotechnical Report – Bldg. Seismic Profiling.
  - GMTS - Structural Investigation.
- Doris J. Quiñones-Rivera, MSCE, PE / Structural Engineering Consultant  
**Structural Assessment Report for Existing Parking Garage Building.**
- Doris J. Quiñones-Rivera, MSCE, PE / Structural Engineering Consultant  
**Structural Seismic Evaluation of Existing Building.**

**BID NO.: 23J-12467**  
**JULY 19, 2023**  
**ADDENDUM 06**

**TECHNICAL REPORT No. 1**

**GEOTECHNICAL SEISMIC PROFILING STUDY for  
911 EMERGENCY BUILDING  
SAN JUAN, PUERTO RICO**

**PROJECT No. G221554A**

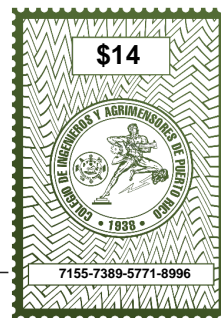


COLEGIO DE INGENIEROS Y AGRIMENSORES  
DE PUERTO RICO

PO Box 363845 San Juan Puerto Rico 00936-3845  
Tel. 787.758.2250 #205 · practica@ciapr.org

**ESTAMPILLA DIGITAL ESPECIAL (EDE)**

Ing. Manuel E. Ochoa Lavergne, PE



Práctica de: Ingeniería  
Licencia: 22275  
Renglón: Servicio Profesional  
Descripción del Trabajo: Realización de Estudios de Ingeniería  
Fecha de Emisión: 06/01/2022  
Monto Emitido: \$14  
Número de Serie: 7155-7389-5771-8996  
Número de Caso: G221554A  
Proyecto / Unidad: 911 EMERGENCY BUILDING  
Rol del Profesional: Consultor

SELLO PROFESIONAL

**Certificación:**

El profesional certifica con la emisión de la estampilla digital especial del Colegio de Ingenieros y Agrimensores de Puerto Rico el haber cumplido con las disposiciones de la Sección 11 de la Ley 319 del 15 de mayo de 1938, según enmendada.

*La colocación del sello profesional constituye la cancelación de la estampilla digital especial*

RENOVACIÓN APROBADA: 19 de enero, 2019

RENEWAL APPROVED ON: January 19, 2019



Gobierno de Puerto Rico  
Government of Puerto Rico

DEPARTAMENTO DE ESTADO  
Department of State

Secretaría Auxiliar de Juntas Examinadoras  
Office of the Assistant Secretary of State for Examining Boards

La Junta Examinadora de Ingenieros y Agrimensores  
The Examining Board of Engineers and Land Surveyors

por la presente certifica que  
hereby certifies that

**Manuel Enrique Ochoa Lavergne**

habiendo cumplido todos los requisitos de Ley, se ha inscrito en el Registro de esta Junta como  
having met all the requirements of law, has been registered as:

**Ingeniero Licenciado**  
Licensed Engineer

En testimonio de lo cual, se expide esta licencia para el ejercicio de dicha profesión, bajo el sello de la Junta Examinadora.  
In testimony whereof, this license is issued to practice this profession, under the seal of the Board of Examiners.

En San Juan, Puerto Rico, efectivo 12 de enero de 2019  
In San Juan, Puerto Rico, effective January 12, 2019.

Número de Licencia: 22275  
License Number

Vencimiento: 11 de enero de 2024  
Expires: January 11, 2024



  
Presidente

  
Directora  
Director



## TECHNICAL REPORT No. 1

June 1, 2022

**Re: GEOTECHNICAL SEISMIC PROFILING STUDY at  
911 EMERGENCY BUILDING  
SAN JUAN, PUERTO RICO  
PROJECT No. G211554A**

As requested, this technical letter presents the factual findings of the **Geotechnical Seismic Profiling Study** performed at the above referenced project. The work was performed in general accordance with **Proposal Pg-22041**, dated April 20, 2022, and approved on May 2, 2022.

### 1. PROJECT DESCRIPTION & SCOPE OF WORK

Based on the information provided to this office, the proposed project considers the structural evaluation of an existing building for the new 911 Emergency facilities in San Juan, PR. **Figure 1 (Site Location Map)** shows the location of the site. As part of the structure evaluation, geotechnical seismic profiling is required. Furthermore, lateral capacity of existing piles was requested with analytical methods (no load testing). No other information and/or requirements have been provided at the time of this report.

The scope of work performed included a site reconnaissance, a subsurface exploration program with soil borings, structural investigation at selected areas by structural engineer, laboratory testing of secured samples, data evaluation, and the preparation of reports. Geotechnical investigation was performed in general accordance with **Section 1803 (Geotechnical Investigation)** of **IBC<sup>1</sup>** (as referenced in the prevailing **PRBC<sup>2</sup>**). This report presents the results of the geotechnical investigation. Findings of the structural investigation shall be presented under separate cover.

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<sup>1</sup> PRBC = Puerto Rico Building Code

<sup>2</sup> IBC = International Building Code

## 2. GENERAL GEOLOGY

According to the **GEOLOGIC MAP OF THE SAN JUAN QUADRANGLE, PUERTO RICO**, the area is mainly underlain by **Guaynabo Formation (Kg)**. This map was prepared by Messrs. M.H. Pease, Jr, and W.H. Monroe, and published by the *United States Geological Survey (USGS)* in 1977. **Figure 2 (Geologic Map)** shows the geologic setting of the project site, including full geologic unit description.

Furthermore, various faults have been identified in close proximity to the site, the closest about 90 meters to the east of the project site. The technical definition of a fault is a fracture or surface zone in which difference in geologic units has been observed due to relative displacement. It should be noted that although faults are generally represented in maps with single lines, they usually are not single, clean fractures but rather a zone of fracturing patterns. There are active faults (generally associated with tectonic movements, or likelihood of producing an earthquake) and inactive faults (those that we can identify but are not expected to produce earthquakes). Faults in Puerto Rico are common due to its origin and geologic evolution. The fact that a fault is present does not necessarily mean that the fault is active. However, it should also be noted that fault activity is generally related to geologic eras.

However, the closest system of faults to site is what is known as **Great Northern Puerto Rico Fault zone (GNPRfz)**, estimated anywhere from about 5 to 9 miles. The **GNPRfz** system of faults is considered active and estimated to be capable of producing earthquakes of up to M6.5. **Figure 3 (Puerto Rico Inner Fault Zones)** shows Puerto Rico's inner faults systems.

## 3. SOIL BORING DATA

The subsoil exploration program consisted of **two (2) soil borings** to depths in the range of about 51 to 55 feet below existing grade elevation, in accessible areas around the general structure perimeter.

The borings were drilled using a CME55 drill rig, advanced with hollow stem augers in accordance with ASTM D6151. Samples were obtained using the "Standard Penetration Test" (SPT), as specified in ASTM D1586, with an automatic SPT hammer. Samples were generally secured continuously within the uppermost 10 feet at selected locations, and at 5-foot intervals thereafter (or from ground surface at all other locations) to the completion depths. Field logging was performed in general accordance with ASTM D5434. The location of the borings drilled are shown in **Figure 4 (Boring Location Plan)**.

The samples secured were tested for:

- a. visual-manual classification procedure, as per ASTM D2488,
- b. natural moisture content, as per ASTM D2216, and
- c. compressive strength values with spring tester and/or soil pocket penetrometer.

The borings drilled disclosed cohesive deposits, within zones of interbedded higher granular content. General soil profile technical information as follows:

- Sample Description: silty clay / clayey silt / sandy silt
- SPT N-Values: 7 to over 50 bpf<sup>3</sup>
- Unconfined Compressive Strength,  $q_u$ <sup>4</sup>: 0.5 to over 4 tsf<sup>5</sup> (stiff to hard)
- Natural Moisture Content: about 5 to 35 percent

The water level was detected at depths of **about 25 feet**, during drilling operations at the time of fieldwork. The reader should be aware that ground water levels, although not expected at site, might fluctuate due to seasonal variations, precipitation, construction activities, and/or other factors not evident at the time of measurement. **Accurate phreatic levels, especially in fine-grained soils, could only be measured by monitoring observation wells until the water table is stabilized.** This is beyond the scope of this work. The undersigned will not be held responsible for assumptions made by others based on phreatic surface information provided in this document.

For a detailed description of soils found at site, please refer to boring logs included in **Appendix 2**. **All depths mentioned in this report, unless otherwise specified, are referred to the exiting ground elevation prevailing during the period of our fieldwork.** It should be noted that the boring logs indicate the SPT N-Values as sampled, without any corrections for hammer efficiency or other correction factors. Also, logs show only the subsurface conditions on the date and locations indicated. Subsoil changes may occur within short distances.

For a detailed description of the procedures followed for the drilling of the soil borings and laboratory testing, please refer to **Appendix 3**. All drilling, logging, and laboratory procedures followed the corresponding ASTM standard(s).

#### 4. SEISMIC SOIL PROFILE CLASSIFICATION

Based on the data recovered at site, an average soil profile was determined at each location. **Table 1** present the average soil profiles determined.

**Table 1: Seismic Soil Profile at Boring Locations**

Boring Location	Based on N-Values	Based on $S_u$
B1	D	D
B2	D	C
<b>General Avg.</b>	<b>D</b>	<b>C</b>

The average soil profiles were determined per the prevailing **IBC, Puerto Rico Building Code (PRBC)**, and **ASCE 7**.

<sup>3</sup> bpf = blows per foot

<sup>4</sup>  $q_u$  = unconfined compressive strength

<sup>5</sup> tsf = tons per square foot

As indicated, the site lies within 5 to 9 miles of what is known as **Great Northern Puerto Rico Fault zone (GNPRfz)**. The **GNPRfz** system of faults is considered active and estimated to be capable of producing earthquakes of up to M6.5. It should be noted that near-fault sites are considered as sites within 9.5 miles of a fault capable of producing  $M > 7$ , and 6.25 miles for faults capable of  $7 > M > 6$ . Hence, this may be considered a near-fault site. In any case, a **site-specific fault and/or seismic study was beyond the scope of the work**.

## 5. LATERAL CAPACITY EVALUATION

As requested, we have performed an evaluation of lateral capacity of existing piles, for estimation of current capacity of foundations at site. We have performed lateral analyses using **LPILE, A Program for the Analysis of Piles and Drilled Shafts under Lateral Loads** (by ENSoft). The analyses performed considered pile top deflections of  $\frac{1}{4}$ " and  $\frac{1}{2}$ " under free-head conditions. We considered concrete with  $f'_c$  of 3 ksi (per available drawings), with 100% pile stiffness (*i.e.* full EI), and 70% of pile stiffness (*i.e.* 0.7EI) to model potential cracked conditions. Pile embedment is unknown and was considered to at least 50 feet based on disclosed soil conditions. No p-delta effects were considered. We considered group effects based on pile configuration, per available drawings, for individual piles ( $P_m=1$ ), leading/first row piles ( $P_m=0.8$ ), second row ( $P_m=0.4$ ), and third row ( $P_m=0.3$ ).

The results of our evaluation are presented in **Appendix 4**.

Our recommendations are provided for soil-pile interaction, based on analytical methods. The structural designer of the project should verify the structural performance of the piles under the working conditions (*i.e.* structural capacity, buckling, etc.), per the prevailing PRBC and IBC codes. This is beyond the scope of this work.

## 6. CLOSING

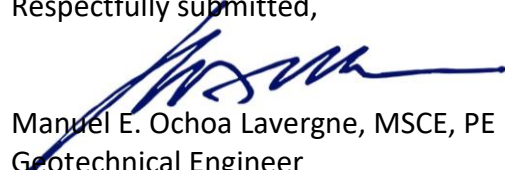
The undersigned states that his professional services are in accordance with the generally accepted principles, professional practice, and standard of care in the field of Geotechnical Engineering. The conclusions and recommendations presented in this report are the result of the professional evaluation made by this firm of the stratigraphic properties of soils, as obtained from the **soil borings and geophysical soundings performed** at site. Interpretation and judgment based on these data may differ from actual conditions, since variations in the nature and behavior of subsurface materials may occur within short distances.

This document has been prepared specifically for **BERSA GROUP, PSC** for the evaluation of subsoil conditions at the **911 Emergency Building** facilities in the municipality of San Juan, Puerto Rico. **This report should not be used by any other entity or for a different project, even at this site, without the express written consent of GMTS, PSC.**



We appreciate the opportunity to be of service and look forward to working with you again in the future. If you have any questions, please contact the undersigned at your convenience.

Respectfully submitted,

  
Manuel E. Ochoa Lavergne, MSCE, PE  
Geotechnical Engineer

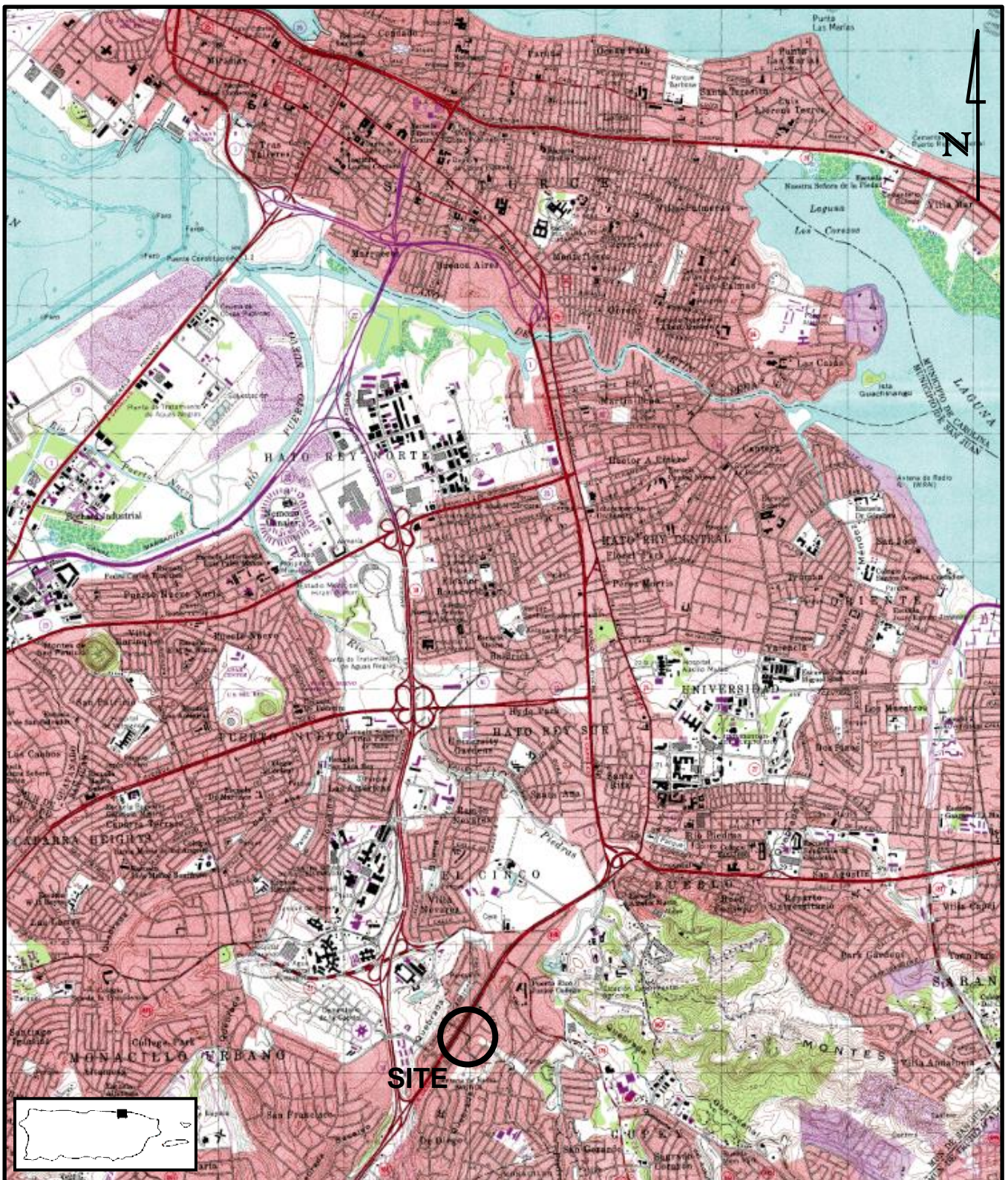
**Enclosures:**      Appendix 1 - Figures  
                         Appendix 2 - Soil Boring Logs  
                         Appendix 3 - Field and Laboratory Testing Procedures  
                         Appendix 4 - LPILE Output charts



## **APPENDIX 1**

### **FIGURES**





**FIGURE 1 – SITE LOCATION MAP**  
**911 EMERGENCY BUILDING**  
**SAN JUAN, PUERTO RICO**

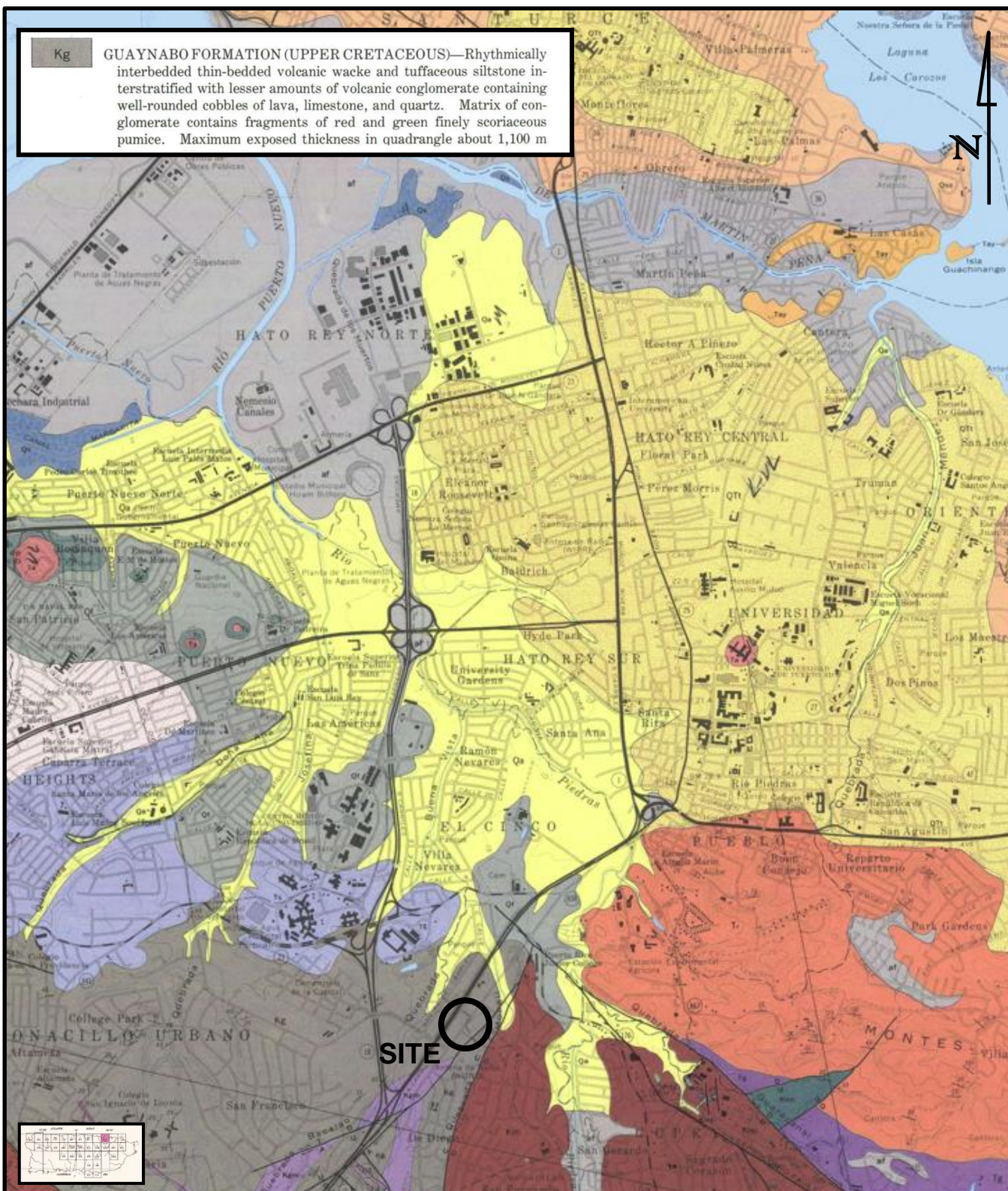
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Dwg. by: LRS

Rev. by: MOL

Project: G221554





**FIGURE 2 – GEOLOGIC MAP  
911 EMERGENCY BUILDING  
SAN JUAN, PUERTO RICO**

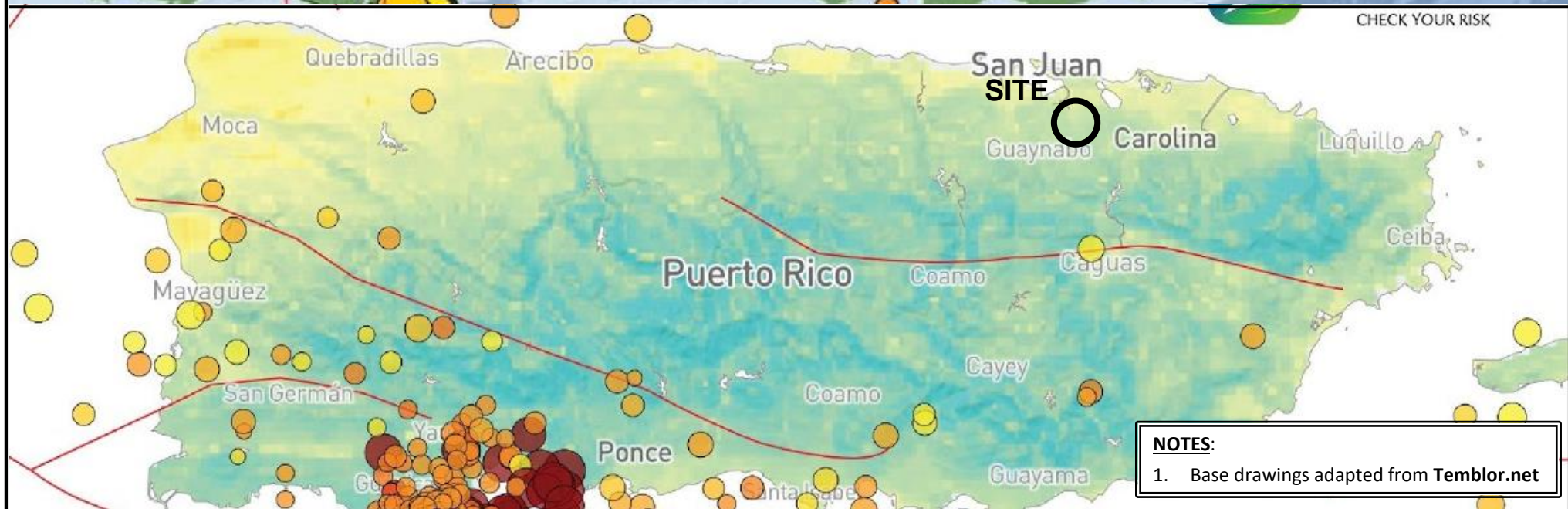
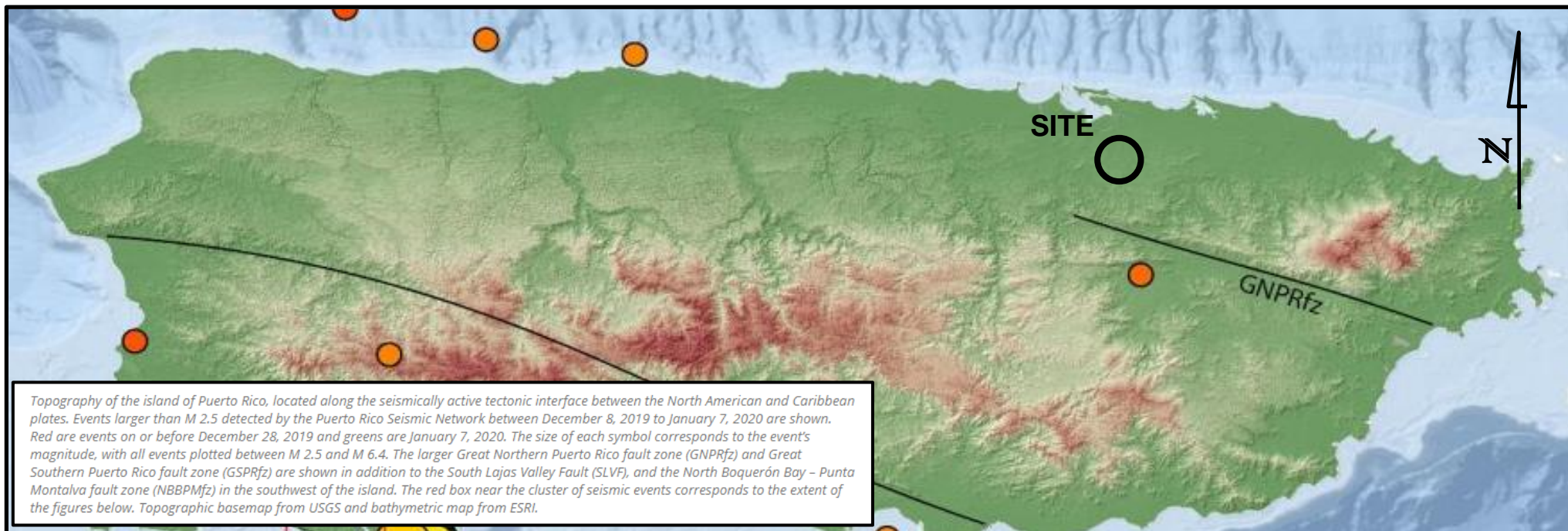
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Dwg. by: LRS

Rev. by: MOL

Project: G221554





Scale: NTS  
Dwg. By: LRS  
Rev. By: MOL  
Project No: G221554  
Client Code: N/A

**FIGURE 3 – PUERTO RICO INNER FAULT ZONES  
911 EMERGENCY BUILDING  
SAN JUAN, PUERTO RICO**





**FIGURE 4 – BORING LOCATION PLAN**  
**911 EMERGENCY BUILDING**  
**SAN JUAN, PUERTO RICO**

**APPENDIX 2**



**SOIL BORING LOGS**

<b>JOB No. :</b>	<b>G221554</b>	<b>BORING No. :</b>	<b>B-1</b>
<b>PROJECT :</b>	911 EMERGENCY BUILDING		
<b>LOCATION :</b>	SAN JUAN, PUERTO RICO		
<b>CLIENT :</b>			

TOTAL DEPTH : 55 FEET	DRILL RIG : CME 55	DRILLER : P. RODRIGUEZ
SURFACE ELEV.: N/A	DRILL METHOD : HOLLOW STEM AUGER	LOGGED BY : M. REYES
WATER DEPTH : 25 FEET	SAMPLER : 2" OD X 24" L	START DATE : 5/18/22
ELAPSED TIME : @ COMPLETION	HAMMER WEIGHT : 140 LBS (AUTO)	FINISH DATE : 5/18/22

WATER LEVEL	DEPTH		SAMPLE No.	BLOWS (per 6 in.)	<div> <div>N-VALUE</div> <div> <div>0</div> <div>100</div> </div> <div> <div>w (%)</div> <div>0</div> <div>100</div> </div> </div>	GRAPHIC LOG	SOIL DESCRIPTION	N (bpf)	Qu (tsf)	PEN (tsf)	TOTAL UNIT Wt. (pcf)	w (%)
	FEET	METERS										
	0	0	B1-1	3-5-8-11			SILTY CLAY, some sand, stiff to very stiff, strong, brown	13		2.0		27.2
	1		B1-2	3-5-8-10			SAME AS ABOVE	13		2.50		26.5
	2		B1-3	3-5-8-10			SAME AS ABOVE	13		2.75		30.5
	3		B1-4	5-9-12-15			SAME AS ABOVE, very stiff	21		3.0		28.3
	4		B1-5	3-4-5-8			SAME AS ABOVE, medium to stiff, strong brown, yellowish brown	9	0.6	0.5	113	34.1
	5		B1-6	6-20-50/5"			SANDY / CLAYEY SILT, little clay, occ. rock fragment, stiff to hard, strong brown	70		1.5		14.2
	6		B1-7	12-17-37-50/6"			SAME AS ABOVE	54		1.5		19.6

**NOTES:** All depths referred to existing grade

	Initial Water Level Reading
	Final Water Level Reading

**COMMENTS:**





<b>JOB No. :</b>	<b>G221554</b>	<b>BORING No. :</b>	<b>B-1</b>
<b>PROJECT :</b>	911 EMERGENCY BUILDING		
<b>LOCATION :</b>	SAN JUAN, PUERTO RICO		
<b>CLIENT :</b>			

TOTAL DEPTH : 55 FEET	DRILL RIG : CME 55	DRILLER : P. RODRIGUEZ
SURFACE ELEV.: N/A	DRILL METHOD : HOLLOW STEM AUGER	LOGGED BY : M. REYES
WATER DEPTH : 25 FEET	SAMPLER : 2" OD X 24" L	START DATE : 5/18/22
ELAPSED TIME : @ COMPLETION	HAMMER WEIGHT : 140 LBS (AUTO)	FINISH DATE : 5/18/22

WATER LEVEL	DEPTH		SAMPLE No.	BLOWS (per 6 in.)	N-VALUE	GRAPHIC LOG	SOIL DESCRIPTION	N (bpf)	Qu (tsf)	PEN (tsf)	TOTAL UNIT Wt. (pcf)	w (%)
	FEET	METERS			0 100 w (%) .....							
	30		B1-8	10-18-23-24			SAME AS ABOVE, very stiff to hard	41		3.25		24.3
	35		B1-9	20-22-38-30/3"			SAME AS ABOVE	60	2.1	3.25	130	22.2
	40		B1-10	12-16-21-30			SAME AS ABOVE	37		2.5		27.6
	45		B1-11	19-19-16-8			Silty clay, some sand, little rock fragment, hard, yellowish brown	35				18.5
	50		B1-12	50/2"			SAME AS ABOVE	50/2"				21.0
	55		B1-13	50/0"			SAME AS ABOVE, olive brown	50/0"				16.6
	60						END OF BORING AT 55 FEET (REFUSAL TO HSA)					

**NOTES:** All depths referred to existing grade

	Initial Water Level Reading
	Final Water Level Reading


**COMMENTS:**

<b>JOB No. :</b>	<b>G221554</b>	<b>BORING No. :</b>	<b>B-2</b>
<b>PROJECT :</b>	911 EMERGENCY BUILDING		
<b>LOCATION :</b>	SAN JUAN, PUERTO RICO		
<b>CLIENT :</b>			

TOTAL DEPTH : 51 FEET	DRILL RIG : CME 55	DRILLER : P. RODRIGUEZ
SURFACE ELEV.: N/A	DRILL METHOD : HOLLOW STEM AUGER	LOGGED BY : M. REYES
WATER DEPTH : 25 FEET	SAMPLER : 2" OD X 24" L	START DATE : 5/19/22
ELAPSED TIME : @ COMPLETION	HAMMER WEIGHT : 140 LBS (AUTO)	FINISH DATE : 5/19/22

WATER LEVEL	DEPTH		SAMPLE No.	BLOWS (per 6 in.)	N-VALUE		GRAPHIC LOG	SOIL DESCRIPTION	N (bpf)	Qu (tsf)	PEN (tsf)	TOTAL UNIT Wt. (pcf)	w (%)
	FEET	METERS			0	100							
					0	100							
	0	0	B2-1	6-5-4-4				SILTY SAND, little rock fragment, occ. roots, stiff, brown	9				5.4
	1		B2-2	4-3-4-6				SILTY CLAY, trace to little sand, medium to hard, yellowish red	7	4.1	3.25	117	31.1
	5		B2-3	3-4-6-8				SAME AS ABOVE, stiff to very stiff	10	2.9	3.25	117	34.0
	10	3	B2-4	3-3-5-7				SAME AS ABOVE, medium to very stiff	8	2.2	2.25	115	34.7
	15	5	B2-5	3-6-9-11				SAME AS ABOVE, stiff to hard	15	4.8	4.5+	124	27.9
	20	6	B2-6	5-6-10-13				SAME AS ABOVE, very stiff, strong brown	16	3.1	3.0	120	30.2
	25	7											
	30	9	B2-7	6-10-16-32				SILTY CLAY, some sand, very stiff, strong brown, light gray	26		3.25		20.3

**NOTES:** All depths referred to existing grade

	Initial Water Level Reading
	Final Water Level Reading



**PAGE**  
**1 of 2**

<b>JOB No. :</b>	<b>G221554</b>	<b>BORING No. :</b>	<b>B-2</b>
<b>PROJECT :</b>	911 EMERGENCY BUILDING		
<b>LOCATION :</b>	SAN JUAN, PUERTO RICO		
<b>CLIENT :</b>			

TOTAL DEPTH : 51 FEET	DRILL RIG : CME 55	DRILLER : P. RODRIGUEZ
SURFACE ELEV.: N/A	DRILL METHOD : HOLLOW STEM AUGER	LOGGED BY : M. REYES
WATER DEPTH : 25 FEET	SAMPLER : 2" OD X 24" L	START DATE : 5/19/22
ELAPSED TIME : @ COMPLETION	HAMMER WEIGHT : 140 LBS (AUTO)	FINISH DATE : 5/19/22

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**NOTES:** All depths referred to existing grade

	Initial Water Level Reading
	Final Water Level Reading

**COMMENTS:**

## **APPENDIX 3**

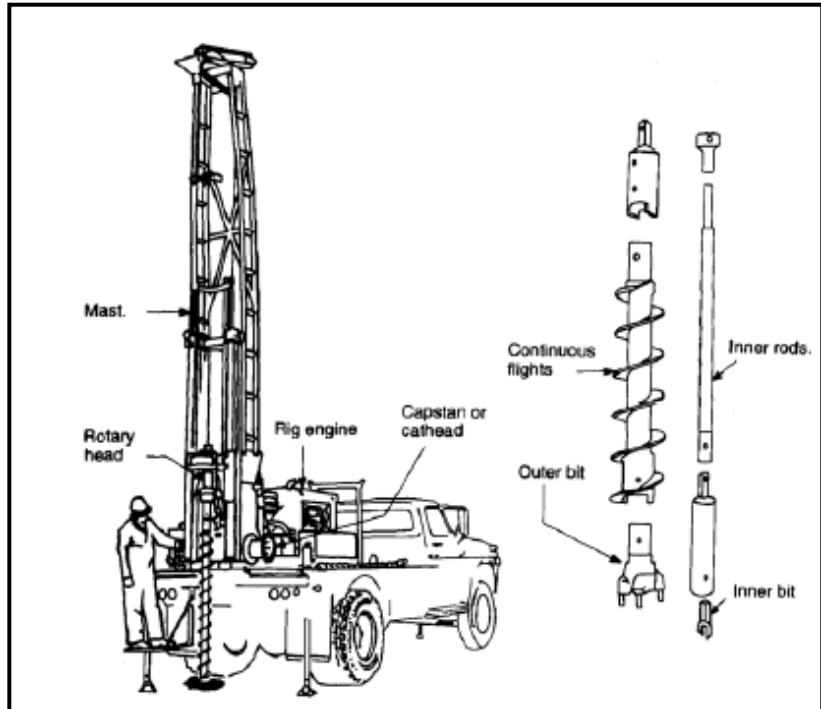
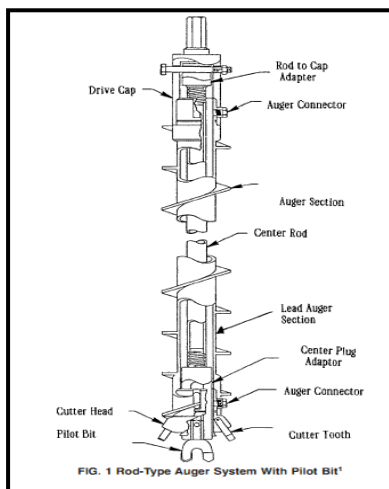
### **FIELDWORK AND LABORATORY TESTING PROCEDURES**

## APPENDIX 3:

# FIELD AND LABORATORY TESTING PROCEDURES

### DRILLING

**Auger Borings (ASTM D 6151).** These are performed by turning a hollow-stem auger into the ground a short distance. As the auger advances into the ground, the cuttings rise to the surface on the auger spirals. The depth from which the cut material comes cannot be accurately determined. By using hollow-stem augers, samples can be recovered from the bottom of the auger, thus eliminating the need for driving casing.



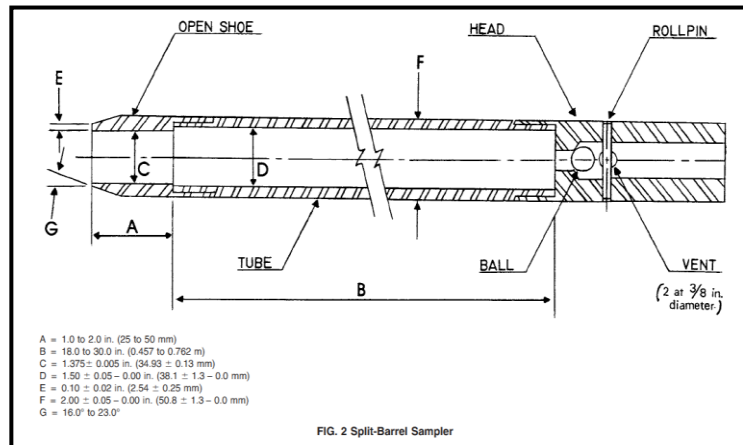
When drilling in caving soils or cohesionless soils below the water table, there is the possibility for sand lock (plugging), heave or blow-up of the borehole bottom, or caving of the soils. In this case, water or drilling fluid is usually injected into the hollow-stem auger, to provide hydrostatic balance while drilling and sampling.

**Core Borings (ASTM D 2113).** Usually performed on rock formations, core borings are advanced by rotating drill rods, a core barrel and diamond bit. As the bit cuts into the rock, the rock core is free to move into the inner core barrel head, which is suspended on a swivel. Cooling water or bentonite slurry is circulated through the drill rods and the core barrel. Penetration depends on the length of the core barrel and the quality (amount of joints or fractures) of the rock. Core runs are longer as rock quality increases. As the core barrel is withdrawn, the core lifter, located inside the diamond bit, wedges itself around the bottom of the rock core, thus permitting it to be pulled free from the underlying rock.

## **SAMPLING AND HANDLING**

**Standard Penetration Test (ASTM D 1586).** Standard Penetration Tests (SPT) are performed by driving a 1.375-in ID x 2-in OD x 18- or 24-in long, split spoon sampler, with 140-lb drop hammer falling freely from a 30-in height. The number of blows for every 6-in of sampler penetration is recorded, and the number of blows between 6 and 18 inches of penetration is reported as the uncorrected N-value. Furthermore, SPT N-Values are dependent on various factors, such as: hammer type (i.e. donut, safety, or automatic), driller experience and proficiency, depth of sampling, diameter of borehole, equipment conditions, etc.

Samples are immediately stored vertically and sealed in moisture-proof glass jars to avoid moisture loss and breakage. These are labeled and transported to the office laboratory for visual classification and other routine laboratory tests.



The SPT has been correlated with the consistency of fine-grained soils, and the angle of internal friction or the relative density of sands. However, these have been based on an energy efficiency of 60% of theoretical. Hence, correction factors, especially to the drop hammer, have to be applied. In the case of fine-grained soils, the correlation of the SPT with the undrained shear strength of medium and stiff silts and clays of low sensitivity have been found to be fairly good. However, in the case of soft silts and clays, the SPT yields poor estimates of the undrained shear strength. Therefore, testing undisturbed samples, and performing other in situ tests (e.g. vane shear, cone penetration, dilatometer, etc.) may be more reliable for these cases.

**Undisturbed Sampling (ASTM D 1587).** Undisturbed samples are obtained with thin-walled Shelby tube samplers, 2- to 5-in OD by 30-in long. The sampler is forced into the soil by applying constant downward pressure and is pulled out. These samplers are sealed in the field with wax and transported to the laboratory. Samples are then extruded at the time of testing by pushing in the same direction that the samples penetrated the sampler. Special care is taken in handling these samples to minimize disturbance.

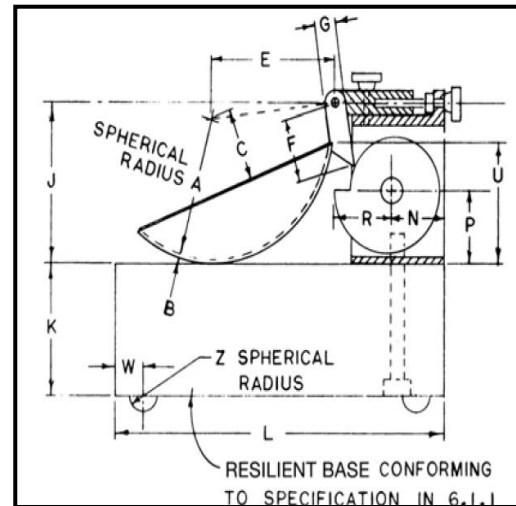
**Preserving and Transporting Soil Samples (ASTM D 4220).** All soil samples recovered from SPT are stored vertically, and immediately transported to the office laboratory for visual classification and other routine laboratory tests. Undisturbed soil samples are transported vertically, and stored in custom-made wooden boxes that provide cushioning (urethane or foam) for each sample container, and, when necessary, shipped via FedEx to a trusted outside laboratory for specialized testing.

## **STANDARD LABORATORY TESTING**

**Natural Moisture Content (ASTM D 2216).** This is the water content of the in situ soil. It is obtained from either disturbed or undisturbed samples. The procedure consists of placing a portion of the soil sample in an oven for 24 hours at a temperature of 110° C. The difference in weight between the natural and oven-dried states of the soil, divided by the dry weight of the dry samples, expressed in percentage, is reported as the natural moisture content ( $w_n$ ).

**Atterberg Limits (ASTM D 4318).** The Atterberg limits refer to moisture content values where the soil mass changes between a semisolid, plastic, or liquid state. They are commonly used in geotechnical engineering for soil identification and classification purposes. They can also be correlated empirically to various soil parameters which are used for preliminary analyses. The procedure used to determine liquid and plastic limits are described in the referenced ASTM standard.

**Particle Size Distribution (ASTM D 422).** The particle-size analysis of soils provides the particle size distribution of soil samples for engineering classification purposes. This is performed by first oven-drying the soil sample, and then using a series of sieves to determine the percentage of soil retained at each sieve size. The results of this test, along with the Atterberg Limits, are used for soil classification purposes.



**Unconfined Compression (UC) Test (ASTM D 2166).** The best-quality samples recovered during SPT Tests are subjected to unconfined compression tests. These samples are disturbed and undrained shear strength obtained is usually lower than the "true" in-situ internal strength, depending on the degree of disturbance and the soil sensitivity. Therefore, the unconfined strength value determined from this test is only used as index property for classification and identification purposes. If more accurate strength values are required, undisturbed samples are used.

**Pocket Penetrometer Test.** This is a test used both in the field and laboratory for quick shear strength estimates. The test provides approximate unconfined shear strength, from which undrained shear strength can be estimated. This test is performed on samples recovered during SPT Tests and compared to UC Tests described above. The advantage of this tool is that it can be used quickly and easily, and can be used to test smaller soil samples.

**Free Swell Test.** This test consists of placing a known volume of dry soil (finer than No. 40 sieve) in a measuring cylinder, and filled to the top with distilled water. The free swell of the soil is measured as the ratio of change in volume over the initial volume of the soil sample, and it is expressed as a percentage.

## **SOIL DESCRIPTION / CLASSIFICATION**

**Visual-Manual Procedure (ASTM D 2488).** The visual-manual description of soils includes the color, soil type (gravel, sand, silt, clay, organic), consistency (if soil is fine-grained), relative density (if soil is coarse-grained), particle size and roundness (if soil is coarse-grained), and other special characteristics which can assist in the identification and classification of the soil.

To describe the apparent particle size distribution based on visual-manual examination, the following terms are used:

Descriptive Term	Percent of Sample
Trace	1 - 10%
Some	10 - 20%
Sandy, Gravelly, Silty, Clayey	20 - 35%
And	35 - 50%

To describe the relative density of sands and consistency of clays, a correlation is used based on SPT N-values and unconfined compressive strength, as follows:

Sands		Clays		
N-Value	Relative Density	N-Value	Unconfined Compressive Strength (tsf)	Consistency
0 - 4	very loose	< 2	< 0.25	very soft
4 - 10	loose	2 - 4	0.25 - 0.50	soft
10 - 30	medium	4 - 8	0.50 - 1.00	medium
30 - 50	dense	8 - 15	1.00 - 2.00	stiff
> 50	very dense	15 - 30	2.00 - 4.00	very stiff
		> 30	> 4.00	hard

**Unified Classification System (ASTM D 2487) and AASHTO (ASTM D 3282).** These are the industry standards for engineering classification of soil. The information obtained from visual-manual procedures (i.e. color, consistency, relative density, etc) are complemented with the results of Atterberg limits and particle size distribution tests to provide a standardized classification of soil for engineering purposes.



## **ROCK DESCRIPTION**

Geologic features used to describe rock cores are the degree of weathering, hardness, joint bedding and foliation spacing, percent recovery, RQD, etc. These are explained as follows:

### **Weathering.**

<b>Degree</b>	<b>Sample Condition</b>
Fresh	Fresh, bright crystals, few joints, may show slight staining. Rock rings under hammer if crystalline.
Very Slight	Generally fresh, joint-stained, some joints may show clay if open, crystals in broken face show clay if open, crystals in broken face show bright. Rock rings under hammer if crystalline.
Slight	Generally fresh, joint-stained and discoloration extends into rock up to 1". Open joints contain clay. In granodiorite rocks, some feldspar crystals are dull and discolored. Crystalline rocks ring under hammer.
Moderate	Significant portions of rock show discoloration and weathering effects. In granodiorite rocks, most feldspars are dull and discolored; some show clayey. Rock has dull sound under hammer, and show significant loss of strength as compared with fresh rock.
Moderately Severe	All rocks, except quartz, discolored or severely stained. In granodiorite rocks, all feldspars are dull and most show kaolinization. Rock shows severe loss of strength and can be excavated with geologist pick. Rock goes "chunk" when struck.
Severe	All rocks, except quartz, discolored or stained. Rock "fabric" clear and evident, but reduced in strength to strong soil. In granodiorite rocks, all feldspars are kaolinized to some extent.
Very Severe	All rocks, except quartz, discolored or stained. Rock "fabric" not discernible, or discernible only in small scattered locations. Quartz may be present as dikes or stringers.

**Joint Bedding and Foliation Spacing in Rock.** Joint spacing refers to the distance normal to the plane of the joints of a single system, or "set" of joints which are parallel to each other or nearly so. The spacing of each "set" should be described if it is possible to establish.

<b>Spacing</b>	<b>Joints</b>	<b>Bedding &amp; Foliation</b>
< 2"	very close	very thin
2" - 1'	close	thin
1' - 3'	mod. close	medium
3' - 10'	wide	thick
> 10'	very wide	very thick

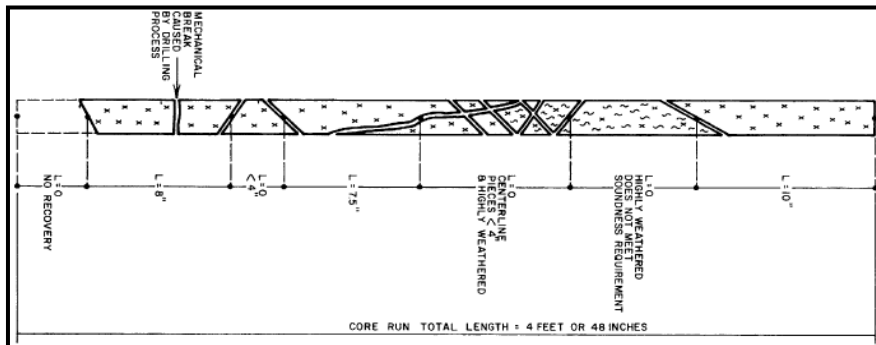
## Hardness.

Degree	Sample Conditions
Very Hard	Cannot be scratched with knife or sharp pick. Breaking of hand specimens requires several hard blows with geologist pick.
Hard	Can be scratched with knife or pick only with difficulty. Hard blow of hammer required to detach hand specimen.
Moderately Hard	Can be scratched with knife or pick. Deep gouges or grooves can be excavated by hard blow with point of geologist pick. Hand specimens can be detached by moderate blow.
Medium	Can be grooved or gouged 1/16" deep by firm pressure of knife or pick point. Can be excavated in small 1" chips with geologist pick.
Soft	Can be gouged or grooved readily with knife or pick point. Can be excavated in chips, several inches in size, by moderate blows of a pick point. Small thin pieces can be broken by finger pressure.
Very soft	Can be carved with knife. Can be excavated readily with point of pick. Pieces, one inch or more in thickness, can be broken by finger pressure. Can be scratched readily by finger nail.

\*These measures of hardness are used for engineering description of rock, not to be confused with Moh's scale for minerals.

**Core Recovery (CR) and Rock Quality Designation (RQD) (ASTM D6032).** In addition to the inspection of the rock core, other valuable information to the engineer is the percent recovery, and the rock quality designation (RQD). The percent recovery is defined as:

$$\% \text{ RECOVERY} = \frac{\text{Length of Core Sample Recovered}}{\text{Length of Cored Run}}$$



If the core is broken by hauling or by the drilling process (i.e., the fracture surfaces are fresh irregular breaks rather than natural joint surfaces), the fresh broken pieces are fitted together and counted as one piece, provided that

they form the required 4-inch length. Some judgment is necessary.

The RQD is expressed in percent for NX or NWM cores as:

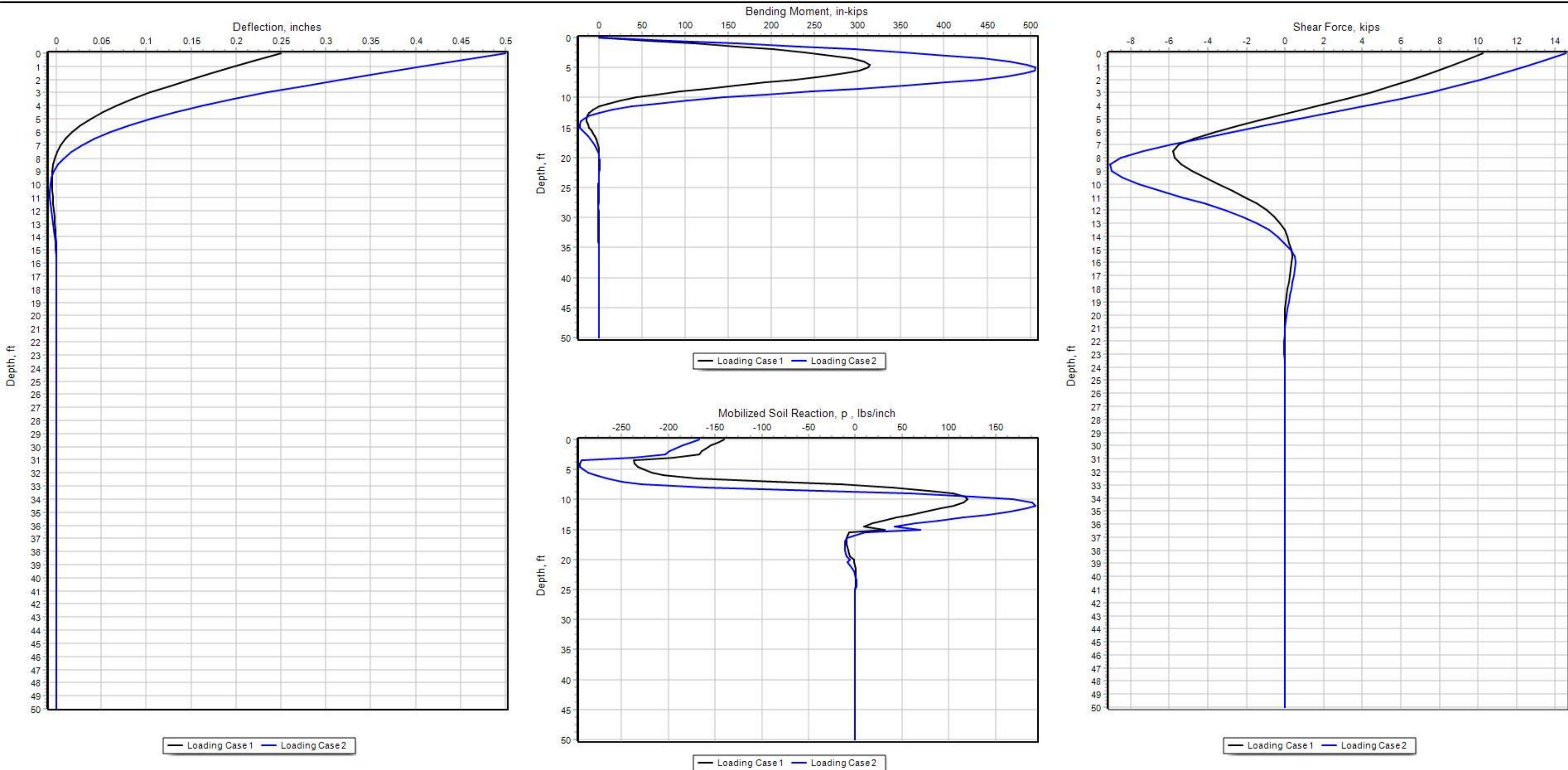
The  $RQD = \frac{\text{Sum of the Lengths of Core Pieces Longer than 4in}}{\text{Length of Cored Run}}$  quality of the rock is described as follows:

RQD, %	Description of Rock Quality
0 - 25	very poor
25 - 50	poor
50 - 75	fair
75 - 90	good
90 - 100	excellent

**APPENDIX 4**

**LPILE OUTPUT CHARTS**

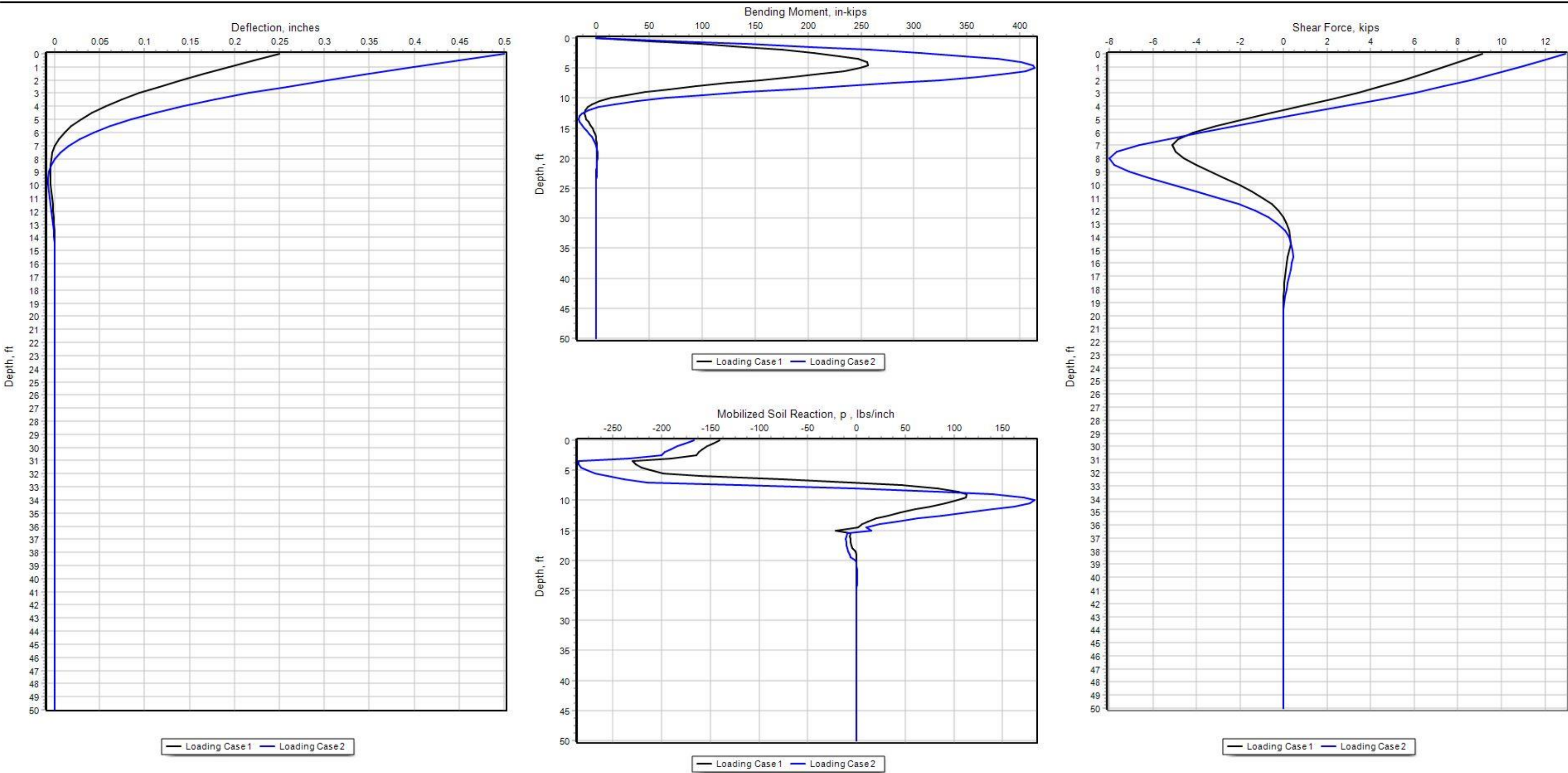
# 12-in SQ CONCRETE PILE – 100% EI (Pm=1 for Individual)



**PROJECT INFORMATION:**  
- Project: 911 EMERGENCY BUILDING  
- Job No.: G221554

**NOTES:**  
1. Loading Case 1: Free Head @ 0.25"  
2. Loading Case 2: Free Head @ 0.5"

# 12-in SQ CONCRETE PILE – 70% EI (Pm=1 for Individual)

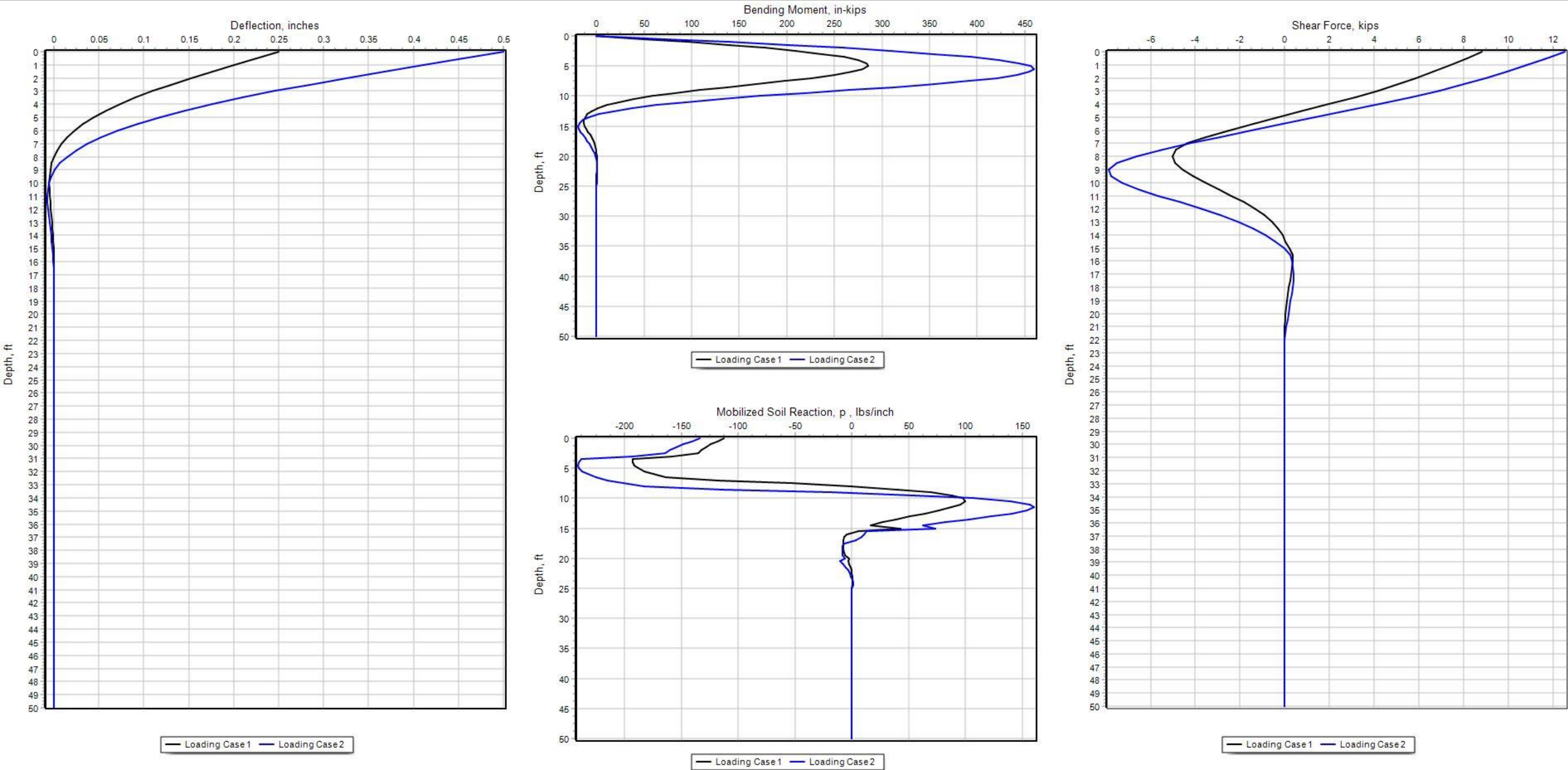


**PROJECT INFORMATION:**  
- Project: 911 EMERGENCY BUILDING  
- Job No.: G221554

**NOTES:**  
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2. Loading Case 2: Free Head @ 0.5"



# 12-in SQ CONCRETE PILE – 100% EI (Pm=0.8 at First Row)



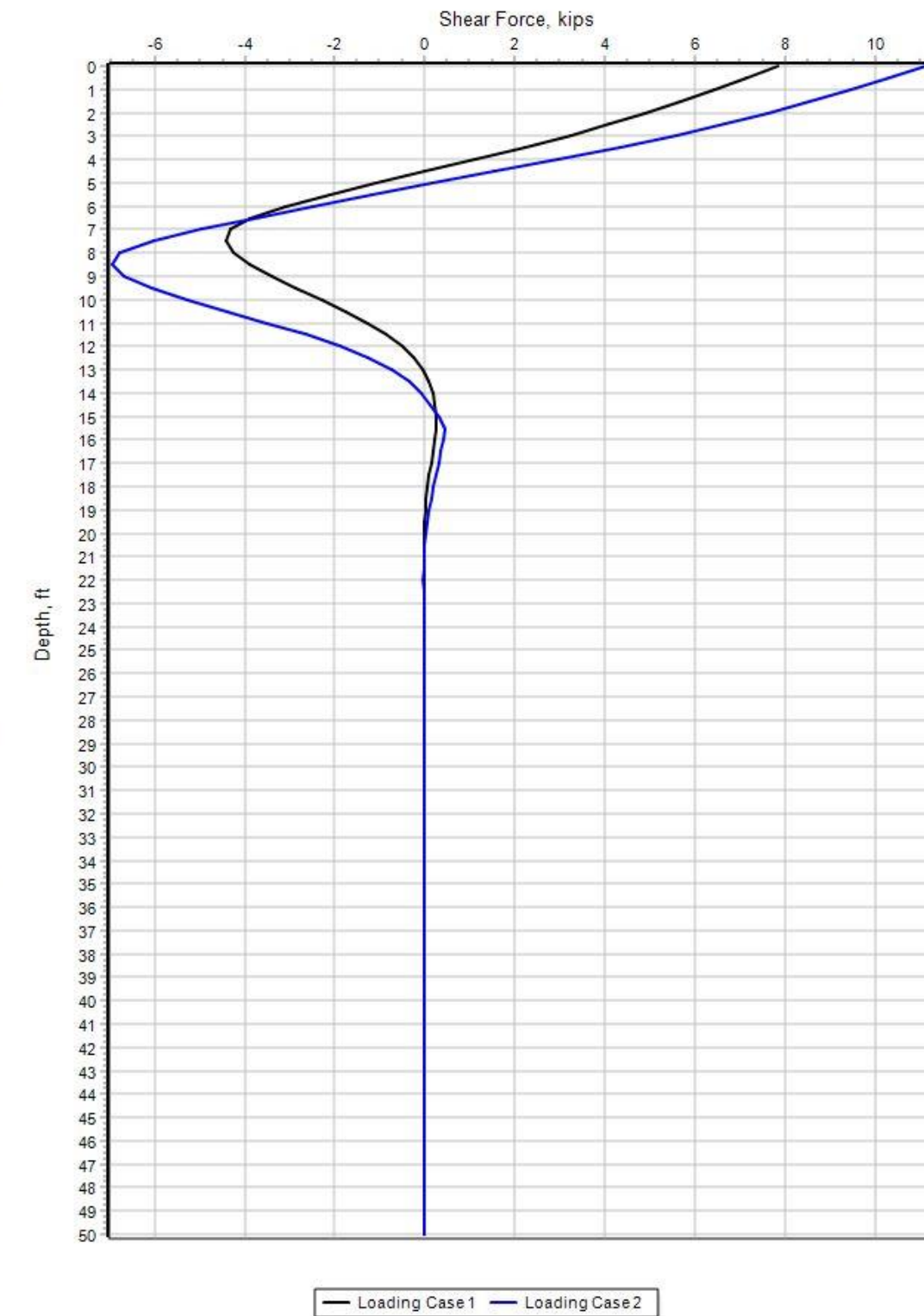
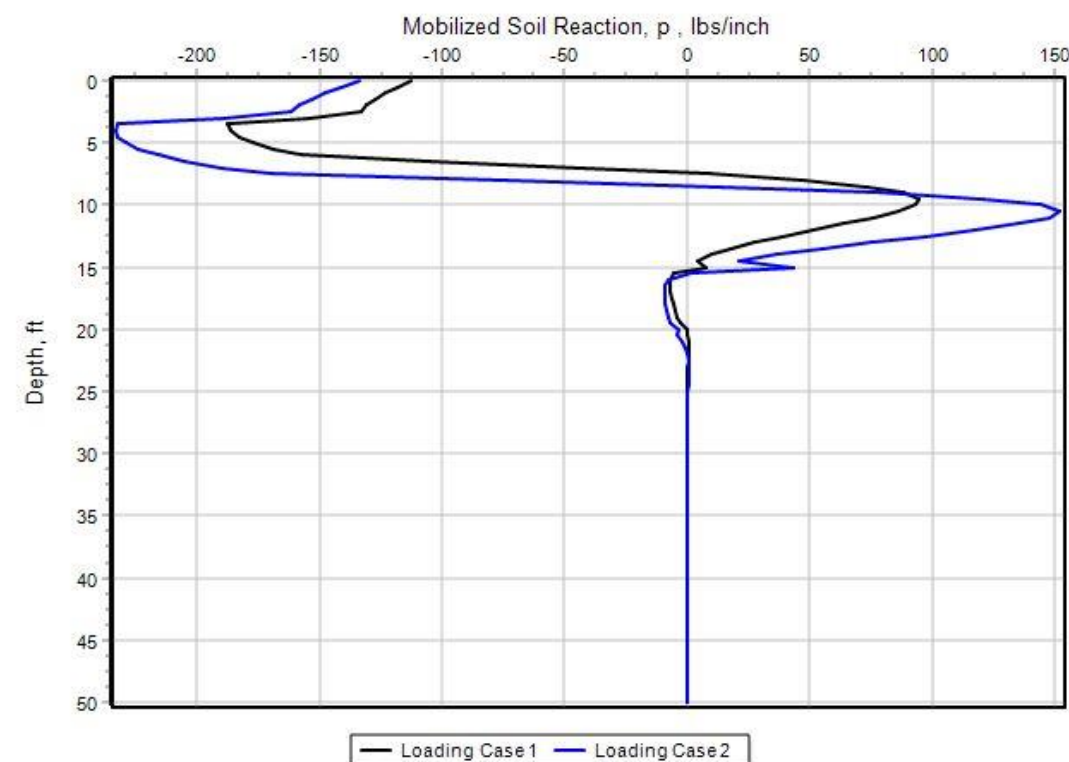
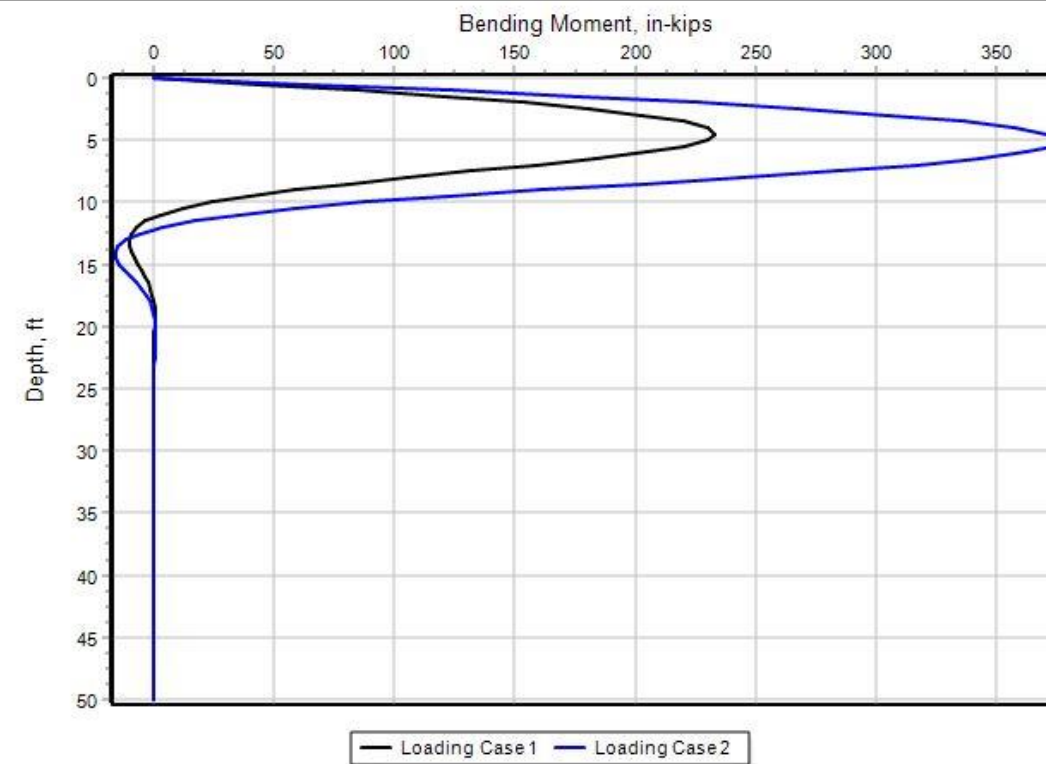
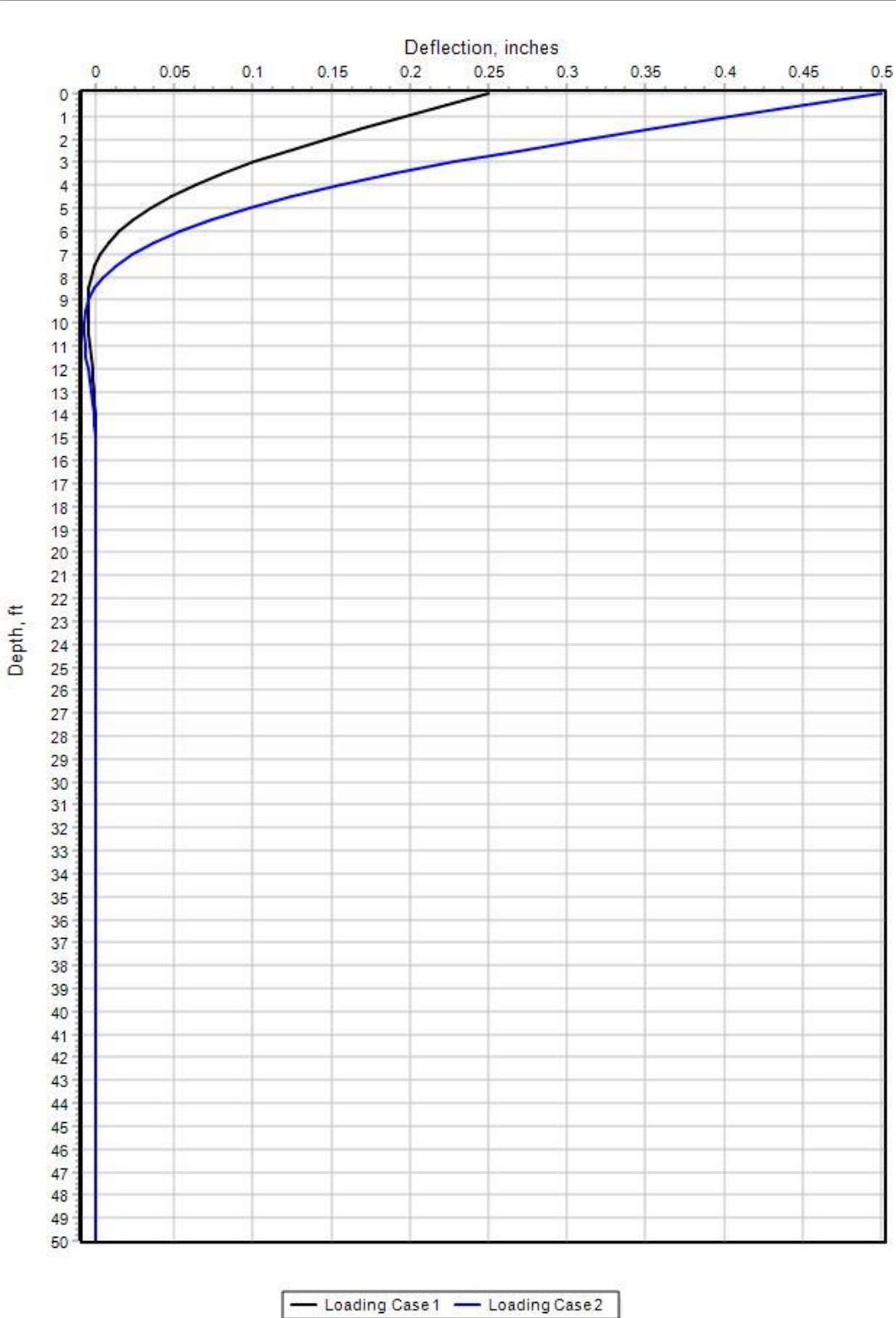
**PROJECT INFORMATION:**

- Project: 911 EMERGENCY BUILDING
- Job No.: G221554

**NOTES:**

1. Loading Case 1: Free Head @ 0.25"
2. Loading Case 2: Free Head @ 0.5"

# 12-in SQ CONCRETE PILE – 70% EI (Pm=0.8 at First Row)



## PROJECT INFORMATION:

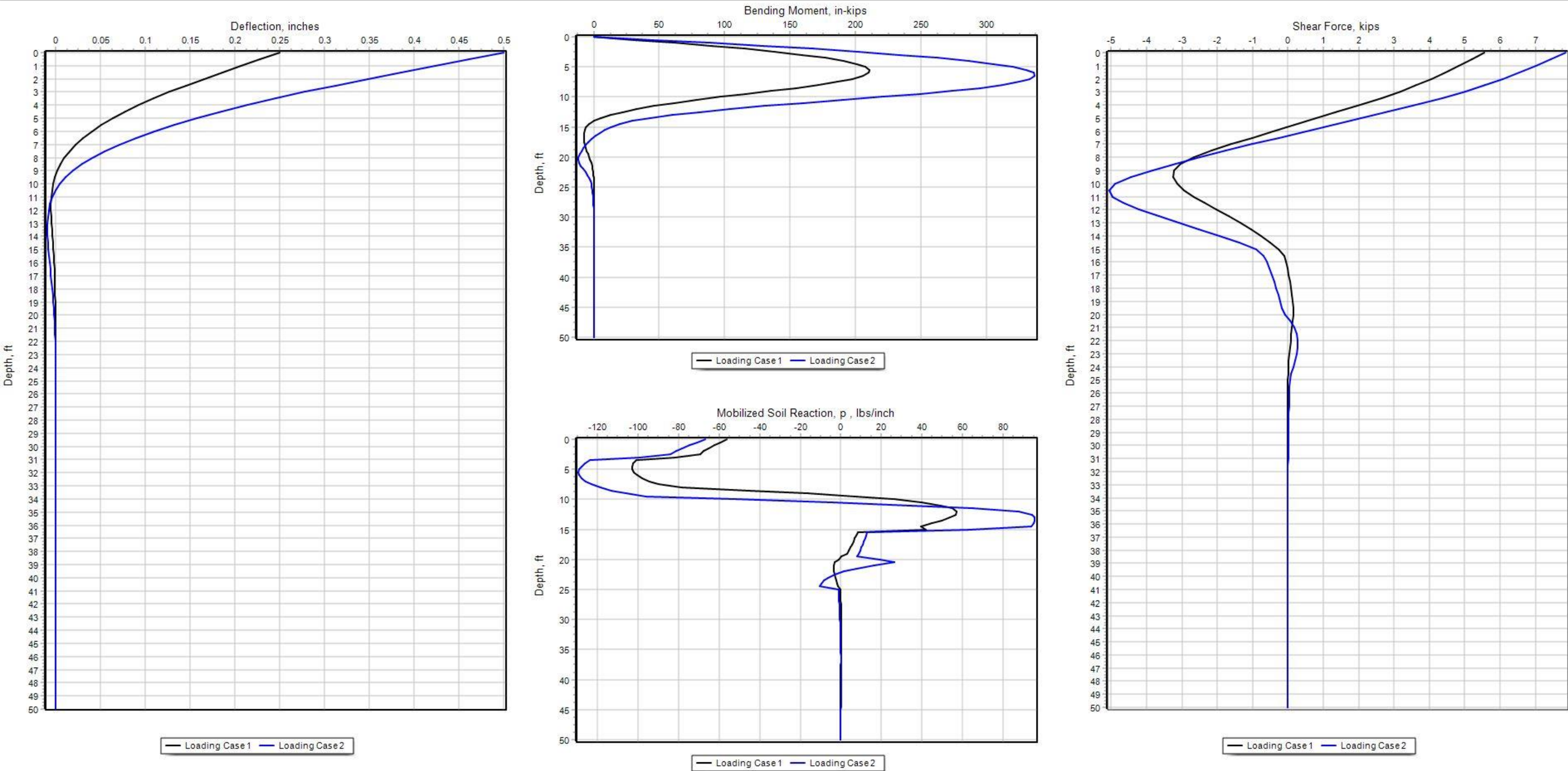
- Project: 911 EMERGENCY BUILDING
- Job No.: G221554

## NOTES:

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2. Loading Case 2: Free Head @ 0.5"



# 12-in SQ CONCRETE PILE – 100% EI (Pm=0.4 at Second Row)



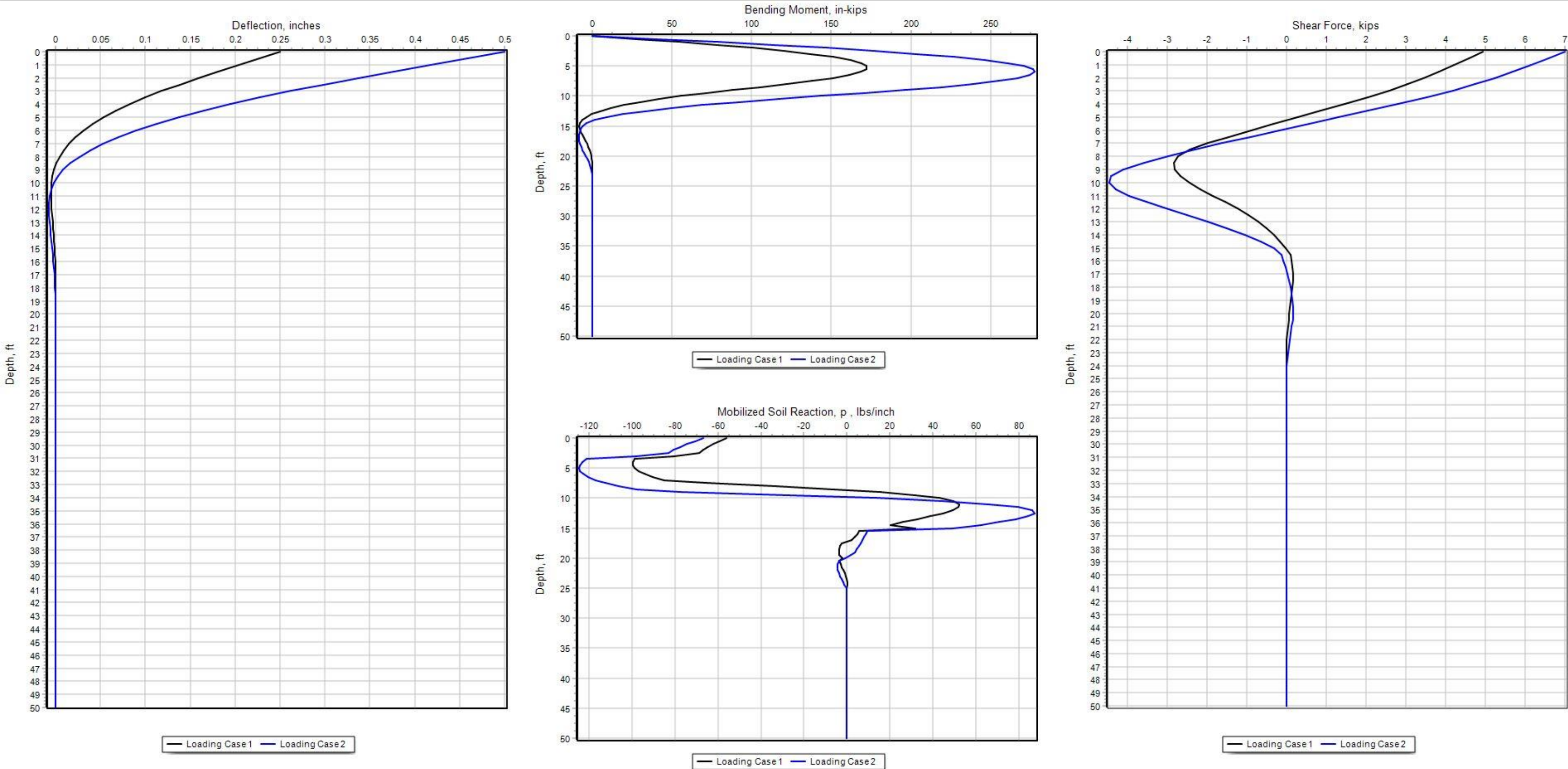
**PROJECT INFORMATION:**

- Project: 911 EMERGENCY BUILDING
- Job No.: G221554

**NOTES:**

- 1. Loading Case 1: Free Head @ 0.25"
- 2. Loading Case 2: Free Head @ 0.5"

# 12-in SQ CONCRETE PILE – 70% EI (Pm=0.4 at Second Row)

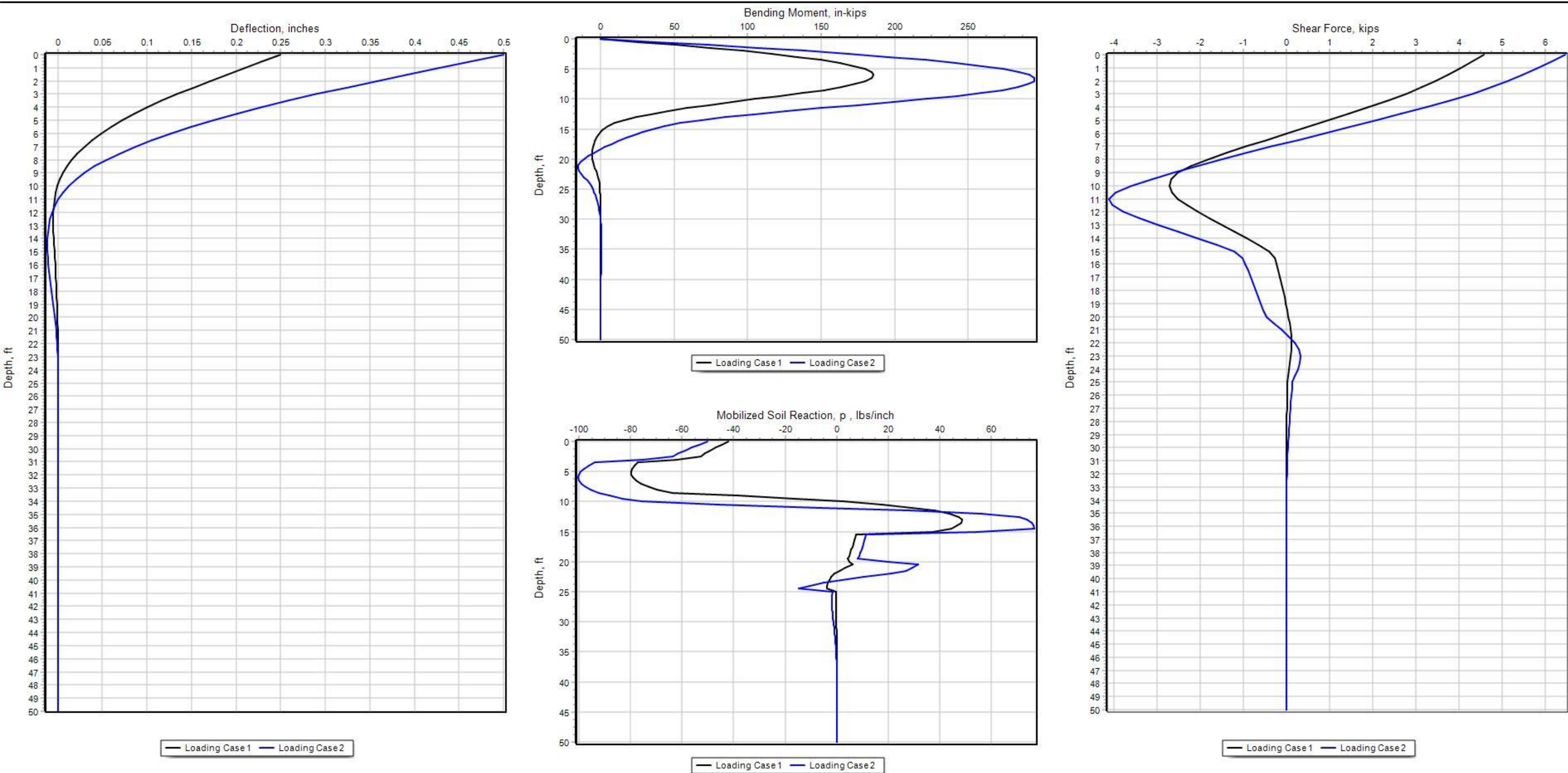


**PROJECT INFORMATION:**  
- Project: 911 EMERGENCY BUILDING  
- Job No.: G221554

**NOTES:**  
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2. Loading Case 2: Free Head @ 0.5"



# 12-in SQ CONCRETE PILE – 100% EI (Pm=0.3 at Third Row)



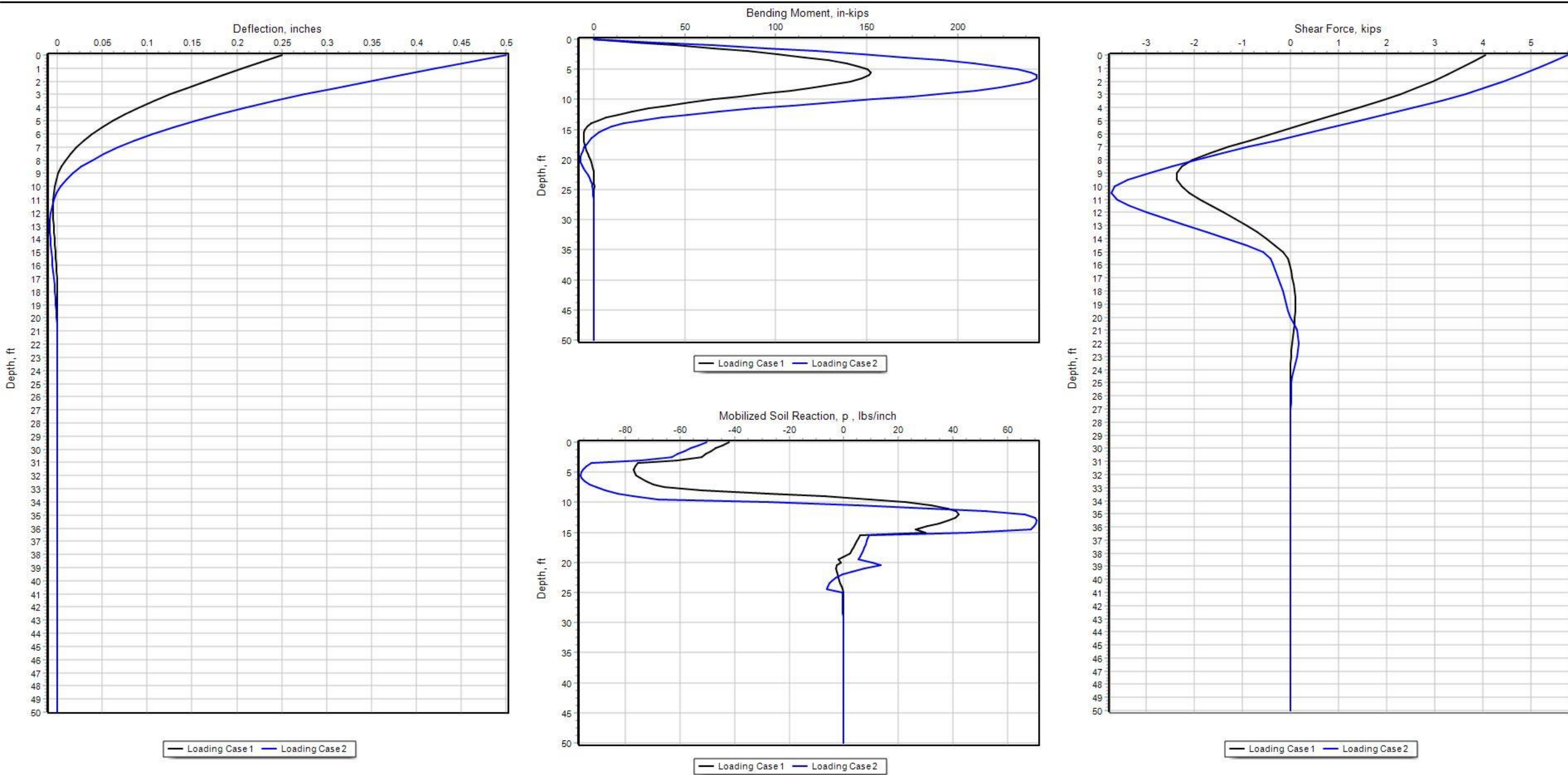
**PROJECT INFORMATION:**

- Project: 911 EMERGENCY BUILDING
- Job No.: G221554

**NOTES:**

- 1. Loading Case 1: Free Head @ 0.25"
- 2. Loading Case 2: Free Head @ 0.5"

# 12-in SQ CONCRETE PILE – 70% EI (Pm=0.3 at Third Row)



**PROJECT INFORMATION:**  
- Project: 911 EMERGENCY BUILDING  
- Job No.: G221554

**NOTES:**  
1. Loading Case 1: Free Head @ 0.25"  
2. Loading Case 2: Free Head @ 0.5"

**TECHNICAL REPORT No. 2**

**STRUCTURAL INVESTIGATION for  
911 EMERGENCY BUILDING  
SAN JUAN, PUERTO RICO**

**PROJECT No. G221524B**

June 30, 2022

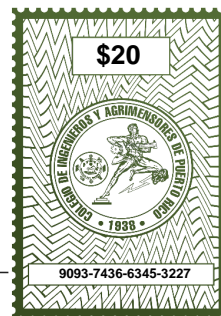


COLEGIO DE INGENIEROS Y AGRIMENSORES  
DE PUERTO RICO

PO Box 363845 San Juan Puerto Rico 00936-3845  
Tel. 787.758.2250 #205 · practica@ciapr.org

**ESTAMPILLA DIGITAL ESPECIAL (EDE)**

Ing. Manuel E. Ochoa Lavergne, PE



Práctica de:	Ingeniería
Licencia:	22275
Renglón:	Servicio Profesional
Descripción del Trabajo:	Realización de Estudios de Ingeniería
Fecha de Emisión:	06/17/2022
Monto Emitido:	\$20
Número de Serie:	9093-7436-6345-3227
Número de Caso:	G221554B
Proyecto / Unidad:	911 EMERGENCY BLDG STRUCTURAL INVESTIGATION
Rol del Profesional:	Consultor

SELLO PROFESIONAL

**Certificación:**

El profesional certifica con la emisión de la estampilla digital especial del Colegio de Ingenieros y Agrimensores de Puerto Rico el haber cumplido con las disposiciones de la Sección 11 de la Ley 319 del 15 de mayo de 1938, según enmendada.

*La colocación del sello profesional constituye la cancelación de la estampilla digital especial*



RENOVACIÓN APROBADA: 19 de enero, 2019

RENEWAL APPROVED ON: January 19, 2019



Gobierno de Puerto Rico  
Government of Puerto Rico

DEPARTAMENTO DE ESTADO  
Department of State

Secretaría Auxiliar de Juntas Examinadoras  
Office of the Assistant Secretary of State for Examining Boards

La Junta Examinadora de Ingenieros y Agrimensores  
The Examining Board of Engineers and Land Surveyors

por la presente certifica que  
hereby certifies that

**Manuel Enrique Ochoa Lavergne**

habiendo cumplido todos los requisitos de Ley, se ha inscrito en el Registro de esta Junta como  
having met all the requirements of law, has been registered as:

**Ingeniero Licenciado**  
Licensed Engineer

En testimonio de lo cual, se expide esta licencia para el ejercicio de dicha profesión, bajo el sello de la Junta Examinadora.  
In testimony whereof, this license is issued to practice this profession, under the seal of the Board of Examiners.

En San Juan, Puerto Rico, efectivo 12 de enero de 2019  
In San Juan, Puerto Rico, effective January 12, 2019.

Número de Licencia: 22275  
License Number

Vencimiento: 11 de enero de 2024  
Expires: January 11, 2024



  
Presidente

  
Directora  
Director



## TECHNICAL REPORT No. 2

June 30, 2022


**Re: STRUCTURAL INVESTIGATION for  
911 EMERGENCY BUILDING  
SAN JUAN, PUERTO RICO  
PROJECT No. G221554B**

As requested, this technical letter presents the factual findings of the **Structural Investigation** performed at the above referenced project. The work was performed in general accordance with **Proposal PL-2022-42**, dated May 18, 2022.

We performed structural investigation consisting of reinforcing steel size and distribution, along with concrete core extraction and testing (including Windsor probe) at various structure locations. Investigated locations consisted of walls, beams, columns, and slabs, as indicated by Engr. Doris Quiñones, structural engineer. Subsequent calibration at selected locations was performed by controlled destructive methods. The results of the structural investigation are presented in **Appendix 1**. Base drawings (as-built) were provided.

We appreciate the opportunity to be of service and look forward to working with you again in the future. If you have any questions, please contact the undersigned at your convenience.

Respectfully submitted,

  
Manuel E. Ochoa Laverne, MSCE, PE  
Geotechnical Engineer

**Enclosures:** Appendix 1 – Structural Investigation Report



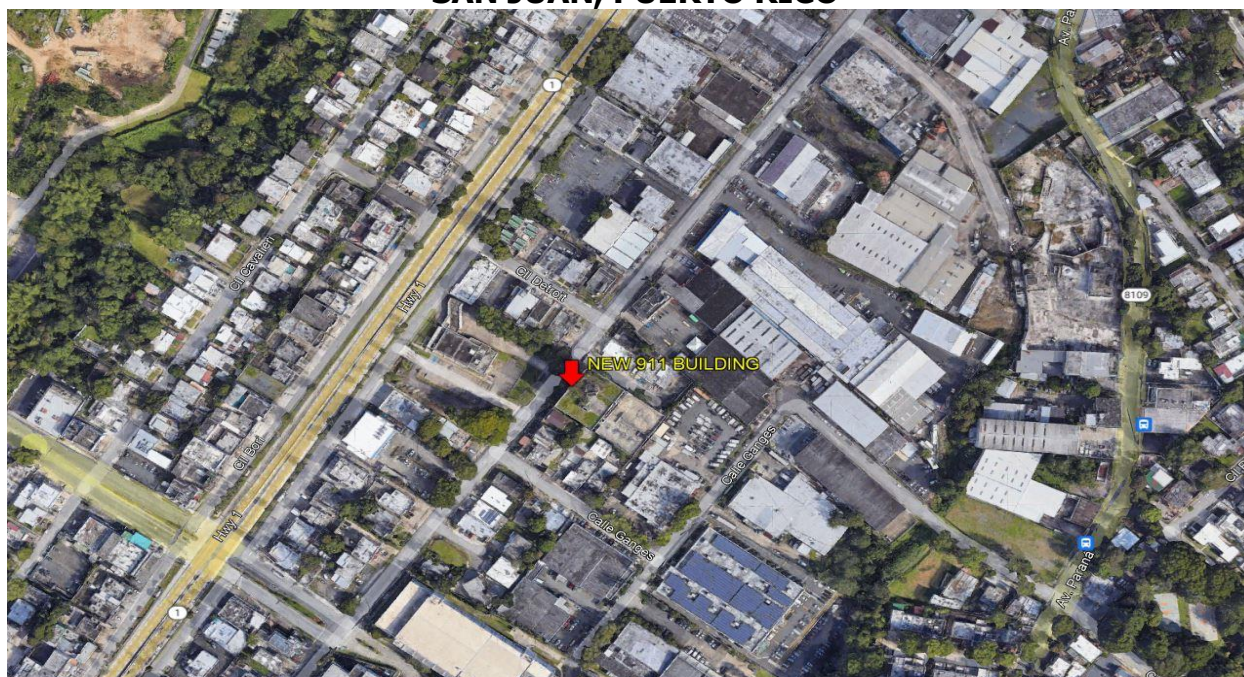


## **APPENDIX 1**

### **STRUCTURAL INVESTIGATION REPORT**

## STRUCTURAL CONCRETE QUALITY ASSESSMENT

**911 EMERGENCY BUILDING  
SAN JUAN, PUERTO RICO**



***June 28, 2022***

## TECHNICAL SERVICES REPORT LR-2022-40

June 28, 2022

**To:**

**Re: STRUCTURAL CONCRETE QUALITY ASSESSMENT at  
911 EMERGENCY BUILDING  
SAN JUAN, PUERTO RICO**

This report presents the results of the actual **Reinforcing Layout and Compressive Strength** of the **New 911 BUILDING**, in San Juan, Puerto Rico.

The work was performed at the request of your good self, to obtain and provide information to **Engr. Doris Quiñones, Structural Consultant**, on the actual reinforcing layout and compressive strength of the mentioned structure, mostly made of concrete walls and frames and partition masonry walls. The data obtained will be used for the corresponding assessment/evaluation, as part of the **Structural Analysis of the New 911 Building**.

The **Scope of Work (SOW)** was performed in coordination with the structural consultant and consisted in the field investigation of the size and distribution of the steel-in-concrete and sampling of selected concrete structural elements for physical laboratory testing. **The Structural Analysis of the mentioned structure is beyond of our scope of work and this report.**

The results of the work performed is presented below. For details of the areas investigated, please refer to **Figures and Photos** enclosed.

To accomplish the above performed the following work:

1. **Reinforcing Steel Size & Distribution** – using of **Non- Destructive Testing (NDT)** technique and Destructive Testing Technique on selective areas, **refer to details AB-102 (beams) and AB-104 (columns).**
2. **Concrete Compressive Strength** – by extraction of hardened concrete cores per **ASTM C42 - *Standard Method for Obtaining and Testing Drilled Cores and***

***Sawed Beams of Concrete* and *ASTM C803 – Standard Test Method for Penetration Resistance of Hardened Concrete.***

3. **Visual Reconnaissance** – a simple visual reconnaissance of the roof slab with photos of findings during the visit.
4. **Penetration Resistance of Hardened Concrete** – per **ASTM C803 - Standard Test Method for Penetration Resistance of Hardened Concrete**

The results of the testing program performed are presented below:

## **1. REINFORCING STEEL SIZE AND DISTRIBUTION**

The rebar scan data was gathered without damaging the existing concrete using **Non-Destructive Testing** techniques. Rebar scans were performed in selected areas distributed along the mentioned structure to determine the existing reinforcement location, size, spacing, and clear cover. The investigated areas included **concrete beams, walls, CMU, slabs** and **columns**. The scans were performed using a combination of two **NDT equipments**: a ferromagnetic device capable of obtaining rebar size, depth, and location (**Hilti Ferroskan PS300**) and a Ground Penetration Radar (**Hilti PS1000 GPR**) capable of obtaining a precise image of detectable objects or voids within the concrete.

The **Hilti Ferroskan PS 300** is an **NDT** investigation tool capable of determining the position, cover, and diameter of the existing rebars. The maximum depth of the rebar that the scan is capable of detecting is 8.0" with an accuracy of  $\pm 0.118$ ". The maximum depth for determining rebar diameter is 2.4" with an accuracy of  $\pm 0.04$ ". It should be noted that measurements of both systems may be significantly affected by site and ambient conditions, such as moisture, radio systems, proximity to magnetic or electromagnetic fields, dampness, construction materials containing metals, aluminum foil backed insulation, multiple layers and materials with cavities or electrically conductive wall covering or tiles. The area covered at each scan is 2' x 2' or also 4' by 4'. Larger continuous areas can be scanned if it is required. The typical quick scan and 2' x 2' full scans on various coverage area were used for this project to get information of the concrete elements. The quick scan mode does not save any data in the memory of the scan, however, shows the reinforcement live in-situ.

The **Hilti Ground-Penetrating Radar (GPR) PS1000**, in this case the **Hilti X-Scan Unit**, also called impulse radar, uses electromagnetic waves to measure discontinuities below a concrete surface. The technique has been used to locate, voids, reinforcing steel, and to measure thickness. Although this device was not designed to determine the concrete thickness of the element, it will give an image of the section of the concrete.

In the case of a surface less than 10", it would show a rebound image of the end of the signal, where the thickness of slab could be estimated. The area covered at each scan is 2' x 2' or also 4' by 4'. Larger continuous areas can be scanned if it is required. The typical quick scan and 2' x 2' full scans on various coverage area were used for this project to get information of the concrete elements. The quick scan mode does not save any data in the memory of the scan, however, shows the reinforcement live in-situ.

The focus of this study is to estimate the existing reinforcement location, spacing, size and clear cover of the existing concrete columns, walls, and ground slab, measured it from the surface at locations needed of the concrete elements of the mentioned structure.

The scans were performed at **ninety-two (92)** locations (**one-hundred and eighty four** scans in total) on beams, walls, columns and slabs on the structure of the **911 Building**. We present general pictures and work performed during the field visits in **Appendix A & B** of this report. Some examples of scan images are included in **Appendix D**. Drawings with the locations of the tests performed and details of the sections are also included in **Appendix E**. It is important to note that the data gathered, was taken in specific areas. Some dimensions of the structural elements made difficult the scanning at some locations. Our team also perform several quick scans to identify the reinforcement in the structural elements and to determine concrete and masonry walls. We did not scan any other locations other than those indicated in this report. areas. **In general**, the typical layout of the reinforcement resulting from the **NDT**, is as follows:

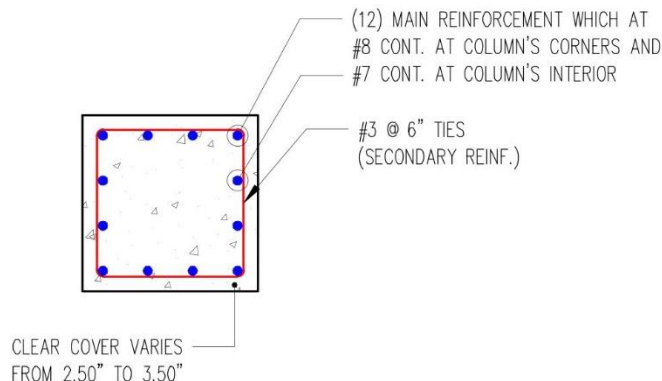
### **Section #1: (Concrete Column)**

*Main Reinforcement: (12) #8 continuous at column's corners and #7 continuous at column's interior.*

*Secondary Reinforcement (TIES): #3 with spacing of 6.0"*

*The clear cover of the reinforcement varies from 2.50" to 3.50".*

**Commentaries:** The detail correspond to most of the interior columns on first level of the building with column's id of **1, 2, 3, 5, 9, 12, 14, 15, 18 & 19**. The scan performed at these columns are **Scan #1, #2, #3, #4, #12, #13, #15, #16, #18, #19, #23, #24, #25, #26, #30, #32, #33 & #69**. Please, refer to **Appendix D** for more information.



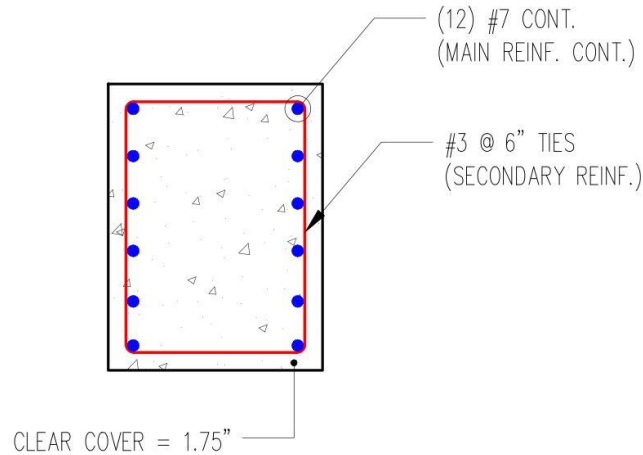
## **Section #2: (Concrete Column)**

*Main Reinforcement: (12) #7 continuous*

*Secondary Reinforcement (TIES): #3 with spacing of 6.0"*

*The clear cover of the reinforcement is 1.75".*

**Commentaries:** The detail correspond to one particular column at interior on the first level of the building with column's id of **7, 10, 13, 17 & 20**. The scan performed at this column s **Scan #7, #20, #27, #28 & #29**. Please, refer to **Appendix D** for more information.



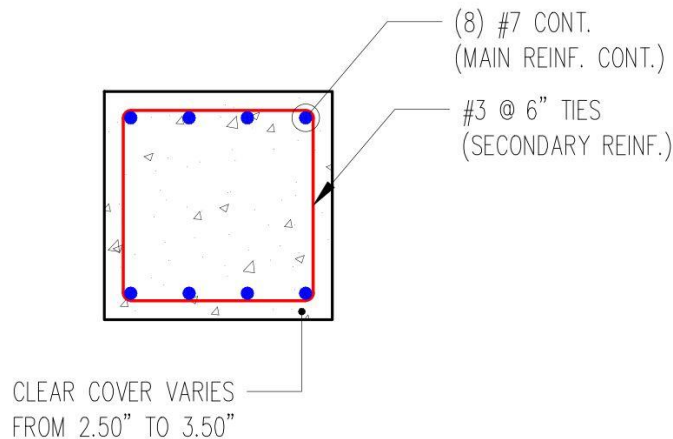
## **Section #3: (Concrete Column)**

*Main Reinforcement: (8) #7 continuous*

*Secondary Reinforcement (TIES): #3 with spacing of 6.0"*

*The clear cover of the reinforcement varies from 2.50" to 3.50".*

**Commentaries:** The detail correspond to few exterior columns on the first level of the building with column's id of **7, 8 & 16**. The scan performed at these columns are **Scan #9, #10, #67 & #68**. Please, refer to **Appendix D** for more information.



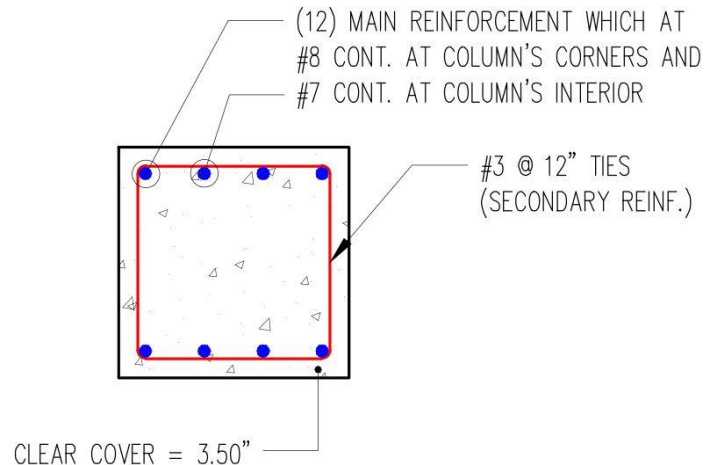
#### **Section #4: (Concrete Column)**

*Main Reinforcement: (12) #8 continuous at column's corners and #7 continuous at column's interior.*

*Secondary Reinforcement (TIES): #3 with spacing of 12.0"*

*The clear cover of the reinforcement is 3.50".*

**Commentaries:** The detail correspond to only one interior column on the first level of the building with column's id of **4**. The scan performed at this column is **Scan #62 & #63**. Please, refer to **Appendix D** for more information.



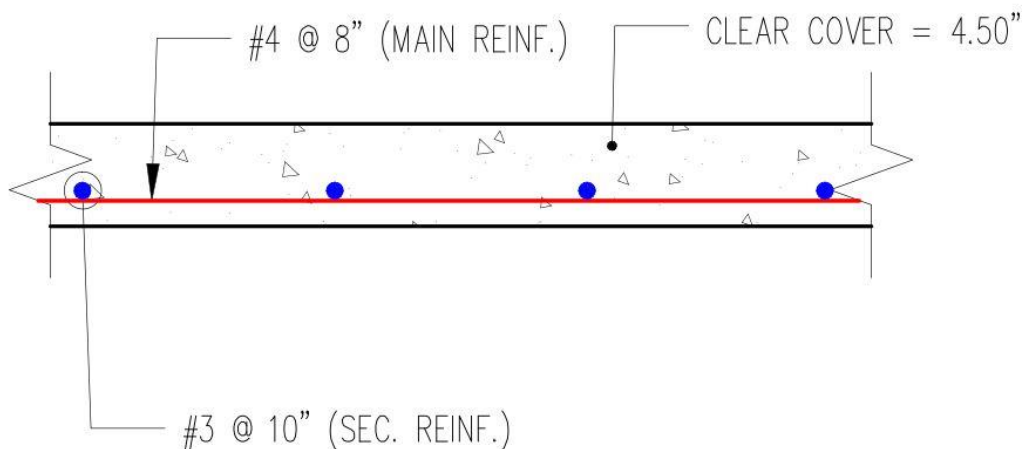
#### **Section #5: (Concrete Slab):**

*Main Reinforcement: #4 with spacing of 8.0"*

*Secondary Reinforcement: #3 with spacing of 10.0"*

*The clear cover of the reinforcement is 4.50"*

**Comments:** The detail corresponds to the **second level slab** of the structure on scanned areas. The scans performed at these slabs are **Scan #87, #88 & #89**. Please, refer to **Appendix D** for more information.





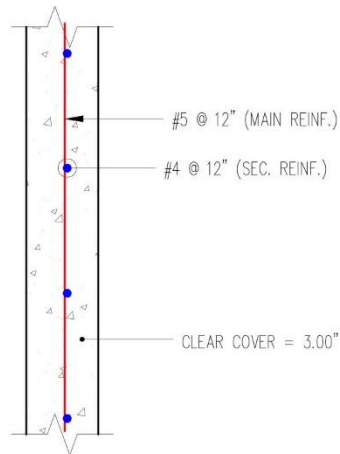
### **Section 6: (Concrete Wall)**

*Main Reinforcement: #5 with spacing of 12.0"*

*Secondary Reinforcement: #4 with spacing of 12.0"*

*The clear cover of the reinforcement is 3.00".*

**Comments:** The detail corresponds to one particular wall on the **first level** of the structure with wall's id of **I**. The scans performed at this wall is **Scan #66**. Please, refer to **Appendix D** for more information.



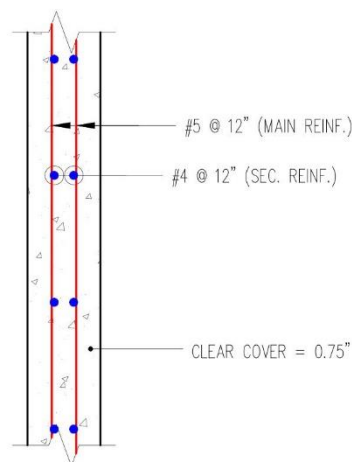
### **Section 7: (Concrete Wall)**

*Main Reinforcement: (2) layers aligned of #5 with spacing of 12.0"*

*Secondary Reinforcement: (2) layers aligned of #4 with spacing of 12.0"*

*The clear cover of the reinforcement is 0.75".*

**Comments:** The detail corresponds to one particular wall on the **first level** of the structure with wall's id of **H**. The scans performed at this wall is **Scan #31**. Please, refer to **Appendix D** for more information.





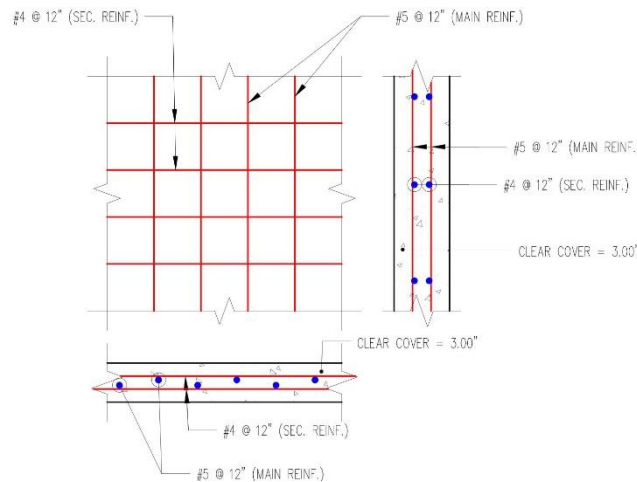
## Section 8: (Concrete Wall)

*Main Reinforcement: (2) layers with offset of #5 with spacing of 12.0"*

*Secondary Reinforcement: (2) layers aligned of #4 with spacing of 12.0"*

*The clear cover of the reinforcement is 3.00".*

**Comments:** The detail corresponds to most of the wall scanned on the **first level** of the structure with wall's id of **A, B, C, D, E, F, G, J, K**. The scans performed at these walls are **Scan #5, #6, #8, #11, #14, #17, #21, #22, #64 & #65**. Please, refer to **Appendix D** for more information.



## Section #9: (Concrete Beam)

*Main Reinforcement (TOP): (4) continuous #Not Determined*

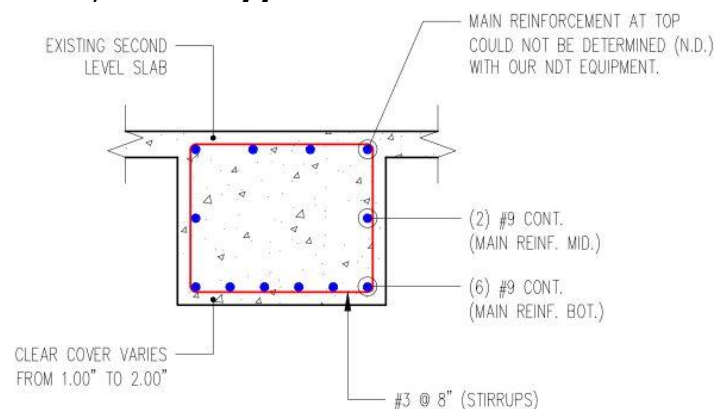
*Main Reinforcement (MIDDLE): (2) #9 continuous*

*Main Reinforcement (BOTTOM): (6) #9 continuous*

*Secondary Reinforcement (STIRRUPS): #3 with spacing of 8.0"*

*The clear cover of the reinforcement varies from 1.00" to 2.00".*

**Comments:** The detail corresponds to one particular beam of the second level of the building with beam's id of **B-1**. The scans performed on these beams are **Scans #34, #37 & #40**. Please, refer to **Appendix D** for more information.



### **Section #10: (Concrete Beam)**

*Main Reinforcement (TOP): Not Determined*

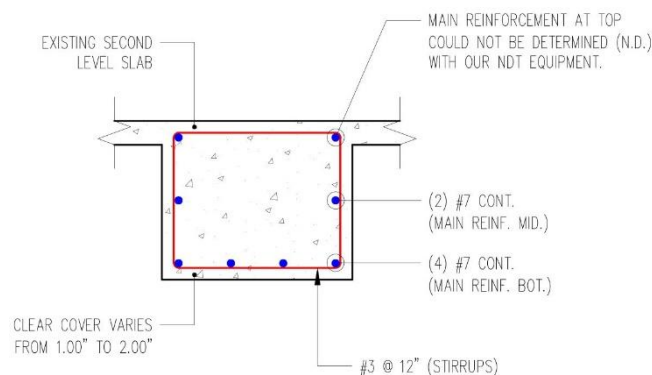
*Main Reinforcement (MIDDLE): (2) #7 continuous*

*Main Reinforcement (BOTTOM): (4) #7 continuous*

*Secondary Reinforcement (STIRRUPS): #3 with spacing of 12.0"*

*The clear cover of the reinforcement varies from 1.00" to 2.00".*

**Comments:** The detail corresponds to interior beams of the second level of the building with beam's id of **B-7, B-8 & B-9**. The scans performed on these beams are **Scans #35, #36, #38, #39, #41, #42, #43, #44 & #47**. Please, refer to **Appendix D** for more information.



### **Section 11: (Concrete Beam)**

*Main Reinforcement (TOP): Not Determined*

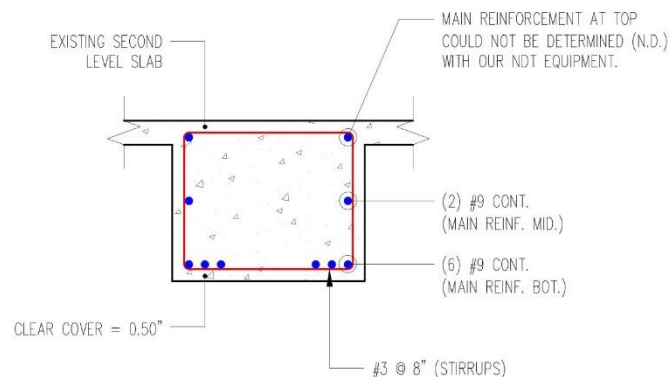
*Main Reinforcement (MIDDLE): (2) #9 continuous*

*Main Reinforcement (BOTTOM): (6) #9 continuous*

*Secondary Reinforcement (STIRRUPS): #3 with spacing of 8.0"*

*The clear cover of the reinforcement is 0.50".*

**Comments:** The detail corresponds to one particular beam of the second level of the building with beam's id of **B-2**. The scans performed on these beams are **Scans #45 & #46**. Please, refer to **Appendix D** for more information.



### **Section #12: (Concrete Beam)**

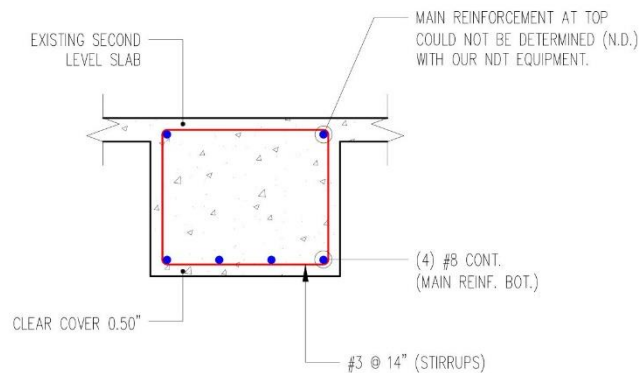
*Main Reinforcement (TOP): Not Determined*

*Main Reinforcement (BOTTOM): (4) #8 continuous*

*Secondary Reinforcement (STIRRUPS): #3 with spacing of 14.0"*

*The clear cover of the reinforcement is 0.50".*

**Comments:** The detail corresponds to two beams of the second level at the west side of the structure with beam's id of **B-3 & B-4**. The scans performed on these beams are **Scans #48, #49, #51, #53 & #75**. Please, refer to **Appendix D** for more information.



### **Section #13: (Concrete Beam)**

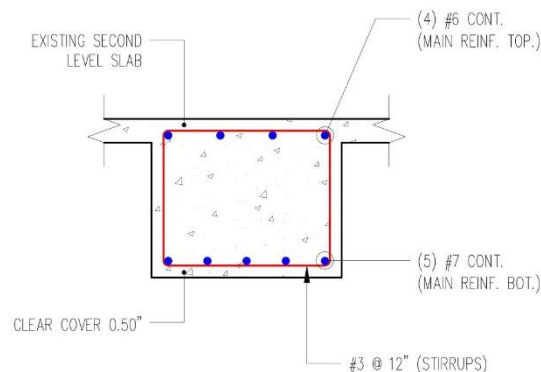
*Main Reinforcement (TOP): (4) #4 continuous*

*Main Reinforcement (BOTTOM): (5) #7 continuous*

*Secondary Reinforcement (STIRRUPS): #3 with spacing of 12.0"*

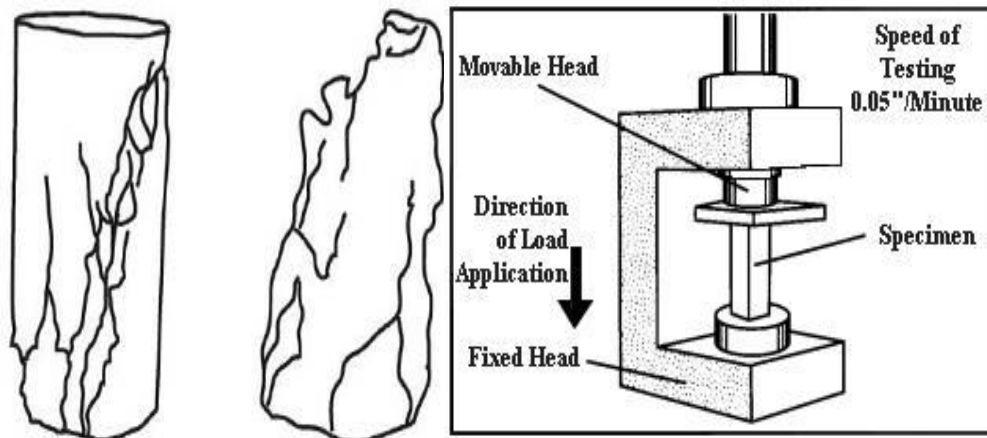
*The clear cover of the reinforcement is 0.50\".*

**Comments:** The detail corresponds to two beams of the second level at the west side of the structure with beam's id of **B-5, B6 & B-10**. The scans performed on these beams are **Scans #50, #52, #54, #56, #74, #76 & #77**. Please, refer to **Appendix D** for more information.



## 2. HARDENED CONCRETE COMPRESSIVE STRENGTH

**Thirteen (13)** hardened concrete samples (cores) were obtained from **Walls** and **Columns** of **New 911 Building**, to determine the compressive strength of the concrete. Core drilling and testing were performed following the requirements of **ASTM C 42, "Standard Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete."** The moisture conditioning of the cores was as specified in **Section 7.3** of **ASTM C 42**. The results are presented in the **Table 1**. For the photos of core tested refer to **Appendix C** and for locations of the secured samples, refer to **Appendix E** at the end of this document.



**Figure 1: Typical Compressive Strength Test on Hardened Concrete Cores**

**Table 1: Compressive Strength of Hardened Extracted Concrete Cores**

Core ID	Level	Element	L/D	Correction Factor	Uncorrected Strength (psi)	Corrected Strength (psi)
CO-1	First	Column	2.018	1.000	3,351	3,350
CO-2	First	Column	1.957	1.000	3,683	3,680
CO-3	First	Column	1.966	1.000	4,931	4,930
CO-8	First	Column	2.074	1.000	3,543	3,540
CO-12	First	Column	2.067	1.000	5,102	5,100
CO-14	First	Column	2.006	1.000	4,193	4,190
CO-16	First	Column	1.976	1.000	3,350	3,350
CO-18	First	Column	2.014	1.000	3,543	3,540
CO-B	First	Wall	2.031	1.000	4,732	4,730
CO-C	First	Wall	2.038	1.000	4,308	4,310
CO-E	First	Wall	2.011	1.000	5,267	5,270
CO-J	First	Wall	2.014	1.000	2,924	2,930
CO-K	First	Wall	2.007	1.000	3,407	3,410

Samples were cured in moisture conditions by sealed plastic bags prior testing, as stated in **ASTM C42 Section 7.3**.

- ✓ **ACI 318-19** states the following:
- ✓ **26.12.6.1 (e)** — Concrete in an area represented by core tests shall be considered structurally adequate if the average of three cores is equal to at least **85 percent** of  $f'_c$  and if no single core is less than **75 percent** of  $f'_c$ . Additional testing of cores extracted from locations represented by erratic core strength results shall be permitted.
- ✓ **85 percent criteria -  $f'_c = 5,000 \text{ psi} = 4,250 \text{ psi}$**
- ✓ **75 percent criteria -  $f'_c = 5,000 \text{ psi} = 3,750 \text{ psi}$**
- ✓ **85 percent criteria -  $f'_c = 4,000 \text{ psi} = 3,400 \text{ psi}$**
- ✓ **75 percent criteria -  $f'_c = 4,000 \text{ psi} = 3,000 \text{ psi}$**
- ✓ **85 percent criteria -  $f'_c = 3,000 \text{ psi} = 2,550 \text{ psi}$**
- ✓ **75 percent criteria -  $f'_c = 3,000 \text{ psi} = 2,250 \text{ psi}$**

### **3. ASTM C803 – Standard Test Method for Penetration Resistance of Hardened Concrete**

**Penetration Resistance of Hardened Concrete** – Fourteen (14) sets of three (3) probes were performed on May 31, 2022, following the guidelines of **ASTM C803 – Standard Test Method for Penetration Resistance of Hardened Concrete**. This method is used extensively to assess the uniformity of concrete and to identify zones of poor quality or deteriorated concrete in structures. With the results obtained the in-place strength may be estimated with proper hardened concrete core strength test correlations, that were performed in several areas to determine the correction factor to be applied for the Windsor Testing presented in the next section.

Nevertheless, we have included (14) fourteen sets of test result in **Table 2** and **Table 3**. The **Table 2** presents the results based on the measured penetration of the test probes, while **Table 3** presents the results of the tests based on the estimated strength of the concrete using the **Standard Power Table** included with the Windsor Probe equipment literature.

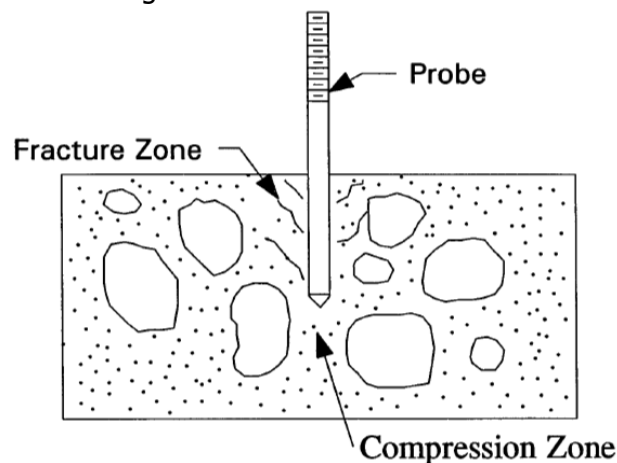
The penetration resistance test is based on the depth of penetration of steel-alloy probes that are shot into the concrete. This test method determines the hardness or penetration resistance of the concrete, which is related to its strength.

The Windsor probe, like the rebound hammer, is a hardness tester. The probe penetration relates to the compressive strength of the concrete below the surface, which makes it possible

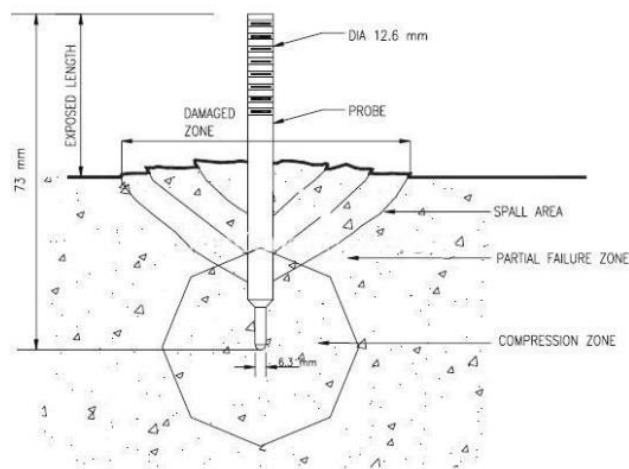


to develop empirical correlations between compressive strength properties and the penetration depth of the probe. The probe causes the concrete to fracture in a cone-shaped zone below the surface with cracks propagating up to the surface. Further penetration below this zone is resisted by the compression of the adjacent material and the hardness of the aggregate.

Some factors like hardness, type and size of aggregates, voids in concrete, moisture content of hardened concrete, curing conditions, surface conditions, degree of carbonation and age of the concrete will have significant effect on probe penetration. The most common and accurate method to determine the compressive strength on hardened concrete is by the extraction of cores. In this particular structure, from various correlation tests (cores vs penetration) is practical to determine, that the average strength determined by the Windsor probe test program represents **60%** of the actual strength of the concrete at the time of the test for this particular building.



**Figure 2: Typical Penetration Resistance on Hardened Concrete Schematic**



**Figure 3: Typical Penetration Resistance on Hardened Concrete Schematic**

**Table 2: Penetration Resistance of Hardened Concrete – Exposed Length**

Test ID	Structure Element	Level Location	Exposed Length (in)			Average (in)
			P1	P2	P3	
<b>WT-1</b>	Interior Column	First	2.08	2.10	1.90	<b>2.03</b>
<b>WT-2</b>	Interior Column	First	2.05	2.11	2.14	<b>2.10</b>
<b>WT-3</b>	Interior Column	First	2.00	2.02	2.09	<b>2.04</b>
<b>WT-J</b>	Exterior Wall	First	1.99	2.08	2.10	<b>2.06</b>
<b>WT-B1</b>	Interior Beam	Second	2.21	2.24	2.12	<b>2.19</b>
<b>WT-B2</b>	Interior Beam	Second	2.06	2.14	2.06	<b>2.09</b>
<b>WT-B3</b>	Interior Beam	Second	2.02	2.06	2.13	<b>2.07</b>
<b>WT-B4</b>	Interior Beam	Second	2.12	1.98	2.13	<b>2.08</b>
<b>WT-B6</b>	Interior Beam	Second	2.08	2.18	2.07	<b>2.11</b>
<b>WT-B7</b>	Interior Beam	Second	2.19	2.04	2.06	<b>2.10</b>
<b>WT-B8</b>	Interior Beam	Second	2.14	2.15	2.33	<b>2.21</b>
<b>WT-B9</b>	Exterior Beam	Second	2.28	2.15	2.17	<b>2.20</b>
<b>WT-B10</b>	Exterior Beam	Second	2.05	2.16	2.15	<b>2.12</b>
<b>WT-B13</b>	Exterior Beam	Second	1.96	2.05	2.13	<b>2.05</b>
<b>Aggregate Mohs Scale #4</b>						

**Table 3: Penetration Resistance of Hardened Concrete – Strength**

Test ID	Structure Element	Level Location	Theoretical Strength (psi)			Average (psi)	Corrected Strength (psi)
			P1	P2	P3		
<b>WT-1</b>	Interior Column	First	7,105	7,221	5,829	6,718	<b>4,030</b>
<b>WT-2</b>	Interior Column	First	6,902	7,293	7,482	7,226	<b>4,340</b>
<b>WT-3</b>	Interior Column	First	6,540	6,655	7,163	6,781	<b>4,070</b>
<b>WT-J</b>	Exterior Wall	First	6,467	7,105	7,221	6,931	<b>4,160</b>
<b>WT-B1</b>	Interior Beam	Second	7,989	8,178	7,351	7,839	<b>4,700</b>
<b>WT-B2</b>	Interior Beam	Second	6,974	7,482	6,974	7,143	<b>4,290</b>
<b>WT-B3</b>	Interior Beam	Second	6,655	6,974	7,409	7,013	<b>4,210</b>
<b>WT-B4</b>	Interior Beam	Second	7,351	6,394	7,409	7,051	<b>4,230</b>
<b>WT-B6</b>	Interior Beam	Second	7,105	7,801	7,032	7,313	<b>4,390</b>
<b>WT-B7</b>	Interior Beam	Second	7,859	6,786	6,974	7,206	<b>4,320</b>
<b>WT-B8</b>	Interior Beam	Second	7,482	7,598	8,801	7,960	<b>4,780</b>
<b>WT-B9</b>	Exterior Beam	Second	8,497	7,598	7,728	7,941	<b>4,760</b>
<b>WT-B10</b>	Exterior Beam	Second	6,902	7,670	7,598	7,390	<b>4,430</b>
<b>WT-B13</b>	Exterior Beam	Second	6,278	6,902	7,409	6,863	<b>4,120</b>
<b>Aggregate Mohs Scale #4</b>							

- **Windsor probe vs core sample correlation/calibration represents a reduction of 40% in strength.**

#### **4. FINAL COMMENTS**

Some of these scans results to be **Concrete Masonry Walls (CMU)**, most typical to many of the interior's walls of the buildings. For these CMU walls, **reinforcement could not be determined** and **connection** with structural concrete column, beams or slabs **could not be found** during the scanning works due to either were not found or CMU wall shows many voids thus reinforcement could not be observed.

**By request of Eng. Doris Quiñones, which is the Structural Consultant, our team perform only one scanning on the second level, with Scan id location #90, which is a scanning performed between an offset of second level column with third level secondary beam. The scan result with (4) four #7 at bottom and stirrups of #3 with spacing of 6". In this particular scanning location, at least (3) three stirrups could be located on the offset between the secondary beam and exterior column.**

The undersigned are available to assist the design team in the evaluation of the test results presented herein and in the development of the rehabilitation plan of **New 911 Building**.

Finally, it is recommended that a copy of this report be provided to the Structural and/or Architect Consultant

If there are any questions, contact the undersigned at your convenience.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read 'Pedro Febo Boria', is written over a horizontal line.

PEDRO FEBO BORIA, AE  
Engineer/Vice-President

## **1. APPENDIX A – GENERAL & FIELD WORKS PHOTOS DURING SITE VISITS**



***Photo 1: Performing scanning on walls before core drilling.***



***Photo 2: Performing scanning on beams before Windsor test.***





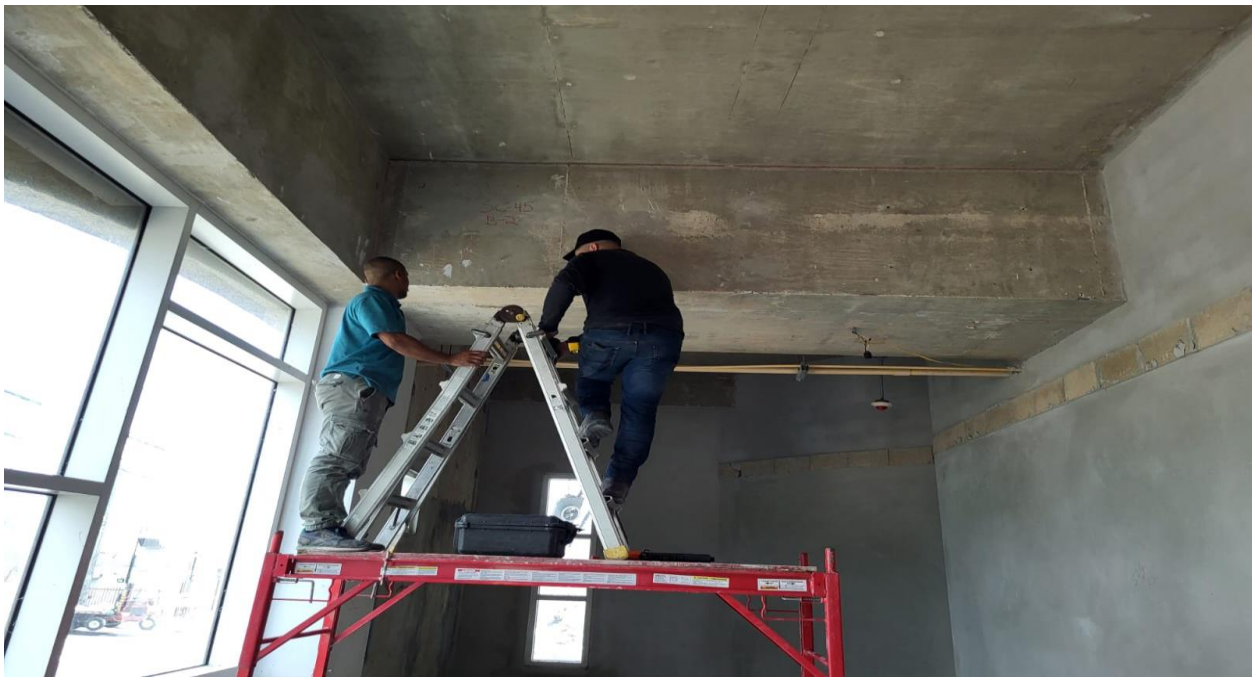
***Photo 3: Performing scanning on CMU walls.***



***Photo 4: Performing scanning on CMU walls.***



***Photo 5: Performing scanning on CMU walls.***



***Photo 6: Scanning beams to determine the reinforcement.***





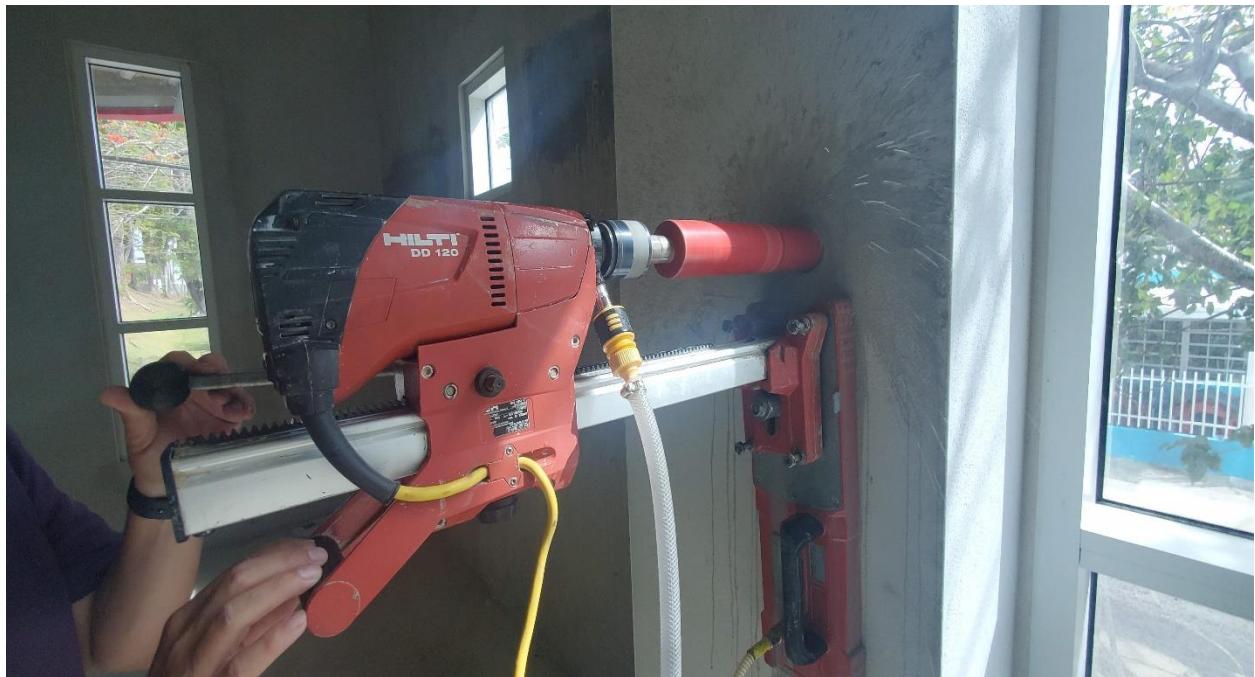
***Photo 7: Scanning beams to determine the reinforcement.***



***Photo 8: Slab of the second level was also scanned.***



***Photo 9: Core drilling to extract concrete sample for physical testing.***



***Photo 10: Core drilling to extract concrete sample for physical testing.***





***Photo 11: After core extraction, holes were backfilled with high strength structural mortar.***



***Photo 12: After core extraction, holes were backfilled with high strength structural mortar.***





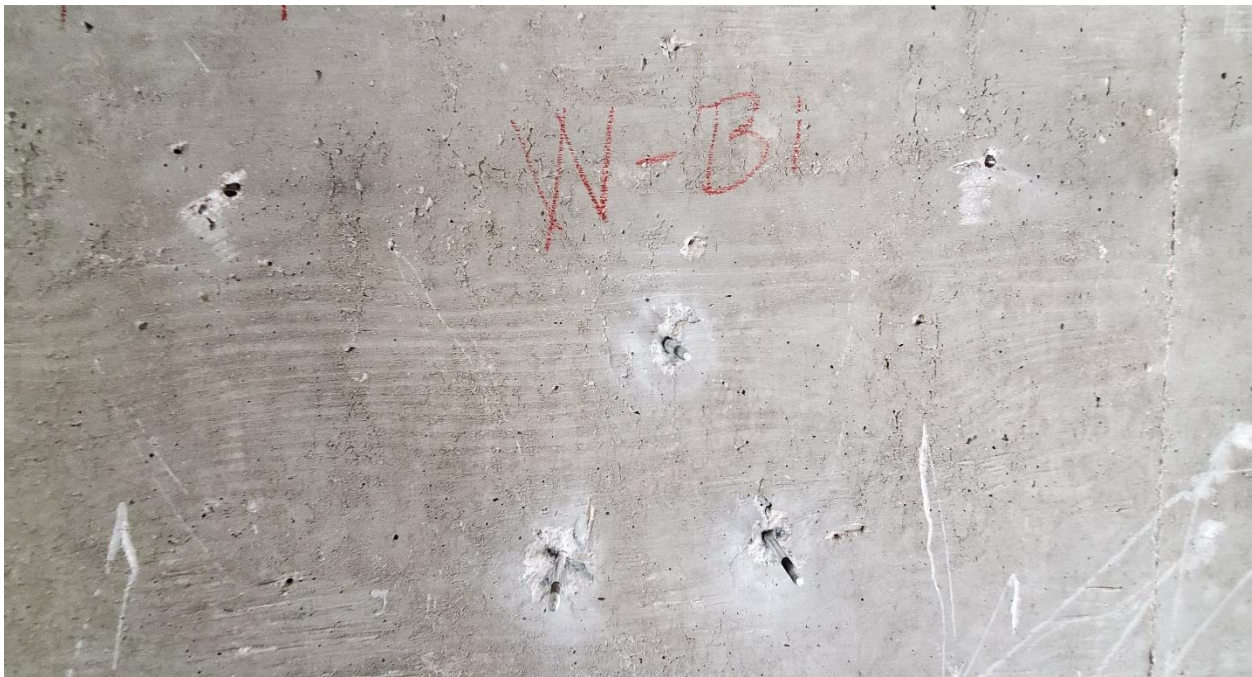
***Photo 13: After core extraction, holes were backfilled with high strength structural mortar.***



***Photo 14: After core extraction, holes were backfilled with high strength structural mortar.***



***Photo 15: Performing Windsor test at columns.***

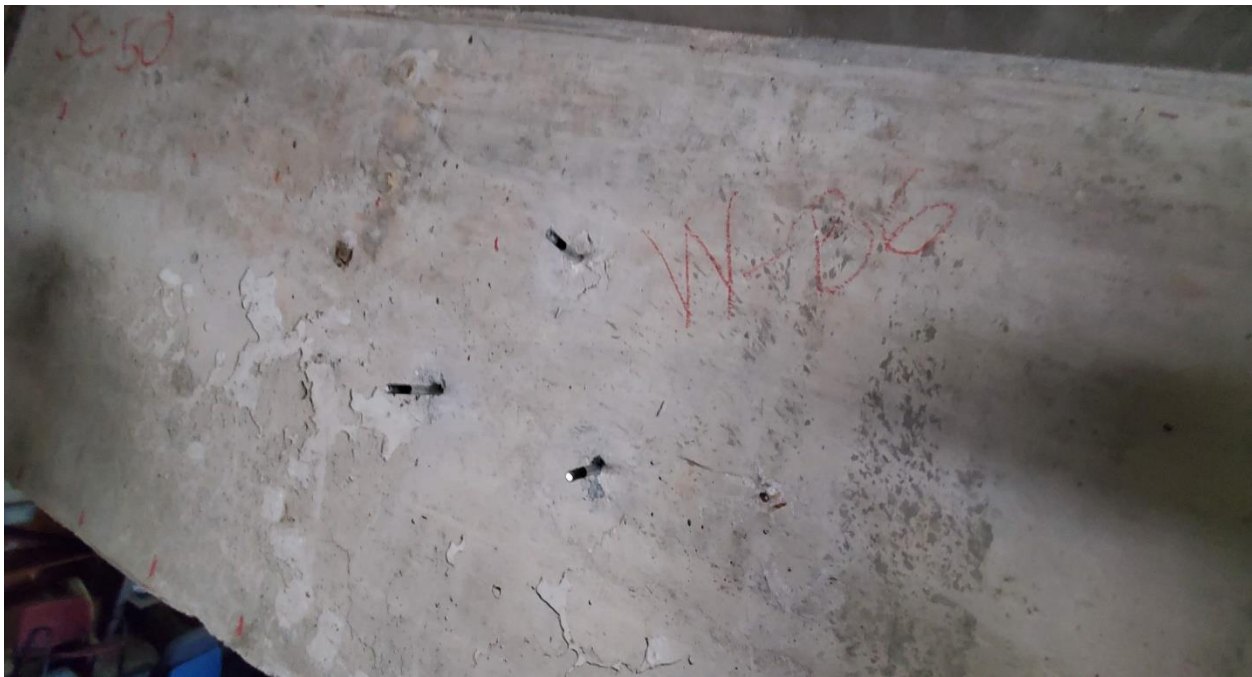


***Photo 16: Windsor probes embedded into concrete beams for measuring.***





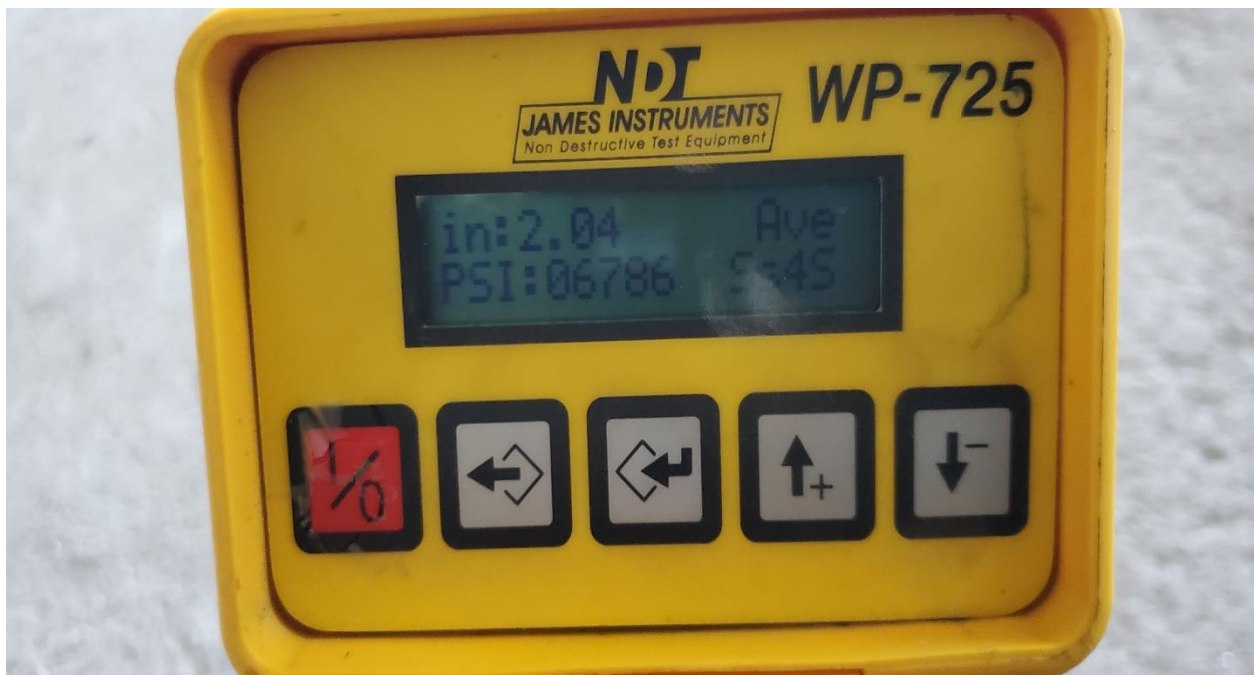
***Photo 17: Windsor probes embedded into concrete beams for measuring.***



***Photo 18: Windsor probes embedded into concrete beams for measuring.***



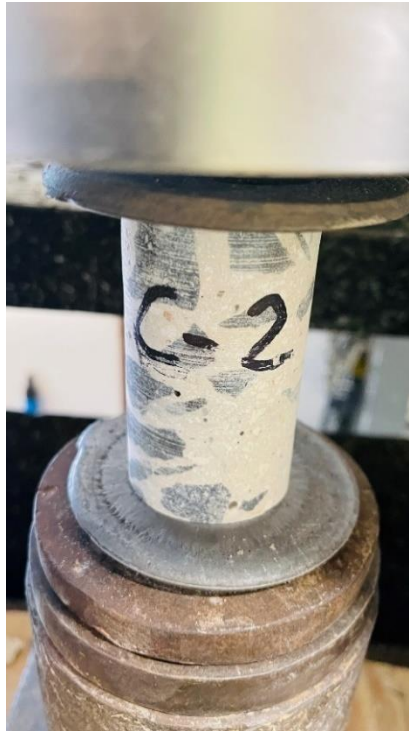
***Photo 19: Windsor probes embedded into concrete columns for measuring.***



***Photo 20: Windsor test on column #3 (WT-3) average results.***

## **2. APPENDIX B – CONCRETE CORES COMPRESSIVE STRENGTH PICTURES**





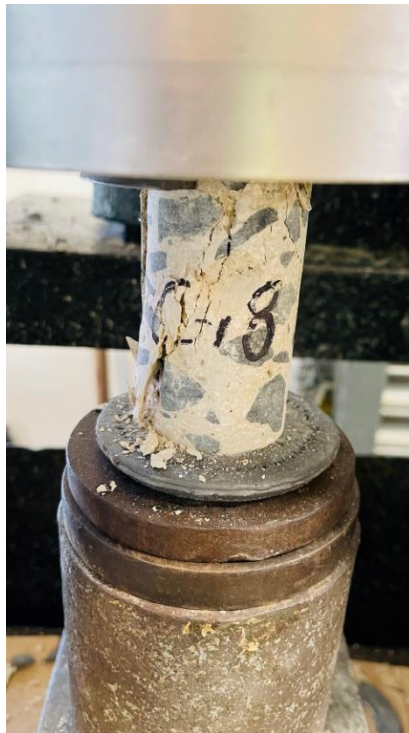
***Photo 21: Core sample CO-2 before testing***



***Photo 22: Core sample CO-2 after testing***



***Photo 23: Core sample CO-18 before testing***



***Photo 24: Core sample CO-18 after testing***



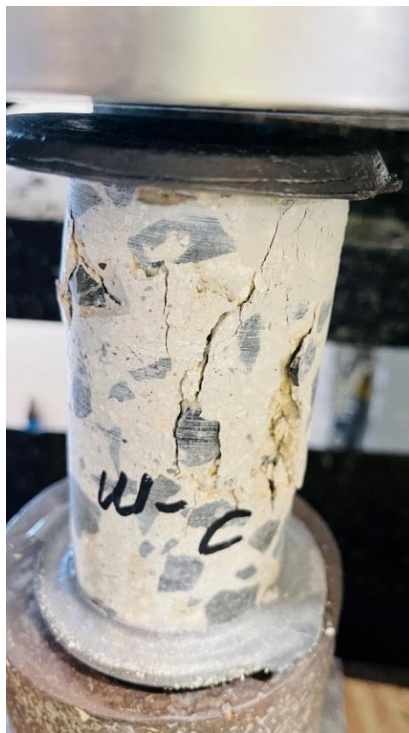
***Photo 25: Core sample CO-B before testing***



***Photo 26: Core sample CO-B after testing***

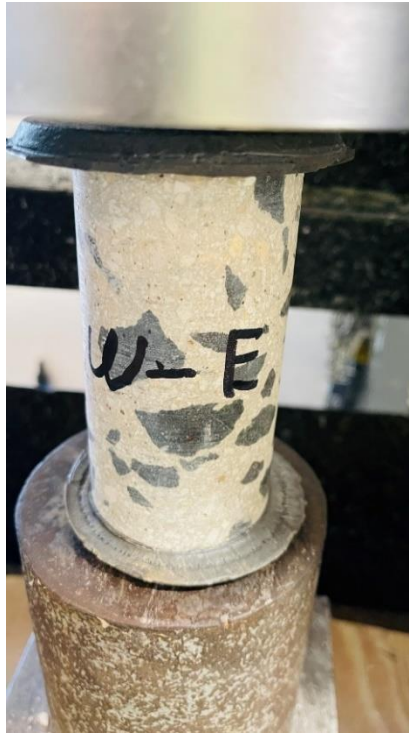


***Photo 27: Core sample CO-C before testing***

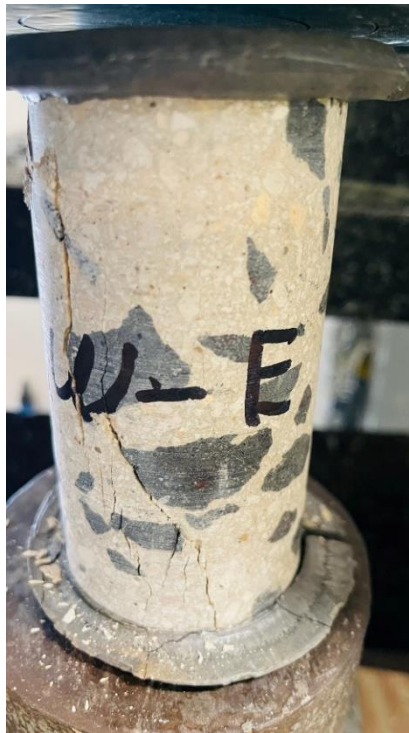


***Photo 28: Core sample CO-C after testing***





***Photo 29: Core sample CO-E before testing***



***Photo 30: Core sample CO-E after testing***



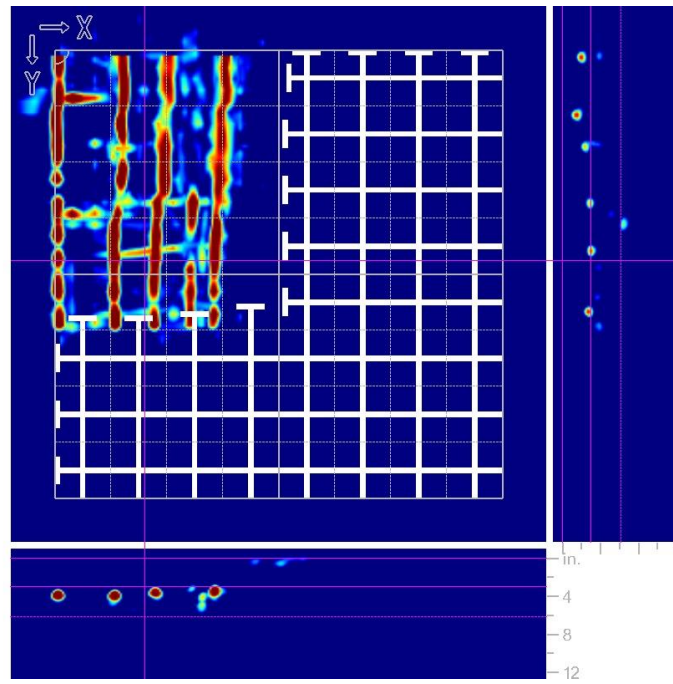


***Photo 31: Core sample CO-J before testing***

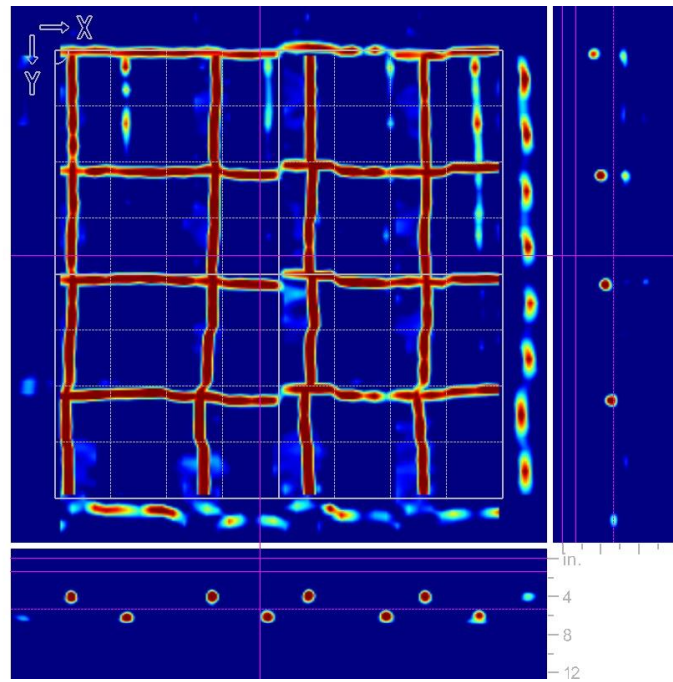


***Photo 32: Core sample CO-J after testing***

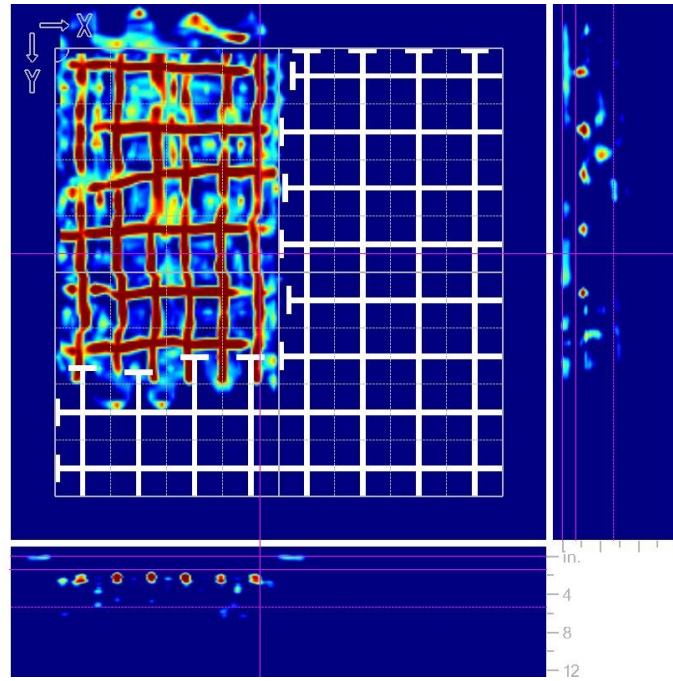
### **3. APPENDIX C – SCANNING OUTPUT IMAGES**



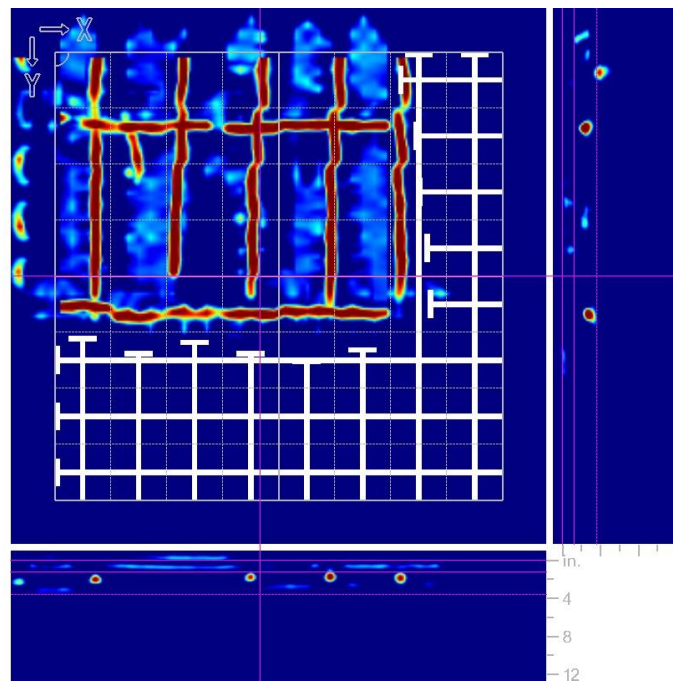
**Photo 24: Scan #3**



**Photo 25: Scan #5**



***Photo 25: Scan #7***



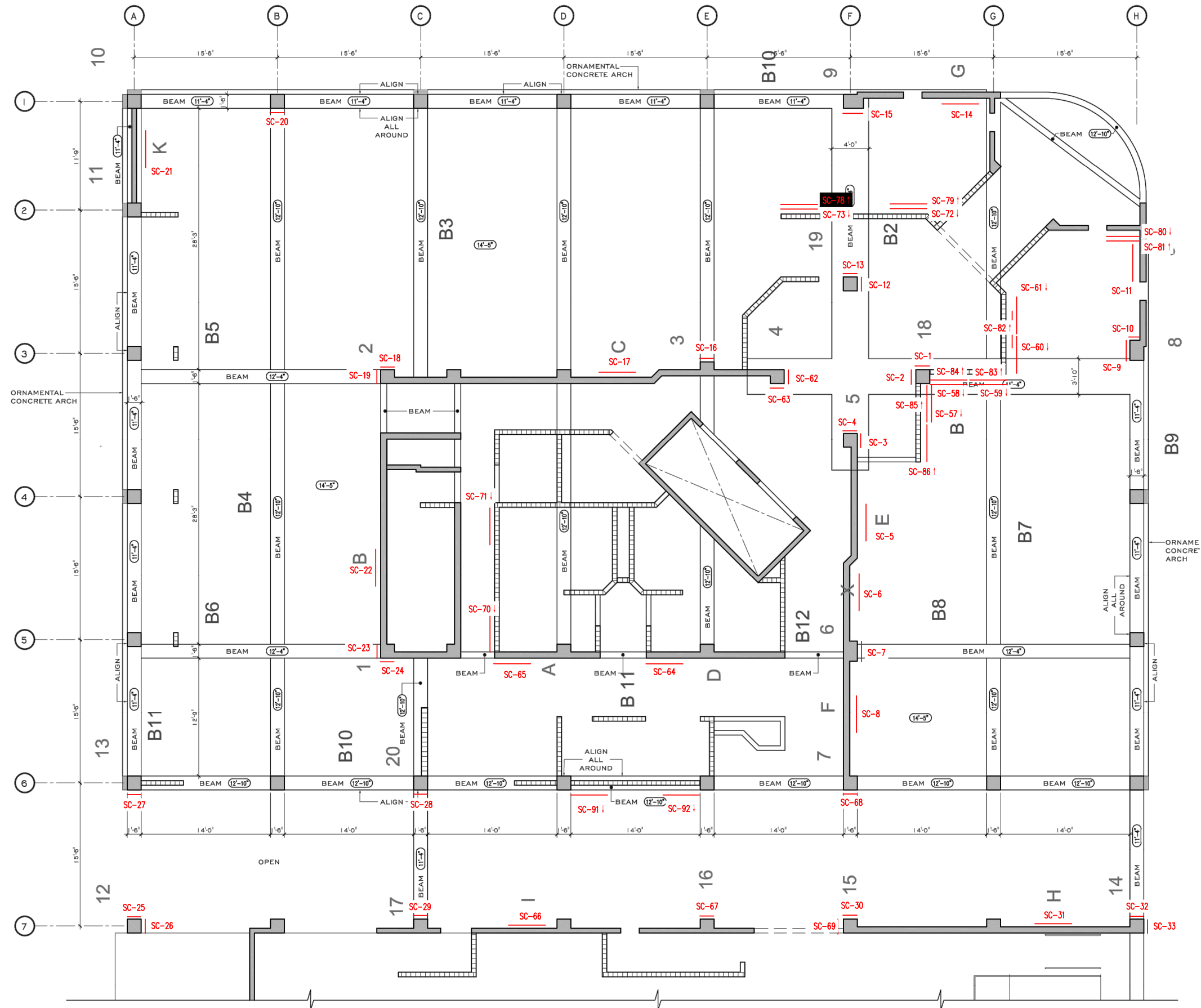
***Photo 26: Scan #40***

#### **4. APPENDIX D – DRAWINGS SKETCHES AND TEST LOCATIONS**



A diagram showing a beam of light entering from the left, passing through a lens, and then through a circular object. The beam is represented by a line with an arrowhead pointing to the right. The circular object is a small circle with a dot in the center. The beam continues to the right after passing through the circle.

