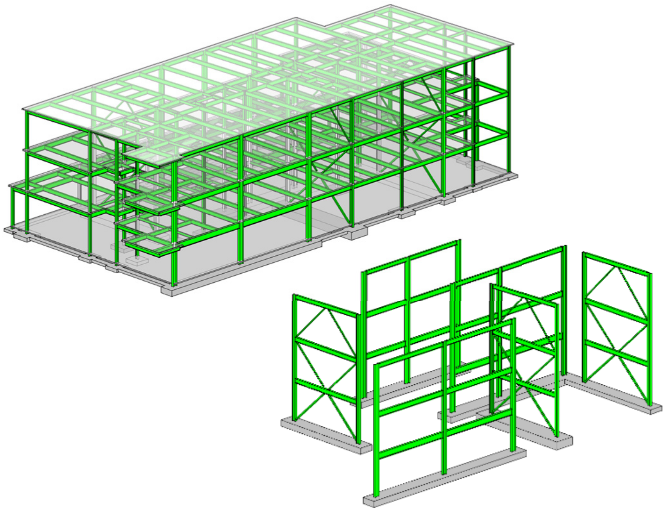
NIST GCR 21-917-48v3A



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

Volume 3A – 3-story Education Building in St. Louis, Missouri Building Designs

Applied Technology Council

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National Institute of Standards and Technology
U.S. Department of Commerce

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NIST GCR 21-917-48v3A

Seismic Design of Archetype Steel Buildings in Central and Eastern United States
Volume 3A – 3-story Education Building in St. Louis, Missouri
Building Designs

Prepared for
U.S. Department of Commerce
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Gina M. Raimondo, Secretary

National Institute of Standards and Technology
James K. Olthoff, Performing the Non-Exclusive Functions and Duties of the Under Secretary of Commerce for Standards and Technology & Director, National Institute of Standards and Technology

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Preface

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 21-917-48v3B.

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 3 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 3, a 3-story education facility located in St. Louis, Missouri; designs for Buildings 1 and 2 are documented in NIST GCR 21-917-48 Volumes 1 and 2, 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 geographic 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

Parameters	Volume 1	Volume 2	Volume 3
Location	Savannah, GA	Long Island, NY	St. Louis, MO
Occupancy	Office	Healthcare	Education
Height	12-story	7-story	3-story
Overall Plan Dimensions	190 ft × 120 ft	124 ft × 129 ft	148 ft × 76 ft
Design Code (old)[a]	1988 SBC	1987 NBC	1987 NBC
Design Code (current)[a]	2018 IBC	2018 IBC	2018 IBC
Performance-based Design		ASCE/SEI 41-17	
Risk Category	II, III	III, IV	II, III
Seismic Design Category	C, D	B, C, D	C, D
Number of Designs	5	6	5

[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.

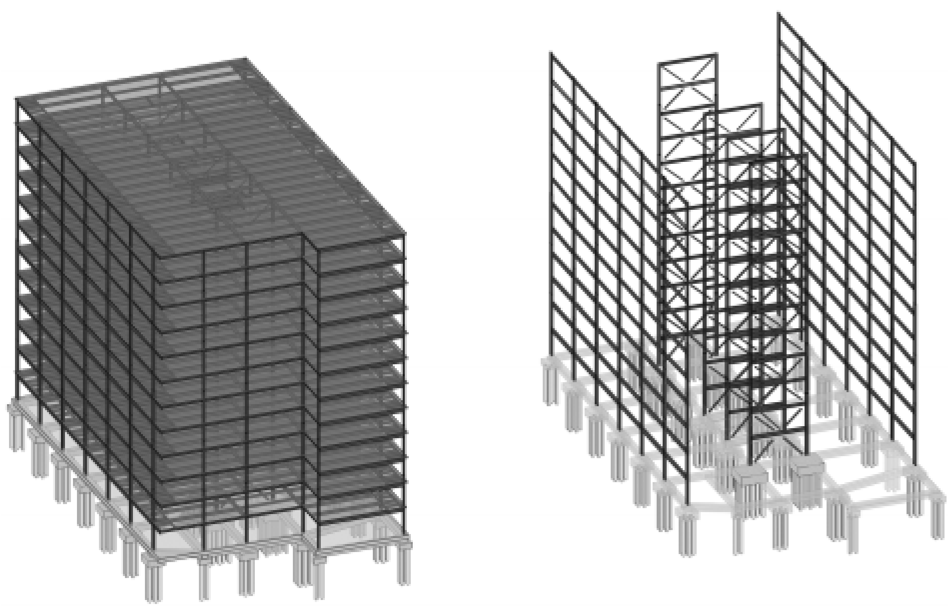

Figure I-1 Schematic for Building 1.

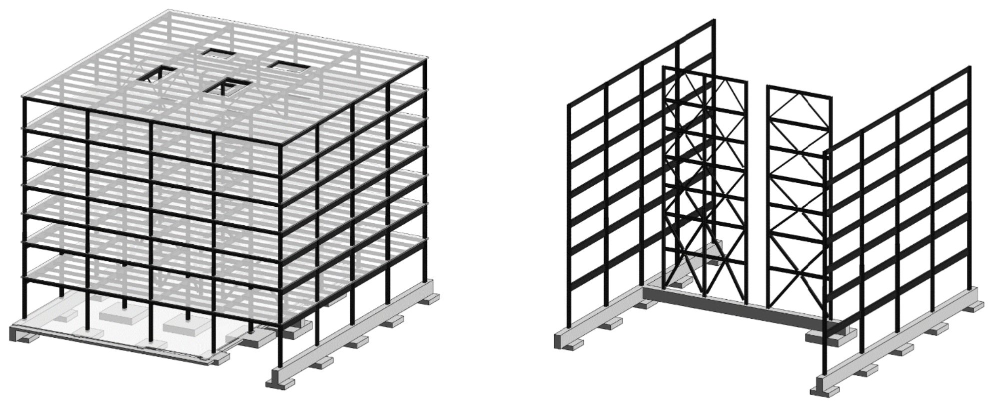

Figure I-2 Schematic for Building 2.

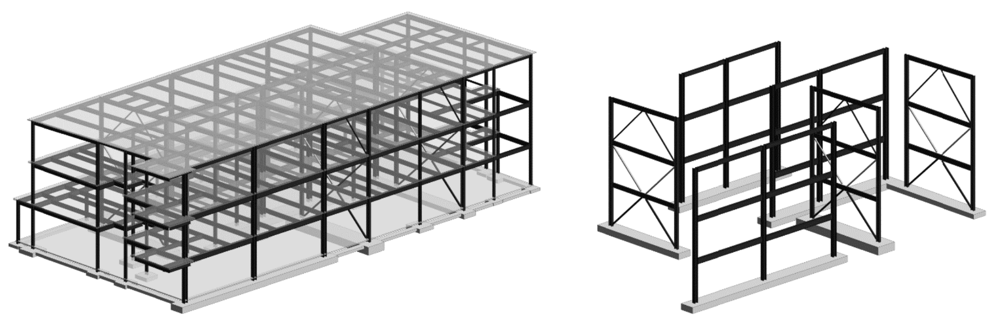

Figure I-3 Schematic for Building 3.

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)

- American Institute of Steel Construction (AISC), *Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings*, 1978 Edition
- American Concrete Institute (ACI) – *318-83: ACI Building Code Requirements for Structural Concrete*, (ACI 318-83)

1988 Standard Building Code (SBC) – not applicable to Building 2

- AISC *Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings*, 1978 Edition
- ACI *318-83: ACI Building Code Requirements for Structural Concrete*, (ACI 318-83)

2018 International Building Code (IBC)

- *Minimum Design Loads and Associated Criteria for Building and Other Structures*, 2016 Edition (ASCE/SEI 7-16)
- 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 3 Design Cases

This volume documents the designs for Building 3, a three-story education building located in St. Louis, Missouri, illustrated in Figure I-2. Five design cases were developed for this building.

A. 1987 NBC "Risk Category II, Seismic Design Category C" Equivalent

B. 2018 IBC Risk Category II – Seismic Design Category C

C. 1987 NBC "Risk Category III, Seismic Design Category C" Equivalent

D. 2018 IBC Risk Category III – Seismic Design Category C

E. 2018 IBC Risk Category III – Seismic Design Category D

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 A and C listed above is used to distinguish which Importance Factor was used in seismic design, 1.25 or 1.5, 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 for 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 NBC designs to mimic the design philosophy that would have been used during this era of structural engineering.

I.4.2 Live Load Reduction

The equation of calculating the live load reduction is very similar between IBC and NBC. However, NBC Section 918.2.2 states that "for a live load of 100 psf or less, no reduction shall be made for building or portions thereof of Use Groups A and E." By definition, this building will be categorized as Group E building (Educational Building) and the live loads are less than 100 psf, therefore all the member designed according to the NBC are without any live load reduction.

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. It was observed that vibration controlled many floor bays in the IBC designed building.

I.5 Variations in Lateral-Force Resisting System Design

The LFRS configurations used for all of designs are the same. For all five study designs, seismic forces controlled the lateral-force resisting system design in both the longitudinal and transverse directions and at each floor. The factors contributing to this are:

- The building geometry and Braced Frame/Moment Frame layout: The building footprint is roughly a 2:1 rectangular aspect ratio and the lateral-force resisting system perpendicular to the long side of the building, where the maximum wind is applied, has a lower seismic response modification factor. This results in seismic forces controlling the design.

- Building Height/Weight and its location: The building is in St. Louis, Missouri and has a fastest-mile design wind speed of 70 mph specified in the NBC with an average roof height of 43 ft. This combination leads to relatively small wind design pressures. Two of the three elevated stories are constructed using concrete slab over metal deck to achieve typical fire ratings required for educational facilities that adds significant mass to the building. At this height and weight combination, wind loading is less likely to control the design.

In the designs, the moment frames are controlled by the applicable code required lateral drift limit. The lateral drift limit for a moment frame structure in NBC is more rigorous than the limits specified in the IBC. To be specific, the drift limit in the NBC is $0.005h \times K/I$, where h = story height, K = horizontal force factor and I = occupancy importance factor and is $0.020h \times I/C_d$ in the IBC, where I = importance factor and C_d = deflection amplification factor with 0.02 a factor that varies between different Risk Categories. For moment frames within these building designs and referencing the Risk Category III design as an example, the drift limit is 0.66 inches per the NBC and 0.83 inches per the IBC.

The forces required for the design of the moment frames determined by the IBC led to estimated forces that were 31% less than the forces derived using the NBC requirements. This was due to the change of the moment frame designations required between the codes, as “ordinary” moment frames are utilized in the NBC designs, but “ordinary” moment frames are not permitted to be used with Seismic Design Category C or D in IBC designs; “special” moment frames are required for these categories. "Special" moment frames have specific detailing requirements that allow the frames to perform in a more ductile manner, which is desired during a seismic event.

Another factor that causes lower design forces based on the IBC requirements is the difference in the equations for calculating the building period for moment frames. The IBC equation returns a longer building period than the NBC equation, which leads to a less conservative seismic force.

Unlike the decreased forces found in the analysis, the steel tonnage was not decreased significantly in IBC designs. The use of "Special" moment frames adds more ductile detailing requirements and unbraced length limitations for the steel sections in the IBC designs. This leads to a similar moment frame column and beams size to NBC.

In all five designs, the braced frames are controlled by strength instead of drift which is common for this lateral-force-resisting system. There is a 25% increase in design force observed from NBC to the IBC, and this is due to the differences between the base shear formula in the respective editions of the code. In the NBC, the base shear from seismic force $V_{seismic} = Z \times K \times I \times C \times S \times W$, where numerical coefficient $C = 1 / (15 \times \sqrt{T})$. The building period T is considered in the general seismic force formula. In the IBC, the building period is only applied when determining the maximum design force. The building period calculated in the NBC and the IBC are similar.

There is a 41% steel tonnage increase from NBC to IBC. IBC refers to AISC 341 seismic provision that requires more checks to steel beam members for steel special concentrically braced frames with chevron shape braces, i.e., unbalanced expected strength forces. The amplification of the accidental torsional moment due to torsional irregularity required in the IBC designs (ASCE 7-16, Section 12.8.4.3) increases the ultimate forces at each braced frame, which did not occur in NBC.

Detailing requirements for the IBC designs may increase the cost as well. Many energy dissipation requirements cause the connections for lateral components to increase in cost. Member compaction requirements in the IBC also dictate the minimum size that can be used to design specific lateral-force-resisting system components, and this will in turn increase tonnage. A few steel kicker braces were added to the frame beam without perpendicular sub-beams, to reduce the unbraced length of frame beams per these new requirements. The detailing material is not covered in the tonnage calculation summary but will contribute to the construction of the LFRS in terms of labor, fabrication, and material cost.

I.6 Comparison of Building 3 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 I-2 Steel Tonnage for Building 3 Designs

Design Case (Code Year, Risk Category, Seismic Design Category)	Steel (tons)
Design A (1987 NBC, "RC II, SDC C" Equivalent)	150 tons
Design B (2018 IBC, RC II, SDC C)	134 tons
Design C (1987 NBC, "RC III, SDC C" Equivalent)	160 tons
Design D (2018 IBC, RC III, SDC C)	138 tons
Design E (2018 IBC, RC III, SDC D)	139 tons

The NBC gravity column designs are roughly 46% heavier, and the gravity floor framing design is around 25% heavier than the IBC designs. Overall, this leads to a 29% steel increase if considering the overall gravity steel framing system for the NBC 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: 1987 NBC "Risk Category II, Seismic Design Category C" Equivalent
- Design Case B: 2018 IBC Risk Category II, Seismic Design Category C

- Design Case C: 1987 NBC "Risk Category III, Seismic Design Category C" Equivalent
- Design Case D: 2018 IBC Risk Category III, Seismic Design Category C
- Design Case E: 2018 IBC Risk Category III, Seismic Design Category D

Representative structural calculations are provided as supporting documentation in NIST GCR 21-917-48v3B.

Designs for Buildings 1 and 2 are documented in NIST GCR 21-917-48 Volumes 1 and 2, respectively.

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

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BOCA, 1987, *The BOCA National Building Code/1987*, Tenth Edition, NBC 1987 Building Officials and Code Administrators International, Inc., Country Club Hills, Illinois.

ICC, 2018, *International Building Code,* 2018 IBC, International Code Council, Washington, DC.

SBC, 1988, *Standard Building Code 1988 Edition*, SBC 1988, Southern Building Code Congress International, Inc., Birmingham, Alabama.

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Design Case A

1987 NBC
"Risk Category II"
"Seismic Design Category C"

A.1 Gravity Design

This building is a three-story Educational Facility. The vertical force-resisting system consists of normal-weight concrete slabs, 2-1/2", over the 3" metal deck with a total slab thickness of 5-1/2" at the second and third floors. The slabs at these floors are supported by a composite steel beam system and wide flange steel columns. The roof deck is comprised of a 2" metal deck with no topping. All steel members (beams and columns) are Grade ASTM A36 steel and were designed using the allowable stress design method (ASD) per the AISC Steel Construction Manual 8th Edition. The deflections are limited to the NBC prescribed limits of L/360 for applied live loads and L/240 for applied total loads.

The calculated design dead load is 70 PSF and partition load of 20 PSF on the second and third floors and a design dead load of 20 PSF at the roof. The live loads chosen for the floors and roof were per Section 1103 of the NBC. It should be noted that the 20 PSF roof minimum snow load controlled the design over the calculated snow load per Section 1111.0 of the NBC.

A.2 Lateral Design

There are two different lateral load resisting systems (LFRS) in this building. The braced frames resist the lateral loads in the N-S direction, and moment frames resist the lateral loads in the E-W direction. The applied wind and seismic loads were determined using Sections 1112.0 and 1113.0, respectively, from the NBC. In each case, the seismic design forces controlled the design, most likely due to the increased dead load of the concrete slab at two stories. In both directions, the eccentric loading, both calculated and required accidental (5%), was included in determining the applied frame forces at each level.

The N-S braced frames have a two-story X configuration and utilize ASTM A501 (yielding stress of 36 KSI) tube steel braces. The relative stiffness between the braced frames were designed to be similar, to efficiently distribute the applied load at each diaphragm to allow for overall efficiency of the brace, beam, and column sizes of the braced frame system. The global stiffness of the braced-frame system is relatively high, and the frames were strength controlled. At the foundations, the anchorage was designed to resist the uplift forces due to overturning and the shear lugs were designed to transfer the applied shear forces to the foundations.

The E-W moment frames have a welded moment connection at the beam to column connection. This connection is a typical pre-Northridge Earthquake steel moment frame that has complete joint penetration continuous welds between column and beam flanges and bolted shear tab connection between column and beam web. This type of connection is not adequate to be treated as a "special moment frame," and therefore, a K =1.0 was chosen for design. The design of the moment frame was controlled by a 0.5% drift limit in NBC.

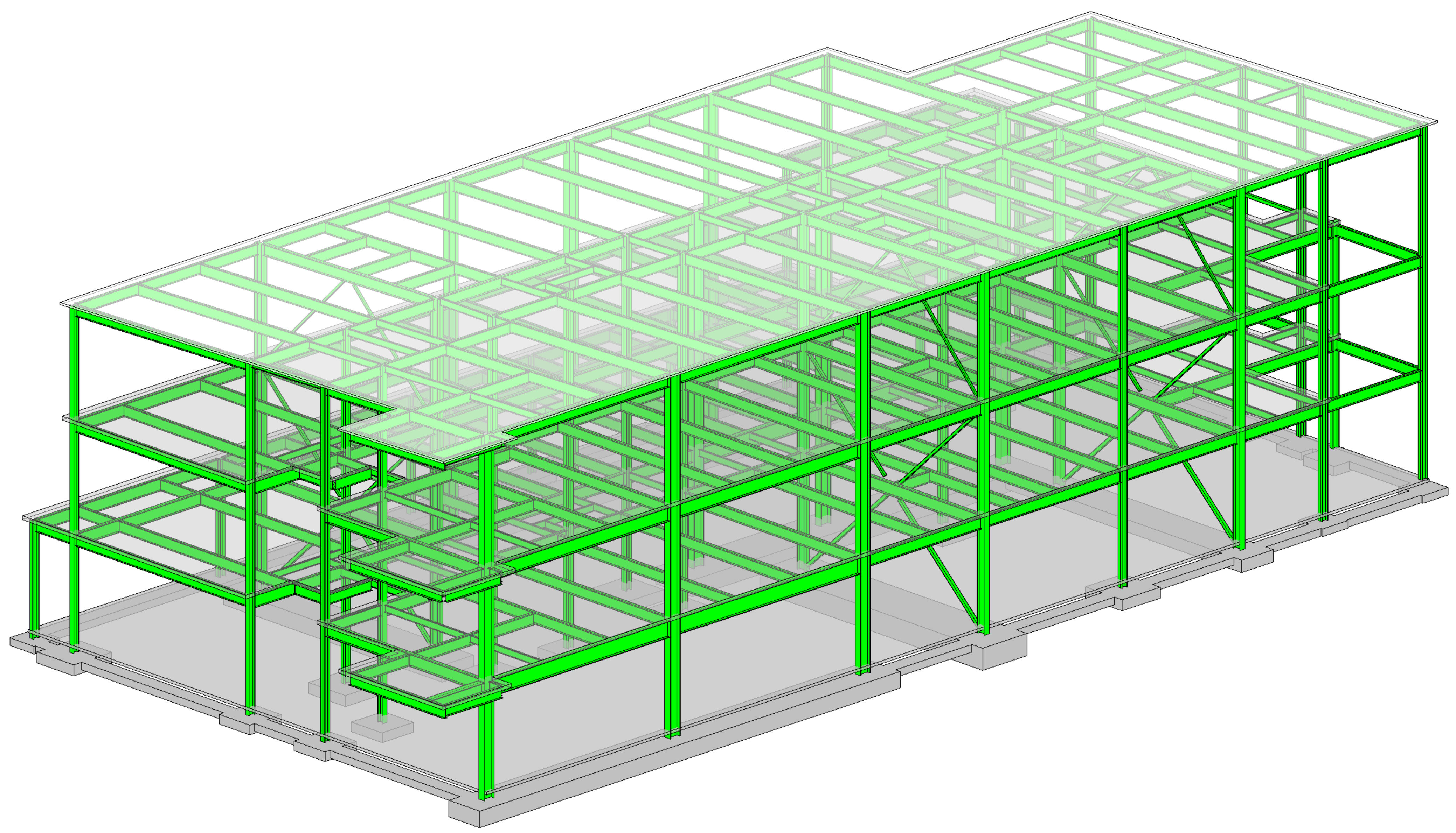
A.3 Steel Tonnage

Total steel tonnage for this design case is calculated as 150 tons.

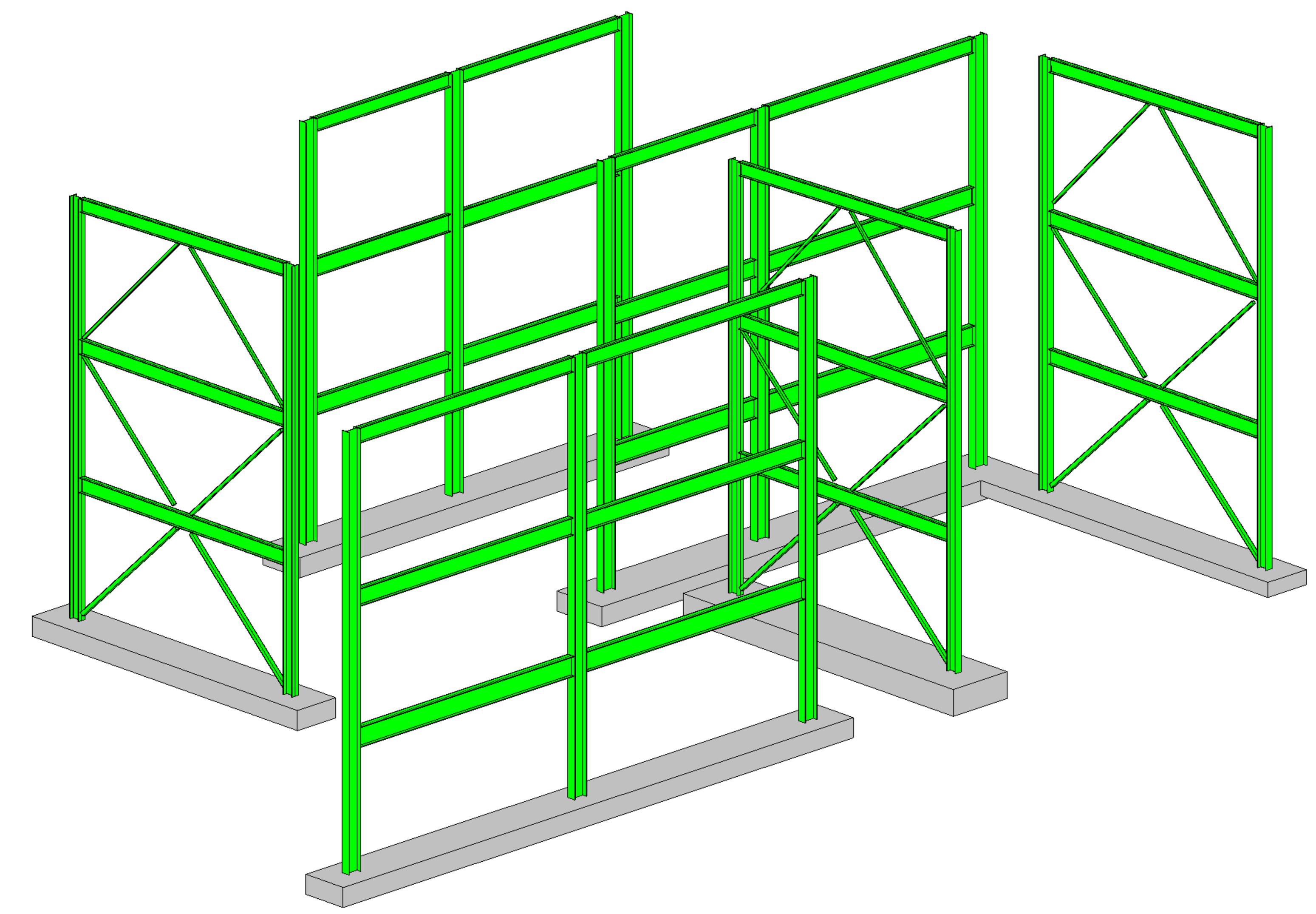
A.4 Structural Drawings

Structural drawings for Design Case A are provided on the following pages.

EDUCATIONAL FACILITY - ST. LOUIS, MISSOURI
DESIGN A - 1987 NBC WITH EQUIVALENT RISK CATEGORY II



OVERALL FRAMING 3D VIEW



FORCE RESISTING SYSTEM 3D VIEW

DESIGN A: 1987 NBC "RISK CATEGORY II" EQUIVALENT	
EDUCATION FACILITY, ST. LOUIS MISSOURI	
ITEM	QUANTITY
WF COLUMNS (Fy = 36 KSI)	22 TONS
WF GIRDERS AND JOISTS (Fy = 36 KSI)	79 TONS
MOMENT FRAME WF COLUMNS (Fy = 36 KSI)	18 TONS
MOMENT FRAME WF BEAMS (Fy = 36 KSI)	14 TONS
BRACED FRAME WF COLUMNS (Fy = 36 KSI)	9 TONS
BRACED FRAME WF BEAMS (Fy = 36 KSI)	7 TONS
STEEL TUBING BRACES (Fy = 46 KSI)	2 TONS
TOTAL	151 TONS

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

STRUCTURAL DRAWING INDEX

CONSULTANTS

National Institute of Standards and Technology

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UZUN +CASE

PROJECT

EDUCATION FACILITY

ST. LOUIS, MISSOURI

PCS STRUCTURAL SOLUTIONS

DESIGN A

1987 NBC WITH EQUIVALENT RISK CATEGORY II

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DRAWINGS

30 SEPTEMBER, 2021

Job Number	19-051
Checked	HL
Approved	DRS

TITLE

COVER SHEET

SHEET NUMBER

S0.00

GENERAL NOTES

STANDARDS
THE DESIGN AND MATERIALS SHALL CONFORM TO THE 1987 NATIONAL BUILDING CODE (NBC) AS AMENDED AND ADOPTED BY THE LOCAL BUILDING OFFICIAL OR APPLICABLE JURISDICTION.

STRUCTURAL DRAWINGS

PRIMARY STRUCTURAL ELEMENTS ARE DIMENSIONED ON STRUCTURAL PLANS AND DETAILS AND OVERALL LAYOUT OF STRUCTURAL PORTION OF WORK. STRUCTURAL DETAILS SHOW DIMENSIONAL RELATIONSHIPS TO CONTROL DIMENSIONS DEFINED BY DRAWINGS.

PROJECT LOCATION

ST. LOUIS, MISSOURI

38.6270 LATITUDE,-90.1994 LONGITUDE

DESIGN CRITERIA

VERTICAL LOADS

AREA	DESIGN DEAD LOAD	LIVE LOAD	CONCENTRATED LOADS
CLASSROOM AND OFFICE	90 PSF	50 PSF	1000#
CORRIDORS ABOVE 1ST FLOOR	90 PSF	80 PSF	1000#
ROOF	20 PSF	20 PSF	-

SNOW:

Pg = 20 PSF = GROUND SNOW LOAD
Pf = CeI Pg = FLAT ROOF SNOW LOAD = 14 PSF, USE 20 FOR CALCULATION
I = 1.0, Ce = 1.0

LATERAL FORCES

LATERAL FORCES ARE TRANSMITTED BY DIAPHRAGM ACTION OF ROOF AND FLOORS TO BRACED FRAME/MOMENT FRAME. LOADS ARE THEN TRANSFERRED TO FOUNDATION BY BRACED FRAME/MOMENT FRAME ACTION WHERE ULTIMATE DISPLACEMENT IS RESISTED BY PASSIVE PRESSURE OF EARTH AND/OR SLIDING FRICTION. OVERTURNING IS RESISTED BY DEAD LOAD OF THE STRUCTURE.

WIND:

THE BUILDING MEETS THE CRITERIA PER NBC 1987 SECTION 1112.0.

- EXPOSURE CATEGORY = B
- BASIC WIND SPEED, V = 70 MPH
- EQUIVALENT RISK CATEGORY PER TABLE 1.5-1 = II
- PRESSURE COEFFICIENT (ENCLOSED) = 0.8, -0.5
- WIND IMPORTANCE FACTOR I_W = 1.0
- BRACE FRAME BASE SHEAR V=78.6 KIPS; MOMENT FRAME BASE SHEAR V=55.5 KIPS

SEISMIC: (NBC 1987) V = Z IKCSW

Z = 3/8
SEISMIC IMPORTANCE FACTOR, I = 1.0
EQUIVALENT RISK CATEGORY PER TABLE 1113.1 = II
K = 1.0 AT BRACED FRAME, K = 1.0 AT MOMENT FRAME
W = EFFECTIVE SEISMIC WEIGHT OF BUILDING = 2340 KIPS
ANALYSIS PROCEDURE USED = EQUIVALENT LATERAL FORCE PROCEDURE
DESIGN BRACE FRAME BASE SHEAR V = 123 KIPS
DESIGN MOMENT FRAME BASE SHEAR V = 115.3 KIPS

FOUNDATION DESIGN CRITERIA

SOIL BEARING PRESSURE: 4000 PSF (ASSUMED)

ACTIVE PRESSURE - RESTRAINED: 50 PCF +14H SEISMIC SURCHARGE (ASSUMED)
ACTIVE PRESSURE - UNRESTRAINED: 35 PCF +6H SEISMIC SURCHARGE (ASSUMED)
PASSIVE RESISTANCE: 200 PCF (INCLUDES F.O.S. ≥ 1.5) (ASSUMED)
COEFFICIENT OF FRICTION: .35 (INCLUDES F.O.S. ≥ 1.5) (ASSUMED)
*1/3 INCREASE ALLOWED FOR SEISMIC OR WIND LOADING

CONCRETE

CAST-IN-PLACE CONCRETE

ITEM	DESIGN f'c (PSI) (AT 28 DAYS U.N.O.)
FOUNDATIONS - UNO	3000
SLAB ON GRADE & CONCRETE OVER METAL DECK	4000
ALL OTHER CONCRETE	4000

REINFORCING STEEL

ASTM A615, GRADE 60 TYPICAL UNLESS NOTED OTHERWISE.

REINFORCING SPLICE AND DEVELOPMENT LENGTH SCHEDULE, Fy=40 KSI (UNLESS NOTED OTHERWISE)

BAR SIZE	MINIMUM LAP SPLICE LENGTHS ("Ls")	MINIMUM DEVELOPMENT LENGTHS ("Ld")
#3	1'-6"	1'-3"
#4	2'-0"	1'-7"
#5	2'-7"	2'-0"
#6	3'-1"	2'-4"
#7	4'-6"	3'-6"
#8	5'-2"	3'-11"
#9	5'-10"	4'-6"
#10	6'-6"	5'-0"
#11	7'-3"	5'-7"

STRUCTURAL STEEL

MATERIAL PROPERTIES

WIDE FLANGE SECTIONS: ASTM A36 (Fy = 36 KSI)

OTHER SHAPES AND PLATES: ASTM A36 (Fy = 36 KSI)

STRUCTURAL TUBING: RECTANGULAR & SQUARE - A500 GRADE BB (Fy = 46 KSI)

MACHINE BOLTS (M.B.): ASTM A307

HIGH-STRENGTH BOLTS: A325, A490

ANCHOR BOLTS (A.B.): ASTM A490, GRADE 36, UNLESS OTHERWISE NOTED

GENERAL REQUIREMENTS

HEADED STUDS: SHALL BE "S3L SHEAR CONNECTORS" FOR STUDS 3/4" DIAMETER AND LARGER AS MANUFACTURED BY NELSON STUD WELDING, INC. OR PRE-APPROVED EQUAL AND SHALL CONFORM TO AWS D1.1.

COMPOSITE FLOOR DECK: SHALL CONTAIN THE MINIMUM PROPERTIES SHOWN ON THE STRUCTURAL DRAWINGS. THE FLOOR UNITS SHALL BE FORMED FROM STEEL SHEETS CONFORMING TO ASTM A653, AND GALVANIZED PER ASTM A924.

ABBREVIATION LIST

@	AT	GR.	GRADE
A.B.	ANCHOR BOLT	HORIZ.	HORIZONTAL
ADD'L	ADDITIONAL	HSS	HOLLOW STRUCTURAL SECTION
ALT.	ALTERNATE	HT	HEIGHT
BLD'G	BUILDING	INT.	INTERIOR
BM	BEAM	JT	JOINT
B.O.F.	BOTTOM OF FOOTING	L	ANGLE
BOT.	BOTTOM	L.F.R.S.	LATERAL FORCE-RESISTING SYSTEM
BRG	BEARING	L.L.	LIVE LOAD
BTWN	BETWEEN	LLH	LONG LEG HORIZONTAL
(C=)	CAMBER	LLV	LONG LEG VERTICAL
CANT.	CANTILEVER	LOC.	LOCATION
C.J.	CONTROL/CONSTRUCTION JOINT	MAX.	MAXIMUM
CL	CENTERLINE	M.B.	MACHINE BOLT
CLR.	CLEARANCE	MIN.	MINIMUM
COL.	COLUMN	MISC.	MISCELLANEOUS
CONC.	CONCRETE	MTL	METAL
CONN.	CONNECTION	N.F.	NEAR FACE
CONST.	CONSTRUCTION	N.S.	NEAR SIDE
CONT.	CONTINUOUS	NTS	NOT TO SCALE
COORD.	COORDINATE	O.C.	ON CENTER
C.P.	COMPLETE PENETRATION	OPN'G	OPENING
CTR'D	CENTERED	OPP.	OPPOSITE
C.Y.	CUBIC YARD	PERP.	PERPENDICULAR
DBL.	DOUBLE	PL.	PLATE
DIA. OR ø	DIAMETER	P.P.	PARTIAL PENETRATION
DIAG.	DIAGONAL	P.S.F.	POUNDS PER SQUARE FOOT
DIM.	DIMENSION	REINF.	REINFORCING
D.L.	DEAD LOAD	REQ'D	REQUIRED
DWG	DRAWING	SCHED.	SCHEDULE
DWL	DOWEL	SIM.	SIMILAR
EA.	EACH	S.O.G.	SLAB ON GRADE
E.F.	EACH FACE	SQ.	SQUARE
EL.	ELEVATION	STD	STANDARD
ENGR.	ENGINEER	STIFF.	STIFFENER
EQ.	EQUAL	STL	STEEL
E.W.	EACH WAY	STRUCT.	STRUCTURAL
EXP.	EXPANSION	T&B	TOP & BOTTOM
EXT.	EXTERIOR	THR'D	THREADED
FDN	FOUNDATION	T.O.F.	TOP OF FOOTING
F.F.	FAR FACE	T.O.S.	TOP OF STEEL
FLR	FLOOR	TYP.	TYPICAL
FRM'G	FRAMING	U.N.O.	UNLESS NOTED OTHERWISE
F.S.	FAR SIDE	VERT.	VERTICAL
FTG	FOOTING	W/	WITH
GA.	GAGE/GAUGE	W.P.	WORK POINT
GALV.	GALVANIZED	WT	WEIGHT

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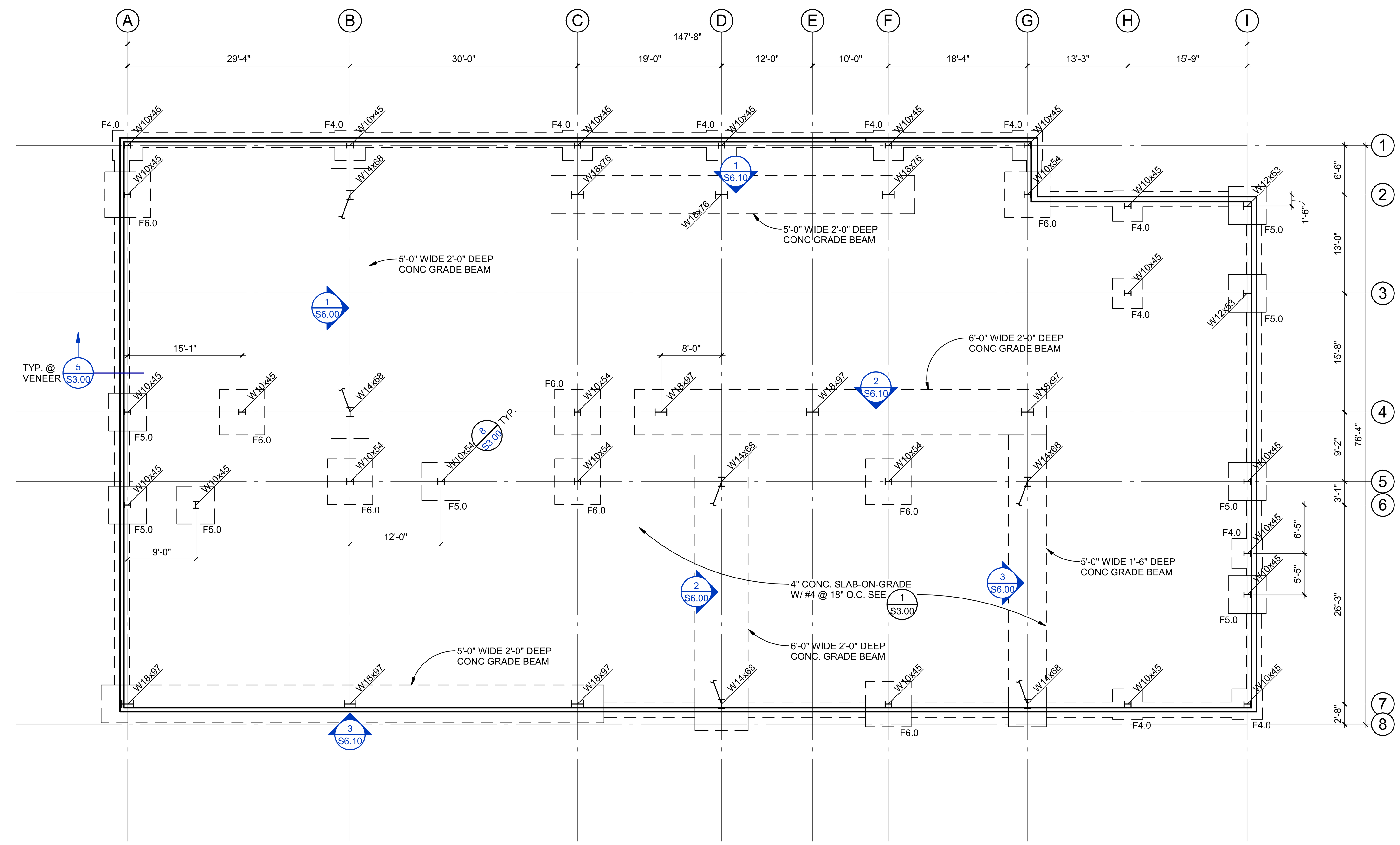
GENERAL NOTES

SHEET NUMBER
S0.10



NORTH

1
S2.00

FOUNDATION AND GRADE LEVEL FRAMING PLAN

1/8" = 1'-0"

FOUNDATION NOTES

1. INDICATES WALL STUDS.
2. INDICATES CONTINUOUS CONCRETE WALL FOOTING. FOR TYPICAL FOOTING AND FOUNDATION WALL DETAILS SEE SHEET S3.00. FOOTING WIDTH ("W") = 2'-0" UNLESS NOTED OTHERWISE ON PLAN. CENTER FOOTINGS ON CONCRETE STEM WALL.
3. "F_" INDICATES CONCRETE SPREAD FOOTING. FOR SCHEDULE SEE 7/S3.00.
4. X X.XX INDICATES BRACED FRAME OR MOMENT FRAME. FOR ELEVATIONS, MEMBER SIZES AND DETAIL CALLOUTS SEE SHEET S6.00 AND S6.10.
5. W10x45 INDICATES STEEL COLUMNS ORIGINATING AT FOUNDATION LEVEL. ALL COLUMNS ARE CONTINUOUS TO ROOF UNLESS NOTED OTHERWISE. FOR TYPICAL DETAIL SEE 8/S3.00.
6. FOR TYPICAL FOUNDATION DETAILS SEE SHEET S3.00.
7. TOP OF FOOTING ELEVATIONS = -1'-0" UNLESS NOTED OTHERWISE ON PLANS AND DETAILS.

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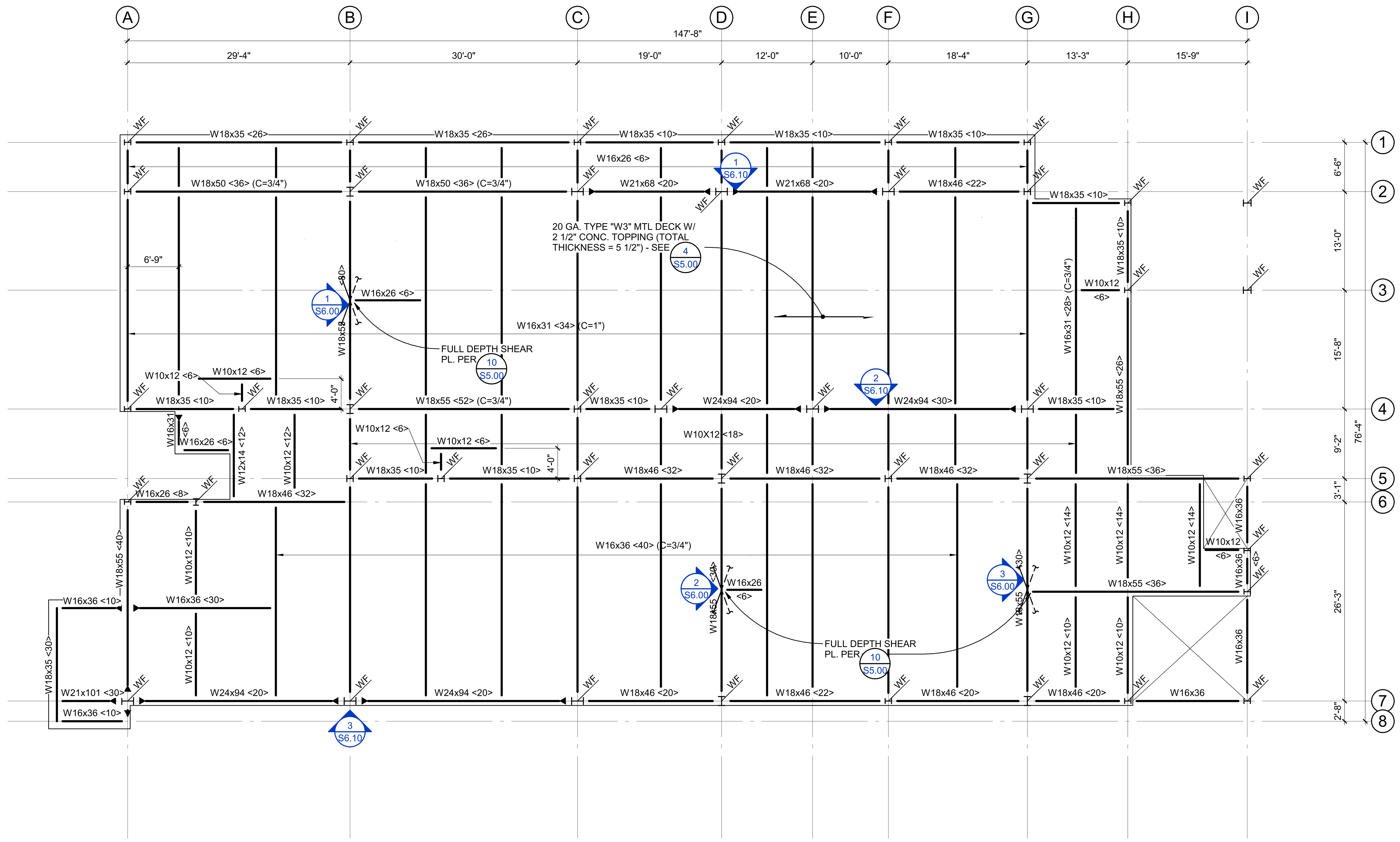
FOUNDATION AND GRADE LEVEL FRAMING PLAN

SHEET NUMBER
S2.00



T.O.S. = 13'-3 1/2"

FOR FRAMING NOTES SEE S2.10

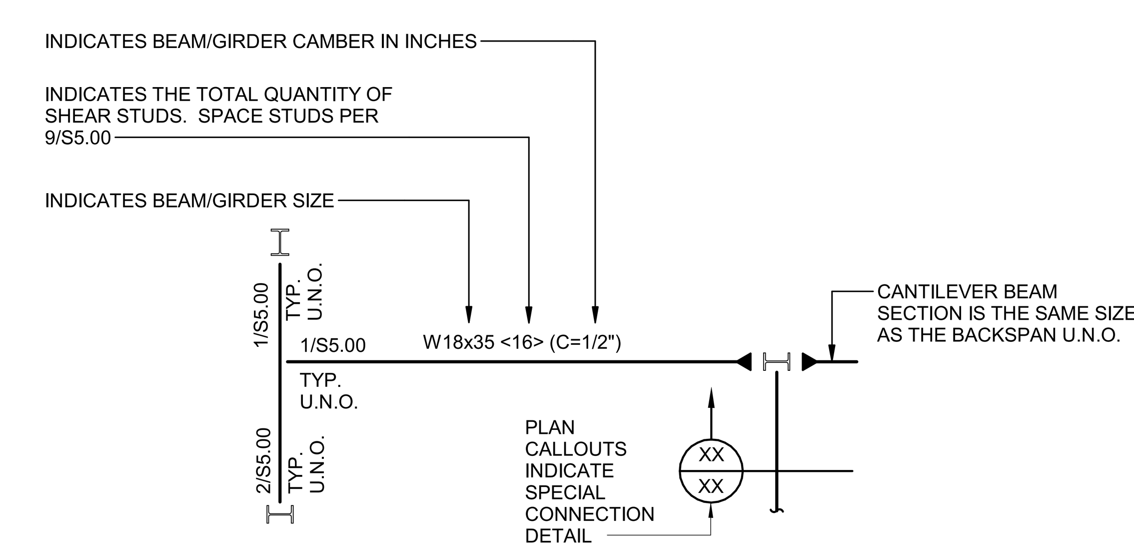
FRAMING PLAN - LEVEL 2

1 / S2.10 — 1/8" = 1'-0"

NORTH

FLOOR FRAMING NOTES

1. INDICATES BRACED FRAME. FOR ELEVATIONS, BRACE SIZES AND DETAIL CALLOUTS SEE SHEET S6.00. ALL BEAMS THAT ARE PART OF A BRACED FRAME SHALL BE CONSIDERED "COLLECTOR" BEAMS. ALL MEMBERS AND CONNECTIONS THAT ARE PART OF A BRACED FRAME SHALL BE CONSIDERED PART OF THE LATERAL-FORCE RESISTING SYSTEM.
2. INDICATES STEEL COLUMN CONTINUOUS TO FLOOR/ROOF ABOVE.
3. INDICATES PENETRATION IN FLOOR STRUCTURE. FOR TYPICAL REINFORCING AROUND OPENINGS SEE 5/S5.00.
4. FOR TYPICAL COMPOSITE BEAM AND METAL DECK DETAILS SEE SHEET S5.00.
5. INDICATES DIRECTION OF SPAN FOR METAL DECK.
6. FOR TYPICAL STEEL CONNECTION DETAILS SEE SHEET S5.00.



7. STEEL MEMBERS ARE EQUALLY SPACED BETWEEN DIMENSION POINTS UNLESS NOTED OTHERWISE.
8. INDICATES MOMENT FRAME. FOR ELEVATIONS AND DETAIL CALLOUT SEE SHEET S6.10. ASSOCIATED MEMBERS AND CONNECTIONS ARE PART OF THE LATERAL-FORCE RESISTING SYSTEM.

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TITLE
FRAMING PLAN - LEVEL 2

SHEET NUMBER
S2.10

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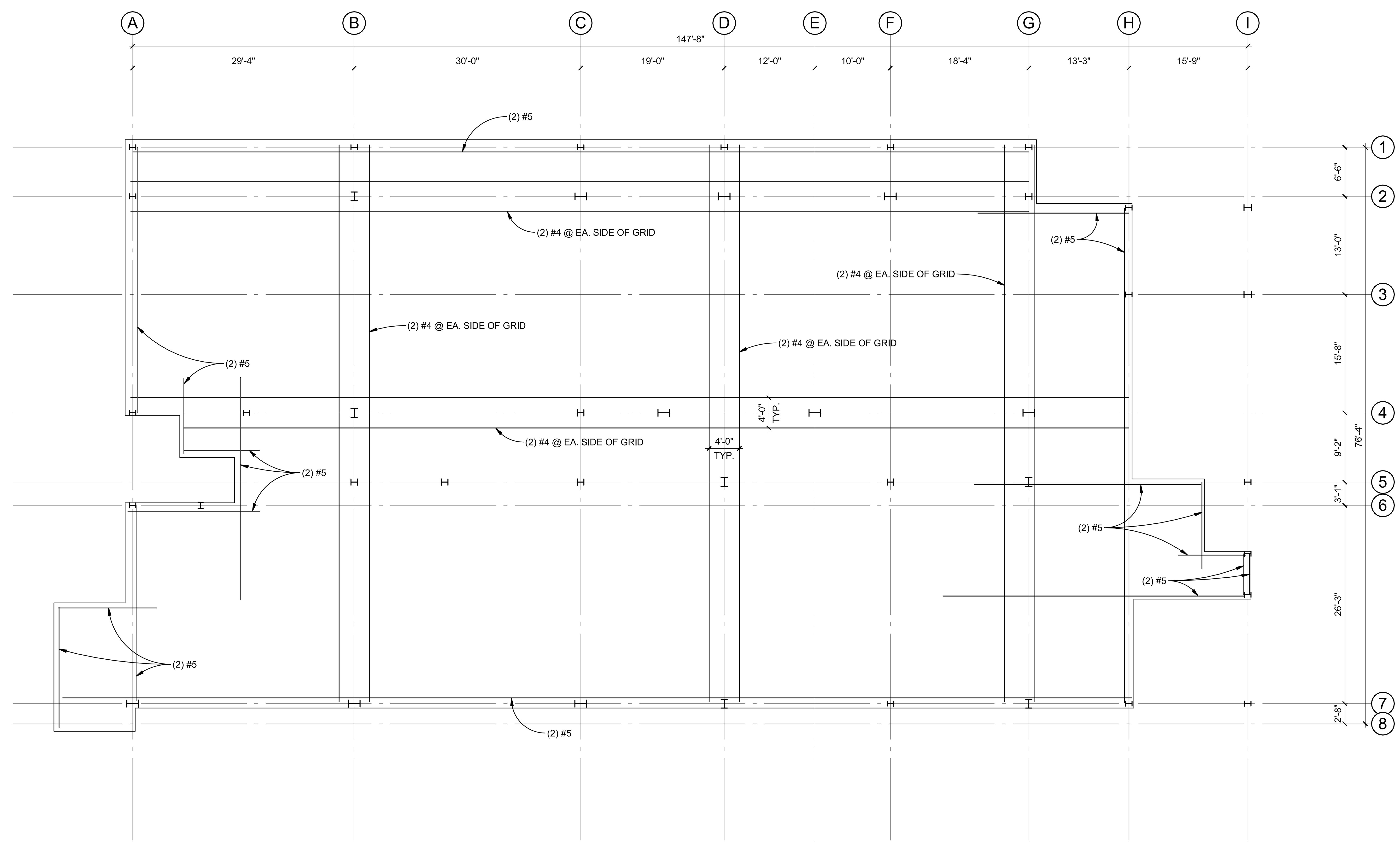

SLAB REINFORCING PLAN - LEVEL 2

1/8" = 1'-0"

SLAB PLAN NOTES:

1. PROVIDE #4 AT 24" O.C. EACH WAY AT SLAB ON METAL DECK-TYPICAL OVER ENTIRE FLOOR.
2. SLAB REINFORCING SHOWN IN THE PLAN IN ADDITION TO TYPICAL REINFORCING NOTED ABOVE.
3. SPLICE ALL REINFORCING PER GENERAL NOTES.
4. PROVIDE STANDARD HOOK AT ALL BARS WHICH CANNOT BE EXTENDED.
5. STAGGER ALL LAP SPLICES.

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TITLE
LEVEL 2 SLAB REINFORCING PLAN

SHEET NUMBER
S2.10R

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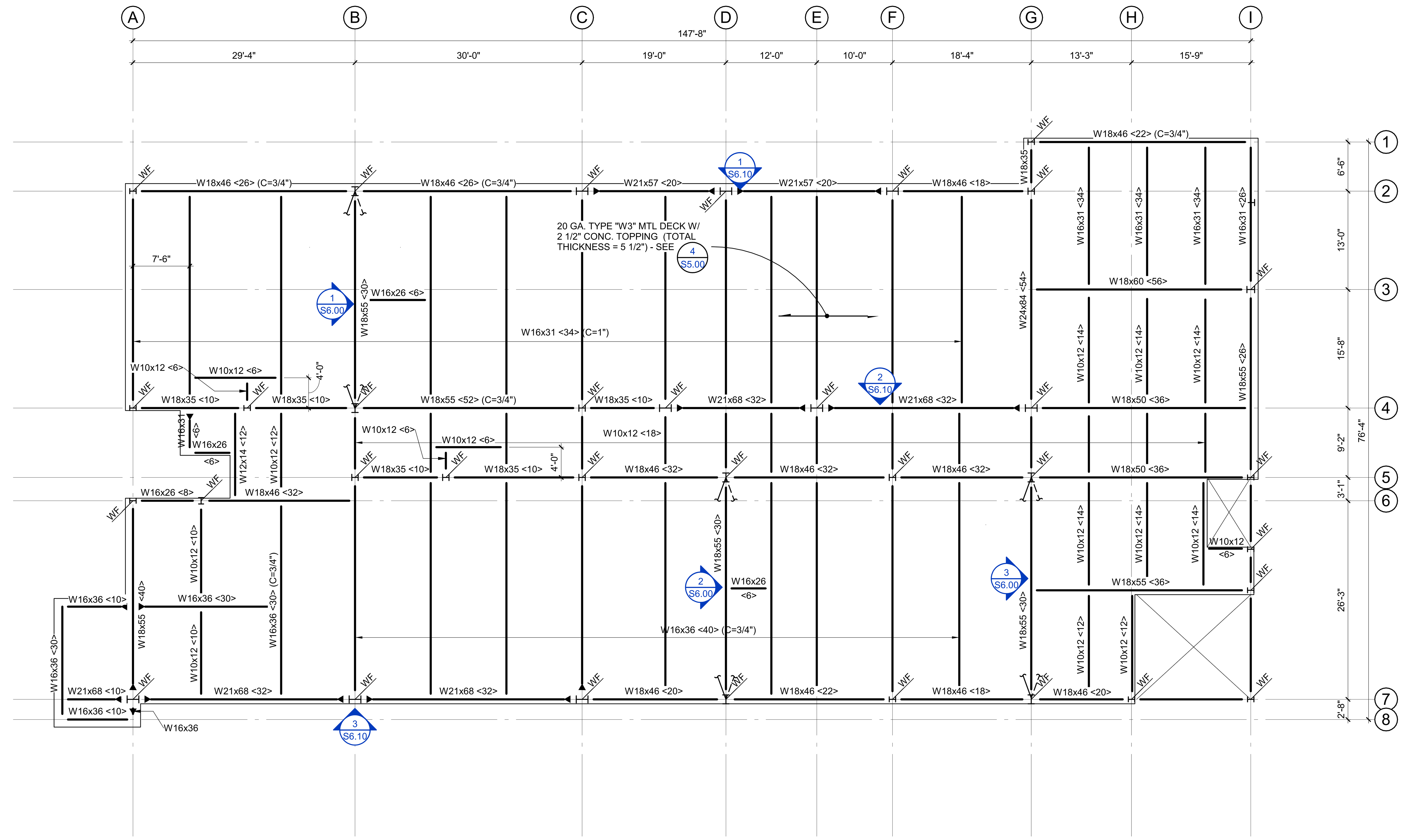

T.O.S. = 27'-0 1/2"

FOR FRAMING NOTES SEE S2.10

NORTH

1 S2.20 FRAMING PLAN - LEVEL 3

1/8" = 1'-0"

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FRAMING PLAN - LEVEL 3

SHEET NUMBER

S2.20

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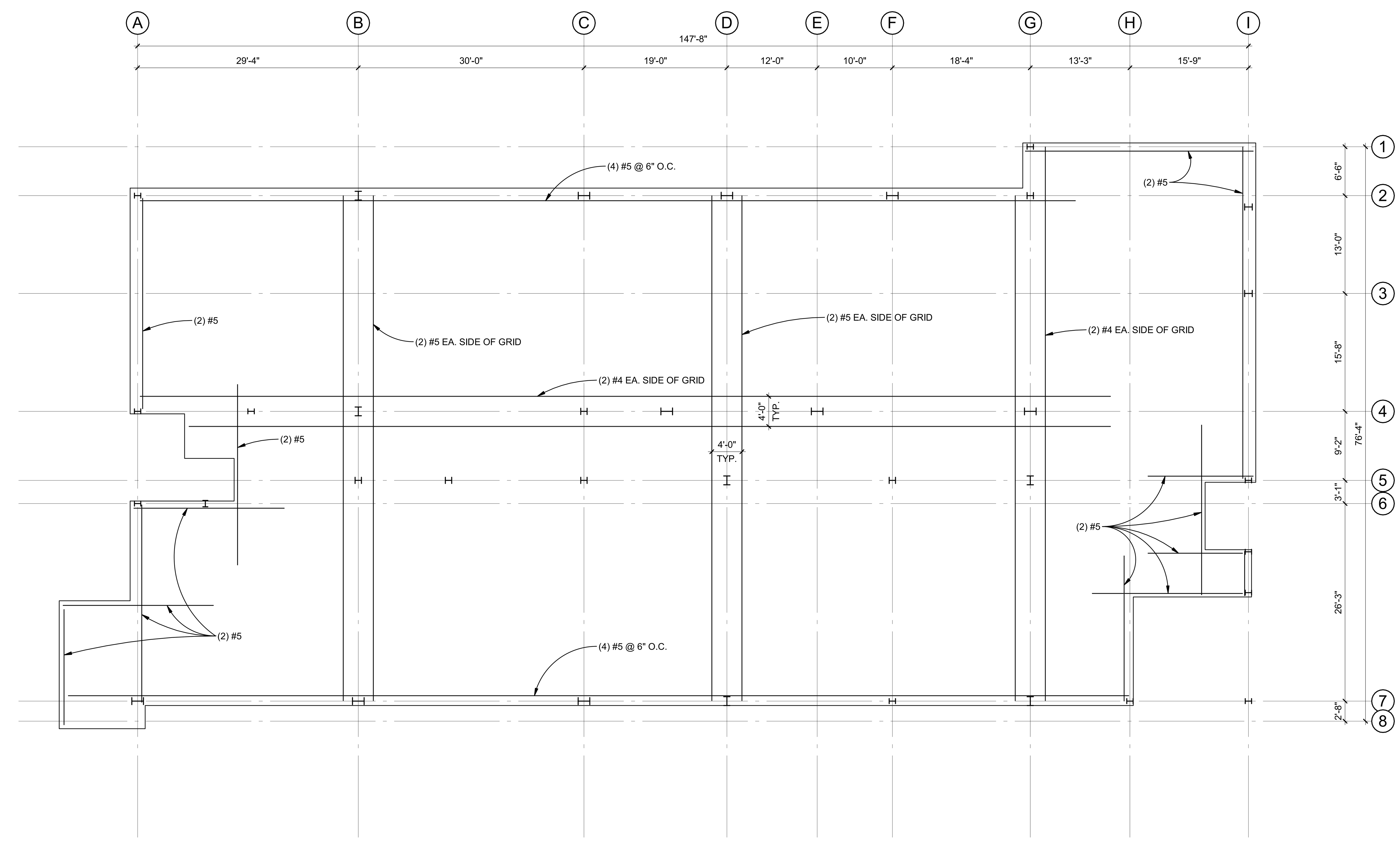

SEE S2.10R FOR SLAB PLAN NOTES

NORTH

1 S2.20R SLAB REINFORCING PLAN - LEVEL 3

1/8" = 1'-0"

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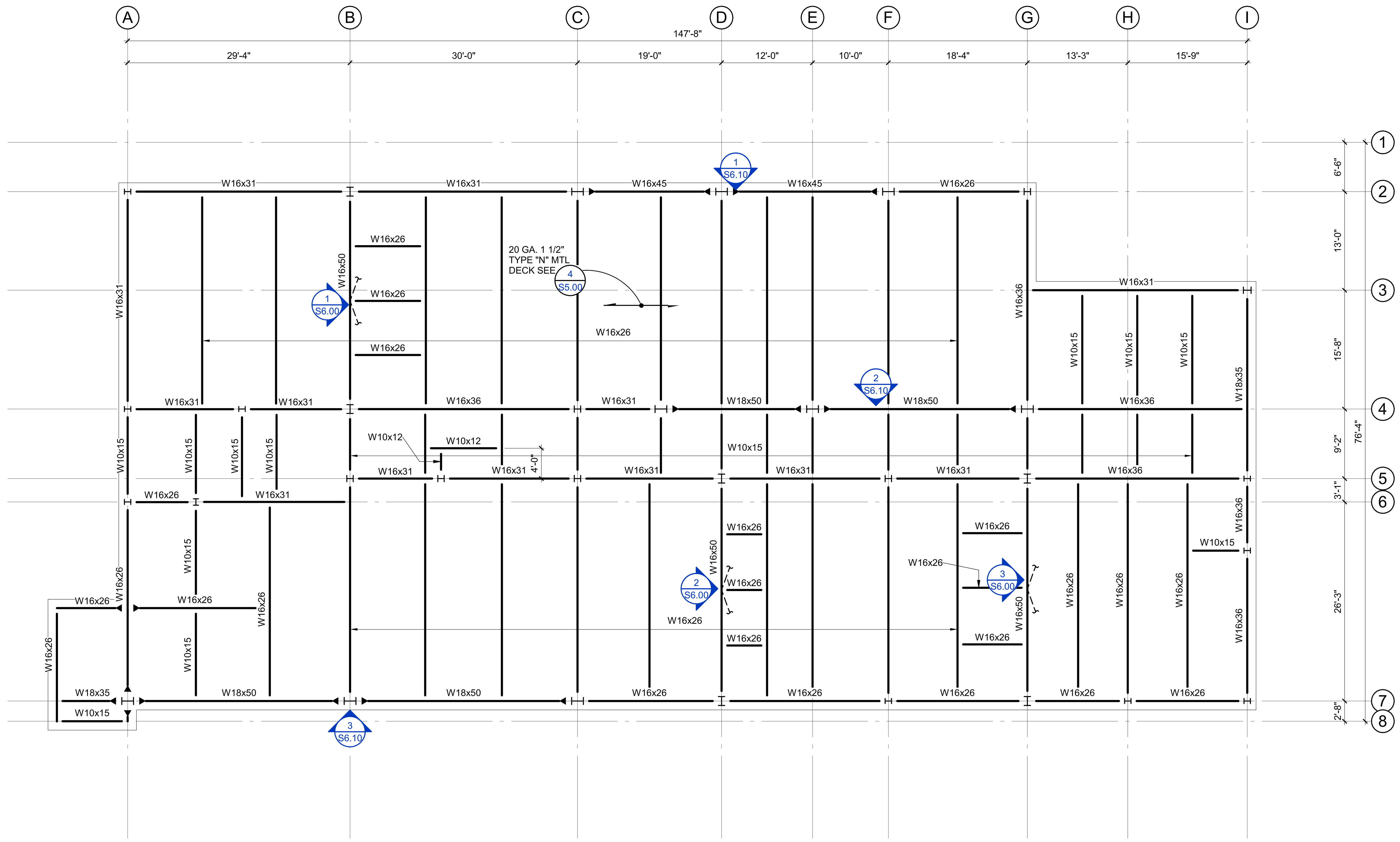
LEVEL 3 SLAB REINFORCING PLAN

SHEET NUMBER

S2.20R



T.O.S. = 41'-0 1/4"

FOR FRAMING NOTES SEE S2.10

1 S2.30 ROOF FRAMING PLAN

1/8" = 1'-0"

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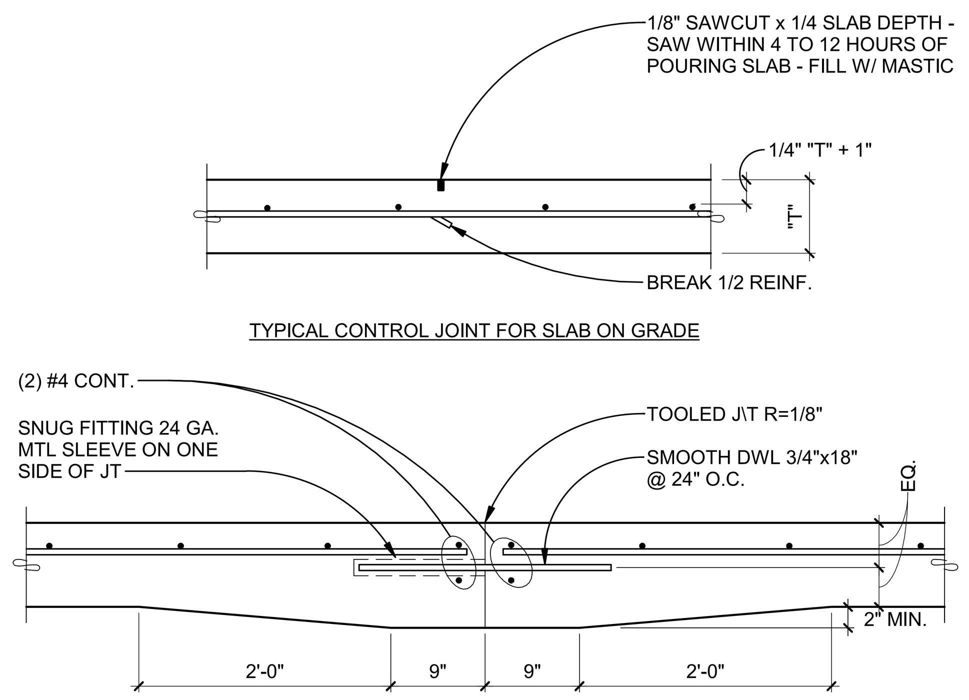
ROOF FRAMING PLAN

SHEET NUMBER

S2.30



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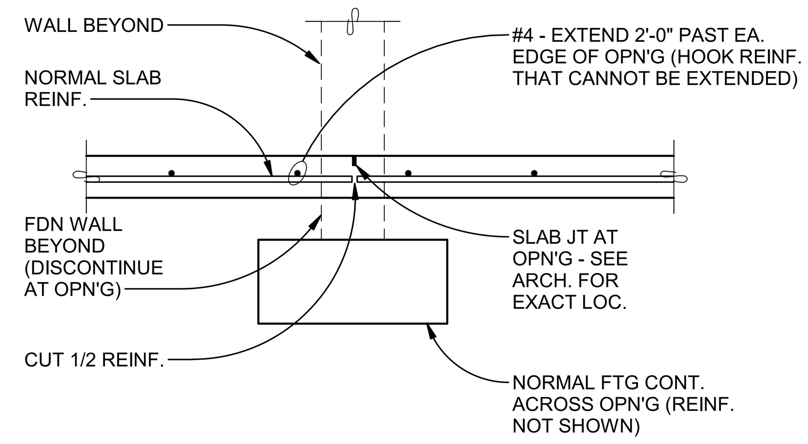

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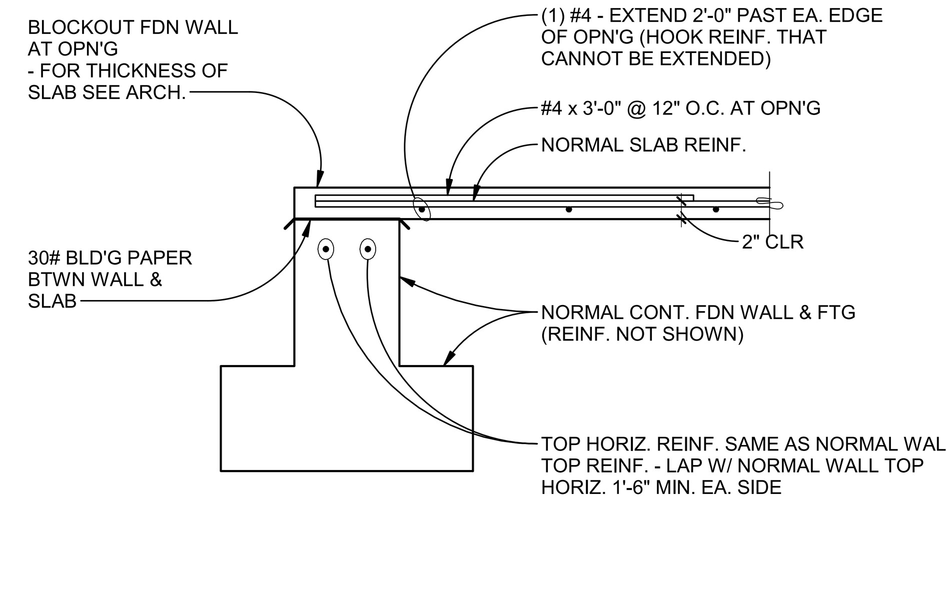

3 S3.00 SECTION
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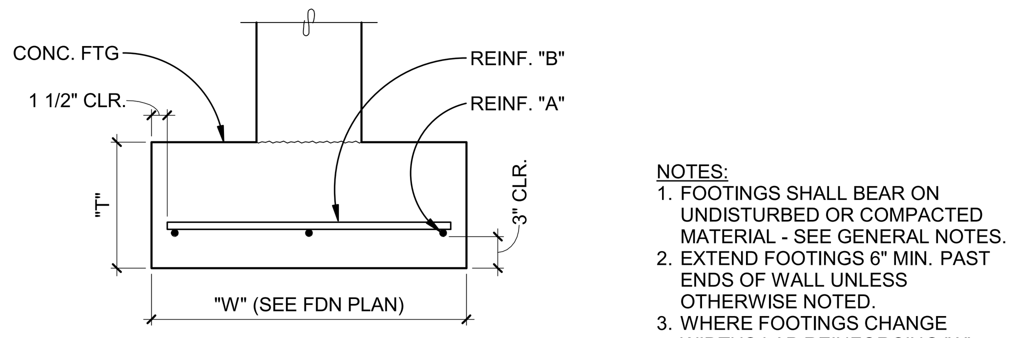
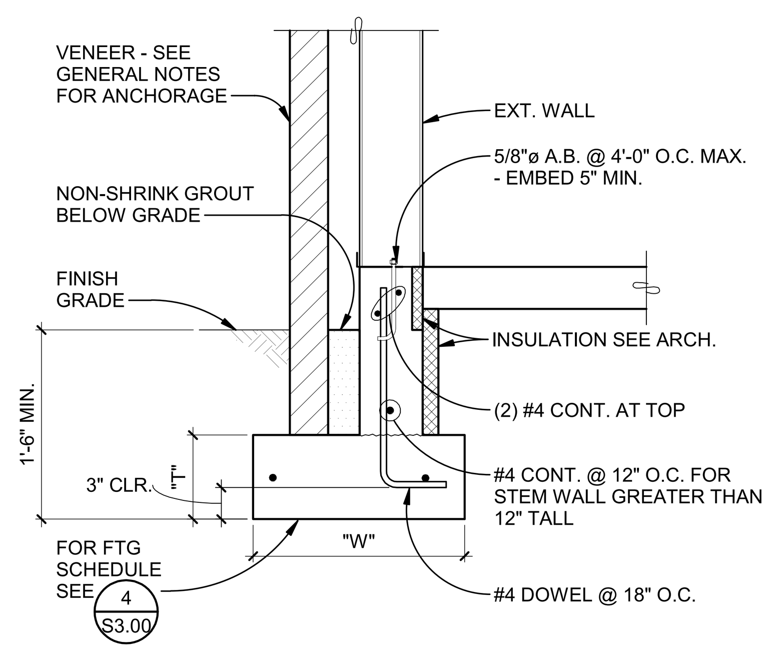


WIDTH "W"	"T"	REINF. "A" CONT.	REINF. "B"
2'-0"	11"	(2) #5	---

NOTES:
1. FOOTINGS SHALL BEAR ON UNDISTURBED OR COMPACTED MATERIAL - SEE GENERAL NOTES.
2. EXTEND FOOTINGS 6" MIN. PAST ENDS OF WALL UNLESS OTHERWISE NOTED.
3. WHERE FOOTINGS CHANGE WIDTHS LAP REINFORCING "A". **"Ls"** PER GENERAL NOTES.

