Seismic Design of Archetype Steel Buildings in Central and Eastern United States

Volume 1A –12-story Office Building in Savannah, Georgia Building Designs

Applied Technology Council

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Seismic design codes in the United States have evolved since first introduced in 1925; however, they are primarily based on the knowledge of performance requirements for buildings located in high seismicity regions of the United States, such as the West Coast. These model codes are extrapolated for use in areas with moderate seismicity, such as the Central and Eastern United States (CEUS), where member sizes of the lateral-force-resisting systems may be governed by wind requirements. There is a need to understand the seismic performance of buildings when the controlling design load is from wind effects.

In September 2018, the Applied Technology Council (ATC) commenced a task order project under National Institute of Standards and Technology (NIST) Contract SB1341-13-CQ-0009 to develop designs for archetype steel buildings to facilitate future research in understanding the seismic performance of buildings when the controlling design load is from wind. For this purpose, three archetype steel buildings were designed in accordance with older building codes and current building codes for specific locations within the CEUS. This document is one of three volumes presenting design of suites of buildings. Representative structural calculations are provided as supplemental documentation in NIST GCR 21-917-48v1B.

The designs presented were developed by design firms PCS Structural Solutions of Seattle, Washington and Uzun + Case of Atlanta, Georgia. The Project Technical Committee, consisting of Don Scott, John Hutton, and Adrian Persaud monitored and guided the technical efforts of the Project Working Groups, which included Steve Antilla, Jared Dragovich, Hai Lin, Chris Putman, Cameron Prince, and Gavin Rinaldo. Project Working Group member McKell Bowen led the development of two of the three designs presented. The Project Review Panel, consisting of Melissa Burton (ATC Board Contact), C.B. Crouse, Ramon Gilsanz, Larry Griffis, Emily Guglielmo, Eric Hines, and Erik Madsen provided technical advice and consultation over the duration of the work. The names and affiliations of all who contributed to this report are provided in the list of Project Participants.

ATC also gratefully acknowledges Jay Harris (Contracting Officer’s Representative) for his input and guidance throughout the project development process. ATC staff member Justin Moresco and Ginevra Rojahn provided project management support and report production services, respectively.

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Building 1 Overview

The objective of this project was to develop designs for archetype steel buildings to facilitate future research in understanding the seismic performance of buildings when the controlling design load is from wind. For this purpose, three buildings were designed in accordance with previous editions of building codes and current building codes for specific locations within Central and Eastern United States (CEUS). This volume documents designs for Building 1, a 12-story office building located in Savannah, Georgia; designs for Buildings 2 and 3 are documented in NIST GCR 21-917-48 Volumes 2 and 3, respectively.

I.1 Building Selection Criteria

Three buildings were selected for design to support the investigation of the relationship between wind-controlled and seismic-controlled design, as well as the effect of seismic detailing. Each building was selected to be in a moderate- to high-seismic region of CEUS with high design wind loads, with different building configurations (height and footprint), and occupancies. For each building, a different lateral-force-resisting system (LFRS) is used in orthogonal directions: a moment frame system in one direction and a braced frame system in the other.

Building designs include the structural framing systems necessary to resist gravity and environmental (wind) and natural hazard (earthquake) lateral loads consistent with those commonly used in the CEUS at the designated benchmark year. Designs include gravity loads and associated performance criteria consistent with the design use and occupancy identified for the building, and include allowances for interior finishes, mechanical and electrical equipment, and façade. Elevators or stairwells are not included, and nonstructural building systems are not designed as part of this project. Floor systems are assumed to be metal deck with concrete infill slabs and roof systems are selected to be appropriate for the building system. The buildings were designed to the minimum requirements of the building code in effect for the time period of the design.

A total of 16 designs were developed, comprising variation of location, occupancy, height, applicable design code, Risk Category, and Seismic Design Category. Table I-1 presents a summary of designs documented in each of the three Volumes.

In addition, one building (Building 2 documented in NIST GCR 21-917-48 Volume 2) was also evaluated using performance-based seismic design principles specified in
ASCE/SEI 41-17 (ASCE, 2017b), for an Immediate Occupancy performance objective.

Table I-1  Summary of Designs Documented in NIST GCR 21-917-48

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Volume 1</th>
<th>Volume 2</th>
<th>Volume 3</th>
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<tbody>
<tr>
<td>Location</td>
<td>Savannah, GA</td>
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<td>St. Louis, MO</td>
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<td>Occupancy</td>
<td>Office</td>
<td>Healthcare</td>
<td>Education</td>
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<tr>
<td>Height</td>
<td>12-story</td>
<td>7-story</td>
<td>3-story</td>
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<tr>
<td>Overall Plan Dimensions</td>
<td>190 ft × 120 ft</td>
<td>124 ft × 129 ft</td>
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<td>III, IV</td>
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<tr>
<td>Number of Designs</td>
<td>5</td>
<td>6</td>
<td>5</td>
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</tbody>
</table>

a  Design code designations are discussed in the next section.

Figures I-1 through I-3 present schematic designs for each of the three buildings.

![Figure I-1](image)  Schematic for Building 1 (this volume).
I.2 Design Codes

To provide designs that are defined by varying Risk Categories, the edition of the national design codes to be used for the “older” buildings were evaluated to reference the ANSI A58.1 – 1982, *American National Standard, Minimum Design Loads for Building and Other Structures* (ANSI, 1982) as this was the first standard in the United States to introduce Importance Factors, which are based upon the use of the building, into the design of buildings. Current building codes now define these Importance Factors as Risk Category Factors.

In the 1980s there were three regional building codes utilized in the United States, the *Standard Building Code* (SBC) used in the Southeast, the *National Building Code* (NBC) used in the Northeast and Midwest, and the *Uniform Building Code* (UBC) used in the West. ANSI A58.1 – 1982 was first referenced by the national building codes in the 1988 edition of the SBC developed by the Southern Building Code Congress International, Inc., and the 1987 NBC developed by the Building Officials and Code Administrators, Inc.

The “current” versions of the designs satisfy the requirements of the 2018 *International Building Code* (IBC) developed by the International Code Council and used throughout the United States.
Based upon the selection of the editions of the overall building codes, the appropriate editions of the material design standards were determined. The material standards used for the designs are as follows.

1987 National Building Code (NBC) – not applicable to Building 1
- American Concrete Institute (ACI) – 318-83: ACI Building Code Requirements for Structural Concrete, (ACI 318-83)

1988 Standard Building Code (SBC)
- ACI 318-83: ACI Building Code Requirements for Structural Concrete, (ACI 318-83)

2018 International Building Code (IBC)
- AISC, Specification for Structural Steel Buildings, (ANSI/AISC 360-16)
- ACI 318-14: Building Code Requirements for Structural Concrete and Commentary, (ACI 318-14)

I.3 Building 1 Design Cases

This volume documents the designs for Building 1, a 12-story office building located in Savannah, Georgia, illustrated in Figure I-1. Five design cases were developed for this building.

A. 2018 IBC Risk Category II, Seismic Design Category D
B. 2018 IBC Risk Category III, Seismic Design Category D
C. 1988 SBC “Risk Category II, Seismic Design Category C” Equivalent
D. 1988 SBC “Risk Category III, Seismic Design Category C” Equivalent
E. 2018 IBC Risk Category II, Seismic Design Category C

As noted previously, the 1980s editions of the building codes did not use the term Risk Category but based the selection of the required “Importance Factor” on the specified Use or Occupancy of the facility. In the current editions of the building codes the “Importance Factor” is based upon the “Risk Category” of the facility. Therefore, the term “Equivalent” found in Designs C and D listed above is used to
distinguish which Importance Factor was used in seismic design, 1.00 or 1.25, and relate it to the current code language.

I.4 Variations in Gravity Framing Design

The primary reason for developing designs with building codes from both 1980s and current building codes was to demonstrate the difference in detailing requirements the LFRS. However, there are also other requirements of the building codes that contribute significantly to the differences in designs.

The occupancy and framing layout are identical for each of the individual archetype building designs. The differences in gravity designs are a result of changes in code provisions, material strengths, and engineering practice between the 1980s and 2018. The differences described below primarily lead to reductions in weight and depth of the structural members for the 2018 IBC design with respect to the 1980s SBC and NBC designs for the gravity system.

I.4.1 ASD vs. LRFD Design

The design philosophy changed from Allowable Stress Design (ASD) in the 1988 SBC and the 1987 NBC to Load and Resistance Factor Design (LRFD) in the 2018 IBC. All things being equal, ASD commonly leads to heavier or deeper member sizes when compared to the LRFD methodology. For this building, ASD is utilized for the SBC designs to mimic the design philosophy that would have been used during this era of structural engineering.

I.4.2 Live Load Reduction

At first glance, the SBC live load reduction provisions appear identical to the 2018 IBC alternate live load reduction provisions, however there is a subtle difference. The SBC live load reduction provisions do not allow a reduction for the first 150 square feet of the tributary area associated with the member and then reductions at a rate of 8% of the entire tributary area once above 150 square feet. IBC requires deduction of 150 square feet from the tributary area in all cases. The net result is that greater live load reduction is allowed under 1988 SBC provisions for members with tributary areas greater than 150 square feet, which represents most of the members in Building 1.

I.4.3 Material Strengths

There was a significant change in the material strengths of commonly available wide flange steel between the 1980s and 2018. ASTM A36 strength steel with $F_y = 36$ ksi was the most commonly available steel in 1980s and was therefore used for the 1980s designs. Whereas today ASTM A992 grade 50, $F_y = 50$ ksi, steel is commonly
available and was used for the 2018 IBC designs. This increase in strength has the general effect of reducing the overall structural material weight.

I.4.4 Engineering Practice – Serviceability

In 1980s, it was not common practice to design buildings explicitly for vibration criteria, whereas it is today. Therefore, vibration criteria were considered for the 2018 IBC designs but not for the 1980s designs. The change in engineering practice between the 1980s and today was driven by necessity, as higher steel strengths and more economical design methodologies, i.e., LRFD, resulted in lighter member designs. In addition, the shift from “paper offices”, where paper was stored in file cabinets throughout the floor plate resulting in heavy dead loads on the floor and dampened effects of vibration, to today’s “electronic offices”, where items are stored electronically and “open” office concepts result in lower applied dead loads, contributed to vibration criteria controlling the design of gravity members.

I.5 Variations in Lateral-Force-Resisting System Design

The resulting lateral designs are considerably different between the 1988 SBC and 2018 IBC. The 1988 SBC designs are controlled by wind loads. The 2018 IBC designs are also controlled by wind loads for strength and drift, but seismic capacity design and detailing requirements influence members sizes and connections significantly for the Seismic Design Category (SDC) D designs (Design Cases A and B). For the SDC C design (Design Case E), the lateral system is detailed as “Steel Systems Not Specifically Detailed for Seismic Resistance,” as is common practice for the East Coast, and therefore seismic requirements do not have as a significant effect.

When adjusted for ASD vs. LFRD, the resulting wind design loads between 1988 SBC and 2018 IBC are found to be very similar. However, the drift requirements used for the 1988 SBC designs are more stringent than the 2018 IBC designs. Specifically, for Risk Category II designs, a $H/360$ drift limit at 50-year return period fastest-mile winds was used for the 1988 SBC designs, whereas a $H/400$ drift limit at 10-year three-second gust wind is used for 2018 IBC designs. Similarly, for the Risk Category III designs, a $H/360$ drift limit at 100-year return period fastest-mile winds is used for the 1988 SBC designs, and a $H/400$ drift limit at 25-year three-second gust wind is used for 2018 IBC designs. Wind drift controls over strength for the 1988 SBC designs.

1988 SBC includes provisions for a 1/3 allowable stress increase for combinations including wind and seismic; these provisions do not exist in the 2018 IBC. However, as noted above, since drift controls the 1988 SBC designs, this was not as significant a factor as it would have been otherwise.

For seismic loads, the 1988 SBC uses regional seismic zones and does not consider the response of the building’s lateral system, while the 2018 IBC uses site specific values,
and considers the response of the lateral system, including the natural frequency of the building. Because the building has very different periods in each orthogonal direction (moment frame in the east-west, braced frame in the north-south), the IBC design yields base shears that differ by a factor of two in each orthogonal direction. For the SBC design, where building response is not considered, has the same base shear in each orthogonal direction.