# BEAMS B1- B11



EXISTING REFLECTIVE CEILING PLAN - FIRST LEVEL

SCALE:  $\frac{3}{16}'' = 1'-0''$



FIRST LEVEL AREA=8,137.556 SQ.FT.

[illegible]

PROJECT:  
CONC. QUALITY ASSESSMENT AT NEW 911 BUILDING  
SAN JUAN, PUERTO RICO

**IDENT:**

PROJECT # 22002\_S  
SCALE AS SHOWN  
PLOT SCALE 1=1  
DESIGNED  
DRAWN L.R.Z.  
DATE 2022.06.17

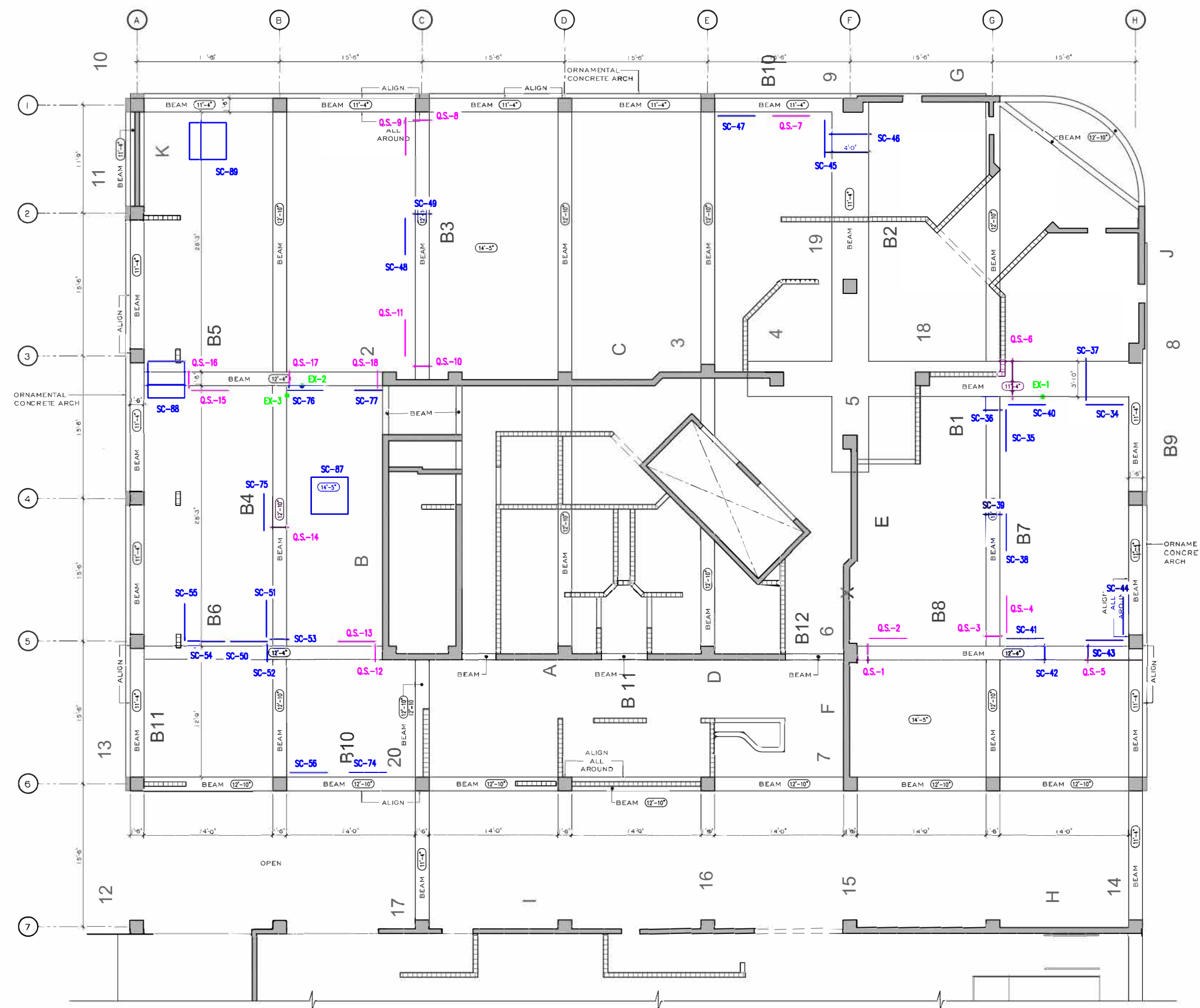
TITLE  
SCAN LOCATIONS ON  
WALLS & COLUMNS  
AT FIRST LEVEL OF  
911 BUILDING

SHEET NO. 1 OF 7

COLUMNS 1-20

R/C WALLS A-K

BEAMS B1- B11



EXISTING REFLECTIVE CEILING PLAN - FIRST LEVEL



FIRST LEVEL AREA=8,137.556 SQ.FT.

REV.	DATE	DESCRIPTION	BY	CHK'D
0				
Consultant				

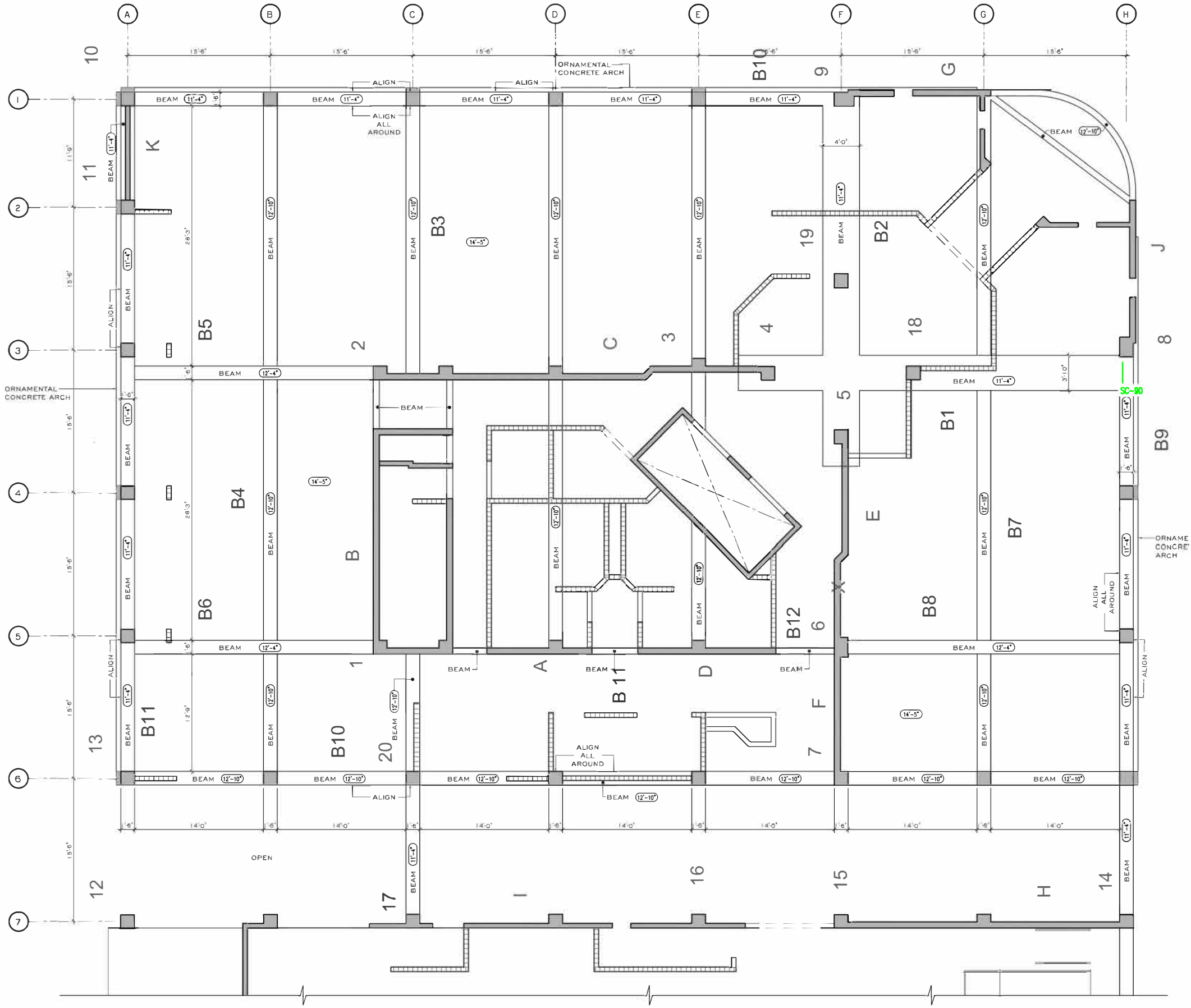
PROJECT: CONG. QUALITY ASSESSMENT AT NEW 911 BUILDING  
SAN JUAN, PUERTO RICO

PROJECT # 22002\_S  
SCALE AS SHOWN  
PLOT SCALE 1/8\"/>  
DESIGNED L.R.Z.  
DATE 2022.06.17  
TITLE SCAN & EXPLORATION ON BEAMS & SLABS AT SECOND LEVEL OF 911 BUILDING  
SHEET NO. 2 OF 7  
DRAWING

COLUMNS 1-20

R/C WALLS A-K

BEAMS B1- B11



EXISTING REFLECTIVE CEILING PLAN - FIRST LEVEL



FIRST LEVEL AREA=8,137.556 SQ. FT.

REV.	DATE	DESCRIPTION	BY	CHKD
0				

PROJECT: CONC. QUALITY ASSESSMENT AT NEW 911 BUILDING  
SAN JUAN, PUERTO RICO

PROJECT # 2022-02-S  
SCALE AS SHOWN  
PLOT SCALE 1/8"=1'-0"  
DESIGNED L.R.Z.  
DATE 2022.06.17  
TIME  
SCAN LOCATIONS ON BEAM AT THIRD LEVEL OF 911 BUILDING

SHEET NO 3 OF 7

DRAWING AB-103

# R/C WALLS A-K



FIRST LEVEL AREA=8,137.556 SQ.FT.

[illegible]

PROJECT:  
**CONC. QUALITY ASSESSMENT AT NEW 911 BUILDING**  
SAN JUAN, PUERTO RICO

PROJECT # 22002 S  
SCALE AS SHOWN  
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DESIGNED L.R.Z.  
DRAWN  
DATE 2022.06.17  
TITLE  
CORE & EXPLORATION  
ON WALLS & COLUMNS  
AT FIRST LEVEL OF  
911 BUILDING  
SHEET # NO. 4 OF 7

COLUMNS 1-20

R/C WALLS A-K

BEAMS B1- B11



EXISTING REFLECTIVE CEILING PLAN - FIRST LEVEL



FIRST LEVEL AREA=8,137.556 SQ.FT.

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PROJECT: CONC. QUALITY ASSESSMENT AT NEW 911 BUILDING  
SAN JUAN, PUERTO RICO

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DATE	2022.06.17

TITLE  
WINDSOR LOCATIONS ON  
WALLS & COLUMNS  
AT FIRST LEVEL OF  
911 BUILDING

SHEET NO 5 OF 7

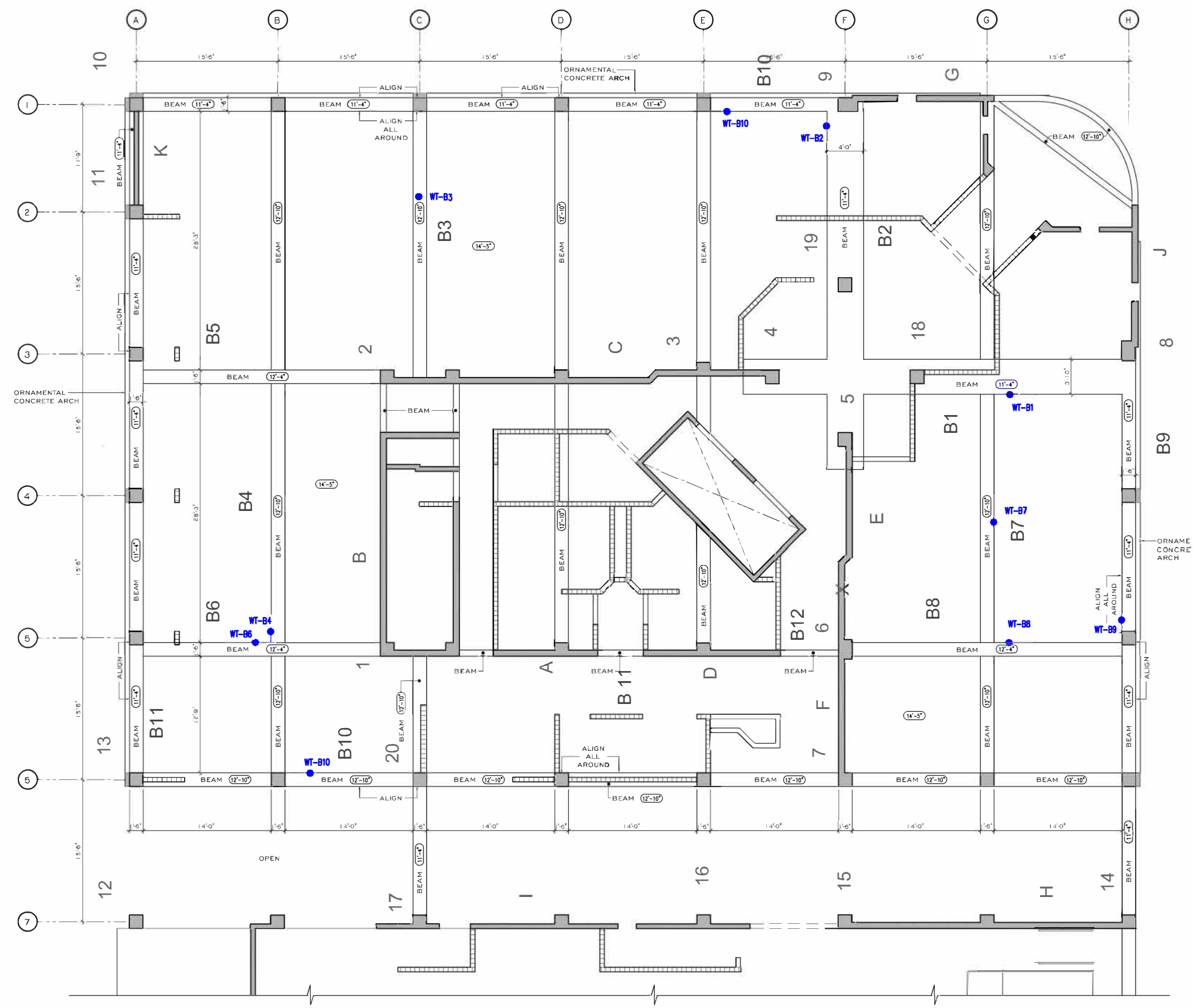
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COLUMNS 1-20

R/C WALLS A-K

BEAMS B1- B11



EXISTING REFLECTIVE CEILING PLAN - FIRST LEVEL

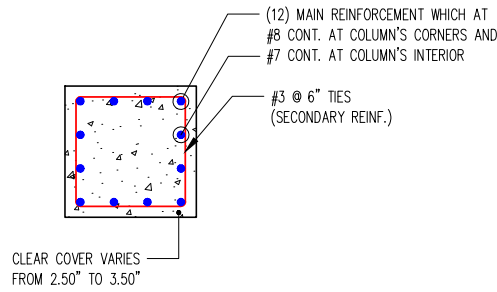


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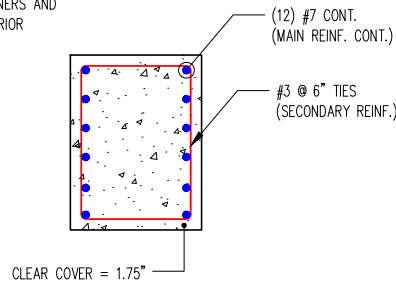
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SAN JUAN, PUERTO RICO

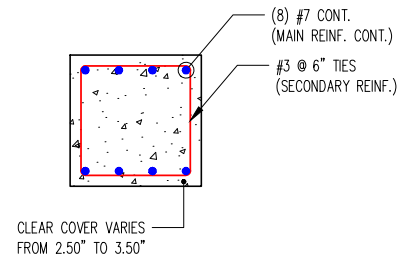
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TITLE WINDSOR LOCATIONS ON BEAMS AT SECOND LEVEL OF 911 BUILDING  
SHEET NO. 6 OF 7  
DRAWING



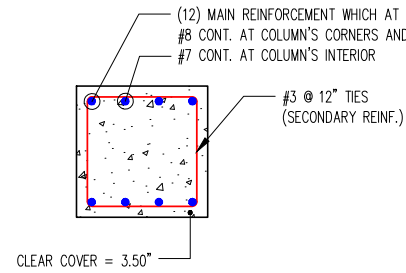
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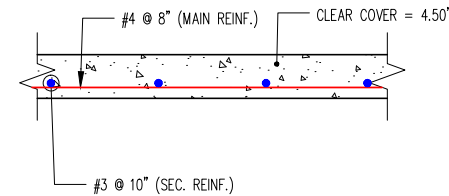
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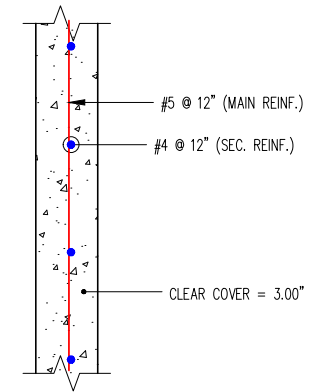
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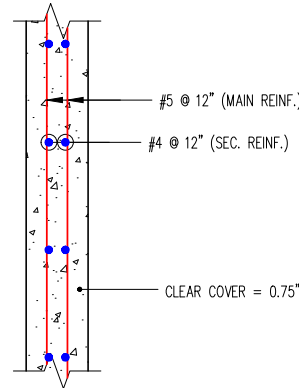
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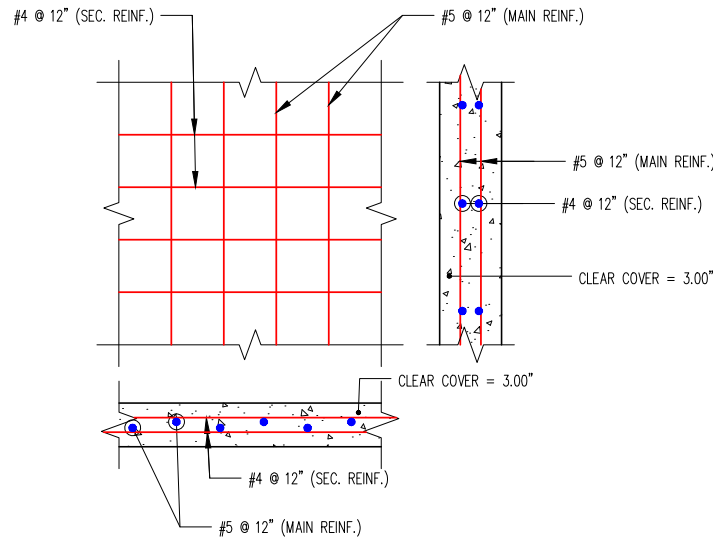
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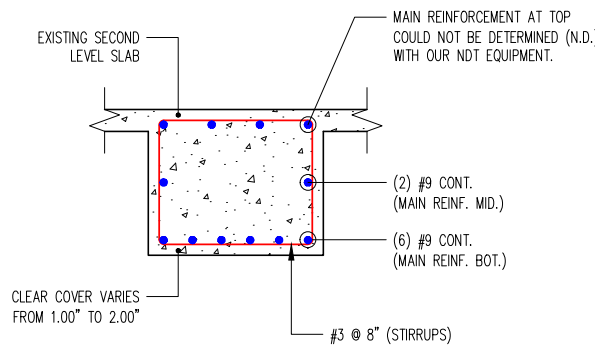
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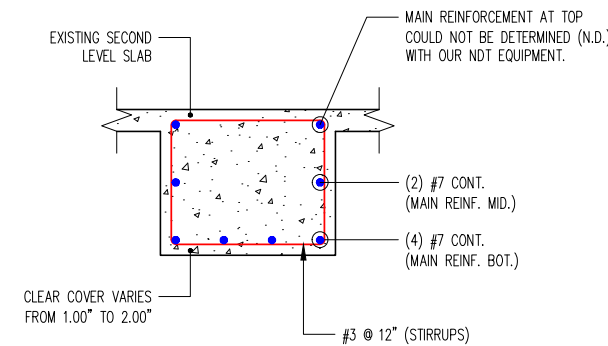
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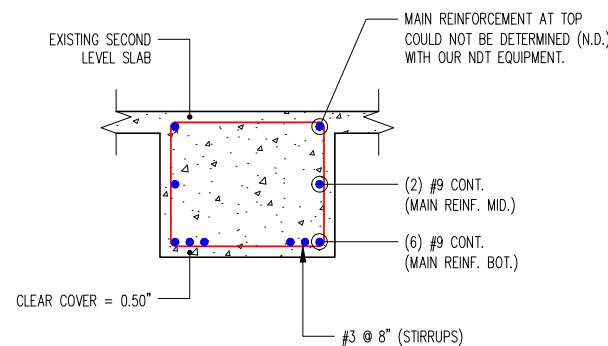
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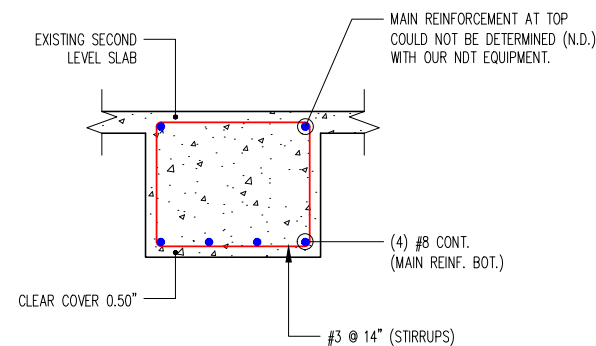
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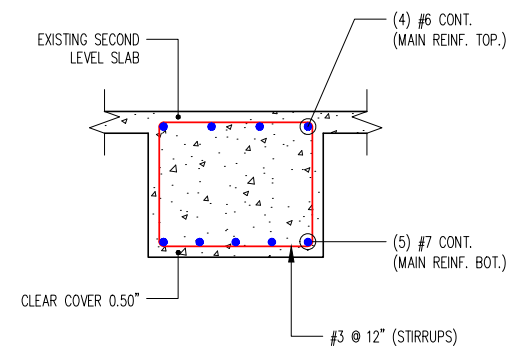
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BEAM SECTION 11  
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BEAM SECTION 12  
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BEAM SECTION 13  
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PROJECT: CONC. QUALITY ASSESSMENT AT NEW 911 BUILDING  
SAN JUAN, PUERTO RICO

PROJECT #	22002 S
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DATE	2022.06.17
TITLE	STRUCTURAL ELEMENTS DETAILS AS RESULTS OF SCANNING WORKS ON 911 BUILDING
SHEET NO.	7 OF 7
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AB-107



**STRUCTURAL ASSESMENT REPORT FOR  
EXISTING PARKING GARAGE BUILDING  
FOR THE CARIBE PLAZA BUILDING  
Per ASCE 41  
Seismic Rehabilitation of Existing Buildings**



Fecha de Expiración: 2024-03-24

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## **CARIBE PLAZA PARKING GARAGE BUILDING**

### **Project No. 2022-10B**

Seismic Evaluation of Existing Parking Garage Building per ASCE 41 and ASCE / SEI 31  
#1547 Paseo De León Avenue  
Rio Piedras, Puerto Rico 00926

### **I. INTRODUCTION :**

We have performed a seismic evaluation of the existing Parking Garage Building, using the ASCE-41, Tier 1 Seismic Evaluation Procedure. ASCE 41, titled “Seismic Rehabilitation of Existing Buildings,” is published by the American Society of Civil Engineers (ASCE). ASCE 41 is the standard for the seismic evaluation and retrofit of existing buildings. The primary objective of the Tier 1 is to evaluate and where necessary, reduce seismic risk efficiently where possible by using simplified procedures targeted to a specific building type. The information below forms the groundwork for this evaluation. This information is either derived from owner requirements, such as Risk Category and desired Structural Performance Level, or is site specific, such as Seismic Hazard Level.

Since the scope of work have changed since the existing structure does not meet the seismic resistance requirements for the Immediate Occupancy Structural Performance Level and would require extensive and unfeasible seismic retrofit work to reliably serve as an Essential Facility, the Basic Performance Objective for the existing building (BPOE) will be **Life Safety Structural Performance Level (S-3)** instead of Immediate Occupancy Performance Level as originally intended.



## II. PARKING GARAGE BUILDING DATA

### A. Documentation provided:

1. Architectural Drawings: Office building and parking building by Architect Fernando R. Díaz and Eng. Raul Colón, P.E., Plans and Elevations, sheets 1 to 150. Year 2007. Included in the architectural drawings set are the electrical, mechanical and structural drawings. **Structural drawings, plans and details** by Eng. Arturo Beale, P.E. Sheets S-1 to S-21 (23 pages total) Year 2007
2. Geotechnical Reports: Original soils report not provided, a new soils report performed by GMTS was done, Report Project No. G221554A, dated June 1<sup>st</sup>, 2022.
3. Other documentation: **NONE.**

### B. Building Data:

1. Square footage: 51,950 square feet
2. Building Width: 93'- 4"
3. Building Length: 111'- 4"
4. Building Height: 50'- 0"
5. Story Height: 10'- 0"
6. Number of Stories above grade: 5
7. Number of basement Stories below grade: 0 (There is a partial basement used as a mechanical room and water cistern room)
8. Year of Construction: 2009-2010
9. Building Codes: **1987 Uniform Building Code** and **ACI 318-95** (as shown in structural notes specification for concrete Note No. 12, page S-21, see Appendix A)

C. **Site Location Coordinates:** Latitude and Longitude 18.3836778, -66.0658617 (Google Earth)

D. **Risk Category:** **Risk Category II**

**E. Basic Performance Objective for the existing buildings (BPOE):**  
Life Safety Structural Performance Level (S-3)

**F. Level of Seismicity: High**

**G. Soil Type: Site Class D**

**H. Lateral force Resisting System as per ASCE 41 Building Type:**

**Longitudinal Direction: C2 - Concrete Shear Walls with Rigid Diaphragm.**

**Transverse Direction: C2 - Concrete Shear Walls with Rigid Diaphragm.**

### **III. PARKING BUILDING STRUCTURE DESCRIPTION:**

The gravity load structural system consists of one-way reinforced concrete slabs supported by reinforced concrete longitudinal beams-columns frames and/or reinforced concrete walls. The longitudinal beams are supported by 8" thick reinforced concrete walls and by interior reinforced concrete columns. The typical floor diaphragms, including the roof level, consist of 5" thick reinforced concrete slabs, except in the outside spans where the slab is 6" thick and in the ramp areas where the reinforced concrete slabs are 7" thick. The longitudinal beams dimensions are 18" wide by 2'-9" deep. They run along Axis 12, Axis 11, Axis 10 and Axis 9. They are supported by R/C columns and transverse shear walls. An 8" by 5'-0" deep reinforced concrete parapet, supported by 8" thick by 4'-0" long reinforced concrete walls located along Axis E-E. A typical floor level plan is shown in Appendix A. **The concrete frames are secondary components and were not designed to be part of the seismic force-resisting system. These are basic structural frames that were designed for gravity loads only.**

The **lateral load system** consists of reinforced concrete shear walls in both principal directions. The transverse shear wall is located along Axis A-A, between Axis 13 and Axis 8. The longitudinal shear wall is located along Axis 13, between Axis A-A and Axis D-D. The reinforced concrete floor slabs serve as horizontal rigid diaphragms to transfer load to the exterior shear walls.

The columns and shear walls are supported on reinforced concrete piles caps supported by 12" square precast piles with a load capacity of 110 tons each. Most of the reinforced concrete pile caps are tied in both directions by reinforced concrete tie beams, but a few piles caps are tied in just one direction. These tie beams support the 9" or 7" thick reinforced concrete ground level slab.

#### IV. PERFORMANCE OBJECTIVE:

Building performance can be described in terms of safety to the building occupants during and after a seismic event, the cost and viability of repairing the building to its pre-earthquake state and its economic and social impacts in its community. The extent of damage to a building is categorized as Building Performance Level. The ASCE 41 code presents a range of target building performance levels that must be determined when selecting a rehabilitation objective. The rehabilitation objective will determine the cost and feasibility of the rehabilitation project as well as the benefits obtained by improving the safety, reduction of property loss and interruption of use after a seismic event.

The performance objective consists of one or more pairings of a selected Seismic Hazard Level with a target Structural Performance Level and Nonstructural Performance Level. The Basic Performance Objective for Existing Buildings (BPOE) is a specific, seismic performance objective (from several available choices) and is dependent on the **risk category** of the building and the desired **seismic performance** expected by the owner. **The performance objective for existing buildings is a slightly lower category which may result in a lower level of safety and a higher probability of collapse than what may be provided by building codes for new buildings.** Buildings meeting the BPOE are expected to incur very little damage from relatively frequent, small to moderate earthquakes but are expected to sustain greater levels of damage and economic loss from severe earthquakes. The level of damage and potential economic loss for buildings rehabilitated to the BPOE will be greater than expected for the Basic Performance Objective for New Buildings (BPON).

The structure under evaluation must conform to the **Life Safety Structural Performance Level**. Life Safety structural performance level as defined by the ASCE 41, as the post-earthquake damage state in which the structure has damaged components but retains a margin against the beginning of partial or total collapse. A structure in compliance with the acceptance criteria specified in the ASCE 41 standard for this Structural Performance Level is expected to achieve this state.

**V. CARIBE PLAZA PARKING BUILDING - SEISMIC PARAMETERS by ASCE 7 and IBC 2018**

**For Risk Category II and Seismic Importance Factor  $I_e = 1.0$   
IBC Chapter 16, Section 1613 Earthquake Loads**

**Site Class** (as per section 1613.3.2) consider **Site Class D**

**Site Coefficients:**  $S_s$  and  $S_1$  from 0.2 and 1-second spectral response accelerations, respectively:

$$S_s = 0.98$$

$$S_1 = 0.39$$

**Per Section 1613.3.3 and Tables 1613.3.3(1) and 1613.3.3(2)**

$$F_v = 1.91$$

$$F_a = 1.108$$

$$S_{MS} = F_a * S_s = 1.108 * 0.98 = 1.086$$

$$S_{M1} = F_v * S_1 = 1.91 * 0.39 = 0.745$$

$$S_{DS} = 2/3 S_{MS} = 0.724$$

$$S_{D1} = 2/3 S_{M1} = 0.4966$$

**Values for BSE 1E** =  $2/3 * \text{BSE 2E}$  but  $\leq \text{BSE 1N}$

BSE 1N =  $2/3$  BSE 2N then  $S_{XS} = 2/3 * 1.086 = 0.724$  and  $S_{DS} = 0.483$

$$S_{X1} = 2/3 * 0.745 = 0.496 \text{ and } S_{D1} = 0.331$$

**Seismic Design Category D** - Since  $0.50g \leq S_{DS}$  and  $0.20g \leq S_{D1}$  (As per Table 1613.3.5(1) and 1613.3.5(2) Seismic Design Category, ICB)

**Soil Type D** - From soils investigation report provided by GMTS, Report No. G221554A, dated June 1<sup>st</sup>, 2022



**Per ASCE 7-10 Table 12.2-1 Design Coefficients and Factors for Seismic Force-Resisting Systems**

Seismic Force Resistance Systems Type B5 - Special Reinforced Concrete Shear Walls:

$$R = 6$$

$$\Omega_0 = 2.5$$

**$C_D = 5.0$  Height limit for Seismic Category D  $\leq 160$  ft (OK)**

Seismic Force Resistance Systems Type B6 - Ordinary Reinforced Concrete Shear Walls:

$$R = 5$$

$$\Omega_0 = 2.5$$

**$C_D = 4.5$  NOT PERMITTED for Seismic Category D**

**Equivalent Lateral Load ASCE 7 12.8**

$$T = C_1 * H^X$$

Where  $H=50' - 0"$ ,  $C_1 = 0.02$  and  $X=0.75$  then  $T_a = 0.02 * 50^{0.75} = 0.376$

$$T_L = 12 \quad T_a < T_L$$

$$C_s = S_{DS} / (R/I_e) \leq C_{s \max} \text{ where } C_{s \max} = S_{D1} / T * (R/I_e)$$

$$C_s = 0.145 \text{ for } S_{DS} = 0.724, R = 5 \text{ and } I_e = 1.0$$

$$C_s \leq C_{s \max} = 0.264$$

$$C_{s \min} = .044 S_{DS} * I = 0.0318$$

**Use  $C_s = 0.145$**

**VI. BUILDING TYPE & CHECKLISTS REQUIRED AS PER ASCE 41 TABLE 4.7:**

The building is primarily classified as **Building Type C2: Concrete Shear Wall with Stiff Diaphragm**. A Tier 1 Evaluation of this building type involves the completion of the following checklists, as per Table 4.7 from ASCE 41:

1. 16. 10 Life Safety Structural Checklist for Building Type C2
2. 16.1 Life Safety Basic Configuration Checklist
3. 16.17 Non Structural Checklist

Please refer to **Appendix C** for the completed checklists mentioned above. The comments next to each item provide a brief explanation of the building features that make it **Compliant** or **Not Compliant**.

## VII. CONDITION ASSESMENT OF THE EXISTING STRUCTURE :

In addition to the assessment for the existing building using ASCE 41 guidelines and requirements, this evaluation required the following additional studies:

As-built information on building configuration and dimensions, structural elements cross sections and its dimensions, adjacent building information, was not provided by Bersa Group Architect. We perform an as-built drawing and compared the dimensions against the structural drawings provided. The visual survey confirmed that the building construction; spans, structural elements locations and dimensions, generally conforms to the information provided on the construction documents. The exception encountered are the R/C column in Level C, Axis 12 and Axis D-D is 1'-4" long instead of 1'-6" long as illustrated in the structural drawings provided. In the next Levels it is 1'-6" long. Also steel guardrails where not provided as shown in architectural drawings.

Field verification was performed to confirm that the building was constructed in general conformance with the record drawings provided and that no modifications have been made during its construction or past renovations that could significantly affect the expected performance of the seismic force resisting system.

An investigative field verification of existing conditions to determine the following information on several existing structural members **must** be performed:

1. Compressive strength of several RC columns, shear walls and beams to be able to verify the actual compressive strength of the member's against the compressive strength specified on the structural drawings. Non-destructive and destructive methods should be employed to obtain in place properties of the existing concrete. When extracting the core samples from an existing member it must be performed without damaging the existing reinforcing steel of the member. Non destructive and destructive test methods used to obtain in place properties of the members comprising the existing structure should comply with the requirements of Section 6.2.2 of the ASCE 41. Also the PH and the chloride contents of the concrete core samples should be determined in the laboratory.

1. Verification of existing reinforcing steel, including the steel area of existing reinforcing steel, spacing and location in several structural members including longitudinal beams, ramp walls and columns. **The top steel reinforcement of the slab along Axis 13 must be verified as well as the longitudinal reinforcement, top and bottom, including stirrups spacing of the parapet beam along Axis E-E between Axis 13 and Axis 11.**

## **VIII. STRUCTURAL DEFICIENCIES :**

### **A. After completing the checklists for this type of structure the following structural deficiencies were identified:**

1. Adjacent Buildings: The 1-1/2" expansion joint between the 5 story parking garage building and the office building may not be large enough to accommodate expected deflections. The minimum separation of the building at any level should be .04 the height at that level under consideration, at least 2" at the fifth level of the garage parking building, to avoid pounding between the buildings. The expansion joint as detailed in the structural drawings doesn't allow for any movement of the existing reinforced concrete slab to properly behave like a seismic joint.(7.2.13 ASCE 41)
2. Shear Stress (Shear Walls): The shear stresses in the concrete shear walls calculated using the Quick Check procedure **exceeds** allowable stresses for the walls in the transverse direction of the building at ground level only. In the longitudinal direction, the shear stresses in the shear walls comply.
3. Uplift at Pile Caps: There is no means to determine if the precast pile reinforcement was anchored into the pile caps properly (is not shown in **all** the foundation details in the structural drawings provided). No reinforcing steel shop drawings were provided or available for us. No inspections reports performed during the construction were available to us either.
4. The rigid diaphragms are composed of split-level floors.

### **B. Additional items that can potentially affect the seismic capacity of the structure after the structural drawings were reviewed:**

1. Compressive strength of 3,000 psi was specified for all structural members; slabs, columns, shear walls, beams, girders, pile caps and tie beams. The compressive strength is below the compressive strength that will be required for the shear wall elements subjected to seismic loading. Furthermore IBC requires minimum compressive strength of **4,000 psi** for pile caps and tie beams when precast piles are employed. (IBC Table 1808.8.1)
2. No lateral capacity for the 12" precast concrete piles is specified in the structural drawings.

3. In several beams and girders there is no end hooks provided for the longitudinal bottom reinforcement. Also the length of the reinforcing bars  $L_d$  for #8 rebar is not sufficient to anchor into the 8" wide R/C Walls.
4. Several structural sections were not detailed for the ductile performance required to accommodate expected building drifts from the current design magnitude earthquake.
5. Only one shear wall was provided in the transverse direction of the building structure.
6. Overhang in Axis 12, Level D. The longitudinal beam along Axis 12, between Axis D-D and Axis E-E, supports on an interior R/C column and the exterior R/C wall along Axis E-E. The exterior wall is supported by the spandrel parapet beam, spanning from Axis 13 to Axis 11. Our analysis confirms that the reinforcement required in this beam is greater than the one illustrated on the structural drawings. This beam portion needs to be strengthened if survey confirms the existing steel is the same as the reinforcement shown in the section illustrated in the structural drawings provided.
7. No Stirrups provided in column-beam joints, no details shown in structural drawings. They are extremely difficult to corroborate on site. Beam-column joints are a critical zone in reinforced concrete frames, they should be designed and detailed to provide sufficient ultimate strength and deformation capacity.
8. The R/C beam parapets running along Axis E-E do not have the capacity to resist the concentrated impact load specified by ASCE 7 required for parking garages. This condition occurs in Levels C, E, G, I, K and J along Axis E-E. This item does not affect the seismic capacity of the existing structure but needs to be resolved.



## **IX. GEOLOGIC SITE HAZARDS AND FOUNDATION DEFICIENCIES:**

1. Ties between Foundation Elements: There are ties between pile caps, which would prevent differential settlement but some pile caps are not tied in both directions, along Axis 8, Axis 9, Axis 12, and Axis 13.
2. Fault Rupture: Near Basis: Geotechnical Investigation Report by GMTS, Report No. G221554A, performed on June 1<sup>st</sup>, 2022.
3. Liquefaction: None Basis: Geotechnical Investigation Report by GMTS, Report No. G221554A, performed on June 1<sup>st</sup>, 2022.
4. Landslide: None
5. Load capacity including the lateral capacity for the existing 12" square precast piles: 110Tons as shown in Structural drawings provided. Geotechnical Investigation Report by GMTS performed on June 1st, 2022, lateral capacity for the precast piles approximately 12 Kips. **Very important note: There is no economical feasible method for increasing the lateral capacity of the existing precast piles.**

## **X. NONSTRUCTURAL DEFICIENCIES:**

The existing building has a small number of non-structural deficiencies based on the actual condition of the structure and its non-structural components. We have not indicated deficiencies related to any non structural items that will be replaced or installed; (like several missing ceiling light fixtures), an assessment of these systems was beyond the scope of this report.

1. We strongly recommend the removal of all the 7 planters in the façade of the building, along Axis E-E. The connection of the existing precast panels used for garden boxes, to the existing spandrel beams. As shown per structural drawings these panels are attached to the concrete frame using #4 @ 12" dowels inserted on the 6" wide spandrel concrete beams. These concrete panels might be considered a falling hazard during a seismic event.
2. **All columns must be protected from car impact with steel corner guards. Especial attention must be given in particular to the column at Axis 12 and Axis D-D, located in front of the ramp. This column must be protected using a padding collision protector that can also serve to increase the visibility of the column thus helping avoid car collisions.**

**\*\*\*Very important note: The parking garage structure was designed for light vehicles only\*\***

## **XI. VISUAL ASSESMENT OF PARKING GARAGE STRUCTURE:**

Several site visits were performed to assess the general quality of construction and maintenance of the structure and verify the condition of its structural members. Furthermore we verify signs of deterioration that could be present in the parking garage structure that could have significant effects on the seismic performance of the existing structure.

During our site visits we encountered several structural members with signs of deteriorated concrete. Please refer to **Appendix D** for photographs depicting the structural members affected and their locations within the garage parking structure. The condition assessment plans illustrating the existing fissures in the R/C slab and their location in each level of the existing parking garage are included in **Appendix E**.

The following items showing signs deterioration in the existing structural members were found:

1. In several structural members spalled concrete was encountered and existing rebar was exposed showing signs of severe corrosion. Spalled concrete over reinforcing bars reduces the available surface for bond between the concrete and steel and corrosion of the existing rebar significantly reduces the cross section of the bar. This situation is a major concern since significant deterioration of the structural members like cracks in concrete, corrosion of steel reinforcement and spalling of concrete, can compromise its structural performance. Please refer to Photograph No. 3, Photograph No. 13, and Photograph No. 20. The structural members showing signs of corrosion and spalled concrete were slabs, columns and shear walls. It can be seen that the proper concrete cover was not provided in some of these locations.
2. The R/C shear walls were inspected in their interior face only, the fissures observed in the existing wall elements are not of concern. The fissures are not concentrated in one location, and they do not form an x pattern.
3. One of the most alarming signs of deterioration in the existing structure was the severe fissures found in the R/C slabs. Most of the fissures occurred in the longitudinal direction, along the direction of the longitudinal beams in Axis 12 to Axis 9 ( Please refer to Photograph No. 9, No. 12, No. 14 and No. 15). Also several fissures occurred around the drainage floor openings in the slab. One fissure that was of our main concern are found in several structural levels, running parallel to the shear wall located along Axis 13 and along Axis 8. (Please refer to photograph No. 5). These fissures in particular did not go through the entire cross section of the slab.
4. Construction joint located at Level J was not sealed properly. Its allowing water to percolate through as shown in Photograph No. 35. Also spalling of the concrete has occurred in this area.

5. Ponding of water occurs in several structural levels. The existing drainages are not efficient in draining the runoff water since they are not located in the lowest elevation of the existing slab.
6. Fissures along the depth of the longitudinal beams. They also occur in the underside of the beams.

Since parking garage structures are open to elements, their structural components are subject to more hostile environment than components in other closed buildings structures. Therefore, they require special considerations for crack control and durability to prevent the deterioration of its structural members.

The field verification confirms that significant deterioration of several structural members has occurred, and the conditions indicated in this report must be attended immediately to prevent further deterioration of the structural member than can impair its structural behavior.

**The repair procedures must be implemented without delay to avoid further deterioration of the garage parking structure.** Please refer to Appendix F where all the repair procedures are outlined.

## **XII. CONCLUSIONS:**

Based on our Tier 1 evaluation, we have determined that the Caribe Plaza Parking Garage Building does **not** meet the assigned performance goal of Life Safety Occupancy Level.

Nevertheless, the repair procedures included in this report for the several structural elements showing signs of deterioration and distress must be performed. Furthermore, a proper maintenance schedule for the parking garage must be implemented to guarantee the service life of this building structure.

## **XIII. CLOSING:**

If there is any subject about this report that you may deem proper for us to clarify, please do not be reluctant to contact us, and we will gladly address the same.

Very respectfully submitted,



Doris J. Quinones Rivera, MSCE, PE  
Lic # 17074

The evaluation, findings, conclusions and recommendations outlined in this report were based on limited information. No other warranty, expressed or implied, is made as to the professional advice in this report.



**APPENDIX A**  
**GENERAL SUMMARY DATA SHEET**  
**Structural Drawings Provided**

## Appendix C: Summary Data Sheet

### BUILDING DATA

Building Name: Caribe Plaza Parking Building Date: July 30 2022  
 Building Address: 1547 Ponce de Leon Avenue, Rio Piedras, Puerto Rico  
 Latitude: 18.3836778 Longitude: -66.0658617 By: DQR, MSCE, PE  
 Year Built: 2009 Year(s) Remodeled: N/A Original Design Code: UBC 1987/ACI 385-95  
 Area (sf): 10,390 sf/ per level Length (ft): 93'-4" Width (ft): 111' -4'  
 No. of Stories: 5 Story Height: 10 Total Height: 50'-0"

USE ☐ Industrial ☐ Office ☐ Warehouse ☐ Hospital ☐ Residential ☐ Educational ☒ Other: Parking Facilities

### CONSTRUCTION DATA

Gravity Load Structural System: R/C Shear walls with R/C beams supported by R/C columns and shear walls  
 Exterior Transverse Walls: R/C shear walls Openings? yes  
 Exterior Longitudinal Walls: R/C shear walls Openings? No  
 Roof Materials/Framing: R/C slabs with R/C beams supported by R/C columns and shear walls  
 Intermediate Floors/Framing: N/A  
 Ground Floor: 9" R/C slabs supported on R/C tie beams and R/C Pile Caps  
 Columns: R/C columns Foundation: 12" R/C Precast Piles  
 General Condition of Structure: Fair  
 Levels Below Grade? N/A  
 Special Features and Comments: Assesment survey was done and attached to this report

### LATERAL-FORCE-RESISTING SYSTEM

	Longitudinal	Transverse
System:	<u>Reinforced concrete shear wall</u>	<u>Reinforced concrete shear wall</u>
Vertical Elements:	<u>R/C columns and R/C wall</u>	<u>R/C columns and R/C wall</u>
Diaphragms:	<u>rigid reinforced concrete slabs - 5" to 7" thick</u>	<u>rigid reinforced concrete slabs - 5" to 7" thick</u>
Connections:		

### EVALUATION DATA

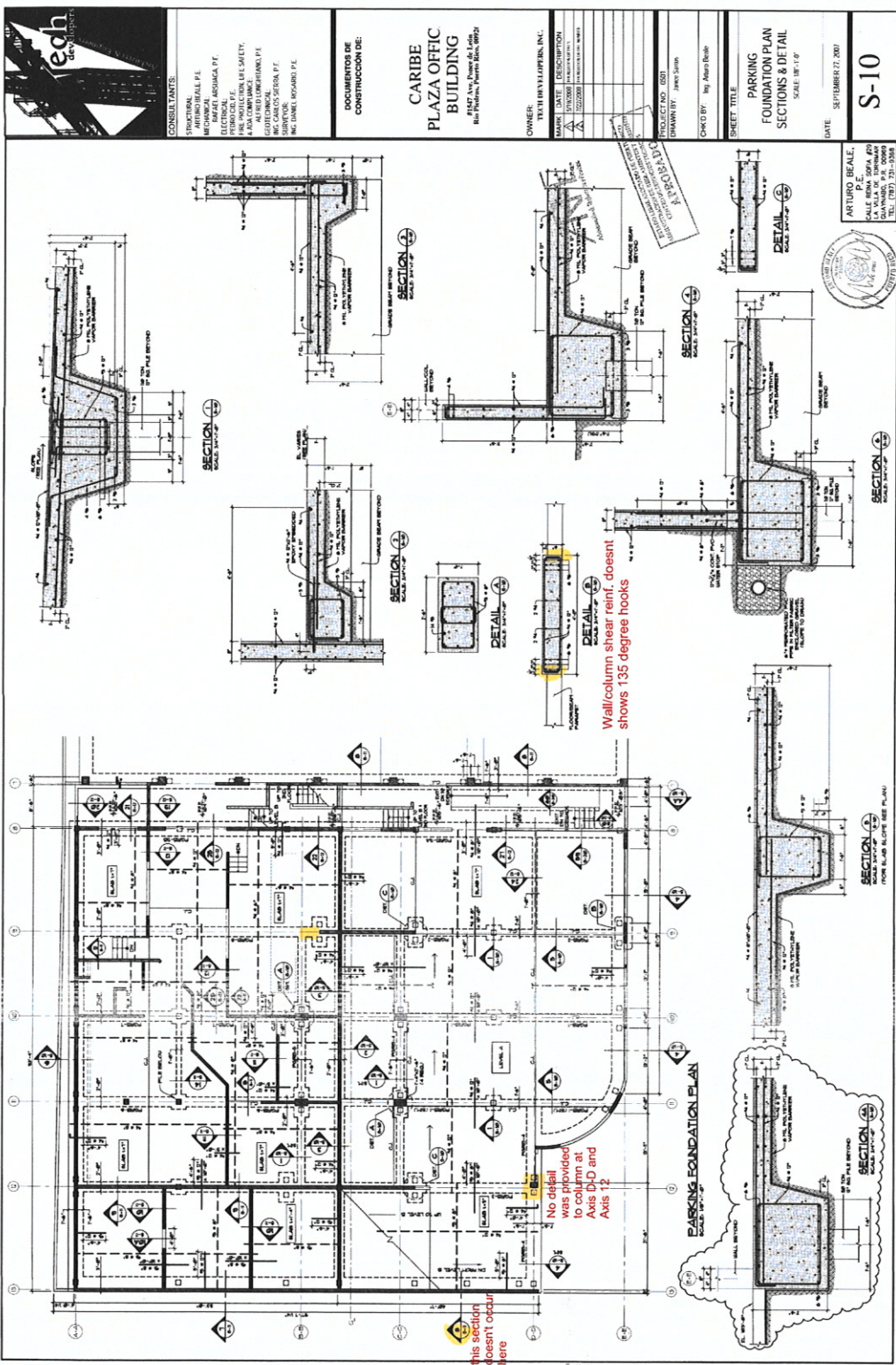
BSE-1N Spectral Response Accelerations:  $S_{D1} = 0.483$   $S_{D1} = 0.331$   
 Soil Factors: Class = D  $F_a = 1.11$   $F_r = 1.9$   
 BSE-1E Spectral Response Accelerations:  $S_{x5} = 0.554$   $S_{x1} = .353$   
 Level of Seismicity: High Performance Level: Life Safety  
 Building Period:  $T = 0.376$   
 Spectral Acceleration:  $S_a = 0.938$   
 Modification Factor:  $C_e C_1 C_2 = 1.0 * .8 * 1.1 = .88$  Building Weight:  $W = 7225$  kips  
 Pseudo Lateral Force:  $V = 5963$   
 $C_w C_1 C_2 S_a W =$

BUILDING CLASSIFICATION: C-2 Concrete shear walls with stiff diaphragms

### REQUIRED TIER 1 CHECKLISTS

	Yes	No
Basic Configuration Checklist	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Building Type <u>C2</u> Structural Checklist	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Nonstructural Component Checklist	<input checked="" type="checkbox"/>	<input type="checkbox"/>

FURTHER EVALUATION REQUIREMENT: NONE



CONSULTANTE:

ING. CARLOS SERRA P.E.

ING. DANIEL ROSARIO P.E.

ING. CARLOS SERRA P.E.

ING. DANIEL ROSARIO P.E.

ING. CARLOS SERRA P.E.

ING. DANIEL ROSARIO P.E.

DOCUMENTOS DE CONSTRUCCION DE

CARIBE PLAZA OFFICE BUILDING

10000 Ave. 100, Suite 1000

San Juan, Puerto Rico 00924

OWNER:

THE CARIBE PLAZA, INC.

10000 Ave. 100, Suite 1000

San Juan, Puerto Rico 00924

NO.	DATE	DESCRIPTION
1	10/22/2009	ISSUED FOR PERMIT
2	10/22/2009	ISSUED FOR PERMIT
3	10/22/2009	ISSUED FOR PERMIT

PROJECT NO. 1001

DRAWN BY: JAMES SMITH

CHECKED BY: Ray M. Ruelas

SHEET TITLE

PARKING FOUNDATION PLAN

SECTIONS & DETAIL

SCALE: 1/8" = 1'-0"

DATE: SEPTEMBER 7, 2010

S-10

ARTURO BEAL

P.E.

10000 Ave. 100, Suite 1000

San Juan, Puerto Rico 00924

TEL: (787) 751-3000







**CONSULTANTS:**  
STRUCTURAL: ARQUITECTURA P.E.  
MECHANICAL: ARQUITECTURA P.E.  
ELECTRICAL: ARQUITECTURA P.E.  
FIRE PROTECTION: LIT. SAFETY, INC.  
AUTOMATED LIFTING: LIT. SAFETY, INC.  
AUTOMATED LIFTING: LIT. SAFETY, INC.  
AUTOMATED LIFTING: LIT. SAFETY, INC.  
AUTOMATED LIFTING: LIT. SAFETY, INC.

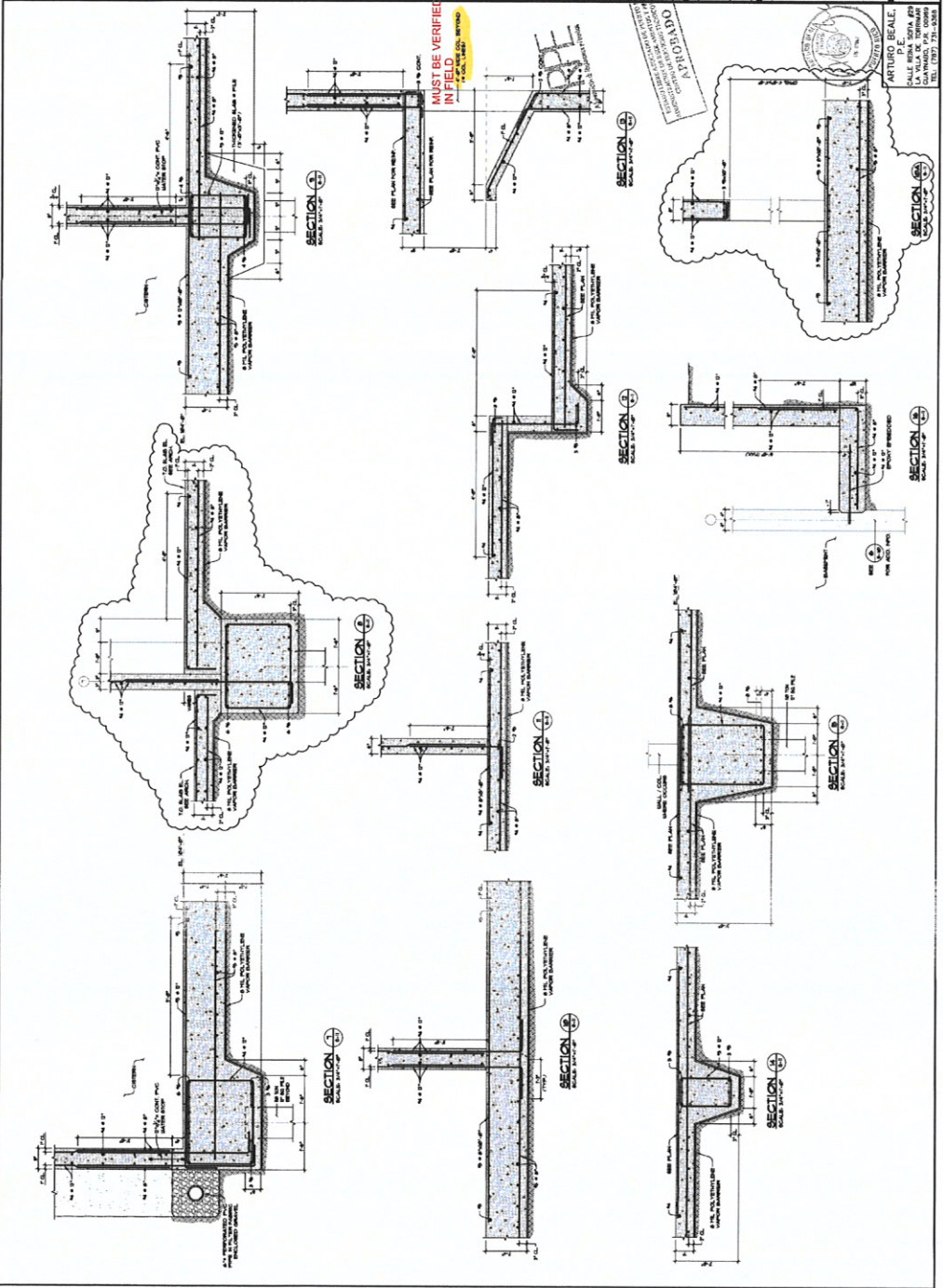
**DOCUMENTOS DE CONSTRUCCIÓN DE:**  
**CARIBE PLAZA OFFICE BUILDING**  
#1047 Ave. Duque de Soria  
San Pedro de Macoris, Santo Domingo, D.R.

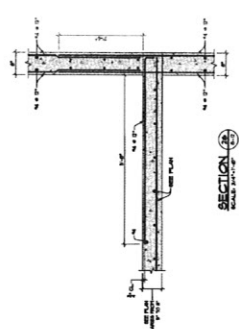
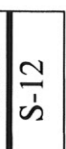
**OWNER:**  
TECH DEVELOPERS, INC.  
#1047 Ave. Duque de Soria  
San Pedro de Macoris, Santo Domingo, D.R.

**PROJECT NO:** 5001  
**DESIGN BY:** JERRY S. BROWN  
**CHECKED BY:** JERRY S. BROWN  
**DATE:** SEPTEMBER 27, 2007

**SHEET TITLE:**  
**PARKING SECTIONS & DETAIL**  
SCALE: 3/4" = 1'-0"

**DATE:** SEPTEMBER 27, 2007  
**S-11**



[illegible]





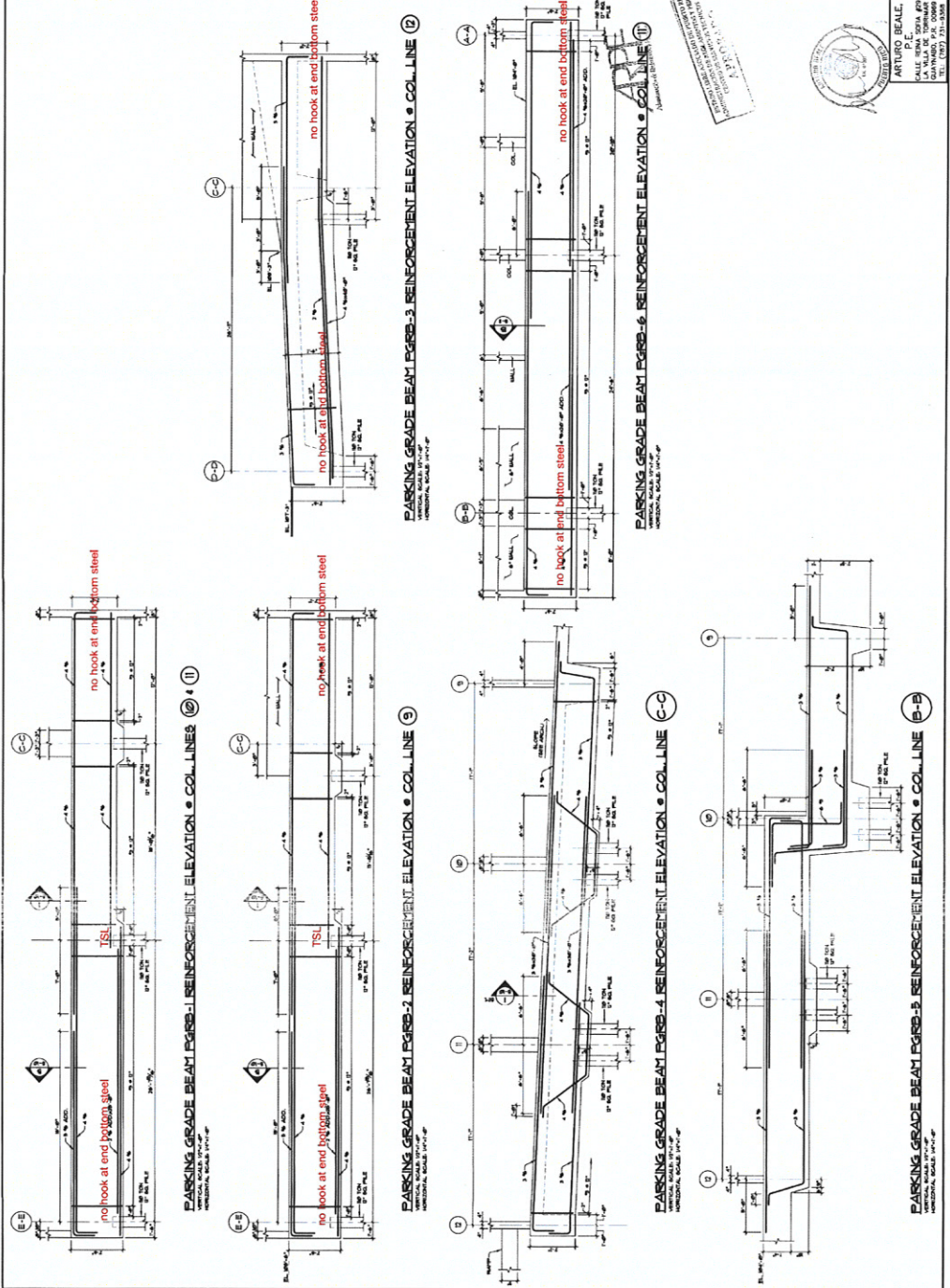
**CONSULTANTS:**  
STRUCTURAL: ARTURO BEALE P.E.  
MECHANICAL: JUAN MIGUEL P.E.  
ELECTRICAL: JUAN MIGUEL P.E.  
FIRE PROTECTION: JUAN MIGUEL P.E.  
ENVIRONMENTAL: JUAN MIGUEL P.E.  
GEOTECHNICAL: JUAN MIGUEL P.E.  
SOILS: JUAN MIGUEL P.E.  
METEOROLOGICAL: JUAN MIGUEL P.E.  
HYDROLOGICAL: JUAN MIGUEL P.E.  
PLANNING: JUAN MIGUEL P.E.

**DOCUMENTOS DE CONSTRUCCION DE:**  
**CARIBE PLAZA OFFICE BUILDING**  
#1247 Ave. Ponce de Leon  
San Pedro, Puerto Rico 00924

**OWNER:** TITAN INVESTMENTS, INC.  
**DATE:** SEPTEMBER 27, 2017  
**PROJECT NO.:** 0501  
**DESIGNER:** JUAN MIGUEL P.E.

**CHECKED BY:** Ing. Arturo Beale  
**SHEET TITLE:** BEAM REINFORCEMENT ELEVATIONS  
**SCALE:** 1/4" = 1'-0"  
**DATE:** SEPTEMBER 27, 2017

**S-13**



**ARTURO BEALE,**  
P.E.  
LA VILLA DE TORREMO  
LA VILLA DE TORREMO  
PUERTO RICO 00924  
TEL: (787) 123-4567





CONSULTANTES  
ARCHITECTURAL  
ANTHONY J. P.E.  
MARCEL ARAGUA P.E.  
STRUCTURAL  
REINFORCEMENT  
THE PROTECTION, U.S. SAFETY,  
ALFREDO CRISTIANI P.E.  
GEOTECHNICAL  
SURFACES  
DR. CARLOS MORALES P.E.

DOCUMENTOS DE  
CONSTRUCCION DE

CARIBE  
PLAZA OFFICE  
BUILDING  
#1027 Ave. Ponce de Leon  
San Juan, Puerto Rico, 00909

OWNER:  
TECH DEVELOPERS, INC.

DATE: 10/27/2007

SCALE: 1/8"=1'-0"

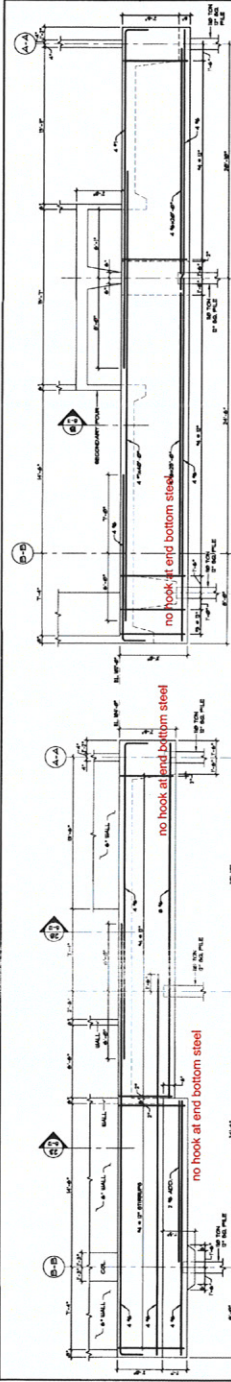
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BEAM  
REINFORCEMENT  
ELEVATIONS

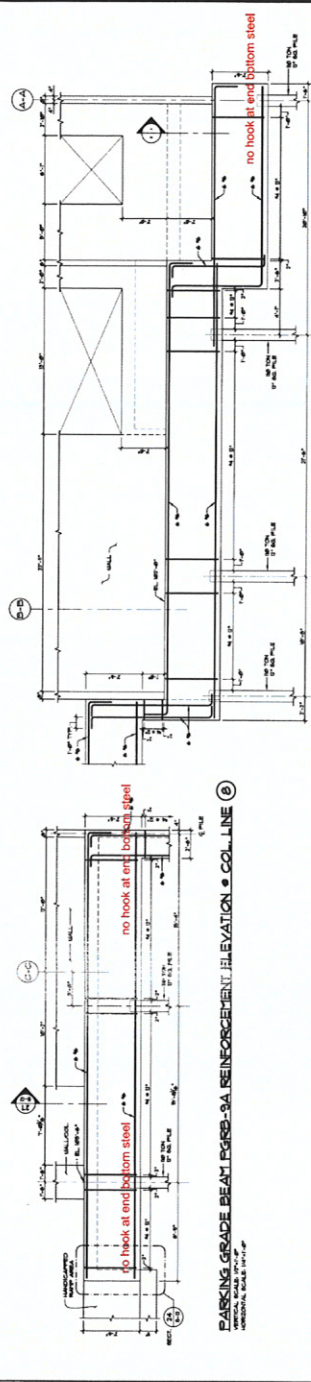
DATE: SEPTEMBER 27, 2007

S-14

ARTURO BEALE  
CALLE ROMA 2074A, 4TH  
FLOOR  
SAN JUAN, P.R. 00909  
TEL: (787) 721-3348



PARKING GRADE BEAM PGRB-1 REINFORCEMENT ELEVATION • COLL. LINE 1  
VERTICAL SCALE: 1/4"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"



PARKING GRADE BEAM PGRB-2 REINFORCEMENT ELEVATION • COLL. LINE 2  
VERTICAL SCALE: 1/4"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"

ARE

REVISIONS  
NO. DESCRIPTION  
1. 10/27/2007











CONSULTANTS  
ARCHITECTURAL P.E.  
MECHANICAL P.E.  
ELECTRICAL P.E.  
STRUCTURAL P.E.  
SAFETY P.E.  
GEOTECHNICAL P.E.  
INC. JUAN CARLOS SERRA P.E.  
INC. DANIEL RODRIGUEZ P.E.

DOCUMENTOS DE CONSTRUCCION DEL

CARIBE PLAZA OFFICE BUILDING  
#1547 Ave. Ponce de Leon  
San Pedro, Puerto Rico, 00924

OWNER: BETA DEVELOPMENT, INC.  
NAME: DATE: DESCRIPTION:

PROJECT NO: 0501  
DRAWN BY: Juan Serrin  
CHECKED BY: Ing. Arturo Roldan

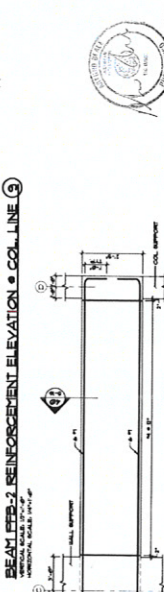
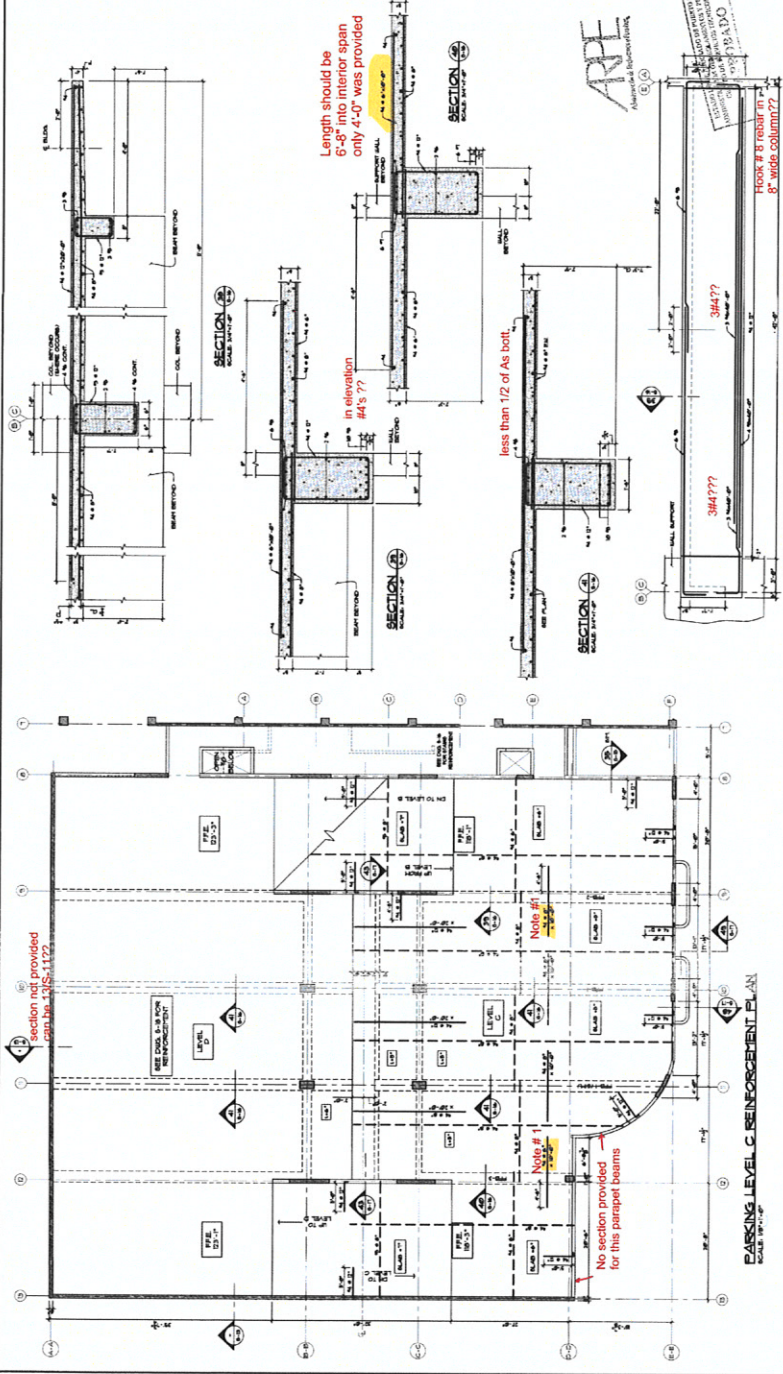
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REINFORCEMENT PLAN  
SECTIONS & DETAIL  
SCALE: AS NOTED

DATE: SEPTEMBER 27, 2007

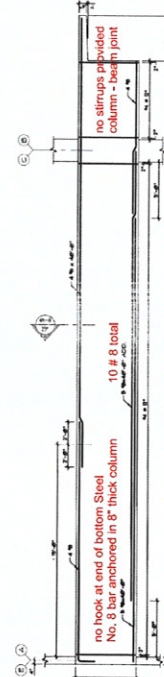
S-16



ARTURO ROLDAN  
P.E.  
SCALE: 1/8" = 1'-0"  
LA VILLA DE TORREMO  
LA VILLA DE TORREMO  
TEL: (787) 721-1345



BEAM FEB-2 REINFORCEMENT ELEVATION • COLUMN LINE 13  
VERTICAL SCALE: 1/4" = 1'-0"



BEAM FEB-1 REINFORCEMENT ELEVATION • COLUMN LINES 10 & 11  
VERTICAL SCALE: 1/4" = 1'-0"





CONSULTANTS:  
STRUCTURAL: ARTURO BEALE, P.E.  
MECHANICAL: JUAN ANTONIO P.E.  
ELECTRICAL: JUAN ANTONIO P.E.  
FIRE PROTECTION: JEFF SMITH, P.E.  
LANDSCAPE ARCHITECTURE: JUAN ANTONIO P.E.  
GEOTECHNICAL: JUAN ANTONIO P.E.  
SOILS: JUAN ANTONIO P.E.  
SURVEYING: JUAN ANTONIO P.E.  
MECHANICAL: JUAN ANTONIO P.E.

DOCUMENTS FOR  
CONSTRUCTION PER.

CARIBE  
PLAZA OFFICE  
BUILDING  
6157 Ave. Ponce de Leon  
San Pedro, Puerto Rico 00924

OWNER:  
TECH INNOVATIONS, INC.

NO.	DATE	DESCRIPTION
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2	11/15/2007	REVISION: AS NOTED

PROJECT NO. 0501

DRAWN BY: JUAN ANTONIO

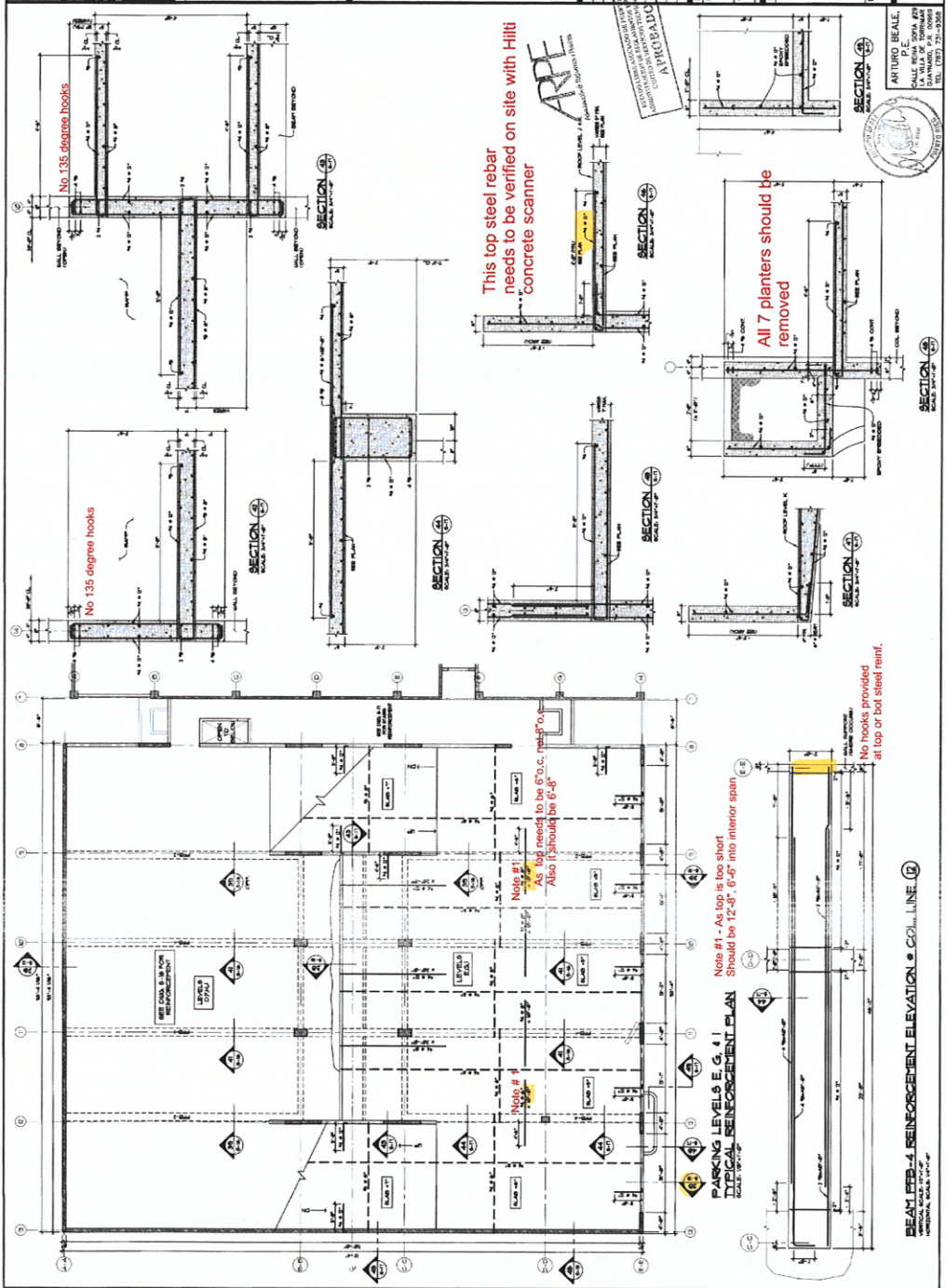
CHECKED BY: Ing. Arturo Beale

SHEET TITLE:  
PARKING LEVELS  
E.G. & TYPICAL  
REINFORCEMENT PU  
SECTIONS & DETAIL  
SCALE: AS NOTED

DATE: SEPTEMBER 27, 2007

S-17

ARTURO BEALE, P.E.  
REGISTERED PROFESSIONAL ENGINEER  
IN THE STATE OF PUERTO RICO  
NO. 12377-721-3555







CONSULTANTES:  
ARTURO BEALE, P.E.  
MECANICA ESTRUCTURAL  
SAN F. ANTONIO, P.E.  
ELECTRICAL  
SAN F. ANTONIO, P.E.  
FIRE PROTECTION, L.E. S.A. P.E.  
SAN F. ANTONIO, P.E.  
GEOTECHNICAL  
SAN F. ANTONIO, P.E.  
SURVEYING  
SAN F. ANTONIO, P.E.  
ING. DANIEL ROSARIO, P.E.

COMMITTEE OF  
CONSTRUCTORES

CARIBE  
PLAZA OFFICE  
BUILDING

1500 1st Ave, Puerto Rico, 00902

OWNER:  
F&B INVESTMENTS, INC.

DESIGNER:  
ARTURO BEALE, P.E.

PROJECT NO.: 001

DATE: 09/27/2007

CHECKED BY: Ing. Arturo Beale

DATE: 09/27/2007

SCALE: AS NOTED

SHEET TITLE:

PKG. LEVELS D, F, H &  
PARKING LEVEL K-RO  
AND STAIRS ROOF  
REINFORCEMENT PLAN  
SECTIONS & DETAIL

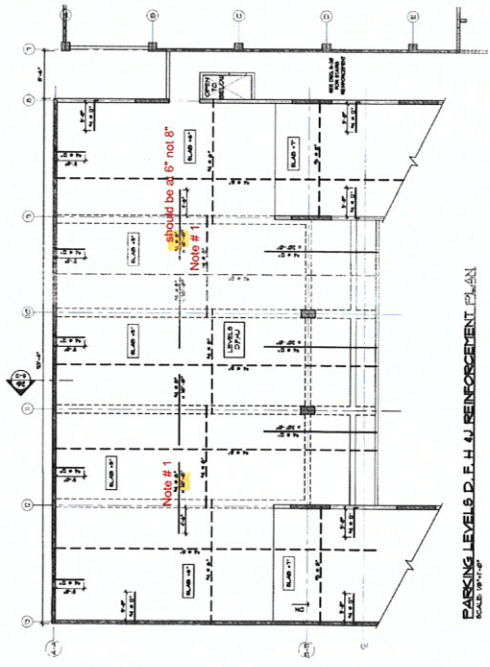
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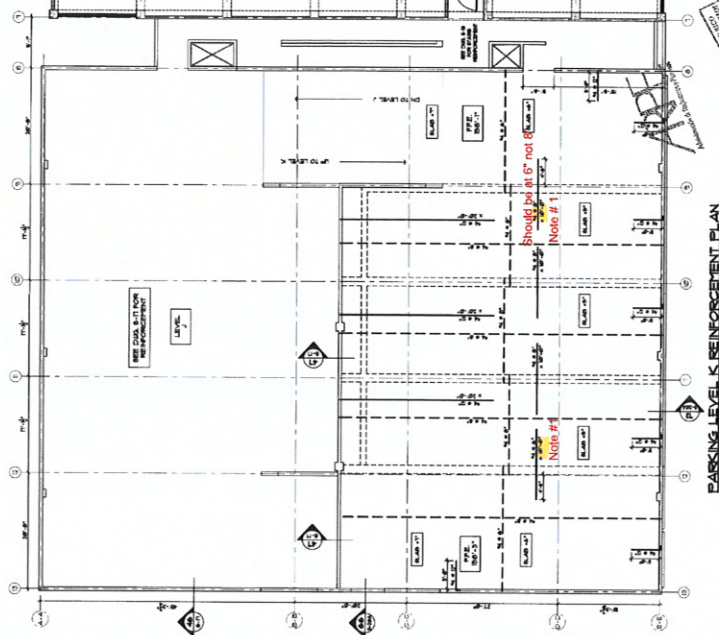
S-18



ARTURO BEALE,  
P.E.  
CALLE PRINCIPAL #100  
LA VILLA DE DOMINICAN  
SAN F. ANTONIO, P.R. 00902  
TEL: (787) 731-1348

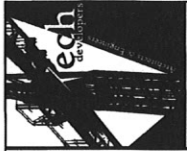


PARKING LEVELS D, F, H & J REINFORCEMENT PLAN  
SCALE: 1/4" = 1'-0"



PARKING LEVEL K REINFORCEMENT PLAN  
SCALE: 1/4" = 1'-0"

ARTURO BEALE, P.E.  
CALLE PRINCIPAL #100  
LA VILLA DE DOMINICAN  
SAN F. ANTONIO, P.R. 00902  
TEL: (787) 731-1348



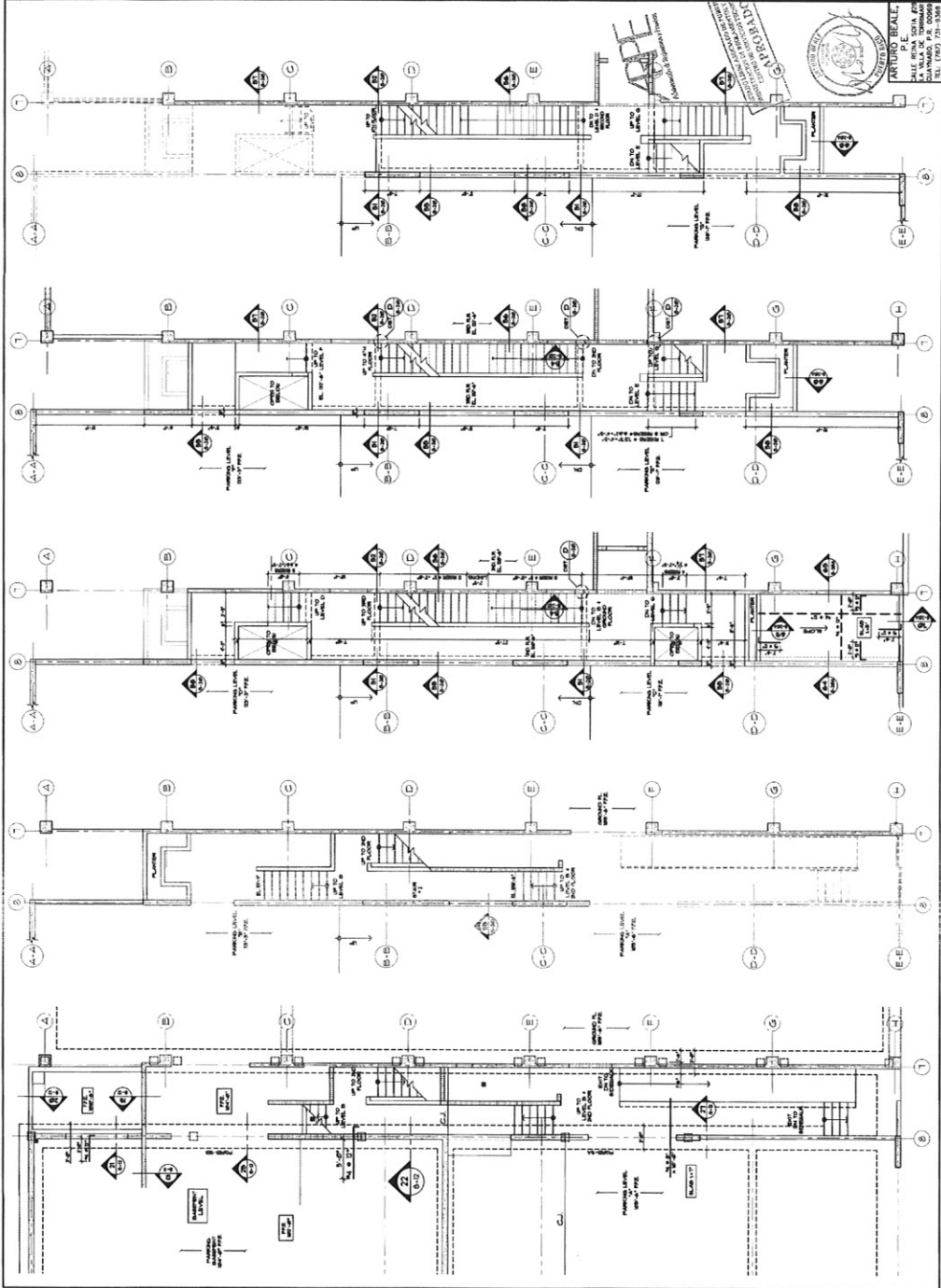
**CONSULTANTS:**  
STRUCTURAL: ARTHUR D. BEALE, P.E.  
MECHANICAL: AMAL ASSOCIATES, P.E.  
ELECTRICAL: AMAL ASSOCIATES, P.E.  
FIRE PROTECTION & SAFETY: AMAL ASSOCIATES, P.E.  
ELECTRONIC: AMAL ASSOCIATES, P.E.  
MECHANICAL: AMAL ASSOCIATES, P.E.  
MECHANICAL: AMAL ASSOCIATES, P.E.

**DOCUMENTOS DE CONSTRUCCIÓN DE:**  
**CARIBE PLAZA OFFICE BUILDING**  
1142 Ave. Ponce de León  
San Juan, Puerto Rico, 00901

**OWNER:** TECH UNIVAPEN, INC.  
**ARCHITECT:** J. J. GARCIA, AIA  
**DATE:** 09/27/2007  
**PROJECT NO.:** 0001  
**PROJECT NAME:** CARIBE PLAZA OFFICE BUILDING

**PROJECT NO.:** 0001  
**PROJECT NAME:** CARIBE PLAZA OFFICE BUILDING  
**DATE:** 09/27/2007  
**PROJECT NO.:** 0001  
**PROJECT NAME:** CARIBE PLAZA OFFICE BUILDING

**DATE:** 09/27/2007  
**PROJECT NO.:** 0001  
**PROJECT NAME:** CARIBE PLAZA OFFICE BUILDING







CONSULTANTS:  
ARCHITECT:  
ANIL K. BHALLA, P.E.  
STRUCTURAL:  
J. L. GARCIA, P.E.  
MECHANICAL:  
J. L. GARCIA, P.E.  
ELECTRICAL:  
J. L. GARCIA, P.E.  
PLUMBING:  
J. L. GARCIA, P.E.  
FIRE PROTECTION, LIFE SAFETY:  
J. L. GARCIA, P.E.  
LANDSCAPE ARCHITECTURE:  
J. L. GARCIA, P.E.  
GEOTECHNICAL:  
J. L. GARCIA, P.E.  
SEWER, SANITARY:  
J. L. GARCIA, P.E.  
SPECIALTY:  
J. L. GARCIA, P.E.

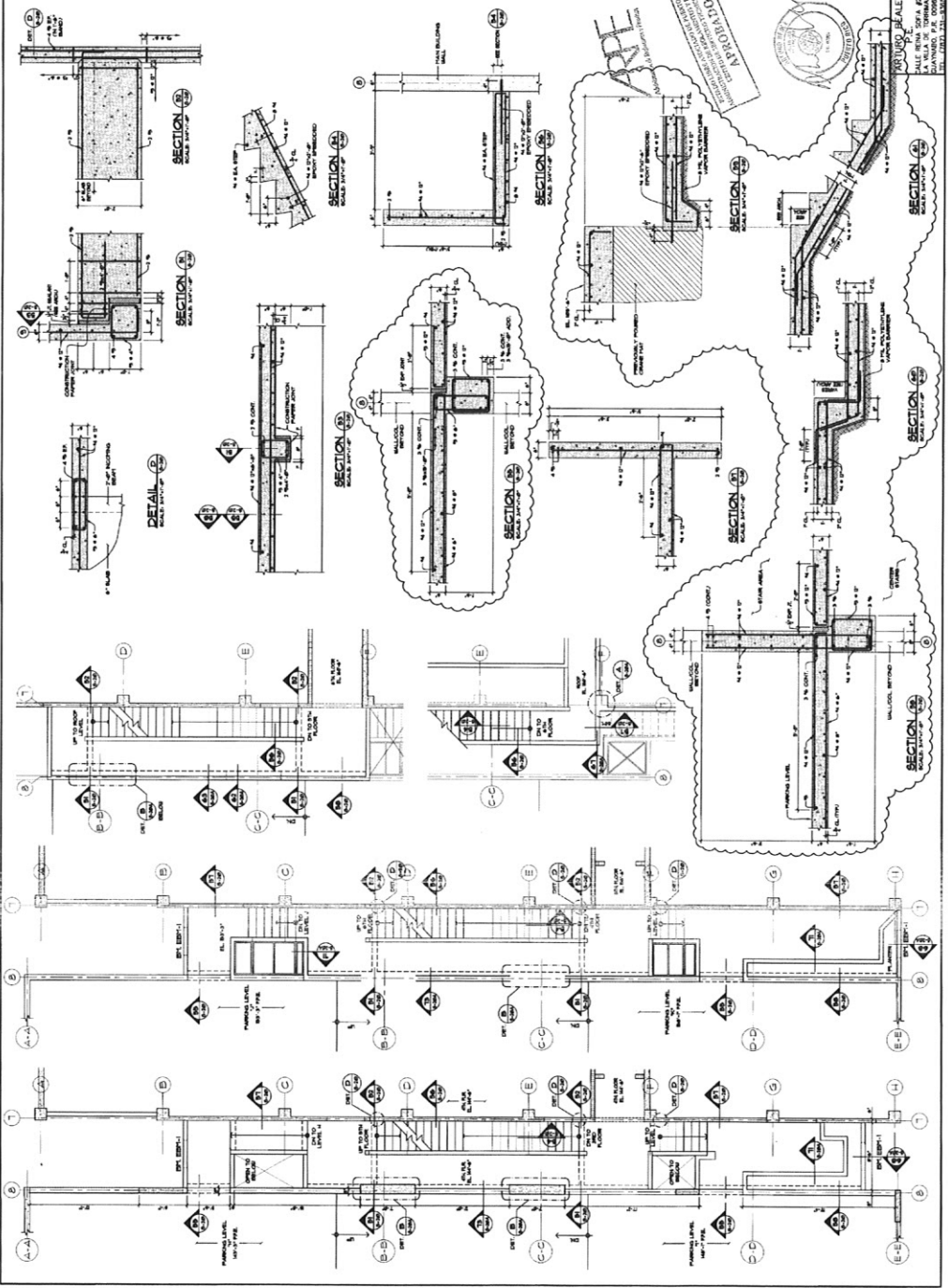
CONSTRUCTORS DE  
CONSTRUCCION DE  
CARIBE  
PLAZA OFFICE  
BUILDING  
#1547 Ave. Ponce de Leon,  
San Antonio, Puerto Rico, 00909

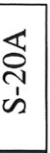
OWNER:  
TITH INVESTMENTS, INC.  
NAME: TITH INVESTMENTS, INC.  
DATE: 09/27/2007  
PROJECT NO.: 0001  
SHEET NO.: 1 OF 1  
DRAWN BY: J. L. GARCIA  
CHECKED BY: J. L. GARCIA

PROJECT NO.: 0001  
SHEET NO.: 1 OF 1  
DRAWN BY: J. L. GARCIA  
CHECKED BY: J. L. GARCIA

MAIN STAIR DETAIL:  
SCALE: 3/8"=1'-0"

DATE: SEPTEMBER 27, 2007  
S-20





**ARTURO BEALE,**  
P.E.  
CALLE REINA SOFIA #29  
LA VILLA DE TORREMAR  
GUAYNABO, P.R. 00969  
TEL: (787) 731-9368





## **APPENDIX B**

### **TIER 1 EVALUATION CHECKLISTS**

#### **16.1LS Life Safety Performance Level Basic Configuration Checklist**

#### **16.10 LS Life Safety Performance Structural Checklist for Building Type C2: Concrete Shear Walls with Stiff Diaphragms**

#### **16.17 Life Safety Non-Structural Checklist**

References:

- ACI 546 R- 14 Concrete Repair Guide
- ACI 364.10T-14 - Rehabilitation of Structure with Reinforcement Section Loss
- ICRI No. 310.1R-2008 - Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion
- ACI 515.2R-13—Guide to Selecting Protective Treatments for Concrete

**PROCEDURE FOR THE STRENGTHENING OF STRUCTURAL MEMBERS USING**  
**CARBON FIBRE FABRIC SIKA WRAP 300 C**

**1. Concrete Substrate preparation**

A. Remove deteriorated concrete, dust, laitance, grease, paint, curing compounds, waxes, impregnations, foreign particles, and other bond inhibiting materials from the surface by blast cleaning or equivalent mechanical means. All concrete surfaces shall be sound. All concrete surfaces shall be air blasted and vacuumed clean to a dust free condition.

B. External concrete corners shall be rounded to at least a 1/2" radius when perpendicular to fiber orientation and internal corners shall be smoothed by toweling epoxy mortar into the corners. Any sharp edges like form lines have to be grounded smooth and flush.

C. Concrete surface irregularities less than one inch shall be ground and smoothed and/or filled with an approved repair mortar. Surface irregularities greater than one inch shall be repaired using an approved cementitious repair mortar like SikaTop 123.

D. The concrete surface should be prepared to a minimum concrete surface profile, CSP 3 as defined by the ICRI.

**2. Fissures (if any)**

Repair any fissures using pressure injected resin.

**3. Apply primer, strictly accordance with Manufacturer's recommendations.**

A. Primer may be applied with a brush or roller. Apply second coat as necessary after first coat has penetrated into concrete.

B. Primer must be covered with fiber within 24 hours of application, depending on temperature conditions. If 24-hour window is exceeded, the primed surfaces must be solvent wiped with a fast flashing solvent or roughened with sandpaper.

**4. Apply FRP Reinforcement in strictly accordance with Manufacturer's recommendations.**

Protect finished installation of FRP Reinforcement from rain, sand, dust, etc. using protective sheeting or other barriers. Do not allow protective sheeting to come in contact with finished application.

- A. Curing of finished application shall be a minimum of 24 hours and in order to achieve full strength curing shall be extended for a period of two weeks at an average ambient temperature of 68°F. Upon completion of the curing process, the installed system shall be checked for areas where saturant has not penetrated or where saturant has not completely cured. Such areas shall be epoxy injected to re-establish bond subject to the approval of the Project Engineer.
- B. Repair procedures shall be performed in accordance with guidelines established by ACI 440.2R-08 and approved by the Project Engineer. All repairs shall be subject to the same application, curing and quality control specifications as the original work.

#### **5. Apply protective coating like Sikagard 550 W**

**Very important Note: Survey must be performed to verify reinforcing steel diameters and spacing for several structural members before any strengthening is executed. Several portions of slab areas, parapet beams along Axis E-E and interior and exterior columns will be tested with Hilti concrete scanner GPR. After all data and information is recollected and submitted then we will proceed to determine the amount of layers required if needed.**



**Contractor must comply with the following reference standards:**

- ACI 440.2R-08, Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures
- ACI 440R-07, Report on Fiber-Reinforced Polymer (FRP) Reinforcement for Concrete Structures
- ACI 440 R-96, State-of-the-Art Report on Fiber Reinforced Plastic (FRP) Reinforcement for Concrete Structures.
- ACI 503 R, Pull-off test to determine FRP adhesion to concrete substrate.
- ACI 562, Code Requirements for Assessment, Repair and Rehabilitation of Existing Concrete Structures.
- ICRI Guideline No. 03742, Guide for the Selection of Strengthening Systems for Concrete Structures
- ICRI Guideline No. 03739, Guide to Using In-Situ Tensile Pull-Off Tests to Evaluate Bond of Concrete Surface Materials

## PRODUCT DATA SHEET

## Sikadur®-55 SLV

Super low-viscosity, moisture-tolerant epoxy resin, crack healer/penetrating sealer

## PRODUCT DESCRIPTION

Sikadur®-55 SLV is a 2-component, 100 % solids, moisture-tolerant, epoxy crack healer / penetrating sealer, having a fast tack-free time to minimize downtime. It is a super low-viscosity, high-strength adhesive formulated specifically for sealing both dry and damp, existing, non-dynamic cracks. It conforms to the current ASTM C-881, Types I and II, Grade-1, Class-C\* and AASHTO M-235 specifications.

\* except for gel time

## USES

Sikadur®-55 SLV may only be used by experienced professionals.

- Sikadur®-55 SLV seals cracked concrete.
- For interior slabs and exterior above-grade slabs.
- For elevated horizontal decks, parking garages and other structures exposed to foot and pneumatic tire traffic.

## CHARACTERISTICS / ADVANTAGES

- Super low viscosity/low surface tension for excellent penetration into existing cracks.
- Seals existing cracks by gravity down to 2 mils (0.002" / 0.05 mm) in width.
- Prolongs life of cracked concrete.
- Penetrates and seals surface from water absorption, chloride-ion intrusion, and chemical attack (patent pending technology).
- Improves concrete surface by reducing water and chloride intrusion.
- Can be open to traffic in 6 hours at 73 °F (23 °C).
- High bond strength, even in damp cracks.
- U.S. Patent No. (pending) for ultra low viscosity healer/sealer to strengthen cracked concrete.

## PRODUCT INFORMATION

Packaging	3 gal. (11.35 l) unit = 'A' = 2 gal. (7.6 l) + 'B' = 1 gal. (3.8 l)
Color	Clear, amber
Shelf Life	2 years in original, unopened containers
Storage Conditions	Store dry at 40–95 °F (4–35 °C). Condition material to 65–75°F (18–24 °C) before using.
Viscosity	Approximately 105 cps

## TECHNICAL INFORMATION

**Compressive Strength**

	<b>40°F (4°C)</b>	<b>60°F (15°C)</b>	<b>73°F (23°C)</b>	<b>90°F (32°C)</b>
1 day	-	320 psi (2.2 MPa)	1,100 psi (7.6 MPa)	4,800 psi (33.1 MPa)
3 days	2,000 psi (13.8 MPa)	6,500 psi (44.8 MPa)	8,300 psi (57.2 MPa)	8,000 psi (55.2 MPa)
7 days	7,800 psi (53.8 MPa)	10,400 psi (71.7 MPa)	10,900 psi (75.1 MPa)	8,300 psi (57.2 MPa)
14 days	9,600 psi (66.2 MPa)	11,000 psi (75.8 MPa)	11,800 psi (81.4 MPa)	10,000 psi (68.9 MPa)
28 days	11,700 psi (80.7 MPa)	12,000 psi (82.7 MPa)	12,000 psi (82.7 MPa)	10,000 psi (68.9 MPa)

<b>Flexural Strength</b>	8,500 psi (58,6 MPa) (7 days)	(ASTM D-790) 73 °F (23 °C) 50 % R.H.
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<b>Modulus of Elasticity in Flexure</b>	3.2 x 10 <sup>5</sup> psi (2,206 MPa) (7 days)	(ASTM D-790) 73 °F (23 °C) 50 % R.H.
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<b>Tensile Strength</b>	7,100 psi (48,9 MPa) (7 days)	(ASTM D-638) 73 °F (23 °C) 50 % R.H.
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<b>Elongation at Break</b>	10 % (7 days)	(ASTM D-638) 73 °F (23 °C) 50 % R.H.
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<b>Tensile Adhesion Strength</b>	<b>Hardened Concrete to Hardened Concrete</b>	(ASTM C-882) 73 °F (23 °C) 50 % R.H.
	2 day (moist cure) 2,500 psi (17.2 MPa)	
	14 day (moist cure) 2,500 psi (17.2 MPa)	
	<b>Hardened Concrete to Steel</b>	(ASTM C-882) 73 °F (23 °C) 50 % R.H.
	2 day (moist cure) 1,500 psi (10.3 MPa)	
	14 day (moist cure) 1,600 psi (11.0 MPa)	

<b>Shear Strength</b>	5,800 psi (40.0 MPa) (7 days)	(ASTM D-732) 73 °F (23 °C) 50 % R.H.
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<b>Heat Deflection Temperature</b>	[fiber stress loading = 264 psi (1.8 MPa) 110 °F (43 °C) (7 days)	(ASTM D-648)
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<b>Water Absorption</b>	0.60 % (7 days, 24 hour immersion)	(ASTM D-570)
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**APPLICATION INFORMATION**

<b>Mixing Ratio</b>	Component 'A' : Component 'B' = 2:1 by volume
<b>Coverage</b>	1 gal. (3.8 liters) yields 231 cu. in. (3,785 cm <sup>3</sup> ) Typical coverage is 150–175 ft <sup>2</sup> /gal. (3.7–4.3 m <sup>2</sup> /L) for surface sealing. Coverage varies with porosity and surface profile of substrate. Higher porosity concrete will reduce coverage. For crack healing, follow Application instructions and allow to pond over cracks.
<b>Pot Life</b>	Approximately 20 minutes

## Cure Time

## Tack-Free Time

40 °F (4 °C)

60 °F (15 °C)

73 °F (23 °C)

90 °F (32 °C)

> 11 h

11 h

6 h

2.5 h

## APPLICATION INSTRUCTIONS

### SUBSTRATE PREPARATION

Substrate must be clean, sound and free of surface moisture. Remove dust, laitance, grease, oils, curing compounds, waxes, impregnations, foreign particles, coatings and disintegrated materials by mechanical means (i.e. shot blasting, sandblasting, etc.). For best results, substrate should be dry. Surfaces prepared by Low Pressure Water Cleaning or High Pressure Water Jetting methods should be allowed to dry for 24 hrs. minimum [at 73 °F (23 °C)].

### MIXING

Mix 1 part Component 'B' to 2 parts Component 'A' by volume into a clean pail. Mix thoroughly for 3 minutes with Sika paddle or jiffy mixer on a low-speed (400–600 rpm) drill until uniformly blended. Mix only that quantity which can be used within its pot life.

### APPLICATION METHOD / TOOLS

**To gravity feed cracks:** Sikadur®-55 SLV is applied to horizontal surfaces by flat squeegee or broom. Spread material over area and allow to pond over cracks. Let material penetrate into cracks and substrate. Remove excess epoxy with roller leaving no visible surface film. For cracks greater than 1/8 in. (3 mm) wide, fill crack with oven-dried sand before applying Sikadur®-55 SLV. Seal cracks from underside, when accessible, to prevent leakage. A second treatment may be required on very porous substrates. Apply second treatment before broadcasting. After treatment, wait a minimum of 20–30 minutes at 73 °F (23 °C) before broadcasting sand. Cover with broadcast of an oven-dried 20/40 silica sand or similar sand. Distribute evenly over the surface to excess at a rate of 30-40 lbs./100 sq. ft.. Allow to cure 6 hours minimum at 73 °F (23 °C). Remove any loose sand and open to traffic once epoxy has cured. Consult Sika Technical Service at 1-800-933-SIKA for additional information.

**To pressure inject cracks:** Use automated injection equipment. Set appropriate injection ports. Seal ports and cracks with Sikadur® 31, Hi-Mod Gel, Sikadur® Injection Gel or Sikadur® AnchorFix 2/Sikadur® AnchorFix 500. When the epoxy adhesive has cured, inject Sikadur®-55 SLV with steady pressure. Consult Technical Service at 1-800-933-SIKA for additional information. Mock ups to ascertain penetration on job site conditions is strongly recommended. Actual penetration should be verified by core testing.

## LIMITATIONS

- Do not thin. Addition of solvents will prevent proper cure.
- Material is a vapor barrier after cure.
- Do not apply if rain is imminent. Water exposure or humidity will affect surface appearance and may cause surface whitening.
- Not an aesthetic product. Color may alter due to variations in lighting and/or UV exposure.
- Sealed concrete surface may appear blotchy due to differential absorption.
- Allow sufficient time for the substrate to dry after rain or other inclement conditions.
- Application temperature of substrate must be minimum 5 °F (3 °C) above the dew point.
- Minimum ambient and substrate temperature 40 °F (4 °C). Maximum application temperature 95 °F (35 °C).
- Do not inject cracks greater than 1/4 in. (6 mm). Consult Technical Service at 1-800-933-SIKA.
- Minimum age of concrete is 21–28 days, depending on curing and drying conditions.
- Not designed to seal or inject cracks under hydrostatic pressure during application.
- Penetration results will vary. Factors that may impede penetration include, but are not limited to, temperature (ambient and material), geometry of crack, concrete porosity, and dirt inside cracks.
- Product is not appropriate for use in dynamic cracks.

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## OTHER RESTRICTIONS

See Legal Disclaimer.

## ENVIRONMENTAL, HEALTH AND SAFETY

Para información y consejo sobre seguridad en la manipulación, almacenamiento y disposición de productos químicos, los usuarios deben referirse a la ficha de datos de seguridad vigente, la cual contiene datos físicos, ecológicos, toxicológicos y otros datos relativos a la seguridad. En caso de emergencia llamar al CITUC a los siguientes fonos: 26353800 por intoxicaciones ó 22473600 por emergencias químicas.

## LEGAL DISCLAIMER

- KEEP CONTAINER TIGHTLY CLOSED



- KEEP OUT OF REACH OF CHILDREN
- NOT FOR INTERNAL CONSUMPTION
- FOR INDUSTRIAL USE ONLY
- FOR PROFESSIONAL USE ONLY



# PRODUCT DATA SHEET

## Sikaflex® PRO-3

### 1-PART HIGH PERFORMANCE CIVIL ENGINEERING JOINT SEALANT



#### DESCRIPTION

Sikaflex® PRO-3 is a 1-component, moisture-curing, elastic joint sealant with high mechanical and chemical resistance. Suitable for use in hot and tropical climatic conditions.

#### USES

Sikaflex® PRO-3 is designed for movement and connection joints in floors, pedestrian and traffic areas (example: parking decks, car parks), warehouses and production areas, applications in the food industry, sewage treatment plants, tunnel construction and in clean rooms. It can be used for vertical and overhead joints.

#### CHARACTERISTICS / ADVANTAGES

- Movement capability of  $\pm 35\%$  (ASTM C 719)
- Very high mechanical and chemical resistance
- Bubble-free curing
- Good adhesion to most construction materials
- Jet fuel and diesel resistance
- Solvent-free
- Very low emissions

#### SUSTAINABILITY

- Sikaflex® PRO-3 conforms to LEED® EQc 4.1
- VOC content  $< 30$  g/l (US EPA method 24)
  - EMICODE EC1<sup>PLUS</sup> R
  - SCAQMD, Rule 1168
  - BAAQMD, Regulation. 8, Rule 51

#### APPROVALS / CERTIFICATES

- ASTM C 920, class 35
- ISO 11600 F 25 HM
- EN 15651-4 PW EXT-INT CC 25 HM
- ISEGA Certificate for foodstuff area usage
- BS 6920 (drinking water contact)
- ASTM C 1248 non-staining on marble
- ISO 16938-1 non-staining on marble
- CSM TVOC tested (ISO -6.8)
- CSM biological resistant: very good
- Tested according principals of DIBt for Waste Water Exposure
- Resistance against Diesel and Jet Fuel according to the DIBt guidelines



#### PRODUCT INFORMATION

Composition	i-Cure® Technology polyurethane
Packaging	600 mL foil pack, 20 foil packs per box
Colour	Concrete grey (further colours available upon request)
Shelf life	Sikaflex® PRO-3 has a shelf life of 15 months from the date of production, if it is stored in undamaged, original, sealed packaging, and if the storage conditions are met.

<b>Storage conditions</b>	Sikaflex® PRO-3 shall be stored in dry conditions, where it is protected from direct sunlight and at temperatures between +5 °C and +25 °C.
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<b>Density</b>	~1.35 kg/l	(ISO 1183-1)
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## TECHNICAL INFORMATION

<b>Shore A Hardness</b>	~37 (28 d)	(ISO 868)
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<b>Secant Tensile Modulus</b>	~0.60 N/mm <sup>2</sup> at 100 % elongation (23 °C) ~1.10 N/mm <sup>2</sup> at 100 % elongation (-20 °C)	(ISO 8339)
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<b>Elongation at Break</b>	~600 %	(ISO 37)
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<b>Elastic Recovery</b>	~90 %	(ISO 7389)
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<b>Tear Propagation Resistance</b>	~8.0 N/mm	(ISO 34)
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<b>Movement Capability</b>	± 35 %	(ASTM C 719)
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<b>Chemical Resistance</b>	Sikaflex® PRO-3 is resistant to water, seawater, diluted alkalis, cement slurry and water dispersed detergent, diesel and jet fuel according to the DIBt guidelines. Sikaflex® PRO-3 is not resistant to alcohols, organic acids, concentrated alkalis and concentrated acids and other hydro-carbons.	
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<b>Service Temperature</b>	-40 °C min. / +70 °C max.
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<b>Joint Design</b>	The joint width must be designed to suit the joint movement required and the movement capability of the sealant. The joint width shall be ≥ 10 mm and ≤ 50 mm. A width to depth ratio of 1 : 0.8 must be maintained (for exceptions, see table below).
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### Standard joint widths for joints between concrete elements:

(Movement Capability: ± 35 % (ASTM C719) and ΔT: 80 °C)

Joint distance [m]	Min. joint width [mm]	Min. joint depth [mm]
2	10	10
4	12	10
6	18	15
8	22	18
10	28	22

For larger joints following depth should be maintained:

Joint width [mm]	Joint depth [mm]
30	24
35	28
40	32
45	35
50	35

All joints must be correctly designed and dimensioned in accordance with the relevant standards, before their construction. The basis for calculation of the necessary joint widths are the type of structure and its dimensions, the technical values of the adjacent building materials and the joint sealing material, as well as the specific exposure of the building and the joints. For more detailed advice and instructions please contact our Technical Department.

## APPLICATION INFORMATION

Consumption	Joint length [m] per 600 ml foil pack	Joint width [mm]	Joint depth [mm]
	6	10	10
	3.3	15	12
	1.9	20	16
	1.2	25	20
	0.8	30	24
	0.5	40	32
	0.3	50	35
<b>Backing Material</b>	Use closed cell, polyethylene foam backing rods.		
<b>Sag Flow</b>	0 mm (20mm profile, 50 °C)		(ISO 7390)
<b>Ambient Air Temperature</b>	+5 °C min. / +40 °C max. (min. 3 °C above dew point temperature)		
<b>Substrate Temperature</b>	+5 °C min. / +40 °C max.		
<b>Curing Rate</b>	~3.5 mm / 24 h (23 °C / 50 % r.h.)		(CQP 049-2)
<b>Skinning time</b>	~60 min (23 °C / 50 % r.h.)		(CQP 019-1)
<b>Tooling Time</b>	~50 min (23 °C / 50 % r.h.)		(CQP 019-2)

## APPLICATION INSTRUCTIONS

### SUBSTRATE PREPARATION

The substrate must be clean, dry, sound and homogeneous, free from oils, grease, dust and loose or friable particles. Sikaflex® PRO-3 adheres without primers and/or activators. However, for optimum adhesion and critical, high performance applications, such as on multi-story buildings, highly stressed joints, extreme weather exposure or water immersion, the following priming and/or pre-treatment procedures shall be followed:

#### Non-porous substrates

Aluminium, anodised aluminium, stainless steel, galvanised steel, powder coated metals or glazed tiles have to be cleaned and pre-treated using Sika® Aktivator-205, wiped on with a clean towel. Before sealing, allow a flash-off time of > 15 minutes (< 2 hours). Other metals, such as copper, brass and titanium-zinc, also have to be cleaned and pre-treated using Sika® Aktivator-205, wiped on with a clean towel. After the necessary flash-off time, use a brush to apply Sika® Primer-3 N and allow a further flash-off time of > 30 minutes (< 4 hours) before sealing the joints. PVC has to be cleaned and pre-treated using Sika® Primer-215 applied with a brush. Before sealing, allow a flash-off time of > 30 minutes (< 4 hours).

#### Porous substrates

Concrete, aerated concrete and cement based renders, mortars and bricks shall be primed using Sika® Primer-3 N applied with a brush. Before sealing, allow a flash-off time of > 30 minutes (< 4 hours).

For more detailed advice and instructions please contact our Technical Department.

Note: Primers are adhesion promoters. They are neither a substitute for the correct cleaning of a surface, nor do they improve the strength of the surface significantly.

### APPLICATION METHOD / TOOLS

Sikaflex® PRO-3 is supplied ready to use. After the necessary substrate preparation, insert a suitable backing rod to the required depth and apply any primer if necessary. Insert a foil pack or cartridge into the sealant gun and extrude Sikaflex® PRO-3 into the joint making sure that it comes into full contact with the sides of the joint and avoids any air entrapment. Sikaflex® PRO-3 sealant must be firmly tooled against the joint sides to ensure adequate adhesion. It is recommended to use masking tape where exact joint lines or neat lines are required. Remove the tape within the skin time. Use a compatible tooling agent (example: Sika® Tooling Agent N) to smooth the joint surfaces.

Do not use tooling products containing solvents.

### CLEANING OF EQUIPMENT

Clean all tools and application equipment immediately after use with Sika® Remover-208 and/or Sika® Top-Clean T. Once cured, residual material can only be removed mechanically.

## FURTHER INFORMATION

- Safety Data Sheet (SDS)
- Pre-treatment Chart Sealing & Bonding
- Method Statement Joint Sealing
- Method Statement Joint Maintenance, Cleaning and Renovation



## IMPORTANT CONSIDERATIONS

## BASIS OF PRODUCT DATA

All technical data stated in this Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.

**Product Data Sheet**

Edition 9.13.2012

Sikaflex-1a

**Sikaflex®-1a**

One part polyurethane, elastomeric  
sealant/adhesive



<b>Description</b>	Sikaflex-1a is a premium-grade, high-performance, moisture-cured, 1-component, polyurethane-based, non-sag elastomeric sealant. Meets Federal specification TT-S-00230C, Type II, Class A. Meets ASTM C-920, Type S, Grade NS, Class 35, use T, NT, O, M, G, I; Canadian standard CAN/CGSB 19.13-M87.
<b>Where to Use</b>	<ul style="list-style-type: none"> <li>■ Designed for all types of joints where maximum depth of sealant will not exceed 1/2 in.</li> <li>■ Excellent for small joints and fillets, windows, door frames, reglets, flashing, common roofing detail applications, and many construction adhesive applications.</li> <li>■ Suitable for vertical and horizontal joints; readily placeable at 40°F.</li> <li>■ Has many applications as an elastic adhesive between materials with dissimilar coefficients of expansion.</li> <li>■ Submerged conditions, such as canal and reservoir joints.</li> </ul>
<b>Advantages</b>	<ul style="list-style-type: none"> <li>■ Eliminates time, effort, and equipment for mixing, filling cartridges, pre-heating or thawing, and cleaning of equipment.</li> <li>■ Fast tack-free and final cure times.</li> <li>■ High elasticity - cures to a tough, durable, flexible consistency with exceptional cut and tear-resistance.</li> <li>■ Stress relaxation.</li> <li>■ Excellent adhesion - bonds to most construction materials without a primer.</li> <li>■ Excellent resistance to aging, weathering.</li> <li>■ Proven in tough climates around the world.</li> <li>■ Odorless, non-staining.</li> <li>■ Jet fuel resistant.</li> <li>■ Certified to the NSF/ANSI Standard 61 for potable water.</li> <li>■ Urethane-based; suggested by EPA for radon reduction.</li> <li>■ Paintable with water-, oil- and rubber-based paints.</li> <li>■ Capable of <math>\pm 35\%</math> joint movement.</li> </ul>
<b>Coverage</b>	10.1 fl. oz. cartridge seals 12.4 lineal ft. of 1/2 x 1/4 in. joint. 20 fl. oz. uni-pac sausage seals 24 lineal ft. of 1/2 x 1/4 in. joint.
<b>Packaging</b>	Disposable 10.1 fl. oz., moisture-proof composite cartridges, 24/case; and uni-pac sausages, 20 fl. oz., 20/carton.

**Typical Data (Material and curing conditions @ 73°F (23°C) and 50% R.H.)**

RESULTS MAY DIFFER BASED UPON STATISTICAL VARIATIONS DEPENDING UPON MIXING METHODS AND EQUIPMENT, TEMPERATURE, APPLICATION METHODS, TEST METHODS, ACTUAL SITE CONDITIONS AND CURING CONDITIONS.

<b>Shelf Life</b>	10.1 fl. oz. cartridges	12 months
	20 fl. oz. uni-pac sausages	12 months
	5 gallon pail	6 months
	55 gallon drum	6 months
<b>Storage Conditions</b>	Store at 40°-95°F (4°-35°C). Condition material to 65°-75°F before using.	
<b>Colors</b>	White, colonial white, aluminum gray, limestone, black, dark bronze, capitol tan, stone and medium bronze. Special architectural colors on request.	
<b>Application Temperature</b>	40° to 100°F. Sealant should be installed when joint is at mid-range of its anticipated movement.	
<b>Service Range</b>	-40° to 170°F	
<b>Curing Rate</b>	Tack-free time	3 to 6 hours
	Tack-free to touch	3 hours
	Final cure	4 to 7 days
<b>Tear Strength (ASTM D-624)</b>	55 lb./in.	
<b>Shore A Hardness (ASTM C-661)</b>	21 day	40 $\pm$ 5
<b>Movement Capability (ASTM C-719)</b>	+/- 35%	
<b>Tensile Properties (ASTM D-412)</b>	21 day	
	Tensile Stress	175 psi (1.21 MPa)
	Elongation at Break	550%
	Modulus of Elasticity	25% 35 psi (0.24 MPa)
		50% 60 psi (0.41 MPa)
		100% 85 psi (0.59 MPa)
<b>Adhesion in Peel (TT-S-00230C, ASTM C 794)</b>	Substrate	Peel Strength Adhesion Loss
	Concrete	20 lb. 0%
	Aluminum	20 lb. 0%
	Glass	20 lb. 0%
<b>Weathering Resistance</b>	Excellent	
<b>Chemical Resistance</b>	Good resistance to water, diluted acids, and diluted alkalines. Consult Technical Service for specific data.	

## How to Use Surface Preparation

Clean all surfaces. Joint walls must be sound, clean, dry, frost-free, and free of oil and grease. Curing compound residues and any other foreign matter must be thoroughly removed. A roughened surface will also enhance bond. Install bond breaker tape or backer rod to prevent bond at base of joint.

## Priming

Priming is not usually necessary. Most substrates only require priming if testing indicates a need or where sealant will be subjected to water immersion after cure. Consult Sikaflex Primer Technical Data Sheet or Technical Service for additional information on priming.

## Application

Recommended application temperatures: 40°-100°F. For cold weather application, condition units at approximately 70°F; remove prior to using.

For best performance, Sikaflex-1a should be gunned into joint when joint slot is at mid-point of its designed expansion and contraction.

Place nozzle of gun into bottom of the joint and fill entire joint. Keep the nozzle in the sealant, continue on with a steady flow of sealant preceding the nozzle to avoid air entrapment.

Avoid overlapping of sealant to eliminate entrapment of air. Tool sealant to ensure full contact with joint walls and remove air entrapment. Joint dimension should allow for 1/4 inch minimum and 1/2 inch maximum thickness for sealant. Proper design is 2:1 width to depth ratio.

For use in horizontal joints in traffic areas, the absolute minimum depth of the sealant is 1/2 in. and closed cell backer rod is recommended.

## Limitations

- Allow 1-week cure at standard conditions when using Sikaflex-1a in total water immersion situations and prior to painting.
- When overcoating with water, oil and rubber based paints, compatibility and adhesion testing is essential.
- Avoid exposure to high levels of chlorine. (Maximum continuous level is 5 ppm of chlorine.)
- Maximum depth of sealant must not exceed 1/2 in.; minimum depth is 1/4 in.
- Maximum expansion and contraction should not exceed 25% of average joint width.
- Do not cure in the presence of curing silicone sealants.
- Avoid contact with alcohol and other solvent cleaners during cure.
- Do not apply when moisture-vapor-transmission condition exists from the substrate as this can cause bubbling within the sealant.
- Use opened cartridges and uni-pac sausages the same day.
- When applying sealant, avoid air-entrapment.
- Since system is moisture-cured, permit sufficient exposure to air.
- White color tends to yellow slightly when exposed to ultraviolet rays.
- Light colors can yellow if exposed to direct gas fired heating element.
- The ultimate performance of Sikaflex-1a depends on good joint design and proper application with joint surfaces properly prepared.
- The depth of sealant in horizontal joints subject to traffic is 1/2 in.
- Do not tool with detergent or soap solutions.
- Do not use in contact with bituminous/asphaltic materials.

## Caution

**WARNING: IRRITANT, SENSITIZER.** Contains Polyisocyanate Prepolymer (Mixture), Xylene (CAS 1330-20-7). Causes eye irritation. May cause skin/respiratory irritation. May cause skin and/or respiratory sensitization after prolonged contact. May be harmful if swallowed. Reports have associated repeated and prolonged exposure to some of the chemicals in this product with permanent brain, liver, kidney and nervous system damage. Headaches and dizziness may result. **Deliberate misuse by inhalation of vapors may be harmful or fatal.** Strictly follow all usage, handling and storage instructions.

## Handling & Storage

Avoid direct contact. Wear personal protective equipment (chemical resistant goggles/gloves/clothing) to prevent direct contact with skin and eyes. Use only in well ventilated areas. Open doors and windows during use. Use a properly fitted NIOSH respirator if ventilation is poor. Wash thoroughly with soap and water after use. Remove contaminated clothing and launder before reuse. Store in cool dry well ventilated area.

## Cleanup

Use personal protective equipment (chemical resistant gloves/goggles/clothing). Without direct contact, remove spilled or excess product and placed in suitable sealed container. Dispose of excess product and container in accordance with applicable environmental regulations.

## First Aid Measures

**Eyes:** Hold eyelids apart and flush thoroughly with water for 15 minutes. **Skin:** Remove contaminated clothing. Wash skin thoroughly for 15 minutes with soap and water. **Inhalation:** Remove to fresh air. **Ingestion:** Do not induce vomiting. Dilute with water. Contact physician. **In all cases contact a physician immediately if symptoms persist.**

## Linear Feet of Sealant per Gallon

Inches	Depth	
	1/4	1/2
1/4	308.0	
1/2	154.0	77.0
3/4	102.7	51.3
1	77.0	38.5
1 1/2	61.6	30.8
1 3/4	51.3	25.7

Width

**KEEP CONTAINER TIGHTLY CLOSED • KEEP OUT OF REACH OF CHILDREN • NOT FOR INTERNAL CONSUMPTION • FOR INDUSTRIAL USE ONLY**  
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1-800-933-SIKA NATIONWIDE

Regional Information and Sales Centers. For the location of your nearest Sika sales office, contact your regional center.

## PRODUCT DATA SHEET

## Sikaflex®-2 C NS

Two-component, non-sag, polyurethane elastomeric sealant

## PRODUCT DESCRIPTION

Sikaflex®-2 C NS is a 2-component, premium-grade, polyurethane-based, elastomeric sealant. It is principally a chemical cure in a non-sag consistency. Meets ASTM C-920, Type M, Grade NS, Class 25, use T, NT, M, G, A, O, I and Federal Specification TT-S-00227E, Type II, Class A. Tested in accordance with ASTM C-1382 for use in EIFS systems.

## USES

- Intended for use in all properly designed working joints with a minimum depth of 1/4 inch.
- Ideal for vertical and horizontal applications.
- Placeable at temperatures as low as 40 °F.
- Adheres to most substrates commonly found in construction.
- An effective sealant for use in Exterior Insulation Finish Systems (EIFS).
- Submerged environments, such as canal and reservoir joints.

## PRODUCT INFORMATION

<b>Packaging</b>	1.5 gal. unit. 3 gal units.
<b>Color</b>	A wide range of architectural colors are available. Special colors available on request.
<b>Shelf Life</b>	One year in original, unopened containers.
<b>Storage Conditions</b>	Store dry at 40–95 °F (4–35 °C). Condition material to 65–75 °F before using.

## TECHNICAL INFORMATION

## CHARACTERISTICS / ADVANTAGES

- Capable of ±50 % joint movement.
- Chemical cure allows the sealant to be placed in joints exceeding 1/2 in. in depth.
- High elasticity with a tough, durable, flexible consistency.
- Exceptional cut and tear resistance.
- Exceptional adhesion to most substrates without priming.
- Available in 35 architectural colors.
- Color uniformity assured via Color-pak system.
- Available in pre-pigmented Limestone (no Color-pak needed).
- Non-sag even in wide joints.
- Easy to mix.
- Paintable with water-, oil-, and rubber-base paints.
- Jet fuel resistant.



<b>Shore Hardness</b>	25 ± 5	(73 °F (23 °C) and 50 % R.H.) (ASTM D-2240)						
<b>Tensile Strength</b>	95 psi at Break	(73 °F (23 °C) and 50 % R.H.) (ASTM D-412)						
<b>Tensile Stress at Specified Elongation</b>	70 psi at 100 %	(73 °F (23 °C) and 50 % R.H.) (ASTM D-412)						
<b>Elongation at Break</b>	500 %	(73 °F (23 °C) and 50 % R.H.) (ASTM D-412)						
<b>Adhesion in Peel</b>	<table> <tr> <td><b>Substrate</b></td><td><b>Peel Strength</b></td><td><b>% Adhesion Loss</b></td></tr> <tr> <td>Concrete</td><td>25 lb.</td><td>Zero</td></tr> </table>	<b>Substrate</b>	<b>Peel Strength</b>	<b>% Adhesion Loss</b>	Concrete	25 lb.	Zero	(73 °F (23 °C) and 50 % R.H.) (Fed Spec. TT-S-00227E)
<b>Substrate</b>	<b>Peel Strength</b>	<b>% Adhesion Loss</b>						
Concrete	25 lb.	Zero						
<b>Tear Strength</b>	45 lb./in.	(73 °F (23 °C) and 50 % R.H.) (ASTM D-624)						
<b>Chemical Resistance</b>	Good resistance to water, diluted acids, diluted alkalines, and residential sewage. Consult Technical Service at 1-800-933-SIKA for specific data.							
<b>Resistance to Weathering</b>	Excellent							
<b>Service Temperature</b>	-40 °F to 170 °F (-40 °C to 75 °C).							

## APPLICATION INFORMATION

Coverage	1 gallon: Yield in Linear feet			
	Width/Depth	1/4"	3/8"	1/2"
	1/4"	307.9		
	3/8"	205.3	136.8	
	1/2"	153.9	102.6	77.0
	3/4"	102.6	68.4	51.3
	1"			38.5
	1.25"			30.8
	1.5"			25.7
Ambient Air Temperature	40 °F to 100 °F. Sealant should be installed when joint is at midrange of its anticipated movement.			
Substrate Temperature	40 °F to 100 °F. Sealant should be installed when joint is at midrange of its anticipated movement.			
Pot Life	3–4 hrs.			
Curing Rate	Tack-Free Time	6–8 hrs.		(ASTM C-679)
	Final Cure	3 days		

## APPLICATION INSTRUCTIONS

### SUBSTRATE PREPARATION

All joint-wall surfaces must be clean, sound, and frost-free. Joint walls must be free of oils, grease, curing compound residues, and any other foreign matter that might prevent bond. Ideally this should be accomplished by mechanical means. Bond breaker tape or backer rod must be used in bottom of joint to prevent bond.

Priming is typically not necessary. Most substrates only require priming if sealant will be subjected to water immersion after cure. Testing should be done, however, on questionable substrates, to determine if priming is

needed. Consult Technical Service or Sikaflex Primer Technical Data Sheet for additional information on priming. Note: Most Exterior Insulation Finish Systems (EIFS) manufacturers recommend the use of a primer. When EIFS manufacturer specifies a primer or if on-site bond testing indicates a primer is necessary, Sikaflex 429 primer is recommended. On-site adhesion testing is recommended with final system prior to the start of a job.

## MIXING

Pour entire contents of Component 'B' into pail of Component 'A'. Add entire contents of Color-pak into pail and mix with a low-speed drill (400–600 rpm) and Sikaflex paddle.\* Mix for 3-5 minutes to achieve a uniform color and consistency. Scrape down sides of pail periodically. Avoid entrapment of air during mixing. When mixing in cold weather (<50 °F), do not force the mixing paddle to the bottom of the pail. After adding Component 'B' and Color-pak into Component 'A', mix the top 1/2 to 3/4 of the pail during the first minute of mixing. After scraping down the sides of the pail, mix again for another minute. The paddle should reach the bottom of the pail between the first and second minute of mixing. Scrape down the sides of the pail a second time and then mix for an additional 2-3 minutes until the sealant is well blended. Color-pak must be used with tint base. For pre-pigmented Limestone base, just mix with low speed drill and Sikaflex paddle (no Color-pak needed).

## APPLICATION METHOD / TOOLS

Recommended application temperatures 40–100 °F. Pre-conditioning units to approximately 70 °F is necessary when working at extremes. Move pre-conditioned units to work areas just prior to application. Apply sealant only to clean, sound, dry, and frost-free substrates. Sikaflex-2c should be applied into joints when joint slot is at mid-point of its designed expansion and contraction. To place, load directly into bulk gun or use a follower plate loading system. Place nozzle of gun into bottom of joint and fill entire joint. Keeping the nozzle deep in the sealant, continue with a steady flow of sealant preceding nozzle to avoid air entrapment. Also, avoid overlapping of sealant since this also entraps air. Joint dimension should allow for 1/4 inch minimum and 1/2 inch maximum thickness for sealant. Proper design is 2:1 width to depth ratio. Tool sealant to ensure full contact with joint walls and remove air entrapment.

## LIMITATIONS

- The ultimate performance of Sikaflex®-2 C NS depends on good joint design and proper application.
- Minimum depth in working joint is 1/4 in.
- Maximum expansion and contraction should not exceed 50 % of average joint width.
- Do not cure in the presence of curing silicones.
- Avoid contact with alcohol and other solvent cleaners during cure.
- Allow 3 day cure before subjecting sealant to total water immersion. Primer is required if sealant will be subjected to total water immersion.
- Avoid exposure to high levels of chlorine. (Maximum level is 5 ppm).
- Do not apply when moisture vapor transmission exists since this can cause bubbling within the sealant.
- Avoid over-mixing sealant.

- White color tends to yellow slightly when exposed to ultraviolet rays.
- Light colors can yellow if exposed to direct gas fired heating elements.
- When overcoating: an on-site test is recommended to determine actual compatibility.
- Rigid paints, coatings or primers will crack when placed over elastomeric sealants experiencing expansion or contraction
- The depth of sealant in horizontal joints subject to traffic is 1/2 inch.
- When used in areas with heavy traffic either recess joint or use TG (Traffic Grade) Additive to increase durability.

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.



## PRODUCT DATA SHEET

## Sikalastic®-720 Base

TWO-COMPONENT, FAST-CURING, SOLVENT-FREE, CRACK-BRIDGING, ELASTOMERIC POLYURETHANE BASE COAT

## PRODUCT DESCRIPTION

Sikalastic®-720 Base is a two-component, aromatic, chemically cured, elastomeric polyurethane coating intended for use as the waterproofing base coat under polyurethane or epoxy wearing surfaces for pedestrian and vehicular traffic bearing applications, and as the waterproofing base coat under a separate wearing course such as concrete or asphalt pavement, and tile in a setting bed.

## USES

Sikalastic®-720 Base may only be used by experienced professionals.

- Multi-story parking garages
- Parking decks and ramps
- Foot bridges and walkways
- Mechanical rooms
- Stadiums and arena
- Plaza and rooftop decks
- Balconies
- Roofing Flood Coat when mixed with approved aggregate

## CHARACTERISTICS / ADVANTAGES

- Low odor and fast turnaround
- Excellent crack-bridging properties and flexibility, even at low temperatures
- Resistant to water and de-icing salts
- Alkaline resistant

## PRODUCT INFORMATION

Packaging	20 gal. kit - four 5 gal. pails (net 4 gal. each) Part A and four 1 gal. cans Part B
Appearance / Color	Gray/White
Shelf Life	12 months in original, unopened containers
Storage Conditions	Store dry at 40–95 °F (4–35 °C). Condition material to 65–85 °F (18–30 °C) before using.



<b>Solid content by volume</b>	100 %	(ASTM D-2697)
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<b>Volatile organic compound (VOC) content</b>	See Product Safety Data Sheet
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## TECHNICAL INFORMATION

<b>Shore A Hardness</b>	80 +/- 5 (75 °F (24 °C) and 50 % R.H.)	(ASTM D-2240)
<b>Tensile Strength</b>	2500 +/- 100 psi (75 °F (24 °C) and 50 % R.H.)	(ASTM D-412)
<b>Elongation at Break</b>	800 +/- 50 % (75 °F (24 °C) and 50 % R.H.)	(ASTM D-412)
<b>Tear Strength</b>	300 +/- 25 pli (75 °F (24 °C) and 50 % R.H.)	(Die C, ASTM D-624)
<b>Chemical Resistance</b>	Resistant to de-icing salts, and alkaline concrete and cementitious mortars/tile adhesives.	

## APPLICATION INFORMATION

<b>Coverage</b>	70 ft <sup>2</sup> /gal. at 23 wet mils (23 dry mils)
<b>Pot Life</b>	10–15 minutes

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## LIMITATIONS

- To avoid dew point conditions during application, relative humidity must be no more than 95 % and substrate temperature must be at least 5 °F (3 °C) above measured dew point temperatures.
- Maximum moisture content of substrate: 4 % by weight with Sikalastic® Primer, Sikalastic® FTP Primer, Sikalastic® PF LoVOC Primer and 6 % by weight with Sikalastic® FTP LoVOC Primer, Sikalastic® MT Primer.
- Minimum ambient and substrate temperature during application and curing of material is 40 °F (4 °C); maximum is 90 °F (32 °C). Frequent monitoring of ambient and substrate temperature should always be done when applying polyurethane coatings. Note that low temperatures and low humidity will slow down the cure, and high temperatures and high humidity will accelerate it.
- Do not store materials outdoors exposed to sunlight for prolonged periods.
- Do not thin with solvents.
- Minimum age of concrete must be 21–28 days, depending on curing and drying conditions.
- Any repairs required to achieve a level surface must be performed prior to application (consult a Sika representative for guidance on various Sika product solutions). Surface irregularities may reflect through the cured system.
- Do not apply to a porous or damp surface where moisture vapor transmission will occur during application and cure.
- Substrate must be dry prior to application. Do not apply to a frosted, wet or damp surface. Do not proceed if rain is imminent within 8–12 hours of application. Allow sufficient time for the substrate to dry after rain or inclement weather as there is the potential for bonding problems.
- When applying over existing coatings compatibility and adhesion testing is recommended.
- On grade, lightweight concrete, asphalt pavement, and applications where chained or studded tires may be used should not be coated with Sikalastic® traffic systems.
- Unvented metal pan decks or decks containing between-slab membranes require further technical evaluation and priming with a moisture-blocking primer - contact Sika regarding recommendations.
- Waterproofing applications under overburden, including concrete pavement, asphalt pavement, and tile in a cementitious setting bed, require further technical evaluation - contact Sika regarding recommendations.
- Do not subject to continuous immersion or ponding water.
- Sikalastic®-720 Base is not UV stable and must be top coated or protected by a separate wearing course.
- Sikalastic®-720 Base must be kept clean and recoated within 24 hours. If this window is exceeded, contact Sika for recommendations.
- Mockups to verify application methods and substrate conditions as well as desired skid resistance and aesthetics are highly recommended.
- Cracks or ruptures which develop in the structure after the waterproofing traffic system has been installed will

not be bridged by the waterproofing traffic system and need to be repaired according to the recommended standard crack treatment details per this PDS.

- When using Sikalastic®-720 Base as a Roofing Flood Coat contact Sika or your local Tech Field Service Rep prior to application.

## ENVIRONMENTAL, HEALTH AND SAFETY

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety Data Sheets containing physical, environmental, toxicological and other safety related data. User must read the current actual Safety Data Sheets before using any products. In case of an emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.

## APPLICATION INSTRUCTIONS

### SURFACE PREPARATION

Surface must be clean, dry, and sound with an open texture. Remove dust, laitance, grease, curing compounds, bond inhibiting impregnations, waxes, and any other contaminants. All projections, rough spots, etc. should be dressed off to achieve a level surface prior to the application.

**Concrete** - Should be cleaned and prepared to achieve a laitance and contaminant free, open textured surface by blast cleaning or equivalent mechanical means (CSP 3-4 per ICRI guidelines).

**Plywood** - Should be clean and smooth, APA and exterior grade, not less than 1/2" thick, and spaced and supported according to APA guidelines. Joints should be sealed with Sikaflex® sealant and detailed and may need embedded fabric reinforcement.

**Metal** - Should be thoroughly cleaned by grinding or blast cleaning.

### Priming

**Primer Selection** - Determine maximum moisture content of concrete substrate by weight with a TrameX CME or CMExpert type concrete moisture meter.

**Sikalastic® Primer** – For concrete decks with a maximum moisture content of 4 % by weight, apply Sikalastic® Primer with a flat squeegee or phenolic resin core roller at approximately 250 - 300 sf/gal. and work well into the substrate to ensure adequate penetration and sealing, and puddles are avoided. Sikalastic® Primer is not suitable for metal substrates. Refer to separate primer data sheet for additional information.

**Sikalastic® FTP Primer** – For concrete decks with a maximum moisture content of 4 % by weight, and for

weathered plywood decks, apply Sikalastic® FTP Primer with a flat squeegee or phenolic resin core roller at approximately 300 sf/gal. and work well into the substrate to ensure adequate penetration and sealing, and puddles are avoided. Sikalastic® FTP Primer is not suitable for metal substrates. Refer to separate primer data sheet for additional information.

**Sikalastic® PF Lo-VOC Primer** - For concrete and plywood decks with a porous or rough surface, and for metal flanges and penetrations, use Sikalastic® PF Lo-VOC Primer. For exterior exposed concrete decks with a maximum moisture content of 4 % by weight, interior protected concrete decks with a maximum moisture content of 5 % by weight, and plywood decks, apply Sikalastic® PF Lo-VOC Primer with a flat squeegee or phenolic resin core roller at approximately 200 sf/gal. and work well into the substrate to ensure adequate penetration and sealing, and puddles are avoided. For exterior exposed concrete decks with a maximum moisture content of 5 % by weight, two applications of Sikalastic® PF Lo-VOC Primer are required. Refer to separate primer data sheet for additional information.

**Sikalastic® FTP LoVOC Primer** - For concrete with a maximum moisture content of 5 % by weight, and for metal flanges and penetrations, apply Sikalastic® FTP LoVOC Primer with a flat squeegee or roller at approximately 175 sf/gal. For concrete decks with a maximum moisture content of 6% by weight, apply two applications of Sikalastic® FTP LoVOC Primer with a flat squeegee or phenolic resin roller at approximately 175 - 220 sf/gal per application. Work primer well into the substrate to ensure adequate penetration and sealing, and puddles are avoided. Refer to separate primer data sheet for additional information.

**Sikalastic® MT Primer** - For concrete with a maximum moisture content of 5 % by weight, and for metal flanges and penetrations, apply Sikalastic® MT Primer with a flat squeegee or roller at approximately 175 sf/gal. For concrete decks with a maximum moisture content of 6% by weight, apply two applications of Sikalastic® MT Primer with a flat squeegee or phenolic resin roller at approximately 175 sf/gal per application. Work primer well into the substrate to ensure adequate penetration and sealing and puddles are avoided. Refer to separate primer data sheet for additional information.

**Sikalastic® Recoat Primer** – For existing polyurethane coatings, incidental exposed concrete deck areas, and as an interlamine primer, apply Sikalastic® Recoat Primer with a flat squeegee or phenolic resin core roller at approximately 300 sf/gal. and work will into the substrate to ensure adequate penetration and sealing, and puddles are avoided. Sikalastic® Recoat Primer is not suitable for metal substrates. Refer to separate primer data sheet for additional information.

**Sikalastic® EP Primer/Sealer** - For Wood (timber, plywood), Metal (aluminum, galvanized, cast iron,

copper, lead, brass, stainless steel, steel, zinc), and for existing asphaltic gravel roofs prior to Flood Coat application. Apply by brush or phenolic resin core roller at the recommended rate, 100-250 sf/gal depending on the substrate. Correct amount of primer will saturate the substrate and leave a slight film on the substrate top surface. Apply evenly without puddling. Refer to separate primer data sheet for additional information

#### Detailing

**Non-structural cracks up to 1/16"** - Apply a detail coat of Sikalastic®-720 Base at 23 wet mils, 4" wide, centered over the crack. Allow to become tack free before over coating.

**Cracks and joints over 1/16" up to 1 inch** - Rout and seal with Sikaflex® sealant and allow to cure. Apply a detail coat of Sikalastic®-720 Base at 23 wet mils, 4" wide, centered over the crack. Allow to become tack free before over coating.

**Joints over 1 inch** - Should be treated as expansion joints and brought up through the Sikalastic®-720 Base waterproofing membrane and sealed with Sikaflex® sealant.

**Fabric Reinforcement** – An optional 3" or 6" wide Sikalastic Flexitape Heavy fabric strip may be embedded within the base coat. Flexitape width shall be chosen such that a minimum of 1" tape is embedded on either side of the crack/joint. Apply additional coating as required to fully embed the Flexitape in the coating.

**Panelized Joints** - Panelized joints that are restrained across the joint and without differential movement may be sealed and the deck coating, including detail coat, applied over the joint.

NOTE: movement within panelized joints may cause deterioration of the aggregated wear coat, in which case the joints should be treated as expansion joints and brought up through the Sikalastic Traffic System and sealed with Sikaflex® sealant. For additional questions please contact Sika Technical Services.

**Expansion Joints** - Should be extended through System.

#### **MIXING**

Premix Part A and Part B components using a mechanical mixer (Jiffy) at slow speed to obtain uniform

color, making sure to scrape the solids from the bottom and sides of the pail. Pour part B into Part A slowly and while mixing scrape the side of the container, Mix the combined material thoroughly until a homogenous mixture and uniform color is obtained (typically 3 minutes). Use care not to allow the entrapment of air into the mixture.

#### **APPLICATION**

Apply at the recommended coverage rate (see appropriate System Guide) using a notched squeegee or trowel, and backroll using a phenolic resin core roller. Extend base coat over entire area including previously detailed cracks and joints. Allow coating to cure a minimum of 3–4 hours at 70 °F and 50 % R.H. or until tack free before top coating.

When used under an overburden system an additional coat of Sikalastic®-720 Base, fully broadcast, is required, allow coating to cure for a minimum of 36 hours before installing separate overburden.

#### **Removal**

Remove liquid coating immediately with dry cloth. Once cured, coating can only be removed by mechanical means.

#### **OTHER RESTRICTIONS**

See Legal Disclaimer.

#### **LEGAL DISCLAIMER**

- **KEEP CONTAINER TIGHTLY CLOSED**
- **KEEP OUT OF REACH OF CHILDREN**
- **NOT FOR INTERNAL CONSUMPTION**
- **FOR INDUSTRIAL USE ONLY**
- **FOR PROFESSIONAL USE ONLY**



## PRODUCT DATA SHEET

# Sikalastic®-745 Textured

Two-component, integrally textured, aliphatic, fast-curing, solvent-free, traffic bearing wear and top coat

## PRODUCT DESCRIPTION

Sikalastic®-745 Textured is a two-component, aliphatic, chemically cured, elastomeric polyurethane coating intended for use as the traffic bearing wear and top coat over polyurethane waterproofing membrane for pedestrian and vehicular traffic bearing applications, and as a protective top coat over polyurethane waterproofing membrane under a separate wearing course such as concrete or asphalt pavement, and tile in a setting bed.

## USES

Sikalastic®-745 Textured may only be used by experienced professionals.

- Multi-story parking garages
- Parking decks and ramps
- Foot bridges and walkways
- Mechanical rooms
- Stadiums and arena
- Plaza and rooftop decks
- Balconies

## PRODUCT INFORMATION

<b>Packaging</b>	17.6 gal. kit - four 5 gal. pails (net 4 gal. each) Part A and four 1 gal. cans (net 0.4 gal. each) Part B
<b>Shelf Life</b>	12 months in original, unopened containers
<b>Storage Conditions</b>	Store dry at 40–95 °F (4–35 °C). Condition material to 65–85 °F (18–30 °C) before using.
<b>Appearance / Color</b>	Gray, Charcoal and Tan; custom colors available



<b>Solid content by volume</b>	100 %	(ASTM D-2697)
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<b>Volatile organic compound (VOC) content</b>	See Product Safety Data Sheet
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## TECHNICAL INFORMATION

<b>Shore A Hardness</b>	85 +/- 5 (75 °F (24 °C) and 50 % R.H.)	(ASTM D-2240)
<b>Tensile Strength</b>	3200 +/- 300 psi (75 °F (24 °C) and 50 % R.H.)	(ASTM D-412)
<b>Elongation at Break</b>	450 +/- 45 % (75 °F (24 °C) and 50 % R.H.)	(ASTM D-412)
<b>Tear Strength</b>	300 +/- 30 pli (75 °F (24 °C) and 50 % R.H.)	(Die C, ASTM D-624)
<b>Chemical Resistance</b>	Resistant to de-icing salts, and alkaline concrete and cementitious mortars/tile adhesives.	