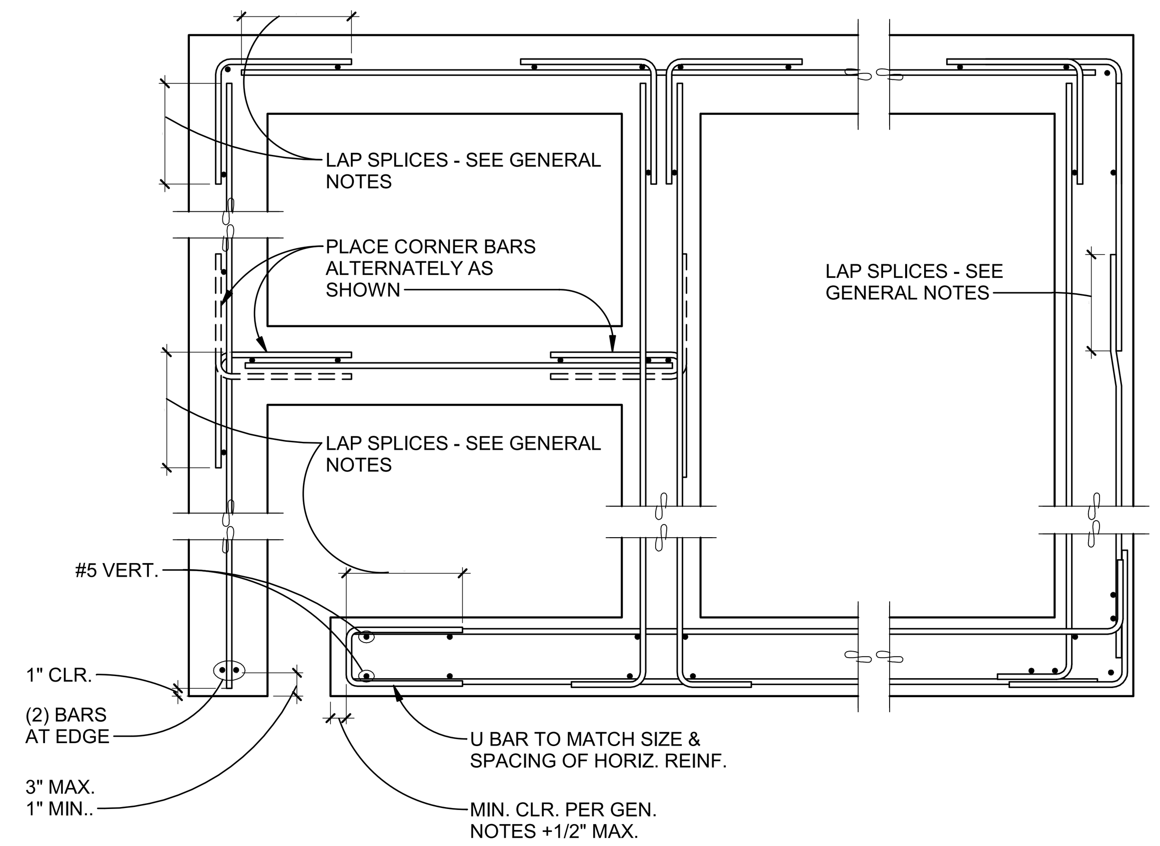
TYPICAL CONTINUOUS FOOTING DETAIL

4 S3.00 SECTION
NO SCALE



TYPICAL FOUNDATION AT EXTERIOR WALL WITH VENEER

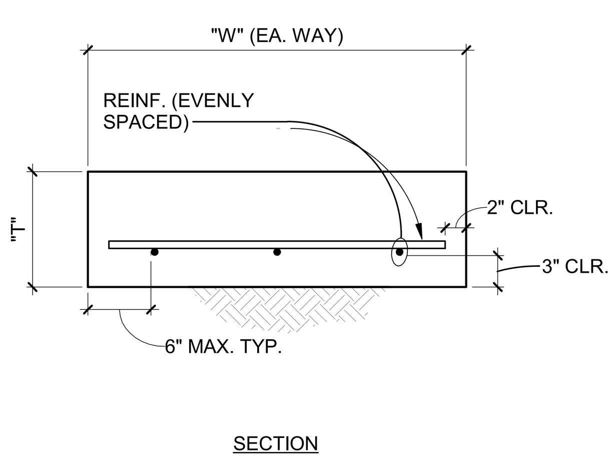
5 S3.00 SECTION
NO SCALE



NOTES:
1. VERT. REINF. SHOWN IS ADD'L IF NORMAL STEM WALL REINF. IS NOT IN PROPER LOCATION.
2. CORNER BARS ARE SAME SIZE & SPACING AS HORIZ. REINF.
3. 90° STD HOOK MAY BE SUBSTITUTED FOR CORNER BARS. SEE NOTE #5.
4. REINF. AT ALL CORNERS, ENDS, & INTERSECTIONS OF WALLS SHALL BE PLACED IN ACCORDANCE W/ APPROPRIATE DETAIL SHOWN.
5. USE 90° STD HOOK FOR EMBEDMENT LESS THAN 24" PAST FACE OF WALL.

TYPICAL REINFORCING PLACEMENT FOR CAST IN PLACE CONCRETE WALLS AND STEM WALLS

6 S3.00 DETAIL
NO SCALE

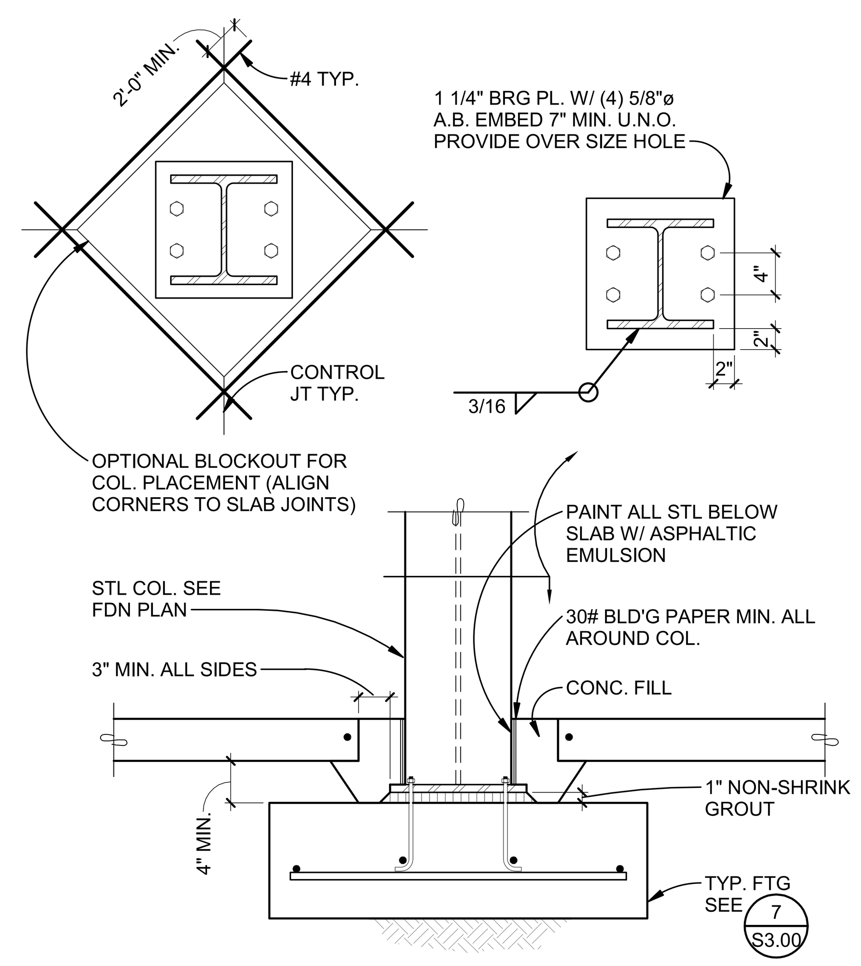


MARK	DIMENSIONS		REINF. EA. WAY
	"W"	"T"	
F4.0	4'-0"	11"	(4) #5
F5.0	5'-0"	14"	(5) #6
F6.0	6'-0"	16"	(6) #7

NOTES:
1. CENTER ALL FOOTINGS ON COLUMN ABOVE EXCEPT AS SHOWN OTHERWISE.
2. FOOTINGS SHALL BEAR ON UNDISTURBED OR COMPACTED MATERIAL, SEE GENERAL NOTES. DESIGN BEARING PRESSURE IS 4000 PSF.

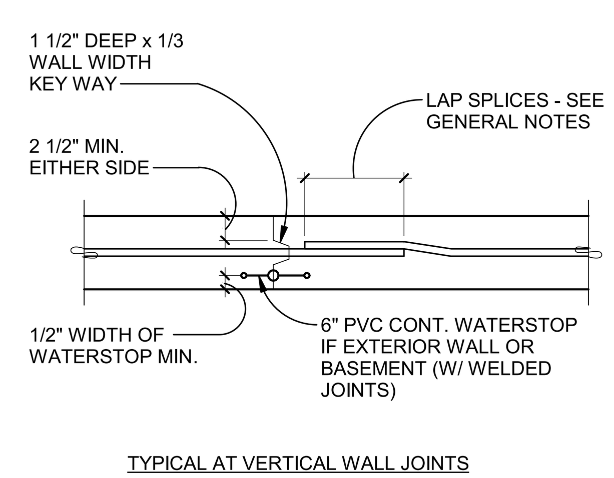
TYPICAL CONCRETE SPREAD FOOTING DETAILS

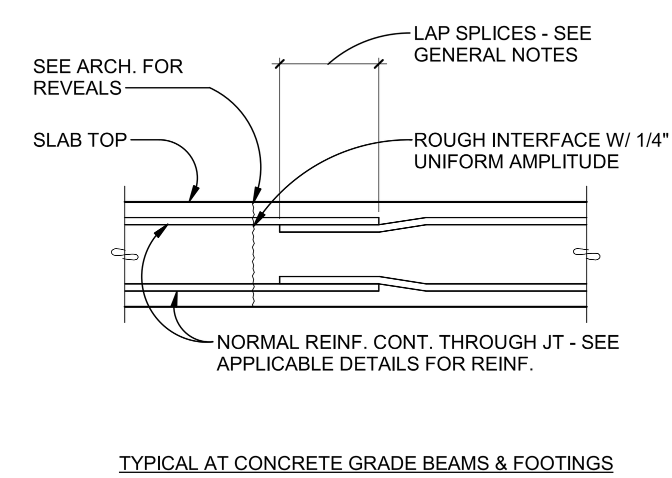
7 S3.00 SECTION
NO SCALE



TYPICAL STEEL COLUMN AT SPREAD FOOTING

8 S3.00 SECTION
NO SCALE





NOTE:
OBTAIN APPROVAL OF ENGINEER FOR LOC. OF ANY C.J.

TYPICAL FOR CAST IN PLACE CONCRETE WALLS, GRADE BEAMS AND FOOTINGS

9 S3.00 CONSTRUCTION JOINTS
NO SCALE

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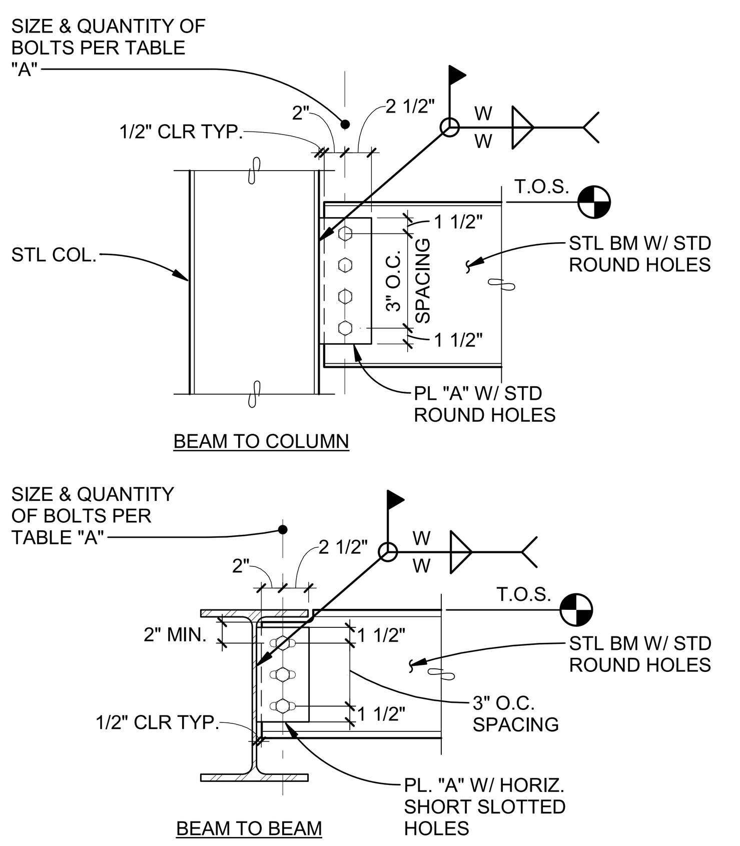


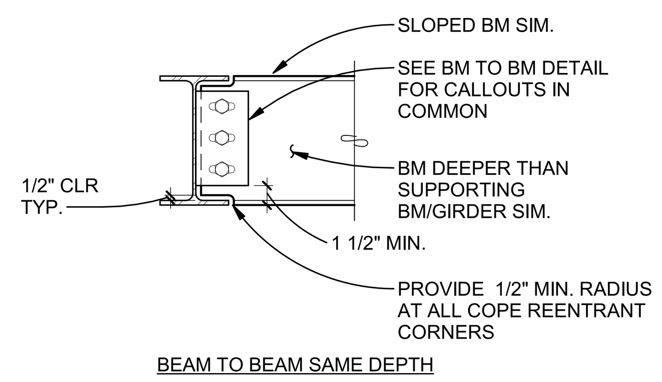
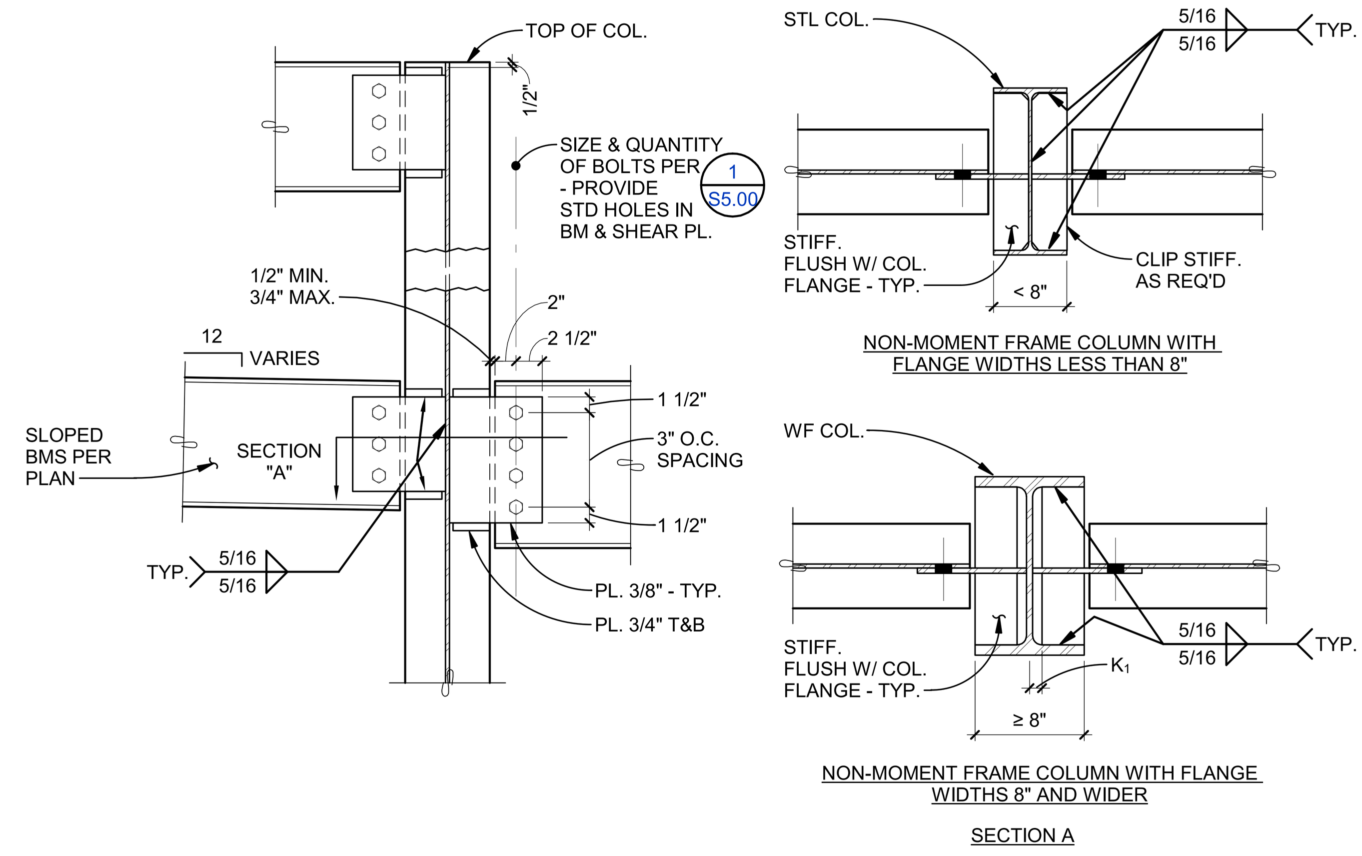


TABLE A			
SUPPORTED BEAM SIZE	QUANTITY OF 7/8"ø A325N BOLTS	SHEAR PLATE THICKNESS "A"	WELD "W" NOTE 1.
W10	2	3/8"	5/16"
W16, W18	4	3/8"	5/16"
W21	5	3/8"	5/16"

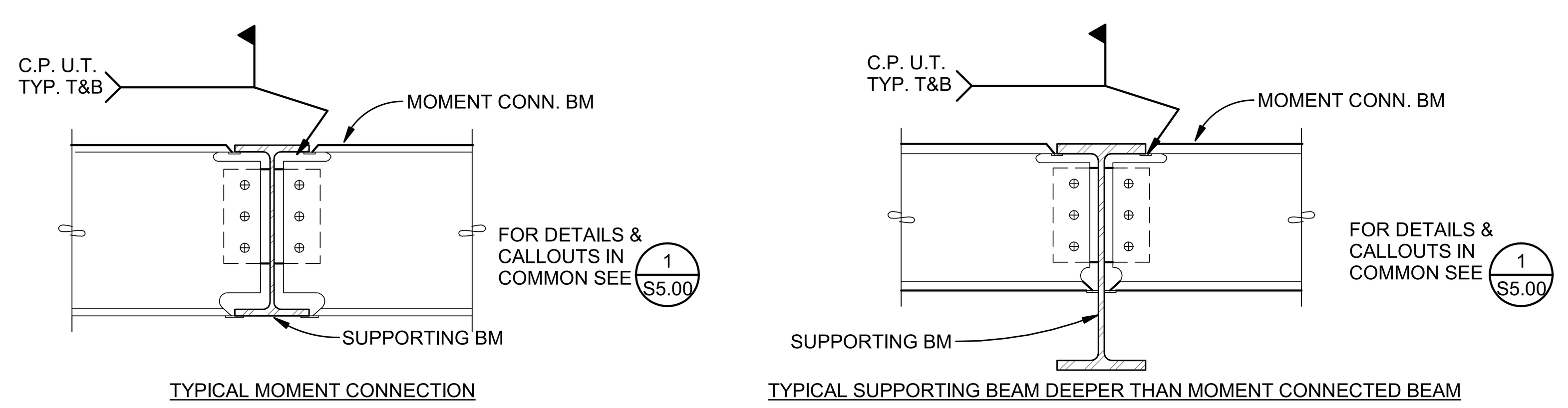
TYPICAL STEEL DETAIL

1 S5.00 DETAIL
NO SCALE

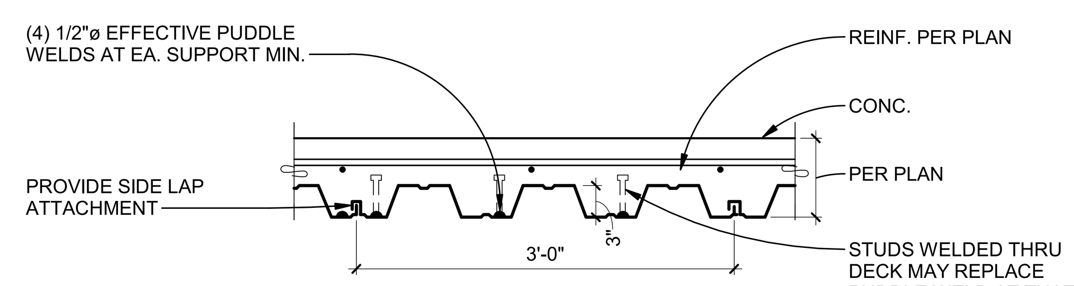


TYPICAL BEAM/COLUMN FRAMING INTO WEB

2 S5.00 DETAIL
NO SCALE

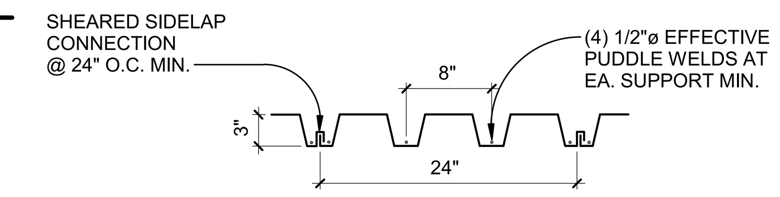


3 S5.00 DETAIL
NO SCALE



NOTES:
1. (2) SPAN MINIMUM, (3) SPAN PREFERRED.
2. AT SUPPORTS PARALLEL TO CORRUGATIONS, PROVIDE PUDDLE WELDS @ 24" O.C. MAXIMUM.

TYPICAL COMPOSITE FLOOR DECK

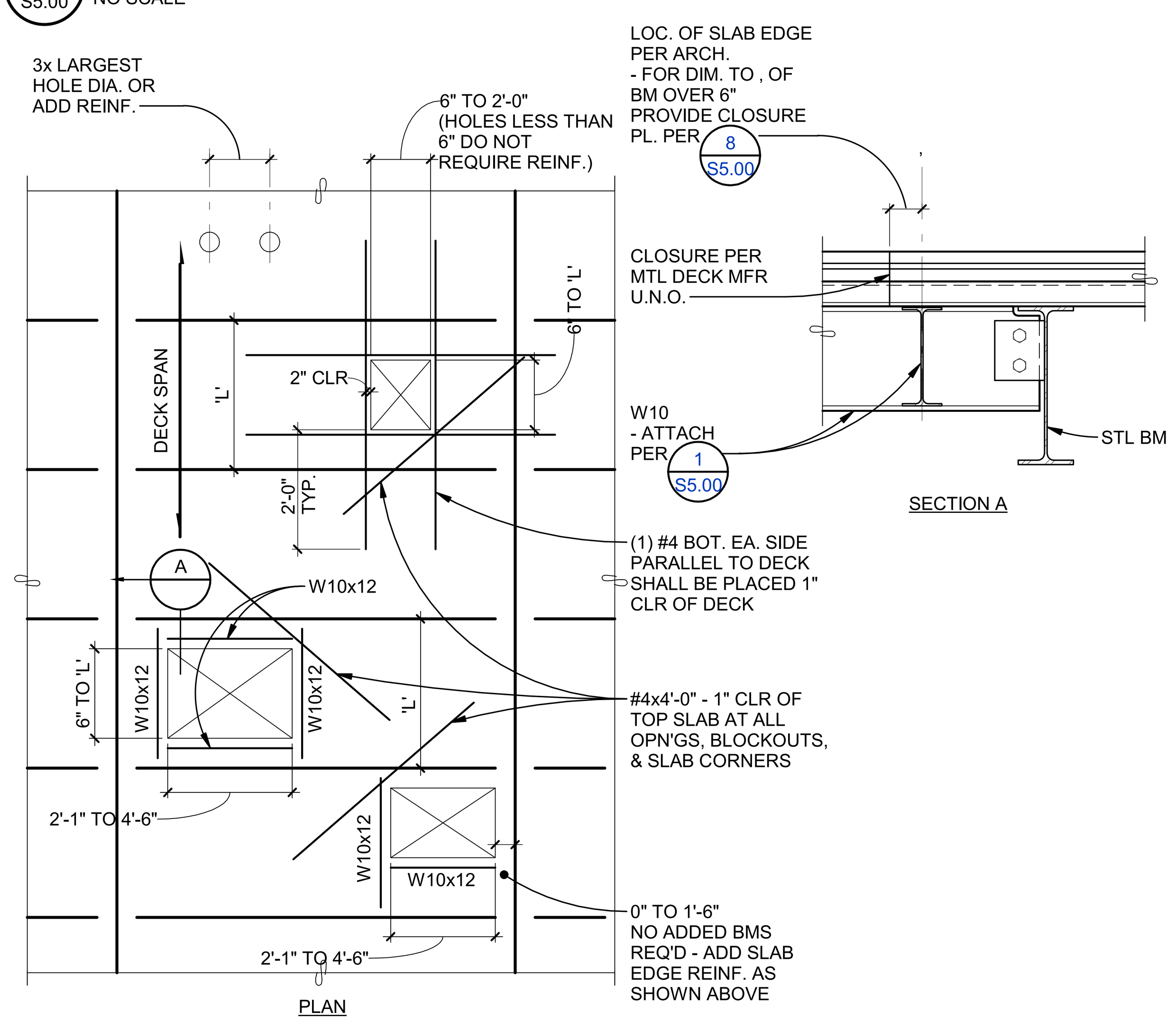


TYPE "N" MIN. DECK PROPERTIES		
GAUGE	I = (in.⁴/ft.)	+S/-S = (in.³/ft)
20	.837	.508/.562

NOTES:
1. (2) SPAN MIN. ,(3) PREFERRED.
2. AT SUPPORTS PARALLEL TO CORRUGATIONS, PROVIDE PUDDLE WELDS @ 24" O.C. MAX.

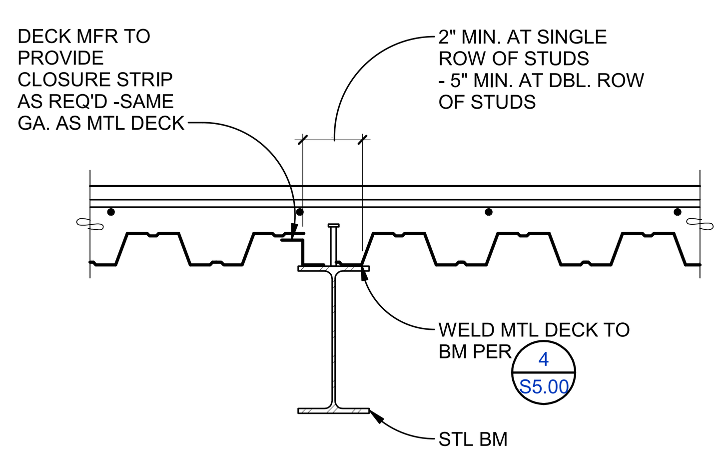
TYPICAL ROOF METAL DECK

4 S5.00 DETAIL
NO SCALE



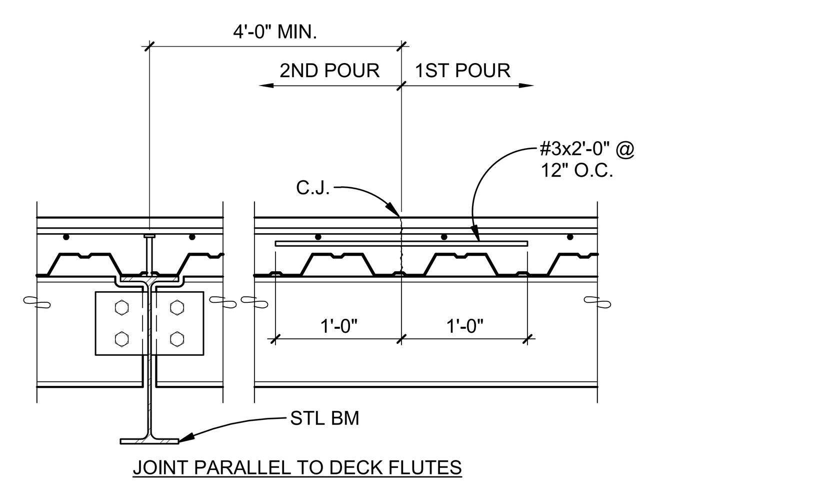
TYPICAL FLOOR PENETRATION REINFORCEMENT

5 S5.00 DETAIL
NO SCALE

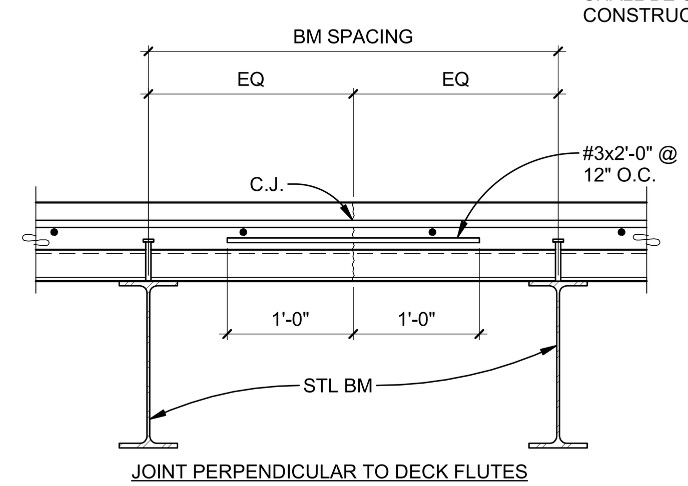


TYPICAL AT METAL DECK PARALLEL TO BEAM

6 S5.00 SECTION
NO SCALE

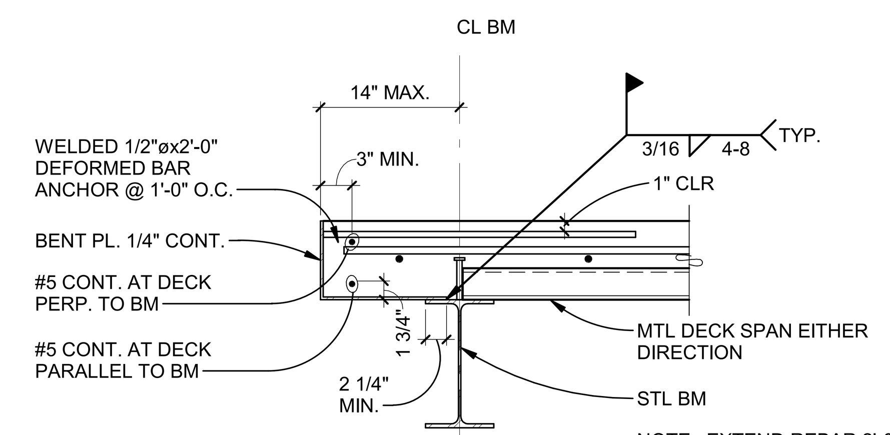


NOTE: ALL REINFORCEMENT SHALL BE CONTINUOUS THRU CONSTRUCTION JOINT



TYPICAL COMPOSITE DECK CONSTRUCTION JOINT

7 S5.00 SECTION
NO SCALE

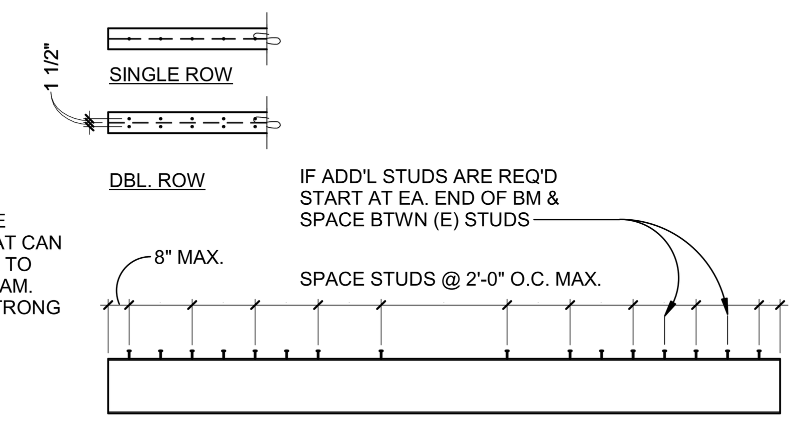


NOTE: EXTEND REBAR 2'-0" PAST EDGE OF ISOLATED OPENING.

TYPICAL SLAB EDGE CONDITION - OVER 6" OVERHANG

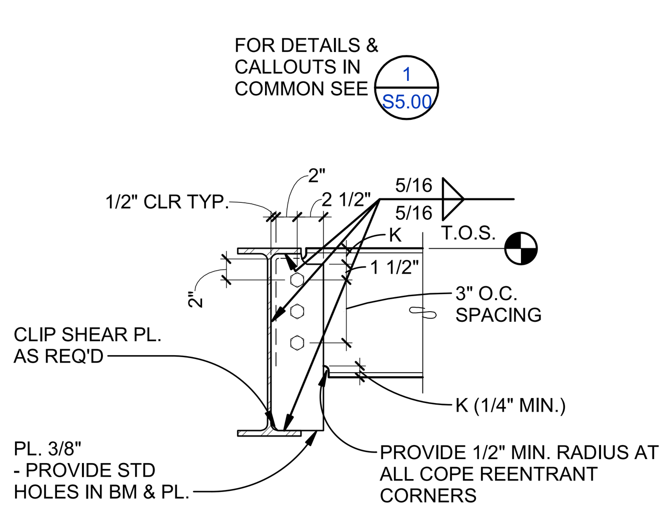
8 S5.00 SECTION
NO SCALE

NOTES:
1. LOCATE STUDS AT CENTER OF BEAM FLANGE.
2. STUDS ARE 3/4"ø x 4 1/2" LONG AFTER WELDING.
3. SEE FRAMING PLANS FOR NUMBER OF STUDS.
4. ALL BEAMS WITH STUDS ARE COMPOSITE STEEL BEAMS.
5. PROVIDE A DOUBLE ROW OF STUDS AT BEAMS WHERE THE REQUIRED NUMBER OF STUDS EXCEEDS THE NUMBER THAT CAN FIT IN A SINGLE ROW AT 6" ON CENTER AT DECK PARALLEL TO BEAM OR 12" ON CENTER AT DECK PERPENDICULAR TO BEAM. STUDS SHOULD BE LOCATED IN DECK FLUTES PER AISC STRONG POSITION.



TYPICAL COMPOSITE BEAM DETAIL

9 S5.00 DETAIL
NO SCALE



TYPICAL BEAM FRAMING AT FULL DEPTH SHEAR PLATE

10 S5.00 DETAIL
NO SCALE

9/27/2021 10:36:32 AM C:_Revit Models\BUILDING 3 - ATC BLDG 3 NBC 1987 SDC C RC2 v2020 (Central)_dhorne@pcs-structural.com.rvt

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PROJECT
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ST. LOUIS, MISSOURI
PCS STRUCTURAL SOLUTIONS
DESIGN A
1987 NBC WITH EQUIVALENT RISK CATEGORY II

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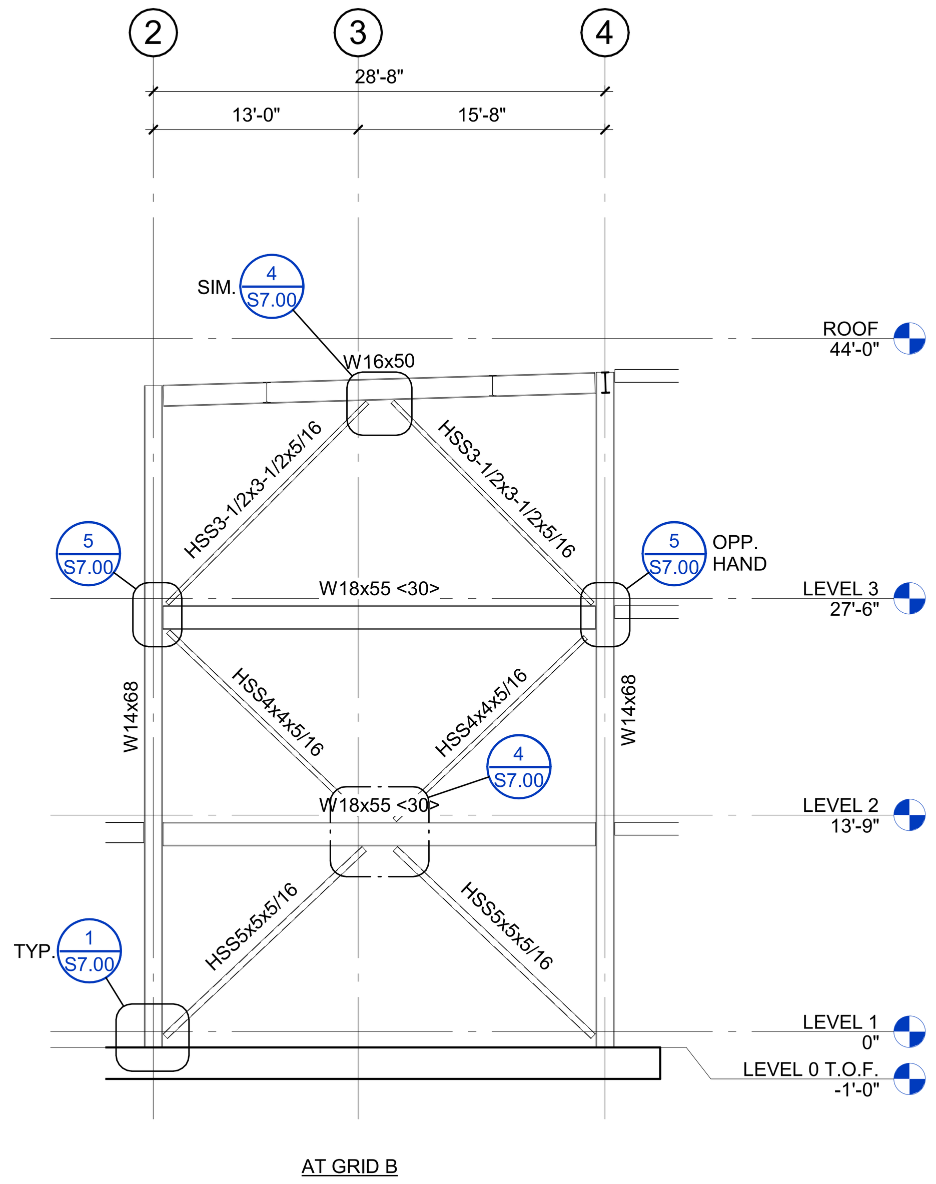
DRAWINGS
30 SEPTEMBER, 2021

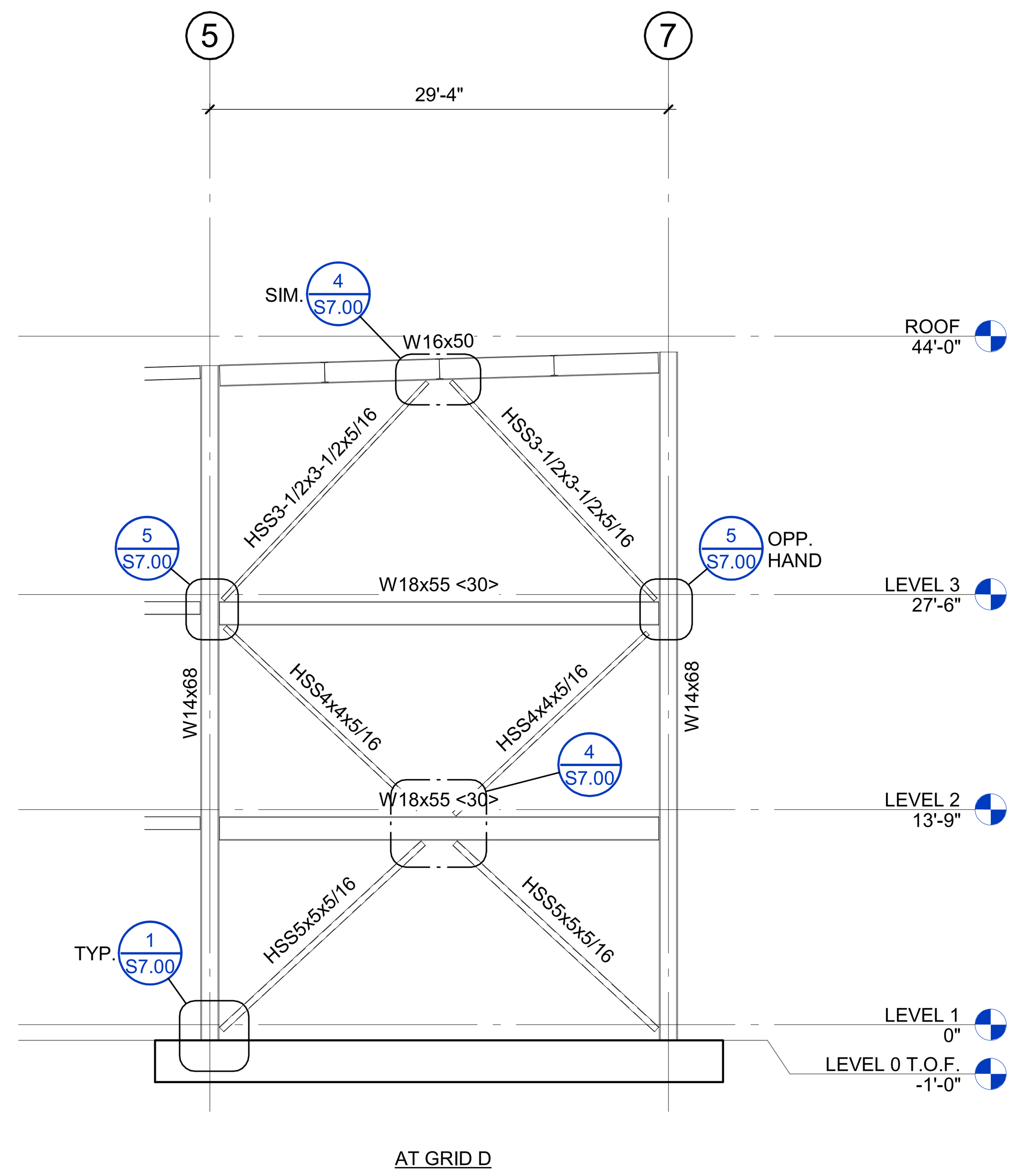
Job Number	19-051
Checked	Checker
Approved	Approver

TITLE
STEEL DETAILS

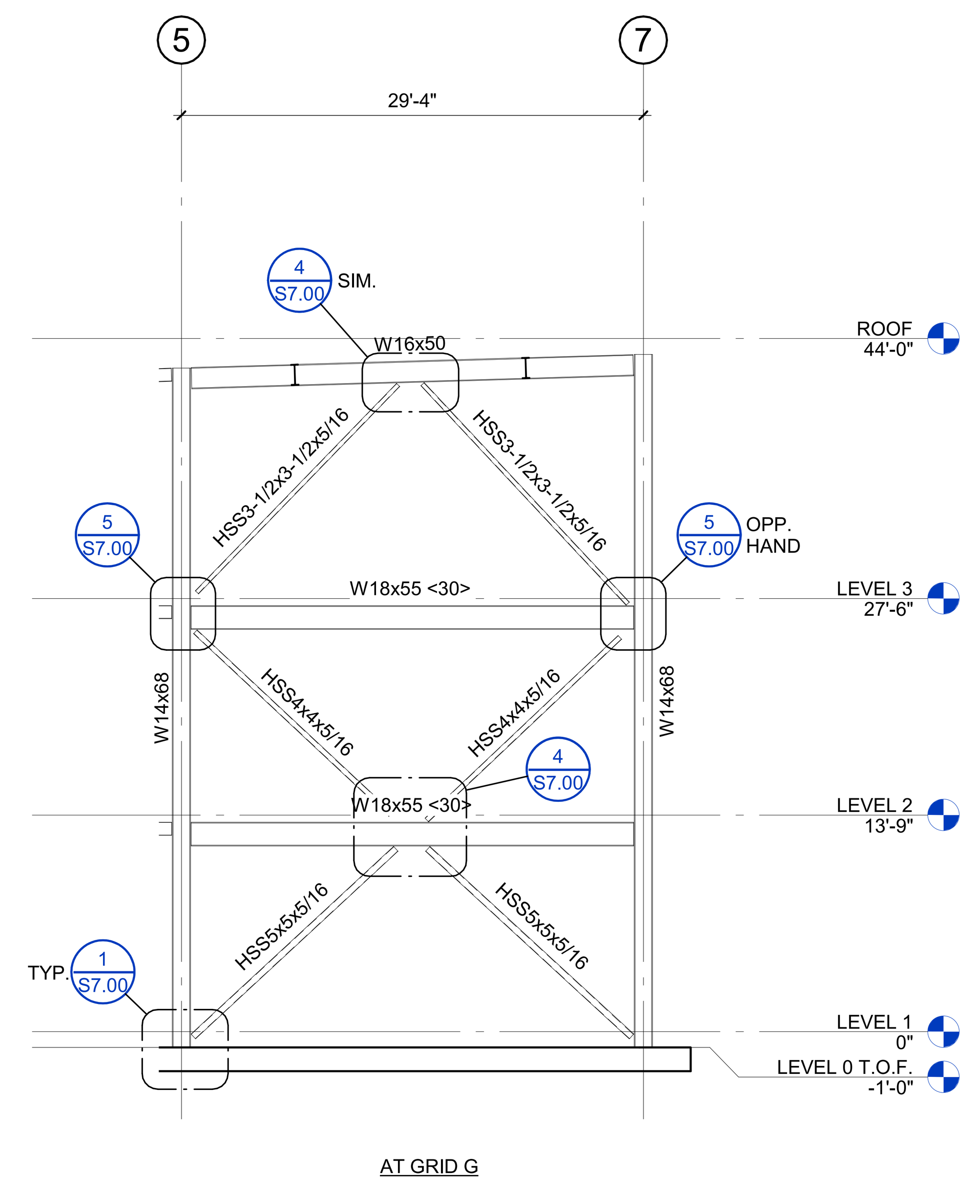
SHEET NUMBER
S5.00



1
S6.00
BRACED FRAME ELEVATION
1/8" = 1'-0"



2
S6.00
BRACED FRAME ELEVATION
1/8" = 1'-0"



3
S6.00
BRACED FRAME ELEVATION
1/8" = 1'-0"

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30 SEPTEMBER, 2021

Job Number	19-051
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TITLE
BRACED FRAME ELEVATIONS

SHEET NUMBER
S6.00

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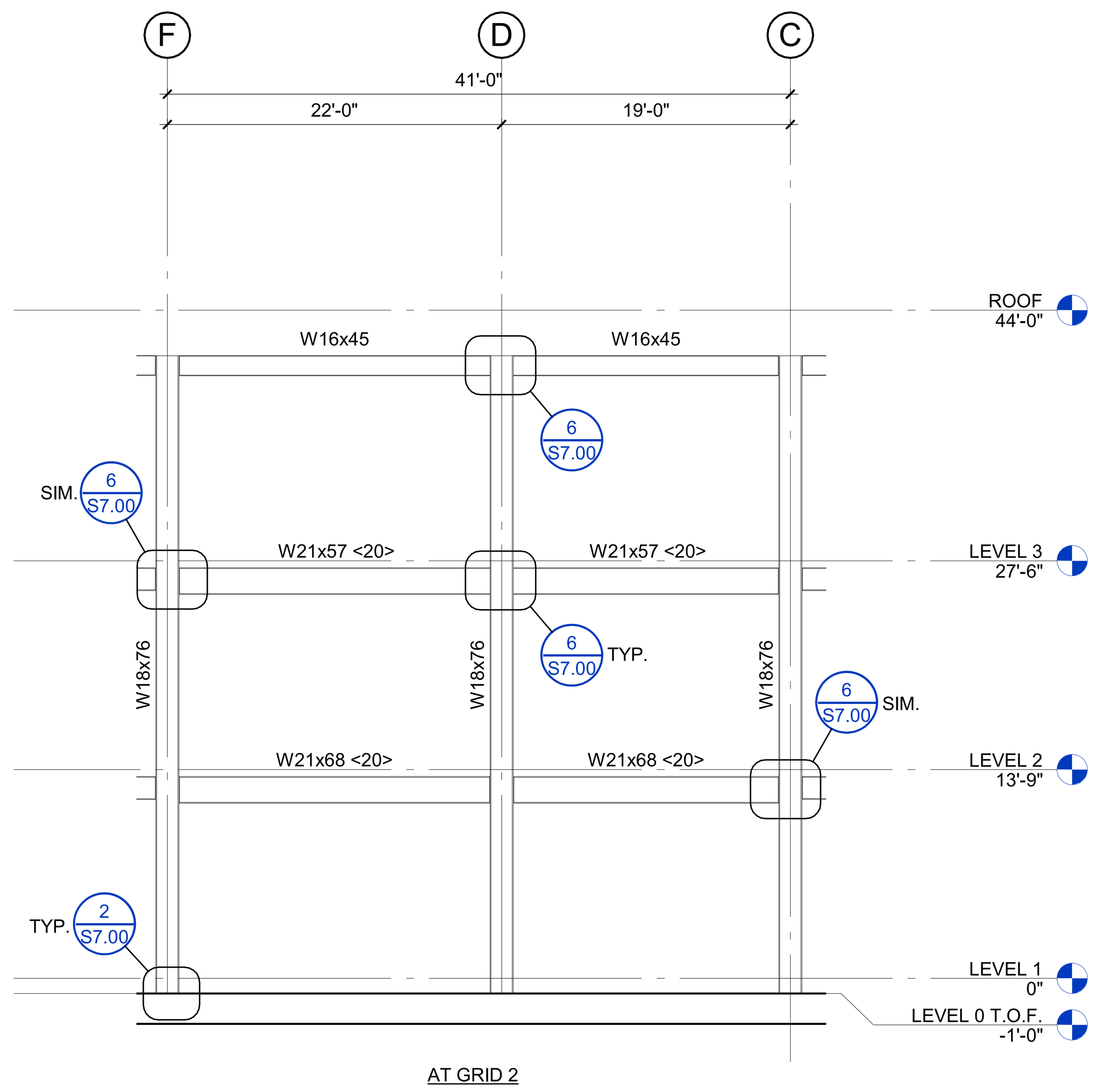
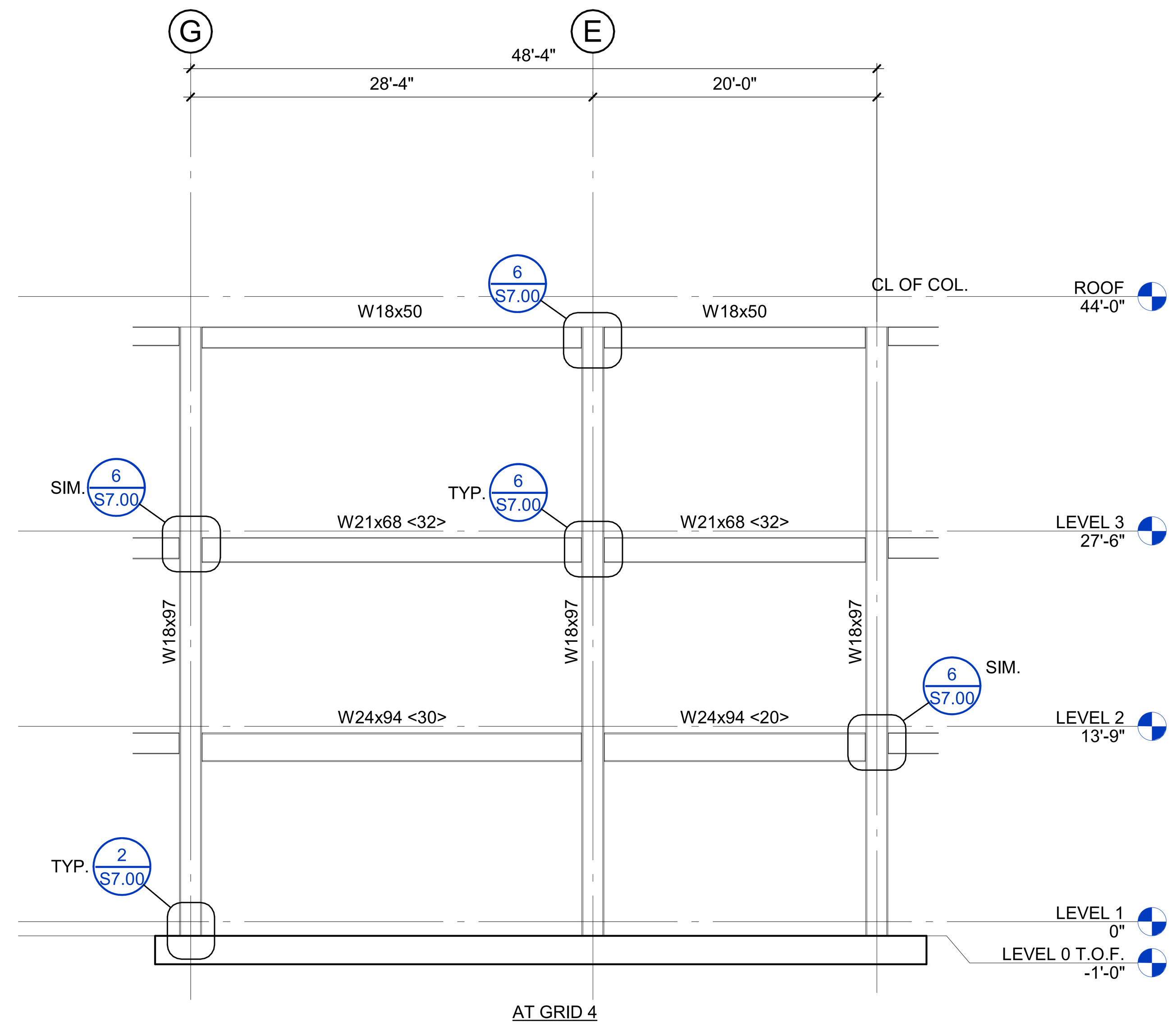
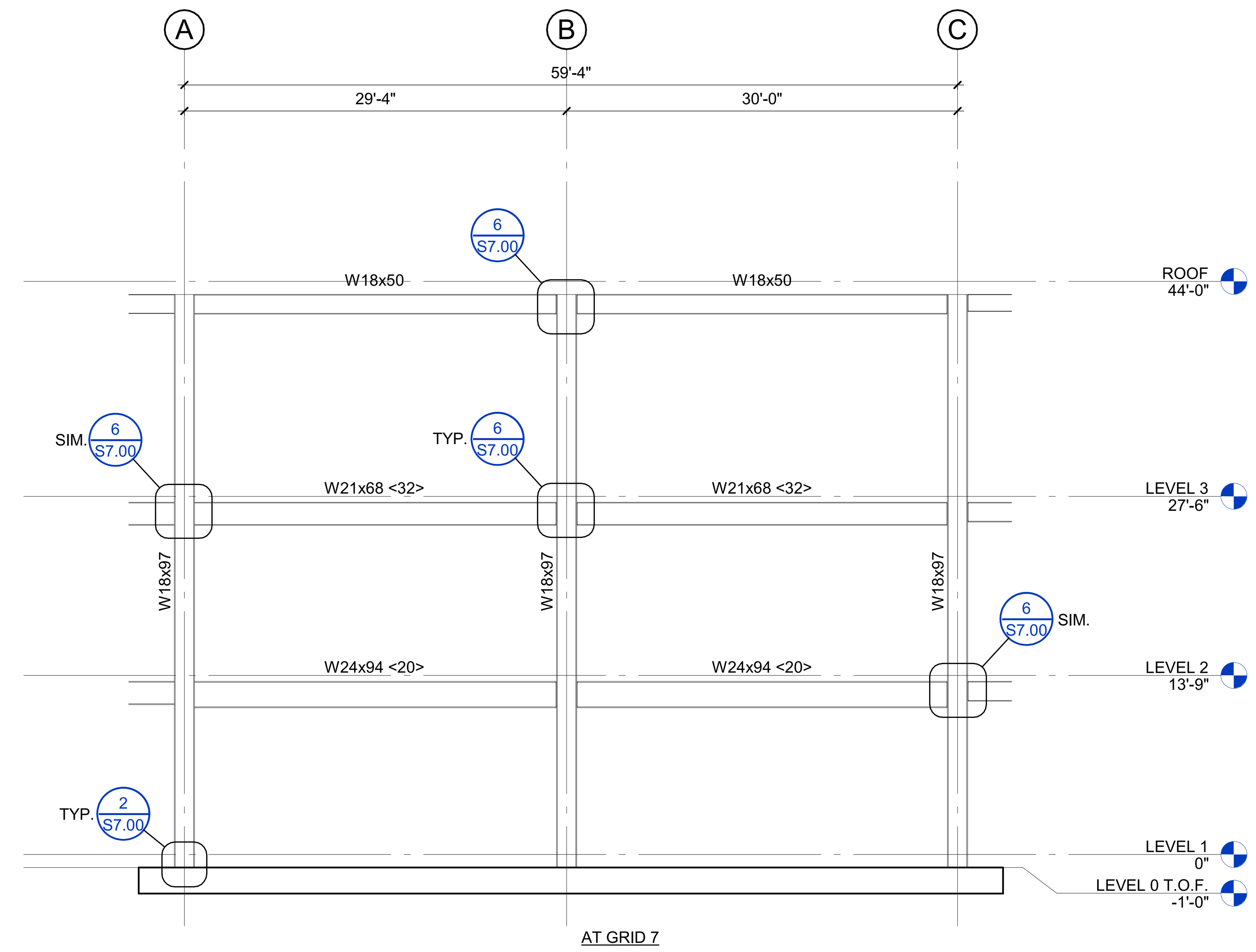


1
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"



2
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"



3
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"

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DRAWINGS
30 SEPTEMBER, 2021

Job Number	19-051
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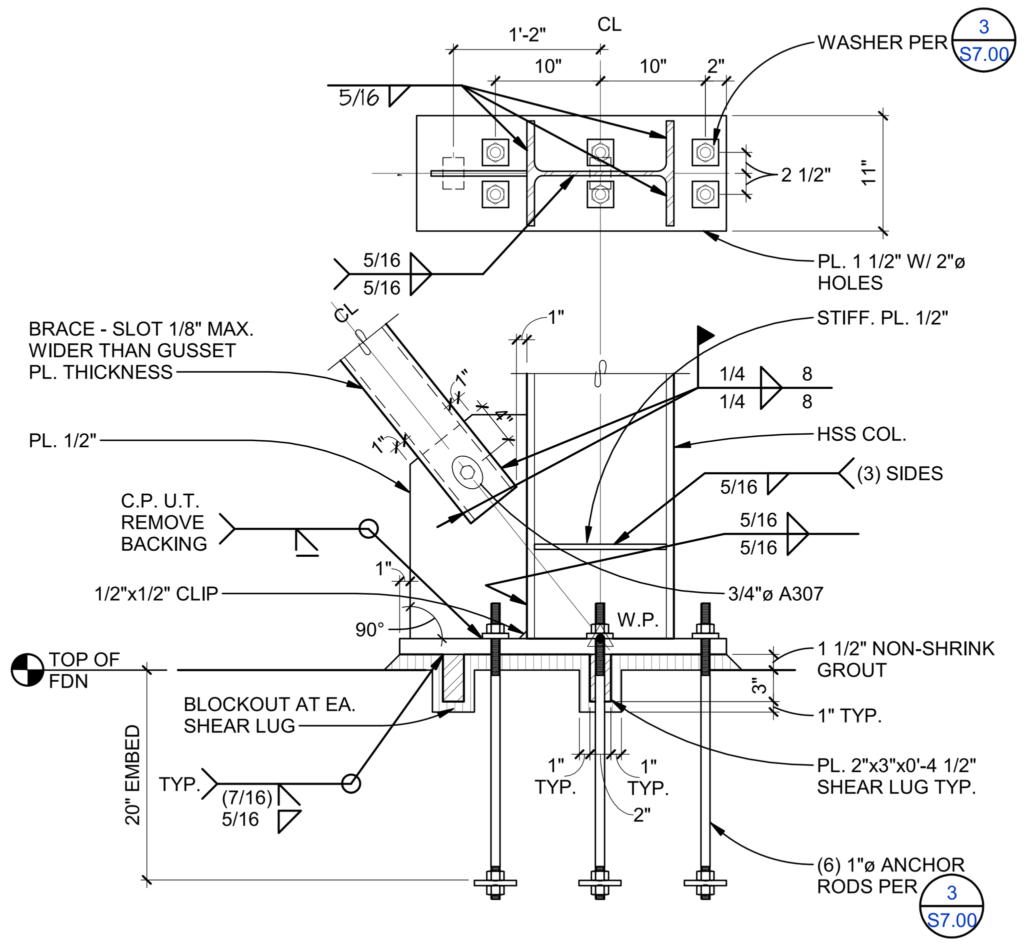
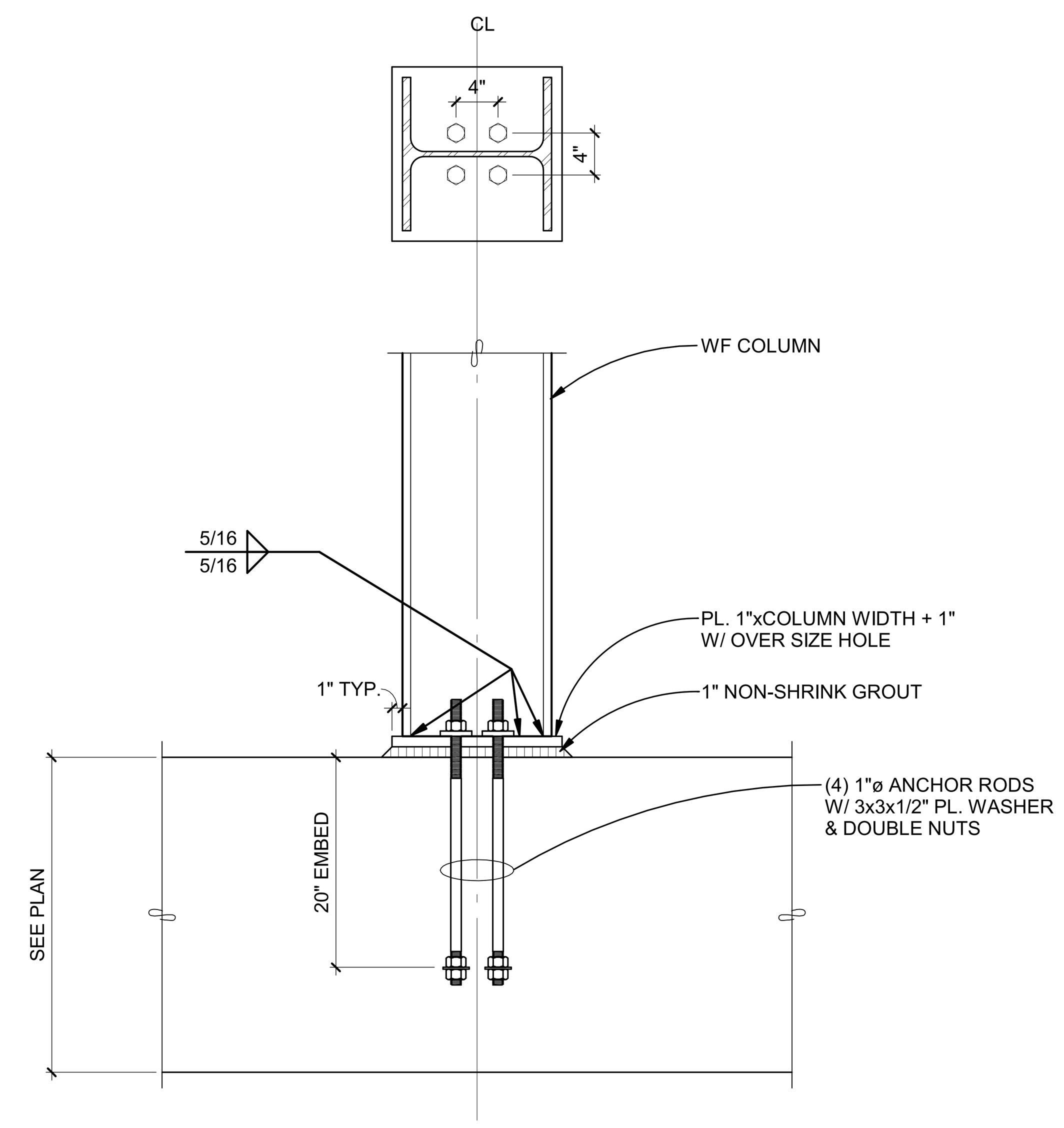
Approved	Approver

TITLE
MOMENT FRAME ELEVATIONS

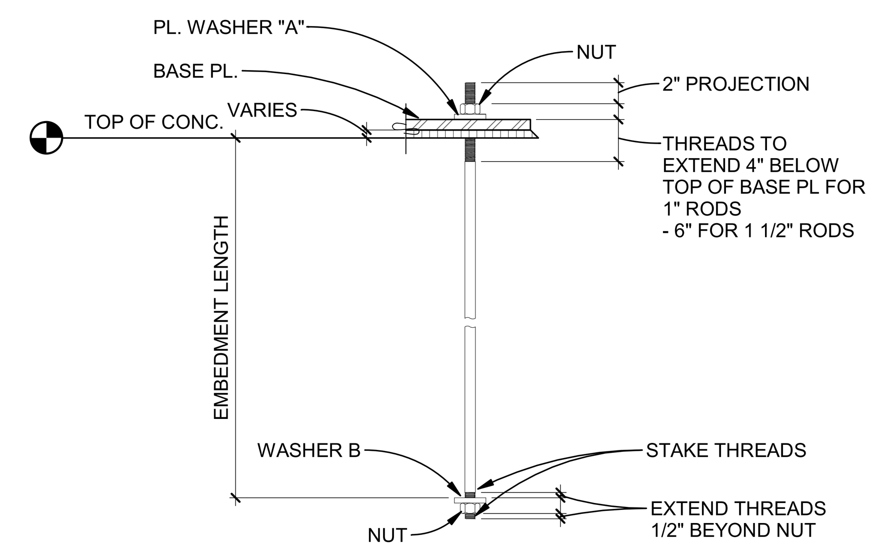
SHEET NUMBER
S6.10



1 SECTION
S7.00 NO SCALE



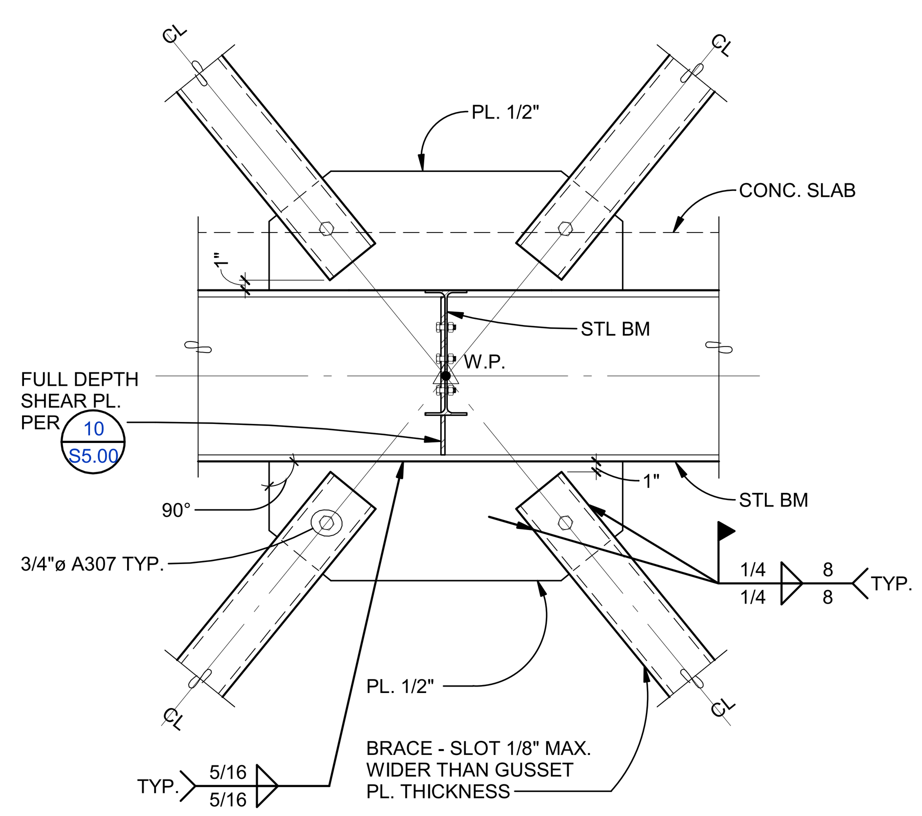
2 SECTION
S7.00 NO SCALE



ANCHOR ROD		WASHER		NUT
SIZE	MATERIAL	TYPE	SIZE	
1 1/2"ø	A490 GRADE 36	A	PL. 1/2"x5"x0'-5" W/ 1 1/16"ø HOLE CTR'D	A563 GRADE A HEAVY HEX
		B	ASTM A529 CARBON FLAT WASHER	

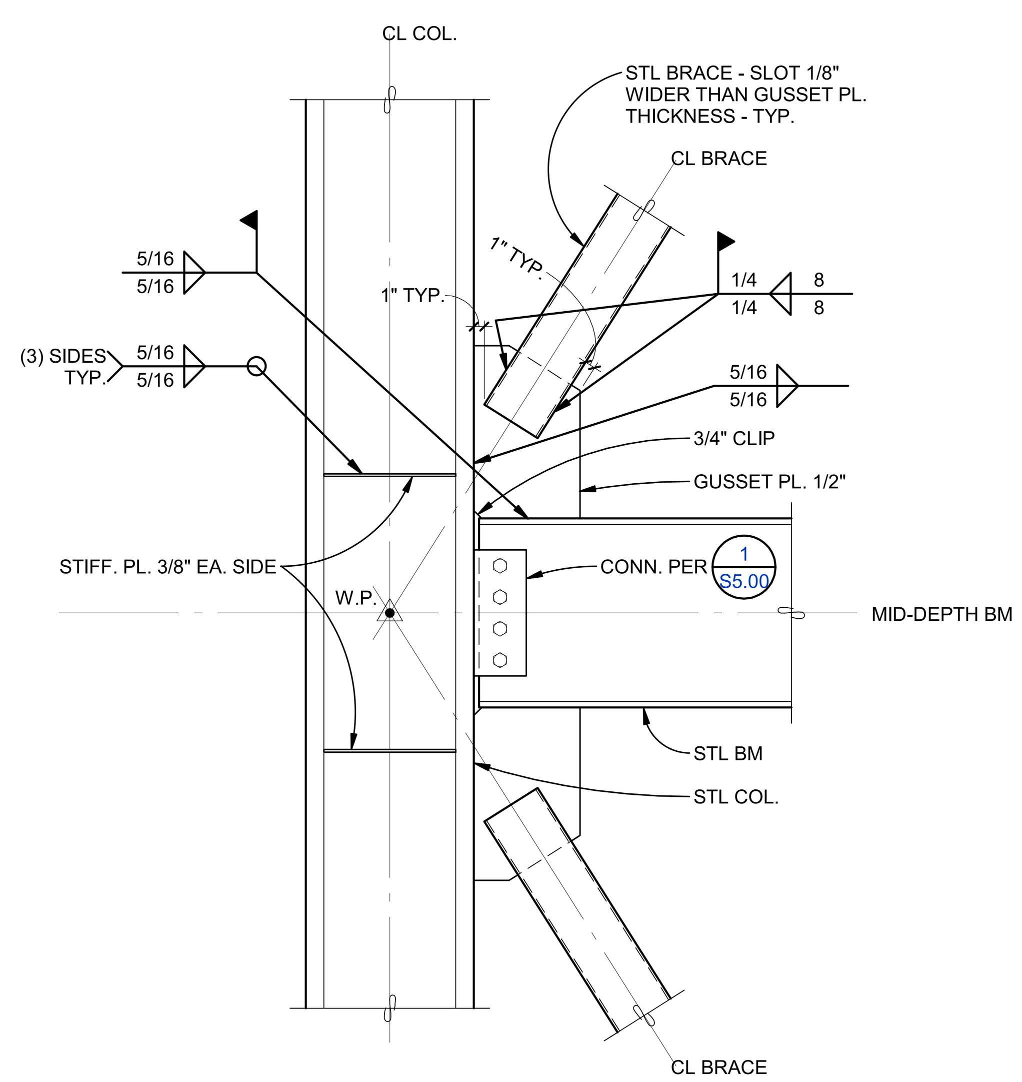
TYPICAL ANCHOR ROD/BOLT DETAIL

3 DETAIL
S7.00 NO SCALE

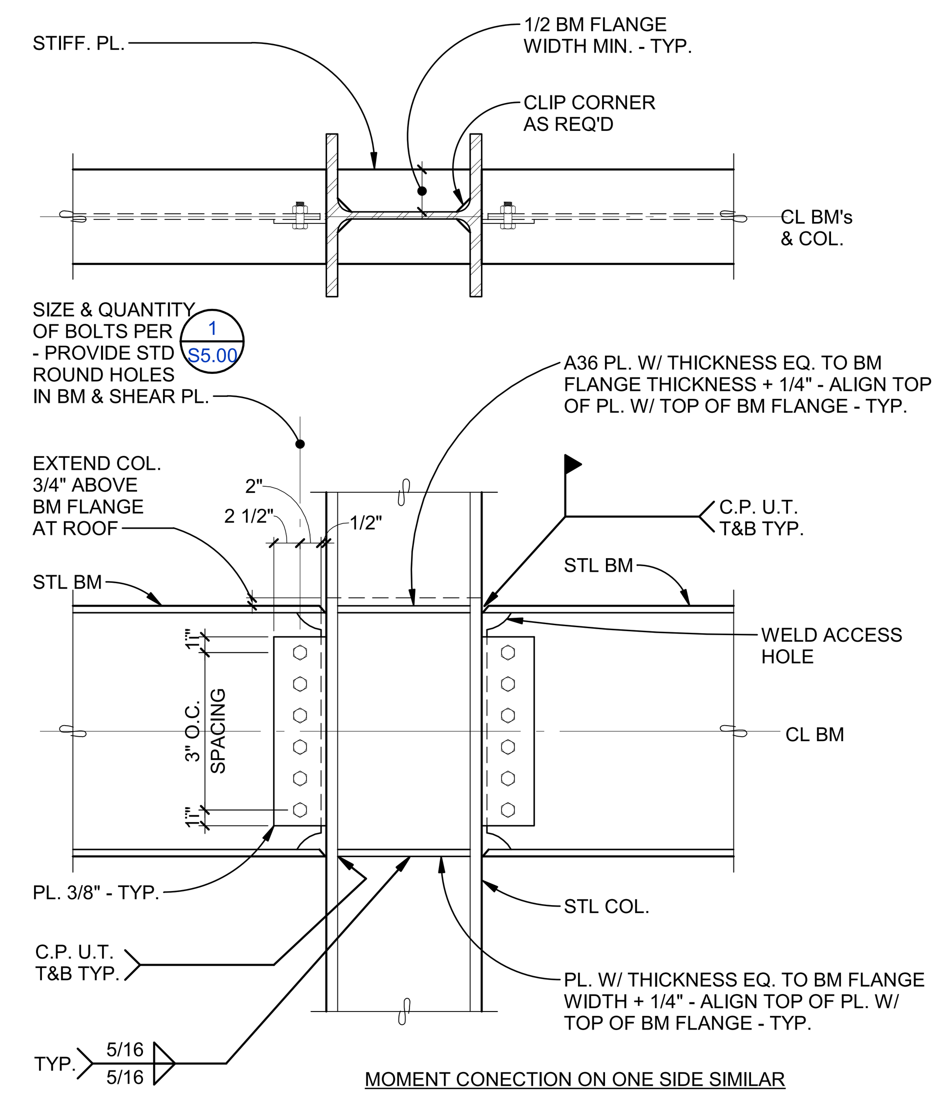


4 SECTION
S7.00 NO SCALE

NOTES:
1. BRACE AT ONE SIDE ONLY AT SIMILAR.