The greatest difference between the design of the lateral systems is due to the seismic detailing requirements to ensure ductility and energy dissipation. The 2018 IBC SDC D designs (Design Cases A and B) had 16-20% greater lateral steel tonnage (moment and braced frame columns, beams, and braces) compared to the 1988 SBC designs (Design Cases C and D). When comparing the 2018 IBC SDC C design (Design Case E) to the corresponding 1988 SBC design (Design Case C), the 2018 IBC design had 15% less lateral steel tonnage, with no significant difference in detailing.

I.6 Comparison of Building 1 Designs

The focus of this project and the designs is the steel structure and thus the foundation systems used are representative for the geographic region of the country that the buildings are in; however, the foundation systems are not fully designed and detailed. The primary observation of the effect the various requirements have on the design of the building structure can be made from the steel tonnage calculated for each of the designs, as shown in Table I-2 below.

<table>
<thead>
<tr>
<th>Design Case (Code Year, Risk Category, Seismic Design Category)</th>
<th>Steel (tons)</th>
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<tbody>
<tr>
<td>Design A (2018 IBC, RC II, SDC D)</td>
<td>1,664 tons</td>
</tr>
<tr>
<td>Design B (2018 IBC, RC III, SDC D)</td>
<td>1,720 tons</td>
</tr>
<tr>
<td>Design C (1988 SBC, “RC II, SDC C” Equivalent)</td>
<td>1,622 tons</td>
</tr>
<tr>
<td>Design D (1988 SBC, “RC III, SDC C” Equivalent)</td>
<td>1,668 tons</td>
</tr>
<tr>
<td>Design E (2018 IBC, RC II, SDC C)</td>
<td>1,336 tons</td>
</tr>
</tbody>
</table>

Overall, a decrease of approximately 16-20% of total lateral-force-resisting system steel tonnage (moment and braced frame beams, columns, and braces) was observed between SBC and IBC designs.

It is noted that because of advancement of seismic engineering, buildings designed to current codes are expected to have higher seismic performance than buildings constructed in the 1980s; however, they are being constructed at a higher cost. This cost increase is not evident in the total steel tonnages; it is due to additional detailing.
and fabrication costs associated with reaching the code required level of ductility within the lateral systems.

I.7 Report Organization

This report provides the necessary context for researchers utilizing the building designs developed on this project. List of references and project participants are provided in the next section.

The remainder of the report includes applicable codes, snow loads, seismic loading criteria, wind loading criteria, description of gravity design, description of lateral design, and structural drawings for the following design cases:

- Design Case A: 2018 IBC Risk Category II, Seismic Design Category D
- Design Case B: 2018 IBC Risk Category III, Seismic Design Category D
- Design Case C: 1988 SBC “Risk Category II, Seismic Design Category C” Equivalent
- Design Case D: 1988 SBC “Risk Category III, Seismic Design Category C” Equivalent
- Design Case E: 2018 IBC Risk Category II – Seismic Design Category C

Representative structural calculations are provided as supporting documentation in NIST GCR 21-917-48v1B.

Designs for Buildings 2 and 3 are documented in NIST GCR 21-917-48 Volumes 2 and 3, respectively.
References

ACI, 1983a, 318-83: *ACI Building Code Requirements for Structural Concrete*, ACI 318-83, American Concrete Institute, Farmington Hills, Michigan.


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A.1 Gravity Design

The 12-story office is a typical steel framed building with 3” metal deck and 3-1/4” lightweight concrete topping providing a total floor depth of 6-1/4”, not including the structural steel. This decking was chosen to provide the required 2-hour fire rating that is typical for office buildings. The columns and beams are ASTM A992 steel wide flange members and were designed using ANSI/AISC 360-16. The deflection was limited to the IBC prescribed limits of $L/360$ for floor live load, $L/240$ for floor total load, $L/240$ for roof live load and $L/180$ for roof total load. The calculated total dead load applied was 62.5 psf at the floors and 72.5 psf at the roof. The live loads for offices, corridors (at and above the first floor) and roofs were per IBC table 1607.1. Partition loads were also applied per IBC 1607.5.

A.2 Lateral Design

The building lateral load resisting system consists of braced frames in the North/South direction and moment frames in the East/West direction. The applied wind and seismic loads were determined using chapters 27 and 12 respectively from the ASCE 7-16. Wind base shears significantly exceeded earthquake base shears in both directions. Thus, for the lateral resisting system in the North/South direction the brace sizes were governed by wind, however, the columns and beams were governed by seismic detailing requirements. In the East/West direction, the moment frame beams were governed by wind drift requirements while the columns were governed by seismic detailing requirements. Wind drifts were limited to $H/400$ during a 10-year mean return interval windstorm. Fixed base connections for the moment frames, utilizing the code required concrete grade beams, were used to limit drift and column sizes.

A.3 Steel Tonnage

Total steel tonnage for this design case is calculated as 1,664 tons.

A.4 Structural Drawings

Structural drawings for Design Case A are provided on the following pages.
# Office Building - Savannah, Georgia

**Design A - 2018 IBC Risk Category II**

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## Structural Framing Details

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</thead>
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<tr>
<td>WF Columns (Fy = 50 ksi)</td>
<td>60 tons</td>
</tr>
<tr>
<td>WF Girders &amp; Joists (Fy = 50 ksi)</td>
<td>933 tons</td>
</tr>
<tr>
<td>Moment Frame WF Columns (Fy = 50 ksi)</td>
<td>187 tons</td>
</tr>
<tr>
<td>Braced Frame WF Columns (Fy = 50 ksi)</td>
<td>198 tons</td>
</tr>
<tr>
<td>Braced Frame WF Beams (Fy = 50 ksi)</td>
<td>62 tons</td>
</tr>
<tr>
<td>HSS Braces Round (Fy = 46 ksi) &amp; Square (Fy = 50 ksi)</td>
<td>49 tons</td>
</tr>
</tbody>
</table>

**Notes:**

1. Steel quantities do not include miscellaneous steel, cut, waste steel, cover, typical steel framing connections, etc.

---

**Overall Framing 3D View**

**Force Resisting System 3D View**

---

**Cover Sheet**

**Drawing:**

- Office Building - Savannah, Georgia
- Design A - 2018 IBC Risk Category II

**Structure:**

- Overall Framing 3D View
- Force Resisting System 3D View
**Level 2-12 Load Map**

**Roof Load Map**

### Superimposed Dead Load Designations

<table>
<thead>
<tr>
<th>MARK</th>
<th>USE</th>
<th>LOAD (PSF)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Office</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>B</td>
<td>Roof</td>
<td>20</td>
<td>10 FOOTBASE + 11 NMB</td>
</tr>
</tbody>
</table>

### Live Load Designations

<table>
<thead>
<tr>
<th>MARK</th>
<th>USE</th>
<th>LOAD (PSF)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Office</td>
<td>10 (R) + 15 (NR)</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Corridors</td>
<td>80 (R)</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Mechanical &amp; Storage</td>
<td>100 (R)</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Lobby</td>
<td>125 (R)</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>S &amp; Stairs</td>
<td>20 (R)</td>
<td>-</td>
</tr>
</tbody>
</table>

**Load Map Key:**
- **A** indicates superimposed dead load
- **B** indicates live load

**Notes:**
- "R" indicates live load reduction per ACI Section 1607.11
- "NR" indicates non-reducible live load.
SECOND FLOOR FRAMING PLAN

FRAME NOTES:
1. IN ADDITION TO SECTIONS AND DETAILS REFERENCED IN THIS PLAN, SEE ALL TYPICAL DETAILS.
2. OUT OF SCALE — JSU 12'X12' TYPICAL LAYOUT OF deepenWALLS AND ENTRANCE DOORS.
3. SEE COLUMN SCHEDULE FOR COLUMN SIZES.
4. SPACE STEEL BEAMS EQUALLY BETWEEN COLUMN. UNLESS NOTED OTHERWISE.
5. COLUMN BEAMS HAVE THE SAME SIZE AS THE BEAMS IN THE BACKSPANS. UNLESS NOTED OTHERWISE.
6. Sawhite indicates floor slab construction. Sawhite depth varies with shallower panels. Use OF 3/4" shears:
7. ENDS OF BEAM SPANS TO BE CONNECTED TO COLUMN COLUMNS. USE W-word in column.
1. ADDITIONAL TO SECTIONS AND DETAIL REFERENCES IN THE PLAN, SEE ALL TYPICAL DETAILS.
2. TOP OF SLAB = 1/2" OF COPPER RAIN. UNLESS NOTED OTHERWISE
3. W24X62 BEAMS ARE CENTERED ON 10'-0" AXES WITH 7'-0" SPOUT DISTANCES TO BEAMS (7'-0" CORNERS). INDICATES RAIN EA. AS CENTERED. SEE PLAN FOR EA. AS CENTERED.
4. TOP OF STEEL = -0'-6 1/4" (RELATIVE TO TOP OF SLAB), UNLESS NOTED OTHERWISE.
5. TOP OF SLAB = +263'-6" AT FINISHED FLOOR UNLESS NOTED OTHERWISE IN ADDITION TO SECTIONS AND DETAILS REFERENCED IN THIS PLAN, SEE ALL TYPICAL DETAILS.
6. FRAME rc 22'-0" RAIN EA. AS CENTERED. INDICATES RAIN EA. AS CENTERED. SEE PLAN FOR EA. AS CENTERED.
7. A = ±50 KA = ±50 K
8. A = ±50 K

FRAMING LEGEND:
- W24x62 (69) W24x62 (69) W24x62 (69)
- W16x26 (30) W16x26 (30) W16x26 (30)
- W21x44 (45) c=1 1/2" W21x44 (45) c=1 1/2" W21x44 (45) c=1 1/2"
- W27x84 (44) c=1" W27x84 (44) c=1" W27x84 (44) c=1"
- HSS8x8x3/8 HSS8x8x3/8 HSS8x8x3/8
- W8x15 (10) W8x15 (10) W8x15 (10) W8x15 (10) W8x15 (10)
- HSS8x8x3/8 HSS8x8x3/8 HSS8x8x3/8
- HOIST BM HOIST BM HOIST BM

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

ROOF FRAMING PLAN

SFRS MOMENT FRAME SFRS MOMENT FRAME SFRS MOMENT FRAME SFRS MOMENT FRAME SFRS MOMENT FRAME SFRS MOMENT FRAME

SFRS BRACED FRAME SFRS BRACED FRAME SFRS BRACED FRAME SFRS BRACED FRAME SFRS BRACED FRAME SFRS BRACED FRAME

SRFS BRACED FRAME SRFS BRACED FRAME SRFS BRACED FRAME SRFS BRACED FRAME SRFS BRACED FRAME SRFS BRACED FRAME

SFRS MOMENT FRAME SFRS MOMENT FRAME SFRS MOMENT FRAME SFRS MOMENT FRAME SFRS MOMENT FRAME SFRS MOMENT FRAME
TYPICAL ELEVATOR PIT SECTION

TYPICAL GRADE BEAM ELEVATION

GRADE BEAM SCHEDULE

TYPICAL GRADE BEAM SECTION

HOOP AND CROSSTIE DETAILS

TYPICAL PILE CAP AT BRACED FRAME AND MOMENT FRAME BASE PLATES

TYPICAL SECTION THROUGH PRECAST PILE
1. AT EXTERIOR COLUMNS, COAT BELOW GRADE PORTION OF COLUMN AND BASE SEE NOTE 1

NOTES:

48 DIA
LAP, TYP.
METER
TAP, TYP.
METER
- 

· 

·

PROVIDE KEYWAY ALL AROUND,
2db
LAP, TYP.
METER
AISC
·

SEE PLAN
GRADE BEAM
PILE, SEE
EXTEND PILE REINFORCING TO
TOP OF CAP

ANCHOR ROD HONES, SEE BASE

SCALE:  1 1/2" = 1'-0"