## APPLICATION INFORMATION

<b>Coverage</b>	80 sf/gal. at 14 wet mils (14 dry mils) 70 sf/gal. at 16 wet mils (16 dry mils) 62 sf/gal. at 18 wet mils (18 dry mils)
	Coverage rates provided are intended to achieve required wet film thickness under optimal conditions. Additional material may be required depending on substrate surface roughness and porosity, material, substrate and air temperatures, and other site-dependent factors. This will result in a lower coverage rate.
<b>Pot Life</b>	20–30 minutes

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## LIMITATIONS

- To avoid dew point conditions during application, relative humidity must be no more than 95 % and substrate temperature must be at least 5 °F (3 °C) above measured dew point temperatures.
- Maximum moisture content of substrate: 4 % by weight with Sikalastic® Primer, Sikalastic® FTP primer and 6 % by weight with Sikalastic® FTP LoVOC Primer or Sikalastic® MT primer.
- Minimum ambient and substrate temperature during application and curing of material is 50 °F (10 °C); maximum is 90 °F (32 °C). Frequent monitoring of ambient and substrate temperature should always be done when applying polyurethane coatings. Note that low temperatures and low humidity will slow down the cure, and high temperatures and high humidity will accelerate it.
- Do not store materials outdoors exposed to sunlight for prolonged periods.
- Do not thin with solvents.
- Use properly graded, oven dried aggregates only.
- Minimum age of concrete must be 21–28 days, depending on curing and drying conditions.
- Any repairs required to achieve a level surface must be performed prior to application (consult a Sika representative for guidance on various Sika product solutions). Surface irregularities may reflect through the cured system.
- Do not apply to a porous or damp surface where moisture vapor transmission will occur during application and cure.
- Substrate must be dry prior to application. Do not apply to a frosted, wet or damp surface. Do not proceed if rain is imminent within 8–12 hours of application. Allow sufficient time for the substrate to dry after rain or inclement weather as there is the potential for bonding problems.
- When applying over existing coatings compatibility and adhesion testing is recommended.
- Opening to traffic or installation of separate wearing course prior to final cure may result in loss of aggregate, or permanent staining and subsequent premature failure.
- Vehicle fluids and some high performance tires can stain the coating. Fluid spills should be removed promptly as the coating can in some cases be damaged from prolonged exposure.

- On grade, lightweight concrete, asphalt pavement, or insulated split slab applications, or applications where chained or studded tires may be used, must not be coated with Sikalastic Traffic Systems without Sika technical review. Contact Sika Technical Services for recommendations.
- Unvented metal pan decks or decks containing between-slab membranes require further technical evaluation and priming with a moisture-blocking primer - contact Sika regarding recommendations.
- Waterproofing applications under overburden, including concrete pavement, asphalt pavement, and tile in a cementitious setting bed, require further technical evaluation - contact Sika regarding recommendations.
- Do not subject to continuous immersion.
- Base coat must be kept clean and recoated within 24 hours for two-component base coat, and 72 hours for single component base coat. If this window is exceeded, contact Sika for recommendations.
- Mockups to verify application methods and substrate conditions as well as desired skid resistance and aesthetics are highly recommended.

## SURFACE PREPARATION

Surface must be clean, dry and sound with an open texture. Remove dust, laitance, grease, curing compounds, bond inhibiting impregnations, waxes, and any other contaminants. All projections, rough spots, etc. should be dressed off to achieve a level surface prior to the application.

**Sikalastic® 720 Waterproofing Base Coat** - Coating should be cured and tack free.

**Existing Coatings** - Should be cleaned and mechanically abraded to provide a contaminant free, open textured surface. Solvent wipe as allowed by state and local regulations. Use Recoat Primer .

## MIXING

Thoroughly premix Part A using a mechanical mixer (Jiffy) at slow speed to obtain uniform color and mixture, making sure to scrape the solids and the aggregate from the bottom and sides of the pail. The aggregate should be evenly diffused in the resin. Pour part B into Part A slowly and while mixing scrape the side of the container, Mix the combined material thoroughly until a homogenous mixture and uniform color is obtained (typically 3 minutes). Use care not to allow the entrapment of air into the mixture.

## APPLICATION

**Wear coat:** Apply at the recommended coverage rate 16 mils wet (70 sf/gal) using a 1/8" or 3/16" notched squeegee or trowel, and backroll using nap roller 3/8" to uniformly backroll prior to applying topcoat. It should be backrolled two times, one perpendicular to the other.

**Top coat:** Apply at the recommended coverage rate 16 mils wet (70 sf/gal) using a 1/8" or 3/16" notched squeegee or trowel, and backroll using nap roller 3/8" to uniformly backroll. The Top coat should be backrolled two times, one perpendicular to the other. Allow coating to cure a minimum of 4 hours at 70 °F and 50 % R.H.; coating must be tack free before overcoating. Allow coating to cure for a minimum of 36 hours before opening to vehicular traffic

## Removal

Remove liquid coating immediately with dry cloth. Once cured, coating can only be removed by mechanical

means.

## OTHER RESTRICTIONS

See Legal Disclaimer.

## LEGAL DISCLAIMER

- KEEP CONTAINER TIGHTLY CLOSED
- KEEP OUT OF REACH OF CHILDREN
- NOT FOR INTERNAL CONSUMPTION
- FOR INDUSTRIAL USE ONLY
- FOR PROFESSIONAL USE ONLY



## PRODUCT DATA SHEET

## Sikalastic® Primer

One-Component, High Solids, Aromatic Polyurethane Primer

## PRODUCT DESCRIPTION

Sikalastic® Primer is cold applied, single component, low-odor moisture-curing polyurethane resin. It is designed for sealing cementitious substrate to reduce the incidence of outgassing.

## USES

Sikalastic® Primer may only be used by experienced professionals.

- Suitable for use on most sound substrate surfaces where both a penetrative and surface lying effect is required.
- Can be used as a recoat primer over existing PU coatings. Adhesion test is recommended.

## CHARACTERISTICS / ADVANTAGES

- Significantly reduces the likelihood of blistering and pin holing
- Fast curing formulation
- Single component
- Compatible with most concrete, masonry, and stone substrate materials
- Low odor
- Lo-VOC
- Low temperature application

## PRODUCT INFORMATION

Chemical Base	Moisture cure polyurethane
Packaging	5 gal. pails
Appearance / Color	Light Amber
Shelf Life	12 months in original, unopened containers
Storage Conditions	Store dry at 41–77 °F (5–25 °C). Condition material to 50–77 °F (10–25 °C) before using for ease of application.
Solid Content	65 %
Volatile organic compound (VOC) content	< 100 g/L

## TECHNICAL INFORMATION

## APPLICATION INFORMATION

<b>Coverage</b>	225 to 300 ft <sup>2</sup> /gal, depending on substrate profile and porosity 250 ft <sup>2</sup> /gal on prepared, dry concrete and masonry (CSP3 surface preparation) Note: On porous/open substrates, apply as two coats, each at maximum spread rate of 275 ft <sup>2</sup> /gal
<b>Cure Time</b>	30–45 minutes at 77 °F (25 °C) and 50 % R.H. Lower temperatures will extend cure time. Recoat Time: Up to 72 hours

## APPLICATION INSTRUCTIONS

### SURFACE PREPARATION

Surface must be clean, sound and dry. Remove dust, laitance, grease, curing compounds, bond inhibiting impregnations, waxes and any other contaminants. All projections, rough spots, etc. should be dressed off to achieve a level surface prior to the application.

**Concrete** - Should be cleaned and prepared to achieve a laitance and contaminant-free, open textured surface by blast cleaning or equivalent mechanical means (CSP-3 per ICRI guidelines). Sweep and vacuum any remaining dirt and dust with a wet/dry vacuum. Removing residual dust will help ensure a tenacious bond between the primer and substrate.

**Plywood** - Should be clean and smooth, APA and exterior grade, not less than 1/2" thick, and spaced and supported according to APA guidelines. Joints should be sealed with Sikaflex® 2c or 1a and detailed, and may need embedded fabric reinforcement. Maximum moisture content 4%.

### MIXING

No mixing necessary.

### APPLICATION

Apply one coat of Sika® Concrete Primer by squeegee and/or medium nap roller ensuring even and consistent coverage. Ensure all excess material is removed by back rolling.

### Removal

Remove liquid uncured resin immediately with dry cloth and do solvent cleanup. Once cured, resin can only be removed by mechanical means.

## LIMITATIONS

- To avoid dew point conditions during application, relative humidity must be no more than 95 % and substrate temperature must be at least 5 °F (3 °C) above measured dew point temperatures.
- Minimum ambient and substrate temperature during application and curing of material is 30 °F (-1 °C); maximum is 95 °F (35 °C). Surface temperatures must be no higher than 140 °F (60 °C).
- Do not apply on substrates with moisture content greater than 4 % by weight, measured by Tramex Concrete Moisture Encounter Meter.
- The substrate should be absolutely free of frost and any residue of ice, snow or moisture.
- Minimum age of concrete must be 21–28 days depending on curing and drying conditions.
- Do not thin with solvents.
- Do not store materials outdoors exposed to sunlight and moisture for prolonged periods.
- Do not apply to substrate surfaces where moisture vapor transmission will occur during application and cure. This condition may be checked using ASTM D-4263 (Polyethylene Sheet method).
- Substrate must be dry prior to application. Do not apply to a frosted, wet or damp surface.
- Allow sufficient time for the substrate to dry after rain or inclement weather, as there is the potential for bonding problems.
- On substrates likely to exhibit outgassing apply during falling ambient and substrate temperature. If applied during rising temperature pin holing may occur.
- Precautions should be taken to prevent vapors and/or odors from entering the building/ structure, including but not limited to turning off and sealing air intake vents and throughwall air conditioners, and other means of vapor/odor ingress during application and cure.
- Any repairs required to achieve a level surface must be performed prior to application (consult a Sika representative for guidance on various product solutions). Surface irregularities may reflect through the cured system.
- When applying over existing coatings or membranes compatibility and adhesion testing, subsequent approval by Technical Services is required.



- On grade concrete decks should not be covered with Sikalastic® membrane systems.
- Unvented metal pan, split/sandwich slab with encapsulated membrane and/or insulation, cinder fill decks, and lightweight insulating concrete overlays should not be covered with Sikalastic® membrane systems without additional deck evaluation to determine substrate moisture content and subsequent.
- Do not thin with solvent.

## **BASIS OF PRODUCT DATA**

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## **OTHER RESTRICTIONS**

See Legal Disclaimer.

## **ENVIRONMENTAL, HEALTH AND SAFETY**

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety Data Sheets containing physical, environmental, toxicological and other safety related data. User must read the current actual Safety Data Sheets before using any products. In case of an emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.

## **LEGAL DISCLAIMER**

- KEEP CONTAINER TIGHTLY CLOSED
- KEEP OUT OF REACH OF CHILDREN
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- FOR INDUSTRIAL USE ONLY
- FOR PROFESSIONAL USE ONLY



## PRODUCT DATA SHEET

# SikaQuick®-1000

Rapid hardening repair mortar with extended working time

## PRODUCT DESCRIPTION

SikaQuick®-1000 is a one-component, rapid hardening, early strength gain, cementitious, patching mortar for concrete. SikaQuick®-1000 LD is a low dust version of this formula.

## USES

- On grade, above grade and below grade concrete conditions
- Highway overlays and repairs
- Structural repair material for concrete roadways, parking structures, bridges, dams and ramps
- Full depth patching repairs (may require multiple lifts)
- Economical patching material for horizontal flatwork repairs of mortar lines and concrete surfaces

## CHARACTERISTICS / ADVANTAGES

- Specially suited for warmer weather applications when extended working time is required
- Epoxy coatings can be applied as early as 6 hours at 73° F (23° C).
- Freeze / thaw resistant
- Easy to use - labor-saving material
- Not gypsum-based
- High early strength
- Open to foot traffic in 4 hours / Open to vehicular traffic in 6 hours at 73° F (23° C)
- Easily applied to clean, sound substrates
- SikaQuick®-1000 LD is an available, low dust version of this product.

## APPROVALS / STANDARDS

- Rapid hardening as defined by ASTM C 928

## PRODUCT INFORMATION

Chemical Base	<ul style="list-style-type: none"><li>▪ SikaQuick®-1000 is a blend of cement, select aggregates and specialty additives</li><li>▪ SikaQuick®-1000 LD is a blend of cement, select aggregates, low dust and specialty additives</li></ul>
Packaging	50 lb (22.7 kg) bag
Appearance / Color	Gray powder
Shelf Life	12 months from date of manufacture if stored properly in original, unopened and undamaged, sealed packaging
Storage Conditions	Store dry at 40° – 95° F (4° – 35° C) Protect from moisture. If damp, discard material

## TECHNICAL INFORMATION

<b>Compressive Strength</b>	3 hours	1,250 psi (8.6 MPa)	(ASTM C 109) 73° F (23° C), 50% R.H.
	1 day	4,000 psi (27.5 MPa)	
	7 days	5,000 psi (34.5 MPa)	
	28 days	7,000 psi (48.3 MPa)	
<b>Modulus of Elasticity in Compression</b>	28 days	4.6 x 10 <sup>6</sup> psi (32 GPa)	(ASTM C-469) 73° F (23° C), 50% R.H.
<b>Flexural Strength</b>	1 day	700 psi (4.8 MPa)	(ASTM C 293) 73° F (23° C), 50% R.H.
	7 days	900 psi (6.2 MPa)	
	28 days	1,000 psi (6.9 MPa)	
<b>Splitting Tensile Strength</b>	1 day	200 psi (1.4 MPa)	(ASTM C 496) 73° F (23° C), 50% R.H.
	7 days	300 psi (2.1 MPa)	
	28 days	400 psi (2.8 MPa)	
<b>Tensile Adhesion Strength</b>	28 days	Approximately 300 psi (2.1 MPa) Substrate failure	(ACI 503R) 73° F (23° C), 50% R.H.
<b>Shrinkage</b>	28 days	0.06%	(ASTM C 157 modified per ASTM C-928) 73° F (23° C), 50% R.H.
<b>Abrasion Resistance</b>	28 days	0.026 inch (0.66 mm) of wear at 1 hour	(ASTM C 779) 73° F (23° C), 50% R.H.
<b>Freeze-Thaw Stability</b>	28 days	98%	(ASTM C 666)
<b>Freeze Thaw De-Icing Salt Resistance</b>	50 cycles	0.080 lb / ft <sup>2</sup> (391 grams / m <sup>2</sup> )	(ASTM C 672)
<b>Rapid Chloride Permeability</b>	28 days	< 1,000 Coulombs	(ASTM C 1202 / AASHTO T 277) 73° F (23° C), 50% R.H.

## APPLICATION INFORMATION

Mixing Ratio	4.5 – 5 pints (2.1 – 2.4 L)		
Coverage	Neat	0.43 ft³ (0.012 m³)	
	Extended with 25 lbs (11.4 kg) of 3/8 inch (10 mm) pea gravel	0.58 ft³ (0.017 m³)	
	(Yield figures do not include allowance for surface profile, porosity or material waste)		
Consumption / Yield / Dosage (PRINT single line)			
Layer Thickness		Min.	Max.
	Neat	1/4 inch (6 mm)	2 inches (50 mm)
	Extended	1 inch (25 mm)	6 inches (152 mm)
<div><div></div><div><div></div><div></div></div></div> <ul style="list-style-type: none"><li>▪ Do not feather edge</li><li>▪ Do not exceed 7 inches (178 mm) slump when extended</li></ul>			

<b>Product Temperature</b>	65° – 75° F (18° – 24° C)	
<b>Ambient Air Temperature</b>	> 40° - 95° F (4° - 35° C)	
<b>Substrate Temperature</b>	> 40° - 95° F (4° - 35° C)	
<b>Set Time</b>	35 – 85 minutes	(ASTM C 266) 73° F (23° C), 50% R.H.
<b>Final Set Time</b>	> 120 minutes	(ASTM C 266) 73° F (23° C), 50% R.H.

## APPLICATION INSTRUCTIONS

### SURFACE PREPARATION

- Concrete surface must be clean and sound.
- Remove all deteriorated concrete, dirt, oil, grease, and other bond-inhibiting materials from the area to be repaired.
- Be sure repair area is not less than 1/4" (6 mm) deep.
- Preparation work should be done by high pressure water blast, scabber or other appropriate mechanical means to obtain an exposed aggregate surface profile of  $\pm 1/8"$  (3 mm) [minimum CSP-6].
- To ensure optimum repair results, the effectiveness of decontamination and preparation should be assessed by a Tensile Adhesion Strength (pull-off) test.
- Saw cutting perimeter edges of concrete repair area at a dovetail is preferred.
- Substrate should be Saturated Surface Dry (SSD) with clean water prior to application. No standing water should remain during application.
- Rust, scale, mortar, concrete, dust and other loose and deleterious material which reduces bond or contributes to corrosion shall be removed from steel reinforcement.
- Surfaces shall be prepared using abrasive blast cleaning techniques or high pressure water blasting to achieve a bright metal finish.

### PRIMING

- Concrete substrate:** Prime the prepared substrate with a scrub coat of SikaQuick®-1000 / SikaQuick®-1000 LD prior to placement of the mortar. The repair mortar has to be applied into the wet scrub coat before it dries.
- Reinforcing Steel:** Steel reinforcement should be thoroughly prepared by mechanical cleaning to remove all traces of rust. Where corrosion has occurred due to the presence of chlorides, the steel should be high pressure washed with clean water after mechanical cleaning. For priming of reinforcing steel use Sika® Armatec® corrosion protection products (consult current Product Data Sheets).

### MIXING

- Wet down all tools and mixer to be used.
- Pour the required amount of clean, potable water [approximately 70° F (21° C)] into a suitably sized and clean mixing container, using a calibrated measuring jug or similar, to ensure strict control of the water content. Do not over-water.
- Add 1 bag while continuing to mix with a low-speed drill (400 - 600 rpm) and mortar mixing paddle, or in an appropriate mortar mixer.
- Once all the powder has been added, mix to a uniform consistency, maximum 3 minutes, until a lump-free blend is achieved.
- Thorough mixing and proper proportioning of the powder and liquid is necessary.
- To help control setting times, colder water may be used in hot weather and warmer water may be used in cold weather.
- Inaccurate proportioning of the powder to liquid will result in a finished product that may not conform to the typical published performance property values.
- With water or undiluted SikaLatex® R:** Pour 4.5 pints (2.1 L) of liquid into the mixing container. Slowly add powder, mix and adjust as above. Add up to another 1/2 pint (0.24 L) maximum of liquid to achieve desired consistency. Do not over-water.
- With diluted SikaLatex® R:** SikaLatex® R admixture may be diluted up to 5:1 (water: SikaLatex® R) for projects requiring minimal polymer modification. Pour 4.5 pints (2.1 L) of the mixture into the mixing container. Slowly add powder, mix and adjust as above.

### EXTENSION WITH AGGREGATES

- For applications greater than 1" (25 mm) in depth, add 3/8" (10 mm) coarse aggregate.
- The typical addition rate is 25 lbs (11.4 kg) of aggregate per bag. It is approximately 2 gallons (7.6 L) by loose volume of aggregate.
- The aggregate must be non-reactive (reference ASTM C 1260, C 227 and C 289), clean, well graded, Saturated Surface Dry (SSD), have low absorption and high density, and comply with ASTM C 33 size number 8 per Table 2.
- Variances in aggregate may result in different

strengths.

- Do not use limestone aggregate.
- Do not exceed a slump of 7" (178 mm). This may cause excessive bleeding and retardation and may reduce the strength and performance of the material.

## APPLICATION

- A neat mix of SikaQuick®-1000 / SikaQuick®-1000 LD mortar must be scrubbed into the mechanically prepared, SSD substrate. Be sure to fill all pores and voids.
- Force material against edge of repair, working toward center. After filling repair, screed off excess.
- Allow material to set to desired stiffness, then finish with wood or sponge float for a smooth finish, or broom or burlap-drag for a rough finish.
- If a smoother finish is desired, a magnesium float should be used.
- To assist in the finishing process, use SikaFilm® finishing aid. Consult current Product Data Sheet.
- Mixing, placing, and finishing should not exceed 30 minutes maximum.
- Refer to ACI 305, the "Guide to Hot Weather Concreting" or ACI 306, the "Guide to Cold Weather Concreting" when there is a need to place this product while either hot or cold temperatures prevail. Thinner placements will be more sensitive to the temperature conditions.

## CURING TREATMENT

- As per ACI recommendations for portland cement concrete, moist curing is required.
- Moist cure with wet burlap and polyethylene, a fine mist of water or with a water based,\* compatible curing compound meeting ASTM C 309.
- Curing compounds adversely affect the adhesion of following lifts of mortar, leveling mortar or protective coatings.
- Moist curing should commence immediately after finishing.
- Protect freshly applied mortar from direct sunlight, wind, rain and frost.
- To prevent from freezing, cover with insulating material (e.g. curing blanket).

\* Pretesting of curing compound is recommended.

## LIMITATIONS

- Avoid application in direct sunlight, during precipitation and/or when strong winds prevail.
- Use only clean, potable water
- As with all cement based materials, avoid contact with aluminum to prevent adverse chemical reaction and possible product failure. Insulate potential areas of contact by coating aluminum bars, rails, posts etc. with an appropriate epoxy such as Sikadur®-32 Hi-Mod.
- Bonding agents (e.g. Sika® Armatex® 110 EpoCem) should not be used. Use of the neat mortar as a scrub coat is recommended and preferred. If bonding agents are used, follow cure times for the bonding agents

used as a guide prior to putting SikaQuick®-1000 / SikaQuick®-1000 LD in service. Assure suitability with the manufacturer of the bonding agent.

- SikaQuick®-1000 / SikaQuick®-1000 LD does not form a vapor barrier when cured.

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## OTHER RESTRICTIONS

See Legal Disclaimer.

## ENVIRONMENTAL, HEALTH AND SAFETY

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## LEGAL DISCLAIMER

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## PRODUCT DATA SHEET

## SikaTop®-122 Plus

Two-component, polymer-modified, cementitious, trowel-grade mortar plus Sika FerroGard® 901 penetrating corrosion inhibitor

## PRODUCT DESCRIPTION

SikaTop®-122 Plus is a two-component, polymer-modified, portland cement based, fast-setting, trowel-grade mortar. It is a high-performance repair mortar for horizontal and vertical surfaces and offers the additional benefit of Sika FerroGard® 901, a penetrating corrosion inhibitor.

## USES

- On grade, above and below grade on concrete and mortar.
- On horizontal surfaces.
- As a structural repair material for parking structures, industrial plants, walkways, bridges, tunnels, dams, ramps, floods, etc.
- To level concrete surfaces.
- As an overlay system for topping/resurfacing concrete.

## CHARACTERISTICS / ADVANTAGES

- Extremely low shrinkage **proven by four industry standard test methods**
- High compressive and flexural strengths
- High abrasion resistance
- Increased freeze/thaw durability and resistance to deicing salts
- Compatible with coefficient of thermal expansion of concrete - Passes ASTM C-884
- Increased density - improved carbon dioxide resistance (carbonation) without adversely affecting water vapor transmission (not a vapor barrier)
- Sika FerroGard® 901, a penetrating corrosion inhibitor - reduces corrosion even in the adjacent concrete

## APPROVALS / STANDARDS

- USDA certifiable for the food industry
- ANSI/NSF Standard 61 potable water compliant
- Tested per ICRI guideline for inorganic repair material data sheet protocol guideline n°320.3R

## PRODUCT INFORMATION

Packaging	Component A	Component B
	1 gal (3.78 L) jug 4/carton	61.5 lb (28.9 kg) bag
Appearance / Color	Concrete gray when mixed	
Shelf Life	12 months from date of production if stored properly in original, unopened and undamaged sealed packaging	
Storage Conditions	Store dry at 40–95 °F (4–35 °C) Protect Component A from freezing. If frozen, discard.	

Protect Component B from moisture. If damp, discard.

Density	136 lbs/ft <sup>3</sup> (2.18 kg/L)	(ASTM C-138)
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## TECHNICAL INFORMATION

Compressive Strength	1 day	2,500 psi (17.2 MPa)	(ASTM C-109) 73 °F (23 °C) 50 % R.H.
	7 days	5,300 psi (36.5 MPa)	
	28 days	7,000 psi (48.3 MPa)	
Modulus of Elasticity in Compression	28 days	3.0x10 <sup>6</sup> psi	(ASTM C-469) 73 °F (23 °C) 50 % R.H.
Flexural Strength	28 days	1,500 psi (10.3 MPa)	(ASTM C-293) 73 °F (23 °C) 50 % R.H.
Splitting tensile strength	28 days	500 psi (3.4 MPa)	(ASTM C-496) 73 °F (23 °C) 50 % R.H.
Tensile Strength	28 days	2,000 psi (13.8 MPa)	(ASTM C-882 modified)*
* Mortar scrubbed into substrate at 73 °F (23 °C) and 50 % R.H.			
Pull-Out Resistance	7 days	>300 psi (2.1 MPa)	(ASTM C-1583) 73 °F (23 °C) 50 % R.H.
	28 days	400 psi (2.8 MPa)	
Shrinkage	28 days	1"x1"x11-1/4" specimen < 0.05 %	(ASTM C-157 modified (mod. ICRI 320.3R)) 73 °F (23 °C) 50 % R.H.
		3"x3"x11-1/4" specimen < 0.021 %	
Ring test	Duration	>70 days	(ASTM C-1581) 73 °F (23 °C) 50 % R.H.
	Average Max Strain	-9 µstrain	
	Average Stress Strain	0.49 psi/day	
	Potential for Cracking	Low	
Baenziger block	90 days	No cracking	
Freeze-Thaw Stability	300 cycles	98 %	(ASTM C-666)
Rapid Chloride Permeability	28 days	< 500 C	(ASTM C-1202 AASHTO T-277)

## APPLICATION INFORMATION

Mixing Ratio	Plant-proportioned kit, mix entire unit.	
Fresh mortar density	136 lbs/ft <sup>3</sup> (2.18 kg/l)	(ASTM C-138)
Coverage	Neat	0.51 ft <sup>3</sup> (0.02 m <sup>3</sup> ) per unit
	Extended with 42 lb (19 kg) of 3/8" (9.5 mm) gravel	0.75 ft <sup>3</sup> (0.03 m <sup>3</sup> ) per unit
(Coverage figures do not include allowance for surface profile and porosity or material waste)		

Layer Thickness		Min.	Max. in one lift
	Neat	1/8" (3.2 mm)	1" (25 mm)
	Extended	1" (25.4 mm)	4" (101.6 mm)
Product Temperature	65–75 °F (18–24 °C)		
Ambient Air Temperature	> 45 °F (7 °C)		
Substrate Temperature	> 45 °F (7 °C)		
Set Time	35–70 minutes	(ASTM C-266)	
Final set time	> 90 minutes	(ASTM C 266) 73° F (23° C), 50% R.H.	
Finishing time	50–120 minutes		
Note: All times start after adding Component 'B' to Component 'A' and are highly affected by temperature, relative humidity, substrate temperature, wind, sun and other job site conditions.			

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## ENVIRONMENTAL, HEALTH AND SAFETY

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## LIMITATIONS

- Do not use solvent-based curing compound.
- Size, shape and depth of repair must be carefully considered and consistent with practices recommended by ACI or ICRI. For additional information, contact Technical Service.
- For additional information on substrate preparation, refer to ICRI Guideline No.310.2R Coatings, Polymer Overlays, and Concrete Repair.
- If aggressive means of substrate preparation is employed, substrate strength should be tested in accordance with ACI 503 Appendix A prior to the repair application.
- As with all cement based materials, avoid contact with aluminum to prevent adverse chemical reaction and possible product failure. Insulate potential areas of contact by coating aluminum bars, rails, posts etc. with an appropriate epoxy such as Sikadur 32 Hi-Mod.
- Refer to Sika® Antisol®-250 W product data sheet for use.

## APPLICATION INSTRUCTIONS

## SURFACE PREPARATION

- Concrete, mortar, and masonry products must be clean and sound.
- Remove all deteriorated concrete, dirt, oil, grease, and other bond-inhibiting materials from the area to be repaired.
- Be sure repair area is not less than 1/8" (3.2mm) in depth.
- Preparation work should be done by high pressure water blast, scabbler or other appropriate mechanical means to obtain an exposed aggregate surface profile of  $\pm 1/16$ "-1/8" (1.6-3.2 mm) (CSP-5-6).
- To ensure optimum repair results, the effectiveness of decontamination and preparation should be assessed by a pull-off test.
- Saw cutting of edges is preferred and a dovetail is recommended.
- Substrate should be Saturated Surface Dry (SSD) with clean water prior to application. No standing water should remain during application.

## PRIMING

- Reinforcing steel:** Steel reinforcement should be thoroughly prepared by mechanical cleaning to remove all traces of rust. Where corrosion has occurred due to the presence of chlorides, the steel should be high pressure washed with clean water after mechanical cleaning. For priming of reinforcing steel use Sika® Armatex® 110 EpoCem (consult PDS).
- Concrete Substrate:** Prime the prepared substrate with a brush or sprayed applied coat of Sika® Armatex® 110 EpoCem (consult PDS). Alternately, a scrub coat of SikaTop®-122 Plus can be applied prior to placement of the mortar. The repair mortar has to be applied into the wet scrub coat before it dries.

## MIXING

- Pour approximately 7/8 of Component 'A' into the mixing container.
- Add Component 'B' (powder) while mixing continuously.
- Mix mechanically with a low-speed drill (400–600 rpm) and mixing paddle or mortar mixer.
- Add remaining Component 'A' (liquid) to mix if a more loose consistency is desired.
- Mix to a uniform consistency, maximum 3 minutes.
- Thorough mixing and proper proportioning of the two components is necessary.
- Refer to ACI 306 Guidelines when there is a need to place this product in cold & hot temperatures. Thinner application will be more sensitive to the temperature

## EXTENSION WITH AGGREGATES

- For applications greater than 1" (25.4 mm) in depth, add 3/8" (9.5 mm) coarse aggregate.
- Pour all of Component 'A' into mixing container.
- Add all of Component 'B' while mixing, then introduce 3/8" (9.5 mm) coarse aggregate at desired quantity.
- Mix to uniform consistency, maximum 3 minutes.
- The aggregate must be non-reactive (reference ASTM C-1260, C-227 and C-289), clean, well graded, Saturated Surface Dry (SSD), have low absorption and high density, and comply with ASTM C-33 size number 8 per Table 2.
- Do not use limestone aggregate.
- Variances in the quality of the aggregate will affect the physical properties of SikaTop®-122 Plus and may result in different strengths.
- The addition rate is 42 lb (19 kg) of aggregate per bag. It is approximately 3.0-4.5 gallons (11.3-17.0 L) by loose volume of aggregate.

## APPLICATION

- SikaTop®-122 Plus must be scrubbed into the substrate, filling all pores and voids.
- Force material against edge of repair, working toward center.
- After filling repair, consolidate, then screed.
- Allow mortar or concrete to set to desired stiffness, then finish with wood or sponge float for a smooth surface, or broom or burlap-drag for a rough finish.

## CURING TREATMENT

- As per ACI recommendations for Portland cement concrete, curing is required.

- Moist cure with wet burlap and polyethylene, a fine mist of water or a water Sika® Antisol®-250 W\* compatible curing compound meeting ASTM C-309.
- Curing compounds adversely affect the adhesion of following lifts of mortar, leveling mortar or protective coatings.
- Moist curing should commence immediately after finishing.
- Protect freshly applied mortar from direct sunlight, wind, rain and frost.
- To prevent from freezing, cover with insulating material.

\* Pretesting of curing compound is recommended.

## OTHER RESTRICTIONS

See Legal Disclaimer.



## LEGAL DISCLAIMER

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## PRODUCT DATA SHEET

# SikaTop®-123 Plus

Two-component, polymer-modified, cementitious, non-sag mortar plus Sika FerroGard® 901 penetrating corrosion inhibitor

## PRODUCT DESCRIPTION

SikaTop®-123 Plus is a two-component, polymer-modified, Portland cement-based, fast-setting, non-sag mortar. It is a high performance repair mortar for vertical and overhead surfaces and offers the additional benefit of Sika FerroGard® 901, a penetrating corrosion inhibitor included in its formulation.

## USES

- On grade, above and below grade on concrete and mortar.
- On vertical and overhead surfaces.
- As a structural repair material for parking structures, industrial plants, walkways, bridges, tunnels, dams and ramps.
- Approved for repairs over cathodic protection systems

## CHARACTERISTICS / ADVANTAGES

- Extremely low shrinkage proven by four industry standard test methods.
- High compressive and flexural strengths.
- Increased freeze/thaw durability and resistance to deicing salts.
- Increased density - improved carbon dioxide resistance (carbonation) without adversely affecting water vapor transmission (not a vapor barrier).
- Enhanced with Sika FerroGard® 901, a penetrating corrosion inhibitor - reduces corrosion even in the adjacent concrete.
- Compatible with coefficient of thermal expansion of concrete - Passes ASTM C 884.

## APPROVALS / STANDARDS

- USDA certifiable for incidental food contact
- ANSI/NSF Standard 61 potable water approved compliant.
- Tested per ICRI Guideline NO. 320.3R for inorganic repair material data sheet protocol

## PRODUCT INFORMATION

Packaging	Component A	1 gal (3.68 L) jug - 4/carton
	Component B	44 lb. (20 kg) bag
Appearance / Color	Gray powder	
Shelf Life	12 months from date of production if stored properly in original, unopened and undamaged sealed packaging	
Storage Conditions	Store dry at 40–95 °F (4–35 °C).	

Protect Component 'B' from moisture. If damp, discard material  
Protect Component 'A' from freezing. If frozen, discard.

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## TECHNICAL INFORMATION

Compressive Strength	1 day	3,000 psi (20.7 MPa)	(ASTM C-109) 73 °F (23 °C) 50 % R.H.
	7 days	4,000 psi (27.6 MPa)	
	28 days	6,000 psi (41.4 MPa)	
Modulus of Elasticity in Compression	2.94 x 10 <sup>6</sup> psi		(ASTM C-469)
Flexural Strength	28 days	1,500 psi (10.3 MPa)	(ASTM C-293) 73 °F (23 °C) 50 % R.H.
Splitting tensile strength	28 days	900 psi (6.2 MPa)	(ASTM C-496) 73 °F (23 °C) 50 % R.H.
Tensile Adhesion Strength	28 days	2,000 psi (13.8 MPa)	(ASTM C-882 modified)
* Mortar scrubbed into substrate at 73 °F (23 °C) and 50 % R.H.			
Pull-Out Resistance	28 days	500 psi (3.4 MPa) Substrate failure	(ASTM C-1583)
Shrinkage	28 days	1x1x11-1/4" specimen	(ASTM C-157, mod. ICRI 320.3R)
	28 days	3x3x11-1/4" specimen	
Ring test	Average Max. Strain	> 70 days - 36 µstrain	(ASTM C-1581)
	Average Stress Strain	4.92 psi/day	
	Potential for Cracking	Low	
Baenziger block	90 days	No cracking	
Freeze-Thaw Stability	300 cycles	98 %	(ASTM C-666)
Rapid Chloride Permeability	28 days	< 500 C	(ASTM C-1202 AASHTO T-277)

## APPLICATION INFORMATION

Fresh mortar density	132 lb/ft <sup>3</sup> (2.2 kg/l)		(ASTM C-138)
Coverage	0.39 ft <sup>3</sup> (0.01 m <sup>3</sup> ) per bag (Coverage figures do not include allowance for surface profile and porosity or material waste)		
Layer Thickness	Min.	Max.	
	1/8" (3 mm)	1.5" (38 mm)	
Product Temperature	65–75 °F (18–24 °C)		
Ambient Air Temperature	> 45 °F (7 °C)		
Substrate Temperature	> 45 °F (7 °C)		
Set Time	15 - 40 min.		(ASTM C-266)
Final set time	< 60 min.		(ASTM C-266)

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## ENVIRONMENTAL, HEALTH AND SAFETY

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety Data Sheets containing physical, environmental, toxicological and other safety related data. User must read the current actual Safety Data Sheets before using any products. In case of an emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.

## DIRECTIVE 2004/42/CE - LIMITATION OF EMISSIONS OF VOC

0 g/l

(EPA method 24)

## LIMITATIONS

- Do not use solvent-based curing compound.
- Size, shape and depth of repair must be carefully considered and consistent with practices recommended by ACI or ICRI.
- For additional information on substrate preparation, refer to ICRI Guideline No. 310.2R.
- If aggressive means of substrate preparation is employed, substrate strength should be tested in accordance with ACI 503 Appendix A prior to the repair application.
- As with all cement based materials, avoid contact with aluminum to prevent adverse chemical reaction and possible product failure. Insulate potential areas of contact by coating aluminum bars, rails, posts etc. with an appropriate epoxy such as Sikadur® 32, Hi-Mod.

## APPLICATION INSTRUCTIONS

### SURFACE PREPARATION

#### Surface preparation

- Surface must be clean and sound. Remove all deteriorated concrete, dirt, oil, grease, and other bond-inhibiting materials from the area to be repaired.
- Be sure repair area is not less than 1/8" (3 mm) in depth.
- Preparation work should be done by high pressure water blast, scabbler or other appropriate mechanical means to obtain an exposed aggregate surface profile of  $\pm 1/16"$  (1.6 mm) (CSP-5).
- To ensure optimum repair results, the effectiveness of decontamination and preparation should be assessed by a pull-off test.
- Saw cutting of edges is preferred and a dovetail is recommended.
- Substrate should be Saturated Surface Dry (SSD) with clean water prior to application. No standing water should remain during application.

#### Priming

- Reinforcing steel: Steel reinforcement should be thoroughly prepared by mechanical cleaning to remove all traces of rust. Where corrosion has occurred due to the presence of chlorides, the steel should be high pressure washed with clean water after mechanical cleaning. For priming of reinforcing steel use Sika® Armatec® 110 EpoCem (consult PDS).
- Concrete Substrate:
  - Prime the prepared substrate with a brush or sprayed



applied coat of Sika® Armatex® 110 EpoCem (consult PDS).

- Alternately, a scrub coat of SikaTop®-123 Plus can be applied prior to placement of the mortar. The repair mortar has to be applied into the wet scrub coat before it dries.

## MIXING

- Pour Component 'A' into mixing container.
- Add Component 'B' while mixing continuously.
- Mix mechanically with a low-speed drill (400–600 rpm) and mixing paddle or mortar mixer.
- Mix to a uniform consistency, maximum 3 minutes.
- Manual mixing can be tolerated only for less than a full unit. Thorough mixing and proper proportioning of the two components is necessary.

## APPLICATION

- SikaTop®-123 Plus must be scrubbed into the substrate, filling all pores and voids.
- Force material against edge of repair, working toward center.
- After filling repair, consolidate, then screed.
- Material may be applied in multiple lifts.

## Multiple lifts

- Where multiple lifts are required score top surface of each lift to produce a roughened surface for next lift.
- Allow preceding lift to reach initial set, 30 minutes minimum, before applying fresh material.
- Substrate should be Saturated Surface Dry (SSD) with clean water prior to application. No standing water should remain during application.
- Scrub fresh mortar into preceding lift.
- Allow mortar or concrete to set to desired stiffness, then finish with wood or sponge float for a smooth surface.

## CURING TREATMENT

- As per ACI recommendations for Portland cement concrete, curing is required.
- Moist cure with wet burlap and polyethylene, a fine mist of water or a water based\* compatible curing compound (ASTM C-309).
- Curing compounds adversely affect the adhesion of following lifts of mortar, leveling mortar or protective coatings.
- Moist curing should commence immediately after finishing.
- Protect freshly applied mortar from direct sunlight, wind, rain and frost.

\* Pretesting of curing compound is recommended.

## OTHER RESTRICTIONS

See Legal Disclaimer.

## LEGAL DISCLAIMER

- KEEP CONTAINER TIGHTLY CLOSED
- KEEP OUT OF REACH OF CHILDREN
- NOT FOR INTERNAL CONSUMPTION
- FOR INDUSTRIAL USE ONLY
- FOR PROFESSIONAL USE ONLY



## PRODUCT DATA SHEET

## SikaTop® Armatec®-110 EpoCem®

## BONDING PRIMER AND REINFORCEMENT CORROSION PROTECTION

## DESCRIPTION

SikaTop® Armatec®-110 EpoCem® is a cementitious, epoxy resin compensated 3-component coating material with corrosion inhibitor, used as bonding primer and reinforcement corrosion protection.

SikaTop® Armatec®-110 EpoCem® meets the requirement of EN 1504-7.

Suitable for use in hot and tropical climatic conditions.

## USES

- Suitable for control of anodic areas (Principle 11, method 11.1 EN 1504-9)
- Suitable in concrete repair as corrosion protection for reinforcement.
- Suitable as a bonding primer on concrete and mortar

## CHARACTERISTICS / ADVANTAGES

- Contains EpoCem® technology - improved bonding agent
- Extended open times for repair mortars
- Compatible with most Sika® repair mortars
- Excellent adhesion to concrete and steel
- Contains corrosion inhibitor
- Certified for application under dynamic load conditions
- Good resistance to water and chloride penetration
- High shear strength
- Long pot life
- Easy to mix
- Can be brushed on or applied using spray gun

## APPROVALS / CERTIFICATES

- Testing according to BS 1881, Part 207 : 1992, Cl. 8

## PRODUCT INFORMATION

Composition	Portland cement, epoxy resin, selected aggregates and additives	
Packaging	20 kg: A (1.14 kg) + B (2.86 kg) + C (16 kg)	
Appearance / Colour	Mixed components grey	
	Component A:	white liquid
	Component B:	colourless liquid
	Component C:	grey powder
Shelf life	12 months	
Storage conditions	Store properly in undamaged original sealed packaging, in dry cool conditions between +5 °C and +25 °C.	

## TECHNICAL INFORMATION

Tensile Adhesion Strength	≥ 1.5 N/mm <sup>2</sup> (MPa) (after 28 d)	(EN 1542)
Shear Adhesion Strength	Pass	(EN 15184)
Coefficient of Thermal Expansion	~18 x 10 <sup>-6</sup> 1/K	(EN 1770)

Diffusion Resistance to Water Vapour	$\mu\text{H}_2\text{O} \sim 500$	
Diffusion resistance to carbon dioxide	$\mu\text{CO}_2 \sim 7300$	
Corrosion Test	Pass	(EN 15183)

## SYSTEMS

System Structure	SikaTop® Armatec®-110 EpoCem® is part of the Sika® repair system complying with the relevant part of European Standard EN 1504 and comprising of:	
	Bonding Primer / Reinforcement Corrosion Protection	SikaTop® Armatec®-110 EpoCem®
	Light Weight Repair Mortar	Sika MonoTop®, SikaRep® series
	Structural Repair Mortar	Sika MonoTop®, SikaRep®, Sikadur® series
	Pore Sealer and Levelling Mortar	Sika MonoTop®, SikaRep®, Sikagard® series

## APPLICATION INFORMATION

Fresh Mortar Density	A + B + C mixed: $\sim 2.0 \text{ kg/l}$ (23 °C)		
Consumption	As reinforcement corrosion protection coating: $\sim 2 \text{ kg per m}^2$ and application layer ( $\sim 1 \text{ mm}$ thick) In total min. 2 layer thickness ( $\sim 2 \text{ mm}$ thick)  As a bonding primer, substrate: $> 1.5$ to $2.0 \text{ kg per m}^2 / \text{mm}$ dependent on substrate conditions		
Ambient Air Temperature	$+5 \text{ °C min.} / +35 \text{ °C max.}$		
Substrate Temperature	$+5 \text{ °C min.} / +35 \text{ °C max.}$		
Pot Life	$\sim 3 \text{ h}$ (at $+20 \text{ °C}$ )		
Waiting Time / Overcoating	Maximum waiting time before application of repair mortar Sika repair mortars and non-fast setting concrete can be applied on SikaTop® Armatec®-110 EpoCem® within a maximum time of:		
	<b>+5 °C</b>	<b>+10 °C</b>	<b>+20 °C</b>
	6 h	5 h	2 h
			<b>+30 °C</b>
			1 h

## APPLICATION INSTRUCTIONS

### SUBSTRATE QUALITY / PRE-TREATMENT

Concrete:  
The concrete shall be free from dust, loose material, surface contamination and materials which reduce bond or prevent suction or wetting by repair materials. Delaminated, weak, damaged and deteriorated concrete and where necessary sound concrete shall be removed by suitable means.  
The surface shall be thoroughly pre-wetted and not be allowed to dry before application of the concrete repair mortar. The surface shall achieve a dark matt appearance without glistening and surface pores and pits shall not contain water.

Steel reinforcement:  
Rust, scale, mortar, concrete, dust and other loose and deleterious material which reduces bond or contributes to corrosion shall be removed and reinforcement cleaned to SA 2 in accordance with ISO 8501-1. Surfaces shall be prepared using abrasive blast cleaning

techniques or high pressure water-blasting.

### MIXING

SikaTop® Armatec®-110 EpoCem® can be mixed with a low speed ( $< 250 \text{ rpm}$ ) electric drill mixer. Shake components A and B thoroughly before opening. Pour liquid components A and B into a suitable mixing vessel and mix for 30 seconds. While still mixing components A and B slowly add powder component C. Mix the three components together for minimum 3 minutes, minimising addition of air. Leave to stand for 5 to 10 minutes until mixed coating material exhibits a brush-able, weakly dripping consistency. DO NOT ADD WATER!

### APPLICATION

As reinforcement corrosion protection:  
Apply first layer approximately 1 millimeter thick, using medium hard brush or spray gun to the cleaned reinforcement. Apply 2<sup>nd</sup> layer when the first coat is hard to the fingernail (approximately 2 to 3 hours at  $+20 \text{ °C}$ ). Apply subsequent repair mortars wet on dry

(so not to wipe off the protection layer).

As a bonding primer:

Apply using medium hard brush or spray gun to prepared substrate. To achieve good bond, SikaTop® Armatec®-110 EpoCem® must be applied well into the substrate, filling all pores (minimum layer thickness 0.5 millimeter). Apply subsequent repair mortars wet on wet freshly applied SikaTop® Armatec®-110 EpoCem® must be protected against contamination and rain until application of the repair mortar.

Application under dynamic loading:

SikaTop® Armatec®-110 EpoCem® has been tested with the following Sika repair mortars and is certified for dynamic loading applications. Refer to separate sheets for further information.

Dry Spray Process:

Corrosion Protection:	SikaTop® Armatec®-110 EpoCem®
Repair and overlay:	SikaCem®-Gunitite 133

Wet Spray Process:

Corrosion Protection and/or Bonding Primer:	SikaTop® Armatec®-110 EpoCem®
Repair and Overlay:	Sika MonoTop®-412 series

## CURING TREATMENT

Protect the fresh mortar from rain while the material has not yet set.

## CLEANING OF EQUIPMENT

Clean all tools and application equipment with water immediately after use. Hardened material can only be mechanically removed.

## IMPORTANT CONSIDERATIONS

- Refer to the Method Statement for Concrete Repair using Sika MonoTop® system for more information regarding substrate preparation or refer to the recommendations provided in EN 1504-10.
- Avoid application in direct sun and/or strong wind and/or rain.

- Do not add water.
- Apply only to sound, prepared substrates.
- NOT recommended for use with fast setting concrete or mortars example Sika MonoTop®-211 FG / RFG.

## BASIS OF PRODUCT DATA

All technical data stated in this Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.

## LOCAL RESTRICTIONS

Note that as a result of specific local regulations the declared data and recommended uses for this product may vary from country to country. Consult the local Product Data Sheet for the exact product data and uses.

## ECOLOGY, HEALTH AND SAFETY

For information and advice on the safe handling, storage and disposal of chemical products, users shall refer to the most recent Safety Data Sheet (SDS) containing physical, ecological, toxicological and other safety-related data.

## LEGAL NOTES

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.



# PRODUCT DATA SHEET

## SikaWrap®-300 C

WOVEN UNIDIRECTIONAL CARBON FIBRE FABRIC, DESIGNED FOR STRUCTURAL STRENGTHENING APPLICATIONS AS PART OF THE SIKA® STRENGTHENING SYSTEM

### DESCRIPTION

SikaWrap®-300 C is a unidirectional woven carbon fibre fabric with mid-range strengths, designed for installation using the dry or wet application process. Suitable for use in hot and tropical climatic conditions.

### USES

SikaWrap®-300 C may only be used by experienced professionals.

Structural strengthening of reinforced concrete, masonry, brickwork and timber elements or structures, to increase flexural and shear loading capacity for:

- Improved seismic performance of masonry walls
- Replacing missing steel reinforcement
- Increasing the strength and ductility of columns
- Increasing the loading capacity of structural elements
- Enabling changes in use / alterations and refurbishment
- Correcting structural design and / or construction defects
- Increasing resistance to seismic movement
- Improving service life and durability
- Structural upgrading to comply with current standards

### CHARACTERISTICS / ADVANTAGES

- Multifunctional fabric for use in many different strengthening applications
- Flexible and accommodating of different surface planes and geometry (beams, columns, chimneys, piles, walls, soffits, silos etc.)
- Low density for minimal additional weight
- Extremely cost effective in comparison to traditional strengthening techniques

### APPROVALS / CERTIFICATES

- Poland: Technical Approval ITB AT-15-5604/2011: Zestaw wyrobów Sika CarboDur do wzmacniania i napraw konstrukcji betonowych.
- Poland: Technical Approval IBDiM Nr AT/2008-03-0336/1, Płaskowniki. pręty, kształtki i maty kompozytowe do wzmacniania betonu o nazwie handlowej: Zestaw materiałów Sika CarboDur® do wzmacniania konstrukcji obiektów mostowych.
- USA: ACI 440.2R-08, Guide for the Design and construction of Externally Bonded FRP Systems for strengthening concrete structures, July 2008.
- UK: Concrete Society Technical Report No. 55, Design guidance for strengthening concrete structures using fibre composite material, 2012.

### PRODUCT INFORMATION

<b>Construction</b>	Fibre orientation	0° (unidirectional)
	Warp	Black carbon fibres 99 %
	Weft	White thermoplastic heat-set fibres 1 %
<b>Fibre Type</b>	Selected mid-range strength carbon fibres	
<b>Packaging</b>	<b>Fabric length per roll</b>	<b>Fabric width</b>
	≥ 100 m	500 mm
<b>Shelf life</b>	24 months from date of production	

<b>Storage conditions</b>	Store in undamaged, original sealed packaging, in dry conditions at temperatures between +5 °C and +35 °C. Protect from direct sunlight.		
<b>Dry Fibre Density</b>	1.82 g/cm <sup>3</sup>		
<b>Dry Fibre Thickness</b>	0.167 mm (based on fibre content)		
<b>Area Density</b>	304 g/m <sup>2</sup> ± 10 g/m <sup>2</sup> (carbon fibres only)		
<b>Dry Fibre Tensile Strength</b>	4 000 N/mm <sup>2</sup>		(ISO 10618)
<b>Dry Fibre Modulus of Elasticity in Tension</b>	230 000 N/mm <sup>2</sup>		(ISO 10618)
<b>Dry Fibre Elongation at Break</b>	1.7 %		(ISO 10618)

## TECHNICAL INFORMATION

<b>Laminate Nominal Thickness</b>	0.167 mm		
<b>Laminate Nominal Cross Section</b>	167 mm <sup>2</sup> per m width		
<b>Laminate Tensile Strength</b>	<b>Average</b>	<b>Characteristic</b>	(EN 2561*)
	3 500 N/mm <sup>2</sup>	3 200 kN/mm <sup>2</sup>	(ASTM D 3039*)
<b>Laminate Modulus of Elasticity in Tension</b>	<b>Average</b>	<b>Characteristic</b>	(EN 2561*)
	225 kN/mm <sup>2</sup>	220 kN/mm <sup>2</sup>	
	<b>Average</b>	<b>Characteristic</b>	(ASTM D 3039*)
	220 kN/mm <sup>2</sup>	210 kN/mm <sup>2</sup>	
* modification: sample with 50 mm Values in the longitudinal direction of the fibres Single layer, minimum 27 samples per test series			
<b>Laminate Elongation at Break in Tension</b>	1.56 %		(EN 2561)
	1.59 %		(ASTM D 3039)
<b>Tensile Resistance</b>	<b>Average</b>	<b>Characteristic</b>	(EN 2561)
	585 N/mm	534 N/mm	(ASTM D 3039)
<b>Tensile Stiffness</b>	<b>Average</b>	<b>Characteristic</b>	(EN 2561)
	37.6 MN/m	36.7 MN/m	
	37.6 kN/m per ‰ elongation	36.7 kN/m per ‰ elongation	
	<b>Average</b>	<b>Characteristic</b>	(ASTM D 3039)
	36.7 MN/m	35.1 MN/m	
	36.7 kN/m per ‰ elongation	35.1 kN/m per ‰ elongation	

## SYSTEMS

<b>System Structure</b>	The system build-up and configuration as described must be fully complied with and may not be changed.		
	Concrete substrate adhesive primer	Sikadur® -30	
	Impregnating / laminating resin	Sikadur®-330 or Sikadur®-300	
	Structural strengthening fabric	SikaWrap®-300 C	
	For detailed information on Sikadur®-330 or Sikadur®-300, together with the resin and fabric application details, please refer to the Sikadur®-330 or Sikadur®-300 Product Data Sheet and the relevant Method Statement.		

## APPLICATION INFORMATION

### Consumption

#### Dry application with Sikadur®-330

First layer including primer layer	1.0 - 1.5 kg/m <sup>2</sup>
Following layers	0.8 kg/m <sup>2</sup>

#### Wet application with Sikadur®-300

Primer layer	0.4 - 0.6 kg/m <sup>2</sup>
Fabric layers	0.6 kg/m <sup>2</sup>

Please also refer to the relevant Method Statement for further information.

## APPLICATION INSTRUCTIONS

### SUBSTRATE QUALITY

Minimal substrate tensile strength: 1.0 N/mm<sup>2</sup> or as specified in the strengthening design. Please also refer to the relevant Method Statement or further information.

### SUBSTRATE PREPARATION

Concrete must be cleaned and prepared to achieve a laitance and contaminant free, open textured surface. Please also refer to the relevant Method Statement for further information.

### APPLICATION METHOD / TOOLS

The fabric can be cut with special scissors or a Stanley knife (razor knife / box-cutter knife). Never fold the fabric. SikaWrap®-300 C is applied using the dry or wet application process. Please refer to the relevant Method Statement for details on the impregnating / laminating procedure

## IMPORTANT CONSIDERATIONS

- SikaWrap®-300 C shall only be applied by trained and experienced professionals.
- A specialist structural engineer must be consulted for any structural strengthening design calculation.
- SikaWrap®-300 C fabric is coated to ensure maximum bond and durability with the Sikadur® adhesives / impregnating / laminating resins. To maintain and ensure full system compatibility, do not interchange different system components.
- SikaWrap®-300 C can be over coated with a cementitious overlay or other coatings for aesthetic and / or protective purposes. The over coating system selection is dependent on the exposure and the project specific requirements. For additional UV light protection in exposed areas use Sikagard®-550 W Elastic (G) or Sikagard®-680 SG.
- Please refer to the Method Statement of SikaWrap® manual dry application, SikaWrap® manual wet application or SikaWrap® machine wet application for further information, guidelines and limitations.

## BASIS OF PRODUCT DATA

All technical data stated in this Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.

## LOCAL RESTRICTIONS

Note that as a result of specific local regulations the declared data and recommended uses for this product may vary from country to country. Consult the local Product Data Sheet for the exact product data and uses.

## ECOLOGY, HEALTH AND SAFETY

This product is an article as defined in article 3 of regulation (EC) No 1907/2006 (REACH). It contains no substances which are intended to be released from the article under normal or reasonably foreseeable conditions of use. A safety data sheet following article 31 of the same regulation is not needed to bring the product to the market, to transport or to use it. For safe use follow the instructions given in the product data sheet. Based on our current knowledge, this product does not contain SVHC (substances of very high concern) as listed in Annex XIV of the REACH regulation or on the candidate list published by the European Chemicals Agency in concentrations above 0,1 % (w/w)

## LEGAL NOTES

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.

# Technical Data Guide

7 | 07 92 00  
Joint  
Sealants

## MasterSeal® P 173 and P 176

### Primers for Master Builders Solutions sealants

FORMERLY SONOLASTIC® PRIMER 733 AND PRIMER 766

#### PACKAGING

One pint (473 ml) cans

Units sold individually. Bulk shipments available in cases of 12 units.

#### COLOR

MASTERSEAL P 173

Light Amber

MASTERSEAL P 176

Transparent (water white)

#### YIELD

35–40 ft<sup>2</sup>/pt (6.87–7.86 m<sup>2</sup>/L)

450 linear ft (137 m) for

1/2" (13 mm) deep joint

#### STORAGE

Store in unopened containers in a cool, dry area out of direct sunlight.

#### SHELF LIFE

2 years when properly stored

#### VOC CONTENT

MASTERSEAL P 173

584 g/L

less water and exempt solvents

MASTERSEAL P 176

339 g/L

less water and exempt solvents

#### DESCRIPTION

MASTERSEAL P 173 is a quick drying solvent-based primer for priming joints and substrates before application of MasterSeal NP 1™, TX 1, NP 2™, CR 195, SL 1™, SL 2™, and NP 150™/NP 100™ series sealants.

MASTERSEAL P 176 is a high-solids, low-VOC solvent-based primer for priming joints and substrates before application of MasterSeal NP 1, TX 1, NP 2, CR 100 and CR 195 sealants.

#### PRODUCT HIGHLIGHTS

MASTERSEAL P 173

- Solvent-based allows for quick drying
- Promotes improved adhesion to many substrates requiring a primer
- Compatible with all Master Builders Solutions polyurethane sealants, providing versatility and convenience

MASTERSEAL P 176

- High-solids, low VOCs and easy to use
- Transparent and non-staining

#### APPLICATIONS

- Interior or exterior
- Above grade
- As primers for Master Builders Solutions joint sealants

#### SUBSTRATES

- Concrete
- Masonry
- Metal
- Fluorocarbon coatings, on aluminum (MasterSeal P 173 only)

#### HOW TO APPLY

##### SURFACE PREPARATION

1. Masonry surfaces must be sound, clean, dry and free of all paint, grease, oil, dirt and foreign matter.
2. Concrete surfaces must be fully cured and free of laitance, moisture or form oils.
3. Where necessary, clean joint surfaces by grinding, sandblasting or mechanical abrading; remove dust, dirt and loose particles before priming.
4. Metal-edged joint surfaces must be clean and free of all rust, oil and dirt.

##### APPLICATION

Do not apply to backer rod

MASTERSEAL P 173

1. Apply MasterSeal P 173 to the cleaned joint surfaces by brushing on a thin, uniform coat. Use primer as is; do not thin. Too much primer may act as a bond breaker.
2. Allow primer to dry tack-free before applying sealant. Dry time will vary depending on temperature and humidity.
3. Sealant must be applied the same day as primer.



**Technical Data**

**Composition**

MasterSeal P 173 and MasterSeal P 176 are solutions of isocyanate adhesion promoters in organic solvents.

**Typical Properties**

P 173

PROPERTY	VALUE
Flash Point, °F (°C)	65 (18)
Viscosity, cps	90
Solids, by volume, %	35

P 176

PROPERTY	VALUE
Flash Point, °F (°C)	35 – 40 (1.7 – 4)
Viscosity, cps	90
Solids, by volume, %	59

Test results are typical values obtained under laboratory conditions.  
Reasonable variations can be expected.

**MASTERSEAL P 176**

1. Apply MasterSeal P 176 to the cleaned joint surfaces by brushing on a thin, uniform coat. Use primer as is; do not thin. Too much primer may act as a bond breaker.
2. Allow primer to dry at least 30 minutes and up to 8 hours before applying sealant. Dry time will vary depending on temperature and humidity.
3. Sealant must be applied the same day as primer.

**DRYING TIME**

MASTERSEAL P 173  
15 minutes at 70 °F (21 °C) and 50% humidity

MASTERSEAL P 176  
30 minutes to 8 hours, depending on temperature and humidity, (60 minutes at 72 °F [22 °C] and 50% relative humidity). MasterSeal P 176 will be tacky to the touch but will not transfer to the finger when dry.

**CLEAN UP**

Brushes and tools may be cleaned with MasterSeal 990 before primer has dried. Dried primer must be removed by abrading.

**FOR BEST PERFORMANCE**

- Substrates such as copper, stainless and galvanized steel typically require the use of a primer; MasterSeal P 173 or MasterSeal P 176 is acceptable. For Kynar 500-based coatings, use MasterSeal P 173 only. An adhesion test is recommended for any other questionable substrate.
- Be careful to apply MasterSeal P 173 only to joint faces; MasterSeal P 173 will darken upon UV exposure.
- Proper application is the responsibility of the user. Field visits by Master Builders Solutions personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.

**LIMITED WARRANTY NOTICE**

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# Technical Data Guide

7 | 07 92 00  
Joint  
Sealants

## MasterSeal® SL 1™

One-component elastomeric, self-leveling polyurethane sealant

FORMERLY SONOLASTIC® SL1™

### PACKAGING

- 5 gallon pails (18.9 L)
- 2 gallon pails (7.6 L)
- 825 ml cartridges,  
12 cartridges per carton
- 300 ml cartridges,  
30 cartridges per carton and  
12 cartridges per carton

### COLOR

Limestone and Gray (only available in 825 ml cartridges)

### YIELD

See page 3 for charts

### STORAGE

Store in unopened containers in a cool, clean, dry area. Storing at elevated temperatures will reduce shelf life.

### SHELF LIFE

#### IN BULK

6 months when properly stored

#### CARTRIDGES

1 year when properly stored

### VOC CONTENT

29 g/L

less water and exempt solvents

### DESCRIPTION

MasterSeal SL 1 is one component, non-priming, self-leveling elastomeric polyurethane designed for expansion joints in concrete floors and decks. Use it where flexibility as well as abrasion and puncture resistance are required.

### PRODUCT HIGHLIGHTS

- Movement capability of  $\pm 35\%$  allows expansion and contraction with joint movement
- Abrasion resistant to provide for longer wearing and durability
- Easy to gun for quick installation
- Variety of types and sizes of packaging to help reduce jobsite waste
- No priming needed on most surfaces, offering excellent adhesion
- Self-leveling, so no tooling needed
- Wide application temperature range makes MasterSeal SL1 suitable for all climates
- Excellent weatherability for long-lasting performance

### SUBSTRATES

- Concrete
- Metal

### HOW TO APPLY

#### JOINT PREPARATION

1. The product may be used in sealant joints designed in accordance with SWR Institute's Sealants - The Professional's Guide.
2. In optimal conditions, the depth of the sealant should be  $\frac{1}{2}$  the width of the joint. The sealant joint depth (measured at the center) should always fall between the maximum depth of  $\frac{1}{2}$ " and the minimum depth of  $\frac{1}{4}$ ". Refer to Table 1.
3. In deep joints, the sealant depth must be controlled by closed cell backer rod or soft backer rod. Where the joint depth does not permit the use of backer rod, a bond breaker (polyethylene strip) must be used to prevent three-point bonding.

### APPLICATIONS

- Horizontal
- Interior and exterior
- Expansion joints
- Control joints
- Pavers
- Plaza decks
- Industrial floors
- Driveways/garages
- Sidewalks
- Decks
- Parking structures
- Pitch pans

## Technical Data

### Composition

MasterSeal SL 1 is a single-component polyurethane sealant, which cures by reaction with atmospheric moisture.

### Compliances

- ASTM C 920, Type S, Grade P, Class 35, Use T, M, NT, A and O\*
- Federal Specification TTS- 00230C, Type 1, Class A
- Corps of Engineers CRD-C-541
- Canadian Specification CAN/CGSB 19.13-M87, Classification C-1-40-B-N and C-1-25-B-N, No. 81028
- CFI accepted
- \* Refer to substrates in Where to Use.

### Typical Properties

PROPERTY	VALUE
Service temperature range, °F (°C)	-40 to 180 (-40 to 82)
Shrinkage	Nil

### Test Data

PROPERTY	RESULTS	TEST METHOD
Movement Capability, %	±35	ASTM C 719
Tensile strength, psi (MPa)	300 (2.1)	ASTM D 412
Elongation, %	800	ASTM D 412
Hardness, Shore A	25	ASTM C 661
Artificial weathering, Xenon arc, 1,000 hrs	Excellent	ASTM G 26
Low temperature flexibility, °F (°C)	-15 (-26)	ASTM C 793
Viscosity, poise	325	Brookfield

Test results are typical values obtained under laboratory conditions. Reasonable variations can be expected.

TABLE 1  
Joint Width and Sealant Depth

JOINT WIDTH, IN (MM)	SEALANT DEPTH AT MIDPOINT, IN (MM)
¼–½ (6–13)	¼ (6)
½–¾ (13–19)	¼–⅜ (6–10)
¾–1 (19–25)	⅜–½ (10–13)
1–1½ (25–38)	½ (13)

4. To maintain the recommended sealant depth, install backer rod by compressing and rolling it into the joint channel without stretching it lengthwise. Closed cell backer rod should be about ⅛" (3 mm) larger in diameter than the width of the joint to allow for compression. Soft backer rod should be approximately 25% larger in diameter than the joint width. The sealant does not adhere to it, and no separate bond breaker is required. Do not prime or puncture the backer rod.

### SURFACE PREPARATION

Substrates must be structurally sound, fully cured, dry and clean. Substrates should always be free of the following: dirt, loose particles, oil, grease, asphalt, tar, paint, wax, rust, waterproofing or curing and parting compounds, membrane materials and sealant residue.

### NEW CONCRETE

Remove all loose material from joints by wire brushing. Sandblast surfaces in contact with form-release agents. Fresh concrete must be fully cured. Laitance must be removed by abrading.

### OLD CONCRETE

For previously sealed joints, remove all old material by mechanical means. If joint surfaces have absorbed oils, remove sufficient concrete to ensure a clean surface.

### PRIMING

1. For most applications, priming is not required; joints subject to periodic water immersion, however, must be primed with MasterSeal P 173. On surfaces other than concrete, conduct a test application to verify adhesion.
2. Apply primer in a thin, uniform film. Avoid buildup of excess primer.
3. Avoid applying primer beyond joint faces. To minimize the contamination of adjacent surfaces, apply masking tape before priming

and remove before the sealant has begun to thicken and set.

4. Allow approximately 15–30 minutes drying time before applying sealant (primer should be tack-free). Priming and sealing must be done on the same day.

### APPLICATION

1. Fill joints by pouring the sealant from a spouted container.
2. Fill joints from the bottom; avoid bridging of the joint, which may form air voids. Sealant will self-level to form a clean joint surface.

### CURING TIME

The cure of MasterSeal SL 1 varies with temperature and humidity. The following times assume 75 °F (24 °C), 50% relative humidity, and a joint 1½" width by ¼" depth (13 by 6 mm).

- Skins: overnight or within 24 hours
- Full cure: approximately 1 week

# Yield

## LINEAR FEET PER GALLON\*

JOINT DEPTH, (INCHES)	JOINT WIDTH (INCHES)									
	1/4	3/8	1/2	5/8	3/4	7/8	1	1 1/2	2	3
1/4	308	205	154	122	—	—	—	—	—	—
3/8	—	—	—	82	68	58	51	—	—	—
1/2	—	—	—	—	51	44	38	26	19	12

## METERS PER LITER

JOINT DEPTH, (MM)	JOINT WIDTH (MM)									
	6	10	13	16	19	22	25	38	50	75
6	24.8	16.5	12.4	9.8	—	—	—	—	—	—
10	—	—	—	6.6	5.5	4.7	4.1	—	—	—
13	—	—	—	—	4.1	3.5	3.0	2.2	1.5	0.7

## LINEAR FEET PER 825 ML CARTRIDGE

JOINT DEPTH, (INCHES)	JOINT WIDTH (INCHES)						
	1/4	3/8	1/2	5/8	3/4	7/8	1
1/4	72	48	36	28.5	—	—	—
3/8	—	—	—	19.25	16	13.5	12
1/2	—	—	—	—	12	10.2	8.8

## LINEAR METER PER 825 ML CARTRIDGE

JOINT DEPTH, (MM)	JOINT WIDTH (MM)						
	6	10	13	16	19	22	25
6	20.5	13.6	10.2	8.1	—	—	—
10	—	—	—	5.4	4.5	3.9	3.4
13	—	—	—	—	3.4	2.9	2.5



#### CLEANUP

Clean equipment with MasterSeal 990 or xylene immediately after use and before sealant has cured. Cured sealant may be removed by cutting with a sharp-edged tool, thin films by abrading.

#### FOR BEST PERFORMANCE

- Do not allow uncured MasterSeal SL 1 to come into contact with alcohol-based materials or solvents.
- Do not apply polyurethane sealants in the vicinity of uncured silicone sealants or uncured MasterSeal NP150™.
- MasterSeal SL 1 is not intended for continuous water immersion. Contact Technical Service for recommendations.
- Backer rods, joint fillers and bond breakers must be tightly installed to prevent loss of sealant through joint bottoms.
- Joints subject to puncture by high heels or umbrella points require a stiffer or higher density backup material; cork or rigid non-impregnated cane-fiber joint fillers are suitable. Separate materials from the sealant by a non-adhering bond breaker (polyethylene tape).
- High temperatures or humidity may cause uncured material to bubble.
- Sealant may bubble if substrates are not dry or if material is applied too deep.
- Do not use other caulks, sand, or incompressibles as a bottom bed in a joint.
- Do not install when rain is expected before the sealant develops a substantial skin.
- For joint widths over 11/2" (38 mm), use MasterSeal SL 2.
- Proper application is the responsibility of the user. Field visits by Master Builders Solutions personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.

#### HEALTH, SAFETY AND ENVIRONMENTAL

Read, understand and follow all Safety Data Sheets and product label information for this product prior to use. The SDS can be obtained by visiting [www.master-builders-solutions.com/en-us](http://www.master-builders-solutions.com/en-us). Master Builders Solutions.us, e-mailing your request to [mbsbscst@mbcc-group.com](mailto:mbsbscst@mbcc-group.com) or calling 1(800)433-9517. Use only as directed.

**IN CASE OF EMERGENCY: Call CHEMTEL +1 (800) 255-3924 or if outside the US or Canada, +1 (813) 248-0585.**

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# Technical Data Guide

7 | 07 18 00  
Traffic  
Coatings

## MasterSeal® Vehicular Traffic 2850

Hybrid polyurethane-methyl methacrylate waterproofing,  
traffic-bearing membrane system

### PACKAGING

- MasterSeal M 270:  
4.66-gallon (17.64 L) pail
- MasterSeal TC 275:  
4.78-gallon (18.1 L) unitized kit
- MasterSeal TC 299FS:  
4.5-gallon (17 L) pail
- MasterSeal 918FS:  
2.5-pound (1.1 KG) bottle
- 50-pound (22.7 KG) box
- MasterSeal 941 Aggregate:  
50-lb (22.72 KG) bag
- MasterSeal 941DR Aggregate:  
50-lb (22.72 KG) bag

### SHELF LIFE

MasterSeal M 270:	1 year
MasterSeal TC 275:	1.25 years
MasterSeal TC 299FS:	2 years
MasterSeal 918FS:	1 year
MasterSeal 941:	5 years
MasterSeal 941DR:	5 years

### STORAGE

Store in unopened containers in a cool, clean, dry area

### YIELD

See preferred MasterSeal Deck Coating Solution for total system yield.

### COLORS

TC 275: Grey, Charcoal & Black TC TC 299FS: Grey, Charcoal For additional color options, see MasterSeal Traffic Deck Coating Color Portfolio

### DESCRIPTION

MasterSeal Traffic 2850 is a fluid-applied, hybrid polyurethane-methyl methacrylate waterproofing system. It allows for fast turnaround time while maintaining durability.

MasterSeal Traffic 2850 is composed of:

- MasterSeal M 270 NP - a two-component, fast-curing polyurethane base coat
- MasterSeal TC 275 - a two-component fast curing aromatic polyurethane top coat
- MasterSeal TC 299FS - a solvent-free, two-component, 100% reactive methyl methacrylate (MMA) resin
- MasterSeal 918FS - a powder hardener that initiates the MMA cure

For projects requiring aggregate, two options are available:

- MasterSeal 941, a hard-wearing, angular aggregate
- MasterSeal 941DR, an aggregate free of respirable crystalline silica

### PRODUCT HIGHLIGHTS

- Two-component system utilizes flexible polyurethane and world-class MMA technologies
- Hybrid system provides waterproofing capabilities as well as faster setting times, even in cooler climates, to help reduce downtime
- MasterSeal 941DR aggregate is free of respirable crystalline silica
- High strength with excellent bonding capabilities to a variety of concrete substrates
- Seamless waterproof membrane helps protect concrete from freeze/thaw damage; protects occupied spaces below from water damage and has no seams that may result in leaks
- Excellent chemical and chloride resistance helps protect against common parking deck chemicals including gasoline, diesel fuel, oil, alcohol, ethylene glycol, de-icing salt, bleach and cleaning agents as well as chloride intrusion
- Provides skid resistance to increase safety and offers excellent durability and superior abrasion resistance

### INDUSTRIES/SECTORS

- Stadiums
- Parking Garages
- Commercial Construction
- Building and Restoration

### VOC CONTENT

- When components are mixed, MasterSeal and MasterTop components have the following g/L VOC contents less water and exempt solvents:
- MasterSeal M 270 Part A: 4 g/L
- MasterSeal M 270 Part B: 5 g/L
- MasterSeal TC 275 Part A: 71 g/L
- MasterSeal TC 275 Part B: 13 g/L
- MasterSeal TC 299FS: 54 g/L

**Technical Data Composition**  
MasterSeal Traffic 2850 is a two-component polyurethane-MMA hybrid system.

**Compliances**

- CSA S413
- ASTM C 957



**Test Data**

PROPERTY	RESULTS M 270 NP	RESULTS TC 275	RESULTS TC 299FS	TEST METHOD
<b>Solids</b>				ASTM D 1259
By weight, %	99	99	100	
<b>Viscosity, cps</b>	3,400	1,600	230-270	ASTM D 2393

\*Uncured material

**Test Data**

PROPERTY	RESULTS	SPECIFICATIONS	TEST METHOD
<b>Crack bridging, MasterSeal M 270 NP</b>	Passes	No cracking	ASTM C 957
<b>Adhesion (Pull-off), psi MasterSeal M 270 NP</b>	400	—	ASTM D 4541
<b>Tensile strength, psi (MPa),</b>			ASTM D 412
Base Coat	3,000 (20.7)	Control	
MasterSeal TC 275	3,000 (20.7)	Control	
MasterSeal TC 299FS	1,050 (7.3)	Control	
<b>Elongation, %,</b>			ASTM D 412
Base Coat	950	Control	
MasterSeal TC 275	30	Control	
MasterSeal TC 299FS	34	Control	
<b>Hardness, Shore A</b>			ASTM D 2240
MasterSeal TC 275	70	Control	
MasterSeal TC 299FS	70	Control	

Test results are averages obtained under laboratory conditions. Reasonable variations can be expected.

**MasterSeal Aggregates**

PROPERTY	941 RESULTS	941 DR RESULTS
Color	Gray	Green to Gray
Compressive Strength	28,000 psi	
Hardness	6–6.5 Mohns	7 Mohns
Specific Gravity	2.90 g/cc	3.3 g/cc
Bulk Density	102 pcf	85 to 105 pcf
US SIEVE SIZE	% RETAINED ON SIEVE	
#6		
#12	71	2–10
#16	23	10–30
20	2	20–35
30	1	20–40
40	0	7–22

## HOW TO APPLY

### Surface Preparation

#### Concrete

1. Concrete must be fully cured (28 days), structurally sound, clean and dry (ASTM D 4263). All concrete surfaces (new and old) must be shot blasted to remove previous coatings, laitance and all miscellaneous surface contamination and to provide profile for proper adhesion. Abrasive shot blasting must occur after concrete repair has taken place. Acid-etching is not permitted. Proper profile should be a minimum of ICRI CSP- 3 (as described in ICRI document 03732.) For balconies and other pedestrian areas with limited space or access for shot-blasting, alternative mechanical methods can be used to achieve the recommended surface profile.
2. Repair voids and delaminated areas with Master Builders Solutions branded cementitious and epoxy patching materials. For application when fastturn repairs are required, MasterSeal 350 can be used to repair patches up to 1.5" in depth when used in aggregate slurry mix. Please refer to the MasterSeal 350 Technical Data Guide for proper application techniques.
3. All units must be applied within the specified pot life.

#### SURFACE PRE-STRIPPING AND DETAILING

1. For non-moving joints and cracks less than 1/16" (1.6 mm) wide, apply 25 wet mils (0.6 mm) prestripping of MasterSeal M 270 NP. MasterSeal M 270 NP must be applied to fill and overlap the joint or crack 3" (76 mm) on each side. Feather the edges.
2. Dynamic cracks and joints over 1/16" (1.6 mm) wide must be routed to a minimum of 1/4 by 1/4" (6 by 6 mm) and cleaned. Install bond breaker tape to prevent adhesion to bottom of joint. Prime joint faces only with MasterSeal P 173 and fill with MasterSeal SL 1™, NP1™. For joints deeper than 1/4" (6 mm), use appropriate backer rod. For cracks, sealant should be flush with the adjacent surface. For expansion joints, sealant should be slightly concave. After the sealant has cured, apply 25–30 wet mils (0.64–0.77 mm) of MasterSeal M 270 NP pre-stripping over the cured sealant, overlap the joint 3" (76 mm) on each side.

3. Sealed joints 1" (25 mm) wide or less can be coated over with the MasterSeal Traffic system. Expansion joints exceeding 1" (25 mm) wide, including the primary wide expansion-joint system, are not to be coated so they can perform independently of the deck coating system.
4. Form a sealant cant into the corner at the junction of all horizontal and vertical surfaces (wall sections, curbs, columns) by priming with MasterSeal P 173 and applying a 1" (25 mm) wide bead of MasterSeal NP 1. Tool to form a 45° cant. Apply masking tape to the vertical surfaces 4–5" (102–127 mm) above the sealant cant to provide a clean termination of the vertical detail coat. After the sealant has cured, apply 25 wet mils (0.64 mm) of MasterSeal M 270 NP over the cured cant up to the masking tape and 4" (102 mm) onto deck surface.
5. Where the coating system will be terminated and no wall, joint, or other appropriate break exists, cut a 1/4 by 1/4" (6 by 6 mm) keyway into the concrete. Fill and coat keyway during application of MasterSeal M 270 NP.

## HOW TO APPLY

### MIXING – MASTERSEAL M 270 NP

1. Precondition both A and B components to a temperature of approximately 70 °F (21 °C).
2. Add entire contents of Part A into Part B. Mix components with a slow-speed drill (400–600) rpm, for a minimum of 3 minutes. Scrape down sides and bottom of mixing vessel, then mix again for 2 minutes. Keep the mixing paddle submerged during mixing to avoid adding air into the mixture.

### MIXING – MASTERSEAL TC 275

1. Precondition both A and B components to a temperature of approximately 70 °F (21 °C).
2. Add entire contents of Part A into Part B. Mix components with a slow-speed drill (400–600) rpm, for a minimum of 3 minutes. Scrape down sides and bottom of mixing vessel, then mix again for 2 minutes. Keep the mixing paddle submerged during mixing to avoid adding air into the mixture.

## MIXING – TC 299FS

1. Measure batches consisting of 1-gallon of resin and 6-ounces of pigment into a 5-gallon pail.
2. Add proper amount of hardener and mix for 30–60 seconds using a pigment dispersing blade (consider a Cowles blade). Minimum 2,500 rpm is required. Reference mixing chart below.
3. Because of the quick rate of cure of this product, do not mix more batches than can be applied in a 5-10 minute application period.

NOTE: A batch consists of:

MasterSeal TC 299FS - 1 gallon

MasterTop PGM 155 - 6 ounces

MasterSeal 918FS - ounces determined by temperature

TEMPERATURE	Master Seal TC 299FS
	HARDENER (VOL.OZ)
24°F (-4.4°C)	8
29°F (-1.7°C)	8
30°F (-1.1°C)	8
33°F (0.6°C)	8
35°F (1.7°C)	7.5
40°F (4.4°C)	7
45°F (7.2°C)	6.5
50°F (10.0°C)	6
55°F (12.8°C)	6
60°F (15.6°C)	5
65°F (18.3°C)	5
70°F (21.1°C)	4.5
75°F (23.9°C)	4.5
80°F (26.7°C)	4.5
85°F (29.4°C)	4.5
90°F (32.2°C)	4.5

#### APPLICATION

1. Apply 25 wet mils (0.64 mm) of MasterSeal M 270 NP with proper notched squeegee at the rate of approximately 60 ft<sup>2</sup>/gal (1.47 m<sup>2</sup>/L). Allow base coat to cure 3-4 hours.
2. Apply 20 wet mils (0.30-0.51 mm) of MasterSeal TC 275 intermediate topcoat using a properly notched squeegee at the rate of approximately 80 ft<sup>2</sup>/gal (1.47 m<sup>2</sup>/L). Immediately back roll to evenly level Top Coat.

#### 3. AGGREGATE TO REFUSAL METHOD

Immediately broadcast MasterSeal 941, 941DR or equivalent 16-30 mesh, rounded silica sand into the wet coating at the rate of 20-30 lbs per 100 ft<sup>2</sup> (1.0-1.5 kg/m<sup>2</sup>). Immediately after the aggregate is broadcast and while the coating is still wet, blow any excess aggregate via a portable blower forward into the wet coating. Do not overlap aggregate: it is acceptable to have localized wet spots in the aggregate surface after completion of this method. This process requires coordination between all members in the work crew. The blower operator wearing clean spiked shoes, should blow the excess aggregate forward towards the freshly applied and backrolled topcoat. In this method, the coating should not accept additional sand, minimal excess aggregate is on the surface, less aggregate is used and the textured appearance should be fairly uniform.

4. Allow to cure 4-6 hours or until there is no moisture on the surface of the aggregate/membrane. Remove all excess or loose aggregate by sweeping or vacuuming before application of the topcoat. Apply the MasterSeal TC 299FS immediately after mixing by pouring directly onto the primed and cured deck surface. Distribute by means of heavy nap, solvent-grade roller, brush or squeegee to tired thickness, at the rate of 25 wet mils or 60sf/ gal (1.47 m<sup>2</sup>/L).

5. Top coat will cure in one hour. Wait 3 hours before opening to traffic. Existing environmental conditions effect the allowable time period.

Important Note: All coverage rates are approximate and may vary due to the application technique used. Coverage rates are affected by substrate texture, choice and distribution of aggregate, intermediate aggregate load and environmental conditions and application methods and are not under the control of Master Builders Solutions. Ensure that an adequate amount of aggregate is utilized to achieve required slip resistance.

#### MOCK-UP

1. Provide mockup of at least 100 ft<sup>2</sup> (9.3 m<sup>2</sup>) to include surface profile, sealant joint, crack, flashing and juncture details and allow for evaluation of slip resistance and appearance.
2. Install mockup with specified coating types and with other components noted.
3. Locate where directed by architect.
4. Mockup may remain as part of work if acceptable to architect.

#### CLEAN UP

Clean tools with MasterTop SRS 100CLN, an MMA solvent. Other solvents such as xylene or acetone may also be used. Collect and dispose of all site waste.

#### CURING TIME

After top coat, allow an additional 2-3 hours before opening to vehicular traffic. Extend the curing time in cool-weather conditions

#### MAINTENANCE

See MasterSeal Traffic maintenance technical bulletin.

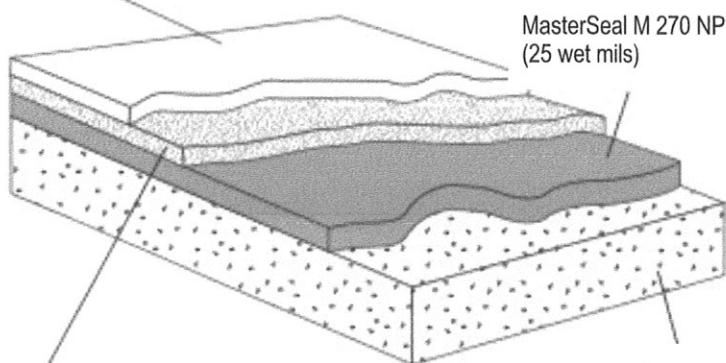
#### FOR BEST PERFORMANCE

- MasterSeal NP 100 and MasterSeal NP150 should not be used in conjunction with this urethane deck coating system due to potential for curing issues.
- If vapor drive is present or suspected, please consult with your local Master Builders Solutions representative prior to system application.
- MasterSeal M 270 NP, TC 275 and TC 299FS have very short working times (approximately 15 minutes) (at 70 °F 50% RH). Once the material has been mixed, the coating must be poured on the surface and applied immediately.
- Minimum application temperature is 40 °F (4 °C) for polyurethane materials.
- If areas of inadequate slip resistance exist, an additional top coat back rolled with aggregate is required. (after cure)
- Do not apply to concrete that is outgassing.
- Warm temperatures will shorten working time; plan work accordingly
- Concrete should have a minimum compressive strength of 3,000 psi (21 MPa) and be cured for a minimum of 28 days.
- Do not apply MasterSeal Vehicular Traffic 2850 to concrete slabs on grade, unvented metal pan decks or split slab applications with

### HEAVY DUTY TRAFFIC SYSTEM

MasterSeal TC 299FS  
(25 wet mils)

MasterSeal M 270 NP  
(25 wet mils)



MasterSeal TC 275 (20 mils)  
MasterSeal 941 / 941DR (broadcast)



a waterproofing membrane between slabs. Contact Master Builders Solutions Technical Services for more information.

- Be sure to allow for movement in the deck by the proper design and use of expansion and control joints.
- Select the proper type and amount of aggregate to achieve desired slip resistance.
- Contact Technical Service when substrates are over 90 °F (32 °C) or under 40 °F (4 °C) or when applying to decks containing between slab membranes.
- The best method to ensure the proper wet film thickness is the use of a grid system. Divide the surface to be coated into grids and calculate the square footage of each. Refer to coverage rates to determine the quantity of coating needed for each grid to arrive at the required mil thicknesses. For example, one pail of MasterSeal M 270 NP should cover approximately 255–280 ft<sup>2</sup> or a minimum grid of 16 x 16 ft at 25 wet mils. Verify via site mockup.
- Avoid application when inclement weather is present or imminent.
- Do not apply to damp, wet, or contaminated surfaces.
- Not suitable for use where chained or metalstudded tires will be used.
- Proper application is the responsibility of the user. Field visits by Master Builders Solutions personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.
- CAD & PDF deck coatings details are available for download from our website, Master Builders Solutions Customer Support can direct you to the site.
- On steep ramps in excess of 15%, contact your local Master Builders Solutions representative. Do not use self-leveling grade product on slopes greater than 15%. Do not coat expansion joints over 1" (25 mm) wide.

#### NOTES

- MasterSeal Vehicular Traffic 2850 is a multiple component system that utilizes a methylmethacrylate (MMA) resin. It is critical that the instructions in the Safety Data Sheet and on the product label for every component of the system be read, understood and followed. MMA resins are flammable liquids

in their uncured state. Smoking, open flames or sparks should not be permitted during the handling of this product. Explosion safe ventilation must be used during the application to minimize vapor collection in the installation area and to improve the overall air quality for the crew.

- MMA resins have a discernible odor. This smell makes people aware of the presence of MMA. The material has an extremely low odor threshold of 83ppb (parts per billion) which dissipates upon curing (approximately 45 minutes to 1 hour). This low odor threshold can create concerns when working in areas where the public can be exposed to the odor.
- This odor, when below permissible exposure limits, does not pose a hazard. It is the responsibility of the applicator to insure proper ventilation is established on site to avoid potential odor concerns as well as communicate product expectations to tenants or the surrounding public.
- In cases where the general public may be affected, an exhaust system will need to be set up. This needs to be planned ahead of time in order to make certain that the proper equipment will be accessible on site. Many projects will require the "tenting off" of certain areas.

#### HEALTH, SAFETY AND ENVIRONMENTAL

Read, understand and follow all Safety Data Sheets and product label information for this product prior to use. The SDS can be obtained by visiting [www.master-builders-solutions.com/en-us](http://www.master-builders-solutions.com/en-us), e-mailing your request to [mbsbscst@mbcc-group.com](mailto:mbsbscst@mbcc-group.com) or calling 1(800) 433-9517. Use only as directed. **IN CASE OF EMERGENCY: Call CHEMTEL +1 (800) 255-3924 or if outside the US or Canada, +1 (813) 248-0585.**

#### LIMITED WARRANTY NOTICE

Master Builders Solutions warrants this product to be free from manufacturing defects and to meet the technical properties on the current Technical Data Guide, if used as directed within shelf life. Satisfactory results depend not only on quality products but also upon many factors beyond our control. **MASTER BUILDERS SOLUTIONS MAKES NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT**

TO ITS PRODUCTS. The sole and exclusive remedy of Purchaser for any claim concerning this product, including but not limited to, claims alleging breach of warranty, negligence, strict liability or otherwise, is the replacement of product or refund of the purchase price, at the sole option of Master Builders Solutions. Any claims concerning this product must be received in writing within one (1) year from the date of shipment and any claims not presented within that period are waived by Purchaser. **MASTER BUILDERS SOLUTIONS WILL NOT BE RESPONSIBLE FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFITS) OR PUNITIVE DAMAGES OF ANY KIND.**

Purchaser must determine the suitability of the products for the intended use and assumes all risks and liabilities in connection therewith. This information and all further technical advice are based on Master Builders Solutions present knowledge and experience. However, Master Builders Solutions assumes no liability for providing such information and advice including the extent to which such information and advice may relate to existing third party intellectual property rights, especially patent rights, nor shall any legal relationship be created by or arise from the provision of such information and advice. Master Builders Solutions reserves the right to make any changes according to technological progress or further developments. The Purchaser of the Product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with a full application of the product(s). Performance of the product described herein should be verified by testing and carried out by qualified experts.

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# Technical Data Guide

# 7

07 18 00  
Traffic  
Coatings

## MasterSeal® Vehicular Traffic 2900

Fast curing methyl methacrylate / polyurethane waterproofing, traffic-bearing membrane system for vehicular areas

### PACKAGING

- MasterSeal P 280FS:  
4.5-Gal (17L) pail; 49-Gal (185.5L) drum
- MasterSeal M 290FS:  
4.5-Gal (17L) pail; 48-Gal (181.7L) drum
- MasterSeal TC 297FS:  
4.5-Gal (17L) pail; 53.5-Gal (202.5L) drum
- MasterSeal TC 299FS:  
4.5-Gal (17L) pail; 50-Gal (189L) drum
- MasterSeal 940:  
50-Lb (22.68KG) bag
- MasterSeal 940DR:  
50-Lb (22.68KG) bag; 3,000-Lb (1360.8KG) Super Sack
- MasterSeal 940:  
50-Lb (22.68KG) bag
- MasterSeal 940DR:  
50-Lb (22.68KG) bag; 3,000-Lb (1360.8KG) Super Sack
- MasterTop PGM 155:  
10-Lb (4.5KG) pail
- MasterSeal 908FS:  
4.5-Gal (17L) pail
- MasterSeal 918FS:  
2.5-Lb (1.1kg) bottle, 4 per case; 50-Lb (22.68kg) carton

### SHELF LIFE

- MasterSeal P 280FS: 2 years
- MasterSeal M 290FS: 1 year
- MasterSeal TC 297FS: 2 years
- MasterSeal TC 299FS: 2 years
- MasterTop PGM 155: 5 years
- MasterSeal 908FS: 1 year
- MasterSeal 918FS: 1 year

### STORAGE

Store in unopened containers in a cool, clean, dry area

### YIELD

All resins require the addition of an initiator, powder hardener and/or pigment. See preferred MasterSeal Deck Coating Solution for total system yield.

### COLORS

For color options, see MasterSeal Fast Cure Color Brochure

### DESCRIPTION

MasterSeal Vehicular Traffic 2900 is a fluid-applied polyurethane-modified methyl methacrylate waterproofing system. The rapid cure characteristic of the system allows for full system cure within a single day – minimizing facility down time. MasterSeal Vehicular Traffic 2900 bridges cracks at low temperatures and can be opened to traffic in just one hour after final application.

MasterSeal Vehicular Traffic 2900 is composed of:

- MasterSeal P 280FS – an MMA solvent-free, two-component, 100% reactive, low viscosity primer
- MasterSeal M 290FS – a polyurethane-modified methyl methacrylate (PMMA) waterproofing base coat
- MasterSeal TC 297FS – an MMA solvent-free, two-component, 100% reactive intermediate coat
- MasterSeal TC 299FS – an MMA solvent-free, two-component, 100% reactive pigmentable top coat
- MasterTop PGM 155 – a powder pigment
- MasterSeal 918FS – a powder hardener
- MasterSeal 908FS – a primer additive

For projects requiring aggregate, four options are available:

- MasterSeal 941 – a silica sand aggregate
- MasterSeal 941DR – an aggregate free of respirable crystalline silica
- MasterSeal 940 – a hard-wearing, angular aggregate
- MasterSeal 940DR – an aggregate free of respirable crystalline silica

### PRODUCT HIGHLIGHTS

- Blend of polyurethane and methyl methacrylate technologies provides extreme durability and abrasion resistance while maintaining crack-bridging properties
- Rapid cure allows for quick installation with minimal facility downtime
- Low temperature cure extends application season
- 940DR and 941DR aggregates are free of respirable crystalline silica
- Seamless, impervious coating that is easy to clean and maintain
- Flexible system that withstands temperature swings
- MasterEmaco S6000 repair mortar can be applied at temperatures down to 14 °F (-10 °C) to meet a wide range of application and timing requirements

### INDUSTRIES/SECTORS

- Stadiums
- Parking Garages
- Plaza Decks
- Loading Docks
- Garbage Rooms
- Commercial Construction
- Building and Restoration

### VOC CONTENT

- MasterSeal and MasterTop components have the following g/L VOC contents less water and exempt solvents:
- MasterSeal P 280FS – 198 g/L
- MasterSeal M 290FS – 87 g/L
- MasterSeal TC 297FS – 14 g/L
- MasterSeal TC 299FS – 54 g/L
- MasterTop PGM 155 – 0 g/L
- MasterSeal 918FS – 0 g/L
- MasterSeal 908FS – 77 g/L

#### Compliances

- CSA S413
- ASTM C957

#### Test Data

PROPERTY	MASTERSEAL P 280FS	MASTERSEAL M 290FS	MASTERSEAL TC 297FS	MASTERSEAL TC 299FS	TEST METHOD
% Solids	100	100	100	100	ASTM D 1259
Crack Bridging, Base Coat	–	Pass	–	–	ASTM C 957
Crack Bridging, System			Pass		ASTM C 1305
System Adhesion, psi			>500		ASTM D 4541
Tensile Strength, psi (MPa)	3500 (24.13)	1600 (11)	1350 (9.31)	1050 (7.24)	ASTM D 412
Elongation, %	1.3	1324	140	34	ASTM D 412
Hardness, Shore A	–	70	61	89	ASTM D 2250
Taber Abrasion Resistance, mgms	–	–	–	179 mg	ASTM D 4060
Electrical Resistivity, ohm/ cm	Volume: 2.5 x 10 <sup>15</sup> Surface: 8 x 10 <sup>12</sup>	–	–	Volume: 10 <sup>14</sup>	ASTM D 257
Water Absorption, %/24 hours	<0.1	–	–	0.04	ASTM D 570

#### HOW TO APPLY

##### Surface Preparation

###### Concrete

1. Concrete must be fully cured (28 days), structurally sound, clean and dry (ASTM D 4263). All concrete surfaces (new and old) must be shot blasted to remove previous coatings, laitance and all miscellaneous surface contamination and to provide profile for proper adhesion. Abrasive shot blasting must occur after concrete repair has taken place. Acid-etching is not permitted. Proper profile should be a minimum of ICRI CSP3 (as described in ICRI document 310.2R - 2013.) For balconies and other pedestrian areas with limited space or access for shot-blasting, alternative mechanical methods can be used to achieve the recommended surface profile.

2. Repair voids and delaminated areas with MasterEmaco S6000. When time permits, MasterEmaco 1060, 1060DR or 1060EX may be used for repair purposes. Wait 6-8 hours before applying MasterSeal Vehicular Traffic 2900 system.
  - Prime with MasterSeal P 280FS before applying MasterEmaco S6000. Measure 3 quarts of resin and 1 quart of MasterSeal 908FS into pail and add proper amount of powder hardener. See mixing chart below. Mix with drill mixer for 30 seconds or until the powder hardener is completely dissolved.
  - Apply primer at approximately 100 ft<sup>2</sup> (9.3 m<sup>2</sup>) per mixed gallon.
  - Measure, add, and mix the MasterEmaco S6000 Resin, Powder Component, and necessary aggregate (if required) in the proportions recommended below. Use mixture to repair any damaged concrete, or to slope any areas as needed.
  - Once cured, material must be re-primed before topping system is applied.
  - Proceed with application as usual.
  - All units must be within the specified pot life.

OVERLAY THICKNESS	AGGREGATE EXTENSION				Per Batch of S6000	CUBIC FEET
	% BY WEIGHT	GRAIN SIZE	WEIGHT IN POUNDS	VOLUME		
¼"	—	—	—	—	12.5	0.26
½"	10%	⅛" – ⅜"	4	1 – ¼ quarts 2 – ½ quarts	7.2	0.30
¾"	25%	⅛" – ⅜"	8	2 – ½ quarts	5.3	0.33
1"	50%	⅜" – ¾"	15	5 quarts	4.4	0.37
1-½"	75%	¾" – 1"	25	2 gallons	3.5	0.44
2"	100%	¾" – 1"	35	2.5 gallons	2.3	0.50
≥ 3"	125%	¾" – 1"	44	3 gallons	2.2	0.55

\*Square feet per batch of MasterEmaco S6000

#### SURFACE PRE-STRIPPING AND DETAILING

- For non-moving joints and cracks less than 1/16" (1.6 mm) wide, pre-stripe with MasterSeal P 280FS 1" (25 mm) beyond all surfaces that require detail work, using a short-nap roller. Just before application of MasterSeal P 280FS, remove all dust, dirt and contaminants. Allow MasterSeal P 280FS to dry tack-free. On the same day, coat primed surfaces with 25 mils of MasterSeal M 290FS. MasterSeal M 290FS must be applied to fill and overlap the joint or crack 2" (51 mm) on each side. Feather the edges.

NOTE: For non-moving joints and cracks, prime the crack before applying MasterSeal M 290FS at 25 mils using a notched trowel - for faster detailing.

- Dynamic cracks and joints over 1/16" (1.6 mm) wide must be routed to a minimum of 1/4 by 1/4" (6 by 6 mm) and cleaned. Install bond breaker tape to prevent adhesion to bottom of joint. Prime joint faces only with MasterSeal P 173 and fill with MasterSeal SL 2™ or NP2™. For joints deeper than ¼" (6 mm), use appropriate backer rod. For cracks, sealant should be flush with the adjacent surface. For expansion joints, sealant should be slightly concave.
- Sealed joints 1" (25 mm) wide or less can be coated over with the MasterSeal Traffic system.  
NOTE: SYSTEM IS NOT TO BE APPLIED ON PLYWOOD Expansion joints exceeding 1" (25 mm) wide, including the primary wide expansion-joint system, are not to be coated so they can perform independently of the deck coating system.
- Form a sealant cant into the corner at the junction of all horizontal and vertical surfaces (wall sections, curbs, columns) by priming with MasterSeal P 173 and applying a 1" (25 mm) wide bead of MasterSeal NP 2. Tool to form a 45° cant. Apply masking tape to the vertical surfaces 4–5" (102–127 mm) above the sealant cant to provide a clean termination of the vertical detail coat. After the sealant has cured, prime with MasterSeal P 280FS at 100 SF/gallon. Apply 25 wet mils (0.64 mm) of MasterSeal M 290FS over the cured cant up to the masking tape and 4" (102 mm) onto deck surface.

NOTE: For a non-moving cant bead, MasterTop 100PAS can be used for rapid cure.

- Where the coating system will be terminated and no wall, joint, or other appropriate break exists, cut a 1/8 by 1/8" (3 by 3 mm) keyway into the concrete. Fill and coat keyway during application of MasterSeal M 290FS.

#### COLOR

- MasterSeal TC 297FS  
Mix 6 oz of MasterTop SRS PGM 155 pigment for every two (1) gallons of resin
- MasterSeal M 290FS  
Comes pre-tinted grey
- MasterSeal TC 299FS  
Mix 6 oz of MasterTop SRS PGM 155 pigment for every one (1) gallon of resin

#### MIXING

- MasterSeal P 280FS  
Measure 3 quarts of resin and 1 quart of MasterSeal 908FS into pail, blend, and add proper amount of powder hardener. See mixing chart below. Mix with drill mixer for 30 seconds or until the powder hardener is completely dissolved.
- MasterSeal M 290FS  
Mix for 2-3 minutes. Measure 1-gallon of resin and add proper amount of powder hardener. See mixing chart below. Mix with drill mixer for 2 minutes.
- MasterSeal TC 297FS  
Measure 1 gallon of resin and 6 oz of PGM 155 pigment into a pail. Mix 2-3 minutes. Add proper amount of powder hardener mix for an additional 1-2 minutes.
- MasterSeal TC 299FS  
Measure 1-gallon of resin and 6-ounces of pigment into a 5-gallon pail. Mix for 2-3 minutes. Add proper amount of powder hardener and mix for an additional 1-2 minutes. See mixing chart below.

**Note:** After mixing, apply immediately. You will have 7 – 15 minutes of working time, dependent on temperature.

### Mixing Chart

required amount of MasterSeal 918FS (in volume ounces) for one gallon resin, based on temperature

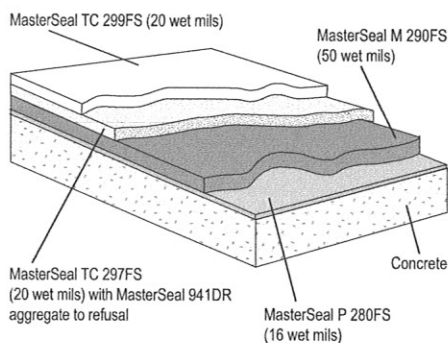
°F	MasterSeal P 280FS with MasterSeal 908FS	MasterSeal M 290FS	MasterSeal TC 297FS	MasterSeal TC 299FS
30	9	8	11	8
33	8	8	11	8
35	7	7.5	11	7.5
40	6.5	7	11	7
45	6	6.5	9	6.5
50	6	6	8.5	6
55	5	6	7.5	6
60	5	5	6.5	5
65	5	5	5.5	5
70	4	4.5	4.5	4.5
76	4	4.5	4	4.5
80	4	4.5	3	4.5
85	4	4.5	2.5	4.5
90	4	4.5	2	4.5

\*Test results obtained under laboratory conditions. Reasonable variations can be expected.

### HOW TO APPLY

The MasterSeal 2900 System is a multiple component system that utilizes a methyl-methacrylate (MMA) resin. It is critical that the instructions listed in the Safety Data Sheet and on the product label for every component of the system be read, understood and followed. MMA resins are flammable liquids in their uncured state. Smoking, open flames or sparks should not be permitted during the handling of the product. Explosion safe ventilation must be used during the application to minimize vapor collection in the installation area and to improve overall air quality for the crew. All foodstuffs must be removed during installation of the system.

### HEAVY-DUTY SYSTEM

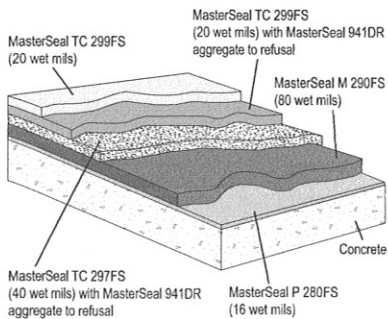


### HEAVY-DUTY TRAFFIC SYSTEM

1. Apply the properly mixed MasterSeal P 280FS/908FS resin to the properly repaired concrete or properly prepared aged coating at approximately 100 ft<sup>2</sup> (9.3 m<sup>2</sup>) per mixed gallon or about 16 mils. Allow primer to cure tack-free to an even, satin-like gloss and re-prime any dry spots.
  2. Apply the properly mixed MasterSeal M 290FS at 32 ft<sup>2</sup> (3 m<sup>2</sup>) per gallon or 50 mils, using a notched tool (or trowel). Material may not be completely tack free upon cure. Do NOT backroll the MasterSeal M 290FS.
  3. Apply the properly mixed MasterSeal TC 297FS at 80 ft<sup>2</sup> (7.4 m<sup>2</sup>) per gallon, rolling on at a 20 mil thickness.
  4. Immediately broadcast MasterSeal 941 or 941DR or equivalent 16–30 mesh, rounded silica sand into the wet coating to refusal at the rate of 20–30 lbs per 100 ft<sup>2</sup> (1.0–1.5 kg/m<sup>2</sup>). Immediately after the aggregate is broadcast and while the coating is still wet, blow any excess aggregate via a portable blower forward into the wet coating.
- NOTE:** the MasterSeal 940 or 940DR aggregate can be used for a more aggressive texture. This may impact coverage rate of MasterSeal TC 299FS.
5. Apply the properly mixed MasterSeal TC 299FS at 80 ft<sup>2</sup> (7.4 m<sup>2</sup>) per gallon, rolling on at a 20 mil thickness using a squeegee.
  6. All components of the MasterSeal Traffic 2900 system fully cure in approximately one hour when properly installed.



#### EXTRA HEAVY-DUTY SYSTEM



#### EXTRA HEAVY-DUTY TRAFFIC SYSTEM

1. Apply the properly mixed MasterSeal P 280FS/908FS resin to the properly repaired concrete or properly prepared aged coating at approximately 100 ft<sup>2</sup> (9.3 m<sup>2</sup>) per mixed gallon or about 16 mils. Allow primer to cure tack-free to an even, satin-like gloss and re-prime any dry spots.
2. Apply the properly mixed MasterSeal M 290FS at 20 ft<sup>2</sup> (1.9 m<sup>2</sup>) per gallon or 80 mils, using a notched tool (or trowel). Material may not be completely tack free upon cure. Do NOT backroll the MasterSeal M 290FS.
3. Apply the properly mixed MasterSeal TC 297FS at 40 ft<sup>2</sup> (3.7 m<sup>2</sup>) per gallon, rolling on at a 40 mil thickness.
4. Immediately broadcast MasterSeal 941 or 941DR or equivalent 16–30 mesh, rounded silica sand into the wet coating to refusal at the rate of 20–30 lbs per 100 ft<sup>2</sup> (1.0–1.5 kg/m<sup>2</sup>). After the aggregate is broadcast and while the coating is still wet, blow any excess aggregate via a portable blower forward into the wet coating.  
**NOTE:** the MasterSeal 940 or 940DR aggregate can be used for a more aggressive texture. This may impact coverage rate of MasterSeal TC 299FS.
5. Apply the properly mixed MasterSeal TC 299FS at 80 ft<sup>2</sup> (7.4 m<sup>2</sup>) per gallon, rolling on at a 20 mil thickness using a squeegee.
6. Immediately broadcast MasterSeal 941 or 941DR or equivalent 16–30 mesh, rounded silica sand into the wet coating to refusal at the rate of 20–30 lbs per 100 ft<sup>2</sup> (1.0–1.5 kg/m<sup>2</sup>). After the aggregate is broadcast and while the coating is still wet, blow any excess aggregate via a portable blower forward into the wet coating.  
**NOTE:** the MasterSeal 940 or 940DR aggregate can be used for a more aggressive texture. This may impact coverage rate of MasterSeal TC 299FS.

7. Apply the properly mixed MasterSeal TC 299FS at 80 ft<sup>2</sup> (7.4 m<sup>2</sup>) per gallon, rolling on at a 20 mil thickness using a squeegee.
8. All components of the MasterSeal Traffic 2900 system fully cure in approximately one hour when properly installed.

#### MOCK-UP

1. Provide mockup of at least 100 ft<sup>2</sup> (9.3 m<sup>2</sup>) to include surface profile, sealant joint, crack, flashing and juncture details and allow for evaluation of slip resistance and appearance.
2. Install mockup with specified coating types and with other components noted.
3. Locate where directed by architect.
4. Mockup may remain as part of work if acceptable to architect.

#### CLEAN UP

Clean tools with MasterTop SRS 100CLN, an MMA solvent. Other solvents such as xylene or acetone may also be used. Collect and dispose of all site waste.

#### CURING TIME

All components of the MasterSeal Traffic 2900 system fully cure within one hour when properly installed. Extend the curing time in cool-weather conditions.

#### MAINTENANCE

See MasterSeal Traffic maintenance technical bulletin. Regular cleaning and maintenance will prolong the life of all polymer flooring systems, enhance their appearance and reduce any tendency to retain dirt.

#### FOR BEST PERFORMANCE

- If vapor drive is present or suspected, please consult with your local Master Builders Solutions representative prior to system application.
- Not for use in areas exposed to strong solvents (consult Master Builders Solutions Technical Service).
- Protect or remove food items prior to application to avoid any possible contamination.
- Proper air flow is critical to curing MMA materials. The use of fans is mandatory where air flow is restricted.
- Minimum application temperature is 30 °F (-1 °C).

- Do not apply to concrete that is outgassing.
- Warm temperatures will shorten working time; plan work accordingly.
- Concrete should have a minimum compressive strength of 3,000 psi (21 MPa) and be cured for a minimum of 28 days.
- Do not apply MasterSeal Vehicular Traffic 2900 to concrete slabs on grade, unvented metal pan decks or split slab applications with a waterproofing membrane between slabs. Contact Master Builders Solutions Technical Services.
- Be sure to allow for movement in the deck by the proper design and use of expansion and control joints.
- Select the proper type and amount of aggregate to achieve desired slip resistance.
- Contact Technical Service when substrates are over 90 °F (32 °C) or under 30 °F (-1 °C) or when applying to decks containing between slab membranes.
- The best method to ensure the proper wet film thickness is the use of a grid system. Divide the surface to be coated into grids and calculate the square footage of each. Refer to the coverage chart to determine the quantity of coating needed for each grid to arrive at the required mil thicknesses.
- Avoid application when inclement weather is present or imminent.
- Do not apply to damp, wet, or contaminated surfaces.
- Not suitable for use where chained or metalstudded tires will be used.
- Proper application is the responsibility of the user. Field visits by Master Builders Solutions personnel are for the purpose of making technical recommendations only and not for supervising or providing quality control on the jobsite.
- CAD & PDF deck coatings details are available for download from our website, Master Builders Solutions Customer Support can direct you to the site.
- On steep ramps in excess of 15%, contact your local Master Builders Solutions representative. Do not use self-leveling grade product on slopes greater than 15%. Do not coat over expansion joints.
- Do not use pre-mixed, integrated MasterSeal 945 aggregate in the MasterSeal Vehicular Traffic 2900 system.

#### **HEALTH, SAFETY AND ENVIRONMENTAL**

Read, understand and follow all Safety Data Sheets and product label information for this product prior to use. The SDS can be obtained by visiting [www.master-builders-solutions.com/en-us](http://www.master-builders-solutions.com/en-us), e-mailing your request to [mbsbscst@mbcc-group.com](mailto:mbsbscst@mbcc-group.com) or calling +1 (800) 433-9517. Use only as directed.

**IN CASE OF EMERGENCY: Call CHEMTEL +1 (800) 255-3924 or if outside the US or Canada, +1 (813) 248-0585**

#### **LIMITED WARRANTY NOTICE**

Master Builders Solutions warrants this product to be free from manufacturing defects and to meet the technical properties on the current Technical Data Guide, if used as directed within shelf life. Satisfactory results depend not only on quality products but also upon many factors beyond our control. MASTER BUILDERS SOLUTIONS MAKES NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO ITS PRODUCTS. The sole and exclusive remedy of Purchaser for any claim concerning this product, including but not limited to, claims alleging breach of warranty, negligence, strict liability or otherwise, is the replacement of product or refund of the purchase price, at the sole option of Master Builders Solutions. Any claims concerning this product must be received in writing within one (1) year from the date of shipment and any claims not presented within that period are waived by Purchaser. MASTER BUILDERS SOLUTIONS WILL NOT BE RESPONSIBLE FOR ANY SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFITS) OR PUNITIVE DAMAGES OF ANY KIND.

Purchaser must determine the suitability of the products for the intended use and assumes all risks and liabilities in connection therewith. This information and all further technical advice are based on Master Builders Solutions present knowledge and experience. However, Master Builders Solutions assumes no liability for providing such information and advice including the extent to which such information and advice may relate to existing third party

intellectual property rights, especially patent rights, nor shall any legal relationship be created by or arise from the provision of such information and advice. Master Builders Solutions reserves the right to make any changes according to technological progress or further developments. The Purchaser of the Product(s) must test the product(s) for suitability for the intended application and purpose before proceeding with a full application of the product(s). Performance of the product described herein should be verified by testing and carried out by qualified experts.

# Technical Data Guide

7 | 07 18 00  
Traffic  
Coatings

## MasterSeal® TC 275

Aromatic Polyurethane Topcoat for MasterSeal Traffic 2000, 2500 and 2575 Deck Coating Systems

### PACKAGING

MasterSeal TC 275

- 4.78 gallon (18.1 L) unitized kit

### SHELF LIFE

When properly stored, MasterSeal TC 275 has the following shelf life:

4.78-Gallon Kit: 1.25 Years

### STORAGE

Store in unopened containers in a cool, clean, dry area

### YIELD

See preferred MasterSeal Deck Coating Solution for total system yield.

### COLORS

Grey  
Charcoal  
Black

### DESCRIPTION

MasterSeal TC 275 is an aromatic, polyurethane top coat for use in MasterSeal Traffic 2000, 2500 and 2575 deck coating systems.

The TC 275 is a two-component, fast-curing waterproofing coating. This material has outstanding mechanical properties, including high tensile strength and excellent tear and abrasion resistance with high solids.

### PRODUCT HIGHLIGHTS

- An economical, two-component waterproofing coating
- Durable intermediate coat with high strength
- Ideal for underground or interior applications
- Available in grey, charcoal and black
- MasterSeal TC 275 is a high solids top coat with low VOC
- Excellent chemical resistance helps protect against common parking deck chemicals

### INDUSTRIES/APPLICATIONS

- Stadiums
- Balconies
- Parking Garages
- Commercial Construction
- Building and Restoration
- Plywood Decks/Balconies
- Plaza Decks

### APPLICABLE SYSTEMS

- MasterSeal Vehicular 2000
- MasterSeal Vehicular 2000 Low VOC
- MasterSeal Vehicular 2500
- MasterSeal Vehicular 2500 Primerless
- MasterSeal Vehicular 2575
- MasterSeal Vehicular 2575 Primerless
- MasterSeal Pedestrian 2000
- MasterSeal Pedestrian 2000 Low VOC
- MasterSeal Pedestrian 2500
- MasterSeal Pedestrian 2500 Primerless

### VOC CONTENT

MasterSeal TC 275 components have the following g/L VOC contents less water and exempt solvents:

- MasterSeal TC 275 Part A: 71 g/L
- MasterSeal TC 275 Part B: 13 g/L

## Technical Data

### Composition

MasterSeal TC 275 is an aromatic polyurethane with high solids available in grey, charcoal and black.

MasterSeal TC 275 cures in 3–4 hours when tested at 73 °F (23 °C) and 50% relative humidity.

## PHYSICAL PROPERTIES

PROPERTY	TC 275 RESULTS	TEST METHOD
Tensile Strength, psi (MPa)	3,000 (20.7)	ASTM D 412
Elongation, %	30	ASTM D 412
Hardness, Shore A	94	ASTM D 2240
Solids, %	96	
Viscosity, cps*	1,600	

See preferred MasterSeal Deck Coating Solution for system-specific physical properties and test results.

\*Cold temperatures will increase viscosity.

### HOW TO APPLY SURFACE PREPARATION | MIXING AND APPLICATION

Please see preferred Master Seal Deck Coating Solution for total system and aggregate surface preparation and application.

MasterSeal TC 275 has very short working time (20 +/- 5 minutes). Once material has been mixed, the coating must be poured onto the surface and applied immediately.

Where UV resistance is required, the application of MasterSeal TC 295 is recommended over MasterSeal TC 275 as MasterSeal TC 275 will discolor if exposed to UV light.

### HEALTH, SAFETY AND ENVIRONMENTAL

Read, understand and follow all Material Safety Data Sheets and product label information for this product prior to use. The MSDS can be obtained by visiting [www.master-builders-solutions.com/en-us](http://www.master-builders-solutions.com/en-us), e-mailing your request to [mbsbscst@mbcc-group.com](mailto:mbsbscst@mbcc-group.com) or calling 1(800)433-9517. Use only as directed.

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## Technical Data Guide

7 | 07 18 00  
Traffic  
Coatings

# MasterSeal® M 270 NP

Polyurethane Base Coat for MasterSeal Traffic 2500, 2530 and 2575 Primerless Deck Coating Systems

#### PACKAGING

MasterSeal M 270 NP

– 4.66 gallon (17.64 L) pails

#### SHELF LIFE

When properly stored, MasterSeal M 270 NP products have the following shelf life:

4.66-Gallon Pail: 1 Year

#### STORAGE

Store in unopened containers in a cool, clean, dry area

#### YIELD

See preferred MasterSeal Deck Coating Solution for total system yield

#### COLORS

Clear/Amber

#### DESCRIPTION

MasterSeal M 270 NP is a two-component polyurethane base coat for use in MasterSeal Traffic 2500, 2530 and 2575 Primerless deck coating systems.

MasterSeal M 270 NP is a fast-curing base coat with outstanding mechanical properties, including excellent elongation without the use of primer.

#### PRODUCT HIGHLIGHTS

- Primerless base coat provides a simpler application process and material and labor cost savings
- Two-component base coat provides faster setting times, even in cooler climates
- Seamless waterproof membrane helps protect concrete from freeze/thaw damage

#### INDUSTRIES/APPLICATIONS

- Stadiums
- Balconies
- Parking Garages
- Commercial Construction
- Building and Restoration
- Plywood Decks/Balconies
- Plaza Decks

#### APPLICABLE SYSTEMS

- MasterSeal Vehicular 2500 Primerless
- MasterSeal Vehicular 2530 Primerless
- MasterSeal Vehicular 2575 Primerless
- MasterSeal Pedestrian 2500 Primerless

#### VOC CONTENT

MasterSeal M 270 NP has the following g/L VOC contents less water and exempt solvents:

- MasterSeal M 270 NP Part A: 4 g/L
- MasterSeal M 270 NP Part B: 5 g/L



#### Technical Data

##### Composition

MasterSeal M 270 NP is a fast-curing polyurethane base coat.

MasterSeal M 270 NP cures in 3–4 hours when tested at 73 °F (23 °C) and 50% relative humidity.

#### PHYSICAL PROPERTIES

PROPERTY	M 270 NP RESULTS	TEST METHOD
Tensile Strength, psi (MPa)	3,000 (20.7)	ASTM D 412
Elongation, %	950	ASTM D 412
Hardness, Shore A	67	ASTM D 2240
Solids, %	99	
Viscosity, cps*	3,400	

See preferred MasterSeal Deck Coating Solution for system-specific physical properties and test results.

\*Cold temperatures will increase viscosity.

#### HOW TO APPLY SURFACE PREPARATION | MIXING AND APPLICATION

Please see preferred Master Seal Deck Coating Solution for total system and aggregate surface preparation and application.

MasterSeal M 270 NP is applied without primer per system application instructions.

#### HEALTH, SAFETY AND ENVIRONMENTAL

Read, understand and follow all Material Safety Data Sheets and product label information for this product prior to use. The MSDS can be obtained by visiting [www.master-builders-solutions.com/en-us](http://www.master-builders-solutions.com/en-us), e-mailing your request to [mbsbscst@mbcc-group.com](mailto:mbsbscst@mbcc-group.com) or calling 1(800)433-9517. Use only as directed.

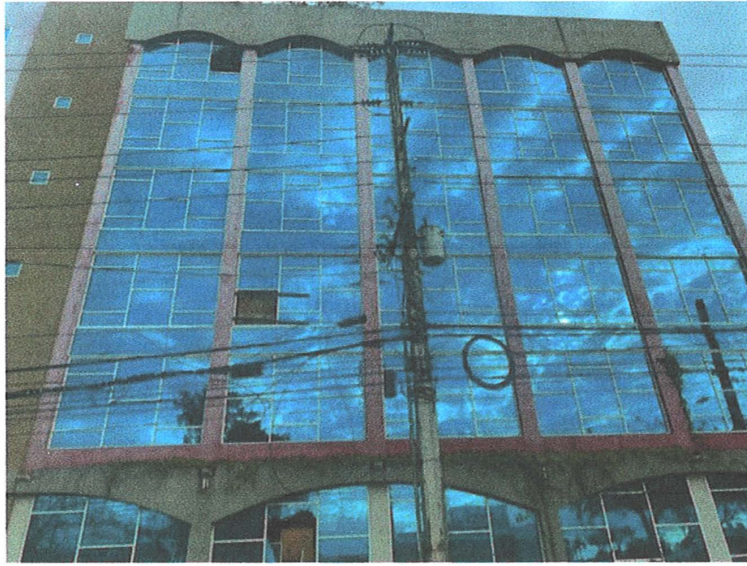
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**STRUCTURAL ASSESMENT REPORT**  
**FOR**  
**CARIBE PLAZA OFFICE BUILDING**  
**Per ASCE 41 Seismic Rehabilitation of Existing Buildings**

1547 Ponce De León Avenue,  
Rio Piedras, Puerto Rico



Fecha de Expiración: 2024-03-24

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## CARIBE PLAZA OFFICE BUILDING

Project No. 2022-10  
Seismic Evaluation of Existing Building per ASCE 41 and ASCE / SEI 31  
#1547 Paseo De León Avenue  
Rio Piedras, Puerto Rico 00926

### I. INTRODUCTION

We have performed a seismic evaluation of the Caribe Plaza Office Building, using the ASCE-41, Tier 1 and Tier 2 Seismic Evaluation Procedure. ASCE 41, titled “Seismic Rehabilitation of Existing Buildings,” published by the American Society of Civil Engineers (ASCE), is the industry standard procedure for the seismic evaluation and retrofit of existing buildings. The primary objective of the Tier 1 screening is to evaluate and where necessary, reduce seismic risk efficiently where possible by using simplified procedures targeted to a specific building type. The information below forms the groundwork for this evaluation. This information is either derived from owner requirements, such as Risk Category and desired Structural Performance Level, or is site specific, such as Seismic Hazard Level.

Since the scope of work has changed since the existing structure does not meet the seismic resistance requirements for the Immediate Occupancy Structural Performance Level and would require extensive and unfeasible seismic retrofit work to reliably serve as an Essential Facility, the Basic Performance Objective for the existing building (BPOE) will be **Life Safety Structural Performance Level (S-3)** instead of Immediate Occupancy Performance Level as originally intended



## **II. EXISTING OFFICE BUILDING DATA**

### **A. Documentation provided:**

1. Architectural Drawings: Office building and parking building by Arq. Fernando R. Díaz and Eng. Raul Colón, P.E., Plans and Elevations, sheets 1 to 150. Year 2007. Included in the architectural drawings set are the electrical, mechanical and structural drawings. **Structural drawings, plans and details** by Eng. Arturo Beale, P.E. Sheets S-1 to S-21 (23 pages total) Year 2007
2. Geotechnical Reports: Original soils report not provided, a new soils report was performed by **GMTS**, Report No. G221554A dated June 1<sup>st</sup>, 2022.
3. As-built performed by **Bersa Group Architects**, illustrating floor plans dimensions and reflected ceilings for each level.
4. Field Studies Report LR-2022-40, Project No. G221554B by GMTS and SPEC GROUP dated June 30<sup>th</sup>, 2022.

### **B. Building Data:**

Total Square footage: 60,075 square feet

Building Width: 99'- 3"

Building Length: 110'- 4"

Building Height: 75'- 0"

Story Height: 15'- 0" first level and 12'- 0" next 5 levels

Number of Stories above grade: 6

Number of basement Stories below grade: 0

Year of Construction: 2008 -2009

Building Codes: 1987 Uniform Building Code and ACI 318-95 (as shown in structural notes specification for concrete Note No. 12, page S-21)

**C. Site Location Coordinates:** Latitude and Longitude 18.3836778, -66.0658617  
(Google Earth)

**D. Risk Category:** Risk Category II

**E. Basic Performance Objective for the existing buildings (BPOE):**

Life Safety Structural Performance Level (S-3)

**F. Level of Seismicity:** High

**G. Soil Type:** Site Class D

**H. Lateral force Resisting System as per ASCE 41 Building Type:**

**Longitudinal Direction:** C2 - Concrete Shear Walls with Rigid Diaphragm,

**Transverse Direction:** C2 - Concrete Shear Walls with Rigid Diaphragm,

### **III. BUILDING DESCRIPTION:**

The gravity load structural system consists of one-way reinforced concrete slabs framing into reinforced concrete beams. These beams are supported by reinforced concrete girders or reinforced concrete columns. When supported by girders, these girders are then supported by columns or exterior spandrel reinforced concrete beams. The typical floor diaphragms, including the roof level, consist of 5" thick reinforced concrete slabs, except in the ground level where the reinforced concrete slabs are 7" thick.

The lateral load system consists of reinforced concrete shear walls in the interior and exterior of the building (interior shear walls with openings and deep spandrel beams). These shear walls include the stairs core located in the interior of the building, between Axis 5 and Axis 3. The reinforced concrete floor slabs serve as horizontal diaphragms to transfer load to the interior and exterior shear walls. There are several lines of concrete frames located in the transverse direction, Axis A, Axis D and Axis H and one line in the longitudinal direction, Axis 1.

**The concrete frames are secondary components and were not designed to be part of the seismic force-resisting system. These are basic structural frames that were designed for gravity loads only.**

The columns and shear walls are supported on reinforced concrete piles caps supported by 12" square precast piles with a load capacity of 110 tons each as shown in the structural drawings provided. Most of the pile caps are tied in both directions by reinforced concrete tie beams. These tie beams support the 7" thick reinforced concrete ground level slab.

#### **IV. PERFORMANCE OBJECTIVE:**

Building performance can be described in terms of safety to the building occupants during and after a seismic event, the cost and viability of repairing the building to its pre-earthquake state and its economic and social impacts in its community. The extent of damage to a building is categorized as Building Performance Level. The ASCE 41 code presents a range of target building performance levels that must be determined when selecting a rehabilitation objective. This rehabilitation objective will determine the cost and feasibility of the rehabilitation project as well as the benefits obtained by improving the safety, reduction of property loss and interruption of use after a seismic event.

The performance objective consists of one or more pairings of a selected Seismic Hazard Level with a target Structural Performance Level and Nonstructural Performance Level. The Basic Performance Objective for Existing Buildings (BPOE) is a specific, seismic performance objective (from several available choices) and is dependent on the **risk category** of the building and the desired **seismic performance** expected by the owner. The performance objective for existing buildings is a slightly lower category which may result in a lower level of safety and a higher probability of collapse than what may be provided by building codes for new buildings. Buildings meeting the BPOE are expected to incur very little damage from relatively frequent, small to moderate earthquakes but are expected to sustain greater levels of damage and economic loss from severe earthquakes. The **level of damage and potential economic loss** for buildings rehabilitated to the BPOE will be greater than expected for the Basic Performance Objective for New Buildings (BPON).

The structure under evaluation must conform to the **Life Safety Structural Performance Level**. Life Safety structural performance level as defined by the ASCE 41, as the post-earthquake damage state in which the structure has damaged components but retains a margin against the beginning of partial or total collapse. A structure in compliance with the acceptance criteria specified in the ASCE 41 standard for this Structural Performance Level is expected to achieve this state.

For the evaluation of this structure we are enhancing the rehabilitation objective, BSE-1E, to BSE- 2N, thus exceeding the basic safety objective. By using a building performance objective as for a new building (BPON) with an earthquake hazard level of **BSE-2N (Basic Safety Earthquake of 2% in 50 yrs)** based on ASCE 7, we can considerably extend its useful life. We must call attention that the existing building under evaluation is a fairly new building structure that has never been utilized, with only 12 years since been constructed.

## **V. CARIBE PLAZA OFFICE BUILDING - SEISMIC PARAMETERS ASCE 7 and IBC 2018**

**Risk Category = II**

**Seismic Importance Factor  $I_e = 1.0$**

IBC Chapter 16, Section 1613 Earthquake Loads

**Site Class** (as per section 1613.3.2) consider **Site Class D**

**Site Coefficients** -  $S_s$  and  $S_1$  from 0.2 and 1-second spectral response accelerations, respectively

$$S_s = 0.98$$

$$S_1 = 0.39$$

Per Section 1613.3.3 and Tables 1613.3.3(1) and 1613.3.3(2)

$$F_v = 1.91$$

$$F_a = 1.108$$

$$S_{MS} = F_a * S_s = 1.108 * 0.98 = 1.086$$

$$S_{M1} = F_v * S_1 = 1.91 * 0.39 = 0.745$$

$$S_{DS} = 2/3 S_{MS} = 0.724$$

$$S_{D1} = 2/3 S_{M1} = 0.496$$

**Seismic Design Category D** - Since  $0.50g \leq S_{DS}$  and  $0.20g \leq S_{D1}$  (As per Table 1613.3.5(1) and 1613.3.5(2) Seismic Design Category, ICB)

**Soil Type D** - From soils investigation performed on June 1<sup>st</sup>, 2022 Report No. G221554A

### **Per ASCE 7-10 Table 12.2-1 Building Frame Systems**

B5 - Special Reinforced Concrete Shear Walls:

$$R = 6$$

$$\Omega_0 = 2.5$$

$C_d = 5.0$  Height limit for Seismic Category D  $\leq 160$  ft (OK)

B6 - Ordinary Reinforced Concrete Shear Walls:

$$R = 5$$

$$\Omega_0 = 2.5$$



**$C_d = 4.5$  NOT PERMITTED for Seismic Category D**

**Equivalent Lateral Load ASCE 7 12.8**

$T_a = 0.510$  where  $T = C_1 * H^X$  then  $T = .02 * H^{0.75}$

$H = 75' - 0"$ ,  $C_1 = 0.02$  and  $X = 0.75$

$T_L = 12$   $T_a < T_L$

$C_s = S_{DS} / (R/I_e) \leq C_{smax}$  where  $C_{smax} = S_{D1}/T*(R/I_e)$

$C_s = 0.121$  for  $S_{DS} = 0.724$ ,  $R = 6$  and  $I_e = 1.0$

$C_s \leq C_{smax} = 0.162$

$C_{smin} = .044 S_{DS} * I = 0.0318$

$C_{smin} = 0.032$

**Use  $C_s = 0.121$**

## **VI. BUILDING TYPE & CHECKLISTS AS PER ASCE 41:**

The building is primarily classified as **Building Type C2: Concrete Shear Wall with Stiff Diaphragm**. A Tier 1 Evaluation of this building types involved completing the following checklists:

- A. 16.17 Nonstructural Checklist
- B. 1610 Life Safety Structural Checklist for Building Type C2
- C. 16.1 Basic Configuration Checklist.

Please refer to **Appendix B** for the completed checklists. The comments next to each item provide a brief explanation of the building features that make it **Compliant** or **Not Compliant**.

## **VII. CONDITION ASSESMENT OF THE EXISTING STRUCTURE:**

In addition to the assessment for the existing building using ASCE 41 guidelines and requirements, this evaluation required the following additional studies to be able to define the scope of the required seismic analysis and retrofit, if feasible:

A. As-built drawings to provide information on building configuration and dimensions, several structural elements cross dimensions, were provided by **Bersa Group Architects**. There is still some information that needs to be verified like the depth of some spandrel beams between the shear walls, since they were covered by the ceiling tiles.

B. The visual surveys confirmed that the building construction; spans, structural elements locations and dimensions, generally conforms to the information provided on the structural drawings provided. There is a wall in the as-built drawings marked as a reinforced concrete wall but it is a cement block partition wall. This wall is located in Axis A between Axis 7 and Axis 6, from the 3<sup>rd</sup> Level to the 6<sup>th</sup> Level. There is a spandrel beam in that location but no reinforced concrete wall.

We inspected the existing building to be able to evaluate the overall condition of the structure. After several site visits we were able to observed several structural elements with signs of distress and/or deterioration. The most significant ones are the fissures through the length of the construction joint, all along Axis 8, between the parking structure and the office building structure. These fissures are observed in every level of the structure. Also fissures in several structural members were noticed. No signs of corrosion of the steel reinforcement were seen during our site visits. Please refer to **Appendix A** were these items and other conditions that might cause further disrepair if not addressed are illustrated. The procedures for the repair of the fissures encountered in several structural members especially the fissures along Axis 8 are presented in **Appendix F**.

C. Since no soils report was provided, a soil investigation was performed to determine the Site Class Type and the presence of any geological site hazards like liquefaction, fault ruptures or any slopes instability. The capacity of the 12" square precast piles including its lateral seismic load capacity, the passive earth resistance at the pile cap, if any, and any load-deformation characteristics of the soils was also determined. The soils study report findings are presented in Part IX of this report.

D. An investigative field study for the verification of existing conditions like the existing concrete compressive strength and the existing reinforcement spacing and areas in several existing member was performed on June 2022. The most significant findings presented in this report are listed below:

1. Compressive strength of several RC columns was determined. The value obtained from the cores extracted from the several structural members from the 1<sup>st</sup> Level only. The compressive strength values varied from 2,930 psi to 5,270 psi with an average of 3,690 psi. The concrete compressive values specified on structural drawings provided was 3,000 psi for all structural members.
2. The verification of existing reinforcing steel, including the steel spacing, reinforcing steel area and location in several structural members was measured using a Hilti Scan Ferro Scan PS 300 and a Ground Penetration Radar Hilti PS 1000 GPR. Even though several members investigated had the same steel reinforcement as shown in the structural drawings details, there were others members that the steel verified on field was less than the one specified on the structural drawings. We must verify these beams and girders at the third level to corroborate the findings and decide if strengthening of the existing beams is required. These beams are identified as GB-3, GB-4, BM-1, and BM-1B and BM 3-B on the structural drawings on the second level framing plan.
3. The steel reinforcement on several of the existing cement block partition walls was not located. Further investigation must be done to determine if the cement block partitions wall were reinforced properly. We are recommending the removal of all the interior partition walls built using cement mortar blocs. The ones that have to remain like the partition walls located at the restroom area must be reinforced and strengthened if they are to remain in the existing building structure.

### **VIII. STRUCTURAL DEFICIENCIES:**

The structural deficiencies identified in this study are as follows:

1. Adjacent Buildings: The 1-1/2" expansion joint between the story garage building and the office building tower may not be large enough to accommodate expected deflections. The minimum separation of the building at any level should be .004 the height at that level under consideration, at least 2" at the fifth level of the office building, to avoid pounding between the buildings. The expansion joint as detailed in the structural drawings doesn't allow for any movement of the existing reinforced concrete slab to properly behave like a seismic joint.(7.2.13 ASCE 41)
2. Uplift at Pile Caps: There is no means to determine if the precast pile reinforcement was anchored into the pile caps properly (is not shown in all foundation details provided in the structural drawings). No reinforcing steel shop drawings were provided or available for us.
3. There are several openings located in the longitudinal shear walls and in the transverse shear walls, deep couple beams are connecting the shear walls.
4. No Stirrups provided in column-beam joints, no details shown in structural drawings. They are extremely difficult to corroborate on site. Beam-column joints are a critical zone in reinforced concrete frames, they should be designed and detailed to provide sufficient ultimate strength and deformation capacity.

Additional items that can potentially affect the seismic capacity of the structure after the structural drawings were reviewed:

1. Compressive strength of 3,000 psi was specified for all structural members; slabs, columns, shear walls, beams, girders, pile caps and tie beams. The compressive strength is well below the compressive strength that will be required for the shear wall elements subjected to seismic loading. Furthermore IBC requires minimum compressive strength of **4,000 psi** for pile caps and tie beams when precast piles are employed. (IBC Table 1808.8.1)
2. No lateral capacity for the 12" precast concrete piles is specified in the structural drawings.



3. In several beams and girders there is no end hooks provided for the longitudinal bottom reinforcement. The stirrups some beam sections are U shaped stirrups.
4. Several structural sections were not detailed for the ductile performance required to accommodate expected building drifts from the current design magnitude earthquake.( Spacing of stirrups, reinforcement in beam-column joints, longitudinal reinforcement anchorage to supporting columns)
5. Several beam-column joints have eccentricity since the centerline of the beam is not located within the width of the column and the beam longitudinal reinforcement passes outside the column core (as defined by the boundaries of the column longitudinal reinforcement).
6. Reinforced concrete **columns A-7 and B-7, height approximately 25 feet** are not laterally restrained.
7. Additional loads on the roof slab produced by the green roof weight and the weight of the concrete planters. **Existing green roof must be removed from the roof level as well as all precast planters.**
8. Drainage of roof slab must be verified. The architect must determine if there is enough drainage openings provided in this level. This item does not affect the seismic capacity of the structure but must be addresses to prevent deterioration of the roof concrete slab.

## **IX. GEOLOGIC SITE HAZARDS AND FOUNDATION DEFICIENCIES:**

1. Ties between Foundation Elements: There are ties between pile caps, which would prevent differential settlement but some pile caps are not tied in both directions, along Axis 7 and Axis H.
2. Fault Rupture: Near Basis: Geotechnical Investigation Report by GMTS performed on June 1<sup>st</sup>, 2022.
3. Liquefaction: None Basis: Geotechnical Investigation Report by GMTS performed on June 1<sup>st</sup>, 2022.
4. Landslide: Low Basis: Geotechnical Investigation Report by GMTS performed on June 1<sup>st</sup>, 2022.
5. Load capacity including the lateral capacity for the existing 12” square precast piles: varies 7-10 kips/pile. Basis: Geotechnical Investigation Report by GMTS performed on June 1<sup>st</sup>, 2022. The lateral capacity for the precast piles depends on spacing of piles, pile stiffness and assumed pile top deflections. **Very important note: There is no economical feasible method for increasing the lateral capacity of the existing precast piles.**

## **X. NONSTRUCTURAL DEFICIENCIES:**

The existing building has a small number of non-structural deficiencies because the building is going to be completely renovated, including mechanical and electrical equipment, ceilings tiles, windows and new partitions walls. We have not indicated deficiencies related to those items that will be replaced or installed; an assessment of these systems was beyond the scope of this report. The following items must be corroborating on the field are:

**A.** The connection of the existing precast panels to the existing spandrel beams. As shown per structural drawings these panels are attached to the concrete frame using #4 @ 12" dowels inserted on the spandrel concrete beams. These relatively rigid concrete panels might be considered a falling hazard during a seismic event if not anchored properly to the structure.

**B.** The existing cement mortar block partition walls should be verified to detect the vertical and horizontal reinforcement and its attachment to the structure. Since these partitions walls are taller than 8 feet in height and longer than 12 feet, they must have a reinforced concrete beam at mid height and a column every 12 feet as specified in the structural notes (Masonry, Note No. 2). The site investigation performed could not find vertical reinforcement in the existing cement block partition walls studied. **We strongly recommend removing these cement block partitions walls. Only the partitions walls located in the restrooms areas will remain if the site investigation shows they were properly reinforced and anchored properly to the structure, if not, they need to be properly reinforced and strengthened.**

## **IX. CONCLUSIONS:**

Following the ASCE 41 Standards, we performed additional analysis for the further evaluation of all the potential deficiencies identified in the Tier I Checklist (denoted by either “Noncompliant” or “Unknown” responses in the Tier I checklist). The additional analysis and evaluation of each potential deficiency shall be sufficient to either confirm the deficiency or demonstrate the adequacy of the structure as it relates to the potential deficiency.

We executed a structural modeling of the existing building structure using ETABS computer modeling software. From the three-dimensional modeling we analyze all the possible deficiencies identified in this ASCE 41 Tier 1 study and our observations from the structural drawings provided. This more detailed investigation provided the numerical results identifying how overstressed the critical elements of the building are and the actual drifts that the existing structure is subjected to under lateral seismic loadings. Once the results were obtained for each load combination under study, we examined and revised each critical element. **Please refer to Appendix D.** Our findings are summarized below:

**A.** We were able to determine the maximum story drift and the total displacements of each level under several seismic loading combinations. The drifts values obtained are within the requirements specified on the ASCE 7-16 Code for the allowable story drifts. The allowable drift limits placed by ASCE 7-16, shown in Table 12.12.1.1., are functions of the risk category and type of seismic forces resisting system. The maximum drift for allowed for this type of structure with a Risk Category II, is **2.88”**. **The maximum drift obtained was approximately 0.086 inches, well below the maximum allowable drift. The total deflection of the existing building structure was approximately 0.45 inches.** We must mentioned that the final drift values were obtained once we added two new 12” thick reinforced concrete shear walls, one at Axis a between Axis 7 and Axis 6 and the second shear wall at Axis 7 between Axis A and Axis B, thus providing lateral stability to the existing corner reinforced concrete column at Axis A-7 and Axis B-7 which resulted in lowering the drift and deflection in the second level within acceptable limits.

**B.** The actual shear stresses and overturning moments for each shear wall of the structure was obtained. From these results we calculated the required reinforcing steel and compare it to the existing steel provided in each shear wall. **From this analysis results we were able to determine that several of the shear walls required more reinforcing steel.** This situation occurs mainly in several shear walls located in the first level of the structure with the exception of Shear Wall F, which needs to be reinforced from the ground level to the roof level.

C. Several reinforced concrete spandrel beams located between the shear walls are under reinforced. This mainly occurs in the first 3 levels of the building structure. Details are provided for the strengthening of these spandrel beams. Furthermore the shear capacity of several girders needs to be increased. The structural drawings provided indicated the shear reinforcement to be provided in these areas but the scans performed during the site investigation were not done in these critical locations. We must verify on site to be able to determine if additional reinforcement is needed in order to provide the required shear reinforcement.

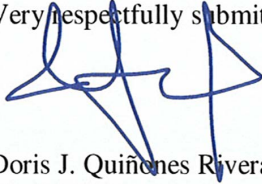
The rehabilitation plans are presented in **Appendix E** included in this report as well as the repair procedures for the existing building structure. The technical information of the repair products to be used in the rehabilitation is also included.



**XIII. CLOSING:**

If there is any subject about this report that you may deem proper for us to clarify, please do not be reluctant to contact us, and we will gladly address the same.

Very respectfully submitted,

A handwritten signature in blue ink, appearing to read 'Doris J. Quiñones Rivera'.

Doris J. Quiñones Rivera, MSCE, PE  
Lic # 17074

The evaluation, findings, conclusions and recommendations outlined in this report were based on limited information. No other warranty, expressed or implied, is made as to the professional advice in this report. This report has been prepared for exclusive use of the **Bersa Group, PSC**, and may not be used by any other individual or entity without the express written approval of Doris Quiñones-Rivera, MSCE, PE.