5 DETAIL
S7.00 NO SCALE



6 DETAIL
S7.00 NO SCALE

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ST. LOUIS, MISSOURI
PCS STRUCTURAL SOLUTIONS
DESIGN A
1987 NBC WITH EQUIVALENT RISK CATEGORY II

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DRAWINGS
30 SEPTEMBER, 2021

Job Number	19-051
Checked	TPP
Approved	Approver

TITLE
STEEL FRAMING DETAILS

SHEET NUMBER
S7.00

Design Case B

2018 IBC
Risk Category II
Seismic Design Category C

B.1 Gravity Design

This building is a three-story Educational Facility. The vertical force-resisting system consists of normal-weight concrete slabs, 2-1/2", over the 3" metal deck with a total slab thickness of 5-1/2" at the second and third floors. The slabs at these floors are supported by a composite steel beam system and wide flange steel columns. The roof deck is comprised of a 2" metal deck with no topping. All steel members (beams and columns) are Grade ASTM A992 steel and are designed using the Load Resistance Factor Design (LRFD) per AISC Steel Construction Manual 15th edition. The deflections were limited to the IBC prescribed limits of L/360 for applied live loads and L/240 for applied total loads.

The calculated design dead load is 75 PSF on the second and third floors and 20 PSF at the roof. The live loads chosen for the floors and roof were provided by 2018 IBC Table 1607.1. It should be noted that the 20 PSF roof minimum snow load controlled the design over the calculated snow load per Chapter 7 of ASCE 7-16.

B.2 Lateral Design

There are two different lateral load resisting systems in this building. The braced frames resist the lateral loads in the N-S direction, and the moment frames resist the lateral loads in the E-W direction (OMF and IMF are not allowed per Section 12.2-1 ASCE 7-16). The applied wind and seismic loads were determined using Chapters 27 and 12, respectively, from ASCE 7-16. In each case, the seismic design forces controlled the design, most likely due to the increased dead load caused by the concrete slab at two stories or the nature of the geometry of the building. The seismic design category per Table 11.6-1 and Table 11.6-2 in ASCE 7-16 should be SDC D, but we treated it as SDC C for design study purposes. In both directions, the eccentric loading, both calculated and required accidental (5%), was included in determining the applied frame forces at each level.

The N-S braced frames have a two-story X configuration and utilize ASTM A500 Gr. C tube steel braces. The braces were designed to maintain the same area of steel at floors, where the upper and lower braces meet at a steel beam to help mitigate the forces that are applied to that steel beam. This is important to help reduce the size of our braced framed beams and the overall tonnage of the building. The beam size of the braced frame is drastically larger than the beam size in Design A because there are more design restrictions and checks that are required to be performed in AISC 360 than in NBC. The “KISS” method was used for force distribution analysis of the connection designs. At the foundations, the anchorage was designed to resist the minimum of the uplift force due to overturning with an applied Ω_o or the expected brace strength. The shear lugs were designed to resist the minimum of the applied shear forces with an applied Ω_o and the expected brace strength.

E-W moment frames have been designed with pre-qualified WUF-W beam to column connections. The moment frames are controlled by building drift limitation in Table 12.12-1 of ASCE 7-16. The frame columns have a typical ‘pin’ base, and the anchorage was designed to resist the uplift force due to overturning with an applied Ω_o. The size and detail of the foundations have not been designed.

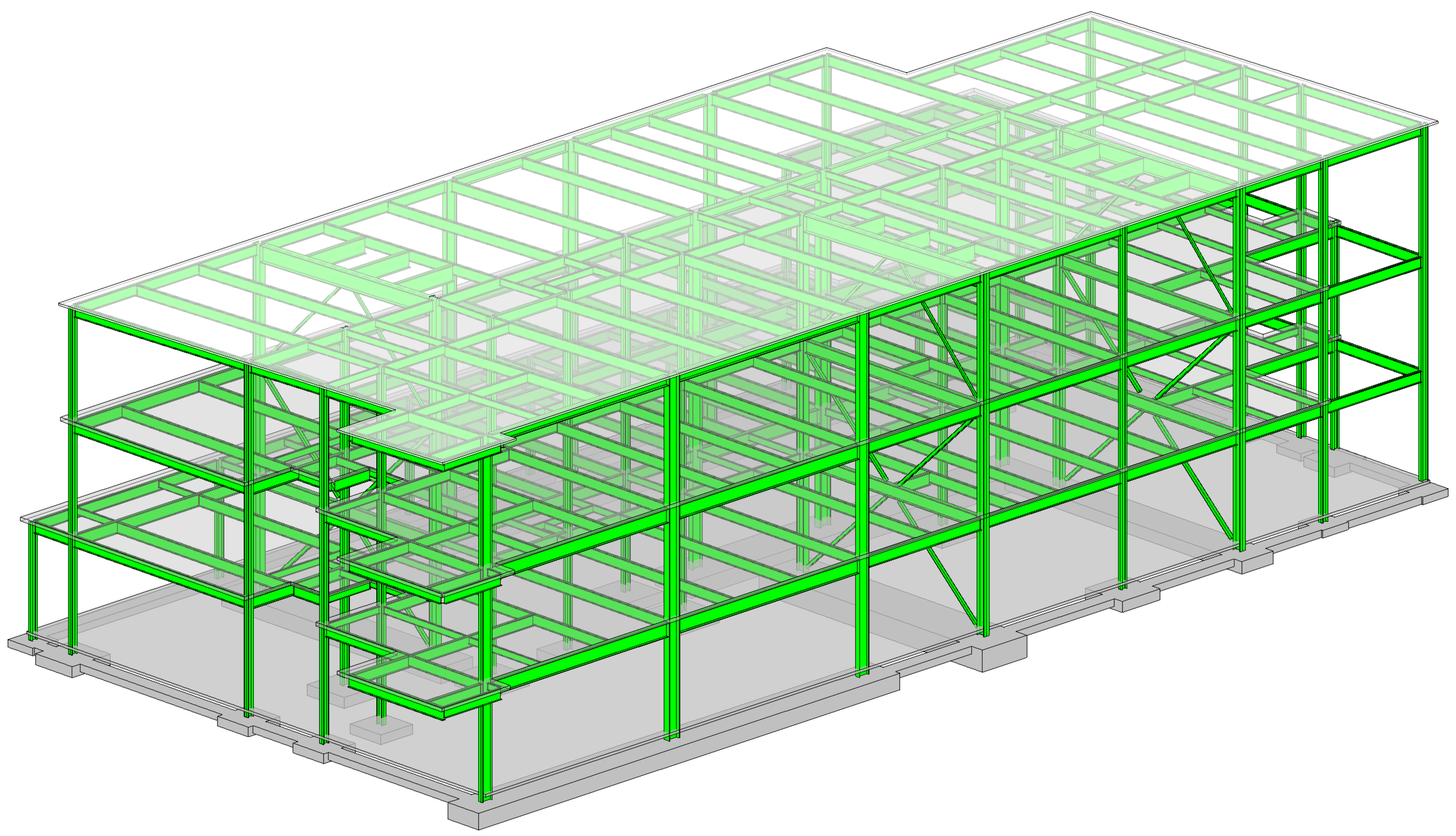
B.3 Steel Tonnage

Total steel tonnage for this design case is calculated as 134 tons.

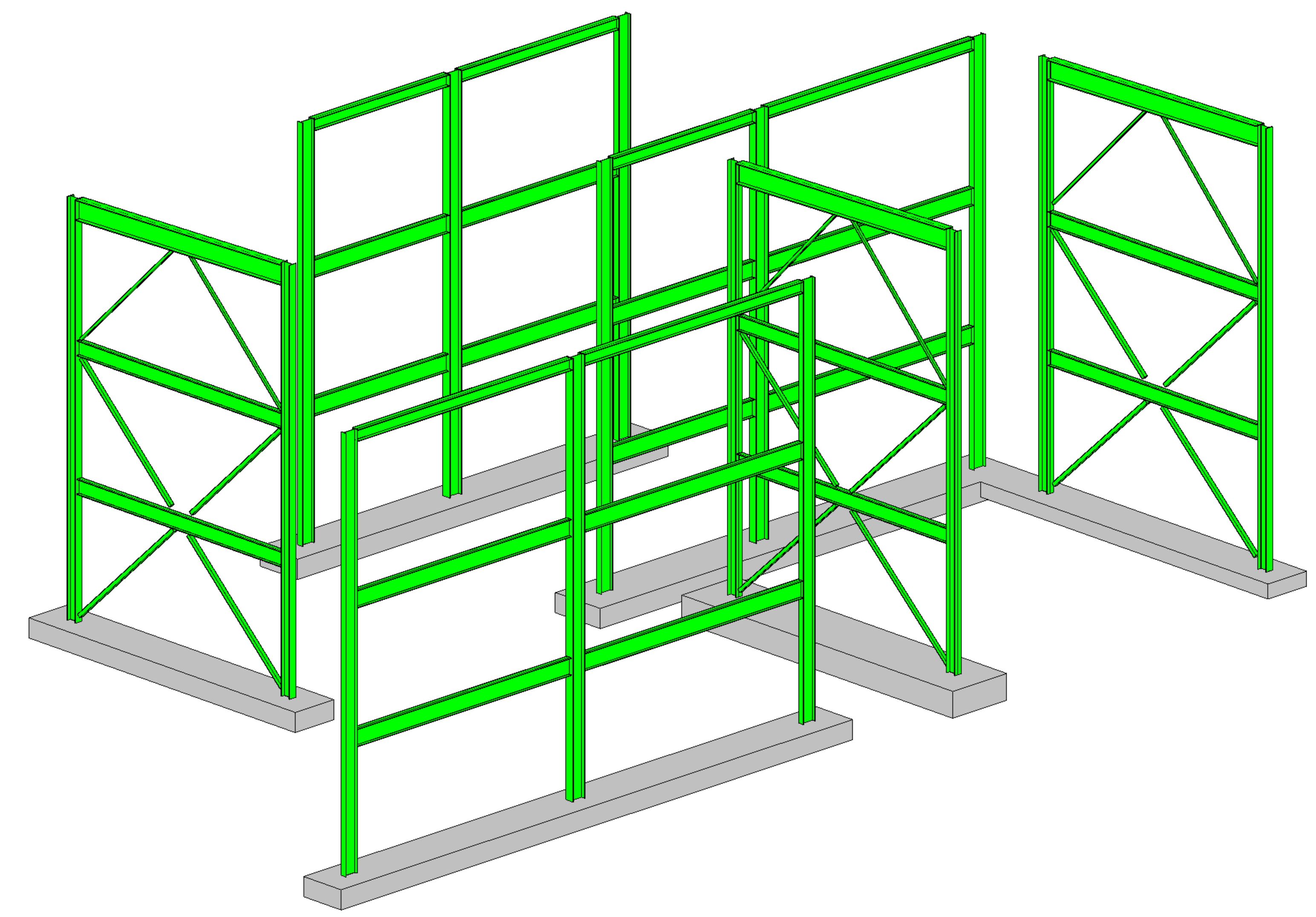
B.4 Structural Drawings

Structural drawings for Design Case B are provided on the following pages.

EDUCATIONAL FACILITY - ST. LOUIS, MISSOURI
DESIGN B - 2018 IBC RISK CATEGORY II



OVERALL FRAMING 3D VIEW



FORCE RESISTING SYSTEM 3D VIEW

DESIGN B: 2018 IBC "RISK CATEGORY II"	
EDUCATION FACILITY, ST. LOUIS MISSOURI	
ITEM	QUANTITY
WF COLUMNS (Fy = 50 KSI)	15 TONS
WF GIRDERS AND JOISTS (Fy = 50 KSI)	63 TONS
MOMENT FRAME WF COLUMNS (Fy = 50 KSI)	18 TONS
MOMENT FRAME WF BEAMS (Fy = 50 KSI)	14 TONS
BRACED FRAME WF COLUMNS (Fy = 50 KSI)	9 TONS
BRACED FRAME WF BEAMS (Fy = 50 KSI)	12 TONS
HSS BRACES (Fy = 50 KSI)	3 TONS
TOTAL	134 TONS

1. STEEL QUANTITIES DO NOT INCLUDE MISCELLANEOUS STEEL, CUT WASTE STEEL, STAIRS, TYPICAL STEEL FRAMING CONNECTIONS, ETC.
2. ON PLANS " ▶ " INDICATES GRAVITY MOMENT CONNECTION WITH (CJP) WELDS AT FLANGES.

STRUCTURAL DRAWING INDEX

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DESIGN B
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DRAWINGS
30 SEPTEMBER, 2021

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TITLE

COVER SHEET

SHEET NUMBER

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GENERAL NOTES

STANDARDS
ALL METHODS, MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE 2018 INTERNATIONAL BUILDING CODE (IBC) AS AMENDED AND ADOPTED BY THE LOCAL BUILDING OFFICIAL OR APPLICABLE JURISDICTION.

STRUCTURAL DRAWINGS PRIMARY STRUCTURAL ELEMENTS ARE DIMENSIONED ON STRUCTURAL PLANS AND DETAILS AND OVERALL LAYOUT OF STRUCTURAL PORTION OF WORK.

PROJECT LOCATION

ST. LOUIS, MISSOURI

38.6270 LATITUDE,-90.1994 LONGITUDE

DESIGN CRITERIA

VERTICAL LOADS

AREA	DESIGN DEAD LOAD	LIVE LOAD (1)	CONCENTRATED LOADS
CLASSROOM AND OFFICE	75 PSF	50 PSF	1000#
CORRIDORS ABOVE 1ST FLOOR	75 PSF	80 PSF	1000#
ROOF	20 PSF	20 PSF	-

(1) LIVE LOADS EXCEPT SNOW LOADS ARE REDUCED PER IBC SECTION 1607.11.

SNOW:

Pg = 20 PSF = GROUND SNOW LOAD
Pf = 0.7CeCtIsPg = FLAT ROOF SNOW LOAD
Is = 1.0 Ce = 1.0, Ct = 1.0. Cs = VARIES

VIBRATION DESIGN CRITERIA:

VIBRATION CONSIDERATIONS WERE DESIGNED PER THE RECOMMENDATIONS IN THE GUIDELINES FOR DESIGN AND CONSTRUCTION OF COMPUTER EQUIPMENT RESIDENCES. FOR CLASSROOM FLOORS A VIBRATION VELOCITY LIMIT OF 8000 MICRO INCHES PER SECOND WAS EVALUATED AT A WALKING SPEED OF 75 STEPS PER MINUTE.

LATERAL FORCES

LATERAL FORCES ARE TRANSMITTED BY DIAPHRAGM ACTION OF ROOF AND FLOORS TO BRACED FRAME/MOMENT FRAME. LOADS ARE THEN TRANSFERRED TO FOUNDATION BY BRACED FRAME/MOMENT FRAME ACTION WHERE ULTIMATE DISPLACEMENT IS RESISTED BY PASSIVE PRESSURE OF EARTH AND/OR SLIDING FRICTION. OVERTURNING IS RESISTED BY DEAD LOAD OF THE STRUCTURE.

WIND:

THE BUILDING MEETS THE CRITERIA TO USE THE "ENCLOSED, PARTIALLY ENCLOSED, AND OPEN BUILDING OF ALL HEIGHTS PROCEDURE" PER ASCE 7-16.

- EXPOSURE CATEGORY = B
- BASIC WIND SPEED, (3 SEC. GUST), V_{ULT} = 106 MPH; V_{ASD} = 80 MPH
- RISK CATEGORY PER IBC TABLE 1604.5 = II
- TOPOGRAPHIC FACTOR K_{ZT} = 1.0
- INTERNAL PRESSURE COEFFICIENT (ENCLOSED) = ± 0.18
- BASE SHEAR V= 103 KIPS AT BRACE FRAMES, 49.6 KIPS AT MOMENT FRAME
- SEE THE FOLLOWING SCHEDULES FOR COMPONENTS AND CLADDING WIND PRESSURES

ROOF SURFACES [1]							
EFFECTIVE WIND AREA	POSITIVE PRESSURES (PSF)			NEGATIVE PRESSURES (PSF)			
	ZONE [2]						
	1	2	3	1'	1	2	3
10 SF	8.9	8.9	8.9	-19.9	-34.7	-45.7	-62.3
20 SF	8.3	8.3	8.3	-19.9	-32.4	-42.8	-56.5
50 SF	7.6	7.6	7.6	-19.9	-29.4	-38.9	-48.7
100 SF	7.0	7.0	7.0	-19.9	-27.1	-36.0	-42.8

WALL SURFACES [1]				
EFFECTIVE WIND AREA	POSITIVE PRESSURE (PSF)		NEGATIVE PRESSURE (PSF)	
	ZONE [2]			
	4	5	4	5
10 SF	21.8	21.8	-23.6	-29.1
20 SF	20.8	20.8	-22.6	-27.2
50 SF	19.5	19.5	-21.3	-24.6
100 SF	18.5	18.5	-20.4	-22.6

1. VALUES SHOWN IN TABLE ARE GROSS ULTIMATE WIND PRESSURES.
2. ZONES ARE AS DEFINED BY FIGURE 30.4-1 IN ASCE 7-16.

SEISMIC: (ASCE 7-16) V = CsW

WHERE $Cs = \frac{S_{DS}}{(\frac{R}{Ie})}$; WITH

$Cs\ MINIMUM = 0.044\ S_{DS} I_E \geq 0.01$
OR
$Cs\ MINIMUM = \frac{0.5S_1}{\frac{R}{Ie}}$ FOR $S_1 > 0.6g$

$Cs\ MAXIMUM = \frac{S_{D1}}{T(\frac{R}{Ie})}$ FOR $T \leq T_L$
OR
$Cs\ MAXIMUM = \frac{S_{D1}T_L}{T^2(\frac{R}{Ie})}$ FOR $T > T_L$

SEISMIC IMPORTANCE FACTOR, Ie = 1.0
RISK CATEGORY OF BUILDING PER IBC TABLE 1604.5 = II
SPECTRAL RESPONSE ACCELERATIONS S_S = 0.453 & S_1 = 0.16
SITE CLASS PER TABLE 20.3-1 = D
DESIGN SPECTRAL RESPONSE ACCELERATIONS S_{DS} = 0.434 & S_{D1} = 0.243
SEISMIC DESIGN CATEGORY = C
W = EFFECTIVE SEISMIC WEIGHT OF BUILDING = 2140 KIPS
ANALYSIS PROCEDURE USED = EQUIVALENT LATERAL FORCE PROCEDURE/MODALRESPONSE SPECTRUM ANALYSIS
RESPONSE MODIFICATION FACTOR PER TABLE 12.2-1, R = 8.0 AT SPECIAL STEEL MOMENT FRAMES, R = 6.0 AT SPECIAL CONCENTRICALLY STEEL BRACED FRAMES
Cs = 0.037 AT MOMENT FRAMES, Cs = 0.072 AT BRACED FRAMES
DESIGN BASE SHEAR V = 154.92 KIPS AT BRACED FRAMES, 80.00 KIPS AT MOMENT FRAMES

FOUNDATION DESIGN CRITERIA

SOIL BEARING PRESSURE: 4000 PSF (ASSUMED)*

ACTIVE PRESSURE - RESTRAINED: 50 PCF +14H SEISMIC SURCHARGE (ASSUMED)
ACTIVE PRESSURE - UNRESTRAINED: 35 PCF +6H SEISMIC SURCHARGE (ASSUMED)
PASSIVE RESISTANCE: 200 PCF (INCLUDES F.O.S. ≥ 1.5) (ASSUMED)
COEFFICIENT OF FRICTION: .35 (INCLUDES F.O.S. ≥ 1.5) (ASSUMED)
*1/3 INCREASE ALLOWED FOR SEISMIC OR WIND LOADING

ITEM	DESIGN f'c (PSI) (AT 28 DAYS U.N.O.)
SLABS ON GRADE - UNO	4000
FOUNDATIONS - UNO	3000
STEM WALLS AND OTHER WALLS - UNO	4000
ELEVATED DECKS, TOPPING SLABS, AND SLABS ON METAL	5000

REINFORCING STEEL

REINFORCING STEEL SHALL CONFORM TO:

ASTM A615, GRADE 60 TYPICAL UNLESS NOTED OTHERWISE.

REINFORCING SPLICE AND DEVELOPMENT LENGTH SCHEDULE, Fy=60 KSI (UNLESS NOTED OTHERWISE)		
BAR SIZE	MINIMUM LAP SPLICE LENGTHS ("Ls")	MINIMUM DEVELOPMENT LENGTHS ("Ld")
#3	1'-6"	1'-3"
#4	2'-0"	1'-7"
#5	2'-7"	2'-0"
#6	3'-1"	2'-4"
#7	4'-6"	3'-6"
#8	5'-2"	3'-11"
#9	5'-10"	4'-6"
#10	6'-6"	5'-0"

STRUCTURAL STEEL

MATERIAL PROPERTIES

WIDE FLANGE SECTIONS: ASTM A992 (Fy = 50 KSI)

OTHER SHAPES AND PLATES: ASTM A36 (Fy = 36 KSI) TYP. U.N.O.; ASTM A572 (Fy = 50 KSI) WHERE INDICATED

HOLLOW STRUCTURAL SECTIONS: RECTANGULAR & SQUARE - ASTM A500, GRADE C (Fy = 50 KSI)

MACHINE BOLTS (M.B.): ASTM A307, GRADE A

HIGH-STRENGTH BOLTS: A325-ASTM F1852, A490-ASTM F2280

ANCHOR BOLTS (A.B.): ASTM F1554, GRADE 36, UNLESS OTHERWISE NOTED, ASTM F1554, GRADE 105 WHERE INDICATED.

WIDE FLANGE STRUCTURAL MEMBERS WHICH ARE ASTM A6 GROUP 3 SHAPES WITH FLANGE THICKNESS 1-1/2" THICK AND THICKER, AND ALL ASTM A6 GROUP 4 AND 5 SHAPES AND PLATE THAT IS 1-1/2" THICK OR THICKER SHALL HAVE A CHARPY V-NOTCH (CVN) TOUGHNESS OF 20 FT-LBS @ 70 DEG F.

GENERAL REQUIREMENTS

HIGH-STRENGTH BOLTS: ALL A325 HIGH-STRENGTH BOLTS (HSB) SHALL BE ASTM F3125, GRADE F1852, UNLESS OTHERWISE DESIGNATED AS A490. ALL HSB DESIGNATED AS A490 SHALL BE ASTM F3125, GRADE F2280. ALL HSB SHALL BE BY "LEJEUNE BOLT COMPANY" OR PRE-APPROVED EQUAL AND SHALL BE INSTALLED PER SECTION 8.2 OF THE "SPECIFICATION FOR STRUCTURAL JOINTS USING HIGH STRENGTH BOLTS", AUGUST 2014 BY THE RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC SPECIFICATION). ALL BOLT HOLES SHALL BE STANDARD ROUND HOLES UNLESS NOTED OTHERWISE. THE FAYING SURFACES OF ALL PLIES WITHIN THE GRIP OF SLIP-CRITICAL BOLTS (A325SC OR A490SC) SHALL MEET THE REQUIREMENTS FOR A CLASS A SURFACE PER SECTION 3.2 OF THE RCSC SPECIFICATION.

HEADED STUDS: SHALL BE "S3L SHEAR CONNECTORS" FOR STUDS 3/4" DIAMETER AND LARGER AS MANUFACTURED BY NELSON STUD WELDING, INC. OR PRE-APPROVED EQUAL AND SHALL CONFORM TO AWS D1.1. ALL HEADED STUDS SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS USING A NELSON WELD GUN, UNLESS NOTED OTHERWISE ON DETAILS. ALL WELDS SHALL BE MADE AND INSPECTED IN ACCORDANCE WITH AWS D1.1.

COMPOSITE FLOOR DECK: SHALL CONTAIN THE MINIMUM PROPERTIES SHOWN ON THE STRUCTURAL DRAWINGS, "W COMPOSITE" AS MANUFACTURED BY ASC STEEL DECK. THE FLOOR UNITS SHALL BE FORMED FROM STEEL SHEETS CONFORMING TO ASTM A653, AND GALVANIZED PER ASTM A924.

ABBREVIATION LIST			
@	AT	GALV.	GALVANIZED
A.B.	ANCHOR BOLT	GR.	GRADE
ADD'L	ADDITIONAL	HORIZ.	HORIZONTAL
ALT.	ALTERNATE	HSS	HOLLOW STRUCTURAL SECTION
BLD'G	BUILDING	HT	HEIGHT
BM	BEAM	INT.	INTERIOR
B.O.F.	BOTTOM OF FOOTING	JT	JOINT
BOT.	BOTTOM	L	ANGLE
BRG	BEARING	L.F.R.S.	LATERAL FORCE-RESISTING SYSTEM
BTWN	BETWEEN	L.L.	LIVE LOAD
(C=)	CAMBER	LLH	LONG LEG HORIZONTAL
CANT.	CANTILEVER	LLV	LONG LEG VERTICAL
C.J.	CONTROL/CONSTRUCTION JOINT	LOC.	LOCATION
CL	CENTERLINE	MAX.	MAXIMUM
CLR.	CLEARANCE	M.B.	MACHINE BOLT
COL.	COLUMN	MIN.	MINIMUM
CONC.	CONCRETE	MISC.	MISCELLANEOUS
CONN.	CONNECTION	MTL	METAL
CONST.	CONSTRUCTION	N.F.	NEAR FACE
CONT.	CONTINUOUS	N.S.	NEAR SIDE
COORD.	COORDINATE	NTS	NOT TO SCALE
C.P.	COMPLETE PENETRATION	O.C.	ON CENTER
CTR'D	CENTERED	OPN'G	OPENING
C.Y.	CUBIC YARD	OPP.	OPPOSITE
DBL.	DOUBLE	PERP.	PERPENDICULAR
DCW	DEMAND CRITICAL WELD	PL.	PLATE
DIA. OR ø	DIAMETER	P.P.	PARTIAL PENETRATION
DIAG.	DIAGONAL	P.S.F.	POUNDS PER SQUARE FOOT
DIM.	DIMENSION	REINF.	REINFORCING
D.L.	DEAD LOAD	REQ'D	REQUIRED
DWG	DRAWING	SCHED.	SCHEDULE
DWL	DOWEL	SIM.	SIMILAR
(E)	EXISTING	S.O.G.	SLAB ON GRADE
EA.	EACH	SQ.	SQUARE
E.F.	EACH FACE	STD	STANDARD
EL.	ELEVATION	STIFF.	STIFFENER
ELEV.	ELEVATOR	STL	STEEL
ENGR.	ENGINEER	STRUCT.	STRUCTURAL
EQ.	EQUAL	T&B	TOP & BOTTOM
E.W.	EACH WAY	THR'D	THREADED
EXP.	EXPANSION	T.O.F.	TOP OF FOOTING
EXT.	EXTERIOR	T.O.S.	TOP OF STEEL
FDN	FOUNDATION	TYP.	TYPICAL
F.F.	FAR FACE	U.N.O.	UNLESS NOTED OTHERWISE
FLR	FLOOR	U.T.	ULTRASONIC TESTED
F.O.S.	FACE OF STUD	VERT.	VERTICAL
FRM'G	FRAMING	W/	WITH
F.S.	FAR SIDE	W.P.	WORK POINT
FTG	FOOTING	WT	WEIGHT
GA.	GAGE/GAUGE		

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DRAWINGS
30 SEPTEMBER, 2021

Job Number	19-051
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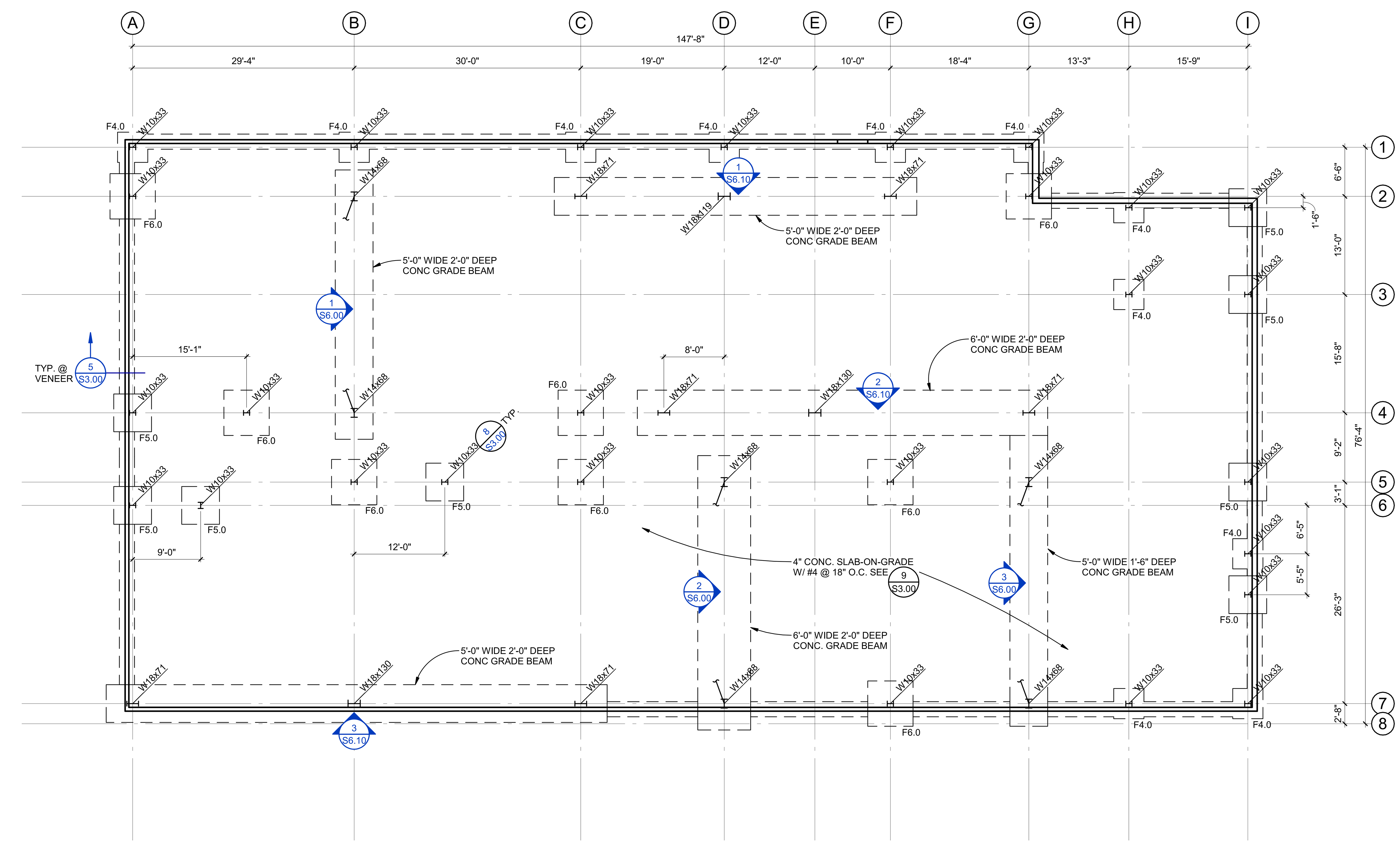
Approved	DRS

TITLE
GENERAL NOTES

SHEET NUMBER
S0.10



1/S2.00 FOUNDATION AND GRADE LEVEL FRAMING PLAN
1/8" = 1'-0"

NORTH

FOUNDATION NOTES

1. INDICATES WALL STUDS.
2. INDICATES CONTINUOUS CONCRETE WALL FOOTING. FOR TYPICAL FOOTING AND FOUNDATION WALL DETAILS SEE SHEET S3.00. FOOTING WIDTH ("W") = 2'-0" UNLESS NOTED OTHERWISE ON PLAN. CENTER FOOTINGS ON CONCRETE STEM WALL.
3. "F_" INDICATES CONCRETE SPREAD FOOTING. FOR SCHEDULE SEE 7/S3.00.
4. X / X.XX INDICATES BRACED FRAME OR MOMENT FRAME. FOR ELEVATIONS, MEMBER SIZES AND DETAIL CALLOUTS SEE SHEET S6.00 AND S6.10.
5. W10x45 INDICATES STEEL COLUMNS ORIGINATING AT FOUNDATION LEVEL. ALL COLUMNS ARE CONTINUOUS TO ROOF UNLESS NOTED OTHERWISE. FOR TYPICAL DETAIL SEE 8/S3.00.
6. FOR TYPICAL FOUNDATION DETAILS SEE SHEET S3.00.
7. TOP OF FOOTING ELEVATIONS = -1'-0" UNLESS NOTED OTHERWISE ON PLANS AND DETAILS.

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TITLE
FOUNDATION AND GRADE LEVEL FRAMING PLAN

SHEET NUMBER
S2.00

NORTH

1 S2.10 FRAMING PLAN - LEVEL 2

1/8" = 1'-0"

FLOOR FRAMING NOTES

1. INDICATES BRACED FRAME. FOR ELEVATIONS, BRACE SIZES AND DETAIL CALLOUTS SEE SHEET S6.00. ALL BEAMS THAT ARE PART OF A BRACED FRAME SHALL BE CONSIDERED "COLLECTOR" BEAMS. ALL MEMBERS AND CONNECTIONS THAT ARE PART OF A BRACED FRAME SHALL BE CONSIDERED PART OF THE LATERAL-FORCE RESISTING SYSTEM.

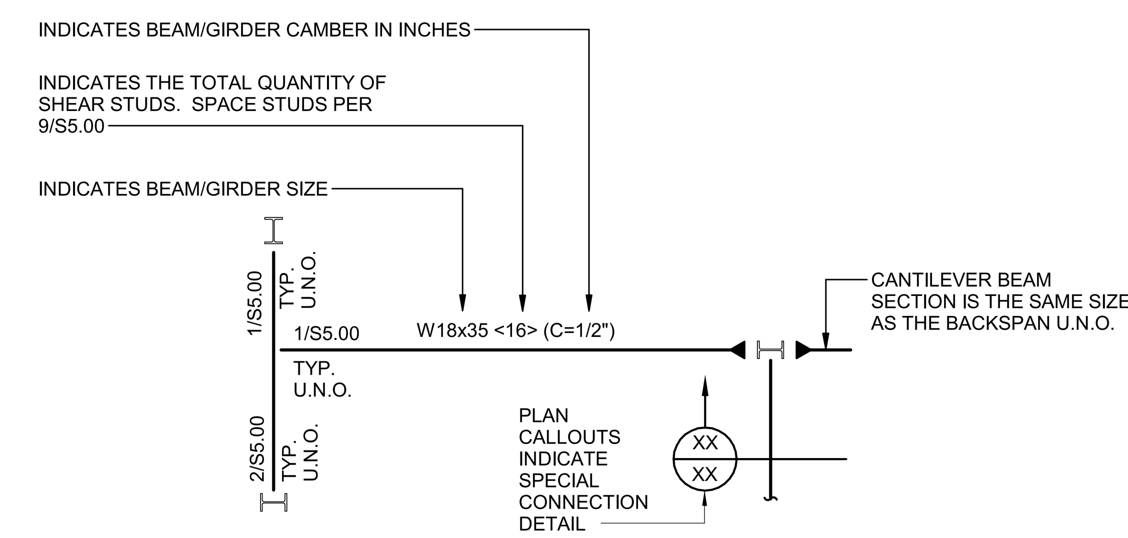
2. INDICATES STEEL COLUMN CONTINUOUS TO FLOOR/ROOF ABOVE.

3. INDICATES PENETRATION IN FLOOR STRUCTURE. FOR TYPICAL REINFORCING AROUND OPENINGS SEE 5/S5.00.

4. FOR TYPICAL COMPOSITE BEAM AND METAL DECK DETAILS SEE SHEET S5.00.

5. INDICATES DIRECTION OF SPAN FOR METAL DECK.

6. FOR TYPICAL STEEL CONNECTION DETAILS SEE SHEET S5.00.



7. STEEL MEMBERS ARE EQUALLY SPACED BETWEEN DIMENSION POINTS UNLESS NOTED OTHERWISE.

8. INDICATES MOMENT FRAME. FOR ELEVATIONS AND DETAIL CALLOUT SEE SHEET S6.10. ASSOCIATED MEMBERS AND CONNECTIONS ARE PART OF THE LATERAL-FORCE RESISTING SYSTEM.

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TITLE

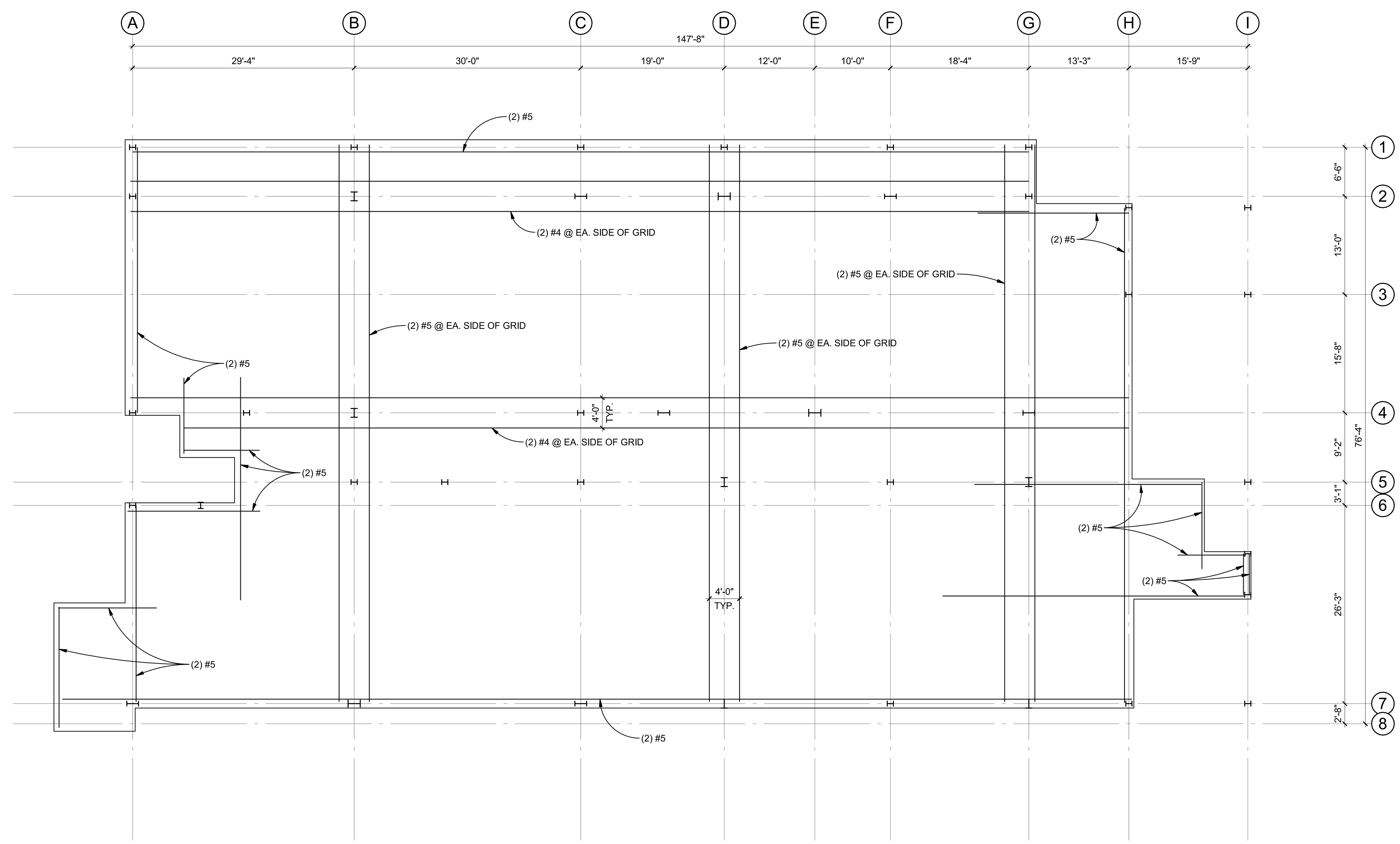
FRAMING PLAN - LEVEL 2

SHEET NUMBER

S2.10

9/27/2021 10:14:07 AM

C:_Revit Models\BUILDING 3 - ATC BLDG 3 IBC 2018 SDC C RC2 v2020 (Central)_dhorne@pcs-structural.com.rvt



NORTH

1 / S2.10R SLAB REINFORCING PLAN - LEVEL 2

1/8" = 1'-0"

SLAB PLAN NOTES:
1. PROVIDE #4 @ 24" O.C. EACH WAY AT SLAB ON METAL DECK - TYPICAL OVER ENTIRE FLOOR.
2. SLAB REINFORCING SHOWN IN THE PLAN IN ADDITION TO TYPICAL REINFORCING NOTED ABOVE.
3. SPLICE ALL REINFORCING PER GENERAL NOTES.
4. PROVIDE STANDARD HOOK AT ALL BARS WHICH CANNOT BE EXTENDED.
5. STAGGER ALL LAP SPLICES.

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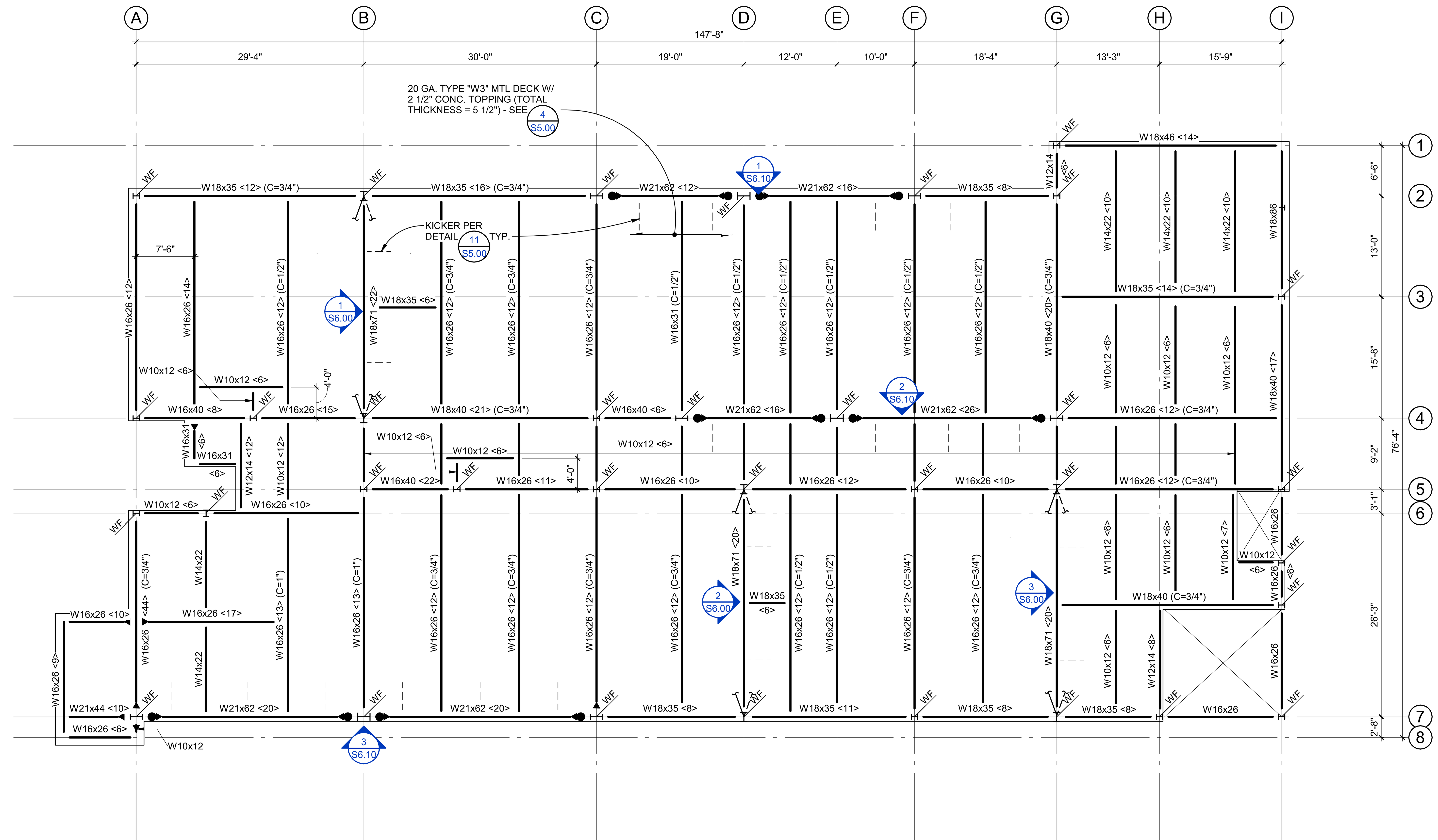
TITLE
LEVEL 2 SLAB REINFORCING PLAN

SHEET NUMBER
S2.10R



T.O.S. = 27'-0 1/2"

FOR FRAMING NOTES SEE S2.10

NORTH

1
S2.20

FRAMING PLAN - LEVEL 3

1/8" = 1'-0"

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FRAMING PLAN - LEVEL 3

SHEET NUMBER

S2.20

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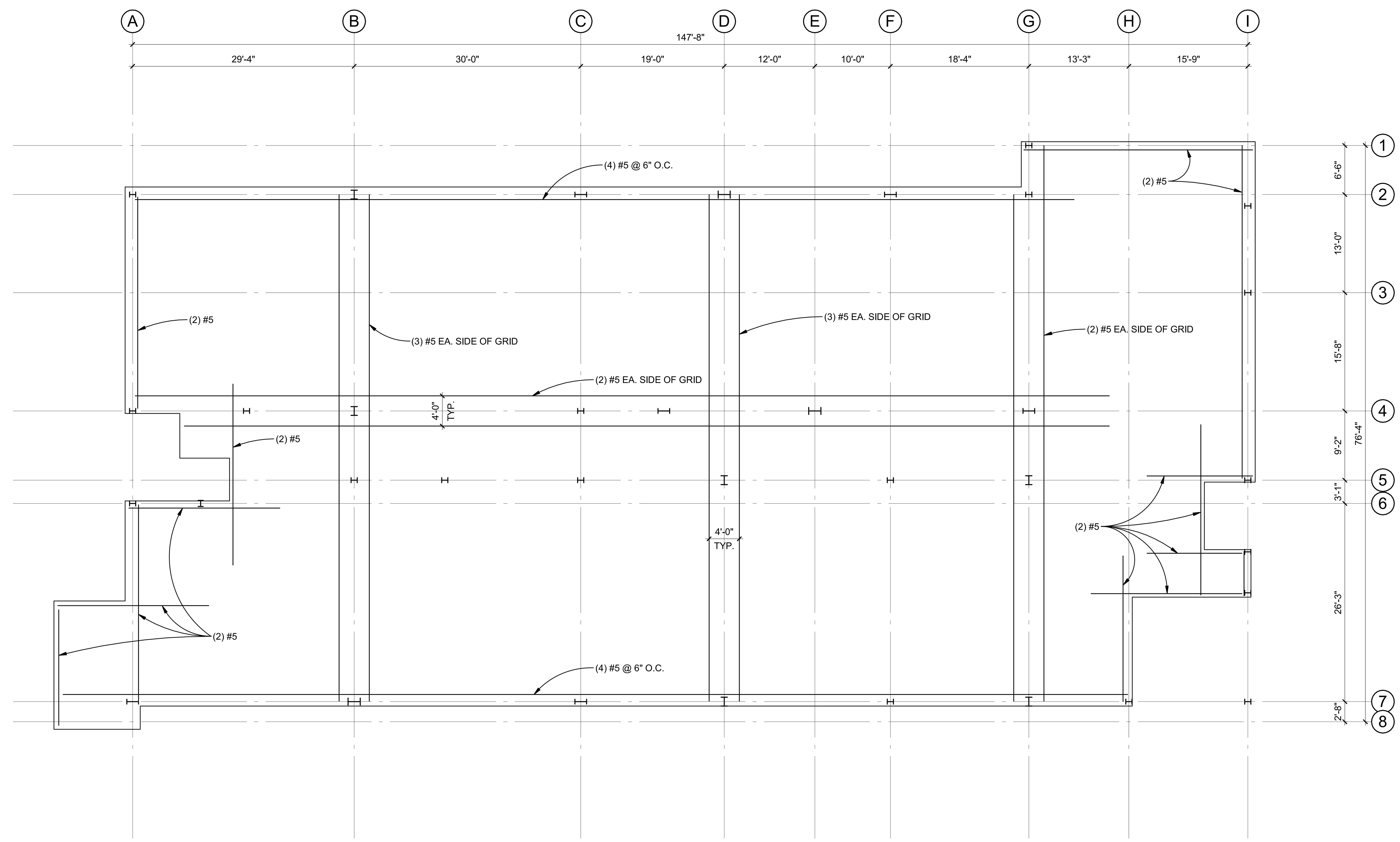

FOR SLAB PLAN NOTES SEE S2.10R

NORTH

1 S2.20R **SLAB REINFORCING PLAN - LEVEL 3**
1/8" = 1'-0"

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TITLE
LEVEL 3 SLAB REINFORCING PLAN

SHEET NUMBER
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ROOF FRAMING PLAN

1/8" = 1'-0"

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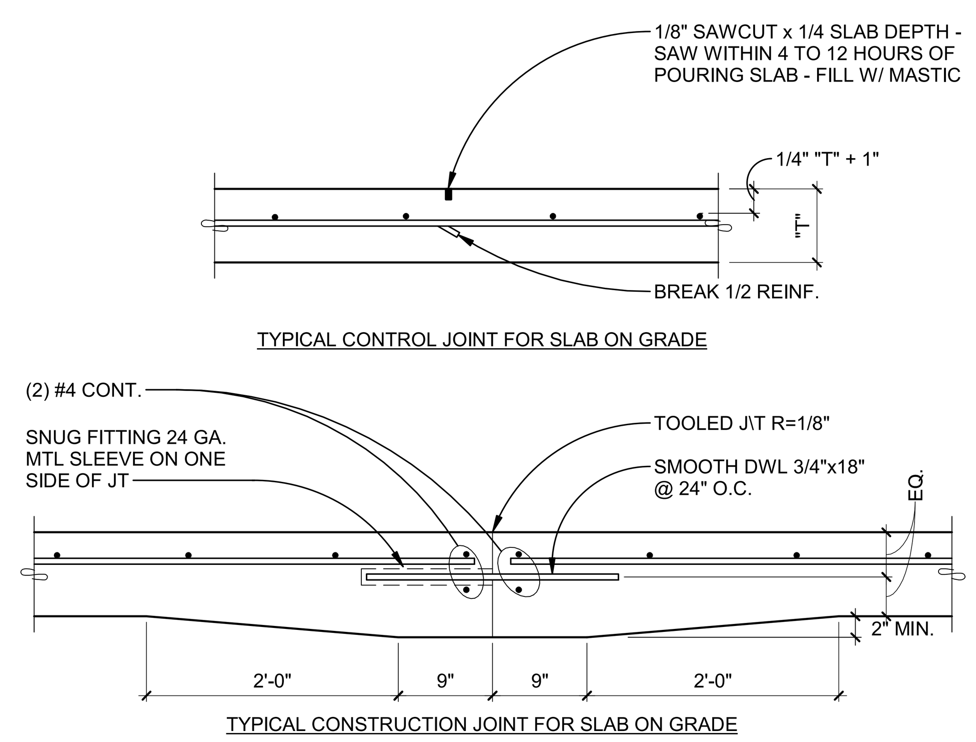
TITLE

ROOF FRAMING PLAN

SHEET NUMBER

S2.30



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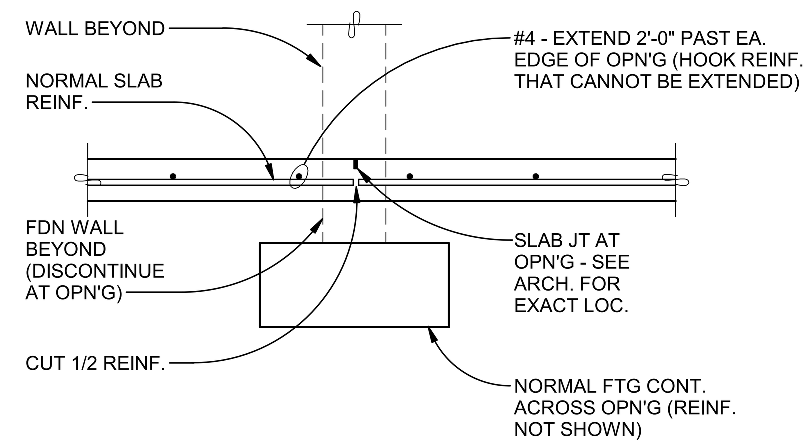

2 S3.00 SECTION
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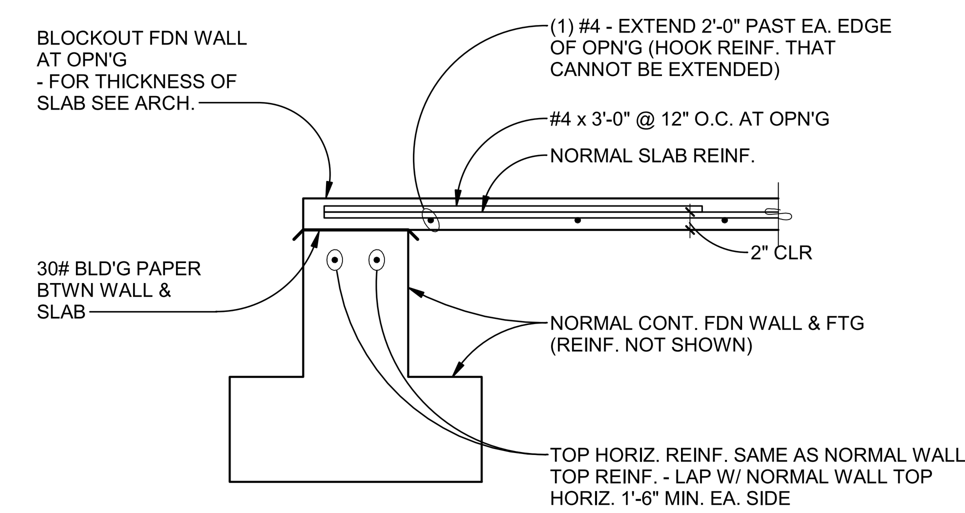
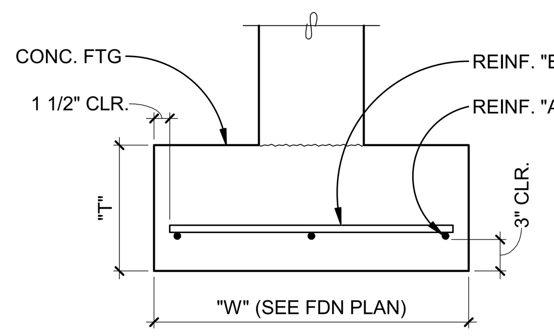


TYPICAL SLAB AT EXTERIOR OPENING

3 S3.00 SECTION
NO SCALE

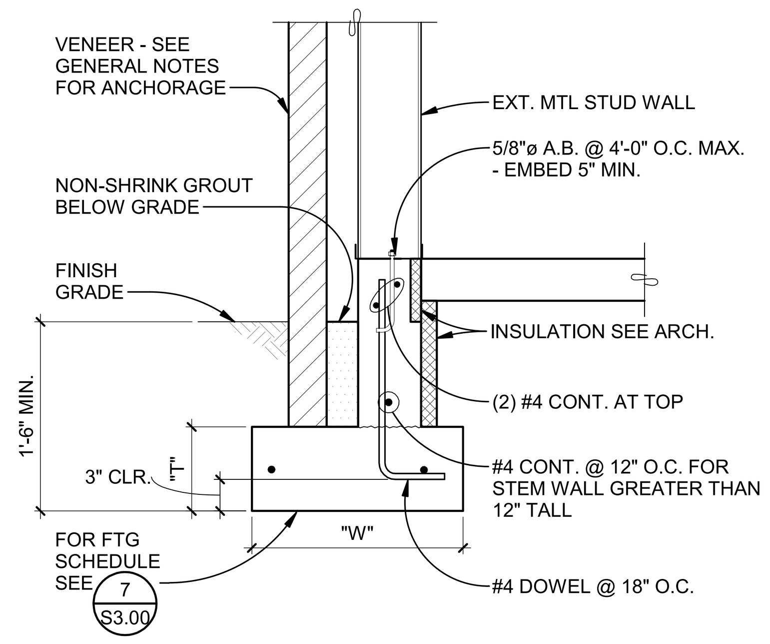


WIDTH "W"	"T"	REINF. "A" CONT.	REINF. "B"
2'-0"	11"	(2) #5	---

NOTES:
1. FOOTINGS SHALL BEAR ON UNDISTURBED OR COMPACTED MATERIAL - SEE GENERAL NOTES.
2. EXTEND FOOTINGS 6" MIN. PAST ENDS OF WALL UNLESS OTHERWISE NOTED.
3. WHERE FOOTINGS CHANGE WIDTHS LAP REINFORCING "A". "**Ls**" PER GENERAL NOTES.

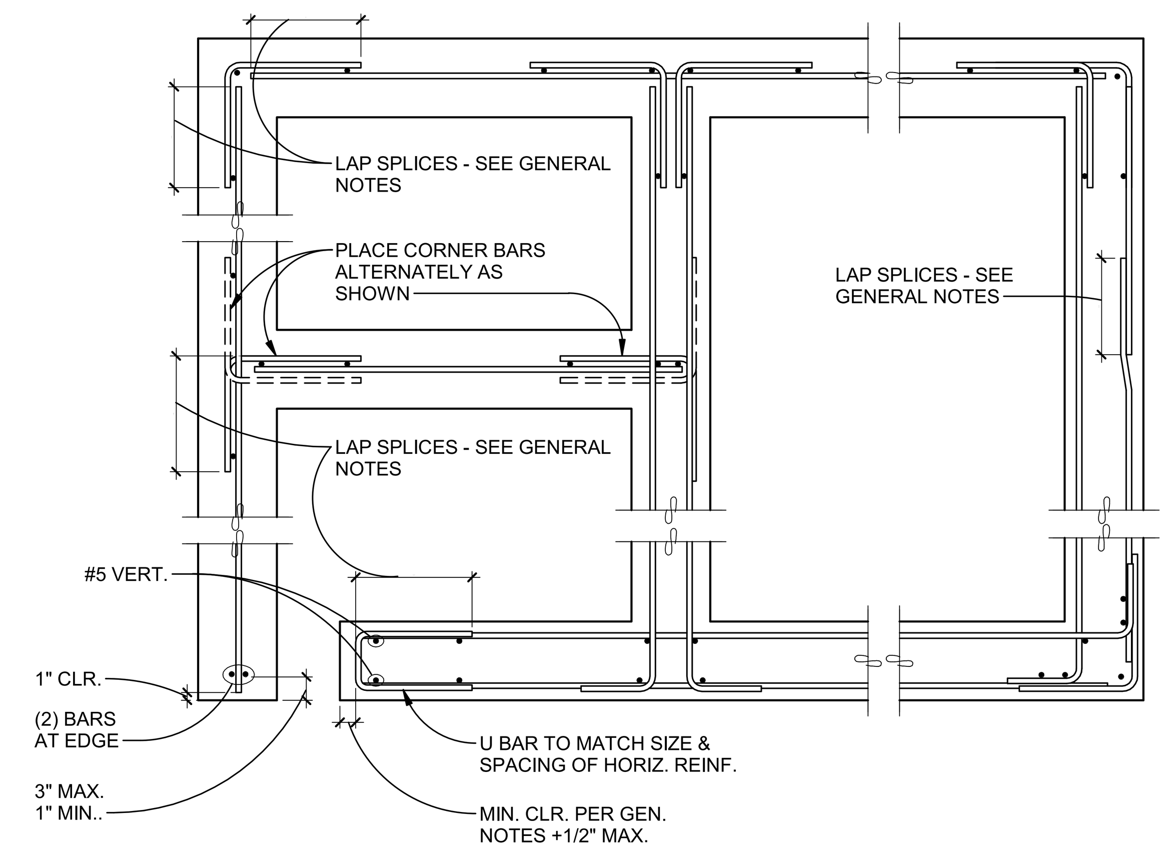
TYPICAL CONTINUOUS FOOTING DETAIL

4 S3.00 SECTION
NO SCALE



TYPICAL FOUNDATION AT EXTERIOR WALL WITH VENEER

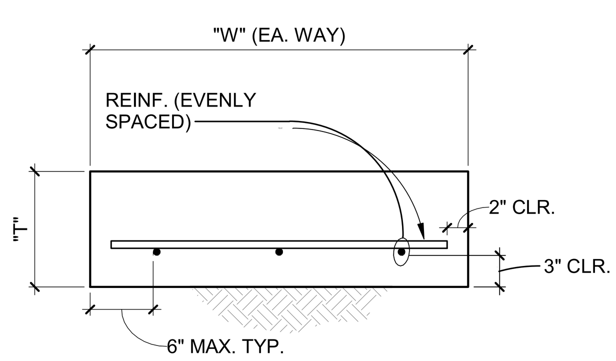
5 S3.00 SECTION
NO SCALE



NOTES:
1. VERT. REINF. SHOWN IS ADD'L IF NORMAL STEM WALL REINF. IS NOT IN PROPER LOCATION.
2. CORNER BARS ARE SAME SIZE & SPACING AS HORIZ. REINF.
3. 90° STD HOOK MAY BE SUBSTITUTED FOR CORNER BARS. SEE NOTE #5.
4. REINF. AT ALL CORNERS, ENDS, & INTERSECTIONS OF WALLS SHALL BE PLACED IN ACCORDANCE W/ APPROPRIATE DETAIL SHOWN.
5. USE 90° STD HOOK FOR EMBEDMENT LESS THAN 24" PAST FACE OF WALL.