ANCHOR ROD DETAIL

2

TYPICAL FOOTING INTERSECTION PLAN DETAIL

3

TYPICAL COLUMN AND PILE CAP DETAIL

4

TYPICAL GRAVITY COLUMN BASE PLATE DETAIL

5

PRECAST PILE CAP SCHEDULE

PILE CAP SCHEDULE FOR 14" SQ. PRECAST PILES 80 TON COMPRESSION AND 60 TON TENSION PILES

P3

P4

P5

P6

P7

P8

P9

P10

P14

P16

P18

S3.10

S3.10

S3.10

S3.10

S3.10

S3.10

S3.10

S3.10

S3.10

S3.10

S3.10

S3.10

S3.10
<table>
<thead>
<tr>
<th>Height (ft)</th>
<th>Locations</th>
<th>Remarks</th>
<th>Base Plate</th>
<th>Anchor Rods</th>
</tr>
</thead>
<tbody>
<tr>
<td>100'-0&quot;</td>
<td>LEVEL 01</td>
<td>A-1</td>
<td>A-2</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>142'-0&quot;</td>
<td>LEVEL 02</td>
<td>A-3</td>
<td>A-4</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>169'-0&quot;</td>
<td>LEVEL 03</td>
<td>A-5</td>
<td>A-6</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>182'-6&quot;</td>
<td>LEVEL 04</td>
<td>A-7</td>
<td>A-8</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>196'-0&quot;</td>
<td>LEVEL 05</td>
<td>C-1</td>
<td>C-2</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>250'-0&quot;</td>
<td>LEVEL 06</td>
<td>C-3</td>
<td>C-4</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>300'-0&quot;</td>
<td>LEVEL 07</td>
<td>C-5</td>
<td>C-6</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>350'-0&quot;</td>
<td>LEVEL 08</td>
<td>C-7</td>
<td>C-8</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>400'-0&quot;</td>
<td>LEVEL 09</td>
<td>D-1</td>
<td>D-2</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>450'-0&quot;</td>
<td>LEVEL 10</td>
<td>D-3</td>
<td>D-4</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>500'-0&quot;</td>
<td>LEVEL 11</td>
<td>D-5</td>
<td>D-6</td>
<td>Anchor Rods</td>
</tr>
<tr>
<td>550'-0&quot;</td>
<td>LEVEL 12</td>
<td>D-7</td>
<td>D-8</td>
<td>Anchor Rods</td>
</tr>
</tbody>
</table>

- **Anchor Rods**: 2" x 22" x 1', 1" DIA. (4) - 10" long
- **Anchor Rods**: 3" x 28" x 2', 1" DIA. (4) - 10" long
- **Anchor Rods**: 4" (SIM) SEE 1/S7.00
- **Anchor Rods**: 2 1/4" x 22" x 1', 1" DIA. (4) - 10" long
- **Anchor Rods**: 1 1/2" x 20" x 1', 8" long

See drawings for column schedule and structural details.
CONNECTION GEOMETRY AND DESIGN WILL VARY BASED ON EACH BRACED FRAME MEMBER SIZES PER AISC 341.

Pet = XXXXK  INDICATES EXPECTED TENSION FORCE IN BRACE FOR DESIGN OF CONNECTIONS
Pec = XXXXK  INDICATES EXPECTED COMPRESSION FORCE IN BRACE FOR DESIGN OF CONNECTIONS

SEE PLANS & ELEVATIONS.
LEVEL 01
100'-0"

LEVEL 02
115'-0"

LEVEL 03
128'-6"

LEVEL 04
142'-0"

LEVEL 05
155'-6"

LEVEL 06
169'-0"

LEVEL 07
182'-6"

LEVEL 08
196'-0"

LEVEL 09
209'-6"

LEVEL 10
223'-0"

LEVEL 11
236'-6"

LEVEL 12
250'-0"

FRAMING NOTES:
1. ALL BEAMS AND COLUMNS INDICATED AS 'SFRS'
   ARE PART OF THE SEISMIC FORCE RESISTING SYSTEM (SFRS).
   SEE PLANS & ELEVATIONS.
2. SEE S7.10 SERIES FOR TYPICAL BRACED FRAME DETAILS.
3. INDICATES DOUBLER PLATE THICKNESS.
   SEE DETAIL 3/ S7.10
This publication is available free of charge from:
https://doi.org/10.6028/NIST.GCR.21-917-48v1A
r = 3/8" MIN.,

TYP.
d (TYP.)
e TYP.

NOTES:
1. FOR ADD'L INFO SEE AISC 360 SECTION J1.6
2. PREHEAT PER AISC 360 SECTION M2.2 BEFORE THERMAL CUTTING.
3. 'tw' IS THE THICKNESS OF THE MATERIAL IN WHICH THE HOLE IS MADE.
4. d = GREATER OF 1 5/16" AND tw.
5. e = 1 1/2 x tw, e = 1" MIN., e MAY BE REDUCED TO 2" FOR W14x426 AND LARGER COLUMNS.

DIMENSION AS FOLLOWS (INCLUDING AISC TOLERANCES)
a = LARGER OF t
bf
OR 1/2" (+ 1/2 x t
bf
, - 1/4 x t
bf
)
b = GREATER OF 3/4 x t
bf
OR 3/4" (± 1/4")
c = 3 x t
bf
(± 1/2")

BEVEL PER AWS, TYP.

CJP, STIFFENER PL. TO COL.
WF COLUMN, SEE SCHED.
·

T&B FLANGE,
DCW
5/16
1"

DETAIL A-A
GR 50 STIFFENER PL. EA.
SIDE OF COLUMN WEB.
MATCH BEAM FLANGE THICKNESS, TYP.

tp-1/16
DETAIL A-A
DETAIL B-B

ERECTION BOLTS
CJP PL. TO COLUMN FLANGE,
BEAM WEB TO COLUMN FLANGE,
DCW
GR 50 PL., t
P TO MATCH BEAM WEB DOUBLER PL., SEE ELEVATION
75% DOUBLER PL. THICKNESS, DOUBLER PL., WELD PER AWS D1.8, CLAUSE 4.3
5/16
5/16 WEB TO BASEPLATE, DEMAND CRITICAL WELD
5/16 3 SIDES, TYP
5/16 DOUBLER
DOUBLER WELD
1/2" DOUBLER PL. (GR. 50)

DOUBLER PL., EACH SIDE OF COL. WEB.
1/2" U-BAR TIE
SEE GRADE BEAM SCHED.
1/2" DOUBLER PL. (GR. 50)

PROTECTED ZONE 0.5 x Dbm
TOP OF SLAB
SEE PLAN

TOP OF CAP
SEE PLAN

GRADE BEAM
2 ROWS OF (3) 75KSI #11 REBAR w/ LENTON C12SW WELDABLE HALF-COUPLECTS TO COLUMN. TOP AND BOTTOM OF GRADE BEAM. EACH SIDE OF COLUMN.

CONSULTANTS
SHEET NUMBER
TITLE
PROJECT
BUILDING

OFFICE

S7.10

S7.10

2018 IBC WITH RISK CATEGORY II
SEISMIC DESIGN CATEGORY D

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S7.10
1 TYP. WELD ACCESS HOLE DETAIL AT COLUMN
2 TYP. WELD ACCESS HOLE DETAIL AT BEAM
3 MOMENT CONNECTION WUF - W
4 MOMENT FRAME CONNECTION

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Design Case B

2018 IBC
Risk Category III
Seismic Design Category D

B.1 Gravity Design
The 12-story office is a typical steel framed building with 3” metal deck and 3-1/4” lightweight concrete topping providing a total floor depth of 6-1/4”, not including the structural steel. This decking was chosen to provide the required 2-hour fire rating that is typical for office buildings. The columns and beams are ASTM A992 steel wide flange members and were designed using ANSI/AISC 360-16. The deflection was limited to the IBC prescribed limits of \( L/360 \) for floor live load, \( L/240 \) for floor total load, \( L/240 \) for roof live load and \( L/180 \) for roof total load.

The calculated total dead load applied was 62.5 psf at the floors and 72.5 psf at the roof. The live loads for offices, corridors (at and above the first floor) and roofs were per IBC table 1607.1. Partition loads were also applied per IBC 1607.5.

B.2 Lateral Design
The building lateral load resisting system consists of braced frames in the North/South direction and moment frames in the East/West direction. The applied wind and seismic loads were determined using Chapters 27 and 12 respectively from the ASCE 7-16. Wind base shears significantly exceeded earthquake base shears in both directions. Thus, for the lateral load resisting system in the North/South direction the brace sizes were governed by wind, however the columns and beams were governed by seismic detailing requirements. In the East/West direction the moment frame beams were governed by wind drift requirements while the columns were governed by seismic detailing requirements. Wind drifts were limited to \( H/400 \) during a 25-year mean return interval windstorm. Fixed base connections for the moment frames, utilizing the code required concrete grade beams, were used to limit drift and column sizes.

B.3 Steel Tonnage
Total steel tonnage for this design case is calculated as 1,720 tons.

B.4 Structural Drawings
Structural drawings for Design Case B are provided on the following pages.
OFFICE BUILDING - SAVANNAH, GEORGIA
DESIGN B - 2018 IBC RISK CATEGORY III

OVERALL FRAMING 3D VIEW

FORCE RESISTING SYSTEM 3D VIEW

DESIGN B: 2018 IBC RISK CATEGORY III

ITEM | QUANTITY
---|---
WF COLUMNS (Fy = 50 ksi) | 60 TONS
WF GIRDERS & JOISTS (Fy = 50 ksi) | 933 TONS
MOMENT FRAME WF COLUMNS (Fy = 50 ksi) | 211 TONS
MOMENT FRAME WF BEAMS (Fy = 50 ksi) | 172 TONSTOTAL
BRACED FRAME WF COLUMNS (Fy = 50 ksi) | 213 TONS
BRACED FRAME WF BEAMS (Fy = 50 ksi) | 62 TONS
HSS BRACES ROUND (Fy = 46 ksi) & SQUARE (Fy = 50 ksi) | 56 TONS

NOTES:
1. STEEL QUANTITIES DO NOT INCLUDE MISCELLANEOUS STEEL, CUT WASTE STEEL, STEAK, TYPICAL STEEL, FRAMING CONNECTORS, ETC.
FOUNDATION & GRADE LEVEL FRAMING PLAN

FOUNDATION AND SOIL NOTES:
1. TOP OF NOMINAL SLAB ELEVATION = 100'-0".
2. SLAB-ON-GROUND THICKNESS IS 5", UNLESS NOTED OTHERWISE.
3. 'GB' INDICATES GRADE BEAM. SEE S3.00 FOR ADDITIONAL INFORMATION.
4. ALL FOOTINGS, PILE CAPS, AND PIERS ARE CENTERED ABOUT COLUMN CENTERLINES, UNLESS NOTED OTHERWISE.
5. SEE S4.00 FOR COLUMN SCHEDULE.

LEGEND:
X'-X"
INDICATES TOP OF WALL FOOTING OR TOP OF GRADE BEAM ELEVATION
X'-X"
INDICATES PILE CAP TYPE. SEE SHEET S3.01
INDICATES TOP OF PILE CAP ELEVATION BELOW SLAB ON GRADE.
TYP. ELEVATION IS -4'-0" BELOW TOP OF SOG, UNLESS NOTED OTHERWISE.
X'-X"
INDICATES PILE, SEE S3.00 FOR ADDITIONAL INFORMATION.