**APPENDIX A**  
**PHOTOGRAPHS**

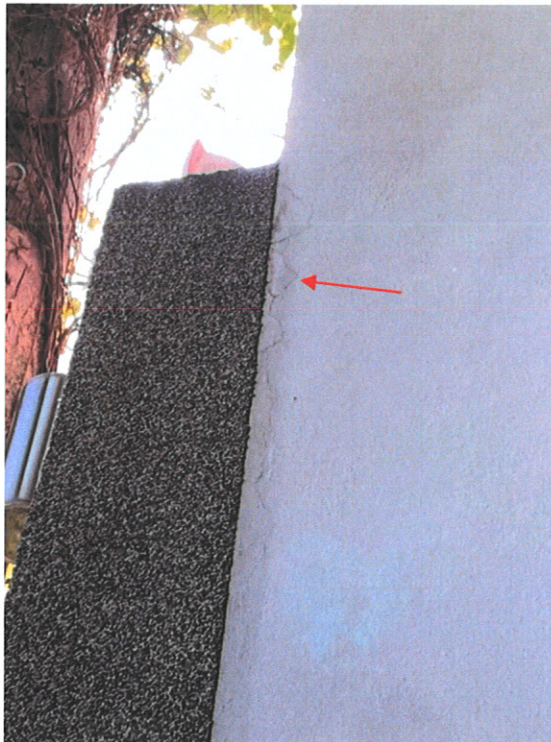


**911 Office Center Building**





**Photograph No. 1 - Frontal Facade along Ponce De Leon Avenue**

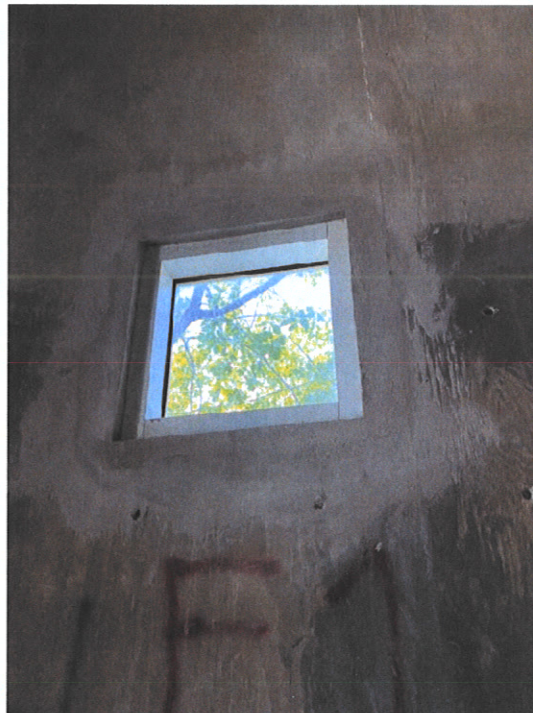


**Photograph No. 2 - Exterior reinforced concrete parapet arch against R/C columns, fissures shown along interface**





**Photograph No. 3 – Reinforced concrete Columns Axis E-6 at Ground Level**

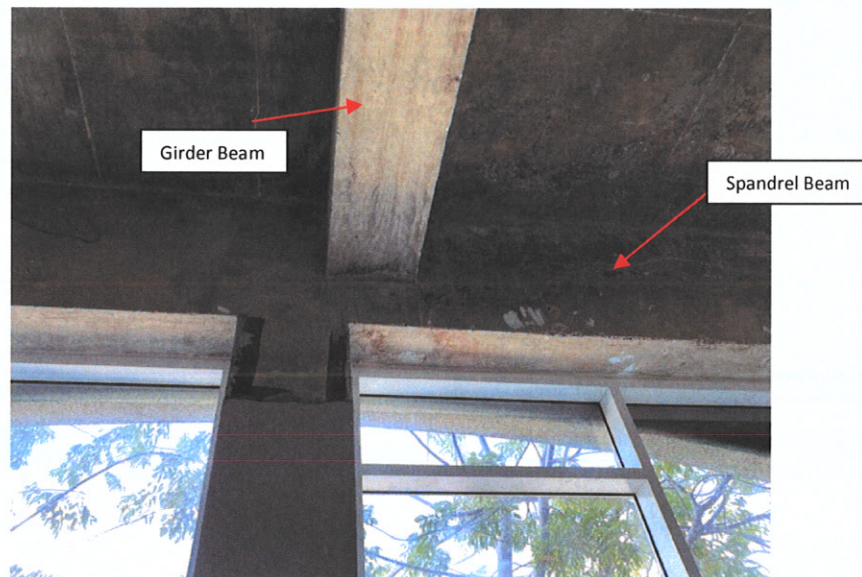


**Photograph No. 4 - Axis H between Axis 3 and Axis 2 Ground Level, opening for window was bigger than window, plaster to fill the gap, occurs in several levels**



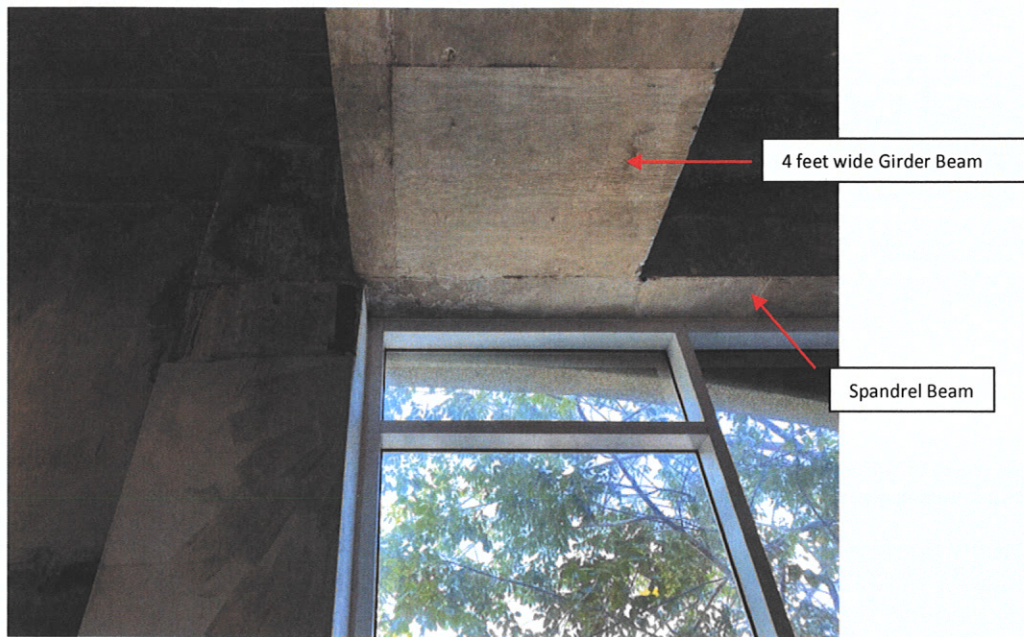


**Photograph No. 5 -Typical reinforced concrete girder supporting reinforced concrete beam, Axis 5' between Axis F and Axis H**



**Photograph No. 6 – The reinforced concrete girders along Axis 5' and Axis 3' rest on the spandrel beam located in Axis H and columns in Axis F. This condition also occurs in the girders along Axis A and C**





**Photograph No. 7- Girder beam along Axis 3', between Axis F and Axis H, supports the maximum amount of dead and live loads of the building structure, it only occurs in the first level, and it supported by the spandrel beam on Axis H and an interior column. This girder type occurs also in Axis G between Axis 3 and Axis 1**



**Photograph No. 8 – Construction joint showing debris between concrete pours**



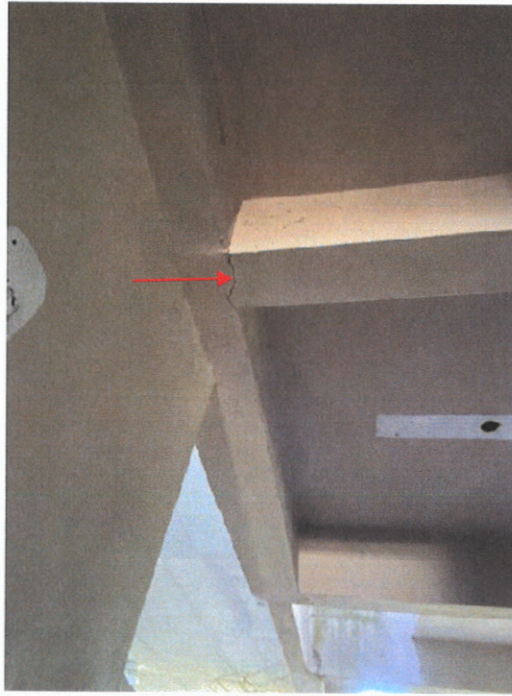


**Photograph No. 9 – Fissure along Axis 8 where there is supposedly a construction joint.**



**Photograph No. 10 – Fissures were found along the construction joint, at Axis 8, in every level**





**Photograph No. 11- The underside of slab along the construction joint at Axis 8**

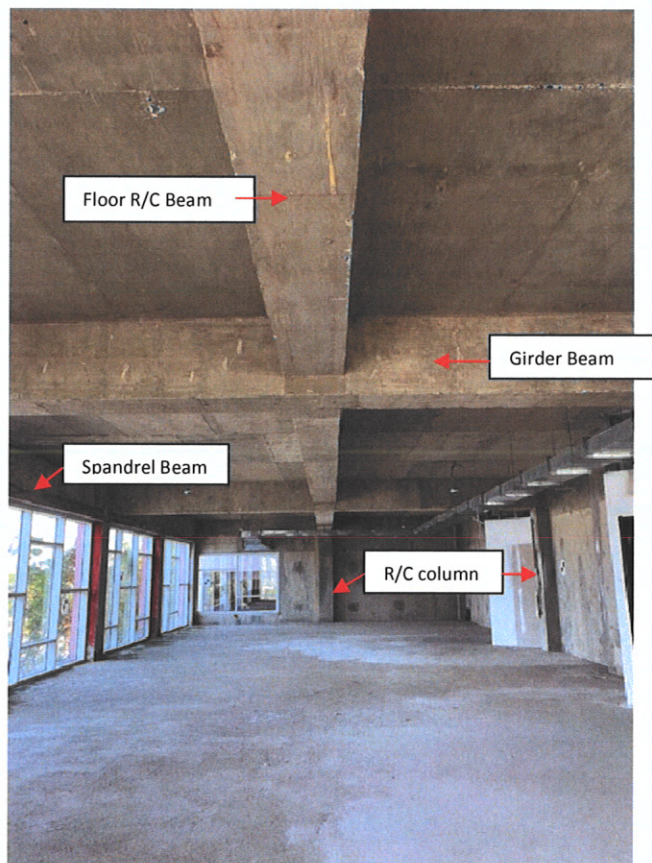


**Photograph No. 12- Fissures along the connection between the reinforced concrete parapet and the parking building reinforced concrete parapet**



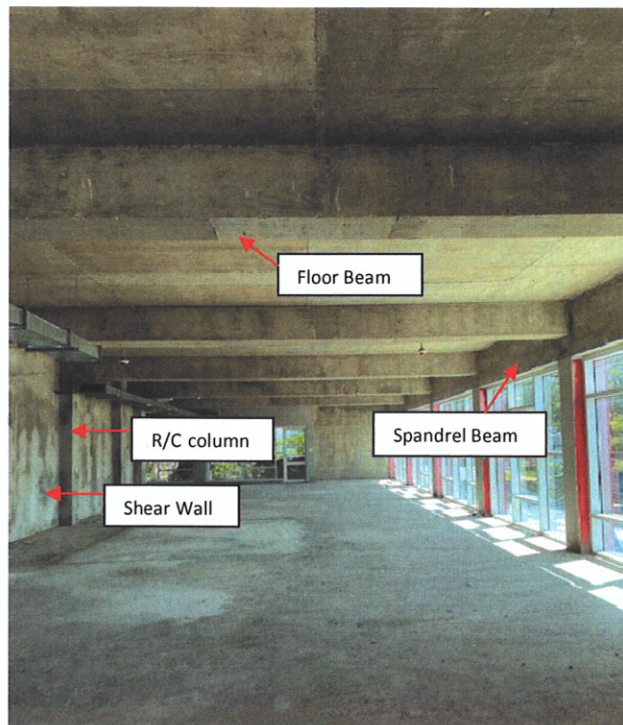


**Photograph No. 13 – Fissures radiating from the corners of the window opening located in the Shear Wall**

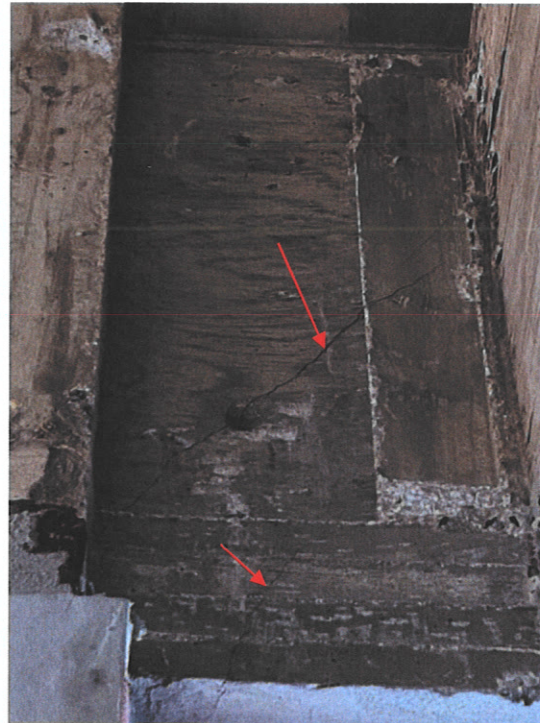


**Photograph No. 14 – Typical level framing plan, between Axis H and Axis F and also between Axis A and Axis C; reinforced concrete slab supported on reinforced concrete beams, which are then supported on reinforced concrete girders.**





**Photograph No. 15 – Structural level framing showing reinforced concrete slab supported on reinforced concrete beams which are then supported on reinforced concrete columns and shear walls.**

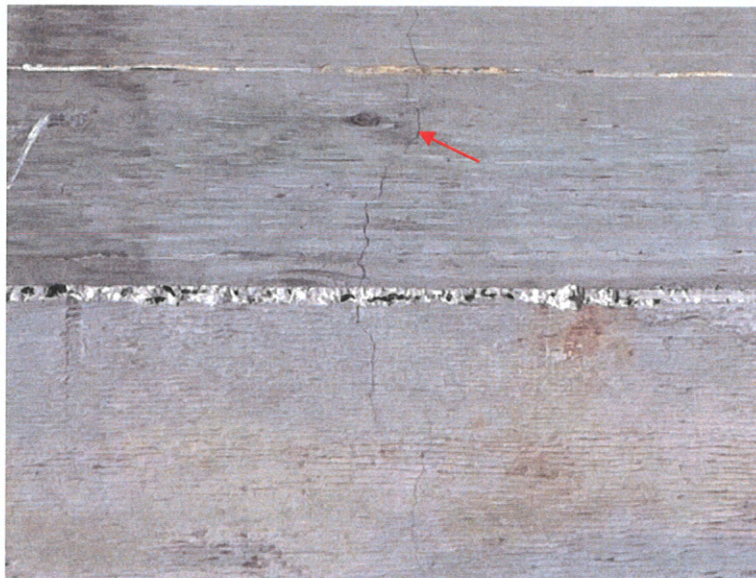


**Photograph No. 16 - Fissures in R/C Spandrel Beam located at Fourth Level, Axis H, between Axis 3 and Axis 4. These fissures are found almost in the same location in every spandrel beam**



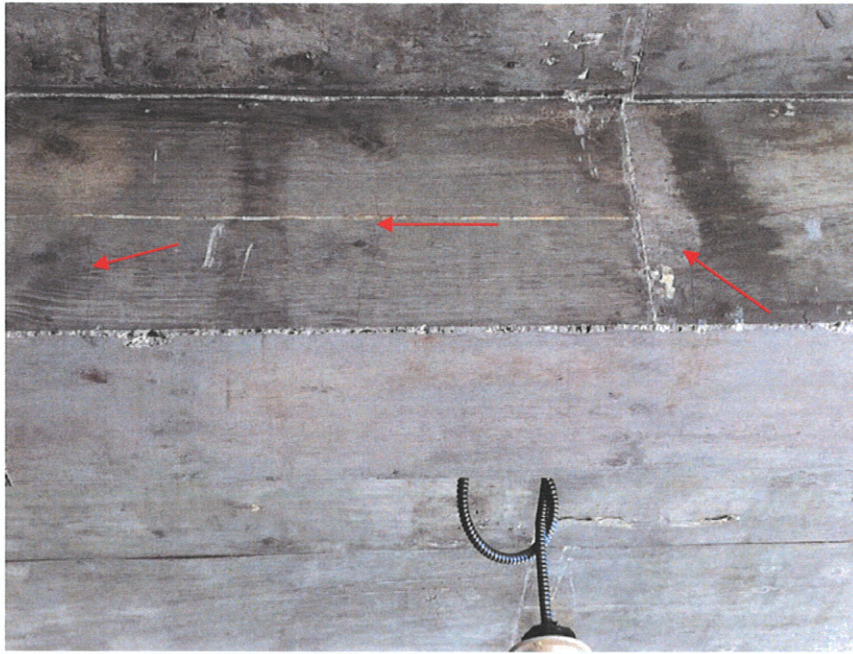


**Photograph No. 17- Repaired reinforced concrete column**



**Photograph No. 18 – Fissures in r/c beam**





**Photograph No. 19 - Typical fissures found in several reinforced concrete beams, the fissures are located at midspan (flexure type fissures). These fissures were found mostly in the upper floors**

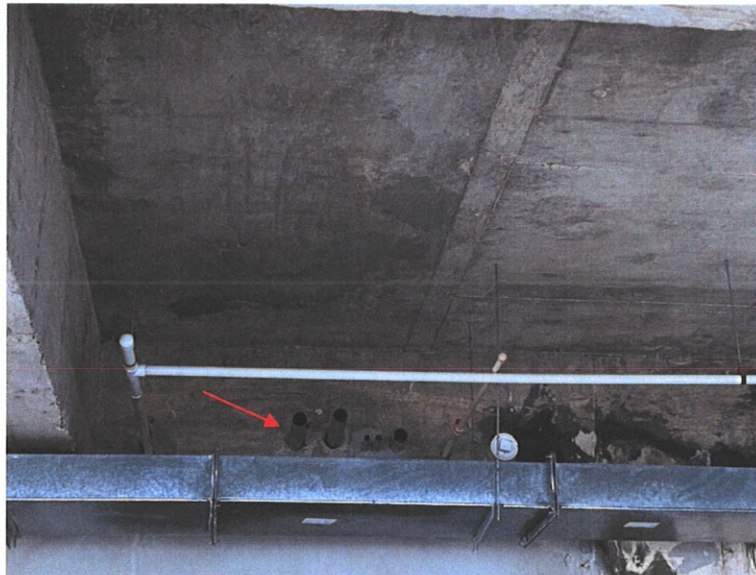


**Photograph No. 20 - Opening through the reinforced concrete slab**



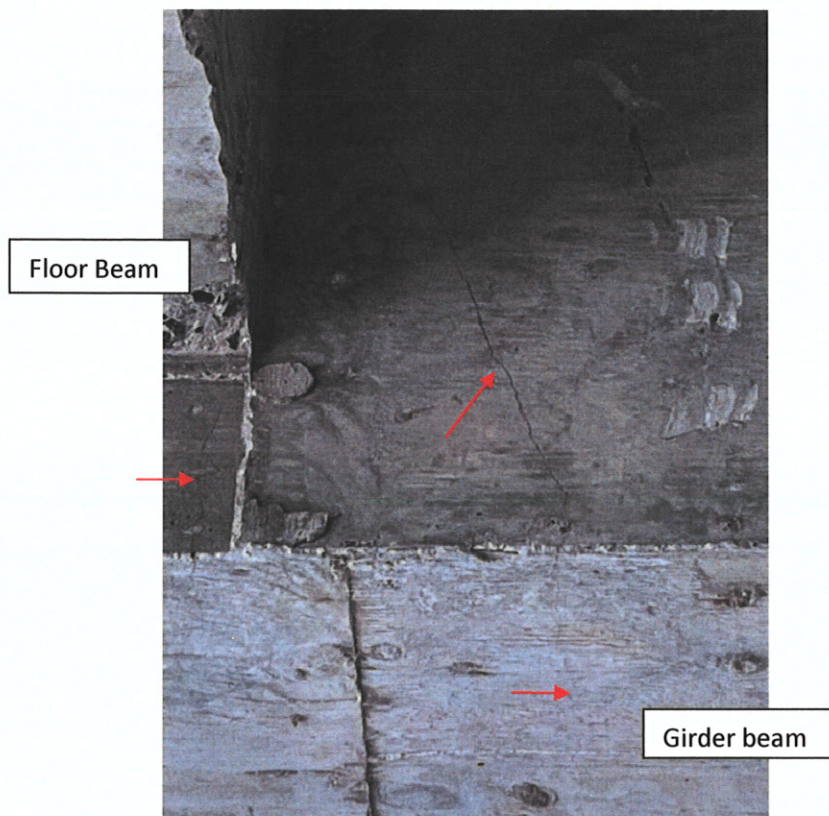


**Photograph No. 21 – Another column that was repaired**

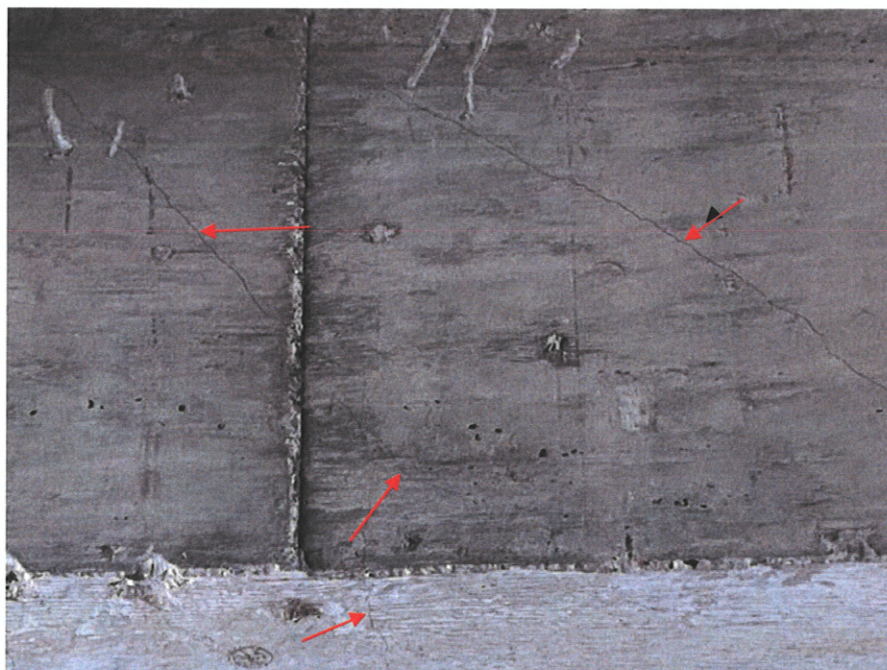


**Photograph No. 22 – In the reinforced concrete deep beams between the shear walls we encountered pipes and electrical conduits going through. Some places are more congested with pipes/conduits than others**





**Photograph No. 23 – Fissures found in the girders beams, near the location where they support the floor beams**



**Photograph No. 24 – Another girder beam with fissures along its depth**



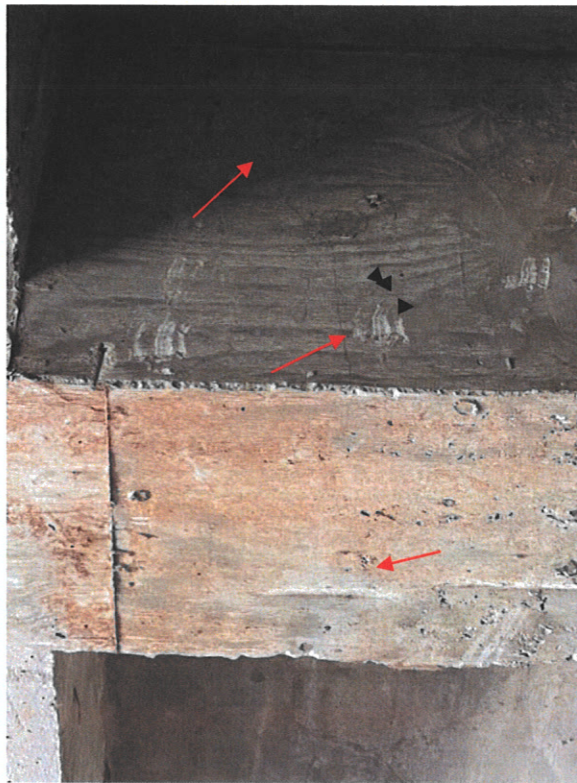


**Photograph No. 25 – This exterior cement block partition wall was shown in the structural drawings as a reinforced concrete shear wall**



**Photograph No. 26 – This reinforced concrete column was repaired?? Most likely it was not poured properly when concrete was placed, creating voids in the structural member**





**Photograph No. 27 – Typical fissure found in several reinforced concrete beams, near their supports**



**Photograph No. 28 – A hole was found in the slab topping, approximately 2-1/2" of topping was used to level floors in that area, could be more**





**Photograph No. 29 – A closeup of picture 16 illustrating the fissures in the spandrel beam that support the girder beams, near its support to the column.**

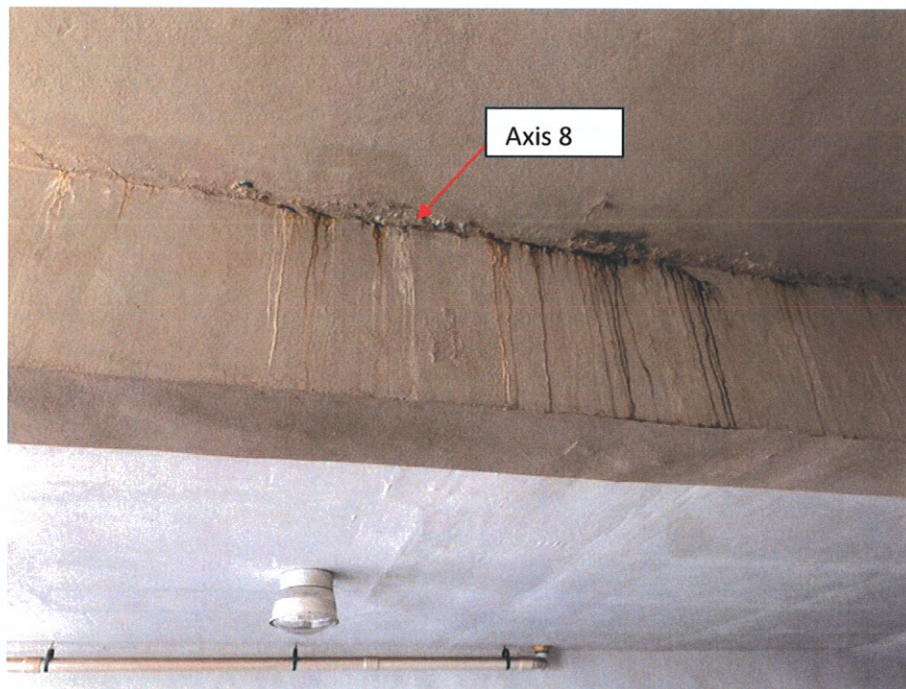


**Photograph No. 30- Concentration of pipes and conduits at a reinforced concrete beam between the shear walls Axis F. The ACI 318 building code requires a minimum spacing between pipes or conduits at 3 times the diameter of the pipe**





**Photograph No. 31 - Mortar placed to cover some deficiency in the existing reinforced concrete beam, this occurs at the Fourth Level, Axis D -3**



**Photograph No. 32 - Underside of the construction joint at Axis 8**





**Photograph No. 33 – Crack in parapet beam in exterior stairs area, where the construction joint is located**

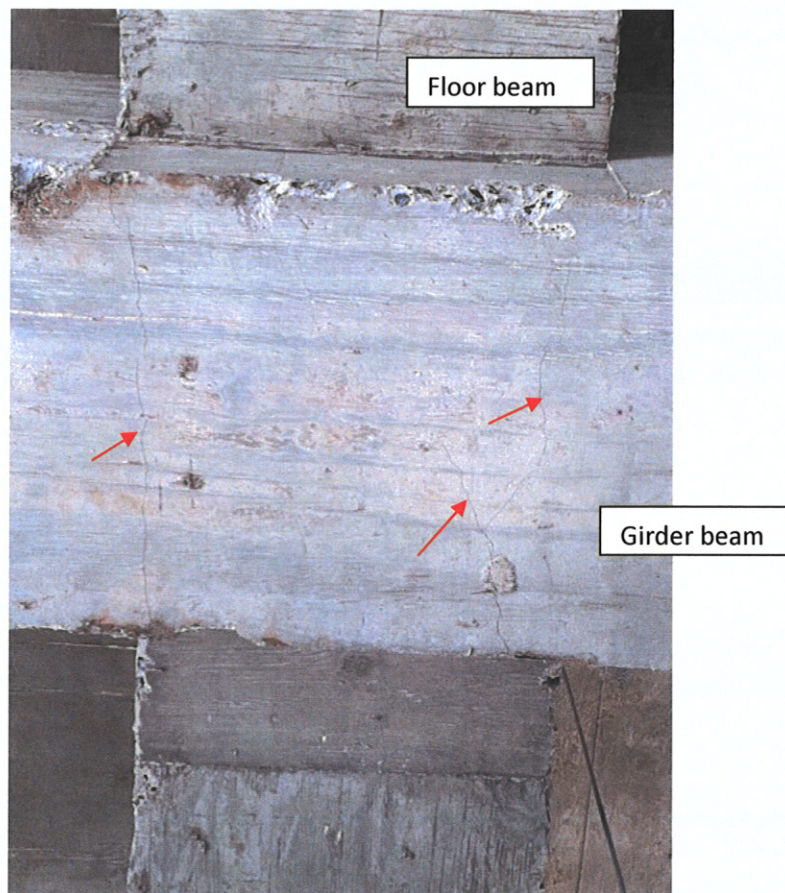


**Photograph No. 34 – This opening for the A/C ducts in this beam occurs in every level , at Axis 7, between Axis G and Axis H. The strucutral drawings indicated a shear wall in this Axis**



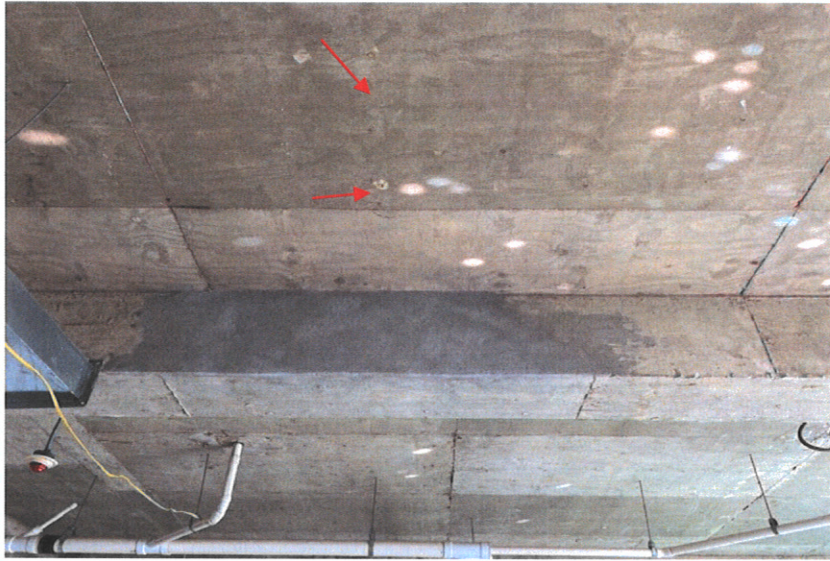


**Photograph No. 35 – Drainage pipe at roof level, opening in the slab was poorly done after slab was already poured**



**Photograph No. 36- Fissures in the girder beam , where the floor beam supports**





**Photograph No. 37 – Fissures in the underneath the roof slab. The fissures observed in the slab elements where found only in this level**



**Photograph No. 38 - Fissure in the reinforced concrete beam near its support.**

## **APPENDIX B**

### **TIER 1 EVALUATION CHECKLISTS**

#### **16.1 Basic Configuration Checklist**

#### **16.10 Life Safety Checklist for Building Type C2: Concrete Shear Walls with Stiff Diaphragms**

#### **16.17 Nonstructural Checklist**



EXISTING CARIBE PULL OFFICE BLDG/ BERSA GROUP DATE MAY 12 2022

DETERMINE WEIGHT OF STRUCTURE :

$$\text{TYPICAL FLOOR AREA : } \underset{W}{92.25'} \times \underset{L}{108.5'} = 10,009 \text{ ft}^2$$

$$\text{AREA 2ND LEVEL : } 9575 \text{ ft}^2$$

WEIGHT ON SUBS :

2ND - 6 <sup>th</sup> SUBS <sup>11</sup>	62.5 PSF
ELECT & MECH	10 PSF
HUNG UP C.	5
PARTITIONS	10 PSF (ASSUMING ALL BRICK PARTITIONS WILL BE REMOVED & GYPSUM BOARD PARTITIONS WILL BE USED)
FLOOR FINISH & TOPPING (3" TOPPING SEEN IN SOME AREAS)	20 PSF

$$\text{WT } 107.5 \text{ PSF}$$

W<sub>ROOF</sub> (GREEN ROOF WILL BE REMOVED)

+ Avg 6 1/4" (DRAINAGE) (4 1/2" TO 8") (PER STRUCT. DRAWINGS)

80 PSF

15 PSF (MECH & ELECT)

5 PSF (HUNG UP CEILING)

$$\text{WT} = 100 \text{ PSF}$$

BEAMS - TRANSV DIRECTION : →

$$\text{AXIS (A) \& AXIS (H) } 2^{\text{ND}} \text{ LEV. } 4 \times 14' \times 2.56' \times 1.5' \times .15 \text{ K/FT}^3 = 33 \text{ K}$$

$$\text{3RD TO 6TH L. } 5 \times 14.0' \times 2.56' \times 0.83' \times .15 \text{ K/FT}^3 = 23 \text{ K}$$

$$\text{ROOF } 5 \times 14.0 \times 2.56 \times \underset{W}{1.5} \times .15 \text{ K/FT}^3 = 40 \text{ K}$$

$$\text{AXIS (B) \& AXIS (G) } 2^{\text{ND}} \text{ LEVEL } \underset{L}{76'} \times \underset{D}{1.56'} \times \underset{W}{1.5'} \times .15 \text{ K/FT}^3 = 26.67 = 27 \text{ K}$$

$$\text{3RD TO ROOF } 91.5 \times 1.56' \times 1.5' \times .15 \text{ K/FT}^3 = 32 \text{ K/L}$$

$$\text{AXIS (C) } 60' \times 1.56' \times 1.5' \times .15 \text{ K/FT}^3 = 21 \text{ K}$$

$$\text{AXIS (D) } 91.5 \times 1.56' \times 1.5' \times .15 \text{ K/FT}^3 = 32 \text{ K}$$

$$\text{AXIS (E) } 83.5' \times 1.56' \times 1.5' \times .15 \text{ K/FT}^3 = 29 \text{ K}$$

$$\text{AXIS (F) } 36.0' \times 41.0' \times 3.1' \times .15 \text{ K} = 67 \text{ K}$$

$$\text{F } 2^{\text{ND}} \text{ 3RD TO ROOF } 29.5 \times 1.56' \times 1.5' \times .15 \text{ K/FT}^3 = 10.5 \text{ K}$$

LONGITUDINAL BEAMS WEIGHT ↓

AXIS 4 (SECTION 4A/5-4) =  $110.38' \times 3.1' \times 15' / FT^3 = 77K$

2ND

AXIS 4 2ND TO 6 (9/5-5) =  $110.33 \times 2.56' \times .83' \times 15' / FT^3 = 36K$

ROOF

$110.33 \times 2.56' \times 1.5' \times 15' / FT^3 = 64K$   
(PARTIAL MASS BE REMOVE)  $110 \times 6.5 \times .5 \times 15' / FT^3 = 54K$

AXIS 3 & AXIS 5

2ND LEVEL (3/5-4)

$26.75' \times 2.08' \times 1.5' \times 15' / FT^3 \times 3 = 38K$   
 $(10) + 26.75' \times 3.1' \times 15' / FT^3 \times 1 = 68K$   
2ND LEVEL  $107 \times 2.08' \times 1.5' \times 15' / FT^3 = 50K$   
TO ROOF

2ND LEVEL AXIS 6 ONLY (1/5-4)

$1.56' \times 1.5' \times 98' \times 15' / FT^3 = 26K$

TRANSV →

WALL AXIS A

GROUND TO 2ND  
2ND TO 3RD

END TO ROOF

STAIRS CORRE: 1 TO 2ND  $66' \times .15K' \times .66' \times 15' = 98K$

2ND TO ROOF

$78.5K / L$

ELEVATION CORRE: 46' L / 9 TO 2ND

37K / L 2ND TO ROOF

WALL AXIS F

146.5

GR - 2ND

70K

2ND - ROOF

74K

WALL AXIS G

15.5' X 15' X .66' X 15' K

9 TO 2 23K

2ND TO R 18K

LONGITUDINAL

AXIS (5) & (3)

1 TO 2ND  
 2ND TO ROOF

$$\pm 42' \times 15' \times 0.66' \times .15 \text{ k/ft}^3 \times 2 = 125 \text{ k}$$

$$\times 12' = 100 \text{ k}$$

AXIS (4)

23 k 1 TO 2ND  
 18 k/L 2ND TO ROOF

AXIS (7)

$\pm 62' \times 15' \times 15' \times .15 \text{ k/ft}^3$   
 $\pm 62'$   
 $\pm 75'$

1 TO 2ND 70 k 1 TO 2

68 k/L 3RD TO ROOF

\* BLOCK PARTITION WALLS TO KITCHEN / BATHROOM AREAS - TO BE REINFORCED

$$\pm 65' \times .048 \times 12' = 38 \text{ k/L}$$

$$+ \text{AXIS A BETWEEN 7 \& 6} - 10' \times .048' \times 14' = 7 \text{ k/L 3RD - ROOF}$$

TOTAL



20 k roof S.C + WE = 32 k

100F 1000 +  
 6 1075 +  
 5 1075 +  
 4 1075 +  
 3 1075 + 723.5 = 1800 k  
 2 1030 + 203 + 421 + 70 + 23 + 125 + 23 + 70 + 38  
 2003

990 - 1990 k (PARTIALS)

1800 k

1800 k

1800 k

1800 k

STAIRS (7) (8) = 90 k LEVEL

AXIS

(W) 11,680 kips



FROM ASCE 41 - SECTION 4.5.2.2 ; (BASED ASCE 7' PARAMETERS) 2N-BSE

SPECTRAL ACCELERATION  $S_a$

$$S_a = S_{x5} / \beta_1 = 0.8152 \quad \beta_1 = 4 / 5.6 \ln \beta^{1.02}$$

$$= 1.086 / 0.8152$$

$S_a = 1.33$  FOR  $T_0 < T \leq T_s$   $T_s = S_{x1} / S_{x5} = 0.745 / 1.086$

$$0.137 < T \leq 0.686 \quad = 0.686$$

$S_a = S_{x5} / \beta_1$   $T_0 = 0.2 T_s$

$$= 1.33 \quad = 0.2 (0.686) = 0.137$$

$T = 1.002 (75)^{.75}$  WHERE  $H$  = HEIGHT OF STRUCT

$$= 0.61$$

BY EQTN 4.4 :

$$S_a = \frac{S_{x1}}{T} = \frac{0.745}{0.51} = 1.46$$

$$\leq S_{x5} = 1.086$$

$\therefore V_T = C S_a W$  EQTN 4-1 ASCE 41

$C = 1.0$  FOR SHEAR WALL STRUCTURES  $C_2$  WITH  $\geq 4$  STORIES

$V_T = 1.086 (111680)^K$  FOR 2N / FOR BSE-1N  $0.724W$   $\therefore S_a = \frac{S_{x1}}{T} = \frac{.497}{.51}$

$$= 12684 \text{ KIPS} \quad (2/3-2N) \quad = 0.973$$

$$\leq S_{x5}$$

VERIFY SHEAR STRESS IN SHEAR WALLS

AVERAGE SHEAR WALL STRESS :

$$V_j = \frac{1}{M_s} \left( \frac{V_j}{A_w} \right) \quad \text{EQTN 4-9}$$

$A_w = \Sigma$  OF HORIZONTAL CROSS SECTIONAL AREAS OF ALL SHEAR WALLS IN DIRECTION OF LOADING

$M_s = 4.0$  SYSTEM MODIFICATION FACTOR TABLE 4.9 - FOR LS

$$\rightarrow V_j = \frac{1}{4} \left( \frac{12684^K}{68} \right) \leq 100 \text{ psi OR } 2\sqrt{f'_c}$$

$$\leq 100 \text{ psi OR } 109 \text{ psi}$$

$$\rightarrow = 46.63 \frac{\text{psi}}{\text{ft}^2} \leq 109 \text{ psi OR } \uparrow 47.26 \text{ psi OK}$$

PSEUDO SEISMIC FORCE  $V_j$  EQ 4-2  $= 0.75 W / 68 \text{ ft}^2 = 12.88 \text{ psi} \geq 109 \text{ psi NG EQTN 4-2}$

SINCE  $M = 1.0$

Project Name 911 Office Building  
Project Number 2022-10

## ASCE 41-13 Tier 1 Checklists

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FIRM:	
PROJECT NAME:	911 Office Bldg (Former Caribe Plaza Office Building)
SEISMICITY LEVEL:	HIGH
PROJECT NUMBER:	2022-10
COMPLETED BY:	Doris J. Quiñones
DATE COMPLETED:	July 6th, 2022
REVIEWED BY:	
REVIEW DATE:	

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

## 16.1 Basic Checklist

### Very Low Seismicity

#### Structural Components

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	LOAD PATH: The structure shall contain a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)	Exception Frame at Axis 3 between Axis F and Axis H and Frame located at Axis F between Axis 3 and Axis 1. Also, r/c shear wall at Axis F between Axis 7 and Axis 6
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	WALL ANCHORAGE: Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	Cement blocks partitions wall must be check on site to verify anchoring to the structure . Assuming r/c wall are properly anchored by slab dowels as shown in structural drawings . We recommend the removal of all interior and exterior block partition walls.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

## 16.1.2LS Life Safety Basic Configuration Checklist

### Low Seismicity

### Building System

### General

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	LOAD PATH: The structure shall contain a complete, well-defined load path, including structural elements and connections, that serves to transfer the inertial forces associated with the mass of all elements of the building to the foundation. (Commentary: Sec. A.2.1.1. Tier 2: Sec. 5.4.1.1)	Exception Frame at Axis 3 between Axis F and Axis H and Frame located at Axis F between Axis 3 and Axis 1.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	ADJACENT BUILDINGS: The clear distance between the building being evaluated and any adjacent building is greater than 4% of the height of the shorter building. This statement need not apply for the following building types: W1, W1A, and W2. (Commentary: Sec. A.2.1.2. Tier 2: Sec. 5.4.1.2)	Separation between Office Bldg and Parking Structure is 1-1/2" less than 2" minimum required
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	MEZZANINES: Interior mezzanine levels are braced independently from the main structure or are anchored to the seismic-force-resisting elements of the main structure. (Commentary: Sec. A.2.1.3. Tier 2: Sec. 5.4.1.3)	No mezaanine levels found in the stucture
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown



**Building Configuration**

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	WEAK STORY: The sum of the shear strengths of the seismic-force-resisting system in any story in each direction is not less than 80% of the strength in the adjacent story above. (Commentary: Sec. A.2.2.2. Tier 2: Sec. 5.4.2.1)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	SOFT STORY: The stiffness of the seismic-force-resisting system in any story is not less than 70% of the seismic-force-resisting system stiffness in an adjacent story above or less than 80% of the average seismic-force-resisting system stiffness of the three stories above. (Commentary: Sec. A.2.2.3. Tier 2: Sec. 5.4.2.2)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	VERTICAL IRREGULARITIES: All vertical elements in the seismic-force-resisting system are continuous to the foundation. (Commentary: Sec. A.2.2.4. Tier 2: Sec. 5.4.2.3)	NC - One R/C shear wall stops at the second level, not continuous to the foundation level , at Axis F between Axis 7 and Axis 6.
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	GEOMETRY: There are no changes in the net horizontal dimension of the seismic-force-resisting system of more than 30% in a story relative to adjacent stories, excluding one-story penthouses and mezzanines. (Commentary: Sec. A.2.2.5. Tier 2: Sec. 5.4.2.4)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C <input checked="" type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	MASS: There is no change in effective mass more than 50% from one story to the next. Light roofs, penthouses, and mezzanines need not be considered. (Commentary: Sec. A.2.2.6. Tier 2: Sec. 5.4.2.5)	
C <input checked="" type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	TORSION: The estimated distance between the story center of mass and the story center of rigidity is less than 20% of the building width in either plan dimension. (Commentary: Sec. A.2.2.7. Tier 2: Sec. 5.4.2.6)	

#### Moderate Seismicity

#### Geologic Site Hazards

RATING				DESCRIPTION	COMMENTS
C <input checked="" type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 ft under the building. (Commentary: Sec. A.6.1.1. Tier 2: 5.4.3.1)	
C <input checked="" type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating any predicted movements without failure. (Commentary: Sec. A.6.1.2. Tier 2: 5.4.3.1)	

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C	NC	N/A	U	SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Commentary: Sec. A.6.1.3. Tier 2: 5.4.3.1)	As per Soils Study report perform by GMTS Report # G221554A dated June 2 2022, a near fault located withing 5 miles.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

### High Seismicity

#### Foundation Configuration

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	OVERTURNING: The ratio of the least horizontal dimension of the seismic-force-resisting system at the foundation level to the building height (base/height) is greater than $0.6S_a$ . (Commentary: Sec. A.6.2.1. Tier 2: Sec. 5.4.3.3)	
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	TIES BETWEEN FOUNDATION ELEMENTS: The foundation has ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Site Class A, B, or C. (Commentary: Sec. A.6.2.2. Tier 2: Sec. 5.4.3.4)	Some pile caps do not have tie beams in both directions, (Pile caps along Axis 7 , Axis A and Axis H).
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

Project Name 911 Office Building  
Project Number 2022-10

## ASCE 41-13 Tier 1 Checklists

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FIRM:	Doris Quiñones- Rivera, MSCE, PE / Structural Engineering Consultants
PROJECT NAME:	911 Office Bldg (Former Caribe Plaza Office Building)
SEISMICITY LEVEL:	Hlgh
PROJECT NUMBER:	2022-10
COMPLETED BY:	Doris Quiñones
DATE COMPLETED:	July 6th, 2022
REVIEWED BY:	
REVIEW DATE:	

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown



## 16.10LS Life Safety Structural Checklist for Building Types C2: Concrete Shear Walls with Stiff Diaphragms and C2A: Concrete Shear Walls with Flexible Diaphragms

### Low and Moderate Seismicity

#### Seismic-Force-Resisting System

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	COMPLETE FRAMES: Steel or concrete frames classified as secondary components form a complete vertical-load-carrying system. (Commentary: Sec. A.3.1.6.1. Tier 2: Sec. 5.5.2.5.1)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	REDUNDANCY: The number of lines of shear walls in each principal direction is greater than or equal to 2. (Commentary: Sec. A.3.2.1.1. Tier 2: Sec. 5.5.1.1)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	SHEAR STRESS CHECK: The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 4.5.3.3, is less than the greater of 100 lb/in. <sup>2</sup> or $2\sqrt{f_c}$ . (Commentary: Sec. A.3.2.2.1. Tier 2: Sec. 5.5.3.1.1)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	REINFORCING STEEL: The ratio of reinforcing steel area to gross concrete area is not less than 0.0012 in the vertical direction and 0.0020 in the horizontal direction. (Commentary: Sec. A.3.2.2.2. Tier 2: Sec. 5.5.3.1.3)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

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### Connections

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	WALL ANCHORAGE AT FLEXIBLE DIAPHRAGMS: Exterior concrete or masonry walls that are dependent on flexible diaphragms for lateral support are anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 4.5.3.7. (Commentary: Sec. A.5.1.1. Tier 2: Sec. 5.7.1.1)	No flexible diaphragms found in the structure
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	TRANSFER TO SHEAR WALLS: Diaphragms are connected for transfer of seismic forces to the shear walls. (Commentary: Sec. A.5.2.1. Tier 2: Sec. 5.7.2)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	FOUNDATION DOWELS: Wall reinforcement is doweled into the foundation with vertical bars equal in size and spacing to the vertical wall reinforcing immediately above the foundation. (Commentary: Sec. A.5.3.5. Tier 2: Sec. 5.7.3.4)	As shown in structural drawings , can not be verified on site.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

### High Seismicity

#### Seismic-Force-Resisting System

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	DEFLECTION COMPATIBILITY: Secondary components have the shear capacity to develop the flexural strength of the components. (Commentary: Sec. A.3.1.6.2. Tier 2: Sec. 5.5.2.5.2)	Longitudinal beams bar splicing , columns tie spacing and stirrup spacing not detailed for ductile behavior of secondary reinforced concrete frames.
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

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C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	FLAT SLABS: Flat slabs or plates not part of the seismic-force-resisting system have continuous bottom steel through the column joints. (Commentary: Sec. A.3.1.6.3. Tier 2: Sec. 5.5.2.5.3)	No flat slabs found in structure
C <input type="checkbox"/>	NC <input checked="" type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	COUPLING BEAMS: The stirrups in coupling beams over means of egress are spaced at or less than $d/2$ and are anchored into the confined core of the beam with hooks of 135 degrees or more. The ends of both walls to which the coupling beam is attached are supported at each end to resist vertical loads caused by overturning. (Commentary: Sec. A.3.2.2.3. Tier 2: Sec. 5.5.3.2.1)	No 135 degree hook shown on structural drawings.

#### Connections

RATING				DESCRIPTION	COMMENTS
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input checked="" type="checkbox"/>	UPLIFT AT PILE CAPS: Pile caps have top reinforcement, and piles are anchored to the pile caps. (Commentary: Sec. A.5.3.8. Tier 2: Sec. 5.7.3.5)	We can not determine if all piles are anchored with dowels to the pile caps.

#### Diaphragms (Flexible or Stiff)

RATING				DESCRIPTION	COMMENTS
C <input checked="" type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	DIAPHRAGM CONTINUITY: The diaphragms are not composed of split-level floors and do not have expansion joints. (Commentary: Sec. A.4.1.1. Tier 2: Sec. 5.6.1.1)	No split levels floors located within structure

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C <input type="checkbox"/>	NC <input checked="" type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls are less than 25% of the wall length. (Commentary: Sec. A.4.1.4. Tier 2: Sec. 5.6.1.3)	Does not comply for Shear Wall located at stairs opening
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**Flexible Diaphragms**

RATING				DESCRIPTION	COMMENTS
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	CROSS TIES: There are continuous cross ties between diaphragm chords. (Commentary: Sec. A.4.1.2. Tier 2: Sec. 5.6.1.2)	No flexible diaphragms found in structure
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	STRAIGHT SHEATHING: All straight sheathed diaphragms have aspect ratios less than 2-to-1 in the direction being considered. (Commentary: Sec. A.4.2.1. Tier 2: Sec. 5.6.2)	No flexible diaphragms found in structure
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	SPANS: All wood diaphragms with spans greater than 24 ft consist of wood structural panels or diagonal sheathing. (Commentary: Sec. A.4.2.2. Tier 2: Sec. 5.6.2)	No flexible diaphragms found in structure

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Project Name 911 Office Building

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C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	DIAGONALLY SHEATHED AND UNBLOCKED DIAPHRAGMS: All diagonally sheathed or unblocked wood structural panel diaphragms have horizontal spans less than 40 ft and aspect ratios less than or equal to 4-to-1. (Commentary: Sec. A.4.2.3. Tier 2: Sec. 5.6.2)	No flexible diaphragms found in structure
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	OTHER DIAPHRAGMS: The diaphragm does not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Commentary: Sec. A.4.7.1. Tier 2: Sec. 5.6.5)	No flexible diaphragms found in structure

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## ASCE 41-13 Tier 1 Checklists

FIRM:	Doris Quiñones- Rivera, MSCE, PE / Structural Engineering Consultants
PROJECT NAME:	911 Office Bldg (Former Caribe Plaza Office Building)
SEISMICITY LEVEL:	Hlgh
PROJECT NUMBER:	2022-10
COMPLETED BY:	Doris J. Quiñones
DATE COMPLETED:	July 6th , 2022
REVIEWED BY:	
REVIEW DATE:	

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## 16.17 Nonstructural Checklist

The Performance Level is designated LS for Life Safety or PR for Position Retention. The level of seismicity is designated as "not required" or by L, M, or H, for Low, Moderate, and High.

### All Seismicity Levels

#### Life Safety Systems

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	LS-LMH; PR-LMH. FIRE SUPPRESSION PIPING: Fire suppression piping is anchored and braced in accordance with NFPA-13. (Commentary: Sec. A.7.13.1. Tier 2: Sec. 13.7.4)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Fire suppression piping has flexible couplings in accordance with NFPA-13. (Commentary: Sec. A.7.13.2. Tier 2: Sec. 13.7.4)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	LS-LMH; PR-LMH. EMERGENCY POWER: Equipment used to power or control life safety systems is anchored or braced. (Commentary: Sec. A.7.12.1. Tier 2: Sec. 13.7.7)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	LS-LMH; PR-LMH. STAIR AND SMOKE DUCTS: Stair pressurization and smoke control ducts are braced and have flexible connections at seismic joints. (Commentary: Sec. A.7.14.1. Tier 2: Sec. 13.7.6)	No seismic joints within the building
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

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C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-MH. SPRINKLER CEILING CLEARANCE: Penetrations through panelized ceilings for fire suppression devices provide clearances in accordance with NFPA-13. (Commentary: Sec. A.7.13.3. Tier 2: Sec. 13.7.4)	
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-LMH. EMERGENCY LIGHTING: Emergency and egress lighting equipment is anchored or braced. (Commentary: Sec. A.7.3.1. Tier 2: Sec. 13.7.9)	

**Hazardous Materials**

RATING				DESCRIPTION	COMMENTS
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-LMH; PR-LMH. HAZARDOUS MATERIAL EQUIPMENT: Equipment mounted on vibration isolators and containing hazardous material is equipped with restraints or snubbers. (Commentary: Sec. A.7.12.2. Tier 2: 13.7.1)	No hazardous materials found in building
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-LMH; PR-LMH. HAZARDOUS MATERIAL STORAGE: Breakable containers that hold hazardous material, including gas cylinders, are restrained by latched doors, shelf lips, wires, or other methods. (Commentary: Sec. A.7.15.1. Tier 2: Sec. 13.8.4)	

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown



C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-MH. HAZARDOUS MATERIAL DISTRIBUTION: Piping or ductwork conveying hazardous materials is braced or otherwise protected from damage that would allow hazardous material release. (Commentary: Sec. A.7.13.4. Tier 2: Sec. 13.7.3 and 13.7.5)	
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-MH. SHUT-OFF VALVES: Piping containing hazardous material, including natural gas, has shut-off valves or other devices to limit spills or leaks. (Commentary: Sec. A.7.13.3. Tier 2: Sec. 13.7.3 and 13.7.5)	
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-LMH; PR-LMH. FLEXIBLE COUPLINGS: Hazardous material ductwork and piping, including natural gas piping, has flexible couplings. (Commentary: Sec. A.7.15.4, Tier 2: Sec.13.7.3 and 13.7.5)	
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-MH. PIPING OR DUCTS CROSSING SEISMIC JOINTS: Piping or ductwork carrying hazardous material that either crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Commentary: Sec. A.7.13.6. Tier 2: Sec.13.7.3, 13.7.5, and 13.7.6)	

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**Partitions**

RATING				DESCRIPTION	COMMENTS
C <input type="checkbox"/>	NC <input checked="" type="checkbox"/>	N/A <input type="checkbox"/>	U <input checked="" type="checkbox"/>	LS-LMH; PR-LMH. UNREINFORCED MASONRY: Unreinforced masonry or hollow-clay tile partitions are braced at a spacing of at most 10 ft in Low or Moderate Seismicity, or at most 6 ft in High Seismicity. (Commentary: Sec. A.7.1.1. Tier 2: Sec. 13.6.2)	Must be verified on site on other levels , no steel reinforcement found in cement block partition walls in the ground floor level when study was performed by GMTS Report No. G221524B
C <input checked="" type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	LS-LMH; PR-LMH. HEAVY PARTITIONS SUPPORTED BY CEILINGS: The tops of masonry or hollow-clay tile partitions are not laterally supported by an integrated ceiling system. (Commentary: Sec. A.7.2.1. Tier 2: Sec. 13.6.2)	Cement block partitions are not attached to the celing system ( there is none ) . Structural drawings shows details attaching them to the concrete slabs. We are removing all cement block partition walls , the ones that will remain must be reinforced.
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-MH. DRIFT: Rigid cementitious partitions are detailed to accommodate the following drift ratios: in steel moment frame, concrete moment frame, and wood frame buildings, 0.02; in other buildings, 0.005. (Commentary A.7.1.2 Tier 2: Sec. 13.6.2)	No cementitious partitions are found in the structure
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. LIGHT PARTITIONS SUPPORTED BY CEILINGS: The tops of gypsum board partitions are not laterally supported by an integrated ceiling system. (Commentary: Sec. A.7.2.1. Tier 2: Sec. 13.6.2)	LS not required

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C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. STRUCTURAL SEPARATIONS: Partitions that cross structural separations have seismic or control joints. (Commentary: Sec. A.7.1.3. Tier 2. Sec. 13.6.2)	LS not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. TOPS: The tops of ceiling-high framed or panelized partitions have lateral bracing to the structure at a spacing equal to or less than 6 ft. (Commentary: Sec. A.7.1.4. Tier 2. Sec. 13.6.2)	LS not required

#### Ceilings

RATING				DESCRIPTION	COMMENTS
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-LMH. SUSPENDED LATH AND PLASTER: Suspended lath and plaster ceilings have attachments that resist seismic forces for every 12 ft <sup>2</sup> of area. (Commentary: Sec. A.7.2.3. Tier 2: Sec. 13.6.4)	No lath and plaster ceilings
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input checked="" type="checkbox"/>	LS-MH; PR-LMH. SUSPENDED GYPSUM BOARD: Suspended gypsum board ceilings have attachments that resist seismic forces for every 12 ft <sup>2</sup> of area. (Commentary: Sec. A.7.2.3. Tier 2: Sec. 13.6.4)	TO be verified in areas where there is suspended ceilings, most of the interior of the structure has not been finished

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. INTEGRATED CEILINGS: Integrated suspended ceilings with continuous areas greater than 144 ft <sup>2</sup> , and ceilings of smaller areas that are not surrounded by restraining partitions, are laterally restrained at a spacing no greater than 12 ft with members attached to the structure above. Each restraint location has a minimum of four diagonal wires and compression struts, or diagonal members capable of resisting compression. (Commentary: Sec. A.7.2.2. Tier 2: Sec. 13.6.4)	LS not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. EDGE CLEARANCE: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft <sup>2</sup> have clearances from the enclosing wall or partition of at least the following: in Moderate Seismicity, 1/2 in.; in High Seismicity, 3/4 in. (Commentary: Sec. A.7.2.4. Tier 2: Sec. 13.6.4)	LS not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. CONTINUITY ACROSS STRUCTURE JOINTS: The ceiling system does not cross any seismic joint and is not attached to multiple independent structures. (Commentary: Sec. A.7.2.5. Tier 2: Sec. 13.6.4)	LS not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. EDGE SUPPORT: The free edges of integrated suspended ceilings with continuous areas greater than 144 ft <sup>2</sup> are supported by closure angles or channels not less than 2 in. wide. (Commentary: Sec. A.7.2.6. Tier 2: Sec. 13.6.4)	LS not required

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C	NC	N/A	U	LS-not required; PR-H. SEISMIC JOINTS: Acoustical tile or lay-in panel ceilings have seismic separation joints such that each continuous portion of the ceiling is no more than 2500 ft <sup>2</sup> and has a ratio of long-to-short dimension no more than 4-to-1. (Commentary: Sec. A.7.2.7. Tier 2: 13.6.4)	
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

**Light Fixtures**

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	LS-MH; PR-MH. INDEPENDENT SUPPORT: Light fixtures that weigh more per square foot than the ceiling they penetrate are supported independent of the grid ceiling suspension system by a minimum of two wires at diagonally opposite corners of each fixture. (Commentary: Sec. A.7.3.2. Tier 2: Sec. 13.6.4 and 13.7.9)	No lighting found in structure yet
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
C	NC	N/A	U	LS-not required; PR-H. PENDANT SUPPORTS: Light fixtures on pendant supports are attached at a spacing equal to or less than 6 ft and, if rigidly supported, are free to move with the structure to which they are attached without damaging adjoining components. (Commentary: A.7.3.3. Tier 2: Sec. 13.7.9)	LS not required
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	LS-not required; PR-H. LENS COVERS: Lens covers on light fixtures are attached with safety devices. (Commentary: Sec. A.7.3.4. Tier 2: Sec. 13.7.9)	LS not required
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

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**Cladding and Glazing**

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	LS-MH; PR-MH. CLADDING ANCHORS: Cladding components weighing more than 10 lb/ft <sup>2</sup> are mechanically anchored to the structure at a spacing equal to or less than the following: for Life Safety in Moderate Seismicity, 6 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 ft. (Commentary: Sec. A.7.4.1. Tier 2: Sec. 13.6.1)	No cladding found in structure
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	LS-MH; PR-MH. CLADDING ISOLATION: For steel or concrete moment frame buildings, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (Commentary: Sec. A.7.4.3. Tier 2: Section 13.6.1)	No cladding found in structure
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	LS-MH; PR-MH. MULTI-STORY PANELS: For multi-story panels attached at more than one floor level, panel connections are detailed to accommodate a story drift ratio of at least the following: for Life Safety in Moderate Seismicity, 0.01; for Life Safety in High Seismicity and for Position Retention in any seismicity, 0.02. (Commentary: Sec. A.7.4.4. Tier 2: Sec. 13.6.1)	No multi story pannels found in structure
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	LS-MH; PR-MH. PANEL CONNECTIONS: Cladding panels are anchored out-of-plane with a minimum number of connections for each wall panel, as follows: for Life Safety in Moderate Seismicity, 2 connections; for Life Safety in High Seismicity and for Position Retention in any seismicity, 4 connections. (Commentary: Sec. A.7.4.5. Tier 2: Sec. 13.6.1.4)	As per structural drawings , we are recommending the removal of the Roof Precast Pannels.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

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C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-MH. BEARING CONNECTIONS: Where bearing connections are used, there is a minimum of two bearing connections for each cladding panel. (Commentary: Sec. A.7.4.6. Tier 2: Sec. 13.6.1.4)	
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-MH. INSERTS: Where concrete cladding components use inserts, the inserts have positive anchorage or are anchored to reinforcing steel. (Commentary: Sec. A.7.4.7. Tier 2: Sec. 13.6.1.4)	
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-MH. OVERHEAD GLAZING: Glazing panes of any size in curtain walls and individual interior or exterior panes over 16 ft <sup>2</sup> in area are laminated annealed or laminated heat-strengthened glass and are detailed to remain in the frame when cracked. (Commentary: Sec. A.7.4.8: Tier 2: Sec. 13.6.1.5)	

**Masonry Veneer**

RATING				DESCRIPTION	COMMENTS
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-LMH; PR-LMH. TIES: Masonry veneer is connected to the backup with corrosion-resistant ties. There is a minimum of one tie for every 2-2/3 ft <sup>2</sup> , and the ties have spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 36 in.; for Life Safety in High Seismicity and for Position Retention in any seismicity, 24 in. (Commentary: Sec. A.7.5.1. Tier 2: Sec. 13.6.1.2)	No masonry veneer found in structure

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-LMH; PR-LMH. SHELF ANGLES: Masonry veneer is supported by shelf angles or other elements at each floor above the ground floor. (Commentary: Sec. A.7.5.2. Tier 2: Sec. 13.6.1.2)	No masonry venner found in structure
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-LMH; PR-LMH. WEAKENED PLANES: Masonry veneer is anchored to the backup adjacent to weakened planes, such as at the locations of flashing. (Commentary: Sec. A.7.5.3. Tier 2: Sec. 13.6.1.2)	No masonry venner found in structure
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-LMH; PR-LMH. UNREINFORCED MASONRY BACKUP: There is no unreinforced masonry backup. (Commentary: Sec. A.7.7.2. Tier 2: Section 13.6.1.1 and 13.6.1.2)	No masonry venner found in structure
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-MH. STUD TRACKS: For veneer with metal stud backup, stud tracks are fastened to the structure at a spacing equal to or less than 24 in. on center. (Commentary: Sec. A.7.6.1. Tier 2: Section 13.6.1.1 and 13.6.1.2)	No masonry venner found in structure

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown



C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-MH. ANCHORAGE: For veneer with concrete block or masonry backup, the backup is positively anchored to the structure at a horizontal spacing equal to or less than 4 ft along the floors and roof. (Commentary: Sec. A.7.7.1. Tier 2: Section 13.6.1.1 and 13.6.1.2)	No masonry veneer found in structure
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. WEEP HOLES: In veneer anchored to stud walls, the veneer has functioning weep holes and base flashing. (Commentary: Sec. A.7.5.6. Tier 2: Section 13.6.1.2)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. OPENINGS: For veneer with metal stud backup, steel studs frame window and door openings. (Commentary: Sec. A.7.6.2. Tier 2: Sec. 13.6.1.1 and 13.6.1.2)	Life safety not required

**Parapets, Cornices, Ornamentation, and Appendages**

RATING				DESCRIPTION	COMMENTS
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input checked="" type="checkbox"/>	LS-LMH; PR-LMH. URM PARAPETS OR CORNICES: Laterally unsupported unreinforced masonry parapets or cornices have height-to-thickness ratios no greater than the following: for Life Safety in Low or Moderate Seismicity, 2.5; for Life Safety in High Seismicity and for Position Retention in any seismicity, 1.5. (Commentary: Sec. A.7.8.1. Tier 2: Sec. 13.6.5)	Cement block parapets are reinforced according to structural drawings must verify on site, section 39/S-9

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-LMH; PR-LMH. CANOPIES: Canopies at building exits are anchored to the structure at a spacing no greater than the following: for Life Safety in Low or Moderate Seismicity, 10 ft; for Life Safety in High Seismicity and for Position Retention in any seismicity, 6 ft. (Commentary: Sec. A.7.8.2. Tier 2: Sec. 13.6.6)	No canopies located in the structure.
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input checked="" type="checkbox"/>	LS-MH; PR-LMH. CONCRETE PARAPETS: Concrete parapets with height-to-thickness ratios greater than 2.5 have vertical reinforcement. (Commentary: Sec. A.7.8.3. Tier 2: Sec. 13.6.5)	Must verify cement block parapets
C <input checked="" type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	LS-MH; PR-LMH. APPENDAGES: Cornices, parapets, signs, and other ornamentation or appendages that extend above the highest point of anchorage to the structure or cantilever from components are reinforced and anchored to the structural system at a spacing equal to or less than 6 ft. This checklist item does not apply to parapets or cornices covered by other checklist items. (Commentary: Sec. A.7.8.4. Tier 2: Sec. 13.6.6)	No cornices, parapets, signs, and other ornamentation found in structure. Precast parapet is attached less than 6 feet.

**Masonry Chimneys**

RATING				DESCRIPTION	COMMENTS
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-LMH; PR-LMH. URM CHIMNEYS: Unreinforced masonry chimneys extend above the roof surface no more than the following: for Life Safety in Low or Moderate Seismicity, 3 times the least dimension of the chimney; for Life Safety in High Seismicity and for Position Retention in any seismicity, 2 times the least dimension of the chimney. (Commentary: Sec. A.7.9.1. Tier 2: 13.6.7)	No unreinforced masonry chimneys found in structure.

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C	NC	N/A	U	LS-LMH; PR-LMH. ANCHORAGE: Masonry chimneys are anchored at each floor level, at the topmost ceiling level, and at the roof. (Commentary: Sec. A.7.9.2. Tier 2: 13.6.7)	No unreinforced masonry chimneys found in structure.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

#### Stairs

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	LS-LMH; PR-LMH. STAIR ENCLOSURES: Hollow-clay tile or unreinforced masonry walls around stair enclosures are restrained out-of-plane and have height-to-thickness ratios not greater than the following: for Life Safety in Low or Moderate Seismicity, 15-to-1; for Life Safety in High Seismicity and for Position Retention in any seismicity, 12-to-1. (Commentary: Sec. A.7.10.1. Tier 2: Sec. 13.6.2 and 13.6.8)	Must verify on site , cement block wall located near stairs enclosure
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
C	NC	N/A	U	LS-LMH; PR-LMH. STAIR DETAILS: In moment frame structures, the connection between the stairs and the structure does not rely on shallow anchors in concrete. Alternatively, the stair details are capable of accommodating the drift calculated using the Quick Check procedure of Section 4.5.3.1 without including any lateral stiffness contribution from the stairs. (Commentary: Sec. A.7.10.2. Tier 2: 13.6.8)	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

#### Contents and Furnishings

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	LS-MH; PR-MH. INDUSTRIAL STORAGE RACKS: Industrial storage racks or pallet racks more than 12 ft high meet the requirements of ANSI/MH 16.1 as modified by ASCE 7 Chapter 15. (Commentary: Sec. A.7.11.1. Tier 2: Sec. 13.8.1)	No industrial storage racks found in structure Building interiors have not been done yet
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	LS-H; PR-MH. TALL NARROW CONTENTS: Contents more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 are anchored to the structure or to each other. (Commentary: Sec. A.7.11.2. Tier 2: Sec. 13.8.2)	Building interiors have not been done yet
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input type="checkbox"/>	U <input type="checkbox"/>	LS-H; PR-H. FALL-PRONE CONTENTS: Equipment, stored items, or other contents weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level are braced or otherwise restrained. (Commentary: Sec. A.7.11.3. Tier 2: Sec. 13.8.2)	Building interiors have not been done yet
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. ACCESS FLOORS: Access floors more than 9 in. high are braced. (Commentary: Sec. A.7.11.4. Tier 2: Sec. 13.8.3)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. EQUIPMENT ON ACCESS FLOORS: Equipment and other contents supported by access floor systems are anchored or braced to the structure independent of the access floor. (Commentary: Sec. A.7.11.5. Tier 2: Sec. 13.7.7 and 13.8.3)	Life safety not required

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown



C	NC	N/A	U	LS-not required; PR-H. SUSPENDED CONTENTS: Items suspended without lateral bracing are free to swing from or move with the structure from which they are suspended without damaging themselves or adjoining components. (Commentary. A.7.11.6. Tier 2: Sec. 13.8.2)	Life safety not required
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

**Mechanical and Electrical Equipment**

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	LS-H; PR-H. FALL-PRONE EQUIPMENT: Equipment weighing more than 20 lb whose center of mass is more than 4 ft above the adjacent floor level, and which is not in-line equipment, is braced. (Commentary: A.7.12.4. Tier 2: 13.7.1 and 13.7.7)	
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
C	NC	N/A	U	LS-H; PR-H. IN-LINE EQUIPMENT: Equipment installed in-line with a duct or piping system, with an operating weight more than 75 lb, is supported and laterally braced independent of the duct or piping system. (Commentary: Sec. A.7.12.5. Tier 2: Sec. 13.7.1)	
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
C	NC	N/A	U	LS-H; PR-MH. TALL NARROW EQUIPMENT: Equipment more than 6 ft high with a height-to-depth or height-to-width ratio greater than 3-to-1 is anchored to the floor slab or adjacent structural walls. (Commentary: Sec. A.7.12.6. Tier 2: Sec. 13.7.1 and 13.7.7)	No equipment yet installed
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-MH. MECHANICAL DOORS: Mechanically operated doors are detailed to operate at a story drift ratio of 0.01. (Commentary: Sec. A.7.12.7. Tier 2: Sec. 13.6.9)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. SUSPENDED EQUIPMENT: Equipment suspended without lateral bracing is free to swing from or move with the structure from which it is suspended without damaging itself or adjoining components. (Commentary: Sec. A.7.12.8. Tier 2: Sec. 13.7.1 and 13.7.7)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. VIBRATION ISOLATORS: Equipment mounted on vibration isolators is equipped with horizontal restraints or snubbers and with vertical restraints to resist overturning. (Commentary: Sec. A.7.12.9. Tier 2: Sec. 13.7.1)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. HEAVY EQUIPMENT: Floor-supported or platform-supported equipment weighing more than 400 lb is anchored to the structure. (Commentary: Sec. A.7.12.10. Tier 2: 13.7.1 and 13.7.7)	Life safety not required

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. ELECTRICAL EQUIPMENT: Electrical equipment is laterally braced to the structure. (Commentary: Sec. A.7.12.11. Tier 2: 13.7.7)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. CONDUIT COUPLINGS: Conduit greater than 2.5 in. trade size that is attached to panels, cabinets, or other equipment and is subject to relative seismic displacement has flexible couplings or connections. (Commentary: Sec. A.7.12.12. Tier 2: 13.7.8)	Life safety not required

**Piping**

RATING				DESCRIPTION	COMMENTS
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. FLEXIBLE COUPLINGS: Fluid and gas piping has flexible couplings. (Commentary: Sec. A.7.13.2. Tier 2: Sec. 13.7.3 and 13.7.5)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. FLUID AND GAS PIPING: Fluid and gas piping is anchored and braced to the structure to limit spills or leaks. (Commentary: Sec. A.7.13.4. Tier 2: Sec. 13.7.3 and 13.7.5)	Life safety not required

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. C-CLAMPS: One-sided C-clamps that support piping larger than 2.5 in. in diameter are restrained. (Commentary: Sec. A.7.13.5. Tier 2: Sec. 13.7.3 and 13.7.5)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. PIPING CROSSING SEISMIC JOINTS: Piping that crosses seismic joints or isolation planes or is connected to independent structures has couplings or other details to accommodate the relative seismic displacements. (Commentary: Sec. A.7.13.6. Tier 2: Sec.13.7.3 and Sec. 13.7.5)	Life safety not required

**Ducts**

RATING				DESCRIPTION	COMMENTS
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. DUCT BRACING: Rectangular ductwork larger than 6 ft <sup>2</sup> in cross-sectional area and round ducts larger than 28 in. in diameter are braced. The maximum spacing of transverse bracing does not exceed 30 ft. The maximum spacing of longitudinal bracing does not exceed 60 ft. (Commentary: Sec. A.7.14.2. Tier 2: Sec. 13.7.6)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. DUCT SUPPORT: Ducts are not supported by piping or electrical conduit. (Commentary: Sec. A.7.14.3. Tier 2: Sec. 13.7.6)	Life safety not required

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown



C	NC	N/A	U	LS-not required; PR-H. DUCTS CROSSING SEISMIC JOINTS: Ducts that cross seismic joints or isolation planes or are connected to independent structures have couplings or other details to accommodate the relative seismic displacements. (Commentary: Sec. A.7.14.5. Tier 2: Sec. 13.7.6)	Life safety not required
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

**Elevators**

RATING				DESCRIPTION	COMMENTS
C	NC	N/A	U	LS-H; PR-H. RETAINER GUARDS: Sheaves and drums have cable retainer guards. (Commentary: Sec. A.7.16.1. Tier 2: 13.8.6)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	LS-H; PR-H. RETAINER PLATE: A retainer plate is present at the top and bottom of both car and counterweight. (Commentary: Sec. A.7.16.2. Tier 2: 13.8.6)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
C	NC	N/A	U	LS-not required; PR-H. ELEVATOR EQUIPMENT: Equipment, piping, and other components that are part of the elevator system are anchored. (Commentary: Sec. A.7.16.3. Tier 2: 13.8.6)	Life safety not required
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. SEISMIC SWITCH: Elevators capable of operating at speeds of 150 ft/min or faster are equipped with seismic switches that meet the requirements of ASME A17.1 or have trigger levels set to 20% of the acceleration of gravity at the base of the structure and 50% of the acceleration of gravity in other locations. (Commentary: Sec. A.7.16.4. Tier 2: 13.8.6)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. SHAFT WALLS: Elevator shaft walls are anchored and reinforced to prevent toppling into the shaft during strong shaking. (Commentary: Sec. A.7.16.5. Tier 2: 13.8.6)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. COUNTERWEIGHT RAILS: All counterweight rails and divider beams are sized in accordance with ASME A17.1. (Commentary: Sec. A.7.16.6. Tier 2: 13.8.6)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. BRACKETS: The brackets that tie the car rails and the counterweight rail to the structure are sized in accordance with ASME A17.1. (Commentary: Sec. A.7.16.7. Tier 2: 13.8.6)	Life safety not required

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. SPREADER BRACKET: Spreader brackets are not used to resist seismic forces. (Commentary: Sec. A.7.16.8. Tier 2: 13.8.6)	Life safety not required
C <input type="checkbox"/>	NC <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>	U <input type="checkbox"/>	LS-not required; PR-H. GO-SLOW ELEVATORS: The building has a go-slow elevator system. (Commentary: Sec. A.7.16.9. Tier 2: 13.8.6)	Life safety not required

Legend: C = Compliant, NC = Noncompliant, N/A = Not Applicable, U = Unknown

**APPENDIX C**  
**GENERAL SUMMARY DATA SHEET**  
**Structural Drawings Provided**





CONSULTANTS:

STRUCTURAL:  
ARTURO BEALE, P.E.  
MICHAEL ASSUNCA, P.E.  
ELECTRICAL:  
PEDRO CO, P.E.  
A. A. COMPTON, P.E.  
GEOTECHNICAL:  
ALFRED LONGHORN, P.E.  
SUSAN ROSARIO, P.E.  
ING. DANIEL ROSARIO, P.E.

DOCUMENTOS DE CONSTRUCCIÓN DE:

CARIBE PLAZA OFFICE BUILDING

#1547 Ave. Ponce de León  
San Juan, Puerto Rico 00909

OWNER:  
TECH DRY FILMERS, INC.

MARK DATE DESCRIPTION

PROJECT NO. 001

DRAWN BY: JIMMY SHERN

CHECKED BY: Ing. Arturo Beale

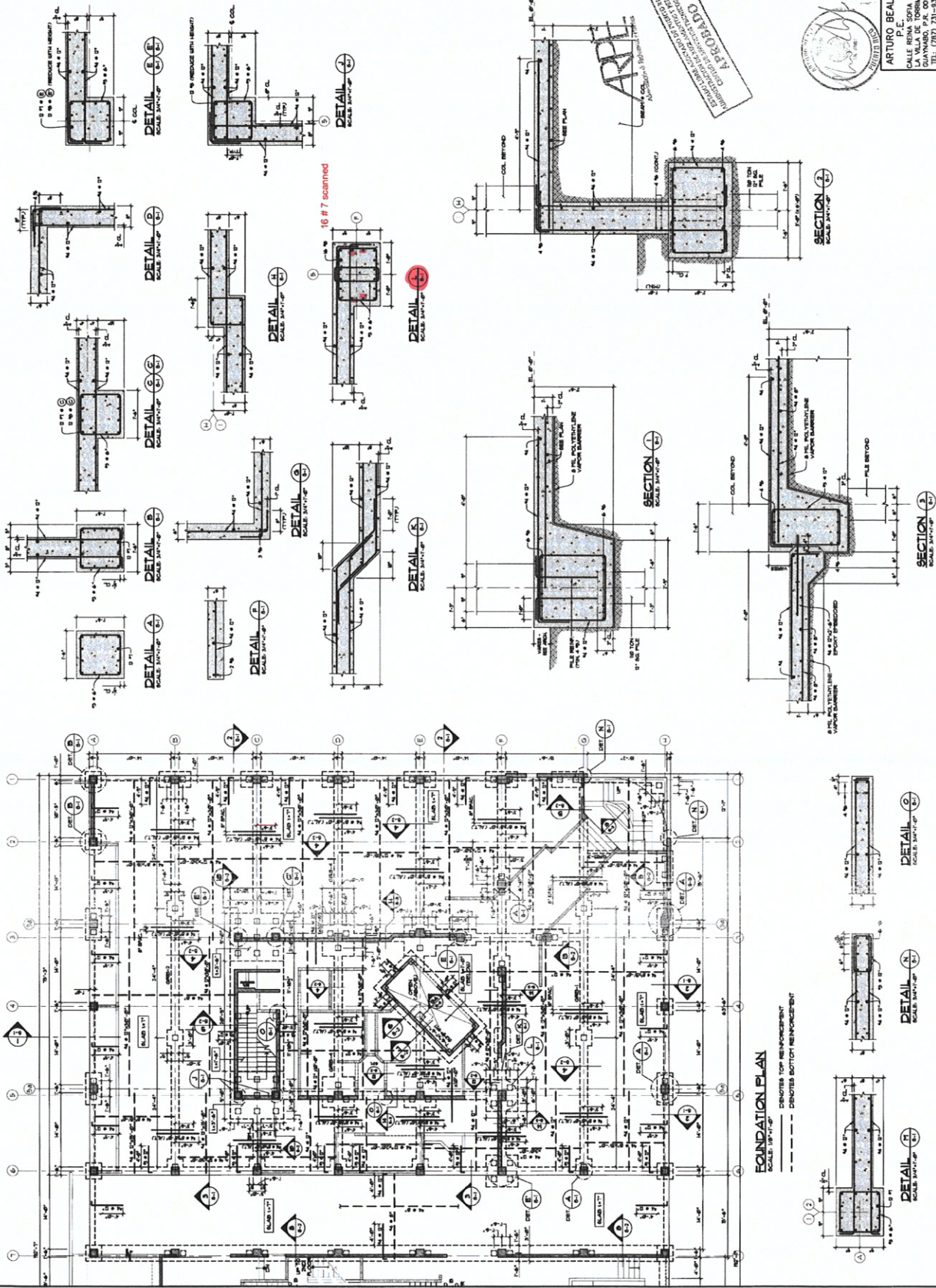
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BUILDING FOUNDATION PLAN SECTIONS & DETAIL SCALE AS NOTED

DATE: SEPTEMBER 27, 2007

S-1

ARTURO BEALE, P.E.  
CALLE REINA SOFIA #29  
LA VILLA DE TORREMAR  
SAN JUAN, P.R. 00909  
TEL: (787) 731-5355







CONSULTANTS:

STRUCTURAL  
ARTURO BEALE, P.E.  
MECHANICAL/ELECTRICAL  
ALFRED LONGHEND, P.E.  
FIRE PROTECTION/LIFE SAFETY  
4. ALFRED LONGHEND, P.E.  
GEOTECHNICAL  
ING. CARLOS SIERRA, P.E.  
SURVEYOR  
ING. DANIEL ROSARIO, P.E.

DOCUMENTOS DE  
CONSTRUCCIÓN DE:

CARIBE  
PLAZA OFFICE  
BUILDING  
#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00924

OWNER:  
TECH DEVELOPERS, INC.

MARK DATE DESCRIPTION

PROJECT NO. 0501

DRAWN BY: Jairo Sandoz

CHECKED BY: Ing. Arturo Beale

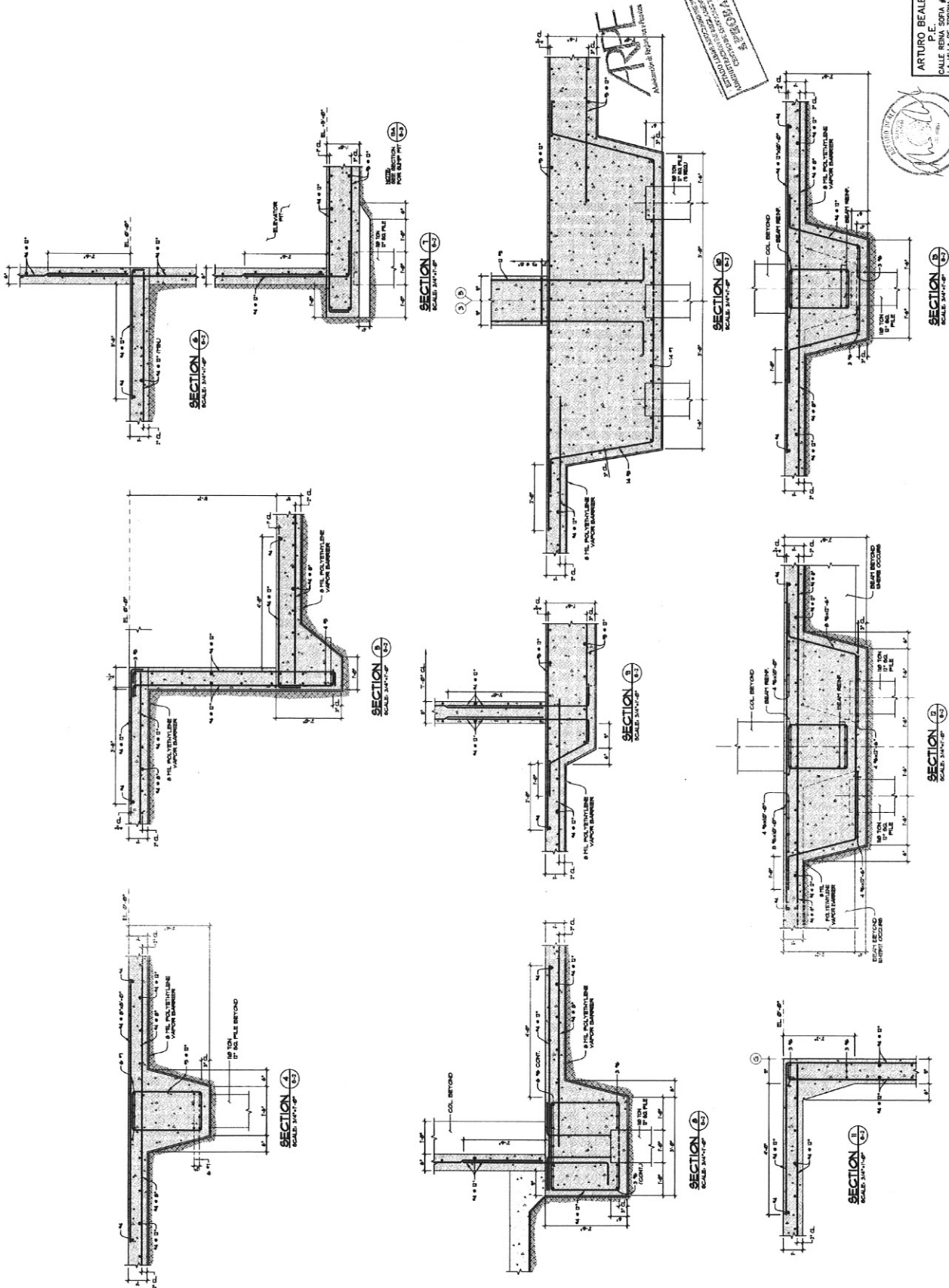
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BUILDING  
SECTIONS & DETAIL  
SCALE: 3/4" = 1'-0"

DATE: SEPTEMBER 27, 2007

S-2

ARTURO BEALE,  
P.E.  
REGISTERED PROFESSIONAL ENGINEER  
LA VILLA DE TORREMAR  
GUAYNABO, P.R. 00969  
TEL: (787) 231-3388





CONSULTANTS:

STRUCTURAL:  
ARTURO BEALE, P.E.  
MECHANICAL:  
JOSE ALVARADO, P.E.  
ELECTRICAL:  
PEDRO CO, P.E.  
FIRE PROTECTION/LIFE SAFETY:  
4. ADA COMPLIANCE:  
GEOLOGICAL:  
ING. CARLOS SIERRA, P.E.  
SURVEYOR:  
ING. DANIEL ROSARIO, P.E.

DOCUMENTOS DE  
CONSTRUCCION DE:

CARIBE  
PLAZA OFFICE  
BUILDING  
#1547 Ave. Ponce de Leon  
Rio Piedras, Puerto Rico, 00924

OWNER:

EXITI DEVELOPERS, INC.

MARK DATE DESCRIPTION

PROJECT NO. 001

DRAWN BY: JING SHING

CHECKED BY: Ing. Arturo Beale

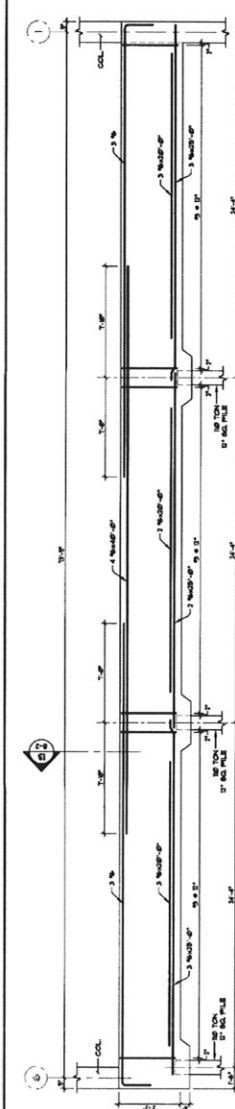
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BEAM  
REINFORCEMENT  
ELEVATIONS

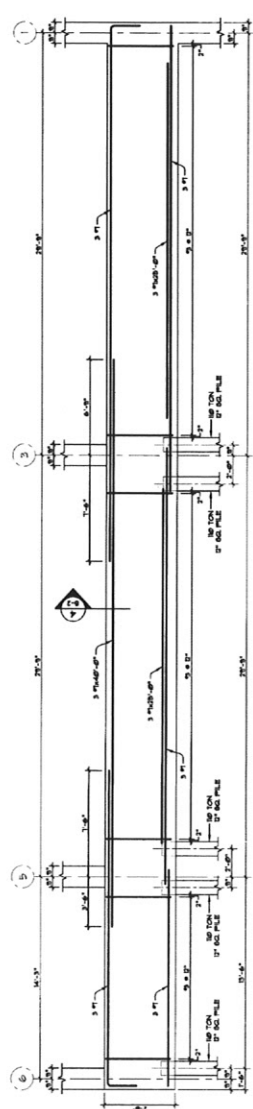
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DATE: SEPTEMBER 27, 2007

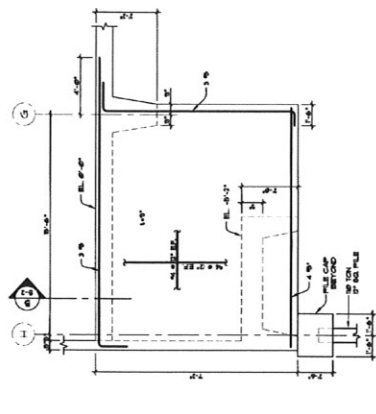
S-3



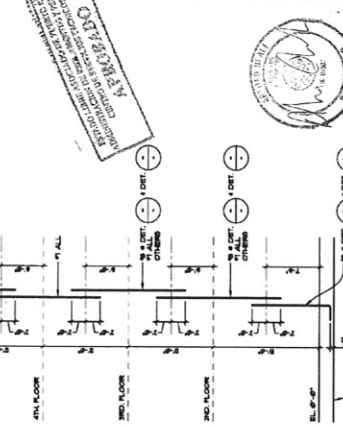
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HORIZONTAL SCALE: 1/4" = 1'-0"



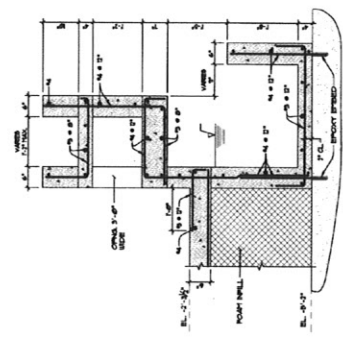
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HORIZONTAL SCALE: 1/4" = 1'-0"



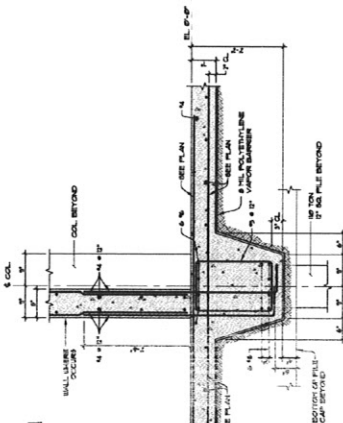
GRADE BEAM GRB-3 REINFORCEMENT ELEVATION  
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HORIZONTAL SCALE: 1/4" = 1'-0"



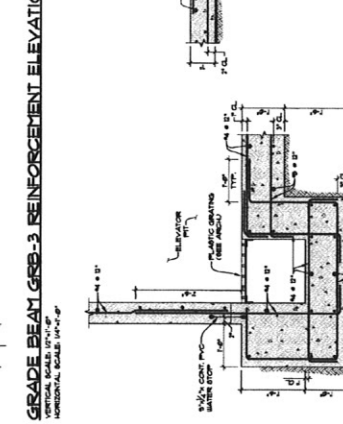
GRADE BEAM GRB-4 REINFORCEMENT ELEVATION • COLL. LINE (C)  
VERTICAL SCALE: 1/4" = 1'-0"  
HORIZONTAL SCALE: 1/4" = 1'-0"



SECTION (A-A)  
SCALE: 3/4" = 1'-0"



SECTION (B-B)  
SCALE: 3/4" = 1'-0"

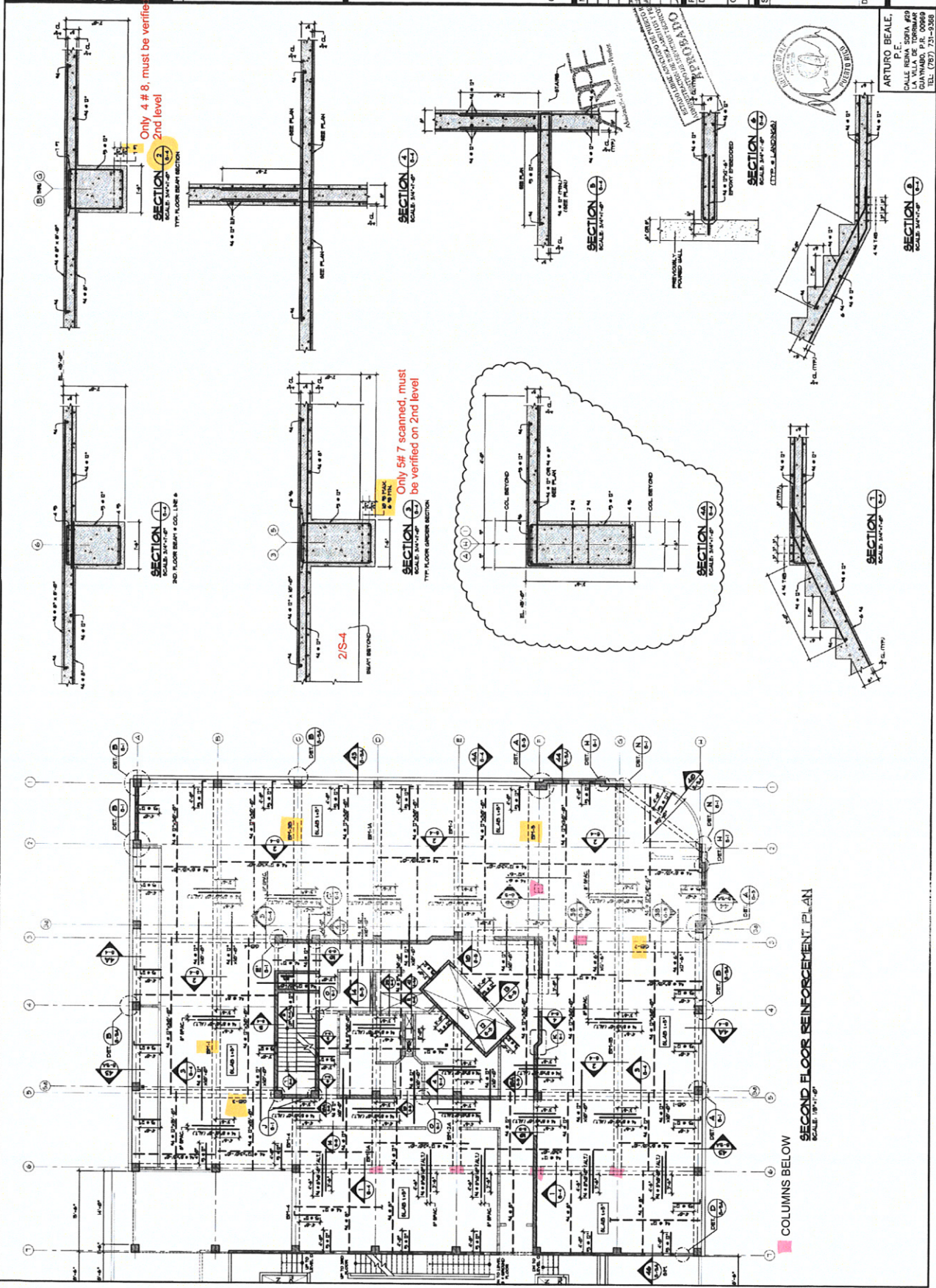


SECTION (C-C)  
SCALE: 3/4" = 1'-0"

NOTE: SPACING OF TOP & BOTTOM REINFORCING BARS SHALL BE 12" ON CENTER.

ARTURO BEALE, P.E.  
DALE RENA SORIA, P.E.  
CLAYTON, P.R. 00980  
TEL: (787) 731-3388









**CONSULTANTS:**  
STRUCTURAL  
ARTURO BEALE, P.E.  
MECHANICAL  
JUAN CARLOS ASSUNGA, P.E.  
ELECTRICAL  
PEDRO CO, P.E.  
FIRE PROTECTION LIFE SAFETY  
A. AURELIO LONGHINO, P.E.  
GEO-TECHNICAL  
ING. CARLOS SIERRA, P.E.  
SURVEYOR  
ING. DANIEL ROSARIO, P.E.

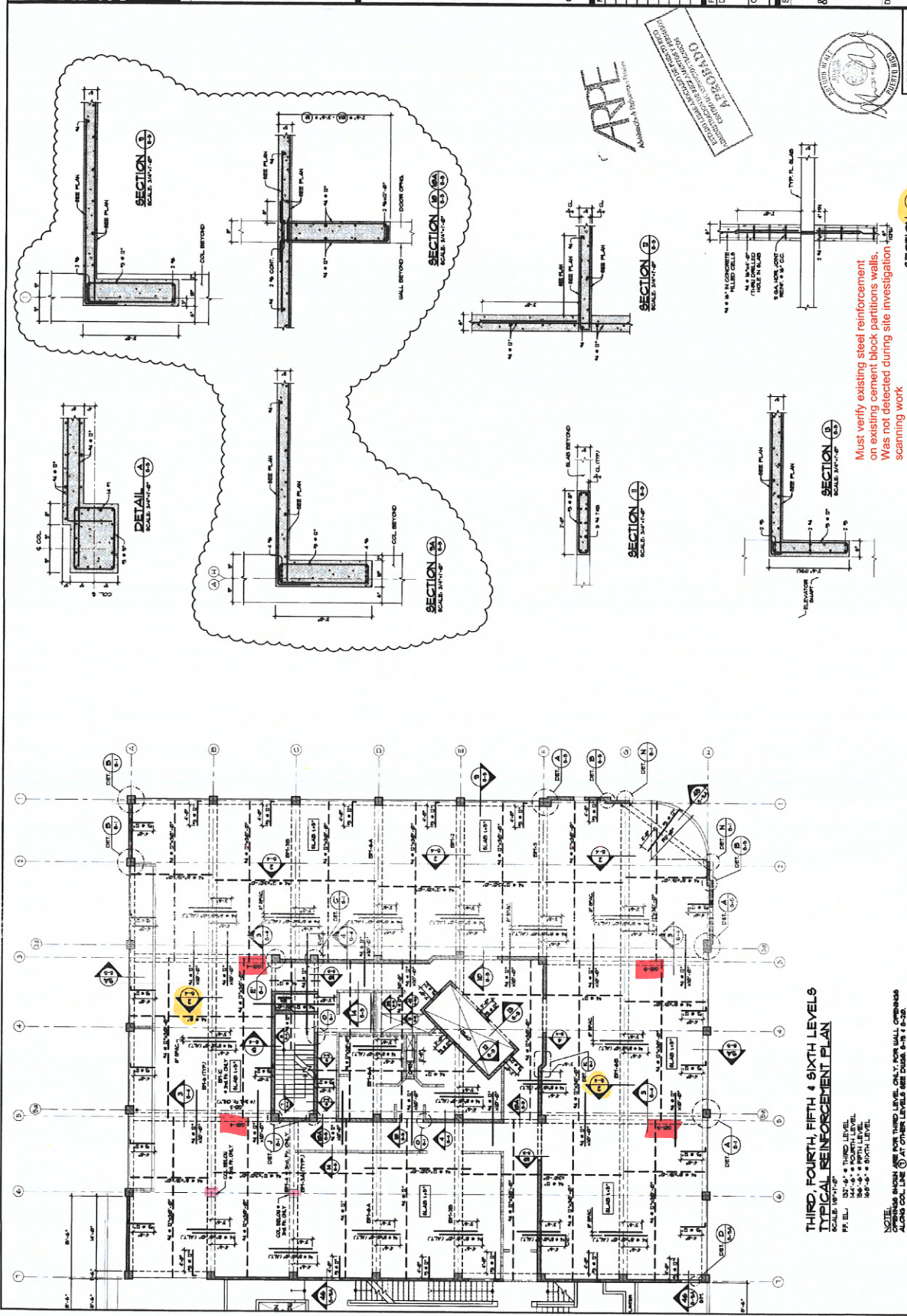
**DOCUMENTOS DE CONSTRUCCIÓN DE:**  
**CARIBE PLAZA OFFICE BUILDING**  
#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00922

**OWNER:**  
TECH INVEYLOWERS, INC.  
**MARK DATE DESCRIPTION**  
A 5/15/2008 REVISION 1

**PROJECT NO:** 0501  
**DRAWN BY:** JIMMY SANCHEZ  
**CHECKED BY:** Ing. Arturo Beale

**SHEET TITLE**  
THIRD, FOURTH, FIFTH & SIXTH LEVELS TYPICAL REINFORCEMENT PLU REINFORCEMENTS & DETAIL  
SCALE: 1/8" = 1'-0"

**DATE:** SEPTEMBER 27, 2007  
**S-5**



**ARTURO BEALE, P.E.**  
REGISTERED PROFESSIONAL ENGINEER  
LA VILLA DE GUAYAMA, P.R. 00969  
TEL: (787) 331-3368

**THIRD, FOURTH, FIFTH & SIXTH LEVELS TYPICAL REINFORCEMENT PLAN**  
SCALE: 1/8" = 1'-0"  
F.F. EL.  
124'-6" = THIRD LEVEL  
124'-6" = FOURTH LEVEL  
124'-6" = FIFTH LEVEL  
124'-6" = SIXTH LEVEL  
**NOTE:** REINFORCEMENT FOR WALLS ONLY FOR WALL CORNERS ALONG COL. LINE @ 4" ON OTHER LEVELS AND CORNERS 4" @ 1'-0"





CONSULTANTS:

STRUCTURAL:  
ARTURO BEALE, P.E.  
MECHANICAL/ELECTRICAL:  
FEDRO CO. P.E.  
FIRE PROTECTION LIFE SAFETY:  
A. ANDERSON  
GEOTECHNICAL:  
ALFRED LONGHITANO, P.E.  
SPECIALTY:  
ING. CARLOS SIERRA, P.E.  
ING. DANIEL ROSARIO, P.E.

DOCUMENTOS DE CONSTRUCCIÓN DE:

CARIBE  
PLAZA OFFICE  
BUILDING  
#1427 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00924

OWNER:  
TECH DEVELOPERS, INC.

MARK	DATE	DESCRIPTION
1	02/20/2008	UPPER ARCHES & SLAB
2	03/20/2008	ROOF BEAMS
3	04/20/2008	UPPER ARCHES & SLAB
4	05/20/2008	UPPER ARCHES & SLAB
5	06/20/2008	UPPER ARCHES & SLAB
6	07/20/2008	UPPER ARCHES & SLAB
7	08/20/2008	UPPER ARCHES & SLAB
8	09/20/2008	UPPER ARCHES & SLAB
9	10/20/2008	UPPER ARCHES & SLAB
10	11/20/2008	UPPER ARCHES & SLAB
11	12/20/2008	UPPER ARCHES & SLAB
12	01/20/2009	UPPER ARCHES & SLAB
13	02/20/2009	UPPER ARCHES & SLAB
14	03/20/2009	UPPER ARCHES & SLAB
15	04/20/2009	UPPER ARCHES & SLAB
16	05/20/2009	UPPER ARCHES & SLAB
17	06/20/2009	UPPER ARCHES & SLAB
18	07/20/2009	UPPER ARCHES & SLAB
19	08/20/2009	UPPER ARCHES & SLAB
20	09/20/2009	UPPER ARCHES & SLAB
21	10/20/2009	UPPER ARCHES & SLAB
22	11/20/2009	UPPER ARCHES & SLAB
23	12/20/2009	UPPER ARCHES & SLAB
24	01/20/2010	UPPER ARCHES & SLAB
25	02/20/2010	UPPER ARCHES & SLAB
26	03/20/2010	UPPER ARCHES & SLAB
27	04/20/2010	UPPER ARCHES & SLAB
28	05/20/2010	UPPER ARCHES & SLAB
29	06/20/2010	UPPER ARCHES & SLAB
30	07/20/2010	UPPER ARCHES & SLAB
31	08/20/2010	UPPER ARCHES & SLAB
32	09/20/2010	UPPER ARCHES & SLAB
33	10/20/2010	UPPER ARCHES & SLAB
34	11/20/2010	UPPER ARCHES & SLAB
35	12/20/2010	UPPER ARCHES & SLAB
36	01/20/2011	UPPER ARCHES & SLAB
37	02/20/2011	UPPER ARCHES & SLAB
38	03/20/2011	UPPER ARCHES & SLAB
39	04/20/2011	UPPER ARCHES & SLAB
40	05/20/2011	UPPER ARCHES & SLAB
41	06/20/2011	UPPER ARCHES & SLAB
42	07/20/2011	UPPER ARCHES & SLAB
43	08/20/2011	UPPER ARCHES & SLAB
44	09/20/2011	UPPER ARCHES & SLAB
45	10/20/2011	UPPER ARCHES & SLAB
46	11/20/2011	UPPER ARCHES & SLAB
47	12/20/2011	UPPER ARCHES & SLAB
48	01/20/2012	UPPER ARCHES & SLAB
49	02/20/2012	UPPER ARCHES & SLAB
50	03/20/2012	UPPER ARCHES & SLAB
51	04/20/2012	UPPER ARCHES & SLAB
52	05/20/2012	UPPER ARCHES & SLAB
53	06/20/2012	UPPER ARCHES & SLAB
54	07/20/2012	UPPER ARCHES & SLAB
55	08/20/2012	UPPER ARCHES & SLAB
56	09/20/2012	UPPER ARCHES & SLAB
57	10/20/2012	UPPER ARCHES & SLAB
58	11/20/2012	UPPER ARCHES & SLAB
59	12/20/2012	UPPER ARCHES & SLAB
60	01/20/2013	UPPER ARCHES & SLAB
61	02/20/2013	UPPER ARCHES & SLAB
62	03/20/2013	UPPER ARCHES & SLAB
63	04/20/2013	UPPER ARCHES & SLAB
64	05/20/2013	UPPER ARCHES & SLAB
65	06/20/2013	UPPER ARCHES & SLAB
66	07/20/2013	UPPER ARCHES & SLAB
67	08/20/2013	UPPER ARCHES & SLAB
68	09/20/2013	UPPER ARCHES & SLAB
69	10/20/2013	UPPER ARCHES & SLAB
70	11/20/2013	UPPER ARCHES & SLAB
71	12/20/2013	UPPER ARCHES & SLAB
72	01/20/2014	UPPER ARCHES & SLAB
73	02/20/2014	UPPER ARCHES & SLAB
74	03/20/2014	UPPER ARCHES & SLAB
75	04/20/2014	UPPER ARCHES & SLAB
76	05/20/2014	UPPER ARCHES & SLAB
77	06/20/2014	UPPER ARCHES & SLAB
78	07/20/2014	UPPER ARCHES & SLAB
79	08/20/2014	UPPER ARCHES & SLAB
80	09/20/2014	UPPER ARCHES & SLAB
81	10/20/2014	UPPER ARCHES & SLAB
82	11/20/2014	UPPER ARCHES & SLAB
83	12/20/2014	UPPER ARCHES & SLAB
84	01/20/2015	UPPER ARCHES & SLAB
85	02/20/2015	UPPER ARCHES & SLAB
86	03/20/2015	UPPER ARCHES & SLAB
87	04/20/2015	UPPER ARCHES & SLAB
88	05/20/2015	UPPER ARCHES & SLAB
89	06/20/2015	UPPER ARCHES & SLAB
90	07/20/2015	UPPER ARCHES & SLAB
91	08/20/2015	UPPER ARCHES & SLAB
92	09/20/2015	UPPER ARCHES & SLAB
93	10/20/2015	UPPER ARCHES & SLAB
94	11/20/2015	UPPER ARCHES & SLAB
95	12/20/2015	UPPER ARCHES & SLAB
96	01/20/2016	UPPER ARCHES & SLAB
97	02/20/2016	UPPER ARCHES & SLAB
98	03/20/2016	UPPER ARCHES & SLAB
99	04/20/2016	UPPER ARCHES & SLAB
100	05/20/2016	UPPER ARCHES & SLAB

PROJECT NO. 0001

DRAWN BY: JIMMY SANCHEZ

CHECKED BY: ING. ARTURO BEALE

SHEET TITLE

ROOF  
REINFORCEMENT PLAN  
SCALE: 1/8" = 1'-0"

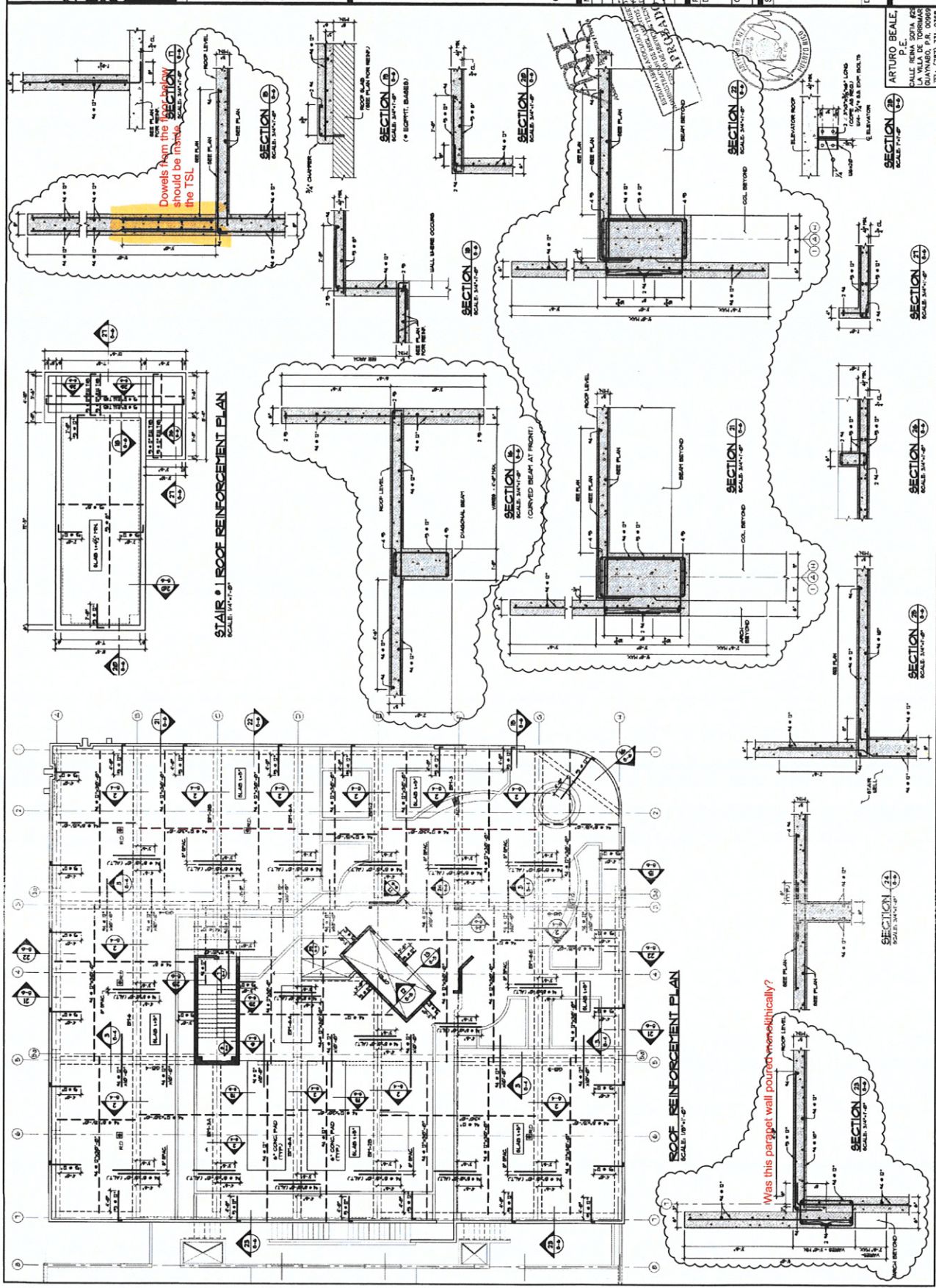
DATE:

AUGUST 20, 2007

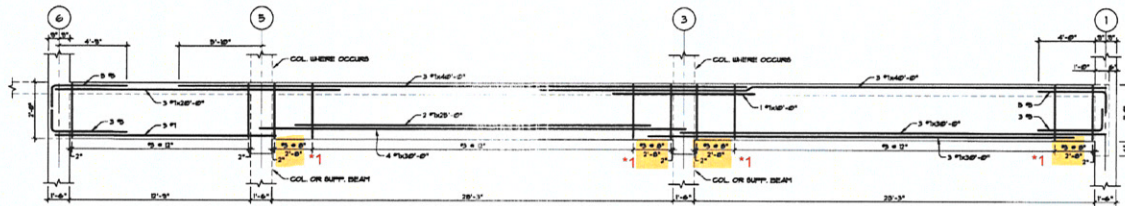
S-6

ARTURO BEALE, P.E.

CALLE RENE SORIA #25  
GUAYNADO, P.R. 00969  
TEL: (787) 231-3555



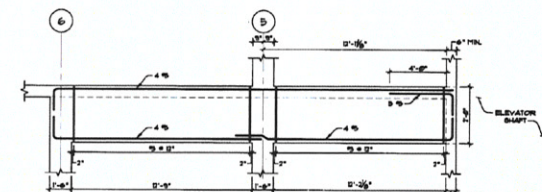




**BEAM BM-1, BM-1A & BM-1B REINFORCEMENT ELEVATIONS • COL. LINES (B) (D) (G)**

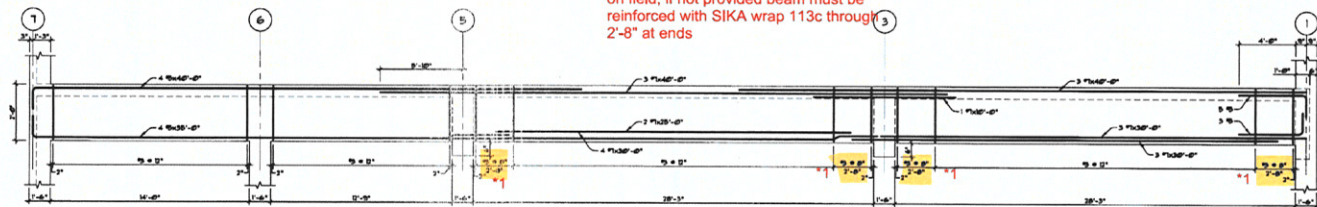
VERTICAL SCALE: 1/4"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"

\*1 - #3@8" o.c. stirrups to be verified on field, if not provided beam must be reinforced with SIKI wrap 113c through 2'-8" at ends



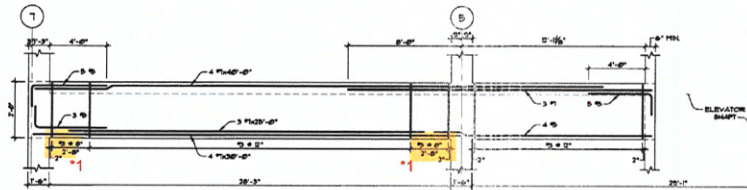
**BEAM BM-2A REINFORCEMENT ELEVATION • COL. LINE (E)**  
(SECOND FLOOR LEVEL ONLY)

VERTICAL SCALE: 1/4"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"



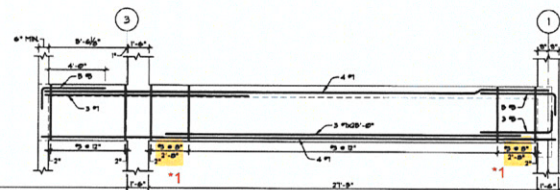
**BEAM BM-1C REINFORCEMENT ELEVATIONS • COL. LINE (B)**  
(THIRD FLOOR LEVEL ONLY)

VERTICAL SCALE: 1/4"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"



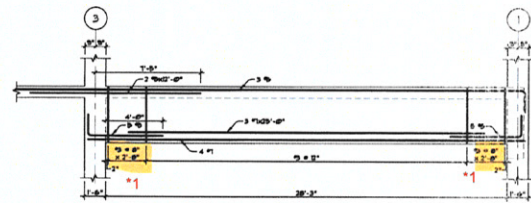
**BEAM BM-2B REINFORCEMENT ELEVATION • COL. LINE (E)**

VERTICAL SCALE: 1/4"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"



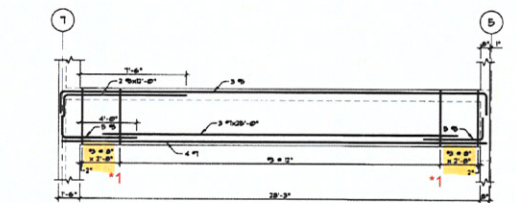
**BEAM BM-2 REINFORCEMENT ELEVATION • COL. LINE (E)**

VERTICAL SCALE: 1/4"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"



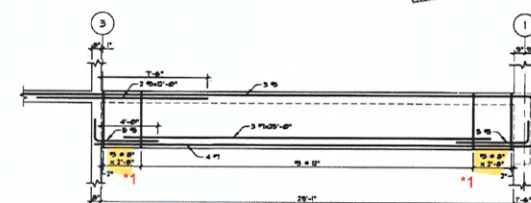
**BEAM BM-3 REINFORCEMENT ELEVATION • COL. LINE (F)**

VERTICAL SCALE: 1/4"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"



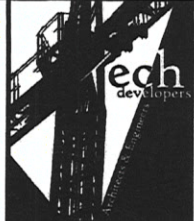
**BEAM BM-3A REINFORCEMENT ELEVATION • COL. LINE (C)**

VERTICAL SCALE: 1/4"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"



**BEAM BM-3B REINFORCEMENT ELEVATION • COL. LINE (C)**

VERTICAL SCALE: 1/4"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"



**CONSULTANTS:**

STRUCTURAL: ARTURO BEALE, P.E.  
MECHANICAL: RAFAEL ARSUAÑA, P.E.  
ELECTRICAL: PEDRO CID, P.E.  
FIRE PROTECTION, LIFE SAFETY, & ADA COMPLIANCE: ALFRED LONGHTANO, P.E.  
GEOLOGICAL: ING. CARLOS SIERRA, P.E.  
SURVEYOR: ING. DANIEL ROSARIO, P.E.

**DOCUMENTOS DE CONSTRUCCIÓN DE:**

**CARIBE PLAZA OFFICE BUILDING**

#1547 Ave. Ponce de León  
Rio Piedras, Puerto Rico, 00921

OWNER: TECH DEVELOPERS, INC.

MARK	DATE	DESCRIPTION

PROJECT NO: 0501

DRAWN BY: Janice Santos

CHKD BY: Ing. Arturo Beale

**SHEET TITLE**

**BEAM REINFORCEMENT ELEVATIONS**

SCALE: 1/8"=1'-0"

DATE: SEPTEMBER 27, 2007

**S-7**



ARTURO BEALE,  
P.E.  
CALLE REINA SOFIA #29  
LA VILLA DE TORREMAR  
GUAYNABO, P.R. 00969  
TEL: (787) 731-9368









**CONSULTANTS:**  
STRUCTURAL  
ARTURO BEALE, P.E.  
MECHANICAL  
JUAN CARLOS ANSILAGA, P.E.  
ELECTRICAL  
PEDRO CO, P.E.  
FIRE PROTECTION  
JESSE SHERIDAN, P.E.  
ACCOMPANYING  
GEOTECHNICAL  
INC. CARLOS SIERRA, P.E.  
SURVEYOR  
INC. DANIEL ROSARIO, P.E.

**DOCUMENTOS DE CONSTRUCCIÓN DE:**

**CARIBE PLAZA OFFICE BUILDING**  
#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00924

**OWNER:**  
TECH DEVELOPERS, INC.

**MARK DATE DESCRIPTION**

**PROJECT NO. (001)**  
**OWNER BY:** JAMES SHERIDAN

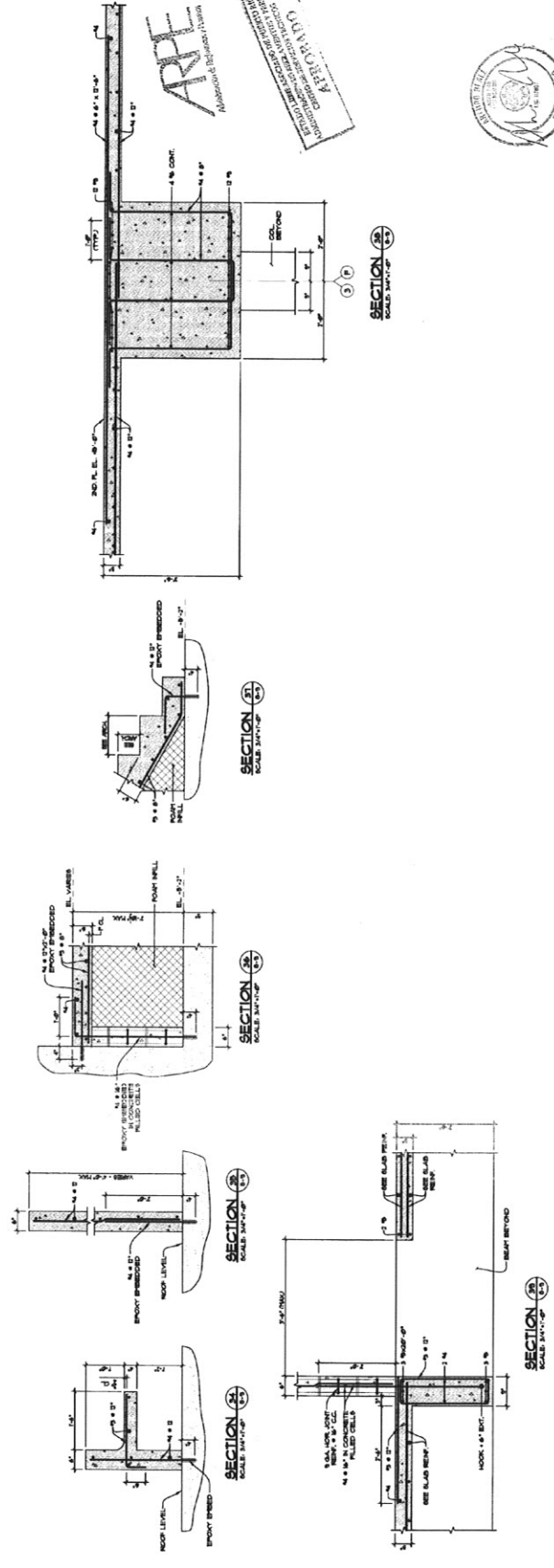
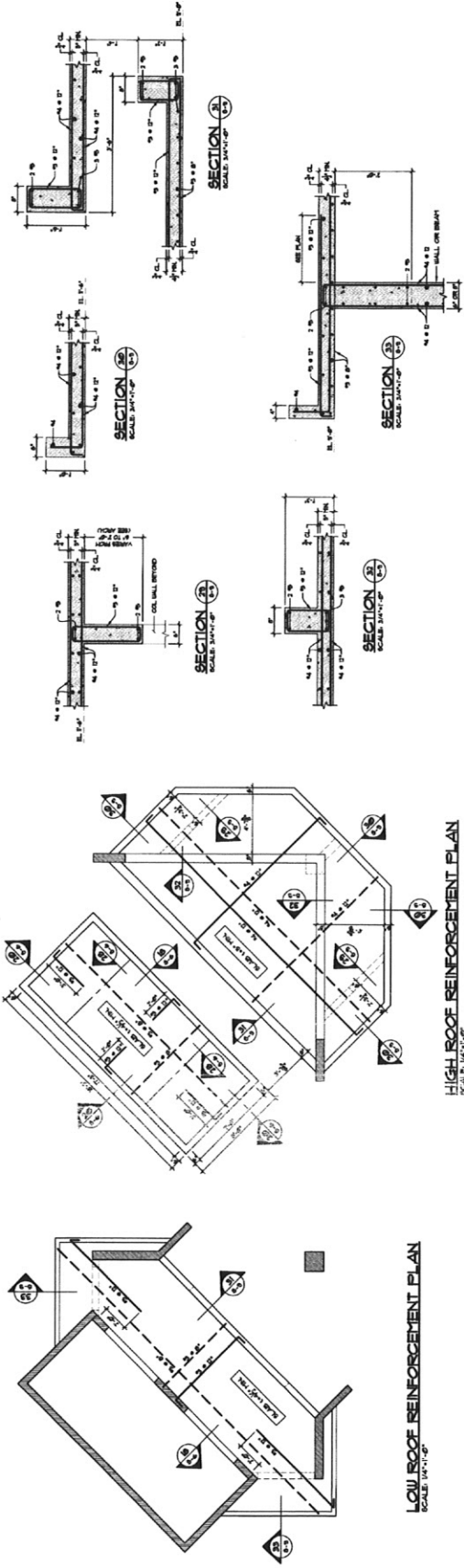
**CHECKED BY:** Ing. Arturo Beale

**SHEET TITLE**  
**ROOF REINFORCEMENT PLU**  
SCALE 1/8"=1'-0"

**DATE:** SEPTEMBER 27, 2001

**S-9**

**ARTURO BEALE, P.E.**  
SUELE BEALE, 829  
LA VILLA DE TORREMAR  
GUAYNADO, P.R. 00969  
TEL: (787) 731-3368





CONSULTANTS:

STRUCTURAL:  
ARTURO BEALE, P.E.  
MECHANICAL:  
JUAN CARLOS SIERRA, P.E.  
ELECTRICAL:  
PEDRO CEB, P.E.  
FIRE PROTECTION LIFE SAFETY:  
ALFONSO L. GARCIA, P.E.  
GEOTECHNICAL:  
ALFONSO LONGHITANO, P.E.  
ING. CARLOS SIERRA, P.E.  
ING. DANIEL ROSARIO, P.E.

DOCUMENTOS DE  
CONSTRUCCIÓN DE:

CARIBE  
PLAZA OFFICE  
BUILDING

#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00922

OWNER:  
TECH DEVELOPERS, INC.

MARK DATE DESCRIPTION  
1 5/19/2008 INITIALS

PROJECT NO: 0501

DRAWN BY: Juan Simoes

CHECKED BY: Ing. Arturo Beale

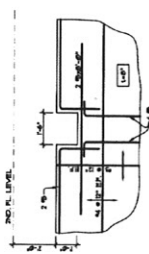
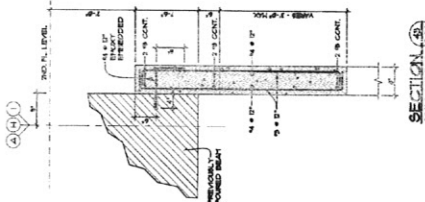
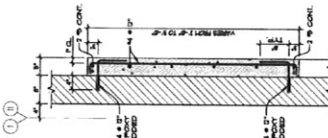
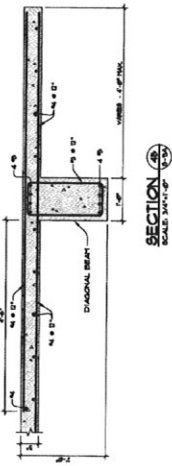
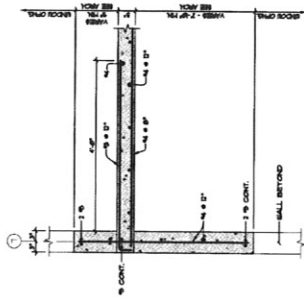
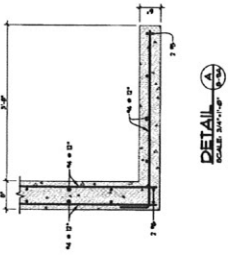
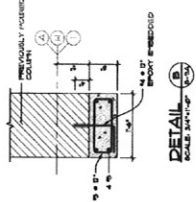
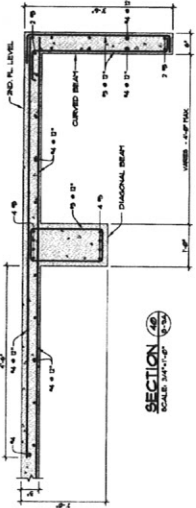
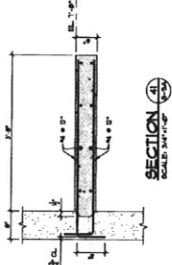
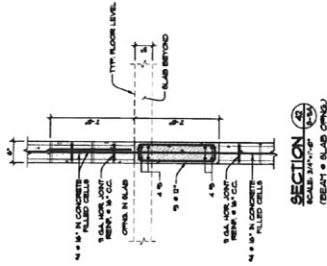
SHEET TITLE

SECTIONS & DETAIL

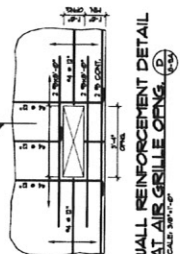
SCALE: 3/4"=1'-0"

DATE: APRIL 25, 2008

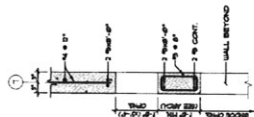
S-9A



DETAIL (A)  
SCALE: 3/4"=1'-0"  
(WALL ELEVATION)



WALL REINFORCEMENT DETAIL  
AT AIR GRILLE OPENING (B)  
SCALE: 3/4"=1'-0"  
(WALL ELEVATION)



SECTION (A)  
SCALE: 3/4"=1'-0"  
(AT AIR GRILLE)  
SEE DET (A)



ARTURO BEALE,  
P.E.  
JUAN CARLOS SIERRA, P.E.  
LA VILLA DE TORRE, INC.  
GUAYNABO, P.R. 00969  
TEL: (787) 731-2308



**CONSULTANTS:**  
STRUCTURAL: ARTURO BEALE, P.E.  
MECHANICAL: JUAN CARLOS ROSARIO, P.E.  
ELECTRICAL: PEDRO CID, P.E.  
FIRE PROTECTION: LIFE SAFETY, INC. CARLOS SIERRA, P.E.  
GEOTECHNICAL: ALFREDO LONGCHAMP, P.E.  
SUPERVISOR: ING. DANIEL ROSARIO, P.E.

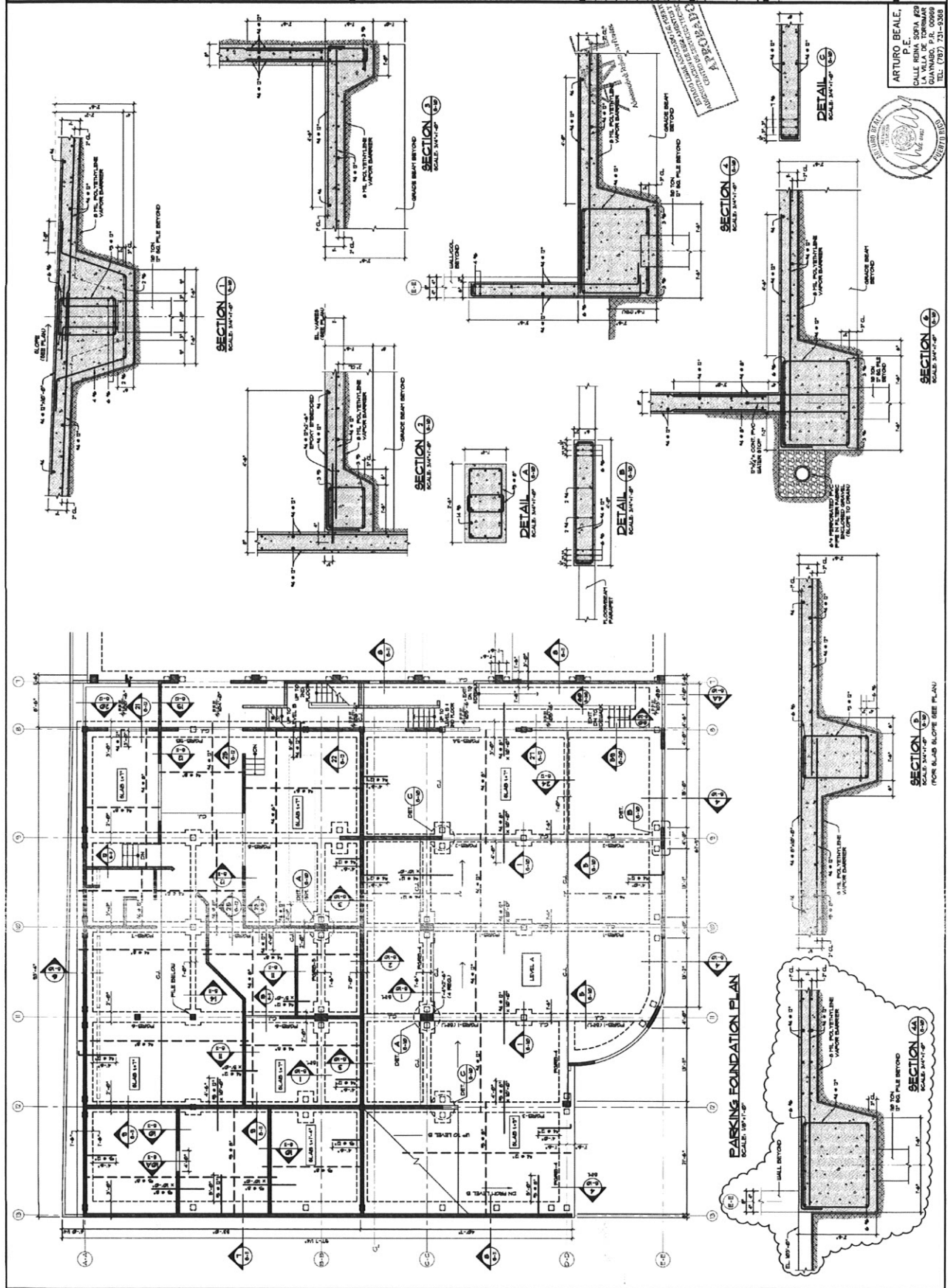
**DOCUMENTOS DE CONSTRUCCIÓN DE:**  
**CARIBE PLAZA OFFICE BUILDING**  
#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico 00926

**OWNER:** TCH DEVELOPERS, INC.  
**MARK DATE DESCRIPTION:**  
1/27/2008 FOUNDATION PLAN  
1/27/2008 FOUNDATION PLAN  
1/27/2008 FOUNDATION PLAN

**PROJECT NO. 0001**  
**DRAWN BY:** JAMES SMITH  
**CHECKED BY:** Ing. Arturo Beale

**SHEET TITLE:**  
**PARKING FOUNDATION PLAN**  
**SECTIONS & DETAIL**  
SCALE: 1/8" = 1'-0"

**DATE:** SEPTEMBER 27, 2007  
**S-10**



ARTURO BEALE, P.E.  
JUAN CARLOS ROSARIO, P.E.  
LA VILLA DE TORREMO  
GUAYNABO, P.R. 00969  
TEL (787) 731-8388





**CONSULTANTS:**  
STRUCTURAL: ARTURO BEALE, P.E.  
MECHANICAL: ANSUNGA P.E.  
ELECTRICAL: PEDRO CO, P.E.  
FIRE PROTECTION: LIFE SAFETY, INC.  
GEOTECHNICAL: ALVARO LONGHIANO, P.E.  
MECHANICAL: ING. CARLOS SIERRA, P.E.  
ELECTRICAL: ING. DANIEL ROSARIO, P.E.

**DOCUMENTOS DE CONSTRUCCIÓN DE:**  
**CARIBE PLAZA OFFICE BUILDING**  
#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00924

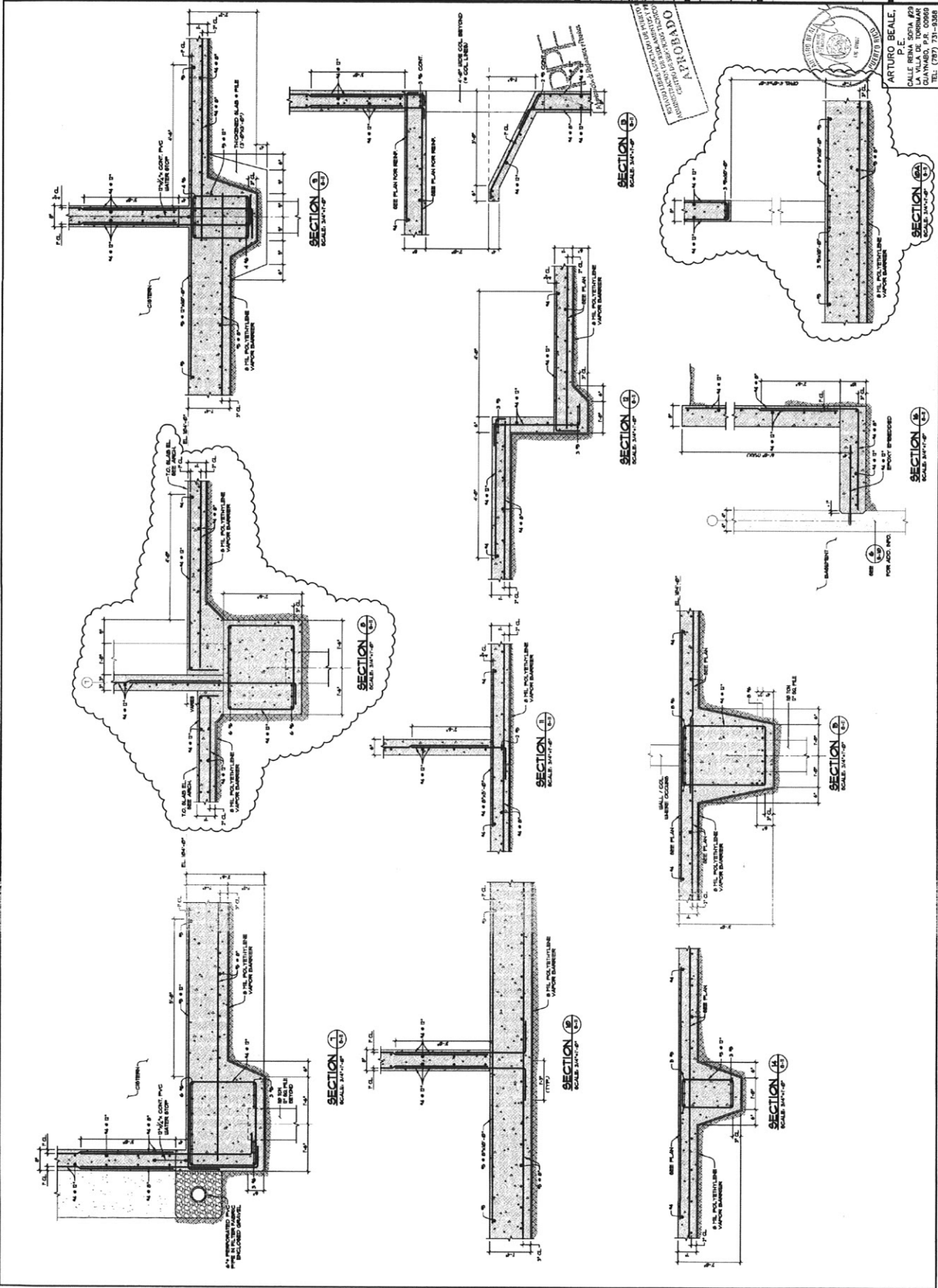
**OWNER:** TECH DEVELOPERS, INC.  
**MARK:** DATE DESCRIPTION  
A 5/15/2008 REVISED SECTION DE  
A 7/22/2008 DETAIL B.A.

**PROJECT NO. 0501**  
**DRAWN BY:** JIMMY SERRA  
**CHECKED BY:** Ing. Arturo Beale

**SHEET TITLE**  
**PARKING SECTIONS & DETAIL**  
SCALE 3/4"=1'-0"

**DATE:** SEPTEMBER 27, 2007

**S-11**



**ARTURO BEALE, P.E.**  
CALLE BRUNO, 678  
LA VILLA DE TORREMAR  
GUAYAMA, P.R. 00960  
TEL: (787) 721-3305





**S-12**



**ARTURO BEALE,**  
P.E.  
CALLE REINA SOFIA #29  
LA VILLA DE TORREMAR  
GUAYNABO, P.R. 00969  
TEL: (787) 731-9368



CONSULTANTS:

STRUCTURAL:  
ARTURO BEALE, P.E.  
MECHANICAL/ELECTRICAL:  
ALFRED LONGHINO, P.E.  
FIRE PROTECTION/LIFE SAFETY:  
ALFRED LONGHINO, P.E.  
GEOTECHNICAL:  
ING. CARLOS SIERRA, P.E.  
SUPERVISOR:  
ING. DANIEL ROSARIO, P.E.

DOCUMENTOS DE CONSTRUCCIÓN DE:

CARIBE  
PLAZA OFFICE  
BUILDING  
#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00929

OWNER:  
TECH DEVELOPERS, INC.

MARK DATE DESCRIPTION

PROJECT NO. 0501

DRAWN BY: Jairo Sarmiento

CHECKED BY: Ing. Arturo Beale

SHEET TITLE

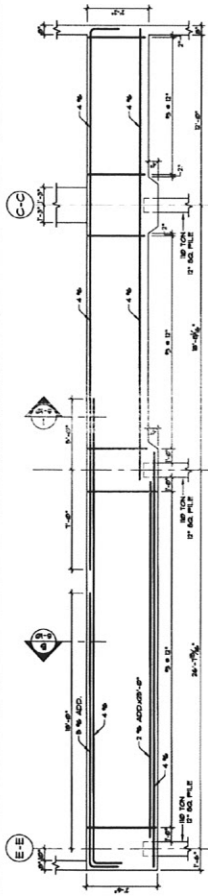
BEAM  
REINFORCEMENT  
ELEVATIONS

SCALE: 1/8"=1'-0"

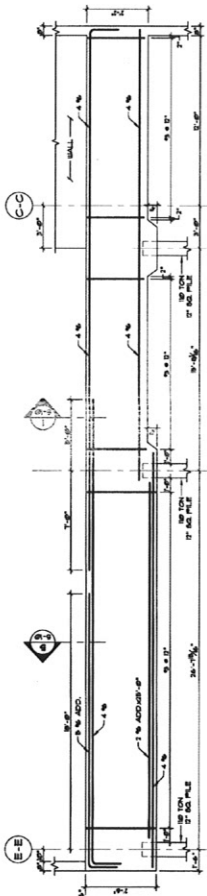
DATE: SEPTEMBER 27, 2007

S-13

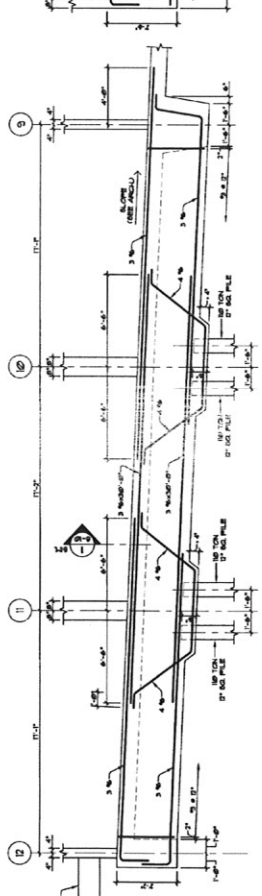
ARTURO BEALE,  
P.E.  
CALLE UNIVERSITARIA, 400  
LA VILLA DE TORREMAR  
GUAYNABO, P.R. 00969  
TEL: (787) 731-9308



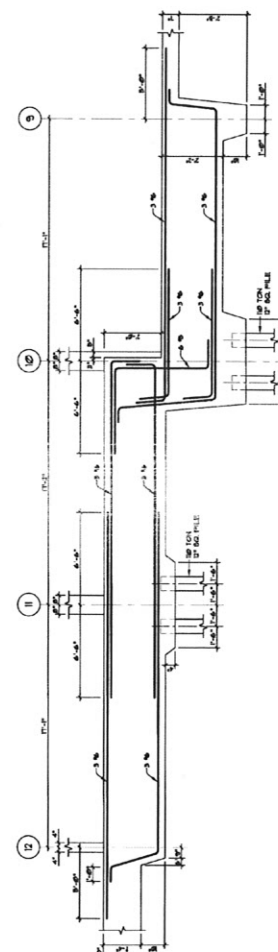
PARKING GRADE BEAM PGRB-1 REINFORCEMENT ELEVATION • COLL. LINE C-C



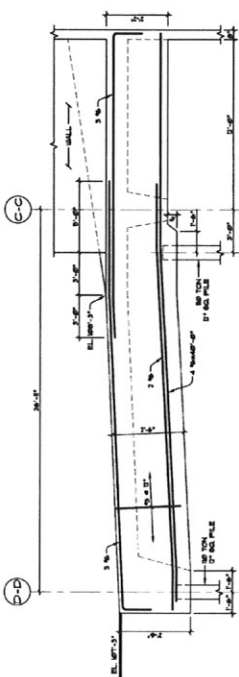
PARKING GRADE BEAM PGRB-2 REINFORCEMENT ELEVATION • COLL. LINE C-C



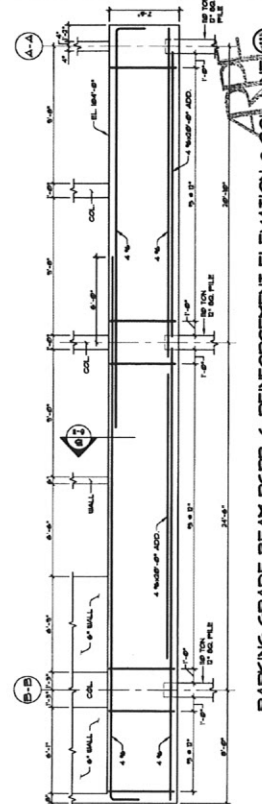
PARKING GRADE BEAM PGRB-4 REINFORCEMENT ELEVATION • COLL. LINE C-C



PARKING GRADE BEAM PGRB-5 REINFORCEMENT ELEVATION • COLL. LINE B-B



PARKING GRADE BEAM PGRB-3 REINFORCEMENT ELEVATION • COLL. LINE C-C



PARKING GRADE BEAM PGRB-6 REINFORCEMENT ELEVATION • COLL. LINE C-C

**CONSULTANTS:**

STRUCTURAL:  
ARTURO DEAL, P.E.

MECHANICAL:  
RAFAEL ARSUGUA, P.E.

ELECTRICAL:  
PEDRO CID, P.E.

PERFUME PROTECTION, LIFE SAFETY,  
AND AIA COMPLIANCE:  
ALFRED LONGHITANO, P.E.

GEOTECHNICAL:  
JIMMY CARLOS SIERRA, P.E.

SURVEYOR:  
JIMMY DANIEL ROSARIO, P.E.

**DOCUMENTOS DE CONSTRUCCIÓN DE:**

**CARIBE  
PLAZA OFFICE  
BUILDING**

#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00921

OWNER:  
TECH DEVELOPERS, INC.

[illegible]

PROJECT NO: 0501	
DRAWN BY: James Santos	
CHECKED BY: Ing. Arturo Beale	

CHKD BY: Inq. Arturo Beale

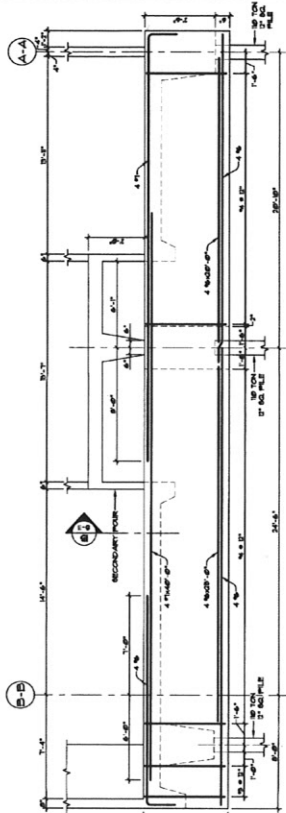
**SHEET TITLE**

BEAM  
REINFORCEMENT  
ELEVATIONS

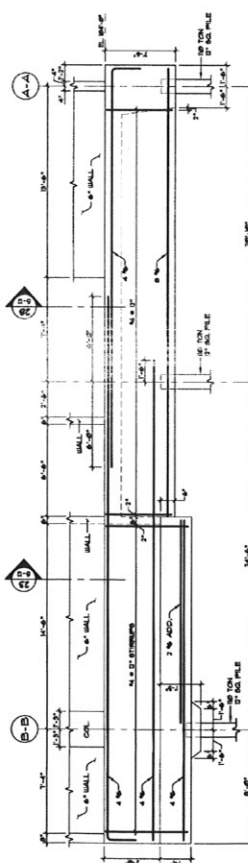
SCALE: 1/8"=1'-0"

DATE: SEPTEMBER 27, 2007

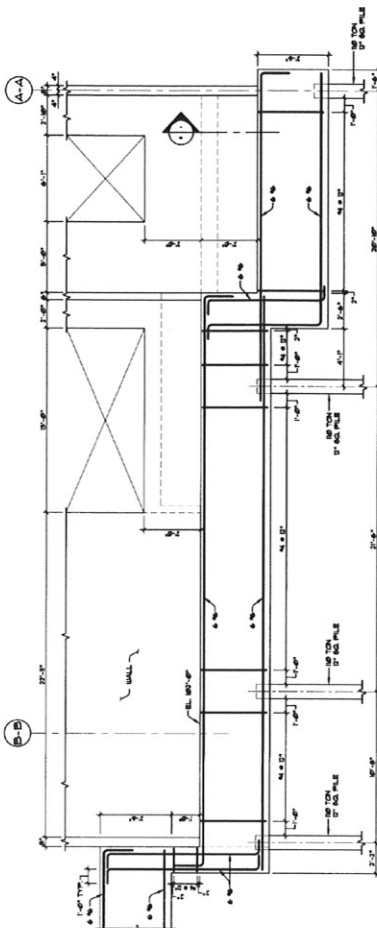
**S-14**



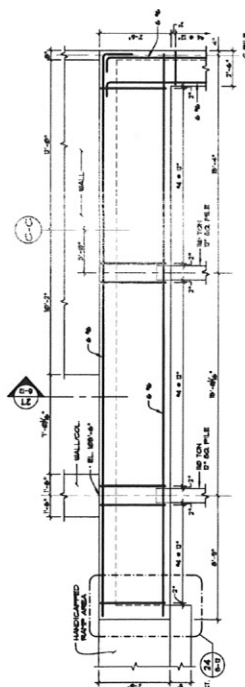
PARKING GRADE BEAM FG9B-8 REINFORCEMENT ELEVATION • COLL. LINE ⑨



VERTICAL SCALE: 1"=1'-0"  
HORIZONTAL SCALE: 1/4"=1'-0"



PARKING GRADE BEAM RGRB-9B REINFORCEMENT ELEVATION • COL. LINE (3)



PARKING GRADE BEAM FGRB-9A REINFORCEMENT ELEVATION • COL. LINE ⑧

RE

AROMATO  
 CENTRO DE INVESTIGACIONES Y SERVICIOS TECNOLÓGICOS  
 INSTITUTO TECNOLÓGICO DE AERONÁUTICA Y ESPACIO



**ARTURO BEALE,**  
**P.E.**  
CALLE REINA SOFIA #29  
LA VILLA DE TORREMAR  
GUAYNABO, P.R. 00969  
TEL: (787) 731-9358



**CONSULTANTS:**  
STRUCTURAL: ARTURO BEALE, P.E.  
MECHANICAL/ELECTRICAL: ALFONSO ARSUAÑA, P.E.  
ELECTRICAL: PEDRO CUBA, P.E.  
FIRE PROTECTION/LIFE SAFETY: ALFONSO ARSUAÑA, P.E.  
FIRE PROTECTION/LIFE SAFETY: ALFONSO ARSUAÑA, P.E.  
GEOTECHNICAL: ALFONSO ARSUAÑA, P.E.  
ING. CARLOS SIERRA, P.E.  
SUPERVISOR: ING. DANIEL ROSARIO, P.E.

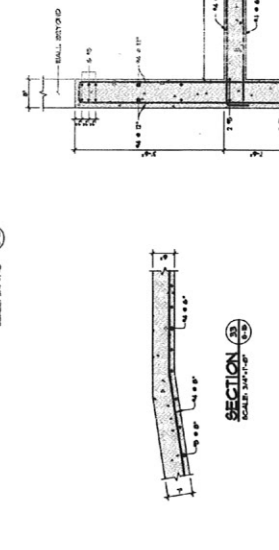
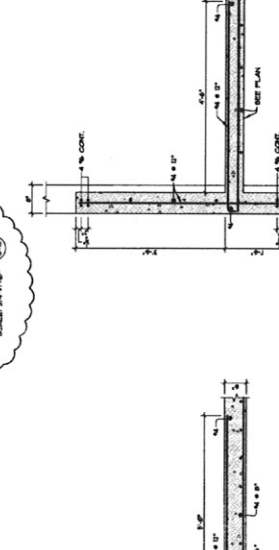
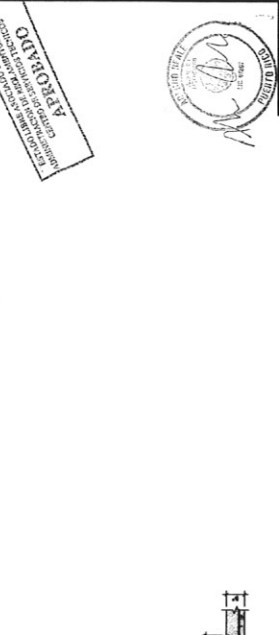
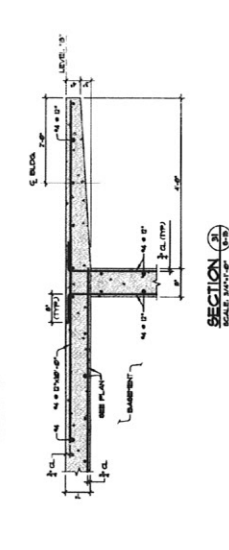
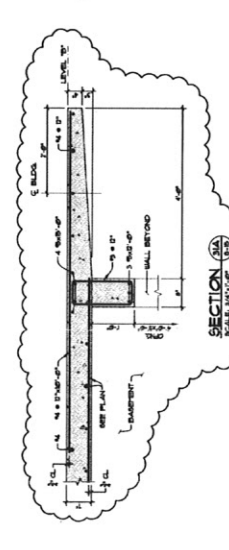
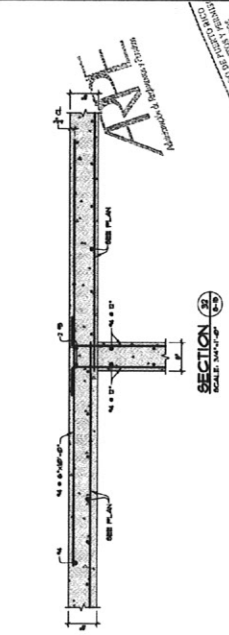
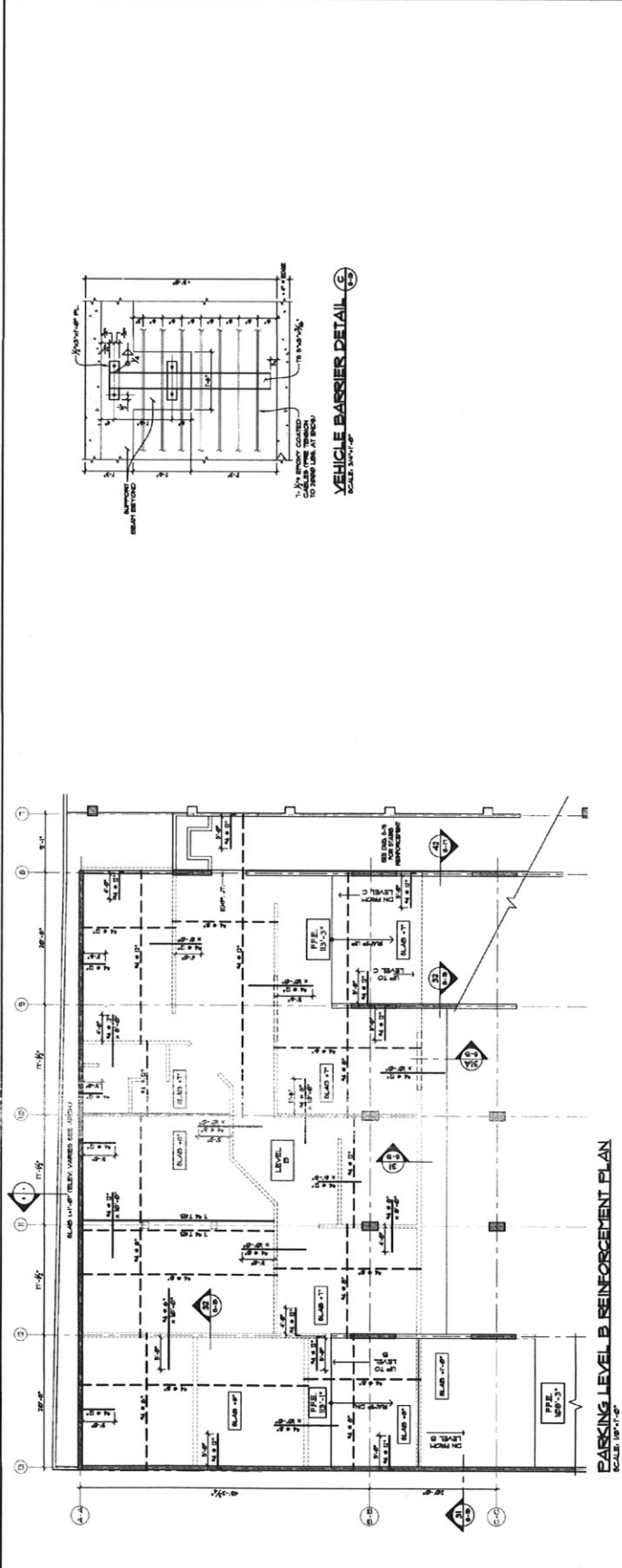
**DOCUMENTOS DE CONSTRUCCIÓN DE:**  
**CARIBE PLAZA OFFICE BUILDING**  
#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00924

**OWNER:** TEKCH DEVELOPERS, INC.  
**MARK:** DATE DESCRIPTION  
5/19/2008 SECTIONAL REBAR

**PROJECT NO:** 0507  
**DRAWN BY:** JAMES SANCHEZ  
**CHECKED BY:** Ing. Arturo Beale

**SHEET TITLE:**  
**PARKING LEVEL B REINFORCEMENT PU SECTIONS & DETAIL**  
SCALE AS NOTED  
**DATE:** SEPTEMBER 27, 2007

**S-15**  
ARTURO BEALE, P.E.  
CALLE PRINCIPAL, TORRE 1000  
GUAYNABO, P.R. 00969  
TEL: (787) 721-2388







CONSULTANTS:

STRUCTURAL:  
ARTURO BEALE, P.E.  
MICHAEL J. HARRIS, P.E.  
ELECTRICAL:  
DAVID ARJUNA, P.E.  
PEDRO CO, P.E.  
MECHANICAL, LIFE SAFETY,  
& ENVIRONMENTAL:  
ALFRED LONGHINO, P.E.  
GEOLOGICAL:  
ING. CARLOS SERRA, P.E.  
ING. DANIEL ROSARIO, P.E.

DOCUMENTOS DE CONSTRUCCION DE:

CARIBE PLAZA OFFICE BUILDING

#1547 Ave. Ponce de Leon  
San Juan, Puerto Rico 00924

OWNER:  
TCH DEVELOPERS, INC.

PROJECT NO. 0501

DRAWN BY: JIMMY SIMON

CHECKED BY: Ing. Arturo Beale

SHEET TITLE

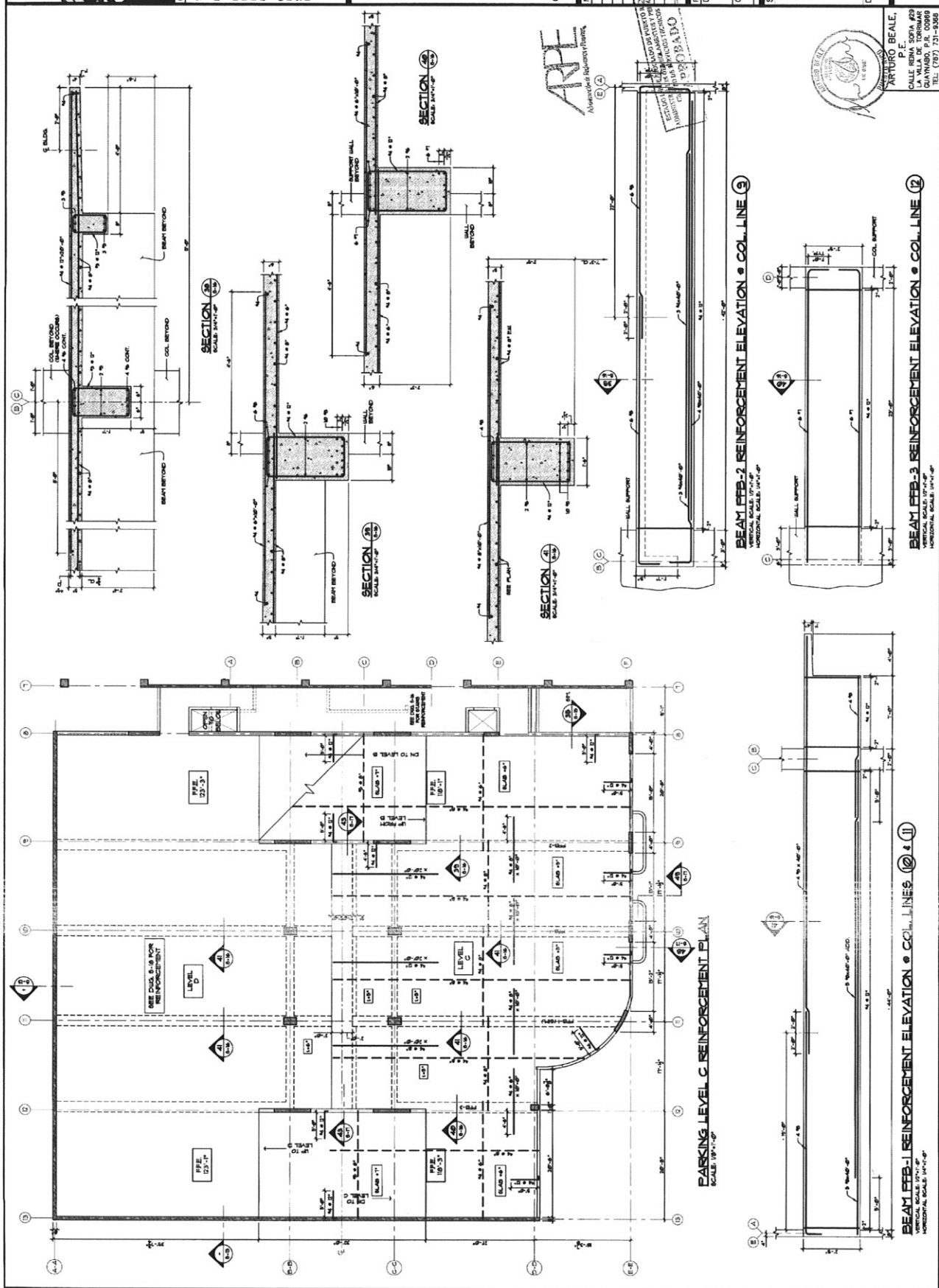
PARKING LEVEL C REINFORCEMENT PLU

SECTIONS & DETAIL

SCALE AS NOTED

DATE: SEPTEMBER 27, 2007

S-16



ARTURO BEALE,  
P.E. CERT. #12345  
LA VILLA DE TORREMAR  
GUAYAMA, P.R. 00969  
TEL. (787) 721-8888

BEAM FFB-2 REINFORCEMENT ELEVATION • COLL. LINE ⑨  
VERTICAL SCALE 1/4" = 1'-0"  
HORIZONTAL SCALE 1/4" = 1'-0"

BEAM FFB-1 REINFORCEMENT ELEVATION • COLL. LINE ⑩ & ⑪  
VERTICAL SCALE 1/4" = 1'-0"  
HORIZONTAL SCALE 1/4" = 1'-0"

**CONSULTANTS:**

**STRUCTURAL:**  
ARTURO BEALE, P.E.

**MECHANICAL:**  
RAFAEL ARSUAAGA, P.E.

**ELECTRICAL:**  
PEDRO CID, P.E.

**FIRE PROTECTION, LIFE SAFETY,  
ADA COMPLIANCE:**  
ALFRED LONGHITANO, P.E.

**GEOTECHNICAL:**  
JIMMY CARLOS SIERRA, P.E.

**SURVEYOR:**  
DANIEL ROSARIO, P.E.

DOCUMENTOS DE  
CONSTRUCCIÓN DE:

CARIBE  
PLAZA OFFICE  
BUILDING

#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00924

OWNER:  
TECH DEVELOPERS, INC.