TYPICAL REINFORCING PLACEMENT FOR CAST IN PLACE CONCRETE WALLS AND STEM WALLS

6 S3.00 DETAIL
NO SCALE



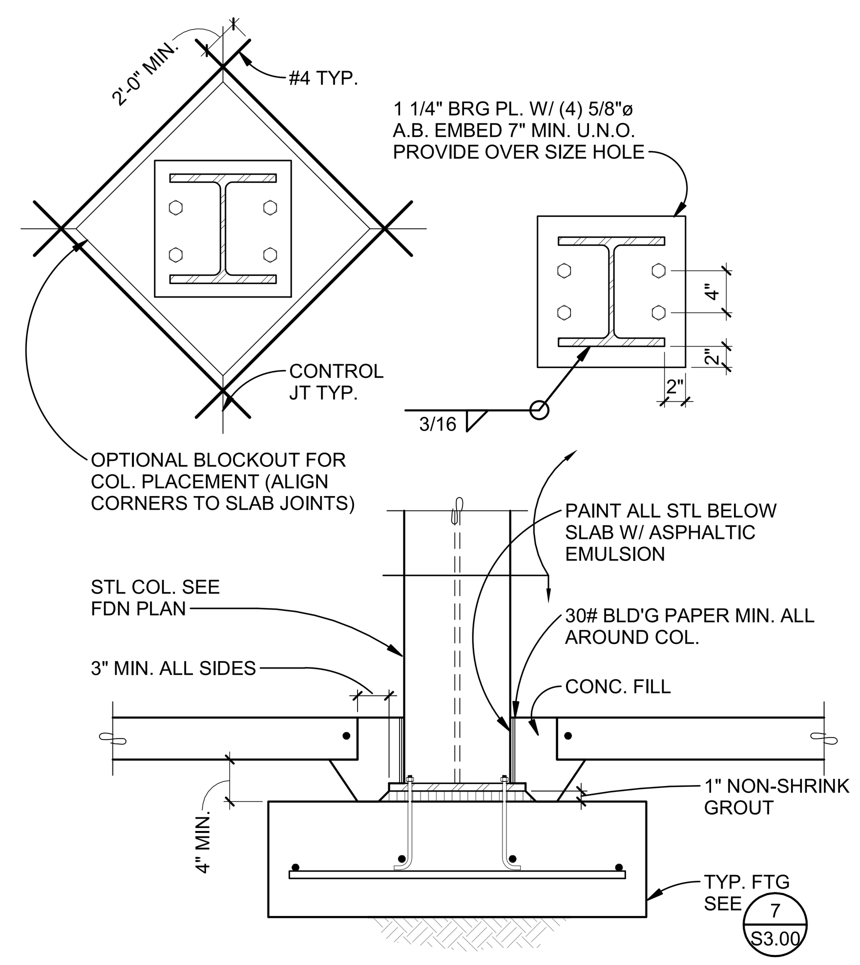
MARK	DIMENSIONS		REINF. EA. WAY
	"W"	"T"	
F4.0	4'-0"	11"	(4) #5
F5.0	5'-0"	14"	(5) #6
F6.0	6'-0"	16"	(6) #7

SECTION

NOTES:
1. CENTER ALL FOOTINGS ON COLUMN ABOVE EXCEPT AS SHOWN OTHERWISE.
2. FOOTINGS SHALL BEAR ON UNDISTURBED OR COMPACTED MATERIAL, SEE GENERAL NOTES. DESIGN BEARING PRESSURE IS 4000 PSF.

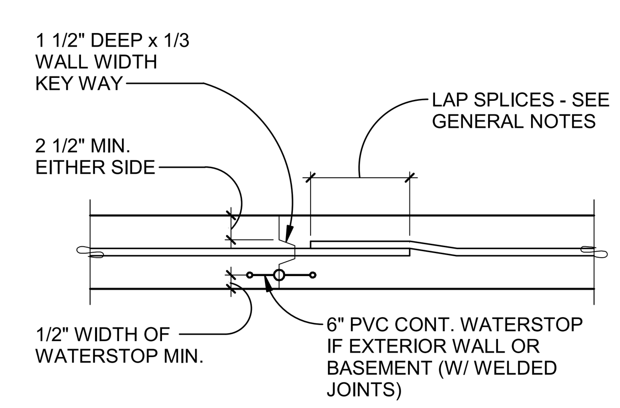
TYPICAL CONCRETE SPREAD FOOTING DETAILS

7 S3.00 SECTION
NO SCALE

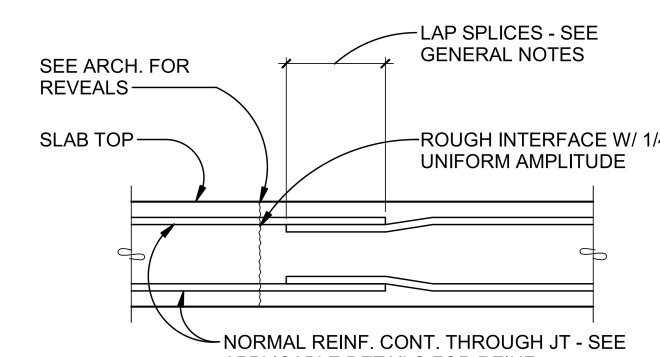


TYPICAL STEEL COLUMN AT SPREAD FOOTING

8 S3.00 SECTION
NO SCALE



TYPICAL AT VERTICAL WALL JOINTS



TYPICAL AT CONCRETE GRADE BEAMS & FOOTINGS

NOTE:
OBTAIN APPROVAL OF ENGINEER FOR LOC. OF ANY C.J.

TYPICAL FOR CAST IN PLACE CONCRETE WALLS, GRADE BEAMS AND FOOTINGS

9 S3.00 CONSTRUCTION JOINTS
NO SCALE

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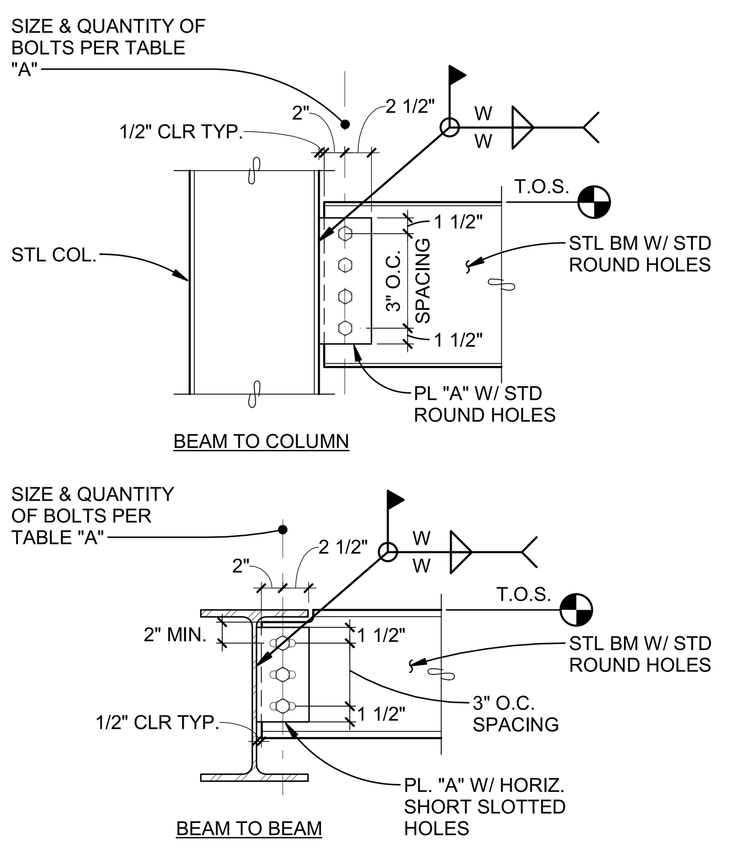
TITLE
FOUNDATION DETAILS

SHEET NUMBER
S3.00



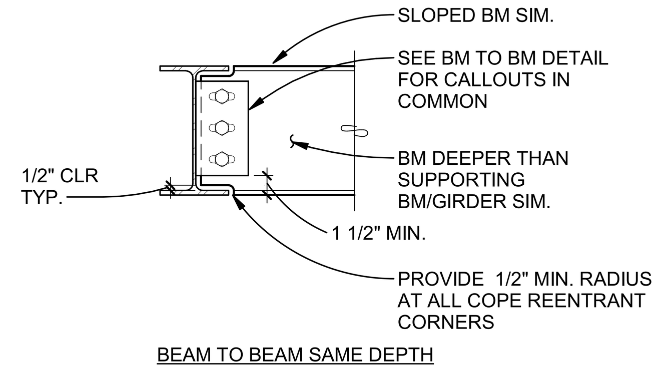
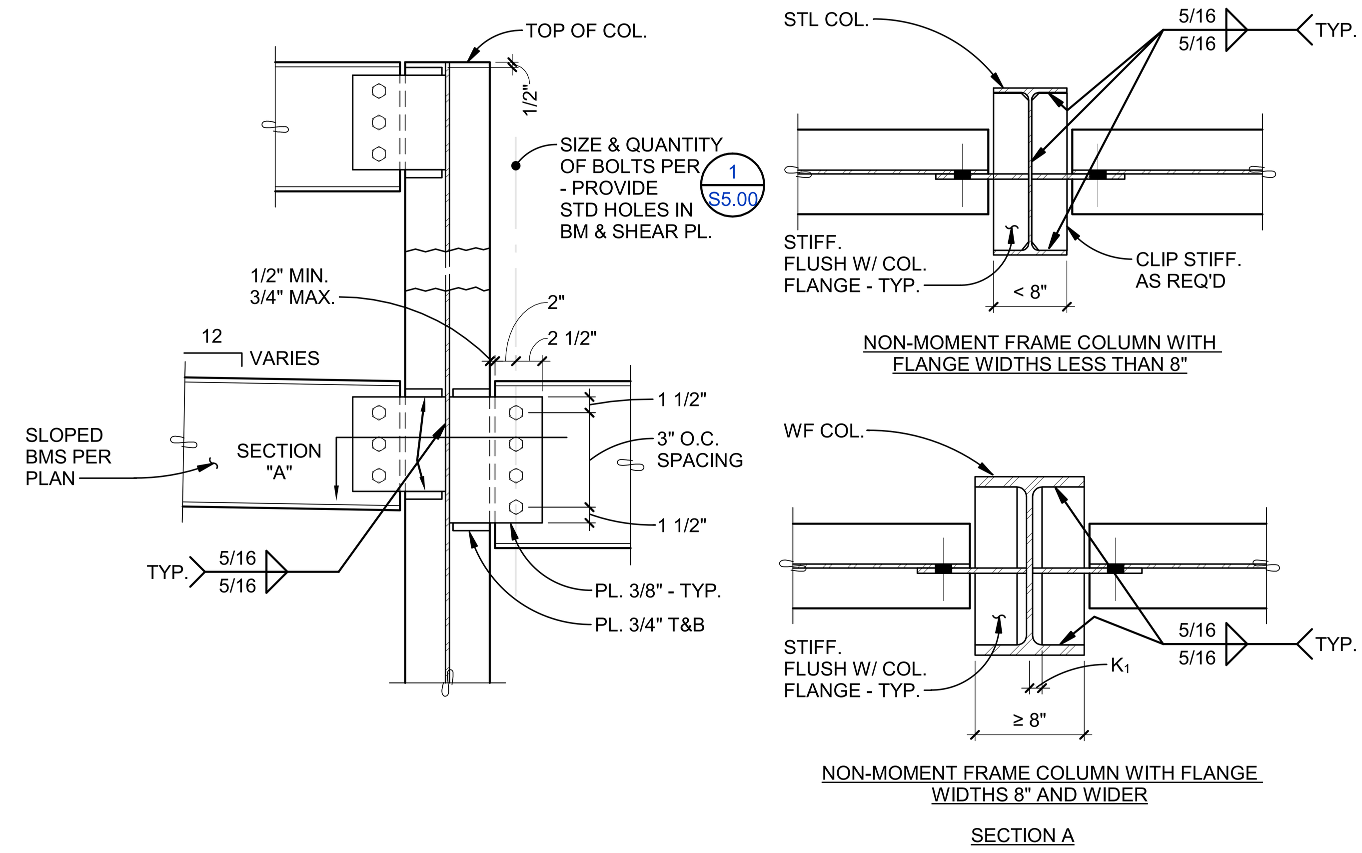


TABLE A			
SUPPORTED BEAM SIZE	QUANTITY OF 7/8"ø A325N BOLTS	SHEAR PLATE THICKNESS "A"	WELD "W" NOTE 1.
W10	2	3/8"	5/16"
W16, W18	4	3/8"	5/16"
W21	5	3/8"	5/16"

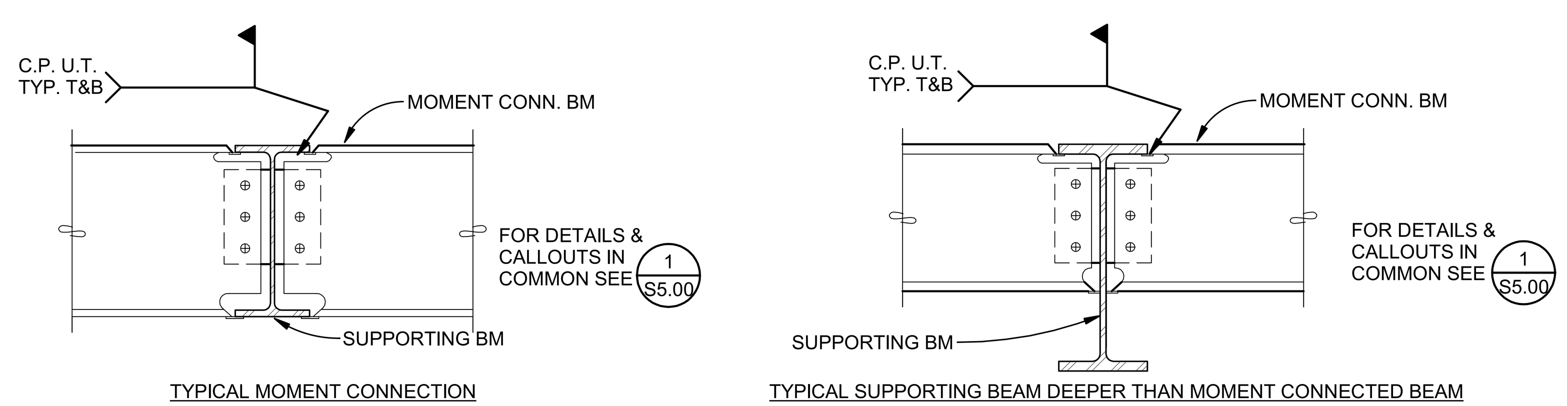
TYPICAL STEEL DETAIL

1 S5.00 DETAIL
NO SCALE

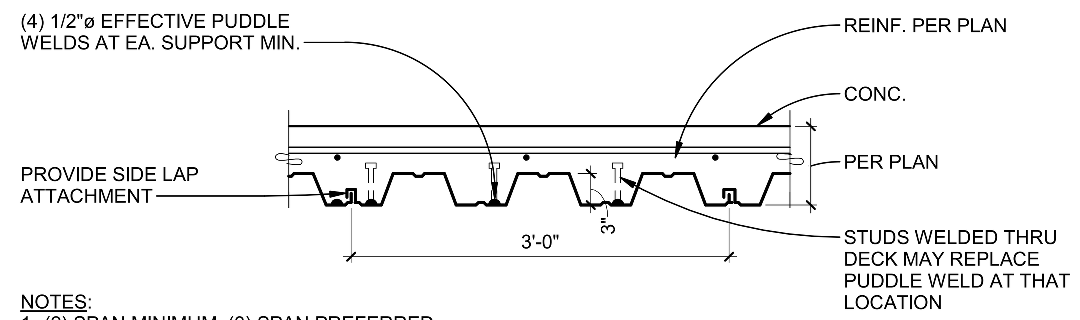


TYPICAL BEAM/COLUMN FRAMING INTO WEB

2 S5.00 DETAIL
NO SCALE

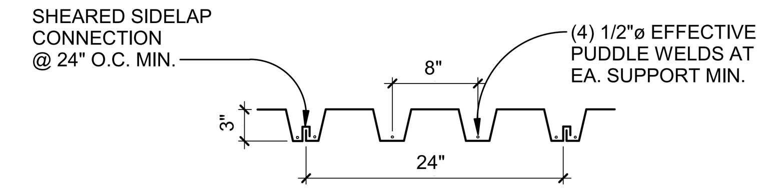


3 S5.00 DETAIL
NO SCALE



NOTES:
1. (2) SPAN MINIMUM, (3) SPAN PREFERRED.
2. AT SUPPORTS PARALLEL TO CORRUGATIONS, PROVIDE PUDDLE WELDS @ 24" O.C. MAXIMUM.

TYPICAL COMPOSITE FLOOR DECK

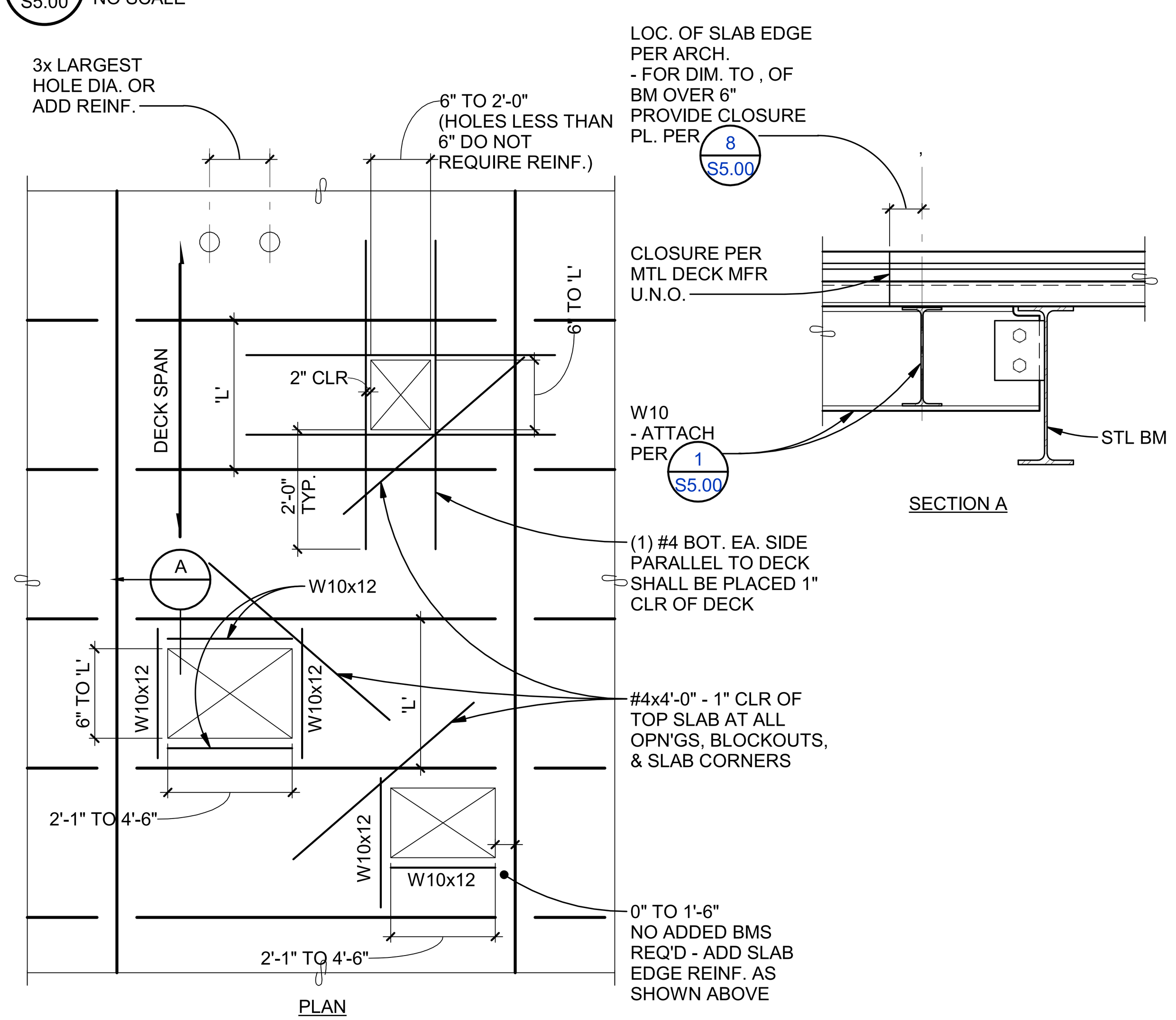


TYPE "N" MIN. DECK PROPERTIES		
GAUGE	I = (in.⁴/ft.)	+S/-S = (in.³/ft)
20	.837	.508/.562

NOTES:
1. (2) SPAN MIN. ,(3) PREFERRED.
2. AT SUPPORTS PARALLEL TO CORRUGATIONS, PROVIDE PUDDLE WELDS @ 24" O.C. MAX.

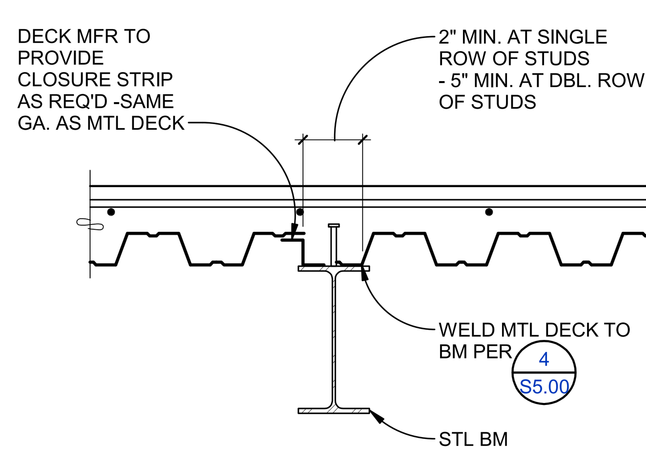
TYPICAL ROOF METAL DECK

4 S5.00 DETAIL
NO SCALE



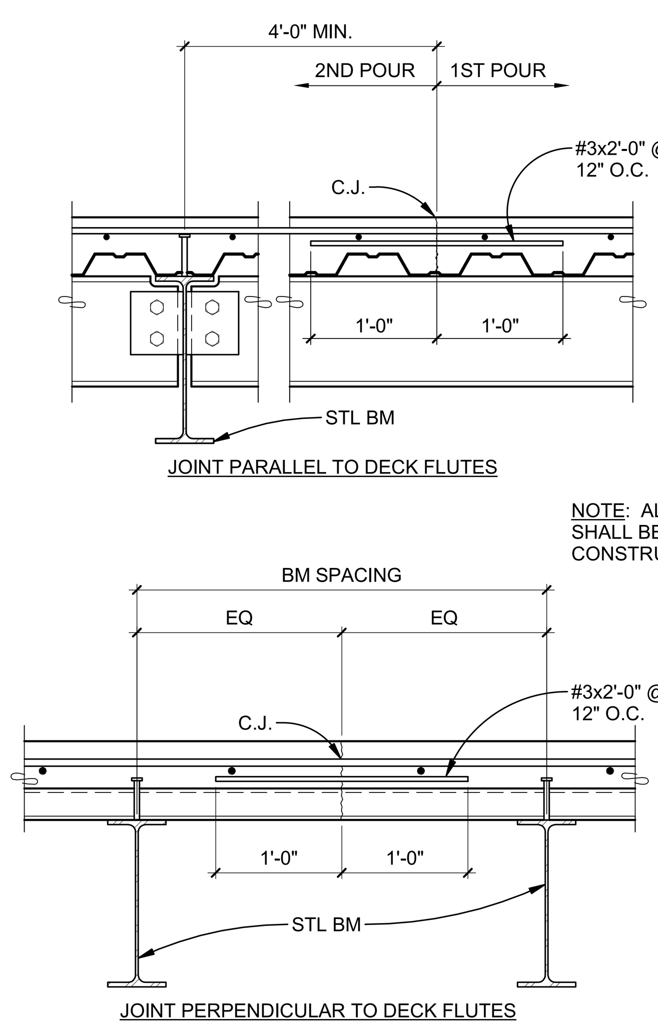
TYPICAL FLOOR PENETRATION REINFORCEMENT

5 S5.00 DETAIL
NO SCALE



TYPICAL AT METAL DECK PARALLEL TO BEAM

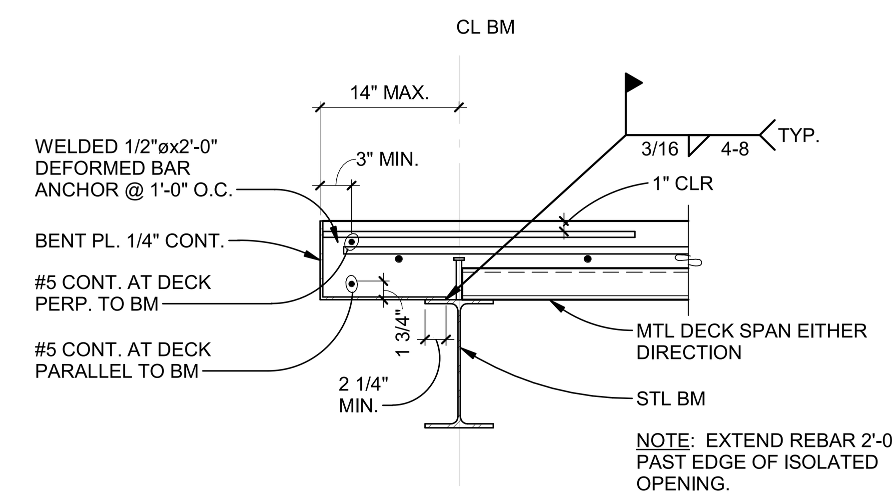
6 S5.00 SECTION
NO SCALE



NOTE: ALL REINFORCEMENT SHALL BE CONTINUOUS THRU CONSTRUCTION JOINT

TYPICAL COMPOSITE DECK CONSTRUCTION JOINT

7 S5.00 SECTION
NO SCALE

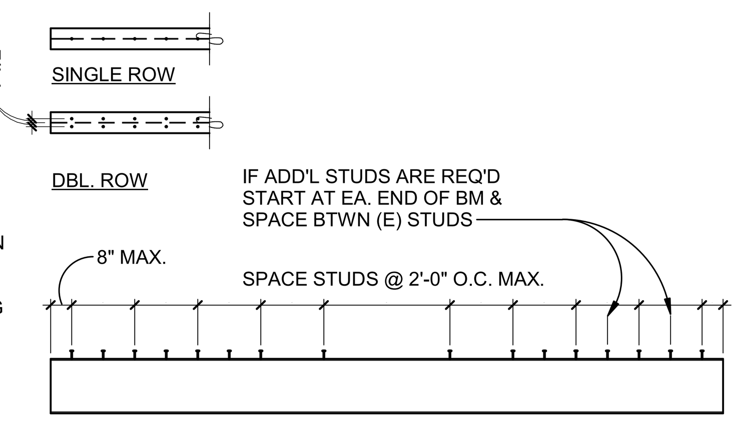


NOTE: EXTEND REBAR 2'-0" PAST EDGE OF ISOLATED OPENING.

TYPICAL SLAB EDGE CONDITION - OVER 6" OVERHANG

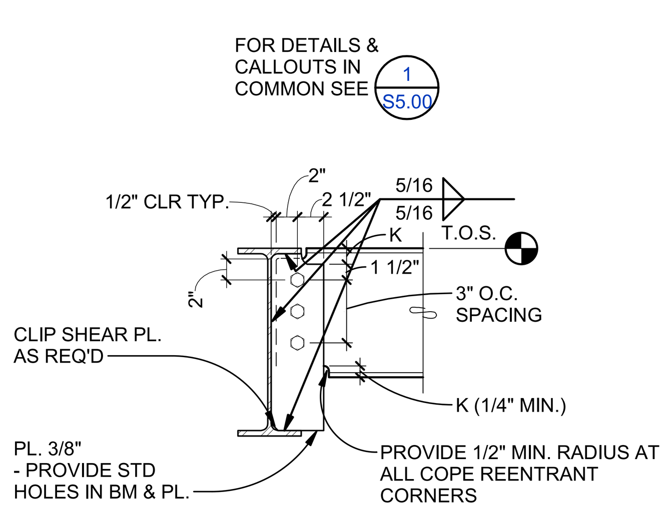
8 S5.00 SECTION
NO SCALE

NOTES:
1. LOCATE STUDS AT CENTER OF BEAM FLANGE.
2. STUDS ARE 3/4"ø x 4 1/2" LONG AFTER WELDING.
3. SEE FRAMING PLANS FOR NUMBER OF STUDS.
4. ALL BEAMS WITH STUDS ARE COMPOSITE STEEL BEAMS.
5. PROVIDE A DOUBLE ROW OF STUDS AT BEAMS WHERE THE REQUIRED NUMBER OF STUDS EXCEEDS THE NUMBER THAT CAN FIT IN A SINGLE ROW AT 6" ON CENTER AT DECK PARALLEL TO BEAM OR 12" ON CENTER AT DECK PERPENDICULAR TO BEAM. STUDS SHOULD BE LOCATED IN DECK FLUTES PER AISC STRONG POSITION.



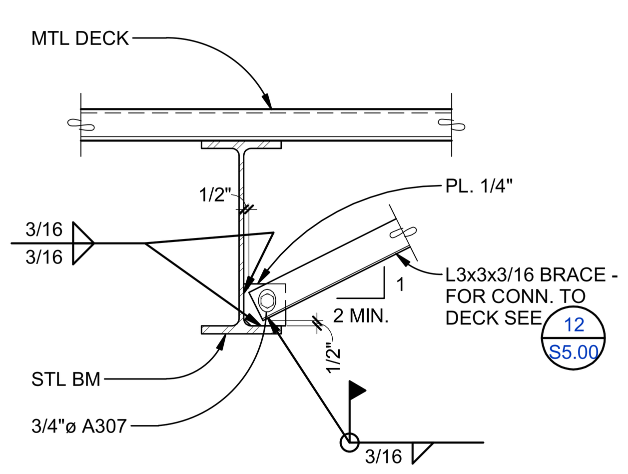
TYPICAL COMPOSITE BEAM DETAIL

9 S5.00 DETAIL
NO SCALE



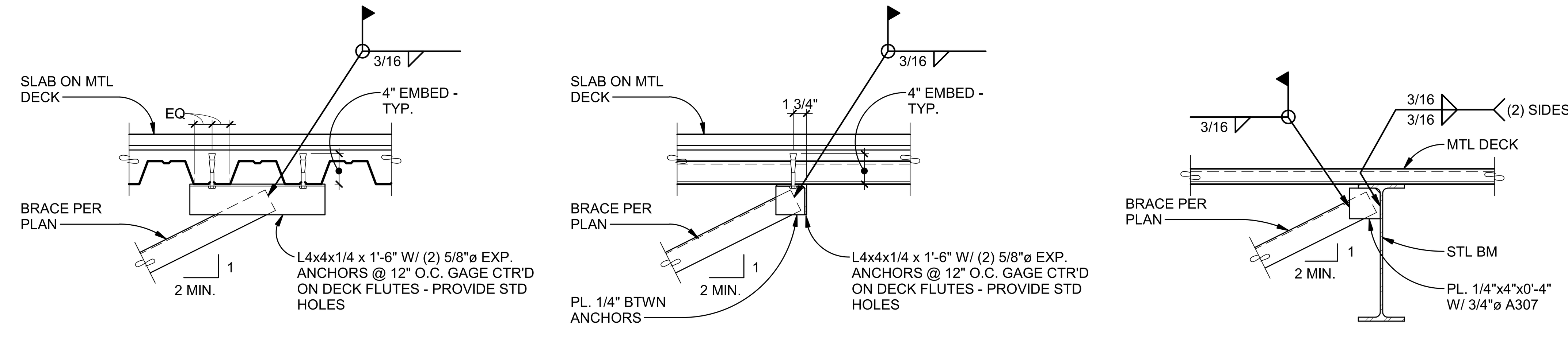
TYPICAL BEAM FRAMING AT FULL DEPTH SHEAR PLATE

10 S5.00 DETAIL
NO SCALE



BEAM BRACING

11 S5.00 SECTION
NO SCALE



12 S5.00 SECTION
NO SCALE

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PROJECT
EDUCATION FACILITY
ST. LOUIS MISSOURI
PCS STRUCTURAL SOLUTIONS
DESIGN B
2018 IBC WITH RISK CATEGORY II

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DRAWINGS
30 SEPTEMBER, 2021

Job Number	19-051
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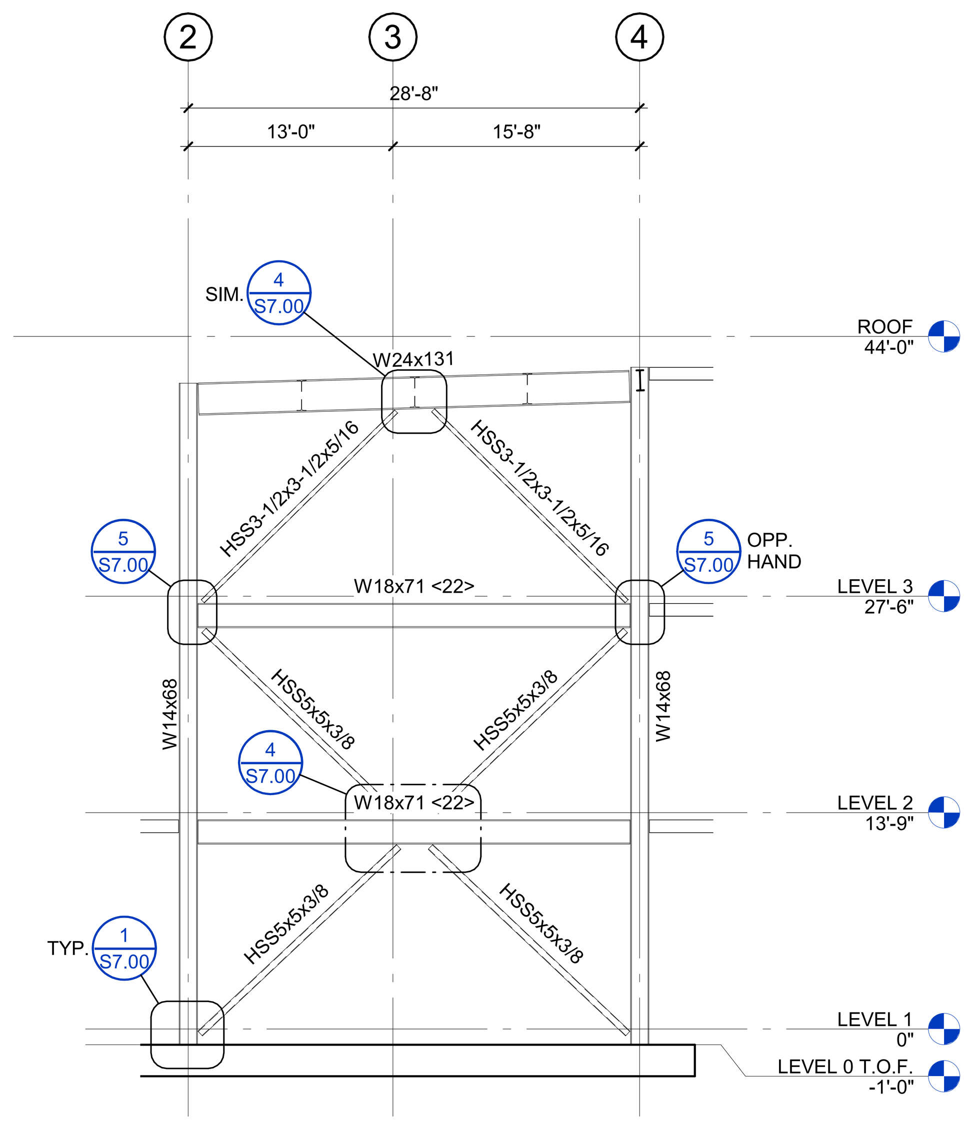
Approved	Approver

TITLE
STEEL DETAILS

SHEET NUMBER
S5.00

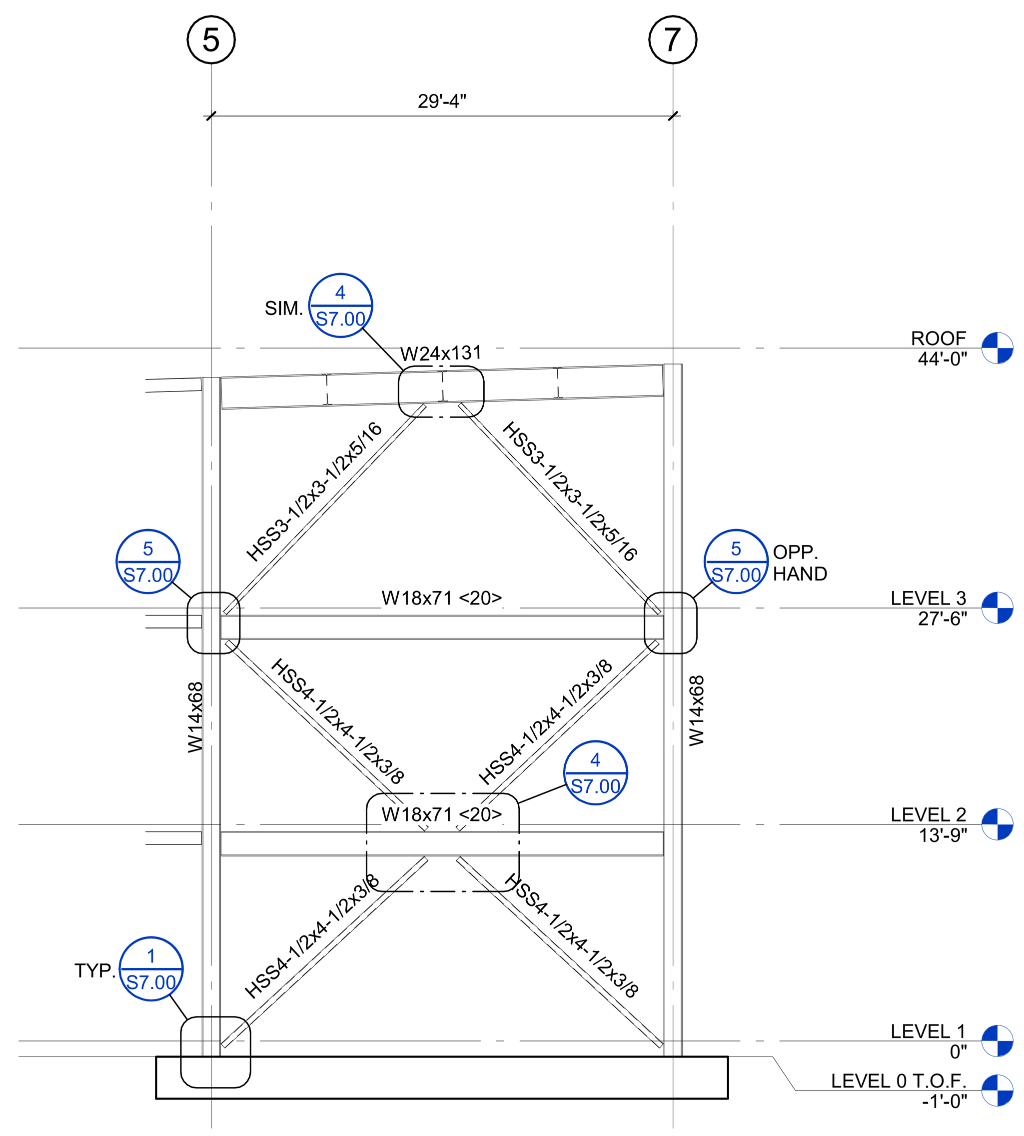


NOTE: SEE 2/S7.01 FOR PROTECTED ZONE

AT GRID B

1 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"

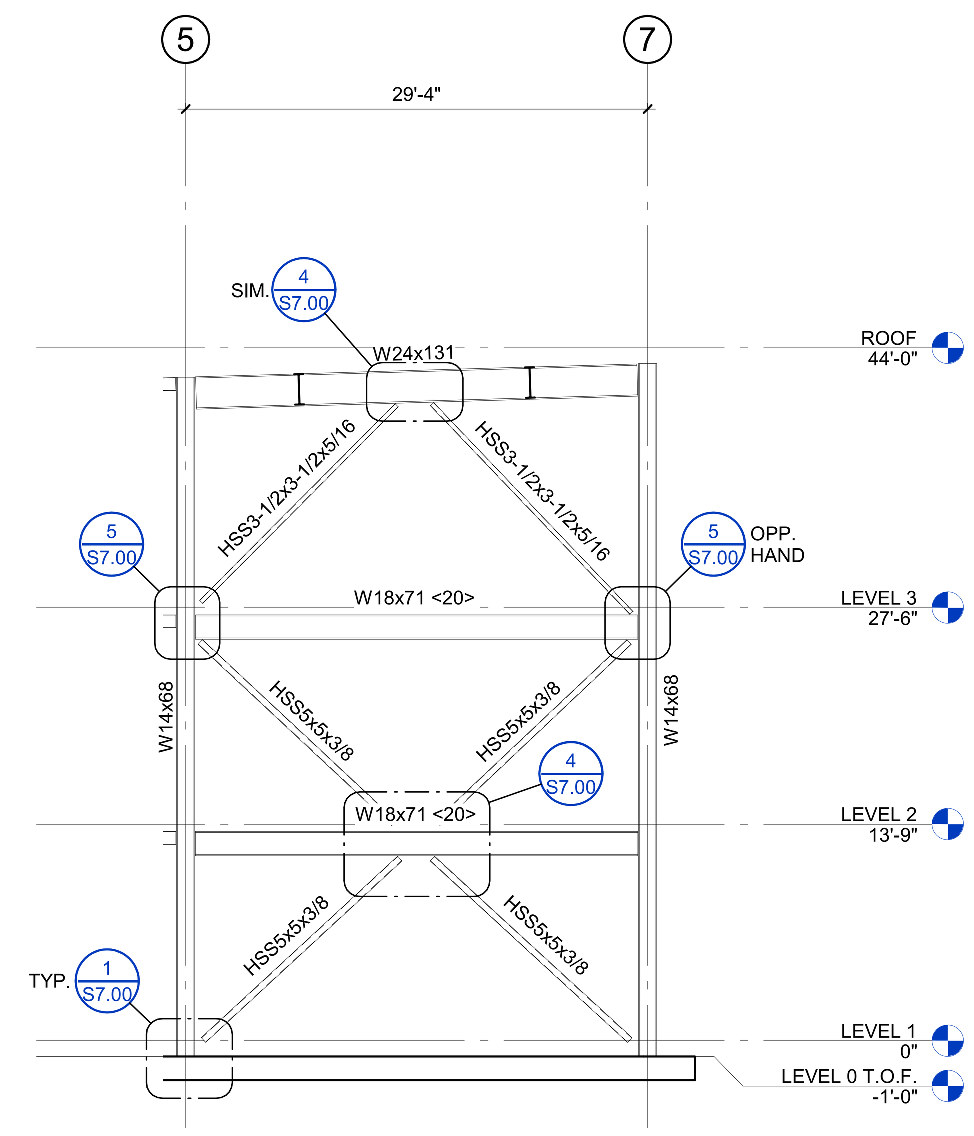


NOTE: SEE 2/S7.01 FOR PROTECTED ZONE

AT GRID D

2 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"



NOTE: SEE 2/S7.01 FOR PROTECTED ZONE

AT GRID G

3 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"

nehrp

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TITLE

BRACED FRAME ELEVATIONS

SHEET NUMBER

S6.00

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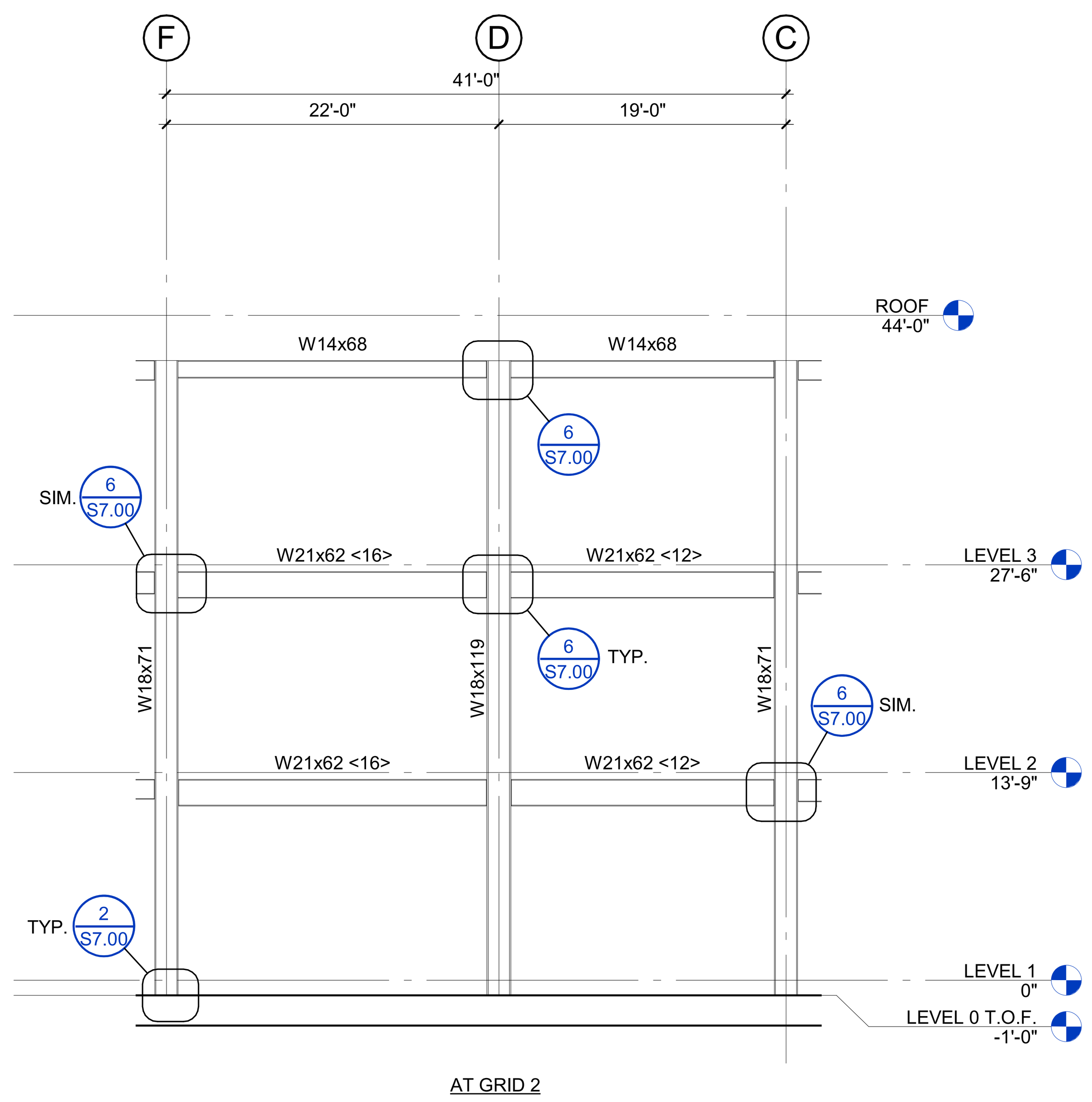
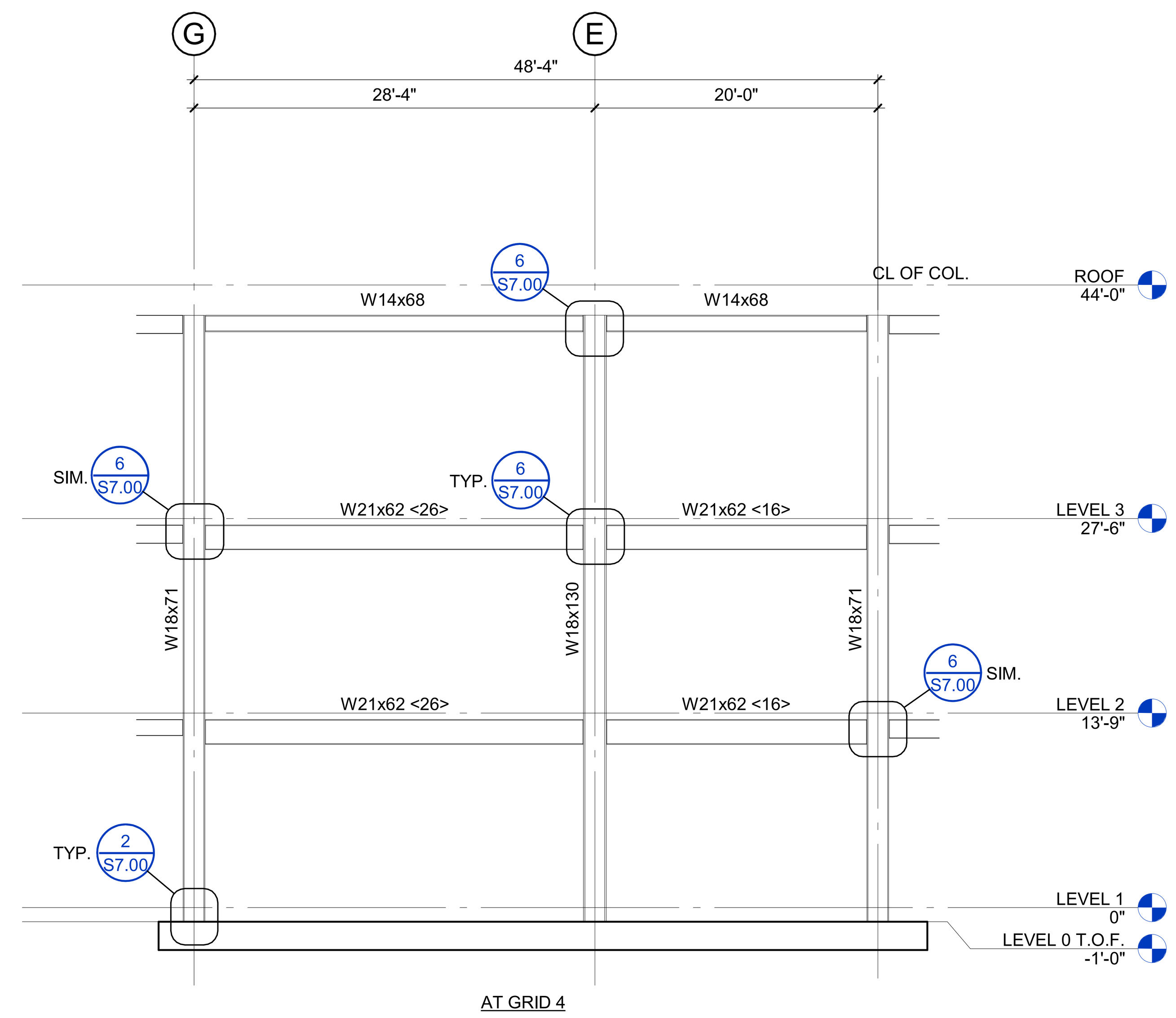
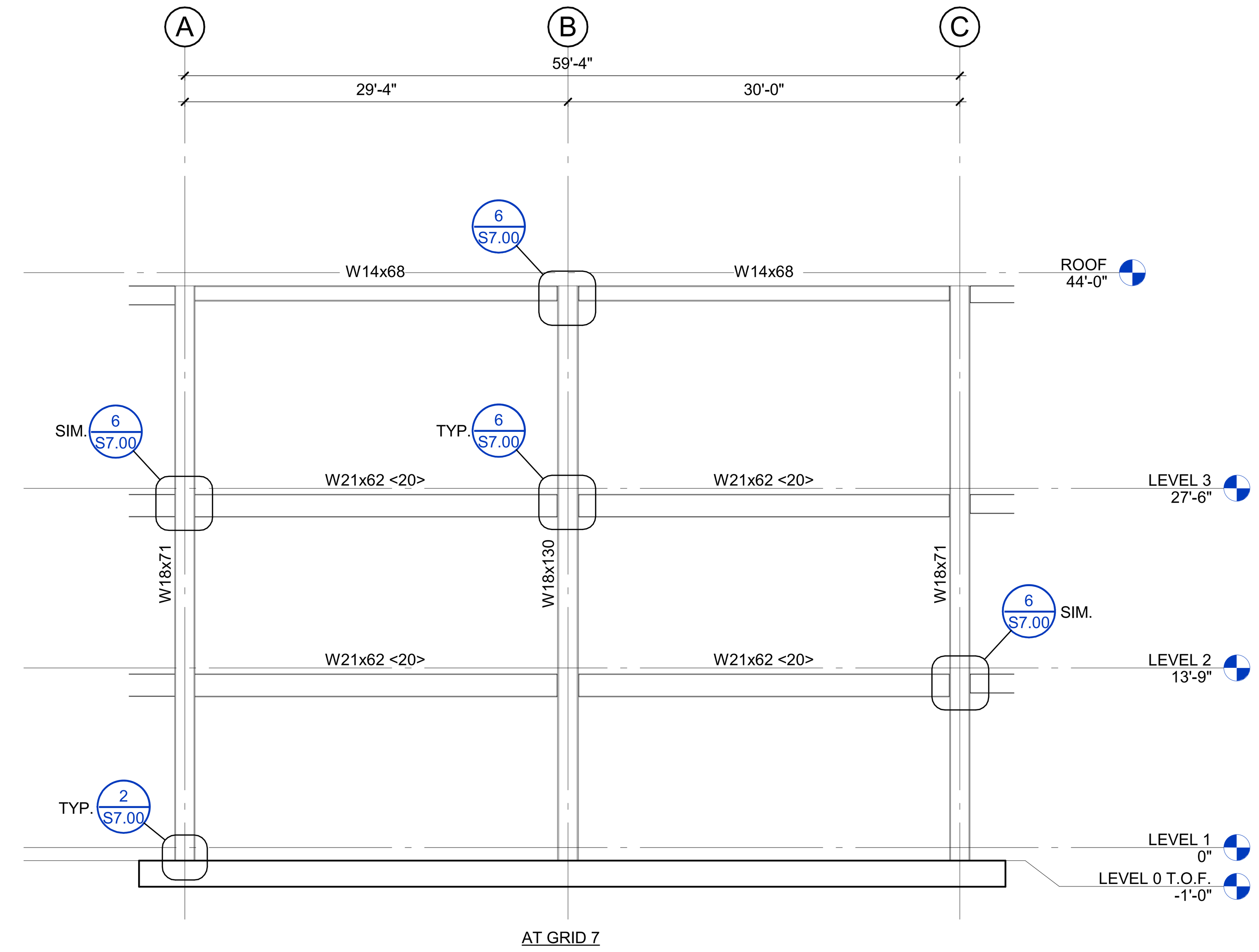


1
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"



2
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"



3
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"

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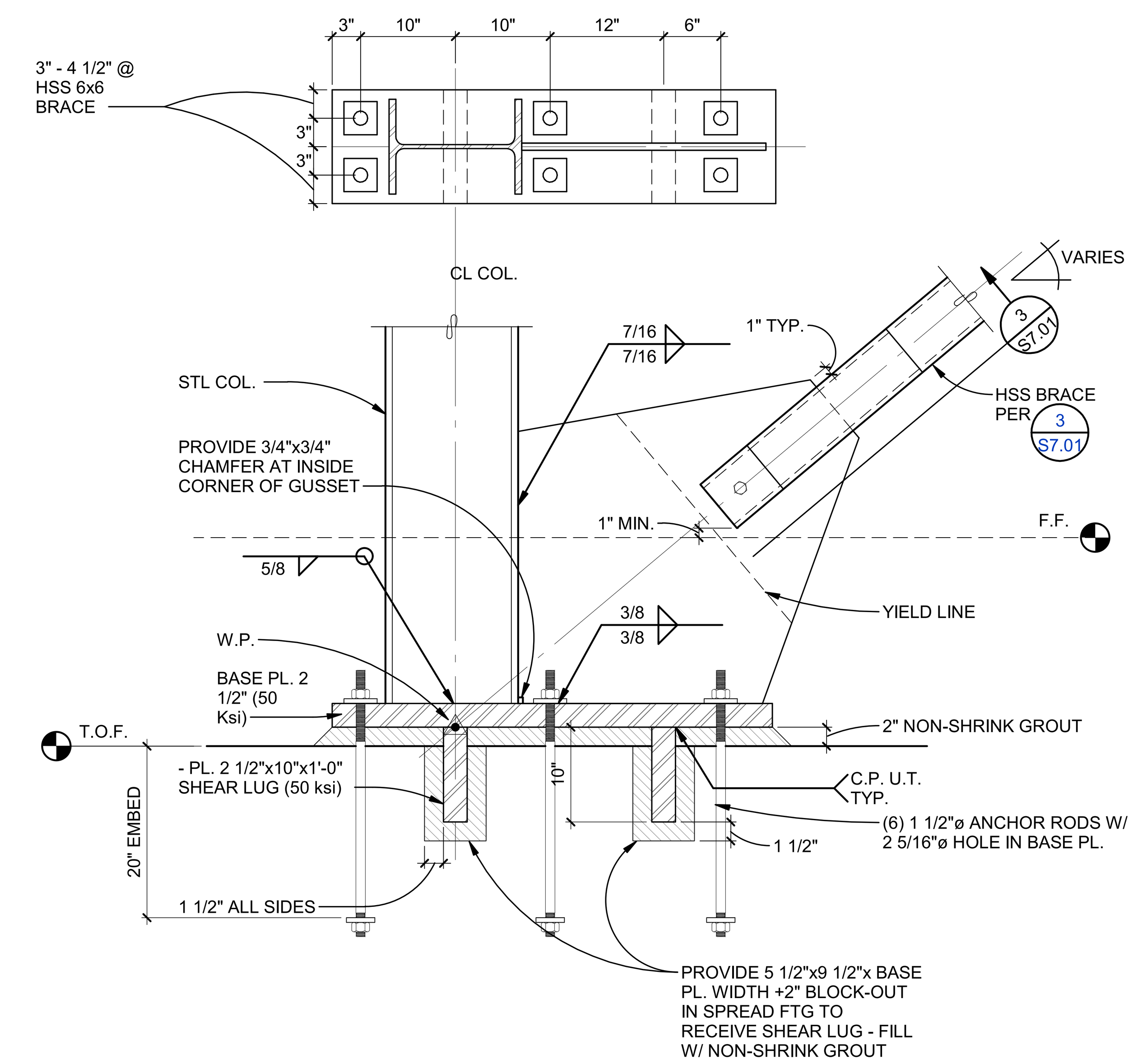
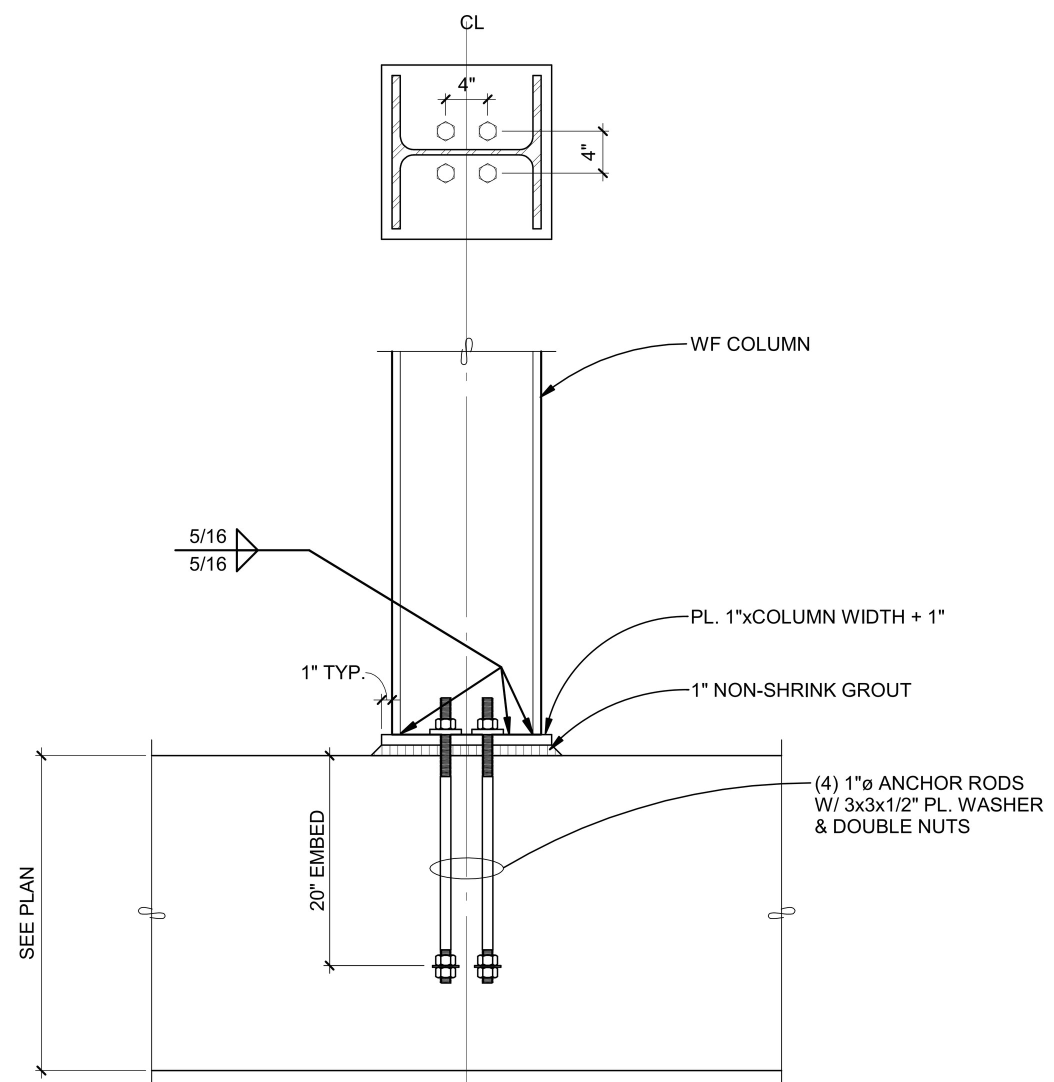
TITLE
MOMENT FRAME ELEVATIONS

SHEET NUMBER
S6.10

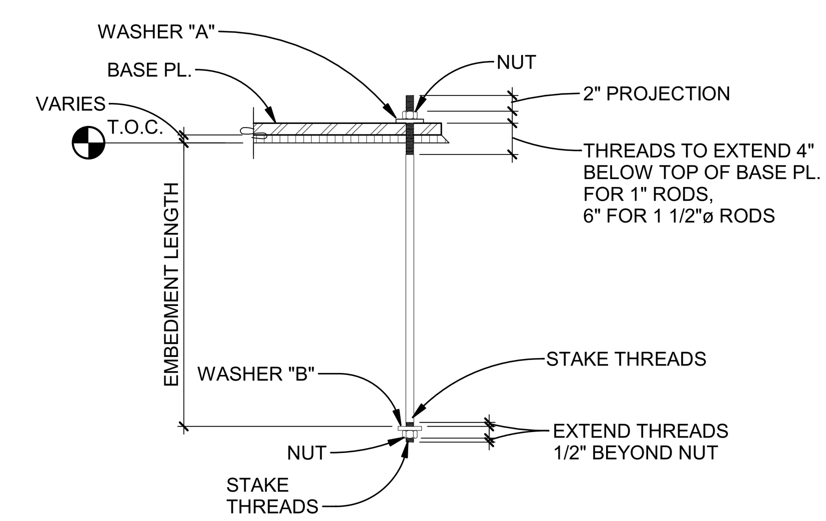


TYPICAL BASE PLATE AT BRACED FRAME

1 SECTION
S7.00 NO SCALE



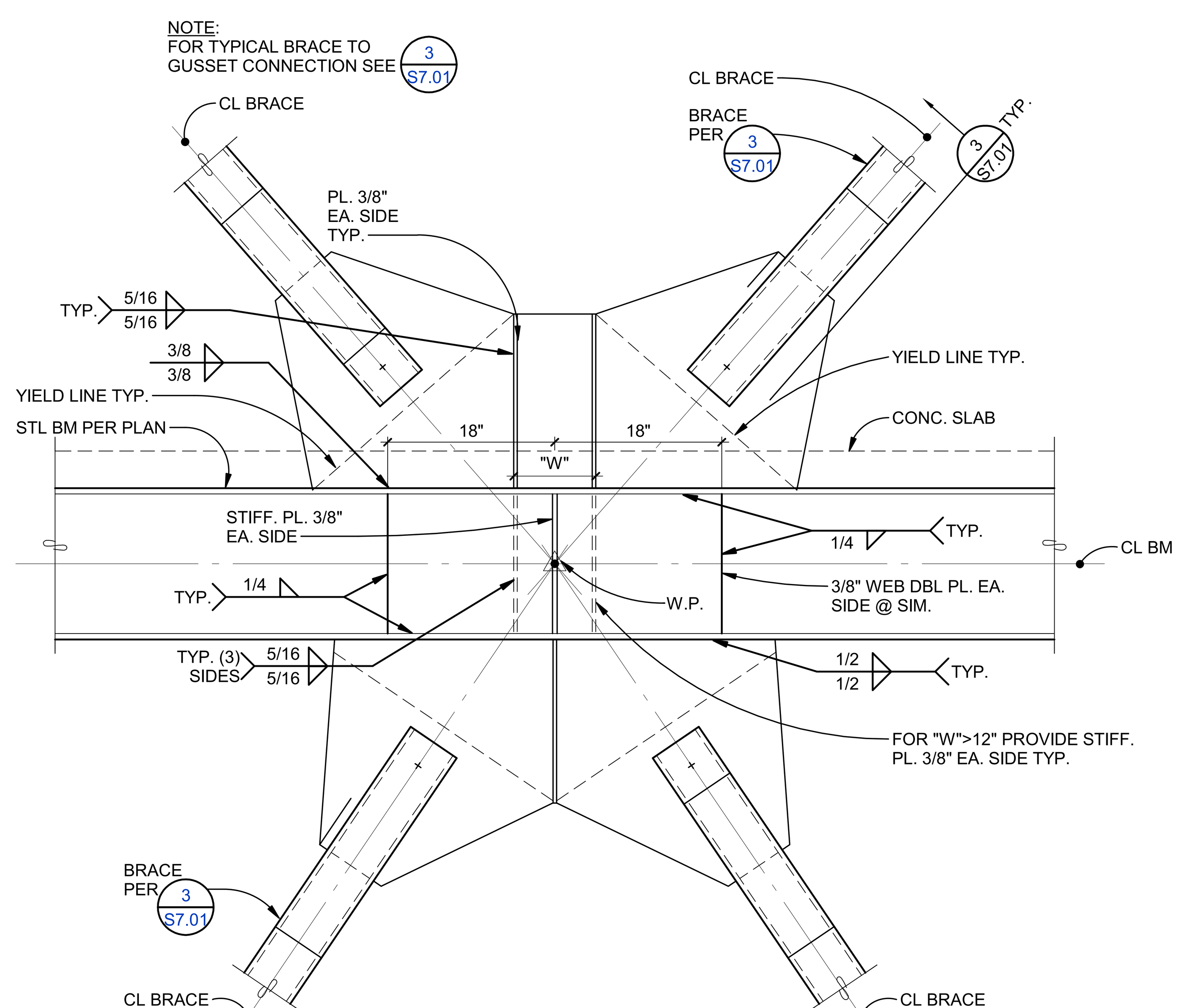
2 SECTION
S7.00 NO SCALE



ANCHOR ROD		WASHER		NUT
SIZE	MATERIAL	TYPE	SIZE	
1 1/2"ø	F1554 GRADE 105	A	PL. 1/2"x3 1/2"x0'-3 1/2" W/ 1 9/16"ø HOLE CTR'D	A563 GRADE DH HEAVY HEX
		B	ASTM F844 CARBON FLAT WASHER	