CONSULTANTS
SHEET NUMBER
TITLE
PROJECT
BEDROOM BUILDING
S2.00
SFRS GB-01 SFRS GB-01 SFRS GB-01 SFRS GB-01 SFRS GB-01 SFRS GB-01
SFRS GB-02 SFRS GB-02 SFRS GB-02 SFRS GB-02 SFRS GB-02 SFRS GB-02
GB-03 GB-03 GB-03 GB-03 GB-03 GB-03 GB-03

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FRAMING NOTES:
1. CANTILEVER BEAMS HAVE THE SAME SIZES AS THE BEAMS IN THE BACKSPANS, UNLESS NOTED OTHERWISE.
2. TOP OF SLAB = +115', AT FINISHED FLOOR UNLESS NOTED OTHERWISE.
3. EDGE OF SLAB AT OPENINGS IS LOCATED 6" FROM THE BEAM CENTERLINE, UNLESS NOTED OTHERWISE.
4. 'A=±xxK' INDICATES FACTORED AXIAL FORCE. PROPORTION CONNECTIONS FOR 'A' IN COMBINATION WITH SHEAR.
5. COMPOSITE FLOOR DECK TOPPED WITH 3.25" LIGHTWEIGHT (115 PCF) CONCRETE, REINFORCED WITH 6x6-W2.9xW2.9 WWR (6 1/4" TOTAL).
6. INDICATES SPAN DIRECTION OF SLAB CONSTRUCTION: 3" 20 GAUGE (MINIMUM) GALVANIZED.
7. FORCE INDICATED AXIAL FORCE MUST BE TRANSFERRED THROUGH COLUMN TO ADJACENT MEMBER.
8. SEE KICKER, TYP.
9. SFRS MOMENT FRAME.
10. SFRS BRACED FRAME.
11. 20.027 CP.
12. 01 MARCH, 2021.
13. 2018 IBC WITH RISK CATEGORY III.
14. BUILDING.
15. OFFICE.
16. DESIGN B.
17. SAVANNAH, GEORGIA.
TYPICAL FLOOR FRAMING PLAN

FRAMING LEGEND:

- **TOP OF STEEL = -0'-6 1/4" (RELATIVE TO TOP OF SLAB), UNLESS NOTED OTHERWISE.**
- **SPACE STEEL BEAMS EQUALLY BETWEEN COLUMNS, UNLESS NOTED OTHERWISE.**
- **TOP OF SLAB = SEE TABLE**
- **CANTILEVER BEAMS HAVE THE SAME SIZES AS THE BEAMS IN THE BACKSPANS, UNLESS NOTED OTHERWISE.**
- **SEE COLUMN SCHEDULE ON S4.00 FOR COLUMN SIZES.**
- **FORCE INDICATED AXIAL FORCE MUST BE TRANSFERRED THROUGH COLUMN TO ADJACENT MEMBER.**
- **'A=±xxK' INDICATES FACTORED AXIAL FORCE. PROPORTION CONNECTIONS FOR 'A' IN COMBINATION WITH SHEAR**
- **6x6-W2.9xW2.9 WWR (6 1/4" TOTAL).**
- **W24x62 (69) W24x62 (69) W16x26 (30)**
- **W21x44 (45) c=1 1/2"**
- **SFRS MOMENT FRAME**
- **SFRS BRACED FRAME**
- **HSS8x8x3/8**
- **W14x22 (12)**

**STUDS, SEE TYPICAL STUD**

**CONNECTION MOMENT**

**FRAMING LEGEND:**

- **S6.20 SFRS MOMENT FRAME**
- **SFRS BRACED FRAME**
- **W27x84 (44) c=1"**
- **W21x44 (45) c=1 1/2"**
- **W16x26 (30) c=1/2"**
- **W21x44 (45) c=1 1/2"**
- **W14x22 (10)**
- **W16x26 (30) c=1/2"**
- **W21x44 (45) c=1 1/2"**
- **HSS8x8x3/8**
- **W24x62 (36) c=1/2"**

**LEVEL B1**

- **LEVEL B2**
- **LEVEL B3**
- **LEVEL B4**
- **LEVEL B5**
- **LEVEL B6**
- **LEVEL B7**
- **LEVEL B8**

**DRAWINGS**

- **SHEET NUMBER**

**DESCRIPTIONS:**

- **FRAME NOTES:**
  1. IN ADDITION TO SECTIONS AND DETAIL REPRESENTED IN THIS PLAN, SEE ALL TYPICAL DETAILS.
  2. TOP OF BANDS AND TIE PLATES ARE RELATIVE TO TOP OF SLAB, UNLESS NOTED OTHERWISE.
  3. INDICATES SPAN DIRECTLY OVER SILL OF CONSTRUCTION; IF IN DOOR OR WINDOW VOLUME, SPAN DIRECTLY OVER SURFACE OF VOLUME, UNLESS NOTED OTHERWISE.
  4. SPACE STEEL BEAMS EQUALLY SPACED BETWEEN COLUMNS, UNLESS NOTED OTHERWISE.
  5. CONSTRUCTION BRACES HAVE THE SAME SIDES AS THE SIDES OF THE BEAM AND IN THE MATERIAL, UNLESS NOTED OTHERWISE.
  6. INDICATES PLACED IN HORIZONTAL POSITION CONNECTIONS FOR 'A' IN COMBINATION WITH SHEAR.
  7. INDICATES AXIAL CONNECTION (A) IN HORIZONTAL POSITION INCLUDES EARTHQUAKE FORCE.
  8. SEE COLUMN SCHEDULE ON S4.00 FOR COLUMN SIZES.
1. INDICATES SPAN DIRECTION OF SLAB CONSTRUCTION: 3" 20 GAUGE (MINIMUM) GALVANIZED.
2. TOP OF STEEL = -0'-6 1/4" (RELATIVE TO TOP OF SLAB), UNLESS NOTED OTHERWISE.
3. SPACE STEEL BEAMS EQUALLY BETWEEN COLUMNS, UNLESS NOTED OTHERWISE.
4. TOP OF SLAB = +263'-6", AT FINISHED FLOOR UNLESS NOTED OTHERWISE.
5. 6x6-W2.9xW2.9 WWR (6 1/4" TOTAL).
6. COMPOSITE FLOOR DECK TOPPED WITH 3.25" LIGHTWEIGHT (115 PCF) CONCRETE, REINFORCED WITH 1'-0" W24x62 (69) c=1/2" W24x62 (69) c=1/2" W16x26 (30) c=1/2".
7. FRAMING NOTES:
   - IN ADDITION TO SECTIONS AND DETAILS REFERENCED IN THIS PLAN, SEE ALL TYPICAL DETAILS.
   - CANTILEVER BEAMS HAVE THE SAME SIZES AS THE BEAMS IN THE BACKSPANS, UNLESS NOTED OTHERWISE.
   - CAP BEAMS INDICATED FEATURES INTEGRAL FORCE TRANSFER CONNECTIONS. COLUMNS CONNECTED WITH BEAM FORCE. INDICATED AREA FORCE MUST BE TRANSFERRED THROUGH COULUM TO ADJACENT MEMBER.
   - MOMENT CONNECTIONS ARE LOCATED IN FRONT OF BEAM CENTRELINE, UNLESS NOTED OTHERWISE.
   - SEE COLUMN SCHEDULE ON BLUE FOR COLUMN SIZES.
   - SEE COLUMN SCHEDULE ON BLUE FOR COLUMN SIZES.
1. Pet = XXXXK indicates expected tension force in brace for design of connections.
2. See S7.00 series for typical braced frame details.
3. Pet = 1215K, Pec = 855K
4. Pet = 754K, Pec = 384K
LEVEL 01
100'-0"

LEVEL 02
115'-0"

LEVEL 03
128'-6"

LEVEL 04
142'-0"

LEVEL 05
155'-6"

LEVEL 06
169'-0"

LEVEL 07
182'-6"

LEVEL 08
196'-0"

LEVEL 09
209'-6"

LEVEL 10
223'-0"

LEVEL 11
236'-6"

LEVEL 12
250'-0"

ROOF
263'-6"

FRAMING NOTES:
1. ALL BEAMS AND COLUMNS INDICATED AS 'SFRS' ARE PART OF THE SEISMIC FORCE RESISTING SYSTEM (SFRS).
   SEE PLANS & ELEVATIONS.
2. SEE S7.10 SERIES FOR TYPICAL MOMENT FRAME DETAILS.
3. INDICATES DOUBLER PLATE THICKNESS.
   SEE DETAIL 3 /S7.10

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FRAMING NOTES:
1. ALL BEAMS AND COLUMNS INDICATED AS 'SFRS' ARE PART OF THE SEISMIC FORCE RESISTING SYSTEM (SFRS).
   SEE PLANS & ELEVATIONS.
2. SEE S7.10 SERIES FOR TYPICAL MOMENT FRAME DETAILS.
3. INDICATES DOUBLER PLATE THICKNESS.
   SEE DETAIL 3 /S7.10
NOTES:
1. FOR ADD'L INFO SEE AISC 360 SECTION J1.6
2. PREHEAT PER AISC 360 SECTION M2.2 BEFORE THERMAL CUTTING.
3. 'tw' IS THE THICKNESS OF THE MATERIAL IN WHICH THE HOLE IS MADE.
4. d = GREATER OF 1 5/16" AND tw.
5. e = 1 1/2 x tw, e = 1" MIN., e MAY BE REDUCED TO 2" FOR W14x426 AND LARGER COLUMNS.
Design Case C

1988 SBC
“Risk Category II”
“Seismic Design Category C”

C.1 Gravity Design

The 12-story office is a typical steel framed building with 3” metal deck and 3-1/4” lightweight concrete topping providing a total floor depth of 6-1/4”, not including the structural steel. This decking was chosen to provide the required 2-hour fire rating that is typical for office buildings. The columns and beams are ASTM A36 steel wide flange members and were designed using AISC Design, Fabrication and Erection of Structural Steel for Buildings 1978. The deflection was limited to the SBC prescribed limits of $L/360$ for floor live load, $L/240$ for floor total load, $L/240$ for roof live load and $L/180$ for roof total load.

The calculated total dead load applied was 90 psf at the floors and 80 psf at the roof. The live loads for offices, corridors (at and above the first floor) and roofs were per SBC table 1203.3. Partition loads were also applied per SBC 1202.2 and are included in the dead load.

C.2 Lateral Design

The building vertical lateral resisting system consists of steel concentrically braced frames in the North/South direction and steel moment frames in the East/West direction. The applied wind and seismic loads were determined using sections 1205 and 1206 respectively from SBC. Wind base shears significantly exceeded earthquake base shears in both directions. Thus, for the vertical lateral resisting system in the North/South direction the brace sizes were governed by wind. In the East/West direction the moment frame beams were governed by wind drift requirements. Wind drifts were limited to $H/360$ at the design wind load. Fixed base connections for the moment frames, were used to limit drift and column sizes.

C.3 Steel Tonnage

Total steel tonnage for this design case is calculated as 1,622 tons.

C.4 Structural Drawings

Structural drawings for Design Case C are provided on the following pages.
OFFICE BUILDING - SAVANNAH, GEORGIA
DESIGN C - 1988 SBC EQUIVALENT RISK CATEGORY II

NOTES:
1. STEEL QUANTITIES DO NOT INCLUDE MISCELLANEOUS STEEL, CUT WASTE STEEL, STAIRS, TYPICAL STEEL FRAMING CONNECTIONS, ETC.

### ITEM

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<td>WF COLUMNS (Fy = 36 ksi)</td>
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<td>WF GIRDERS &amp; JOISTS (Fy = 36 ksi)</td>
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<td>BRACED FRAME WF COLUMNS (Fy = 36 ksi)</td>
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<tr>
<td>HSS BRACES (Fy = 46 ksi)</td>
<td>30 TONS</td>
</tr>
<tr>
<td>BRACED FRAME WF BEAMS (Fy = 36 ksi)</td>
<td>33 TONS</td>
</tr>
<tr>
<td>MOMENT FRAME WF BEAMS (Fy = 36 ksi)</td>
<td>162 TONS</td>
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#### Total
1622 TONS

---

OVERALL FRAMING 3D VIEW

FORCE RESISTING SYSTEM 3D VIEW

---

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GENERAL


2.0. STRUCTURAL CONSIDERATIONS

2.1. Nature of Occupancy:

2.2. Snow Loading Criteria:

2.3. Wind Loading Criteria:

2.4. Seismic Loading Criteria:

3.0. DRAWINGS

3.1. PRECAST CONCRETE PLATE SHEAR WALLS SHALL BE 4 INCHES SQUARE WITH THE FOLLOWING ALLOWABLE CAPACITIES:

4.0. CONCRETE CONCRETE

4.1. ALL CONCRETE WORK SHALL CONFORM TO ACI 211.1-09, SPECIFICATIONS FOR STRUCTURAL CONCRETE, WITH THE FOLLOWING MODIFICATIONS:

4.2. UNLESS NOTED OTHERWISE, ALL CONCRETE SHALL BE NORMAL WEIGHT AND HAVE THE FOLLOWING MINIMUM DESIGN STRENGTH:

4.3. PRECAST STEEL SHELL CONFORM TO ASTM A618. LOADS ARE UNLESS NOTED OTHERWISE.

4.4. MOLDED STEEL SHELL CONFORM TO ASTM A618. LOADS ARE UNLESS NOTED OTHERWISE.

4.5. PROVIDE CLEAR VIEW TRANSITIONS BETWEEN SHELLS AND WALLS, LAMINATED GLASS, AND UPON COMMAND. IN STRUCTURAL DESIGN:

5.0. STRUCTURAL STEEL

5.1. ALL STRUCTURAL STEEL CONSTRUCTION SHALL CONFORM TO ANSI A500, "SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS."