MARK	DATE	DESCRIPTION
------	------	-------------

PROJECT NO: 0501

RAWN BY: Janice Santos

BOOK BY: Lee Anne DeLoe

**SHEET TITLE**

PARKING LEVELS

FARMING LEVELS  
F O R I T E R R I T O R I A L

E, G, & I TYPICAL

REINFORCEMENT PL/

## SECTIONS & DETAIL

SCALE: AS NOTED

**Figure 1**

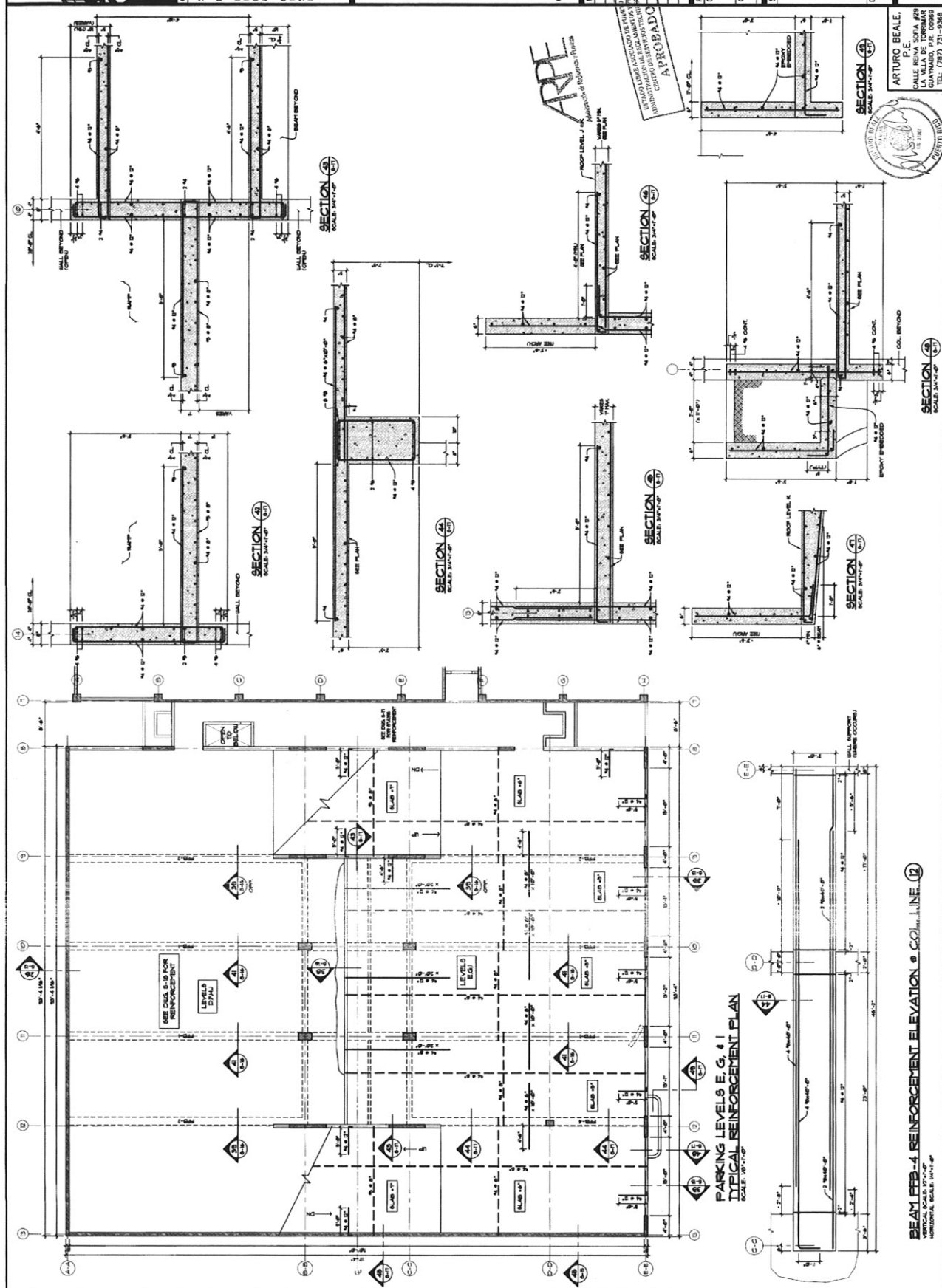
SEPTEMBER 27, 2007

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512

ش

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BEAM FEB-4 REINFORCEMENT ELEVATION • COL. LINE ⑫



CONSULTANTS:  
STRUCTURAL:  
ARTURO BEALE, P.E.  
MECHANICAL:  
RAFAEL ANSILUAGA, P.E.  
ELECTRICAL:  
PEDRO CEB, P.E.  
FIRE PROTECTION, LIFE SAFETY,  
& ALARMS:  
ALFREDO LONGHIANO, P.E.  
GEO-TECHNICAL:  
ING. CARLOS SIERRA, P.E.  
ING. DANIEL ROSARIO, P.E.

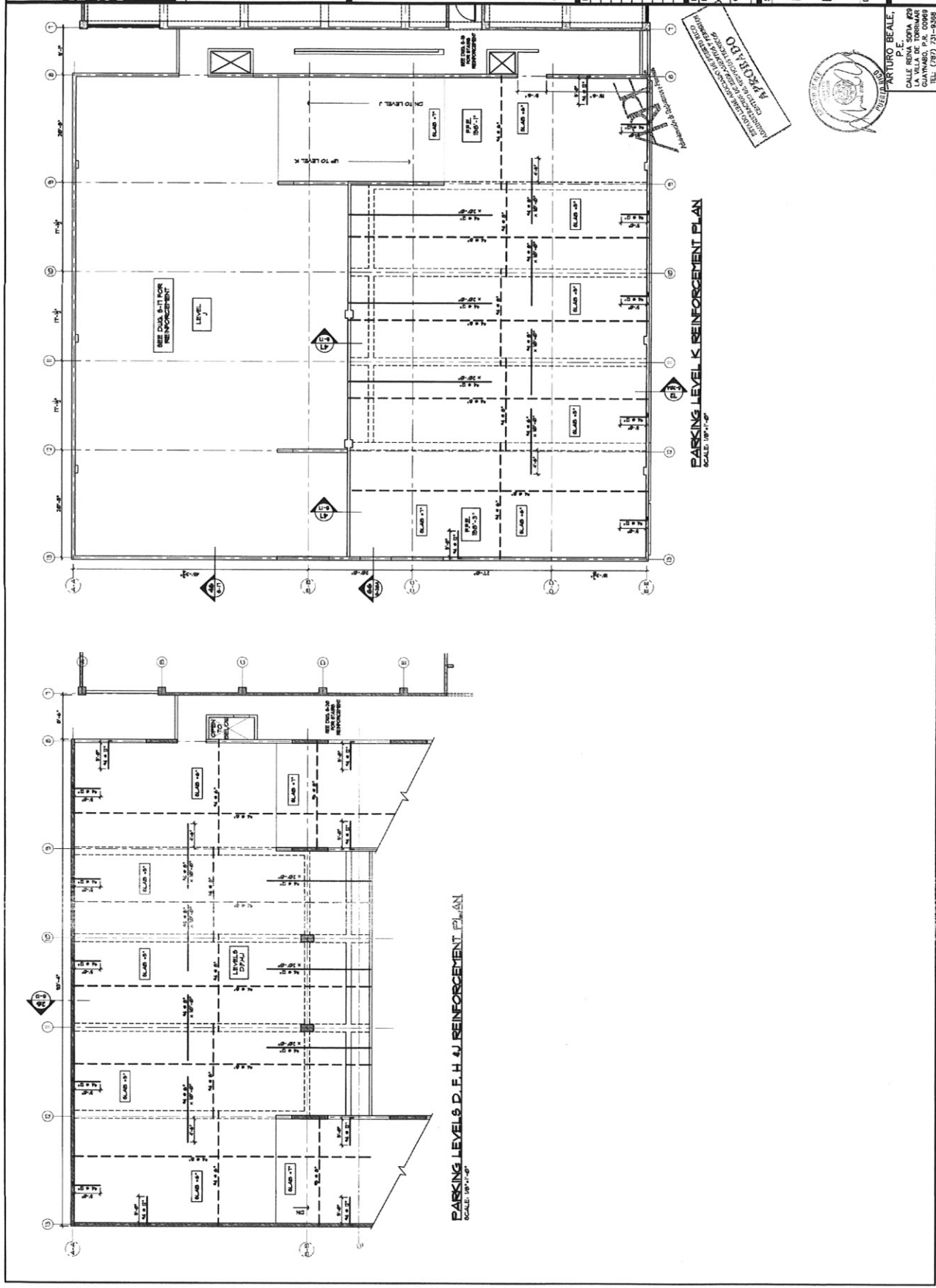
DOCUMENTOS DE  
CONSTRUCCIÓN DE:  
**CARIBE  
PLAZA OFFICE  
BUILDING**  
#1547 Ave. Ponce de León  
San Pedro, Puerto Rico, 00921

OWNER:  
TCH DEVELOPERS, INC.  
MARK DATE DESCRIPTION  
A 5/10/2008 SECTION 16, 17 & 18

PROJECT NO.: 0501  
DRAWN BY: JIMMY SANCHEZ  
CHECKED BY: Ing. Arturo Beale

SHEET TITLE  
PKG. LEVELS D.F.H. 8  
PARKING LEVEL K-RO  
AND STAIRS ROOF  
REINFORCEMENT PL  
SECTIONS & DETAIL  
SCALE AS NOTED  
DATE: SEPTEMBER 27, 2007

**S-18**





**CONSULTANTS:**  
STRUCTURAL: ARTURO BEALE P.E.  
MECHANICAL: RAFAEL ANSUAQUIA P.E.  
ELECTRICAL: PEDRO CO P.E.  
SAFETY: ALFRED LONGHIANO P.E.  
GEOTECHNICAL: JUAN CARLOS SERRA P.E.  
SURVEYING: DANIEL ROSARIO P.E.

**DOCUMENTOS DE CONSTRUCCIÓN DE:**  
**CARIBE PLAZA OFFICE BUILDING**  
#1547 Ave. Ponce de León  
San Juan, Puerto Rico, 00924

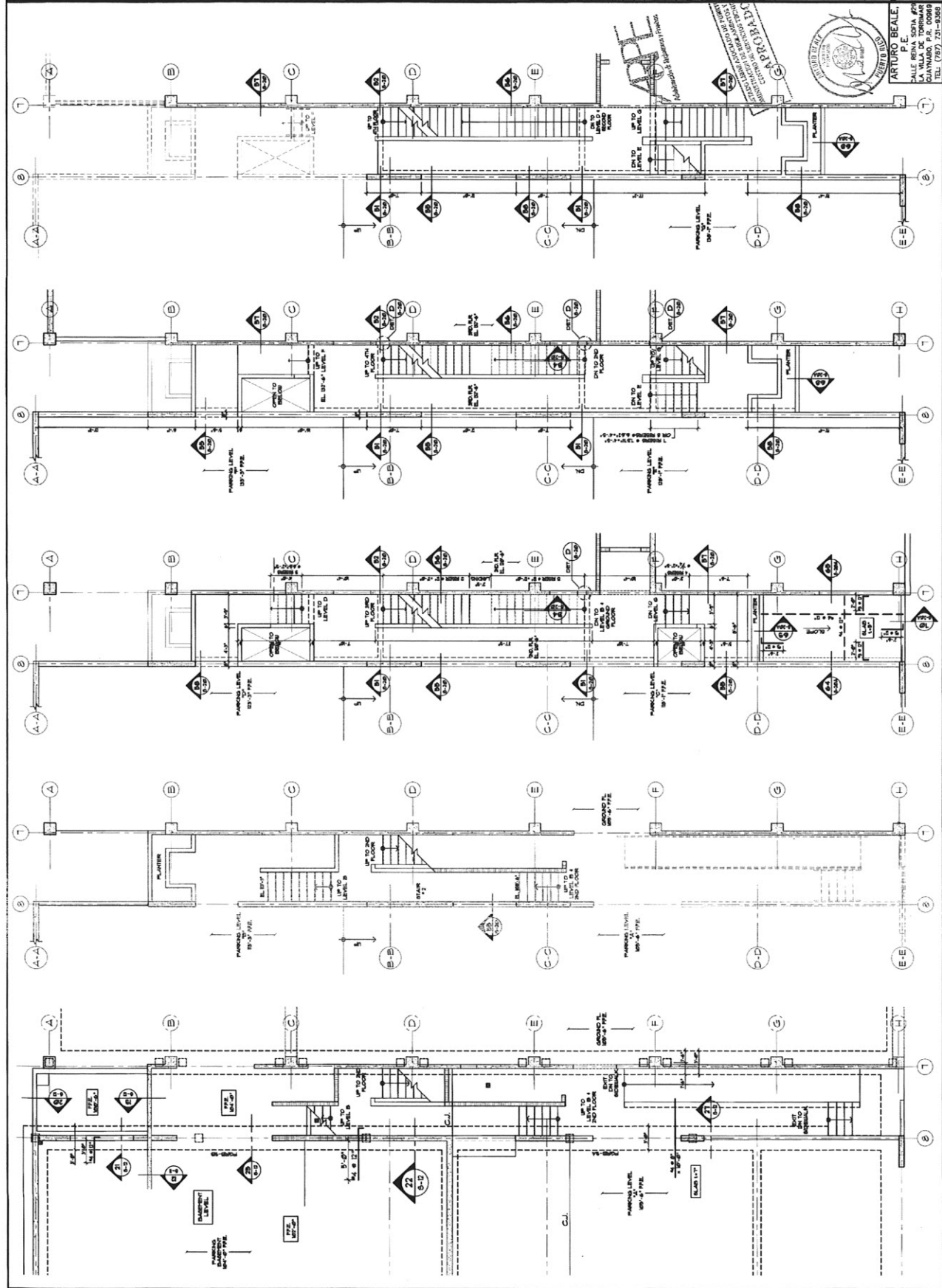
**OWNER:**  
TYKH MYKLOWERS, INC.

MARK	DATE	DESCRIPTION
A	5/15/2008	STRUCTURAL & ALL

**PROJECT NO. 0001**  
**DESIGNED BY:** James Sauter  
**CHECKED BY:** Ing. Arturo Beale

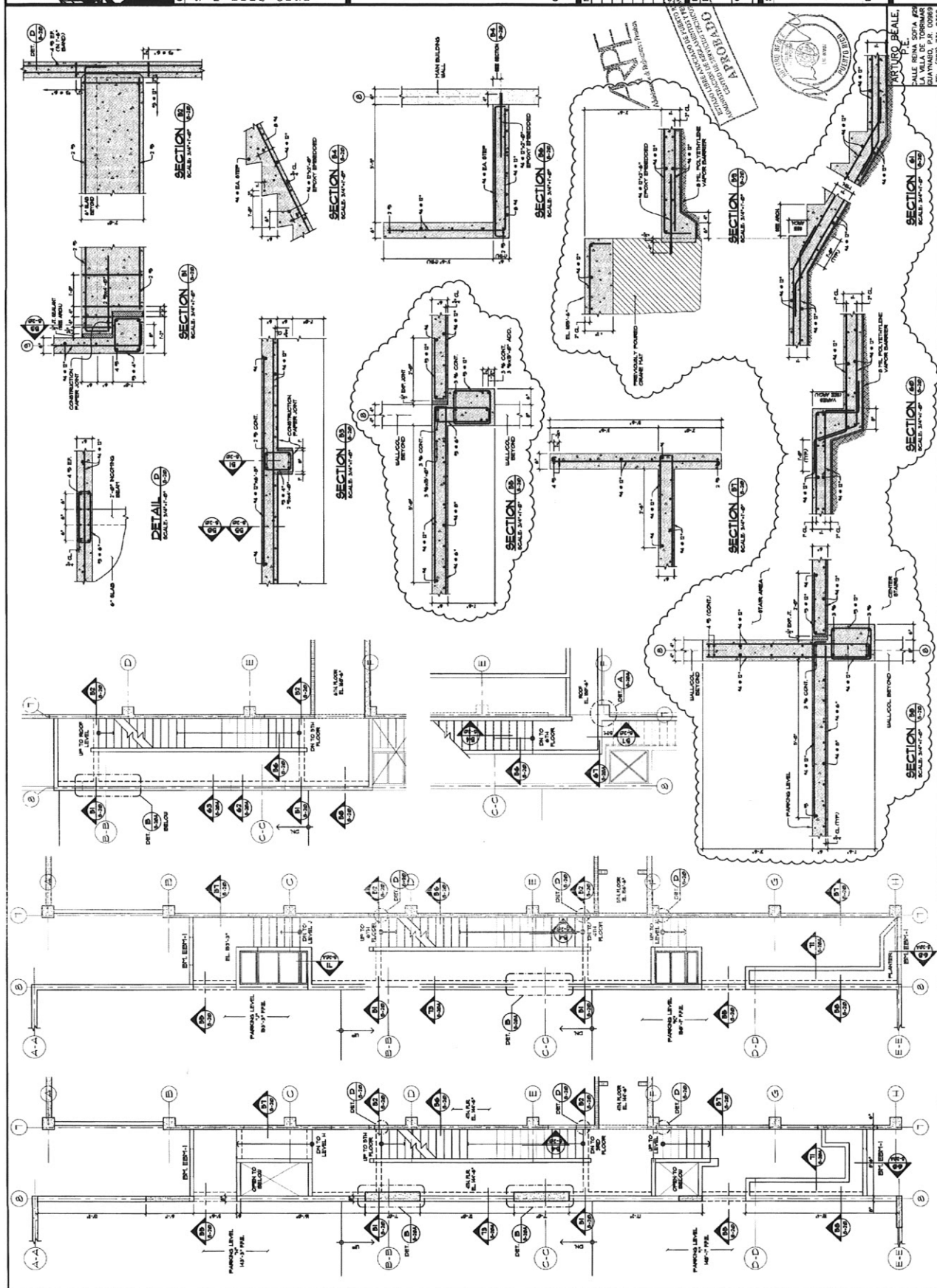
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**MAIN STAIR DETAIL**  
SCALE: 3/16"=1'-0"

**DATE:** SEPTEMBER 27, 2007  
**S-19**



**ARTURO BEALE, P.E.**  
S-19  
LA VILLA DE TORREMAR  
GUAYAMA, P.R. 00969  
TEL: (787) 331-4300





**CONSULTANTS:**

STRUCTURAL:  
ARTURO BEALE, P.E.

MECHANICAL:  
RAFAEL ANSUAÑA, P.E.

ELECTRICAL:  
PEDRO CID, P.E.

FIRE PROTECTION, LIFE SAFETY,  
& ADA COMPLIANCE:  
ALFRED LONGHANTANO, P.E.

GEOTECHNICAL:  
WING, CARLOS SIERRA, P.E.

SURVEYOR:  
WING, DANIEL ROSARIO, P.E.

DOCUMENTOS DE  
CONSTRUCCIÓN DE:

CARIBE  
PLAZA OFFICE  
BUILDING

#1547 Ave. Ponce de León  
Río Piedras, Puerto Rico, 00924

MARK	DATE	DESCRIPTION
OWNER:		
TECH DEVELOPERS, INC.		

[illegible]

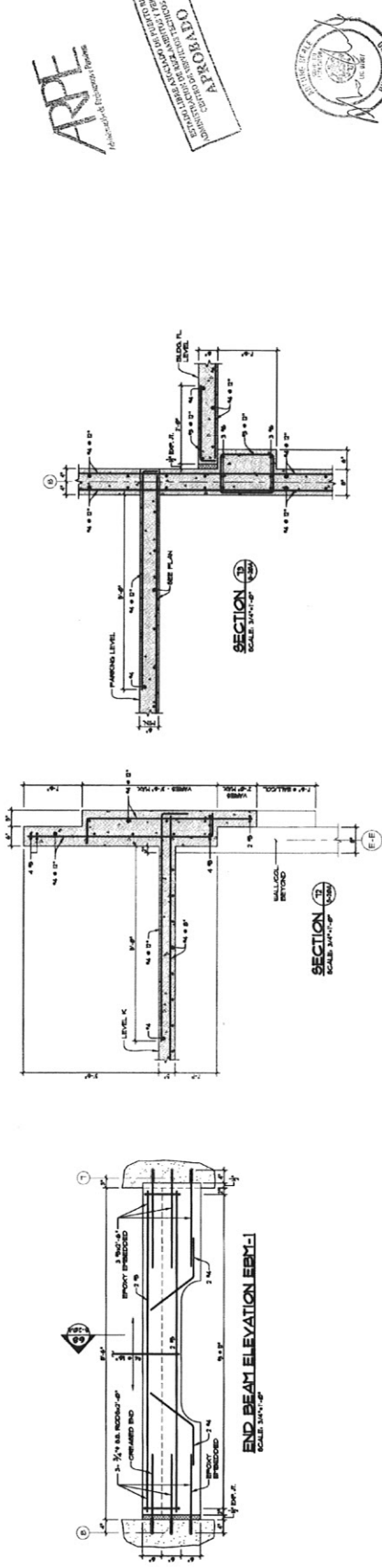
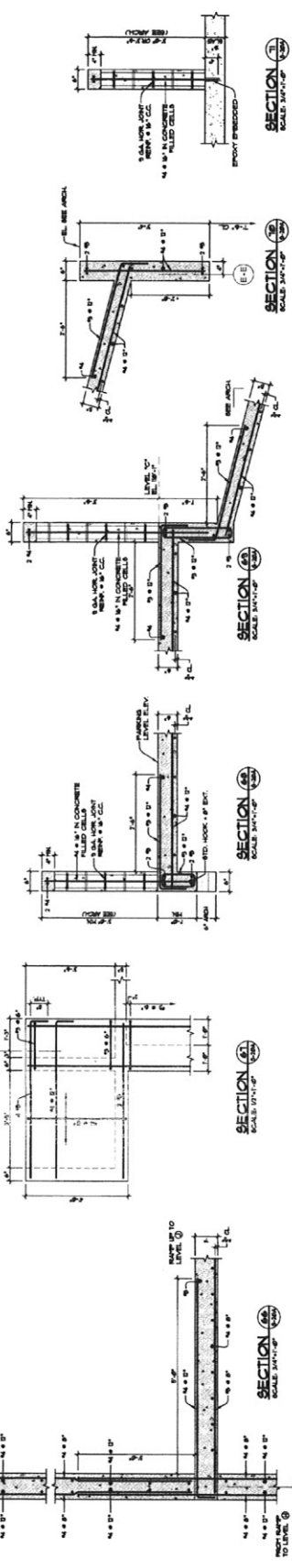
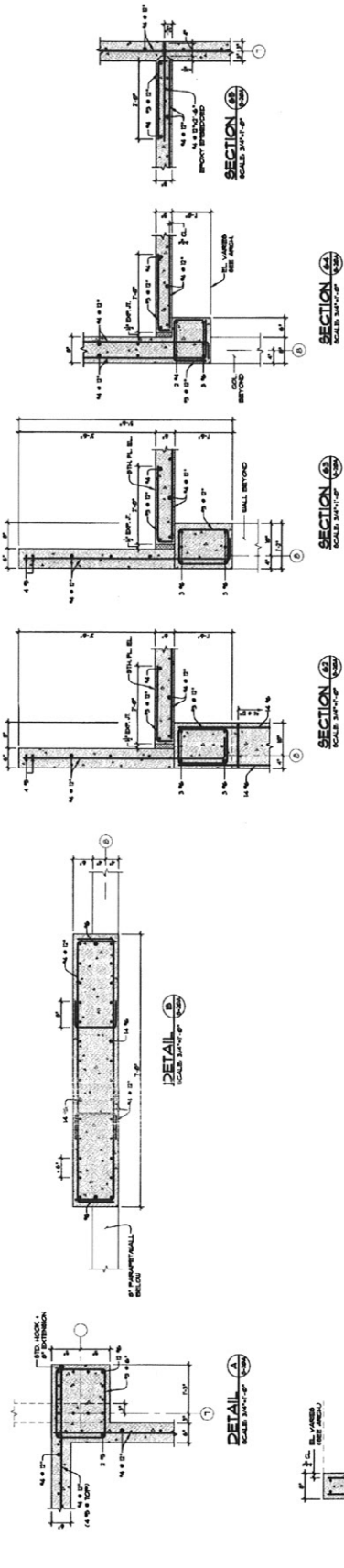
PROJECT NO: 0501
DRAWN BY: Janice Santos
CHECKED BY: Ing. Arturo Beale

CHKD BY: Ing. Arturo Beale

SCALE: 3/4"=1'-0"

DATE: MAY 19, 2008

S-20A



RE

**AEROPORTO**  
 ESTAB. LINEAS AER. NAC. ARGENT.  
 CENTRO DE SERVICIOS DE PASAJEROS  
 1700 BARRIO DE LOS REYES  
 BUENOS AIRES 1700



**ARTURO BEALE,  
P.E.**  
CALLE REINA SOFIA #29  
LA VILLA DE TORREMAR  
GUAYNABO, P.R. 00969  
TEL: (787) 731-9368



CONSULTANTS:

STRUCTURAL: ARTURO BEALE, P.E.  
MECHANICAL: ANTONIO M. L. P.E.  
ELECTRICAL: ANTONIO M. L. P.E.  
FIRE PROTECTION, LIFE SAFETY, 4 ADI CONSULTING ENGINEERS, P.E.  
GEOLOGICAL: ANTONIO M. L. P.E.  
SURVEYOR: ANTONIO M. L. P.E.

DOCUMENTOS DE CONSTRUCCION DE:

CARIBE PLAZA OFFICE BUILDING

#1547 Ave. Ponce de León  
Rio Piedras, Puerto Rico, 00924

OWNER:

TYNCH INTERNATIONAL, INC.

MARK DATE DESCRIPTION

Table with 3 columns: MARK, DATE, DESCRIPTION. Contains multiple rows for project milestones.

PROJECT NO. 0001

DATE: 10/10/00

BY: JMC/SMB

CHECKED BY: Ing. Arturo Beale

SHEET TITLE

STRUCTURAL NOTE

AND DETAILS

AS NOTED

DATE: SEPTEMBER 27, 2007

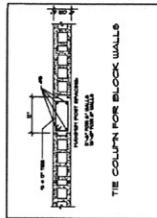
S-21

ARTURO BEALE, P.E.

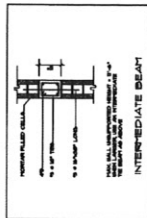
1547 Ponce de León Ave., Suite 200

San Juan, P.R. 00909

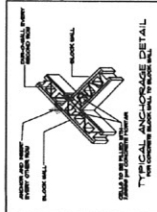
TEL: (787) 731-3368



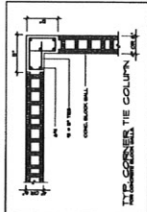
THE COLUMN FOR BLOCK WALLS



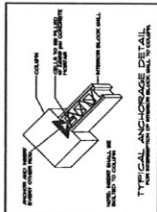
INTERMEDIATE BEAM



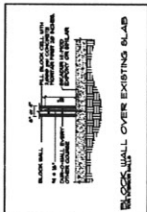
TYPICAL ANCHORAGE DETAIL



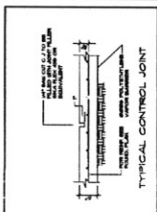
THE COLUMN REINFORCEMENT



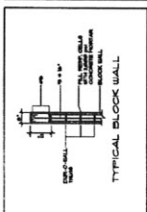
TYPICAL ANCHORAGE DETAIL



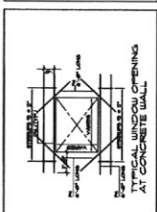
BLOCK WALL OVER EXISTING SLAB



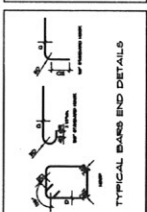
TYPICAL CONTROL JOINT



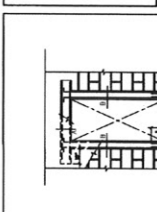
TYPICAL BLOCK WALL



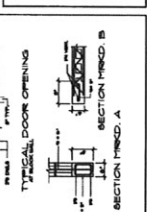
TYPICAL DOOR OPENING



TYPICAL WINDOW OPENING



TYPICAL WINDOW OPENING DETAIL



TYPICAL WINDOW OPENING DETAIL

REINFORCED CONCRETE

- 1. The contractor shall comply with all local and Federal government safety regulations.
2. Preparation of surfaces for epoxy application shall be done in accordance to manufacturer's recommendations.
3. The contractor shall ensure that all epoxy is applied in accordance to the manufacturer's recommendations.
4. The contractor shall ensure that all epoxy is applied in accordance to the manufacturer's recommendations.

REINFORCED CONCRETE

- 1. All reinforcement shall be made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).
2. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).

REINFORCED CONCRETE

- 1. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).
2. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).

REINFORCED CONCRETE

- 1. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).
2. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).

REINFORCED CONCRETE

- 1. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).
2. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).

REINFORCED CONCRETE

- 1. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).
2. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).

REINFORCED CONCRETE

- 1. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).
2. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).

REINFORCED CONCRETE

- 1. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).
2. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).

REINFORCED CONCRETE

- 1. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).
2. The contractor shall ensure that all reinforcement is made in accordance with the "Manual of Reinforcing Steel" (MRS) published by the American Institute of Steel Construction, Inc. (AISC).

STRUCTURAL NOTES

GENERAL

- 1. The contractor shall be responsible for coordinating the requirements of all disciplines involved in the project.
2. Materials listed below shall conform to the latest revisions of the following specifications:
- Reinforcing Steel: ASTM A-601, Grade 60
- Structural Steel: ASTM A-500, Grade B
- Welding: AWS D1.1, Section 5.1
- Concrete: ACI 308, Section 5.1

STRUCTURAL NOTES

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- Concrete: ACI 308, Section 5.1

# Appendix C: Summary Data Sheet

## BUILDING DATA

Building Name: <u>Caribe Plaza Office Building</u>		Date: <u>July 30, 2022</u>
Building Address: <u>1547 Ponce De Leon Avenue, Rio Piedras, Puerto Rico</u>		
Latitude: <u>18.3836778</u>	Longitude: <u>-66.0658617</u>	By: <u>DQR, MSCE, PE</u>
Year Built: <u>2009-2010</u>	Year(s) Remodeled: <u>N/A</u>	Original Design Code: <u>UBC 1987/ACI318-95</u>
Area (sf): <u>65,700sf</u>	Length (ft): <u>110'-4"</u>	Width (ft): <u>99'-3"</u>
No. of Stories: <u>6</u>	Story Height: <u>15' first level &amp; 12' others</u>	Total Height: <u>75'-0"</u>

**USE**   ☐ Industrial   ☒ Office   ☐ Warehouse   ☐ Hospital   ☐ Residential   ☐ Educational   ☒ Other: 911 Center

## CONSTRUCTION DATA

Gravity Load Structural System:	<u>R/C shear walls with R/C concrete beams and R/C columns frames</u>	
Exterior Transverse Walls:	<u>R/C frames and R/C Walls</u>	Openings? <u>Yes</u>
Exterior Longitudinal Walls:	<u>R/C frame and R/C walls</u>	Openings? <u>Yes</u>
Roof Materials/Framing:	<u>R/C slab supported on R/C beams and R/C Shear Walls</u>	
Intermediate Floors/Framing:	<u>R/C slabs supported on R/C beams and R/C Shear Walls</u>	
Ground Floor:	<u>R/C slabs supported by R/C beams- R/C beams supported on R/C pile caps</u>	
Columns:	<u>R/C columns</u>	Foundation: <u>12"sq precast piles</u>
General Condition of Structure:	<u>Good/ Some fisures in some structural elements/Cracks along joint at Axis 8</u>	
Levels Below Grade?	<u>none</u>	
Special Features and Comments:	<u>Beams not always supported in columns, 1 column not all the way to the Ground Level</u>	

## LATERAL-FORCE-RESISTING SYSTEM

	Longitudinal	Transverse
System:	<u>R/C shear walls</u>	<u>R/C shear walls</u>
Vertical Elements:	<u>R/C columns and shear walls</u>	<u>R/C columns and shear walls</u>
Diaphragms:	<u>Rigid R/C slabs</u>	<u>Rigid R/C Slabs</u>
Connections:		

## EVALUATION DATA

BSE-1N Spectral Response Accelerations:	$S_{Ds} =$ <u>0.483</u>	$S_{D1} =$ <u>0.331</u>
Soil Factors:	Class= <u>D</u>	$F_a =$ <u>1.11</u> $F_v =$ <u>1.9</u>
BSE-1E Spectral Response Accelerations:	$S_{xs} =$ <u>0.558</u>	$S_{x1} =$ <u>0.335</u>
Level of Seismicity:	<u>High</u>	Performance Level: <u>Life Safety</u>
Building Period:	$T =$ <u>0.51</u>	
Spectral Acceleration:	$S_a =$ <u>0.938</u>	
Modification Factor:	$C_m C_1 C_2 =$ <u>.8 * 1.1 = .88</u>	Building Weight: $W =$ <u>11,680 kips</u>
Pseudo Lateral Force:	$V =$ <u>9640 kips</u>	
	$C_m C_1 C_2 S_a W =$	

**BUILDING CLASSIFICATION:** C2 - Concrete Shear Walls with Stiff Diaphragms

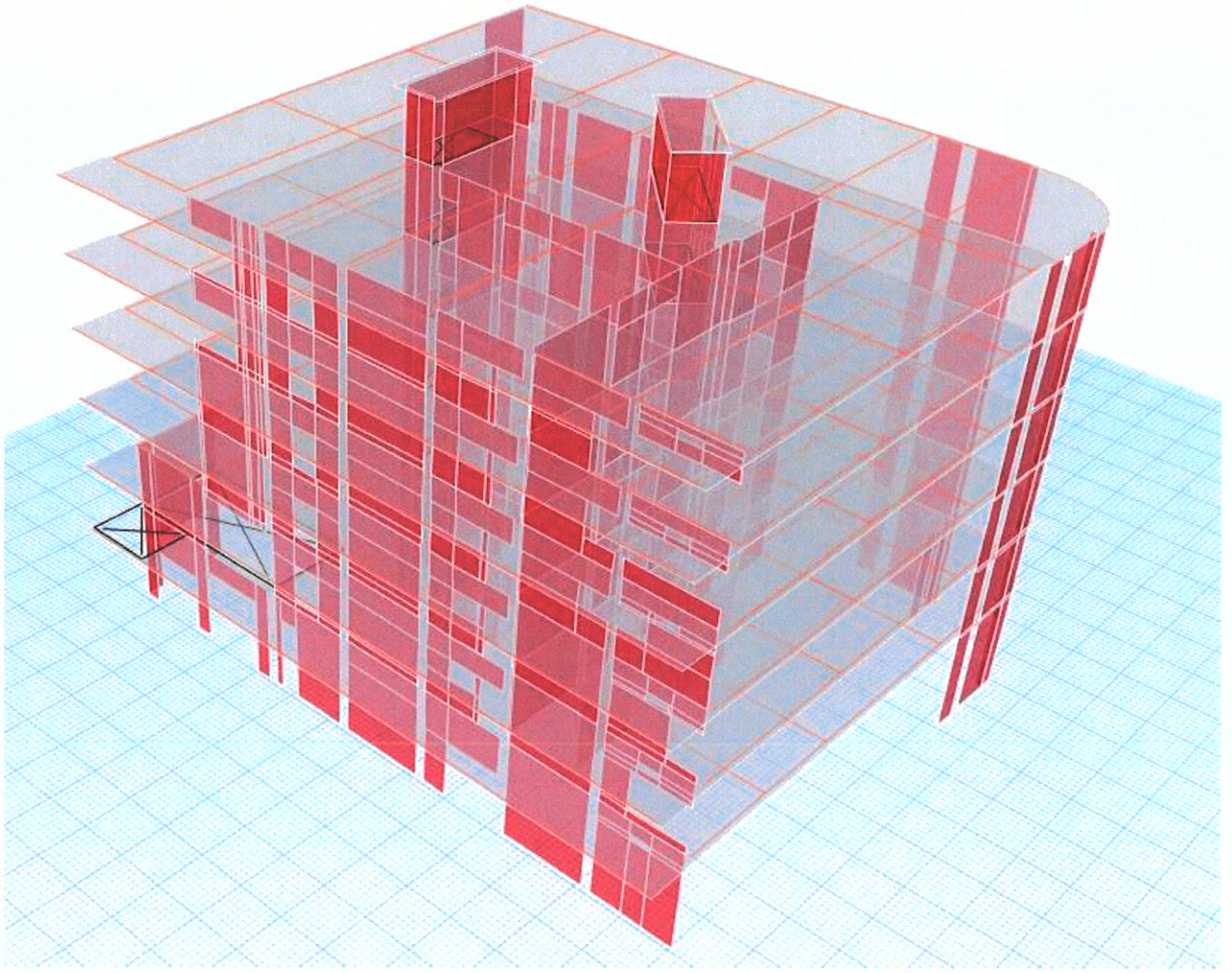
## REQUIRED TIER 1 CHECKLISTS

	Yes	No
Basic Configuration Checklist	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Building Type <u>C2</u> Structural Checklist	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Nonstructural Component Checklist	<input checked="" type="checkbox"/>	<input type="checkbox"/>

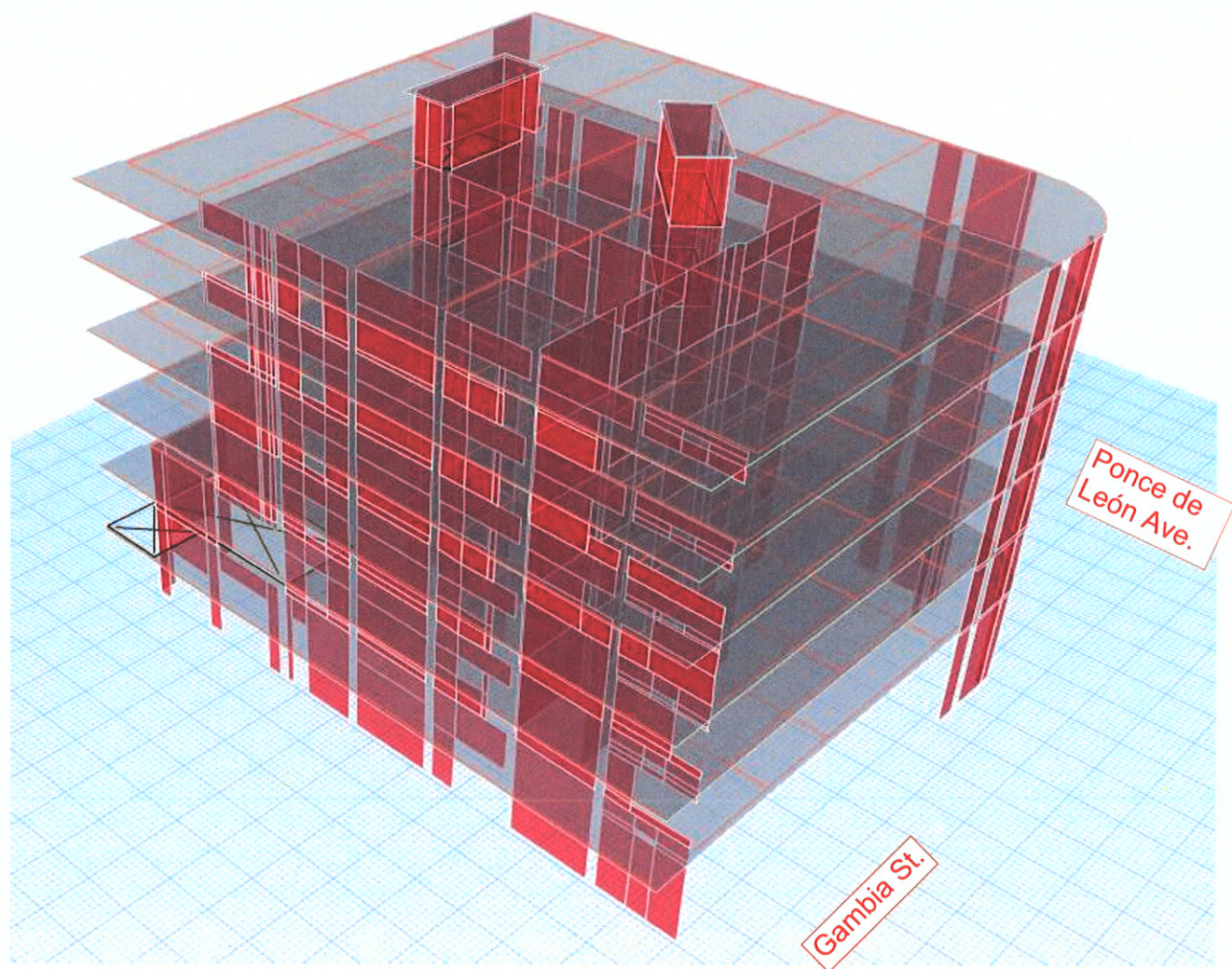
**FURTHER EVALUATION REQUIREMENT:** Tier 2 Required for Non-Compliant Items



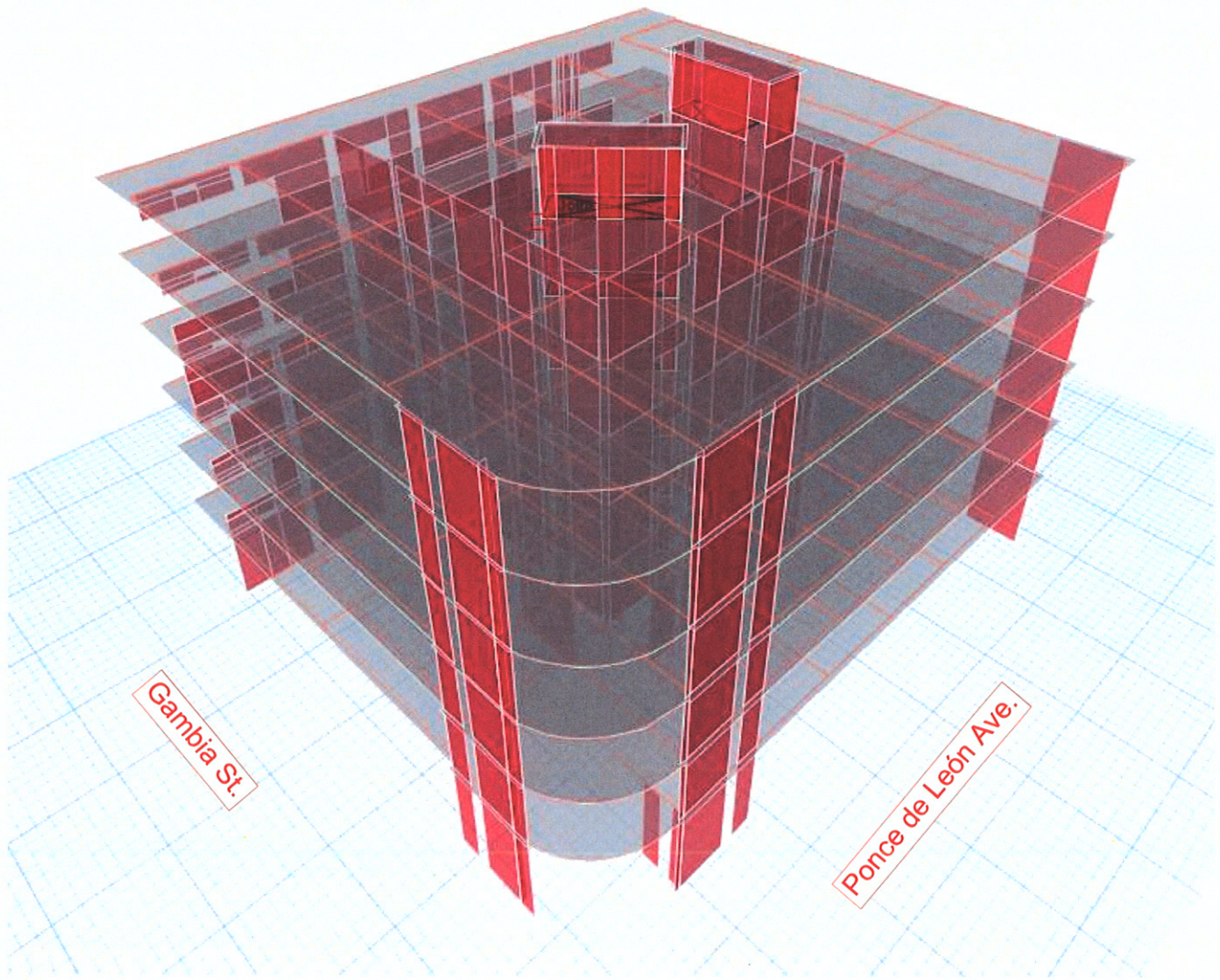
**APPENDIX D**  
**Structural Modeling**  
**Displacement Results**  
**Shear Wall Analysis and Design**



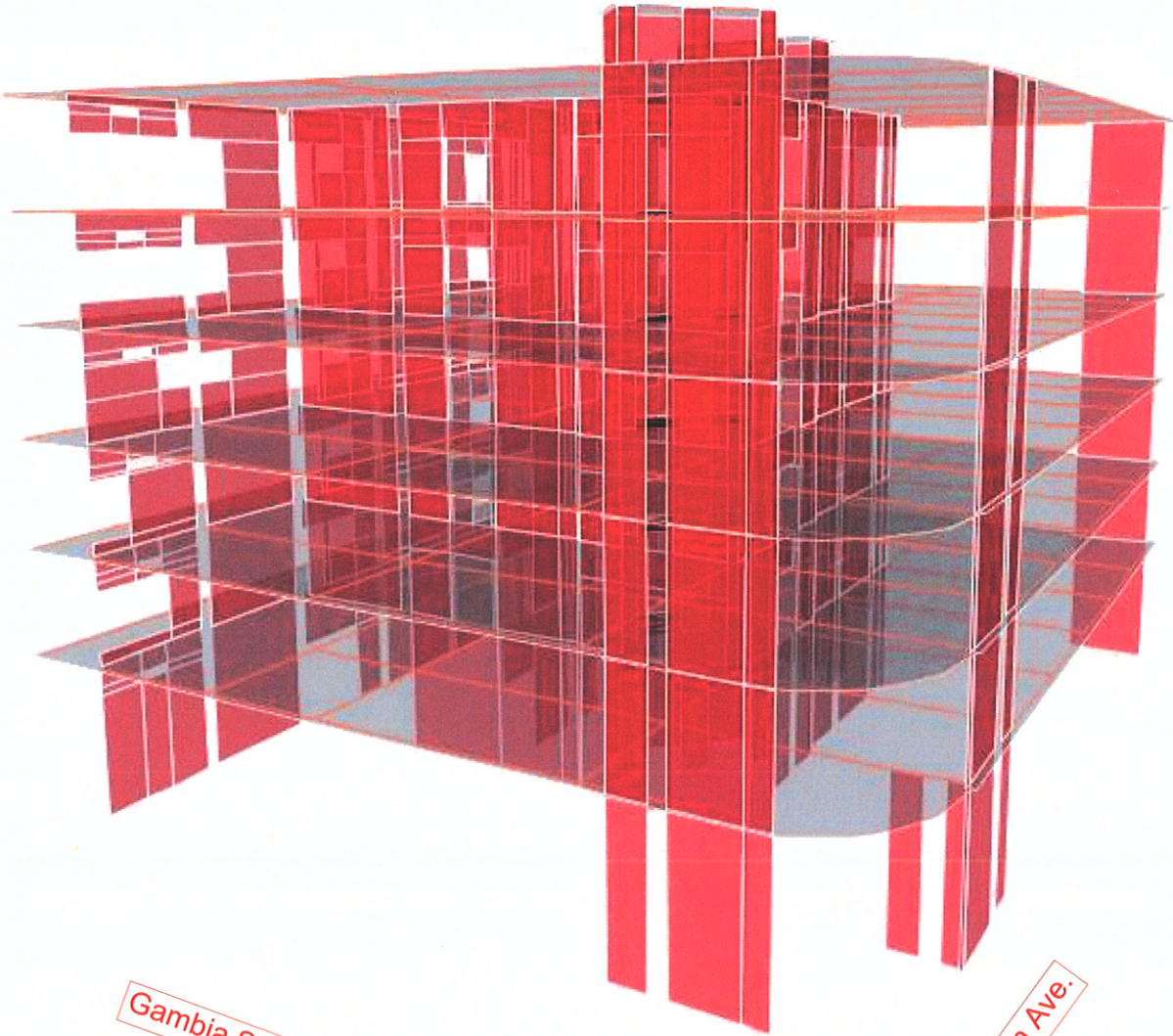












Gambia St.

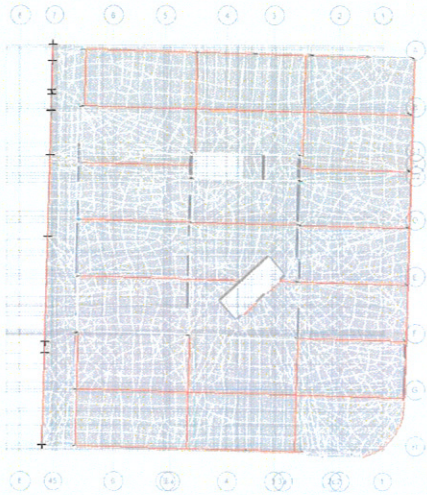
Ponce de León Ave.



## Displacement Results for Existing Building Structure



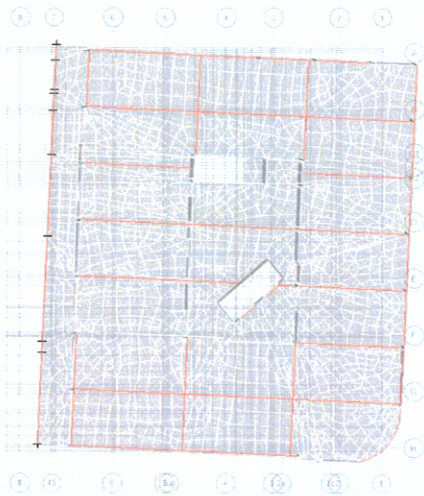
# Earthquake Cases



EQ-1



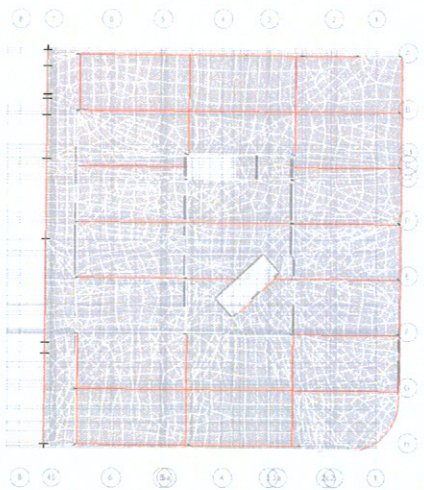
EQ-2



EQ-3



EQ-4



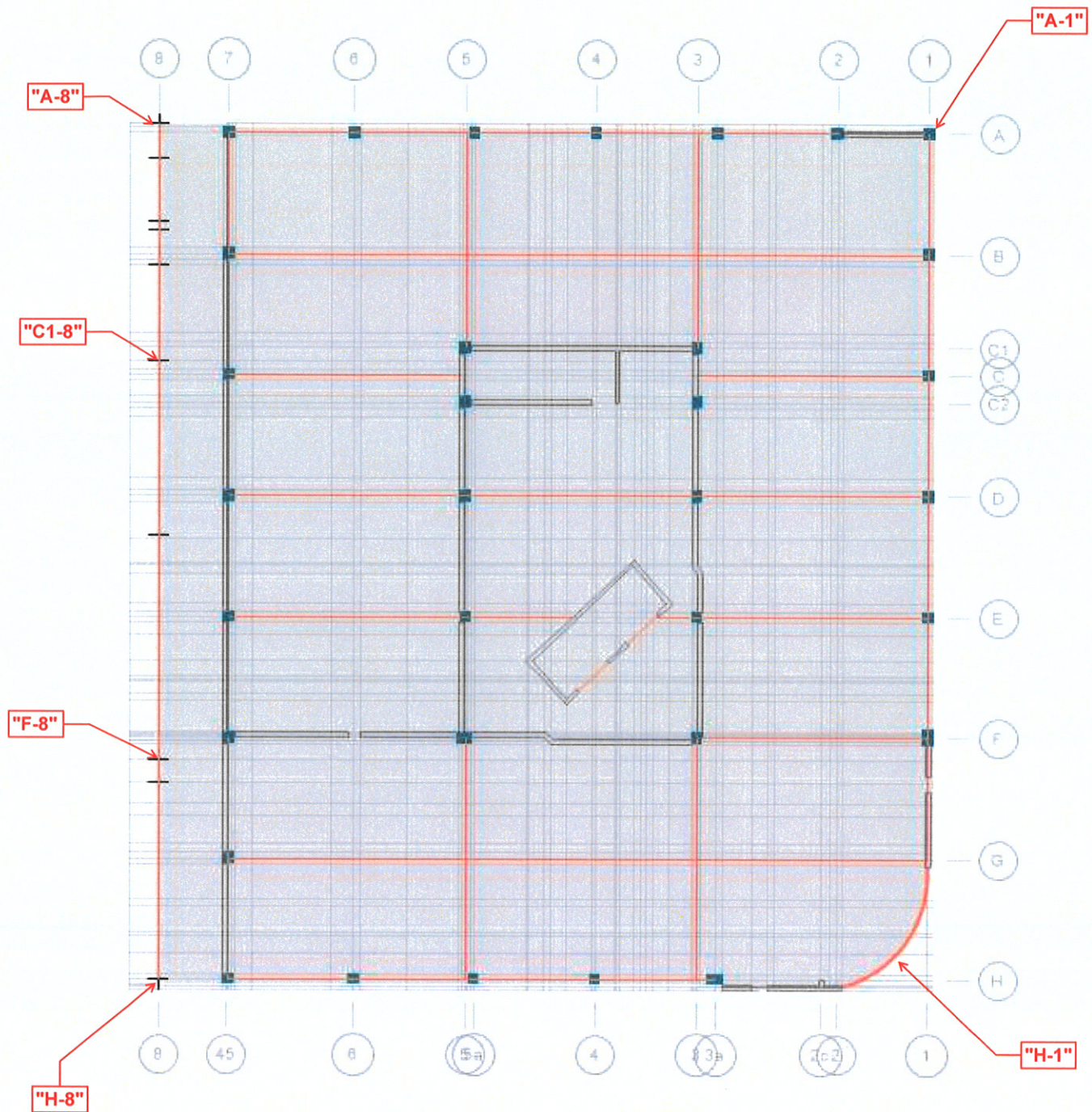
EQ-5



EQ-6



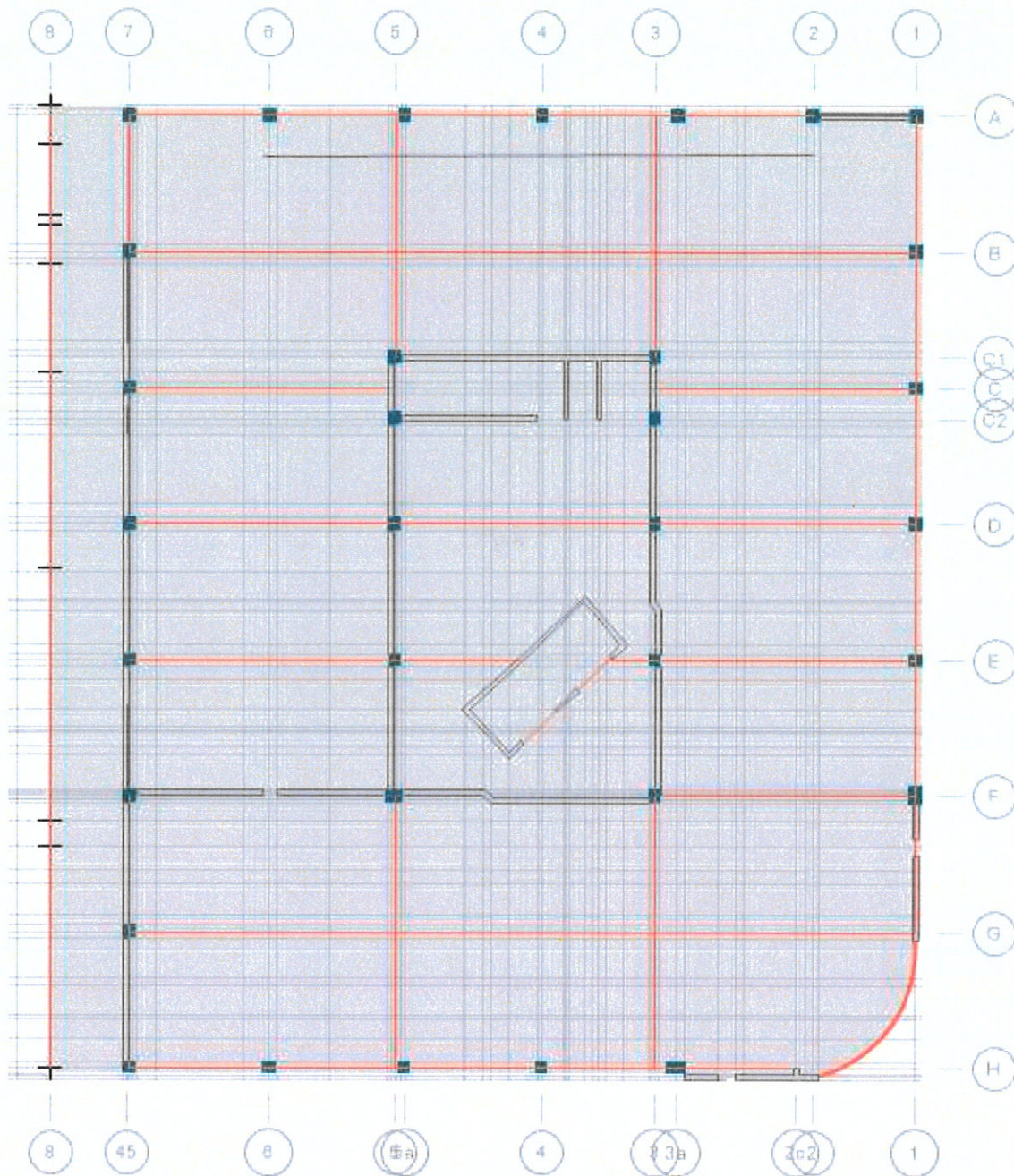
# Roof Level



ROOF LEVEL												
Case	Point "A-1"		Point "H-1"		Point "H-8"		Point "F-8"		Point "C1-8"		Point "A-8"	
	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]
EQ-1	0.343	-0.092	0.230	-0.090	0.227	0.010	0.260	0.010	0.310	0.010	0.340	0.010
EQ-2	-0.157	0.352	0.060	0.342	0.070	0.142	0.012	0.142	-0.096	0.142	-0.160	0.142
EQ-3	0.388	-0.138	0.200	-0.130	0.193	0.040	0.244	0.040	0.335	0.040	0.390	0.040
EQ-4	-0.198	0.393	0.096	0.381	0.103	0.119	0.025	0.119	-0.116	0.119	-0.200	0.119
EQ-5	0.298	-0.046	0.262	-0.040	0.261	-0.012	0.271	-0.012	0.288	-0.012	0.299	-0.011
EQ-6	-0.117	0.310	0.038	0.304	0.040	0.166	0.001	0.166	-0.074	0.166	-0.119	0.166



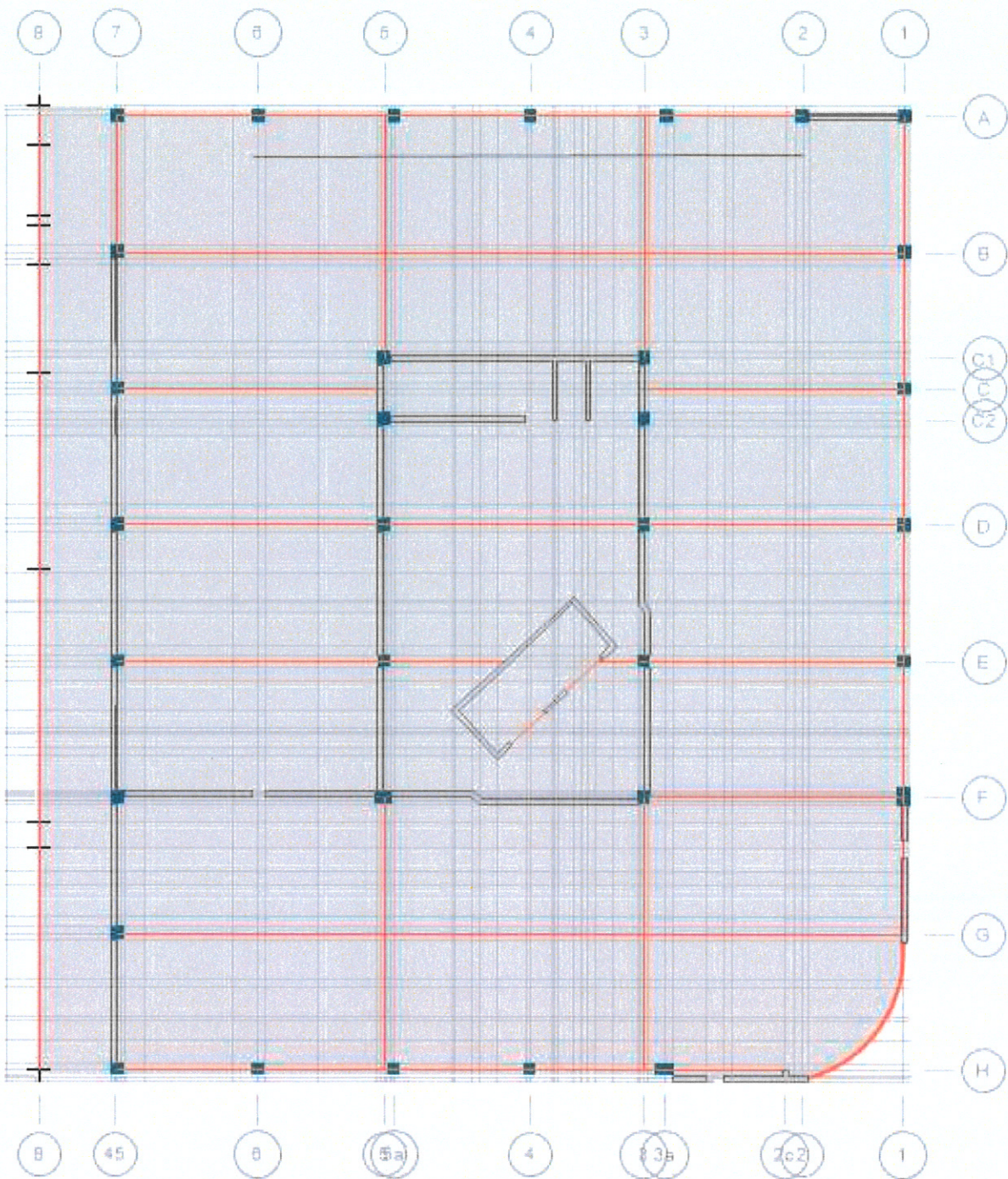
## Sixth Level



SIXTH LEVEL												
Case	Point "A-1"		Point "H-1"		Point "H-8"		Point "F-8"		Point "C1-8"		Point "A-8"	
	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]
EQ-1	0.284	-0.069	0.205	-0.066	0.203	0.005	0.224	0.005	0.263	0.005	0.285	0.005
EQ-2	-0.130	0.304	0.058	0.296	0.062	0.128	0.012	0.128	-0.078	0.128	-0.132	0.128
EQ-3	0.320	-0.109	0.177	-0.103	0.173	0.027	0.212	0.027	0.280	0.027	0.324	0.027
EQ-4	-0.164	0.339	0.083	0.329	0.089	0.108	0.024	0.108	-0.096	0.108	-0.167	0.107
EQ-5	0.247	-0.030	0.233	-0.030	0.233	-0.017	0.237	-0.017	0.243	-0.017	0.247	-0.017
EQ-6	-0.096	0.268	0.032	0.260	0.036	0.148	0.001	0.148	-0.060	0.148	-0.098	0.147



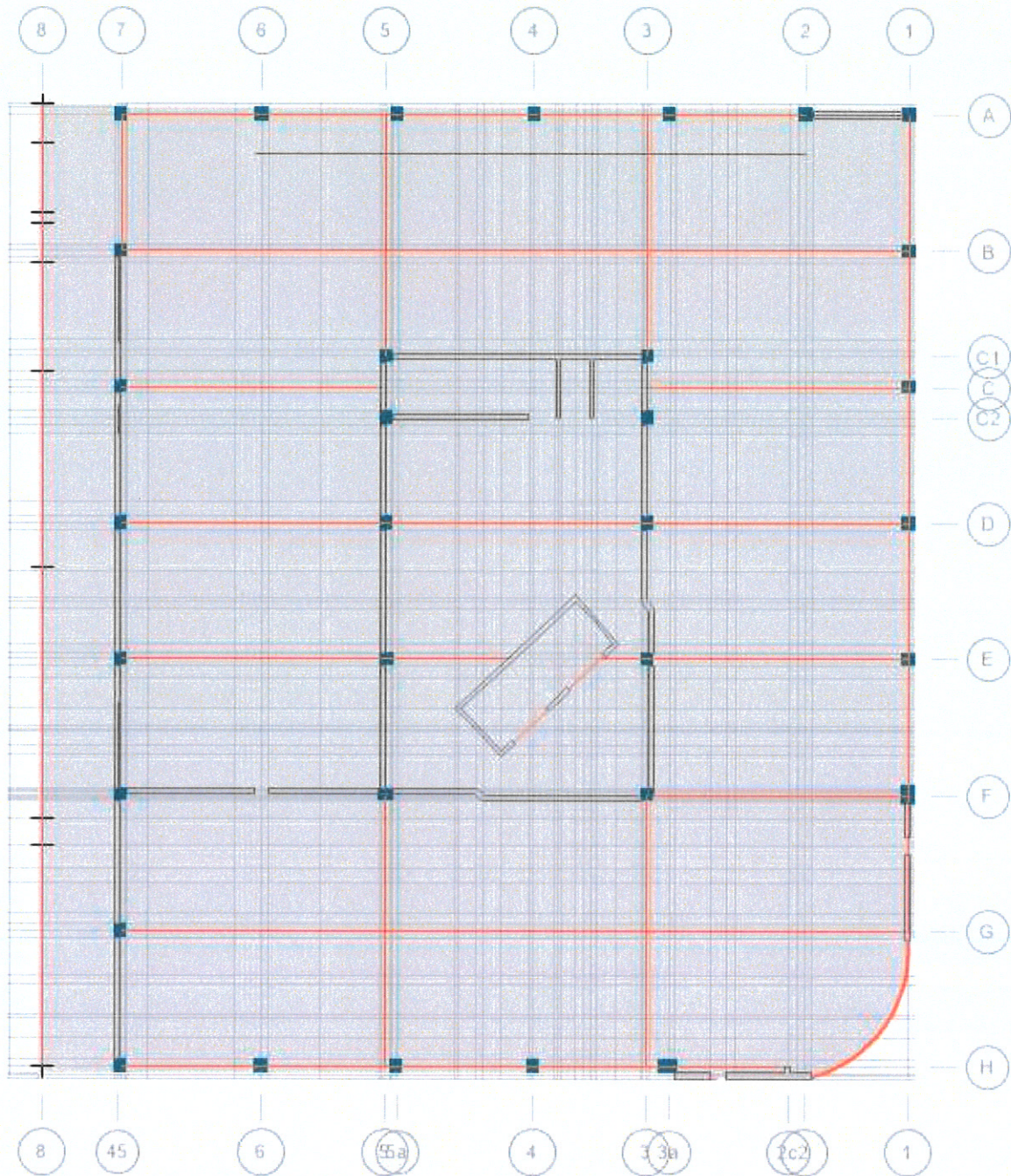
## Fifth Level



FIFTH LEVEL												
Case	Point "A-1"		Point "H-1"		Point "H-8"		Point "F-8"		Point "C1-8"		Point "A-8"	
	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]
EQ-1	0.219	-0.047	0.173	-0.045	0.172	-0.004	0.184	-0.004	0.207	-0.004	0.220	-0.004
EQ-2	-0.101	0.246	0.048	0.240	0.051	0.107	0.012	0.107	-0.060	0.107	-0.103	0.107
EQ-3	0.248	-0.078	0.150	-0.074	0.148	0.014	0.174	0.014	0.221	0.014	0.249	0.014
EQ-4	-0.127	0.274	0.068	0.266	0.073	0.091	0.020	0.091	-0.074	0.091	-0.130	0.091
EQ-5	0.190	-0.015	0.196	-0.015	0.196	-0.021	0.195	-0.021	0.192	-0.021	0.190	-0.021
EQ-6	-0.074	0.218	0.027	0.213	0.029	0.126	0.002	0.123	-0.047	0.123	-0.076	0.123



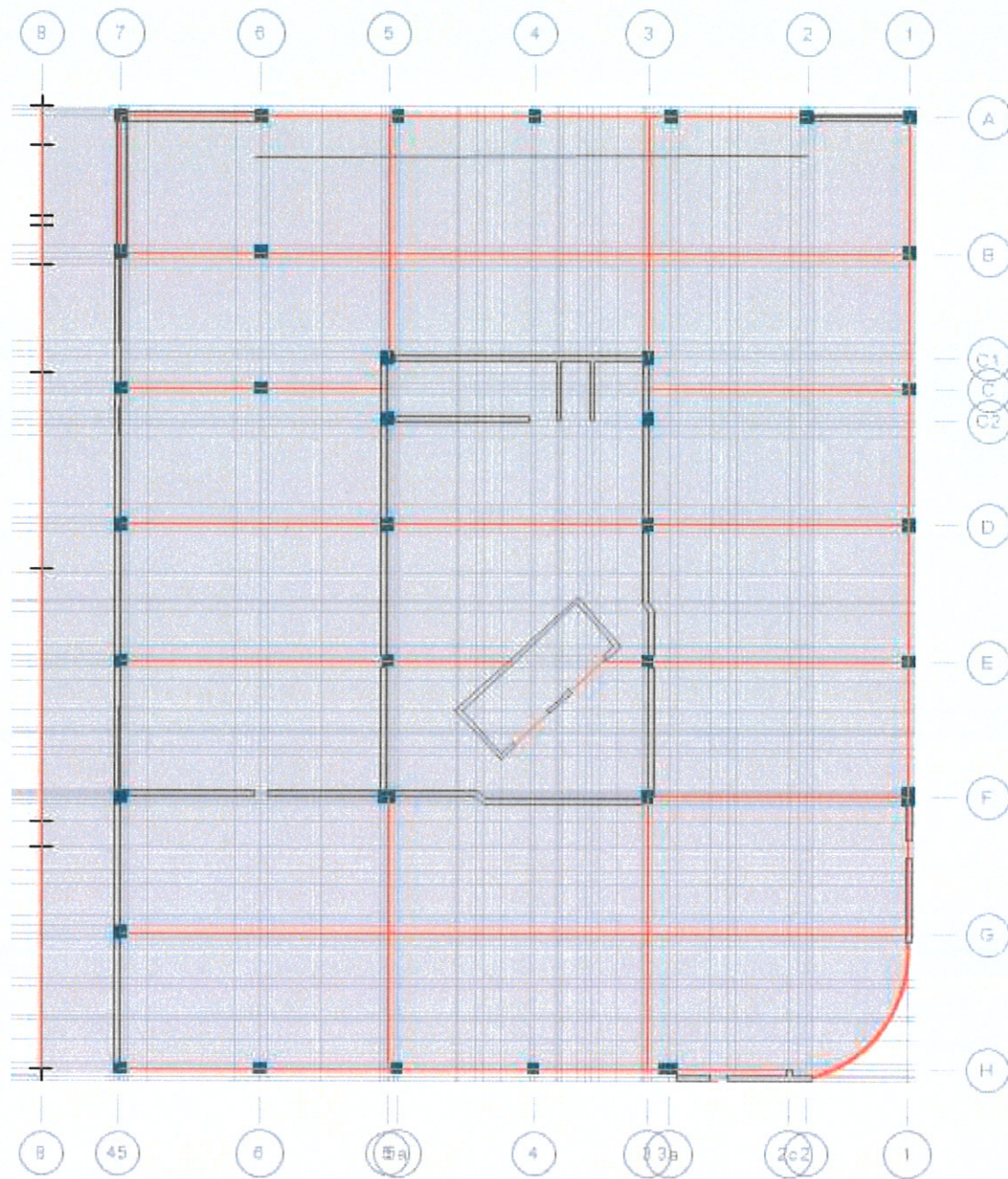
## Fourth Level



FOURTH LEVEL												
Case	Point "A-1"		Point "H-1"		Point "H-8"		Point "F-8"		Point "C1-8"		Point "A-8"	
	X [in.]	Y[in.]	X [in.]	Y[in.]	X [in.]	Y[in.]	X [in.]	Y[in.]	X [in.]	Y[in.]	X [in.]	Y[in.]
EQ-1	0.151	-0.026	0.134	-0.025	0.134	-0.010	0.138	-0.010	0.147	-0.010	0.151	-0.010
EQ-2	-0.070	0.180	0.030	0.175	0.040	0.083	0.010	0.083	-0.040	0.083	-0.070	0.083
EQ-3	0.172	-0.050	0.117	-0.046	0.116	0.003	0.130	0.003	0.157	0.003	0.172	0.003
EQ-4	-0.090	0.200	0.050	0.194	0.053	0.070	0.016	0.070	-0.050	0.070	-0.089	0.070
EQ-5	0.130	-0.003	0.151	-0.004	0.151	-0.022	0.146	-0.020	0.137	-0.020	0.131	-0.022
EQ-6	-0.050	0.160	0.018	0.157	0.020	0.094	0.002	0.094	-0.030	0.094	-0.050	0.094



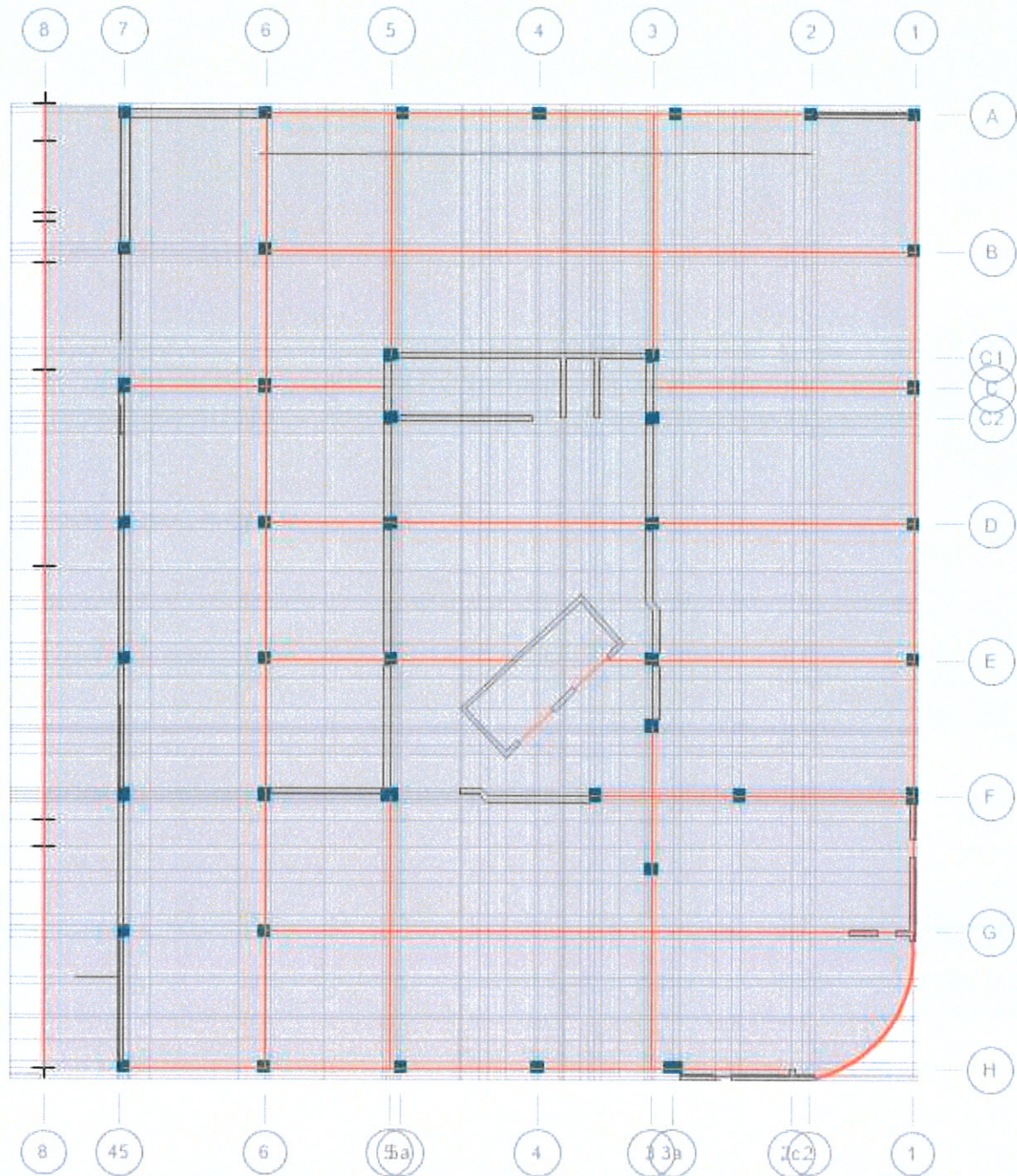
## Third Level



THIRD LEVEL												
Case	Point "A-1"		Point "H-1"		Point "H-8"		Point "F-8"		Point "C1-8"		Point "A-8"	
	X [in.]	Y[in.]	X [in.]	Y[in.]	X [in.]	Y[in.]	X [in.]	Y[in.]	X [in.]	Y[in.]	X [in.]	Y[in.]
EQ-1	0.087	-0.010	0.090	-0.010	0.090	-0.010	0.090	-0.010	0.090	-0.010	0.090	-0.012
EQ-2	-0.039	0.111	0.019	0.109	0.021	0.057	0.005	0.057	-0.023	0.057	-0.040	0.057
EQ-3	0.099	-0.022	0.080	-0.020	0.080	-0.005	0.084	-0.005	0.093	-0.005	0.099	-0.005
EQ-4	-0.049	0.123	0.029	0.120	0.031	0.050	0.010	0.050	-0.028	0.050	-0.050	0.050
EQ-5	0.076	0.004	0.101	0.003	0.102	-0.020	0.096	-0.020	0.083	-0.020	0.075	-0.020
EQ-6	-0.029	0.099	0.010	0.098	0.010	0.060	0.0003	0.064	-0.020	0.060	-0.030	0.064

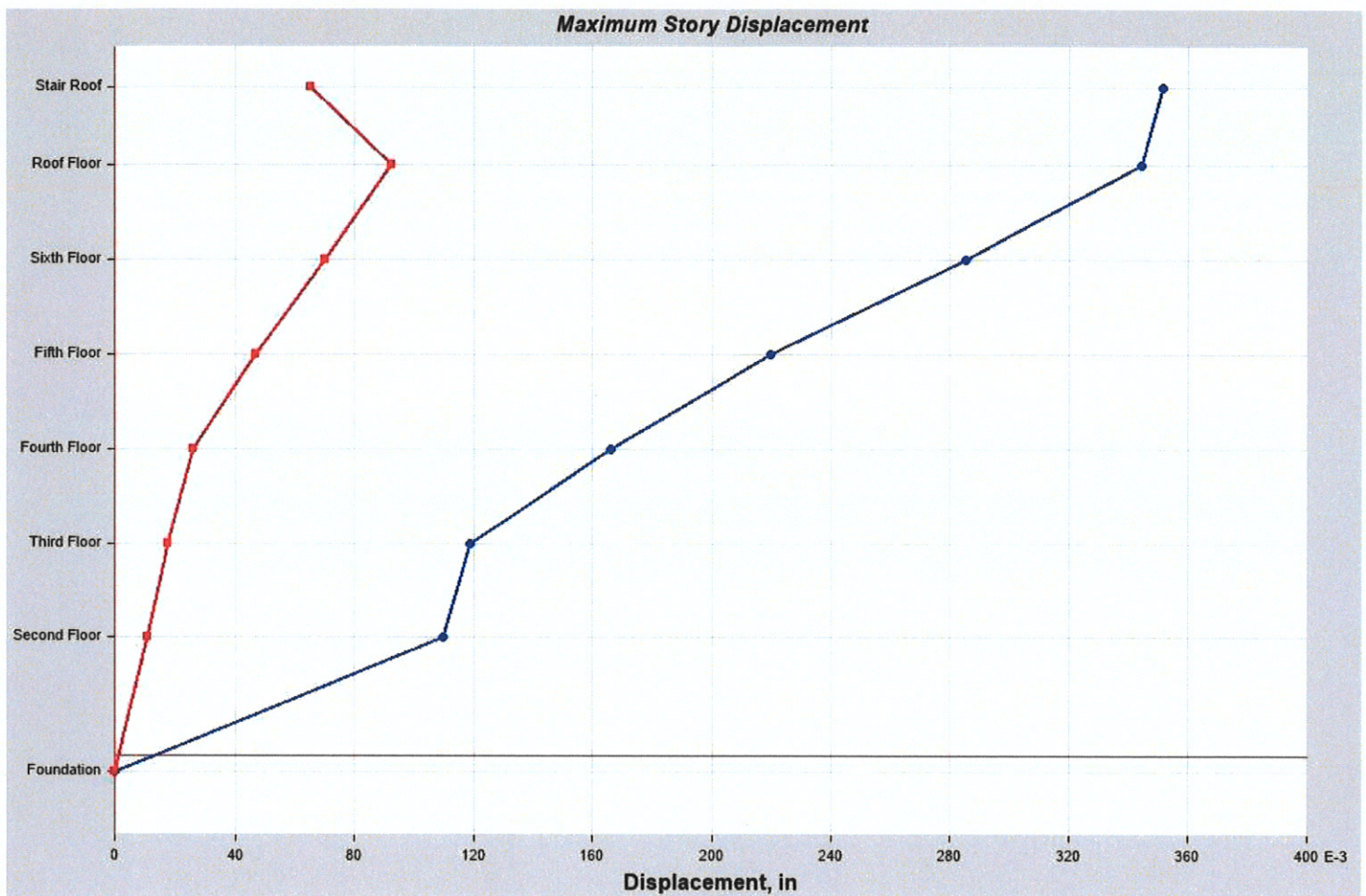


## Second Level



SECOND LEVEL												
Case	Point "A-1"		Point "H-1"		Point "H-8"		Point "F-8"		Point "C1-8"		Point "A-8"	
	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]	X [in.]	Y [in.]
EQ-1	0.042	-0.003	0.045	-0.003	0.045	-0.006	0.040	-0.006	0.042	-0.006	0.040	-0.006
EQ-2	-0.016	0.050	0.007	0.050	0.008	0.030	0.002	0.030	-0.009	0.030	-0.020	0.030
EQ-3	0.047	-0.010	0.039	-0.010	0.039	-0.002	0.040	-0.002	0.040	-0.002	0.050	-0.002
EQ-4	-0.020	0.056	0.012	0.050	0.010	0.030	0.004	0.030	-0.010	0.030	-0.020	0.030
EQ-5	0.040	0.004	0.050	0.002	0.050	-0.010	0.050	-0.010	0.040	-0.010	0.040	-0.010
EQ-6	-0.010	0.044	0.002	0.040	0.003	0.030	-0.0010	0.030	-0.007	0.030	-0.010	0.030



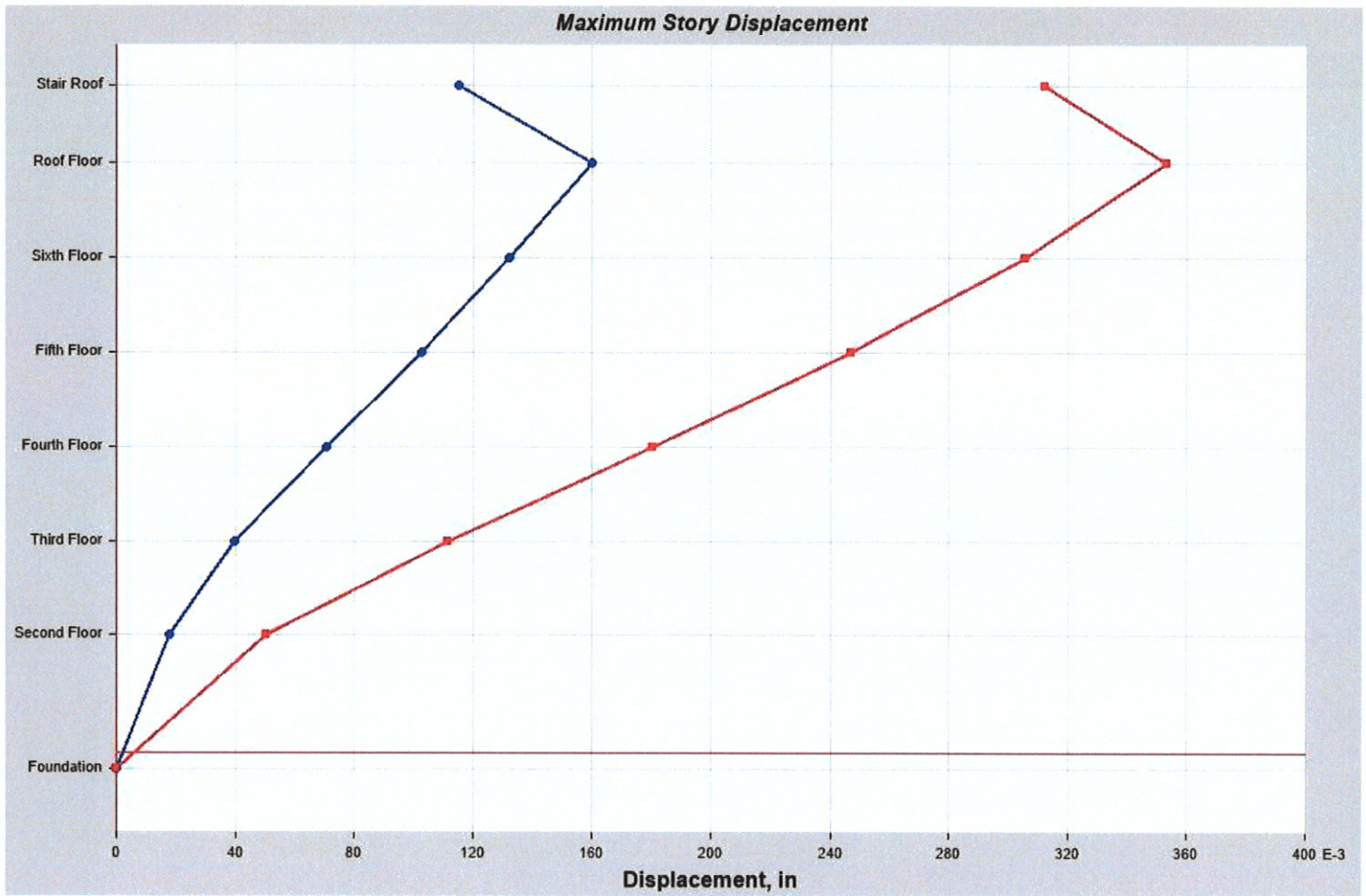


Maximum Story Displacement - Case EQ-1				
Story	Elevation ft	Location	X-Dir in	Y-Dir in
Stair Roof	85	Top	0.3512	0.0651
Roof Floor	75	Top	0.3441	0.0926
Sixth Floor	63	Top	0.2853	0.0700
Fifth Floor	51	Top	0.2198	0.0471
Fourth Floor	39	Top	0.1661	0.0259
Third Floor	27	Top	0.1190	0.0173
Second Floor	15	Top	0.1096	0.0106

■ Global X  
■ Global Y

Maximum Story Displacement -  
Case EQ-1



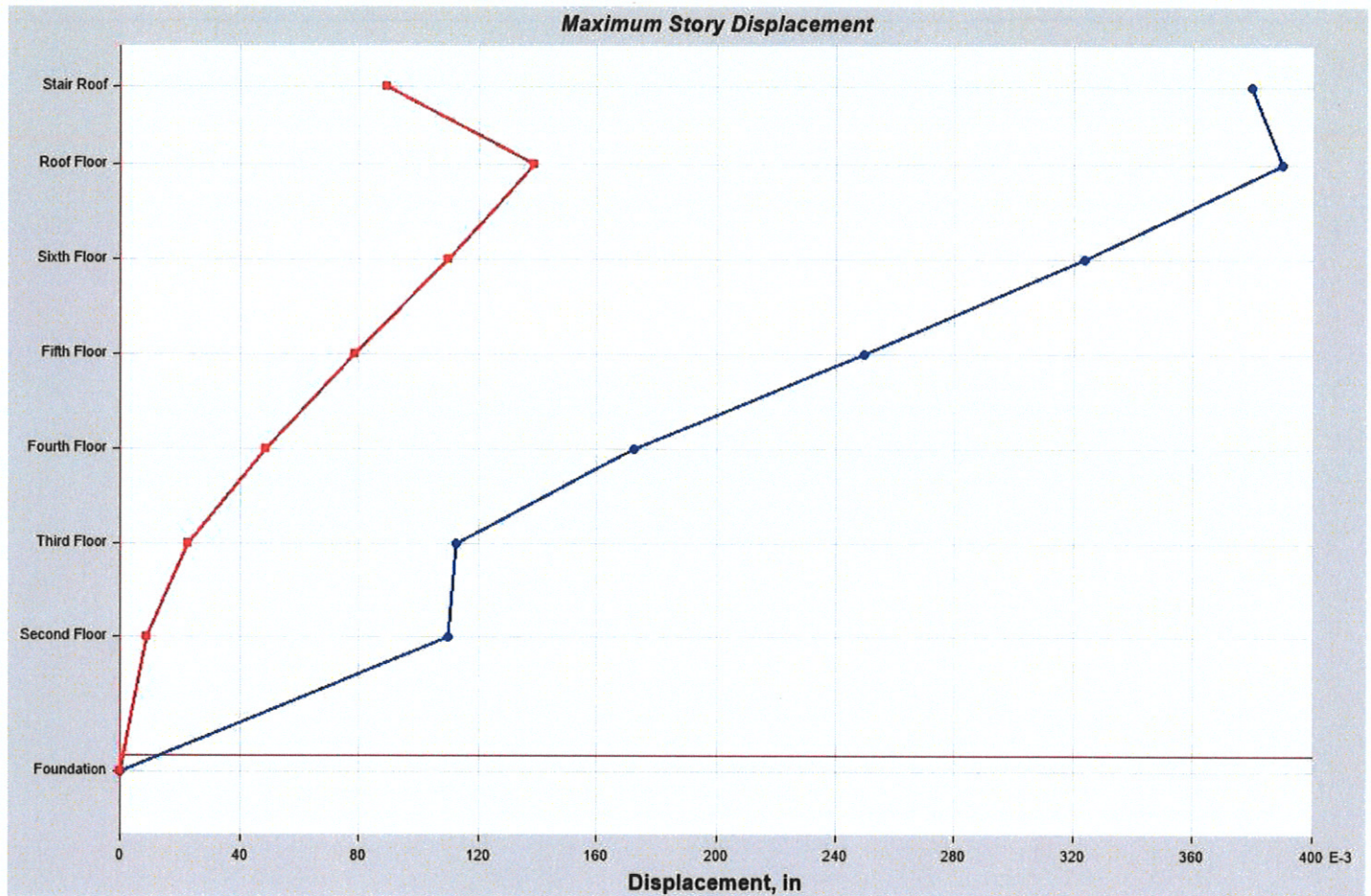


Maximum Story Displacement - Case EQ-2				
Story	Elevation ft	Location	X-Dir in	Y-Dir in
Stair Roof	85	Top	0.1150	0.3119
Roof Floor	75	Top	0.1597	0.3533
Sixth Floor	63	Top	0.1321	0.3053
Fifth Floor	51	Top	0.1028	0.2469
Fourth Floor	39	Top	0.0706	0.1804
Third Floor	27	Top	0.0396	0.1117
Second Floor	15	Top	0.0178	0.0502

■ Global X  
■ Global Y

Maximum Story Displacement -  
Case EQ-2





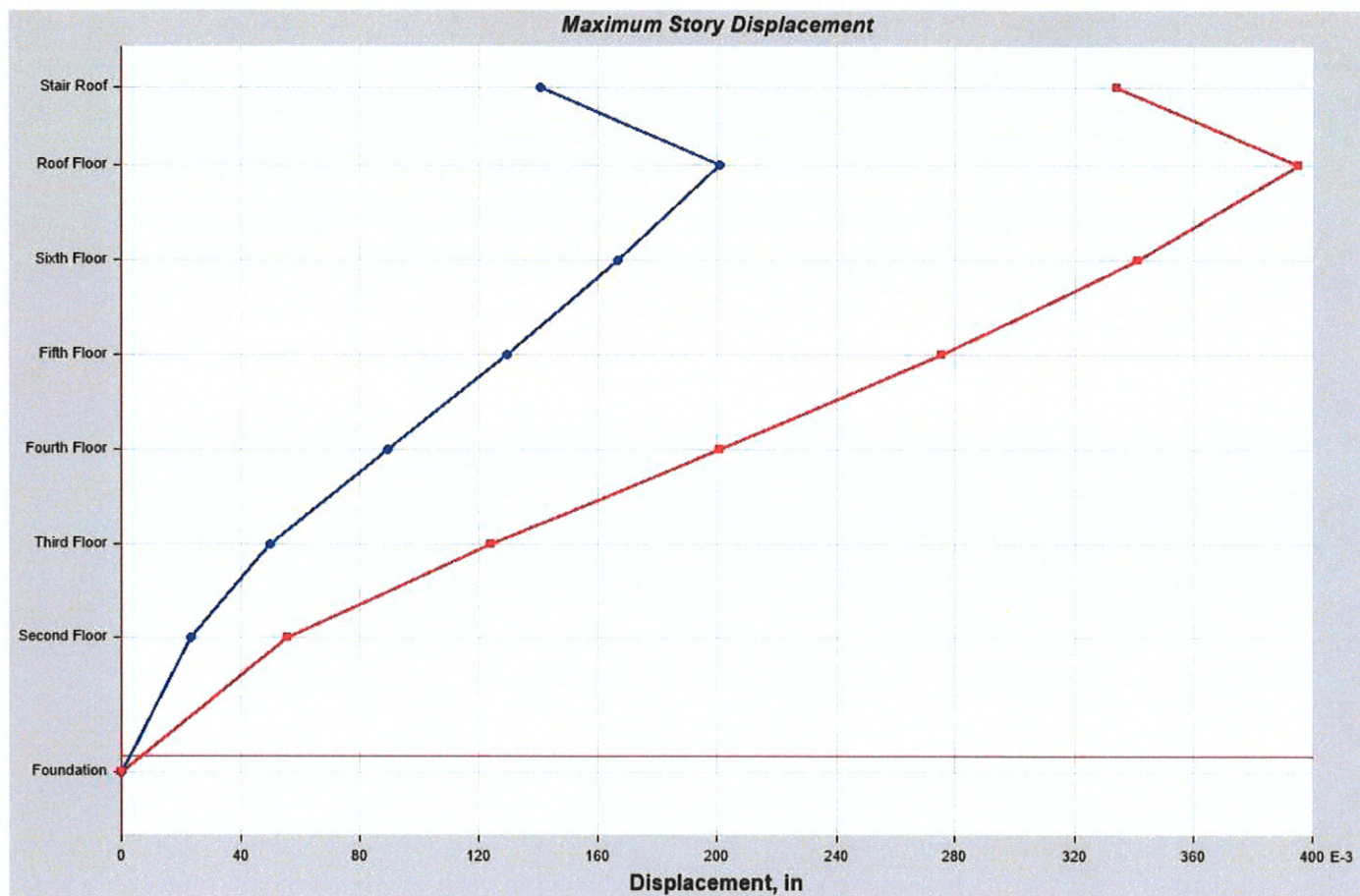
**Maximum Story Displacement - Case EQ-3**

Story	Elevation ft	Location	X-Dir in	Y-Dir in
Stair Roof	85	Top	0.3795	0.0895
Roof Floor	75	Top	0.3896	0.1390
Sixth Floor	63	Top	0.3236	0.1098
Fifth Floor	51	Top	0.2495	0.0788
Fourth Floor	39	Top	0.1722	0.0486
Third Floor	27	Top	0.1126	0.0226
Second Floor	15	Top	0.1096	0.0089

■ Global X  
■ Global Y

Maximum Story Displacement -  
Case EQ-3



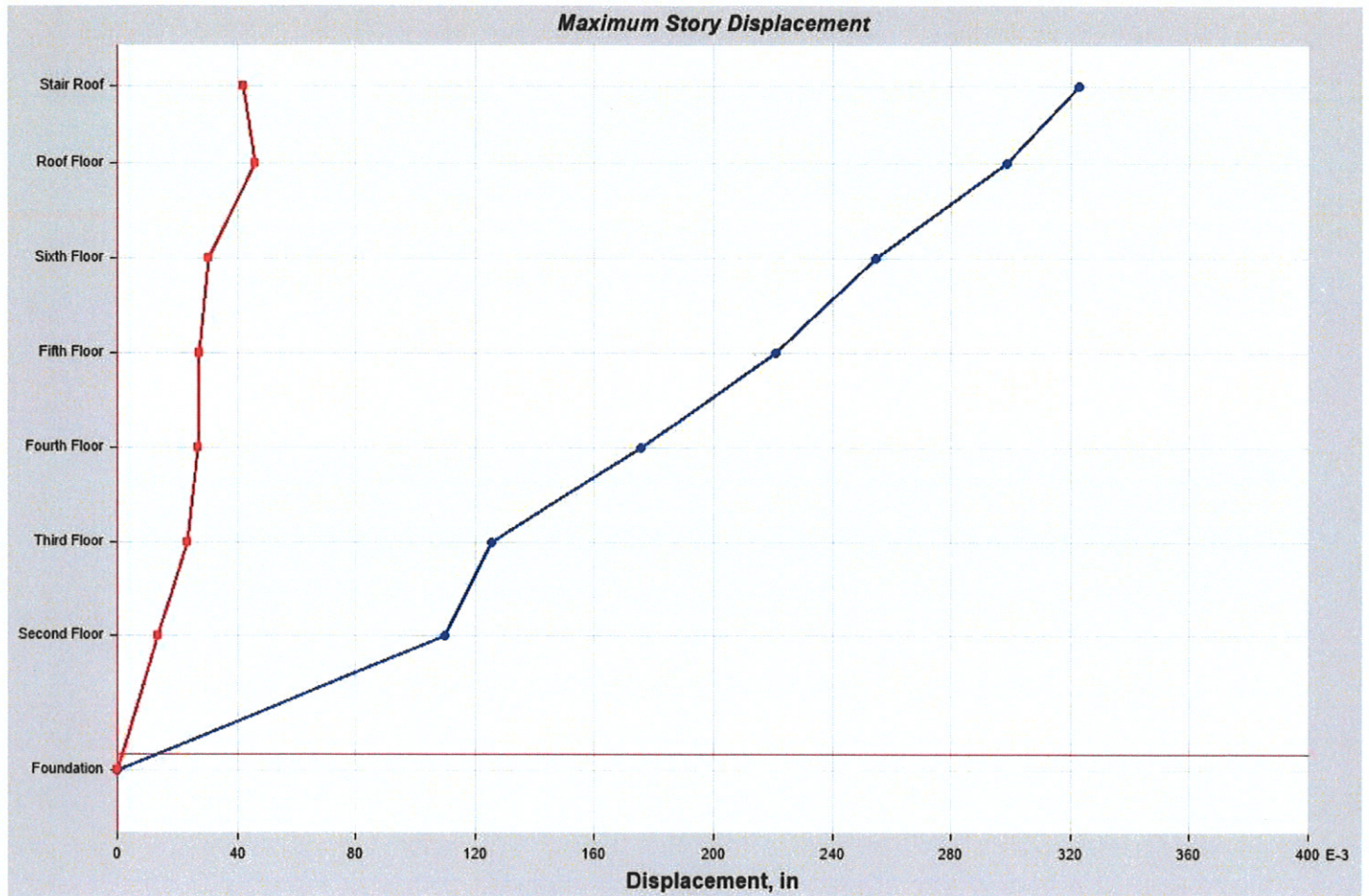


Maximum Story Displacement - Case EQ-4				
Story	Elevation ft	Location	X-Dir in	Y-Dir in
Stair Roof	85	Top	0.1405	0.3339
Roof Floor	75	Top	0.2008	0.3952
Sixth Floor	63	Top	0.1667	0.3412
Fifth Floor	51	Top	0.1296	0.2755
Fourth Floor	39	Top	0.0891	0.2009
Third Floor	27	Top	0.0502	0.1239
Second Floor	15	Top	0.0233	0.0559

Global X  
 Global Y

Maximum Story Displacement - Case EQ-4



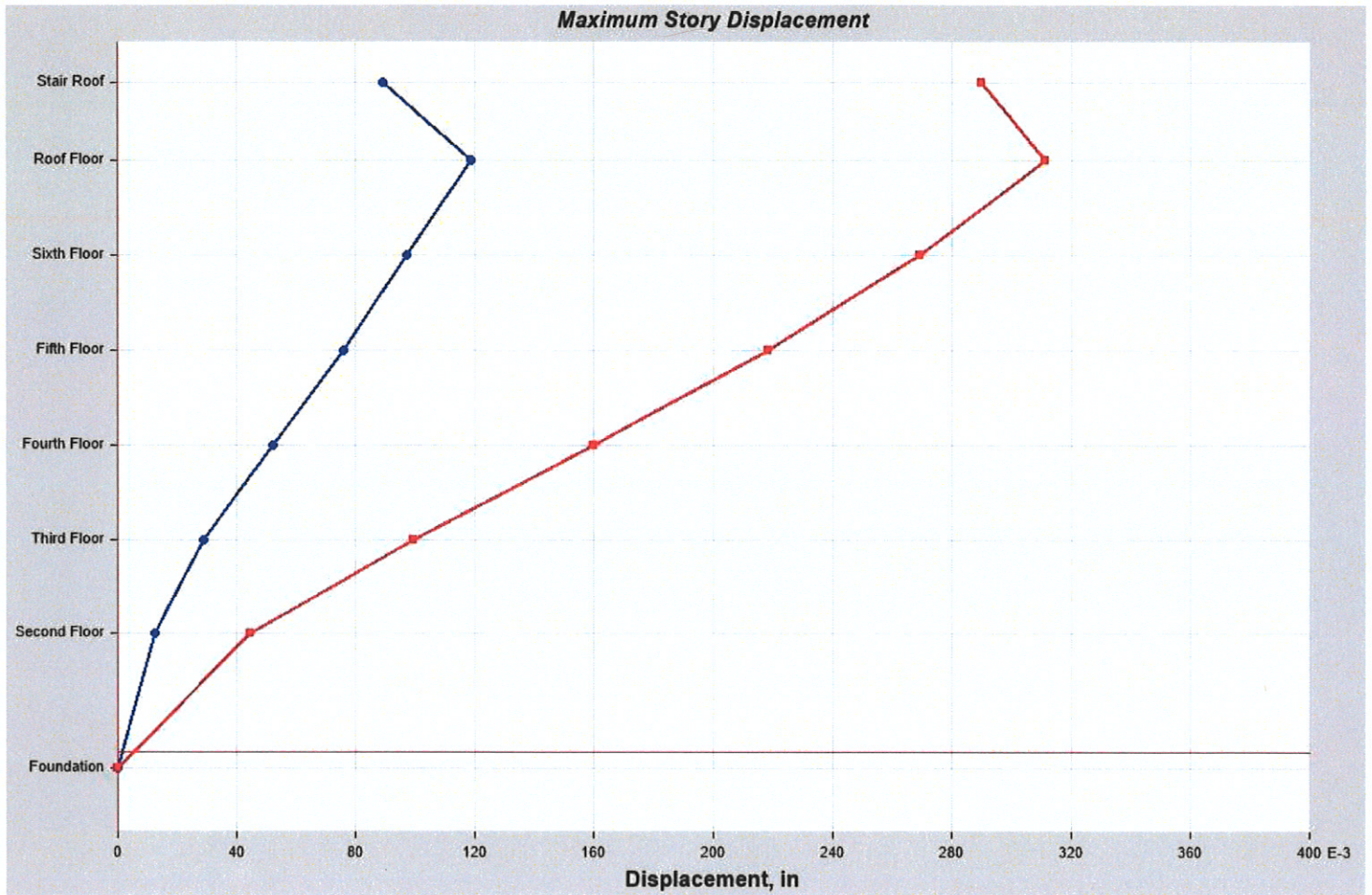


Maximum Story Displacement - Case EQ-5				
Story	Elevation ft	Location	X-Dir in	Y-Dir in
Stair Roof	85	Top	0.3229	0.0418
Roof Floor	75	Top	0.2986	0.0461
Sixth Floor	63	Top	0.2546	0.0302
Fifth Floor	51	Top	0.2211	0.0273
Fourth Floor	39	Top	0.1755	0.0268
Third Floor	27	Top	0.1254	0.0232
Second Floor	15	Top	0.1096	0.0135

■ Global X  
■ Global Y

Maximum Story Displacement -  
Case EQ-5





Maximum Story Displacement - Case EQ-6				
Story	Elevation ft	Location	X-Dir in	Y-Dir in
Stair Roof	85	Top	0.0894	0.2899
Roof Floor	75	Top	0.1187	0.3114
Sixth Floor	63	Top	0.0975	0.2694
Fifth Floor	51	Top	0.0759	0.2183
Fourth Floor	39	Top	0.0520	0.1600
Third Floor	27	Top	0.0291	0.0995
Second Floor	15	Top	0.0124	0.0446

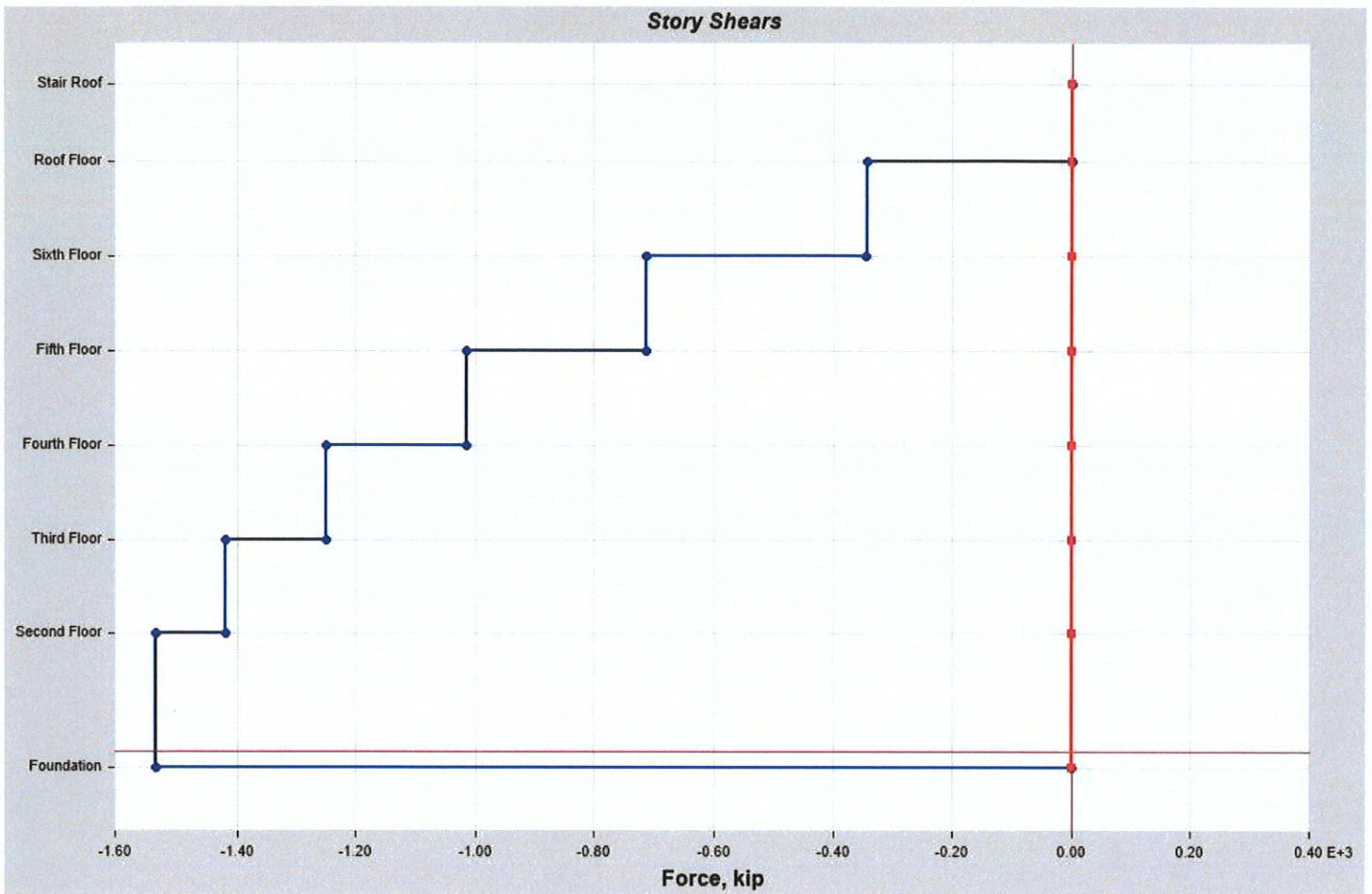
Global X  
 Global Y

Maximum Story Displacement -  
Case EQ-6



## Story Shears



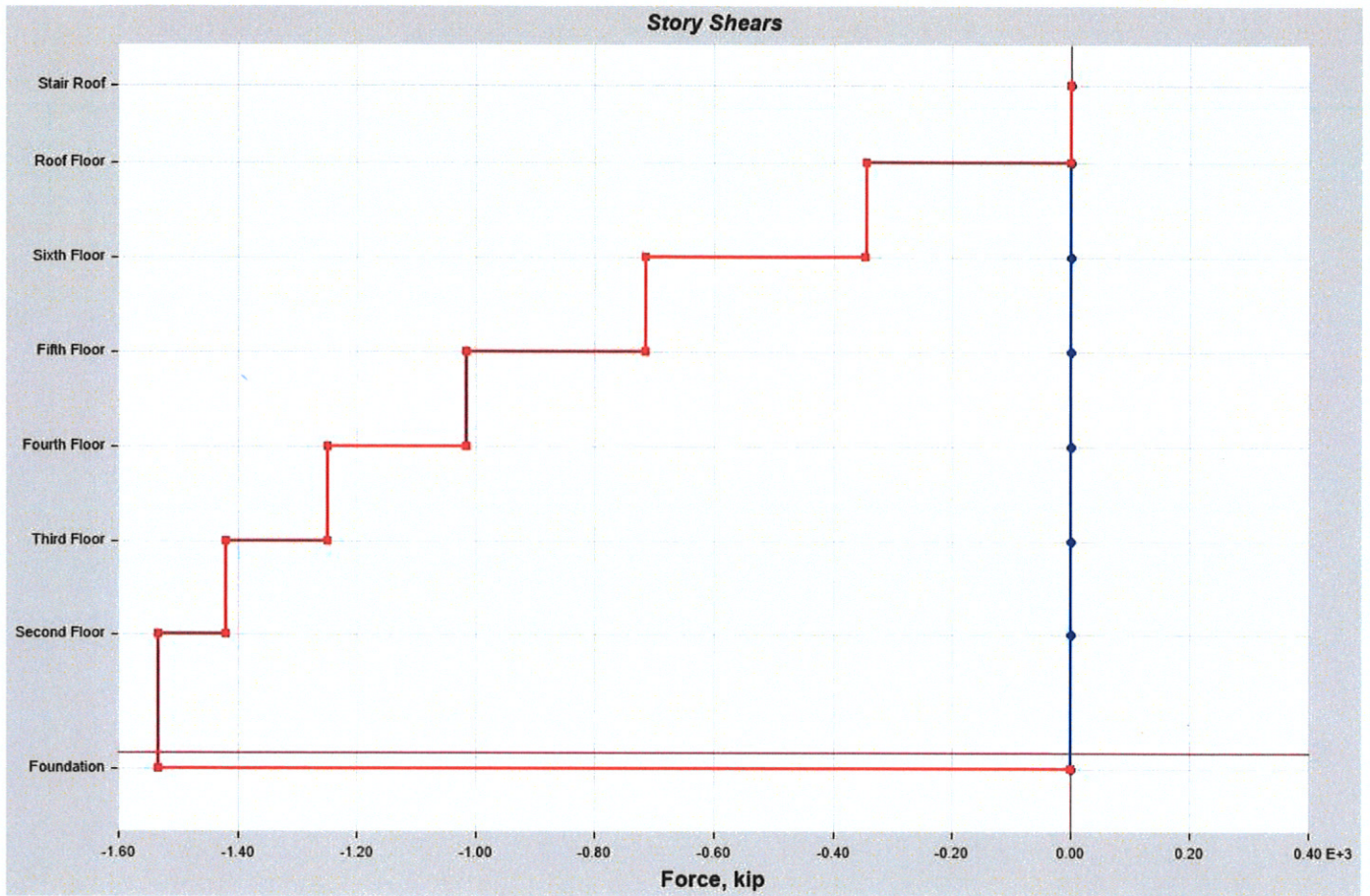


Story Shears - EQ-1				
Story	Elevation ft	Location	X-Dir kip	Y-Dir kip
Stair Roof	85	Top	-0.02	0.003
		Bottom	-0.02	0.003
Roof Floor	75	Top	-344.30	0.066
		Bottom	-344.72	0.066
Sixth Floor	63	Top	-714.28	0.142
		Bottom	-714.50	0.142
Fifth Floor	51	Top	-1016.01	0.214
		Bottom	-1016.07	0.214
Fourth Floor	39	Top	-1250.58	0.279
		Bottom	-1250.58	0.279
Third Floor	27	Top	-1419.24	0.335
		Bottom	-1419.24	0.335
Second Floor	15	Top	-1533.61	0.376
		Bottom	-1533.69	0.376

Global X  
 Global Y

Story Shears - Case EQ-1





Story Shears - EQ-2				
Story	Elevation ft	Location	X-Dir kip	Y-Dir kip
Stair Roof	85	Top	0.01	-0.018
		Bottom	0.01	-0.018
Roof Floor	75	Top	0.07	-344.242
		Bottom	0.07	-344.666
Sixth Floor	63	Top	0.15	-714.168
		Bottom	0.15	-714.388
Fifth Floor	51	Top	0.22	-1015.853
		Bottom	0.22	-1015.909
Fourth Floor	39	Top	0.28	-1250.391
		Bottom	0.28	-1250.391
Third Floor	27	Top	0.33	-1419.027
		Bottom	0.33	-1419.027
Second Floor	15	Top	0.36	-1533.36
		Bottom	0.36	-1533.44

Global X  
 Global Y

Story Shears - Case EQ-2



**12.11.2.2.7 Walls with Pilasters** Where pilasters are present in the wall, the anchorage force at the pilasters shall be calculated considering the additional load transferred from the wall panels to the pilasters. However, the minimum anchorage force at a floor or roof shall not be reduced.

## 12.12 DRIFT AND DEFORMATION

### 12.12.1 Story Drift Limit

The design story drift ( $\Delta$ ) as determined in Sections 12.8.6, 12.9.2, or 16.1, shall not exceed the allowable story drift ( $\Delta_a$ ) as obtained from Table 12.12-1 for any story.

#### 12.12.1.1 Moment Frames in Structures Assigned to Seismic Design Categories D through F

For seismic force-resisting systems comprised solely of moment frames in structures assigned to Seismic Design Categories D, E, or F, the design story drift ( $\Delta$ ) shall not exceed  $\Delta_a/\rho$  for any story.  $\rho$  shall be determined in accordance with Section 12.3.4.2.

### 12.12.2 Diaphragm Deflection

The deflection in the plane of the diaphragm, as determined by engineering analysis, shall not exceed the permissible deflection of the attached elements. Permissible deflection shall be that deflection that will permit the attached element to maintain its structural integrity under the individual loading and continue to support the prescribed loads.

### 12.12.3 Structural Separation

All portions of the structure shall be designed and constructed to act as an integral unit in resisting seismic forces unless separated structurally by a distance sufficient to avoid damaging contact as set forth in this section.

Separations shall allow for the maximum inelastic response displacement ( $\delta_M$ ).  $\delta_M$  shall be determined at critical locations with consideration for translational and torsional displacements of the structure including torsional amplifications, where applicable, using the following equation:

$$\delta_M = \frac{C_d \delta_{\max}}{I_e} \quad (12.12-1)$$

Where  $\delta_{\max}$  = maximum elastic displacement at the critical location.

Adjacent structures on the same property shall be separated by at least  $\delta_{MT}$ , determined as follows:

$$\delta_{MT} = \sqrt{(\delta_{M1})^2 + (\delta_{M2})^2} \quad (12.12-2)$$

where  $\delta_{M1}$  and  $\delta_{M2}$  are the maximum inelastic response displacements of the adjacent structures at their adjacent edges.

Where a structure adjoins a property line not common to a public way, the structure shall be set back from the property line by at least the displacement  $\delta_M$  of that structure.

**EXCEPTION:** Smaller separations or property line setbacks are permitted where justified by rational analysis based on inelastic response to design ground motions.

**Table 12.12-1 Allowable Story Drift,  $\Delta_a^{a,b}$**

Structure	Risk Category		
	I or II	III	IV
Structures, other than masonry shear wall structures, 4 stories or less above the base as defined in Section 11.2, with interior walls, partitions, ceilings, and exterior wall systems that have been designed to accommodate the story drifts.	$0.025h_{sx}^c$	$0.020h_{sx}$	$0.015h_{sx}$
Masonry cantilever shear wall structures <sup>d</sup>	$0.010h_{sx}$	$0.010h_{sx}$	$0.010h_{sx}$
Other masonry shear wall structures	$0.007h_{sx}$	$0.007h_{sx}$	$0.007h_{sx}$
All other structures	$0.020h_{sx}$	$0.015h_{sx}$	$0.010h_{sx}$

<sup>a</sup> $h_{sx}$  is the story height below Level x.

<sup>b</sup>For seismic force-resisting systems comprised solely of moment frames in Seismic Design Categories D, E, and F, the allowable story drift shall comply with the requirements of Section 12.12.1.1.

<sup>c</sup>There shall be no drift limit for single-story structures with interior walls, partitions, ceilings, and exterior wall systems that have been designed to accommodate the story drifts. The structure separation requirement of Section 12.12.3 is not waived.

<sup>d</sup>Structures in which the basic structural system consists of masonry shear walls designed as vertical elements cantilevered from their base or foundation support which are so constructed that moment transfer between shear walls (coupling) is negligible.



ELEVATION GRID 5 - "42" BETWEEN AXIS (F) & AXIS (C-1)

GROUND LEVEL TO 2ND :

PIER # 1 : LENGTH = 7.33'  
 (WALL SEGMENT)  $A_s \text{ REQ'D} = 1.76 \text{ m}^2$   $A_s \text{ PROVIDED } 1 \# 12' \text{ o.c. E.F.C. } 14(.20) = 2.8 \text{ m}^2$   
 $A_{sV} \text{ REQ'D} \leq A_{sV} \text{ PROVIDED OK}$

PIER # 2 : LENGTH = 5.83'  
 (WALL SEG.)  $A_{sV} \text{ REQ'D} = 1.40 \text{ m}^2$   $A_s \text{ PROVIDED } 10 \# 4 = 2.0 \text{ m}^2$   
 $A_{sV} \text{ REQ'D} \leq A_{sV} \text{ PROVIDED OK}$

PIER # 3 : LENGTH = 3'-2"  
 (WALL SEG.)  $A_{sV} \text{ REQ'D} = 1.45 \text{ m}^2$   $A_s \text{ PROVIDED } 2 \# 5 + 4 \# 4 = 1.42 \text{ m}^2$   
 $A_{sV} \text{ REQ'D} \leq A_{sV} \text{ PROVIDED OK}$

PIER # 4 : LENGTH = 6.89'  
 (WALL SEGMENT)  $A_{sV} \text{ REQ'D} = 2.25 \text{ m}^2$   $A_s \text{ PROVIDED } 7 \# 4 \text{ E.F.C. } 14 \times 120 = 2.8 \text{ m}^2$   
 $A_{sV} \text{ REQ'D} \leq A_{sV} \text{ PROVIDED OK}$

PIER # 5 : LENGTH 33" = 2.75' LENGTH TOTAL 5.5  
 $A_s \text{ TOTAL REQ'D} = 2.21 \text{ m}^2$   $A_s \text{ PROVIDED } 10 \# 4 = 2 \text{ m}^2$   
 $2.54 \text{ m}^2$   
 $\leq 4.75 \text{ m}^2 \geq 2 \text{ m}^2 \text{ PROVIDED NG}$   
 @ SECOND LEVEL  $A_{s \text{ req'd}} 2.2 \geq 2 \text{ m}^2$

$A_s \text{ horizontal (SHEAR REINF. REQ'D)}$   
 $= 0.24 \text{ m}^2/\text{ft}^2$   $A_s \text{ PROVIDED } 0.40 \text{ m}^2/\text{ft}^2 \text{ OK!}$

SPANDREL BEAMS @ 2ND LEVEL :

S1  $A_s \text{ long req'd TOP } 1.93 \geq A_s \text{ PROVIDED } 2 \# 6 = 0.88 \text{ m}^2$  NG  
 $\text{REQ'D BOT } 1.12 \geq A_s \text{ " } 2 \# 6 = 0.88 \text{ m}^2$  NG

S2  $A_s \text{ long req'd TOP } 1.30 \text{ m}^2$   $A_s \text{ PROVIDED } 0.88 \text{ m}^2$  NG  
 $\text{" BOT } .93 \text{ m}^2 \geq \text{" " } = 0.88 \text{ m}^2$  NG

S3  $A_s \text{ long req'd } 0.71 \text{ m}^2 \leq A_s \text{ PROVIDED } A_s \text{ BOT } 0.66 \leq 0.88 \text{ m}^2 \text{ prov. OK}$



JOB 911 OFFICE FACILITIES NOTES BY DOV MISC, PE PAGE 2 OF 9  
BENS GROUP ARCHITECTS DATE SEP 28 '12

CONT GRID C 1

SPANREL SHEAR REINF REQ'D :  $A_s = 0.31 \text{ m}^2 < 0.20 \text{ m}^2$  PROVIDED  
0.10  $\text{m}^2$  REQ'D

PERSA GROUP ARCHITECTS - - - - - DATE - SEP 28 '22 - - - - -

ELEVATION GRID C1 - STAIRS CORE - BETWEEN AXIS ⑤ & AXIS ③

GROUND TO 2ND LEVEL

PANEL 7 SHEAR WALL :

LENGTH BETWEEN COLUMNS 22'-8" #4 @ 12" o.c EFC = .40 m<sup>2</sup>/ft

$A_{s req'd} = 9.32 \text{ m}^2 \geq 8.8 \text{ m}^2$  NG.  $A_{s prov} = 8.8 \text{ m}^2$  AS NEEDED  
= 1.32 m<sup>2</sup>

ALL OTHER LEVELS :

$A_{s total req'd vertical} = 5.44 \text{ m}^2 \leq A_{s provided}$  OK ✓

$A_{s horizontal req'd}$   $A_{sh} = .24 \text{ m}^2$   $A_{s provided} = 0.40 \text{ m}^2$  OK ✓

ASSUMED SECTION FOR BEAM 10/S-5

$A_{s req} = 1.93 - 0.88$  (2 #6 PROVIDED, TOP & BOT) = 1.05 m<sup>2</sup> NEEDED  
LONG.  $A_{s top}$

BEAM LENGTH 5'-6"  $A_{s bott}$  OK ✓

$A_{s bott} = 0.92 \text{ m}^2$  .88 m<sup>2</sup> PROVIDED

2.04 = NEG.

$A_{s shear beam req'd} = 1.34 \text{ m}^2$  0.20 m<sup>2</sup> PROVIDED

BENSA GROUP ARCHITECTS

DATE SEP 28 '22

PG 22

ELEVATION GRID 3 "39" AXIS (D-S) & AXIS (C1)

GROUND TO 2ND

PANEL 11 - 10 - 9 - 8 (WALL SEGMENTS)

PANEL 11: LENGTH 8'-2"  $A_s$  PROVIDED #4 @ 12" OC EFC  $0.40 \text{ m}^2 / \text{ft}^2$

$A_s \text{ REQ'D} = 4.039 \text{ m}^2 \geq A_s \text{ PROVIDED NG}$   $8 \# 4 \times 2 \times 1.20 \text{ m}^2 = 3.2 \text{ m}^2$

$A_s \text{ REQ'D} = 4.039 \text{ m}^2 - 3.2 \text{ m}^2 \text{ NG STEEL NEEDED } .84 \text{ m}^2$

✓ COL @ END

C 2ND LEVEL  $A_s \text{ PROVIDED } 3.2 \text{ m}^2 > 1.96 \text{ m}^2 \text{ REQ'D OK}$

PANEL 10:

PANEL LENGTH 10'-6"  $A_s$  PROVIDED  $20 \# 4 \times 1.20 = 4 \text{ m}^2$

4 TO 2  $A_s \text{ REQ'D} = 4.62 \geq 4 \text{ m}^2 \text{ PROVIDED NG}$

2 TO 3  $A_s \text{ REQ'D} = 2.62 \leq 4 \text{ m}^2 \text{ PROVIDED OK}$

$A_s \text{ SHEAR REINF REQ'D} = 0.24 \text{ m}^2 \leq 0.40 \text{ m}^2 \text{ PROVIDED OK}$

PANEL 9 & 8:

PANEL 9  $A_s \text{ REQ'D} = \text{UP TO LEVEL 6 } 2.50 \text{ m}^2$

LENGTH 33"  $3 \# 4 \text{ EFC } 6 \times 1.20 = 1.20 \text{ m}^2$

$A_s \text{ REQ'D} = 2.50 \geq 1.20 \text{ m}^2 \text{ NG NEEDED } 1.3 \text{ m}^2$

$\# 6 \text{ TO ROOF} = 5.31 \text{ m}^2 \text{ } A_s \text{ REQ'D}$

PANEL 8: LENGTH 33"  $A_s \text{ PROVIDED } 6 \# 4 \text{ } A_s = 1.20 \text{ m}^2$

ADDIT.  $A_s \text{ REQ'D } 5.31 - 1.2 = 4.1 \text{ m}^2 (\# 6 @ 6" \text{ OC EFC})$

PANEL 8 =  $A_s \text{ REQ'D} = 3.0 \text{ m}^2 - 1.2 \text{ m}^2 = 1.8 \text{ m}^2 \text{ ADDITIONAL REQ'D}$

$6^{\text{th}} \text{ TO ROOF} = 5.77 \text{ m}^2 \text{ } A_s \text{ REQ'D}$   $\# 4 @ 6" \text{ OC EFC}$

ADD.  $\geq A_s \text{ PROVIDED } 1.2 \text{ ADDITIONAL } A_s \text{ REQ'D} = 4.57 \text{ m}^2$

$\# 6 @ 6" \text{ OC EFC}$

$A_s \text{ SHEAR REQ'D } 0.24 \text{ m}^2 \leq 0.40 \text{ m}^2 \text{ PROVIDED OK!}$



BERSA GROUP ARCHITECTS

DATE SEP 28 '22

GRID 3 ("37") BETWEEN AXIS (D) & AXIS (F)

GROUND TO 2ND LEVEL

P-13 & P-12 WALL SEGMENTS

PG-28 \* PANEL 13 :  $A_{SV} \text{ REQ'D} = 6.3 \text{ m}^2$  PANEL LENGTH 6'  $A_{S} \text{ PROVIDED} = 2.4 \text{ m}^2$   
 ADDITIONAL  $A_{SV} \text{ REQ'D} = 3.87 \text{ m}^2$  #4 @ 6" OC EFC

PANEL 12 :  $A_{SV} \text{ REQ'D} = 4.70 \text{ m}^2$  PANEL LENGTH 4'-11"  $A_{S} \text{ PROVIDED} = 2.0 \text{ m}^2$   
 ADDITIONAL  $A_{SV} \text{ REQ'D} = 2.70 \text{ m}^2$  #5 @ 12" OC EFC OR  
 #4 @ 6" OC EFC

→ PANEL 12 : 2ND TO 4TH =  $2.34 \text{ m}^2 \geq 2.0 \text{ m}^2$  PROVIDED ( #3 @ 12" OC EFC )  
 1TH TO ROOF  $1.92 \text{ m}^2 \leq 2.0 \text{ m}^2$  PROVIDED OK

PANEL 14 : LENGTH 8'-6"  $A_{S} \text{ PROVIDED} = 3.2 \text{ m}^2$  ( #4 @ 12" OC EFC )  
 GROUND TO 2ND  $A_{SV} \text{ REQ'D} = 4.16 \text{ m}^2 \geq 3.2 \text{ m}^2$  PROVIDED 0.96  $A_{SV} \text{ REQ'D}$  #4 @ 12" OC EFC

2ND TO ROOF  $A_{SV} \text{ REQ'D} = 2.04 \text{ m}^2 \leq 3.2 \text{ m}^2$  PROVIDED OK!

GR \* \* 6 TO ROOF  $6.85 \text{ m}^2$   $A_{SV} \text{ REQ'D} = 3.2 = 3.68 \text{ m}^2$  ∴ #4 @ 12" OC EFC

$A_{S} \text{ SHEAR REINF. REQ'D} =$  PANEL 14 2ND TO 3RD  $0.53 \geq 0.40$  PROVIDED = 1.13  $\text{m}^2$  REIN  
 3RD TO ROOF  $0.24 \text{ m}^2 \leq 0.40 \text{ m}^2$  OK ✓

PANEL 12  $A_{SV} \text{ REQ'D} = 0.42 \text{ m}^2 \geq 0.40 \text{ m}^2$  PROVIDED OK!

PANEL 13  $A_{SV} \text{ REQ'D} = 0.24 \text{ m}^2 \leq 0.40 \text{ m}^2$  " OK ✓

SPANDREL BEAM AXIS (3) BETWEEN AXIS (E) & (F)

@ 3RD LEVEL  $2.03$   $A_{S} \text{ REQ'D LONG. BOT} < 2 \#6$  NG

$1.73$   $A_{S} \text{ REQ'D LONG. TOP} < 2 \#6$  NG

DEPTH 4'-0" ?

PROVIDE  $1.15 \text{ m}^2$

$A_{S} \text{ SHEAR REINF. REQ'D} = .55 - .20 = .35 \text{ m}^2$  #4 @ 6" OC

Pg 35  
36

ELEVATION C GRID F "43" BETWEEN AXIS (7) & AXIS (4.3)

GROUND TO 2ND LEVEL

PANEL 20 & 18 (WHOLE SEGMENTS)

LENGTH 20 = 12'-10"  $A_{SV} \text{ req} = 8.76 \text{ m}^2 \geq A_{\text{provided}} 5.2 \text{ m}^2$  NG

$A_{SV}$  STILL REQ'D 3.56  $\text{m}^2$  # 4 @ 12" OC

WE @ 3'-0" FROM END # 5 @ 12" OC 3 # SE EACH END / EFC

PANEL 21 - 2ND TO ROOF

$A_s = 2.40 \text{ m}^2$  LENGTH 6'-0"  $A_{s \text{ provided}} 2.8 \text{ m}^2$  (4 @ 12" OC EFC)

$V_{\text{REQ'D}} \leq A_{\text{provided}} \text{ OK!}$

PANEL 18 G TO 2ND 11.86  $\text{m}^2$  \*

LENGTH 21'-4"  $\Delta 2.52 / \text{ft}^2$

STILL REQ'D 0.66  $\text{m}^2$  # 4 @ 3" OC

PANEL 22 : G TO 2ND LENGTH 14'-7"  $A_s \text{ provided } 6 \text{ m}^2$  (4 @ 12" OC EFC)

$A_{SV} \text{ REQ'D} = 4.03 \text{ m}^2 \leq 6 \text{ m}^2 \text{ OK } \checkmark$

PANEL 19 2ND TO 3RD LENGTH = 8'-7"  $A_s \text{ provided } 3.6 \text{ m}^2$  (4 @ 12" OC EFC)

$A_{SV} \text{ req} = 7.14 \text{ m}^2 - 3.6 \text{ m}^2 = 3.6 \text{ REQ'D ADDITIONAL}$

$\geq A_{\text{provided}} \text{ NG}$

$A_{SV} \text{ REQ'D 3RD TO ROOF} = 3.6 \geq 3.6 \text{ PROVIDED OK -}$

Pg 38

PANEL SHEAR  $A_s \text{ REQ'D} = < 0.40 \text{ m}^2$  PROVIDED FOR

# PANELS P-22, P-21, P-20  $A_s = 0.24 \text{ m}^2 < 0.40 \text{ m}^2 \text{ PROVIDED OK}$

P-19 - 0.63  $\text{m}^2$  2ND TO 3RD  $> 0.40 \text{ PROVIDED NG}$

P-18 - 0.54  $\text{m}^2$  G TO 2ND  $> 0.40 \text{ m}^2 \text{ PROVIDED NG}$

P-16 - 0.46  $\text{m}^2$  2ND TO 3RD  $> 0.40 \text{ m}^2$  " "

3RD TO ROOF 0.31  $\leq 0.40 \text{ m}^2 \text{ PROVIDED OK}$

ELEVATION ALONG GRID F "50" BETWEEN AXIS (1.2) & AXIS (3)

- P14 1<sup>ST</sup> TO 2<sup>ND</sup> LEVEL P-15 (WALL SEGMENTS)  
P-15: LENGTH = 11.7'  $A_{S REQ} = 8.99 \text{ m}^2 \geq A_{S PROVIDED} 5.2 \text{ m}^2$  NG  
PROVIDE ADDITIONAL  $3.8 \text{ m}^2$  @ 3'-0" ENDS
- P16 \* 2<sup>ND</sup> TO 4<sup>TH</sup> LENGTH 5.25'  $A_{S REQ'D} = 3.51 \text{ m}^2 \geq 4 \# 5 \text{ EF each EFC.}$   
 $A_{S PROVIDED} = 2.4 \text{ m}^2$ ;  $1.11 \text{ m}^2$  STILL NEEDED  
2<sup>ND</sup> TO 3<sup>RD</sup> LEVEL: P-17 LENGTH 6.416' (WALL SEGMENT) 3 # 4 @ 12" OC  
 $A_{S REQ'D} = 4.90 \text{ m}^2 \geq 2.8 \text{ m}^2$  PROVIDED NG  
 $2.1 \text{ m}^2$  STILL REQ'D 3 # 4 each FACE EACH END @ 2'-0" )
- 3<sup>RD</sup> LEVEL:  $A_{S REQ'D} = 3.082 \geq 2.8 \text{ m}^2$  (.175 m<sup>2</sup>)  
TO 4<sup>TH</sup>
- 4<sup>TH</sup> TO ROOF  $A_{S REQ'D} = 2.9 \geq 2.8 \text{ m}^2$  OK
- $A_{SH} = .45 \text{ m}^2$  2<sup>ND</sup> TO 3<sup>RD</sup>  
 $\therefore \leq .040 \text{ m}^2$  PROVIDED NG ←
- 3<sup>RD</sup> TO ROOF  $A_{S REQ'D} = 0.25 \text{ m}^2 \leq A_{S PROVIDED} .040 \text{ m}^2$  OK
- P-15 & P-16  $A_{SH REQ'D} < .040 \text{ m}^2$  PROVIDED OK ✓



ELEVATION ALONG AXIS (A) BETWEEN AXIS (7) & AXIS (1)

FOR SW AXIS A-1 & 2 GROUND TO 2ND

$$A_s \text{ req'd} = 2.46 \text{ m}^2 \leq A_s \text{ PROVIDED } 4.0 \text{ m}^2 \text{ OK } \checkmark$$

V LENGTH = 10'-3" V

$$A_s \text{ req'd} = 0.24 \text{ m}^2 \leq A_s \text{ PROVIDED } 0.40 \text{ m}^2 \text{ OK } \checkmark$$

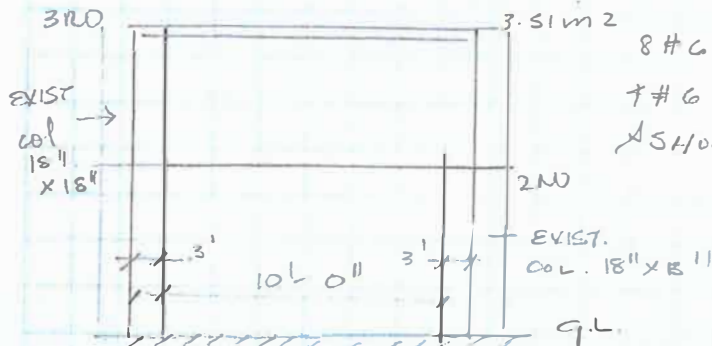
H

→ WALL PANEL AXIS A BETWEEN AXIS 7 & AXIS 6 - NEW WALL PIEK \*\*\*  
 Pg 49

P 23 & P 24 G TO 2ND WITH SB S-7 \* HNECO HAS REQUESTED \*  
 LENGTH = 3'-0"  $A_s = 11.85 \text{ in}^2 \text{ req'd}$  97/ft<sup>2</sup>  
 V # 7 @ 4" OC

2ND TO 3RD  $A_s = 7.89 \text{ m}^2 \text{ req'd}$  4#6 ← EFC  
 V

$A_s \text{ req'd} = 0.64 \text{ m}^2$  # 4 @ 6" OC G TO 2ND  
 # 4 @ 8" OC 2ND TO 3RD



ELEVATION ALONG GRID AXIS 1 BETWEEN AXES F & G

GROUND TO 2ND LEVEL

PG 57 PANELS 28-29-30 (WALL SEGMENTS)

29-  $A_{S REQ'D} = 4.1 m^2$  LENGTH 8'-8"  $A_{S, PROV.} = 4.0 m^2$  (#4 @ 12" o.c. EFC)  
 $\checkmark$   $4.1 m^2 \leq 4.0 m^2$  PROVIDED OK

PANEL 30 :  $A_{S, REQ'D} = 5.49 m^2$  LENGTH 4'-0"  $A_{S, PROV.} = 2.0 m^2$  PROV. NG  
 STILL REQ'D 3.49 m<sup>2</sup> 3# S EF @ ENDS !!!

$A_{S, REQ'D}$  FOR ALL PANELS (28-29-30) 0.24 m<sup>2</sup>  $\leq$  0.40" PROVIDED OK.  $\checkmark$

? ASK J

PG 63

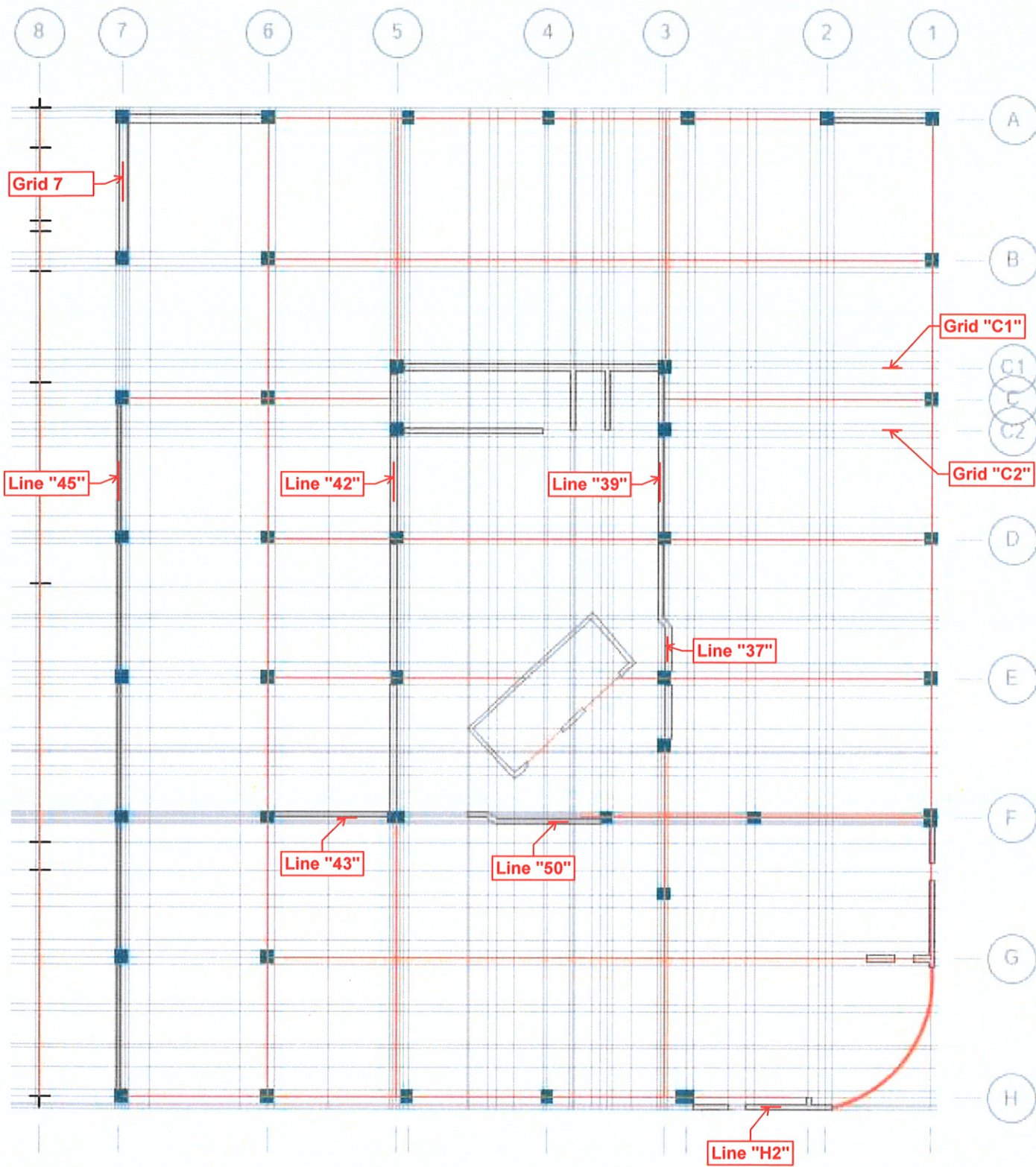
ELEVATION AXIS (4-2) BETWEEN AXIS (2-1) & AXIS (1-9)

GRID 2ND LEVEL

PANELS 31-32-(33)  $\leftarrow$  ONLY GRID 2ND

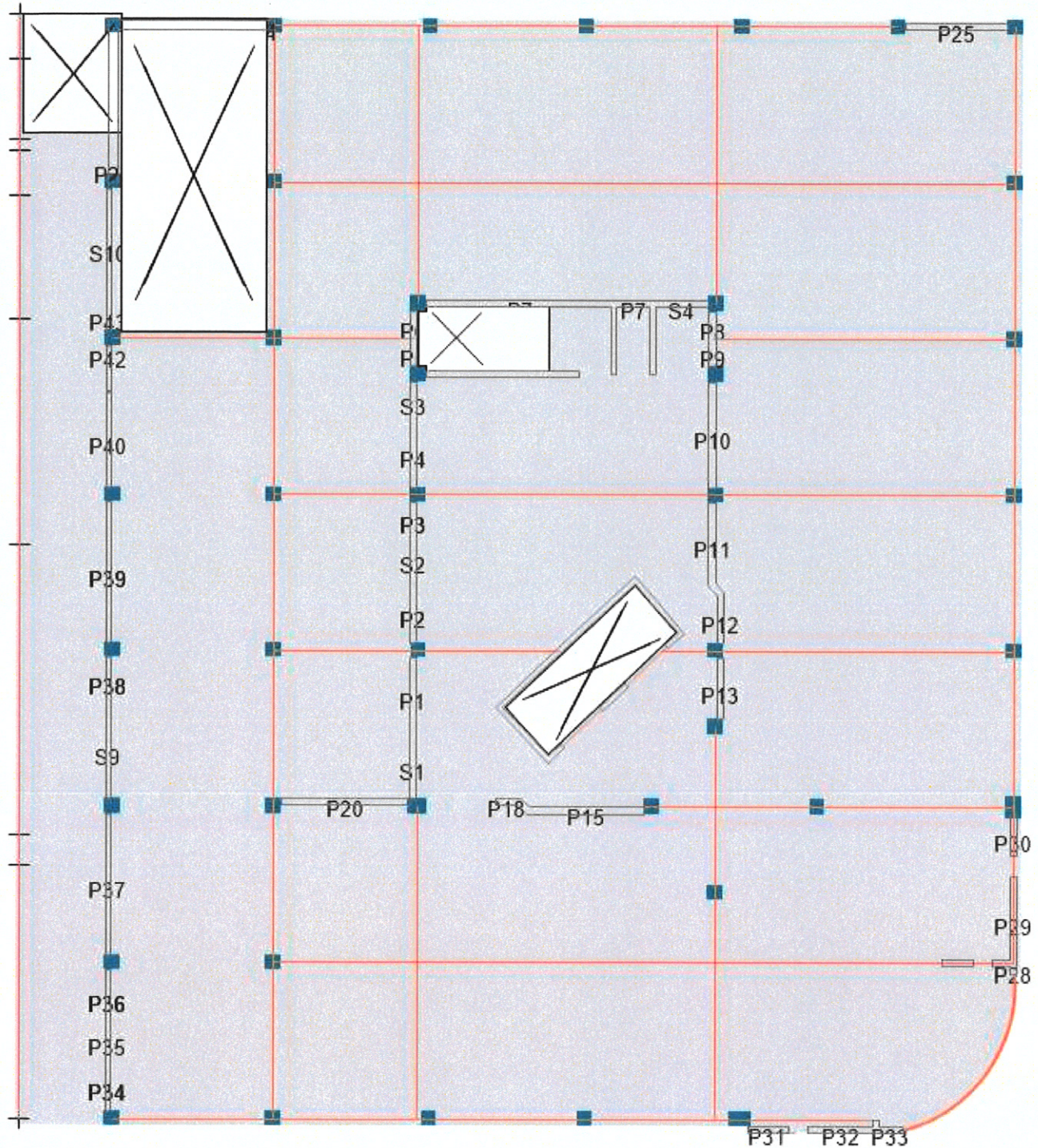
GG-  $A_{S, REQ'D} = 0.24 m^2 \leq 0.40 m^2$  PROVIDED OK  $\checkmark$







## Second Floor - Layout with Pier Labels



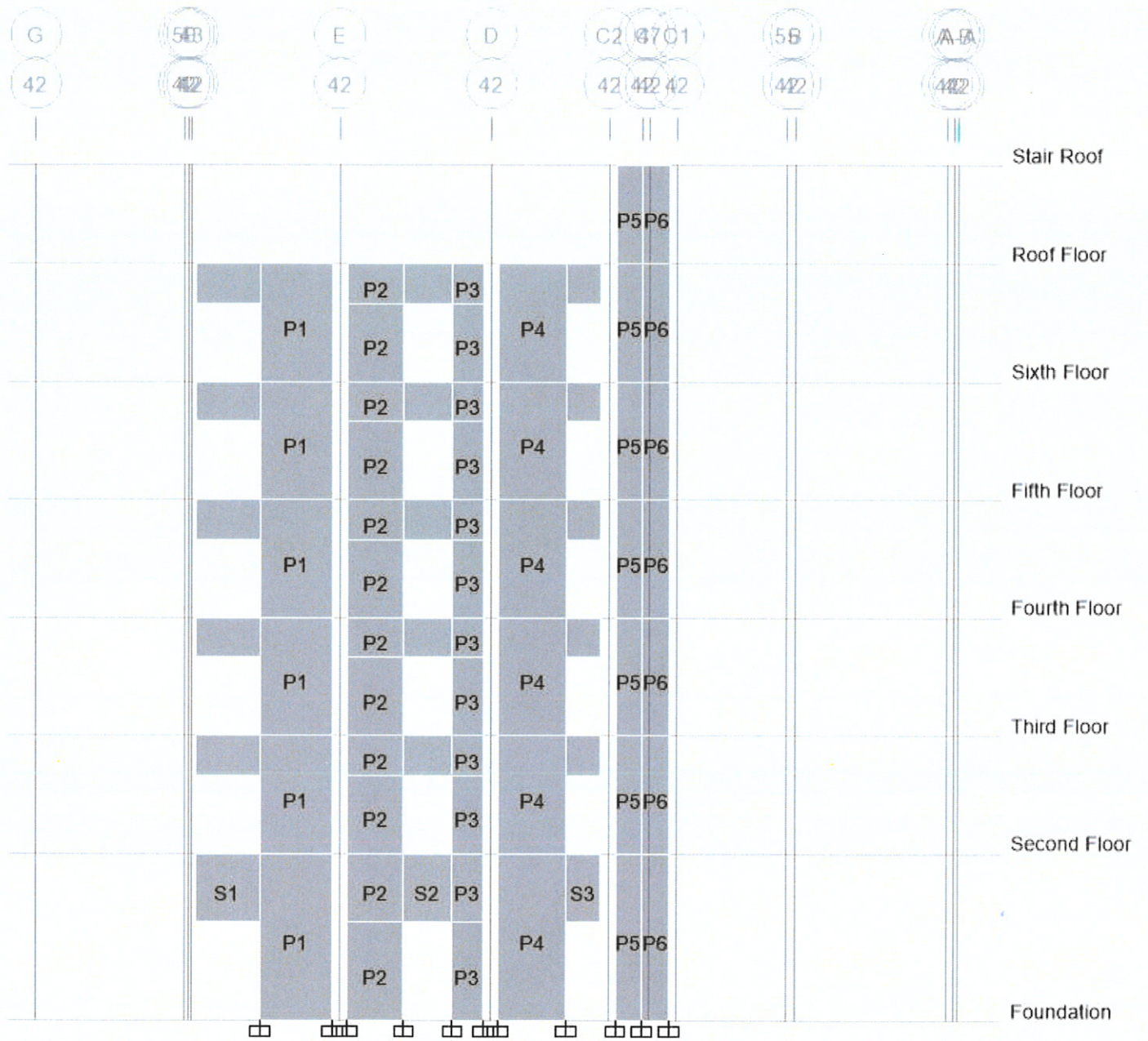
Not all pier labels are reflected on the plan view. Refer to corresponding elevations for Pier labels .