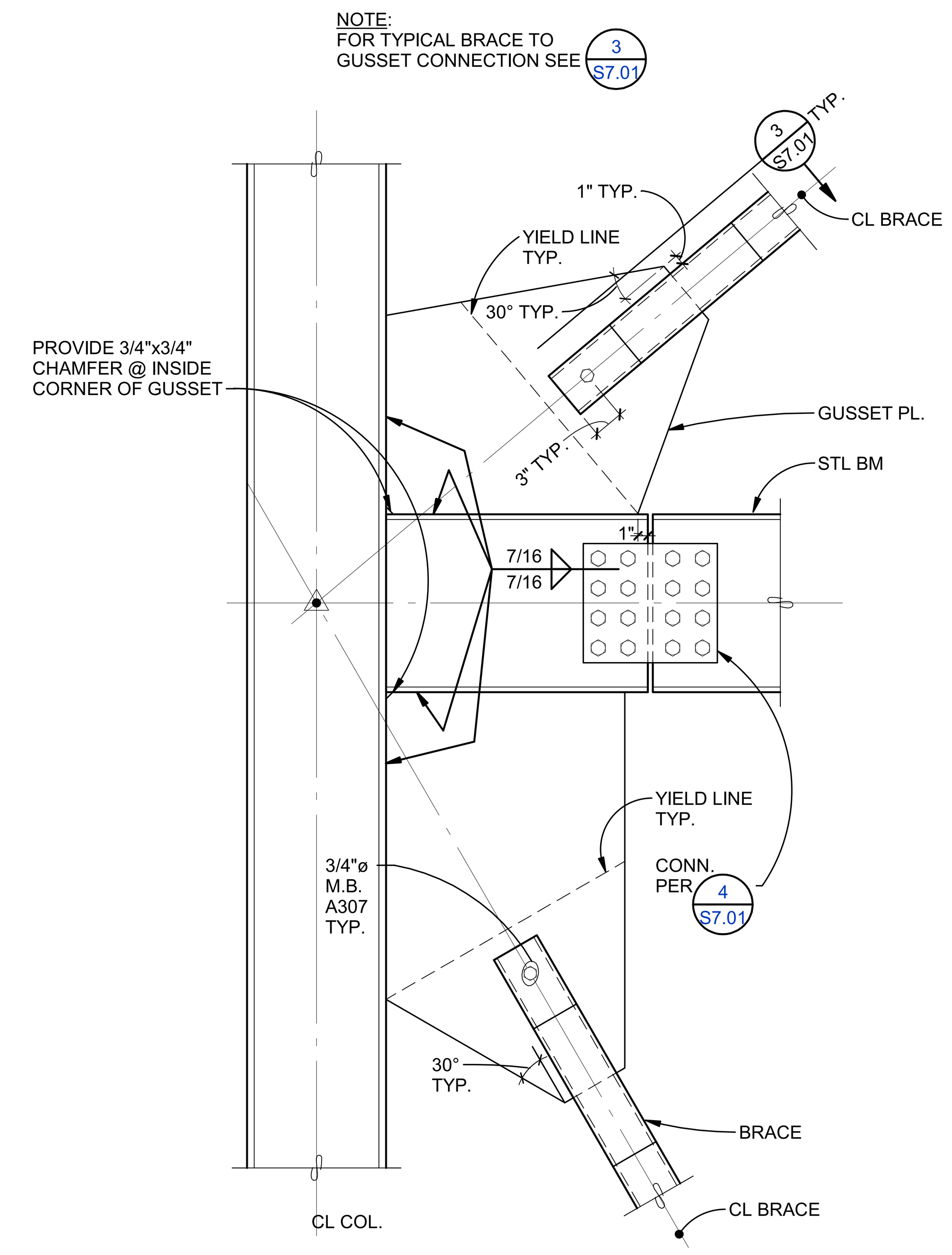
TYPICAL ANCHOR ROD/BOLT DETAIL AT BRACED FRAMES

3 DETAIL
S7.00 NO SCALE

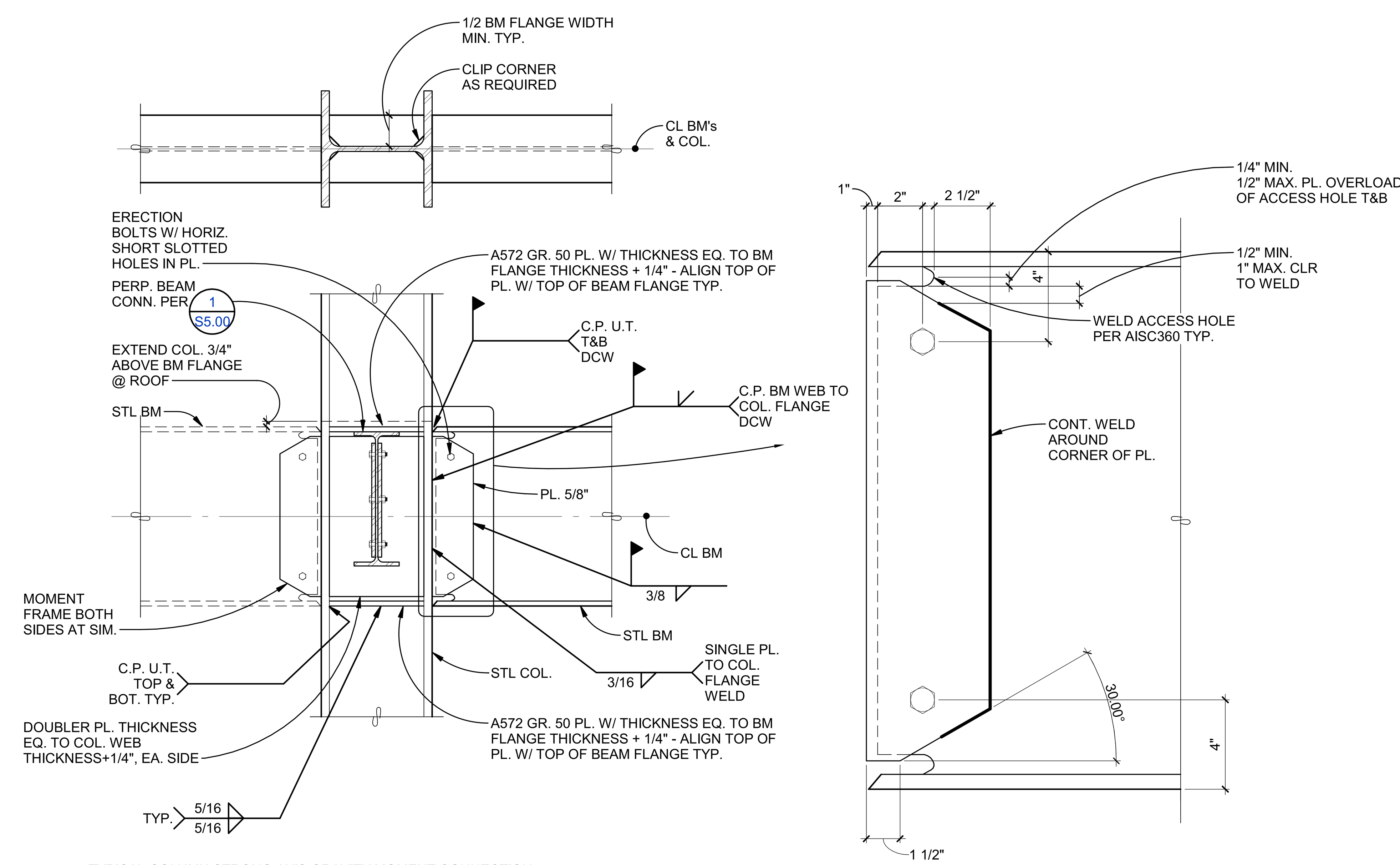


TYPICAL AT SIMILAR BRACE ANGLES

4 SECTION
S7.00 NO SCALE



5 SECTION
S7.00 NO SCALE



TYPICAL COLUMN STRONG AXIS GRAVITY MOMENT CONNECTION

6 DETAIL
S7.00 NO SCALE

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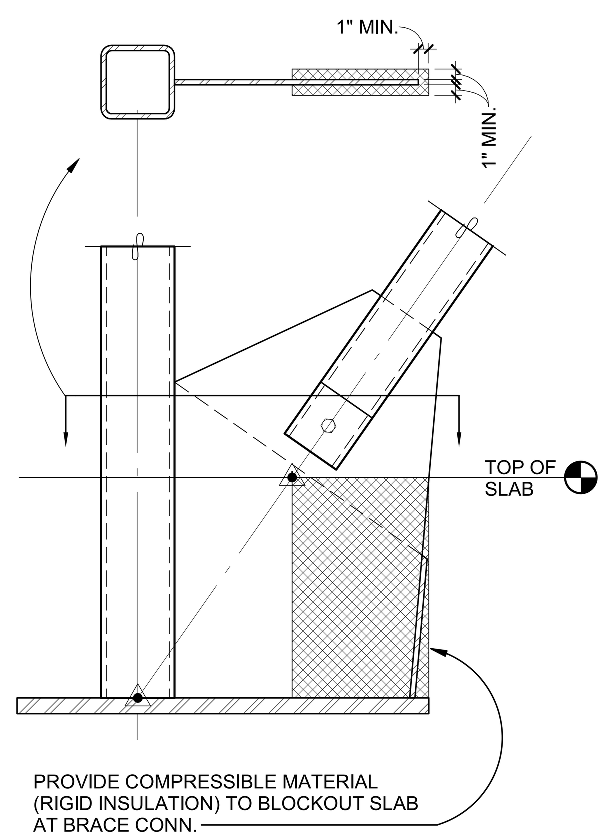
TITLE
STEEL FRAMING DETAILS

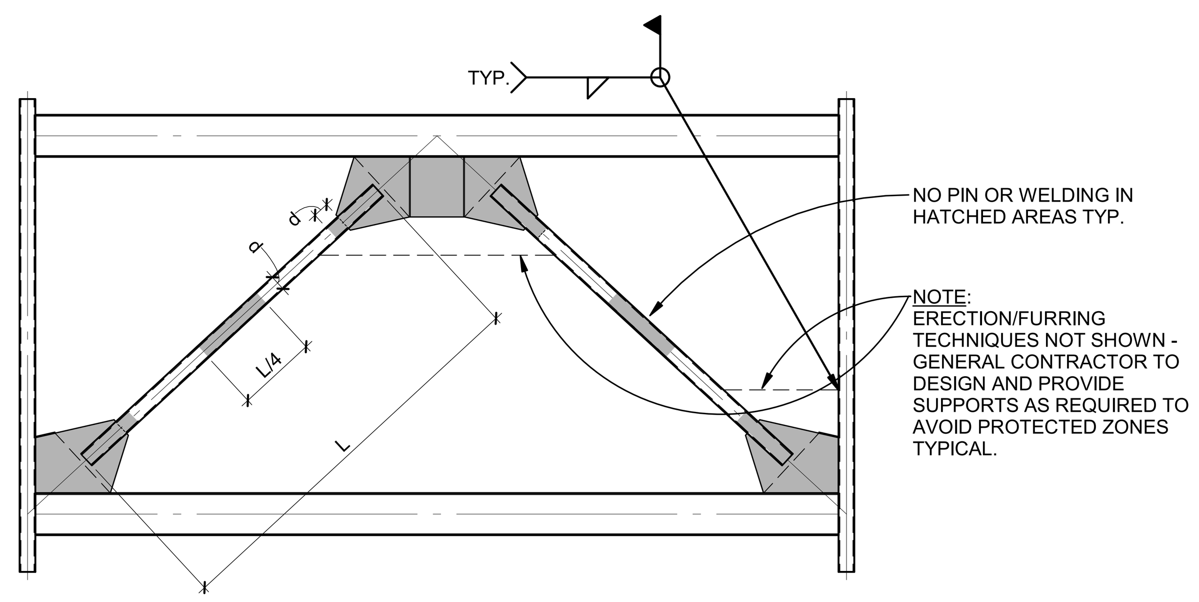
SHEET NUMBER
S7.00

9/27/2021 10:14:43 AM
C:_Revit Models\BUILDING 3 - ATC BLDG 3 IBC 2018 SDC C RC2 v2020 (Central)_dhome@pcs-structural.com.rvt



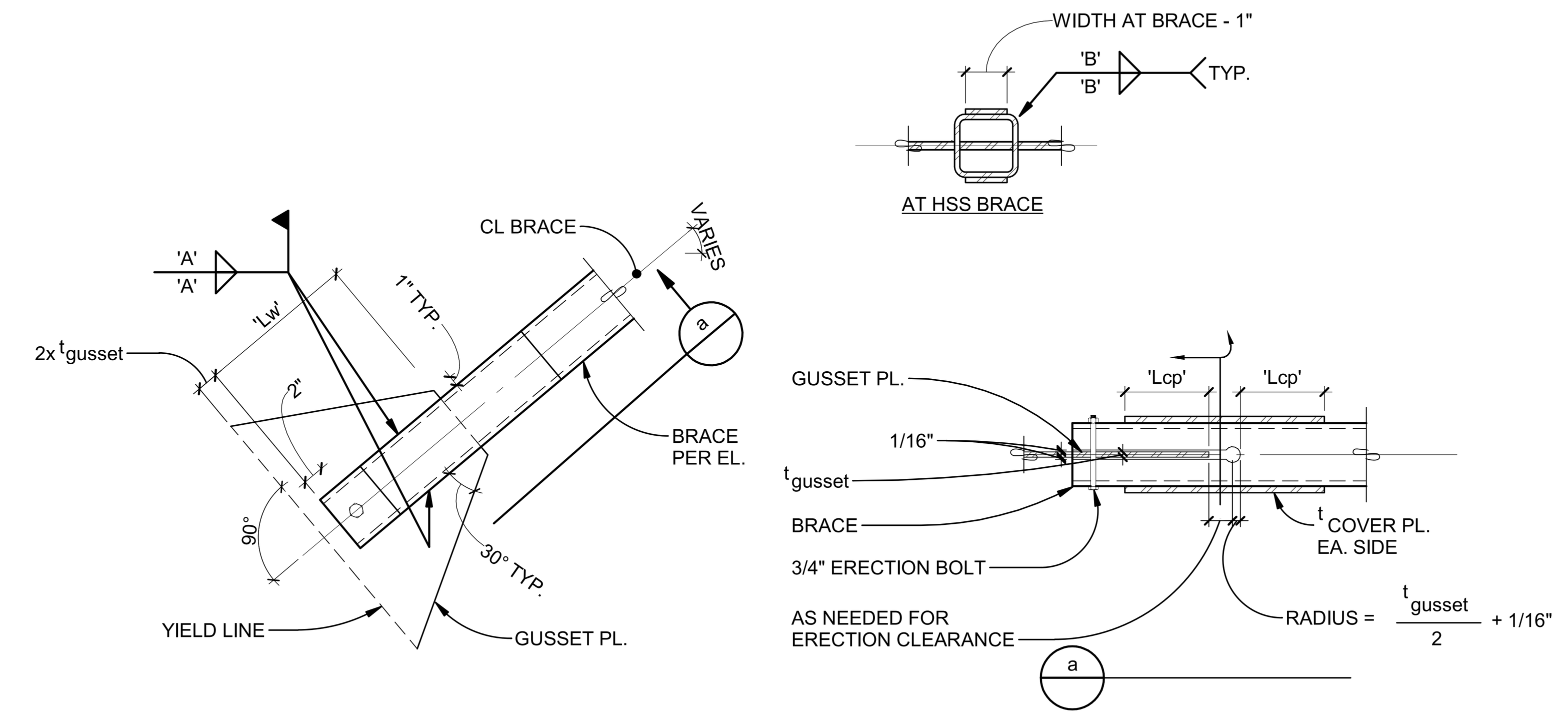
TYPICAL FOUNDATION SLAB BLOCKOUT AT BRACE CONNECTION

1 S7.01 DETAIL
NO SCALE



PROTECTED ZONE OF INVERTED-V BRACED FRAME

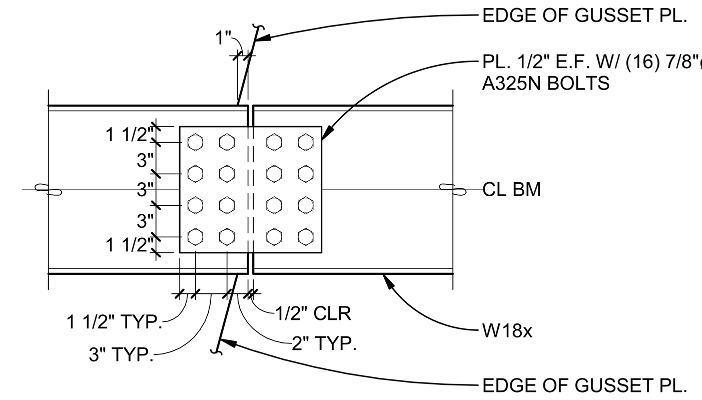
2 S7.01 SECTION
NO SCALE



SCHEDULE						
BRACE SIZE	t_{gusset} (in)	"Lw" (in)	WELD 'A'	$t_{COVER\ f}$ (in)	'Lcp" (in)	WELD 'B'
HSS 3 1/2x3 1/2	3/4"	16"	5/16	3/8"	10"	1/4
HSS 5x5 AND HSS 4 1/2x4 1/2	3/4"	18"	5/16	7/16"	10"	1/4

PIPE BRACE TO GUSSET PLATE CONNECTION

3 S7.01 DETAIL
NO SCALE



4 S7.01 DETAIL
1" = 1'-0"

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DRAWINGS
30 SEPTEMBER, 2021

Job Number	19-051
Checked	Checker
Approved	Approver

TITLE
STEEL FRAMING DETAILS

SHEET NUMBER
S7.01

Design Case C

1987 NBC
"Risk Category III"
"Seismic Design Category C"

C.1 Gravity Design

This building is a three-story Educational Facility. The vertical force-resisting system consists of normal-weight concrete slabs, 2-1/2", over the 3" metal deck with a total slab thickness of 5-1/2" at the second and third floors. The slabs at these floors are supported by a composite steel beam system and wide flange steel columns. The roof deck is comprised of a 2" metal deck with no topping. All the steel members (beams and columns) are Grade of ASTM A36 steel and are designed using the allowable stress design method (ASD) per AISC 8th Edition. The deflection was limited to the NBC prescribed limits of L/360 for applied live load and L/240 for applied total load.

The calculated design dead load is 75 PSF and partition load of 20 PSF on the second and third floors and a design dead load of 20 PSF at the roof. The live loads chosen for the floors and roof were provided by Section 1103 of the NBC. It should be noted that the 20 PSF roof min snow load controlled the design over the calculated snow load per Section 1111.0 of the NBC.

C.2 Lateral Design

There are two different LFRS in this building. The braced frames resist the lateral loads in the N-S direction, and moment frames resist the lateral loads in the E-W direction. The applied wind and seismic loads were determined using Section 1112.0 and 1113.0, respectively, from the NBC. In each case, the seismic design forces controlled the design, most likely due to the increased dead load caused by the concrete slab at two stories. In both directions, the eccentric loading, both calculated and required accidental (5%), was included in determining the applied frame forces at each level.

The N-S braced frames have a two-story X configuration and utilize ASTM A500 Gr B (yielding stress of 46 KSI) tube steel braces. The relative stiffness between the braced frames were designed to be similar, to efficiently distribute the applied load at each diaphragm to allow for overall efficiency of the brace, beam, and column sizes of the braced frame system. The global stiffness of the braced-frame system is relatively high, and the frames were strength controlled. Per NBC 1113.9.5, for building having an importance factor I greater than 1.0 and located in Seismic Zone 2(this design is within this category), all members in braced frames shall be designed for 1.25 times the force determined in accordance with Section 1113.4. At the foundations, the anchorage was designed to resist the uplift force due to overturning and the shear lugs were designed to transfer the applied shear forces to the foundations.

The E-W moment frames have a welded moment connection at the beam to column connection. This connection is a typical pre-Northridge Earthquake steel moment frame that has complete joint penetration continuous welds between column and beam flanges and bolted shear tab connection between column and beam web. This type of connection is not adequate to be treated as a “special moment frame,” and therefore, a K =1.0 was chosen for design. The design of the moment frame was controlled by a 0.5% drift limit in NBC.

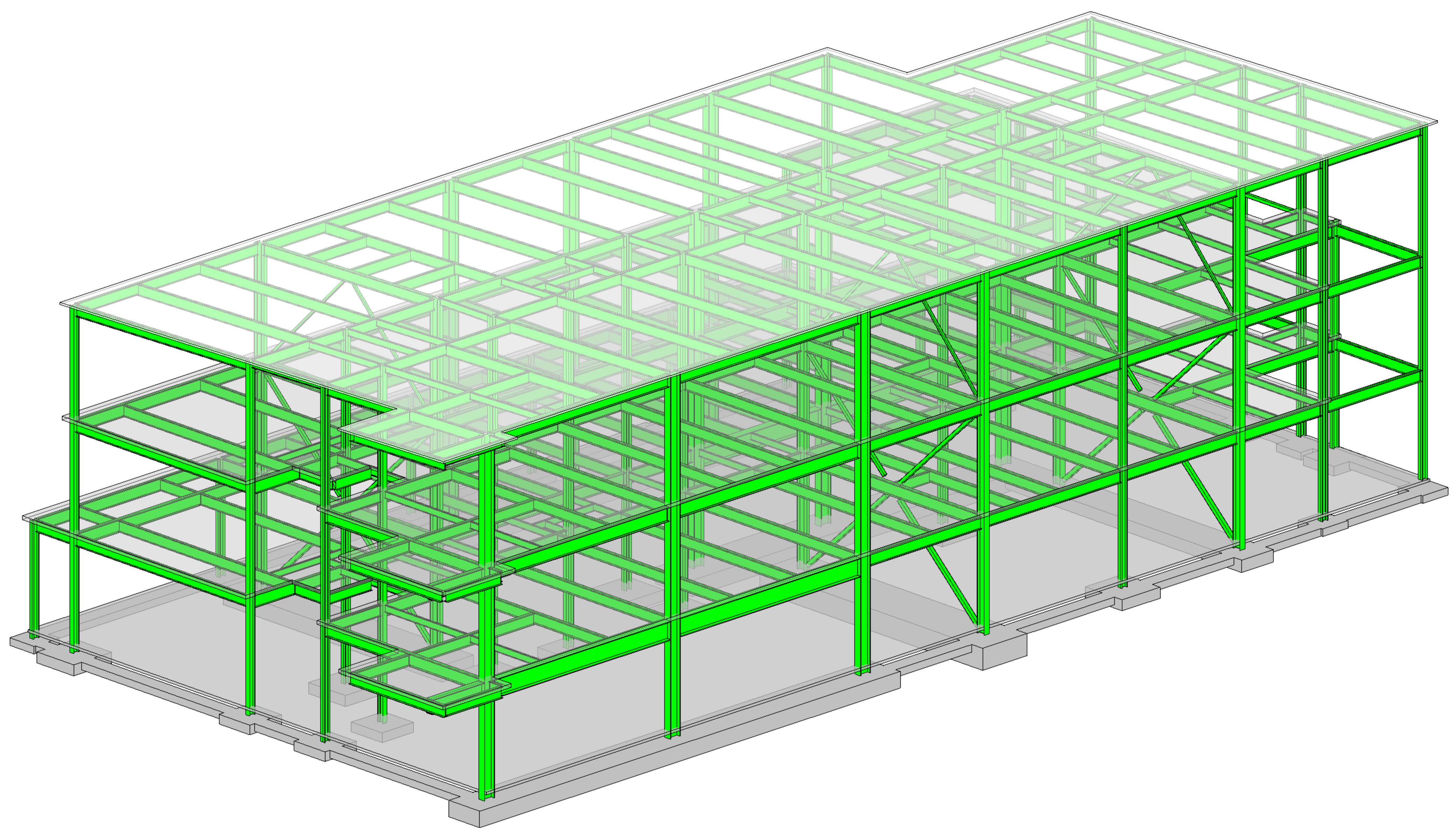
C.3 Steel Tonnage

Total steel tonnage for this design case is calculated as 160 tons.

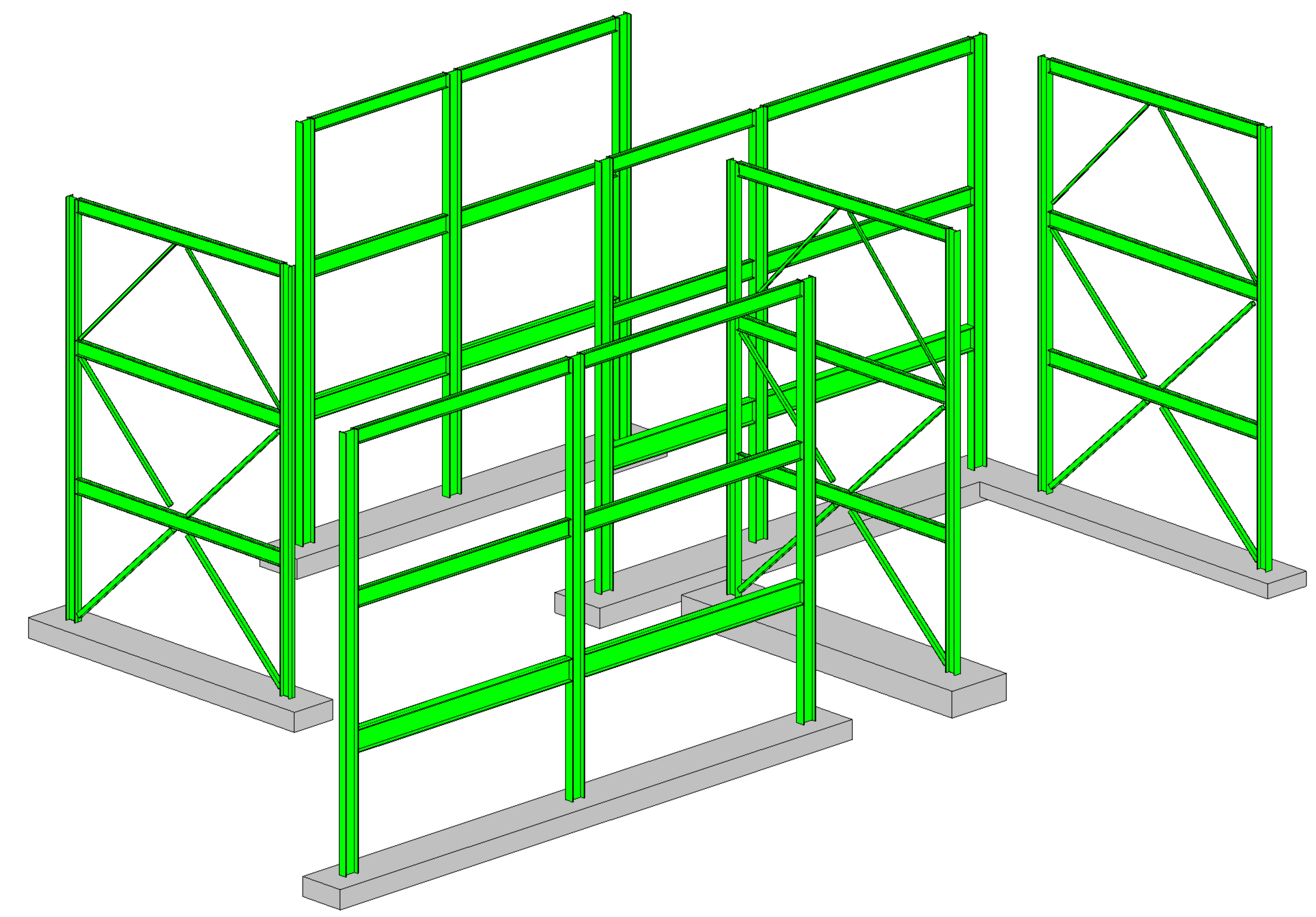
C.4 Structural Drawings

Structural drawings for Design Case B are provided on the following pages.

EDUCATIONAL FACILITY - ST. LOUIS, MISSOURI
DESIGN C - 1987 NBC WITH EQUIVALENT RISK CATEGORY III



OVERALL FRAMING 3D VIEW



FORCE RESISTING SYSTEM 3D VIEW

DESIGN A: 1987 NBC "RISK CATEGORY III" EQUIVALENT	
EDUCATION FACILITY, ST. LOUIS MISSOURI	
ITEM	QUANTITY
WF COLUMNS (Fy = 36 KSI)	22 TONS
WF GIRDERS AND JOISTS (Fy = 36 KSI)	79 TONS
MOMENT FRAME WF COLUMNS (Fy = 36 KSI)	23 TONS
MOMENT FRAME WF BEAMS (Fy = 36 KSI)	18 TONS
BRACED FRAME WF COLUMNS (Fy = 36 KSI)	9 TONS
BRACED FRAME WF BEAMS (Fy = 36 KSI)	7 TONS
STEEL TUBING BRACES (Fy = 46 KSI)	2 TONS
TOTAL	160 TONS

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

STRUCTURAL DRAWING INDEX

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1987 NBC WITH EQUIVALENT RISK CATEGORY III

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DRAWINGS
30 SEPTEMBER, 2021

Job Number	19-051
Checked	HL
Approved	DRS

TITLE
COVER SHEET

SHEET NUMBER
S0.00

GENERAL NOTES

STANDARDS
THE DESIGN AND MATERIALS SHALL CONFORM TO THE 1987 NATIONAL BUILDING CODE (NBC) AS AMENDED AND ADOPTED BY THE LOCAL BUILDING OFFICIAL OR APPLICABLE JURISDICTION.

STRUCTURAL DRAWINGS

PRIMARY STRUCTURAL ELEMENTS ARE DIMENSIONED ON STRUCTURAL PLANS AND DETAILS AND OVERALL LAYOUT OF STRUCTURAL PORTION OF WORK. STRUCTURAL DETAILS SHOW DIMENSIONAL RELATIONSHIPS TO CONTROL DIMENSIONS DEFINED BY DRAWINGS.

PROJECT LOCATION

ST. LOUIS, MISSOURI

38.6270 LATITUDE,-90.1994 LONGITUDE

DESIGN CRITERIA

VERTICAL LOADS

AREA	DESIGN DEAD LOAD	LIVE LOAD	CONCENTRATED LOADS
CLASSROOM AND OFFICE	90 PSF	50 PSF	1000#
CORRIDORS ABOVE 1ST FLOOR	90 PSF	80 PSF	1000#
ROOF	20 PSF	20 PSF	-

SNOW:

Pg = 20 PSF = GROUND SNOW LOAD
Pf = CeI Pg = FLAT ROOF SNOW LOAD = 15.4 PSF, USE 20 FOR CALCULATION
I = 1.1, Ce = 1.0

LATERAL FORCES

LATERAL FORCES ARE TRANSMITTED BY DIAPHRAGM ACTION OF ROOF AND FLOORS TO BRACED FRAME/MOMENT FRAME. LOADS ARE THEN TRANSFERRED TO FOUNDATION BY BRACED FRAME/MOMENT FRAME ACTION WHERE ULTIMATE DISPLACEMENT IS RESISTED BY PASSIVE PRESSURE OF EARTH AND/OR SLIDING FRICTION. OVERTURNING IS RESISTED BY DEAD LOAD OF THE STRUCTURE.

WIND:

THE BUILDING MEETS THE CRITERIA PER NBC 1987 SECTION 1112.0.

- EXPOSURE CATEGORY = B
- BASIC WIND SPEED, V = 70 MPH
- EQUIVALENT RISK CATEGORY PER TABLE 1.5-1 = III
- PRESSURE COEFFICIENT (ENCLOSED) = 0.8, -0.5
- WIND IMPORTANCE FACTOR I_W = 1.07
- BRACE FRAME BASE SHEAR V = 89.9 KIPS; MOMENT FRAME BASE SHEAR V=63.5 KIPS

SEISMIC: (NBC 1987) V = Z IKCSW

Z = 3/8
SEISMIC IMPORTANCE FACTOR, I = 1.25
EQUIVALENT RISK CATEGORY PER TABLE 1113.1 = III
K = 1.0 AT BRACED FRAME, K = 1.0 AT MOMENT FRAME
W = EFFECTIVE SEISMIC WEIGHT OF BUILDING = 2340 KIPS
ANALYSIS PROCEDURE USED = EQUIVALENT LATERAL FORCE PROCEDURE
DESIGN BRACE FRAME BASE SHEAR V = 154 KIPS
DESIGN MOMENT FRAME BASE SHEAR V = 144 KIPS

FOUNDATION DESIGN CRITERIA

SOIL BEARING PRESSURE: 4000 PSF (ASSUMED)

ACTIVE PRESSURE - RESTRAINED: 50 PCF +14H SEISMIC SURCHARGE (ASSUMED)
ACTIVE PRESSURE - UNRESTRAINED: 35 PCF +6H SEISMIC SURCHARGE (ASSUMED)
PASSIVE RESISTANCE: 200 PCF (INCLUDES F.O.S. ≥ 1.5) (ASSUMED)
COEFFICIENT OF FRICTION: .35 (INCLUDES F.O.S. ≥ 1.5) (ASSUMED)
*1/3 INCREASE ALLOWED FOR SEISMIC OR WIND LOADING

CONCRETE

CAST-IN-PLACE CONCRETE

ITEM	DESIGN f'c (PSI) (AT 28 DAYS U.N.O.)
FOUNDATIONS - UNO	3000
SLAB ON GRADE & CONCRETE OVER METAL DECK	4000
ALL OTHER CONCRETE	4000

REINFORCING STEEL

ASTM A615, GRADE 60 TYPICAL UNLESS NOTED OTHERWISE.

REINFORCING SPLICE AND DEVELOPMENT LENGTH SCHEDULE, Fy=40 KSI (UNLESS NOTED OTHERWISE)

BAR SIZE	MINIMUM LAP SPLICE LENGTHS ("Ls")	MINIMUM DEVELOPMENT LENGTHS ("Ld")
#3	1'-6"	1'-3"
#4	2'-0"	1'-7"
#5	2'-7"	2'-0"
#6	3'-1"	2'-4"
#7	4'-6"	3'-6"
#8	5'-2"	3'-11"
#9	5'-10"	4'-6"
#10	6'-6"	5'-0"
#11	7'-3"	5'-7"

STRUCTURAL STEEL

MATERIAL PROPERTIES

WIDE FLANGE SECTIONS: ASTM A36 (Fy = 36 KSI)

OTHER SHAPES AND PLATES: ASTM A36 (Fy = 36 KSI)

STRUCTURAL TUBING: RECTANGULAR & SQUARE - A500 GRADE BB (Fy = 46 KSI)

MACHINE BOLTS (M.B.): ASTM A307

HIGH-STRENGTH BOLTS: A325, A490

ANCHOR BOLTS (A.B.): ASTM A490, GRADE 36, UNLESS OTHERWISE NOTED

GENERAL REQUIREMENTS

HEADED STUDS: SHALL BE "S3L SHEAR CONNECTORS" FOR STUDS 3/4" DIAMETER AND LARGER AS MANUFACTURED BY NELSON STUD WELDING, INC. OR PRE-APPROVED EQUAL AND SHALL CONFORM TO AWS D1.1.

COMPOSITE FLOOR DECK: SHALL CONTAIN THE MINIMUM PROPERTIES SHOWN ON THE STRUCTURAL DRAWINGS. THE FLOOR UNITS SHALL BE FORMED FROM STEEL SHEETS CONFORMING TO ASTM A653, AND GALVANIZED PER ASTM A924.

ABBREVIATION LIST

@	AT	GR.	GRADE
A.B.	ANCHOR BOLT	HORIZ.	HORIZONTAL
ADD'L	ADDITIONAL	HSS	HOLLOW STRUCTURAL SECTION
ALT.	ALTERNATE	HT	HEIGHT
BLD'G	BUILDING	INT.	INTERIOR
BM	BEAM	JT	JOINT
B.O.F.	BOTTOM OF FOOTING	L	ANGLE
BOT.	BOTTOM	L.F.R.S.	LATERAL FORCE-RESISTING SYSTEM
BRG	BEARING	L.L.	LIVE LOAD
BTWN	BETWEEN	LLH	LONG LEG HORIZONTAL
(C=)	CAMBER	LLV	LONG LEG VERTICAL
CANT.	CANTILEVER	LOC.	LOCATION
C.J.	CONTROL/CONSTRUCTION JOINT	MAX.	MAXIMUM
CL	CENTERLINE	M.B.	MACHINE BOLT
CLR.	CLEARANCE	MIN.	MINIMUM
COL.	COLUMN	MISC.	MISCELLANEOUS
CONC.	CONCRETE	MTL	METAL
CONN.	CONNECTION	N.F.	NEAR FACE
CONST.	CONSTRUCTION	N.S.	NEAR SIDE
CONT.	CONTINUOUS	NTS	NOT TO SCALE
COORD.	COORDINATE	O.C.	ON CENTER
C.P.	COMPLETE PENETRATION	OPN'G	OPENING
CTR'D	CENTERED	OPP.	OPPOSITE
C.Y.	CUBIC YARD	PERP.	PERPENDICULAR
DBL.	DOUBLE	PL.	PLATE
DIA. OR ø	DIAMETER	P.P.	PARTIAL PENETRATION
DIAG.	DIAGONAL	P.S.F.	POUNDS PER SQUARE FOOT
DIM.	DIMENSION	REINF.	REINFORCING
D.L.	DEAD LOAD	REQ'D	REQUIRED
DWG	DRAWING	SCHED.	SCHEDULE
DWL	DOWEL	SIM.	SIMILAR
EA.	EACH	S.O.G.	SLAB ON GRADE
E.F.	EACH FACE	SQ.	SQUARE
EL.	ELEVATION	STD	STANDARD
ENGR.	ENGINEER	STIFF.	STIFFENER
EQ.	EQUAL	STL	STEEL
E.W.	EACH WAY	STRUCT.	STRUCTURAL
EXP.	EXPANSION	T&B	TOP & BOTTOM
EXT.	EXTERIOR	THR'D	THREADED
FDN	FOUNDATION	T.O.F.	TOP OF FOOTING
F.F.	FAR FACE	T.O.S.	TOP OF STEEL
FLR	FLOOR	TYP.	TYPICAL
FRM'G	FRAMING	U.N.O.	UNLESS NOTED OTHERWISE
F.S.	FAR SIDE	VERT.	VERTICAL
FTG	FOOTING	W/	WITH
GA.	GAGE/GAUGE	W.P.	WORK POINT
GALV.	GALVANIZED	WT	WEIGHT

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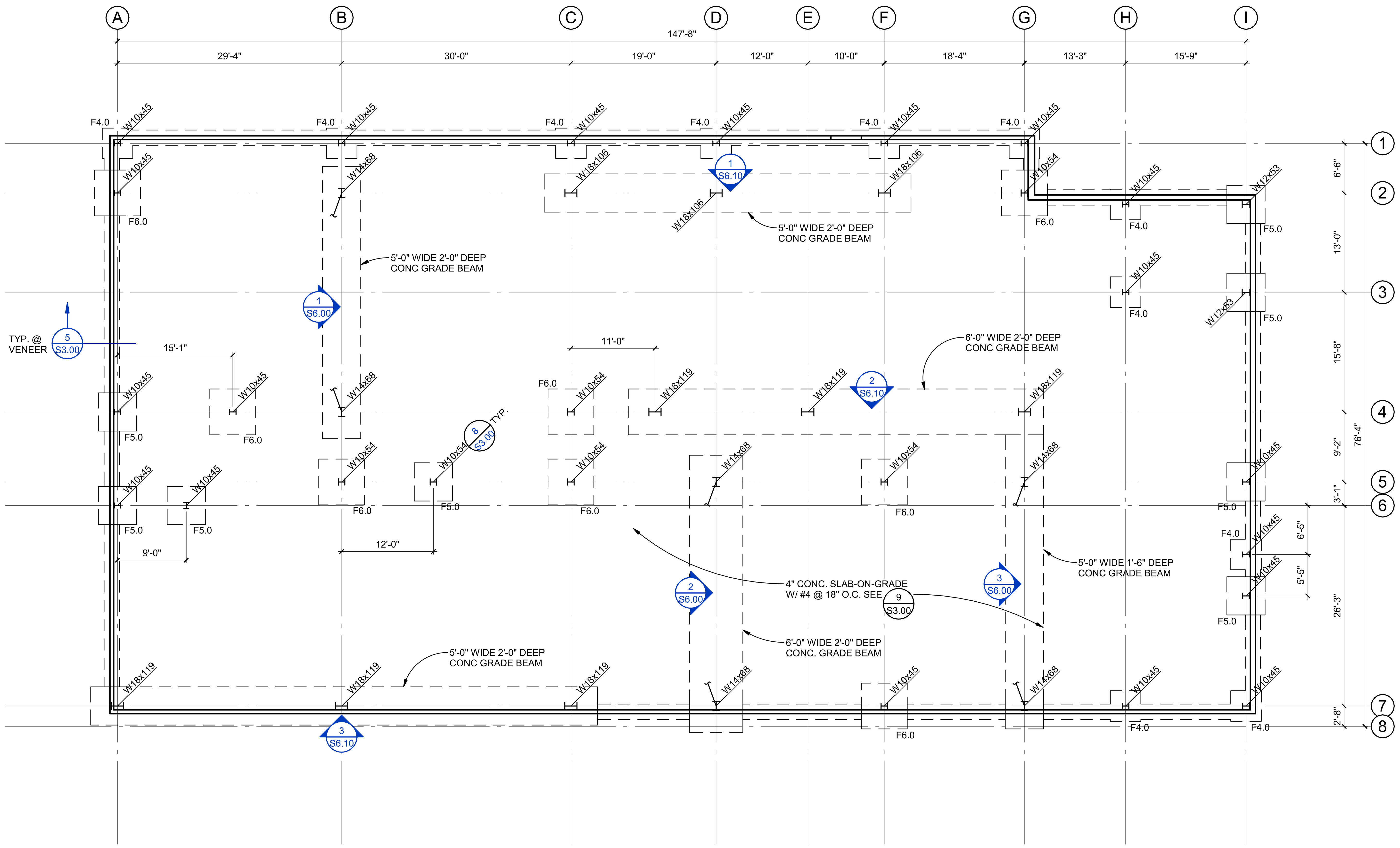
TITLE
GENERAL NOTES

SHEET NUMBER
S0.10



NORTH

1 S2.00 FOUNDATION AND GRADE LEVEL FRAMING PLAN
1/8" = 1'-0"

FOUNDATION NOTES

1. INDICATES WALL STUDS.
2. INDICATES CONTINUOUS CONCRETE WALL FOOTING. FOR TYPICAL FOOTING AND FOUNDATION WALL DETAILS SEE SHEET S3.00. FOOTING WIDTH ("W") = 2'-0" UNLESS NOTED OTHERWISE ON PLAN. CENTER FOOTINGS ON CONCRETE STEM WALL.
3. "F_" INDICATES CONCRETE SPREAD FOOTING. FOR SCHEDULE SEE 7/S3.00.
4. X X.XX INDICATES BRACED FRAME OR MOMENT FRAME. FOR ELEVATIONS, MEMBER SIZES AND DETAIL CALLOUTS SEE SHEET S6.00 AND S6.10.
5. W10x45 INDICATES STEEL COLUMNS ORIGINATING AT FOUNDATION LEVEL. ALL COLUMNS ARE CONTINUOUS TO ROOF UNLESS NOTED OTHERWISE. FOR TYPICAL DETAIL SEE 8/S3.00.
6. FOR TYPICAL FOUNDATION DETAILS SEE SHEET S3.00.
7. TOP OF FOOTING ELEVATIONS = -1'-0" UNLESS NOTED OTHERWISE ON PLANS AND DETAILS.

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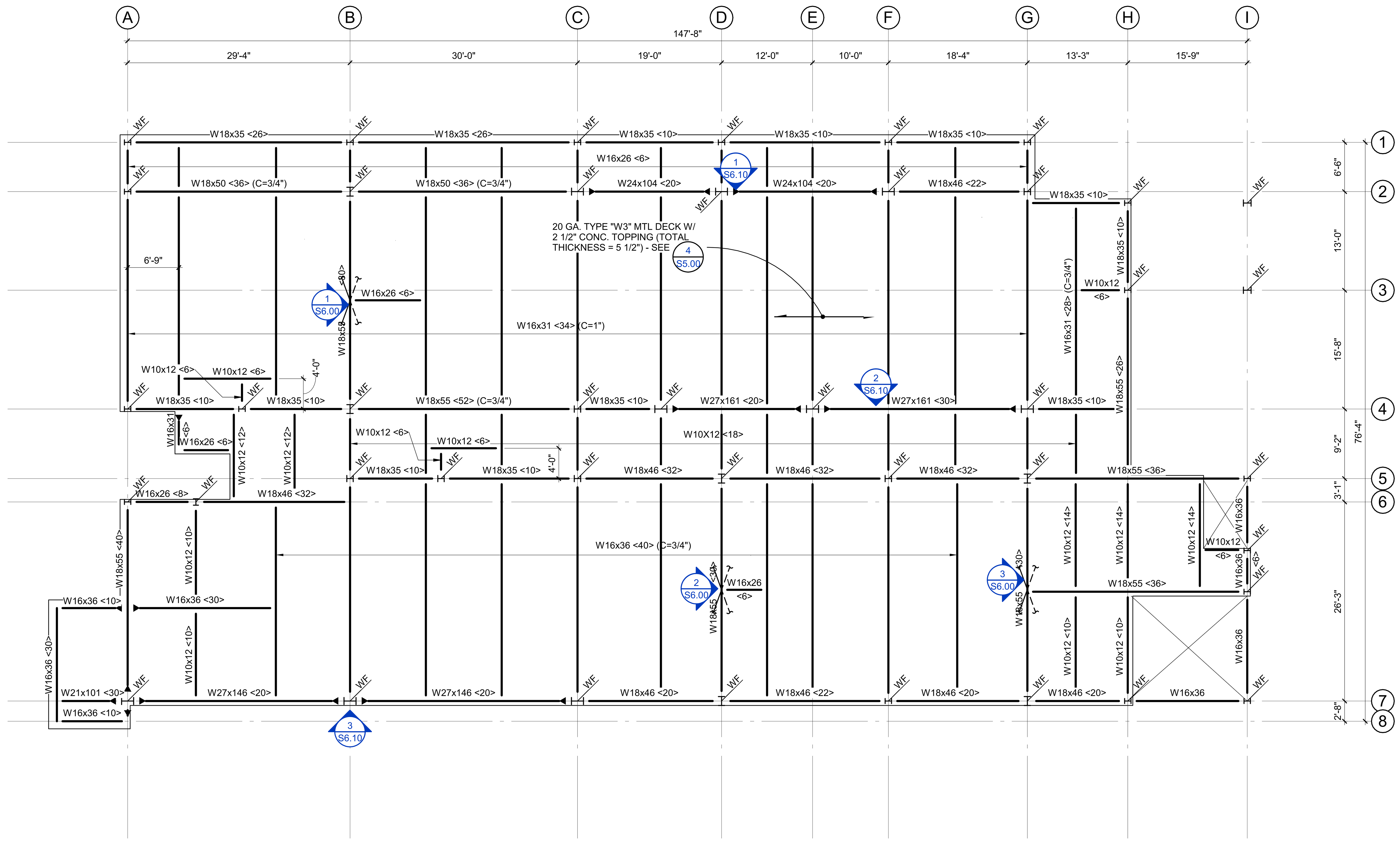
TITLE
FOUNDATION AND GRADE LEVEL FRAMING PLAN

SHEET NUMBER
S2.00

9/27/2021 10:42:43 AM



T.O.S. = 13'-3 1/2"

FOR FRAMING NOTES SEE S2.10

NORTH

1
S2.10

FRAMING PLAN - LEVEL 2

1/8" = 1'-0"

FLOOR FRAMING NOTES

1. INDICATES BRACED FRAME. FOR ELEVATIONS, BRACE SIZES AND DETAIL CALLOUTS SEE SHEET S6.00. ALL BEAMS THAT ARE PART OF A BRACED FRAME SHALL BE CONSIDERED "COLLECTOR" BEAMS. ALL MEMBERS AND CONNECTIONS THAT ARE PART OF A BRACED FRAME SHALL BE CONSIDERED PART OF THE LATERAL-FORCE RESISTING SYSTEM.
2. INDICATES STEEL COLUMN CONTINUOUS TO FLOOR/ROOF ABOVE.
3. INDICATES PENETRATION IN FLOOR STRUCTURE. FOR TYPICAL REINFORCING AROUND OPENINGS SEE 5/S5.00.
4. FOR TYPICAL COMPOSITE BEAM AND METAL DECK DETAILS SEE SHEET S5.00.
5. INDICATES DIRECTION OF SPAN FOR METAL DECK.
6. FOR TYPICAL STEEL CONNECTION DETAILS SEE SHEET S5.00.

INDICATES BEAM/GIRDER CAMBER IN INCHES

INDICATES THE TOTAL QUANTITY OF SHEAR STUDS. SPACE STUDS PER 9/S5.00

INDICATES BEAM/GIRDER SIZE

1/S5.00 TYP. U.N.O.

1/S5.00 TYP. U.N.O.

W18x35 <16> (C=1/2")

2/S5.00 TYP. U.N.O.

CANTILEVER BEAM SECTION IS THE SAME SIZE AS THE BACKSPAN U.N.O.

PLAN CALLOUTS INDICATE SPECIAL CONNECTION DETAIL

XX
XX

7. STEEL MEMBERS ARE EQUALLY SPACED BETWEEN DIMENSION POINTS UNLESS NOTED OTHERWISE.
8. INDICATES MOMENT FRAME. FOR ELEVATIONS AND DETAIL CALLOUT SEE SHEET S6.10. ASSOCIATED MEMBERS AND CONNECTIONS ARE PART OF THE LATERAL-FORCE RESISTING SYSTEM.

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TITLE

FRAMING PLAN - LEVEL 2

SHEET NUMBER

S2.10

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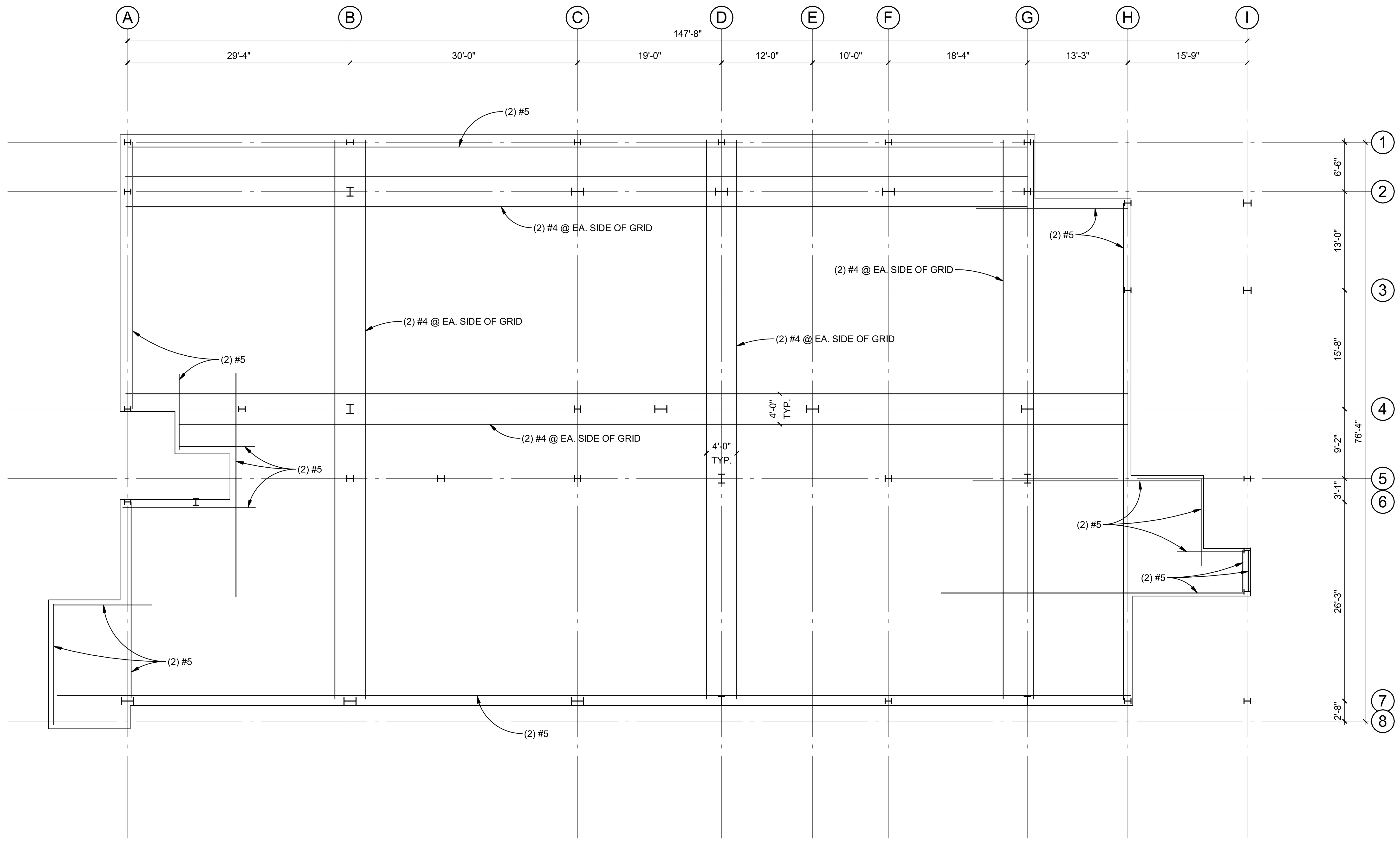

NORTH

1 S2.10R SLAB REINFORCING PLAN - LEVEL 2

1/8" = 1'-0"

SLAB PLAN NOTES:
1. PROVIDE #4 AT 24" O.C. EACH WAY AT SLAB ON METAL DECK-TYPICAL OVER ENTIRE FLOOR.
2. SLAB REINFORCING SHOWN IN THE PLAN IN ADDITION TO TYPICAL REINFORCING NOTED ABOVE.
3. SPLICE ALL REINFORCING PER GENERAL NOTES.
4. PROVIDE STANDARD HOOK AT ALL BARS WHICH CANNOT BE EXTENDED.
5. STAGGER ALL LAP SPLICES.

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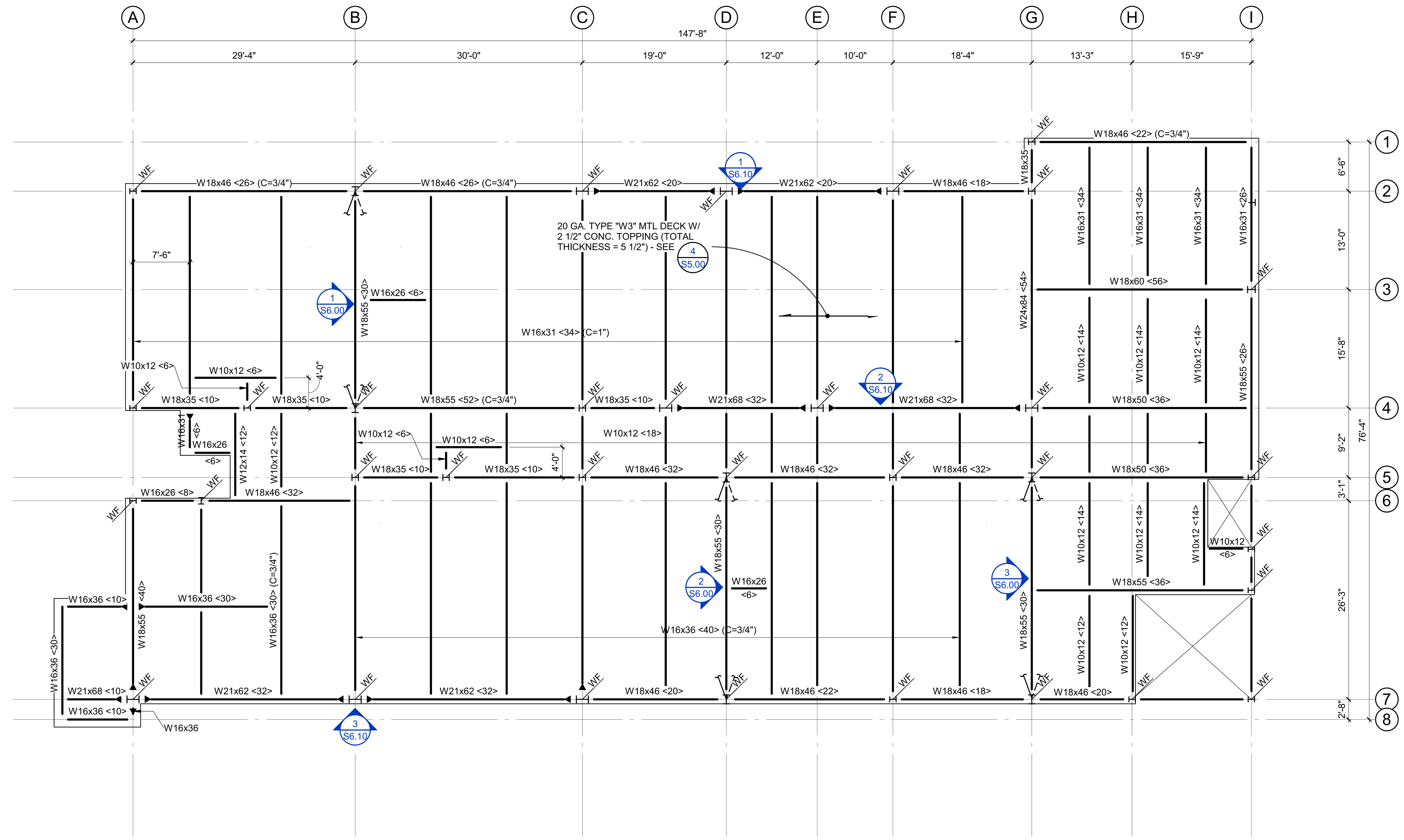
TITLE

LEVEL 2 SLAB REINFORCING PLAN

SHEET NUMBER

S2.10R



T.O.S. = 27'-0 1/2"

FOR FRAMING NOTES SEE S2.10

FRAMING PLAN - LEVEL 3

1/8" = 1'-0"

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TITLE

FRAMING PLAN - LEVEL 3

SHEET NUMBER

S2.20

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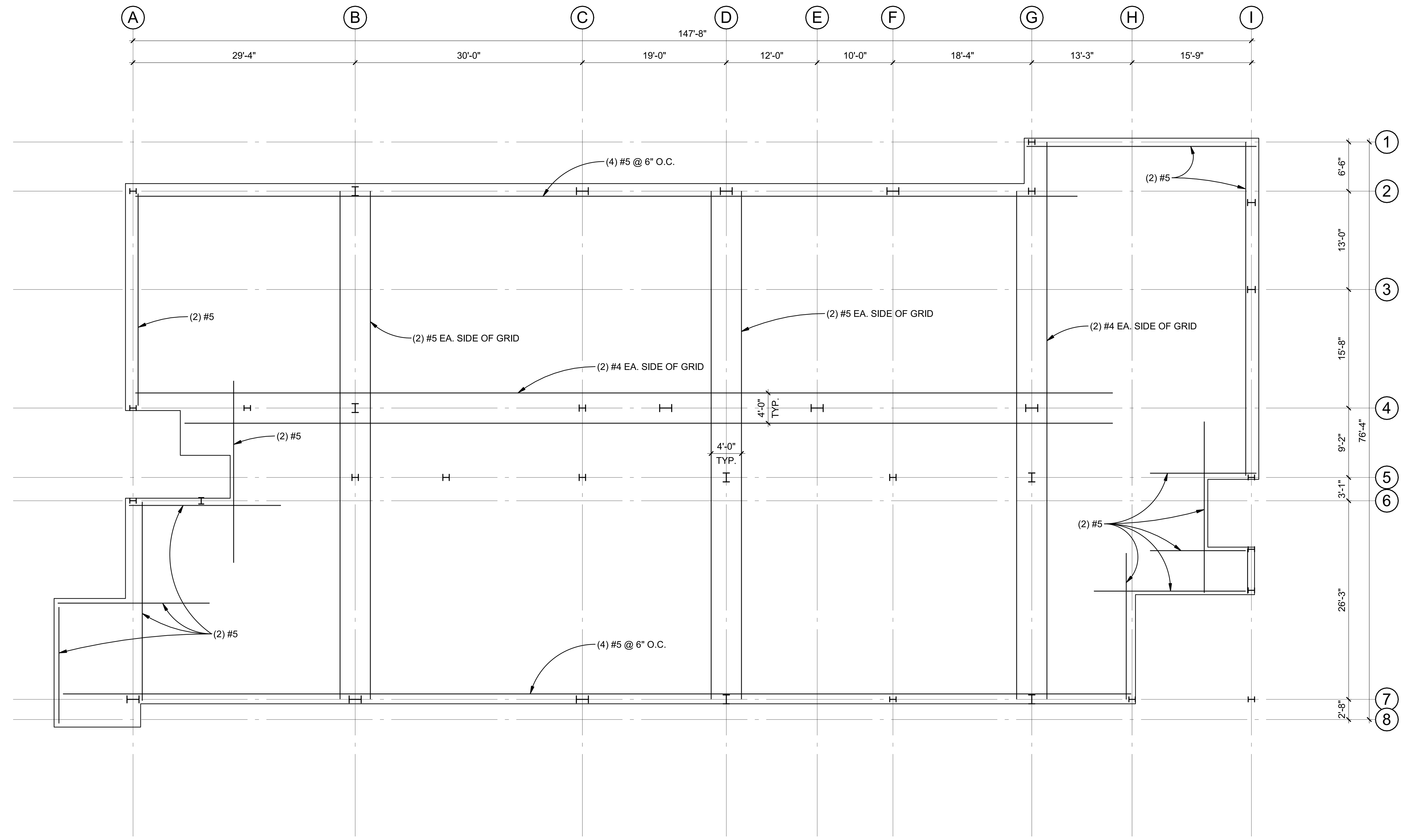

FOR SLAB PLAN NOTES SEE S2.10R

NORTH

1 S2.20R **SLAB REINFORCING PLAN - LEVEL 3**

1/8" = 1'-0"

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TITLE

LEVEL 3 SLAB REINFORCING PLAN

SHEET NUMBER

S2.20R

T.O.S. = 41'-0 1/4"

FOR FRAMING NOTES SEE S2.10

ROOF FRAMING PLAN

1 S2.30

1/8" = 1'-0"

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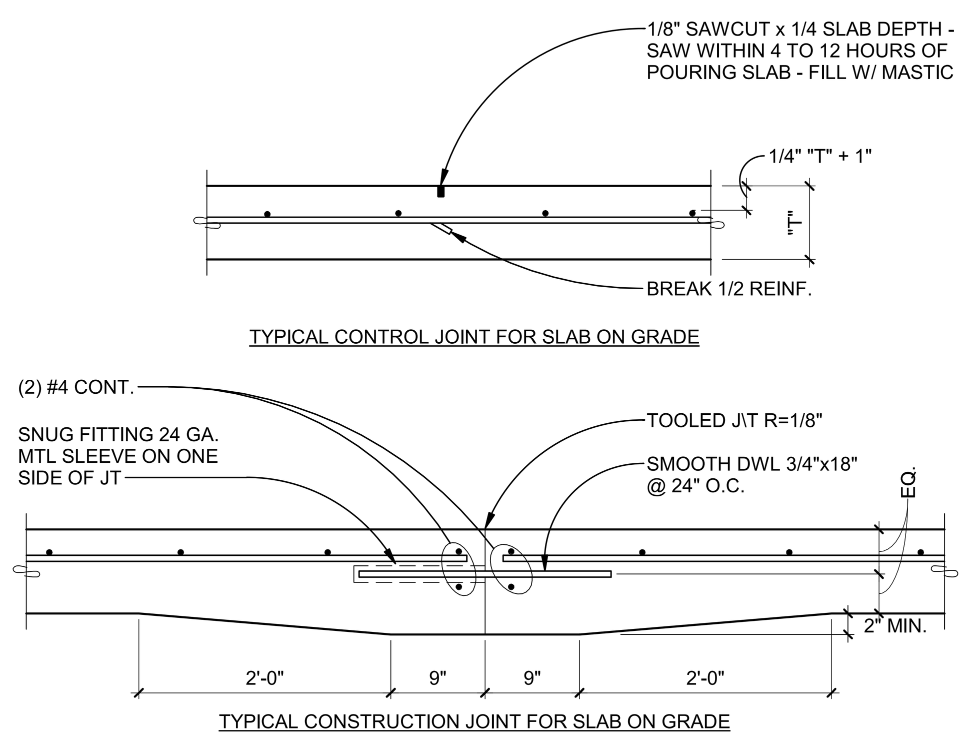
TITLE

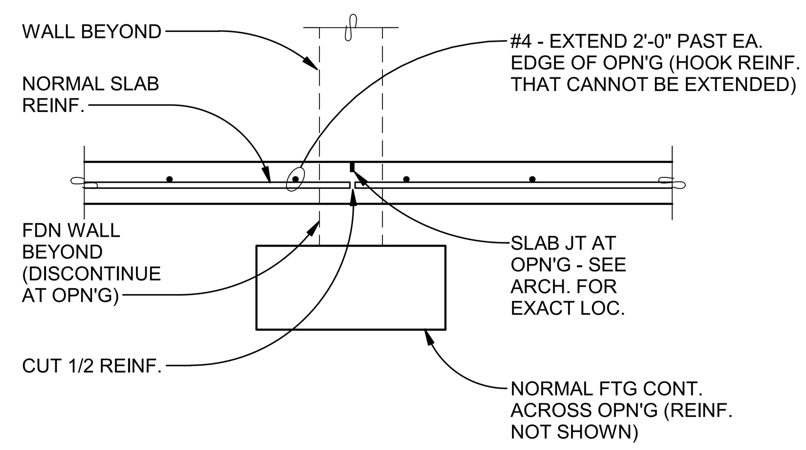
ROOF FRAMING PLAN

SHEET NUMBER

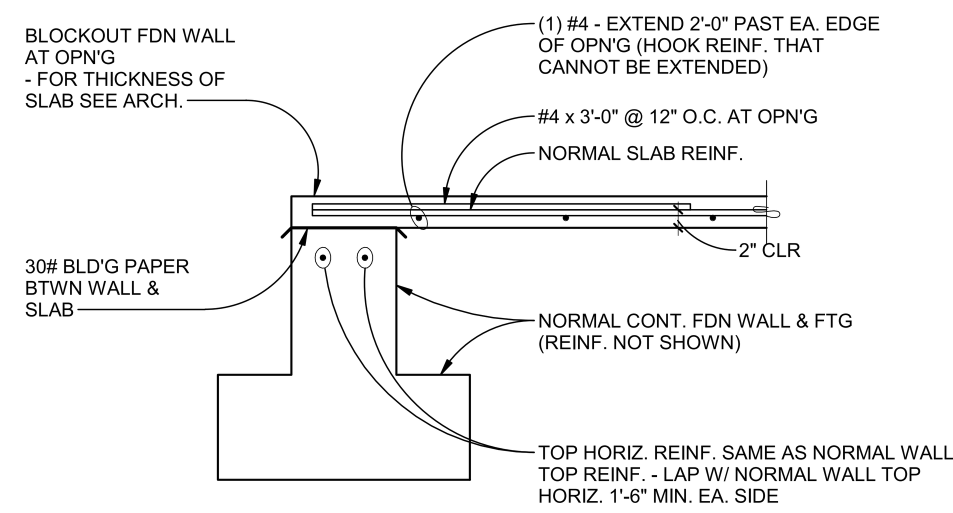
S2.30



1 SECTION
S3.00 NO SCALE

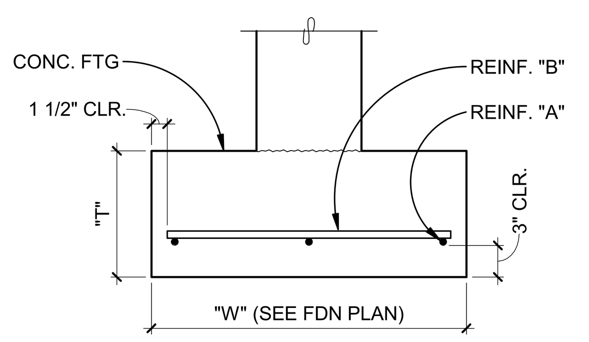


2 SECTION
S3.00 NO SCALE



TYPICAL SLAB AT EXTERIOR OPENING

3 SECTION
S3.00 NO SCALE

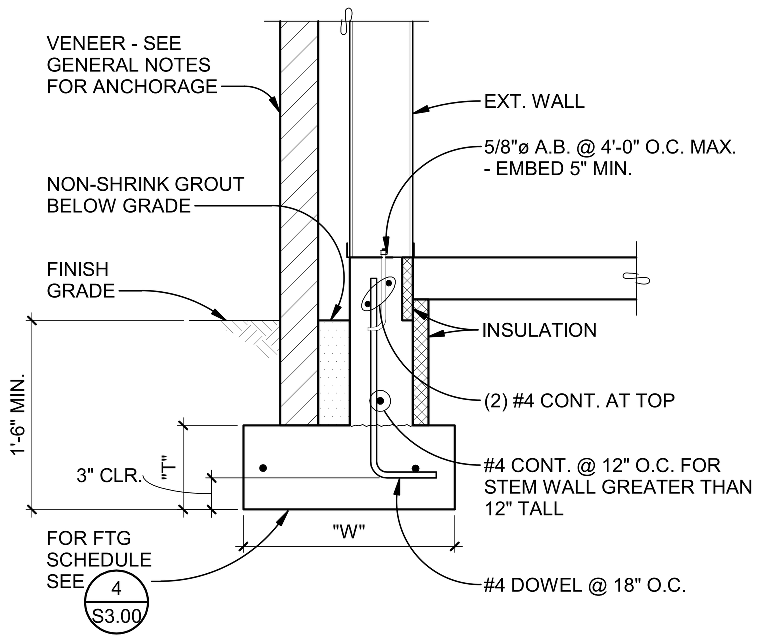


WIDTH "W"	"T"	REINF. "A" CONT.	REINF. "B"
2'-0"	11"	(2) #5	---

NOTES:
1. FOOTINGS SHALL BEAR ON UNDISTURBED OR COMPACTED MATERIAL - SEE GENERAL NOTES.
2. EXTEND FOOTINGS 6" MIN. PAST ENDS OF WALL UNLESS OTHERWISE NOTED.
3. WHERE FOOTINGS CHANGE WIDTHS LAP REINFORCING "A". "Ls" PER GENERAL NOTES.

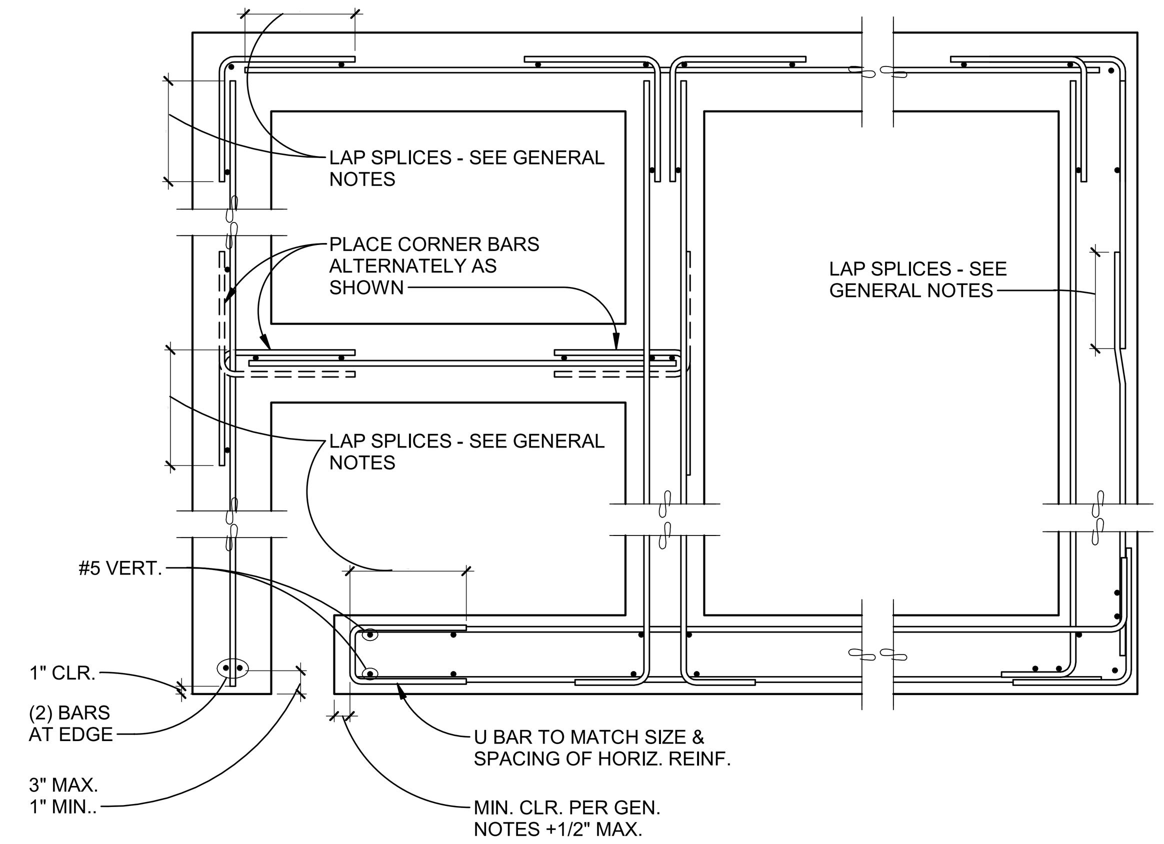
TYPICAL CONTINUOUS FOOTING DETAIL

4 SECTION
S3.00 NO SCALE



TYPICAL FOUNDATION AT EXTERIOR WALL WITH VENEER

5 SECTION
S3.00 NO SCALE

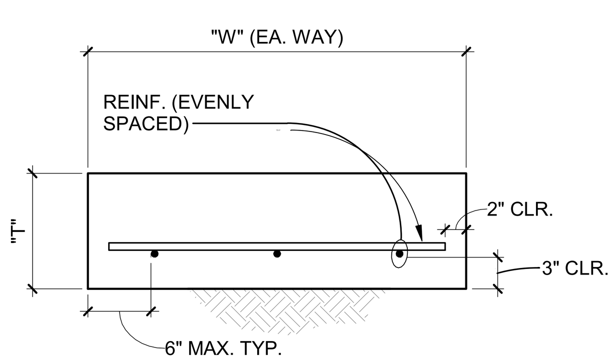


NOTES:
1. VERT. REINF. SHOWN IS ADD'L IF NORMAL STEM WALL REINF. IS NOT IN PROPER LOCATION.
2. CORNER BARS ARE SAME SIZE & SPACING AS HORIZ. REINF.
3. 90° STD HOOK MAY BE SUBSTITUTED FOR CORNER BARS. SEE NOTE #5.
4. REINF. AT ALL CORNERS, ENDS, & INTERSECTIONS OF WALLS SHALL BE PLACED IN ACCORDANCE W/ APPROPRIATE DETAIL SHOWN.
5. USE 90° STD HOOK FOR EMBEDMENT LESS THAN 24" PAST FACE OF WALL.