5.2. UNLESS NOTED OTHERWISE, STRUCTURAL STEEL WORK PULLED AND TESTS SHALL CONFORM TO ANSI A500. ROUND STUBS AND BOLTS ARE UNLESS NOTED OTHERWISE.

5.3. STEEL FRAMING CONNECTIONS SHALL BE AS BOX C-9-0-0-ISOL.

5.4. ANCHOR NUTS SHALL CONFORM TO ANSI A500. STRUCTURAL STEEL.

5.5. STEEL SURFACES TO BE 1/8 INCH MAX. BEFORE ROLLFORMING. CONNECTIONS REFERENCED IN THIS DOCUMENT SHALL BE AS N522.5.4, DESIGN AND INSTALLATION OF Connections using SURFACE-MOUNTED Connections shall BE AS N522.5.4.

5.6. PLATE NONSHAKE, HIGH STRENGTH DOUBLE MUSCLE PLATE PLATES AFTER ATTACHMENT AND SEALING.

5.7. ALL STEEL CONNECTIONS REFERENCED IN THIS DOCUMENT SHALL BE AS N522.5.4, DESIGN AND INSTALLATION OF Connections using SURFACE-MOUNTED Connections shall BE AS N522.5.4.

6.0. DRAWINGS

6.1. UNLESS NOTED OTHERWISE, STEEL CONSTRUCTION SHALL BE GALVANIZED MINIMUM, 26 Gauge, CORRUGATED TO STEEL DECK INSULATION, 26 Gauge, FURNISHED.

6.2. STEEL CONNECTORS VARIOUS STEEL SHEET-STEEL PRIMING WITH SAFETY HATCHES.

6.3. STEEL COLUMNS:

6.4. STEEL SHEET-STEEL WALLS SHALL BE PRIMED WITH SAFETY HATCHES.

7.0. GENERAL NOTES

7.1. THIS PUBLICATION IS AVAILABLE FREE OF CHARGE FROM:

https://doi.org/10.6028/NIST.GCR.21-917-48v1A
SUPERIMPOSED DEAD LOAD DESIGNATIONS

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<td>SFMD + PARTESTA</td>
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<tr>
<td>B</td>
<td>T/OFP</td>
<td>20</td>
<td>15 FOOT AL FIBER GLASS</td>
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LIVE LOAD DESIGNATIONS

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<td>2</td>
<td>CORRIDOR</td>
<td>80 (R)</td>
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<td>3</td>
<td>Lobbies &amp; Stairs</td>
<td>125 (NR)</td>
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</tr>
<tr>
<td>4</td>
<td>MECHANICAL &amp; STORAGE</td>
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</tr>
<tr>
<td>5</td>
<td>ROOFP</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>

LOAD MAP KEY:

- NUMBER INDICATES LIVE LOAD MARK
- LETTER INDICATES SUPERIMPOSED DEAD LOAD MARK
- 200 INDICATES CLADDING LOAD IN POUNDS PER LINEAR FOOT. CLADDING LOAD IS 200 POUNDS PER LINEAR FOOT U.N.O.
FOUNDATION & GRADE LEVEL FRAMING PLAN

1. TOP OF NOMINAL SLAB ELEVATION = 100'-0".
2. SLAB-ON-GROUND THICKNESS IS 5" UNLESS NOTED OTHERWISE.
3. "GB" INDICATES GRADE BEAM. SEE S3.00 FOR ADDITIONAL INFORMATION.
4. ALL FOOTINGS, PILE CAPS, AND PIERS ARE CENTERED ABOUT COLUMN CENTERLINES UNLESS NOTED OTHERWISE.
5. SEE S4.00 FOR COLUMN SCHEDULE.

LEGEND:
- X'-X" INDICATES TOP OF WALL FOOTING OR TOP OF GRADE BEAM ELEVATION
- PILE CAP TYPE. SEE SHEET S3.01 INDICATES TOP OF PILE CAP ELEVATION BELOW SLAB ON GRADE, TYP. ELEVATION IS -4'-0" BELOW TOP OF SOG, UNLESS NOTED OTHERWISE.
- P INDICATES PILE, SEE PX X'-X" 3/S3.00

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S2.00
Scale: 1/8" = 1'-0"

1. **Framing Notes:**
   - In addition to sections and details referenced in this plan, see all typical details.
   - Top of Slab = -0'-6 1/4" (relative to top of slab), unless noted otherwise.
   - Cantilever beams have the same sizes as the beams in the backspans, unless noted otherwise.
   - Space steel beams equally between columns, unless noted otherwise.
   - Top of slab = +115', at finished floor unless noted otherwise.
   - Edge of slab at openings is located 6" from the beam centerline, unless noted otherwise.
   - See column schedule on S4.00 for column sizes.
   - 6x6-W2.9xW2.9 WWR (6 1/4" total).
   - Composite floor deck topped with 3.25" lightweight (110 PCF) concrete, reinforced with 3/8"@24, top and bottom.
   - Indicates span direction of slab construction: 3" 20 ga. (minimum) galvanized steel bar reinforcement.

2. **Connections:**
   - Beam to column connection (see details for details).
   - Beam to beam connection (see details for details).
   - Beam cap connection (see details for details).

3. **Design:**
   - Beam sizes are per plan.
   - Column sizes are per schedule.
   - Slab thickness is 5 5/6".

4. **Construction:**
   - All construction details are per codes and standards.
   - All construction details are per plans and specifications.
TYPICAL FLOOR FRAMING PLAN

FRAME NOTES:
1. In addition to sections and details referenced in this plan, see all TYPICAL DETAILS.
2. Top of sole plate shall be 5'-6 1/4" (relative to top of slab), unless noted otherwise.
3. Indicated spin direction of slab construction; if 25 gauge, bonded on hand only.
4. Steel beam or column shall be capped with top containment (2 1/2" top concrete), reinforced with
   stirrups and tied to members.
5. Space steel beams regularly between columns, unless noted otherwise.
6. Column size shall be the same size as the beam in the backbone, unless noted otherwise.
7. Size of slab or opening is located by number of beams in column, unless noted otherwise.
8. See COLUMN SCHEDULE on sheet for Column Size.

FRAME DETAILS:

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<td>2</td>
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</table>

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1. FRAMING NOTES:

2. TOP OF SLAB = +263'-6", AT FINISHED FLOOR UNLESS NOTED OTHERWISE.

3. TOP OF STEEL = -0'-6 1/4" (RELATIVE TO TOP OF SLAB), UNLESS NOTED OTHERWISE.

4. INDICATES SPAN DIRECTION OF SLAB CONSTRUCTION: 3" 20 GAUGE (MINIMUM) GALVANIZED COMPOSITE FLOOR DECK TOPPED WITH 3.25" LIGHTWEIGHT (110 PCF) CONCRETE, REINFORCED WITH 6x6-W2.9xW2.9 WWR (6 1/4" TOTAL).

5. SPACE STEEL BEAMS EQUALLY BETWEEN COLUMNS, UNLESS NOTED OTHERWISE.

6. CANTILEVER BEAMS HAVE THE SAME SIZES AS THE BEAMS IN THE BACKSPANS, UNLESS NOTED OTHERWISE.

7. EDGE OF SLAB AT OPENINGS IS LOCATED 6" FROM THE BEAM CENTERLINE, UNLESS NOTED OTHERWISE.

8. SEE COLUMN SCHEDULE ON S4.00 FOR COLUMN SIZES.
**NOTES:**

1. At exterior columns, coat below grade portion of column and base plate with bituminous mastic and provide 1/2" prefabricated joint filler around columns. At interior columns, provide 30# roofing felt.

2. Provide weld in workable flat portion of tube, typical.

3. All reinforcement shown is bottom reinforcement, unless noted otherwise. See plan for additional information.

4. Top bars, if required, shall follow the same lap pattern.

5. Layout of piles is shown on this detail and not as shown on plan.

---

**PILE CAP SCHEDULE FOR 14" SQ. PRECAST PILES 80 TON COMPRESSION AND 60 TON TENSION PILES**

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**ACKNOWLEDGEMENTS:**

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**Notes:**
- Consultants Office
- Project Title: FS
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MOMENT FRAME ELEVATION ALONG GRID A

Framing Notes:
1. See S7.10 series for typical moment frame details.
MOMENT FRAME ELEVATION ALONG GRID E

FRAMING NOTES:
1. SEE S7.XX SERIES FOR TYPICAL MOMENT FRAME DETAILS.

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FINISH, TYP.

FLANGE

5/8"x8"x1'-6" PLATES ON EACH SIDE. PROVIDE (12)-3/4" DIA. A325 BOLTS.

4'-0" ABOVE F.F.E., U.N.O.

W14x342

W14x257

CONSULTANTS

SHEET NUMBER

TITLE

Approved

Checked

Job Number

PROJECT

UZUN+CASE

SAVANNAH, GEORGIA

1988 SBC WITH EQUIVALENT RISK CATEGORY II

DRAWINGS

DESIGN C

01 MARCH, 2021

OFFICE

BUILDING

S7.00

SCALE:  3/4" = 1'-0"

3/4" = 1'-0"

3/4" = 1'-0"

3/4" = 1'-0"

S7.00

S7.00

S7.00

S7.00

TYPICAL BRACED FRAME COLUMN SPLICE

TYPICAL BRACED FRAME COLUMN DETAIL

BRACED FRAME CONNECTION DETAIL

TYPICAL BRACED FRAME CONNECTION DETAIL

BRACED FRAME BASE PLATE DETAIL

TYPICAL COLUMN ISOLATION PLAN DETAIL AT BRACED FRAME

TYPICAL BRACED FRAME CONNECTION DETAIL

TYPICAL BRACED FRAME CONNECTION DETAIL

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https://doi.org/10.6028/NIST.GCR.21-917-48v1A
FINISH, TYP.
2"x1'-6"x2'-10" PLATE 
4'-0" ABOVE F.F.E., U.N.O.
W27x146
W30x173
1'-5" T&B, TYP.
5/16
5/16 TYP.
W36x245
1" THICK STIFFENER PLATES ALIGNED WITH BEAM FLANGES EACH SIDE.
·
L4x4x3/8x2'-0" ON EACH SIDE.
PROVIDE (8) 3/4" DIA. A325 BOLTS TYP. AT EACH L4x4 5/16 3 SIDES
3 1/2" 1'-7 1/2" 1'-0 1/2" 3 1/2" 5/16
Design Case D

1988 SBC
“Risk Category III”
“Seismic Design Category C”

D.1 Gravity Design

The 12-story office is a typical steel framed building with 3” metal deck and 3-1/4” lightweight concrete topping providing a total floor depth of 6-1/4”, not including the structural steel. This decking was chosen to provide the required 2-hour fire rating that is typical for office buildings. The columns and beams are ASTM A36 steel wide flange members and were designed using AISC Design, Fabrication and Erection of Structural Steel for Buildings 1978. The deflection was limited to the SBC prescribed limits of $L/360$ for floor live load, $L/240$ for floor total load, $L/240$ for roof live load and $L/180$ for roof total load.

The calculated total dead load applied was 90 psf at the floors and 80 psf at the roof. The live loads for offices, corridors (at and above the first floor) and roofs were per SBC table 1203.3. Partition loads were also applied per SBC 1202.2 and are included in the dead load.

D.2 Lateral Design

The building vertical lateral resisting system consists of steel concentrically braced frames in the North/South direction and steel moment frames in the East/West direction. The applied wind and seismic loads were determined using sections 1205 and 1206 respectively from SBC. Wind base shears significantly exceeded earthquake base shears in both directions. Thus, for the vertical lateral resisting system in the North/South direction the brace sizes were governed by wind. In the East/West direction the moment frame beams were governed by wind drift requirements. Wind drifts were limited to $H/360$ at the design wind load. Fixed base connections for the moment frames, were used to limit drift and column sizes.

D.3 Steel Tonnage

Total steel tonnage for this design case is calculated as 1,668 tons.

D.4 Structural Drawings

Structural drawings for Design Case D are provided on the following pages.
NOTES:
1. STEEL QUANTITIES DO NOT INCLUDE MISCELLANEOUS STEEL, CUT WASTE STEEL, STAIRS, TYPICAL STEEL FRAMING CONNECTIONS, ETC.