Elevation - Grid 5 ("42"), Bet. F and C1



# Elevation - Grid 5 ("42"), Bet. F and C1









F

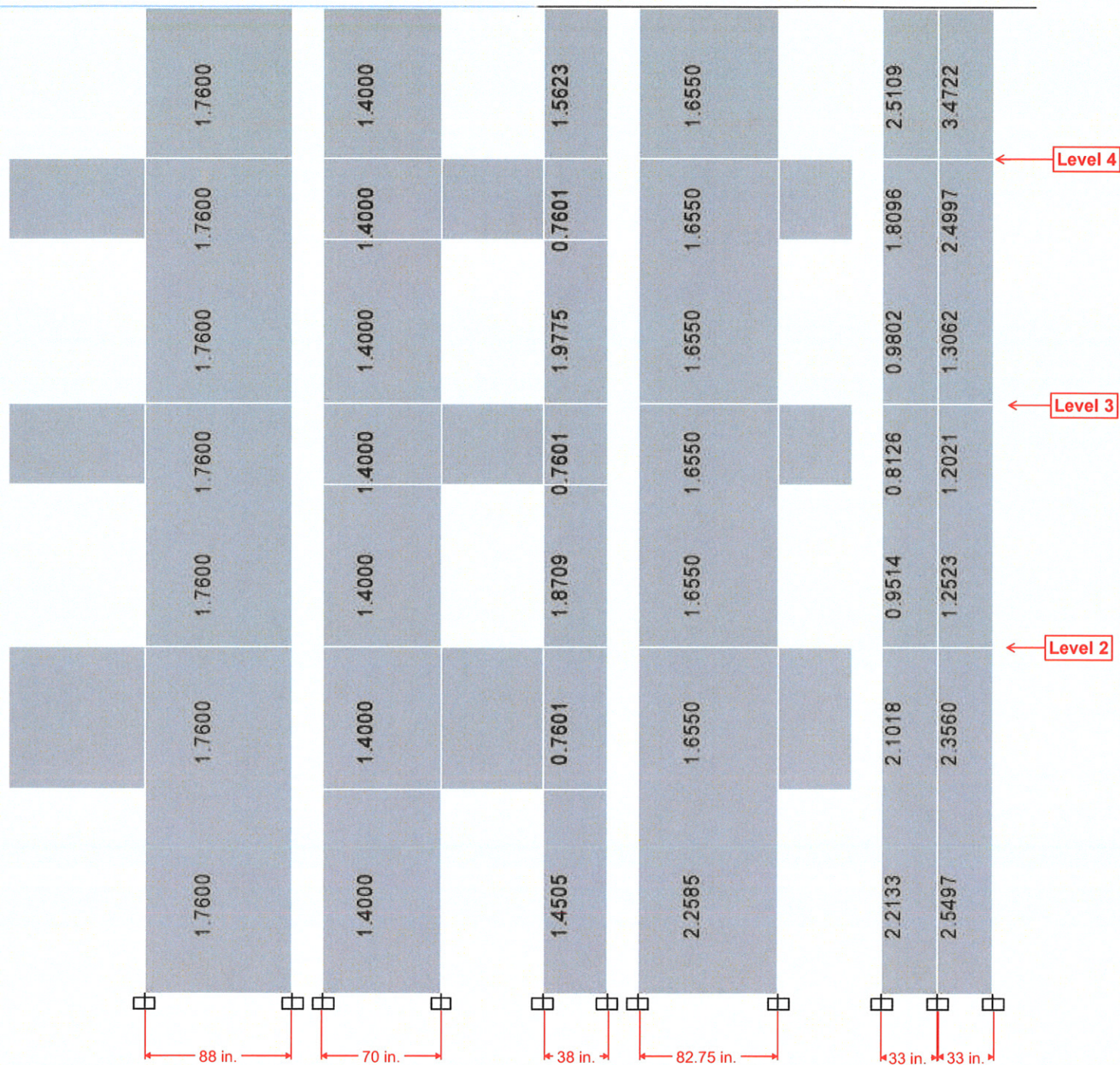
E

D

C2

C

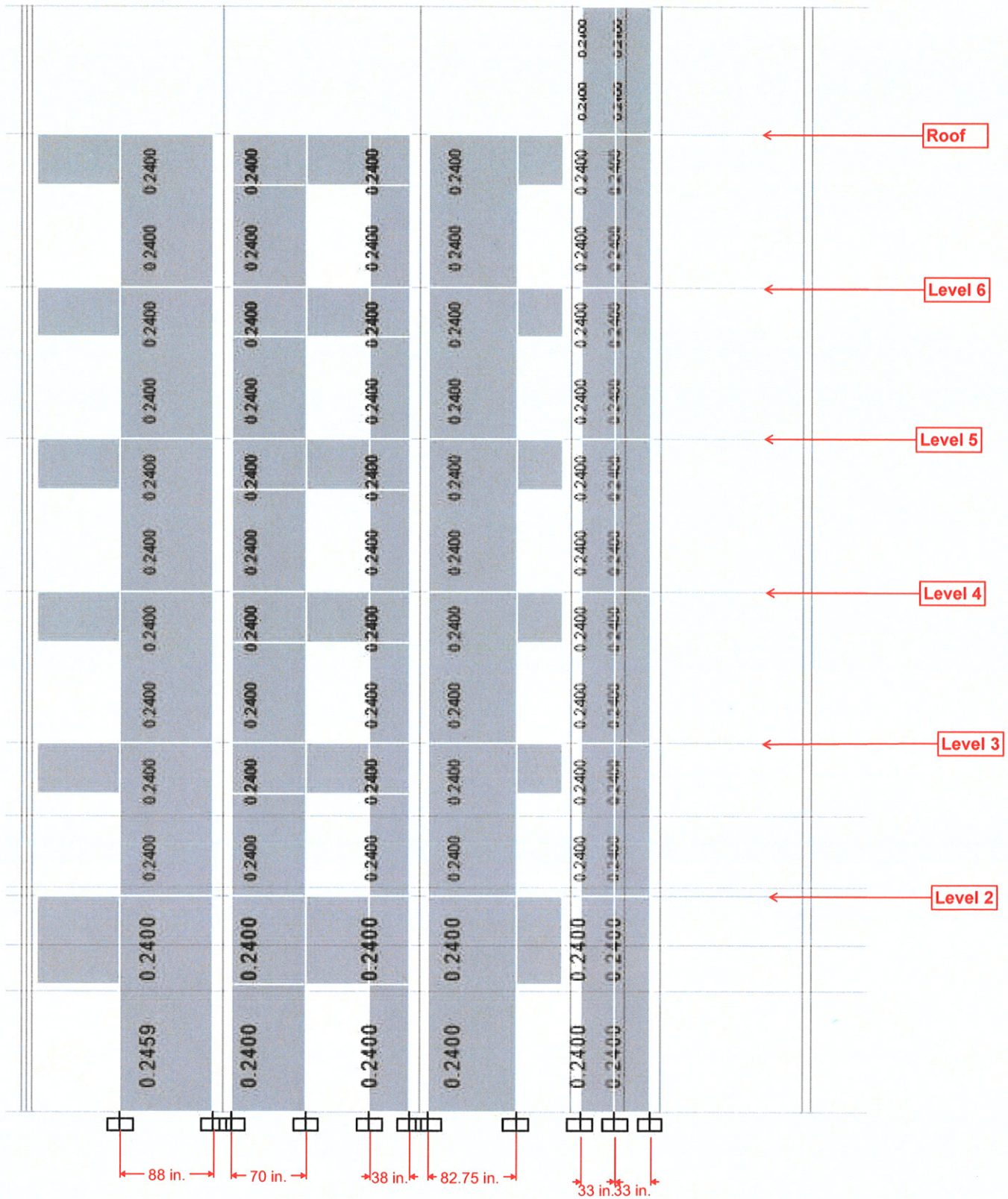
C1



PIER Total Reinforcement Areas [in²]  
- Longitudinal (Vertical)

Elevation - Grid 5 ("42"), Bet. F and C1





PIER Total Reinforcement Areas  
[in²/Ft] - Shearing (Horizontal)

Elevation - Grid 5 ("42"), Bet. F and C1



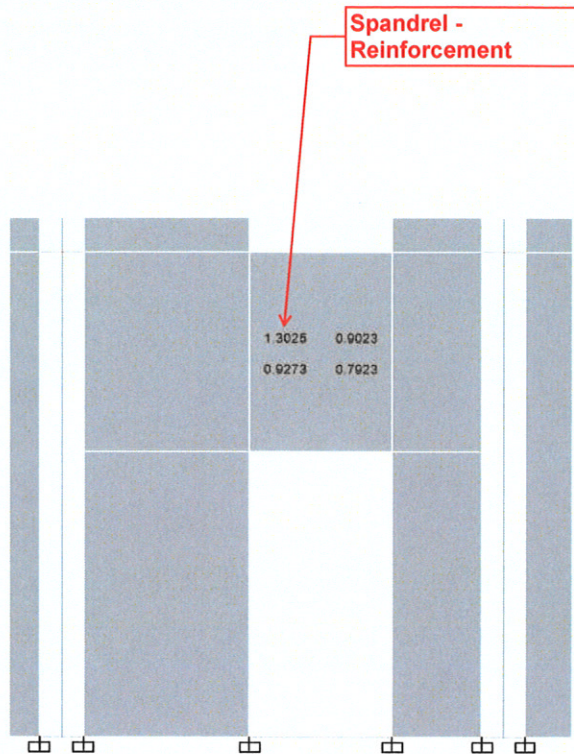


PIER Total Reinforcement Areas  
[in<sup>2</sup>/Ft] - Shearing (Horizontal)

Elevation - Grid 5 ("42"), Bet. F and C1

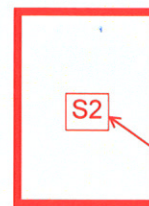


# SPANDREL REINFORCEMENT LAYOUT



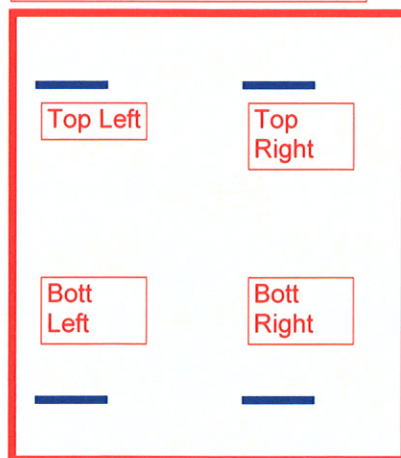
Spandrel - Left Edge

Spandrel - Right Edge

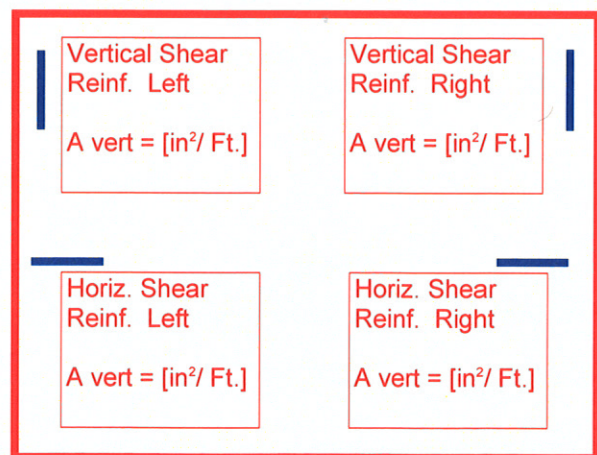


Spandrel - Label

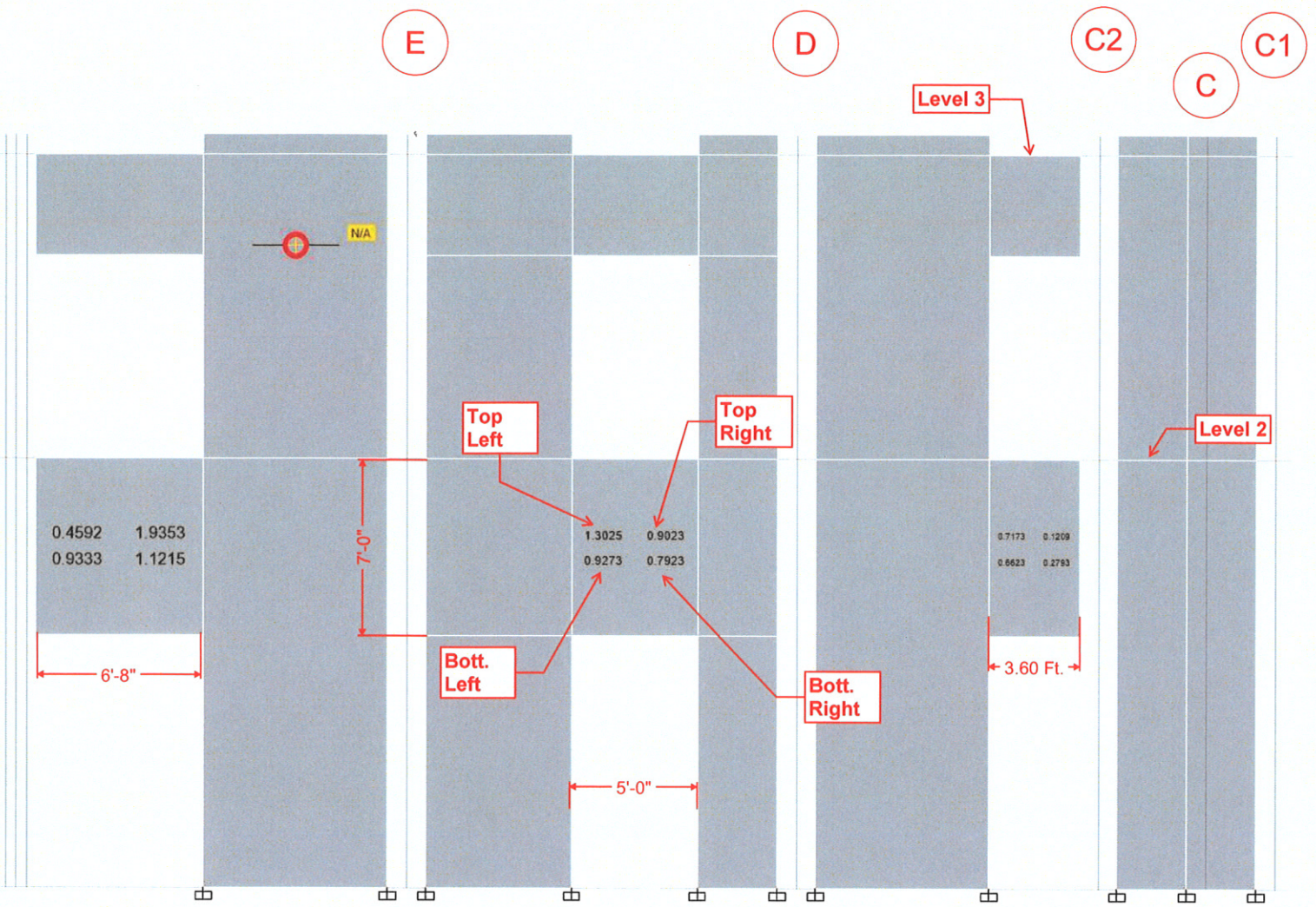
Spandrel Flexural Reinforcement [Output format]  
As = [in<sup>2</sup>]



Spandrel Shear Reinforcement [Output format]



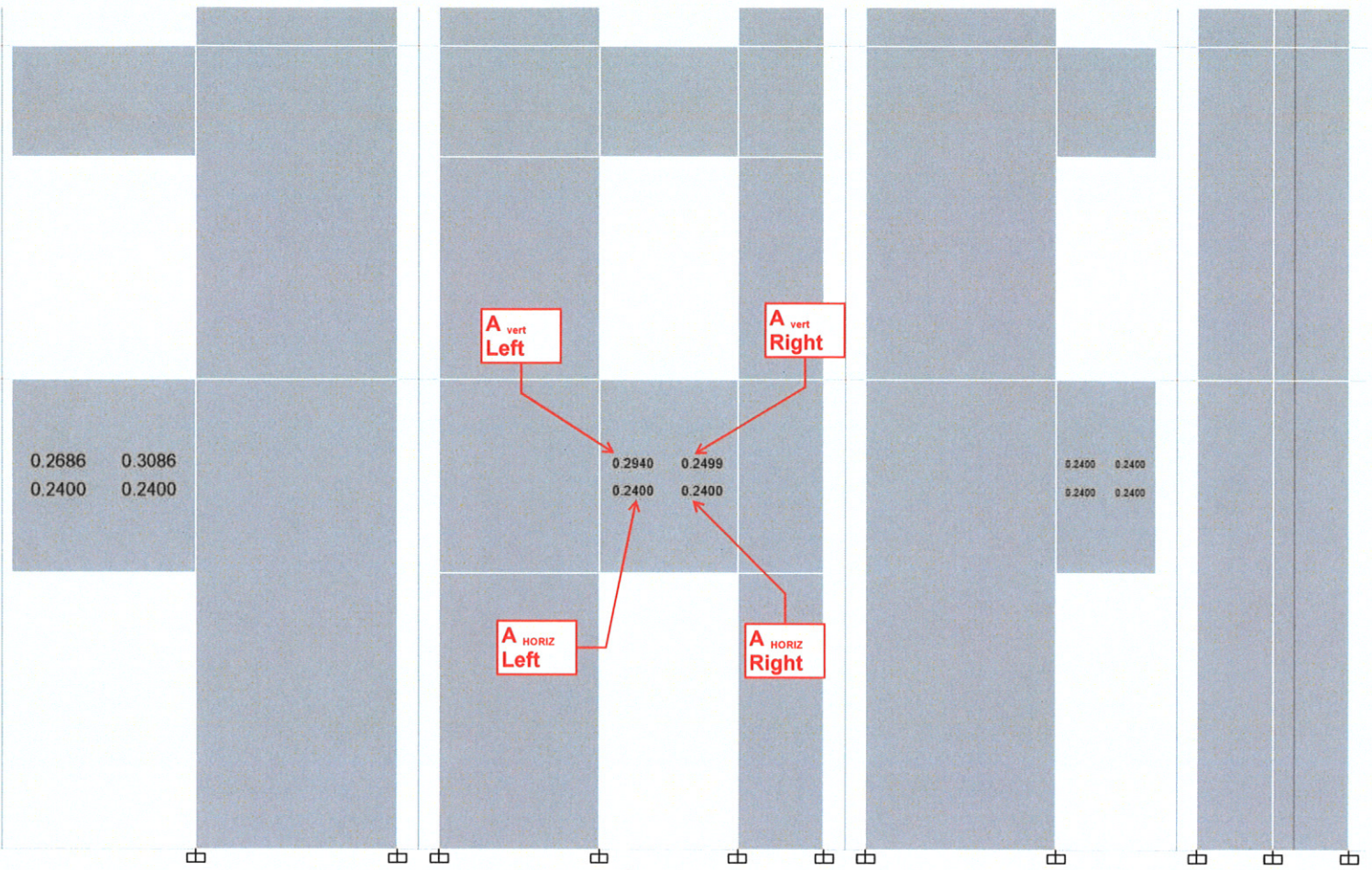




Spandrel Reinforcement Areas  
[in<sup>2</sup>] - Flexural Longitudinal  
(Horizontal)

Elevation - Grid 5 ("42"), Bet. F and C1





Spandrel Shear Reinforcement  
[in² / Ft]

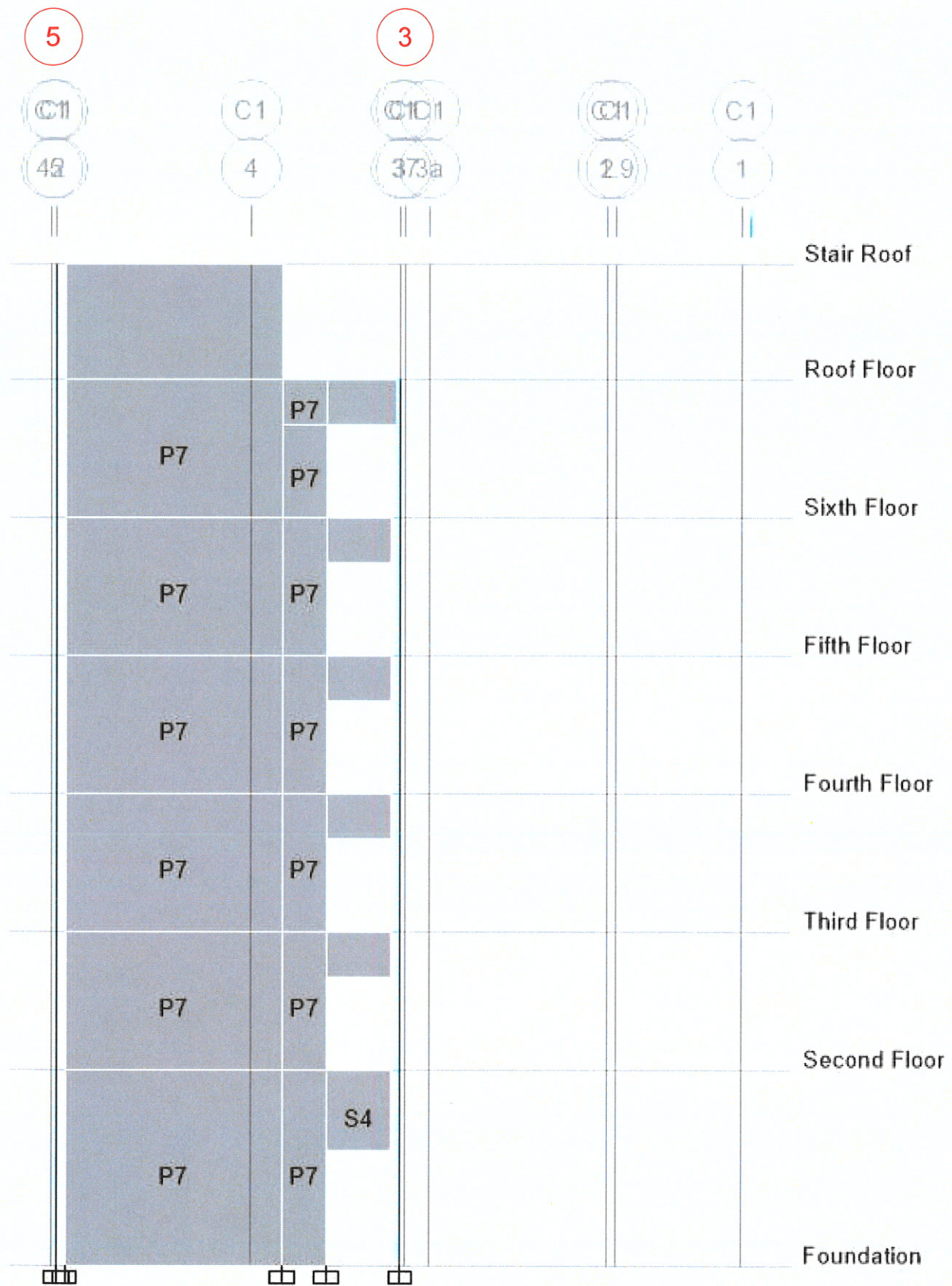
Elevation - Grid 5 ("42"), Bet. F and C1



Elevation - Grid C1, Bet. 5 and 3



# Elevation - Grid C1, Bet. 5 and 3



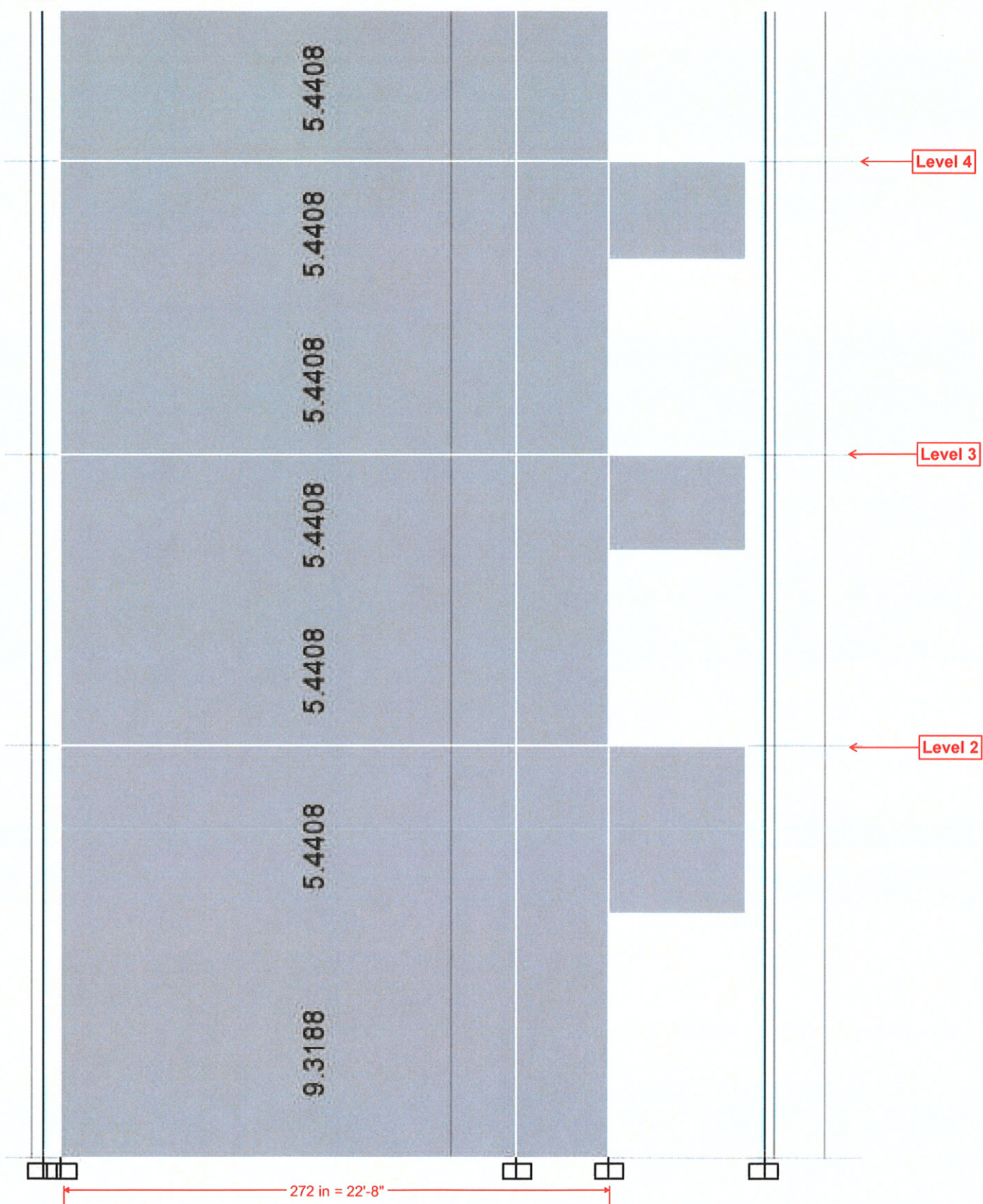






5

3



PIER Total Reinforcement Areas [in²]  
- Longitudinal (Vertical)

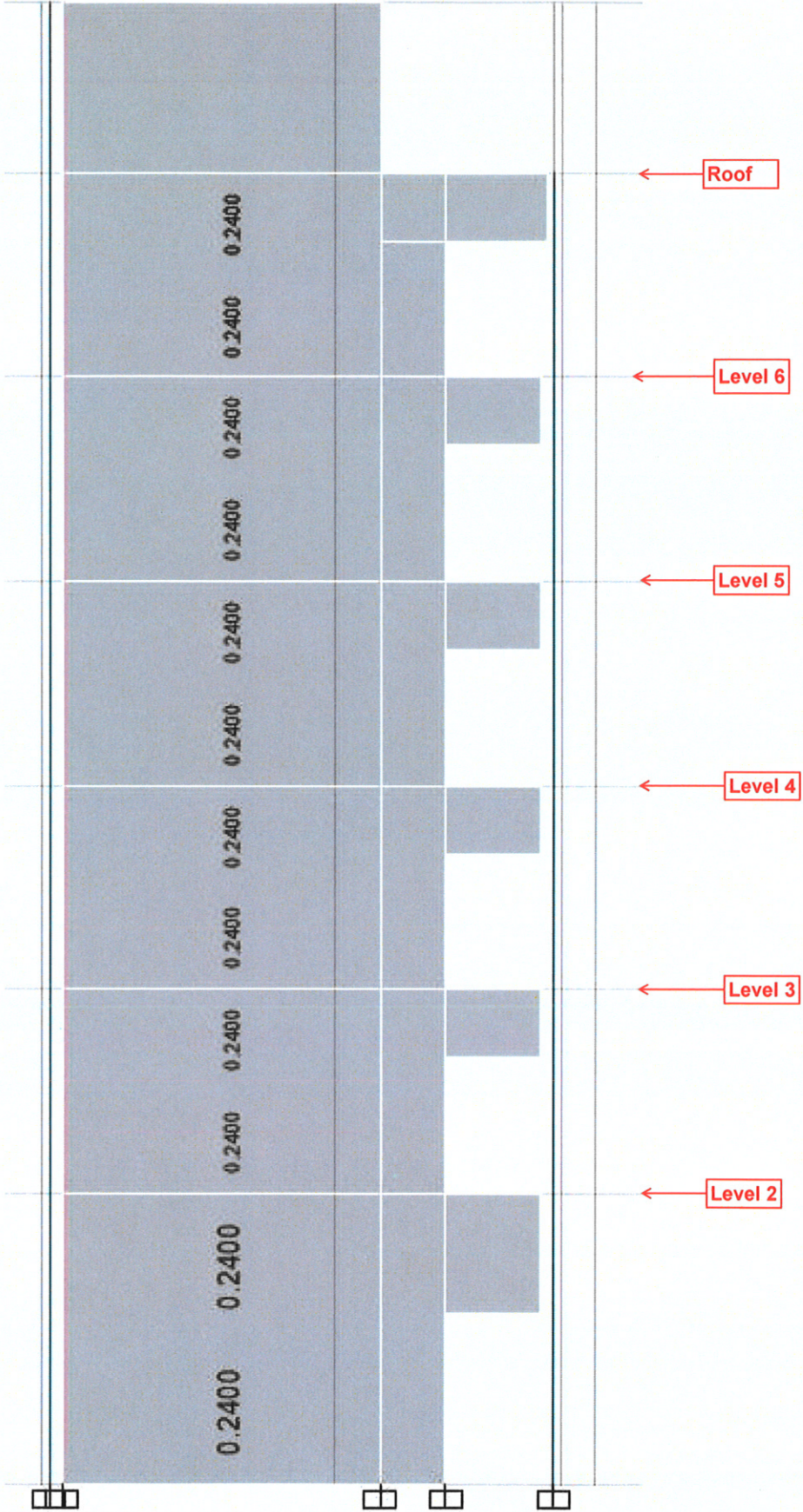
This is the entire width of  
the two piers combined.

Elevation - Grid C1, Bet. 5 and 3



5

3



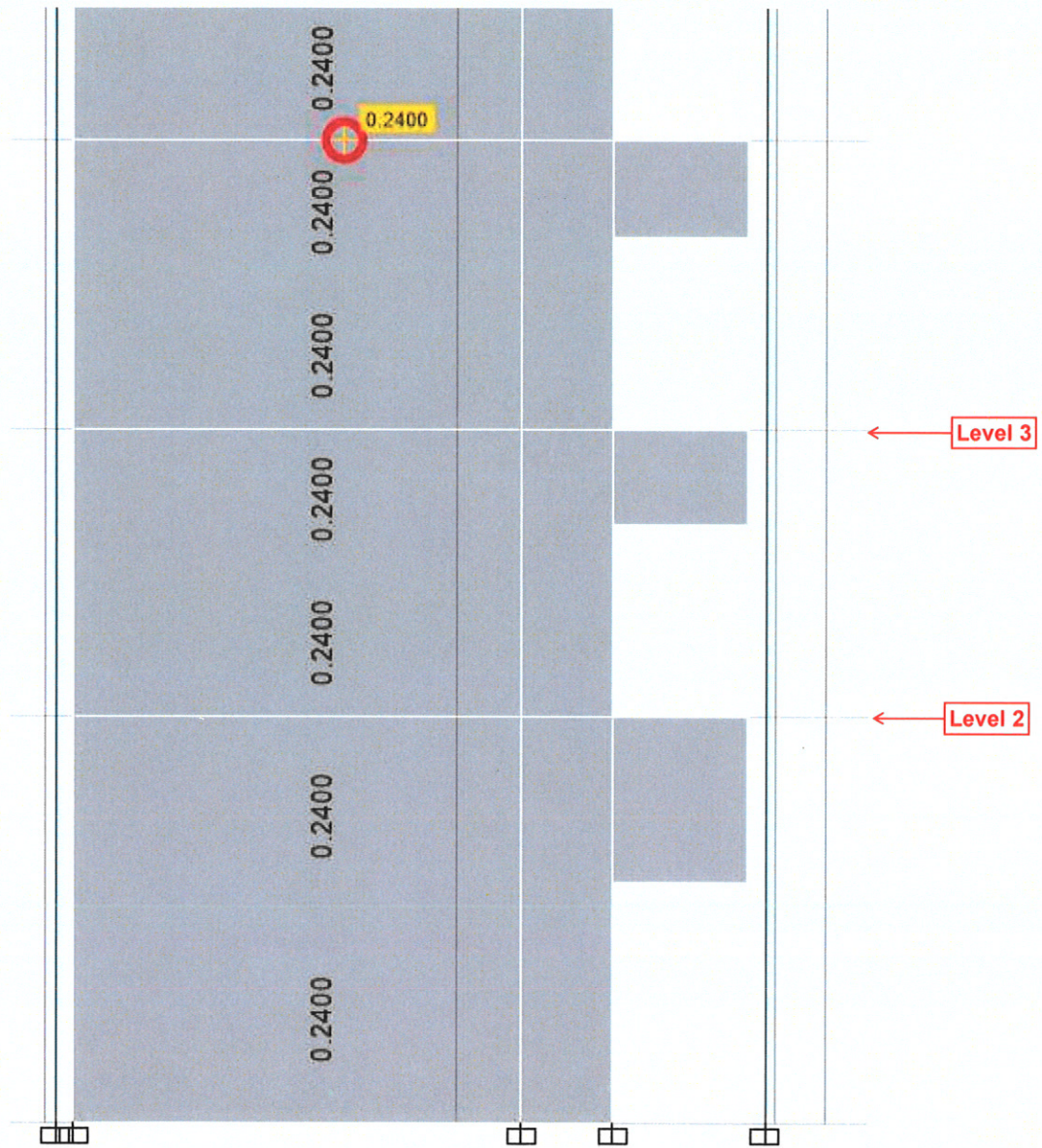
PIER Total Reinforcement Areas [in²/Ft]  
- Shearing (Horizontal)

Elevation - Grid C1, Bet. 5 and 3



5

3



PIER Total Reinforcement Areas [in<sup>2</sup>/Ft] -  
Shearing (Horizontal)

Elevation - Grid C1, Bet. 5 and 3



5

3

Level 2

7'-0"

1.9304	0.2202
0.9268	0.6932

5'-8"

Spandrel Reinforcement Areas  
[in<sup>2</sup>] - Flexural Longitudinal  
(Horizontal)

Elevation - Grid C1, Bet. 5 and 3



5

3

Level 2

0.3423	0.3044
0.2400	0.2400

Spandrel Shear Reinforcement  
[in<sup>2</sup> / Ft]

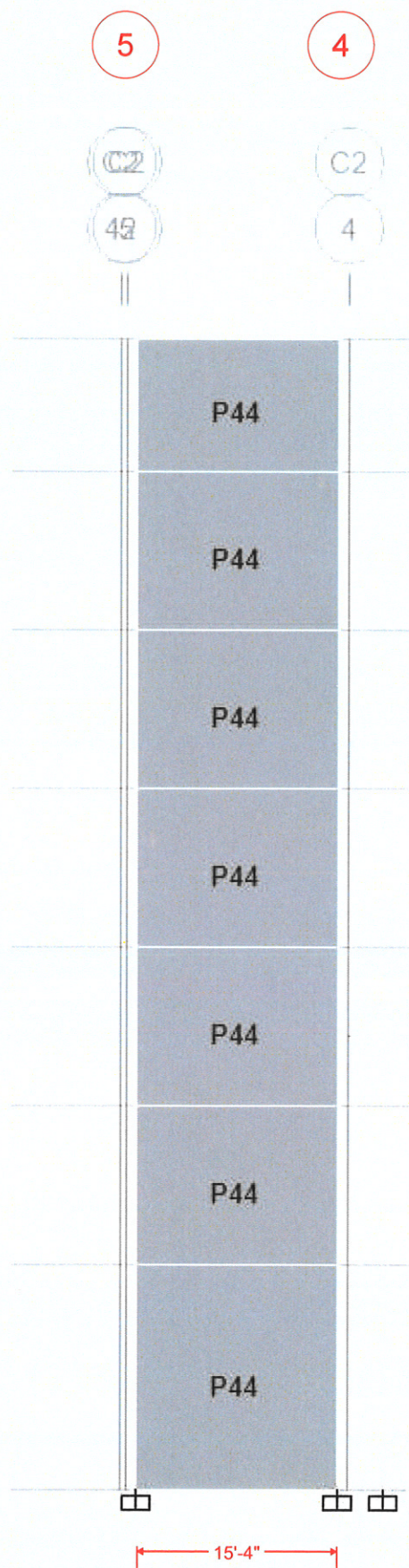
Elevation - Grid C1, Bet. 5 and 3



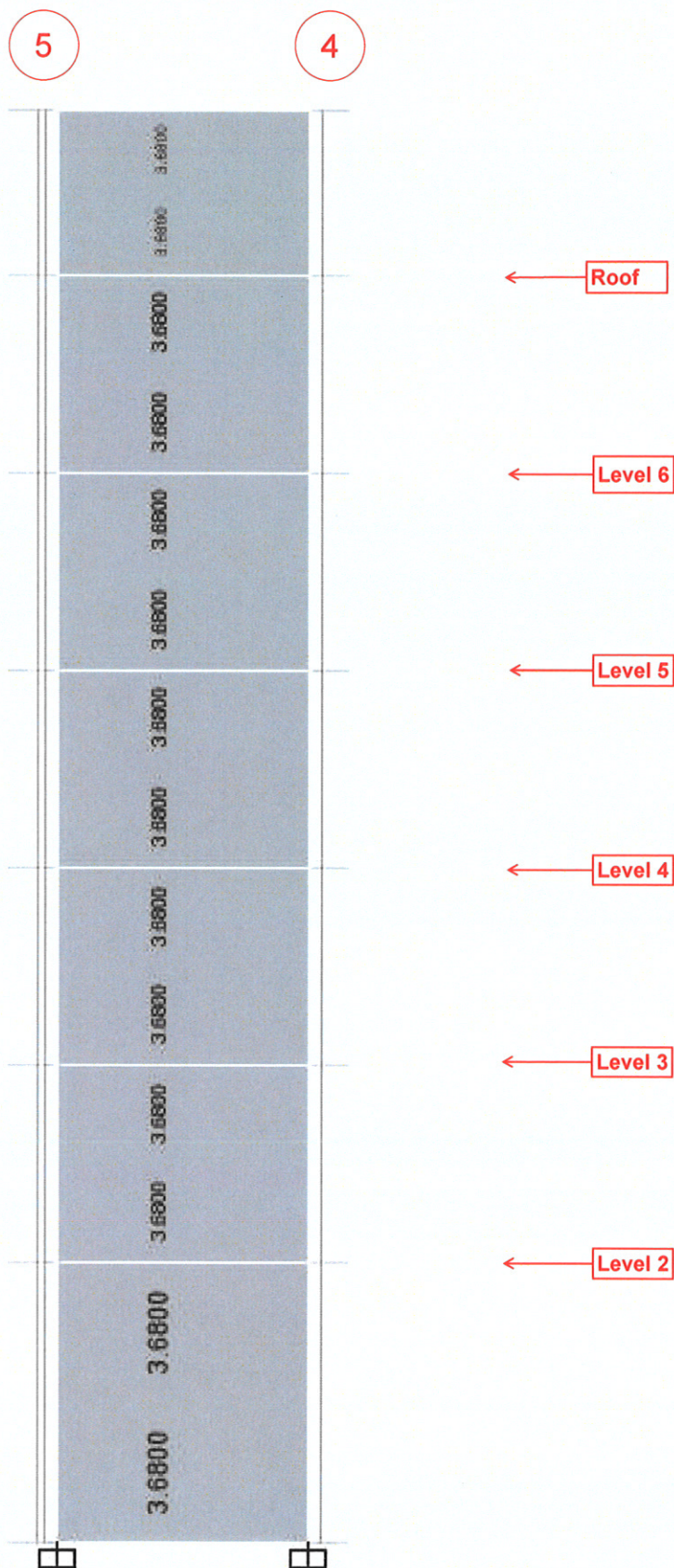
Elevation - Along Grid C2, Bet.  
Grids 5 (line "42") and 4



## Elevation - Grid C2, Bet. 5 and 4







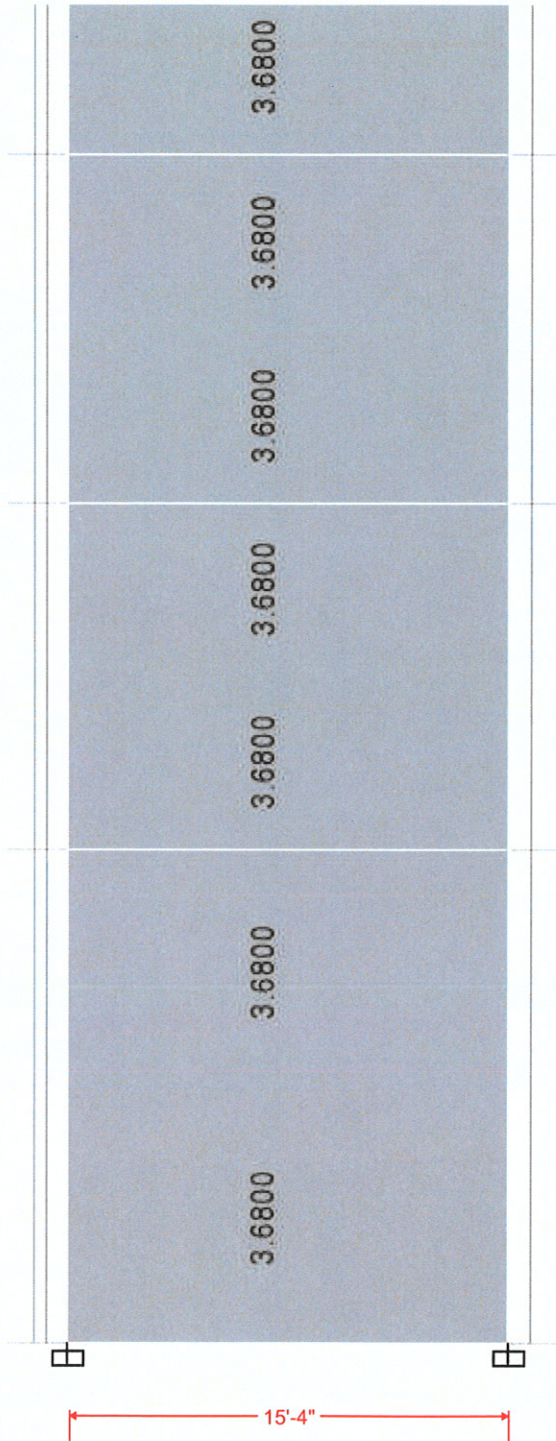
PIER Total Reinforcement Areas [in<sup>2</sup>]  
- Longitudinal (Vertical)

Elevation - Grid C2, Bet. 5 and 4



5

4



← Level 4

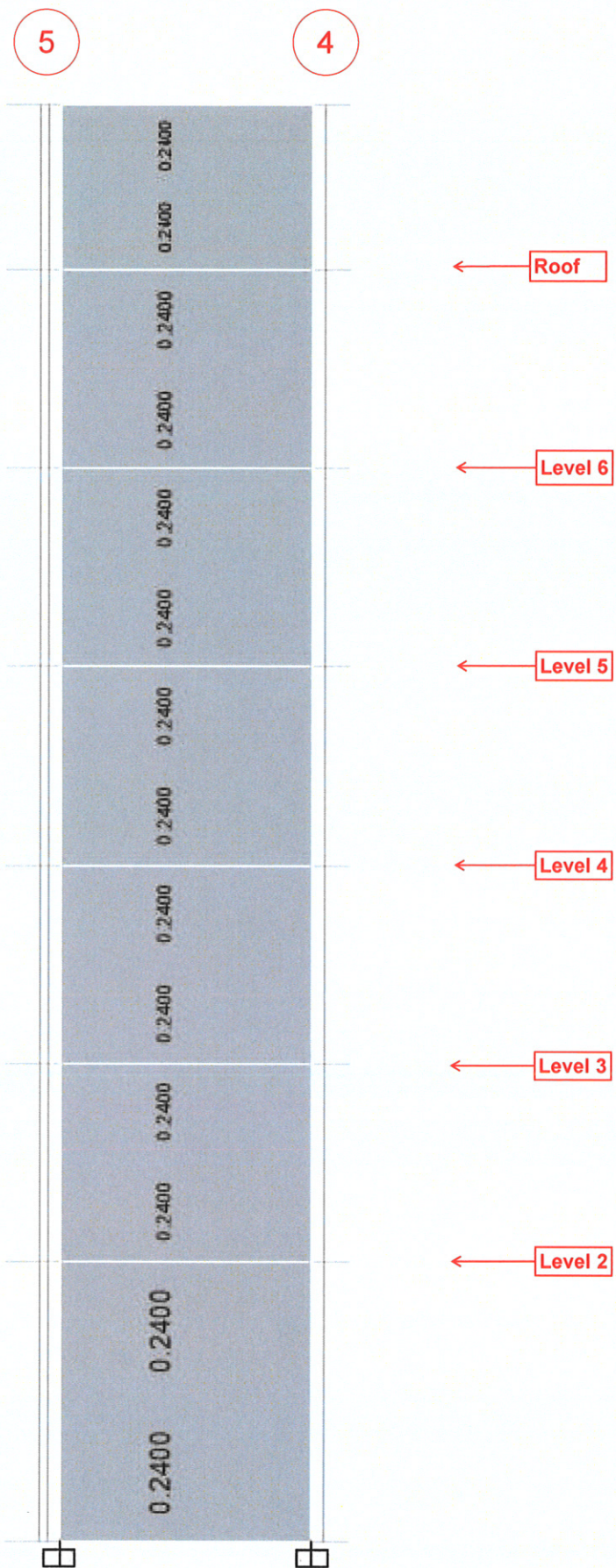
← Level 3

← Level 2

PIER Total Reinforcement Areas [in<sup>2</sup>]  
- Longitudinal (Vertical)

Elevation - Grid C2, Bet. 5 and 4

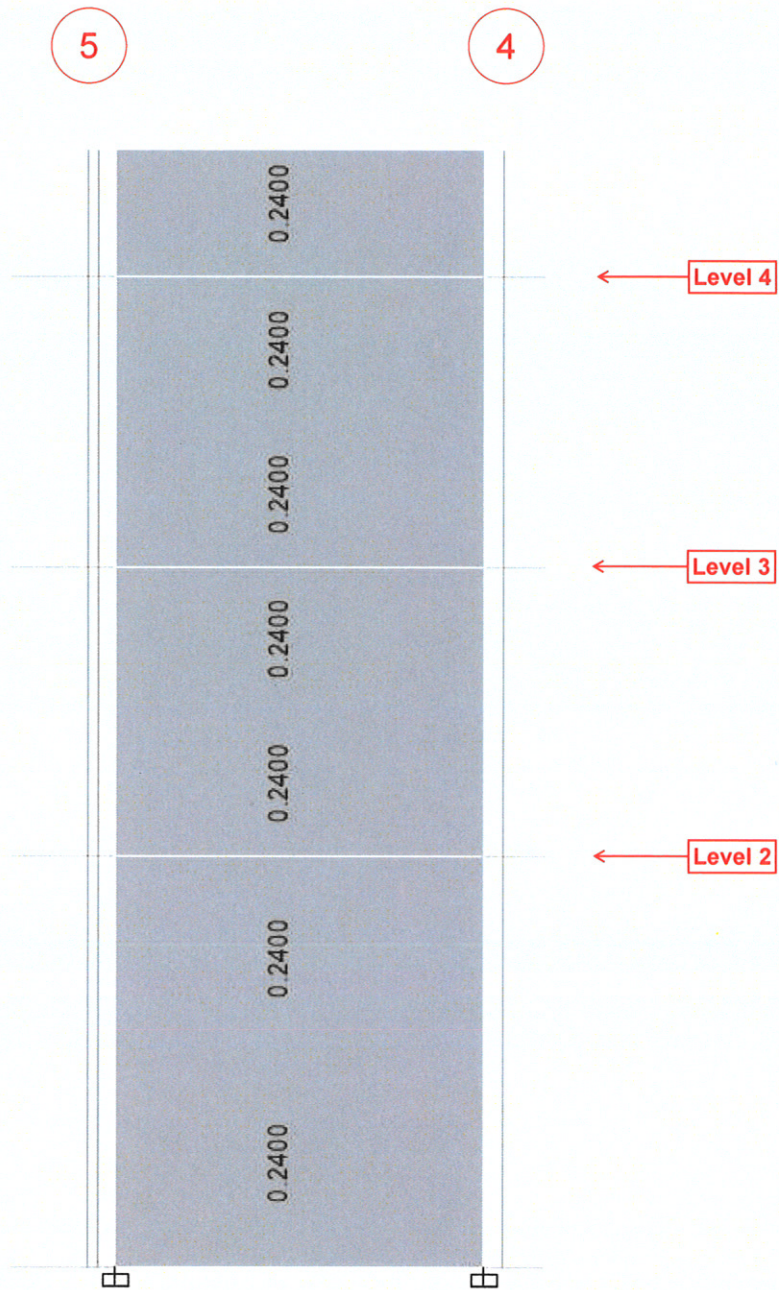




PIER Total Reinforcement Areas [in<sup>2</sup>/Ft]  
- Shearing (Horizontal)

Elevation - Grid C2, Bet. 5 and 4





PIER Total Reinforcement Areas [ $\text{in}^2/\text{Ft}$ ]  
- Shearing (Horizontal)

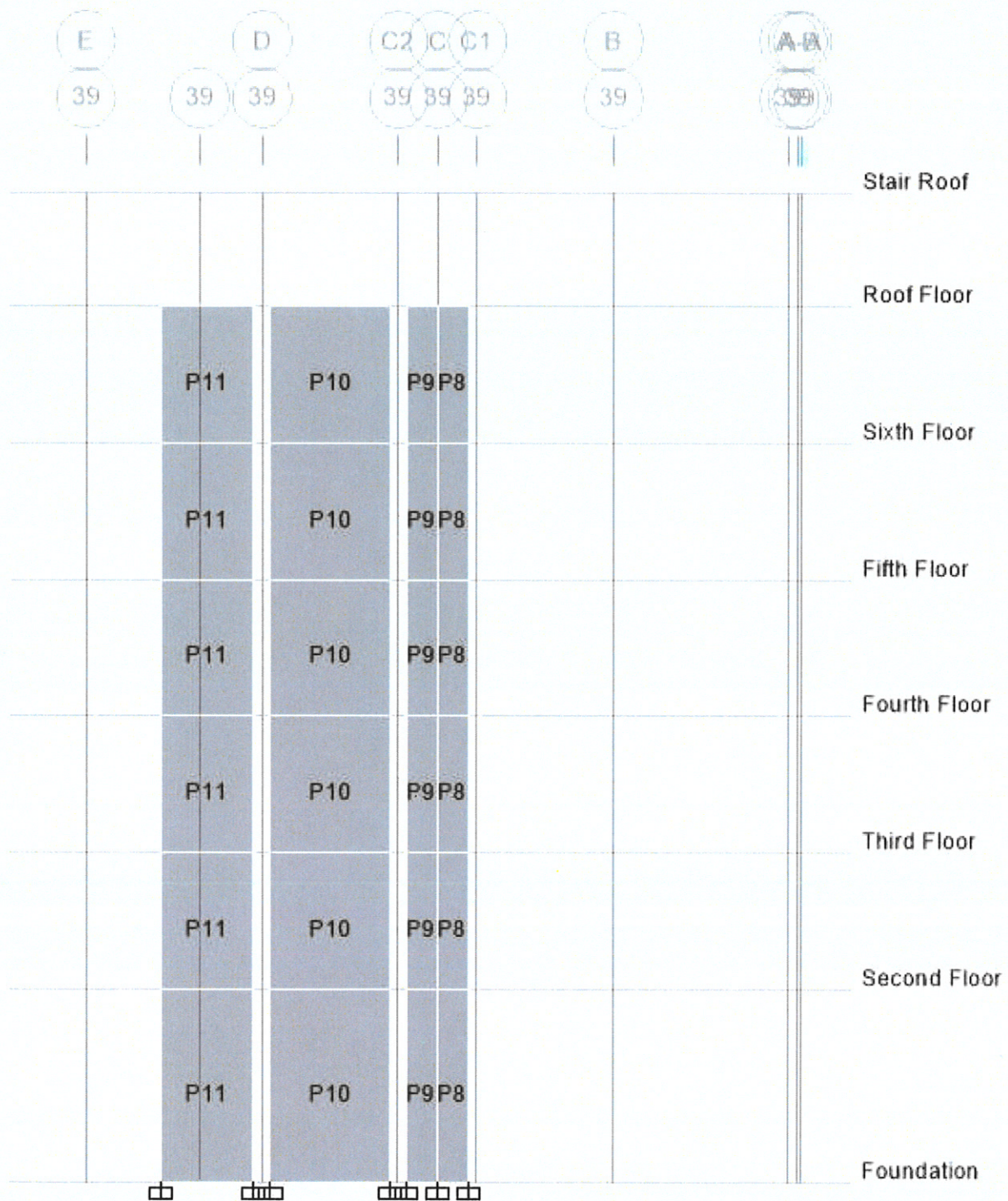
Elevation - Grid C2, Bet. 5 and 4



Elevation - Along Grid 3 ("39"),  
Bet. D.5 and C1

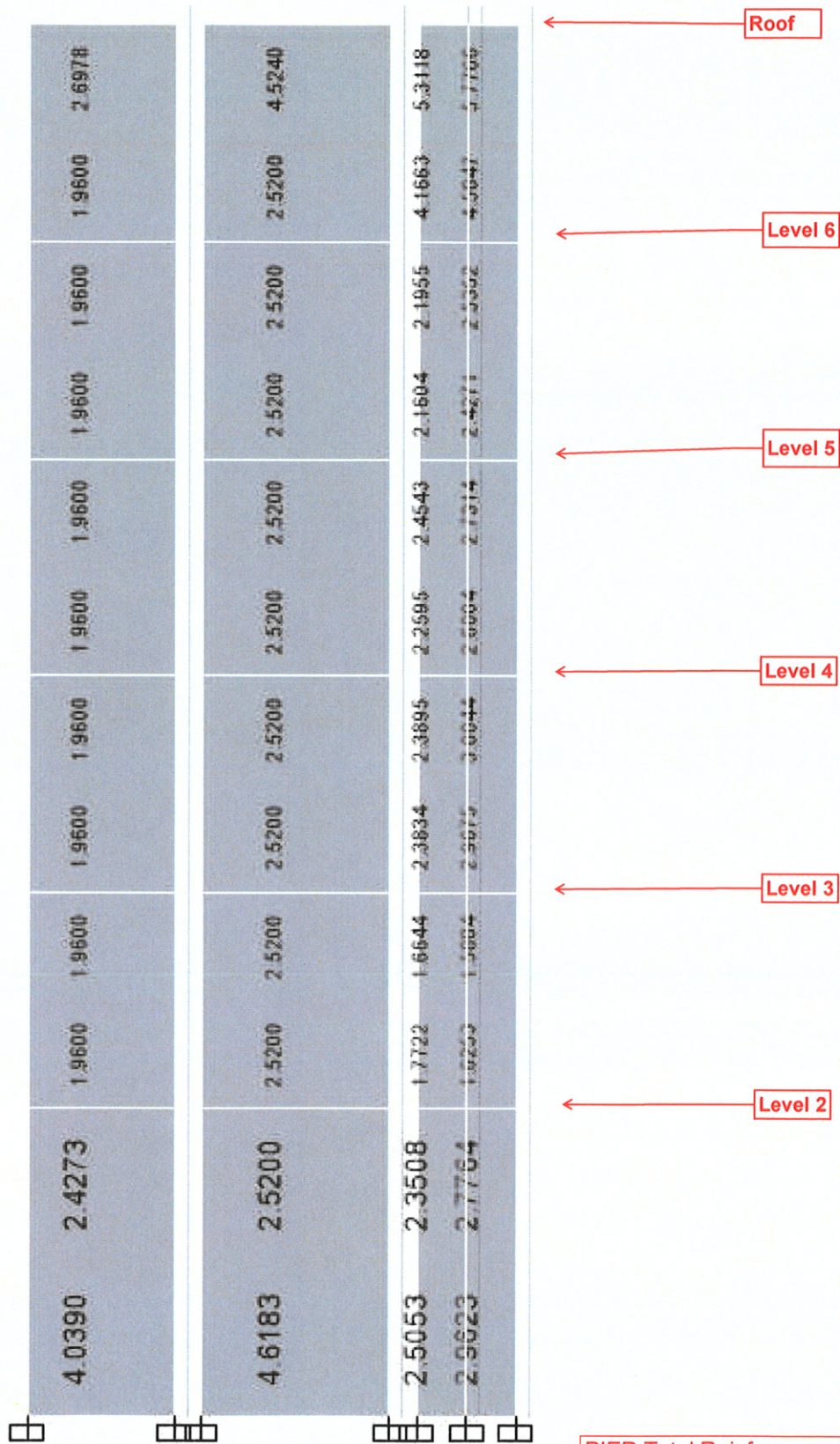


# Elevation - Along Grid 3 ("39"), Bet. D.5 and C1





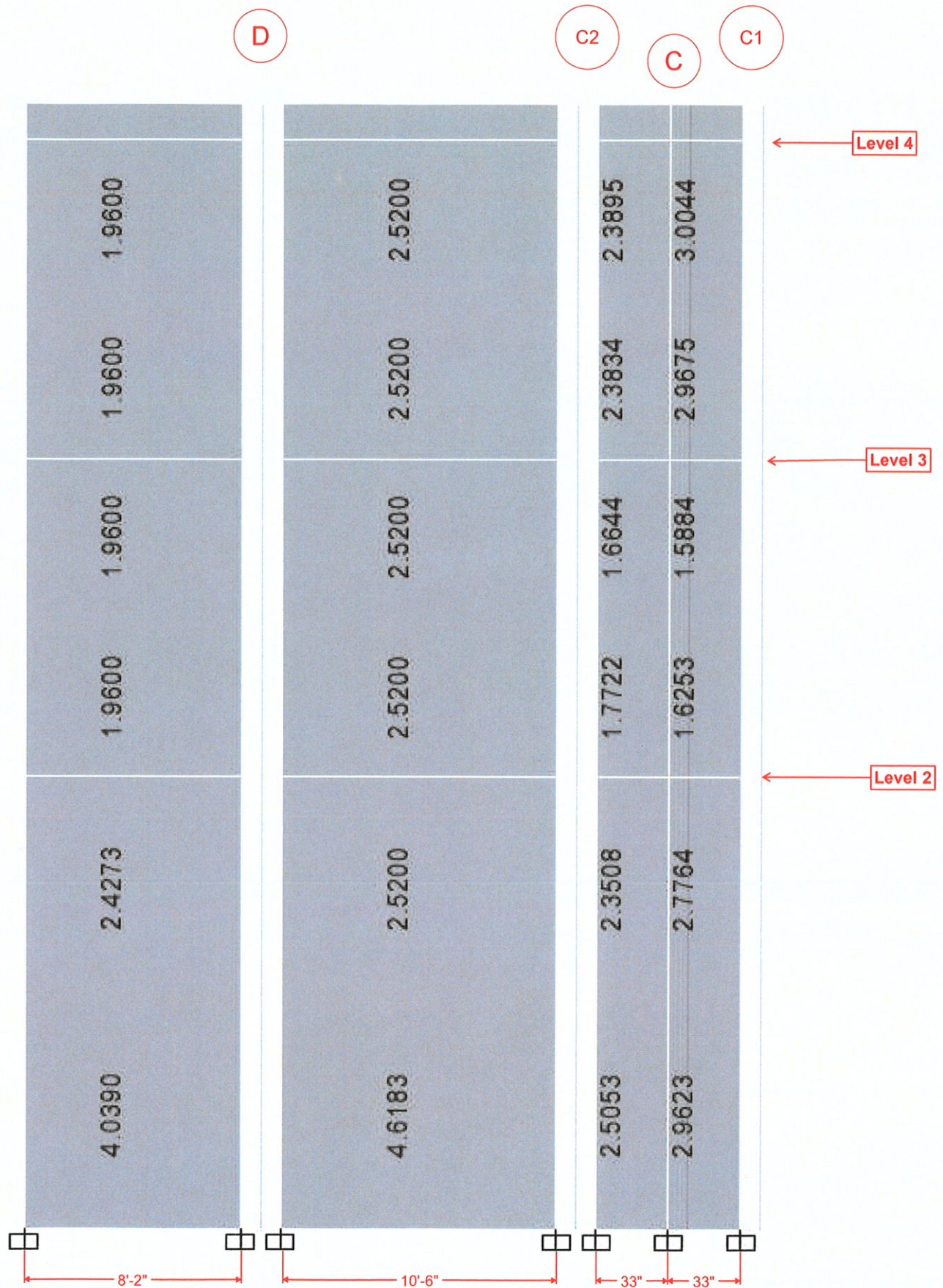
E                      D                      C2                      C                      C1



PIER Total Reinforcement Areas [in<sup>2</sup>]  
- Longitudinal (Vertical)

Elevation - Along Grid 3 ("39"),  
Bet. D.5 and C1

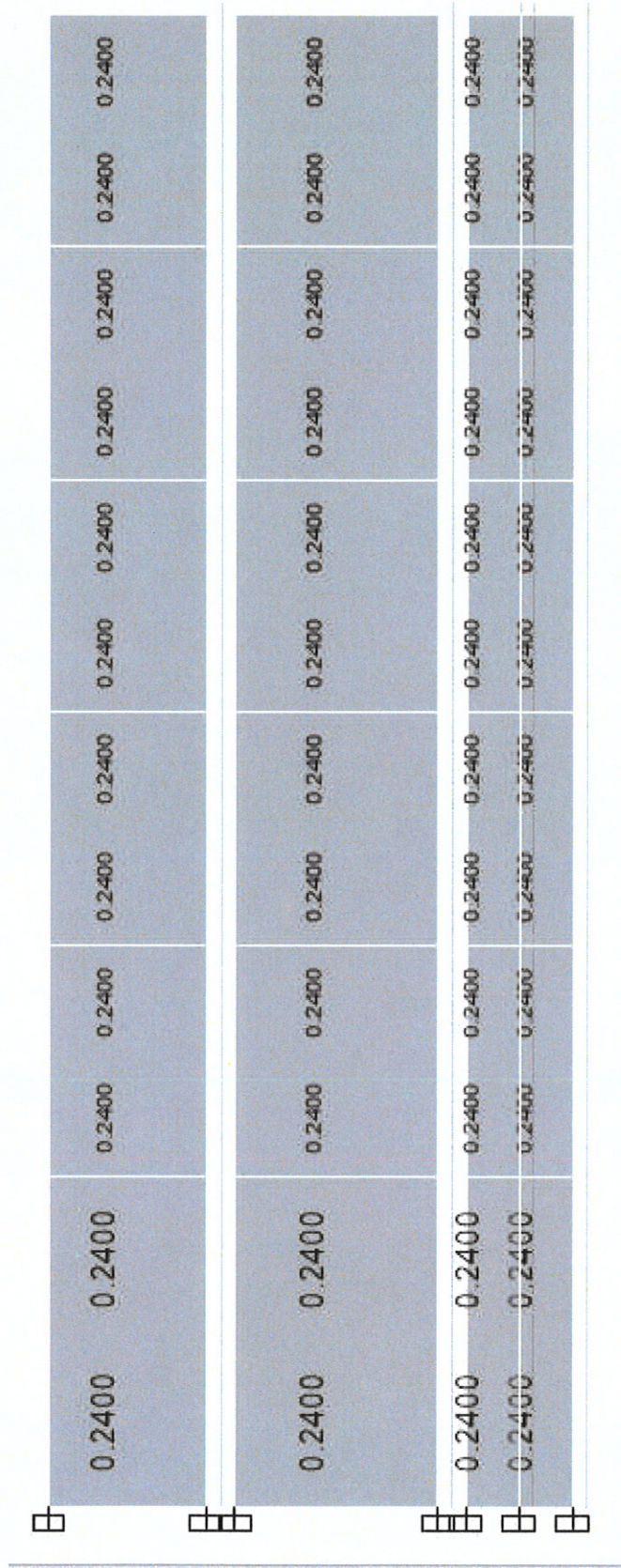




Elevation - Along Grid 3 ("39"),  
Bet. D.5 and C1

PIER Total Reinforcement Areas [in²]  
- Longitudinal (Vertical)

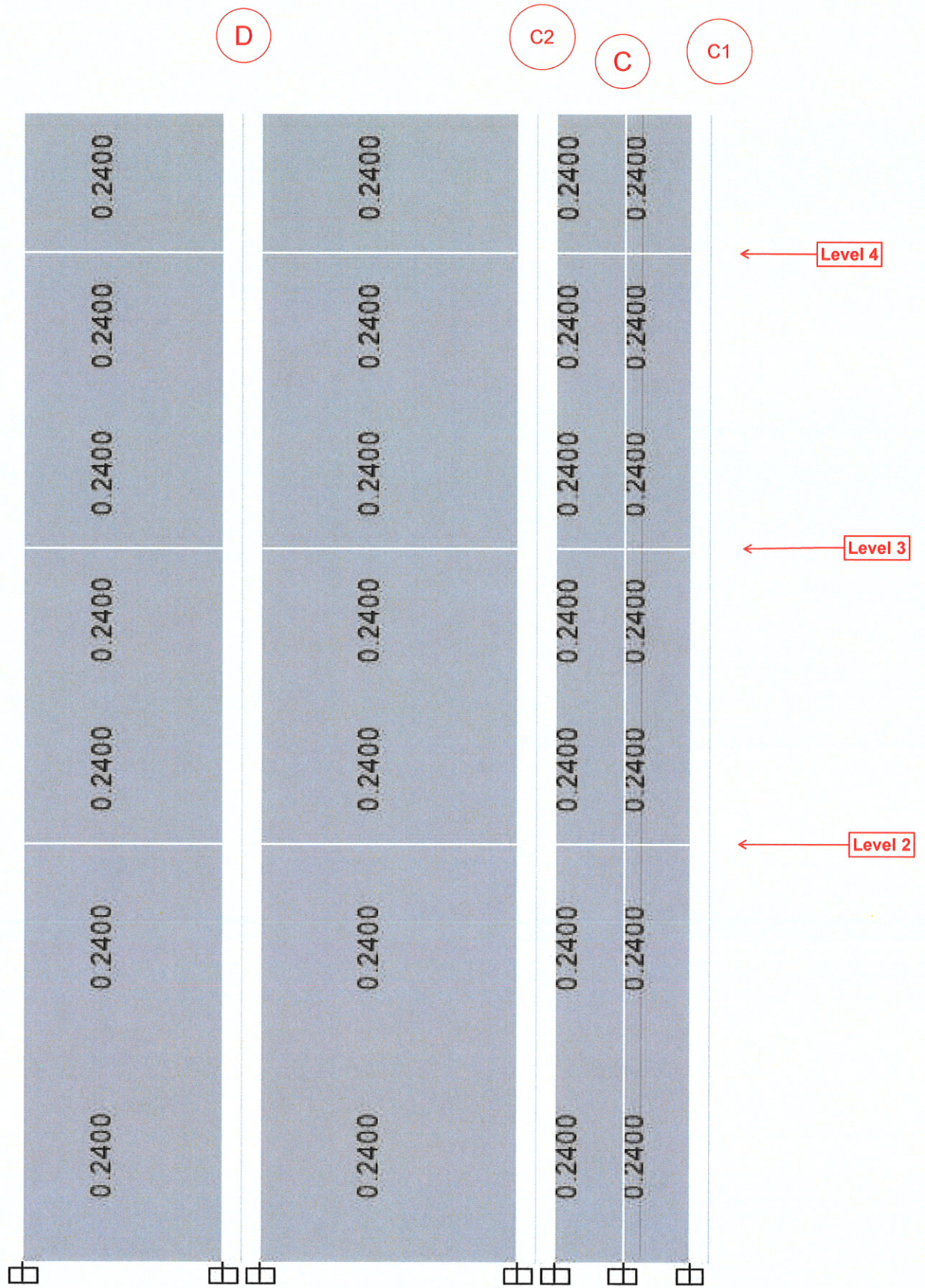




Elevation - Along Grid 3 ("39"),  
Bet. D.5 and C1

PIER Total Reinforcement Areas [in²/Ft]  
- Shearing (Horizontal)





PIER Total Reinforcement Areas [in<sup>2</sup>/Ft] -  
Shearing (Horizontal)

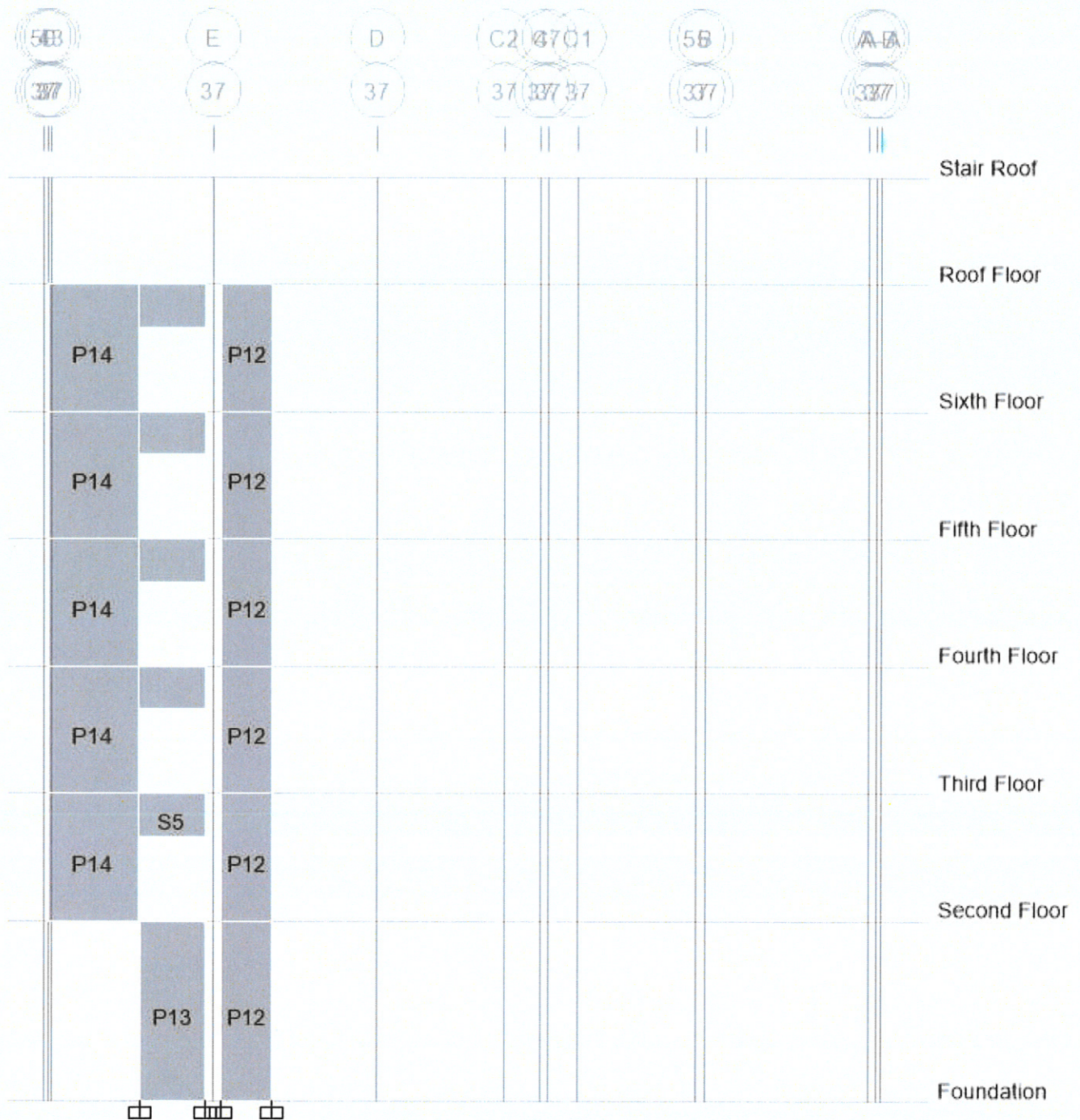
Elevation - Along Grid 3 ("39"),  
Bet. D.5 and C1



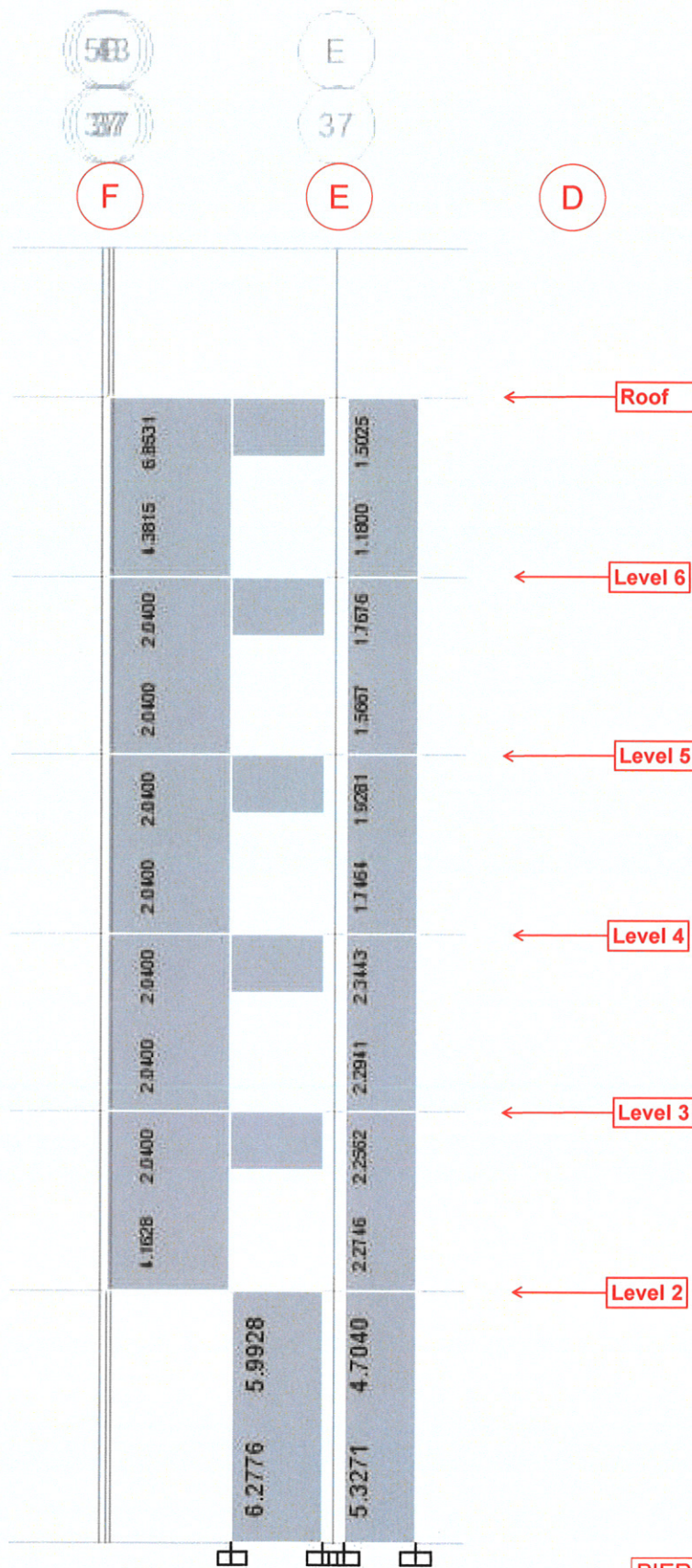
Elevation - Along Grid 3 ("37"),  
Bet. D.5 and F



Elevation - Along Grid 3 ("37"),  
Bet. D.5 and F



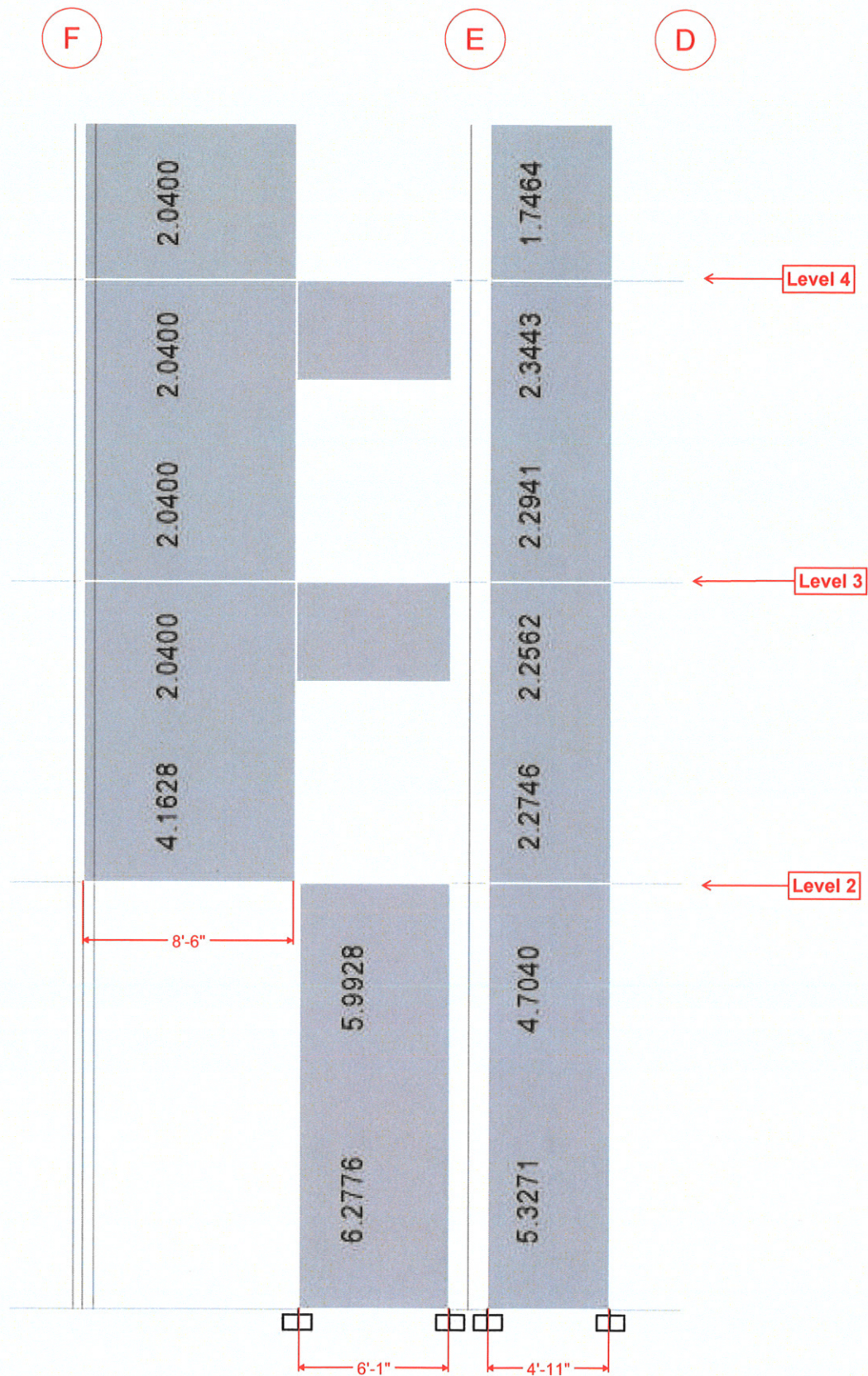




PIER Total Reinforcement Areas [in²]  
- Longitudinal (Vertical)

Elevation - Along Grid 3 ("37"),  
Bet. D.5 and F

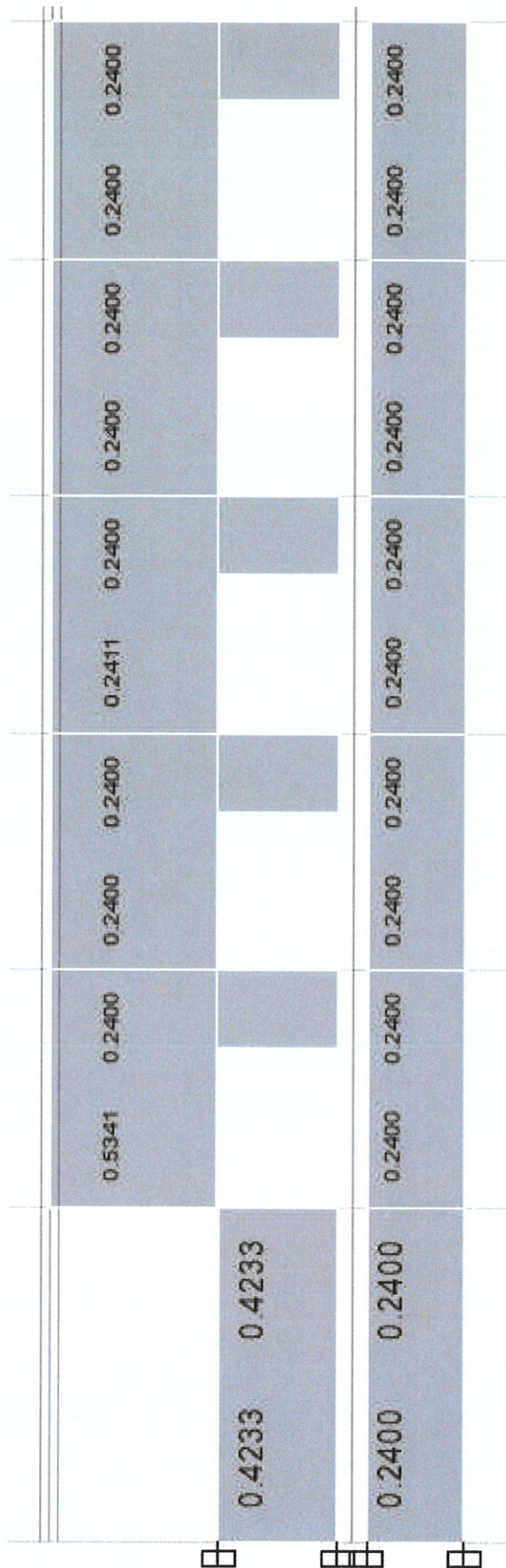




PIER Total Reinforcement Areas [ $\text{in}^2$ ]  
- Longitudinal (Vertical)

Elevation - Along Grid 3 ("37"),  
Bet. D.5 and F

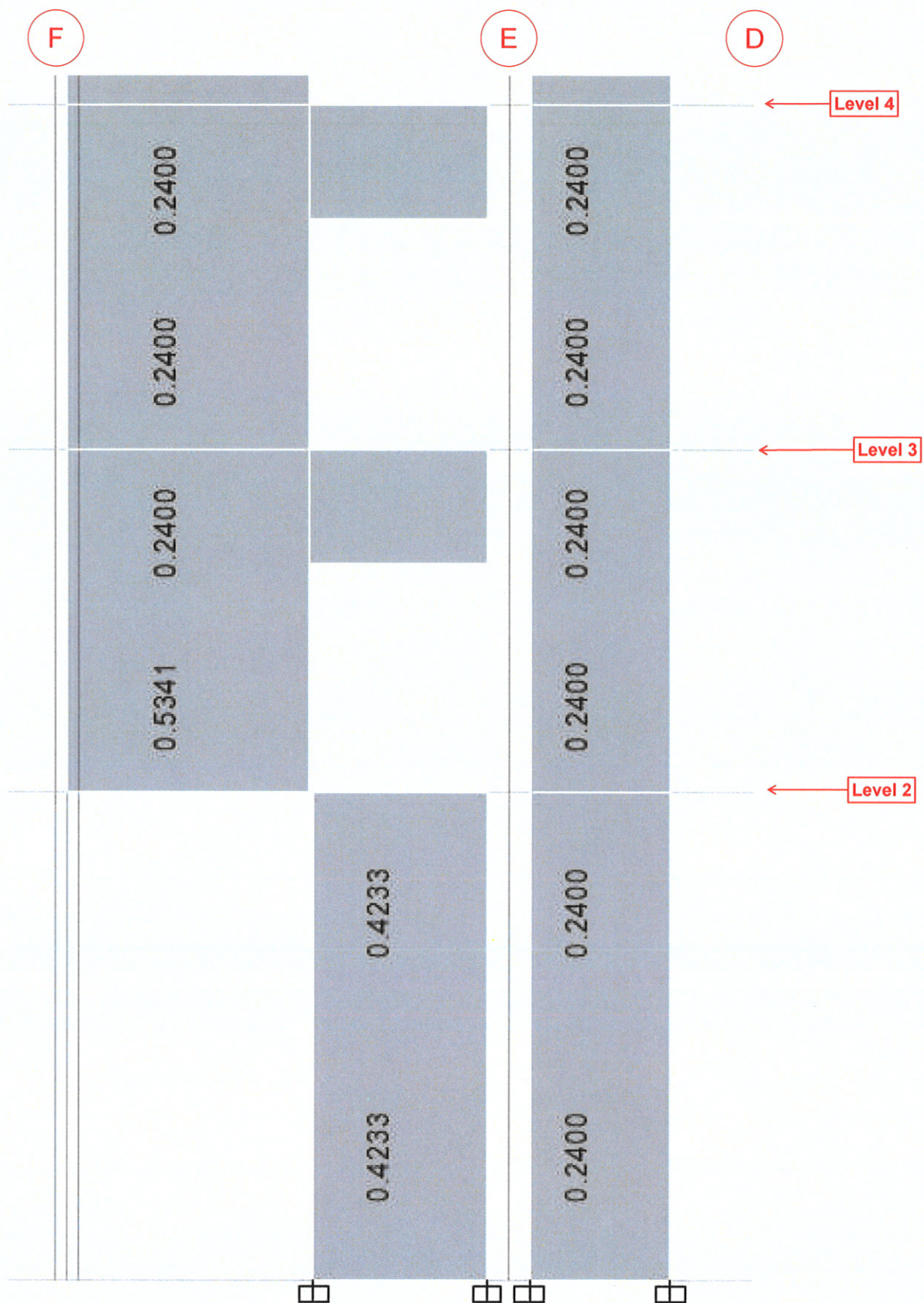




PIER Total Reinforcement Areas [in²/Ft]  
- Shearing (Horizontal)

Elevation - Along Grid 3 ("37"),  
Bet. D.5 and F

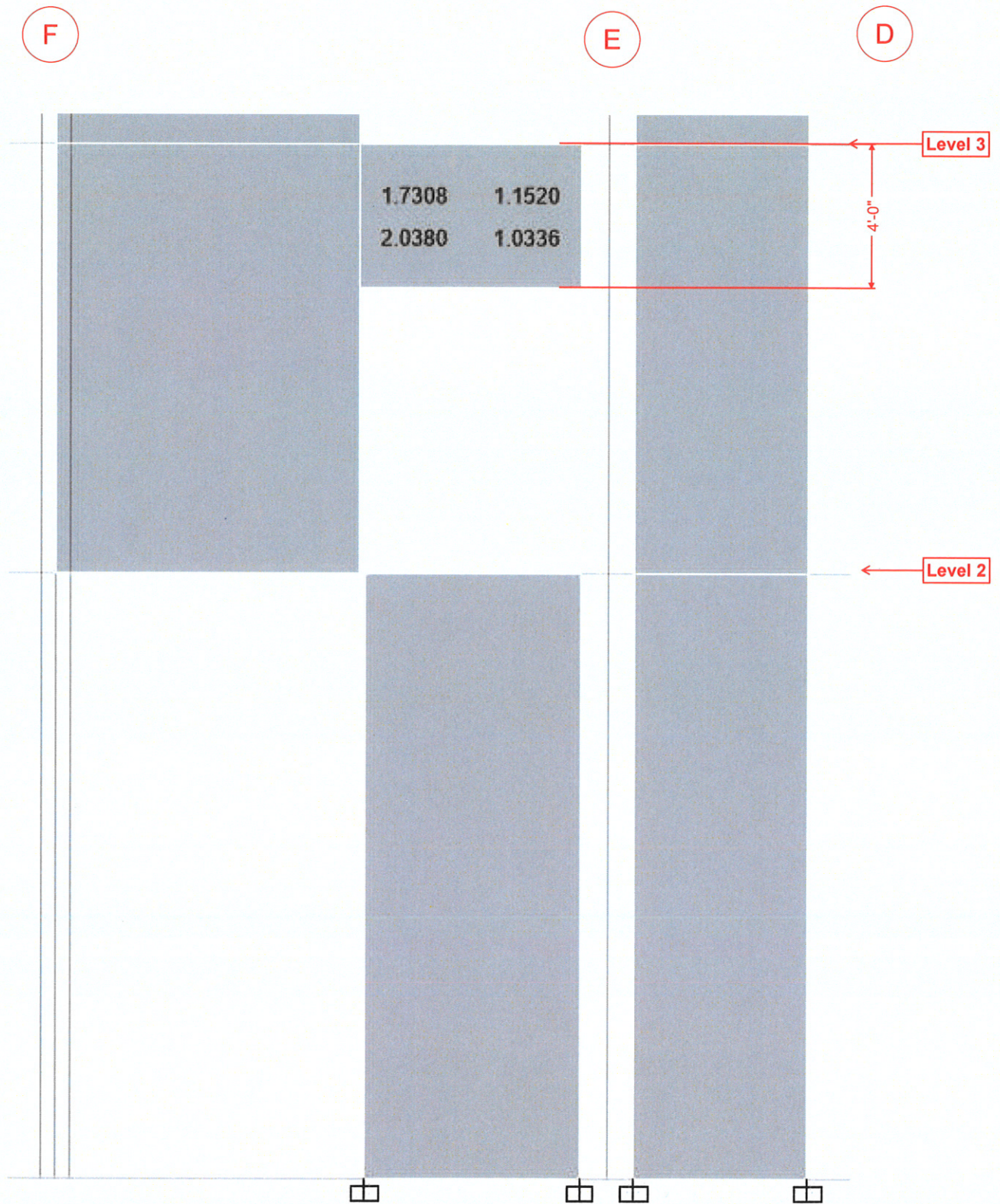




PIER Total Reinforcement Areas [in<sup>2</sup>/Ft]  
- Shearing (Horizontal)

Elevation - Along Grid 3 ("37"),  
Bet. D.5 and F





Spandrel Reinforcement Areas [in<sup>2</sup>]  
- Flexural Longitudinal (Horizontal)

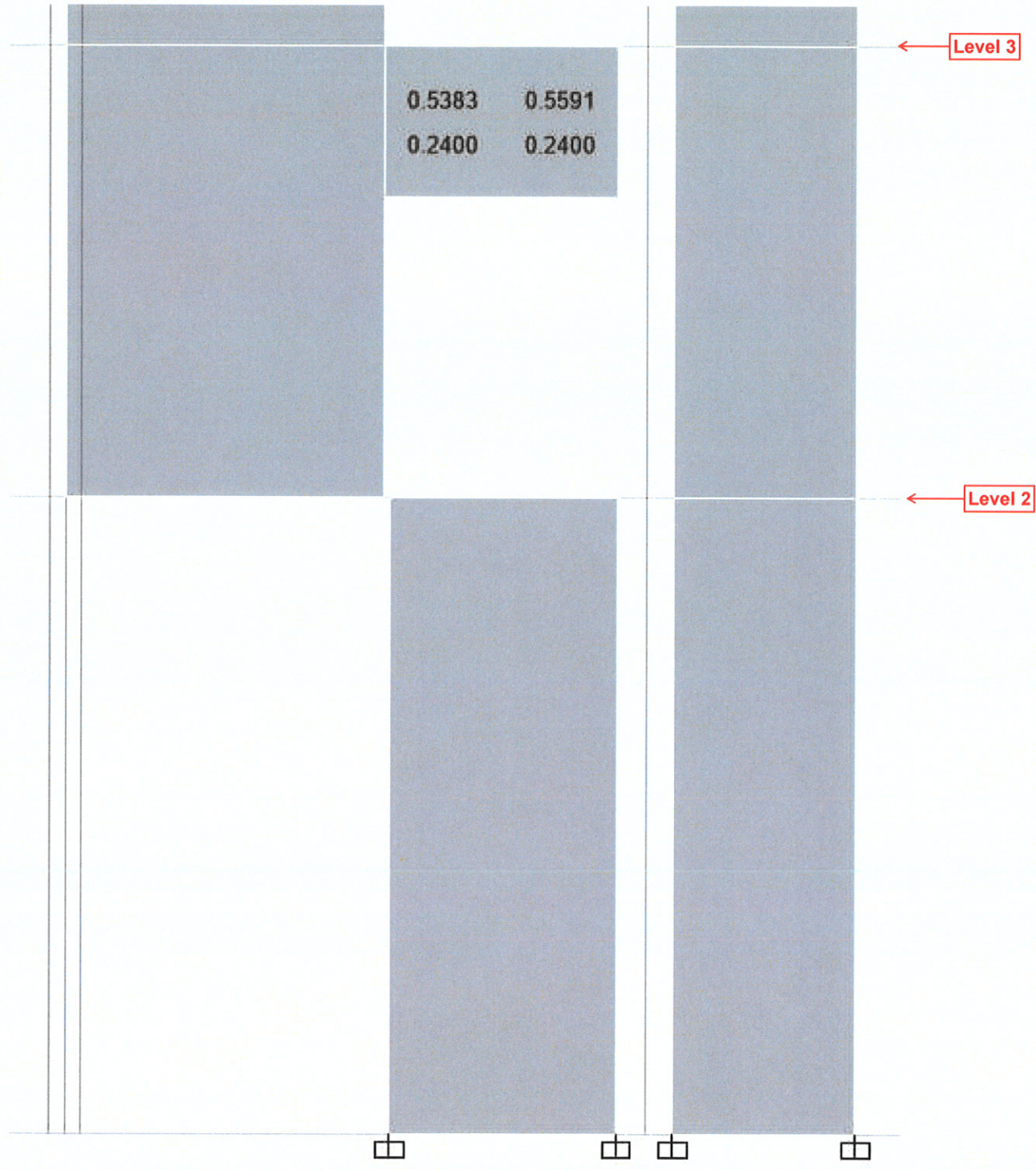
Elevation - Along Grid 3 ("37"),  
Bet. D.5 and F



F

E

D



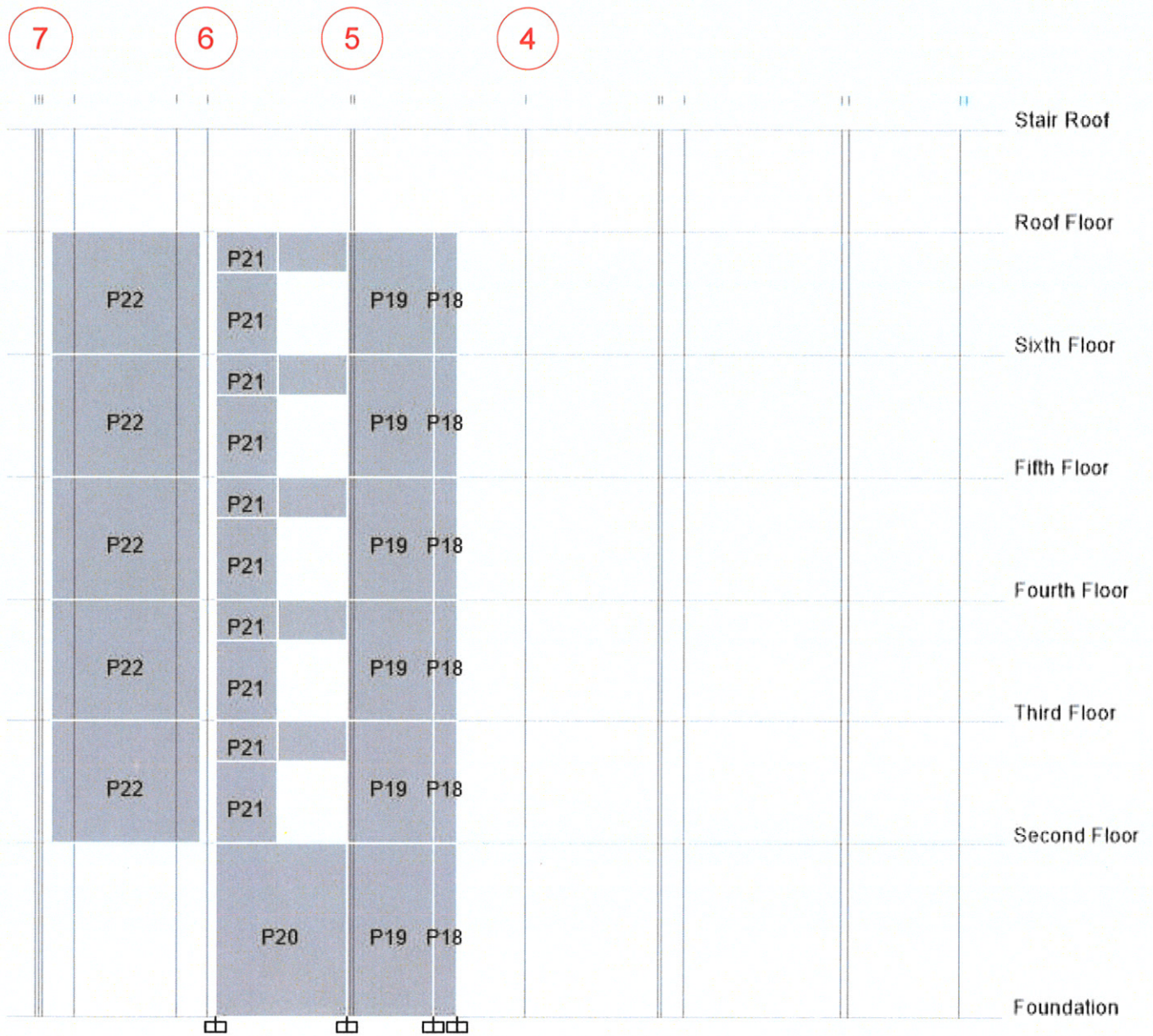
Spandrel Shear Reinforcement  
[in<sup>2</sup> / Ft]

Elevation - Along Grid 3 ("37"),  
Bet. D.5 and F



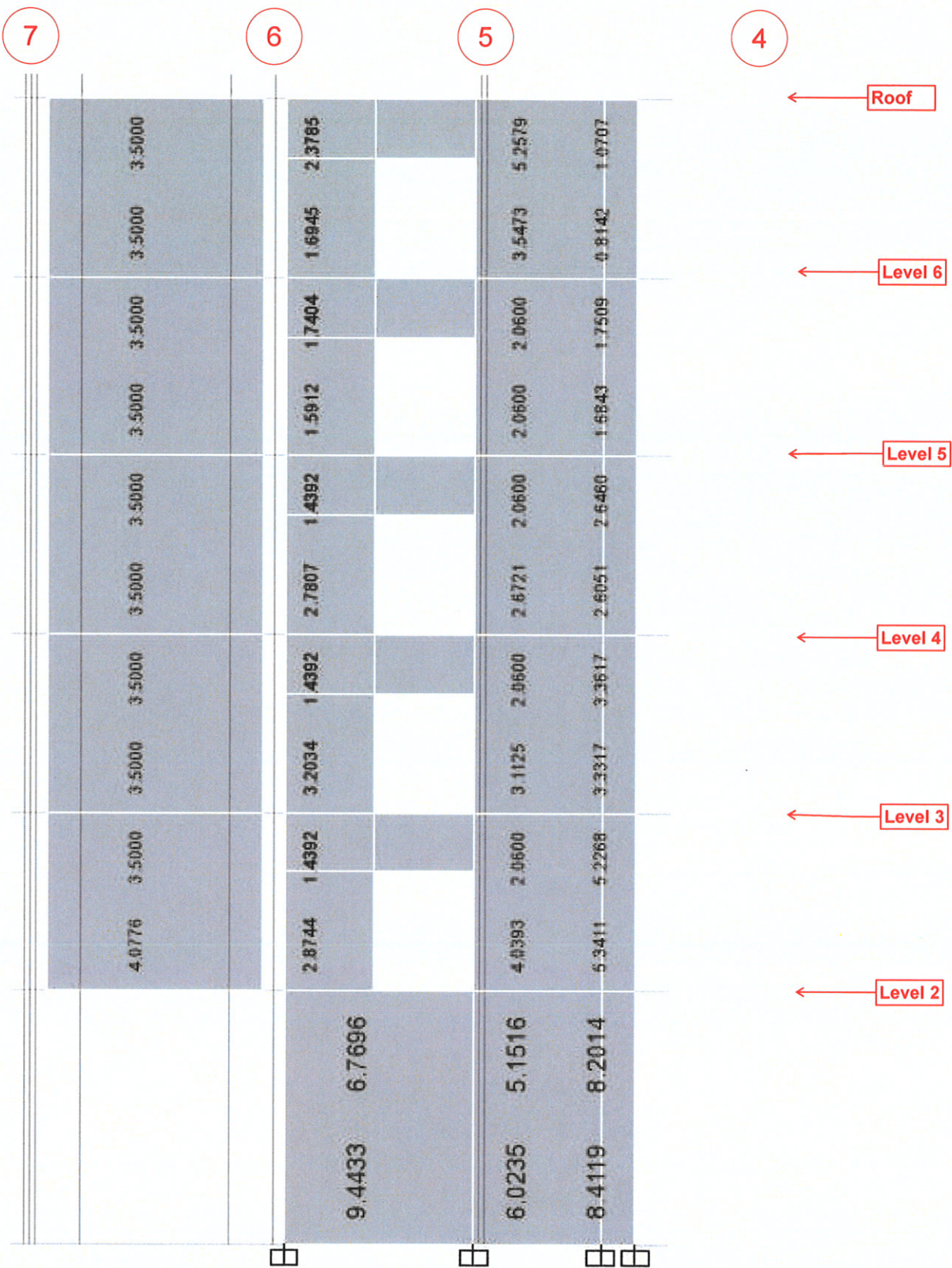
Elevation - Along Grid F ("43"),  
Bet. 7 and "4.3"





Elevation - Along Grid F ("43"),  
Bet. 7 and "4.3"

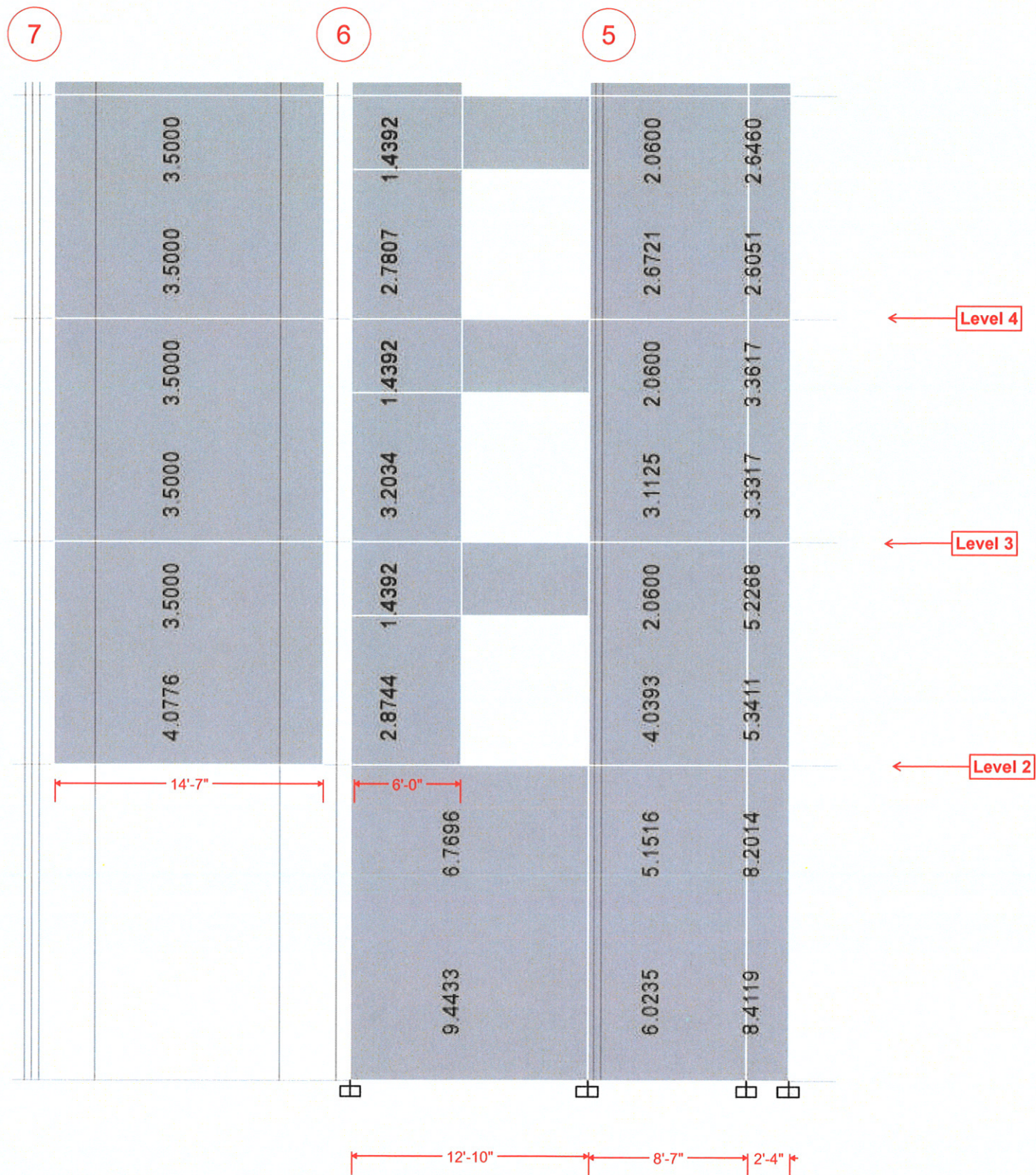




PIER Total Reinforcement Areas [in<sup>2</sup>]  
- Longitudinal (Vertical)

Elevation - Along Grid F ("43"),  
Bet. 7 and "4.3"

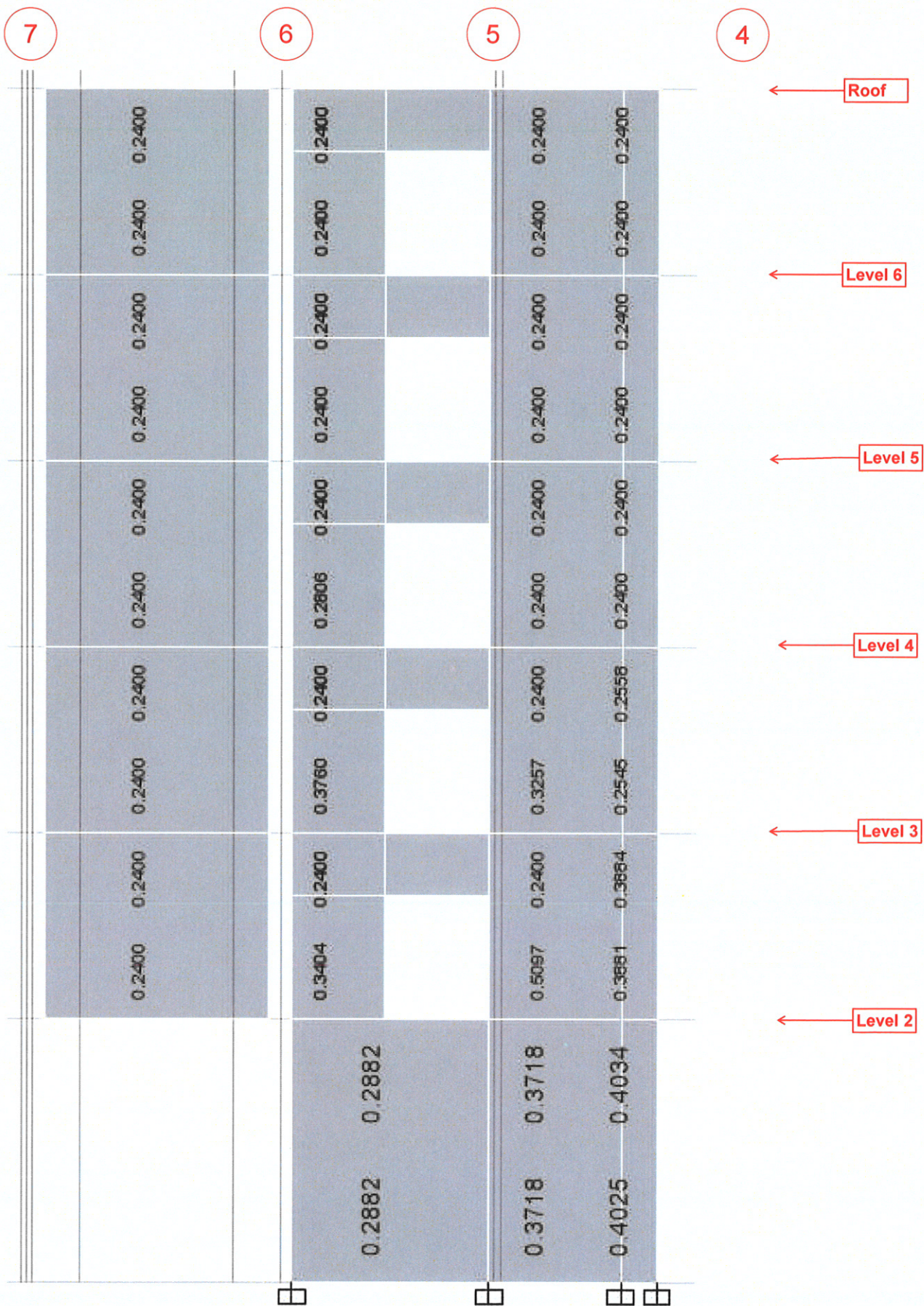




PIER Total Reinforcement Areas [in²]  
- Longitudinal (Vertical)

Elevation - Along Grid F ("43"),  
Bet. 7 and "4.3"

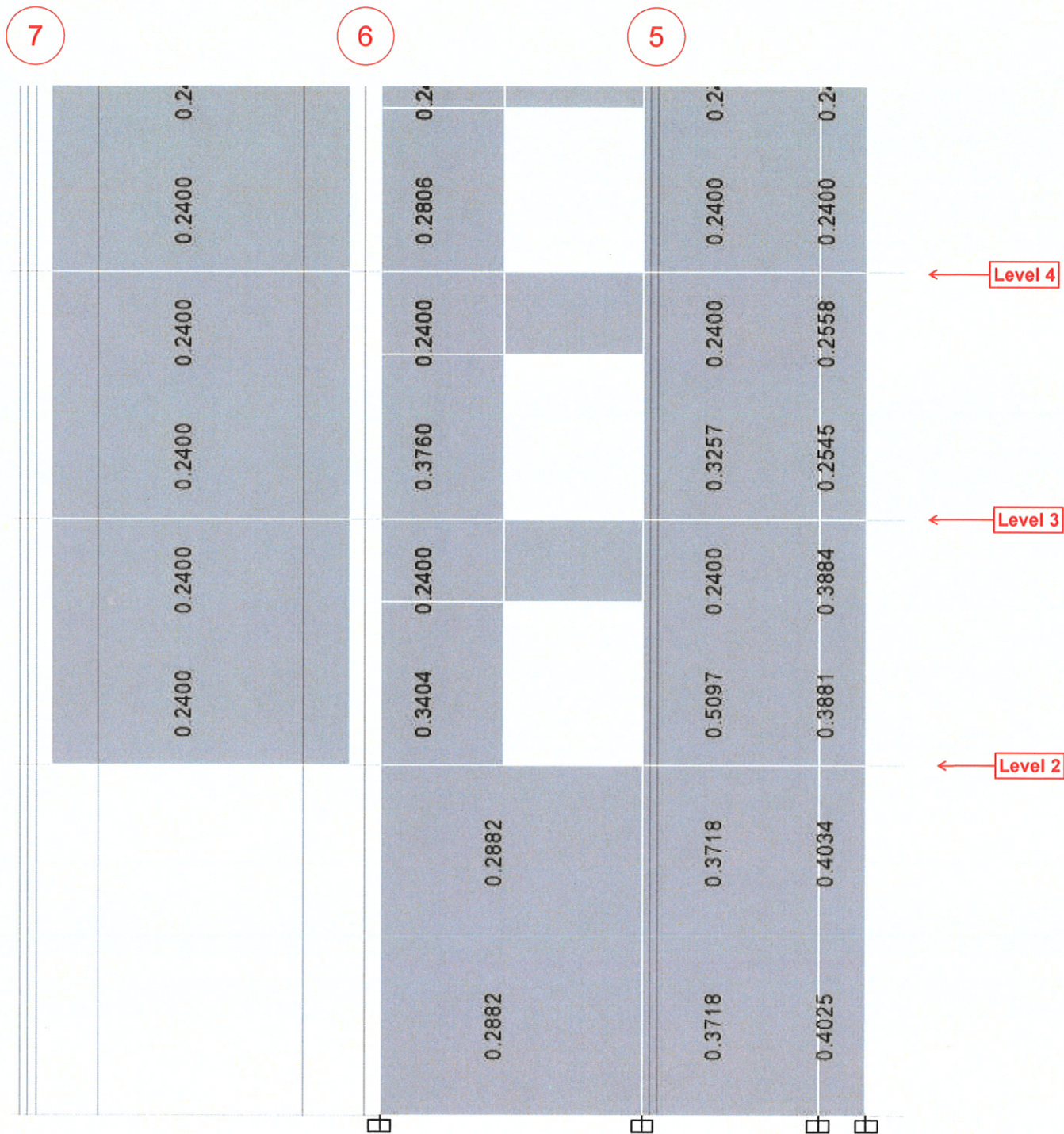




**Elevation - Along Grid F ("43"),  
Bet. 7 and "4.3"**

PIER Total Reinforcement  
Areas [in²/Ft] - Shearing  
(Horizontal)





PIER Total Reinforcement Areas [ $\text{in}^2/\text{Ft}$ ]  
- Shearing (Horizontal)

Elevation - Along Grid F ("43"),  
Bet. 7 and "4.3"



Elevation - Along Grid F ("50"),  
Bet. "4.2" and 3

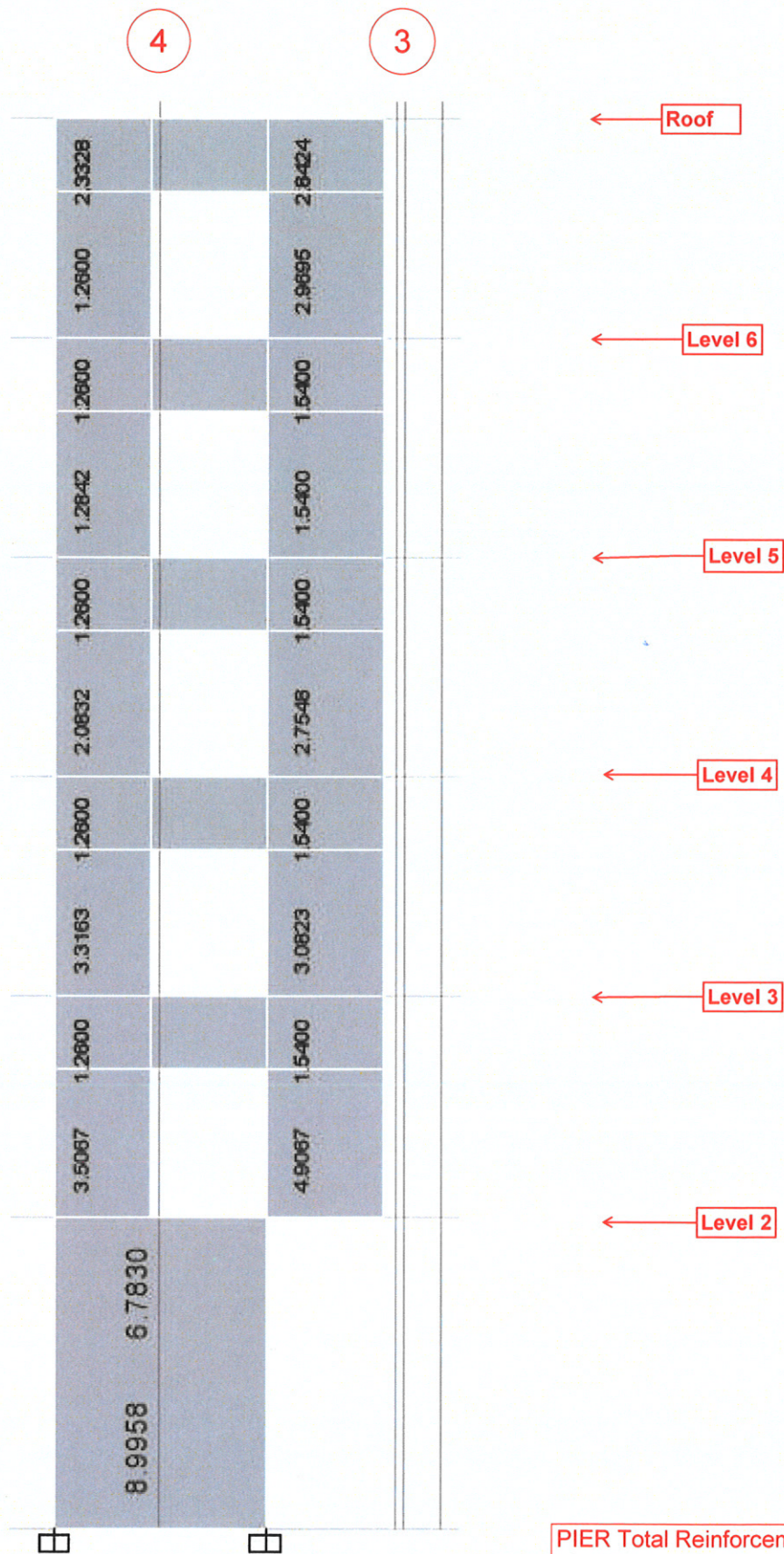




						Stair Roof
						Roof Floor
	P16	S6	P17			
	P16		P17			
	P16	S6	P17			Sixth Floor
	P16		P17			
	P16	S6	P17			Fifth Floor
	P16		P17			
	P16	S6	P17			Fourth Floor
	P16		P17			
	P16	S6	P17			Third Floor
	P16		P17			
	P15					Second Floor
						Foundation

Elevation - Along Grid F ("50"),  
Bet. "4.2" and 3

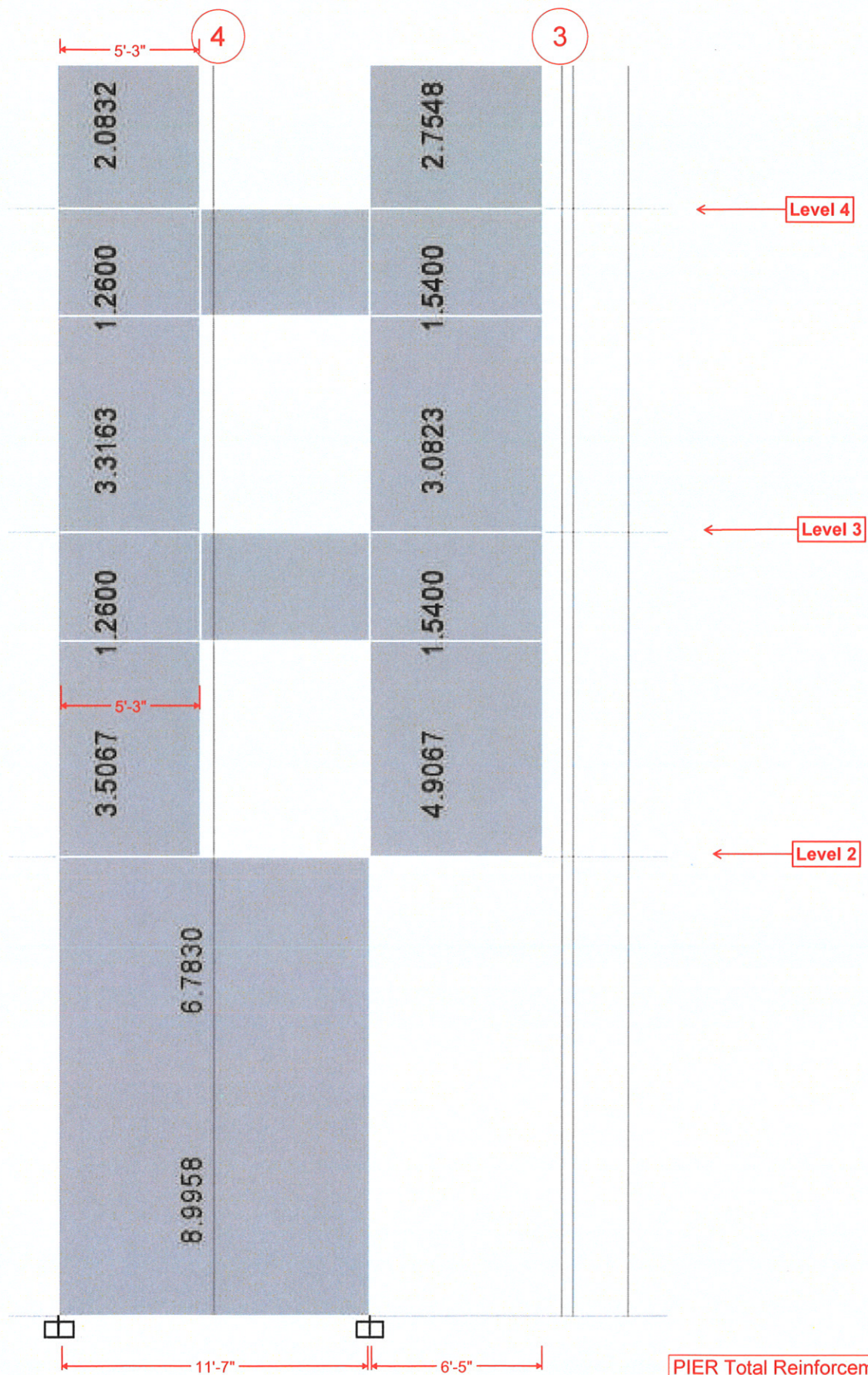




PIER Total Reinforcement Areas [in²]  
- Longitudinal (Vertical)

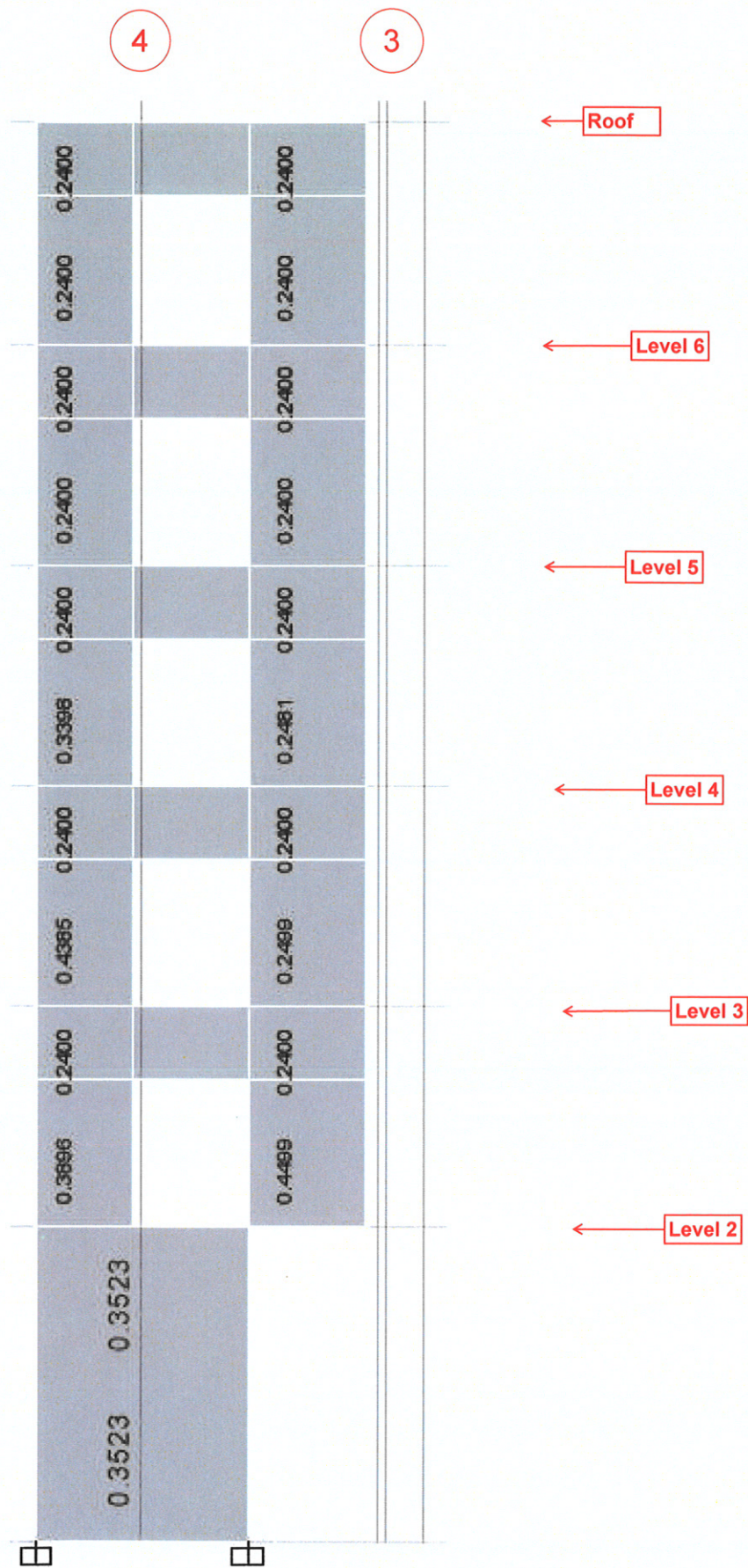
Elevation - Along Grid F ("50"),  
Bet. "4.2" and 3





Elevation - Along Grid F ("50"),  
Bet. "4.2" and 3

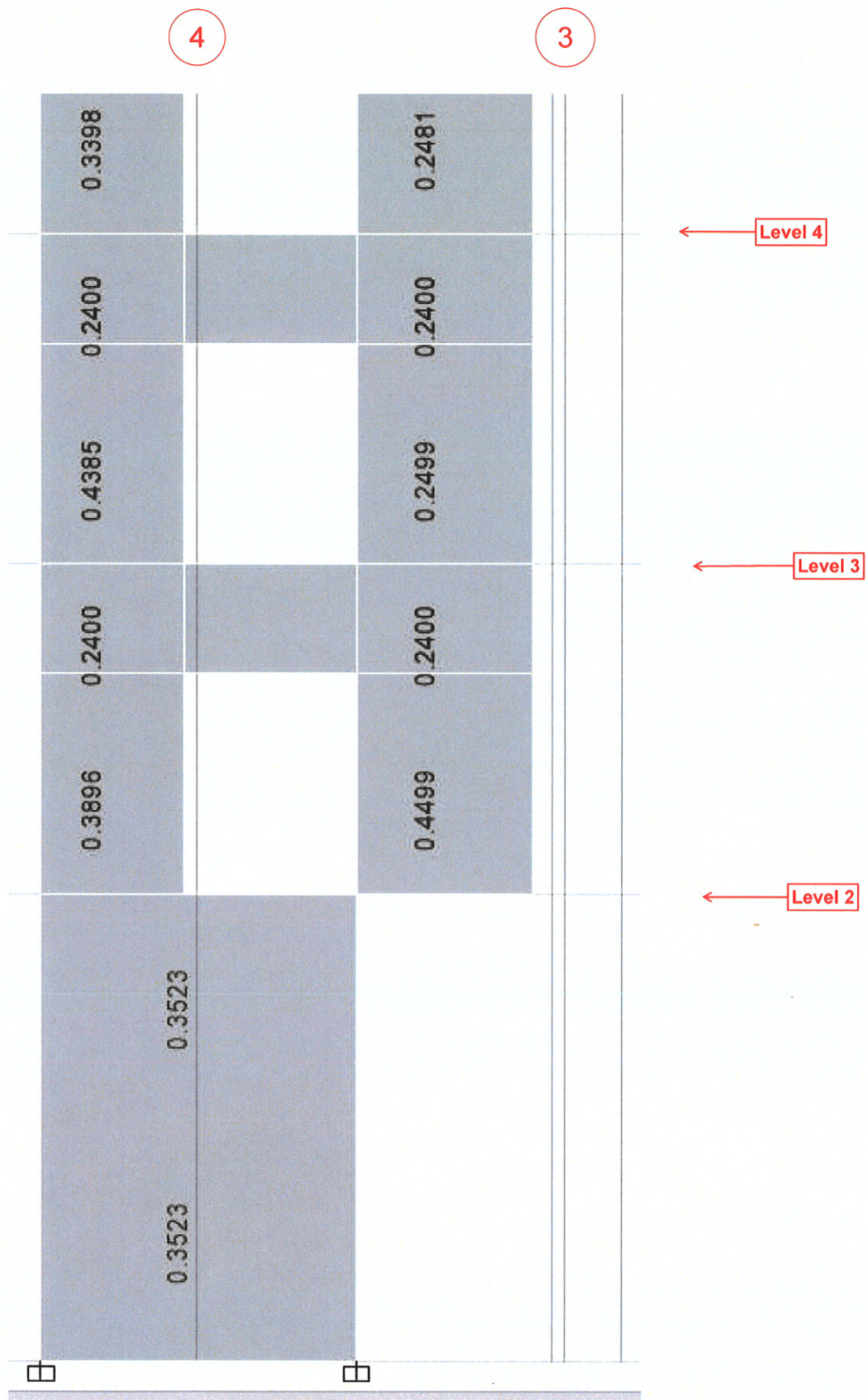




Elevation - Along Grid F ("50"),  
Bet. "4.2" and 3

PIER Total Reinforcement  
Areas [in²/Ft] - Shearing  
(Horizontal)

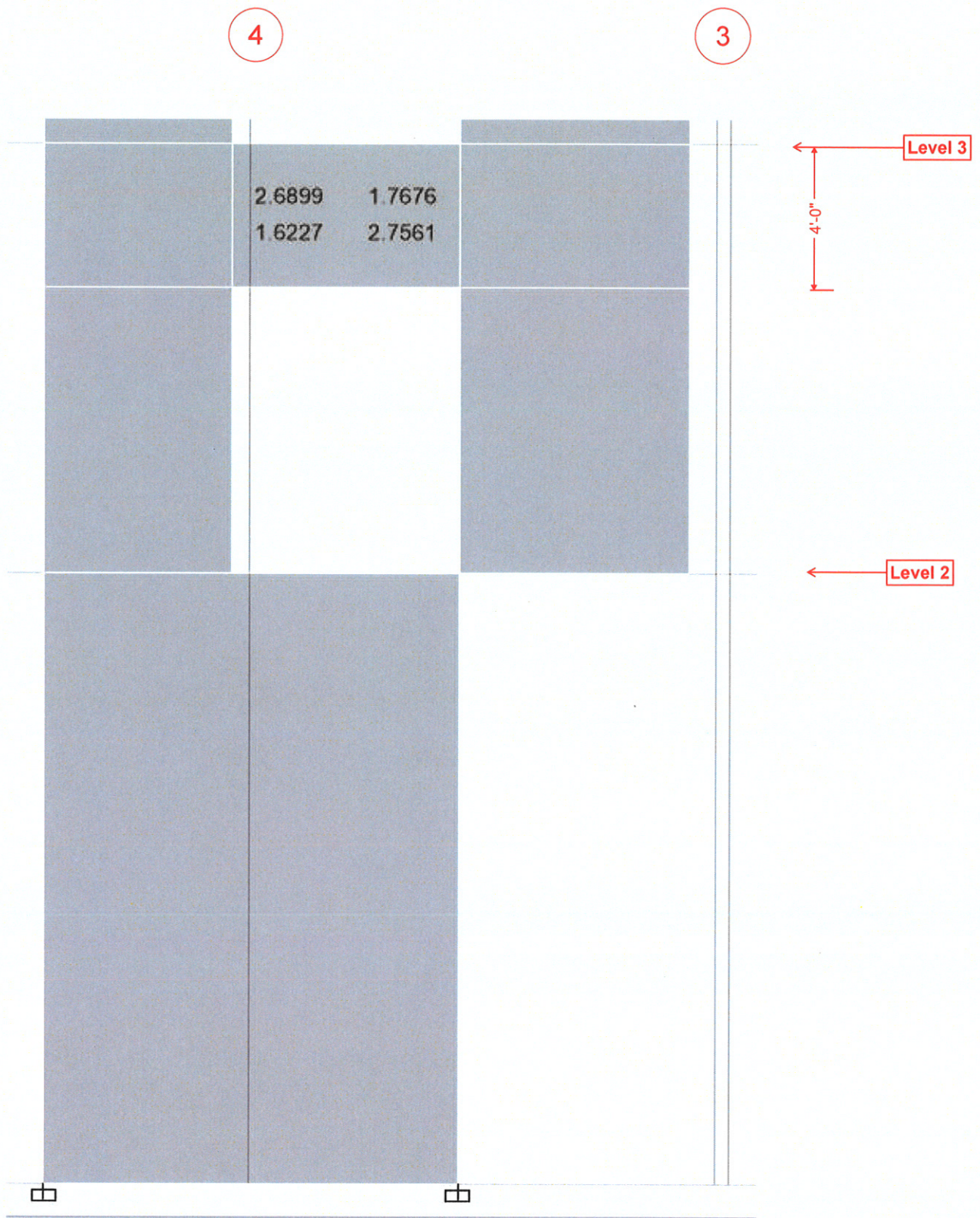




Elevation - Along Grid F ("50"),  
Bet. "4.2" and 3

PIER Total Reinforcement  
Areas [in²/Ft] - Shearing  
(Horizontal)





Spandrel Reinforcement Areas [in<sup>2</sup>]  
- Flexural Longitudinal (Horizontal)

Elevation - Along Grid F ("50"),  
Bet. "4.2" and 3



## ACI 318-14 Spandrel Design

### Spandrel Details

Story ID	Spandrel ID	Centroid X (in)	Centroid Y (in)	Depth (in)	Width (in)	LLRF
Third Floor	S6	3597.9984	4819	48	8	1

### Material Properties

$E_c$ (lb/in <sup>2</sup> )	$f'_c$ (lb/in <sup>2</sup> )	Lt.Wt Factor (Unitless)	$f_y$ (lb/in <sup>2</sup> )	$f_{yk}$ (lb/in <sup>2</sup> )
3122019	3000	1	60000	60000

### Design Code Parameters

$\Phi_T$	$\Phi_c$	$\Phi_v$	$\Phi_v$ (Seismic)
0.9	0.65	0.75	0.6

### Spandrel Flexural Design—Top Reinforcement

Station Location	Reinf Area in <sup>2</sup>	Reinf Percentage	Reinf Combo	Moment, $M_u$ kip-ft
Left	2.6899	0.7	1.3 D 1.0 L - 1.0 E	-475.0384
Right	1.7676	0.46	0.8 D 1.0 E	-322.9391

### Spandrel Flexural Design—Bottom Reinforcement

Station Location	Reinf Area in <sup>2</sup>	Reinf Percentage	Reinf Combo	Moment, $M_u$ kip-ft
Left	1.6227	0.42	0.8 D 1.0 E	298.0222
Right	2.7561	0.72	1.3 D 1.0 L - 1.0 E	485.5195

### Spandrel Shear Design

Station Location	$A_{vert}$ in <sup>2</sup> /ft	$A_{horiz}$ in <sup>2</sup> /ft	ShearCombo	$V_u$ kip	$\Phi V_c$ kip	$\Phi V_s$ kip	$\Phi V_n$ kip
Left	OS	OS	1.3 D 1.0 L - 1.0 E	147.859	21.884	125.975	147.859
Right	OS	OS	1.3 D 1.0 L - 1.0 E	136.904	21.884	115.02	136.904

### Spandrel Shear Design—Diagonal Reinforcement

Station Location	$A_{diag}$ in <sup>2</sup>	Shear Combo	$V_u$ kip	$V_{u,limit}$ kip	L/H Ratio	Seismic Design	Diag Reinf Mandatory
Left	3.2144	1.3 D 1.0 L - 1.0 E	147.859	75.717	1.583	Yes	Yes
Right	2.9763	1.3 D 1.0 L - 1.0 E	136.904	75.717	1.583	Yes	Yes

Design inadequacy Message: Shear force exceeds maximum allowed !!

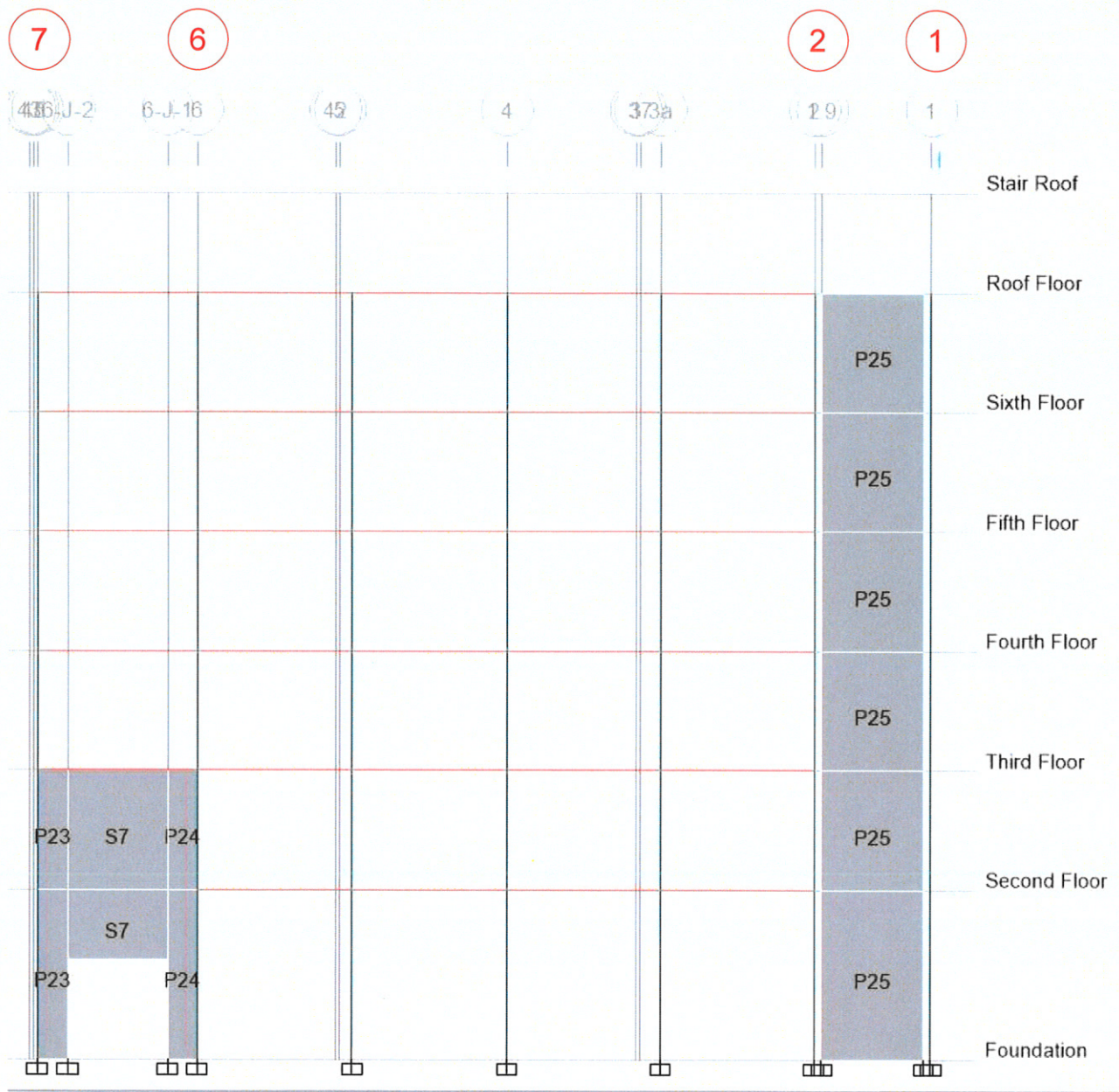
This calc's are for the Spandrel S6, underside of Level 3 (worst condition).  
Spandrels underside of levels 4 and 5 present similar results

Elevation - Along Grid F ("50"),  
Bet. "4.2" and 3



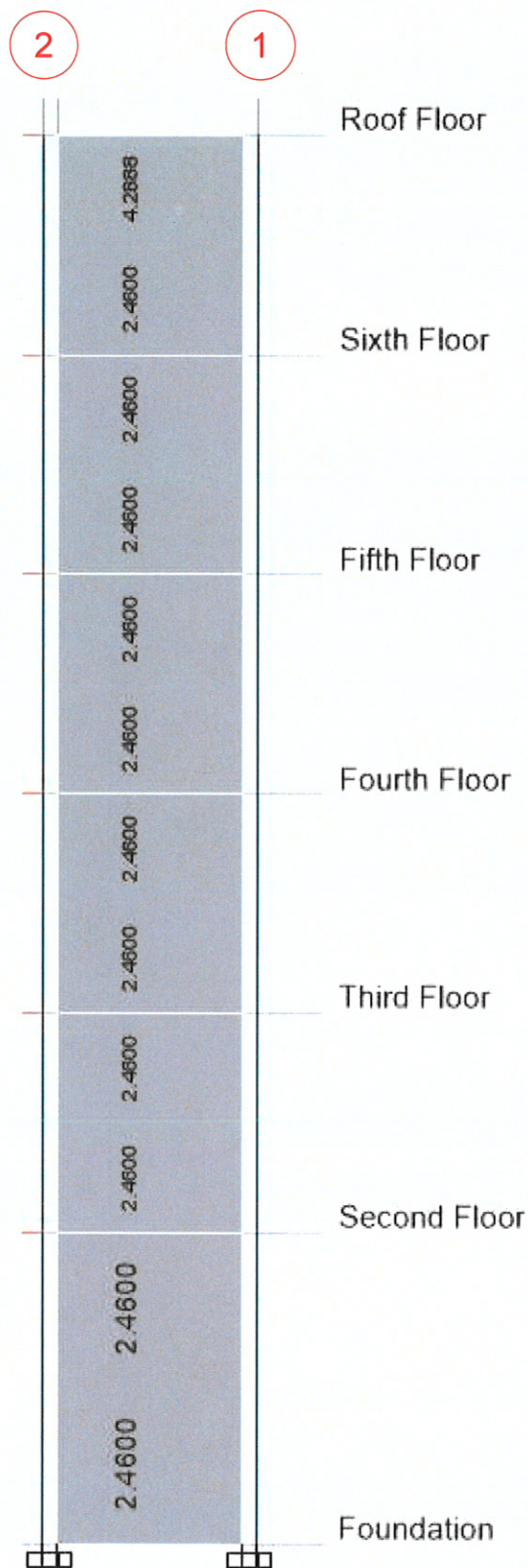
Elevation - Along Grid A, Bet.  
Grids 7 and 1





Elevation - Along Grid A, Bet.  
Grids 7 and 1

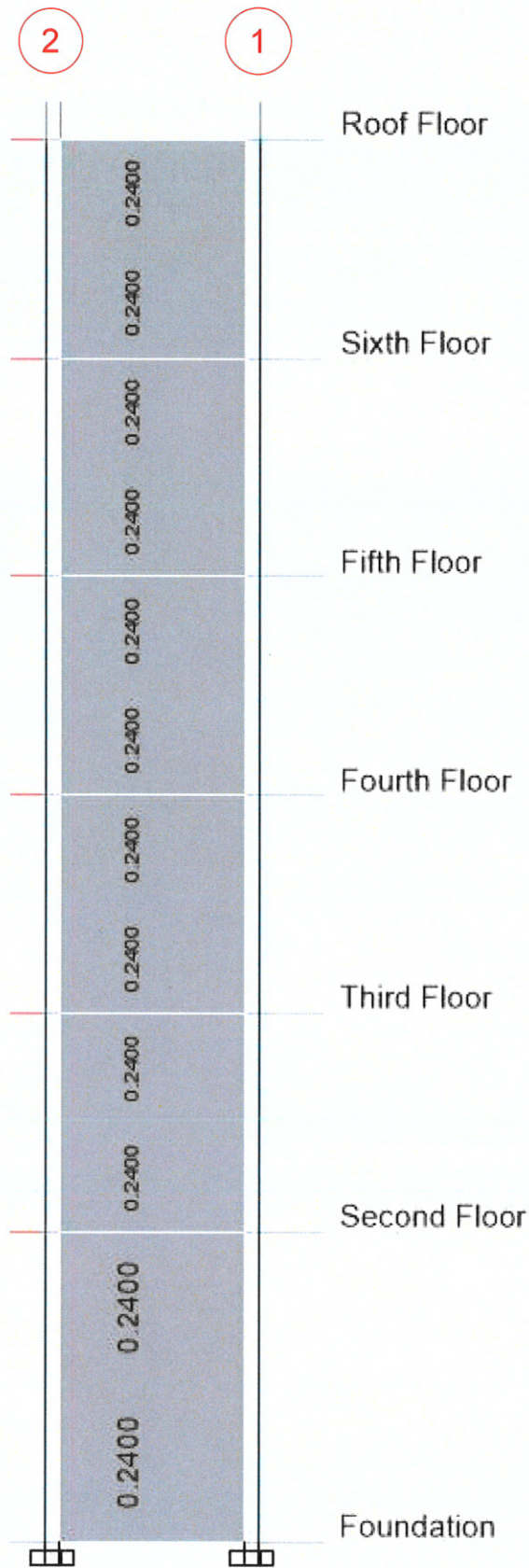




PIER Total Reinforcement Areas [in<sup>2</sup>]  
- Longitudinal (Vertical)

Elevation - Along Grid A, Bet.  
Grids 7 and 1

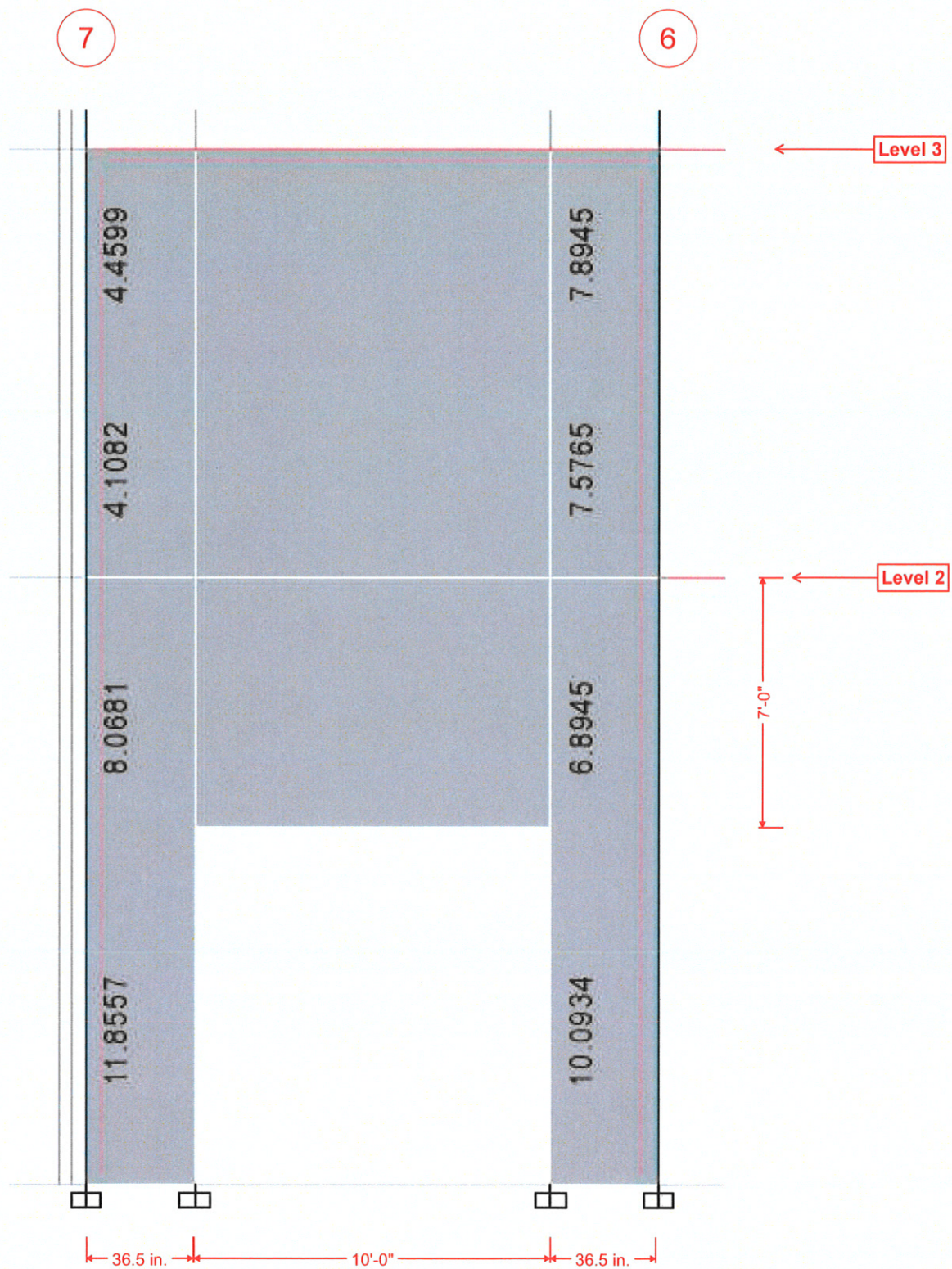




PIER Total Reinforcement  
Areas [in²/Ft] - Shearing  
(Horizontal)

Elevation - Along Grid A, Bet.  
Grids 7 and 1

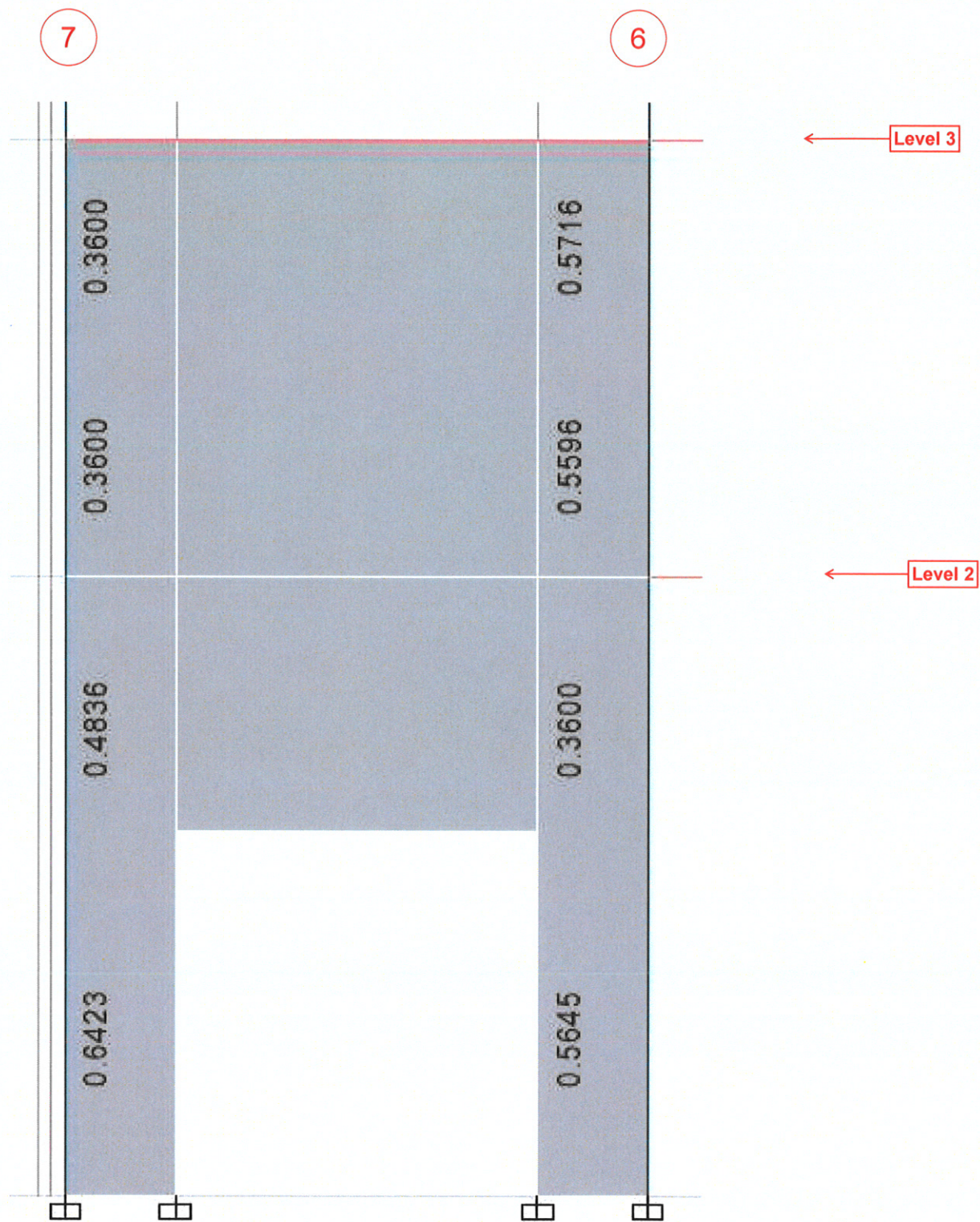




PIER Total Reinforcement Areas [in²]  
- Longitudinal (Vertical)

Elevation - Along Grid A, Bet.  
Grids 7 and 1

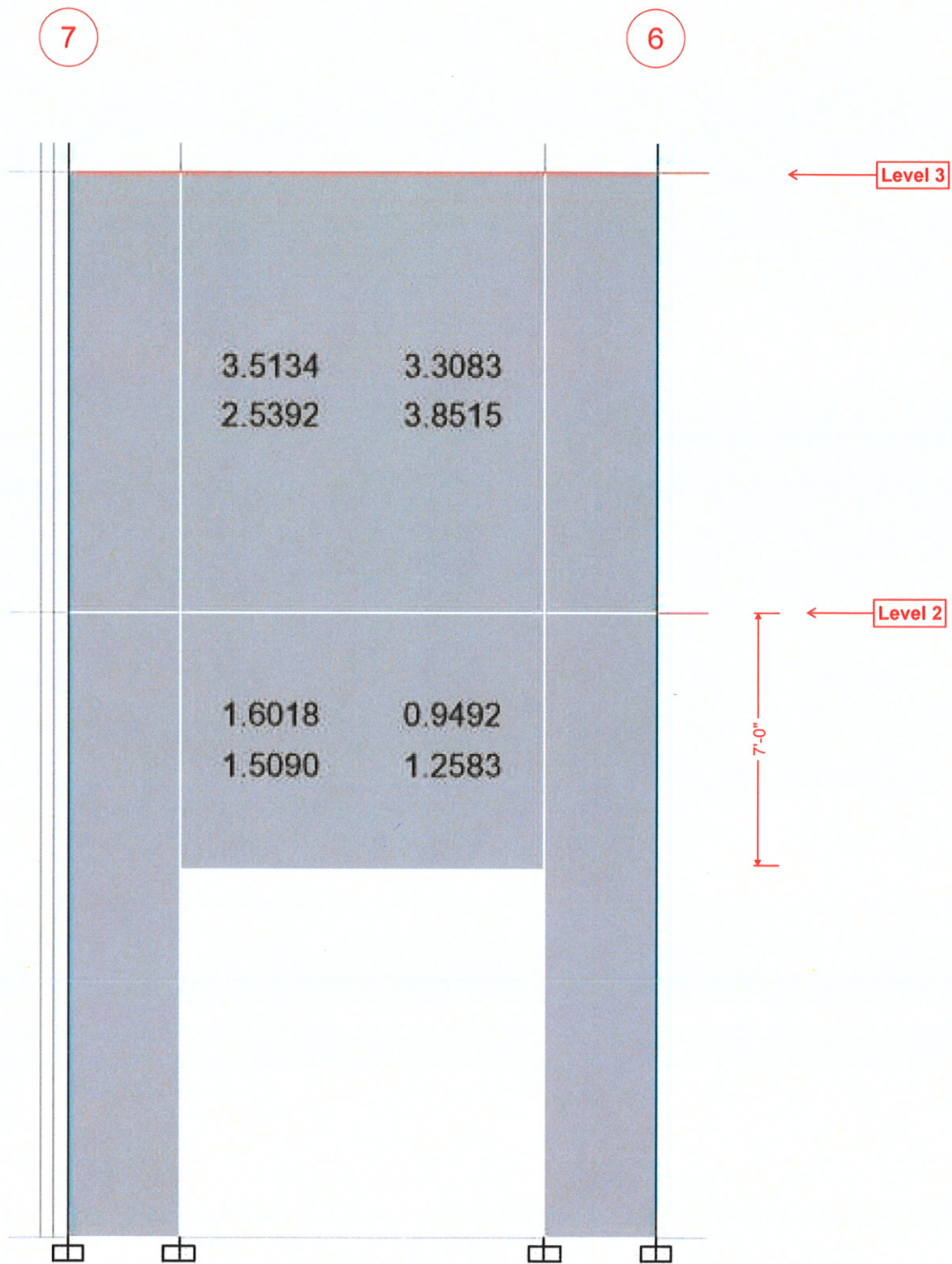




PIER Total Reinforcement  
Areas [ $\text{in}^2/\text{ft}$ ] - Shearing  
(Horizontal)

Elevation - Along Grid A, Bet.  
Grids 7 and 1

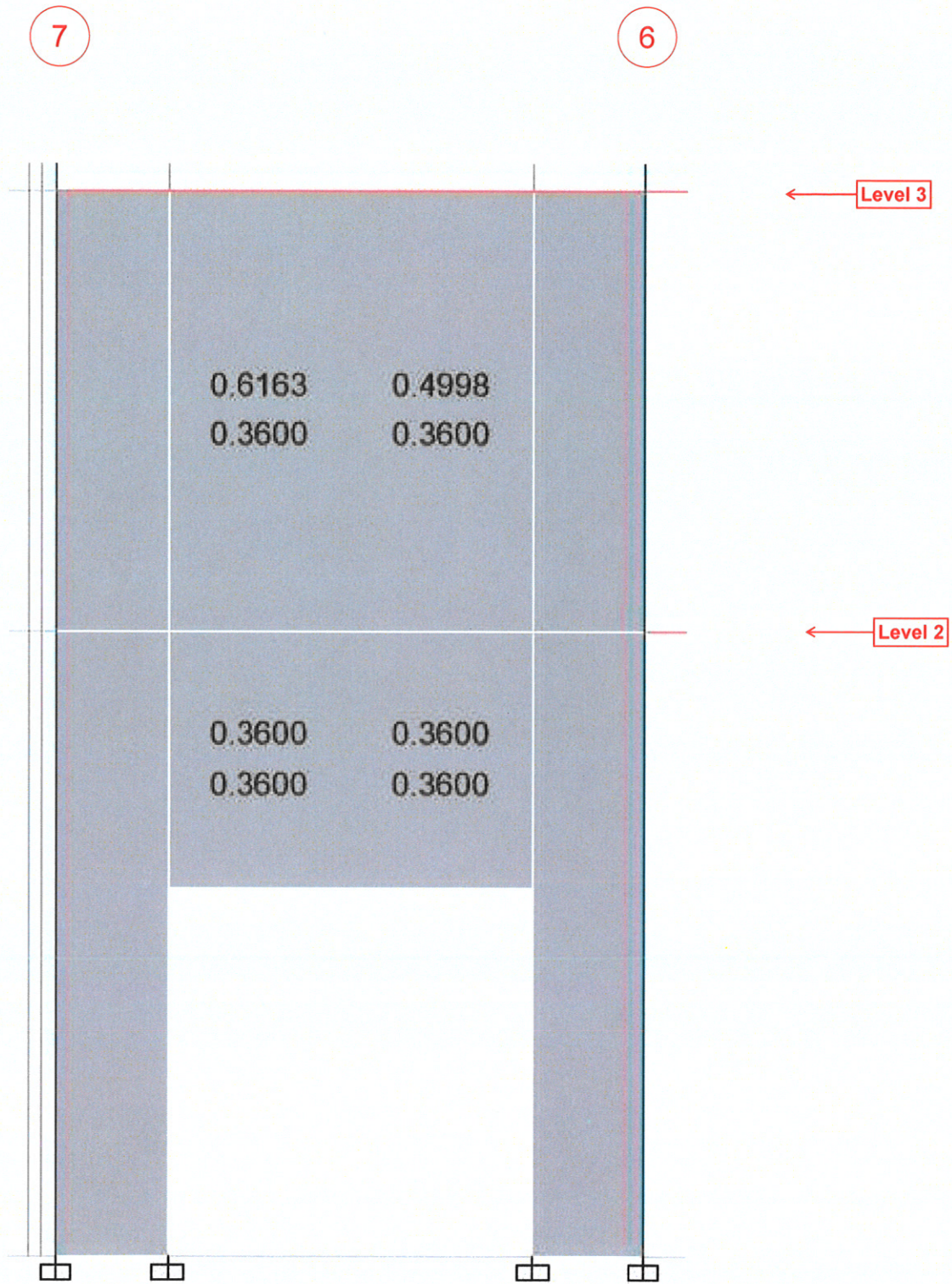




Spandrel Reinforcement Areas [in<sup>2</sup>]  
- Flexural Longitudinal (Horizontal)