TYPICAL REINFORCING PLACEMENT FOR CAST IN PLACE CONCRETE WALLS AND STEM WALLS

6 DETAIL
S3.00 NO SCALE

MARK	DIMENSIONS		REINF. EA. WAY
	"W"	"T"	
F4.0	4'-0"	11"	(4) #5
F5.0	5'-0"	14"	(5) #6
F6.0	6'-0"	16"	(6) #7

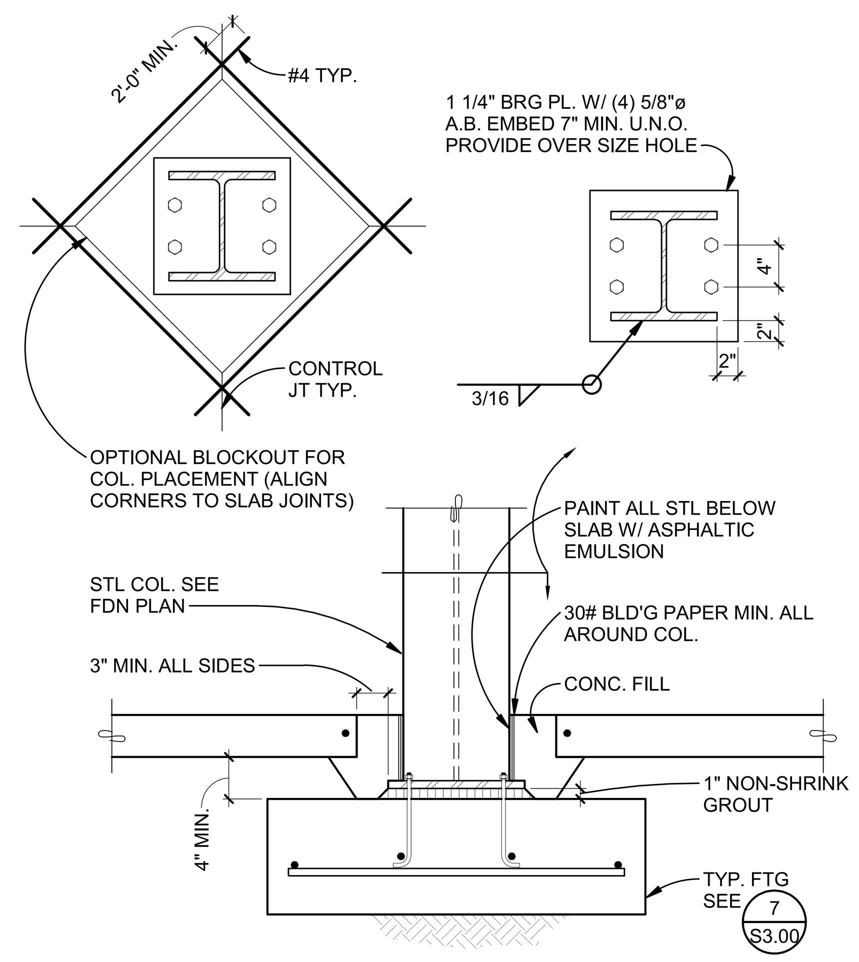


SECTION

NOTES:
1. CENTER ALL FOOTINGS ON COLUMN ABOVE EXCEPT AS SHOWN OTHERWISE.
2. FOOTINGS SHALL BEAR ON UNDISTURBED OR COMPACTED MATERIAL, SEE GENERAL NOTES. DESIGN BEARING PRESSURE IS 4000 PSF.

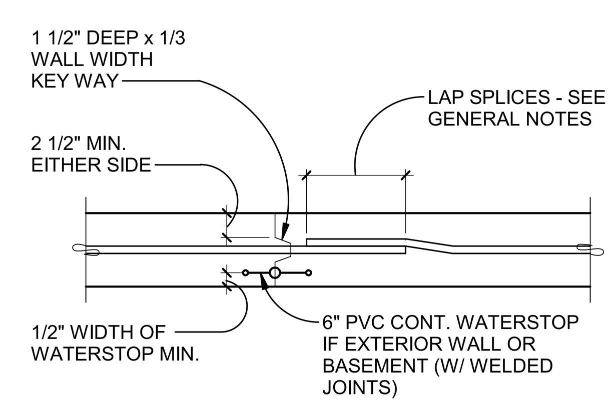
TYPICAL CONCRETE SPREAD FOOTING DETAILS

7 SECTION
S3.00 NO SCALE

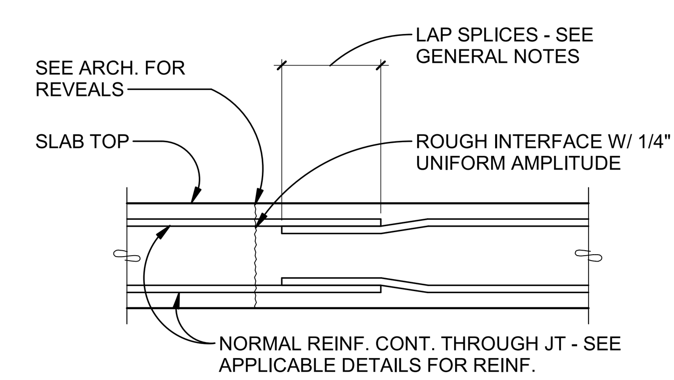


TYPICAL STEEL COLUMN AT SPREAD FOOTING

8 SECTION
S3.00 NO SCALE



TYPICAL AT VERTICAL WALL JOINTS



TYPICAL AT CONCRETE GRADE BEAMS & FOOTINGS

NOTE:
OBTAIN APPROVAL OF ENGINEER FOR LOC. OF ANY C.J.

TYPICAL FOR CAST IN PLACE CONCRETE WALLS, GRADE BEAMS AND FOOTINGS

9 CONSTRUCTION JOINTS
S3.00 NO SCALE

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TITLE
FOUNDATION DETAILS
SHEET NUMBER
S3.00

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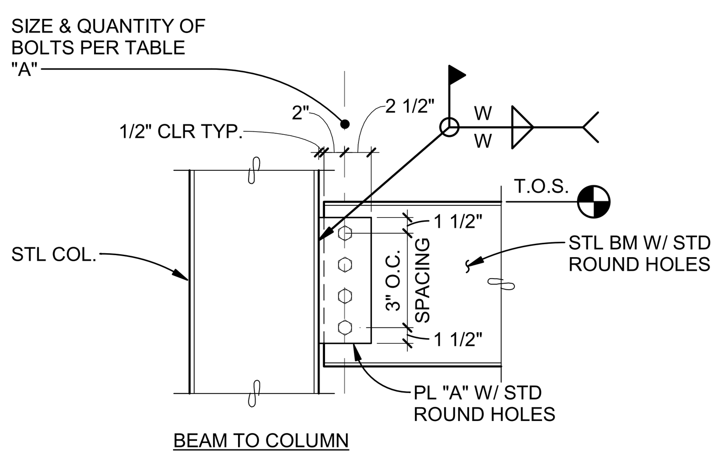
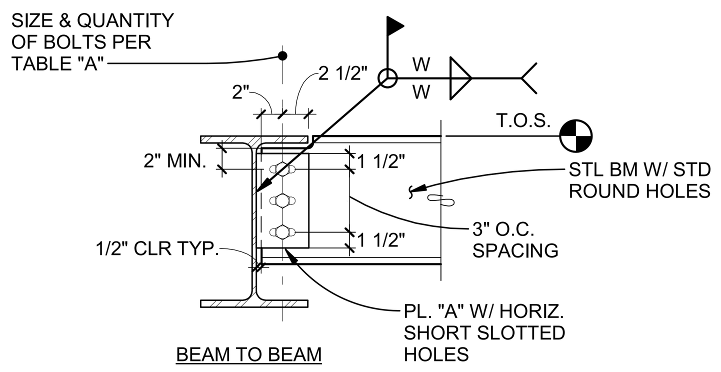
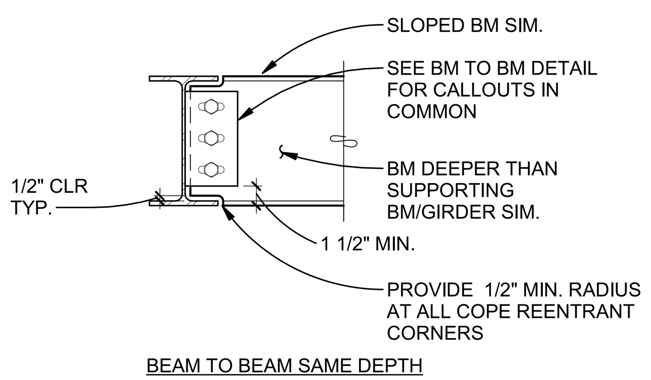


BEAM TO COLUMN



BEAM TO BEAM

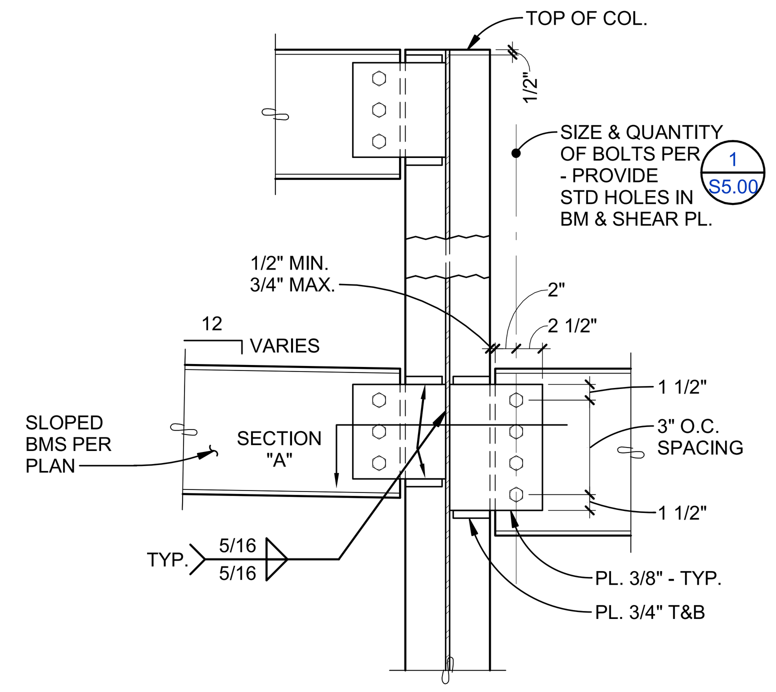


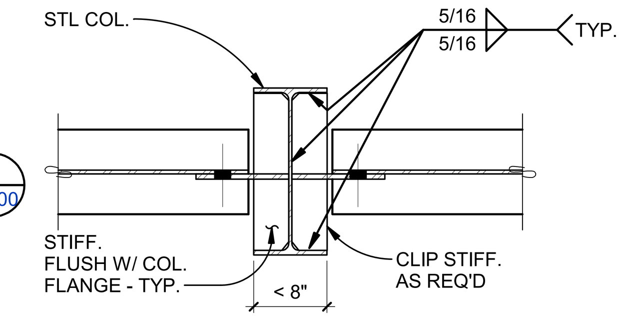
BEAM TO BEAM SAME DEPTH

TABLE A			
SUPPORTED BEAM SIZE	QUANTITY OF 7/8"ø A325N BOLTS	SHEAR PLATE THICKNESS "A"	WELD "W" NOTE 1.
W10	2	3/8"	5/16"
W16, W18	4	3/8"	5/16"
W21	5	3/8"	5/16"

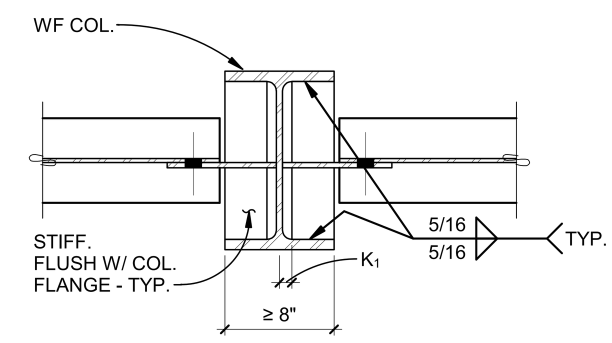
TYPICAL STEEL DETAIL

1 S5.00 DETAIL
NO SCALE





NON-MOMENT FRAME COLUMN WITH FLANGE WIDTHS LESS THAN 8"

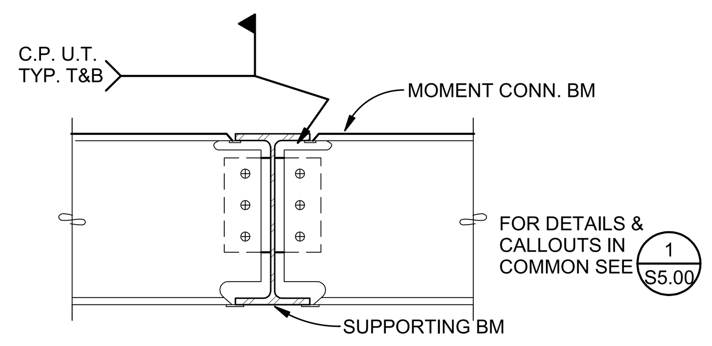


NON-MOMENT FRAME COLUMN WITH FLANGE WIDTHS 8" AND WIDER

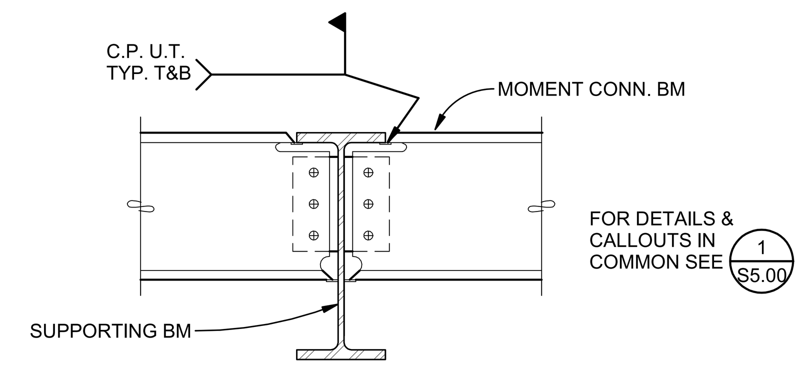
SECTION A

TYPICAL BEAM/COLUMN FRAMING INTO WEB

2 S5.00 DETAIL
NO SCALE

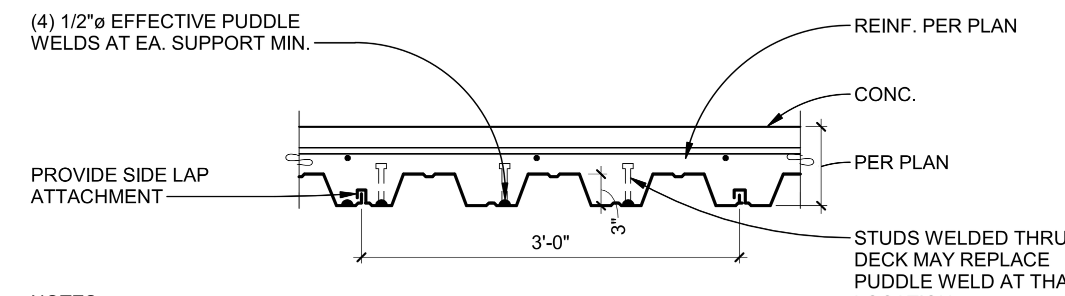


TYPICAL MOMENT CONNECTION



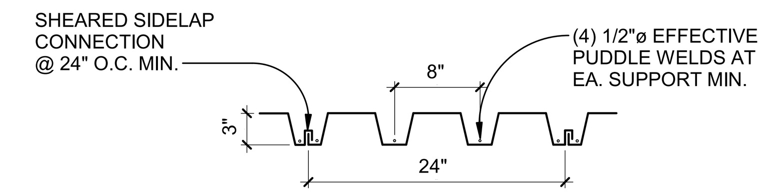
TYPICAL SUPPORTING BEAM DEEPER THAN MOMENT CONNECTED BEAM

3 S5.00 DETAIL
NO SCALE



NOTES:
1. (2) SPAN MINIMUM, (3) SPAN PREFERRED.
2. AT SUPPORTS PARALLEL TO CORRUGATIONS, PROVIDE PUDDLE WELDS @ 24" O.C. MAXIMUM.

TYPICAL COMPOSITE FLOOR DECK

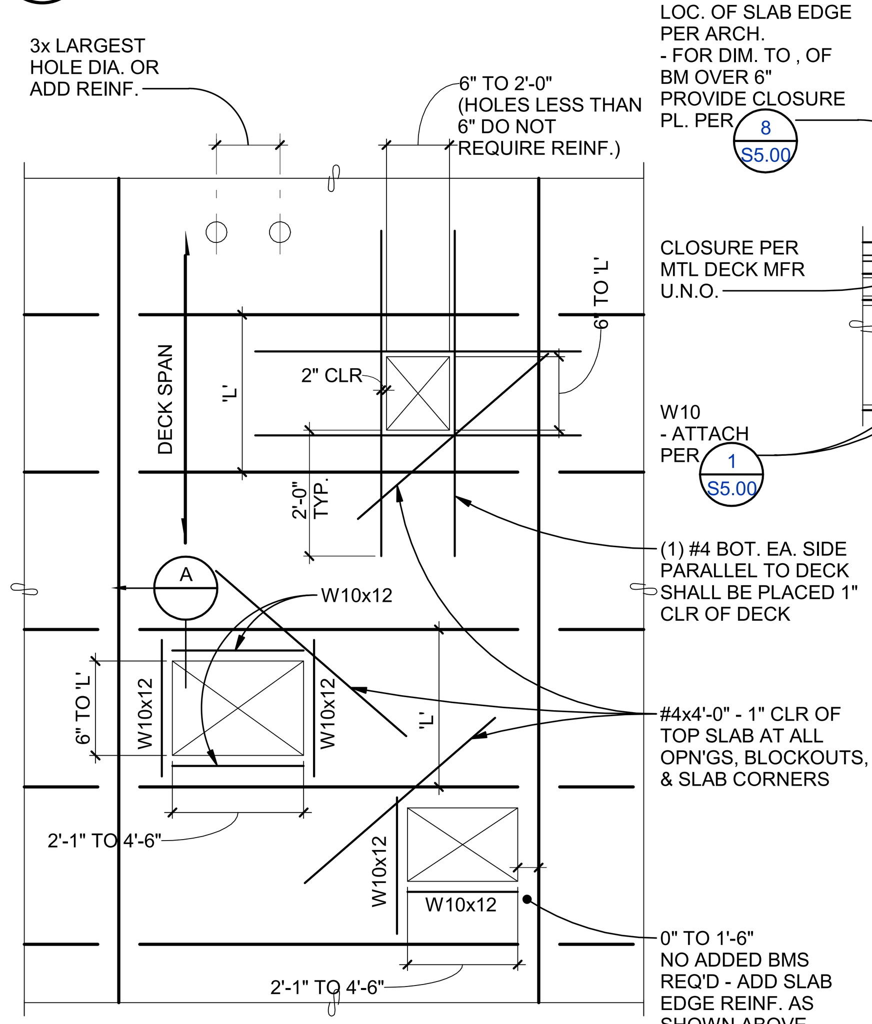


TYPE "N" MIN. DECK PROPERTIES		
GAUGE	I = (in.⁴/ft.)	+S/-S = (in.³/ft)
20	.837	.508/.562

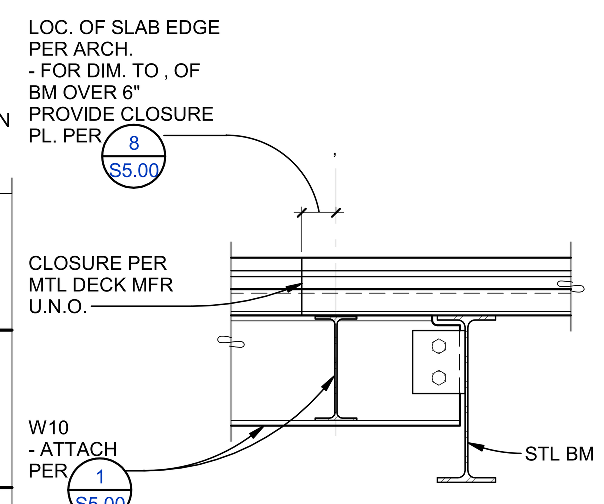
NOTES:
1. (2) SPAN MIN. ,(3) PREFERRED.
2. AT SUPPORTS PARALLEL TO CORRUGATIONS, PROVIDE PUDDLE WELDS @ 24" O.C. MAX.

TYPICAL ROOF METAL DECK

4 S5.00 DETAIL
NO SCALE



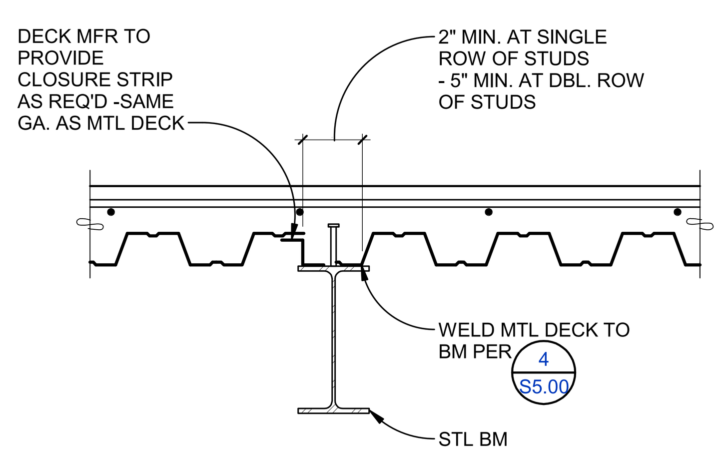
PLAN



SECTION A

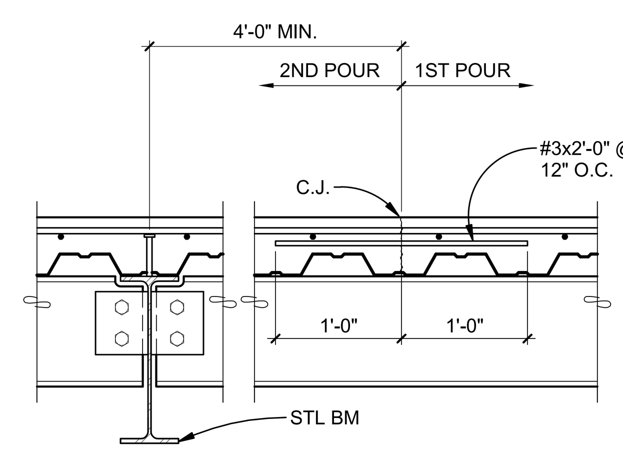
TYPICAL FLOOR PENETRATION REINFORCEMENT

5 S5.00 DETAIL
NO SCALE



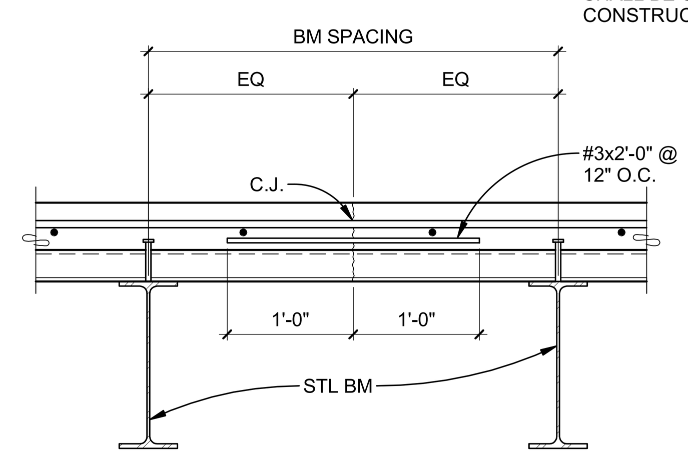
TYPICAL AT METAL DECK PARALLEL TO BEAM

6 S5.00 SECTION
NO SCALE



JOINT PARALLEL TO DECK FLUTES

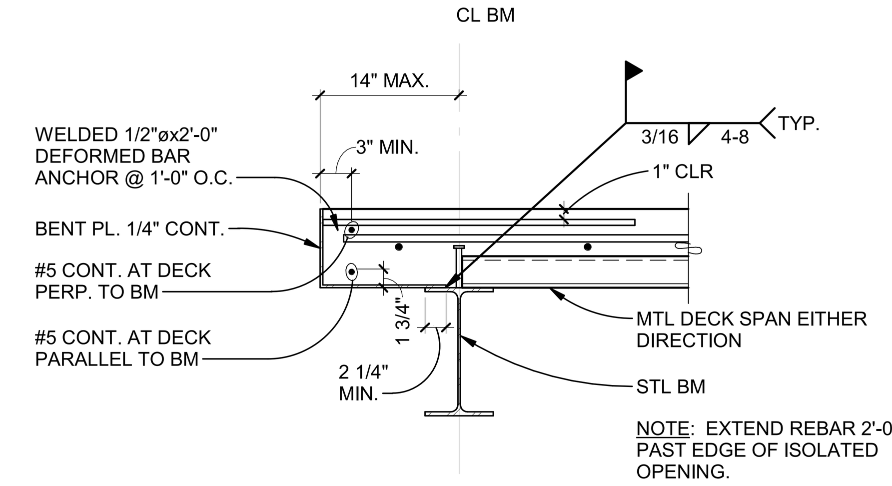
NOTE: ALL REINFORCEMENT SHALL BE CONTINUOUS THRU CONSTRUCTION JOINT



JOINT PERPENDICULAR TO DECK FLUTES

TYPICAL COMPOSITE DECK CONSTRUCTION JOINT

7 S5.00 SECTION
NO SCALE

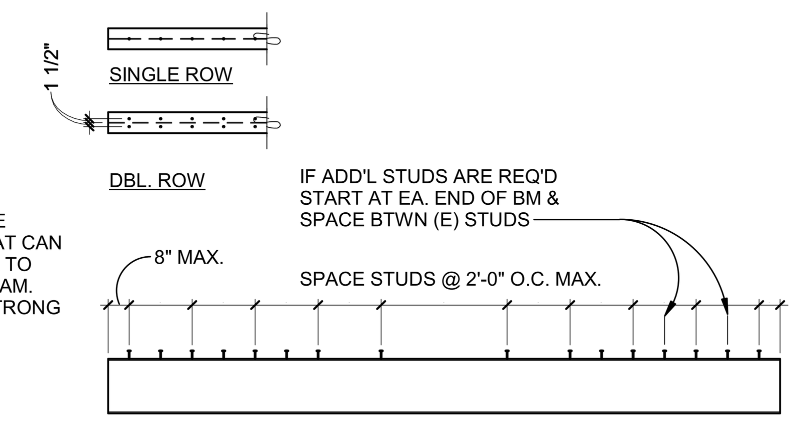


NOTE: EXTEND REBAR 2'-0" PAST EDGE OF ISOLATED OPENING.

TYPICAL SLAB EDGE CONDITION - OVER 6" OVERHANG

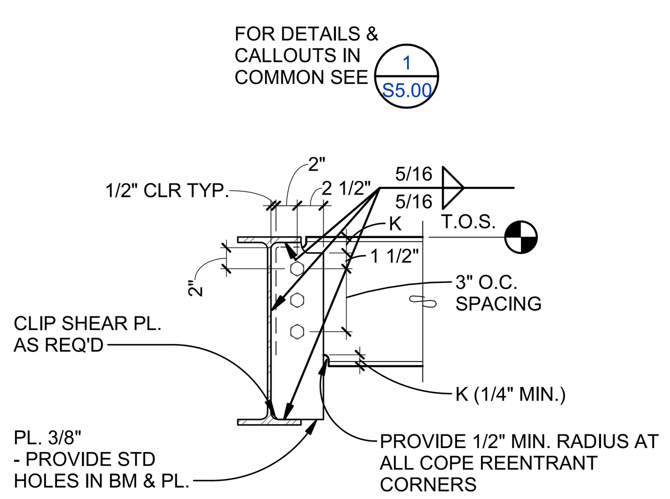
8 S5.00 SECTION
NO SCALE

NOTES:
1. LOCATE STUDS AT CENTER OF BEAM FLANGE.
2. STUDS ARE 3/4"ø x 4 1/2" LONG AFTER WELDING.
3. SEE FRAMING PLANS FOR NUMBER OF STUDS.
4. ALL BEAMS WITH STUDS ARE COMPOSITE STEEL BEAMS.
5. PROVIDE A DOUBLE ROW OF STUDS AT BEAMS WHERE THE REQUIRED NUMBER OF STUDS EXCEEDS THE NUMBER THAT CAN FIT IN A SINGLE ROW AT 6" ON CENTER AT DECK PARALLEL TO BEAM OR 12" ON CENTER AT DECK PERPENDICULAR TO BEAM. STUDS SHOULD BE LOCATED IN DECK FLUTES PER AISC STRONG POSITION.



TYPICAL COMPOSITE BEAM DETAIL

9 S5.00 DETAIL
NO SCALE



TYPICAL BEAM FRAMING AT FULL DEPTH SHEAR PLATE

10 S5.00 DETAIL
NO SCALE

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PROJECT
EDUCATION FACILITY
ST. LOUIS, MISSOURI
PCS STRUCTURAL SOLUTIONS
DESIGN C
1987 NBC WITH EQUIVALENT RISK CATEGORY III

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DRAWINGS
30 SEPTEMBER, 2021

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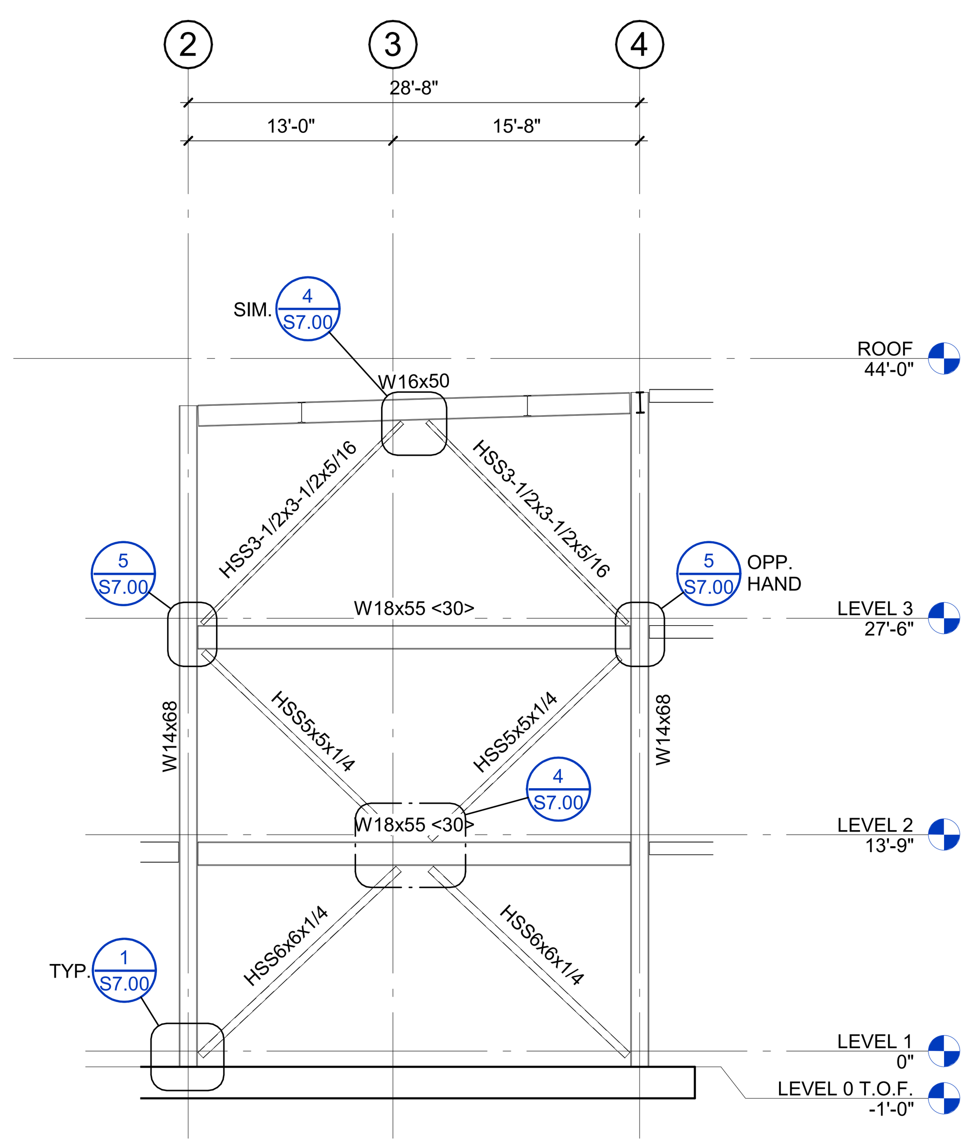
TITLE
STEEL DETAILS

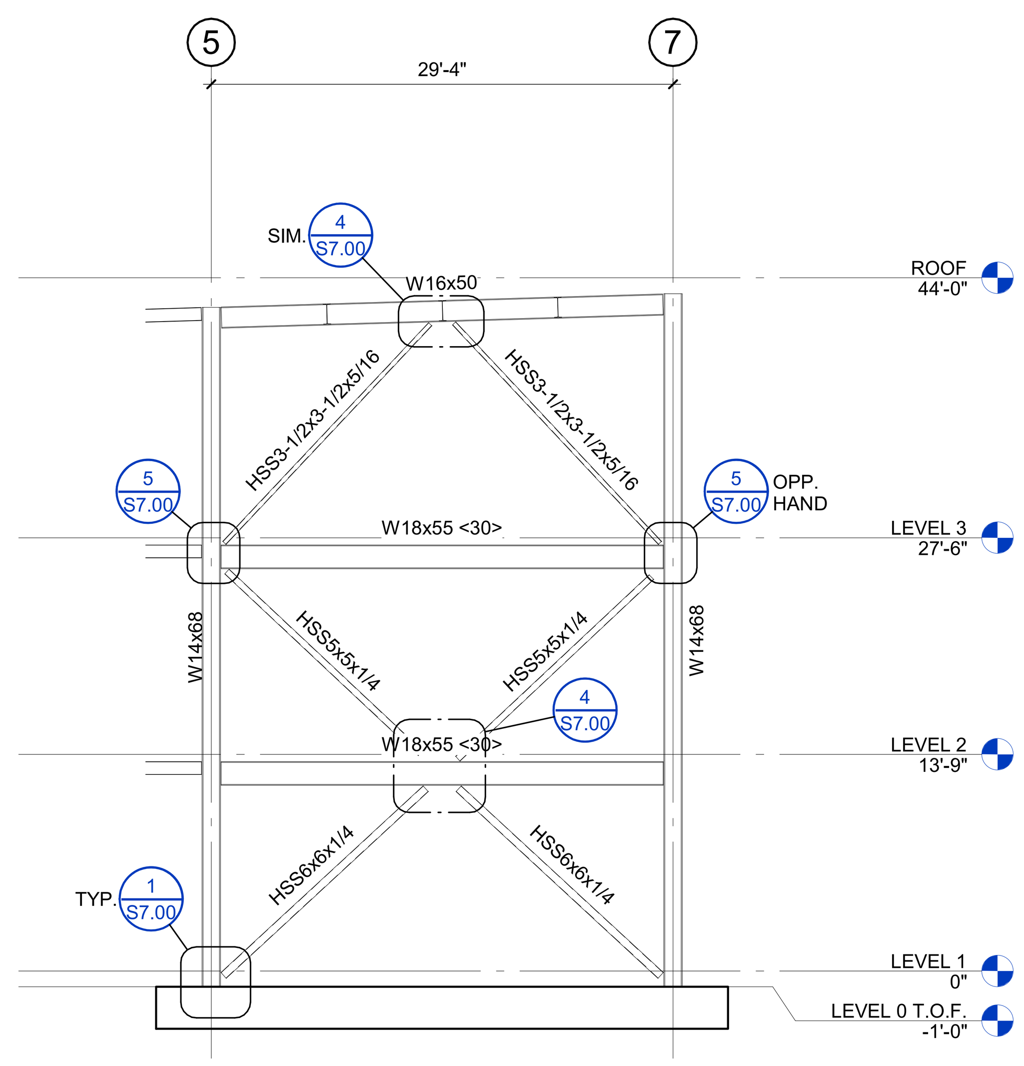
SHEET NUMBER
S5.00



AT GRID B

1 S6.00 BRACED FRAME ELEVATION

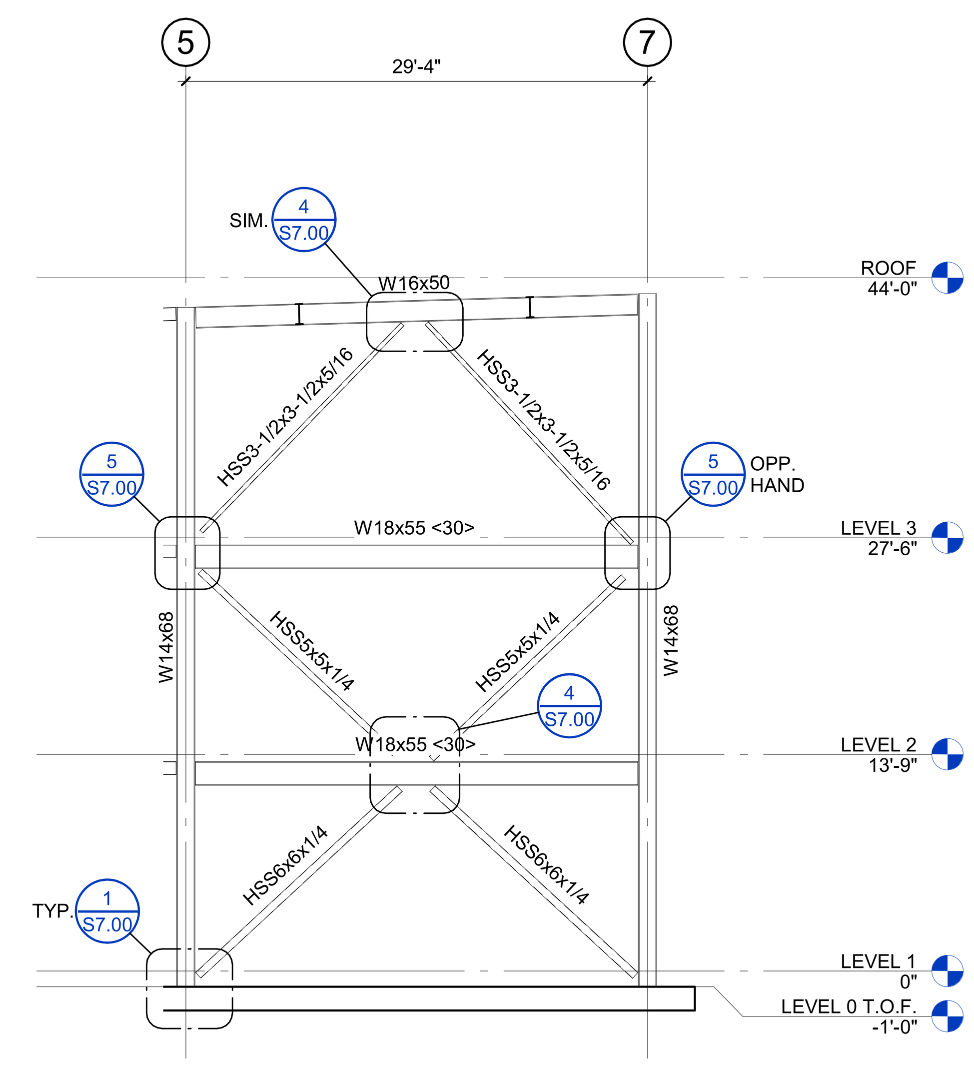
1/8" = 1'-0"



AT GRID D

2 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"



AT GRID G

3 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"

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TITLE

BRACED FRAME ELEVATIONS

SHEET NUMBER

S6.00

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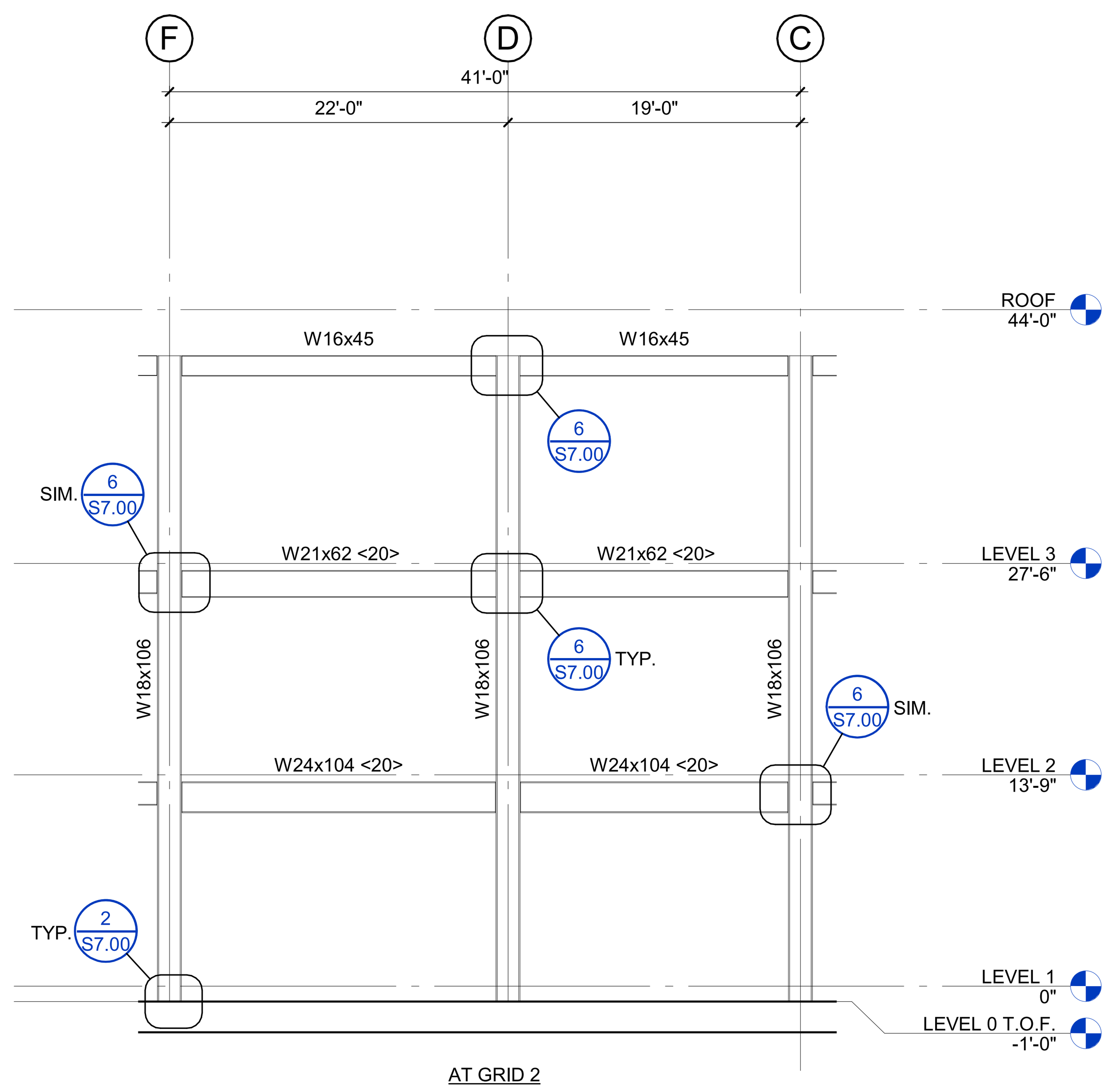
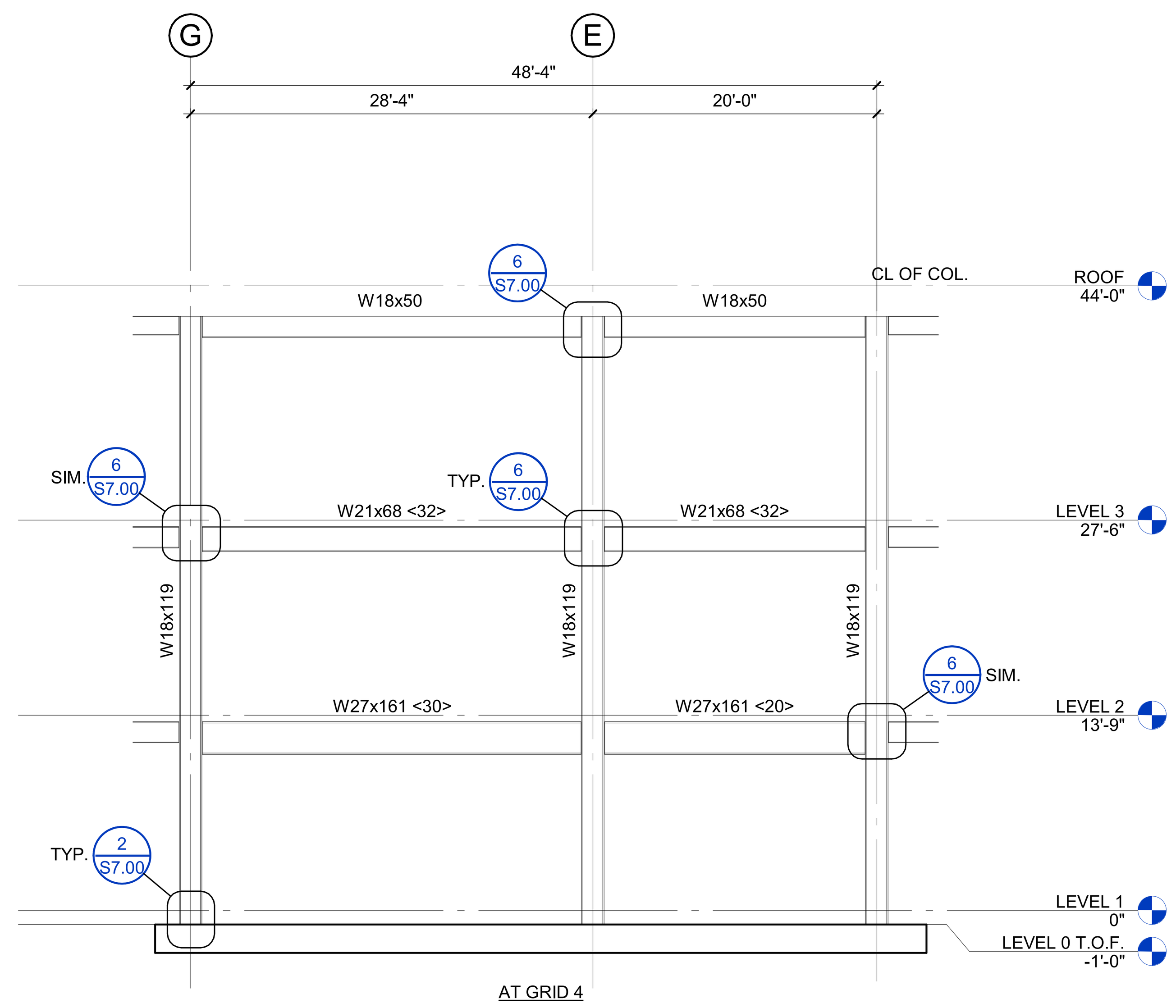
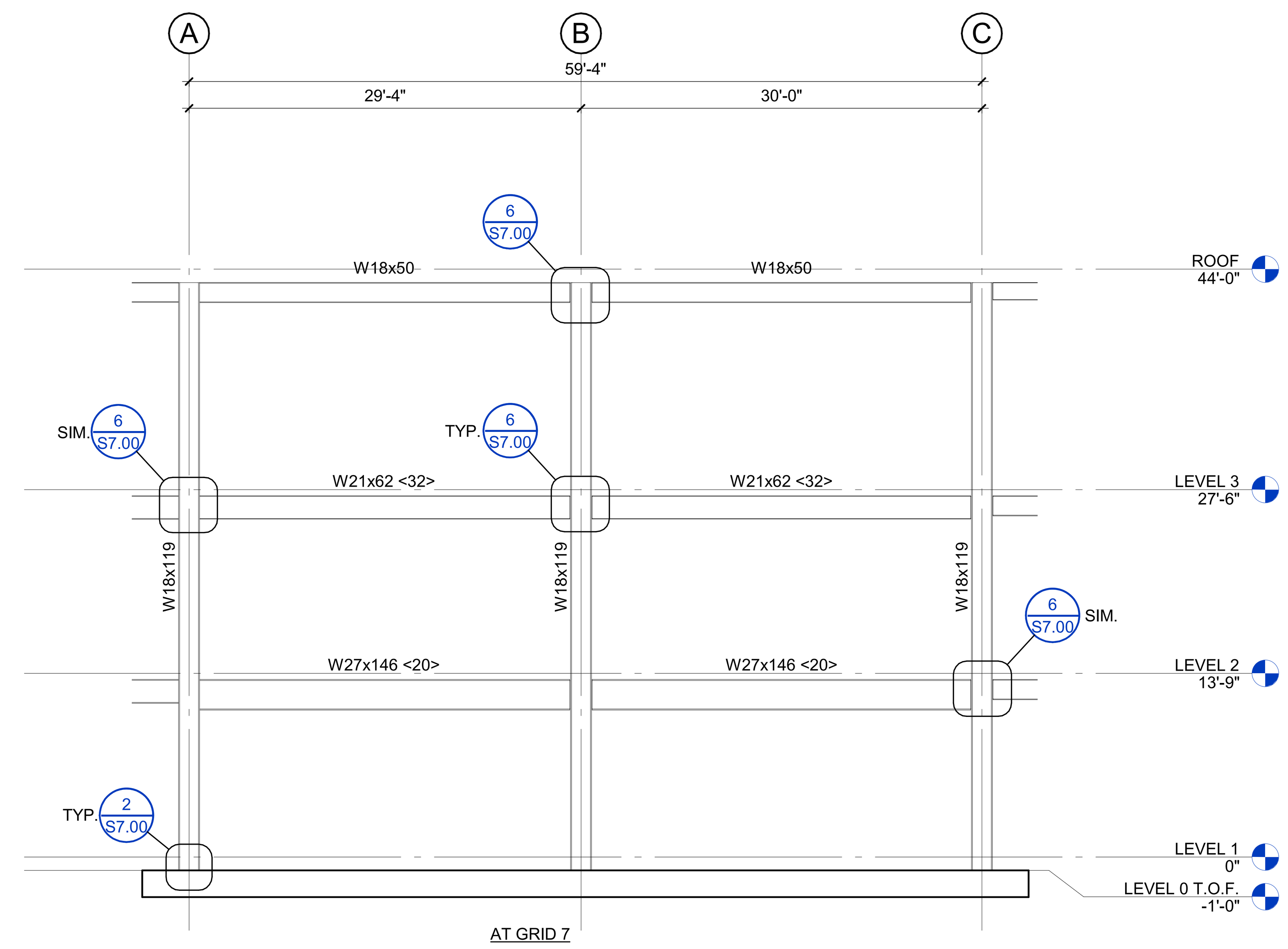


1
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"



2
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"



3
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"

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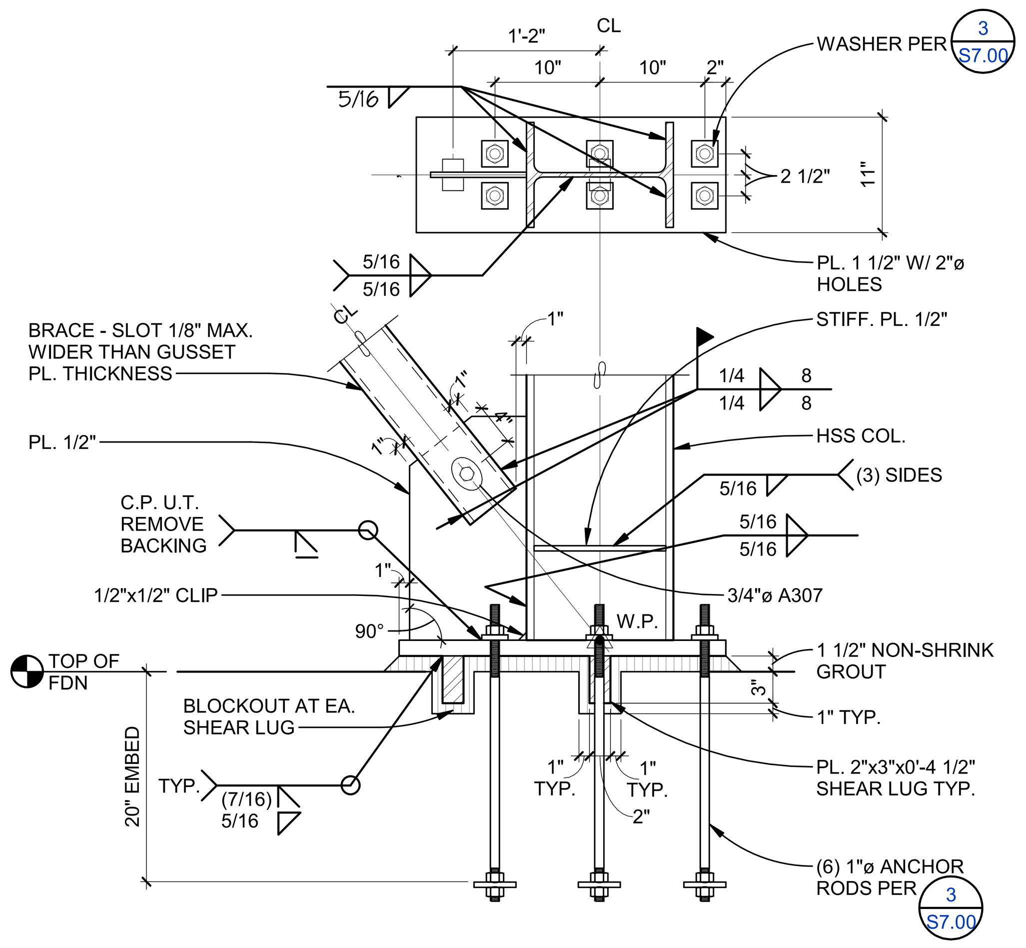
TITLE

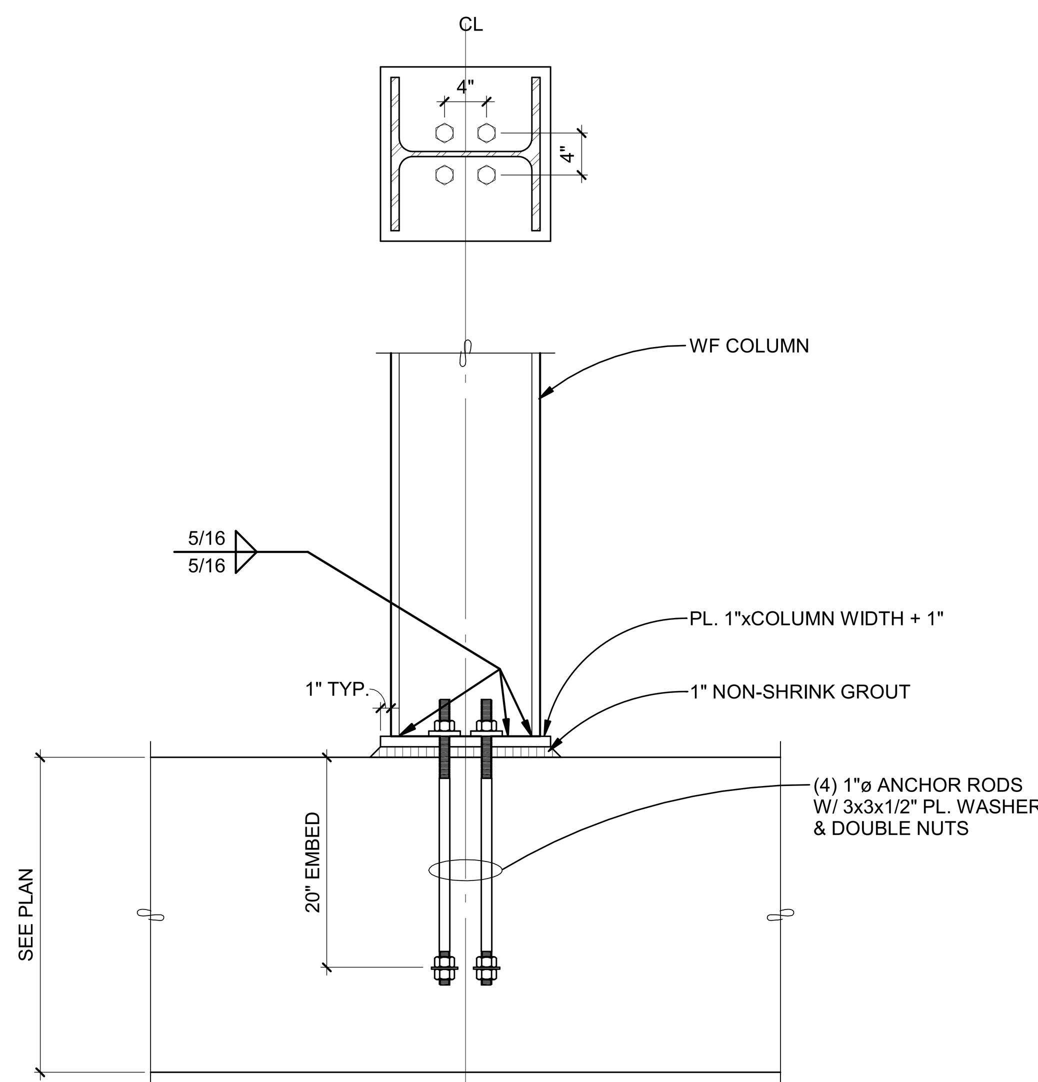
MOMENT FRAME ELEVATIONS

SHEET NUMBER

S6.10



1 SECTION
S7.00 NO SCALE



2 SECTION
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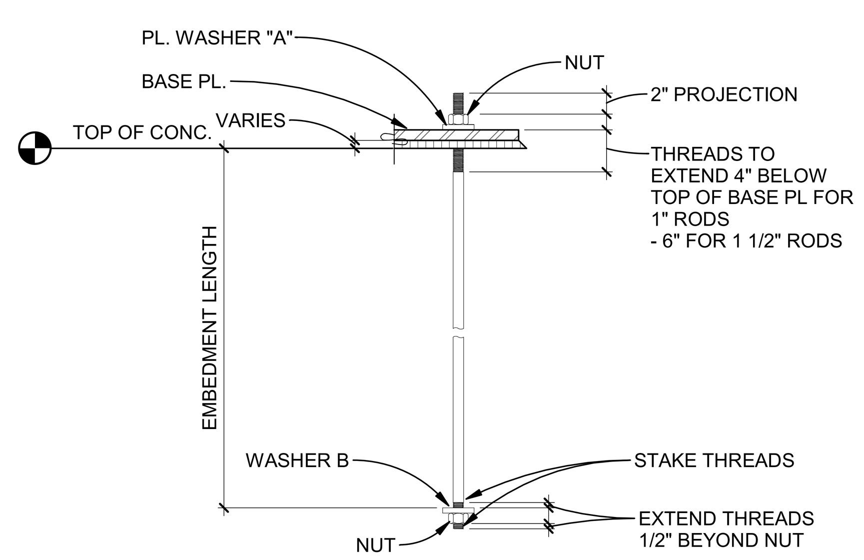
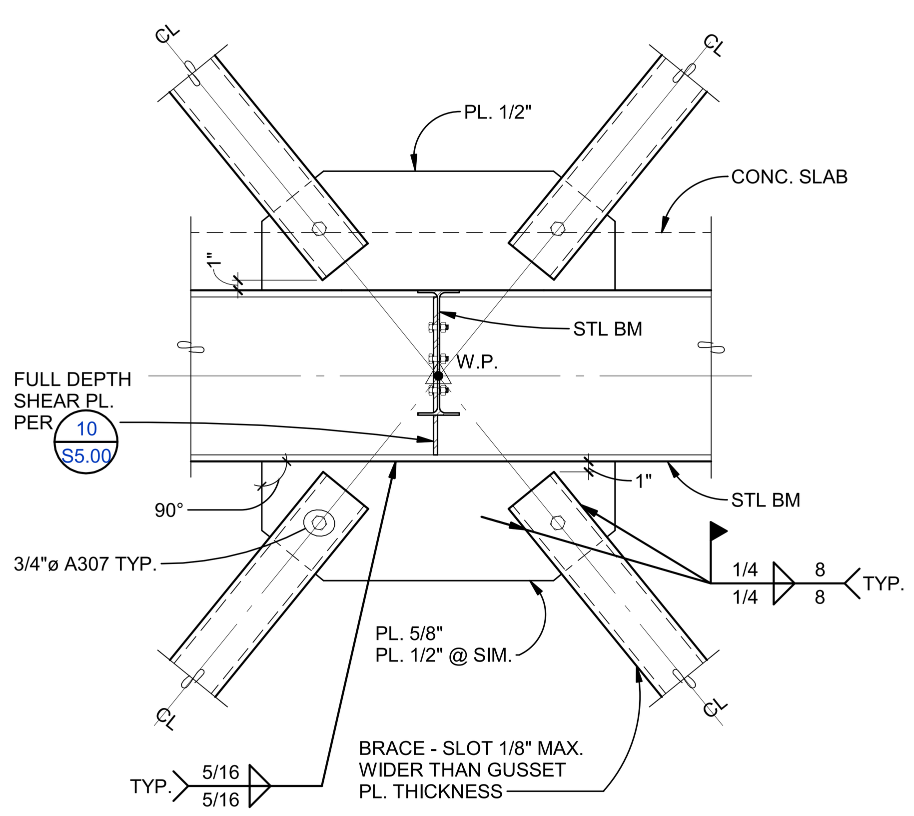


ANCHOR ROD		WASHER		NUT
SIZE	MATERIAL	TYPE	SIZE	
1 1/2"ø	A490 GRADE 36	A	PL. 1/2"x5"x0'-5" W/ 1 1/16"ø HOLE CTR'D	A563 GRADE A HEAVY HEX
		B	ASTM A529 CARBON FLAT WASHER	

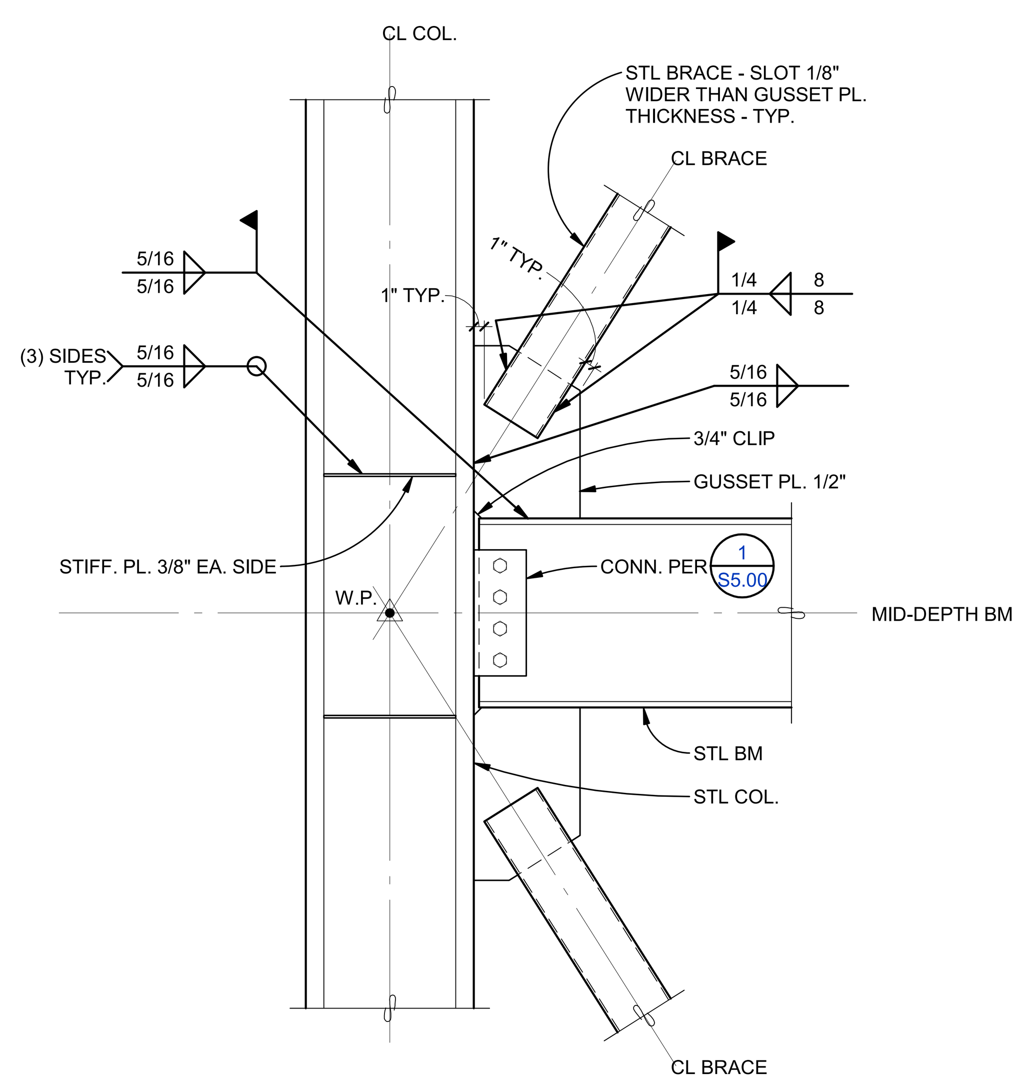
TYPICAL ANCHOR ROD/BOLT DETAIL

3 DETAIL
S7.00 NO SCALE

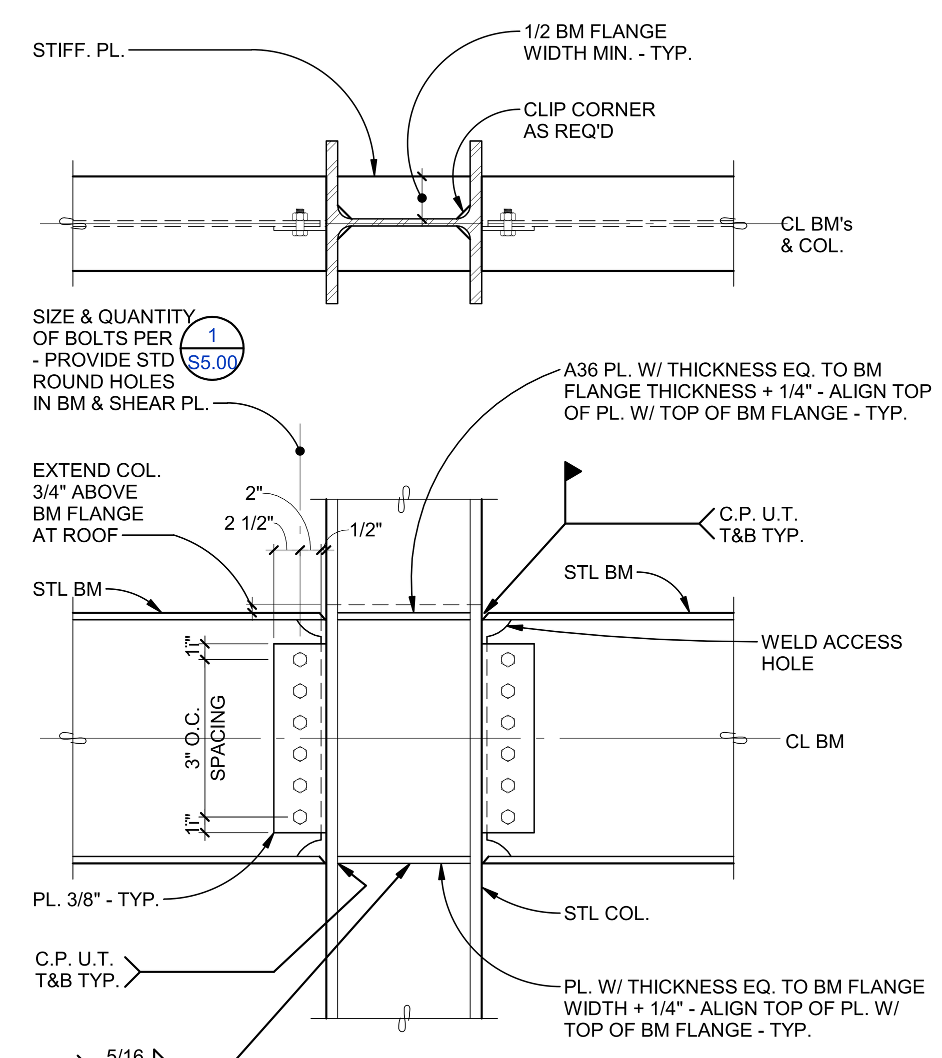
NOTES:
1. BRACE AT ONE SIDE ONLY AT SIMILAR.