### OFFICE BUILDING - SAVANNAH, GEORGIA
### DESIGN D - 1988 SBC EQUIVALENT RISK CATEGORY III

#### OVERALL FRAMING 3D VIEW

#### FORCE RESISTING SYSTEM 3D VIEW

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<tbody>
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<td>92 TONS</td>
</tr>
<tr>
<td>WF GIRDERS &amp; JOISTS (Fy = 36 ksi)</td>
<td>972 TONS</td>
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<tr>
<td>HSS BRACES (Fy = 46 ksi)</td>
<td>40 TONS</td>
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<td>MOMENT FRAME WF BEAMS (Fy = 36 ksi)</td>
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<tr>
<td>BRACED FRAME WF BEAMS (Fy = 36 ksi)</td>
<td>32 TONS</td>
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</table>

TOTAL: 1688 TONS

**NOTES:**
1. STEEL QUANTITIES DO NOT INCLUDE MISCELLANEOUS STEEL, CUT WASTE STEEL, STAIRS, TYPICAL STEEL FRAMING CONNECTIONS, ETC.
FOUNDATION AND SOIL NOTES:
1. TOP OF NOMINAL SLAB ELEVATION = 100'-00".
2. SLAB-ON-GROUND THICKNESS IS 5", UNLESS NOTED OTHERWISE.
3. 'GB' INDICATES GRADE BEAM. SEE S3.00 FOR ADDITIONAL INFORMATION.
4. ALL FOOTINGS, PILE CAPS, AND PIERS ARE CENTERED ABOUT COLUMN CENTERLINES, UNLESS NOTED OTHERWISE.
5. SEE S4.00 FOR COLUMN SCHEDULE.

LEGEND:
X'-X" INDICATES TOP OF WALL FOOTING OR TOP OF GRADE BEAM ELEVATION
INDICATES PILE CAP TYPE. SEE SHEET S3.01 FOR ADDITIONAL INFORMATION
INDICATES TOP OF PILE ELEVATION BELOW SLAB ON GRADE, TYP. ELEVATION IS -2'-6" BELOW TOP OF SOG, UNLESS NOTED OTHERWISE.
INDICATES TOP OF PILE CAP ELEVATION ON SLAB ON GRADE.
3. EDGE OF SLAB AT OPENINGS IS LOCATED 6" FROM THE BEAM CENTERLINE, UNLESS NOTED OTHERWISE.

4. 6x6-W2.9xW2.9 WWR (6 1/4" TOTAL).

COMPOSITE FLOOR DECK TOPPED WITH 3.25" LIGHTWEIGHT (110 PCF) CONCRETE, REINFORCED WITH 20 GAUGE (MINIMUM) GALVANIZED.

INDICATES SPAN DIRECTION OF SLAB CONSTRUCTION: 3"
### Typical Floor Framing Plan

**Frame Notes:**
1. The lines on the plan represent the structural frames and columns.
2. The steel sections are indicated with their exact dimensions.
3. The floor slabs are shown with their thickness and material.
4. The columns are marked with their specifications, such as height and spacing.
5. The beams are labeled with their sizes and locations.
6. The locations of openings in the slabs are marked with their dimensions.
7. The connections between the frames and columns are shown with their details.

**Legend:**
- **Columns:** HSS8x8x3/8
- **Braced Frame:** BRACED FRAME
- **Moment Frame:** MOMENT FRAME
- **Connections:** CONNECTION
- **Framing Legend:** FRAMING LEGEND
- **Level Elevation:** LEVEL ELEVATION

---

**Diagram Details:**
- **Scale:** 1/8" = 1'-0"
- **Typical Floor Framing Plan S2.20**
- **Project:** UZUN+CASE
- **Office:** UZUN+CASE
- **Title:** 20.027 AP/JH

---

**References:**
- [ATC 20.027](https://doi.org/10.6028/NIST.GCR.21-917-48v1A)
- [Building Savanna, Georgia](https://doi.org/10.6028/NIST.GCR.21-917-48v1A)

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**Drawings:**
- DRAWINGS
- BY: [ATC](https://doi.org/10.6028/NIST.GCR.21-917-48v1A)
- DATE: 01 MARCH, 2021

---

**Design:**
- **Design D**
- **Approved and Checked:**
- **Job Number:**

---

**Additional Notes:**
- This publication is available free of charge from the website mentioned above.
- The document includes a comprehensive set of plans and details for the typical floor framing.
SCALE:  1/2" = 1'-0"

**TYPICAL ELEVATOR PIT SECTION**

1. **PILE DETAILS**
   - Compression Pile Detail
   - Tension Pile Detail

2. **TYPICAL GRADE BEAM SECTION**

3. **PILE DETAILS**
   - TYPICAL SECTION THROUGH PRECAST PILE

---

**TYPICAL GRADE BEAM ELEVATION**

- **GRADE BEAM SCHEDULE**
  - GB BAR EXTENSION
  - GB BAR EXTENSION, WHERE REQUIRED NOT TO EXCEED 36" LONG

- **HOOP AND CROSSTIE DETAILS**
  - Cold Drawn Spiral

---

**GRADE BEAM DETAIL**

- **GRADE BEAM SCHEDULE**
  - GB BAR EXTENSION
  - GB BAR EXTENSION, WHERE REQUIRED NOT TO EXCEED 36" LONG

- **HOOP AND CROSSTIE DETAILS**
  - Cold Drawn Spiral

---

**GRADE BEAM DETAIL**

- **GRADE BEAM SCHEDULE**
  - GB BAR EXTENSION
  - GB BAR EXTENSION, WHERE REQUIRED NOT TO EXCEED 36" LONG

- **HOOP AND CROSSTIE DETAILS**
  - Cold Drawn Spiral

---

**GRADE BEAM DETAIL**

- **GRADE BEAM SCHEDULE**
  - GB BAR EXTENSION
  - GB BAR EXTENSION, WHERE REQUIRED NOT TO EXCEED 36" LONG

- **HOOP AND CROSSTIE DETAILS**
  - Cold Drawn Spiral

---

**GRADE BEAM DETAIL**

- **GRADE BEAM SCHEDULE**
  - GB BAR EXTENSION
  - GB BAR EXTENSION, WHERE REQUIRED NOT TO EXCEED 36" LONG

- **HOOP AND CROSSTIE DETAILS**
  - Cold Drawn Spiral

---

**GRADE BEAM DETAIL**

- **GRADE BEAM SCHEDULE**
  - GB BAR EXTENSION
  - GB BAR EXTENSION, WHERE REQUIRED NOT TO EXCEED 36" LONG

- **HOOP AND CROSSTIE DETAILS**
  - Cold Drawn Spiral

---

**GRADE BEAM DETAIL**

- **GRADE BEAM SCHEDULE**
  - GB BAR EXTENSION
  - GB BAR EXTENSION, WHERE REQUIRED NOT TO EXCEED 36" LONG

- **HOOP AND CROSSTIE DETAILS**
  - Cold Drawn Spiral

---

**GRADE BEAM DETAIL**

- **GRADE BEAM SCHEDULE**
  - GB BAR EXTENSION
  - GB BAR EXTENSION, WHERE REQUIRED NOT TO EXCEED 36" LONG

- **HOOP AND CROSSTIE DETAILS**
  - Cold Drawn Spiral
### Anchor Rods

<table>
<thead>
<tr>
<th>Level</th>
<th>Remarks</th>
<th>Locations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>100'-0&quot;</td>
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<tr>
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<td>LEVEL 02</td>
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<td>128'-6&quot;</td>
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<td>142'-0&quot;</td>
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<td></td>
<td></td>
<td>LEVEL 04</td>
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<td>155'-6&quot;</td>
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<td></td>
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<td>LEVEL 09</td>
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<tr>
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<td>182'-6&quot;</td>
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<tr>
<td></td>
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<tr>
<td></td>
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<td>LEVEL 08</td>
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<tr>
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<td></td>
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<tr>
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<td></td>
<td>LEVEL 11</td>
</tr>
<tr>
<td></td>
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<td>250'-0&quot;</td>
</tr>
</tbody>
</table>

#### Column Details

- **Anchor Rods**: 3/4" DIA. x 21"
- **Anchor Rods**: 3" x 34" x 4'
- **Anchor Rods**: 4" (6) x 2'
- **Anchor Rods**: 3" x 34" x 4'
- **Anchor Rods**: 3/4" DIA. x 28" (6) x 2'
- **Anchor Rods**: 2" DIA. x 24" (6) x 2'
- **Anchor Rods**: 1/4" DIA. x 30" x 4' (6) x 2'
- **Anchor Rods**: 1/2" x 30" x 4' (6) x 2'
- **Anchor Rods**: 3/4" DIA. x 33" (6) x 2'
- **Anchor Rods**: 1" DIA. (4) x 1'
- **Anchor Rods**: 2" DIA. x 24" (4) x 1'
- **Anchor Rods**: 1/4" DIA. x 30" x 4' (4) x 1'
- **Anchor Rods**: 1/2" x 30" x 4' (4) x 1'

---

*This publication is available free of charge from: [https://doi.org/10.6028/NIST.GCR.21-917-48v1A](https://doi.org/10.6028/NIST.GCR.21-917-48v1A)*
1. TYPICAL STUDE PLACEMENT DETAIL

2. FLOOR EDGE BEAM PARALLEL TO DECK

3. FLOOR EDGE BEAM PERPENDICULAR TO DECK

4. DECK PENETRATION ≤ 2'-0"  

5. TYPICAL DETAIL AT COMPOSITE FLOOR OPENING

6. TYPICAL DETAIL AT COMPOSITE FLOOR CONSTRUCTION JOINT

7. TYPICAL DETAIL AT GIRDER

8. TYPICAL INTERRUPTED DECK SUPPORT AT COLUMN

NOTES:

- MAX. OPENING DIMENSION = 5'-0".

- BETWEEN PAIRS OF STUDS SHALL NOT BE LESS THAN 3".

- PLACE A SINGLE ROW OF STUDS ALONG GIRDER AT EQUAL SPACING.

- PLACE A SECOND STUD IN FLUTES, STARTING AT MAXIMUM SPACING ALLOWED IS 24" OC.

- STUD REMAIN, PLACE IN FLUTES NOT ALREADY HAVING A STUD, BETWEEN PAIRS OF STUDS. 

- PLACE SPECIFIED NUMBER OF STUDS IN EACH SEGMENT OF GIRDER STARTING AT BEAM ENDS.

- SEE TYPICAL EDGE DETAIL A.

- SEE TYPICAL EDGE DETAIL B.

- INTERIOR OPENINGS.

- COMPOSITE FLOOR CONSTRUCTION JOINT.

- TRANSVERSE STEEL HEAD ANCHORS WHERE SHOWN ON PLANS.

- MECHANICAL DRAWINGS FOR LOCATION.

- DBA REQUIRED AT FRAMED BEAM OR GIRDER.

- DBA NOT REQUIRED AT FRAMED PLATE.

- CLOSURE MUST BE WELDED TO THE BEAM AND SCREWED OR WELDED TO THE DECK TO ENSURE THAT THE FLANGE DOES NOT FALL UNDER THE DECK AS ROLLING.

- PLACE AT BOTTOM OF TRANSVERSE BAR AT BUTT JOINTS:

- CENTER AT EACH FRAMING BEAM.

- CENTERLINE.

- LOCATED ON BEAM CENTER AT EACH CONSTRUCTION JOINT.

- SUPPORT CL DECK UNTIL AFTER SLAB HAS REACHED TRANSVERSE position - CORRECT ATTACHMENT.

- SLAB HAS REACHED TRANSVERSE position - CORRECT ATTACHMENT.

- USE A SINGLE ROW OF STUDS ALONG GIRDER AT EQUAL SPACING.

- PLACE A SECOND STUD IN FLUTES, STARTING AT MAXIMUM SPACING ALLOWED IS 24" OC.

- STUD REMAIN, PLACE IN FLUTES NOT ALREADY HAVING A STUD, BETWEEN PAIRS OF STUDS.

- PLACE SPECIFIED NUMBER OF STUDS IN EACH SEGMENT OF GIRDER STARTING AT BEAM ENDS.

- SEE TYPICAL EDGE DETAIL A.

- SEE TYPICAL EDGE DETAIL B.

- INTERIOR OPENINGS.

- COMPOSITE FLOOR CONSTRUCTION JOINT.

- TRANSVERSE STEEL HEAD ANCHORS WHERE SHOWN ON PLANS.

- MECHANICAL DRAWINGS FOR LOCATION.