Elevation - Along Grid A, Bet.  
Grids 7 and 1





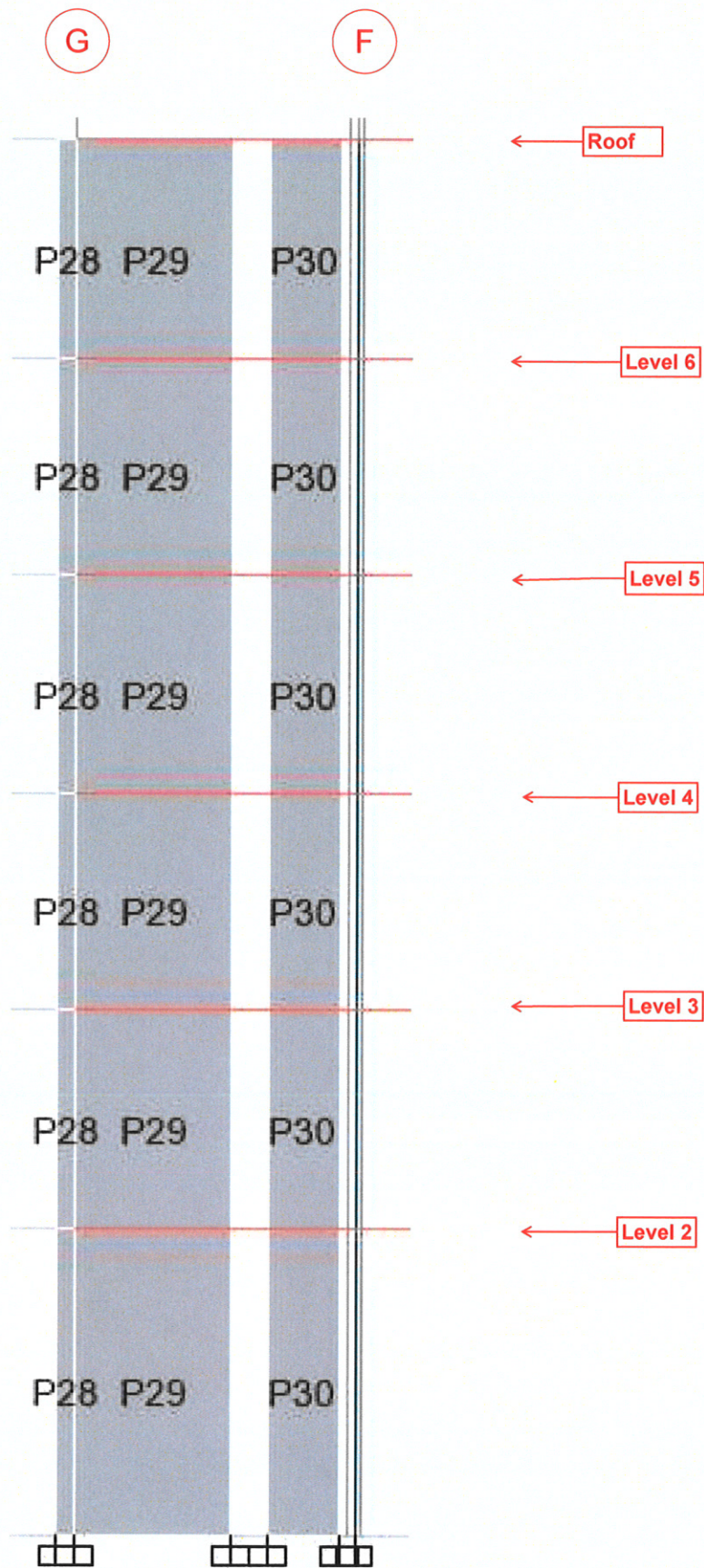
Spandrel Shear Reinforcement  
[in<sup>2</sup> / Ft]

Elevation - Along Grid A, Bet.  
Grids 7 and 1



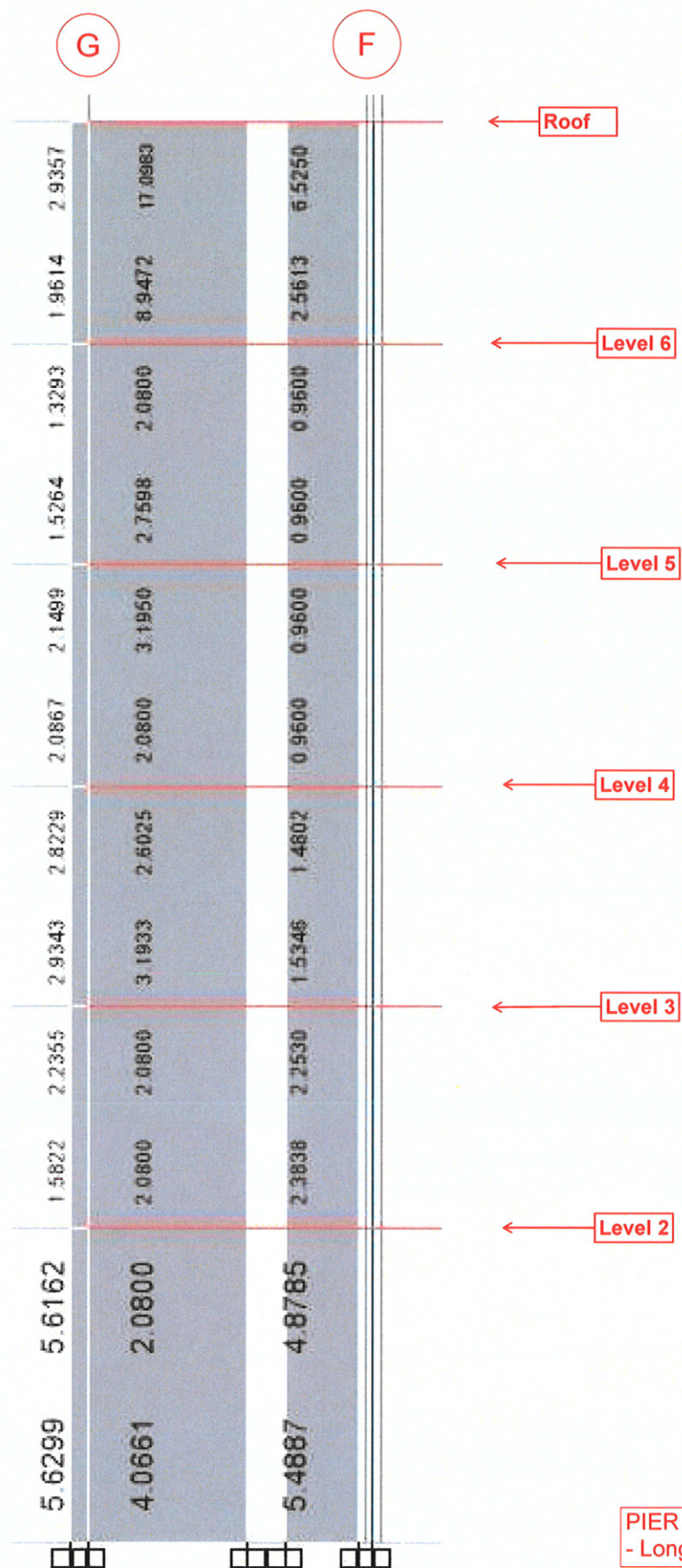
Elevation - Along Grid 1, Bet.  
Grids F and "G.1"





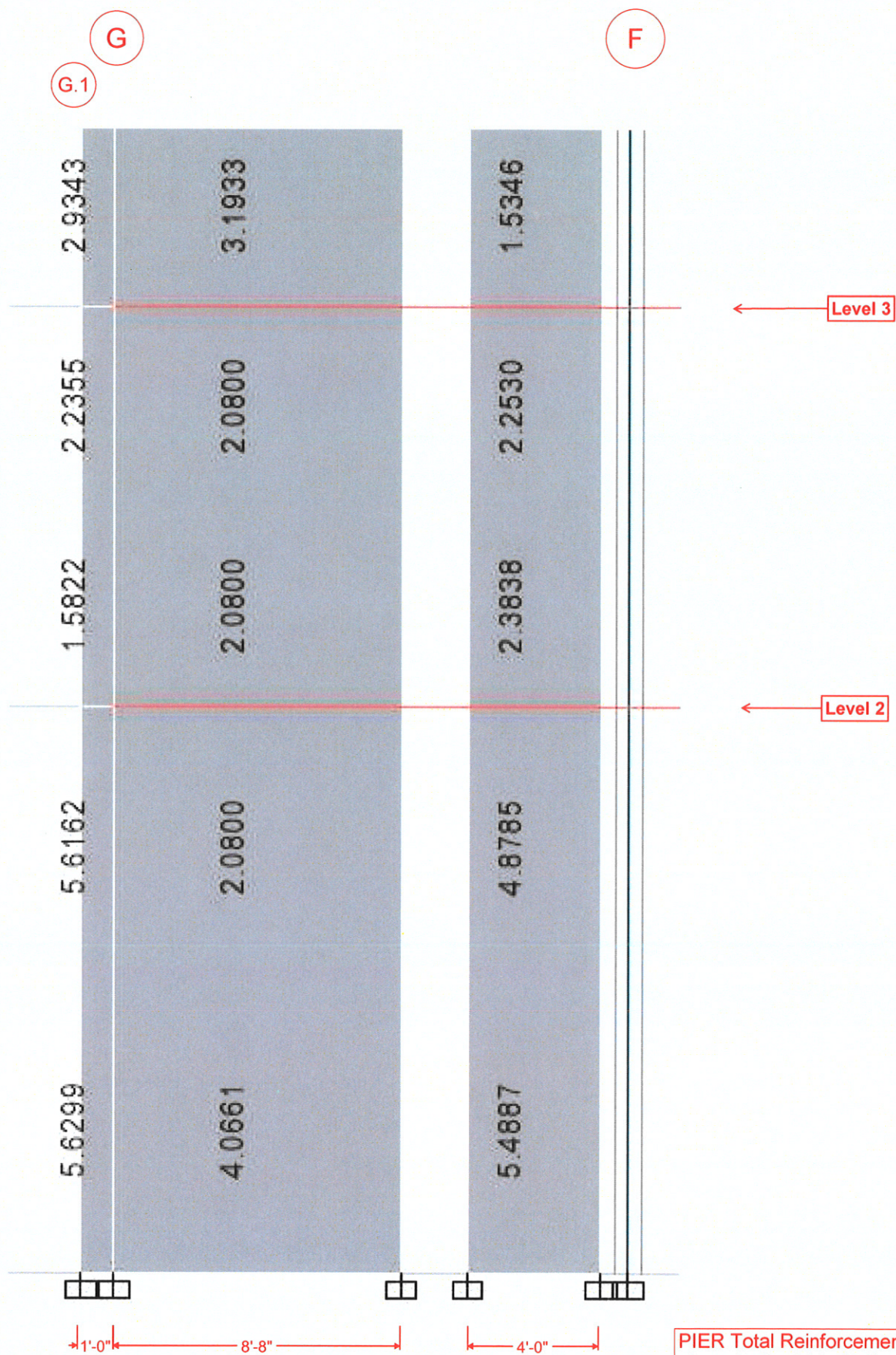
Elevation - Along Grid 1, Bet.  
Grids F and "G.1"





Elevation - Along Grid 1, Bet.  
Grids F and "G.1"

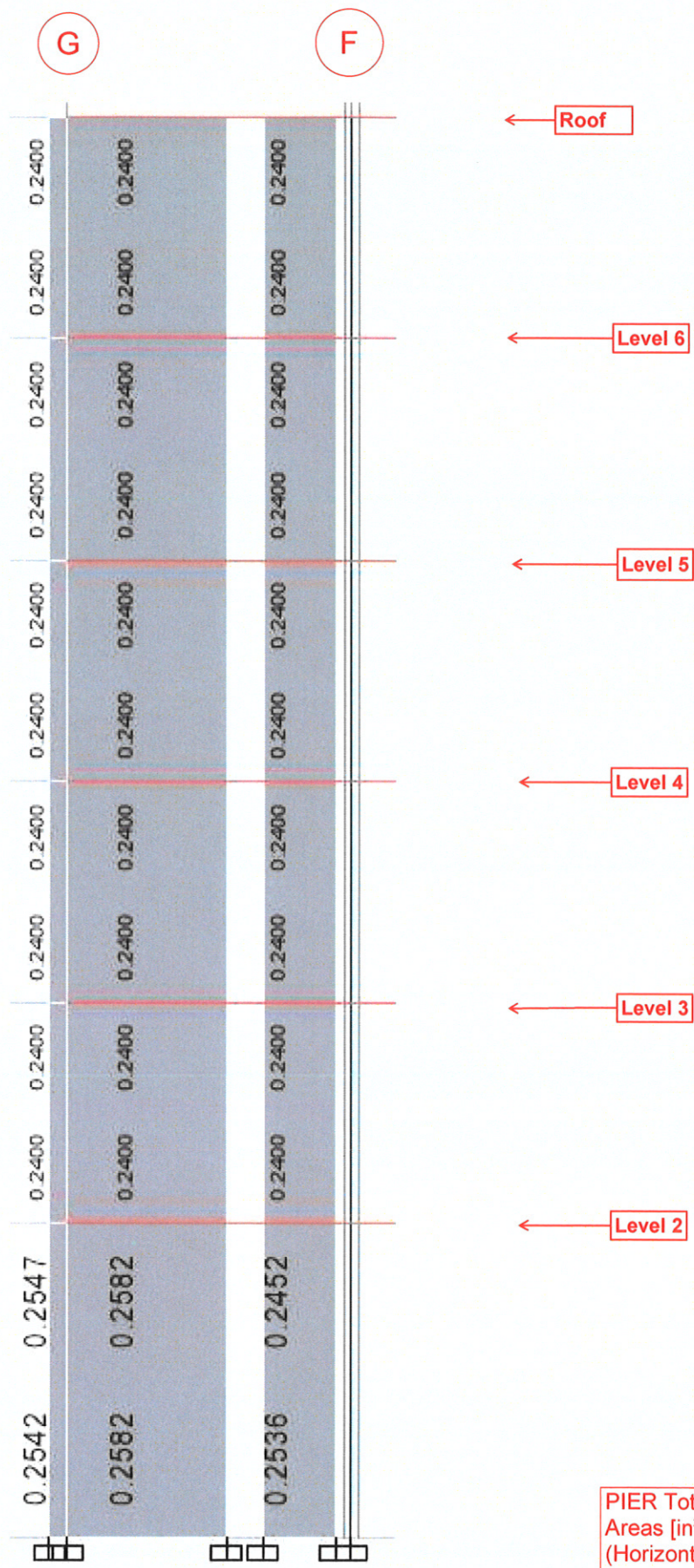




Elevation - Along Grid 1, Bet.  
Grids F and "G.1"

PIER Total Reinforcement Areas [in²]  
- Longitudinal (Vertical)

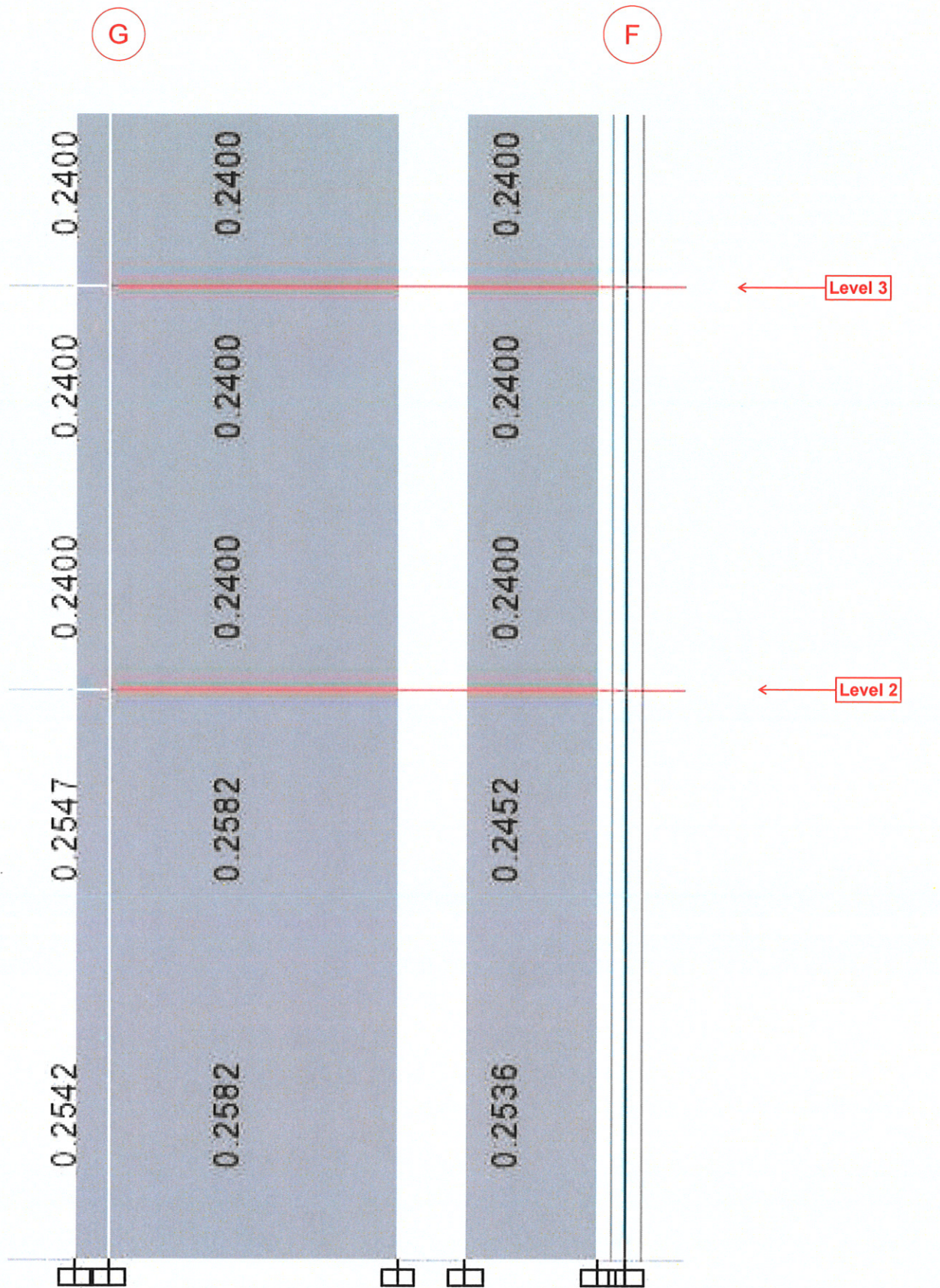




PIER Total Reinforcement  
Areas [in²/Ft] - Shearing  
(Horizontal)

Elevation - Along Grid 1, Bet.  
Grids F and "G.1"





Elevation - Along Grid 1, Bet.  
Grids F and "G.1"

PIER Total Reinforcement  
Areas [in²/Ft] - Shearing  
(Horizontal)



Elevation - Along Grid "H.2",  
Bet. Grids 3a and "1.9"



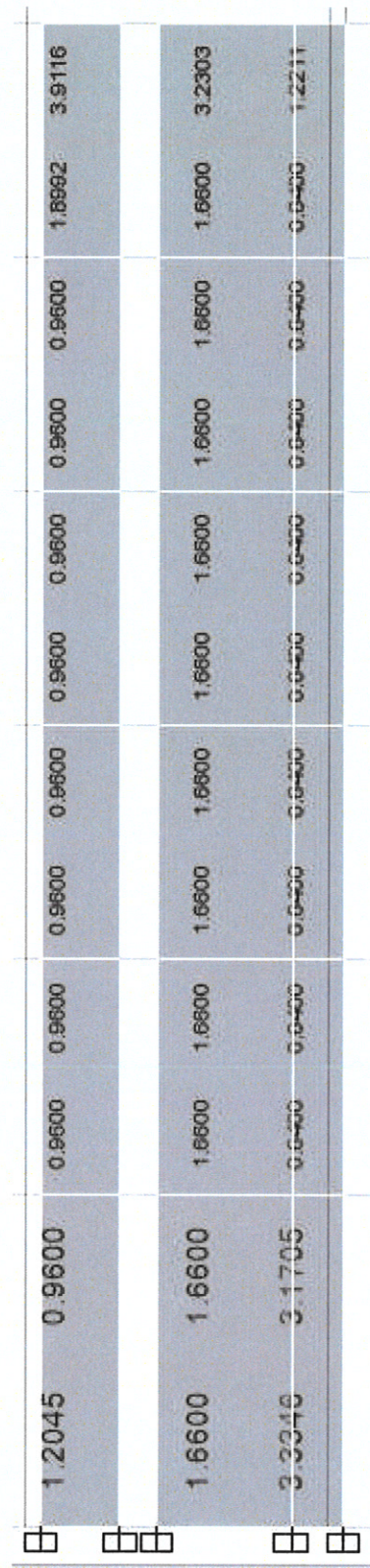


Elevation - Along Grid "H.2",  
Bet. Grids 3a and "1.9"



3a

2



Roof

Level 6

Level 5

Level 4

Level 3

Level 2

PIER Total Reinforcement Areas [in<sup>2</sup>]  
- Longitudinal (Vertical)

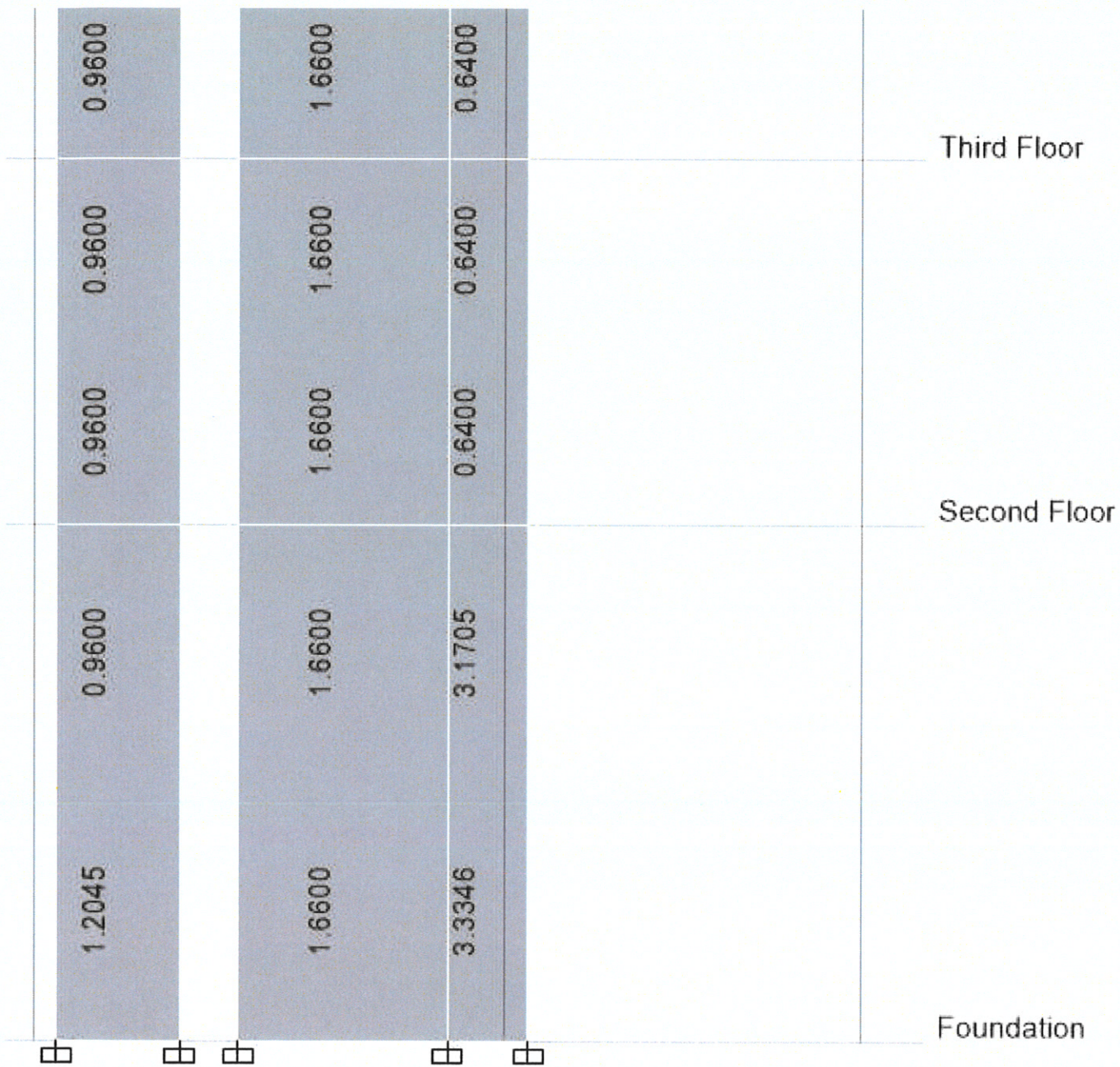
Elevation - Along Grid "H.2",  
Bet. Grids 3a and "1.9"



3a

2

1.9



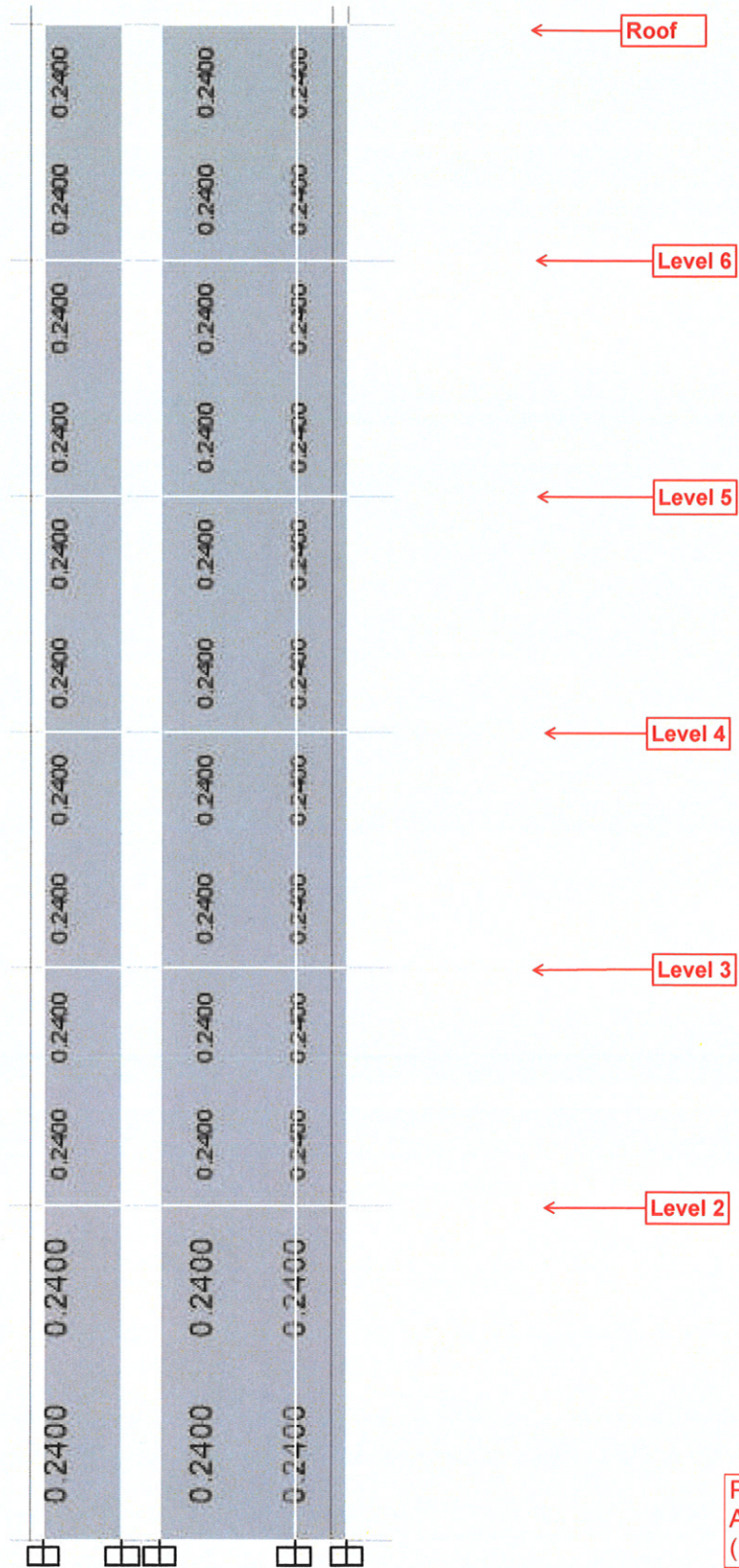
PIER Total Reinforcement Areas [in<sup>2</sup>]  
- Longitudinal (Vertical)

Elevation - Along Grid "H.2",  
Bet. Grids 3a and "1.9"



3a

2



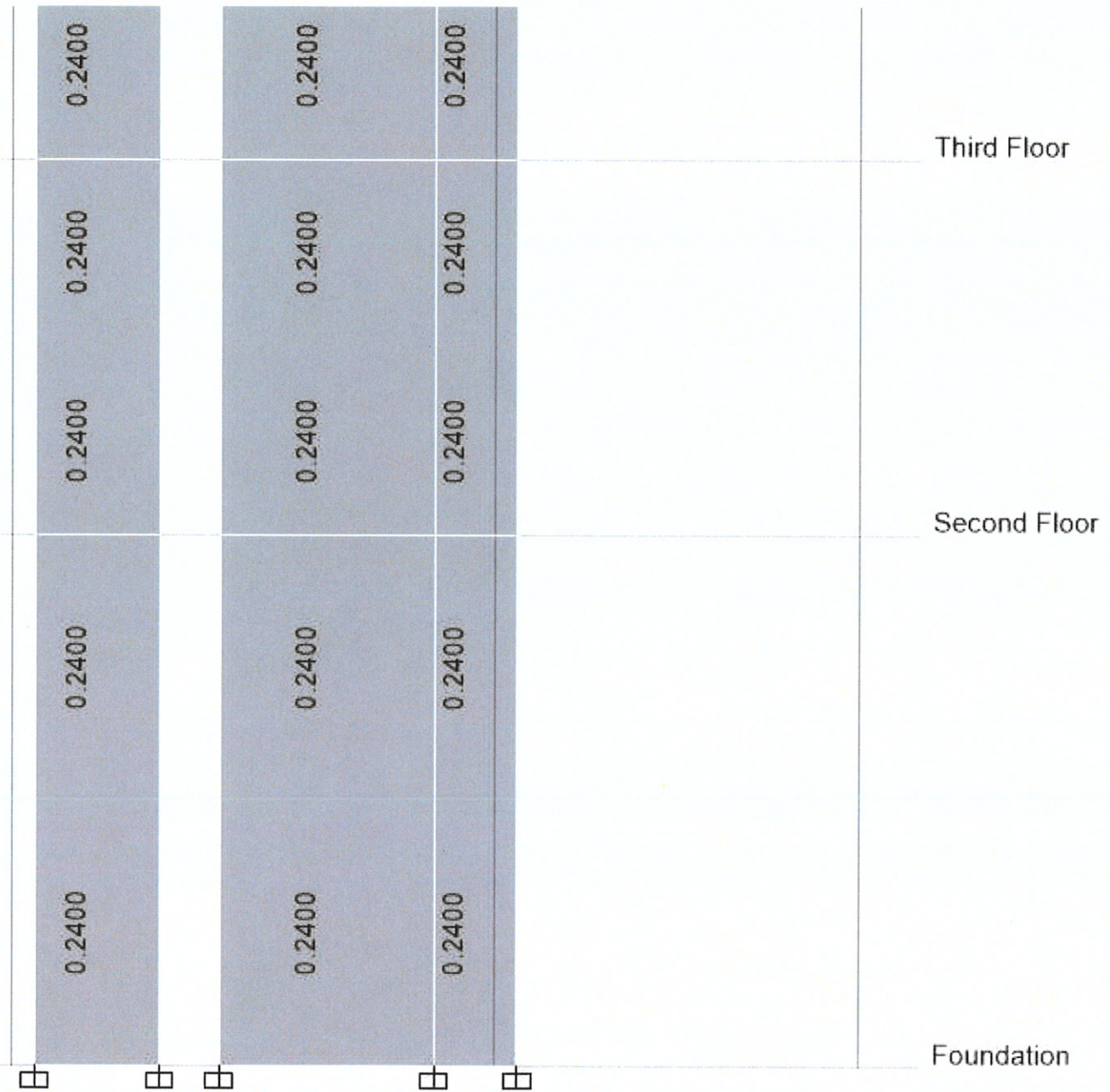
Elevation - Along Grid "H.2",  
Bet. Grids 3a and "1.9"



3a

2

1.9



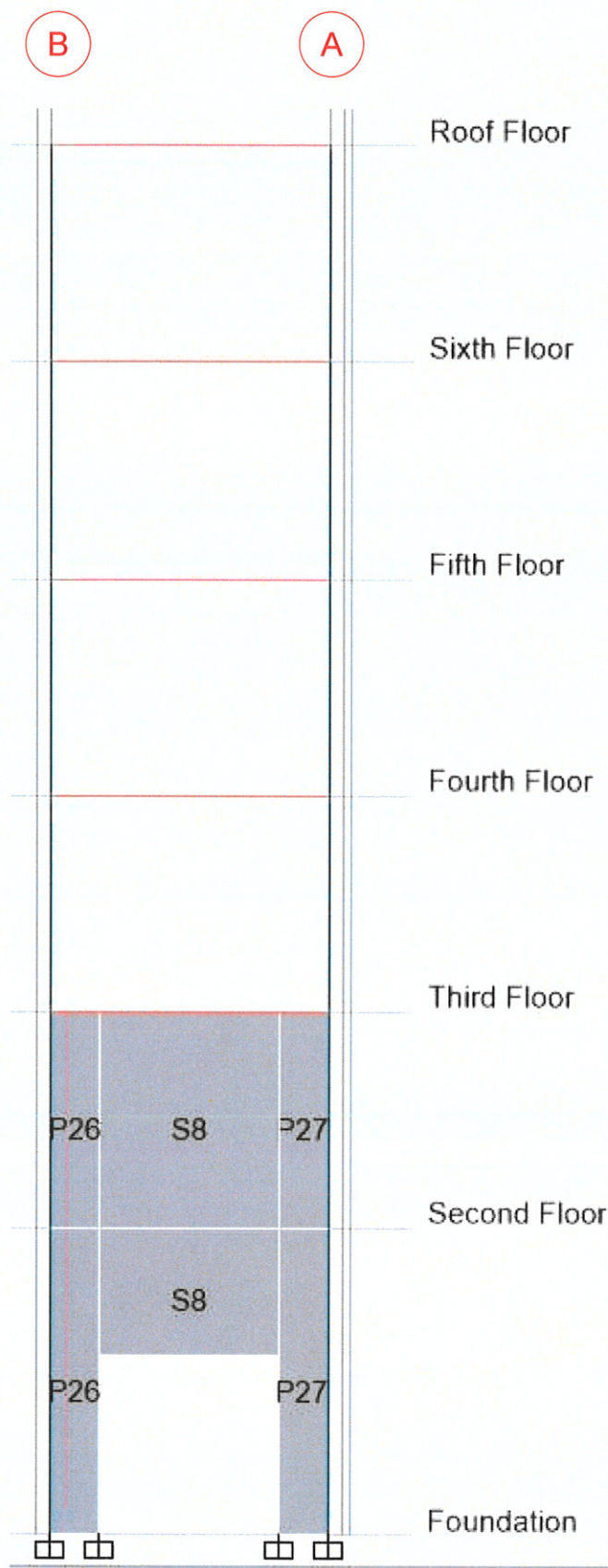
PIER Total Reinforcement  
Areas [in²/Ft] - Shearing  
(Horizontal)

Elevation - Along Grid "H.2",  
Bet. Grids 3a and "1.9"



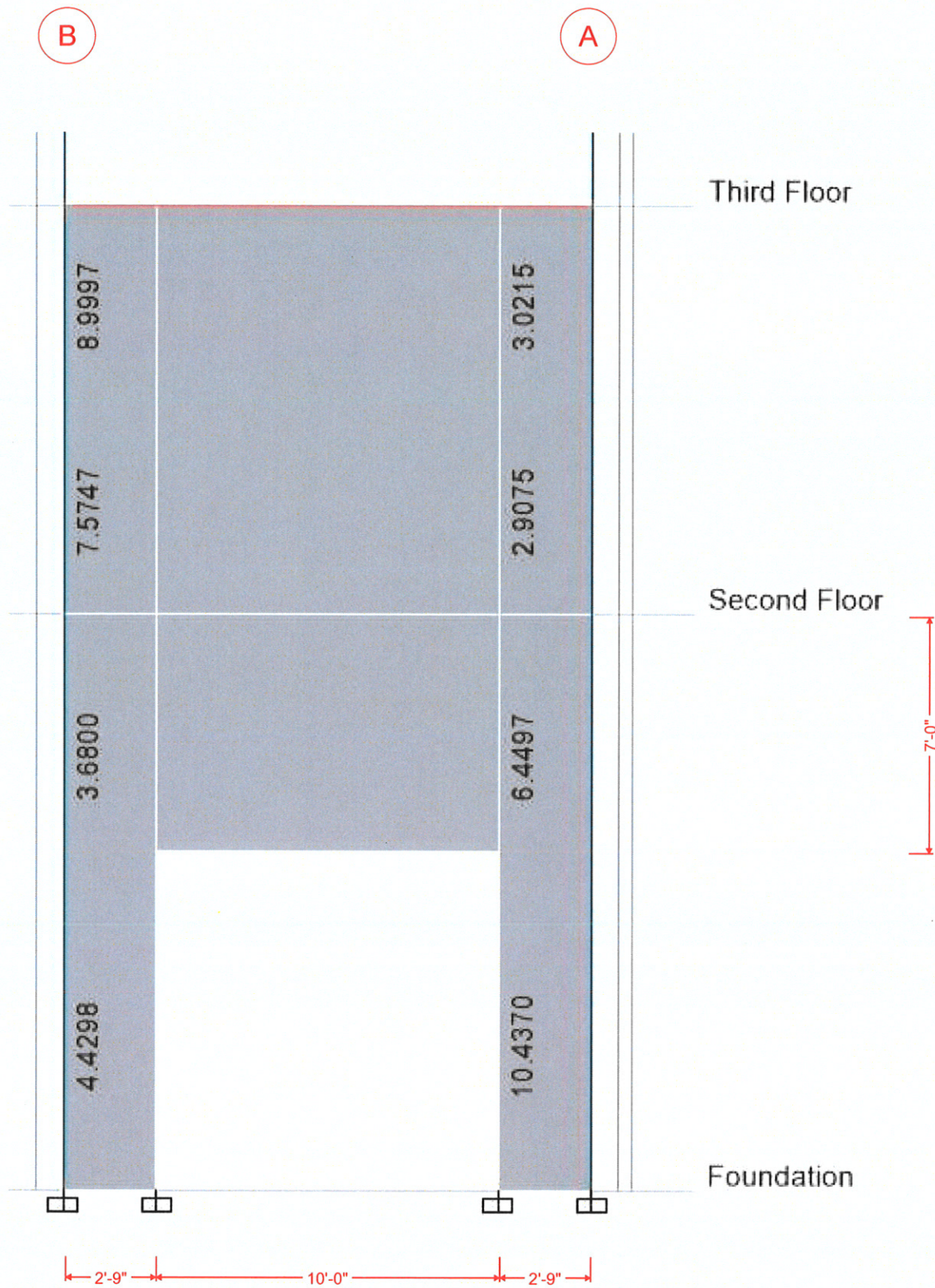
Elevation - Along Grid 7, Bet.  
Grids A and B





Elevation - Along Grid 7, Bet.  
Grids A and B

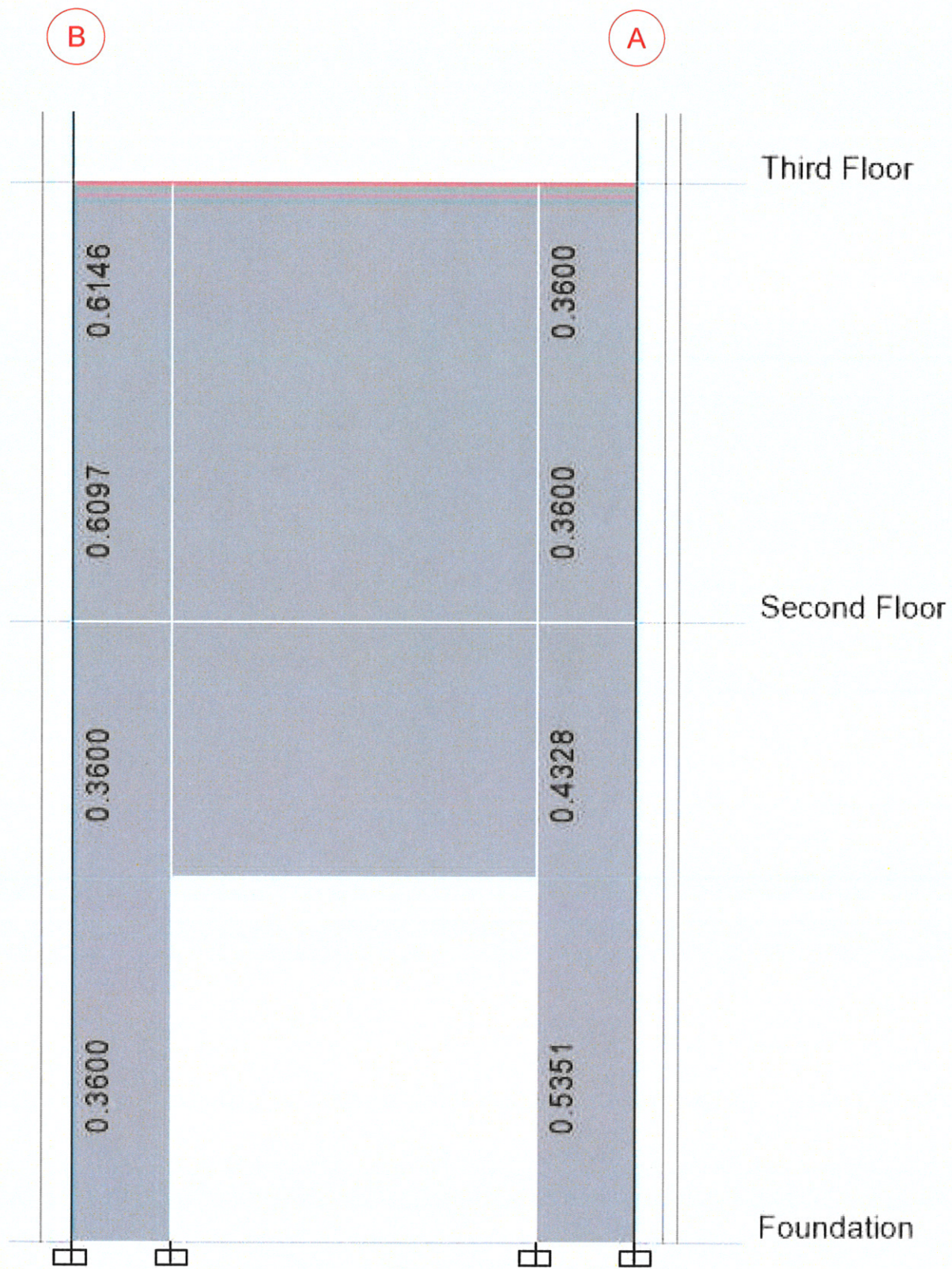




PIER Total Reinforcement Areas [in<sup>2</sup>]  
- Longitudinal (Vertical)

Elevation - Along Grid 7, Bet.  
Grids A and B

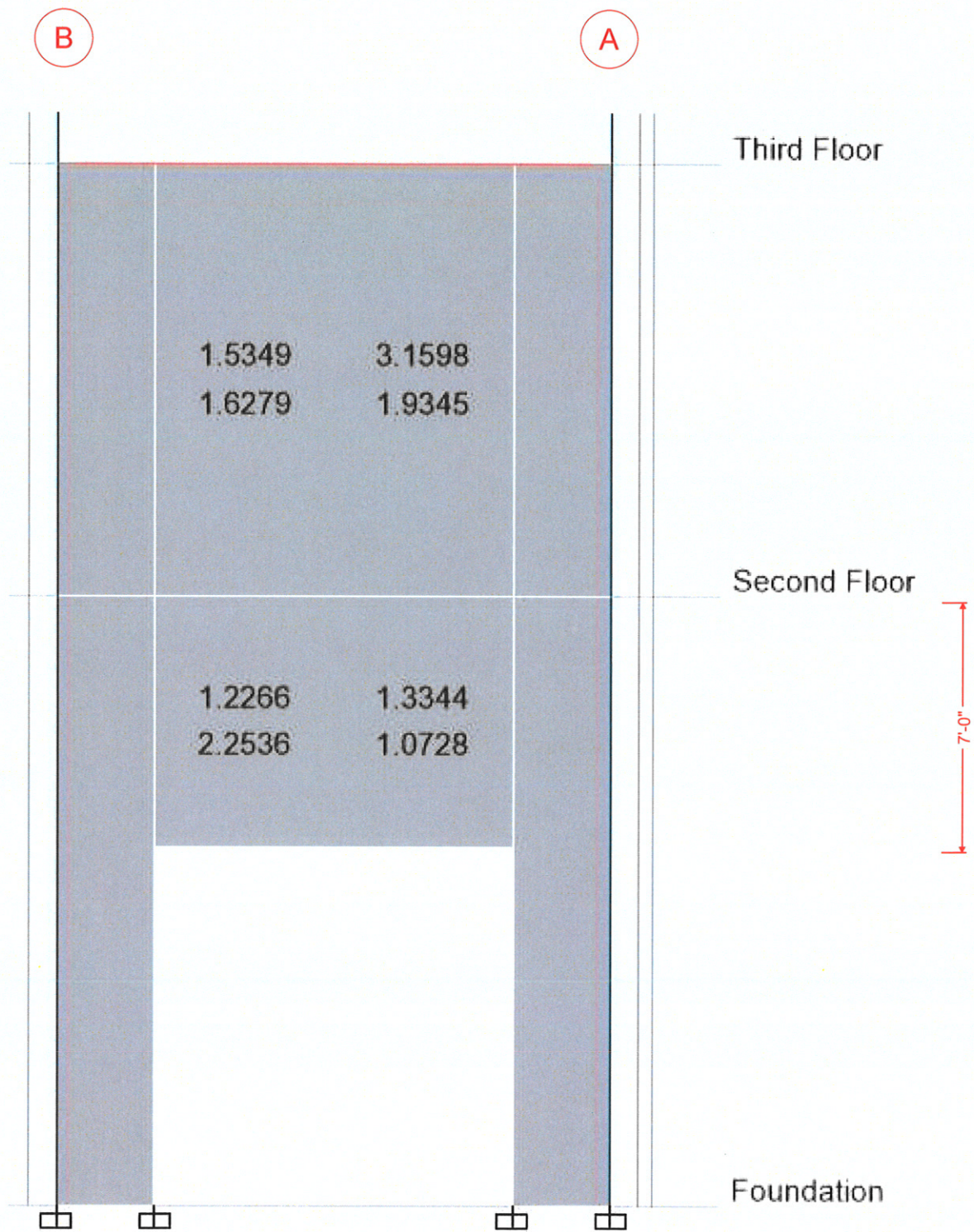




Elevation - Along Grid 7, Bet.  
Grids A and B

PIER Total Reinforcement  
Areas [in<sup>2</sup>/Ft] - Shearing  
(Horizontal)

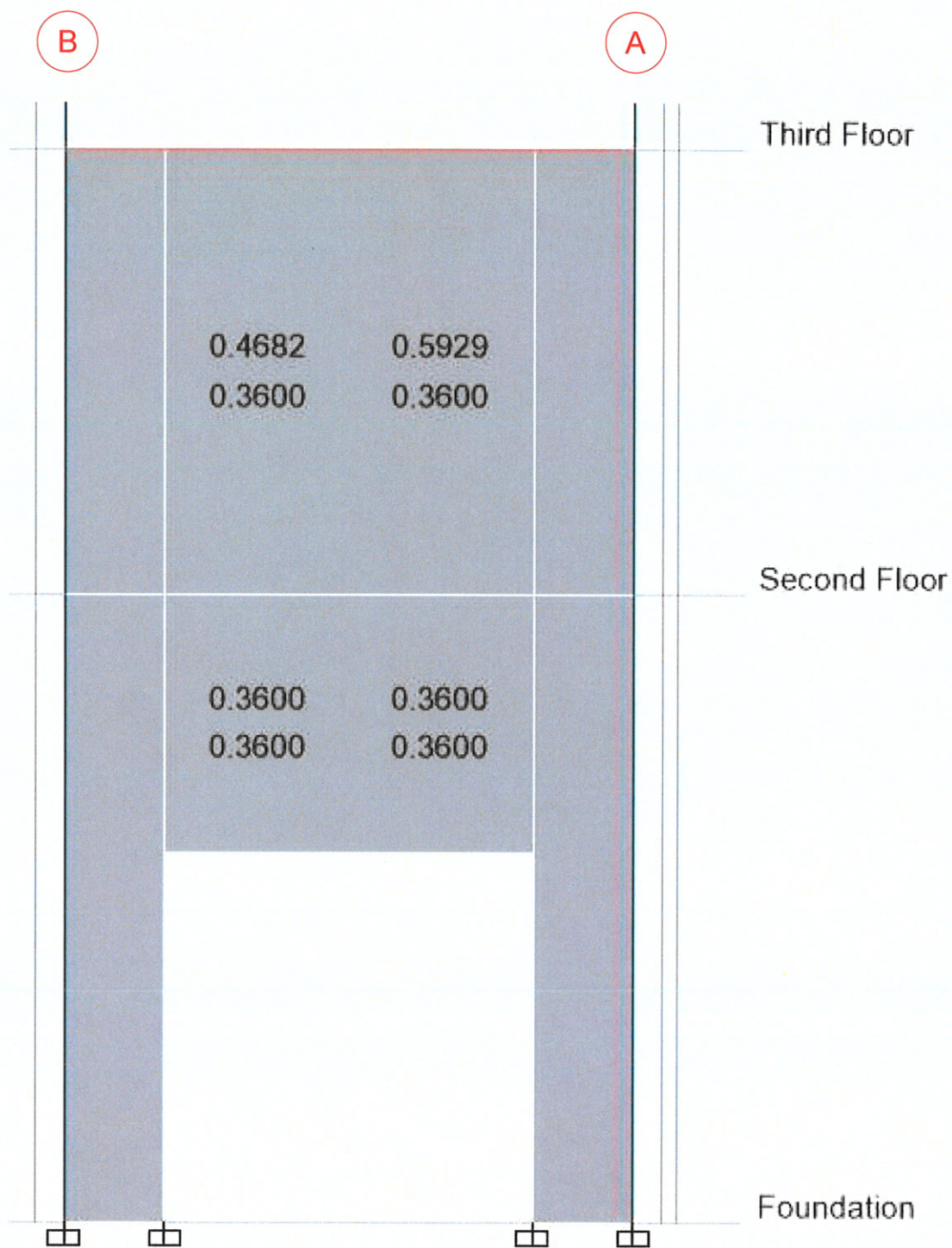




Spandrel Reinforcement Areas [in<sup>2</sup>]  
- Flexural Longitudinal (Horizontal)

Elevation - Along Grid 7, Bet.  
Grids A and B





Spandrel Shear Reinforcement  
[in<sup>2</sup> / Ft]

Elevation - Along Grid 7, Bet.  
Grids A and B



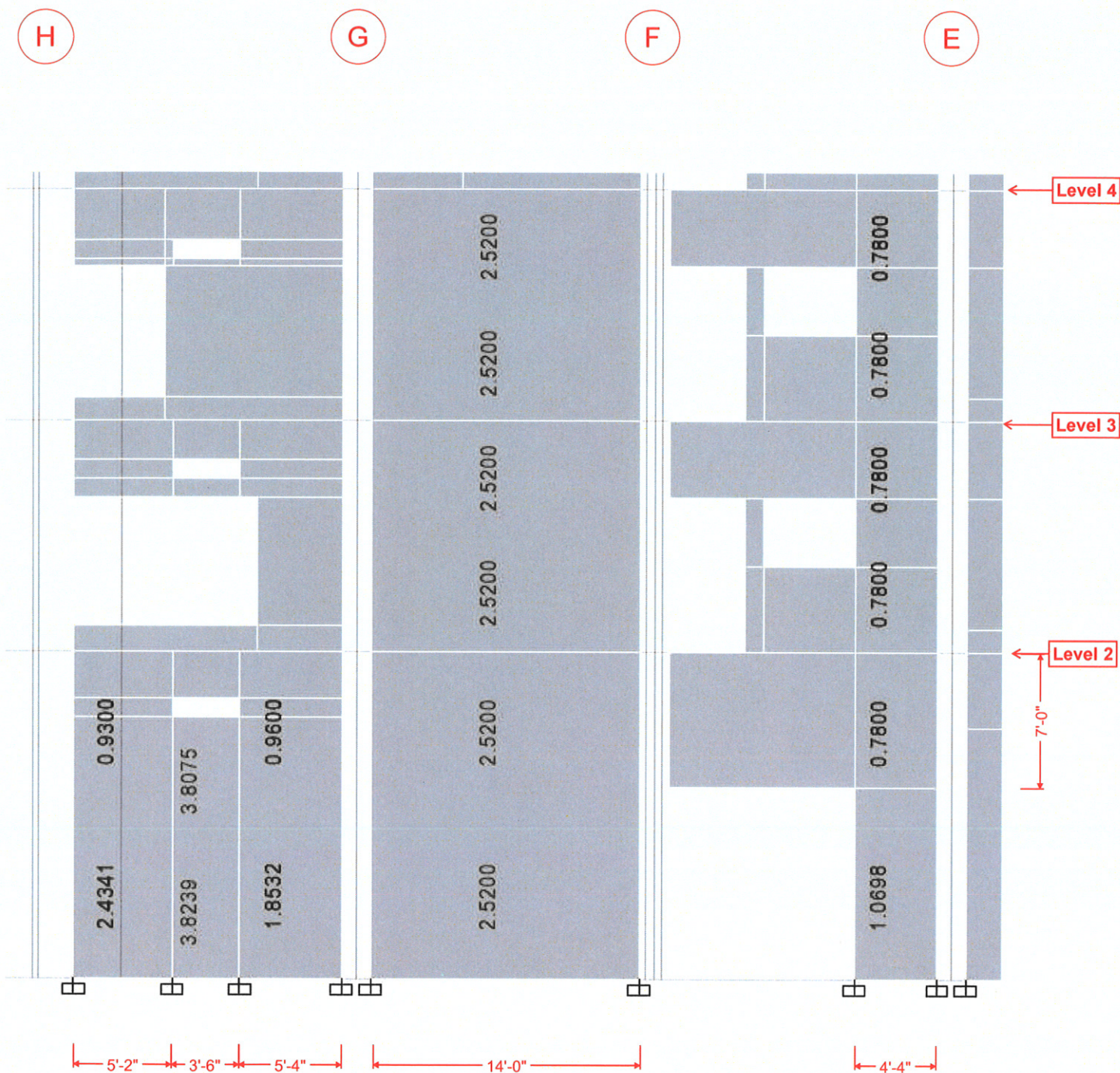
Elevation - Along Grid 7 ("45"),  
Bet. Grids H and B





Elevation - Along Grid 7 ("45"),  
Bet. Grids H and B

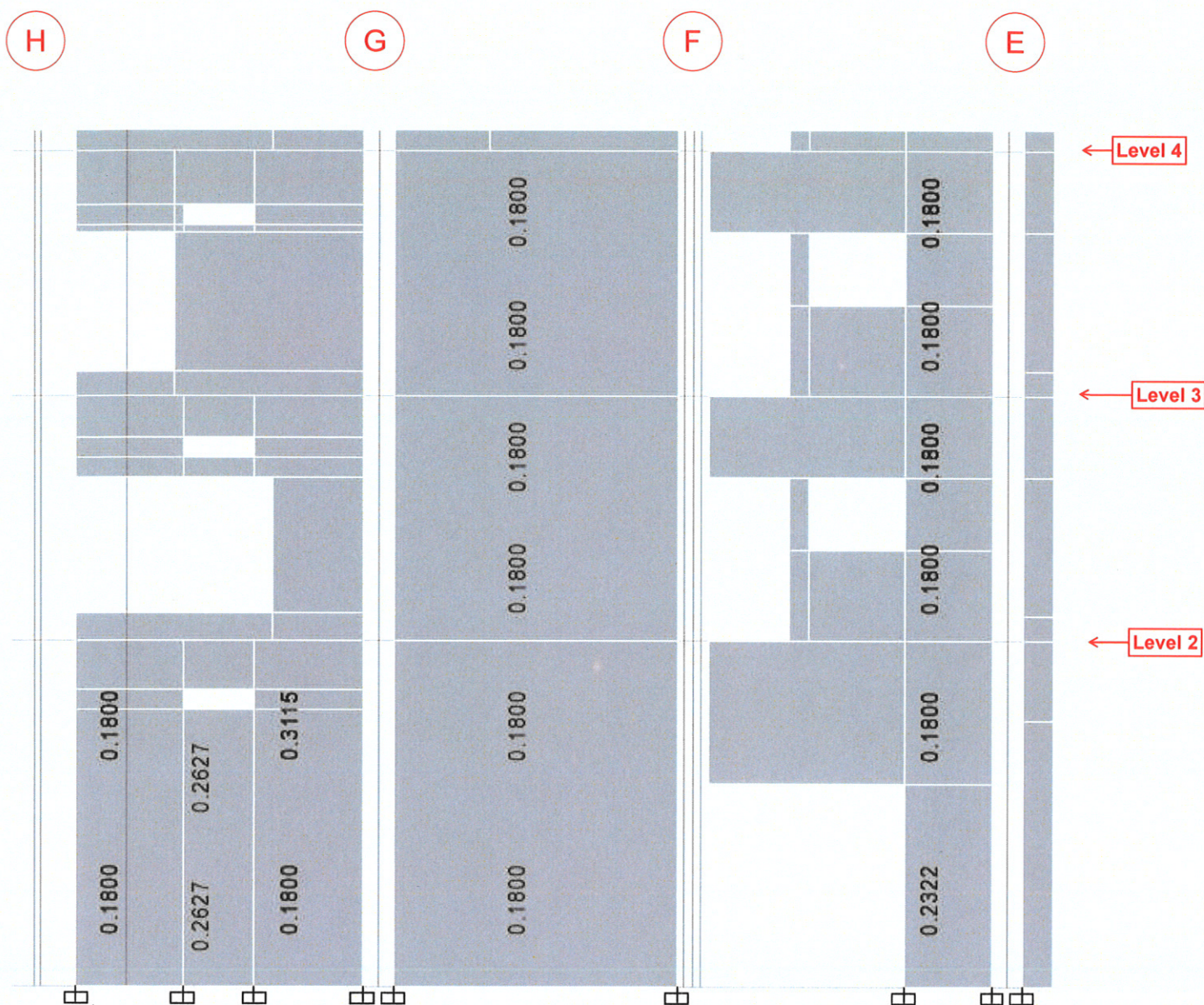




PIER Total Reinforcement Areas [in²]  
- Longitudinal (Vertical)

Elevation - Along Grid 7 ("45"),  
Bet. Grids H and B

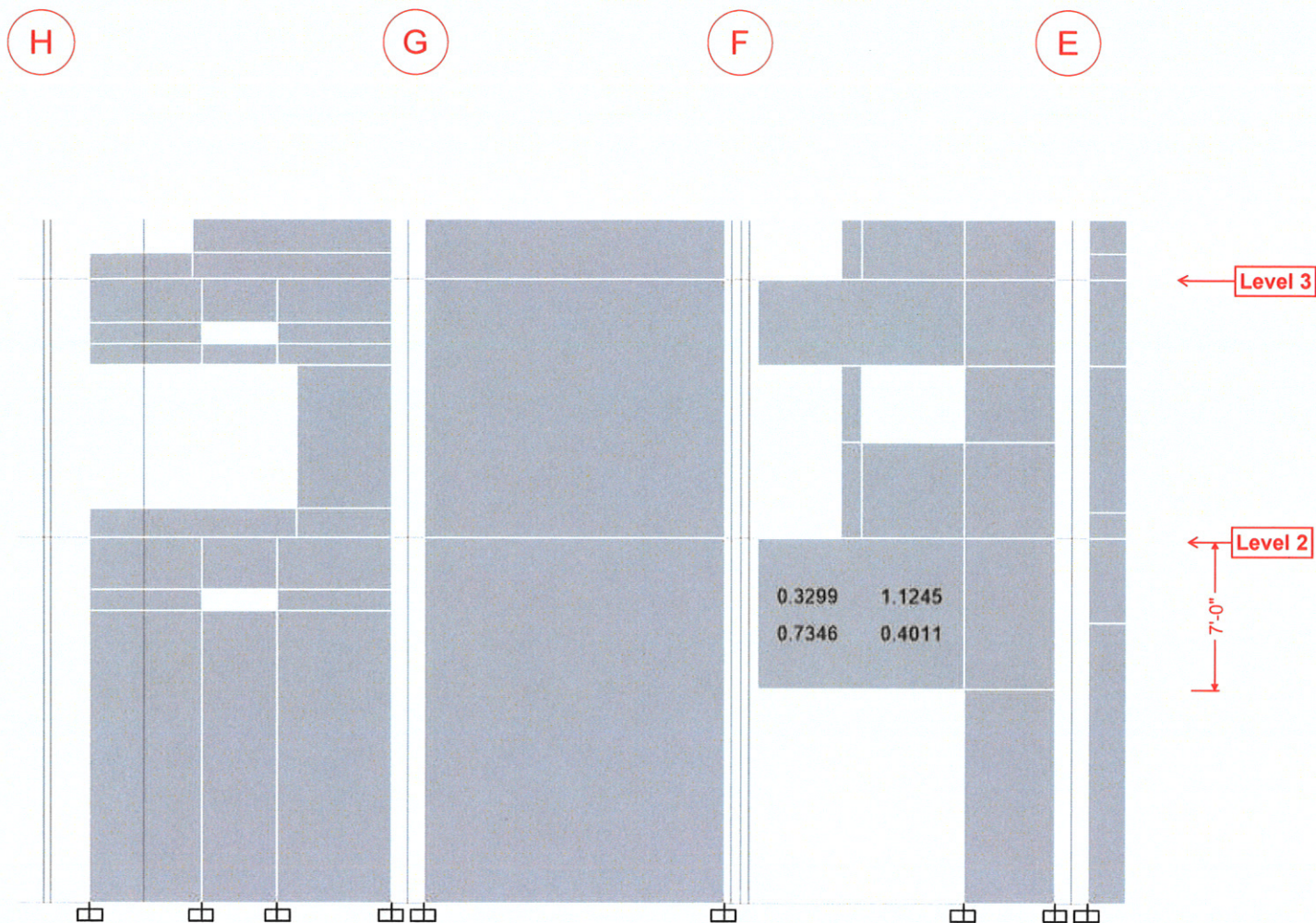




PIER Total Reinforcement  
Areas [ $\text{in}^2/\text{Ft}$ ] - Shearing  
(Horizontal)

Elevation - Along Grid 7 ("45"),  
Bet. Grids H and B





Spandrel Reinforcement Areas [in<sup>2</sup>]  
- Flexural Longitudinal (Horizontal)

Elevation - Along Grid 7 ("45"),  
Bet. Grids H and B

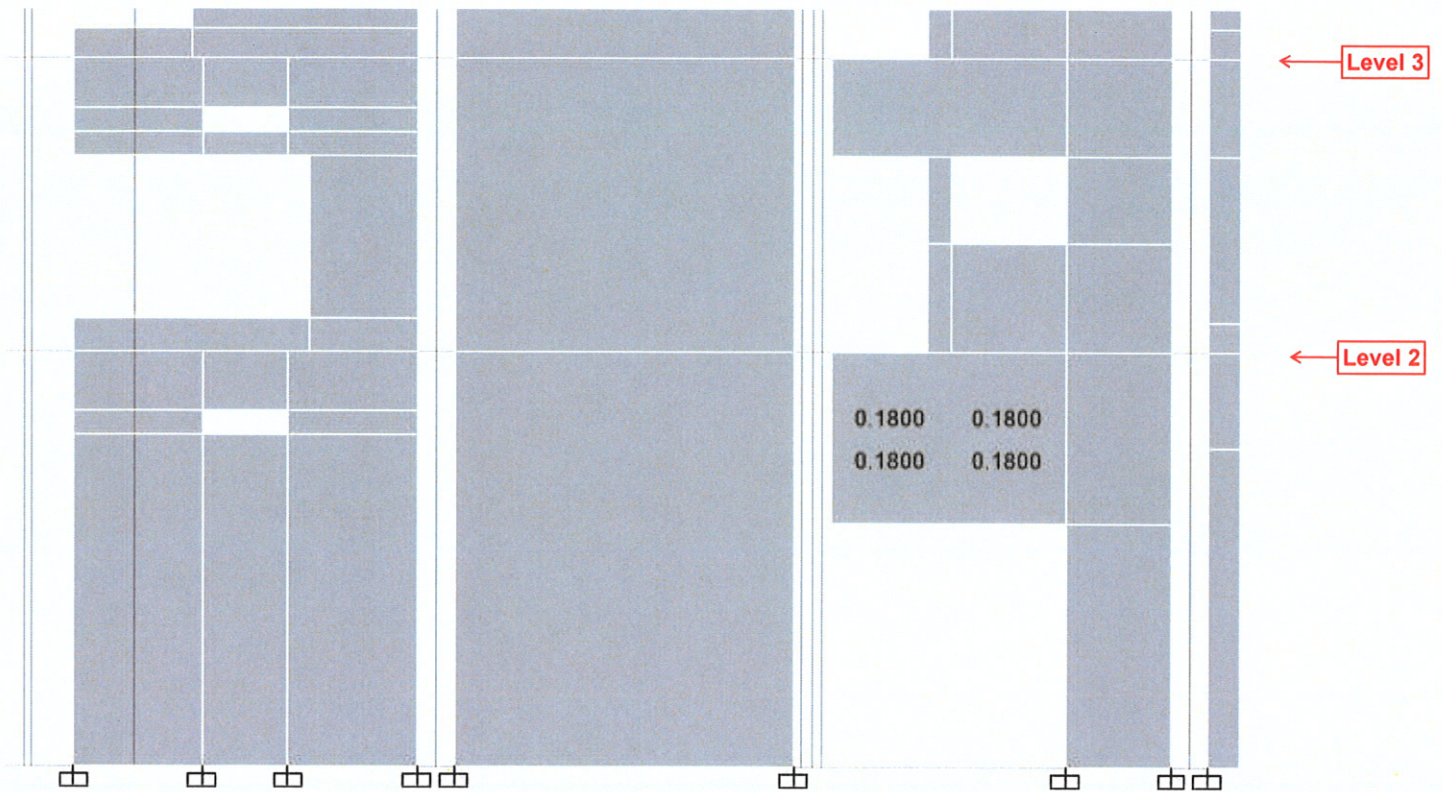


H

G

F

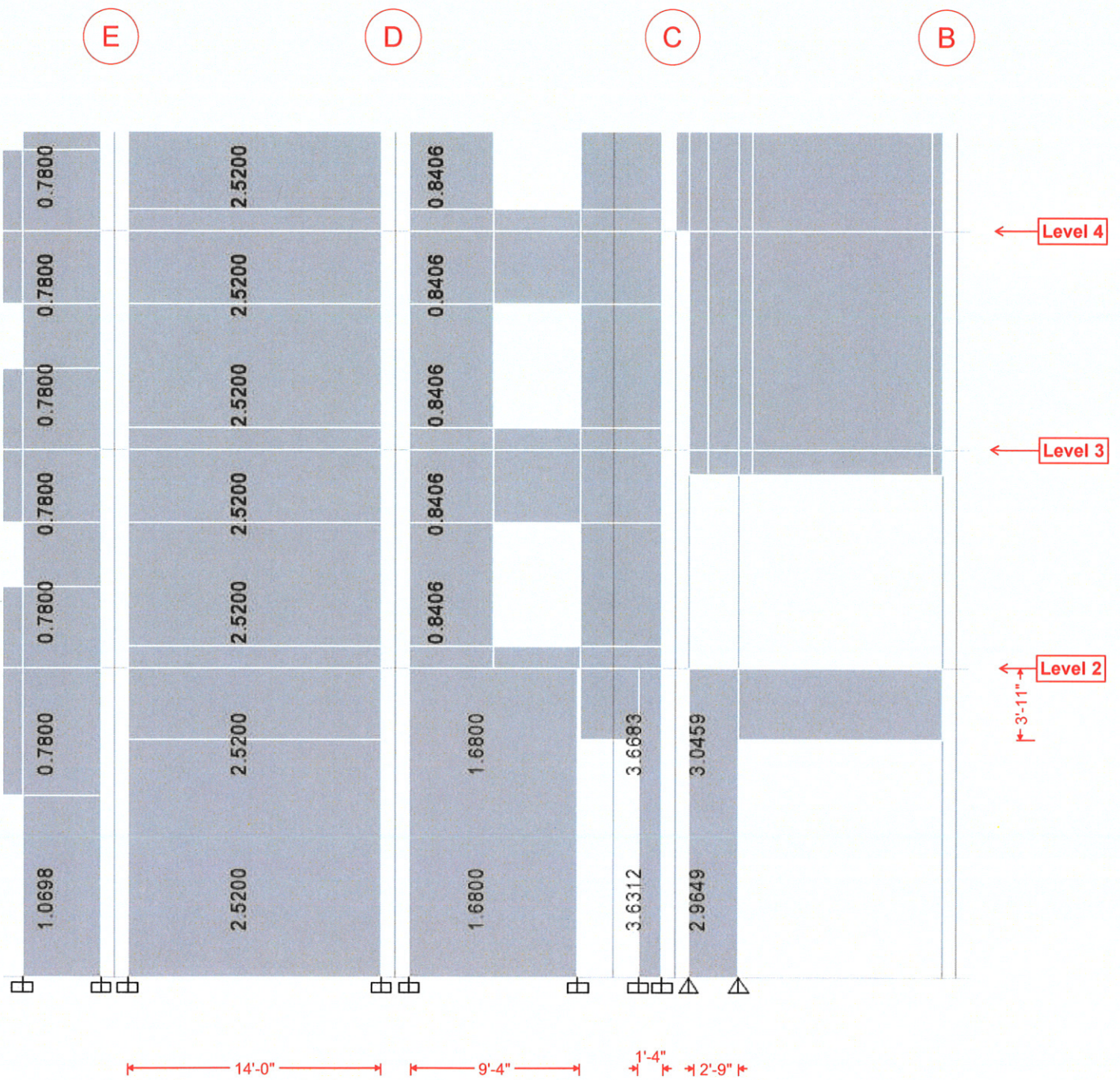
E



Spandrel Shear Reinforcement  
[in<sup>2</sup> / Ft]

Elevation - Along Grid 7 ("45"),  
Bet. Grids H and B

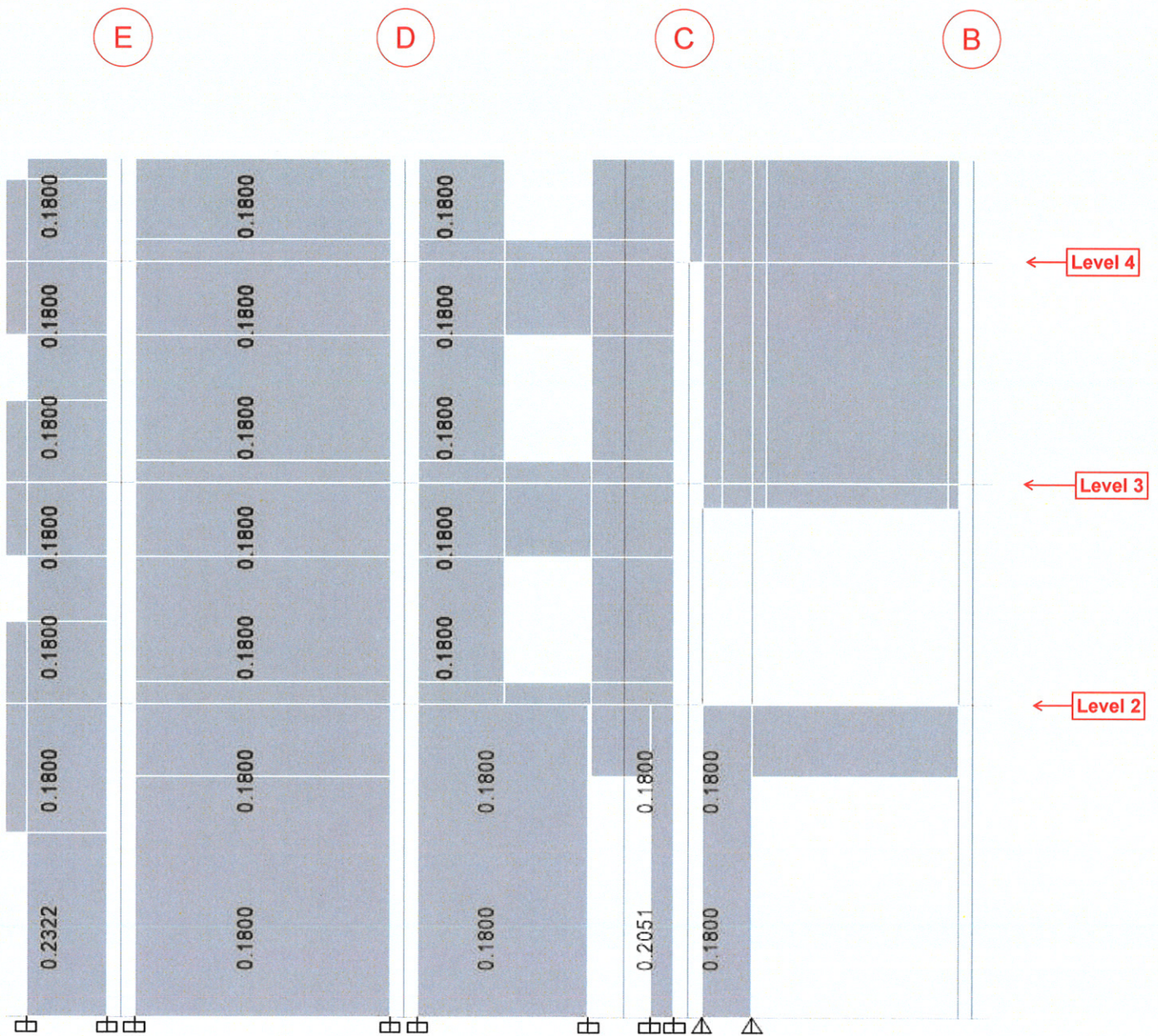




PIER Total Reinforcement Areas [in<sup>2</sup>]  
- Longitudinal (Vertical)

Elevation - Along Grid 7 ("45"),  
Bet. Grids H and B

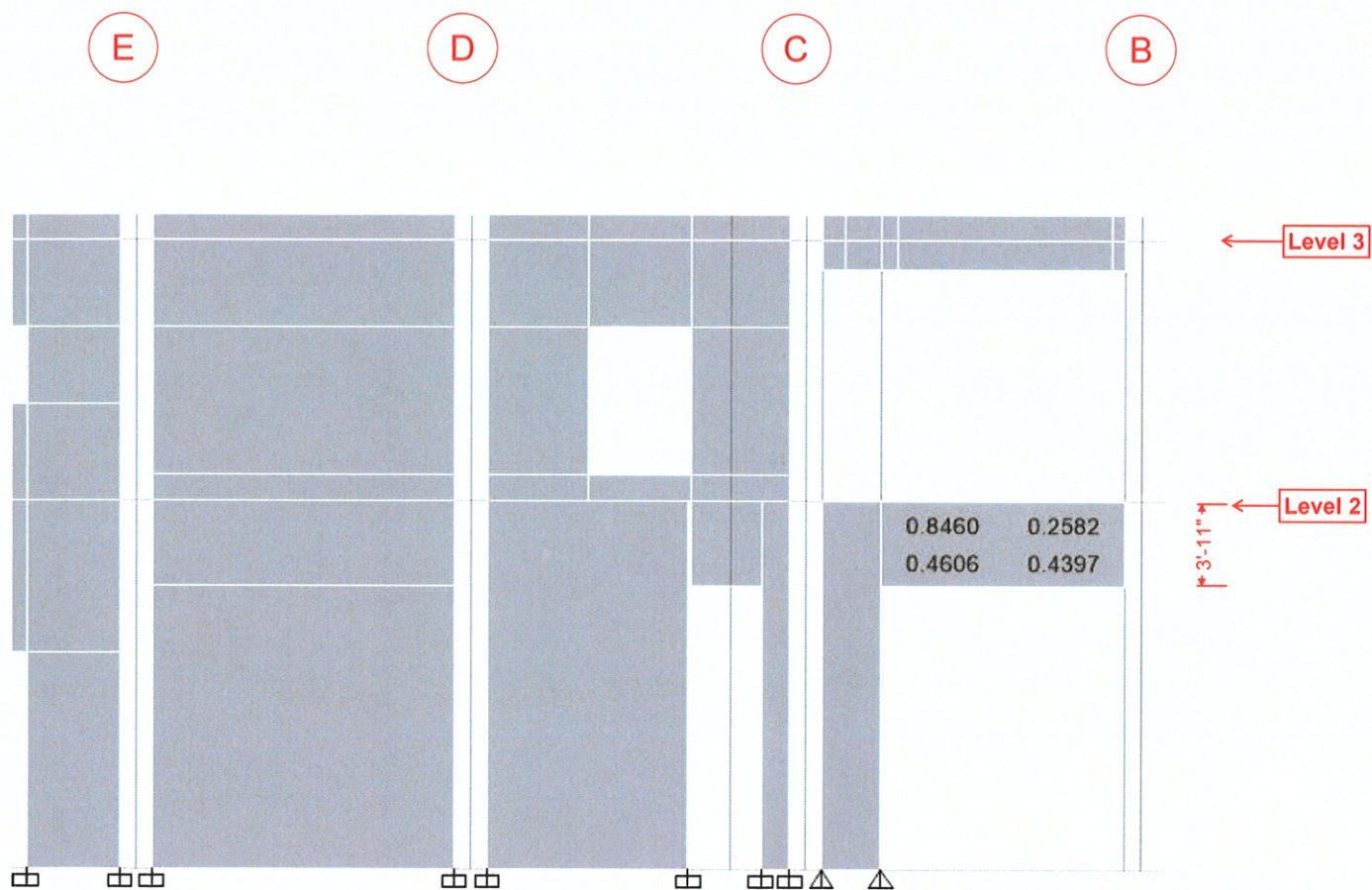




PIER Total Reinforcement  
Areas [in²/Ft] - Shearing  
(Horizontal)

Elevation - Along Grid 7 ("45"),  
Bet. Grids H and B

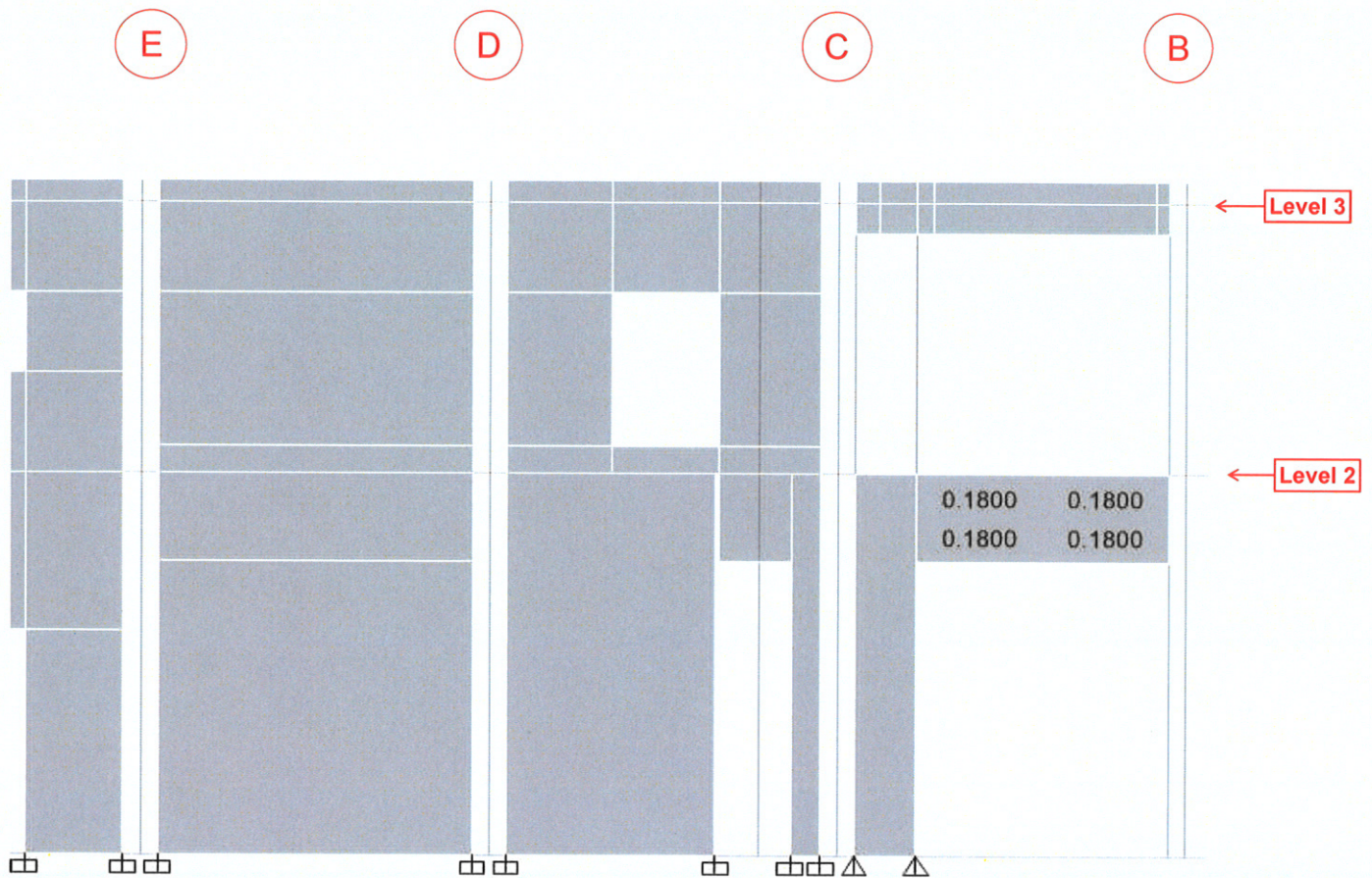




Spandrel Reinforcement Areas [in<sup>2</sup>]  
- Flexural Longitudinal (Horizontal)

Elevation - Along Grid 7 ("45"),  
Bet. Grids H and B





Spandrel Shear Reinforcement  
[in<sup>2</sup> / Ft]

Elevation - Along Grid 7 ("45"),  
Bet. Grids H and B

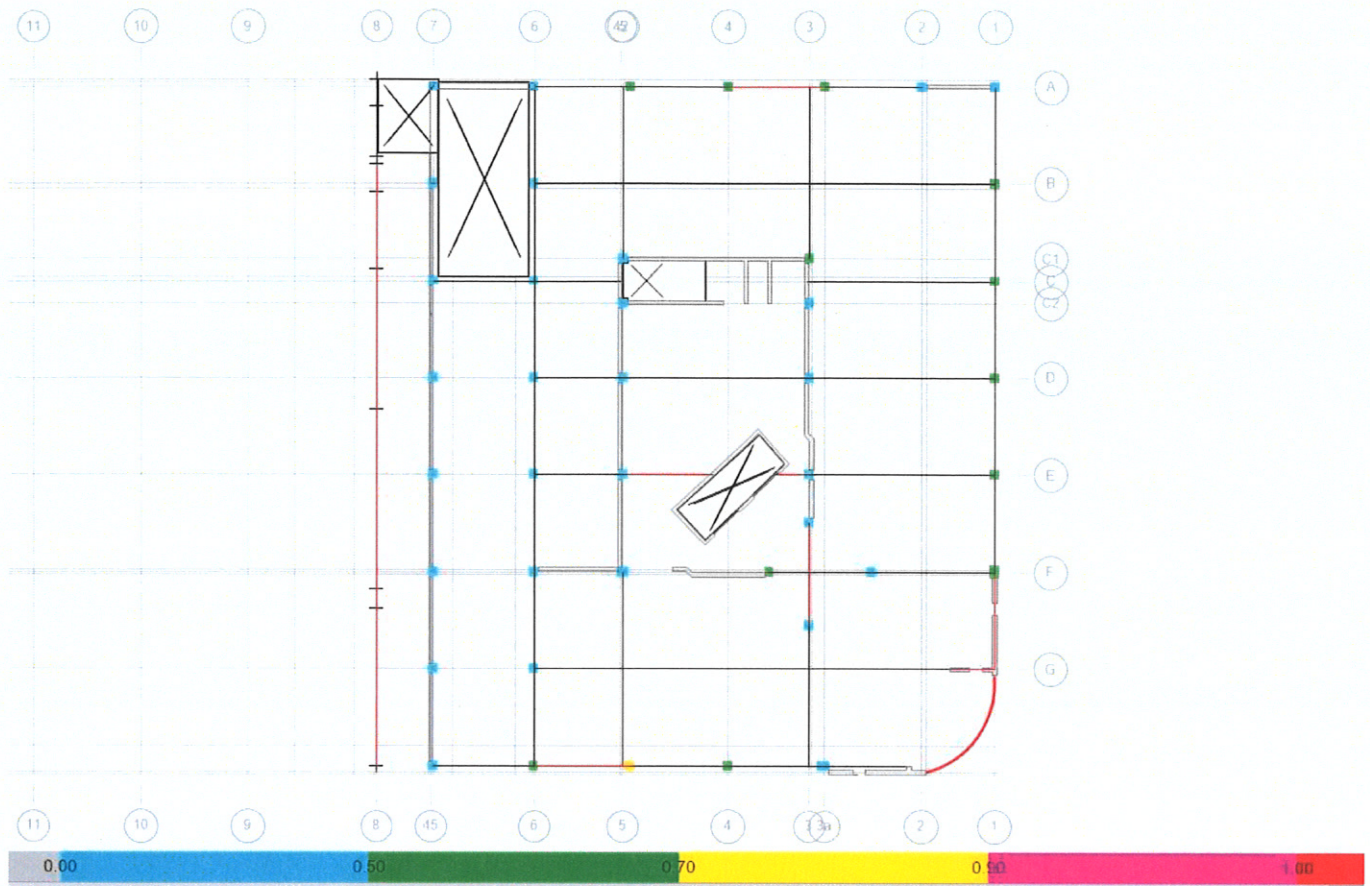


COLUMNS





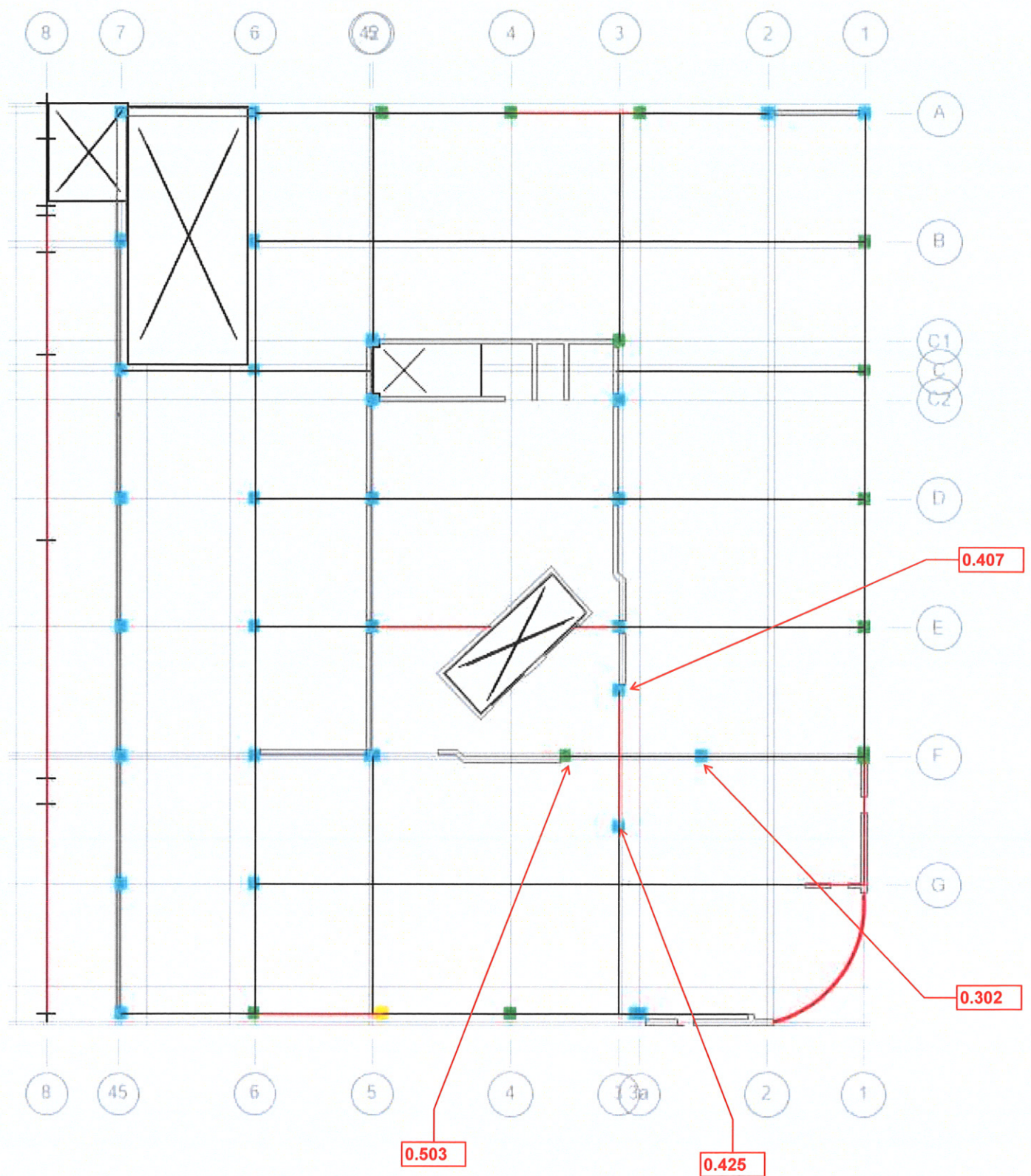




Columns shown on a floor plan  
are located underneath that floor  
level (typical all floor plans)

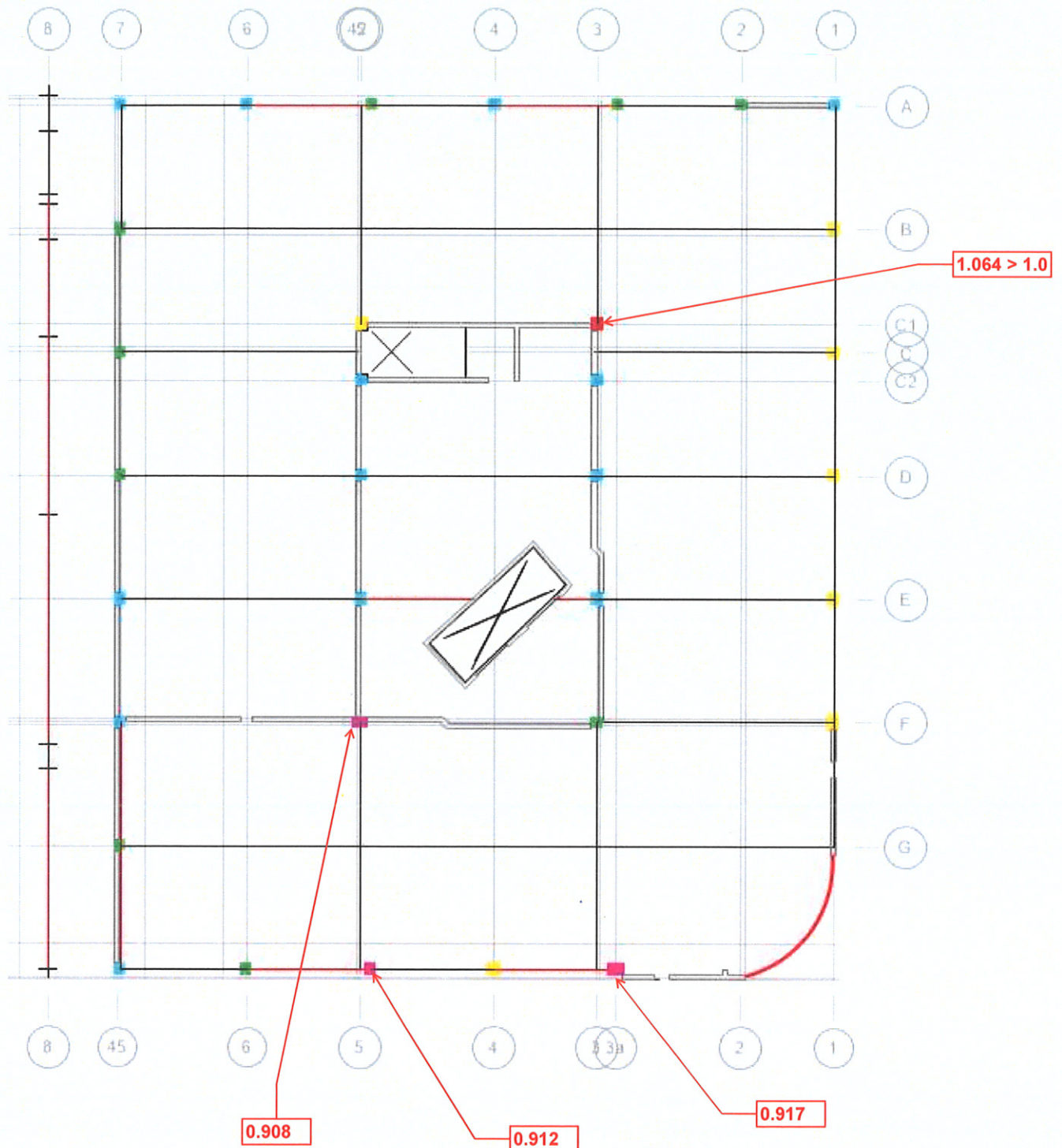
**Second Floor - Column  
Interaction Ratios  
Color Coded Value**





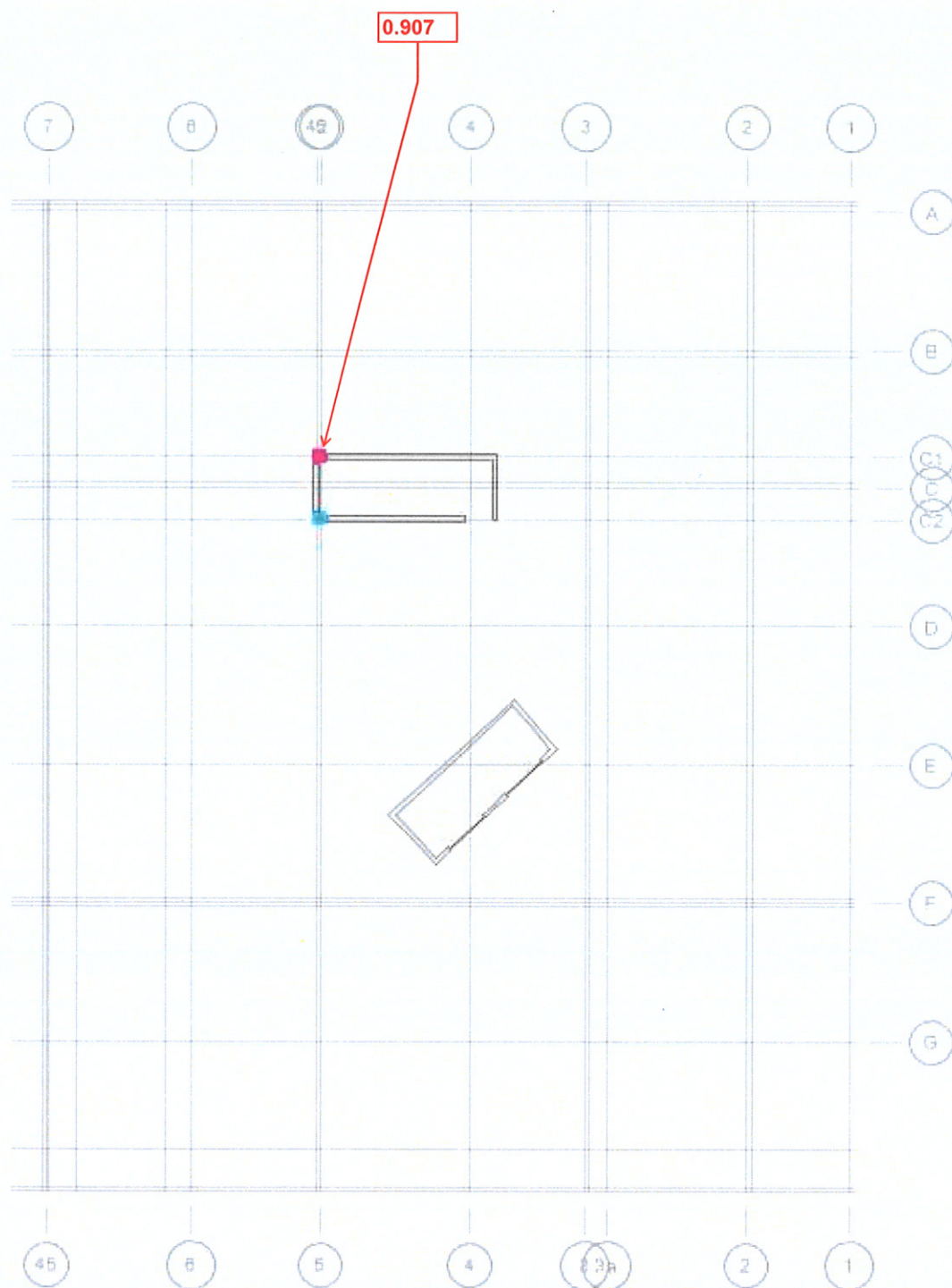
Second Floor - Column  
Interaction Ratios Color Coded





**Roof Level - Columns  
(underneath Roof Level)  
Interaction Ratios Color Coded**



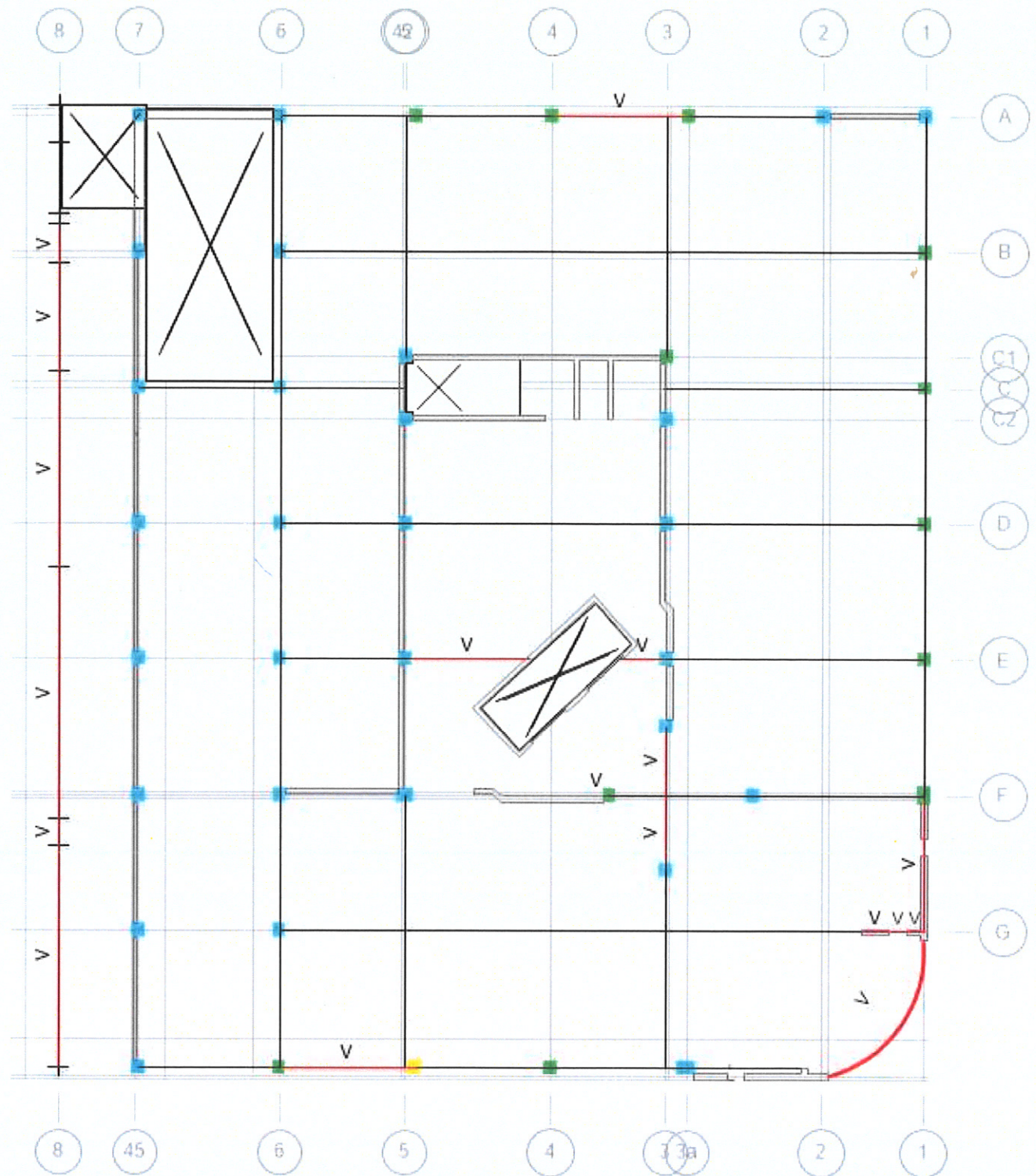


**Stair Roof Level - Columns  
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Interaction Ratios Color Coded**



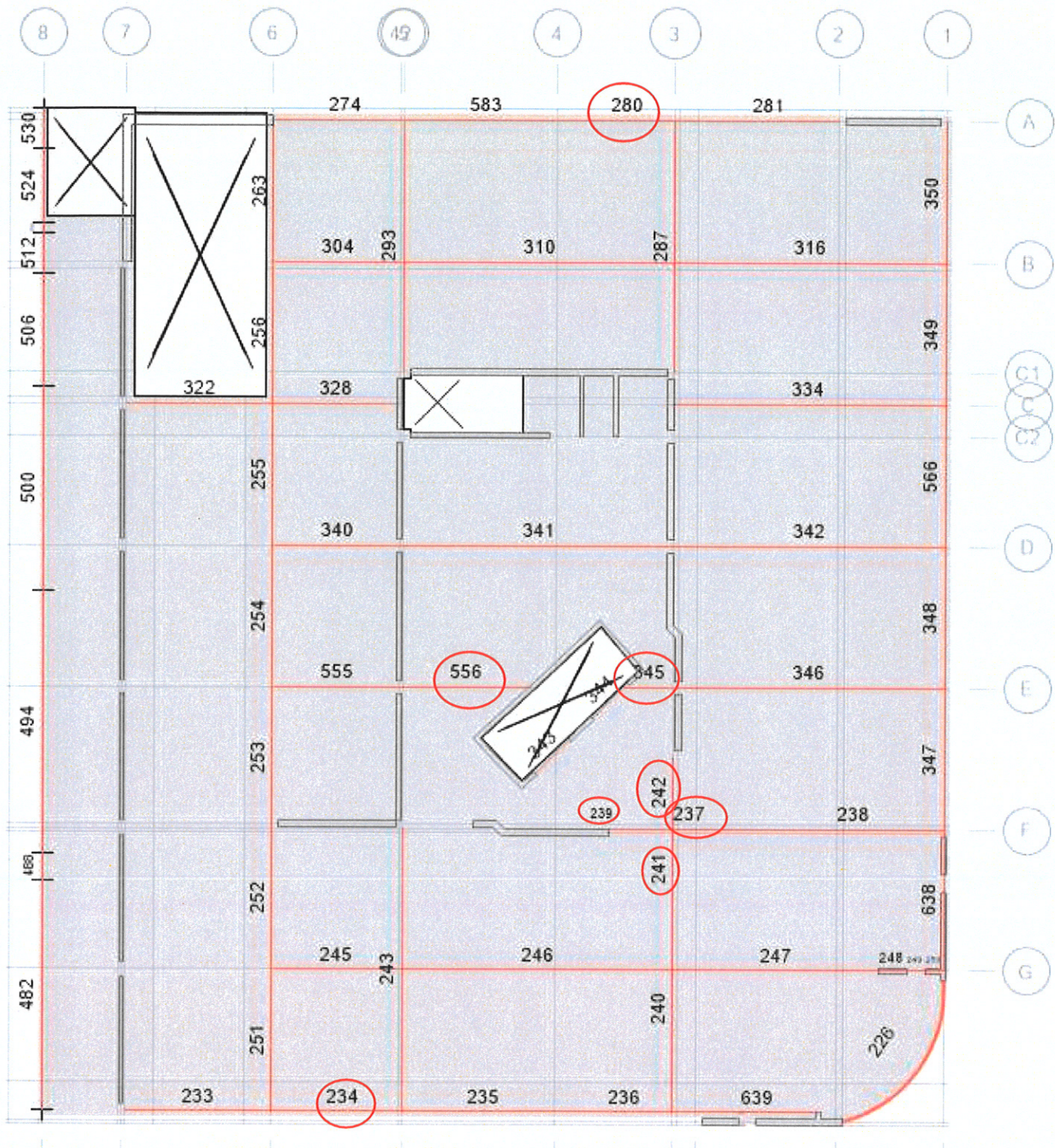
BEAMS





**Second Floor - Beams - Shear**



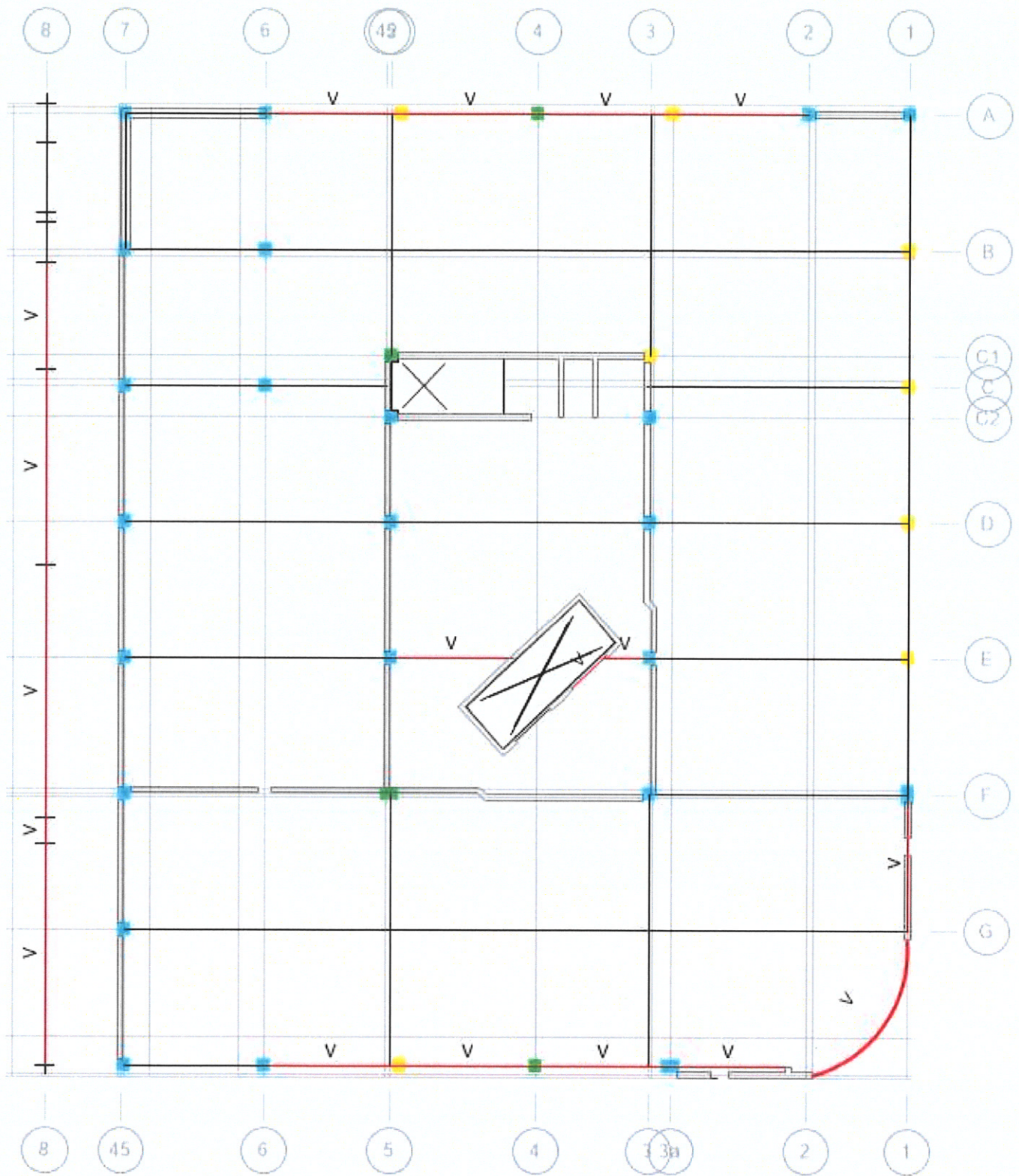


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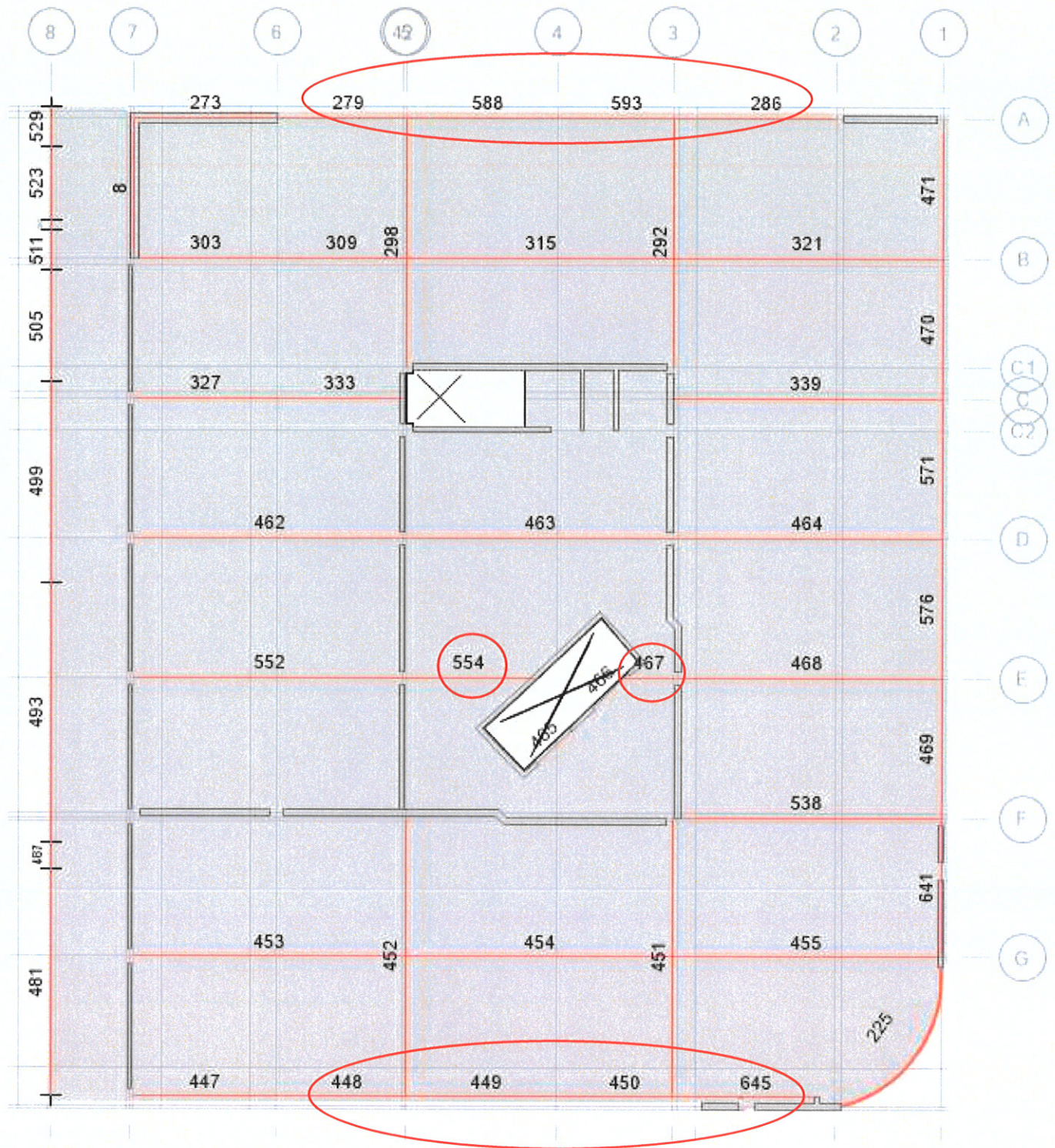
**Second Floor - Beams -  
Labels for Output Files  
Reference**





Third Floor - Beams - Shear



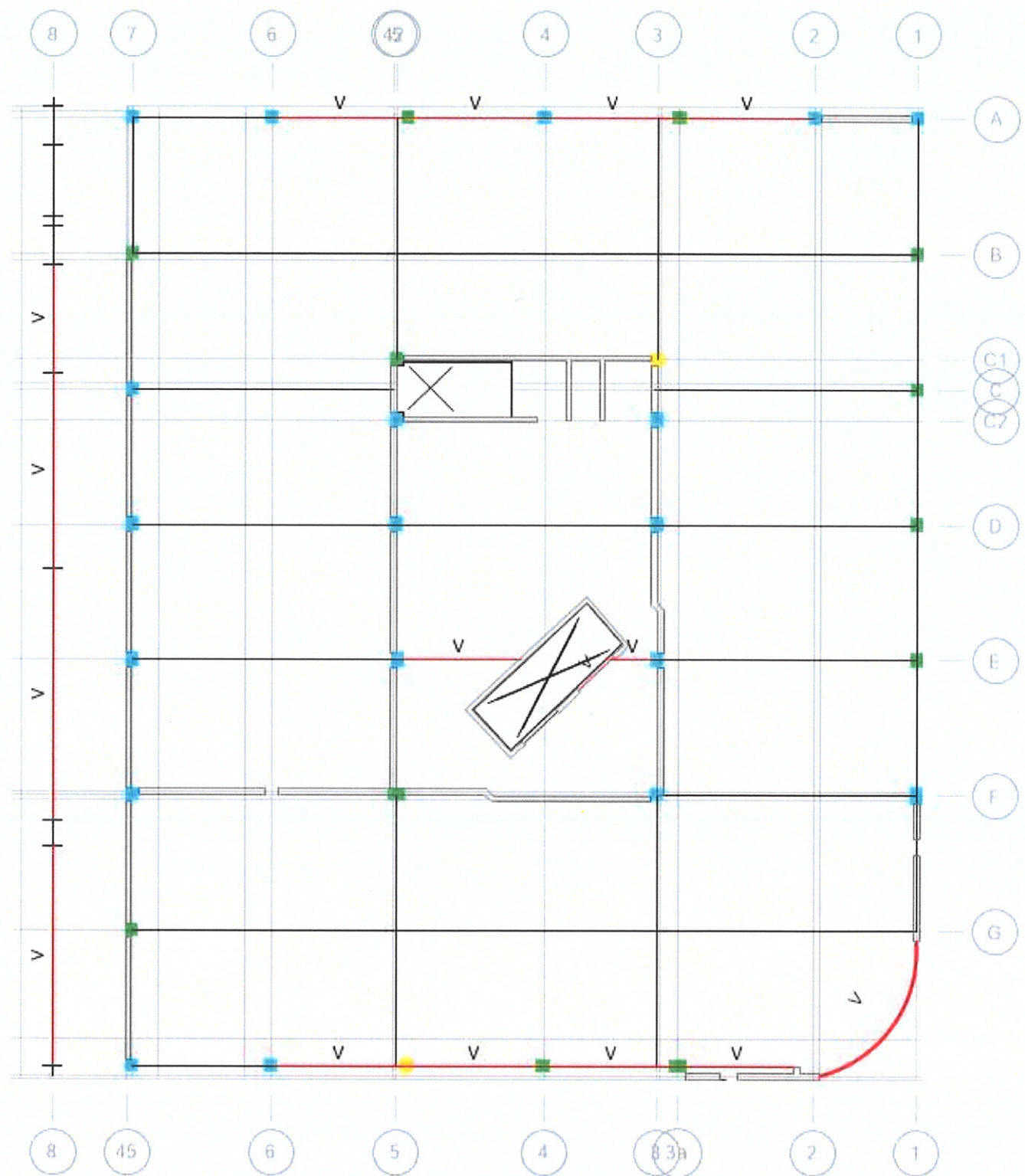


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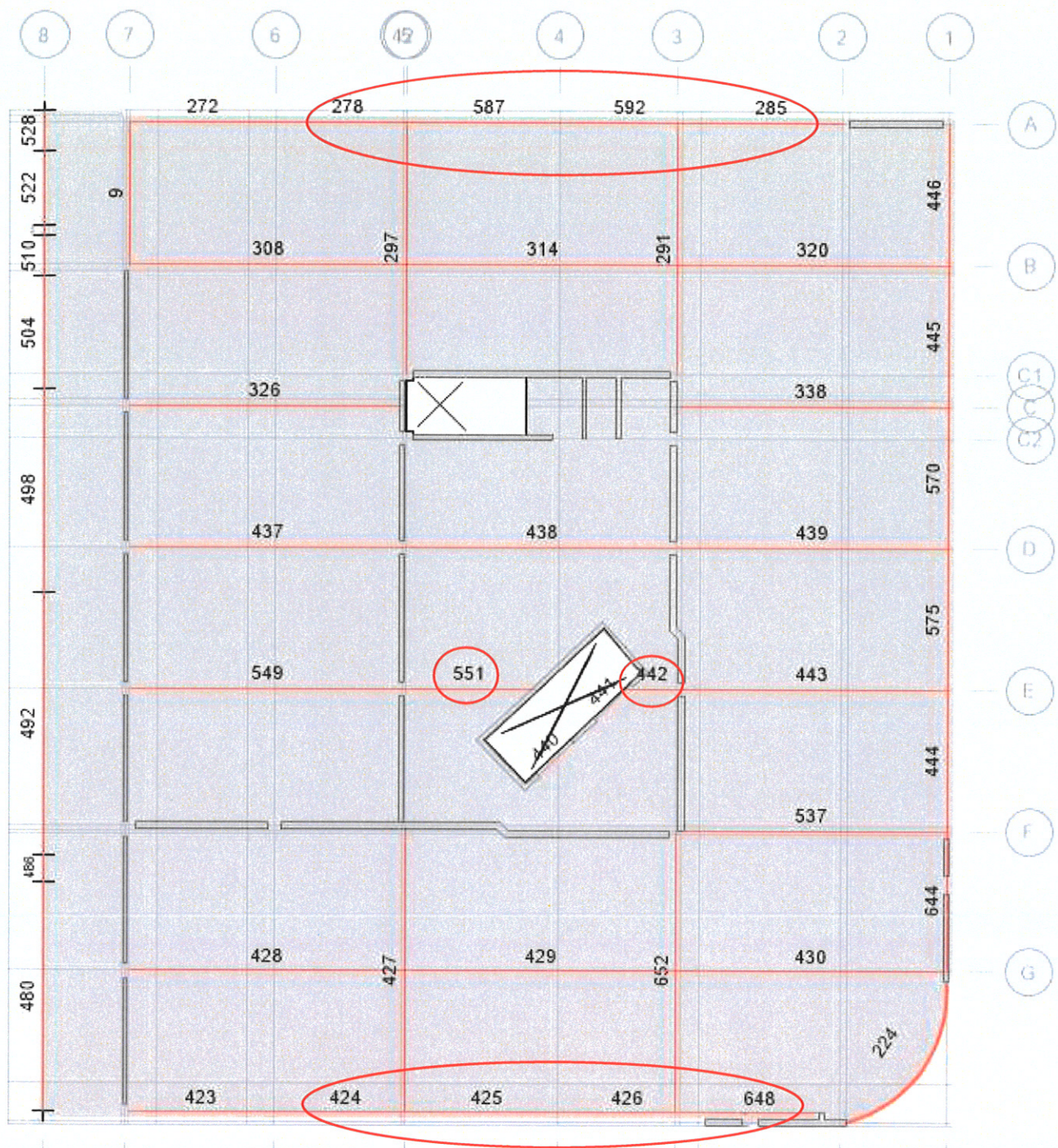
**Third Floor - Beams - Labels  
for Output Files Reference**





Fourth Floor - Beams - Shear



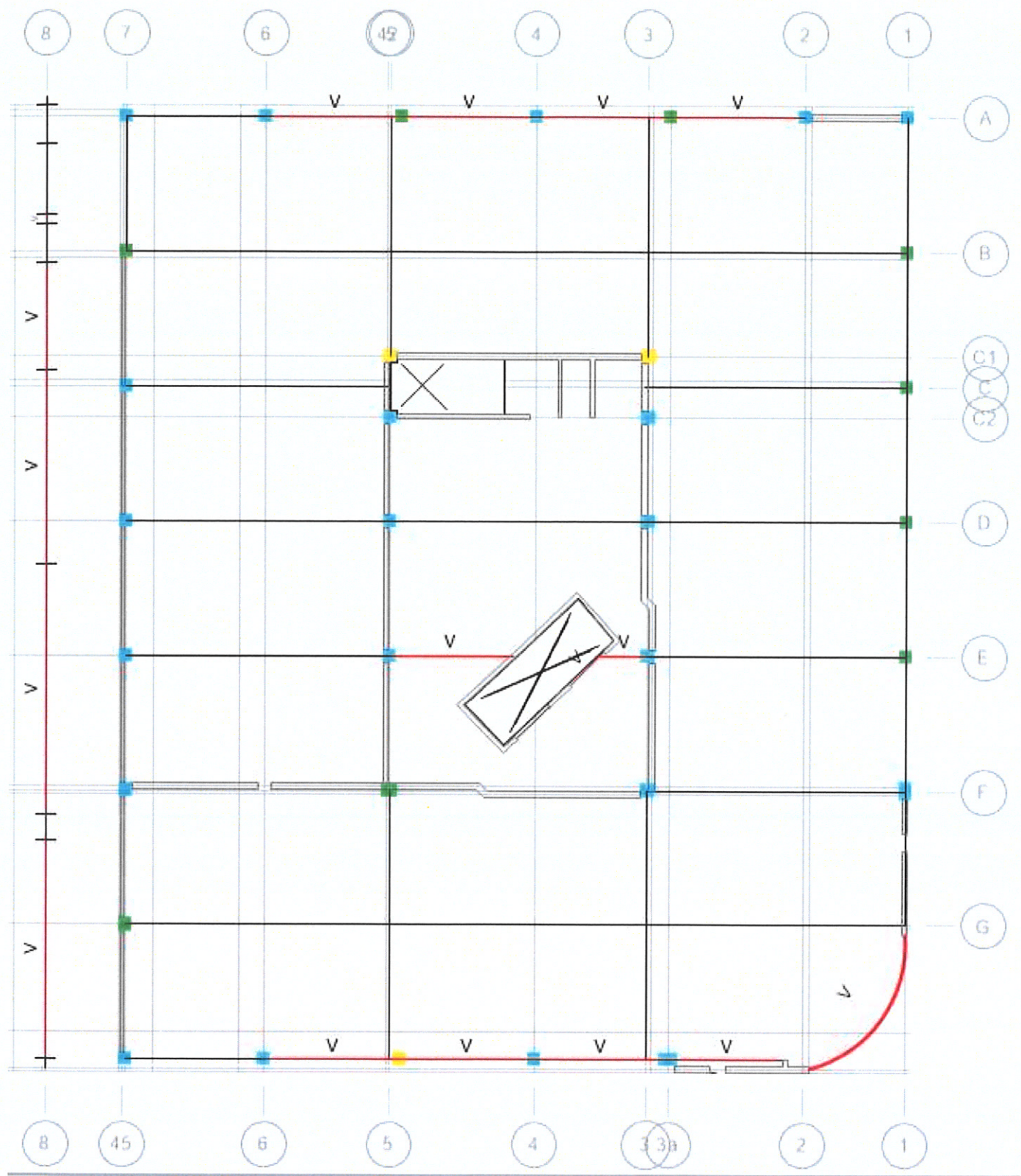


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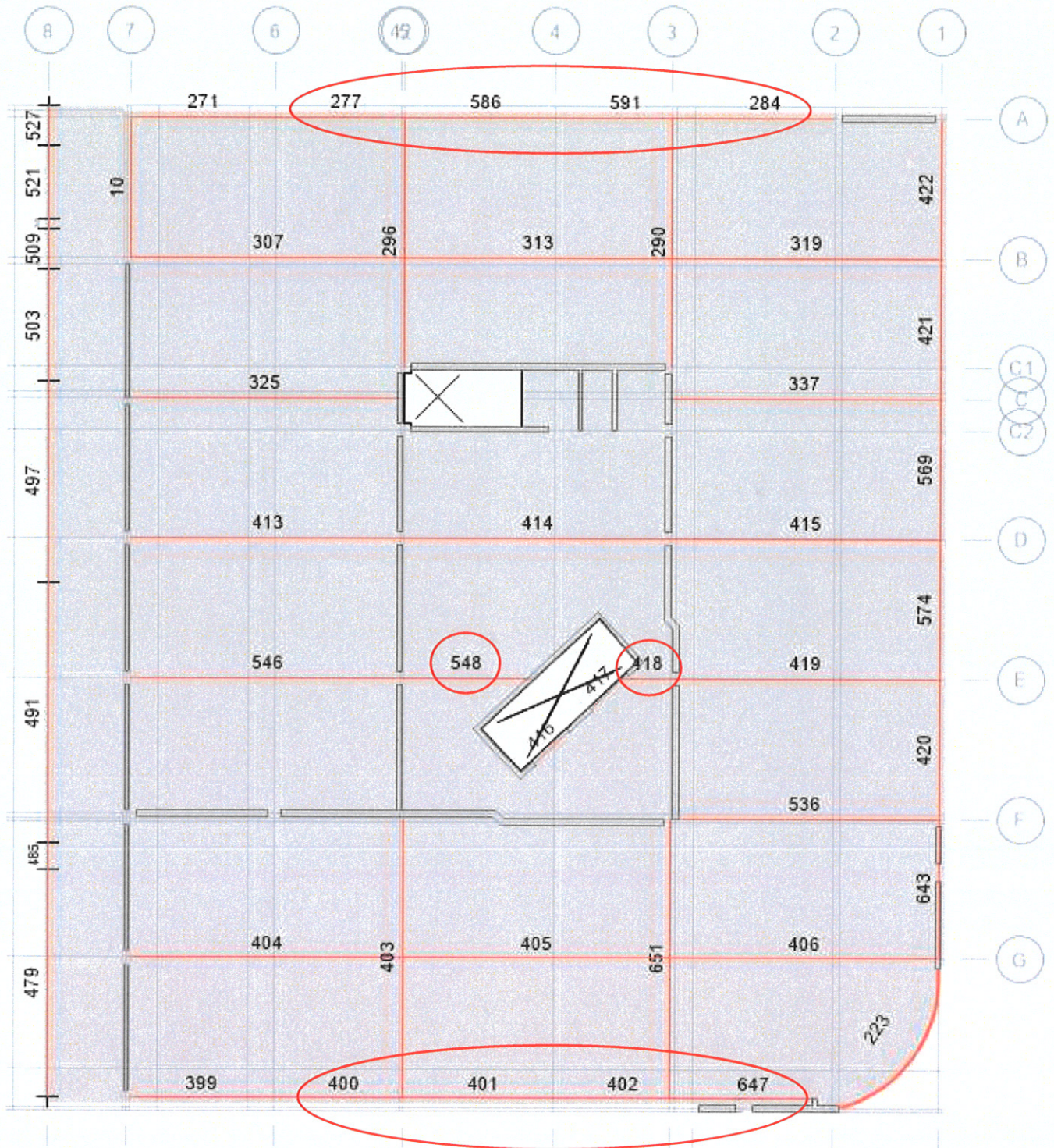
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for Output Files Reference**





Fifth Floor - Beams - Shear



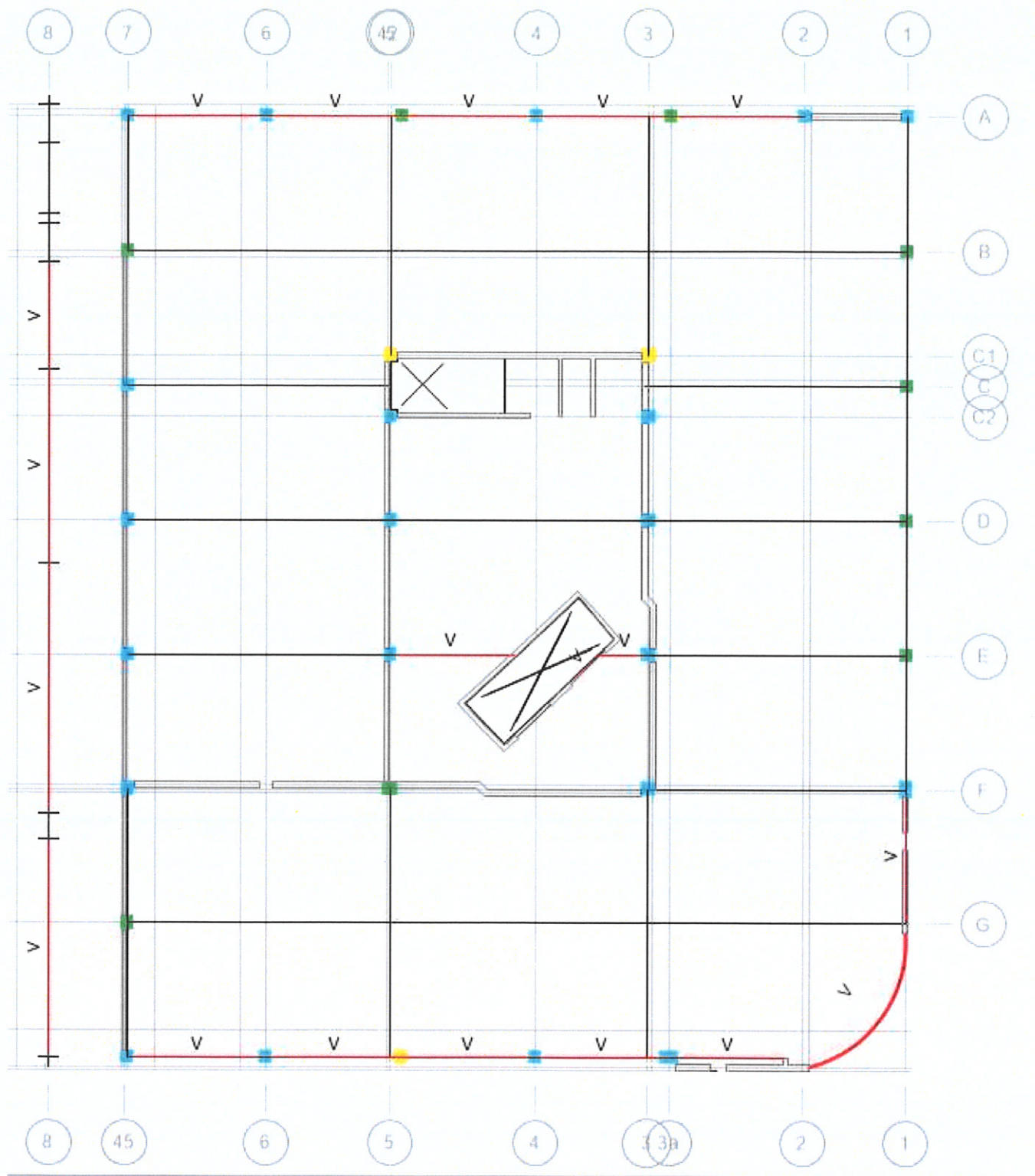


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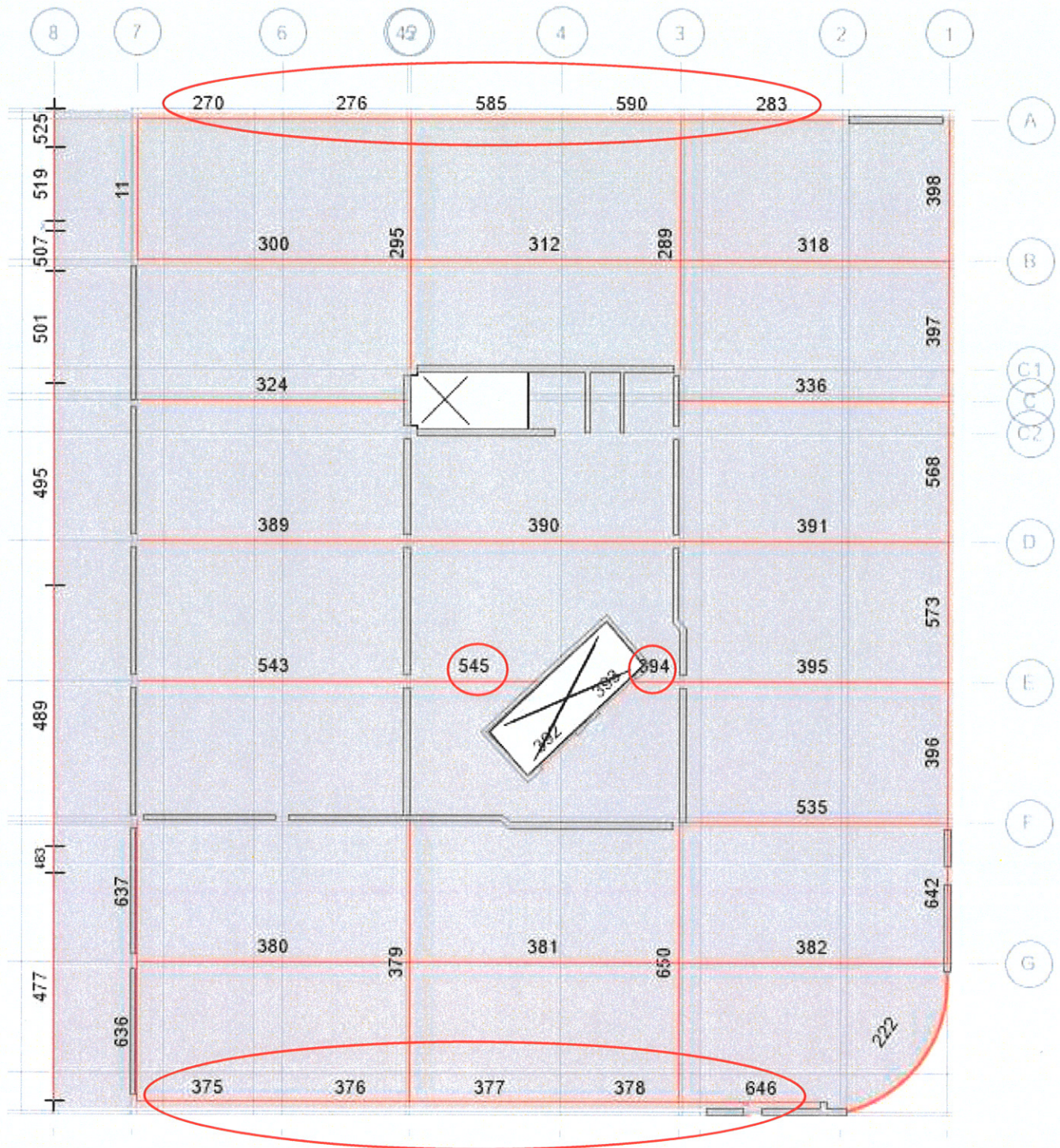
**Fifth Floor - Beams - Labels  
for Output Files Reference**





Sixth Floor - Beams - Shear



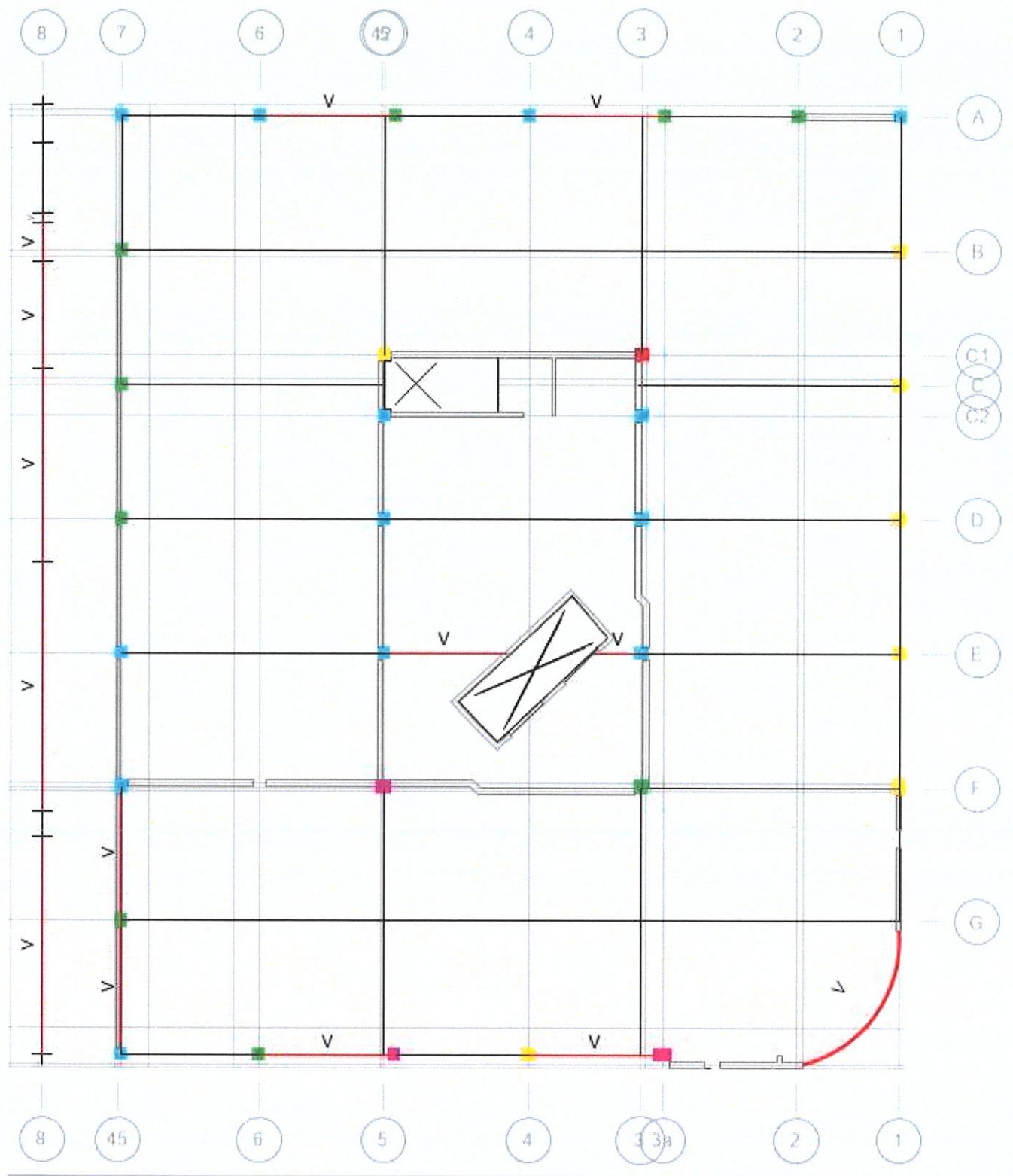


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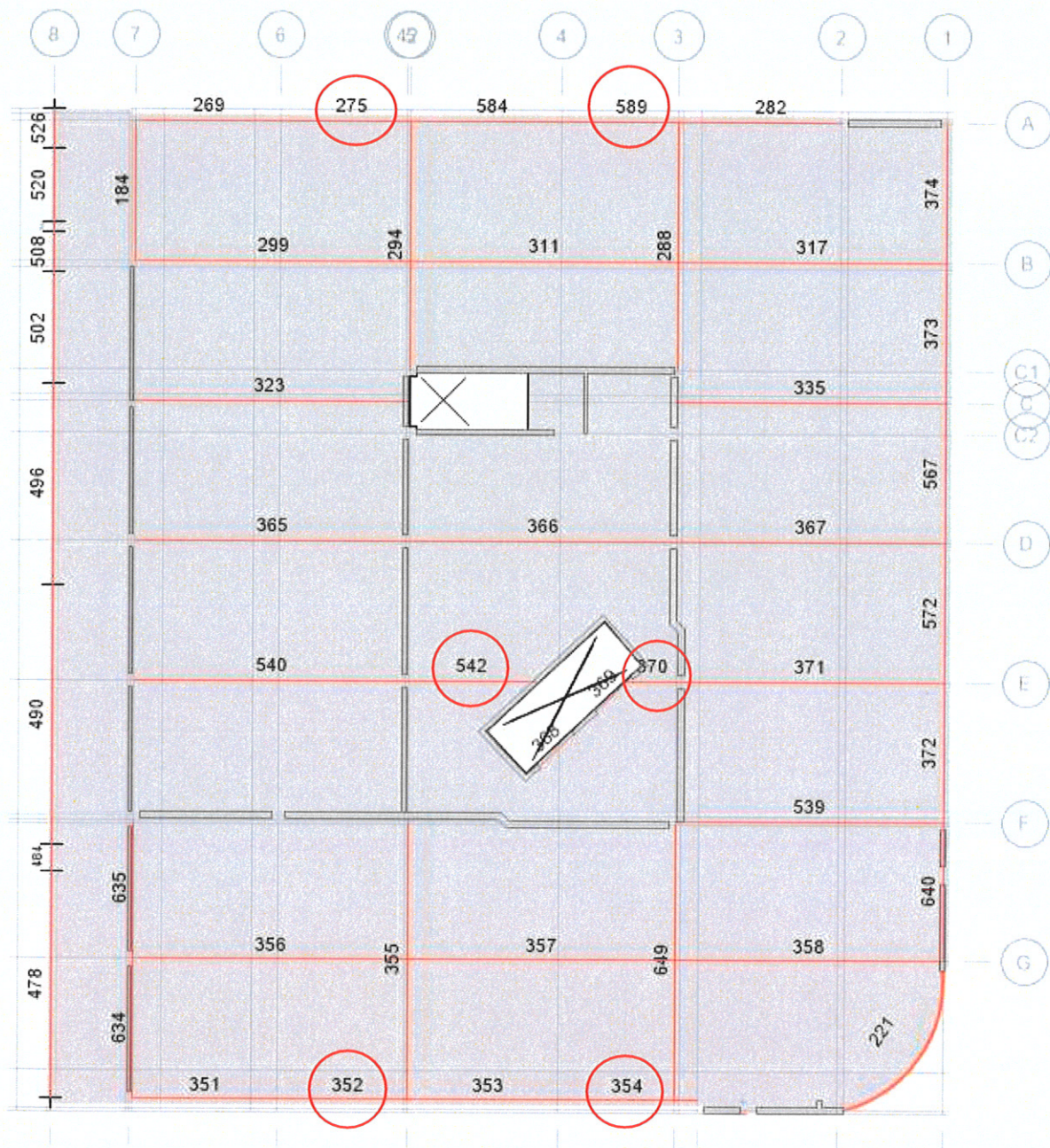
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for Output Files Reference**





**Roof Level - Beams - Shear**





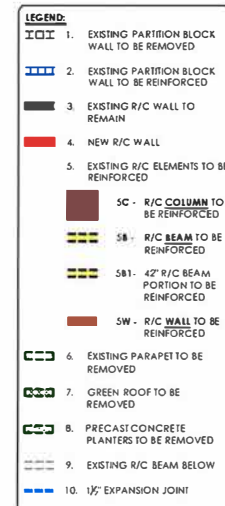
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275, 352, 354, 370, 542, 589

**Roof Level - Beams - Labels  
for Output Files Reference**



**APPENDIX E**  
**Structural Rehabilitation Drawings**

[illegible]

#### APPROVALS

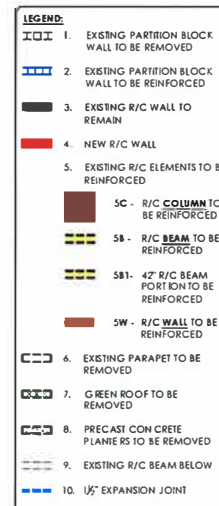
Drawing Title  
**EXISTING  
GROUND  
LEVEL  
FLOOR PLAN**

Grade	Library Number
AS NOTED	S.I
Date	Class Number

DESIGNED BY: QJQ/MS/CF/RF  
 DRAWN BY: [redacted] DATE: 08/01/2022  
 CHECKED BY: [redacted]  
 APPROVED BY: AG SHOWN  
 DATE: AUGUST, 2022

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REVISIONS		
NO.	Date	Remarks

APPROVALS

Drawing Title  
**EXISTING  
SECOND  
LEVEL  
FLOOR PLAN**  
Scale

**EXISTING:**  
**BEAR: 300 FT**

[illegible]DESIGNED BY  
BY NED WOODS

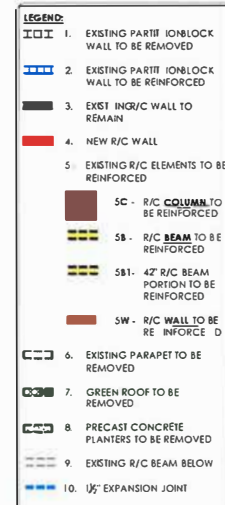
DATE **AUGUST, 2022**

787-644 6131

P.R. 00938 -4129

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Section	Drawing Number
AS NOTED	S2
Date	Page Number

[illegible]

### APPROVALS

Drawing Title  
**EXISTING  
THIRD  
LEVEL  
FLOOR PLAN**

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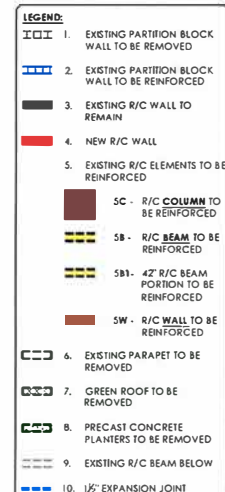
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DESIGNED BY: DAVID M. DE  
DESIGN REVIEWED BY: \_\_\_\_\_  
DRAWN BY: \_\_\_\_\_ DATE REVISION: \_\_\_\_\_  
SCALE: AS SHOWN  
DATE: AUGUST, 2022

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Grade	Reading Number
AS NOTED	93
Date	Page Number





REVISIONS		
NO.	Date	Remarks

APPROVALS

Drawing Title  
**EXISTING  
TYPICAL  
FLOOR PLAN  
(4TH - 6TH)**  
Seal

Search

AS NOTED	Drilling Number
	<b>5.4</b>
Unit	Fracture

SCALE, 9/10 - 1-0

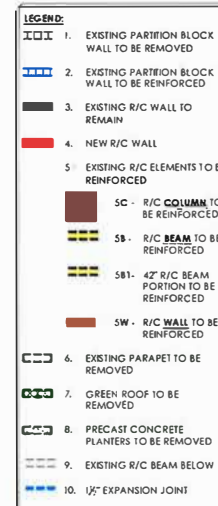
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DESIGNED BY:	DJQ,MSCE,PE	
DESIGN REVISD BY:		
DRAWN BY:		DNB, PE/MSCE
SCALE:	AS SHOWN	
DATE:	AUGUST, 2022	

C.P.O. BOX 364129

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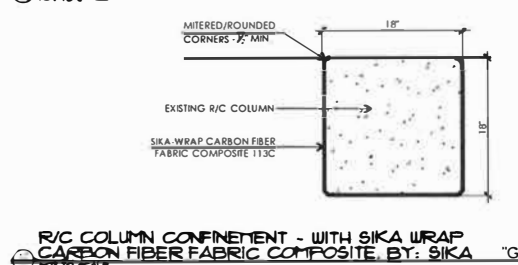
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AUGUST

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Symbol	Drawing Number
AS NOTED	<b>9.1</b>
Date	Page Number

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AS NOTED	92
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## **APPENDIX F**

### **Repair Procedures and Strengthening Details**

### **Repair Products Technical Information Data**

**PROCEDURE FOR THE REPAIR OF FISSURES LOCATED IN THE EXISTING  
REINFORCED CONCRETE BEAMS AND COLUMNS AT THE OFFICE BUILDING  
STRUCTURE**

1. Surfaces shall be clean, dry, sound and free of surface contaminants by removing all dirt and debris, grease, oil, curing compounds.
2. Identify and document all the fissures and existing joints in the existing floor slabs.
3. Preparation and sealing of all the fissures and existing construction joints in the floor slab with **Sikaflex 2 CNS** and **Sikaflex 1A**, elastomeric polyurethane sealants, strictly following product specifications. Some construction joints are to be re cut to produce smooth, stable edges and joint filler must be flush to create a smooth transition for wheeled traffic. Cracks and Joints over 1/16 inch up to 1/2 inch maximum: Rout and seal with Sikaflex 2C or 1A sealant. Joints over 1 inch to be treated as expansion joints must be sealed with Sikaflex Pro 3 or Sikaflex.

**Very important note: The contractor must always read and follow the warnings and instructions on the product's most current Technical Data Sheet, product labels and Material Safety Data Sheets prior to product use.**

**PROCEDURE FOR PRESURE INJECTION OF FISSURES IN CONCRETE SLABS  
AND REINFORCED CONCRETE BEAMS**

1. Substrate must be clean, sound and free of surface moisture. Remove dust, laitance, grease, oils, curing compounds, waxes, impregnations, foreign particles, coatings and disintegrated materials by mechanical means like shot blasting or sandblasting. Substrate should be dry. Surfaces prepared by low pressure water cleaning or high pressure water jetting methods should be allowed to dry for 24 hrs. minimum.
2. Use automated injection equipment. Set appropriate injection ports. Seal ports and cracks with Sikadur® 31, Hi-Mod Gel, Sikadur Injection Gel or Sikadur AnchorFix. When the epoxy adhesive has cured, inject Sikadur 55 SLV with steady pressure. Mock ups to determine penetration on job site conditions are strongly recommended. Actual penetration should be verified.



**PROCEDURE FOR THE REPAIR AND SEALING OF “ EXPANSION JOINT ” IN  
FLOOR SLAB ALONG AXIS 8 - 2<sup>ND</sup> LEVEL TO 5<sup>TH</sup> LEVEL**

1. Saw cut the damaged sides of the existing joint to make sure the joint is straight and not a feathered joint edge, do not more than 2” deep into existing slab thickness.
2. Remove any dirt or contaminants from the joint to have a clean and sound joint. Remove the old sealant, if any, using a scraping tool. Once finished, sweep the area to remove any leftover dirt or dust which can be bond breakers and used a vacuum to ensure no dirt particles or debris are present in the joint. A clean joint is essential for a proper repair.
3. Apply **Sikaquick 1000** repair mortar to fill in the removed concrete material strictly following manufacturers technical specifications.
4. After the repair mortar has set on the sides of the joint, and once the joint is cleaned and free of any debris or dirt particles, you can begin to fill the joint. Insert a backer rod and fill with **Sikaflex 2 C NS**. Backer rod prevents 3 sided adhesion of the sealant and will prolong the service life of the joint. The backer rod should be ¼” larger than the width of the joint. Dry tooling is recommended so no contaminants are introduced to the surface of the sealant.

**PROCEDURE FOR THE STRENGTHENING OF STRUCTURAL MEMBERS USING**  
**CARBON FIBRE FABRIC SIKA WRAP HEX - 113 C AND SIKA CARBODUR**  
**CARBON FIBER LAMINATE**

**1. Concrete Substrate preparation**

A. Remove deteriorated concrete, dust, laitance, grease, paint, curing compounds, waxes, impregnations, foreign particles, and other bond inhibiting materials from the surface by blast cleaning or equivalent mechanical means. All concrete surfaces shall be sound. All concrete surfaces shall be air blasted and vacuumed clean to a dust free condition.

B. External concrete corners shall be rounded to at least a 1/2" radius when perpendicular to fiber orientation and internal corners shall be smoothed by troweling epoxy mortar into the corners. Any sharp edges like form lines have to be grounded smooth and flush.

C. Concrete surface irregularities less than one inch shall be ground and smoothed and/or filled with an approved repair mortar. Surface irregularities greater than one inch shall be repaired using an approved cementitious repair mortar like SikaTop 123.

D. The concrete surface should be prepared to a minimum concrete surface profile, CSP 3 as defined by the ICRI.

**2. Fissures (if any)**

Repair any fissures using pressure injected resin.

**3. Apply epoxy adhesive primer Sikadur 330, strictly accordance with Manufacturer's recommendations.**

A. Primer may be applied with a brush or roller. Apply second coat as necessary after first coat has penetrated into concrete.

B. Primer must be covered with fiber within 24 hours of application, depending on temperature conditions. If a 24-hour window is exceeded, the primed surfaces must be solvent wiped with a fast flashing solvent or roughened with sandpaper.

**4. Apply FRP Reinforcement in strictly accordance with Manufacturer' Recommendations.**



Protect finished installation of FRP Reinforcement from rain, sand, dust, etc. using protective sheeting or other barriers. Do not allow protective sheeting to come in contact with finished application.

- A. Curing of finished application shall be a minimum of 24 hours and in order to achieve full strength curing shall be extended for a period of two weeks at an average ambient temperature of 68°F. Upon completion of the curing process, the installed system shall be checked for areas where saturant has not penetrated or where saturant has not completely cured. Such areas shall be epoxy injected to re-establish bond subject to the approval of the Project Engineer.
- B. Repair procedures shall be performed in accordance with guidelines established by **ACI 440.2R-08** and approved by the Project Engineer. All repairs shall be subject to the same application, curing and quality control specifications as the original work.

#### **5. Apply protective coating like Sikagard 550 W**

#### **FOR INSTALATION OF SIKA CARBODUR CARBON FIBER LAMINATES:**

##### **Follow steps 1 and 2 above**

**3.** Immediately prior to installation, Sika CarboDur laminates surfaces should be wiped with Sika Colma Cleaner or an Isopropanol based cleaner, to remove any possible contaminants. The plates may only be installed if the surface is completely dry before applying the adhesive.

**4.** Apply the neat mixed **Sikadur 30** epoxy paste adhesive onto the concrete with a trowel or spatula to a nominal thickness of 1/16" (1.5 mm). Apply the mixed Sikadur 30 onto the Sika CarboDur laminate/plate with a "roof-shaped" spatula to a nominal thickness of 1/16" (1.5 mm).