4 SECTION
S7.00 NO SCALE



5 DETAIL
S7.00 NO SCALE



MOMENT CONECTION ON ONE SIDE SIMILAR

6 DETAIL
S7.00 NO SCALE

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30 SEPTEMBER, 2021

Job Number	19-051
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Approved	Approver

TITLE
STEEL FRAMING DETAILS

SHEET NUMBER
S7.00

Design Case D

2018 IBC
Risk Category III
Seismic Design Category C

D.1 Gravity Design

This building is a three-story Educational Facility. The vertical force-resisting system consists of normal-weight concrete slabs, 2-1/2", over the 3" metal deck with a total slab thickness of 5-1/2" at the second and third floors. The slabs at these floors are supported by a composite steel beam system and wide flange steel columns. The roof deck is comprised of a 2" metal deck with no topping. All steel members (beams and columns) are Grade ASTM A992 steel and are designed using the Load Resistance Factor Design (LRFD) per AISC Steel Construction Manual 15th edition. The deflections were limited to the IBC prescribed limits of L/360 for applied live loads and L/240 for applied total loads.

The calculated design dead load is 75 PSF on the second and third floors and 20 PSF at the roof. The live loads chosen for the floors and roof were provided by 2018 IBC Table 1607.1. It should be noted that the 20 PSF roof minimum snow load controlled the design over the calculated snow load per Chapter 7 of ASCE 7-16.

C.2 Lateral Design

There are two different LFRS in this building. The braced frames resist the lateral loads in the N-S direction, and the moment frames resist the lateral loads in the E-W direction (OMF and IMF are not allowed per Section 12.2-1 ASCE 7-16). The applied wind and seismic loads were determined using Chapters 27 and 12, respectively, from ASCE 7-16. In each case, the seismic design forces controlled the design, most likely due to the increased dead load caused by the concrete slab at two stories or the nature of the geometry of the building. The seismic design category per Table 11.6-1 and Table 11.6-2 in ASCE 7-16 should be SDC D, but we treated it as SDC C for design study purposes. In both directions, the eccentric loading, both calculated and required accidental (5%), was included in determining the applied frame forces at each level.

The N-S braced frames have a two-story X configuration and utilize ASTM A500 Gr. C HSS steel braces. The braces were designed to maintain the same area of steel at floors, where the upper and lower braces meet at a steel beam to help mitigate the forces that are applied to that steel beam. This is important to help reduce the size of our braced framed beams and the overall tonnage of the building. The beam size of the braced frame is drastically larger than the beam size in Design A because there are more design restrictions and checks that are required to be performed in AISC 360 than in NBC. The "KISS" method was used for force distribution analysis of the connection designs. At the foundations, the anchorage was designed to resist the minimum of the uplift force due to overturning with an applied Ω_o or the expected brace strength. The shear lugs were designed to resist the minimum of the applied shear forces with an applied Ω_o and the expected brace strength.

E-W moment frames have been designed with pre-qualified WUF-W beam to column connections. The moment frames are controlled by building drift limitation in Table 12.12-1 of ASCE 7-16. The frame columns have a typical 'pin' base, and the anchorage was designed to resist the minimum of the uplift force due to overturning with an applied Ω_o. The size and detail of the foundations have not been detailed.

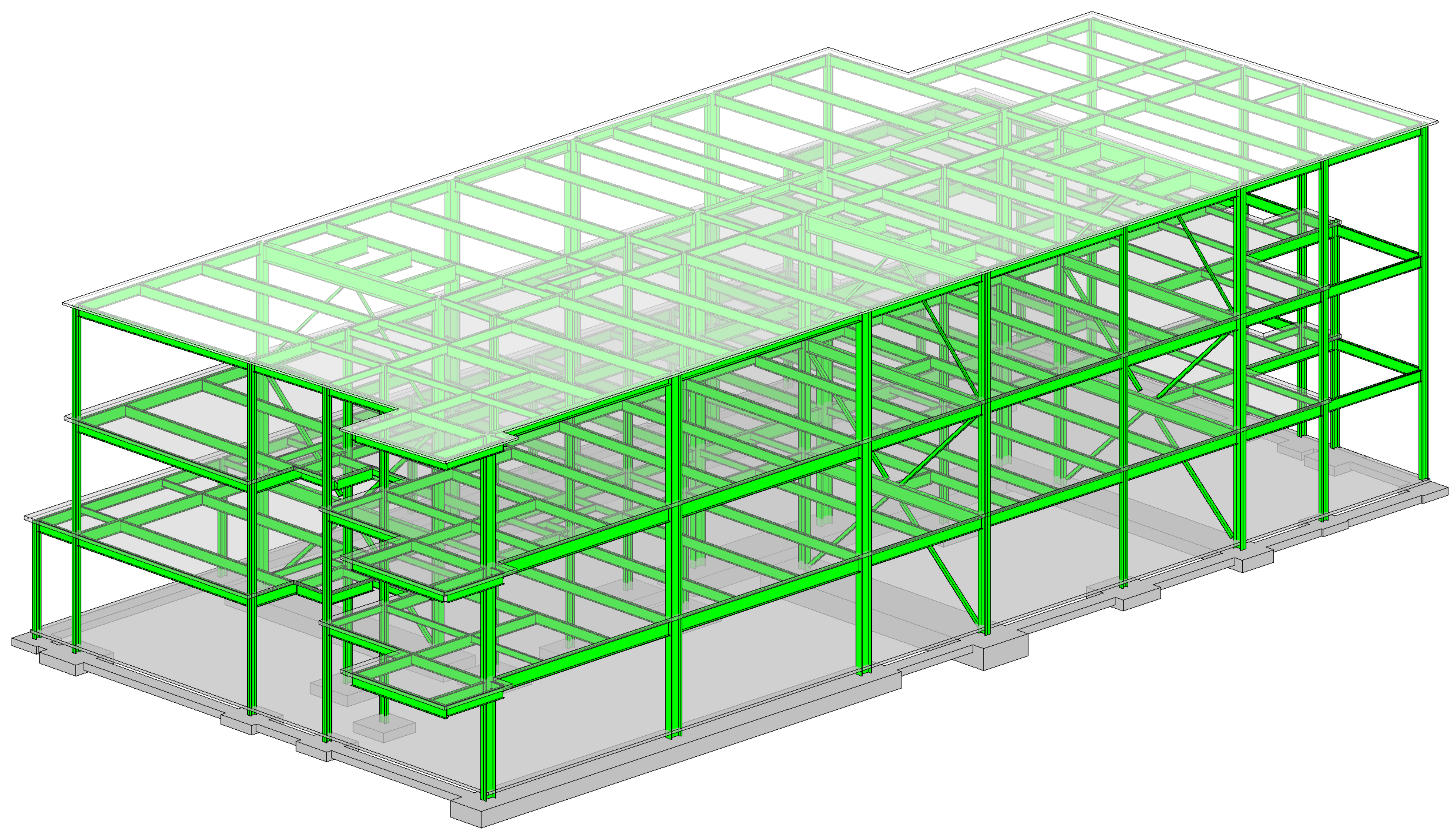
D.3 Steel Tonnage

Total steel tonnage for this design case is calculated as 138 tons.

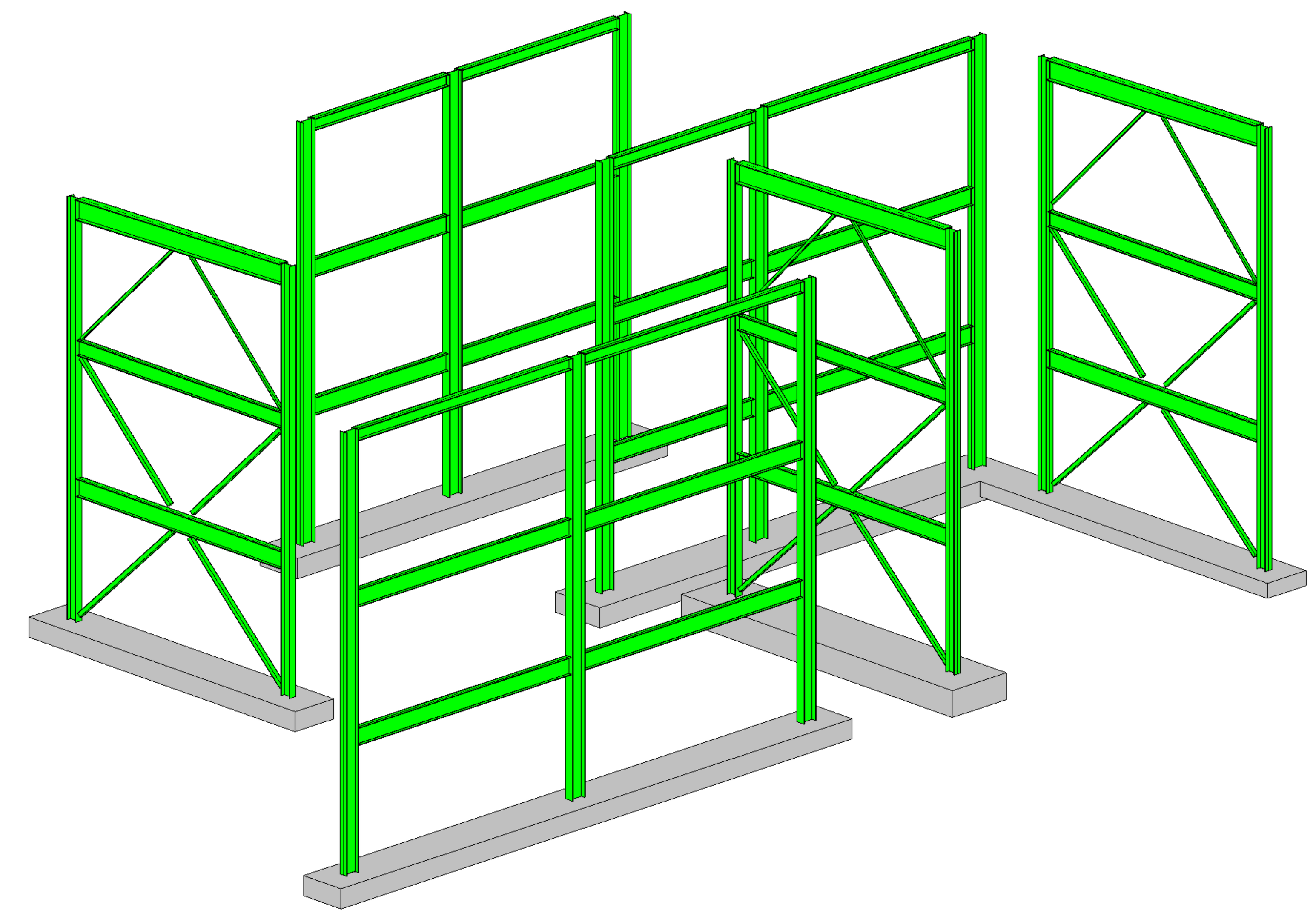
D.4 Structural Drawings

Structural drawings for Design Case D are provided on the following pages.

EDUCATIONAL FACILITY - ST. LOUIS, MISSOURI
DESIGN D - 2018 IBC RISK CATEGORY III



OVERALL FRAMING 3D VIEW



FORCE RESISTING SYSTEM 3D VIEW

DESIGN B: 2018 IBC "RISK CATEGORY III"	
EDUCATION FACILITY, ST. LOUIS MISSOURI	
ITEM	QUANTITY
WF COLUMNS (Fy = 50 KSI)	15 TONS
WF GIRDERS AND JOISTS (Fy = 50 KSI)	63 TONS
MOMENT FRAME WF COLUMNS (Fy = 50 KSI)	21 TONS
MOMENT FRAME WF BEAMS (Fy = 50 KSI)	14 TONS
BRACED FRAME WF COLUMNS (Fy = 50 KSI)	9 TONS
BRACED FRAME WF BEAMS (Fy = 50 KSI)	13 TONS
HSS BRACES (Fy = 50 KSI)	3 TONS
TOTAL	138 TONS

1. STEEL QUANTITIES DO NOT INCLUDE MISCELLANEOUS STEEL, CUT WASTE STEEL, STAIRS, TYPICAL STEEL FRAMING CONNECTIONS, ETC.
2. ON PLANS " ▶ " INDICATES GRAVITY MOMENT CONNECTION WITH (CJP) WELDS AT FLANGES.

STRUCTURAL DRAWING INDEX

SHEET NUMBER	SHEET DESCRIPTION
S0.00	COVER SHEET
S0.10	GENERAL NOTES
S2.00	FOUNDATION AND GRADE LEVEL FRAMING PLAN
S2.10	FRAMING PLAN - LEVEL 2
S2.10R	LEVEL 2 SLAB REINFORCING PLAN
S2.20	FRAMING PLAN - LEVEL 3
S2.20R	LEVEL 3 SLAB REINFORCING PLAN
S2.30	ROOF FRAMING PLAN
S3.00	FOUNDATION DETAILS
S5.00	STEEL DETAILS
S6.00	BRACED FRAME ELEVATIONS
S6.10	MOMENT FRAME ELEVATIONS
S7.00	STEEL FRAMING DETAILS
S7.01	STEEL FRAMING DETAILS
Grand total: 14	

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ST. LOUIS MISSOURI
PCS STRUCTURAL SOLUTIONS
DESIGN D
2018 IBC WITH RISK CATEGORY III

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DRAWINGS
30 SEPTEMBER, 2021

Job Number	19-051
Checked	Checker
Approved	Approver

TITLE
COVER SHEET

SHEET NUMBER
S0.00

GENERAL NOTES

STANDARDS
ALL METHODS, MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE 2018 INTERNATIONAL BUILDING CODE (IBC) AS AMENDED AND ADOPTED BY THE LOCAL BUILDING OFFICIAL OR APPLICABLE JURISDICTION.

STRUCTURAL DRAWINGS PRIMARY STRUCTURAL ELEMENTS ARE DIMENSIONED ON STRUCTURAL PLANS AND DETAILS AND OVERALL LAYOUT OF STRUCTURAL PORTION OF WORK.

PROJECT LOCATION

ST. LOUIS, MISSOURI

38.6270 LATITUDE,-90.1994 LONGITUDE

DESIGN CRITERIA

VERTICAL LOADS

AREA	DESIGN DEAD LOAD	LIVE LOAD (1)	CONCENTRATED LOADS
CLASSROOM AND OFFICE	75 PSF	50 PSF	1000#
CORRIDORS ABOVE 1ST FLOOR	75 PSF	80 PSF	1000#
ROOF	20 PSF	20 PSF	-

(1) LIVE LOADS EXCEPT SNOW LOADS ARE REDUCED PER IBC SECTION 1607.11.

SNOW:

Pg = 20 PSF = GROUND SNOW LOAD
Pf = 0.7CeCtIsPg = FLAT ROOF SNOW LOAD
Is = 1.1 Ce = 1.0, Ct = 1.0. Cs = VARIES

VIBRATION DESIGN CRITERIA:

VIBRATION CONSIDERATIONS WERE DESIGNED PER THE RECOMMENDATIONS IN THE GUIDELINES FOR DESIGN AND CONSTRUCTION OF COMPUTER EQUIPMENT RESIDENCES. FOR CLASSROOM FLOORS A VIBRATION VELOCITY LIMIT OF 8000 MICRO INCHES PER SECOND WAS EVALUATED AT A WALKING SPEED OF 75 STEPS PER MINUTE.

LATERAL FORCES

LATERAL FORCES ARE TRANSMITTED BY DIAPHRAGM ACTION OF ROOF AND FLOORS TO BRACED FRAME/MOMENT FRAME. LOADS ARE THEN TRANSFERRED TO FOUNDATION BY BRACED FRAME/MOMENT FRAME ACTION WHERE ULTIMATE DISPLACEMENT IS RESISTED BY PASSIVE PRESSURE OF EARTH AND/OR SLIDING FRICTION. OVERTURNING IS RESISTED BY DEAD LOAD OF THE STRUCTURE.

WIND:

THE BUILDING MEETS THE CRITERIA TO USE THE "ENCLOSED, PARTIALLY ENCLOSED, AND OPEN BUILDING OF ALL HEIGHTS PROCEDURE" PER ASCE 7-16.

- EXPOSURE CATEGORY = B
- BASIC WIND SPEED, (3 SEC. GUST), V_{ULT} = 114 MPH; V_{ASD} = 88 MPH
- RISK CATEGORY PER IBC TABLE 1604.5 = III
- TOPOGRAPHIC FACTOR K_{ZT} = 1.0
- INTERNAL PRESSURE COEFFICIENT (ENCLOSED) = ± 0.18
- BASE SHEAR V= 146 KIPS AT BRACE FRAMES, 64 KIPS AT MOMENT FRAME
- SEE THE FOLLOWING SCHEDULES FOR COMPONENTS AND CLADDING WIND PRESSURES

ROOF SURFACES [1]							
EFFECTIVE WIND AREA	POSITIVE PRESSURES (PSF)			NEGATIVE PRESSURES (PSF)			
	ZONE [2]						
	1	2	3	1'	1	2	3
10 SF	9.7	9.7	9.7	-21.8	-37.9	-50.0	-68.1
20 SF	9.1	9.1	9.1	-21.8	-35.4	-46.8	-61.7
50 SF	8.3	8.3	8.3	-21.8	-32.1	-42.5	-53.2
100 SF	7.7	7.7	7.7	-21.8	-29.6	-39.3	-46.8

WALL SURFACES [1]				
EFFECTIVE WIND AREA	POSITIVE PRESSURE (PSF)		NEGATIVE PRESSURE (PSF)	
	ZONE [2]			
	4	5	4	5
10 SF	23.8	23.8	-25.8	-31.9
20 SF	22.7	22.7	-24.7	-29.7
50 SF	21.3	21.3	-23.3	-26.9
100 SF	20.3	20.2	-22.2	-24.7

1. VALUES SHOWN IN TABLE ARE GROSS ULTIMATE WIND PRESSURES.
2. ZONES ARE AS DEFINED BY FIGURE 30.6-2 IN ASCE 7-16.

SEISMIC: (ASCE 7-16) V = CsW

WHERE $Cs = \dfrac{S_{DS}}{(\frac{R}{Ie})}$; WITH

$Cs\ MINIMUM = 0.044\ S_{DS}I_E \geq 0.01$
OR
$Cs\ MINIMUM = \dfrac{0.5S_1}{\frac{R}{Ie}}$ FOR $S_1 > 0.6g$

$Cs\ MAXIMUM = \dfrac{S_{D1}}{T(\frac{R}{Ie})}$ FOR $T \leq T_L$
OR
$Cs\ MAXIMUM = \dfrac{S_{D1}T_L}{T^2\ (\frac{R}{Ie})}$ FOR $T > T_L$

SEISMIC IMPORTANCE FACTOR, Ie = 1.25
RISK CATEGORY OF BUILDING PER IBC TABLE 1604.5 = III
SPECTRAL RESPONSE ACCELERATIONS S_S = 0.453 & S_1 = 0.16
SITE CLASS PER TABLE 20.3-1 = D
DESIGN SPECTRAL RESPONSE ACCELERATIONS S_{DS} = 0.434 & S_{D1} = 0.243
SEISMIC DESIGN CATEGORY = C
W = EFFECTIVE SEISMIC WEIGHT OF BUILDING = 2140 KIPS
ANALYSIS PROCEDURE USED = EQUIVALENT LATERAL FORCE PROCEDURE/MODALRESPONSE SPECTRUM ANALYSIS
RESPONSE MODIFICATION FACTOR PER TABLE 12.2-1, R = 8.0 AT SPECIAL STEEL MOMENT FRAMES, R = 6.0 AT SPECIAL CONCENTRICALLY STEEL BRACED FRAMES
Cs = 0.047 AT MOMENT FRAMES, Cs = 0.09 AT BRACED FRAMES
DESIGN BASE SHEAR V = 188.4 KIPS AT BRACED FRAMES, 97.62 KIPS AT MOMENT FRAMES

FOUNDATION DESIGN CRITERIA

SOIL BEARING PRESSURE: 4000 PSF (ASSUMED)*

ACTIVE PRESSURE - RESTRAINED: 50 PCF +14H SEISMIC SURCHARGE (ASSUMED)
ACTIVE PRESSURE - UNRESTRAINED: 35 PCF +6H SEISMIC SURCHARGE (ASSUMED)
PASSIVE RESISTANCE: 200 PCF (INCLUDES F.O.S. ≥ 1.5) (ASSUMED)
COEFFICIENT OF FRICTION: .35 (INCLUDES F.O.S. ≥ 1.5) (ASSUMED)
*1/3 INCREASE ALLOWED FOR SEISMIC OR WIND LOADING

ITEM	DESIGN f'c (PSI) (AT 28 DAYS U.N.O.)
SLABS ON GRADE - UNO	4000
FOUNDATIONS - UNO	3000
STEM WALLS AND OTHER WALLS - UNO	4000
ELEVATED DECKS, TOPPING SLABS, AND SLABS ON METAL	5000

REINFORCING STEEL

REINFORCING STEEL SHALL CONFORM TO:

ASTM A615, GRADE 60 TYPICAL UNLESS NOTED OTHERWISE.

REINFORCING SPLICE AND DEVELOPMENT LENGTH SCHEDULE, Fy=60 KSI (UNLESS NOTED OTHERWISE)		
BAR SIZE	MINIMUM LAP SPLICE LENGTHS ("Ls")	MINIMUM DEVELOPMENT LENGTHS ("Ld")
#3	1'-6"	1'-3"
#4	2'-0"	1'-7"
#5	2'-7"	2'-0"
#6	3'-1"	2'-4"
#7	4'-6"	3'-6"
#8	5'-2"	3'-11"
#9	5'-10"	4'-6"
#10	6'-6"	5'-0"

STRUCTURAL STEEL

MATERIAL PROPERTIES

WIDE FLANGE SECTIONS: ASTM A992 (Fy = 50 KSI)

OTHER SHAPES AND PLATES: ASTM A36 (Fy = 36 KSI) TYP. U.N.O.; ASTM A572 (Fy = 50 KSI) WHERE INDICATED

HOLLOW STRUCTURAL SECTIONS: RECTANGULAR & SQUARE - ASTM A500, GRADE C (Fy = 50 KSI)

MACHINE BOLTS (M.B.): ASTM A307, GRADE A

HIGH-STRENGTH BOLTS: A325-ASTM F1852, A490-ASTM F2280

ANCHOR BOLTS (A.B.): ASTM F1554, GRADE 36, UNLESS OTHERWISE NOTED, ASTM F1554, GRADE 105 WHERE INDICATED.

GENERAL REQUIREMENTS

HIGH-STRENGTH BOLTS: ALL A325 HIGH-STRENGTH BOLTS (HSB) SHALL BE ASTM F3125, GRADE F1852, UNLESS OTHERWISE DESIGNATED AS A490. ALL HSB DESIGNATED AS A490 SHALL BE ASTM F3125, GRADE F2280. ALL HSB SHALL BE BY "LEJEUNE BOLT COMPANY" OR PRE-APPROVED EQUAL AND SHALL BE INSTALLED PER SECTION 8.2 OF THE "SPECIFICATION FOR STRUCTURAL JOINTS USING HIGH STRENGTH BOLTS", AUGUST 2014 BY THE RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC SPECIFICATION). ALL BOLT HOLES SHALL BE STANDARD ROUND HOLES UNLESS NOTED OTHERWISE. THE FAYING SURFACES OF ALL PLIES WITHIN THE GRIP OF SLIP-CRITICAL BOLTS (A325SC OR A490SC) SHALL MEET THE REQUIREMENTS FOR A CLASS A SURFACE PER SECTION 3.2 OF THE RCSC SPECIFICATION.

HEADED STUDS: SHALL BE "S3L SHEAR CONNECTORS" FOR STUDS 3/4" DIAMETER AND LARGER AS MANUFACTURED BY NELSON STUD WELDING, INC. OR PRE-APPROVED EQUAL AND SHALL CONFORM TO AWS D1.1. ALL HEADED STUDS SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS USING A NELSON WELD GUN, UNLESS NOTED OTHERWISE ON DETAILS. ALL WELDS SHALL BE MADE AND INSPECTED IN ACCORDANCE WITH AWS D1.1.

COMPOSITE FLOOR DECK: SHALL CONTAIN THE MINIMUM PROPERTIES SHOWN ON THE STRUCTURAL DRAWINGS AND SHALL BE "FORMLOK" AS MANUFACTURED BY VERCO MANUFACTURING CO., "W COMPOSITE" AS MANUFACTURED BY ASC STEEL DECK, "EPICORE" AS MANUFACTURED BY EPIC METALS, OR PRE-APPROVED EQUAL. THE FLOOR UNITS SHALL BE FORMED FROM STEEL SHEETS CONFORMING TO ASTM A653, AND GALVANIZED PER ASTM A924.

ABBREVIATION LIST			
@	AT	GALV.	GALVANIZED
A.B.	ANCHOR BOLT	GR.	GRADE
ADD'L	ADDITIONAL	HORIZ.	HORIZONTAL
ALT.	ALTERNATE	HSS	HOLLOW STRUCTURAL SECTION
BLD'G	BUILDING	HT	HEIGHT
BM	BEAM	INT.	INTERIOR
B.O.F.	BOTTOM OF FOOTING	JT	JOINT
BOT.	BOTTOM	L	ANGLE
BRG	BEARING	L.F.R.S.	LATERAL FORCE-RESISTING SYSTEM
BTWN	BETWEEN	L.L.	LIVE LOAD
(C=)	CAMBER	LLH	LONG LEG HORIZONTAL
CANT.	CANTILEVER	LLV	LONG LEG VERTICAL
C.J.	CONTROL/CONSTRUCTION JOINT	LOC.	LOCATION
CL	CENTERLINE	MAX.	MAXIMUM
CLR.	CLEARANCE	M.B.	MACHINE BOLT
COL.	COLUMN	MIN.	MINIMUM
CONC.	CONCRETE	MISC.	MISCELLANEOUS
CONN.	CONNECTION	MTL	METAL
CONST.	CONSTRUCTION	N.F.	NEAR FACE
CONT.	CONTINUOUS	N.S.	NEAR SIDE
COORD.	COORDINATE	NTS	NOT TO SCALE
C.P.	COMPLETE PENETRATION	O.C.	ON CENTER
CTR'D	CENTERED	OPN'G	OPENING
C.Y.	CUBIC YARD	OPP.	OPPOSITE
DBL.	DOUBLE	PERP.	PERPENDICULAR
DCW	DEMAND CRITICAL WELD	PL.	PLATE
DIA. OR ø	DIAMETER	P.P.	PARTIAL PENETRATION
DIAG.	DIAGONAL	P.S.F.	POUNDS PER SQUARE FOOT
DIM.	DIMENSION	REINF.	REINFORCING
D.L.	DEAD LOAD	REQ'D	REQUIRED
DWG	DRAWING	SCHED.	SCHEDULE
DWL	DOWEL	SIM.	SIMILAR
(E)	EXISTING	S.O.G.	SLAB ON GRADE
EA.	EACH	SQ.	SQUARE
E.F.	EACH FACE	STD	STANDARD
EL.	ELEVATION	STIFF.	STIFFENER
ELEV.	ELEVATOR	STL	STEEL
ENGR.	ENGINEER	STRUCT.	STRUCTURAL
EQ.	EQUAL	T&B	TOP & BOTTOM
E.W.	EACH WAY	THR'D	THREADED
EXP.	EXPANSION	T.O.F.	TOP OF FOOTING
EXT.	EXTERIOR	T.O.S.	TOP OF STEEL
FDN	FOUNDATION	TYP.	TYPICAL
F.F.	FAR FACE	U.N.O.	UNLESS NOTED OTHERWISE
FLR	FLOOR	U.T.	ULTRASONIC TESTED
F.O.S.	FACE OF STUD	VERT.	VERTICAL
FRM'G	FRAMING	W/	WITH
F.S.	FAR SIDE	W.P.	WORK POINT
FTG	FOOTING	WT	WEIGHT
GA.	GAGE/GAUGE		

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30 SEPTEMBER, 2021

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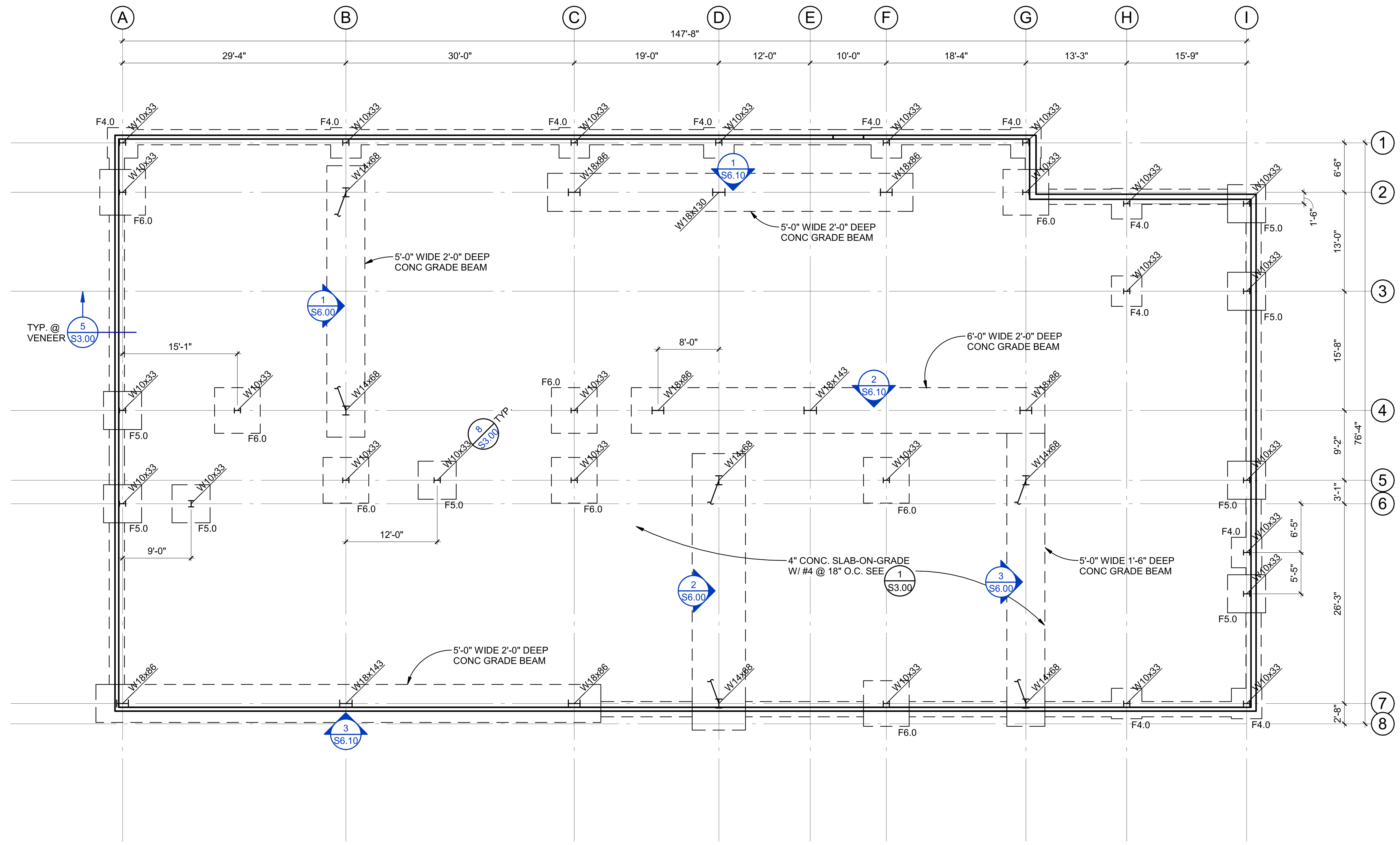
TITLE
GENERAL NOTES

SHEET NUMBER



1 S2.00 FOUNDATION AND GRADE LEVEL FRAMING PLAN
1/8" = 1'-0"

FOUNDATION NOTES

1. INDICATES WALL STUDS.
2. INDICATES CONTINUOUS CONCRETE WALL FOOTING. FOR TYPICAL FOOTING AND FOUNDATION WALL DETAILS SEE SHEET S3.00. FOOTING WIDTH ("W") = 2'-0" UNLESS NOTED OTHERWISE ON PLAN. CENTER FOOTINGS ON CONCRETE STEM WALL.
3. "F_" INDICATES CONCRETE SPREAD FOOTING. FOR SCHEDULE SEE 5/S3.00.
4. X X.XX INDICATES BRACED FRAME OR MOMENT FRAME. FOR ELEVATIONS, MEMBER SIZES AND DETAIL CALLOUTS SEE SHEET S6.00 AND S6.10.
5. W10x45 INDICATES STEEL COLUMNS ORIGINATING AT FOUNDATION LEVEL. ALL COLUMNS ARE CONTINUOUS TO ROOF UNLESS NOTED OTHERWISE. FOR TYPICAL DETAIL SEE 8/S3.00.
6. FOR TYPICAL FOUNDATION AND CONCRETE SLAB-ON-GRADE DETAILS SEE SHEET S3.00.
7. TOP OF FOOTING ELEVATIONS = -1'-0" UNLESS NOTED OTHERWISE ON PLANS AND DETAILS.

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TITLE
FOUNDATION AND GRADE LEVEL FRAMING PLAN

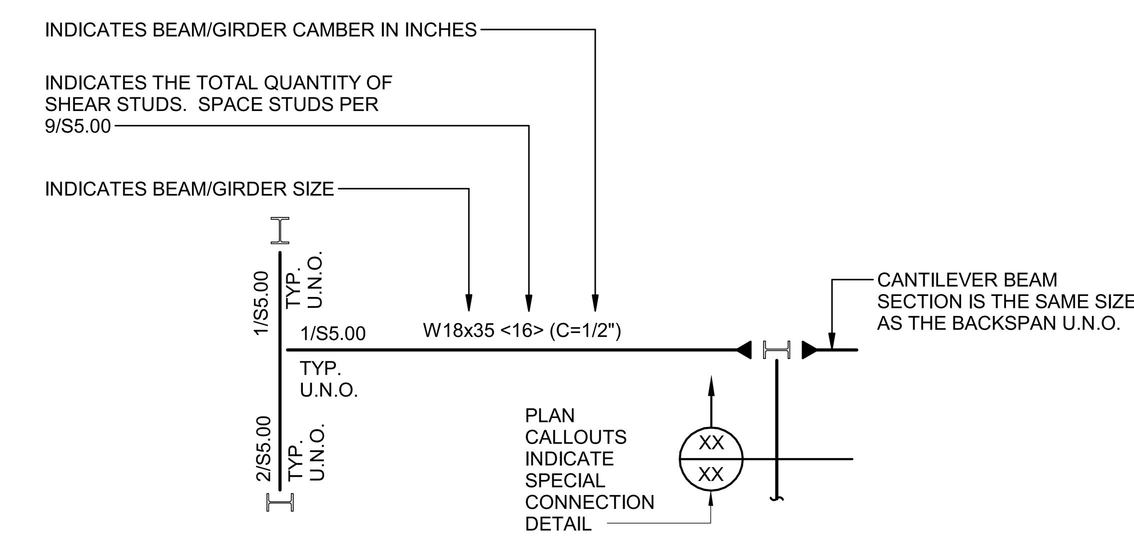
SHEET NUMBER
S2.00

1 S2.10 FRAMING PLAN - LEVEL 2
1/8" = 1'-0"

NORTH

FLOOR FRAMING NOTES

1. INDICATES BRACED FRAME. FOR ELEVATIONS, BRACE SIZES AND DETAIL CALLOUTS SEE SHEET S6.00. ALL BEAMS THAT ARE PART OF A BRACED FRAME SHALL BE CONSIDERED "COLLECTOR" BEAMS. ALL MEMBERS AND CONNECTIONS THAT ARE PART OF A BRACED FRAME SHALL BE CONSIDERED PART OF THE LATERAL-FORCE RESISTING SYSTEM.
2. INDICATES STEEL COLUMN CONTINUOUS TO FLOOR/ROOF ABOVE.
3. INDICATES PENETRATION IN FLOOR STRUCTURE. FOR TYPICAL REINFORCING AROUND OPENINGS SEE 5/S5.00.
4. FOR TYPICAL COMPOSITE BEAM AND METAL DECK DETAILS SEE SHEET S5.00.
5. INDICATES DIRECTION OF SPAN FOR METAL DECK.
6. FOR TYPICAL STEEL CONNECTION DETAILS SEE SHEET S5.00.



7. STEEL MEMBERS ARE EQUALLY SPACED BETWEEN DIMENSION POINTS UNLESS NOTED OTHERWISE.
8. INDICATES MOMENT FRAME. FOR ELEVATIONS AND DETAIL CALLOUT SEE SHEET S6.10. ASSOCIATED MEMBERS AND CONNECTIONS ARE PART OF THE LATERAL-FORCE RESISTING SYSTEM.

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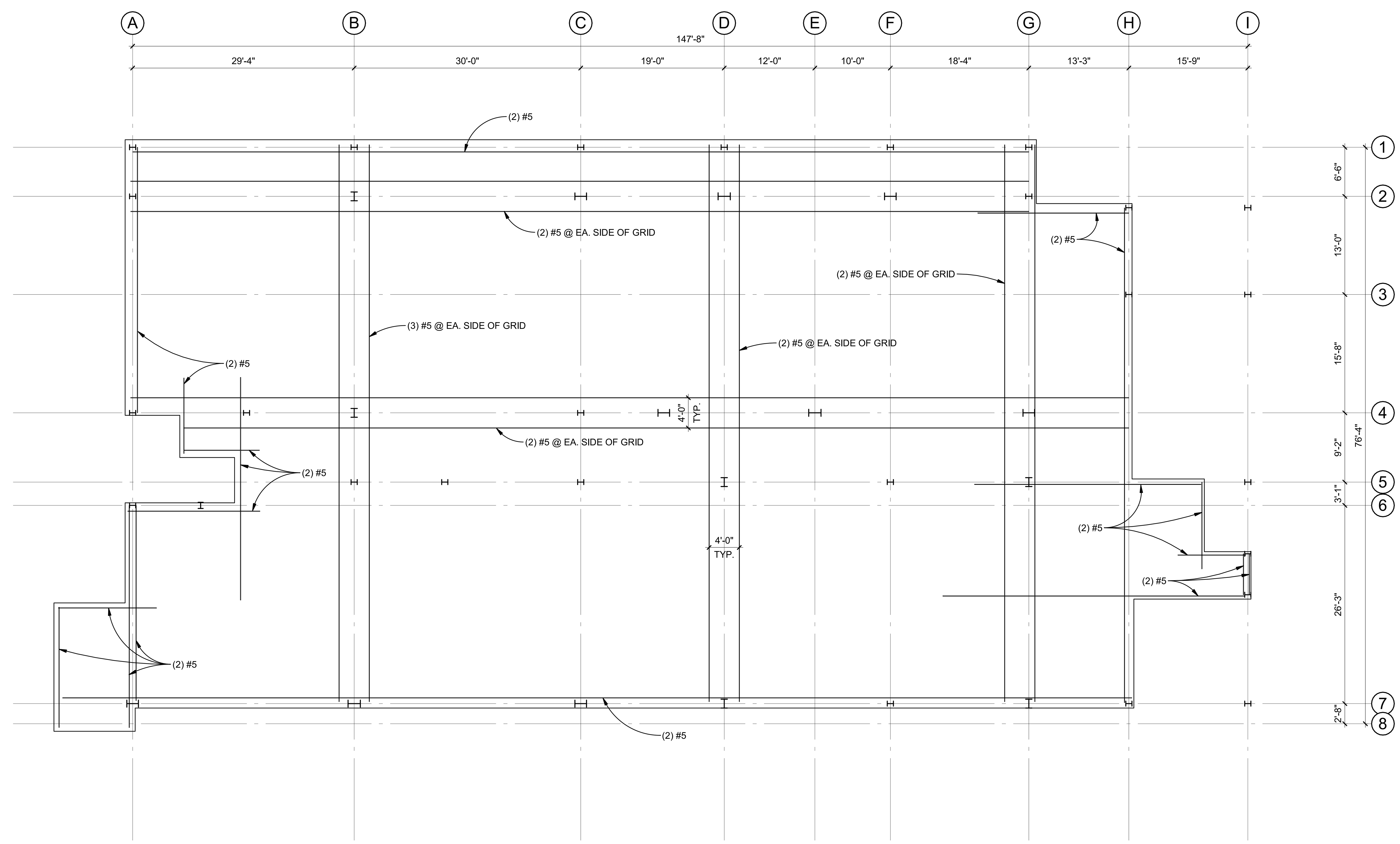
TITLE
FRAMING PLAN - LEVEL 2

SHEET NUMBER
S2.10



SLAB PLAN NOTES:

1. PROVIDE #4 24" O.C. EACH WAY AT SLAB ON METAL DECK - TYPICAL OVER ENTIRE FLOOR.
2. SLAB REINFORCING SHOWN IN THE PLAN IN ADDITION TO TYPICAL REINFORCING NOTED ABOVE.
3. SPLICE ALL REINFORCING PER GENERAL NOTES.
4. PROVIDE STANDARD HOOK AT ALL BARS WHICH CANNOT BE EXTENDED.
5. STAGGER ALL LAP SPLICES.

1
S2.10R

SLAB REINFORCING PLAN - LEVEL 2

1/8" = 1'-0"

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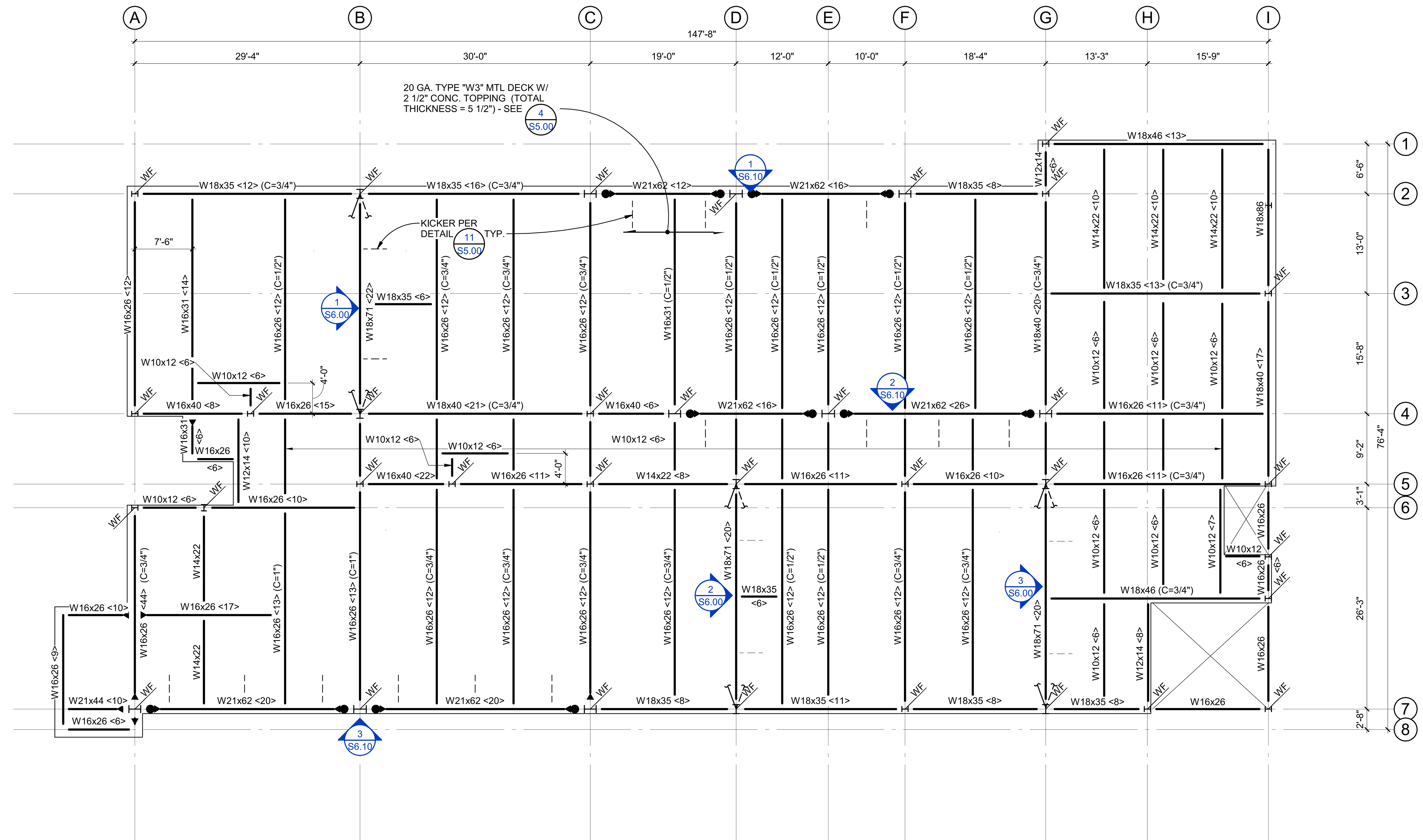
LEVEL 2 SLAB REINFORCING PLAN

SHEET NUMBER

S2.10R



T.O.S. = 27'-0 1/2"

FOR FRAMING NOTES SEE S2.10

NORTH

1
S2.20

FRAMING PLAN - LEVEL 3

1/8" = 1'-0"

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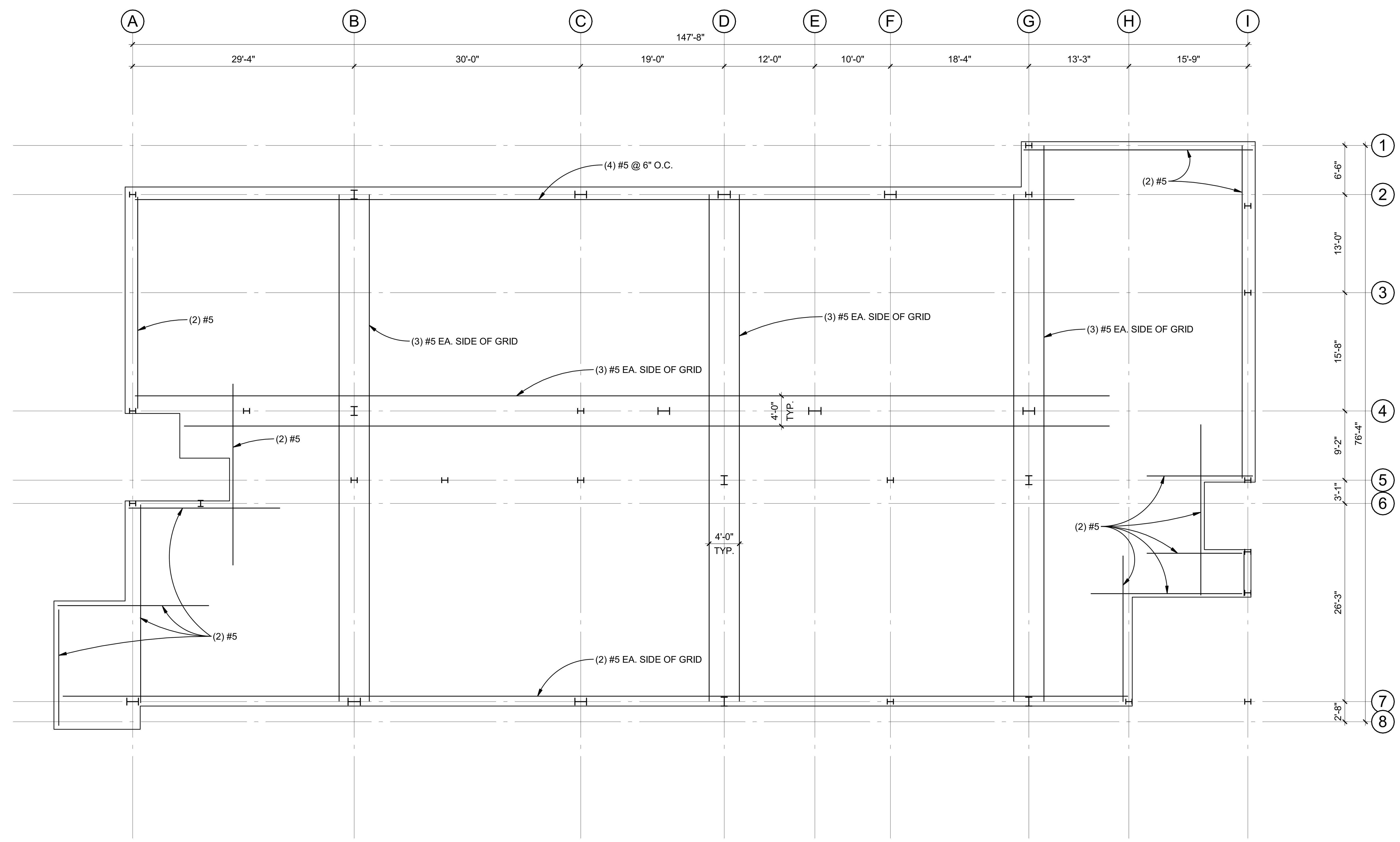
TITLE

FRAMING PLAN - LEVEL 3

SHEET NUMBER

S2.20



FOR SLAB PLAN NOTES SEE S2.10R

1 S2.20R SLAB REINFORCING PLAN - LEVEL 3

1/8" = 1'-0"

NORTH

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LEVEL 3 SLAB REINFORCING PLAN

SHEET NUMBER

S2.20R

T.O.S. = 41'-0 1/4"

FOR FRAMING NOTES SEE S2.10

ROOF FRAMING PLAN

1 S2.30 1/8" = 1'-0"

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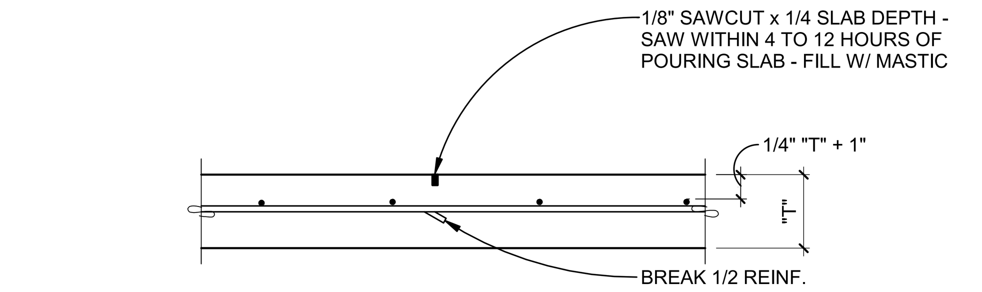
TITLE

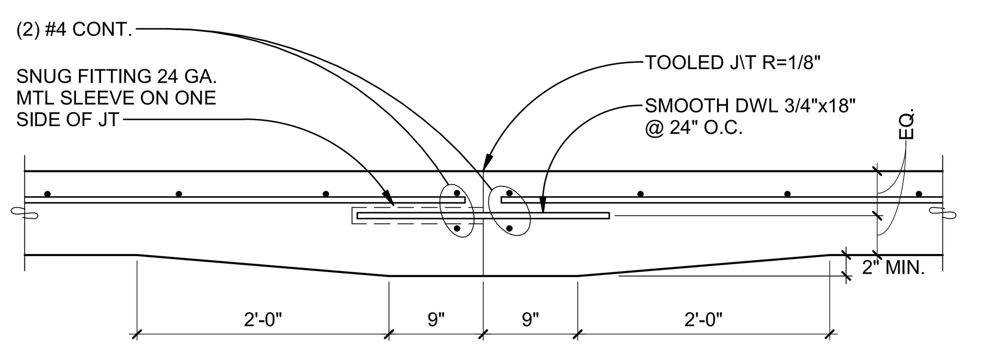
ROOF FRAMING PLAN

SHEET NUMBER

S2.30

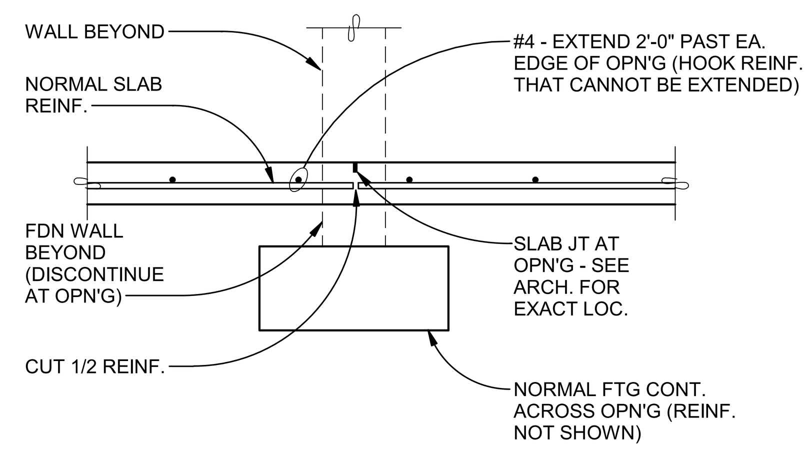


TYPICAL CONTROL JOINT FOR SLAB ON GRADE

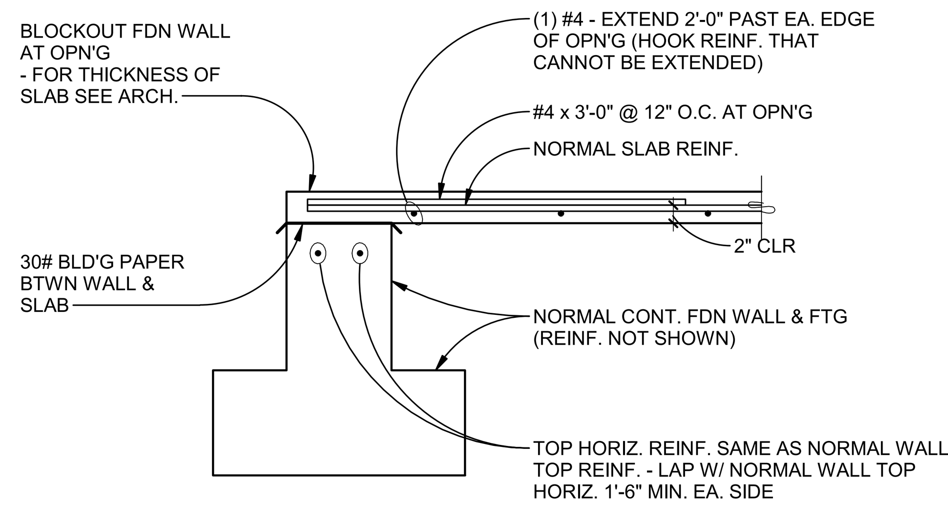


TYPICAL CONSTRUCTION JOINT FOR SLAB ON GRADE

1 SECTION S3.00
NO SCALE

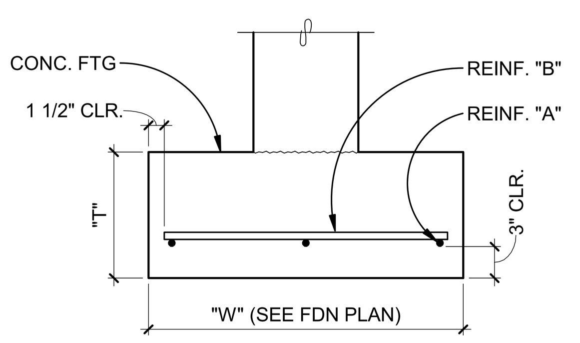


2 SECTION S3.00
NO SCALE



TYPICAL SLAB AT EXTERIOR OPENING

3 SECTION S3.00
NO SCALE

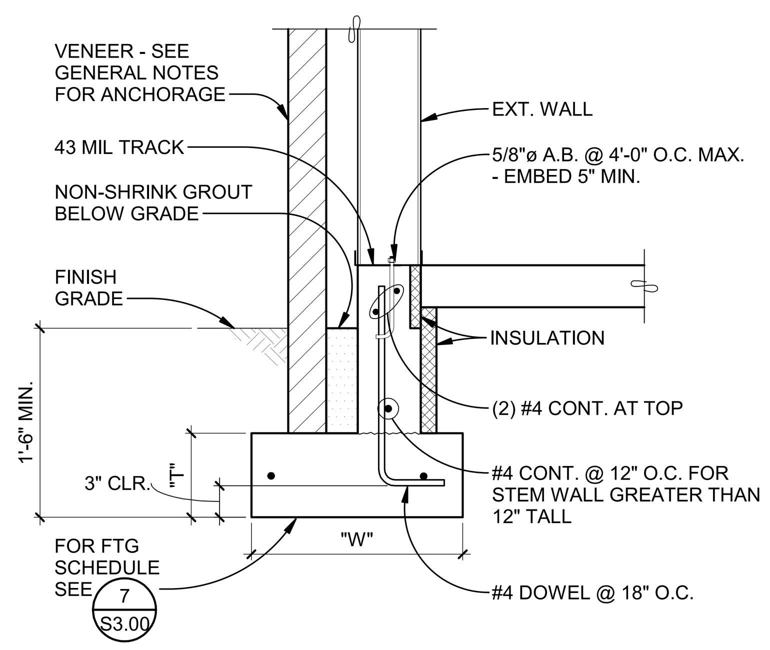


NOTES:
1. FOOTINGS SHALL BEAR ON UNDISTURBED OR COMPACTED MATERIAL - SEE GENERAL NOTES.
2. EXTEND FOOTINGS 6" MIN. PAST ENDS OF WALL UNLESS OTHERWISE NOTED.
3. WHERE FOOTINGS CHANGE WIDTHS LAP REINFORCING "A". "**Ls**" PER GENERAL NOTES.

WIDTH "W"	"T"	REINF. "A" CONT.	REINF. "B"
2'-0"	11"	(2) #5	---

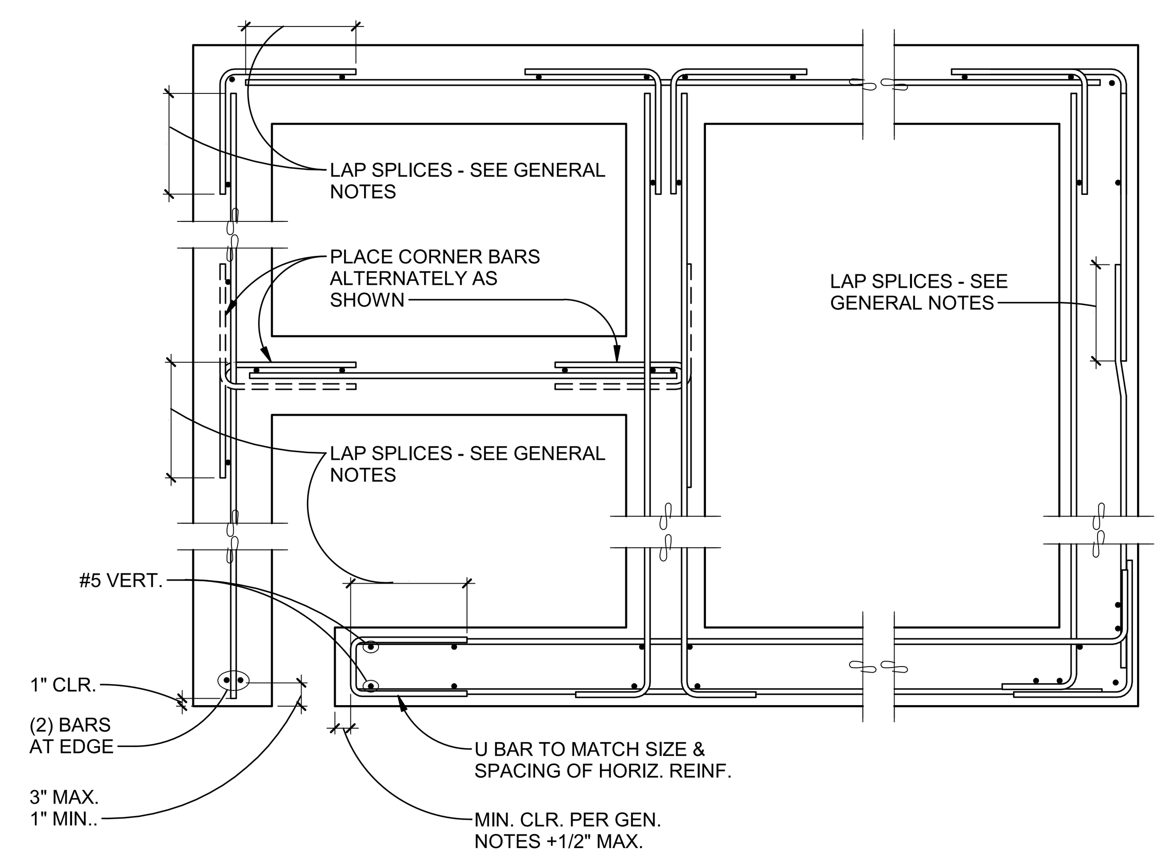
TYPICAL CONTINUOUS FOOTING DETAIL

4 SECTION S3.00
NO SCALE



TYPICAL FOUNDATION AT EXTERIOR WALL WITH VENEER

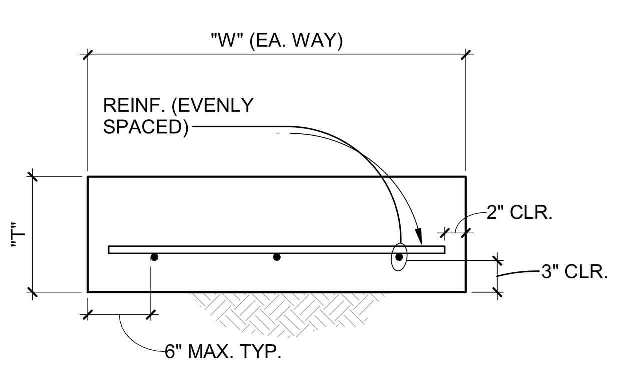
5 SECTION S3.00
NO SCALE



NOTES:
1. VERT. REINF. SHOWN IS ADD'L IF NORMAL STEM WALL REINF. IS NOT IN PROPER LOCATION.
2. CORNER BARS ARE SAME SIZE & SPACING AS HORIZ. REINF.
3. 90° STD HOOK MAY BE SUBSTITUTED FOR CORNER BARS. SEE NOTE #5.
4. REINF. AT ALL CORNERS, ENDS, & INTERSECTIONS OF WALLS SHALL BE PLACED IN ACCORDANCE W/ APPROPRIATE DETAIL SHOWN.
5. USE 90° STD HOOK FOR EMBEDMENT LESS THAN 24" PAST FACE OF WALL.

TYPICAL REINFORCING PLACEMENT FOR CAST IN PLACE CONCRETE WALLS AND STEM WALLS

6 DETAIL S3.00
NO SCALE



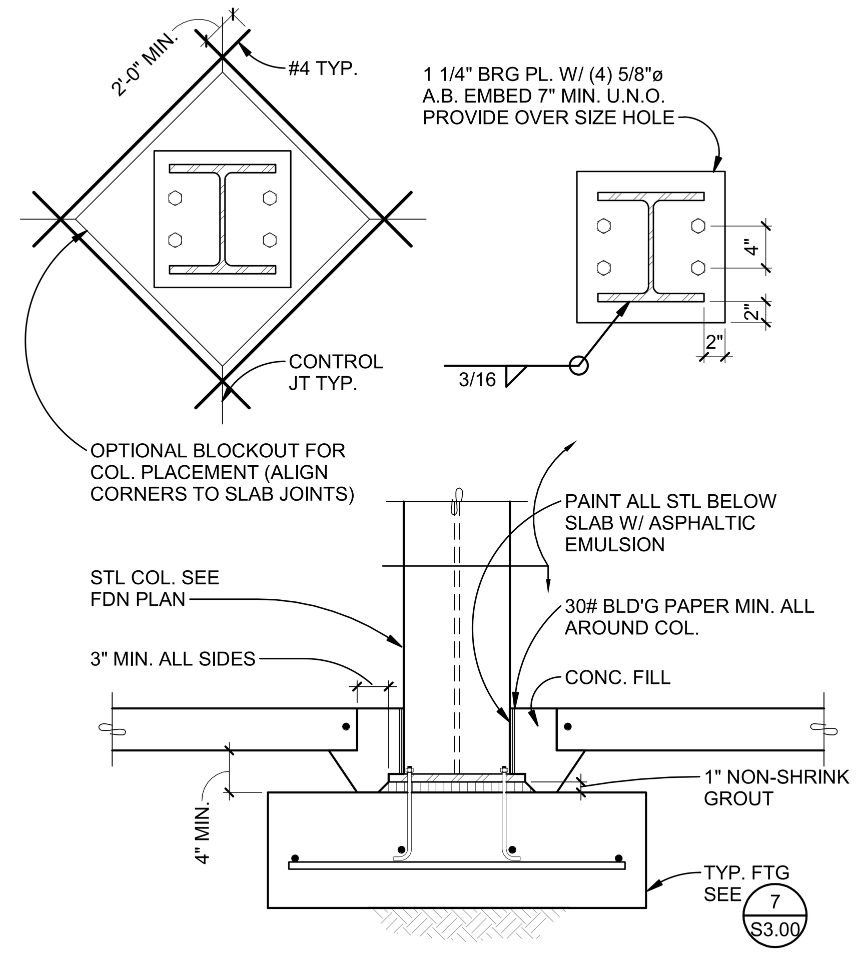
MARK	DIMENSIONS "W"	DIMENSIONS "T"	REINF. EA. WAY
F4.0	4'-0"	11"	(4) #5
F5.0	5'-0"	14"	(5) #6
F6.0	6'-0"	16"	(6) #7

SECTION

NOTES:
1. CENTER ALL FOOTINGS ON COLUMN ABOVE EXCEPT AS SHOWN OTHERWISE.
2. FOOTINGS SHALL BEAR ON UNDISTURBED OR COMPACTED MATERIAL, SEE GENERAL NOTES. DESIGN BEARING PRESSURE IS 4000 PSF.

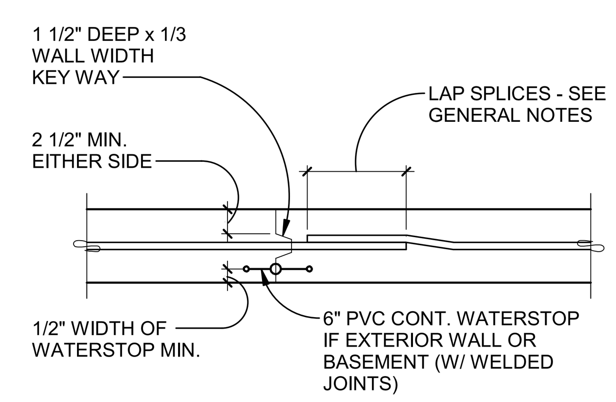
TYPICAL CONCRETE SPREAD FOOTING DETAILS

7 SECTION S3.00
NO SCALE

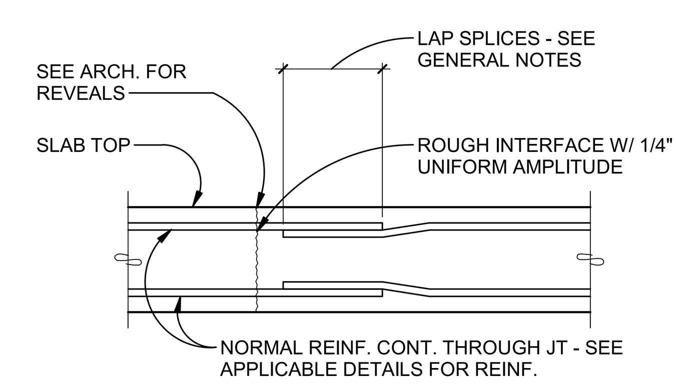


TYPICAL STEEL COLUMN AT SPREAD FOOTING

8 SECTION S3.00
NO SCALE



TYPICAL AT VERTICAL WALL JOINTS



TYPICAL AT CONCRETE GRADE BEAMS & FOOTINGS

NOTE:
OBTAIN APPROVAL OF ENGINEER FOR LOC. OF ANY C.J.