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- PLACE SPECIFIED NUMBER OF STUDS IN EACH SEGMENT OF GIRDER STARTING AT BEAM ENDS.

- SEE TYPICAL EDGE DETAIL A.

- SEE TYPICAL EDGE DETAIL B.

- INTERIOR OPENINGS.

- COMPOSITE FLOOR CONSTRUCTION JOINT.

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- SEE TYPICAL EDGE DETAIL A.

- SEE TYPICAL EDGE DETAIL B.

- INTERIOR OPENINGS.

- COMPOSITE FLOOR CONSTRUCTION JOINT.

- TRANSVERSE STEEL HEAD ANCHORS WHERE SHOWN ON PLANS.

- MECHANICAL DRAWINGS FOR LOCATION.

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- PLACE AT BOTTOM OF TRANSVERSE BAR AT BUTT JOINTS:

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- SEE TYPICAL EDGE DETAIL A.

- SEE TYPICAL EDGE DETAIL B.

- INTERIOR OPENINGS.

- COMPOSITE FLOOR CONSTRUCTION JOINT.

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- DBA REQUIRED AT FRAMED BEAM OR GIRDER.

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- SEE TYPICAL EDGE DETAIL A.

- SEE TYPICAL EDGE DETAIL B.

- INTERIOR OPENINGS.

- COMPOSITE FLOOR CONSTRUCTION JOINT.

- TRANSVERSE STEEL HEAD ANCHORS WHERE SHOWN ON PLANS.

- MECHANICAL DRAWINGS FOR LOCATION.

- DBA REQUIRED AT FRAMED BEAM OR GIRDER.

- DBA NOT REQUIRED AT FRAMED PLATE.

- CLOSURE MUST BE WELDED TO THE BEAM AND SCREWED OR WELDED TO THE DECK TO ENSURE THAT THE FLANGE DOES NOT FALL UNDER THE DECK AS ROLLING.

- PLACE AT BOTTOM OF TRANSVERSE BAR AT BUTT JOINTS:

- CENTER AT EACH FRAMING BEAM.

- CENTERLINE. 
FINISH, TYP.

EA.

FLANGE

3/4"x8"x2'-0" PLATES ON EACH SIDE. PROVIDE (16)-3/4" DIA. A325 BOLTS.

4'-0" ABOVE F.F.E., U.N.O.

2" W14x257

1 1/2" W14x342

3/4" GUSSET PLATE.

SLOTTED INTO BRACE

HSS10x10x3/8

1'-6 1/4"

W16x31

2'-0 7/8"

2'-4 3/4"

1'-10 1/2"

1'-6 1/2"

2'-6"

4'-2"

2'-0"

1 1/2"

5/16 14

1/4 14

5/16 14

1/4 14

5/16 14

1/4 14

1/2" GUSSET PLATE, SLOTTED INTO BRACE

1/4 3 SIDES TYP.

(2) L4x4x3/8x1'-7" EA. SIDE

3/16 3 SIDES TYP.

(6) 3/4" DIA. A325 BOLTS AT EA. ANGLE

(4) 3/4" DIA. A325 BOLTS AT EA. ANGLE

(6) 3/4" DIA. A325 BOLTS AT EA. ANGLE

(2) L4x4x3/8x1'-0" EA. SIDE

CONSULTANTS

SHEET NUMBER

TITLE

Approved

Checked

Job Number

PROJECT

UZUN + CASE

SAVANNAH, GEORGIA

1988 SBC WITH EQUIVALENT RISK CATEGORY III

DRAWINGS

DESIGN D

01 MARCH, 2021

OFFICE

BUILDING

S7.00

SCALE: 3/4" = 1'-0"

This publication is available free of charge from:

https://doi.org/10.6028/NIST.GCR.21-917-48v1A
TYPICAL BEAM TO WF COLUMN FLANGE MOMENT CONNECTION

TYPICAL MOMENT FRAME COL. SPLICE

TYP. MOMENT FRAME COL. BASE PLATE
Design Case E

2018 IBC
Risk Category II
Seismic Design Category C

E.1 Gravity Design

The 12-story office is a typical steel framed building with 3” metal deck and 3-1/4” lightweight concrete topping providing a total floor depth of 6-1/4”, not including the structural steel. This decking was chosen to provide the required 2-hour fire rating that is typical for office buildings. The columns and beams are ASTM A992 steel wide flange members and were designed using ANSI/AISC 360-16. The deflection was limited to the IBC prescribed limits of $L/360$ for floor live load, $L/240$ for floor total load, $L/240$ for roof live load and $L/180$ for roof total load.

The calculated total dead load applied was 62.5 psf at the floors and 72.5 psf at the roof. The live loads for offices, corridors (at and above the first floor) and roofs were per IBC table 1607.1. Partition loads were also applied per IBC 1607.5.

E.2 Lateral Design

The building vertical lateral resisting system consists of steel concentrically braced frames not specifically detailed for seismic resistance in the North/South direction and steel moment frames not specifically detailed for seismic resistance in the East/West direction. The applied wind and seismic loads were determined using chapters 27 and 12 respectively from the ASCE 7-16. Wind base shears significantly exceeded earthquake base shears in both directions. Thus, for the vertical lateral resisting system in the North/South direction the brace sizes were governed by wind. In the East/West direction the moment frame beams were governed by wind drift requirements. Wind drifts were limited to $H/400$ during a 25-year mean return interval windstorm. Fixed base connections for the moment frames, utilizing concrete grade beams, were used to limit drift and column sizes.

E.3 Steel Tonnage

Total steel tonnage for this design case is calculated as 1,336 tons.

E.4 Structural Drawings

Structural drawings for Design Case E are provided on the following pages.
**OFFICE BUILDING - SAVANNAH, GEORGIA**  
**DESIGN E - 2018 IBC RISK CATEGORY II**

### DESIGN E: 2018 IBC RISK CATEGORY II

#### STEEL QUANTITIES

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>WF Columns ($F_y = 50$ ksi)</td>
<td>60 Tons</td>
</tr>
<tr>
<td>WF Girders &amp; Joists ($F_y = 50$ ksi)</td>
<td>778 Tons</td>
</tr>
<tr>
<td>Moment Frame WF Columns ($F_y = 50$ ksi)</td>
<td>188 Tons</td>
</tr>
<tr>
<td>Braced Frame WF Columns ($F_y = 50$ ksi)</td>
<td>95 Tons</td>
</tr>
<tr>
<td>HSS Braces Round ($F_y = 46$ ksi) &amp; Square ($F_y = 50$ ksi)</td>
<td>43 Tons</td>
</tr>
<tr>
<td>Moment Frame WF Beams ($F_y = 50$ ksi)</td>
<td>1336 Tons</td>
</tr>
<tr>
<td>Total</td>
<td>147 Tons</td>
</tr>
</tbody>
</table>

### NOTES:

1. Steel quantities do not include miscellaneous steel, cut, typical, and framing connections, etc.

**OVERALL FRAMING 3D VIEW**

**FORCE RESISTING SYSTEM 3D VIEW**

---

**CONTRACTOR:

S0.00**
FOUNDATION AND SOIL NOTES:

1. TOP OF NOMINAL SLAB ELEVATION = 100'-00". SEE CIVIL DRAWINGS FOR DATUM ELEVATION.

2. SLAB-ON-GROUND THICKNESS IS 5", UNLESS NOTED OTHERWISE. SEE GENERAL NOTES FOR ADDITIONAL INFORMATION.

3. 'CJ' INDICATES CONTRACTION JOINT, SEE DETAIL FOR ADDITIONAL INFORMATION.

4. 'GB' INDICATES GRADE BEAM. SEE FOR ADDITIONAL INFORMATION.

5. ALL FOOTINGS, PILE CAPS, AND PIERS ARE CENTERED ABOUT COLUMN CENTERLINES, UNLESS NOTED OTHERWISE.

6. VERIFY PILE CAP ELEVATIONS AT WET COLUMNS WITH ARCHITECTURAL AND PLUMBING DRAWINGS.

7. SEE ARCHITECTURAL DRAWINGS FOR EDGE OF SLAB DIMENSIONS, LOCATIONS OF DRAINS, SLOPES, AND CONTOURS OF AREAS SLOPED TO DRAIN NOT SHOWN. COORDINATE BEFORE POURING.

8. SEE S4.00 FOR COLUMN SCHEDULE.

9. CONSULTANTS SHEET NUMBER

This publication is available free of charge from:
https://doi.org/10.6028/NIST.GCR.21-917-48v1
FRAMING NOTES:
1. Alignment and measurements are approximate. See all typical details.
2. Top of slabs = +115', at finished floor unless noted otherwise.
3. Top of steel = -0'-6 1/4" (relative to top of slab), unless noted otherwise.
4. Indicated span direction of slab construction: 3" 20 gauge (minimum) galvanized.
5. Indicates beam size and layout at beams, unless noted otherwise.
6. Space steel beam equal width columns, unless noted otherwise.
7. Gaskets and beams have the same size as the beam in the background, unless noted otherwise.
8. Reinforced concrete columns and beams have the same size as the beam in the background, unless noted otherwise.
9. Identical structural connections at beam ends shall be mirrored at all other ends.
10. LRFD beam end reaction (same on each side)
11. Typical floor plans and elevations shown for location of beams and floor slab information.
12. Coordinate elevator opening dimensions with purchased equipment.
13. Checked: DRAWINGS

This publication is available free of charge from: https://doi.org/10.6028/NIST.GCR.21-917-48v1A
TYPICAL FLOOR FRAMING PLAN

FRAME NOTES:
1. IN ADDITION TO SECTIONS AND DETAILS REFERENCED IN THIS PLAN, SEE ALL TYPICAL DETAILS.
2. TOP OF SLAB = SEE LEVEL ELEVATION
3. SHEETED MULTIPLE AXIAL FORCES RELATIVE TO TOP OF SLAB, UNLESS NOTED OTHERWISE
4. DUAL SHEETED MULTIPLE AXIAL FORCES RELATIVE TO TOP OF SLAB, UNLESS NOTED OTHERWISE
5. SPACE STEEL BEAMS EQUALLY BETWEEN COLUMNS, UNLESS NOTED OTHERWISE
6. FORCE INDICATED AXIAL FORCE MUST BE TRANSFERRED THROUGH COLUMN TO ADJACENT MEMBER.
7. TOP OF STEEL = ±0'-6 1/4" (RELATIVE TO TOP OF SLAB), UNLESS NOTED OTHERWISE
8. 'A=±xxK' INDICATES FACTORED AXIAL FORCE. PROPORTION CONNECTIONS FOR 'A' IN COMBINATION WITH SHEAR
9. SEE COLUMN SCHEDULE FOR COLUMN SIZES
10. SEE ARCHITECTURAL DRAWINGS FOR LOCATION OF DRAINS AND FLOOR SLOPE INFORMATION
11. SEE TYPICAL STUD
12. SEE ELEVATIONS
13. SEE CUT-OUT DETAILS
14. SEE PREFERRED COMBINED AXIAL AND SHEAR CONNECTION DETAILS
15. COORDINATE ELEVATOR OPENINGS EMBRELLISHED WITH PURCHASED EQUIPMENT

TYPICAL REBAR LAYOUT:
- W24x62 (36) c=3/4"
- W21x44 (45) c=1-1/2"
- W16x26 (30) c=1/2"
- W14x22 (12)
- HSS8x8x3/8
- HSS8x8x3/8
- W27x84 (44) c=1"
- W20x50 (10)
- W18x40 (44) c=1 1/2"
- HK = 180°, TYP.
- +HK @4"
- +HK @4"
- 10'/5" 9'-2"
- 10'/5" 9'-2"
- 10'/5" 9'-2"
- 10'/5" 9'-2"
- 10'/5" 9'-2"
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**ROOF FRAMING PLAN**

**DRAWINGS**

1. SCHEMATIC TO SECTIONS AND DETAILS REFERENCES IN THE PLAN; SEE ALL TYPICAL DETAILS.
2. TOP OF SLAB = 20G 6 1/4" STEEL DECK TOPPED WITH 3+3.25" LIGHTWEIGHT (110 PCF) CONCRETE, REINFORCED WITH 6x6-W2.9xW2.9 WWR (6 1/4"") TOTAL.
3. COMPOSITE FLOOR DECK TOPPED WITH 3+3.25" LIGHTWEIGHT (110 PCF) CONCRETE, REINFORCED STUDS, SEE TYPICAL STUD.
4. MOMENT FRAME CANTILEVERED WITH 6x6-W2.9xW2.9 WWR (6 1/4"") TOTAL.
5. MOMENT FRAME BRACED FRAME A = ±105 KA = ±110 KA = ±135 K
6. INDICATES SPAN DIRECTION OF SLAB CONSTRUCTION: 3" 20 GAUGE (MINIMUM) GALVANIZED.
7. TOP OF SLAB = +263'-6" AT FINISHED FLOOR UNLESS NOTED OTHERWISE.
8. EDGE OF SLAB AT OPENINGS IS LOCATED 6" FROM THE BEAM CENTERLINE, UNLESS NOTED OTHERWISE.
9. FORCE INDICATED AXIAL FORCE MUST BE TRANSFERRED THROUGH COLUMN TO ADJACENT MEMBER.
10. TOP OF STEEL = -0'-6 1/4" (RELATIVE TO TOP OF SLAB), UNLESS NOTED OTHERWISE.