**5.** Within the open time of the epoxy, place the **Sika CarboDur** laminate onto the concrete surface. Using a hard rubber roller, press the laminate into the epoxy resin until the adhesive is forced out on both sides. Remove excess adhesive. Glue line should not exceed 1/8 inch. The external reinforcement must not be disturbed for a minimum of 24 hours. The epoxy will reach its design strength after 7 days.

**Very important Note: Survey must be performed to verify reinforcing steel diameters and spacing for several structural members before any strengthening is executed. Several portions of reinforced concrete beams at the third level will be tested with Hilti concrete scanner GPR and corroborated with the values obtained from the study already performed in the second level. After all data and information is recollected and submitted then we will proceed to determine the amount of layers required if needed.**

**Contractor must comply with the following reference standards:**

- ACI 440.2R-08, Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures
- ACI 440R-07, Report on Fiber-Reinforced Polymer (FRP) Reinforcement for Concrete Structures
- ACI 440 R-96, State-of-the-Art Report on Fiber Reinforced Plastic (FRP) Reinforcement for Concrete Structures.
- ACI 503 R, Pull-off test to determine FRP adhesion to concrete substrate.
- ACI 562, Code Requirements for Assessment, Repair and Rehabilitation of Existing Concrete Structures.
- ICRI Guideline No. 03742, Guide for the Selection of Strengthening Systems for Concrete Structures
- ICRI Guideline No. 03739, Guide to Using In-Situ Tensile Pull-Off Tests to Evaluate Bond of Concrete Surface Materials



### I. Required Vertical Reinforcement for Existing Reinforced Concrete Shear Walls

Shear Wall	Total Vertical Reinforcement Required	Length of Reinforcement	Levels Required	Additional Strengthening Requirements
Shear Wall 5- Stairs Core	4.0 in <sup>2</sup>	Reinforce across SW length 5'-8"	G. Level - Roof Level	Provide 1 layer Sikawrap 117 C or 113 C
Shear Wall 5	1.0 in <sup>2</sup>	At each end through 3'-0" length	G. Level - 2 <sup>nd</sup> Level	Provide 1 layer Sikawrap 117 C or 113 C
Shear Wall C	1.0 in <sup>2</sup>	At each end through 3'-0" length	G. Level - 3 <sup>rd</sup> Level	Provide 1 layer Sikawrap 117 C or 113 C
Shear Wall 3	4.0 in <sup>2</sup> 1.0 in <sup>2</sup>	At each end through 11'-0" At each end through 3'-0"	G. Level - 2 <sup>nd</sup> Level 2 <sup>nd</sup> to 4 <sup>th</sup>	Provide 1 layer Sikawrap 117 C or 113 C
Shear Wall 3A	4.0 in <sup>2</sup>	Reinforce across SW length 5'-8"	G. Level - Roof Level	Provide 1 layer Sikawrap 117 C or 113 C
Shear Wall F	9.25 in <sup>2</sup> From Axis 6 to Axis 4' 6.5 in <sup>2</sup> From Axis 5 to Axis 4 2.5 in <sup>2</sup> From Axis 4' to Axis 3 1.5 in <sup>2</sup> From Axis 5 to Axis 4	Between two ends, each 4.5 in <sup>2</sup> Between two ends, each 3.25 in <sup>2</sup> Between two ends, each 1.25 in <sup>2</sup> Between two ends, each 0.75 in <sup>2</sup>	G. Level - 2 <sup>th</sup> Level 2 <sup>nd</sup> Level - 3 <sup>rd</sup> Level 2 <sup>nd</sup> Level - 3 <sup>rd</sup> Level 3 <sup>rd</sup> Level - 4 <sup>th</sup> level	Provide 1 layer Sikawrap 117 C or 113 C
Shear Wall 7	2.0 in <sup>2</sup>	At each end, through 3'-0" length	G. Level - 2 <sup>nd</sup> Level	Provide 1 layer Sikawrap 117 C or 113 C
Shear Wall 7 C	5.5 in <sup>2</sup>	Reinforce across SW length approx. 4'-0" (not including R/C column)	G. Level - 2 <sup>nd</sup> Level	Provide 1 layer Sikawrap 117 C or 113 C
Shear Wall I	6.5 in <sup>2</sup> 2.5 in <sup>2</sup>	Reinforce across SW length At each end, through 3'-0" length	G. Level - 2 <sup>nd</sup> Level 2 <sup>nd</sup> Level - 4 <sup>th</sup> Level	Provide 1 layer Sikawrap 117 C or 113 C
Shear Wall H	1.0 in <sup>2</sup>	At each end through 3'-0" length	G. Level - 2 <sup>nd</sup> Level	Provide 1 layer Sikawrap 117 C or 113 C

The equivalent Sika Carbodur carbon fiber reinforced polymer laminates/plates must be installed in each Shear Wall/Spandrel Beam to provide the required area of vertical reinforcement or longitudinal reinforcement as indicated in the table above and below. Contractor must submit shop drawings to be approved by structural engineer before any installation is begun.

### II. Required Longitudinal and Shear Reinforcement for Existing Reinforced Concrete Spandrel Beams

Spandrel Beam	Total Longitudinal Reinforcement Required	Length of Reinforcement	Levels Required	Additional Strengthening Requirements
Along SW 5 3 Spandrel Beams	As top 1.5 in <sup>2</sup> As bott. 1.5 in <sup>2</sup>	Across length of member	2 <sup>nd</sup> level	Provide 1 layer Sikawrap 117 C or 113 C
Along SW 3	As top 1.5 in <sup>2</sup> As bott. 1.5 in <sup>2</sup>	Across length of member	2 <sup>nd</sup> level - 3 <sup>rd</sup> level	Provide 1 layer Sikawrap 117 C or 113 C
Along SW F - 2 Spandrel Beams 1- Between Axis 7 to 5	As top 2.0 in <sup>2</sup> As bott. 2.0 in <sup>2</sup>	Across length of member	2 <sup>nd</sup> level - Roof level	Provide 2 layers Sikawrap 117 C or 113 C
1- Between Axis 5 to 3	None	N/A	2 <sup>nd</sup> level - 3 <sup>rd</sup> level	Provide 1 layer Sikawrap 117 C or 113 C
Along Shear Wall C	As top 1.0 in <sup>2</sup>	Across length of member	2 <sup>nd</sup> level - Roof Level	Provide 1 layer Sikawrap 117 C or 113 C
Along Shear Wall 7 - Axis E & F	As top 0.75 in <sup>2</sup> As bott. 0.75 in <sup>2</sup>	Across length of member	2 <sup>nd</sup> level	Provide 1 layer Sikawrap 117 C or 113 C

### **III. Required Shear Reinforcement for Existing Reinforced Concrete Columns**

<b>Location Axis</b>	<b>Shear Reinforcement Required</b>	<b>Levels Required</b>	<b>Additional Strengthening Requirements</b>
A1 , A2 , A6, A7	2 layers Sikawrap 113 C or Sikawrap 117 C	G. Level to 3 <sup>rd</sup> Level	NONE
B1 , B7	2 layers Sikawrap 113 C or Sikawrap 117 C	G. Level to 3 <sup>rd</sup> Level	NONE
B'3' , B'5	2 layers Sikawrap 113 C or Sikawrap 117 C	G. Level to Roof Level	NONE
C7	1 layers Sikawrap 113 C or Sikawrap 117 C	G. Level to 2 <sup>nd</sup> Level	NONE
C3' , C'5	2 layers Sikawrap 113 C or Sikawrap 117 C	G. Level to Roof Level	NONE
E3	2 layers Sikawrap 113 C or Sikawrap 117 C	G. Level to 4 <sup>th</sup> Level	NONE
F2' , F'3, F3' , F5, F6	2 layers Sikawrap 113 C or Sikawrap 117 C	G. Level to 2 <sup>nd</sup> Level	NONE
F1	2 layers Sikawrap 113 C or Sikawrap 117 C	G. Level to 4 <sup>th</sup> Level	NONE
H3	2 layers Sikawrap 113 C or Sikawrap 117 C	G. Level to 4 <sup>th</sup> Level	NONE
H6, H7	2 layers Sikawrap 113 C or Sikawrap 117 C	G. Level to 3 <sup>rd</sup> Level	NONE



## PRODUCT DATA SHEET

# Sika® CarboDur® S

Carbon fiber laminate for structural strengthening

### PRODUCT DESCRIPTION

Sika® CarboDur® S is a pultruded carbon fiber reinforced polymer (CFRP) laminate designed for strengthening concrete, timber and masonry structures. Sika® CarboDur® S is bonded onto the structure as external reinforcement using Sikadur 30 epoxy resin as the adhesive.

### USES

Sika® CarboDur® S may only be used by experienced professionals.

#### Load increases

- Increased live loads in warehouses
- Increased traffic volumes on bridges
- Installation of heavy machinery in industrial buildings
- Vibrating structures
- Changes of building utilization

#### Damage to structural parts

- Aging of construction materials
- Steel reinforcement corrosion
- Vehicle impact
- Fire

#### Serviceability improvements

- Decrease in deformation
- Stress reduction in steel reinforcement
- Crack width reduction

#### Change in structural system

- Removal of walls or columns
- Removal of slab sections for openings

#### Design or construction defects

- Insufficient reinforcements
- Insufficient structural depth

### CHARACTERISTICS / ADVANTAGES

- Very high strength
- Lightweight
- Non-corrosive
- Unlimited lengths
- Minimal preparation of laminates
- Very easy to install, especially overhead
- High modulus of elasticity
- Outstanding fatigue resistance
- Alkali resistant
- Simple laminate intersections or crossings

### PRODUCT INFORMATION

<b>Packaging</b>	Available in any length up to 250 m (820 ft.). Type S 512 width 50 mm (approx. 2"). Type S 812 width 80 mm (approx. 3"). Type S 1012 width 100 mm (approx. 4").				
<b>Appearance / Color</b>	Black				
<b>Shelf Life</b>	Unlimited				
<b>Storage Conditions</b>	No exposure to direct sunlight.				
<b>Density</b>	0.058 lb./in <sup>3</sup> (1.60 g/cm <sup>3</sup> )				
<b>Dimensions</b>	<b>Type Sika® CarboDur® S</b>	<b>Width</b>	<b>Thickness</b>	<b>Cross section area</b>	<b>Tensile Strength</b>
	512	1.97 in. (50 mm)	0.047 in. (1.2 mm)	0.093 sq. in. (60 mm <sup>2</sup> )	37.8 x 10 <sup>3</sup> lbs. (168 kN)
	812	3.15 in. (80 mm)	0.047 in. (1.2 mm)	0.149 sq. in. (96 mm <sup>2</sup> )	60.4 x 10 <sup>3</sup> lbs. (269 kN)
	1012	3.94 in. (100 mm)	0.047 in. (1.2 mm)	0.186 sq. in. (120 mm <sup>2</sup> )	75.5 x 10 <sup>3</sup> lbs. (336 kN)
<b>Fiber Volume Content</b>	> 68 %				

## TECHNICAL INFORMATION

<b>Tensile Strength</b>	Mean Value	4.49 x 10 <sup>5</sup> psi (3,100 MPa)
	Design Value	4.06 x 10 <sup>5</sup> psi (2,800 MPa)
<b>Tensile Modulus</b>	Mean Value	23.9 x 10 <sup>6</sup> psi (165,000 MPa)
	Design Value	23.2 x 10 <sup>6</sup> psi (160,000 MPa)
<b>Tensile % Elongation</b>	Elongation at Break: 1.69 %	
<b>Thermal Resistance</b>	> 300 °F (> 150 °C)	
<b>Glass transition temperature</b>	>100 °C (EN 61006)	

## APPLICATION INFORMATION

<b>Coverage</b>	Coverage of Sikadur® 30 epoxy resin with CarboDur: Type S 512: approx. 50 LF/gallon. Type S 812: approx. 32 LF/gallon. Type S 1012: approx. 22 LF/gallon.
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## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## LIMITATIONS

Design calculations must be made and certified by an independent licensed professional engineer. Design guidelines are available from Sika Corporation.

## ENVIRONMENTAL, HEALTH AND SAFETY

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety Data Sheets containing physical, environmental, toxicological and other safety related data. User must read the current actual Safety Data Sheets before using any products. In case of an emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.

## APPLICATION INSTRUCTIONS

### SUBSTRATE PREPARATION

Surface must be clean and sound. It may be dry or damp, but free of standing water and frost. Remove dust, laitance, grease, curing compounds,



impregnations, waxes, foreign particles, disintegrated materials and other bond inhibiting materials from the surface. Existing uneven surfaces must be filled with an appropriate repair mortar (e.g. mixed Sikadur 30 epoxy with the addition of 1 part oven-dried sand). The adhesive strength of the concrete must be verified after surface preparation by random pull-off testing (ACI 503R) at the discretion of the engineer. Minimum tensile strength, 200 psi (1.4 MPa) with concrete substrate failure.

**Surface Levelness/Irregularities:** Maximum allowable deviation in 6 ft. shall be limited to 1/4" (6 mm) but no greater than 1/8" (3 mm) per foot. Any sharp edges (i.e. fins, form-marks, etc.) must be ground smooth and flush.

**Preparation Work: Concrete** - Blast clean, shotblast or use other approved mechanical means to provide an open roughened texture.

**CarboDur** - Wipe clean with appropriate cleaner (e.g. MEK).

#### **Cutting the CarboDur Laminate:**

**Preferred:** CarboDur laminates should be cut with tools using a "shearing" force (e.g. guillotine or heavy duty shears). Care must be taken to support both sides of the CarboDur laminate to avoid splintering.

**Alternate:** A hack saw or other abrasive cutting method may be used. However, extra care must be taken to support the CarboDur laminate on both sides to avoid splintering. In addition, extra care must be taken to avoid exposure to carbon dust.

#### **Mixing**

Consult Sikadur 30 technical data sheet for information on epoxy resin.

#### **APPLICATION METHOD / TOOLS**

Apply the neat mixed Sikadur 30 epoxy onto the concrete with a trowel or spatula to a nominal thickness of 1/16" (1.5 mm). Apply the mixed Sikadur 30 epoxy onto the CarboDur laminate with a "roofshaped" spatula to a nominal thickness of 1/16" (1.5 mm). Within the open time of the epoxy, depending on the temperature, place the CarboDur laminate onto the concrete surface. Using a hard rubber roller, press the laminate into the epoxy resin until the adhesive is forced out on both sides. Remove excess adhesive. Glue line should not exceed 1/8 inch (3 mm). The external reinforcement must not be disturbed for a minimum of 24 hours. The epoxy will reach its design strength after 7 days.

#### **OTHER RESTRICTIONS**

See Legal Disclaimer.

## LEGAL DISCLAIMER

- KEEP CONTAINER TIGHTLY CLOSED
- KEEP OUT OF REACH OF CHILDREN
- NOT FOR INTERNAL CONSUMPTION
- FOR INDUSTRIAL USE ONLY
- FOR PROFESSIONAL USE ONLY





# PRODUCT DATA SHEET

## Sika® Colma Cleaner

### SOLVENT-BASED CLEANING AGENT FOR SUBSTRATES AND TOOLS

#### DESCRIPTION

Sika® Colma Cleaner is a grease-free, solvent-based cleaning agent.  
Suitable for use in hot and tropical climatic conditions.

#### USES

Sika® Colma Cleaner is designed for cleaning surfaces prior to bonding and for cleaning of tools and equipment such as light metals and alloys, steel and stainless steel.

#### CHARACTERISTICS / ADVANTAGES

- Easy to use
- Very powerful, fast cleaning

#### PRODUCT INFORMATION

Composition	1-component, solvent-based cleaner	
Packaging	20 L pail 200 L drum	
Colour	Transparent	
Shelf life	Sika® Colma Cleaner has a shelf life of 24 months from the date of production, if it is stored in undamaged, original, sealed packaging, and if the storage conditions are met.	
Storage conditions	Sika® Colma Cleaner shall be stored in dry conditions, where it is protected from direct sunlight and at temperatures between +5 °C and +25 °C.	
Density	~0.85 kg/l	(ISO 1128-1)
Flash Point	~14 °C	(ISO 13736)
Viscosity	~1 mPa*s	(ISO 3219)

## APPLICATION INFORMATION

<b>Consumption</b>	~50 mL/m <sup>2</sup>
<b>Ambient Air Temperature</b>	+5 °C min. / +40 °C max.
<b>Substrate Temperature</b>	+5 °C min. / +40 °C max.
<b>Flash-off time</b>	Min. 15 min Max. 8 h

## APPLICATION INSTRUCTIONS

### APPLICATION METHOD / TOOLS

Soak a clean rag or lint-free paper towel in Sika® Colma Cleaner and clean the bonding areas to remove surface contamination. Tightly reseal the container immediately after each use. After a flash-off time of 15 minutes apply the appropriate Primer or Aktivator and respect relevant flash-off times again.

## FURTHER INFORMATION

- Safety Data Sheet
- Pre-treatment Chart Sealing and Bonding

## IMPORTANT CONSIDERATIONS

Sika® Colma Cleaner shall not be used on porous substrates.

## BASIS OF PRODUCT DATA

All technical data stated in this Data Sheet are based on laboratory tests. Actual measured data may vary due to circumstances beyond our control.

## LOCAL RESTRICTIONS

Note that as a result of specific local regulations the declared data and recommended uses for this product may vary from country to country. Consult the local Product Data Sheet for the exact product data and uses.

## ECOLOGY, HEALTH AND SAFETY

For information and advice on the safe handling, storage and disposal of chemical products, users shall refer to the most recent Safety Data Sheet (SDS) containing physical, ecological, toxicological and other safety-related data.

## LEGAL NOTES

The information, and, in particular, the recommendations relating to the application and end-use of Sika products, are given in good faith based on Sika's current knowledge and experience of the products when properly stored, handled and applied under normal conditions in accordance with Sika's recommendations. In practice, the differences in materials, substrates and actual site conditions are such that no warranty in respect of merchantability or of fitness for a particular purpose, nor any liability arising out of any legal relationship whatsoever, can be inferred either from this information, or from any written recommendations, or from any other advice offered. The user of the product must test the product's suitability for the intended application and purpose. Sika reserves the right to change the properties of its products. The proprietary rights of third parties must be observed. All orders are accepted subject to our current terms of sale and delivery. Users must always refer to the most recent issue of the local Product Data Sheet for the product concerned, copies of which will be supplied on request.





## PRODUCT DATA SHEET

# Sikadur®-30

High-modulus, high-strength, structural epoxy paste adhesive for use with Sika® CarboDur® reinforcement.

### PRODUCT DESCRIPTION

Sikadur®-30 is a 2-component, 100% solids, moisture-tolerant, high-modulus, high-strength, structural epoxy paste adhesive. It conforms to the current ASTM C-881 Type I, IV Grade 3, Class C and AASHTO M-235 specifications.

### USES

Sikadur®-30 may only be used by experienced professionals.

- Adhesive for bonding external reinforcement to concrete, masonry, steel, wood, stone, etc.
- Structural bonding of composite laminates (Sika® CarboDur® CFRP) to concrete.
- Structural bonding of steel plates to concrete.
- Suitable for use in vertical and overhead configurations.
- As a binder for epoxy mortar repairs.

### CHARACTERISTICS / ADVANTAGES

- Long pot life.
- Long open time.
- Tolerant of moisture before, during and after cure.
- High strength, high modulus, structural paste adhesive.
- Excellent adhesion to concrete, masonry, metals, wood and most structural materials.
- Fully compatible and excellent adhesion to Sika® CarboDur® CFRP composite laminate.
- Paste consistency ideal for vertical and overhead applications of Sika® CarboDur®.
- High abrasion and shock resistance.
- Convenient easy mix ratio A:B=3:1 by volume.
- Solvent-free.
- Color-coded components to ensure proper mixing control.

### PRODUCT INFORMATION

Chemical Base	Epoxy resin
Packaging	1 gal. units.
Color	Light gray
Shelf Life	2 years in original, unopened containers.
Storage Conditions	Store dry at 40°-95°F (4°-35°C). Condition material to 65°-85°F (18°- 29°C) before using.
Consistency	Non-sag paste.

## TECHNICAL INFORMATION

<b>Compressive Strength</b>	Bond Strength: Hardened Concrete to Hardened Concrete		
	<b>2 day (moist cure)</b>	<b>2,700 psi (18.6 MPa)</b>	(ASTM C-882)
	<b>2 day (dry cure)</b>	<b>3,200 psi (22.0 MPa)</b>	
	<b>14 day (moist cure)</b>	<b>3,100 psi (21.3 MPa)</b>	
	Bond Strength: Hardened Concrete to Steel		
	2 day (moist cure)	2,600 psi (17.9 MPa)	(ASTM C-882)
	2 day (dry cure)	3,000 psi (20.6 MPa)	
	14 day (moist cure)	2,600 psi (17.9 MPa)	
<b>Compressive Properties (ASTM D-695) - Compressive Strength, psi (MPa)</b>			
	<b>40°F* (4°C)</b>	<b>73°F* (23°C)</b>	<b>90°F* (32°C)</b>
4 hour	-	-	5,500 (37.9)
8 hour	-	3,500 (24.1)	6,700 (46.2)
16 hour	-	6,700 (46.2)	7,400 (51.0)
1 day	750 (5.1)	7,800 (53.7)	7,800 (53.7)
3 day	6,800 (46.8)	8,300 (57.2)	8,300 (57.2)
7 day	8,000 (55.1)	8,600 (59.3)	8,600 (59.3)
14 day	8,500 (58.6)	8,600 (59.3)	8,900 (61.3)
28 day	8,500 (58.6)	8,600 (59.3)	9,000 (62.0)
<b>Modulus of Elasticity in Compression</b>	7 day	3.9 x 10 <sup>5</sup> psi (2,689 MPa)	
<b>Flexural Strength</b>	14 day	6,800 psi (46.8 MPa)	(ASTM D-790)
<b>Modulus of Elasticity in Flexure</b>	14 day	1.7 X 10 <sup>6</sup> psi (11,721 MPa)	(ASTM D-790)
<b>Tensile Strength</b>	7 day	3,600 psi (24.8 MPa)	(ASTM D-638)
<b>Tensile Modulus of Elasticity</b>	7 day	6.5 X 10 <sup>5</sup> psi (4,482 MPa)	(ASTM D-638)
<b>Elongation at Break</b>	7 day	1%	(ASTM D-638)
<b>Shear Strength</b>	14 day	3,600 psi (24.8 MPa)	(ASTM D-732)
<b>Heat Deflection Temperature</b>	7 day	[fiber stress loading=264 psi (1.8 MPa)]	118°F (47°C) (ASTM D-648)

## APPLICATION INFORMATION

<b>Mixing Ratio</b>	Component 'A': Component 'B' = 3:1 by volume.		
<b>Coverage</b>	Type S 512 CarboDur®: approx. 50 LF/gal.; Type S 812 CarboDur: approx. 32 LF/gal.; Type S 1012 CarboDur®: approx. 22 LF/gal.		
<b>Substrate Moisture Content</b>	7 day (24 hour immersion)	0.0-3%	(ASTM D-570)
<b>Pot Life</b>	Approximately 70 minutes @ 73°F (23°C) (1 qt.)		



## APPLICATION INSTRUCTIONS

### SUBSTRATE PREPARATION

The concrete surface should be prepared to a minimum concrete surface profile (CSP) 3 defined by the ICRI surface-profile chips. Localized out-of-plane variations, including form lines, should not exceed 1/32 in. (1 mm). Surface must be clean and sound. It may be dry or damp, but free of standing water and frost. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles, disintegrated materials, and other bond inhibiting materials from the surface. Existing uneven surfaces must be filled with an appropriate repair mortar (e.g., Sikadur® 30 with the addition of 1 part oven-dried sand). The adhesive strength of the concrete must be verified after surface preparation by random pull-off testing (as defined by ACI 503R, ASTM C1583) at the discretion of the engineer. Minimum tensile strength, 200 psi (1.4 MPa) with concrete substrate failure.

**Concrete** - Blast clean, shot blast or use other approved mechanical means to provide an open roughened texture.

**Steel** - Should be cleaned and prepared thoroughly by blast cleaning to a white metal finish.

**CarboDur®** - Wipe clean with appropriate cleaner (e.g. MEK)

### MIXING

**Pre-mix each component.** Proportion 1 part Component 'B' to 3 parts Component 'A' by volume into a clean pail or appropriately sized mixing container. Mix thoroughly for 3 minutes with Sika paddle on low speed (400-600 rpm) drill until uniform in color. Mix only that quantity which can be used within its pot life.

**To prepare an epoxy mortar:** slowly add up to 1 part by loose volume of an oven-dried aggregate to 1 part of the mixed Sikadur® 30 and mix until uniform in consistency.

### APPLICATION METHOD / TOOLS

**For bonded, external reinforcement:** Apply the neat mixed Sikadur® 30 onto the concrete with a trowel or spatula to a nominal thickness of 1/16" (1.5 mm). Apply the mixed Sikadur® 30 onto the CarboDur® laminate with a "roof-shaped" spatula to a nominal thickness of 1/16" (1.5 mm). Within the open time of the epoxy, depending on the temperature, place the CarboDur® laminate onto the concrete surface. Using a hard rubber roller, press the laminate into the epoxy resin until the adhesive is forced out on both sides. Remove excess adhesive. Glue line should not exceed 1/8 inch (3 mm). The external reinforcement must not be disturbed for a minimum of 24 hours. The epoxy will reach its design strength after 7 days.

**For interior vertical and overhead patching:** Work the material into the prepared substrate, filling the cavity. Strike off level. Lifts should not exceed 1 inch (25 mm).

## LIMITATIONS

- Minimum substrate and ambient temperature is 40°F (4°C).
- Do not thin. Addition of solvents will prevent proper cure.
- Use oven-dried aggregate only.
- Maximum glue line of neat epoxy is 1/8 inch (3 mm).
- Maximum epoxy mortar thickness is 1 inch (25 mm) per lift.
- Minimum age of concrete must be 21-28 days, depending upon curing and drying conditions.
- Porous substrates must be tested for moisture vapor transmission prior to mortar applications.
- Not an aesthetic product. Color may alter due to variations in lighting and/or UV exposure.

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## OTHER RESTRICTIONS

See Legal Disclaimer.

## ENVIRONMENTAL, HEALTH AND SAFETY

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## LEGAL DISCLAIMER

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- KEEP OUT OF REACH OF CHILDREN
- NOT FOR INTERNAL CONSUMPTION
- FOR INDUSTRIAL USE ONLY
- FOR PROFESSIONAL USE ONLY

Prior to each use of any product of Sika Corporation, its subsidiaries or affiliates ("SIKA"), the user must always read and follow the warnings and instructions on the product's most current product label, Product Data Sheet and Safety Data Sheet which are available at [usa.sika.com](http://usa.sika.com) or by calling SIKA's Technical Service Department at 1-800-933-7452. Nothing contained in any SIKA literature or materials relieves the user of the obligation to read and follow the warnings and instructions for each SIKA product as set forth in the current product label, Product Data Sheet and Safety Data Sheet prior to use of the SIKA product.





## PRODUCT DATA SHEET

# Sikadur®-300

High-modulus, high-strength, impregnating resin

### PRODUCT DESCRIPTION

Sikadur®-300 is a two-component 100% solids, moisture-tolerant, high strength, high modulus epoxy.

### USES

Sikadur®-300 may only be used by experienced professionals.

- For use as an impregnating resin with SikaWrap® Structural Strengthening System.
- Sikadur® 300 is used as a seal coat and impregnating resin for horizontal and vertical applications.

### CHARACTERISTICS / ADVANTAGES

- Long pot life.
- Long open time.
- Easy to mix.
- Tolerant of moisture before, during and after cure.
- High strength, high modulus adhesive.
- Excellent adhesion to concrete, masonry metals, wood and most structural materials.
- Fully compatible and developed specifically for the SikaWrap® System.
- High temperature resistance.
- High abrasion and shock resistance.
- Solvent-free, VOC compliant.

### PRODUCT INFORMATION

<b>Packaging</b>	4 gallon units.
<b>Color</b>	Clear, amber.
<b>Shelf Life</b>	2 years in original, unopened container.
<b>Storage Conditions</b>	Store dry at 40°-95°F (4°-35°C). Condition material to 65°-75°F (18°-24°C) before using.
<b>Viscosity</b>	approx. 500 cps
<b>Reactivity:</b>	6-7 hours (time to reach 10,000 cps)
<b>Tack-Free (30 mils) ByK Drying Recorder</b>	14-16 hours

### TECHNICAL INFORMATION

<b>Flexural Strength</b>	11,500 psi (79 MPa)	(ASTM D-790) 14 day cure @73°F (23°C) 50% RH
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**Modulus of Elasticity in Flexure**

5 x 105 psi (3,450 MPa)

(ASTM D-790)  
14 day cure @73°F (23°C)  
50% RH**Tensile Strength**

8,000 psi (55 MPa)

(ASTM D-638)  
14 day cure @73°F (23°C)  
50% RH**Tensile Modulus of Elasticity**

2.5 x 105 psi (1,724 MPa)

(ASTM D-638)  
14 day cure @73°F (23°C)  
50% RH**Elongation at Break**

3%

(ASTM D-638)  
14 day cure @73°F (23°C)  
50% RH**Service Temperature**

-40°F to 140°F (-40°C to 60°C)

**APPLICATION INFORMATION****Mixing Ratio**

Mix entire unit, do not batch.

**Coverage**As a sealer: 100 ft.<sup>2</sup>/gal.  
As an impregnating resin:  
120 ft.<sup>2</sup>/gal. - 9 oz. per sq.yd. fabrics  
60 ft.<sup>2</sup>/gal. - 18 oz. per sq.yd. fabrics  
30 ft.<sup>2</sup>/gal. - 37 oz. per sq.yd. fabrics**APPLICATION INSTRUCTIONS****SUBSTRATE PREPARATION**

The concrete surface should be prepared to a minimum concrete surface profile (CSP) 3 as defined by the ICRI surface-profile chips. Localized out-of-plane variations, including form lines, should not exceed 1/32 in. (1 mm). Substrate must be clean, sound, and free of surface moisture. Remove dust, laitance, grease, oils, curing compounds, waxes, impregnations, foreign particles, coatings and disintegrated materials by mechanical means (i.e., sandblasting). For best results, substrate should be dry. However, a saturated surface dry condition is acceptable.

**MIXING**

Pre-mix each component. Mix entire unit, do not batch. Pour contents of part B to part A. Mix thoroughly for 5 minutes on low using a paddle style mixer on low speed (400-600 rpm) drill until uniformly blended.

**APPLICATION METHOD / TOOLS**

**As a sealer:** Apply mixed Sikadur® 300 epoxy to a properly prepared substrate using a brush, roller or airless sprayer. Sikadur® 300 should be applied at a sufficient rate to fully saturate the substrate without producing a surface film. Coverage rates are based on a substrate with normal porosity.

**As an impregnating resin:** As an impregnating resin for

vertical and horizontal applications, use Sikadur® 300. Resins may be applied to fabric by either manual or automatic means. For further information, consult installation guidelines.

**LIMITATIONS**

- Minimum substrate and ambient temperature 50°F (10°C).
- Do not thin with solvents.
- Material is a vapor barrier after cure.
- Minimum age of concrete must be 21-28 days depending on curing and drying conditions.
- Not an aesthetic product. Color may alter due to variations in lighting and/or UV exposure.

**BASIS OF PRODUCT DATA**

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

**OTHER RESTRICTIONS**

See Legal Disclaimer.

**ENVIRONMENTAL, HEALTH AND SAFETY**

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety



## LEGAL DISCLAIMER

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- KEEP OUT OF REACH OF CHILDREN
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## PRODUCT DATA SHEET

# Sikadur®-330

High-modulus, high-strength, impregnating resin

### PRODUCT DESCRIPTION

Sikadur®-330 is a two-component, solvent-free, moisture-tolerant, high strength, high modulus structural epoxy adhesive.

### USES

Sikadur®-330 may only be used by experienced professionals.

For use as an impregnating resin with the SikaWrap® Hex 106G, 113C, 117C, 230C and 430G Structural Strengthening Systems.

### CHARACTERISTICS / ADVANTAGES

- Long pot life.
- Long open time.
- Easy to mix.
- Tolerant of moisture before, during and after cure.
- High strength, high modulus adhesive.
- Excellent adhesion to concrete, masonry, metals, wood and most structural materials.
- Fully compatible and developed specifically for the SikaWrap® Systems.
- High temperature resistance.
- High abrasion and shock resistance.
- Solvent-free, VOC compliant.

### PRODUCT INFORMATION

<b>Packaging</b>	3.2 gal. (12 L) kit / (2) two 1.25 gal. (4.7 L) Component A pails, (2) two 0.35 gal. (1.3 L) Component B pails
<b>Color</b>	Light gray
<b>Shelf Life</b>	2 years in original, unopened container
<b>Storage Conditions</b>	Store dry at 40–95 °F (4–35 °C). Condition material to 65–75 °F (18–24 °C) before using.
<b>Consistency</b>	Non-sag paste



## TECHNICAL INFORMATION

Compressive Strength				(ASTM D-695) 50 % R.H.
		60 °F (16 °C)	73 °F (23 °C)	90 °F (32 °C)
	8 hour	-	-	8,000 psi (55.2 MPa)
	1 day	8,100 psi (55.8 MPa)	10,700 psi (73.7 MPa)	10,600 psi (73.1 MPa)
	3 day	11,200 psi (77.2 MPa)	11,100 psi (76.5 MPa)	11,000 psi (75.8 MPa)
	7 day	11,600 psi (80.0 MPa)	11,200 psi (77.2 MPa)	11,800 psi (81.3 MPa)
	14 day	12,400 psi (85.5 MPa)	11,800 psi (81.3 MPa)	11,900 psi (82.0 MPa)
Flexural Strength	8,800 psi (60.6 MPa) (7 days)			(ASTM D-790) 73 °F (23 °C) 50 % R.H.
Modulus of Elasticity in Flexure	5.06 x 105 psi (3,489 MPa) (7 days)			(ASTM D-790) 73 °F (23 °C) 50 % R.H.
Tensile Strength	4,900 psi (33.8 MPa) (7 days)			(ASTM D-638) 73 °F (23 °C) 50 % R.H.
Elongation at Break	1.2 % (7 days)			(ASTM D-638) 73 °F (23 °C) 50 % R.H.
Heat Deflection Temperature	120 °F (50 °C) (7 days)			(ASTM D-648) [fiber stress loading=264 psi (1.8 MPa)]

## APPLICATION INFORMATION

Mixing Ratio	Component 'A' : Component 'B' = 4 : 1 by weight
Coverage	First coat: 40-50 ft <sup>2</sup> /gal.; Additional coats: 100 ft <sup>2</sup> /gal.; Final coat: 160 ft <sup>2</sup> /gal.
Pot Life	57 minutes (325 ml)
Cure Time	Tack Free Time: 4–5 hours

## APPLICATION INSTRUCTIONS

### SUBSTRATE PREPARATION

The concrete surface should be prepared to a minimum concrete surface profile (CSP-3) as defined by the ICRI-surface-profile chips. Localized out-of-plane variations, including form lines, should not exceed 1/32 in. (1 mm). Substrate must be clean, sound, and free of surface moisture. Remove dust, laitance, grease, oils, curing compounds, waxes, impregnations, foreign particles, coatings and disintegrated materials by mechanical means (i.e. sandblasting). For best results, substrate should be dry. However, a saturated surface dry condition is acceptable.

### MIXING

Pre-mix each component. Mix entire unit, do not batch. Pour contents of part B to part A. Mix thoroughly for 5 minutes with a 1/2 inch "Jiffy" mixer mounted on a rotary drill and set at a slow speed (400–600 rpm) until uniformly blended. Mix only that quantity that can be used within its pot life.

### APPLICATION METHOD / TOOLS

**Dry Lay-Up:** When installing a SikaWrap® Hex fabric in the dry lay-up process apply the mixed Sikadur®-330 epoxy resin directly onto the substrate at a rate of 40–50 ft.<sup>2</sup>/gal. (0.95–1.18 m<sup>2</sup>/L). Coverage rate will depend on the actual surface profile. This equates to a

thickness of approximately 32–40 mils. Carefully place the fabric into the applied resin with gloved hands and smooth out. Work out any irregularities or air pockets with a plastic laminating roller. Let the resin squeeze out between the rovings of the fabric. If more than one layer of fabric is required, apply additional Sikadur®-330 at a rate of 100 ft<sup>2</sup>/gal. (2.37 m<sup>2</sup>/L) and repeat as described above. This equates to a thickness of approximately 16 mils. Add a final layer of Sikadur®-330 onto the exposed surface at a rate of 160 ft<sup>2</sup>/gal. (3.79 m<sup>2</sup>/L). This equates to a thickness of approximately 10 mils.

**Wet Lay-Up:** When installing a SikaWrap® Hex fabric vertically or overhead in the wet lay-up process, mixed Sikadur®-330 can be applied to the substrate as a primer/tack coat to prevent the impregnated fabric from sliding down the concrete. Due to its mixed viscosity, do not use Sikadur®-330 with an automatic fabric saturating device. Consult the SikaWrap® Hex fabric technical data sheet for information on saturating/impregnating fabric in a wet lay-up installation.

### CLEANING OF TOOLS

Clean all equipment immediately with Sika® Colma Cleaner. Cured material can only be removed mechanically.

### LIMITATIONS

- Minimum age of concrete is 21–28 days, depending on curing and drying conditions.
- All repairs required to achieve a level surface must be performed prior to application.
- Do not apply or cure Sikadur®-330 in direct sunlight.
- Minimum substrate temperature 40 °F (4 °C). Maximum application temperature 95 °C (35 °C)
- Do not thin with solvents.
- Material is a vapor barrier after cure.
- Do not encapsulate saturated concrete in areas of freezing and thawing.
- Color of Sikadur®-330 may alter due to variations in lighting and/or UV exposure.
- Due to its mixed viscosity, do not use Sikadur®-330 with an automatic saturating device. Fabric must be saturated/impregnated manually when the wet lay-up process is used.
- At low temperatures and/or high relative humidity, a slight oily residue (blush) may form on the surface of the cured epoxy. If an additional layer of fabric, or a coating is to be applied onto the cured epoxy. This residue must first be removed to ensure adequate

bond. The residue can be removed with either a solvent wipe (e.g. MEK) or with water and detergent. In both cases, the surface should be wiped dry prior to application of the next layer or coating.

- Not an aesthetic product. Color may alter due to variations in lighting and/or UV exposure.



## **BASIS OF PRODUCT DATA**

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## **OTHER RESTRICTIONS**

See Legal Disclaimer.

## **ENVIRONMENTAL, HEALTH AND SAFETY**

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## **LEGAL DISCLAIMER**

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## PRODUCT DATA SHEET

# Sikaflex®-2 C NS

Two-component, non-sag, polyurethane elastomeric sealant

### PRODUCT DESCRIPTION

Sikaflex®-2 C NS is a 2-component, premium-grade, polyurethane-based, elastomeric sealant. It is principally a chemical cure in a non-sag consistency. Meets ASTM C-920, Type M, Grade NS, Class 25, use T, NT, M, G, A, O, I and Federal Specification TT-S-00227E, Type II, Class A. Tested in accordance with ASTM C-1382 for use in EIFS systems.

### USES

- Intended for use in all properly designed working joints with a minimum depth of 1/4 inch.
- Ideal for vertical and horizontal applications.
- Placeable at temperatures as low as 40 °F.
- Adheres to most substrates commonly found in construction.
- An effective sealant for use in Exterior Insulation Finish Systems (EIFS).
- Submerged environments, such as canal and reservoir joints.

### PRODUCT INFORMATION

<b>Packaging</b>	1.5 gal. unit. 3 gal units.
<b>Color</b>	A wide range of architectural colors are available. Special colors available on request.
<b>Shelf Life</b>	One year in original, unopened containers.
<b>Storage Conditions</b>	Store dry at 40–95 °F (4–35 °C). <b>Condition material to 65–75 °F before using.</b>

### TECHNICAL INFORMATION

### CHARACTERISTICS / ADVANTAGES

- Capable of ±50 % joint movement.
- Chemical cure allows the sealant to be placed in joints exceeding 1/2 in. in depth.
- High elasticity with a tough, durable, flexible consistency.
- Exceptional cut and tear resistance.
- Exceptional adhesion to most substrates without priming.
- Available in 35 architectural colors.
- Color uniformity assured via Color-pak system.
- Available in pre-pigmented Limestone (no Color-pak needed).
- Non-sag even in wide joints.
- Easy to mix.
- Paintable with water-, oil-, and rubber-base paints.
- Jet fuel resistant.



<b>Shore Hardness</b>	25 ± 5	(73 °F (23 °C) and 50 % R.H.) (ASTM D-2240)
<b>Tensile Strength</b>	95 psi at Break	(73 °F (23 °C) and 50 % R.H.) (ASTM D-412)
<b>Tensile Stress at Specified Elongation</b>	70 psi at 100 %	(73 °F (23 °C) and 50 % R.H.) (ASTM D-412)
<b>Elongation at Break</b>	500 %	(73 °F (23 °C) and 50 % R.H.) (ASTM D-412)
<b>Adhesion in Peel</b>	<b>Substrate</b> Concrete	<b>Peel Strength</b> 25 lb. <b>% Adhesion Loss</b> Zero (73 °F (23 °C) and 50 % R.H.) (Fed Spec. TT-S-00227E)
<b>Tear Strength</b>	45 lb./in.	(73 °F (23 °C) and 50 % R.H.) (ASTM D-624)
<b>Chemical Resistance</b>	Good resistance to water, diluted acids, diluted alkalines, and residential sewage. Consult Technical Service at 1-800-933-SIKA for specific data.	
<b>Resistance to Weathering</b>	Excellent	
<b>Service Temperature</b>	-40 °F to 170 °F (-40 °C to 75 °C).	

## APPLICATION INFORMATION

<b>Coverage</b>	<b>1 gallon: Yield in Linear feet</b>			
	<b>Width/Depth</b>	<b>1/4"</b>	<b>3/8"</b>	<b>1/2"</b>
	1/4"	307.9		
	3/8"	205.3	136.8	
	1/2"	153.9	102.6	77.0
	3/4"	102.6	68.4	51.3
	1"			38.5
	1.25"			30.8
	1.5"			25.7
<b>Ambient Air Temperature</b>	40 °F to 100 °F. Sealant should be installed when joint is at midrange of its anticipated movement.			
<b>Substrate Temperature</b>	40 °F to 100 °F. Sealant should be installed when joint is at midrange of its anticipated movement.			
<b>Pot Life</b>	3–4 hrs.			
<b>Curing Rate</b>	<b>Tack-Free Time</b>	6–8 hrs.	(ASTM C-679)	
	<b>Final Cure</b>	3 days		

## APPLICATION INSTRUCTIONS

### SUBSTRATE PREPARATION

All joint-wall surfaces must be clean, sound, and frost-free. Joint walls must be free of oils, grease, curing compound residues, and any other foreign matter that might prevent bond. Ideally this should be accomplished by mechanical means. Bond breaker tape or backer rod must be used in bottom of joint to prevent bond.

Priming is typically not necessary. Most substrates only require priming if sealant will be subjected to water immersion after cure. Testing should be done, however, on questionable substrates, to determine if priming is

needed. Consult Technical Service or Sikaflex Primer Technical Data Sheet for additional information on priming. Note: Most Exterior Insulation Finish Systems (EIFS) manufacturers recommend the use of a primer. When EIFS manufacturer specifies a primer or if on-site bond testing indicates a primer is necessary, Sikaflex 429 primer is recommended. On-site adhesion testing is recommended with final system prior to the start of a job.

## MIXING

Pour entire contents of Component 'B' into pail of Component 'A'. Add entire contents of Color-pak into pail and mix with a low-speed drill (400–600 rpm) and Sikaflex paddle.\* Mix for 3-5 minutes to achieve a uniform color and consistency. Scrape down sides of pail periodically. Avoid entrapment of air during mixing. When mixing in cold weather (<50 °F), do not force the mixing paddle to the bottom of the pail. After adding Component 'B' and Color-pak into Component 'A', mix the top 1/2 to 3/4 of the pail during the first minute of mixing. After scraping down the sides of the pail, mix again for another minute. The paddle should reach the bottom of the pail between the first and second minute of mixing. Scrape down the sides of the pail a second time and then mix for an additional 2-3 minutes until the sealant is well blended. Color-pak must be used with tint base. For pre-pigmented Limestone base, just mix with low speed drill and Sikaflex paddle (no Color-pak needed).

## APPLICATION METHOD / TOOLS

Recommended application temperatures 40–100 °F. Pre-conditioning units to approximately 70 °F is necessary when working at extremes. Move pre-conditioned units to work areas just prior to application. Apply sealant only to clean, sound, dry, and frost-free substrates. Sikaflex-2c should be applied into joints when joint slot is at mid-point of its designed expansion and contraction. To place, load directly into bulk gun or use a follower plate loading system. Place nozzle of gun into bottom of joint and fill entire joint. Keeping the nozzle deep in the sealant, continue with a steady flow of sealant preceding nozzle to avoid air entrapment. Also, avoid overlapping of sealant since this also entraps air. Joint dimension should allow for 1/4 inch minimum and 1/2 inch maximum thickness for sealant. Proper design is 2:1 width to depth ratio. Tool sealant to ensure full contact with joint walls and remove air entrapment.

## LIMITATIONS

- The ultimate performance of Sikaflex®-2 C NS depends on good joint design and proper application.
- Minimum depth in working joint is 1/4 in.
- Maximum expansion and contraction should not exceed 50 % of average joint width.
- Do not cure in the presence of curing silicones.
- Avoid contact with alcohol and other solvent cleaners during cure.
- Allow 3 day cure before subjecting sealant to total water immersion. Primer is required if sealant will be subjected to total water immersion.
- Avoid exposure to high levels of chlorine. (Maximum level is 5 ppm).
- Do not apply when moisture vapor transmission exists since this can cause bubbling within the sealant.
- Avoid over-mixing sealant.

- White color tends to yellow slightly when exposed to ultraviolet rays.
- Light colors can yellow if exposed to direct gas fired heating elements.
- When overcoating: an on-site test is recommended to determine actual compatibility.
- Rigid paints, coatings or primers will crack when placed over elastomeric sealants experiencing expansion or contraction
- The depth of sealant in horizontal joints subject to traffic is 1/2 inch.
- When used in areas with heavy traffic either recess joint or use TG (Traffic Grade) Additive to increase durability.



## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## OTHER RESTRICTIONS

See Legal Disclaimer.

## ENVIRONMENTAL, HEALTH AND SAFETY

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## PRODUCT DATA SHEET

# Sikagard®-550 W Elastic

Crack bridging protective coating for concrete

### PRODUCT DESCRIPTION

Sikagard®-550 W Elastic is an elastomeric, crack-bridging, anti-carbonation, acrylic protective coating. Sikagard®-550 W Elastic provides protection to reinforced concrete from the ingress of carbon dioxide and other aggressive gasses. It offers high resistance to chlorides and other waterborne salts and excellent UV light resistance. Sikagard®-550 W Elastic will not act as a vapor barrier and will enhance the appearance of the structure.

### USES

Protective, crack-bridging coating for concrete, mortar, stucco, masonry, and exterior finishing systems subject to cracking/dynamic movement. For use on building and civil engineering structures subject to cracking or as the top coat in complete repair and protection systems.

### CHARACTERISTICS / ADVANTAGES

- Can bridge dynamically moving cracks.
- Excellent carbonation barrier.
- Vapor permeable.
- Provides resistance to weathering and frost.
- Crack bridging properties maintained at low temperatures.
- Excellent long term UV light resistance.
- Can be applied by brush, roller, or airless spray.
- Good color stability.
- Extremely resistant to dirt pick up and mildew.
- Non-flammable as a system.
- Easily maintained silk finish.

### PRODUCT INFORMATION

Chemical Base	Acrylate dispersion
Packaging	5 gal. (19 L), re-closable plastic pails
Appearance / Color	463 standard colors. Custom color-matching available
Shelf Life	24 months from date of production if stored properly in undamaged and unopened original sealed packaging.
Storage Conditions	Store in cool and dry conditions. Protect from direct sunlight and frost.
Density	~ 1.39 kg/l (at 68 °F, 20 °C)
Solid content by weight	~ 66.1 %
Solid content by volume	~ 53.4 %



## TECHNICAL INFORMATION

Elongation at Break	Elongation at break <ul style="list-style-type: none"><li>▪ at room temperature (not exposed to weathering): 120 %</li><li>▪ at -4 °F (-20 °C): 70 %</li></ul>		
Tensile Adhesion Strength	2,9 (2,8) N/mm²	(EN 1542)	
Crack Bridging Ability	Class A1 (-4 °F/-20 °C) - 2 coats Class B2 (5 °F/-15 °C) - 3 coats	(EN 1062-7)	
Reaction to Fire			
Freeze Thaw De-Icing Salt Resistance	2,9 (2,1) N/mm²	(EN 13687 part 1 & part 2)	
Resistance to Weathering	Excellent, no chalking or cracking (10,000 hours)	(ASTM G-23)	
Behavior after Artificial Weathering	Pass after 2000 hours	(EN 1062-11)	
Permeability to Water Vapor	Dry film thickness	d = 230 µm	(EN ISO 7783-1)
	Equivalent air layer thickness	SD, H <sub>2</sub> O = 0.35 m	(EN ISO 7783-2)
	Diffusion coefficient H <sub>2</sub> O	µH <sub>2</sub> O = 1,5 x 10³	
	Requirements for breathability	≤ 5 m	
Water Vapor Transmission			
Diffusion Resistance to Water Vapor			
Capillary Absorption	w = 0,02 kg/(m²h <sup>0.5</sup> )	(EN 1062-3)	
Permeability to CO2	Dry fil mthickness	d = 160 µm	(EN 1062-6)
	Equivalent air layer thickness	S <sub>D</sub> , CO <sub>2</sub> = 51 m	
	Diffusion coefficient CO <sub>2</sub>	µCO <sub>2</sub> = 3,1 x 10 <sup>5</sup>	
	Requirements for protection	SD, CO <sub>2</sub> ≥ 50 m	

## SYSTEM INFORMATION

System Structure	System	Product <sup>1)</sup>	Number of applications
	Priming <sup>2)</sup>	Sikagard®-552 W Aquaprimer	1
	Top coat <sup>3)</sup>	Sikagard®-550 W Elastic	2 – 3
<sup>1)</sup> Please refer to the respective product data sheet for additional information. <sup>2)</sup> For very difficult substrate (very dense or weak with tensile strength < 1 N/mm <sup>2</sup> ) and at low temperature, use solvent containing primer Sikagard®-551 S Elastic Primer. <sup>3)</sup> In case of an intensive yellow or red colour shade and/or a dark substrate, more than two coats might be required. A third coat is also required in order to achieve the required thickness for full durability (crack bridging, adhesion after thermal cycling, etc.)			

## APPLICATION INFORMATION

<b>Coverage</b>	Theoretical yield per coat: 100 ft <sup>2</sup> /gal/coat. Recommended 'wet' film thickness: 16 mils/coat. Recommended 'dry' film thickness: 8 mils/coat. Normal coating system is two coats at a total dry film thickness of 16 mils. Consumption is dependent on porosity of substrate. In addition, allowance must be made for surface profile, unavoidable variation in applied film thickness, loss and waste. Sikagard® Elastic Base Coat can be used as a first coat in a two coat system of Sikagard®-550 W Elastic		
<b>Layer Thickness</b>	<b>Minimum</b> required dry film thickness to achieve the required characteristics (CO <sub>2</sub> equivalent air thickness of 50 m) ≈ 160 µm. Minimum required dry film thickness to achieve full durability characteristics (CO <sub>2</sub> diffusion, adhesion after thermal cycling and crack bridging) ≈ 340 µm.		
<b>Ambient Air Temperature</b>	46.4 °F (8 °C) min. / 95 °F (35 °C) max.		
<b>Relative Air Humidity</b>	< 80 %		
<b>Dew Point</b>	Temperature must be at least 3°C above dew point.		
<b>Substrate Temperature</b>	46.4 °F (8 °C) min. / 95 °F (35 °C) max.		
<b>Waiting / Recoat Times</b>	Waiting time between coats at 68 °F (20 °C) substrate temperature:		
	<b>Previous coating</b>	<b>Waiting time</b>	<b>Next coating</b>
	Sikagard®-552 W Aquaprimer	5 hours min.	Sikagard®-550 W Elastic
	Sikagard®-551 S Elastic Primer	18 hours min.	Sikagard®-550 W Elastic
	Sikagard®-550 W Elastic	8 hours min.	Sikagard®-550 W Elastic
Note: When application is on existing coatings, the waiting time for both primers will increase by 100 %. Refresher coats of Sikagard®-550 W Elastic can be applied without priming if the existing coat has been thoroughly cleaned.			
<b>Curing Treatment</b>	Sikagard®-550 W Elastic does not require any special curing but must be protected from rain for at least 4 hours at 68 °F (20 °C).		
<b>Applied Product Ready for Use</b>	Full cure: ~ 7 days at 68 °F (20°C)		

## APPLICATION INSTRUCTIONS

### SURFACE PREPARATION

#### *Exposed concrete without existing coating:*

- The surface must be dry, sound and free from loose and friable particles.
- Suitable preparation methods are steam cleaning, high pressure water jetting or blastcleaning.
- New concrete must be at least 28 days old.
- If required, a levelling pore sealer (e.g. Sika® MonoTop®-723 N, Sikagard®-720 EpoCem®, Sikagard®-545 W Elastofill, etc.) shall be applied – refer to the respective product data sheet. For cement based products, allow a curing time of at least 4 days before coating (except when the EpoCem is used, then coating can be applied within 24 hours).

#### *Exposed concrete with existing coating:*

- Existing coatings must be tested to confirm their adhesion to the substrate and their suitability -

adhesion test average > 0.8 N/mm<sup>2</sup> with no single value below 0.5 N/mm<sup>2</sup>.

- For water based coating, use Sikagard-552 W AquaPrimer as primer.
- For solvent based coating, use Sikagard-551 S Elastic Primer as primer.
- In case of doubt, carry out adherence testing to determine which primer is most suitable – wait at least 2 weeks prior to conduct the adhesion test - an average value of 0.8 N/mm<sup>2</sup> is required with no single value below 0.5 N/mm<sup>2</sup>.



## APPLICATION

Apply Sikagard®-551 S Elastic Primer or Sikagard®-552 W AquaPrimer evenly onto the substrate. For use on very dense substrates up to 10% Sika Thinner C may be added to Sikagard®-551 S Elastic Primer.

Sikagard®-550 W Elastic can be applied by brush, roller or airless spray.

For more details, refer to Protective Coating Application Method Statement.

## CLEANING OF TOOLS

Clean all tools and application equipment with clean water immediately after use.

Hardened / cured material can only be removed mechanically.

For Sikagard®-551 S Elastic Primer use Sika® Thinner C.

## LIMITATIONS

Do not apply when there is:

- Expected rain
- Relative humidity > 80 %
- Temperature below 46.4 °F (8 °C) and/or below dew point
- Concrete younger than 28 days

The system is resistant to aggressive atmospheric influences.

Dark colour shades (especially black, dark red and blue, etc.) may fade more rapidly than other lighter tone colours.

Refreshing coat might be required at earlier interval than usual.

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## OTHER RESTRICTIONS

See Legal Disclaimer.

## ENVIRONMENTAL, HEALTH AND SAFETY

For information and advice on the safe handling, storage and disposal of chemical products, users shall refer to the most recent Safety Data Sheet (SDS) containing physical, ecological, toxicological and other safety-related data.

## DIRECTIVE 2004/42/CE - LIMITATION OF EMISSIONS OF VOC

According to the EU-Directive 2004/42, the maximum allowed content of VOC (Product category IIA / c type wb) is 40 g/l (Limits 2010) for the ready to use product. The maximum content of Sikagard®-550 W Elastic is < 40 g/l VOC for the ready to use product.

## LEGAL DISCLAIMER

- KEEP CONTAINER TIGHTLY CLOSED
- KEEP OUT OF REACH OF CHILDREN
- NOT FOR INTERNAL CONSUMPTION
- FOR INDUSTRIAL USE ONLY
- FOR PROFESSIONAL USE ONLY





## PRODUCT DATA SHEET

# SikaQuick®-1000

Rapid hardening repair mortar with extended working time

### PRODUCT DESCRIPTION

SikaQuick®-1000 is a one-component, rapid hardening, early strength gain, cementitious, patching mortar for concrete. SikaQuick®-1000 LD is a low dust version of this formula.

### USES

- On grade, above grade and below grade concrete conditions
- Highway overlays and repairs
- Structural repair material for concrete roadways, parking structures, bridges, dams and ramps
- Full depth patching repairs (may require multiple lifts)
- Economical patching material for horizontal flatwork repairs of mortar lines and concrete surfaces

### CHARACTERISTICS / ADVANTAGES

- Specially suited for warmer weather applications when extended working time is required
- Epoxy coatings can be applied as early as 6 hours at 73° F (23° C).
- Freeze / thaw resistant
- Easy to use - labor-saving material
- Not gypsum-based
- High early strength
- Open to foot traffic in 4 hours / Open to vehicular traffic in 6 hours at 73° F (23° C)
- Easily applied to clean, sound substrates
- SikaQuick®-1000 LD is an available, low dust version of this product.

### APPROVALS / STANDARDS

- Rapid hardening as defined by ASTM C 928

### PRODUCT INFORMATION

#### Chemical Base

- SikaQuick®-1000 is a blend of cement, select aggregates and specialty additives
- SikaQuick®-1000 LD is a blend of cement, select aggregates, low dust and specialty additives

#### Packaging

50 lb (22.7 kg) bag

#### Appearance / Color

Gray powder

#### Shelf Life

12 months from date of manufacture if stored properly in original, unopened and undamaged, sealed packaging

#### Storage Conditions

Store dry at 40° – 95° F (4° – 35° C)  
Protect from moisture. If damp, discard material

### TECHNICAL INFORMATION

<b>Compressive Strength</b>	3 hours	1,250 psi (8.6 MPa)	(ASTM C 109) 73° F (23° C), 50% R.H.
	1 day	4,000 psi (27.5 MPa)	
	7 days	5,000 psi (34.5 MPa)	
	28 days	7,000 psi (48.3 MPa)	
<b>Modulus of Elasticity in Compression</b>	28 days	4.6 x 10 <sup>6</sup> psi (32 GPa)	(ASTM C-469) 73° F (23° C), 50% R.H.
<b>Flexural Strength</b>	1 day	700 psi (4.8 MPa)	(ASTM C 293) 73° F (23° C), 50% R.H.
	7 days	900 psi (6.2 MPa)	
	28 days	1,000 psi (6.9 MPa)	
<b>Splitting Tensile Strength</b>	1 day	200 psi (1.4 MPa)	(ASTM C 496) 73° F (23° C), 50% R.H.
	7 days	300 psi (2.1 MPa)	
	28 days	400 psi (2.8 MPa)	
<b>Tensile Adhesion Strength</b>	28 days	Approximately 300 psi (2.1 MPa) Substrate failure	(ACI 503R) 73° F (23° C), 50% R.H.
<b>Shrinkage</b>	28 days	0.06%	(ASTM C 157 modified per ASTM C-928) 73° F (23° C), 50% R.H.
<b>Abrasion Resistance</b>	28 days	0.026 inch (0.66 mm) of wear at 1 hour	(ASTM C 779) 73° F (23° C), 50% R.H.
<b>Freeze-Thaw Stability</b>	28 days	98%	(ASTM C 666)
<b>Freeze Thaw De-Icing Salt Resistance</b>	50 cycles	0.080 lb / ft <sup>2</sup> (391 grams / m <sup>2</sup> )	(ASTM C 672)
<b>Rapid Chloride Permeability</b>	28 days	< 1,000 Coulombs	(ASTM C 1202 / AASHTO T 277) 73° F (23° C), 50% R.H.

## APPLICATION INFORMATION

Mixing Ratio	4.5 – 5 pints (2.1 – 2.4 L)		
Coverage	Neat	0.43 ft³ (0.012 m³)	
	Extended with 25 lbs (11.4 kg) of 3/8 inch (10 mm) pea gravel	0.58 ft³ (0.017 m³)	
	(Yield figures do not include allowance for surface profile, porosity or material waste)		
Consumption / Yield / Dosage (PRINT single line)			
Layer Thickness		Min.	Max.
	Neat	1/4 inch (6 mm)	2 inches (50 mm)
	Extended	1 inch (25 mm)	6 inches (152 mm)
<div><div></div><div>▪ Do not feather edge</div><div>▪ Do not exceed 7 inches (178 mm) slump when extended</div></div>			



<b>Product Temperature</b>	65° – 75° F (18° – 24° C)	
<b>Ambient Air Temperature</b>	> 40° - 95° F (4° - 35° C)	
<b>Substrate Temperature</b>	> 40° - 95° F (4° - 35° C)	
<b>Set Time</b>	35 – 85 minutes	(ASTM C 266) 73° F (23° C), 50% R.H.
<b>Final Set Time</b>	> 120 minutes	(ASTM C 266) 73° F (23° C), 50% R.H.

## APPLICATION INSTRUCTIONS

### SURFACE PREPARATION

- Concrete surface must be clean and sound.
- Remove all deteriorated concrete, dirt, oil, grease, and other bond-inhibiting materials from the area to be repaired.
- Be sure repair area is not less than 1/4" (6 mm) deep.
- Preparation work should be done by high pressure water blast, scabblor or other appropriate mechanical means to obtain an exposed aggregate surface profile of  $\pm 1/8"$  (3 mm) [minimum CSP-6].
- To ensure optimum repair results, the effectiveness of decontamination and preparation should be assessed by a Tensile Adhesion Strength (pull-off) test.
- Saw cutting perimeter edges of concrete repair area at a dovetail is preferred.
- Substrate should be Saturated Surface Dry (SSD) with clean water prior to application. No standing water should remain during application.
- Rust, scale, mortar, concrete, dust and other loose and deleterious material which reduces bond or contributes to corrosion shall be removed from steel reinforcement.
- Surfaces shall be prepared using abrasive blast cleaning techniques or high pressure water blasting to achieve a bright metal finish.

### PRIMING

- Concrete substrate: Prime the prepared substrate with a scrub coat of SikaQuick®-1000 / SikaQuick®-1000 LD prior to placement of the mortar. The repair mortar has to be applied into the wet scrub coat before it dries.
- Reinforcing Steel: Steel reinforcement should be thoroughly prepared by mechanical cleaning to remove all traces of rust. Where corrosion has occurred due to the presence of chlorides, the steel should be high pressure washed with clean water after mechanical cleaning. For priming of reinforcing steel use Sika® Armatec® corrosion protection products (consult current Product Data Sheets).

### MIXING

- Wet down all tools and mixer to be used.
- Pour the required amount of clean, potable water [approximately 70° F (21° C)] into a suitably sized and clean mixing container, using a calibrated measuring jug or similar, to ensure strict control of the water content. Do not over-water.
- Add 1 bag while continuing to mix with a low-speed drill (400 - 600 rpm) and mortar mixing paddle, or in an appropriate mortar mixer.
- Once all the powder has been added, mix to a uniform consistency, maximum 3 minutes, until a lump-free blend is achieved.
- Thorough mixing and proper proportioning of the powder and liquid is necessary.
- To help control setting times, colder water may be used in hot weather and warmer water may be used in cold weather.
- Inaccurate proportioning of the powder to liquid will result in a finished product that may not conform to the typical published performance property values.
- **With water or undiluted SikaLatex® R**: Pour 4.5 pints (2.1 L) of liquid into the mixing container. Slowly add powder, mix and adjust as above. Add up to another 1/2 pint (0.24 L) maximum of liquid to achieve desired consistency. Do not over-water.
- **With diluted SikaLatex® R**: SikaLatex® R admixture may be diluted up to 5:1 (water: SikaLatex® R) for projects requiring minimal polymer modification. Pour 4.5 pints (2.1 L) of the mixture into the mixing container. Slowly add powder, mix and adjust as above.

### EXTENSION WITH AGGREGATES

- For applications greater than 1" (25 mm) in depth, add 3/8" (10 mm) coarse aggregate.
- The typical addition rate is 25 lbs (11.4 kg) of aggregate per bag. It is approximately 2 gallons (7.6 L) by loose volume of aggregate.
- The aggregate must be non-reactive (reference ASTM C 1260, C 227 and C 289), clean, well graded, Saturated Surface Dry (SSD), have low absorption and high density, and comply with ASTM C 33 size number 8 per Table 2.
- Variances in aggregate may result in different

strengths.

- Do not use limestone aggregate.
- Do not exceed a slump of 7" (178 mm). This may cause excessive bleeding and retardation and may reduce the strength and performance of the material.

## APPLICATION

- A neat mix of SikaQuick®-1000 / SikaQuick®-1000 LD mortar must be scrubbed into the mechanically prepared, SSD substrate. Be sure to fill all pores and voids.
- Force material against edge of repair, working toward center. After filling repair, screed off excess.
- Allow material to set to desired stiffness, then finish with wood or sponge float for a smooth finish, or broom or burlap-drag for a rough finish.
- If a smoother finish is desired, a magnesium float should be used.
- To assist in the finishing process, use SikaFilm® finishing aid. Consult current Product Data Sheet.
- Mixing, placing, and finishing should not exceed 30 minutes maximum.
- Refer to ACI 305, the "Guide to Hot Weather Concreting" or ACI 306, the "Guide to Cold Weather Concreting" when there is a need to place this product while either hot or cold temperatures prevail. Thinner placements will be more sensitive to the temperature conditions.

## CURING TREATMENT

- As per ACI recommendations for portland cement concrete, moist curing is required.
- Moist cure with wet burlap and polyethylene, a fine mist of water or with a water based,\* compatible curing compound meeting ASTM C 309.
- Curing compounds adversely affect the adhesion of following lifts of mortar, leveling mortar or protective coatings.
- Moist curing should commence immediately after finishing.
- Protect freshly applied mortar from direct sunlight, wind, rain and frost.
- To prevent from freezing, cover with insulating material (e.g. curing blanket).

\* Pretesting of curing compound is recommended.

## LIMITATIONS

- Avoid application in direct sunlight, during precipitation and/or when strong winds prevail.
- Use only clean, potable water
- As with all cement based materials, avoid contact with aluminum to prevent adverse chemical reaction and possible product failure. Insulate potential areas of contact by coating aluminum bars, rails, posts etc. with an appropriate epoxy such as Sikadur®-32 Hi-Mod.
- Bonding agents (e.g. Sika® Armatec® 110 EpoCem) should not be used. Use of the neat mortar as a scrub coat is recommended and preferred. If bonding agents are used, follow cure times for the bonding agents

used as a guide prior to putting SikaQuick®-1000 / SikaQuick®-1000 LD in service. Assure suitability with the manufacturer of the bonding agent.

- SikaQuick®-1000 / SikaQuick®-1000 LD does not form a vapor barrier when cured.

## BASIS OF PRODUCT DATA

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

## OTHER RESTRICTIONS

See Legal Disclaimer.

## ENVIRONMENTAL, HEALTH AND SAFETY

For further information and advice regarding transportation, handling, storage and disposal of chemical products, user should refer to the actual Safety Data Sheets containing physical, environmental, toxicological and other safety related data. User must read the current actual Safety Data Sheets before using any products. In case of an emergency, call CHEMTREC at 1-800-424-9300, International 703-527-3887.

## LEGAL DISCLAIMER

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## PRODUCT DATA SHEET

# SikaWrap®-117 C Pre-saturated

Carbon fiber fabric for structural strengthening

### PRODUCT DESCRIPTION

SikaWrap®-117 C Pre-saturated is a unidirectional carbon fiber fabric pre-saturated to form a carbon fiber reinforced polymer (CFRP) used to strengthen structural concrete elements.

### USES

#### Load Increases

- Increased live loads
- Increased traffic volumes on bridges
- Installation of heavy machinery in industrial buildings
- Vibrating structures
- Changes of building utilization

#### Seismic Strengthening

- Column wrapping
- Masonry walls

#### Damage to Structural Parts

- Aging of construction materials
- Vehicle impact
- Fire
- Blast resistance

#### Change in Structural System

- Removal of walls or columns
- Removal of slab sections for openings

#### Design or Construction Defects

- Insufficient reinforcements
- Insufficient structural depth

### CHARACTERISTICS / ADVANTAGES

- Used for shear, confinement or flexural strengthening
- Flexible, can be wrapped around complex geometries
- High Strength
- Light Weight
- Non-corrosive
- Alkali Resistant
- Low aesthetic impact

### PRODUCT INFORMATION

<b>Fiber Type</b>	<b>Primary Fiber Direction:</b> 0°F (unidirectional) <b>Color:</b> Black
<b>Packaging</b>	Rolls: 24 in. x 30 ft.; Box of 2 rolls



<b>Shelf Life</b>	1 year in original packaging at recommended storage conditions
<b>Storage Conditions</b>	Store dry at 40°F - 95°F (4° - 35°C)
<b>Dry Fibre Density</b>	0.065 lbs./in <sup>3</sup> (1.8 g/cc)
<b>Mass per Unit Length</b>	9 oz. / sq. yd. (300 g/m <sup>2</sup> )

## TECHNICAL INFORMATION

<b>Nominal Ply Thickness</b>	<b>Cured Properties:</b>		
	Avg. Ultimate Value	Design Value	
	0.019 <u>psi</u>	0.018 <u>psi</u>	
	0.48 MPa	0.48 MPa	
<b>Tensile Strength</b>	5.5 x 10 <sup>5</sup> psi (3,793 MPa)		
	<b>Cured Properties:</b>		
	Avg. Ultimate Value	Design Value	(ASTM D-3039)
	119,770 <u>psi</u>	(f*fu) 93,662* <u>psi</u>	(ASTM D-7565)
	825 MPa	645* MPa	
	* Average ultimate value minus 3 standard deviations		
<b>Tensile Modulus</b>	34 x 10 <sup>6</sup> (234,500 MPa)		
	<b>Cured Properties:</b>		
	Avg. Ultimate Value	Design Value	(ASTM D-3039)
	-	(E) 8,973,997 <u>psi</u>	(ASTM D-7565)
	-	61,873 MPa	
<b>Tensile % Elongation</b>	1.5%		
	<b>Cured Properties:</b>		
	Avg. Ultimate Value	Design Value	(ASTM D-3039)
	1.22 <u>psi</u>	(ε*fu) 1.04* <u>psi</u>	(ASTM D-7565)
	1.22 MPa	1.04* MPa	
	* Average ultimate value minus 3 standard deviations		
<b>Tensile Resistance</b>	<b>Cured Properties:</b>		
	Avg. Ultimate Value	Design Value	
	5.17 kips/in. width <u>psi</u>	1.78 kips/in. width* <u>psi</u>	
	-	-	
	* Average ultimate value minus 3 standard deviations		
<b>Tensile Stiffness</b>	<b>Cured Properties:</b>		
	Avg. Ultimate Value	Design Value	
	-	170.5 kips/in. width <u>psi</u>	
	-	-	

## APPLICATION INSTRUCTIONS

### SUBSTRATE PREPARATION

Surface must be clean and sound. It may be dry or damp, but free of standing water and frost. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles, disintegrated materials and other bond inhibiting materials from the surface. Consult the current product data sheets for

Sikadur 330/Sikadur 340/Sikadur 345 for additional information on surface preparation.

Existing uneven surfaces must be filled with an appropriate repair mortar. The adhesive strength of the concrete must be verified after surface preparation by random pull-off testing (ASTM D-4541) at the discretion of the engineer. Minimum tensile strength, 200 psi (1.4 MPa) with concrete substrate failure.

**Preparation Work: Concrete** - Blast clean, shot-blast or use other approved mechanical means to provide a roughened, open-textured surface. Round all corners to

1/2" radius in certain "contact critical" applications and at the engineer's discretion, a thorough cleaning of the substrate using low pressure sand or water blasting may be sufficient.

#### **APPLICATION METHOD / TOOLS**

Prior to placing the fabric, the concrete surface is primed and sealed using either Sikadur 330, Sikadur 340 or Sikadur 345. In either case, installation of this system should be performed only by a specially trained contractor.

##### **Tooling & Finishing**

Fabric can be cut to appropriate lengths by using a commercial quality heavy duty scissor. Since the dull or worn cutting implements can damage, weaken or fray the fabric, their use should be avoided.

**Open Time:** 2 hrs. after foil is opened

#### **LIMITATIONS**

- System is a vapor barrier. Concrete should not be fully encapsulated in areas of freeze/thaw.
- Design calculations must be made and certified by an independent licensed professional engineer.
- Do not place carbon fiber in direct contact with steel. Must be isolated (e.g. glass fabric) to protect against corrosion.

#### **BASIS OF PRODUCT DATA**

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

#### **OTHER RESTRICTIONS**

See Legal Disclaimer.

#### **ENVIRONMENTAL, HEALTH AND SAFETY**

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#### **LEGAL DISCLAIMER**

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## PRODUCT DATA SHEET

# SikaWrap® Hex-113 C

Bi-directional Carbon fiber fabric for structural strengthening

### PRODUCT DESCRIPTION

SikaWrap® Hex-113 C is a bi-directional carbon fiber fabric. Material is field laminated using Sikadur® 300/Hex 300, Sikadur® 301 or Sikadur® Hex 330 epoxy to form a carbon fiber reinforced polymer (CFRP) used to strengthen structural elements.

### USES

SikaWrap® Hex-113 C may only be used by experienced professionals.

#### Load Increases

- Increased live loads in warehouses
- Increased traffic volumes on bridges
- Installation of heavy machinery in industrial buildings
- Vibrating structures
- Changes of building utilization

#### Seismic strengthening

- Column wrapping
- Masonry walls

#### Damage to structural parts

- Aging of construction materials
- Vehicle impact
- Fire

#### Change in structural system

- Removal of walls or columns
- Removal of slab sections for openings

#### Design or construction defects

- Insufficient reinforcements
- Insufficient structural depth

### CHARACTERISTICS / ADVANTAGES

- Lightweight fabric ideal for confined spaces
- Can be applied in dry or wet lay-up process
- Used for shear, confinement or flexural strengthening
- Flexible, can be wrapped around complex shapes
- High strength
- Non-corrosive
- Alkali resistant
- Low aesthetic impact

### PRODUCT INFORMATION

Fiber Type

0 °/90 ° (bi-directional)

<b>Packaging</b>	Rolls: 50 in. (1.3 m) x 300 ft. (91.4 m)
<b>Shelf Life</b>	10 years in original packaging
<b>Storage Conditions</b>	Store dry at 40–95 °F (4–35 °C)
<b>Dry Fibre Density</b>	0.065 lb./in <sup>3</sup> (1.8 g/cc)
<b>Area Density</b>	5.7 osy (196 gsm)
<b>Dry Fibre Tensile Strength</b>	5 x 10 <sup>5</sup> psi (3,450 MPa)
<b>Dry Fibre Modulus of Elasticity in Tension</b>	33.4 x 10 <sup>6</sup> psi (230,000 MPa)
<b>Dry Fibre Elongation at Break</b>	1.5 %

## TECHNICAL INFORMATION

<b>Nominal Ply Thickness</b>	<b>Design Value</b> 0.010 in. (0.25 mm)	73 °F (23 °C) 50 % R.H.
<b>Tensile Strength</b>	<b>Design Value</b> 66,000 psi (456 MPa)	(ASTM D-3039) 73 °F (23 °C) 50 % R.H.
	<b>Design Value (Per Inch Width)</b> 660 lbs/layer (2.92 kN)	(ASTM D-7565) 73 °F (23 °C) 50 % R.H.
<b>Tensile Modulus</b>	<b>Design Value</b> 6.0 x 10 <sup>6</sup> psi (41,400 MPa)	(ASTM D-3039) 73 °F (23 °C) 50 % R.H.
<b>Tensile % Elongation</b>	<b>Design Value</b> 1.2 %	(ASTM D-3039) 73 °F (23 °C) 50 % R.H.

## APPLICATION INSTRUCTIONS

### SUBSTRATE PREPARATION

Surface must be clean and sound. It may be dry or damp, but free of standing water and frost. Remove dust, laitance, grease, curing compounds, impregnations, waxes, foreign particles, disintegrated materials and other bond inhibiting materials from the surface. Consult Sikadur® Hex 300 and Sikadur® 330 technical data sheets for additional information on surface preparation. Existing uneven surfaces must be filled with an appropriate repair mortar. The adhesive strength of the concrete must be verified after surface preparation by random pull-off testing (ACI 503R) at the discretion of the engineer. Minimum tensile strength, 200 psi (1.4 MPa) with concrete substrate failure.

**Preparation Work: Concrete** - Blast clean, shotblast or use other approved mechanical means to provide an open roughened texture. In certain applications and at the engineer's discretion, the intimate contact between the substrate and the fabric may be determined to be non-critical. In these cases, a thorough cleaning of the substrate using low pressure sand or water blasting is

sufficient.

### Mixing

Consult Sikadur® 300/Hex 300, Sikadur® 301 or Sikadur® 330 product data sheets for information.

### APPLICATION METHOD / TOOLS

SikaWrap® Hex-113 C can be applied using wet or dry lay-up methods.

**Dry Lay-Up:** Apply the mixed Sikadur® 330 or Sikadur® 301 epoxy resin directly onto the substrate at a rate of 40–50 ft<sup>2</sup>/gal. (32–40 mils), depending on the surface profile. Carefully place the fabric into the resin with gloved hands and smooth out any irregularities or air pockets using a plastic laminating roller. Allow the resin to squeeze out between the rovings of the fabric. If more than one layer of fabric is required, apply additional Sikadur® 330 or Sikadur® 301 at a rate of 100 ft<sup>2</sup>/gal. (16 mils) and repeat as above. Apply a final coat of Sikadur® 330 or Sikadur® 301 to the exposed surface at a rate of 160 ft<sup>2</sup>/gal. (10 mils).

**Wet Lay-Up:** Seal the prepared concrete surface using Sikadur® 300/Hex 300 or Sikadur® 301. Material may be



applied by spray, brush or roller. SikaWrap® Hex-113 C can be impregnated using the Sikadur® 300/Hex 300 or Sikadur® 301 epoxy. For best results, the impregnation process should be accomplished using an automated fabric saturator. Once saturated, apply fabric to the sealed concrete surface and smooth out any irregularities or air pockets using a plastic laminating roller. If required, apply additional layers of fabric while epoxy on previous layer is still tacky. Coat the exposed surface of final fabric layer using Sikagard® 670W or Sikagard® 62. Installation of SikaWrap® Products should be performed only by specially trained approved contractors.

#### **Cutting SikaWrap**

Fabric can be cut to appropriate length by using a commercial quality heavy duty scissor. Since dull or worn cutting implements can damage, weaken or fray the fiber, their use should be avoided. Consult MSDS for proper handling procedures.

#### **LIMITATIONS**

- Design calculations must be made and certified by an independent licensed professional engineer.
- System is a vapor barrier. Concrete should not be encapsulated in areas of freeze/thaw.

#### **BASIS OF PRODUCT DATA**

Results may differ based upon statistical variations depending upon mixing methods and equipment, temperature, application methods, test methods, actual site conditions and curing conditions.

#### **OTHER RESTRICTIONS**

See Legal Disclaimer.

#### **ENVIRONMENTAL, HEALTH AND SAFETY**

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## **SECTION 03100 - CONCRETE FORMWORK**

## **DIVISION 3 – CONCRETE**

### **1. RELATED DOCUMENTS:**

A. The general provision of the contract, including General and Special Conditions, apply to the work specified in this section.

### **2. DESCRIPTION OF WORK:**

A. The extent of formwork is indicated by the concrete structures shown on the drawings. The work includes providing formwork and shoring for architectural and structural cast-in-place concrete, and the installation into formwork of anchor bolts, setting plates, bearing plates, anchorages, inserts frames, nosing and other items to be embedded in concrete (but not including reinforcing steel).

### **3. GENERAL:**

A. Codes and Standards: Unless otherwise shown or specified, design, construct, erect, maintain and remove forms and related structures for cast-in-place concrete work in compliance with the American Concrete Institute standard ACI-347-14, "Recommended Practice for Concrete Formwork", ACI 301, ACI 318 and ACI 117.

B. Mock-up or Sample Panels: Provide formwork for mock-up or sample panels as may be required for the cast-in-place concrete work specified in Section 03300. Construct forms using facing materials required to provide the specified finishes and textures.

### **4. DESIGN OF FORMWORK:**

A. Design, erect, support, brace and maintain formwork so that it will safely support all vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Carry vertical and lateral loads to the ground by the formwork system and by the in-place construction that has attained adequate strength for that purpose. Construct formwork so that concrete members and structures are of the correct size, shape, alignment, elevation and position. **Design of formwork, shoring, and reshoring and its removal is the contractor's responsibility.**



## **SECTION 03100 - CONCRETE FORMWORK**

## **DIVISION 3 -CONCRETE**

**B.** Design forms and false work to include assumed values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.

**C.** Provide shores and struts with positive means of adjustment capable of taking up all formwork settlement during concrete placing operations, using wedges or jacks or combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.

**D.** Support form facing materials by structural members spaced sufficiently close to prevent deflection of the form facing material. Fit forms placed in successive units for continuous surfaces to accurate alignment to assure a smooth completed surface, free from irregularities and within the allowable tolerances.

**E.** Provide camber in formwork as required for anticipated deflections in formwork due to weight and pressure of fresh concrete and construction loads for long-span members without intermediate supports. Provide temporary openings in wall forms, column forms and at other locations necessary to permit inspection and facilitate clean-out.

**F.** Design formwork to be readily removable without impact, shock or damage to the cast-in-place concrete surfaces and adjacent materials.

**G.** Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt all joints and provide backup material at joints as may be required to prevent leakage and fins.

**H.** Side forms of footings may be omitted and concrete placed directly-against the neat excavation only when requested by the Contractor and accepted by the Owner. When omission of forms is accepted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as detailed.

**1.** Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal framed plywood-faced or other panel type materials acceptable to the Architect, to provide continuous, straight, smooth exposed surfaces. Furnish in the largest practicable sizes to minimize number of joints and to conform to the joint system shown on the drawings. Provide form material with sufficient thickness to withstand the pressure of newly placed concrete without bow or deflection.

## **SECTION 03100 - CONCRETE FORMWORK**

## **DIVISION 3 – CONCRETE**

2. Unless otherwise shown or specified, use plywood complying with U.S. Product Standards PS-1, "B-B High Density Overlaid Concrete Form" Class I.

### **5. FORM MATERIALS:**

#### **A. Forms for Exposed Finish Concrete:**

1. Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other panel type materials to provide continuous, straight, smooth exposed surfaces. Furnish in the largest practicable sizes to minimize number of joints and conform to the joint system shown on the drawings. Provide form material with sufficient thickness to withstand the pressure of newly placed concrete without bow or deflection. Unless otherwise shown or specified, use plywood complying with U.S. Product Standard PS-1, "B-B High density Overlaid Concrete Form", Class I.

#### **B. Forms for Unexposed Finish Concrete:**

1. Form concrete surfaces which will be unexposed in the finished structure with plywood, boards, metal or other acceptable material. Provide lumber that is dressed on at least 2 edges and 1 side for a tight fit.

#### **C. Forms for Textured Finish Concrete:**

1. For textured finish concrete provide forms as required by the drawings, if any.

### **6. TOLERANCES FOR FORMWORK CONSTRUCTION:**

- A. Construct formwork to provide completed concrete surfaces complying with the tolerances specified in ACI-347, Section 2.4, after removal of forms and prior to patching and finishing of cast-in-place formed surfaces.

### **7. FORM CONSTRUCTION:**

#### **A. General:**

1. Construct forms complying with ACI-347, to the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location grades, level and plumb work in the finished structure. Provide for opening, offsets, sinkages, keyways, recesses, moldings, rustication, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required on the work. Use selected materials to obtain the required finishes.



## **SECTION 03100 - CONCRETE FORMWORK**

## **DIVISION 3 – CONCRETE**

2. Fabricated forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Romero wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
3. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent the loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible consistent with requirements of the work.
4. Where chamfer exposed external corners and edges occur use chamfer strips accurately fabricated to produce uniform smooth lines and tight edge joints. Provide chamfers of wood, metal, or PVC, to form the required corner or edge shapes as shown. Select one material and use throughout entire job.
5. Carefully form intersecting planes to provide true, clean-out corners.
6. Provide all openings in forms to accommodate other work, including mechanical and electrical work. Accurately place and securely support all items required to be built into the forms.

## **SECTION 03100 - CONCRETE FORMWORK**

## **DIVISION 3 – CONCRETE**

### **B. Falsework:**

1. Erect falsework and adequately support, brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until each loads can be supported by the in-place concrete structure. Construct falsework so that adjustments can be made for take-up and settlement.
2. Provide suitable wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine any abnormal deflection or signs of failure in the work; make necessary adjustments to produce work of the required dimensions.

### **C. Forms for Exposed Concrete:**

1. Drill forms to suit the used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.
2. Do not use metal cover plates for patching holes or defects in forms.
3. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Provide back joints with extra studs or girds to maintain true, square intersections.
4. Provide extra studs, wailers and bracing as required to prevent bowing of forms between studs and to avoid a bowed appearance in concrete. Do not use narrow strips of form material which will produce bow.
5. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
6. Form molding shapes, recesses and projection with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

### **D. Form Ties:**

1. Provide factory-fabricated, adjustable-length, removable or snap off metal form ties, designed to prevent form deflection, and to prevent spalling of concrete surfaces upon removal.



## **SECTION 03100 - CONCRETE FORMWORK**

## **DIVISION 3 – CONCRETE**

2. Unless otherwise shown, provide ties so that the portion remaining within the concrete after removal of the exterior parts is at least 1-1/2" inside form the concrete surface. Unless otherwise shown, provide form ties which will not leave a hole larger than 1" diameter in the concrete surface.
3. Form ties fabricated in the project site and wire ties are not acceptable.
4. At concrete smooth finish where tie holes are indicated in the drawings cone holes shall be plugged with Burke snap lugs of the reveal type. They shall be pre-cast, high strength, cement compound plugs and shall be glued with snaplug bonder. Where holes are not indicated on drawings, plugs of the flush type shall be used.

### **E. Corner Treatment:**

1. Form exposed corners of beams and columns to produce square, smooth, solid, unbroken lines, except as otherwise shown.
2. Where chamfered corners occur form chamfers with 3/4" x 3/4" strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and right edge joints. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
3. Unexposed corners may be found either square or chamfered. See drawings.

### **F. Provisions for Other Trades:**

1. Provide openings in concrete formwork to accommodate work of other trades. Size and location of openings, recesses and chases are the responsibility of the trade requiring such items. Accurately place and securely support items to be built into forms.

### **G. Cleanouts, Cleaning and Tightening:**

1. Provide temporary opening in forms as required to facilitate cleaning and inspection. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed.

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2. Retighten forms immediately after concrete placement as required to eliminate mortar leaks

### **8. PREPARATION OF FORM SURFACES:**

A. Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed. Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of the form-coating compound manufacturer's direction. Do not allow excess form coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with the manufacturer's instructions.

B. Coat steel forms with a non-staining, rust-preventive form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

### **9. SHORES AND SUPPORTS:**

A. Extend shoring from ground to roof for structures 4-stories or less, unless otherwise permitted.

B. Extend shoring at least 3-floors under floor or roof being placed for structures over 4- stories. Shore floor directly under floor placed, so that loads from construction above will transfer directly to these shores. Space out shoring in stories below this level in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimums if required to ensure the proper distribution of loads throughout the structure.

C. Perform removal of shores and reshoring in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support the work.



## **SECTION 03100 - CONCRETE FORMWORK**

## **DIVISION 3 – CONCRETE**

**D.** Remove forms from one girder at a time, and re-shore before other support is removed. After girders are re-shored, forms for one beam and its adjacent slab may be removed and immediately re-shored before other supports are removed.

**E.** All structures have been designed according to final behavior and conditions. However, during erection of same, certain conditions can arise for which the behavior of the structure has not been contemplated. Therefore, the contractor should provide at all times adequate shoring and reshoring until the design conditions have been met. If there is any doubt during any phase of the construction, please consult and/or notify the structural designers.

**F.** All structures have been designed according to final behavior and conditions. However, during erection of same, certain conditions can arise for which the behavior of the structure has not been contemplated. Therefore, the contractor should provide at all times adequate shoring and reshoring until the design conditions have been met. If there is any doubt during any phase of the construction, please consult and/or notify the structural designers.

**G.** In flat-slab construction, allow shores for area within intersection of middle strips of each panel to remain in place during stripping and reshoring operation. After other shores in each panel are removed, place reshores at midpoints between columns and on column lines before next panel is stripped. Keep reshores in place until the concrete has obtained its required 28-day strength and heavy loads due to construction operations have been removed.

## SECTION 03100 - CONCRETE FORMWORK

## DIVISION 3 – CONCRETE

### 10. REMOVAL OF FORMS:

#### A. General:

Form and supports shall remain in place for not less than the following periods of time or earlier than the recommended by ACI 301 and ACI 347:

Walls	24 hrs.
Columns	24 hrs.
Sides of beams and girders	24 hrs.
Pan Joist forms 30 inch wide or fewer	3 days
Over 30 inch wide	4 days
Arch centers	14 days
Joist, beam, or girders under	
10-foot clear span between supports	7 days
10 to 20 feet clear span between supports	14 days
Over 20 feet clear span between supports, cantilevers	21 days
Floor slabs under 10-foot clear span between supports	4 days
10 to 20 feet clear span between supports	7 days
<b>Over 20 feet clear span between supports</b>	<b>10 days</b>



## **SECTION 03100 - CONCRETE FORMWORK**

## **DIVISION 3 – CONCRETE**

### **11. RE-USE OF FORMS:**

**A.** Clean and repair the surfaces of forms that are to be re-used in the work, except that split, frayed, delaminated or otherwise damaged form facing material will not be acceptable.

Apply new form coating compound material to all concrete contact form surfaces as specified for new formwork.

**B.** When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure all joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to the owner.

### **12. SUBMITTALS:**

#### **A. Manufacturer's Data, Concrete Formwork:**

1. Submit 2 copies of manufacturer's specifications and installation instruction for proprietary materials and items as may be required, including form coatings, manufactured form systems, ties, and accessories.

#### **B. Shop Drawings, Concrete Formwork:**

2. Submit shop drawings for the fabrication and erection of specific finished concrete surfaces as shown or specified. Show the general construction of the forms including jointing, any special formed joints or reveals, location and pattern of form tie placement, and other items which affect the exposed concrete visually.

**\*\*\*END OF SECTION\*\*\***

## SECTION 03200 - CONCRETE REINFORCEMENT

## DIVISION 3 - CONCRETE

### 1. RELATED DOCUMENTS:

The general provisions of the contract, including General and Special Conditions, apply to the work specified in this section.

### 2. DESCRIPTION OF WORK:

The extent of concrete reinforcement is shown on the drawings and in schedules.

The work includes fabrication and placement of reinforcement for cast in place architectural and structural concrete, including bars, welded wire fabric, ties and supports.

### 3. GENERAL:

#### Codes and Standards:

Comply with the requirements of the following codes and standards, except as herein modified:

American Concrete Institute, ACI-315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures".

American Concrete Institute, ACI 318 "Building Code Requirements for Reinforced Concrete". (Latest Edition).

Concrete Reinforcing Steel Institute, "Manual of Standard Practice"

### 4. MATERIALS:

#### A. Reinforcing Bars:

Comply with the requirements of ASTM-A-615 and with grades given on drawings.

#### B. Steel Wire:

Provide plain, cold-drawn, steel wire complying with ASTM-A-82.



## SECTION 03200 - CONCRETE REINFORCEMENT

## DIVISION 3 - CONCRETE

### C. Welded Wire Fabric:

Provide welded steel wire fabric for concrete reinforcement complying with ASTM A 185.

Furnish in flat sheets, not rolls, unless rolls are acceptable to the Architect.

### D. Column Spirals: (If any)

Provide plain, cold-drawn wire complying with ASTM-A-82, or hotrolled rods for spirals complying ASTM-A-615.

### F. Support for Reinforcement:

Provide supports for reinforcement including bolsters, chairs, spacers and other devices suitable for proper spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with PS-7-66. Wood, brick, and other devices will not be acceptable.

For slabs on grade, use supports with sand plates or horizontal runners where base materials will not support chair legs.

For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are hotdip galvanized, or plastic protected.

## 5. FABRICATION:

### A. General:

Shop-fabricate reinforcing bars to conform to the required shapes and dimensions, with fabrication tolerances complying with ACI 315. In case of fabricating errors, do not re-bent or straighten reinforcement in a manner that will injure or weaken the material. The use of heat for this purpose will not be permitted.

### B. Identification:

Deliver all reinforcement to the project site bundle, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to marking shown on placement diagrams.

## SECTION 03200 - CONCRETE REINFORCEMENT

## DIVISION 3 - CONCRETE

### C. Rejected Materials:

1. Deliver all reinforcement to project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to marking shown on placement diagrams.

2. Reinforcement with any of the following defects will not be permitted in the work:

- a. Bends or kinks not indicated on drawings or final shop drawings.
- b. Bars with reduced cross-section due to excessive rusting or other cause.

### D. Fabricating and placing tolerances:

1. Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

- a. Sheared length: plus or minus 1-inch
- b. Depth of truss bars: plus 0, minus 1/2-in.
- c. Stirrups, ties, and spirals: plus or minus 1/2-in.
- d. All other bends: plus or minus 1 in.

2. Bars shall be placed to the following tolerances:

- a. Concrete over to formed surfaces: plus or minus 1/4 inch
- b. Minimum spacing between bars: minus 1/4 inch
- c. Top bars in slabs and beams:
  - 1. Members 8 inches deep or less: plus or minus 1/4 inch
  - 2. Members more than 8 inches but not over 2 ft. deep: plus or minus 1/2 inch
  - 3. Members more than 2-feet deep: plus or minus 1 inch



## SECTION 03200 - CONCRETE REINFORCEMENT

## DIVISION 3 - CONCRETE

d. Crosswise of members: spaced evenly within 2 inches

e. Lengthwise of members: plus or minus 2 inches

### 6. PLACING

#### A. General:

1. Comply with the specified codes and standards, and the Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement, placement and supports, and as herein specified.

2. Clean reinforcement to be free from loose rust, mill scale, earth, and other material which reduce or destroy bond with concrete.

3. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, bolsters, runners, spacers and hangers, as required.

4. Place reinforcement to obtain at least the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that ends are directed into the concrete, not toward exposed concrete surfaces.

5. Install welded wire fabric in long lengths as practicable. Lap adjoining pieces at least on full mesh and lace splices with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that ends are directed into the concrete, not toward exposed concrete surfaces. Do not make end laps between supporting beams. Offset and laps in adjacent widths to prevent continuous laps in either direction.

## SECTION 03200 - CONCRETE REINFORCEMENT

## DIVISION 3 - CONCRETE

7. Provide sufficient numbers of supports and of strength to carry the reinforcement. Do not place reinforcing bars more than 2" beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

8. Space reinforcing bars to comply with ACI-318, Chapter 7.6. Reinforcing bars may be relocated as necessary to avoid interference with other reinforcement, conduit or other embedded items. However, if any reinforcing bar is moved a distance exceeding one bar diameter or the specified placing tolerance, the resulting rearrangement of the reinforcement will be subject to acceptance by the Owner.

**B. Splices in Reinforcement:**

1. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Comply with the requirements of ACI-318 Chapter 12.13 /12.20 for minimum lap of spliced bars, and with details shown on drawings.

### 7. SUBMITTALS

**A. Manufacturer's Data, Concrete Reinforcement:**

Submit 2 copies of manufacturer's specifications and installation instructions for all proprietary materials and reinforcement accessories.

**B. Mill Certificates, Concrete Reinforcement:**

Submit 2 copies of steel producer's certificates of mill tests for all reinforcing steel.

**C. Shop Drawings, Concrete Reinforcement:**

**Submit shop drawings for fabrication, bending and placement of concrete reinforcement.** Comply with the ACI-313 "Manual of Standard Practice for Detailing Reinforced Concrete Structures", showing bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement. Include all special reinforcement required and openings through concrete structures. Show wall reinforcement as elevations drawn at a scale of not less than 1/4" to 1' - 0".



## **SECTION 03200 - CONCRETE REINFORCEMENT**

## **DIVISION 3 - CONCRETE**

### **8. SAMPLING AND TESTING**

The contractor shall employ, at his own expense, a testing laboratory (preferably the same used for concrete testing) accepted by the architect/owner to perform the tests hereinafter specified and to submit test reports to the owner. The testing laboratory shall be responsible for conducting and interpreting the tests, and shall state in each report whether or not the test specimens comply with the specified requirements, and shall indicate any deviations.

Test reinforcement for tensile and bending requirements set forth in ANSI/ASTM A-613 and tables 2 and 3 from that standard.

Disregard article 10 Number of Tests from ASTM Standard. Take one set of three 30" long samples for each bar size from each truck even if the reinforcement is already bent.

**\*\*\*END OFF SECTION\*\*\***





## **SECTION 03300 - CAST-IN-PLACE CONCRETE**

## **DIVISION 3 - CONCRETE**

### **1. RELATED DOCUMENTS**

The general provisions of the contract, including General Conditions and Special Conditions (if any), apply to the work specified in this section.

### **2. DESCRIPTION OF WORK**

The extent of cast-in-place concrete work is shown on the drawings.

The work includes providing cast-in-place concrete consisting of portland cement, fine aggregate, coarse aggregate, water, admixtures; designed, proportioned, mixed, placed, finished and cured as herein specified.

The following types of cast-in-place concrete as specified in this section:

A. Standard weight concrete

### **3. GENERAL**

#### **A. Codes and Standards:**

1. Comply with the provisions of the following codes, specifications and standards, (latest edition) except as otherwise shown or specified:

ACI-301	"Specifications for Structural Concrete for Buildings"
ACI-318	"Building Code Requirements for Reinforced Concrete"
ACI-614	"Recommended Practice for Measuring, Mixing and Placing Concrete"
ACI-311	"Recommended Practice for Concrete Inspection"

#### **B. Workmanship:**

1. All concrete work which does not conform to the specified requirements including strength, tolerances, and finishes, shall be corrected as directed by the owner at the Contractor's expense, without extension of time therefore. The Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to the concrete work.

## **SECTION 03300 - CAST-IN-PLACE CONCRETE**

## **DIVISION 3 – CONCRETE**

### **C. Qualifications of Contractor's Testing Laboratory:**

1. Contractor's selection of a testing laboratory is subject to the owner acceptance.
2. Select a testing laboratory thoroughly experienced in design and testing of concrete materials and mixes. Submit a written description of the proposed concrete testing laboratory giving qualifications of personnel, laboratory facilities and may be requested by the owner.

## **4. CONCRETE MATERIALS**

### **A. Portland Cement:**

1. Comply with the requirements of ASTM-C-150.
2. Only one brand of cement may be used for each required type throughout the project, unless otherwise accepted by the Owner.

### **B. Aggregates:**

1. Comply with the requirements of ASTM-C-33 and as herein specified.
2. Do not use aggregates containing soluble salts or other substances such as iron sulphide, pyrite, marcasite or ochre which can cause stains on exposed concrete surfaces.
3. Provide aggregates from a single source for all exposed aggregate finish and exposed architectural concrete.
4. Fine aggregate shall be clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
5. Coarse aggregate shall be clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
  - a. Crushed stone, processed from natural rock or stone.
  - b. Washed gravel, either natural or crushed with water that is clean, fresh and free of oil, acid, organic matter or other deleterious substances.



## **SECTION 03300 - CAST-IN-PLACE CONCRETE**

## **DIVISION 3 - CONCRETE**

c. Use size 57 (maximum aggregate size 1") for columns, beams and other concrete, except as otherwise specified.

**C. Water:**

Provide water for mixing and curing that is fresh and does not contain impurities in sufficient amount to etch concrete surfaces, or cause discoloration to concrete indicated to remain exposed and unpainted.

### **5. CONCRETE ADMIXTURES**

**A.** Provide admixtures produced by recognized admixture manufacturers and use in compliance with the manufacturer's printed directions. Do not use admixtures which have not been incorporated and tested in the accepted design mixes, unless otherwise authorized in writing by the owner.

**B.** Air-entraining admixtures shall comply with the requirements of ASTM-C-260.

**C.** Water reducing set retarding admixtures shall comply with the requirements of ASTM-C-494.

**D.** Do not use calcium chloride in concrete, except as otherwise authorized in writing by the owner. Do not use any admixtures containing calcium chloride where concrete is placed against nay galvanized steel, or in any mix using high-early strength cement.

**E.** All concrete that is to be left exposed shall be poured with a superplasticiser admixture producing a slump of 8" X 1". Product shall comply with ASTM Specification C-1017 and C-494G. Admixture shall be controlled and readily dispensed at the batch plant.

**F.** Product to be used shall be Master Builder Pozzolith 440 superplasticiser. The mix shall contain a proportion of 10-12 fluid ounces of Pozzolith 440 for each 100-pounds of cement.

**6. JOINT MATERIALS**

**A. Waterstops:**

Provide flat, dumbbell type or centerbulb type waterstops at construction joints and other joints where no movement is expected, unless otherwise shown; having a web thickness of not less than 3/16" for units up to 5" wide, and having a web thickness of not less than 3/8" for widths 3" and over.

Provide polyvinyl chloride (PVC) waterstops complying with Corps of Engineers CRD-C572.

**7. SUBGRADE COVER MATERIALS:**

**A.** Unless otherwise shown on drawings, provide water barrier cover over subgrade materials under building slabs on ground as follows:

Use clear polyethylene sheeting, 0.006" (6 mils) thick, complying with CS-238. Materials shall be resistant to decay when tested in accordance with ASTM-E-134

**8. BONDING MATERIALS**

**A.** Provide an aqueous phase, film forming, concrete bonding agent, compound suitable for brush or spray application complying with Mil B-19235.

**9. FLOOR FINISH MATERIALS**

**A. Liquid Chemical Floor Hardener:**

Provide a colorless aqueous solution containing a blend of magnesium fluosilicate and zinc fluosilicate combined with a wetting agent, containing not less than 2 lbs. of fluosilicate per gallon.



## SECTION 03300 - CAST-IN-PLACE CONCRETE

## DIVISION 3 - CONCRETE

Products offered by manufacturers to comply with the requirements for colorless liquid chemical floor hardener include the following:

Sciolith:	Chem-Master Corp.
Euco Surhard:	Euclid Chemical Co.
Hornolith:	A.C. Horn/W.R. Grace
Saniseal 50:	Master Builders Co.
Lapidolith:	Sonneborn Bldg. Products
RIW Flintox Liquid:	Toch Bros.

### A. Abrasive Aggregate for Non-Slip Finish:

Fused aluminum oxide Grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing less than 40% aluminum oxide and not less than 25% ferric oxide.

Use material that is factory-graded, packaged, rust-proof and non glazing, and is unaffected by moisture and cleaning materials.

### B. Dry Shake Materials for Colored Wear - Resistant Finish:

Where shown on drawings provide packaged, dry, combination of materials formulated for producing colored and wear resistant monolithic surface treatments, consisting of Portland Cement, graded quartz aggregate, coloring pigments, and dispersing agents. Use coloring pigments that are finely ground, non-fading mineral oxides, interground with the cement, as selected by the Architect unless otherwise shown.

## **SECTION 03300 - CAST-IN-PLACE CONCRETE**

## **DIVISION 3 - CONCRETE**

### **10. CONCRETE CURING MATERIALS:**

#### **A. Absorptive Cover:**

Provide absorptive cover for curing concrete consisting of burlap cloth made from jute or kenaf, weighing approximately 9 oz. per square yard and complying with AASHO-M-182, Class 3, or provide cotton mats complying with ASTM-C-440.

#### **B. Moisture-Retaining Cover:**

Provide moisture retaining cover for curing concrete of any of the following:

1. Waterproof paper, complying with ASTM-C-171, Type 1 or 2 Type 2.
2. Polyethylene sheeting, complying with AASHO-M-171.
3. Polyethylene - coated burlap.

#### **C. Membrane-Forming Curing Compound:**

1. Provide a liquid type membrane-forming curing compound complying with ASTM-C-309.

2. Use Type 1, clear with fugitive dye, for interior and exterior surfaces to receive applied finishes.

### **11. CONCRETE SAMPLING AND TESTING**

#### **A. Concrete Testing Service:**

The Contractor shall employ, at his own expense, a testing laboratory accepted by the owner, to perform all other tests and to submit test reports to the owner. The testing laboratory shall be responsible for conducting and interpreting the tests, and shall state in each report whether or not the test specimens comply to the specified requirements and shall indicate any deviations there from.

Materials and installed work may require testing and retesting as directed by the owner at anytime during the progress of the work. Allow free access to material stockpiles and facilities at all times.



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Tests, not specifically indicated to be done at the Owner's expense, including the retesting of rejected materials and installed work, shall be done at the Contractor's expense.

### **B.** Tests for Concrete Materials:

**1.** Sample and test proposed concrete materials for design concrete mixes as listed below:

Test fine aggregate from each material source and report the following:

Sieve Analysis	ASTM-C-136
Fineness Modulus	ASTM-C-125
Material Passing No. 200 Sieve	ASTM-C-117
Amount of Friable Particles	ASTM-C-142
Amount of Organic Impurities	ASTM-C- 40
Magnesium Sulphate Soundness Tests	ASTM-C- 88

**2.** Test coarse aggregate from each material source and each grading, and report the following:

Sieve Analysis	ASTM-C-136
Fineness Modulus	ASTM-C-125
Amount of Friable Particles	ASTM-C-142
Amount of Soft Particles	ASTM-C-235
Material Passing No. 200 Sieve	ASTM-C-117
Magnesium Sulphate Soundness Tests	ASTM-C-88
Compacted Unit Weight	ASTM-C-29
Los Angeles Abrasion Test	ASTM-C-131 and ASTM-C-335

**3.** Test Portland Cement from each material source, type and color, and report the following:

Chemical Analysis	ASTM-C-114
Fineness of Grind	ASTM-C-115 or ASTM-C-204
Autoclave Expansion	ASTM-C-151
Time of Setting	ASTM-C-266
Air Content of Mortar	ASTM-C-185

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Compressive Strength	ASTM-C-109
Heat of Hydration	ASTM-C-186
False Set	ASTM-C-451

Submit written reports to the owner for each material sampled and tested prior to the start of work. Provide the project identification name number, date of report, name of contractor, name of concrete testing service, source of concrete aggregates, manufacturer and brand name for manufactured material, values specified in the referenced specification for each material, and test results.

### C. Quality Control Testing During Construction:

1. Concrete shall be sampled and tested for quality control during the placement of concrete as follows:

a. Sampling Fresh Concrete ASTM-C-172

Except modified for slump to comply with ASTM-C-94

b. Slump ASTM-C-143

One test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.

c. Compression Test Specimens ASTM-C-31

One set of 6 standard cylinders for each compressive strength test.









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**d.** Concrete temperature: Test hourly when air temperature is 80°F. and above; and each time a set of compression test specimens is made.

**e.** Compressive Strength Test: ASTM-C-39; one set for each 100 cu. yards or fraction thereof, or each concrete class placed in any one day; 2 specimens tested at 7-days, 3 specimens tested at 28-days, and one specimen retained in reserve for later testing if required.

**f.** Test results shall be reported in writing to the owner and the Contractor on the same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of contractor, name of concrete supplier and truck number, name of concrete testing service, concrete type and class, location of concrete batch in the structure, design compressive strength at 28-days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.

### **D. Additional Tests:**

The testing service shall take core samples of in-place concrete when test results are such that the specified concrete strengths and other characteristics have not been attained in the structure. The testing service shall conduct tests to determine the strength and other characteristics of the in-place concrete by compression tests on cored cylinders complying with ASTM-C-42, or by load as outlined in ACI-318, or other as directed. The Contractor shall pay for such tests conducted and any other additional testing as may be required.

## **12. PROPORTIONING AND DESIGN OF MIXES**

**A.** Prepare design mixes for each type of concrete shown and specified. Proportion design mixes by weight for each class of concrete required, complying with ACI-613

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"Recommended Practice for Selecting Proportions for Concrete", and report the following data:

1. Complete identification of aggregate source of supply.
2. Tests of aggregates for compliance with specified requirements.
3. Scale weight of each aggregate.
4. Absorbed water in each aggregate.
5. Brand, type and composition of cement.
6. Brand, type and amount of each admixture.
7. Amount of water used in trial mixes.
8. Proportions of each material per cubic yard.
9. Gross weight and yield per cubic yard of trial mixtures

**B.** Compressive strength developed at 7-days and 28-days, from not less than 3 tests cylinders cast for each 7 and 28-day test, and for each design mix.

**C.** Submit written reports to the owner of each design mix for each type and class of concrete, at least 13 calendar days prior to the start of the specified work. Include in each report the project identification name and number, date of report, name of contractor, name of concrete testing service, concrete class, source of concrete aggregates, manufacturer and brand name of manufactured materials, the precise proportions of specified herein for the type and class of concrete, and the test results for each property specified for the design mix.

The criteria specified herein are maximums or minimums, and shall not be construed to pre-determine fixed quantities of materials in the mix design, or to preclude change of an accepted mix design at any time.

Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner and as accepted by the Owner. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the Owner, before using in the work.

### **13. CONCRETE MIXES**

**A.** Provide the classes of concrete shown on the drawings.

**B.** Use water-reducing admixtures in strict compliance with the manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used at the Contractor's option subject to the Owner's acceptance.



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C. When admixtures are used, a reduction in the specified minimum cement content of concrete mixes will not be permitted.

D. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities of admixtures as required to maintain quality control.

E. Proportion and design mixes to result in concrete slump at the point of placement as follows:

1. Ramp and Sloping Surfaces: Not more than 3".
2. Reinforced Foundation Systems: Not less than 1" and not more than 3"
3. All other concrete: Not less than 1" And not more than 4"

### 14. SAMPLE SECTIONS FOR CONTROL OF FINISHES:

The continuity of color exposed concrete surfaces is of prime importance. Maintain such controls and procedures, in addition to those specified, as necessary to provide the specified finish surfaces.

#### Architect's Samples:

Samples of finishes acceptable to the Owner shall be made available by the Contractor before starting the work. Coordinate the procurement and selection of all materials, and the design and mixing of all concrete in order to obtain the acceptable color and finish in the completed structures.

#### Field Constructed Samples:

Fabricate sample sections representative of the specified finish surfaces, in locations as directed by the Architect. Form, reinforce, mix, cast, cure and finish the sample units using selected materials approved for the work and construction methods proposed for the work. Provide sample sections as follows:

Construct a wall section of "L" shape panels, approximately 4' high X 3' each side X 6" thick, unless otherwise indicated by Owner. Form faces to represent as-cast surface finish. Include not less than 2 form ties, form panel intersection, one vertical construction joint and one horizontal construction joint.

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Construct a column section approximately 4' high and not less than 12" diameter for round sections and not less than 12" in least dimensions for rectangular sections, unless otherwise directed by Owner. Chamfer the exposed edges of rectangular sample columns as required.

Do not remove sample sections without written permission from the Owner. When directed, demolish sample sections and remove from the site.

### 15. JOINTS

#### A. Construction Joints:

1. Locate and install construction joints, which are not shown on the drawings, so as not to impair the strength and appearance of the structure, as acceptable to the Owner. Locate construction joints, if required but not shown, as follows:
2. In walls, at not more than 60-feet in any horizontal direction; at top of footings; at top of slabs on ground; at top and bottom of door and window openings or as required to conform to architectural details as directed by the Owner; and at the outside of the deepest beam or girder framing into wall.
3. In columns or piers, at the top of footing; at the top of slabs on ground; and at the underside of the deepest beam or girder framing into the column or pier, or to conform to architectural details.
4. In slabs on ground, so as to divide the slab into areas not in excess of 1,200 square feet, unless otherwise accepted by the Owner. Conform to slab placement diagrams or pattern layout for placement, where shown.
5. Provide keyways at least 1-1/2" deep where called for, and as shown on the drawings.
6. Provide waterstops in construction joints as shown on the drawings. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions. Protect waterstop material from damage where it protrudes from any joint.





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### B. Isolation Joints in Slabs on Ground:

1. Provide insulation joints in slabs on ground at all points of contact between slabs on ground and vertical surfaces. These joints shall be of pre-molded expansion- joint filler strips. Unless otherwise noted or specified, such joints shall be 1/2 inch thick and the full depth of slab.

### C. Control Joints in Slab on Ground:

1. Provide control joints in slabs on ground to form panels or patterns as shown. Use inserts 1/4" wide 1/5 to 1/4 of the slab depth, unless otherwise shown.
2. Form control joints by inserting a pre-molded hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface. After the concrete has cured for at least 7 days, remove inserts and clean groove of loose debris.

## 16. INSTALLATION OF EMBEDDED ITEMS

### A. General:

1. Set and build into the work anchorage devices and other embedded items required the other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instruction and directions provided by suppliers of the items to be attached thereto.

### B. Edge Forms and Screed Strips for Slabs:

1. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the type of screeds required. Align the concrete surface to the elevation of the screed strips by the use of strike-off templates or accepted compacting type screeds.



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### C. Metal Inserts:

1. Provide metal inserts for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work.
2. Provide adjustable wedge inserts of malleable cast iron, furnished complete with full depth bolts; 3/4 bolt size, unless otherwise shown.
3. Provide threaded inserts of malleable cast iron, furnished completed with full-depth bolts; 3/4" bolt size, unless otherwise shown.
4. Provide flashing reglets formed of sheet metal of the same type and gauge as the flashing metal to be built into the reglet, where shown. Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 20 gauge galvanized sheet steel. Size, shape and install as detailed. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

## 17. CONCRETE MIXING

### A. General:

1. Concrete may be mixed at batch plants or it may be transit-mixed as specified herein. Batch plants must comply with the requirements of ACI-614, with sufficient capacity to produce concrete of the qualities specified in quantities required to meet the construction schedule. All plant facilities are subject to the acceptance of the Owner.

### B. Job Site Mixing:

1. Mix all materials for concrete in an acceptable drum type batch machine mixer. For mixers of one cubic yard, or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5-minutes after all ingredients are in the mixer, before any part of the batch is released. For mixers of capacity larger than one cubic yard, increase the minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cubic yard, or fraction thereof. Do not exceed the catalog rating or name-plate capacity for the total volume of materials used per batch. Equip the mixer with automatic controls, or semi-automatic controls if acceptable, for proportioning materials and the proper measured quantities. Do not exceed 30

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minutes total elapsed time between intermingling of damp aggregates and cement to the discharge of the completed mix.

2. Provide a batch ticket for each batch discharged and used in the work indicating the project identification name and number, date, mix type, quantity and amount of water introduced.

### C. Ready-mix Concrete:

1. Comply with the requirements of ASTM-C-94, and as herein specified, provided the quantity and rate of delivery will permit unrestricted progress of the work in accordance with the placement schedule. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM-C-94 may be required, as specified below. Proposed changes in mixing procedures, other than herein specified, must be accepted by the Owner before implementation.

### D. Modification to ASTM-C-94 are as follows:

#### 1. Quality of Concrete:

Provide concrete materials, proportions, and properties as herein specified, in lieu of ASTM Section 4.

#### 2. Tolerances in Slump:

Provide slump of not more than the values as herein specified, in lieu of ASTM Section 5.1. Comply with other criteria of ASTM Section 5.

#### 3. Mixing and Delivery:

Delete the references for allowing additional water to be added to the batch for material with insufficient slump. Addition of water to the batch will not be permitted as specified in ASTM Section 9.7. In addition to the requirements of ASTM Section 9.7, when the air temperature is between 85°F., and 90°F., reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90°F., reduce the mixing and delivery time to 60 minutes. When a truck mixer is used the complete mixing of the concrete, begin the mixing operation within 30 minutes after the cement has been intermingled with the aggregates.



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### 4. Certification:

Furnish duplicate delivery tickets with each load of concrete delivered to the site, one for the Owner and one for the Contractor. In addition to the requirements of ASTM Section 14.1, provide the following information on delivery tickets:

- a) Type and brand of cement.
- b) Cement content (in 94-lbs. sacks) per cubic yard of concrete.
- c) Maximum size of aggregate.
- d) Amount and brand name of each admixture.
- e) Total water content expressed as water/cement ratio.

### 5. Strength:

Delete ASTM Section 15; comply with concrete testing requirements as herein specified.

Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery in order to prevent delay of placing the concrete after mixing, or holding dry-mixed materials too long in the mixer before the addition of water and admixtures.

## 18. CONCRETE PLACEMENT

### A. General:

1. Place concrete in compliance with the practices and recommendations of ACI-614, and as herein specified.

2. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is

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still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.

**3.** Screed concrete which is to receive other construction to the proper level to avoid excessive skimming or grouting.

**4.** Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the project site and dispose of in an acceptable location.

### **B. Pre-Placement Inspection:**

**1.** Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work, as required. Thoroughly wet wood forms immediately before placing concrete, as required where form coating are not used.

### **C. Concrete Conveying:**

**1.** Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the location of final deposit as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.

**2.** Provide mechanical equipment of such size and design for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposits. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, and other deleterious materials.

### **D. Placing Concrete in Forms:**

**1.** Deposit concrete in forms in horizontal layers not deeper than 18" and in a manner to avoid inclined construction joints



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2. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
3. Consolidate all concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use vibrators designed to operate with vibratory element submerged in concrete, maintaining a speed of not less than 6000 impulses per minute when submerged in the concrete. Vibration of forms and reinforcing will not be permitted, unless otherwise accepted by the Owner.
4. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
5. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
6. Do not place concrete in supporting elements until the concrete previously placed in columns and walls is no longer plastic.

### **E. Placing Concrete Slabs:**

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

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2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners. Consolidate concrete placed in beams and girders of supported slabs, and against bulkheads of slabs on ground, as specified for formed concrete structures. Consolidate concrete in the remainder of slabs by vibrating bridge screeds, roller pipe screeds, or other acceptable methods. Limit the time of vibrating consolidation to prevent bringing an excess of fine aggregate to the surface.

3. Bring slab surfaces to the correct level with a straight edge and strike off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

4. Maintain reinforcing steel in the proper position continuously during concrete placement operations.

### F. Bonding:

1. Roughen surfaces of set concrete at all joints, except where bonding is obtained by use of a concrete bonding agent, and clean surfaces of laitance, coating, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and do not leave laitance, loose particles of aggregate, or damaged concrete at the surface.

2. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:

3. At joints between footings and walls or columns, and between walls or columns and beams of slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

4. At joints in exposed work; at vertical joints in walls; at joints in girders, beams, supported slabs and other structural members; and at joints designed to contain liquids, dampen, but do not saturate, the roughened and cleaned surface of set concrete and apply a liberal coating of neat cement grout.



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5. Use neat cement grout consisting of equal parts portland cement and fine aggregate by weight and not more than 6-gals. of water per sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1/16". Deposit fresh concrete before cement grout has attained its initial set.

6. In lieu of neat cement grout, bonding grout may be a commercial bonding agent. Apply to cleaned concrete surfaces in accordance with the printed instructions of the bonding material manufacturer.

7. Prepare for bonding of fresh concrete to fully-cured hardened concrete or existing concrete by using an epoxy-resin adhesive binder, as follows:

a. Handle and store epoxy-resin adhesive binder in compliance with the manufacturer's printed instructions, including safety precautions.

b. Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.

c. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1/16" thick. Place fresh concrete while the epoxy-resin material is still tacky, without removing the in-place grout coat, and as directed by the epoxy-resin manufacturer.

G. Hot Weather Placing: Concrete deposited in hot weather shall not have a placing temperature over 90 F.

### **19. FINISH OF FORMED SURFACES**

A. Standard Rough Form Finish:

1. Provide as-cast rough form finish to formed concrete surfaces that are to be concealed in the finish work or by other construction, unless otherwise indicated.

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Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and all fins and other projections exceeding 1/4" in height rubbed down or chipped off.

**B.** Standard Smooth Finish (SSF):

1. Provide standard smooth finish for all concrete formed surfaces that are to be covered with a coating material applied directly to the concrete or a covering material bonded to the concrete such as waterproofing, damp-proofing, painting, or other similar system, unless otherwise shown or specified.

**C.** Architectural Exposed Concrete Finish (When applicable):

1. Provide where shown on the drawings, architectural exposed concrete finish.

2. Architectural exposed concrete finish shall be the as-cast concrete surface as obtained with the form facing material. Absolutely no patching will be permitted. Formed concrete must conform with the exact shapes and dimensions shown on drawings and shall be free of imperfections affecting the intended appearance.

a. Exposed Textured Finish Concrete (TFC). TFC shall show the texture of the form required by the drawings.

b. Exposed Smooth Finish Concrete (SFC). SFC shall be as smooth as the form facing material. Fins and other projections on the surface shall be completely removed and smoothed.

**D.** Bush Hammer Concrete Finish:

1. Bush hammering shall be executed using a Kanyo hammer with disk type head or a Kanyo hammer with roller type head. Arises shall be rounded with the same finish as large surfaces. Toll the concrete surface at least 1/8" deep so that coarse aggregate shows uniformly.

2. Tests shall be made before starting operation for the Architect's inspection and approval



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3. When directed by the Architect remove and replace concrete not meeting the above requirements.

### E. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

## 20. MONOLITHIC (INTEGRAL) SLAB FINISHES

### A. Scratch Finish:

1. Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping (applied cement finish) or mortar setting beds for tile, portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as shown on the drawings.

2. After placing slabs, plane the surface to a tolerance not exceeding 1/4" in 2" when tested with a 2" straightedge. Slope surfaces uniformly to drains where required. After leveling, roughen the surface before the final set with stiff brushes, brooms or rakes.

### B. Float Finish:

1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified, and as shown on the drawings or in schedules.

2. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently to permit the operation of a power-driven float, or both. Consolidate the surface with power-driven floats, or by hand-floating of area is small or inaccessible to power units. Check and level the surface plane to a tolerance not exceeding 1/4" in 10" when tested with a 10' straightedge placed

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on the surface at not less than 2 different angles. Cut down light spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float the surface to the uniform smooth, granular texture.

3. Apply trowel finish to monolithic slab surfaces that are to be exposed to view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring paint, or other thin-film finish coating system.

4. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

5. Consolidate the concrete surface by the final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge. Grind smooth surface defects which would telegraph through applied floor covering system.

### **C. Non-Slip Aggregate Finish:**

1. Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, and elsewhere as shown on the drawings or in schedules.

2. After completion of float finishing, and before starting trowel finish, uniformly spread 25-lbs. of dampened non-slip aggregate per 100 square feet of surface. Tamp aggregate flush with the surface using a steel trowel, but do not force the non-slip aggregate particles below the surface. After broadcasting and tamping, apply trowel finishing as herein specified.

3. After curing, lightly work the surface with a steel wire brush, or a abrasive stone, and water to expose the non-slip aggregate.

### **D. Non-Slip Broom Finish:**

1. Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as shown on the drawings or in schedules.

2. Immediately after trowel finishing, slightly roughen the concrete surface by



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brooming in the direction perpendicular to the main traffic route. Coordinate the required final finish with the Owner before application.

### **E. Integral Colored Concrete:**

1. Integrally color concrete shall be provided at all pedestrim walls and paved areas, except street sidewalks and curbs and/or unless otherwise indicated on drawings.
2. Use CEROMIX admixture as manufactured by L.M. Scofield Company of color selected by the Owner or approved equal.
3. Concrete shall be mixed at plant following manufacturer's recommendations. Contractor shall pour a field sample for determining color and texture of finish. Broom finish all surfaces in one direction and protect adjacent areas from staining with colored concrete.

### **F. Colored Wear-Resistant Finish:**

1. Provide colored wear-resistant finish to monolithic slab surfaces and applied cement finishes where shown on the drawings or in schedules.
2. Apply dry shake material for colored wear-resistant finish at the rate of not less than 60-lbs. per 100-sq. ft., unless greater amount is recommended by the material manufacturer.
3. Immediately following the first floating operation, uniformly distribute approximately 2/3 of the required weight of dry shake material over the concrete surface, and embed by means of power floating. After the first dry shake application, uniformly distribute the remainder of the dry shake material at right angles to the first application, and embed by power floating.
4. After completion of broadcasting and floating, apply a trowel finish as herein specified.

## **21. CONCRETE CURING AND PROTECTION**

### **A. General:**

1. Protect freshly placed concrete from premature drying and excessive hot

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temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing as soon as free water has disappeared from the concrete surface after placing and finishing. Keep continuously moist for not less than 72-hours.

3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 168 cumulative hours (not necessarily consecutive) during which the concrete has been exposed to air temperature above 50°F. Avoid rapid drying at the end of the final curing period.

### B. Curing Methods:

1. Provide moisture curing by any of the following methods:

- a) Keep the surface of the concrete continuously wet by covering with water.
- b) Continuous water-fog spray.
- c) Covering the concrete surface with the specified absorptive cover, thoroughly saturating the cover with water, and keeping the absorptive cover continuously wet. Place absorptive cover so as to provide coverage of the concrete surfaces and edges, with a 4" lap over adjacent absorptive covers.

2. Provide moisture-cover curing as follows:

Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete, placed in the widest practicable width with side and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.

3. Provide membrane curing as follows:

Apply the specified membrane-forming curing compound to damp concrete surfaces as soon as the water film has disappeared. Apply



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uniformly in a 2-coat continuous operation by power spray equipment in accordance with the manufacturer's directions. Re-coat areas which are subjected to heavy rainfall within 3 hours after initial application.

Maintain the continuity of the coating and repair damage to the coat during the entire curing period. Do not use membrane curing compounds on surfaces which are to be covered with a coating material bonded to the concrete, such as other concrete, liquid floor hardener, waterproofing, damp-proofing, membrane roofing, flooring, painting, and other coatings and finish materials.

### 4. Curing Formed Surfaces:

Cure formed concrete surfaces, including the undersides of girders, beams supported slabs and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by any of the methods specified above, as applicable.

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### **5. Curing Unformed Surfaces:**

Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing.

Final cure unformed surfaces, unless otherwise specified, by any of the methods specified above, as applicable.

Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

### **6. Temperature of Concrete During Curing:**

When the atmospheric temperature is 80°F. and above, or during other climatic conditions which will cause too rapid drying of the concrete make arrangements before the start of concrete placing for wet sprinkling, or moisture-retaining covering. Protect the concrete continuously for the concrete period. Provide hot weather protection complying with the requirements of ACI-605.

Maintain concrete temperature as uniformly as possible, and protect from rapid atmospheric temperature changes. Avoid temperature changes to concrete which exceed 5°F. in any one hour.

### **7. Protection from Mechanical Injury:**

During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

## **22. MISCELLANEOUS CONCRETE ITEMS**

### **A. Filling In:**

1. Fill-in holes and openings left in concrete structures for the passage of work by other trades, unless otherwise shown as directed, after the work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place



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construction. Provide all other miscellaneous concrete filling shown or required to complete the work.

### B. Curbs:

1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersection, and termination slightly rounded.

### C. Equipment Bases and Foundations:

1. Provide machine and equipment bases and foundations, when shown on the drawings. Set anchor bolts for machines and equipment to complete at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.

## 23. CONCRETE EVALUATIONS

### A. Evaluation of Quality Control Tests:

1. The concrete quality control testing as hereinafter specified will be evaluated by the following criteria.

2. Do not use concrete delivered to the final point of placement which has a slump outside the values specified.

3. Strength of working stress type concrete shall be considered satisfactory if the average of five consecutive strength tests of the laboratory cured specimens representing each specified strength of concrete is equal to or greater than the specified strength, and if no more than 20 percent of the strength tests have values less than the specified strength, and no individual strength test result falls below the required strength by more than 500-psi.

4. Strength tests of specimens cured under field conditions may be required by the Owner to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded by the field quality control laboratory at the same time and from the same samples as the laboratory cured specimens.

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5. Provide improved means and procedures for protecting concrete when the 28-day compressive strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders.

6. When laboratory-cured cylinder strengths are appreciably higher than the minimum required compressive strength, field-cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi, even though the 85% criterion is not met.

7. If individual tests of laboratory-cured specimens produce strengths more than 500 psi. below the required minimum compressive strength, or if tests of field-cured cylinders indicate deficiencies in protection and curing, provide additional measures to assure that the load-bearing capacity of the structure is not jeopardized. If the likelihood of low-strength concrete is confirmed and computations indicated the load-bearing capacity may have been significantly reduced, tests of cores drilled from the areas in question may be required.

8. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by each tests will be considered deficient in strength and subject to additional testing as herein specified.

9. Strength of ultimate strength type concrete shall be considered satisfactory if the average of any three consecutive strength tests of the laboratory cured specimens representing each specified strength of concrete is equal to or greater than specified strength, and if not more than 10 percent of the strength tests have values less than the specified strength and no individual strength test result falls below the required strength by more than 500-PSI.

### **B.** Formed Concrete Dimensional Tolerances:

1. Formed concrete having any dimension smaller or greater than required, and outside the specified tolerances limits, will be considered deficient in strength and subject to additional testing as herein specified.

2. Formed concrete having any dimension greater than required will be rejected if the appearance or function of the structure is adversely affected, or if the larger dimension interfere with other construction. When permitted, accomplish the removal of excessive material in a manner to maintain the strength of the section without affecting function and appearance.



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### C. Strength of Concrete Structure:

1. The strength of the concrete structure in-place will be considered potentially deficient if fails to comply with any of the requirements which control the strength of structure, including the following conditions.
2. Failure to meet compressive strength tests requirements.
3. Concrete which differs from the required dimensions or location in such a manner to reduce strength.
4. Concrete subjected to damaging mechanical disturbances; particularly load stresses, heavy shock, and excessive vibration.
5. Poor workmanship and quality control likely to result in deficient strength.

### D. Testing Concrete Structure for Strength:

1. When there is evidence that the strength of the concrete structure in-place does not meet specification requirements, the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM-C-42 and as follows:
2. Take at least 3 representative cores from each member or area of suspect strength, from locations directed by the Owner.
3. Test cores in a saturated-surface-dry condition per ACI-318 if the concrete will be wet during the use of the completed structure.
4. Test cores in an air-dry condition per ACI-318 if the concrete will be dry at all times during use of the completed structure.
5. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85% and no single core is less than 75% of the 28-day required compressive strength.
6. Report tests results in writing to the Owner, on the same day that tests are made.

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7. Include in test reports the project identification name and number, date, name of Contractor Testing Service, location of test core in a structure, type or class of concrete represented by core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of the concrete as placed, and the moisture condition of the core at time of testing.
8. Fill core holes solid with non-shrinking patching mortar, with identical compressive strength as the specified for the concrete meter and finish to match adjacent concrete surfaces.
9. Conduct static load tests and evaluation complying with ACI-318 if the results of the core tests are unsatisfactory, or if core tests are impracticable to obtain, as directed by the Owner.
10. Correct all concrete work that is found structurally inadequate by core tests or by results of static load tests, as directed by the Owner.

### **24. CONCRETE SURFACE REPAIRS**

#### **A. Patching Defective Areas:**

1. Repair and patch defective areas with cement mortar immediately after removal of forms, but only when directed by the Owner.
2. Cut out honeycomb, rock pockets, voids over 1/2" diameter, and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with water, and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to the Owner.
3. Fill holes extending through concrete by means of a plunger-type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure complete filling.

#### **B. Repair of Formed Surfaces:**



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1. Repair exposed concrete surfaces that contain defects which adversely affect the appearance of the finish only with the approval of the Owner. Remove and replace the concrete having defective surfaces if the defects cannot be repaired to the satisfaction of the Owner. Surface defects, as such include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, and holes left by the rods and bolts; fins and other projections on the surface and stains and other discolorations that cannot be removed by cleaning.

2. Repair concealed formed concrete surfaces, where possible, that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete having defective surfaces. Surface defects, as such, include cracks in excess of 0.01" wide, cracks of any width and other surface deficiencies which penetrate to the reinforcement or completely through non-reinforced section, honeycomb, rock pockets, holes left by tie rods and bolts, and spalls except minor breakage at corners.

### C. Repair of Unformed Surfaces:

1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.

2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.

3. Repair finished unformed surfaces that contain defects which adversely affect the durability of the concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to the reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

4. Correct high areas in unformed surfaces by grinding, after the concrete has cured at least 14-days.

5. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Owner

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6. Repair defective areas, except random cracks and single hole not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least 3/4" clearance all around. Dampen all concrete surfaces in contact with patching concrete, and brush with a neat cement grout coating or concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of the same material to provide concrete of the same type or class as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

7. Repair isolated random cracks and single holes not over 1" in diameter by the dry- pack method. Groove the top of cracks, and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with a neat cement grout coating. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of one part portland cement to 2 1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72-hours.

8. Repair methods not specified above may be used, subject to the acceptance of the Owner.

### 25. SUBMITTALS

#### A. Manufacturer's Data:

1. Submit 2 copies of manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures, bonding agents, epoxy-resin grout, patching compounds, waterstops, joint systems, chemical floor hardeners, and dry shake finish materials.



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### **B. Samples, Cast-In-Place Concrete:**

1. Submit samples of materials as specified and as otherwise may be requested by the Owner, including names, sources and description as required.
2. Provide sample panels as herein specified under "Sample Sections for Control of Finishes". Perform revisions and corrective work required to produce finished concrete and surfaces as required by the Owner. Construct additional sample panels as may be required if original results are not satisfactory to the Owner.

### **C. Laboratory Test Reports, Cast-In-Place Concrete:**

1. Submit 2 copies of laboratory test report for concrete materials and mix design tests as specified herein to the Owner.

### **D. Material Certificates, Cast-In-Place Concrete:**

1. Provide materials certificates in lieu of materials laboratory test reports only when permitted by the Owner. Material certificates shall be signed by the material manufacturer and the Contractor, certifying that each material item complies with, or exceeds, the specified requirements.

**\*\*\*END OF SECTION\*\*\***





## **Section 03 01 30- Strengthening of Concrete with Fiber Reinforced Polymer, FRP Reinforcement**

### **PART 1 - GENERAL**

#### **1.1 Related Documents**

- A. The Conditions of the Contract for Construction and the General Requirements of Division 1 of these Specifications apply to the Work in this Section.

#### **1.2 Work Included**

- A. The Work of this Section shall include furnishing all labor, materials, equipment, and supervision to prepare the surface of the structural concrete members and to install the FRP Reinforcement as indicated on the Drawings.

#### **1.3 Related Work**

- A. The following work is related to this Section:

- |                    |  |
|--------------------|--|
| 1. Concrete Repair | Section 03 01 30.71 (cast-in-place concrete) |
| 2. Epoxy Injection | Section 03 64 23                             |

#### **1.4 Reference Standards**

- A. Comply with the following reference standards, except where more stringent requirements are indicated on the Drawings or specified herein:

- 1. American Concrete Institute (ACI)

- a. ACI 440.2R-08, Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures
- b. ACI 440R-07, Report on Fiber-Reinforced Polymer (FRP) Reinforcement for Concrete Structures
- c. ACI 440 R-96, State-of-the-Art Report on Fiber Reinforced Plastic (FRP) Reinforcement for Concrete Structures.
- d. ACI 503 R, Pull-off test to determine FRP adhesion to concrete substrate.
- e. ACI 562, Code Requirements for Assessment, Repair and Rehabilitation of Existing Concrete Structures.

- 2. International Concrete Repair Institute (ICRI)

- a. ICRI Guideline No. 03742, Guide for the Selection of Strengthening Systems for Concrete Structures
- b. ICRI Guideline No. 03739, Guide to Using In-Situ Tensile Pull-Off Tests to Evaluate Bond of Concrete Surface Materials

3. Sika CarboDur Composite Strengthening Systems
  - a. Engineering Guidelines for Design and Application
  - b. Sika CarboDur Calculation Software
4. American Society of Testing and Materials (ASTM)
  - a. ASTM D4541, Standard Test Method for Pull-Off Strength of Coatings using Portable Adhesion Testers

## **1.5 Quality Control**

- A. Quality Control procedures performed by the Manufacturer shall include, but not be limited to the following:
  1. Manufacturer shall have a nationally recognized program of contractor training, certification and technical support.
  2. The Manufacturer shall have minimum ten years experience in FRP Reinforcement confirmed by actual field tests of minimum 500 successful installations.
  3. The Manufacturer shall be able to supply testing data to demonstrate system properties and durability of the actual FRP Reinforcement to be used.
- B. Quality Control procedures performed by the Contractor shall include, but not be limited to the following:
  1. The Contractor shall be trained by the Manufacturer and shall have completed a program of instruction in the use of FRP Reinforcement.
  2. The Contractor shall have a minimum of two years experience in FRP Reinforcement confirmed by actual field tests of at least 5 successful installations.
  3. The Contractor shall inspect all materials prior to application to assure that they meet specifications and have arrived to the job-site undamaged.
  4. The FRP Reinforcement shall be completely inspected by the contractor during and immediately following application of the composite materials. Conformance with the design drawings, proper alignment of fibers and quality workmanship shall be assured. Entrapped air shall be released or rolled out before the epoxy sets. Defects shall be noted in the Daily Construction Log.
  5. After FRP Reinforcement has cured, the contractor shall inspect the all work to check for voids and or debonding. Repairs shall be made as per Par.3.7 Repair of Defects, and noted in the Daily Construction Log.
  - 6.



## **1.6 Submittals**

- A. Submit for record Material Safety Data Sheets (MSDS) of each product, used on site.
- B. Submit product data indicating product standards, physical and chemical characteristics, environmental durability, technical specifications, limitations, installation instructions, and general recommendations regarding each material.
- C. Submit for record, a qualification statement by the Contractor listing their completed FRP Reinforcement projects, including size, location, owner, engineer/architect and contact numbers.
- D. Submit for record a complete description of the FRP Reinforcing system materials, surface preparation, application procedures, application rates, and cure times.
- E. Submit for record copies of purchase order and packaging slips showing quantities and dates of primer and resin purchased.
- F. Submit for review and approval shop drawings including, the following:
  - 1. Limits of FRP Reinforcing.
  - 2. Details of epoxy injection crack repair and epoxy resin patching.
  - 3. Complete system details including, but not limited to, FRP Reinforcement, primer, resin, and protective coating.
- G. Submit for record test results of the Pull-off test to determine FRP adhesion to concrete substrate.
- H. Submit for record Daily Construction Logs kept by the Contractor. These logs shall include the following information: Weather and temperature at application times; Amount of product used and square footage/linear footage of substrate covered; Batch numbers of all products used; Names of all crew members; Any bond-strength tests, noting location, quantity and who performed these tests.
- I. Submit an approved ICC Evaluation Report in the name of the proposed FRP system to be used on this project.
- J. Submit independent test report verifying the environmental durability of the proposed system to be used on this project. Such reports shall include as a minimum:
  - 1. 10,000 hr. resistance to salt water
  - 2. 10,000 hr. resistance to high temperature (38C) and high humidity (100%)
  - 3. 10,000 hr. resistance to alkali solution (pH 9.5)
  - 4. 3,000 hr. resistance to dry heat (60C)
  - 5. resistance to 20 freeze/thaw cycles
  - 6. resistance to UV/condensation @ 100 cycles

7.resistance to diesel fuel (4 hr. exposure)

### **1.7 Job-Site Conditions**

- A. Do not apply FRP Reinforcement materials if raining, snowing, or dew condensation is expected or existing concrete surface is wet or if the ambient or surface temperature are below 40° F (4°C).
- B. The ambient temperature and temperature of the epoxy components shall be between 50° F (10°C) and 80° F (27°C) at the time of mixing. See appropriate technical data sheets for more specific instructions.
- C. Precautions should be taken to avoid damage to any surface near the work zone due to mixing and handling of the specified material.
- D. The Contractor is solely responsible for fume control and shall take necessary precautions against injury to Installer personnel or adjacent building occupants during application of primer and resin, etc. Contractor personnel shall use protective equipment and area shall be well vented to the outside. As a minimum, Installer must take the following precautions:
  - 1. Contractor to locate and protect building air intake during application.
  - 2. Contractor to follow all state, federal, and local safety regulations.
  - 3. Contractor to follow all Manufacturers' safety requirements as indicated on appropriate SDS sheets.

### **1.8 Delivery, Storage, and Handling**

- A. Deliver primer, saturant and protective coating in original, unopened containers with the Manufacturer's name, labels, product identification, and batch numbers.
- B. FRP Reinforcement shall be stored in a cool dry area away from direct sunlight, flame, moisture, or other hazards.
- C. Store primer, saturant and protective coating under conditions as recommended by the Manufacturer in a cool dry place out of direct sunlight. Products that have exceeded their shelf life shall not be used.
- D. Contractor is required to confirm that all materials used in accordance with this Section conform to local, state, and federal environmental and worker's safety laws and regulations.
- E. During operations Contractor shall maintain barricades.
- F. The Contractor shall properly dispose of empty containers in accordance with local regulations.



## PART 2 - PRODUCTS

### 2.1 FRP Reinforcement Fabric and/or Laminate

- A. FRP Reinforcement fabric shall be high strength, high modulus, fiber fabric that may be unidirectional or woven (in various fiber architectures) to suit specific repair needs.

1.FRP Reinforcement fabric shall be of the type, size, layer and location as indicated on the Drawings.

2.FRP Reinforcement fabric shall meet the following minimum requirements:

	SikaWrap Hex 100G	SikaWrap Hex 103C	
Property	Requirement	Requirement	ASTM Test Method
<b>Laminate Tensile Strength</b>	78.4 ksi	160.9 ksi	D3039
<b>Laminate Tensile Strength</b> , In primary fiber direction – 1 layer, per inch width	3.1 kips/in./ply	6.4 kips/in./ply	D7565
<b>Laminate Tensile Modulus</b> , In primary fiber direction	3.97 msi	10.39	D3039
<b>Laminate Elongation</b> at break	1.82%	1.45%	D3039
<b>Dry Fabric Weight</b> , Minimum, per square yard	27 oz./yd <sup>2</sup> (917 g/m <sup>2</sup> )	18 oz./yd <sup>2</sup> (611 g/m <sup>2</sup> )	
<b>Percent Laminate Tensile Strength</b> Retained after: 7 days, 100% humidity,100°F (38°C) 3,000 hrs exposure to alkali 3,000 hrs exposure to salt water 3,000 hrs exposure at 140°F (60°C)	90% 90% 90% 90%	90% 90% 90% 90%	
<b>Visual Defects</b>	✓	✓	D2563

	SikaWrap Hex 103C HM	SikaWrap Hex 103C-2X	
Property	Requirement	Requirement	ASTM Test Method
<b>Laminate Tensile Strength</b>	152.0 ksi	160.1 ksi	D3039
<b>Laminate Tensile Strength</b> , In primary fiber direction – 1 layer, per	6.1 kips/in./ply	11.2 kips/in./ply	D7565

inch width			
<b>Laminate Tensile Modulus, In primary fiber direction</b>	13.5 msi	12.3 msi	D3039
<b>Laminate Elongation at break</b>	1.05%	1.15%	D3039
<b>Dry Fabric Weight, Minimum, per square yard</b>	18 oz./yd <sup>2</sup> (611 g/m <sup>2</sup> )	37.2 oz./yd <sup>2</sup> (1,262 g/m <sup>2</sup> )	

3. Approved products are:

- a. SikaWrap Hex Fabrics (100G, 106G, 103C, 103C HM, 103C-2X, 113C, 117C, 230C, 600C +/-45), Sika Corp, Lyndhurst, NJ.
- b. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

B. FRP Precured Strip shall be high strength, high modulus, unidirectional carbon fiber reinforced polymer (CFRP).

1. FRP Precured Strip shall be of the type, size, layer and location as indicated on the Drawings.

2. FRP Precured Strip, shall meet the following minimum requirements:

	Sika CarboDur Strip	
<b>Property</b>	<b>Requirement</b>	<b>ASTM Test Method</b>
<b>Laminate Tensile Strength, In primary fiber direction</b>	406,000 psi (2,800 MPa)	D3039
<b>Laminate Tensile Modulus, In primary fiber direction</b>	23.2x10 <sup>6</sup> psi (160,000 MPa)	D3039
<b>Laminate Elongation at break</b>	1.69 %	D3039
<b>Laminate Thickness</b>	0.047 in. (1.2mm)	
<b>Fiber Volume, minimum</b>	68%	D2563

3. Approved products are:

- A. Sika CarboDur, Sika Corp., Lyndhurst, NJ.
- B. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

C. FRP Precured Rods shall be high strength, high modulus, unidirectional carbon fiber reinforced polymer (CFRP)

1. FRP Precured Rods shall be of the type, size, layer and location as indicated on the Drawings.



2.FRP Precured Rods, shall meet the following minimum requirements:

	Sika CarboDur Rods	
<b>Property</b>	<b>Requirement</b>	<b>ASTM Test Method</b>
<b>Laminate Tensile Strength</b> , In primary fiber direction	406,000 psi (2,800 MPa)	D3039
<b>Laminate Tensile Modulus</b> , In primary fiber direction	22.5x10 <sup>6</sup> psi (155,000 MPa)	D3039
<b>Laminate Elongation</b> at break	1.89 %	D3039
<b>Fiber Volume</b> , minimum	65%	D2563

3. Approved products are:

D. Sika CarboDur Rods, Sika Corp., Lyndhurst, NJ.

E. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

## 2.2 Concrete Surface Primer

- A. Surface Primer shall be a two component, 100% solids, moisture/tolerant, high modulus, high strength epoxy.
- B. Surface Primer shall meet the following minimum requirements:

	Sikadur 330	
<b>Property</b>	<b>Requirement</b>	<b>ASTM Test Method</b>
<b>Tensile Strength</b>	4,900 psi	D638
<b>Elongation at Break</b>	1.2%	D638
<b>Flexural Strength</b>	8,800 psi	D790
<b>Flexural Modulus</b>	506,000 psi	D790
<b>Heat Deflection Temp. (HDT)</b>	120F (48C)	D648

C. Approved products are:

1. Sikadur 330, Sika Corp., Lyndhurst, NJ.
2. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

### 2.3 Fabric Saturant

- A. Saturant resin shall be two component, 100% solids, moisture tolerant, high strength, high modulus epoxy.
- B. Saturants shall meet the following minimum requirements:

	Sikadur (Hex) 300	
Property	Requirement	ASTM Test Method
Tensile Strength	7,500 psi	D638
Tensile Modulus	280,000 psi	D638
Elongation at Break	3.2%	D638
Flexural Strength	11,500 psi	D790
Flexural Modulus	510,000 psi	D790
Heat Deflection Temp. (HDT)	112 F	D648

- C. Approved products are:
1. Sikadur 300, Sika Corp, Lyndhurst, NJ.
  2. Sikadur Hex 300, Sika Corp, Lyndhurst, NJ.
  3. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

### 2.4 Epoxy Repair Mortar

- A. Repair mortar shall be 100% solids, non-sag paste epoxy.
- B. Approved products are:
1. Sikadur 30, Sika Corp., Lyndhurst, NJ.
  2. Sikadur 31, Sika Corp., Lyndhurst, NJ
  3. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

### 2.5 Protective Coating

- A. Protective coating shall be polymer or acrylic based and shall be UV resistant.
- B. Approved products are:
1. Sikagard 550W, Sika Corp., Lyndhurst, NJ.
  2. Sikagard 670W, Sika Corp., Lyndhurst, NJ.



3. Alternate products must be submitted **and** approved by the Engineer a minimum of two weeks prior to the bid date.

## **PART 3 - EXECUTION**

### **3.1 General**

- A. Inspect surfaces to receive the work and report immediately in writing to the Engineer as required in the General Conditions and deficiencies in the surface that render it unsuitable for proper execution of this work.
- B. Protect vehicles, concrete, and other items surrounding work area from dust or damage due to Work of this Section.

### **3.2 Surface Preparation**

- A. All concrete surfaces shall be dry and free of surface moisture and frost, and tested by the Contractor to evaluate moisture transmission in accordance with ASTM D4263 "Indicating Moisture in Concrete by the Plastic Sheet Method."
- B. All concrete surfaces shall be sound. Remove all deteriorated concrete, dust, laitance, grease, paint, curing compounds, waxes, impregnations, foreign particles, and other bond inhibiting materials from the surface by blast cleaning or equivalent mechanical means.
- C. All concrete surfaces shall be air blasted and vacuumed clean to a dust free condition.
- D. Concrete surface irregularities less than one inch shall be ground and smoothed and/or filled with an approved repair mortar (e.g., Sikadur 30) with the addition of 1 part oven dried sand to make an epoxy mortar. Surface irregularities shall be limited to less than 0.04 inches. Surface irregularities greater than one inch shall be repaired using an approved cementitious repair mortar like Sika Top 123. Any sharp edges (e.g. fins, form lines, etc.) must be ground smooth and flush.
- E. Surface levelness (CarboDur strips) – maximum allowable deviation in 6 ft. shall be limited to 1/4 in. (6 mm), but no greater than 1/8 in. per linear ft. (305 mm).
- F. External concrete corners shall be rounded to at least a 1/2" radius when perpendicular to fiber orientation and internal corners shall be smoothed by troweling epoxy mortar into the corners.
- G. The concrete surface should be prepared to a minimum concrete surface profile (CSP) 3 as defined by the ICRI surface profile chips.
- H. The adhesive strength of the concrete shall be verified after preparation by random pull-off testing (ACI 503R or ASTM D4541) at the direction of the Engineer.

Minimum tensile strength is 200 psi with concrete substrate failure, or as approved by the Engineer.

### **3.3 Mixing Primer and Saturant**

- A. Mix components in accordance with Manufacturer's recommendations.
- B. Diluting is not permitted. Pre-condition materials as indicated on technical data sheet.
- C. Mix only that quantity which can be used within its pot life.
- D. Do not batch delivered units into smaller quantities. Mix only full units.

### **3.4 Primer Application**

- A. Apply primer in strictly accordance with Manufacturer's recommendations.
- B. Primer may be applied with a brush or roller. Apply second coat as necessary after first coat has penetrated into the concrete.
- C. Surface depressions shall be filled with epoxy filler as per manufacturers' instructions.
- D. Primer must be covered with fiber within 24 hours of application, depending on temperature conditions. If 24-hour window is exceeded, the primed surfaces must be solvent wiped with a fast flashing solvent (e.g. MEK) or roughened with sandpaper to break the amine blush.

### **3.5 FRP Reinforcement Application**

#### **Method 1: Wet Lay-Up**

- A. Apply FRP Reinforcement in accordance with Manufacturer's recommendations.
- B. When using saturator equipment, follow Manufacturer's procedures for proper machine set-up and calibration. Rollers shall be calibrated to saturate the fabric with the proper resin-to-fabric ratio. The roller gap shall be checked daily by a qualified technician for accuracy. The resin-to-fabric ratio shall also be verified by resin usage and documented on the daily project logs.
- C. Once the fabric is saturated, it may then either be spooled for easy handling, or cut to specified lengths and booked for handling. Care must be taken not to damage the fibers.



- D. The fabric may then be applied to the surface with no delay. Work from one end to the other, taking care to orient the fibers as specified. Remove any air entrapped in the fabric with a ribbed roller or squeegee.
- E. Sheets shall be lapped in the longitudinal direction 6 inches minimum or as indicated on the Drawings. Note: no lapping is required of the sheets parallel to the direction of fiber orientation.

### **Method 2: Dry Lay-Up**

- A. Apply FRP Reinforcement in accordance with Manufacturer's recommendations.
- B. FRP Reinforcement sheets shall be cut beforehand into prescribed lengths. Sheets shall be lapped in the longitudinal direction 6 inches minimum or as indicated on the Drawings. Note: no lapping is required of the sheets parallel to the direction of fiber orientation.
- C. Follow Manufacturer's recommendations regarding primer open times.
- D. Apply a primary saturant coat uniformly by roller brush.
- E. Apply FRP Reinforcement sheets fiber side down to the concrete over the fresh saturant using a ribbed roller to remove any air bubbles.
- E. FRP Reinforcement sheets shall be left alone for about 30 minutes allowing for the primary saturant to soak through the fabric. Correct any dislocation on lifting.
- G. Apply secondary saturant coat with roller over installed sheets in order to impregnate and replenish primary saturant.
- H. If succeeding FRP Reinforcement sheets are specified on the Drawings repeat application procedures.

### **Method 3: Precured Strip Application**

- A. Apply FRP Precured Strip in accordance with Manufacturer's recommendations.
- B. Care shall be taken not to damage the fibers in handling and unpacking the Strips.
- C. Strips may be either delivered to project site in factory pre-cut lengths, or cut on site. Care must be taken not to fray or otherwise damage the fibers when field cutting. Follow Manufacturer's recommendations for field cutting of strips.
- D. Strips shall be cleaned with a fast flashing solvent (e.g. MEK) to remove any bond inhibiting materials. A clean white cotton rag shall be used for this purpose. Continue

cleaning the Strip in this manner until no black residue shows on the rag. Cleaning shall be performed the same day the strips are to be used.

#### **Method 4: Precured Rods Application, Near Surface Mounted (NSM)**

- A. Apply FRP Precured Rods strictly in accordance with Manufacturer's recommendations.
- B. Care shall be taken not to damage the fibers in handling and unpacking the rods.
- C. Rods may be either delivered to project site in factory pre-cut lengths, or cut on site. Care must be taken not to fray or otherwise damage the fibers when field cutting. Strictly follow Manufacturer's recommendations for field cutting of rods.
- D. Rods can be sanded with medium grit sandpaper to create roughened finish if necessary per job specifications.
- E. Rods shall be cleaned with a fast flashing solvent (e.g. MEK) to remove any bond inhibiting materials. A clean white cotton rag shall be used for this purpose. Continue cleaning the rods in this manner until no black residue shows on the rag. Cleaning shall be performed the same day the rods are to be used.

### **3.6 Curing**

- A. Protect finished installation of FRP Reinforcement from rain, sand, dust, etc. using protective sheeting or other barriers. Do not allow protective sheeting to come in contact with finished application.
- B. Curing of finished application shall be a minimum of 24 hours and in order to achieve full strength curing shall be extended for a period of two weeks at an average ambient temperature of 68°F.

### **3.7 Repair of Defects**

- A. Upon completion of the curing process, the installed system shall be checked for areas where saturant has not penetrated or where saturant has not completely cured. Such areas shall be epoxy injected to re-establish bond subject to the approval of the Project Engineer.
- B. Repair procedures shall be performed in accordance with guidelines established by ACI 440.2R-08 (paragraph 7.2.3) and approved by the Project Engineer. All repairs



shall be subject to the same application, curing and quality control specifications as the original work.

1. Small delaminations and voids less than 2 in<sup>2</sup> each are permissible as long as the delaminated area is less than 5% of the total laminate area and there are no more than 10 such delaminations per 10 ft<sup>2</sup>.
2. Medium sized delaminations and voids greater than 2 in<sup>2</sup> but less than 25 in<sup>2</sup> may be repaired by epoxy resin injection or ply replacement, depending on the size and number of delaminations and their location. The repair procedure should be determined by the Project Engineer.
3. Larger size delaminations and voids greater than 25 in<sup>2</sup> should be repaired by selectively cutting away the affected sheet and applying an overlapping sheet patch of equivalent plies. The overlap should extend a minimum of 6 in. in all directions.

### **3.8 Protective Coating**

- A. Apply the protective coating strictly in accordance with Manufacturer's recommendations.

### **3.9 Cleaning**

- A. Uncured saturants may be cleaned from tools with an approved solvent and properly disposed.
- B. Cured saturants shall be removed by mechanical means and properly disposed.

END OF SECTION