**PLAN**

- **COORDINATE ELEVATOR OPENING DIMENSIONS WITH PURCHASED EQUIPMENT.**
- **SEE ARCHITECTURAL DRAWINGS FOR LOCATION OF DRAINS AND FLOOR SLOPE INFORMATION.**
- **SEE COLUMN SCHEDULE FOR COLUMN SIZES.**
- **LRFD BEAM END REACTION (SAME ON EACH SIDE) +HK @4".**
- **NUMBER OF 3/4"Ø x5" SHEAR CONNECTIONS TO BE USED.**
- **SITE BASED AND PROVISIONS BY (3) 1'-0" BOLTS IN FRAME (A) SHOWN IN DETAILS FRAME SEE SPECIFICATIONS.**
- **SEE SHEET AB-2 FOR EXTERIOR WALLS AND FLOOR PLAN.**
- **TOP OF STUDS = +263'-6" AT FINISHED FLOOR UNLESS NOTED OTHERWISE.**

**NOTES**

- **1'-0" W24x62 (69) W24x62 (69) W16x26 (30).**
- **W21x48 (45) c=1-1/2".**
- **W21x44 (45) c=1-1/2" W21x44 (45) c=1-1/2".**
- **W24x62 (30).**
- **W24x62 (75).**
- **HSS8x8x3/8.**
- **W8x15 (10) W8x15 (10) W8x15 (10).**
- **W16x26 (30) c=3/4".**
- **W24x62 (36).**
- **W14x22 (10) W14x22 (10).**
- **W18x40 (44) c=1 1/2".**
- **HSS8x8x3/8.**
- **HOIST BM HOIST BM HOIST BM.**
- **2#4x5'-0".**
- **2#3x7'-6" @4", 2#3x8'-0" @4".**
- **BOLTS (3) 1'-0" BOLTS IN FRAME (A) SHOWN IN DETAILS FRAME SEE SPECIFICATIONS.**
- **HSS8x8x3/8.**
- **W21x44 (45) c=1-1/2" W21x44 (45) c=1-1/2" W16x26 (30) c=3/4".**

**REFERENCES**

- **UZUN + CASE OFFICE BUILDING SAVANNAH, GEORGIA 2018 IBC WITH RISK CATEGORY II SEISMIC DESIGN CATEGORY C 01 MARCH, 2021.**

This publication is available free of charge from: [https://doi.org/10.6028/NIST.GCR.21-917-48v1A](https://doi.org/10.6028/NIST.GCR.21-917-48v1A)
### TYPICAL FOOTING INTERSECTION PLAN DETAIL

- Column sections for column weir flow and ground water information.
- Steel reinforcement bars, see schedule for sizes and number of reinforcement bars.
- All reinforcement shown is bottom reinforcement, unless noted otherwise. See detail 3/S3.01 for additional information.

### TYPICAL COLUMN AND PILE CAP DETAIL

- Details for column weir flow and ground water information.
- Steel reinforcement bars, see schedule for sizes and number of reinforcement bars.

### TYPICAL BASE PLATE DETAIL

- Details for steel, including anchor rod holes, see base plate detail and anchor rod details.
- Plate washer, see schedule for column, base plate and anchor rod details.

### PRECAST PILE CAP SCHEDULE

<table>
<thead>
<tr>
<th>Pile Cap Schedule for 14&quot; Sq. Precast Piles 80 Ton Compression and 60 Ton Tension Piles</th>
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</thead>
<tbody>
<tr>
<td><strong>Pile Cap</strong></td>
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### PILE CAP SCHEDULE FOR 14" SQ. PRECAST PILES 80 TON COMPRESSION AND 60 TON TENSION PILES

<table>
<thead>
<tr>
<th>PILE CAP SCHEDULE</th>
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<tbody>
<tr>
<td><strong>Pile Cap</strong></td>
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**NOTES:**

- See plan for footing size.
- Top bars, if required, shall follow the same lap pattern.
- See pile cap schedule for sizes and number of reinforcement bars.
- Bent corner reinforcement shall match size and spacing of columns around columns. At interior columns, provide 30# roofing felt.
- Plate washer, see schedule for column, base plate and anchor rod details.
- Anchor rod holes, see base plate detail and anchor rod details.
- Plate washer, see schedule for column, base plate and anchor rod details.
- See general notes for required pile and pile cap concrete strengths.
- All reinforcement shown is bottom reinforcement, unless noted otherwise. See detail 3/S3.01 for additional information.
- ソフトウェアを使用して生成されたPDFから自然なテキストを生成しました。
<table>
<thead>
<tr>
<th>Location</th>
<th>Column</th>
<th>Anchor Rods</th>
<th>Base Plate</th>
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</thead>
<tbody>
<tr>
<td>115'-0&quot;</td>
<td>115'-0&quot;</td>
<td>LEVEL 04</td>
<td>LEVEL 04</td>
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<tr>
<td>142'-0&quot;</td>
<td>142'-0&quot;</td>
<td>LEVEL 09</td>
<td>LEVEL 10</td>
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<tr>
<td>155'-6&quot;</td>
<td>155'-6&quot;</td>
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<td>169'-0&quot;</td>
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<tr>
<td>250'-0&quot;</td>
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</table>

**Locations:**
- 115'-0"
- 142'-0"
- 155'-6"
- 169'-0"
- 250'-0"

**Anchor Rods:**
- (10) 2" DIA.x16" 3 1/4"x54"x5'
- (12) 2" DIA.x16" 3 1/4"x54"x5'
- (12) 2" DIA.x24" 4 1/2"x48"x4'
- (12) 2" DIA.x24" 4 1/2"x48"x4'
- (4) 1" DIA. 1 3/4"x24"x2'
- (4) 1" DIA. 1 3/4"x24"x2'
- (4) 1" DIA. 1 3/4"x24"x2'
- (4) 1" DIA. 1 3/4"x24"x2'

**Base Plate:**
- 1 3/4"x24"x2'
- 1 3/4"x24"x2'
- 1 3/4"x24"x2'
- 1 3/4"x24"x2'

**Title:**
- 20.027

**SCHEDULE:**
- SAVANNAH, GEORGIA
- DESIGN E

**Checked:**
- 2018 IBC WITH RISK CATEGORY II
- SEISMIC DESIGN CATEGORY C
**FLOOR EDGE BEAM PARALLEL TO DECK**

**DECK PERPENDICULAR TO BEAM**
- Studs shall be placed in strong position. A stud placed on the side of the reinforcing rib nearest the end of the span is in the strong position.
- Studs shall be placed in the strong position. A stud placed on the side of the reinforcing rib nearest the end of the span is in the strong position.

**DECK PARALLEL TO BEAM**
- Studs shall be placed in strong position. A stud placed on the side of the reinforcing rib nearest the end of the span is in the strong position.
- Studs shall be placed in strong position. A stud placed on the side of the reinforcing rib nearest the end of the span is in the strong position.

**TYPICAL STUD PLACEMENT DETAIL**

**TYPICAL DETAIL AT COMPOSITE FLOOR OPENING**

**TYPICAL DETAIL AT GIRDER**

**TYPICAL DETAIL AT CROSSING BEAMS**

**TYPICAL INTERRUPTED DECK SUPPORT AT COLUMN**
ELEVATION ALONG GRID 2 BETWEEN GRID C AND D

ELEVATION ALONG GRID 3 BETWEEN GRID C AND D

ELEVATION ALONG GRID 4 BETWEEN GRID C AND D

ELEVATION ALONG GRID 5 BETWEEN GRID C AND D

ELEVATION ALONG GRID 6 BETWEEN GRID C AND D

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

LEVEL 01

LEVEL 02

LEVEL 03

LEVEL 04

LEVEL 05

LEVEL 06

LEVEL 07

LEVEL 08

LEVEL 09

LEVEL 10

LEVEL 11

LEVEL 12

ROOF

W14x211
W14x145
W14x99
W14x68
W14x43
W14x283
W14x145
W14x99
W14x68
W14x43
W14x283
W14x193
W14x145
W14x90
W14x61
W14x43
W16x26 (30)
W16x31 (30)
W16x31 (30)
W16x36 (30)
W16x36 (30)
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HSS12x12x5/16
HSS12x12x5/16
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W16x67 (30)
W16x67 (30)
FRAMING NOTES:
1. SEE S7.XX SERIES FOR TYPICAL MOMENT FRAME DETAILS.

S7.10
S3.10
3
S7.10
2
S7.10
1
4'-0" (TYP.)
FRAMING NOTES:

1. DESIGN OF BRACED FRAME CONNECTION IS A DEFERRED SUBMITTAL THAT SHALL BE SEALED, SIGNED AND DATED BY A STRUCTURAL ENGINEER REGISTERED IN THE PROJECT STATE. ALL CONNECTIONS SHALL BE DESIGNED TO DEVELOP THE FORCES INDICATED ON THE BRACED FRAME ELEVATIONS.

2. "Pu" INDICATES ULTIMATE BRACE FORCE (KIPS) IN TENSION (+) OR COMPRESSION (-).

3. "Vu" INDICATES ULTIMATE SHEAR FORCE (KIPS) DOWNWARDS (+) UPWARDS (-).

4. "Au" INDICATES ULTIMATE DRAG FORCE (KIPS) IN TENSION (+) OR COMPRESSION (-).

5. FORCES AND MEMBERS ARE SYMMETRICAL ABOUT CENTERLINES.

6. INCREASE WELD SIZE BY AMOUNT OF GAP.

FINISH, TYP. EA.

TYP. EA.

FLANGE

1/2"x8"x1'-6" PLATES ON EACH SIDE. PROVIDE (12)-3/4" DIA. A325 BOLTS.

4'-0" ABOVE F.F.E., U.N.O.

2"

2"

2"

1 1/2"

3"

3"

3"

3"

3"

3"

3"

3"

3"

3"

1" GUSSET PLATE.

SLOTTED INTO BRACE

W14x283

W14x211

HSS12x12x1/2

2'-5 1/4"

1'-6 7/8"

TYP.

1"

1/2 15

1/2 15

CJ

CJ

CJ

SEE TYPICAL REINFORCING AT RE-ENTRANT CORNERS FOR ADDITIONAL INFORMATION (DO NOT CROSS CONTROL JOINTS)

DIAGONAL BRACE

BASE PLATE (GR. 50) AND ANCHOR RODS

BRACED FRAME COLUMN

COLUMN ISOLATION EXTENSION AS REQUIRED TO CLEAR BRACE

4'-4"

4'-0"

7"

1'-5"

1'-5"

7"

7"

5"

11 3/8"

16#9 U-BARS

·

·

·

SEE SCHEDULE AND 2/S7.00 FOR BASE PLATE AND ANCHOR BOLTS.

HEAVY HEX DOUBLE NUTS WITH STANDARD WASHER

5/16

3/8

3/8

3/8

3/8

1" GUSSET PLATE.

SLOTTED INTO BRACE

W14x283

·

HSS12x12x1/2

2'-0"

2'-0"

TYP.

1/4 36

1/4 36

1/4

1/4

1/4

1/4

1/4

1/4

1/4

1/4

1/4

1/4

W18x40

TYP.

1"

TYP.

1"
TYPICAL BEAM TO WF COLUMN FLANGE MOMENT CONNECTION

TYPICAL MOMENT FRAME COLUMN SPLICE

TYP. MOMENT FRAME COL. BASE PLATE