TYPICAL FOR CAST IN PLACE CONCRETE WALLS, GRADE BEAMS AND FOOTINGS

9 CONSTRUCTION JOINTS S3.00
NO SCALE

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TITLE
FOUNDATION DETAILS

SHEET NUMBER
S3.00

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C:_Revit Models\BUILDING 3 - ATC BLDG 3 IBC 2018 SDC C RC3 v2020 (Central)_dhome@pcs-structural.com.rvt

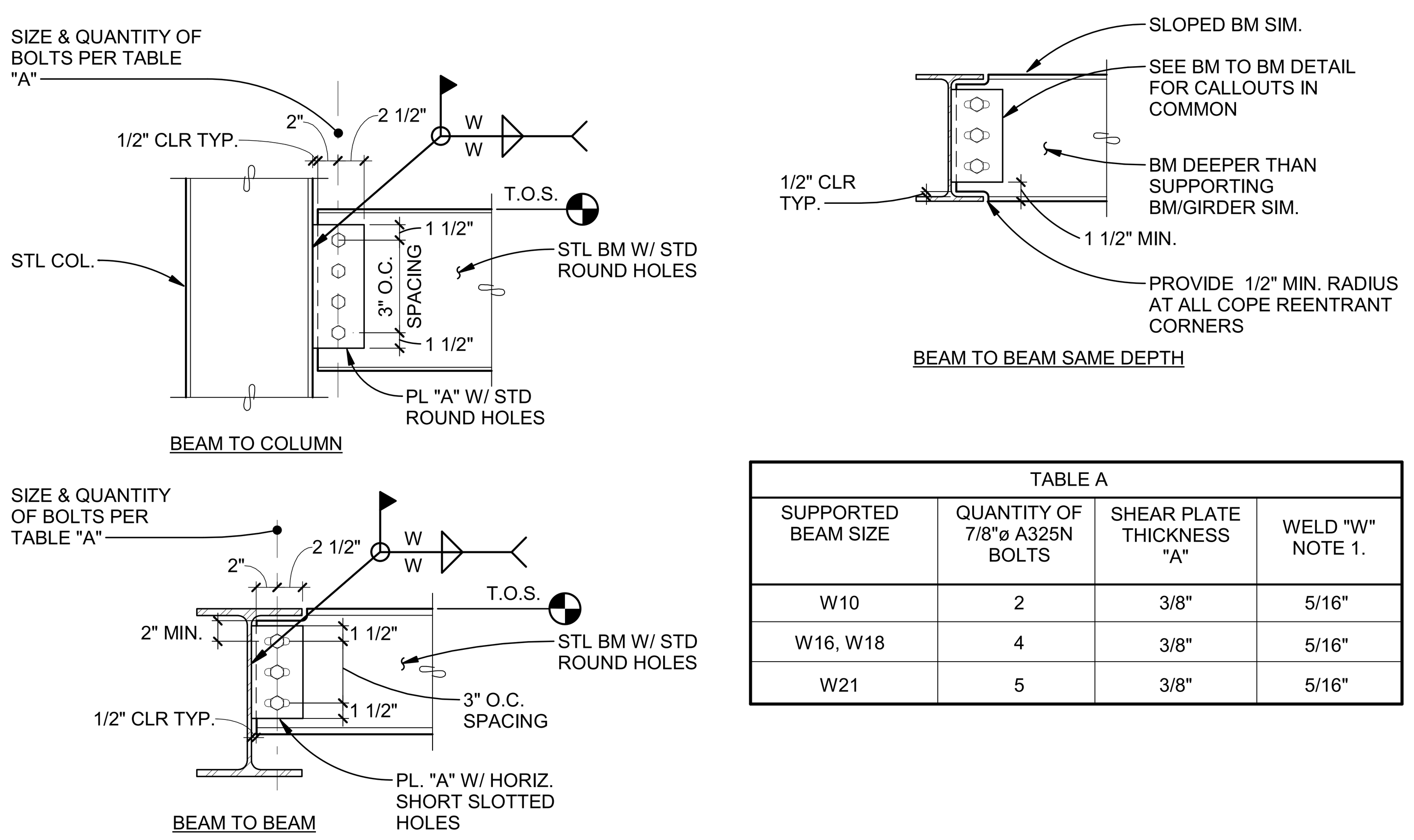
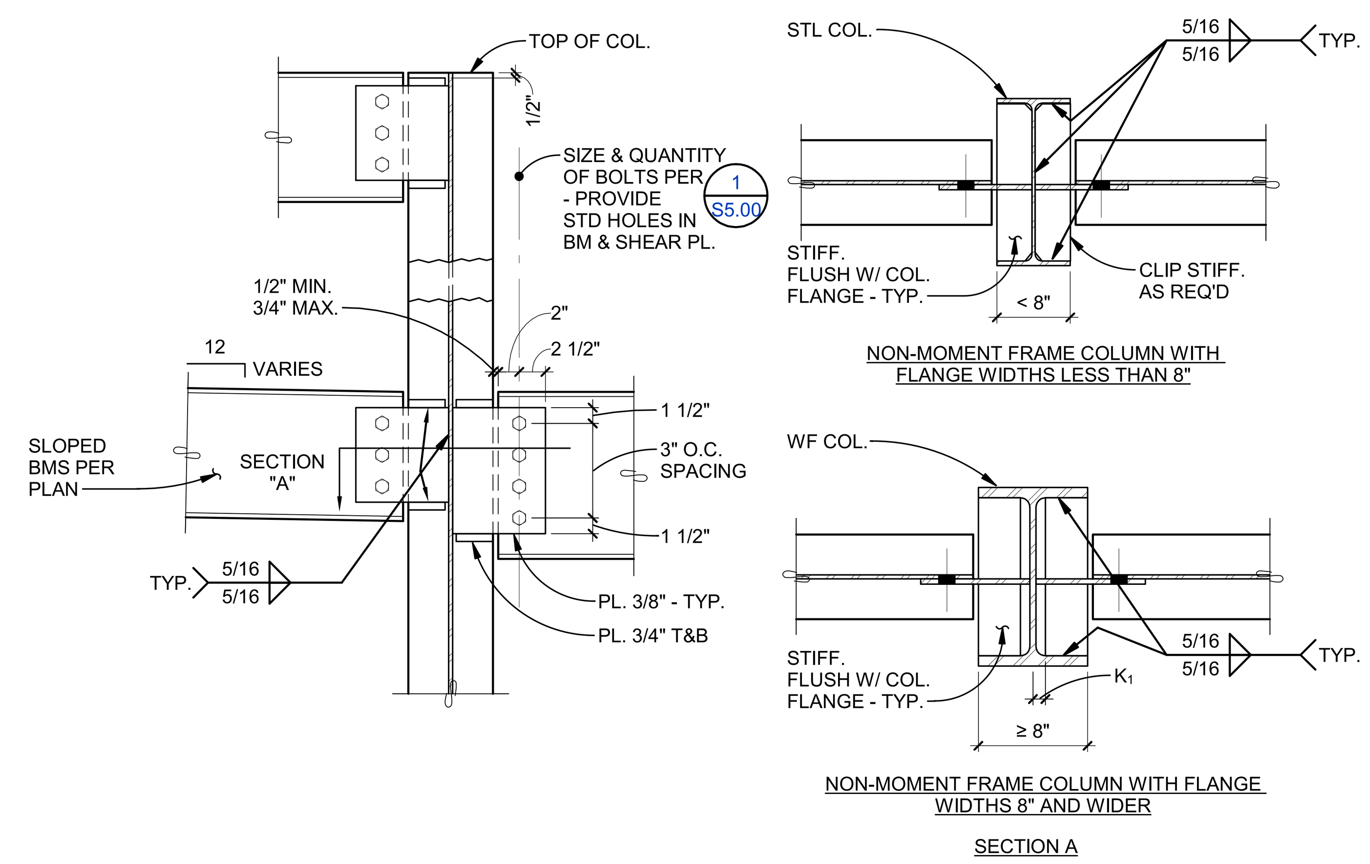


TABLE A			
SUPPORTED BEAM SIZE	QUANTITY OF 7/8"ø A325N BOLTS	SHEAR PLATE THICKNESS "A"	WELD "W" NOTE 1.
W10	2	3/8"	5/16"
W16, W18	4	3/8"	5/16"
W21	5	3/8"	5/16"

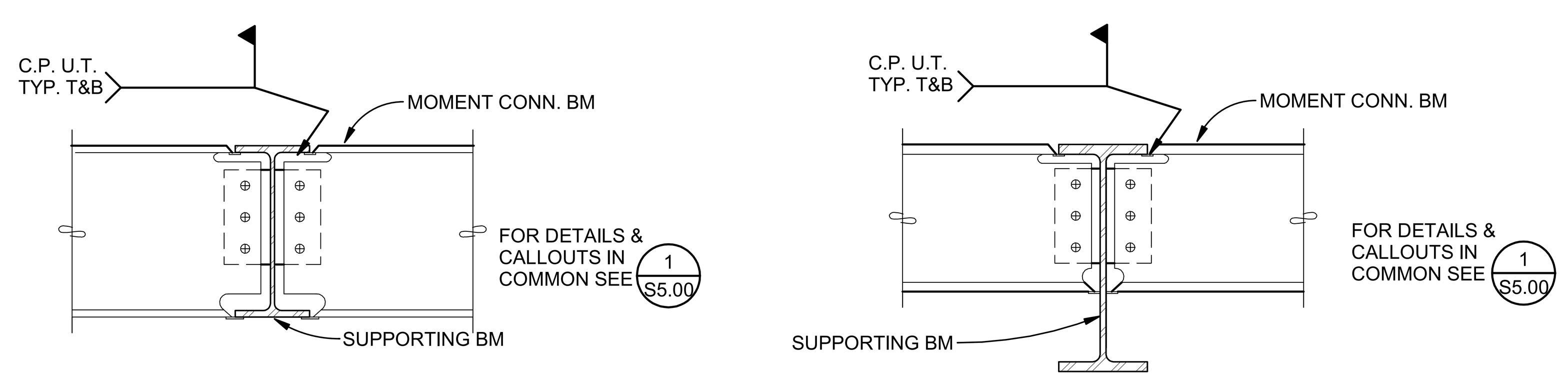
TYPICAL STEEL DETAIL

1 S5.00 DETAIL
NO SCALE

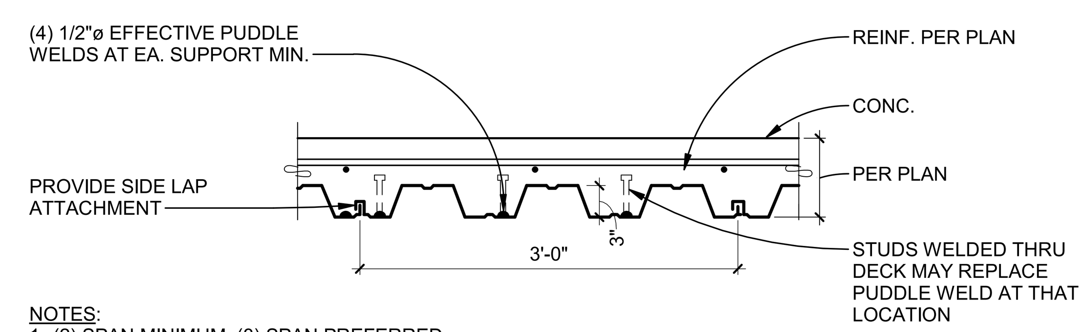


TYPICAL BEAM/COLUMN FRAMING INTO WEB

2 S5.00 DETAIL
NO SCALE

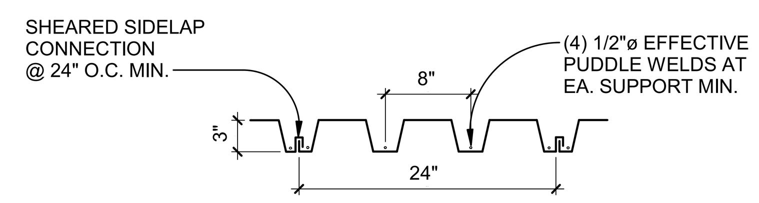


3 S5.00 DETAIL
NO SCALE



NOTES:
1. (2) SPAN MINIMUM, (3) SPAN PREFERRED.
2. AT SUPPORTS PARALLEL TO CORRUGATIONS, PROVIDE PUDDLE WELDS @ 24" O.C. MAXIMUM.

TYPICAL COMPOSITE FLOOR DECK

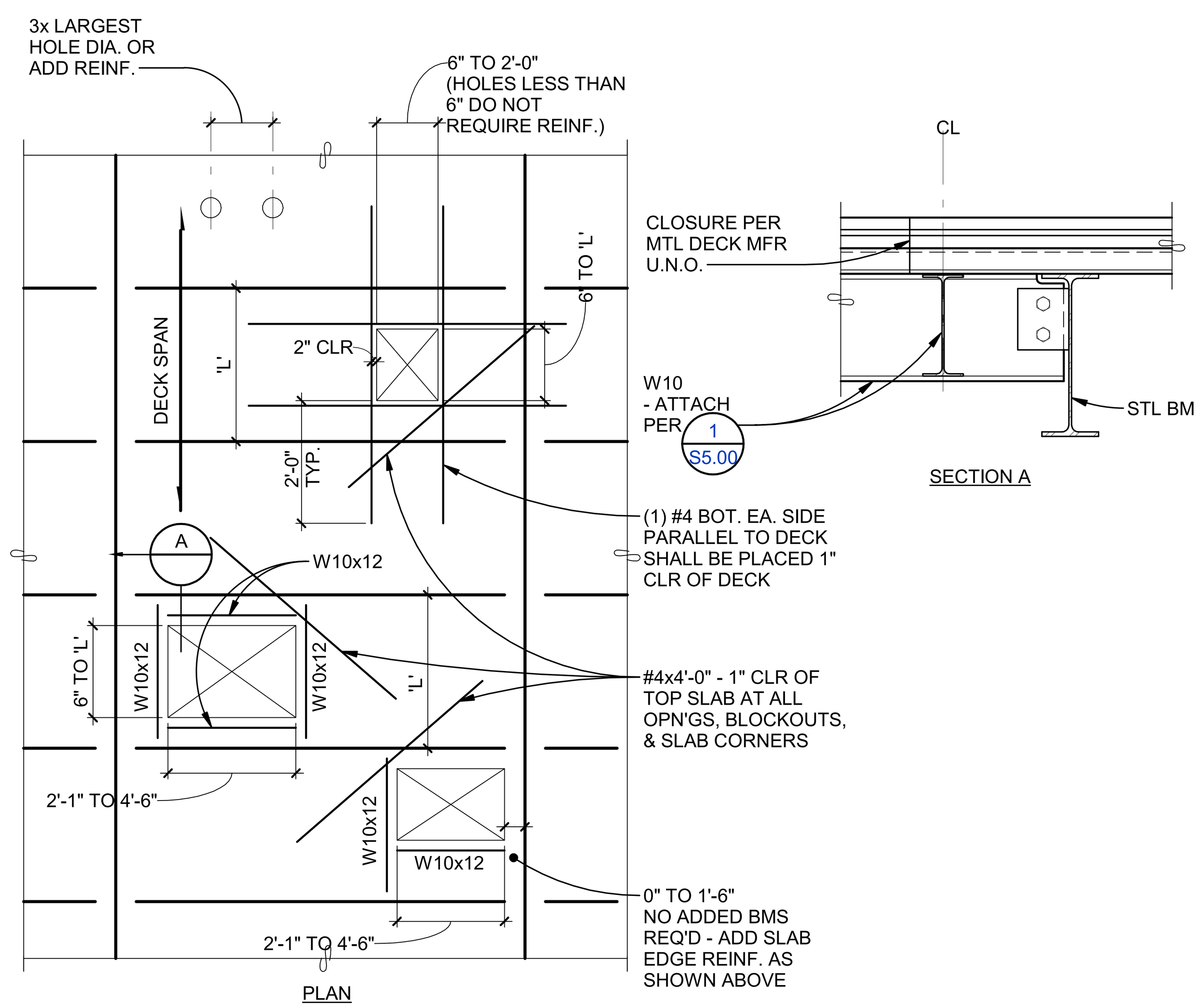


TYPE "N" MIN. DECK PROPERTIES		
GAUGE	I = (in.⁴/ft.)	+S/-S = (in.³/ft)
20	.837	.508/.562

NOTES:
1. (2) SPAN MIN. ,(3) PREFERRED.
2. AT SUPPORTS PARALLEL TO CORRUGATIONS, PROVIDE PUDDLE WELDS @ 24" O.C. MAX.

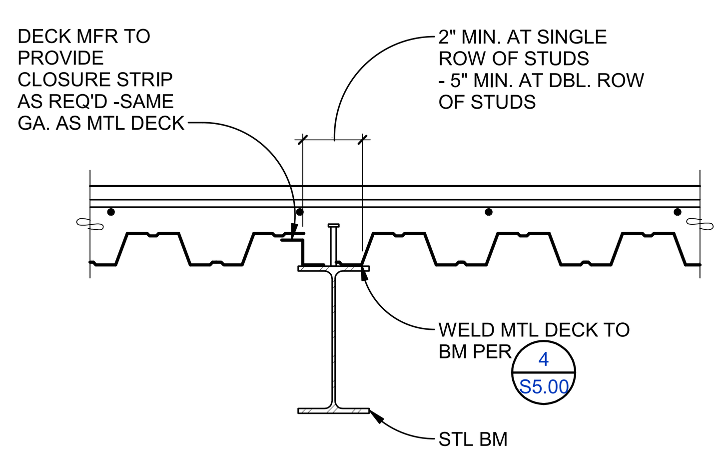
TYPICAL ROOF METAL DECK

4 S5.00 DETAIL
NO SCALE



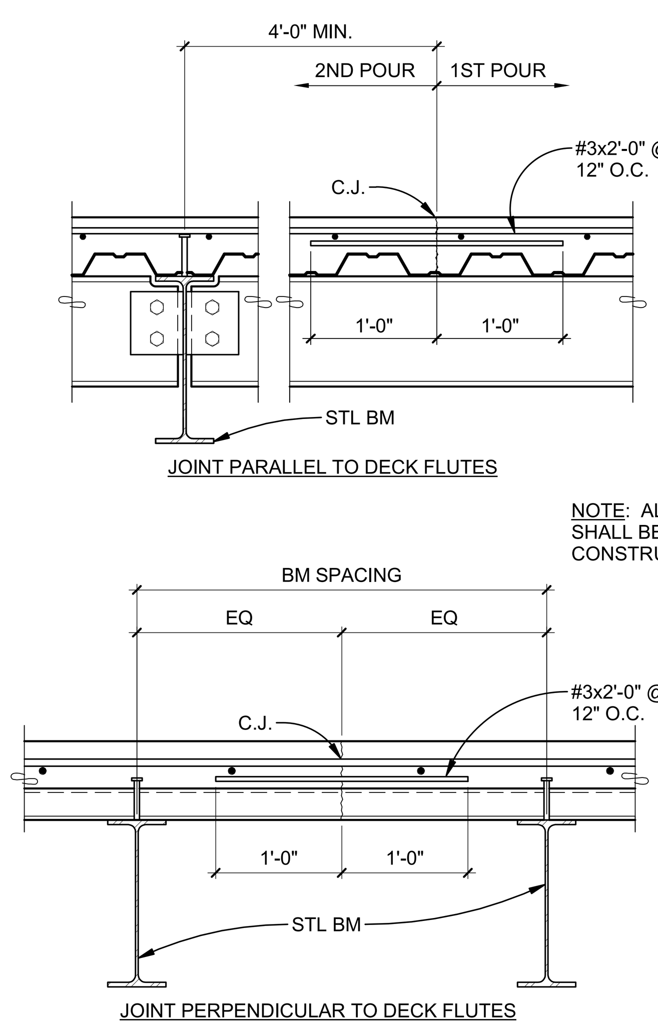
TYPICAL FLOOR PENETRATION REINFORCEMENT

5 S5.00 DETAIL
NO SCALE



TYPICAL AT METAL DECK PARALLEL TO BEAM

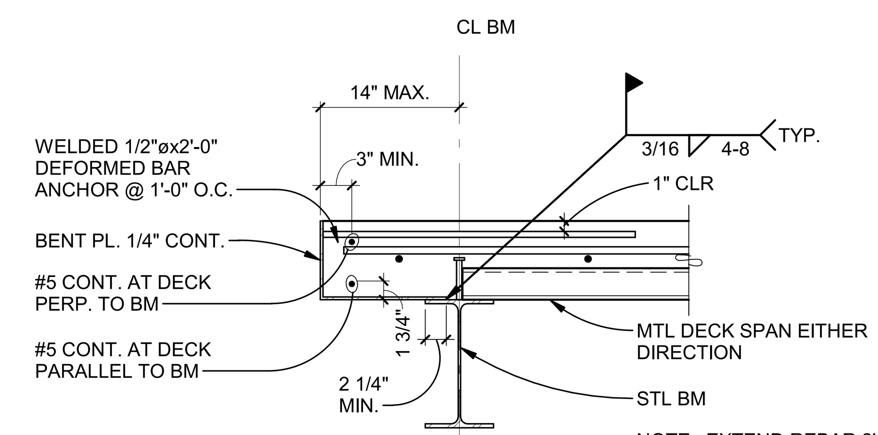
6 S5.00 SECTION
NO SCALE



NOTE: ALL REINFORCEMENT SHALL BE CONTINUOUS THRU CONSTRUCTION JOINT

TYPICAL COMPOSITE DECK CONSTRUCTION JOINT

7 S5.00 SECTION
NO SCALE

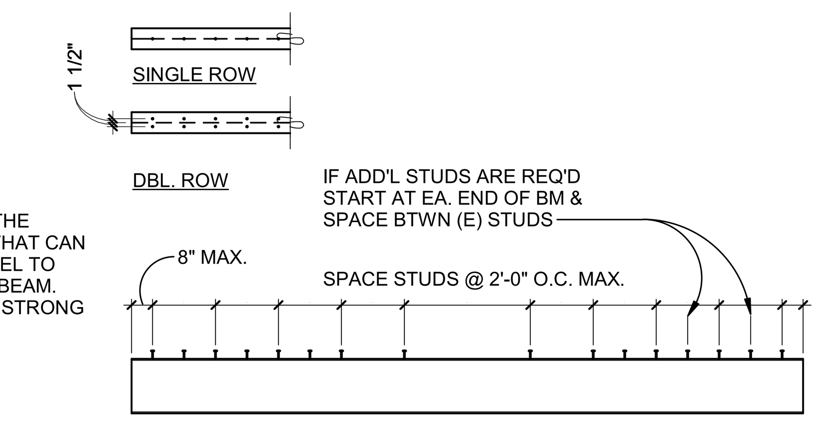


NOTE: EXTEND REBAR 2'-0" PAST EDGE OF ISOLATED OPENING.

TYPICAL SLAB EDGE CONDITION - OVER 6" OVERHANG

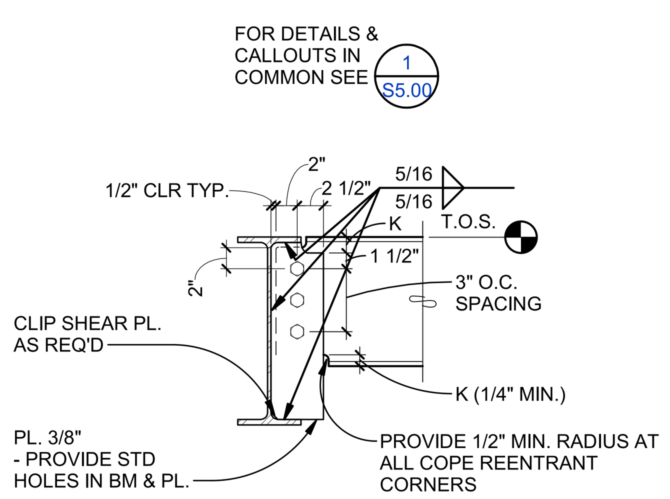
8 S5.00 SECTION
NO SCALE

NOTES:
1. LOCATE STUDS AT CENTER OF BEAM FLANGE.
2. STUDS ARE 3/4"ø x 4 1/2" LONG AFTER WELDING.
3. SEE FRAMING PLANS FOR NUMBER OF STUDS.
4. ALL BEAMS WITH STUDS ARE COMPOSITE STEEL BEAMS.
5. PROVIDE A DOUBLE ROW OF STUDS AT BEAMS WHERE THE REQUIRED NUMBER OF STUDS EXCEEDS THE NUMBER THAT CAN FIT IN A SINGLE ROW AT 6" ON CENTER AT DECK PARALLEL TO BEAM OR 12" ON CENTER AT DECK PERPENDICULAR TO BEAM. STUDS SHOULD BE LOCATED IN DECK FLUTES PER AISC STRONG POSITION.



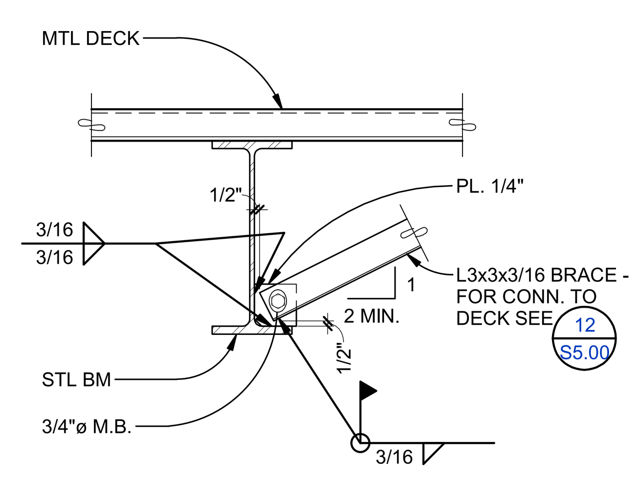
TYPICAL COMPOSITE BEAM DETAIL

9 S5.00 DETAIL
NO SCALE



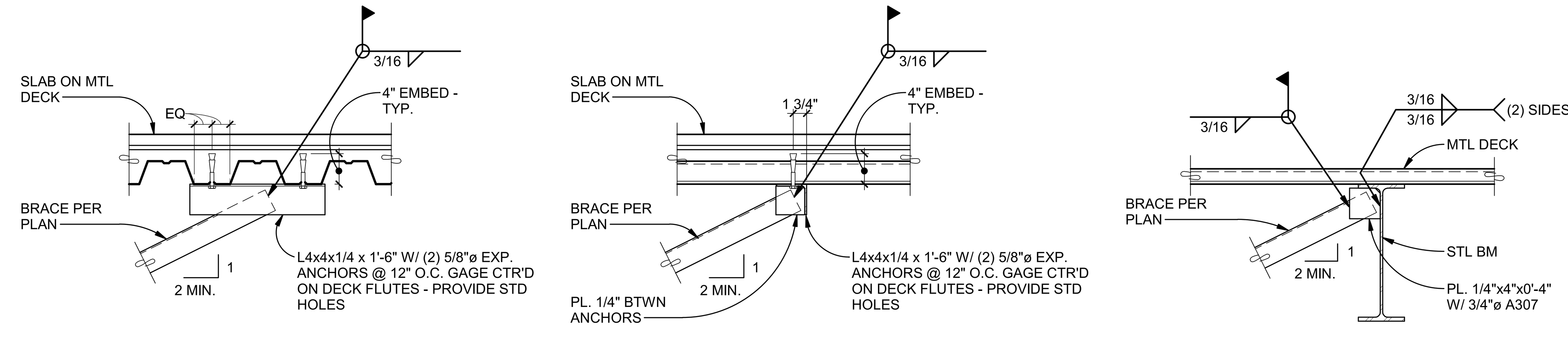
TYPICAL BEAM FRAMING AT FULL DEPTH SHEAR PLATE

10 S5.00 DETAIL
NO SCALE



BEAM BRACING

11 S5.00 SECTION
NO SCALE



12 S5.00 SECTION
NO SCALE

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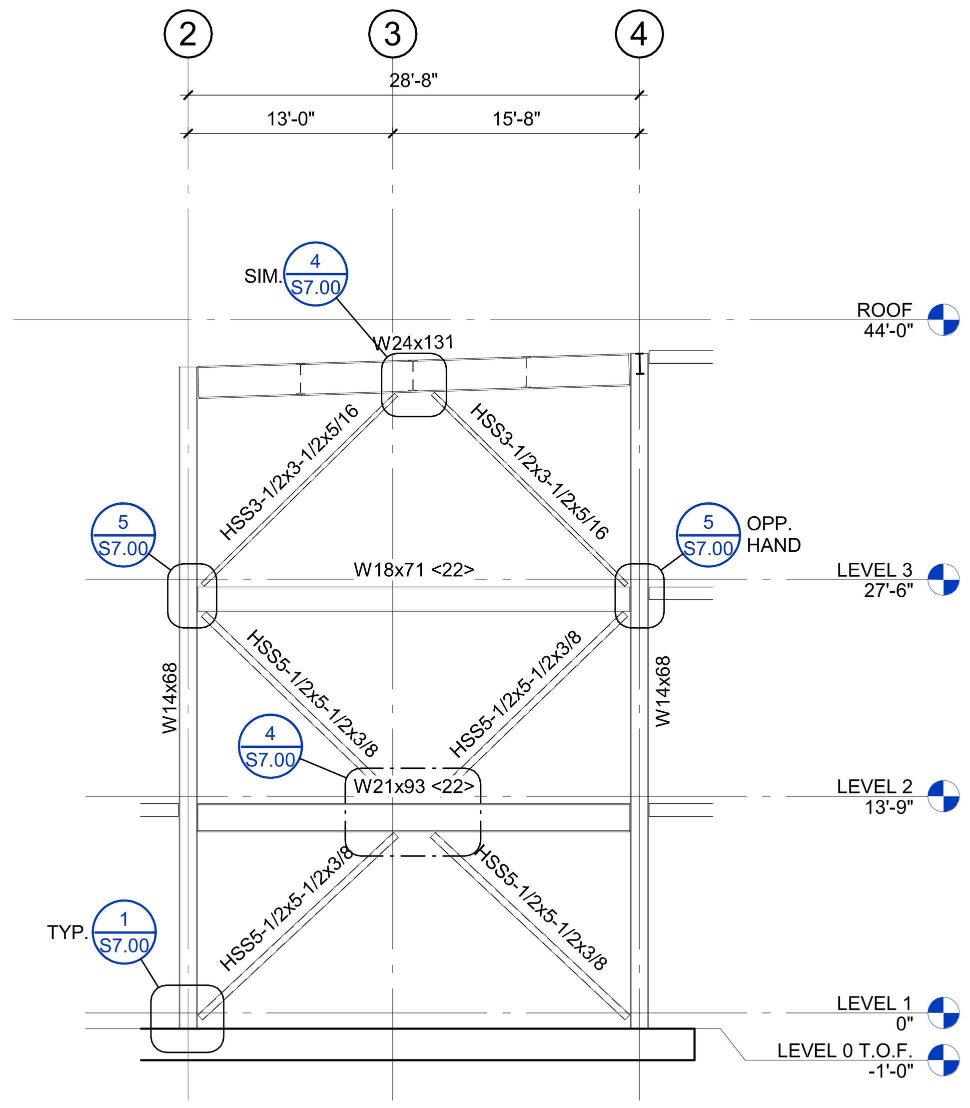
STEEL DETAILS

SHEET NUMBER
S5.00

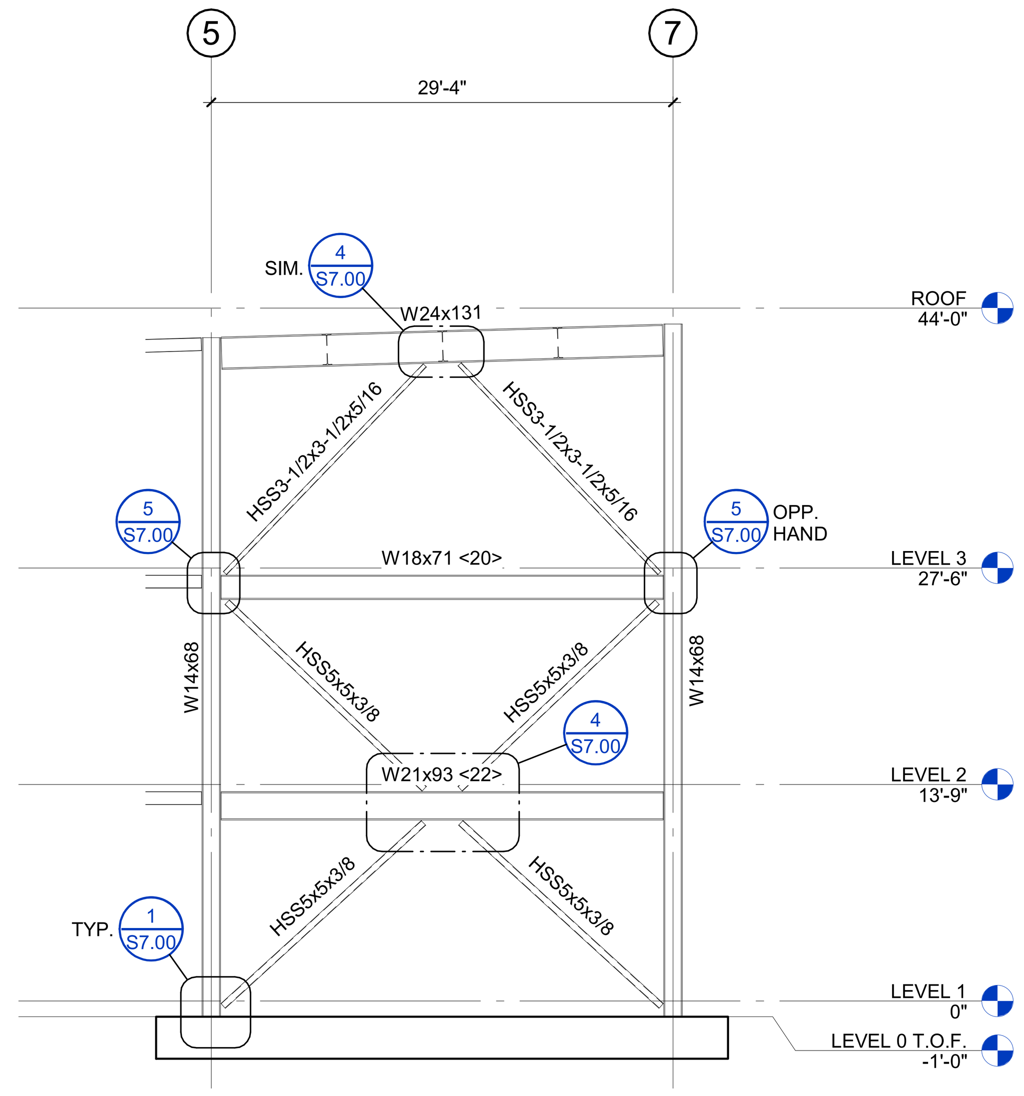


NOTE: SEE 2/S7.01 FOR PROTECTED ZONE

AT GRID B

1 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"

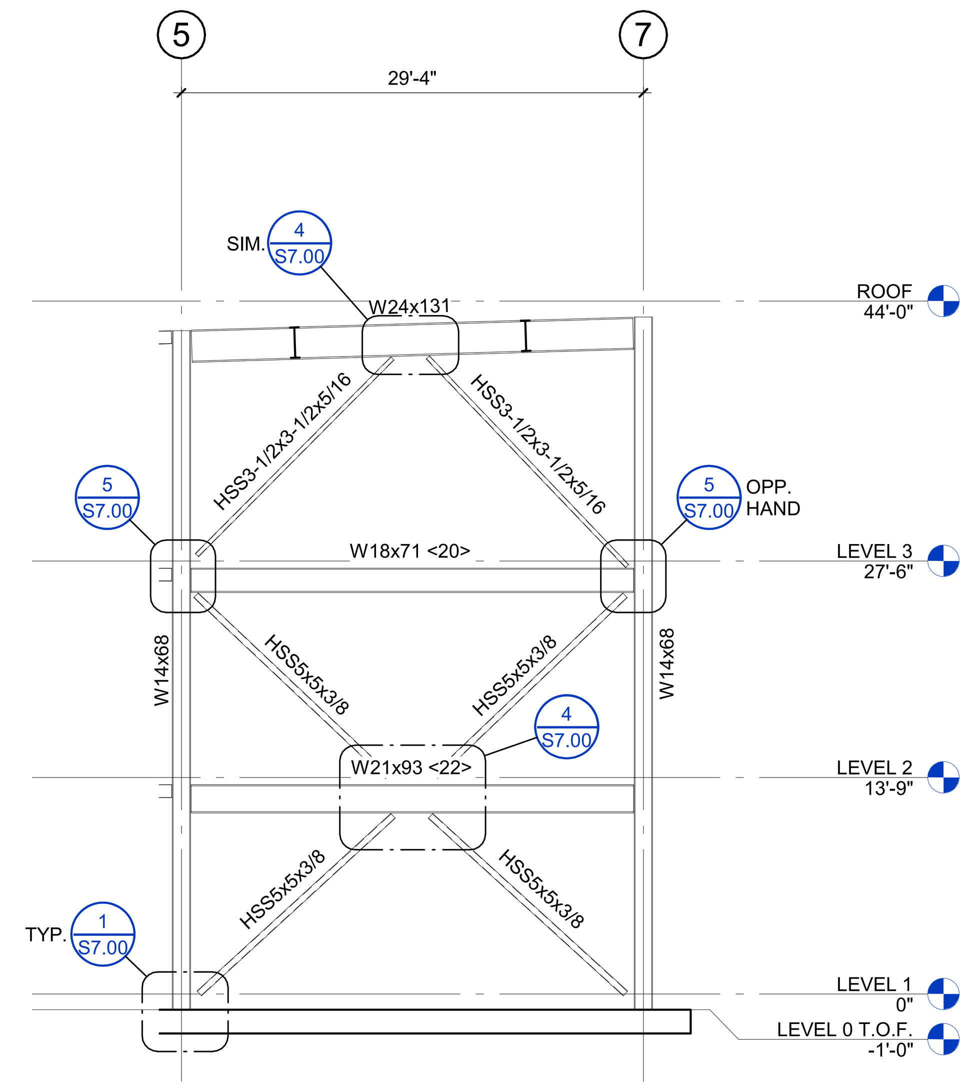


NOTE: SEE 2/S7.01 FOR PROTECTED ZONE

AT GRID D

2 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"



NOTE: SEE 2/S7.01 FOR PROTECTED ZONE

AT GRID G

3 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"

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EDUCATION FACILITY

ST. LOUIS MISSOURI
PCS STRUCTURAL SOLUTIONS
DESIGN D
2018 IBC WITH RISK CATEGORY III

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DRAWINGS

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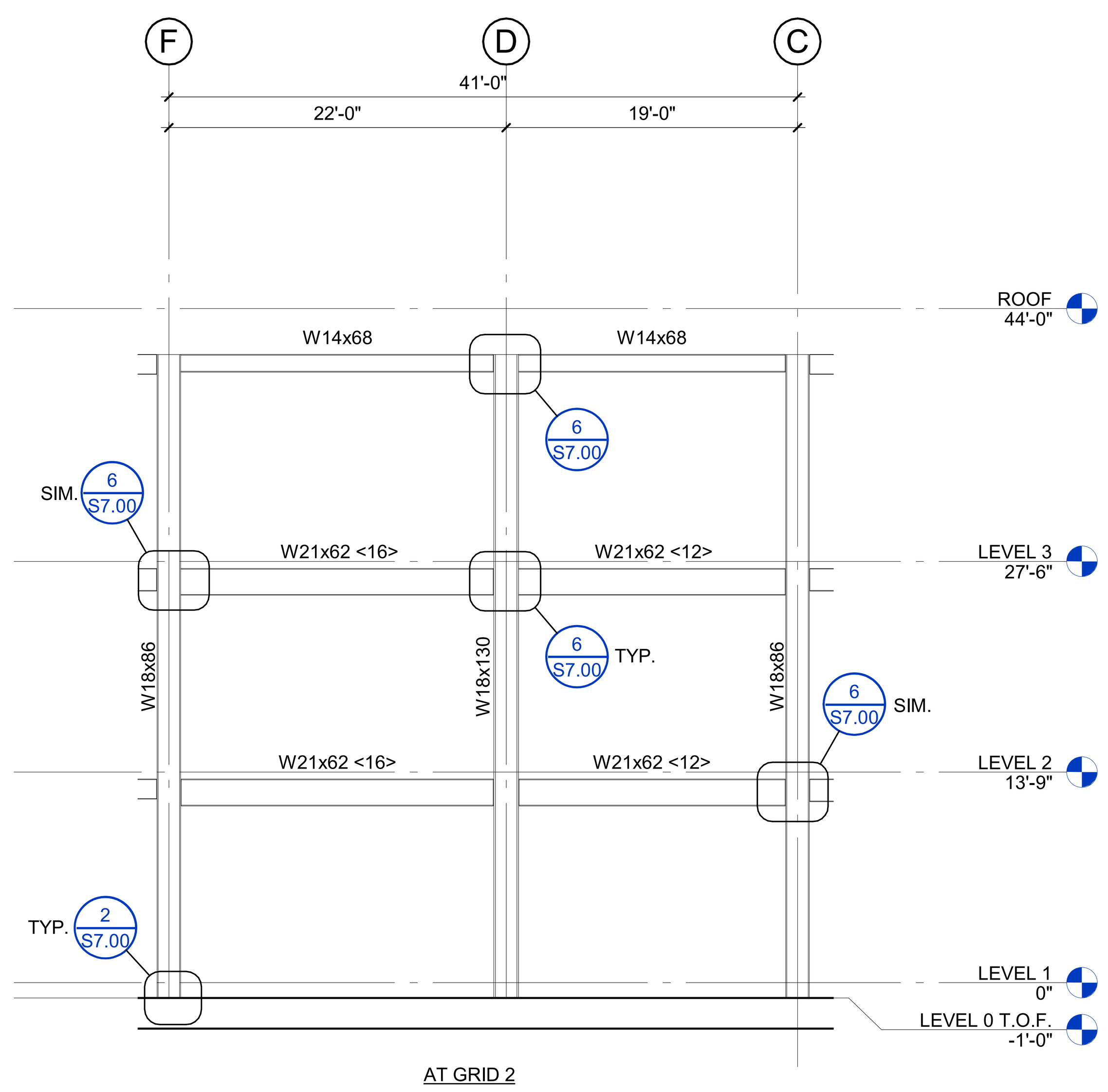
TITLE

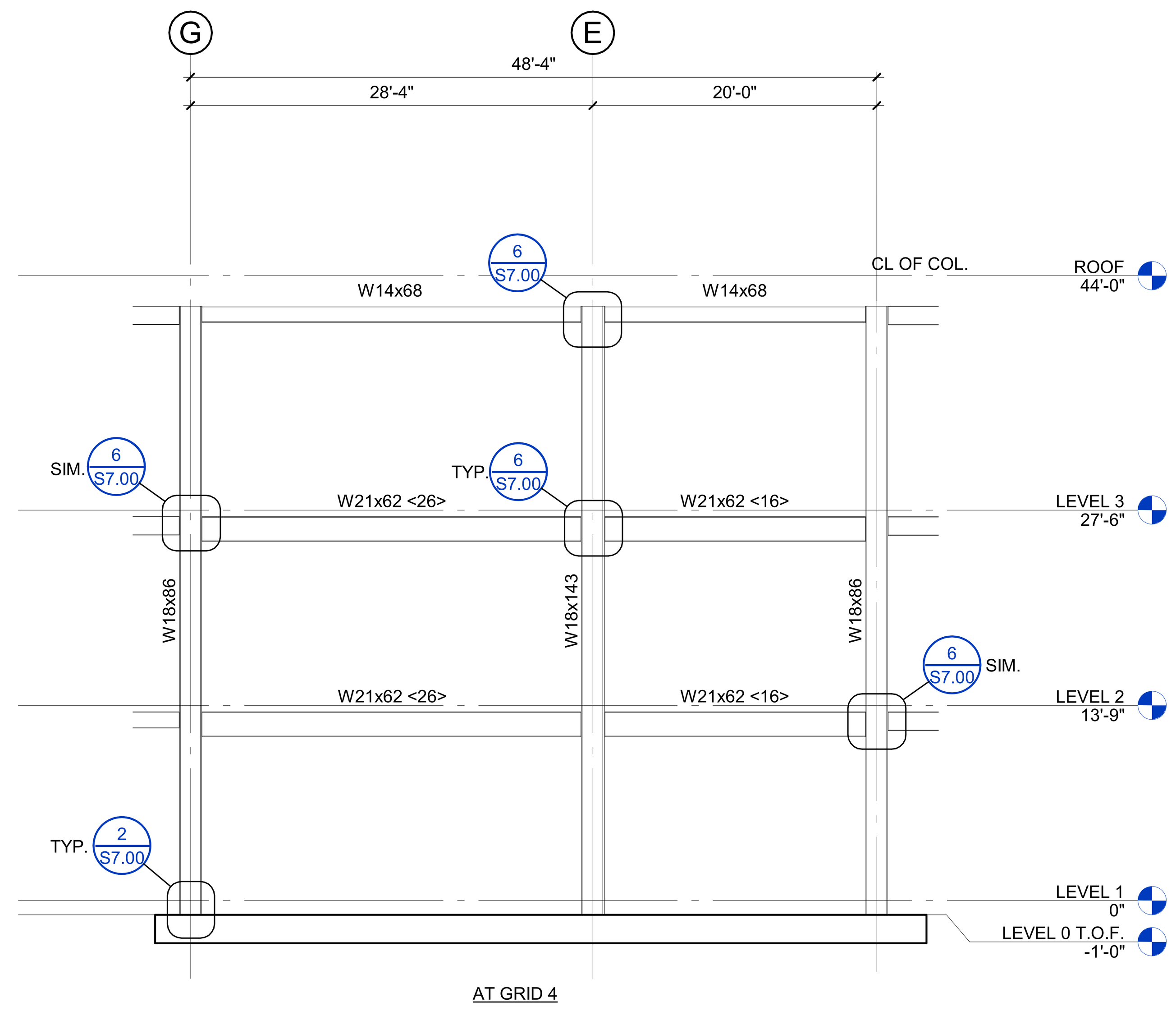
BRACED FRAME ELEVATIONS

SHEET NUMBER

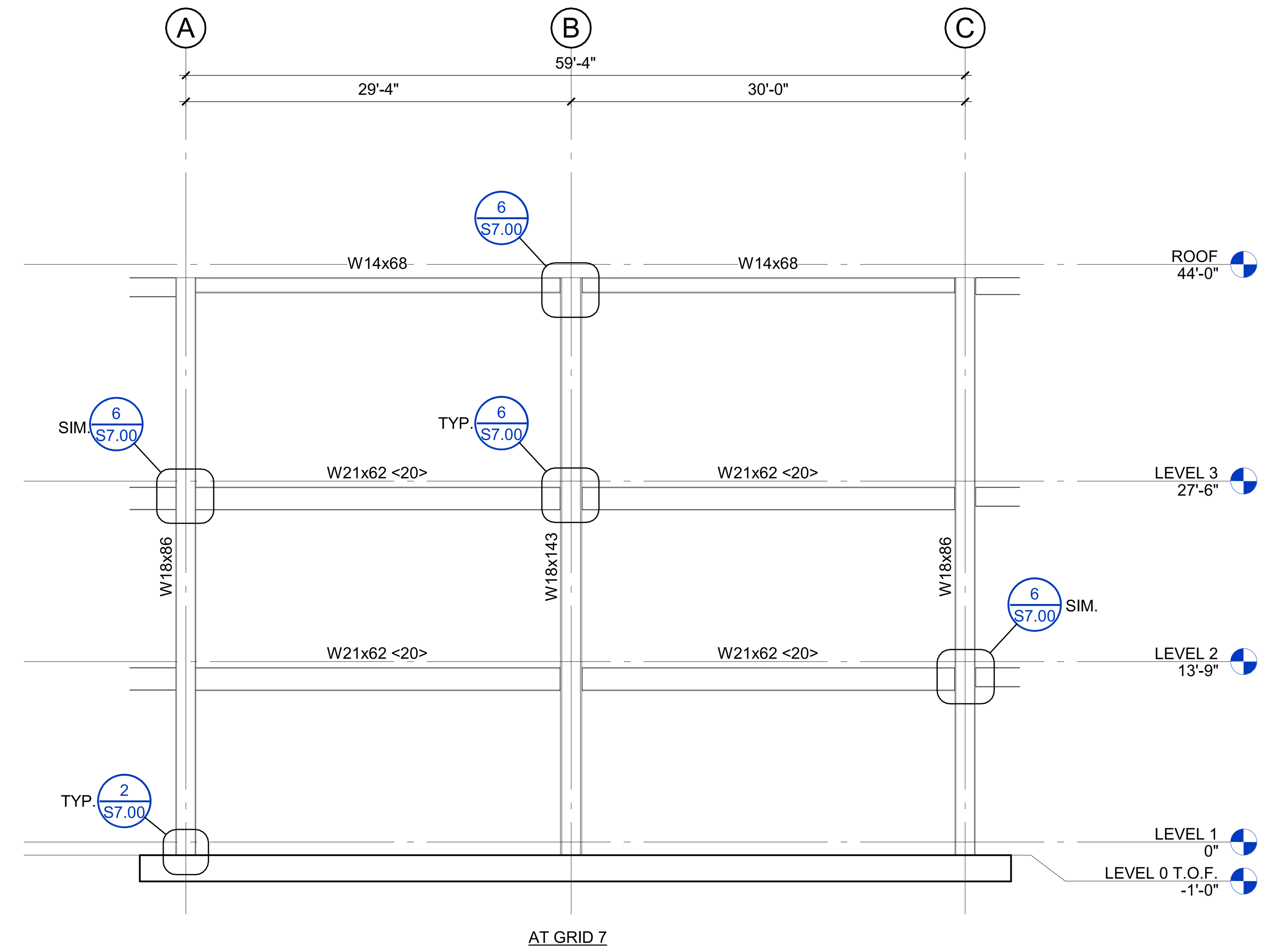
S6.00



1 S6.10 MOMENT FRAME ELEVATION
1/8" = 1'-0"



2 S6.10 MOMENT FRAME ELEVATION
1/8" = 1'-0"



3 S6.10 MOMENT FRAME ELEVATION
1/8" = 1'-0"

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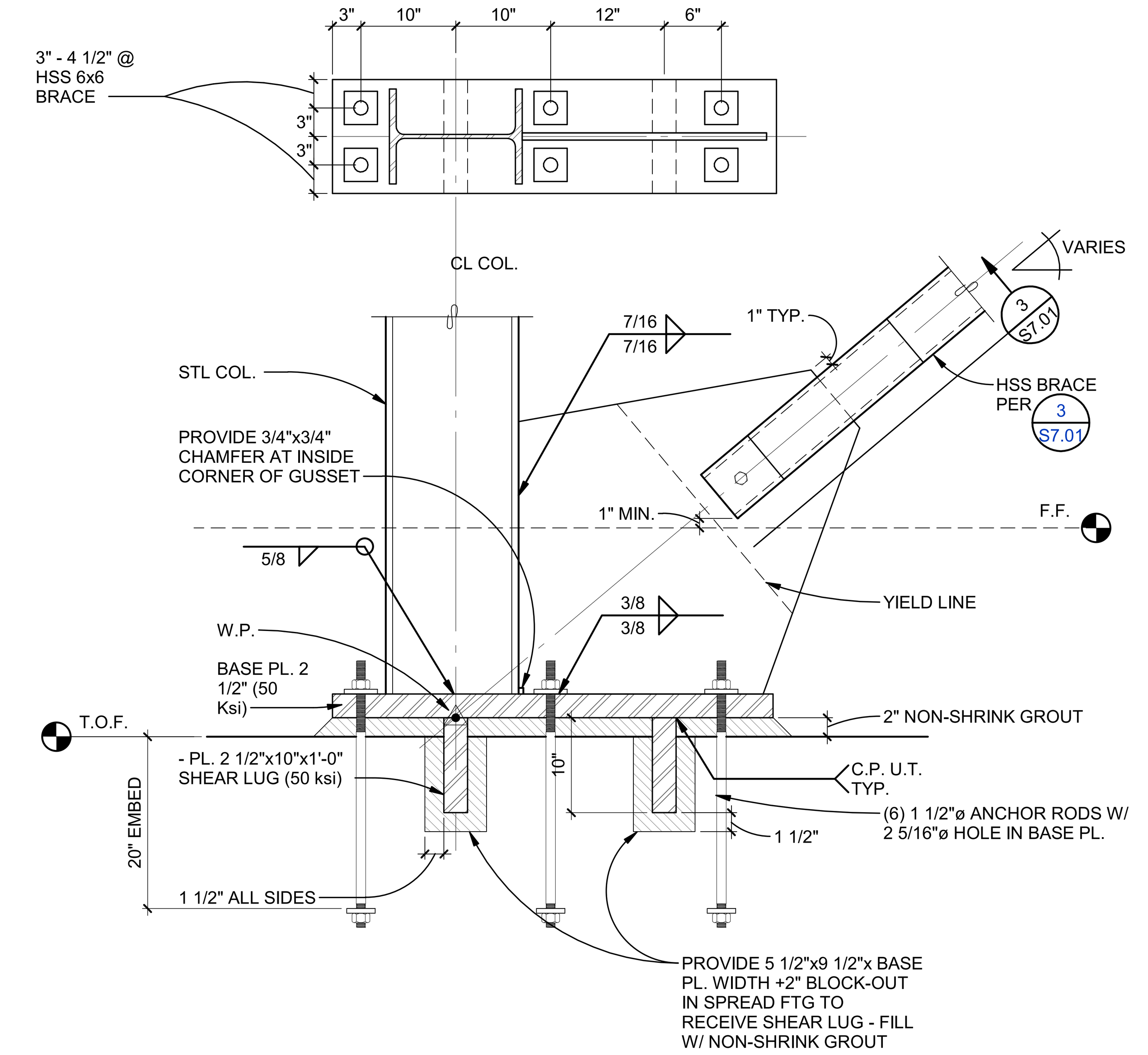
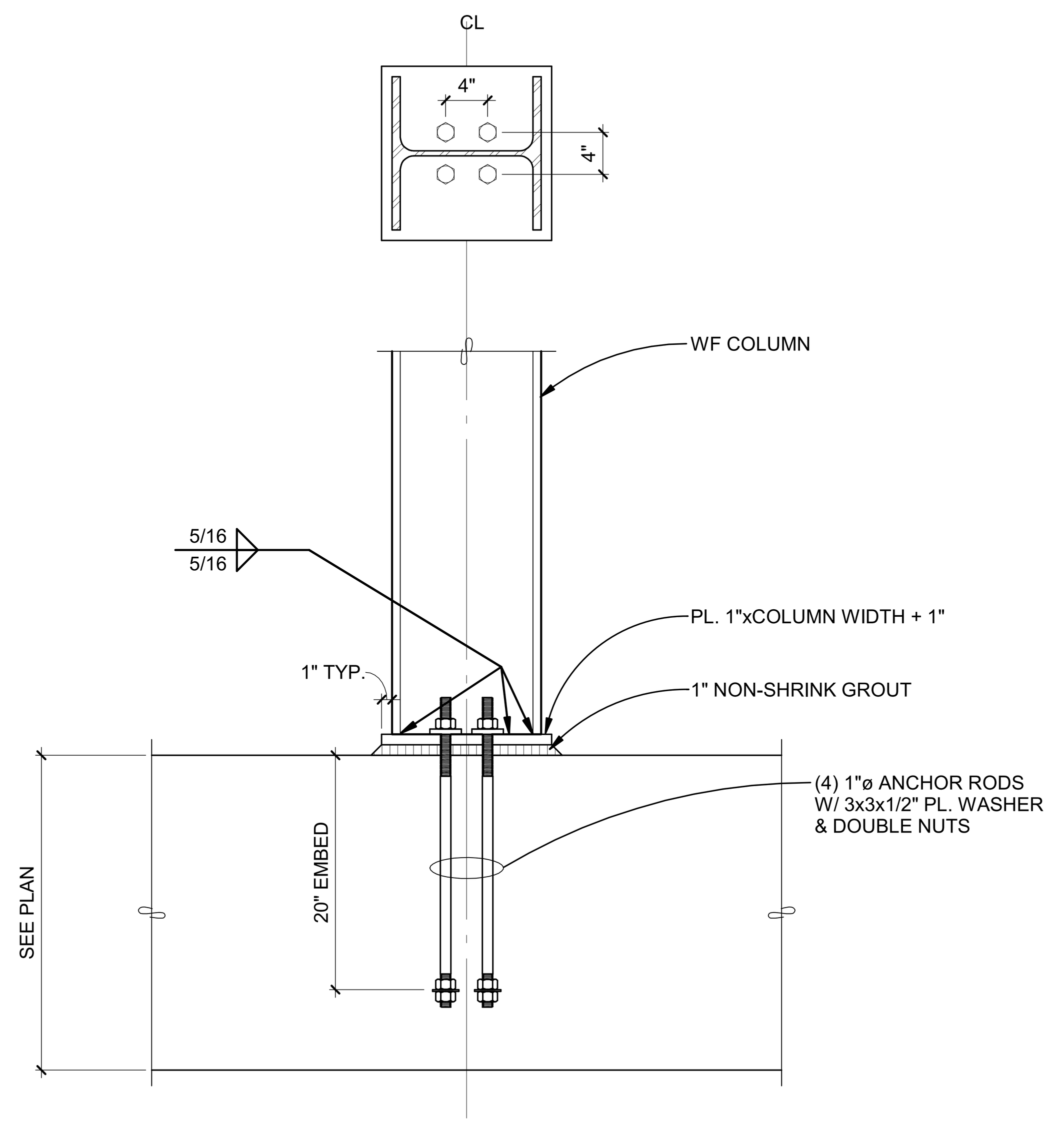
TITLE
MOMENT FRAME ELEVATIONS

SHEET NUMBER
S6.10

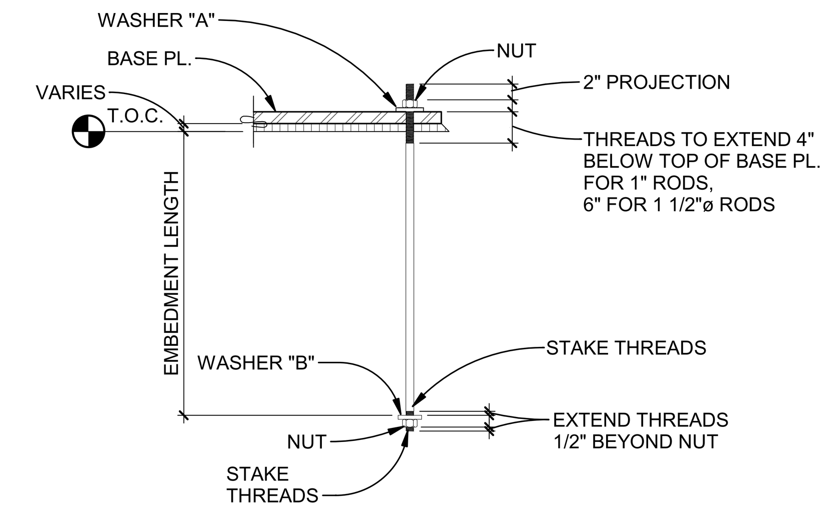


TYPICAL BASE PLATE AT BRACED FRAME

1 S7.00 SECTION
NO SCALE



2 S7.00 SECTION
NO SCALE

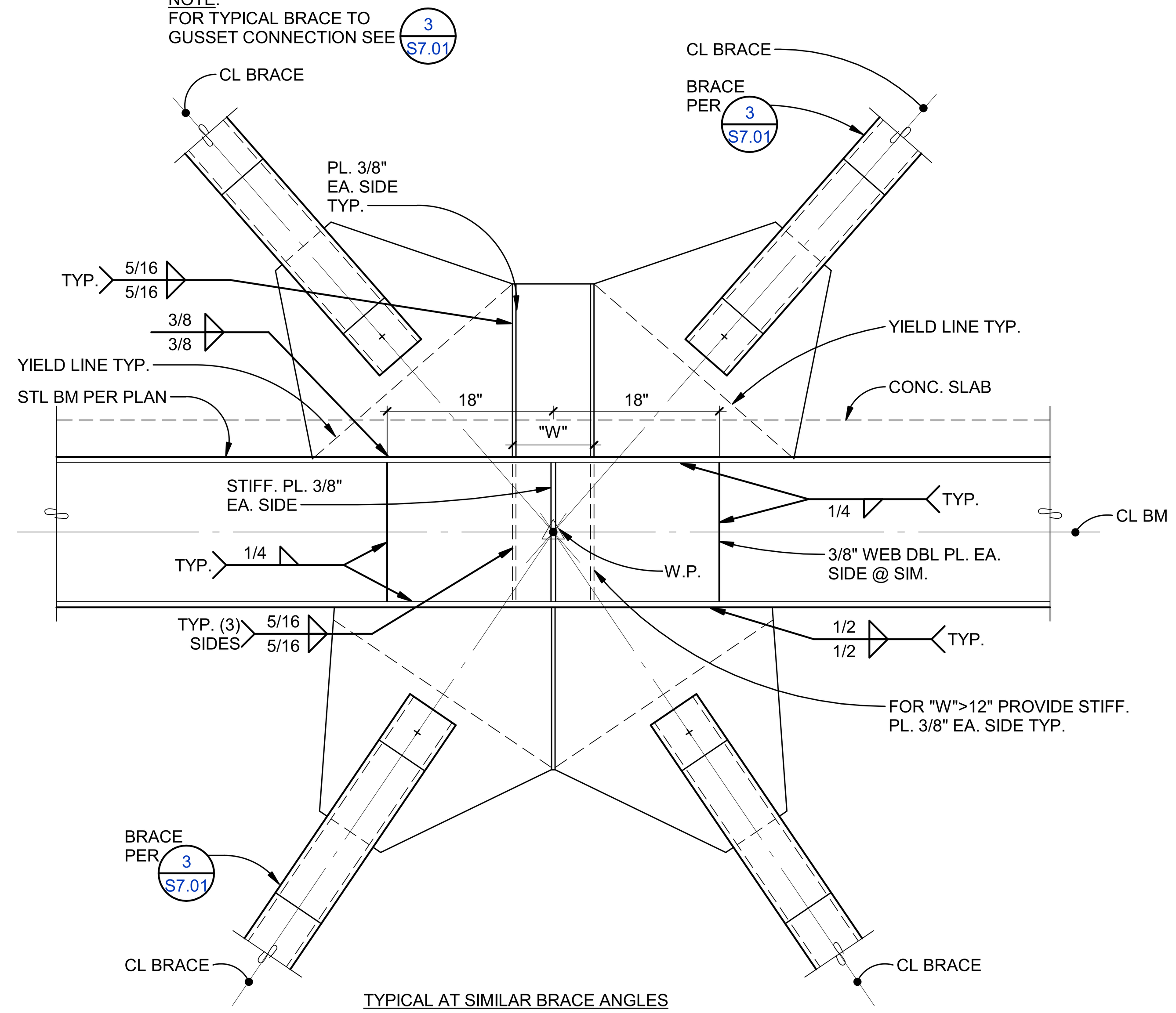


ANCHOR ROD		WASHER		NUT
SIZE	MATERIAL	TYPE	SIZE	
1 1/2"ø	F1554 GRADE 105	A	PL. 1/2"x3 1/2"x0'-3 1/2" W/ 1 9/16"ø HOLE CTR'D	A563 GRADE DH HEAVY HEX
		B	ASTM F844 CARBON FLAT WASHER	

TYPICAL ANCHOR ROD/BOLT DETAIL AT BRACED FRAMES

3 S7.00 DETAIL
NO SCALE

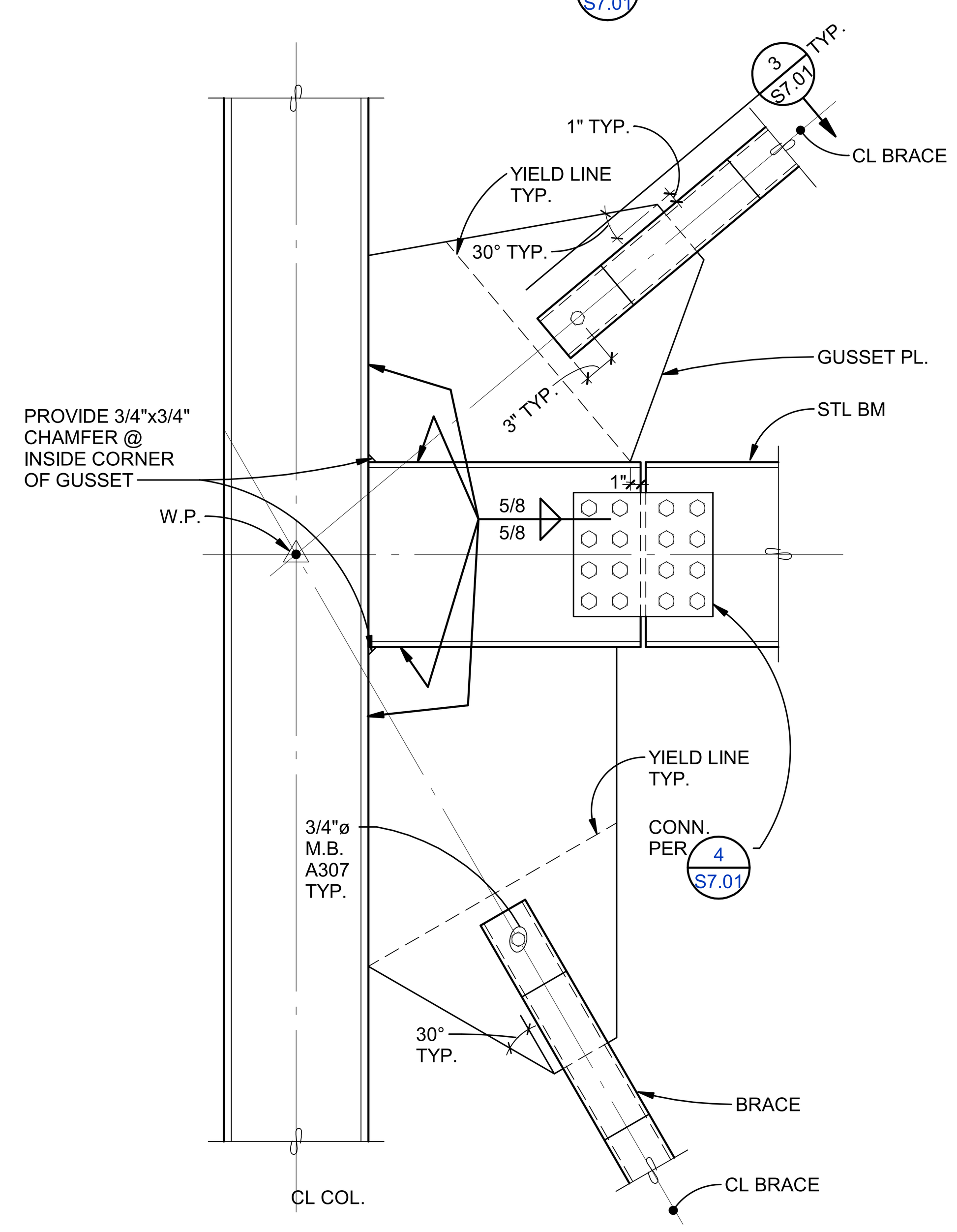
NOTE:
FOR TYPICAL BRACE TO GUSSET CONNECTION SEE 3 S7.01



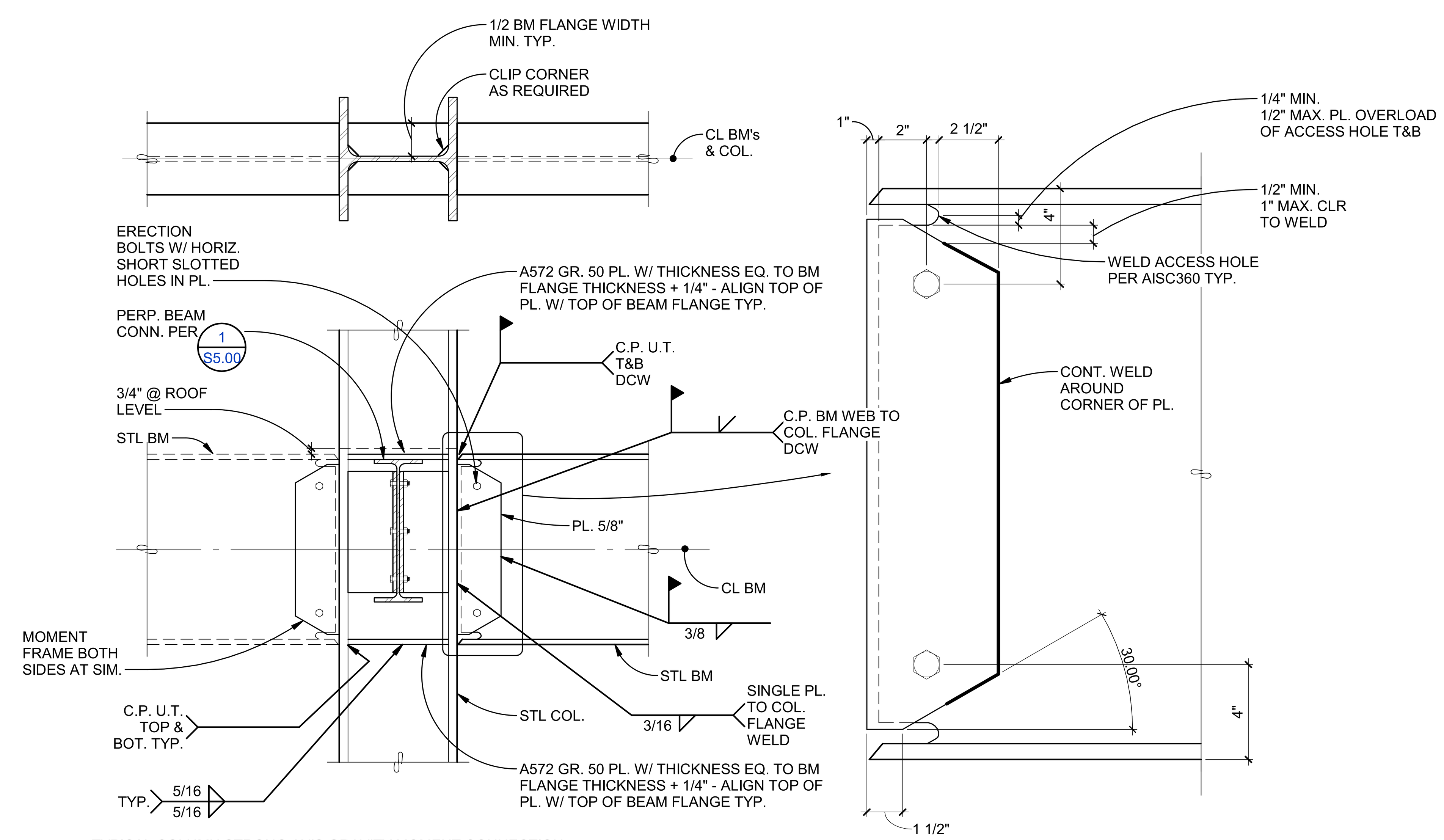
TYPICAL AT SIMILAR BRACE ANGLES

4 S7.00 SECTION
NO SCALE

NOTE:
FOR TYPICAL BRACE TO GUSSET CONNECTION SEE 3 S7.01



5 S7.00 SECTION
NO SCALE



TYPICAL COLUMN STRONG AXIS GRAVITY MOMENT CONNECTION

6 S7.00 DETAIL
NO SCALE

nehrp

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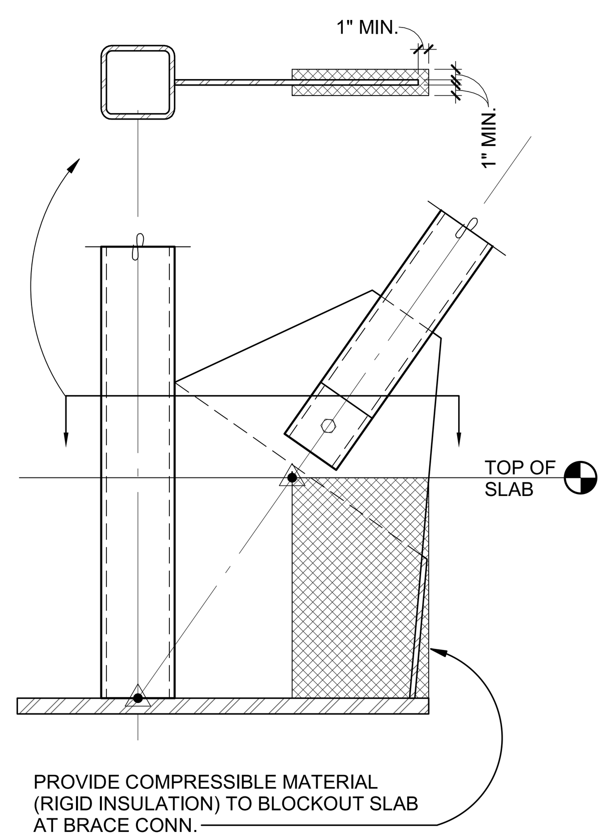
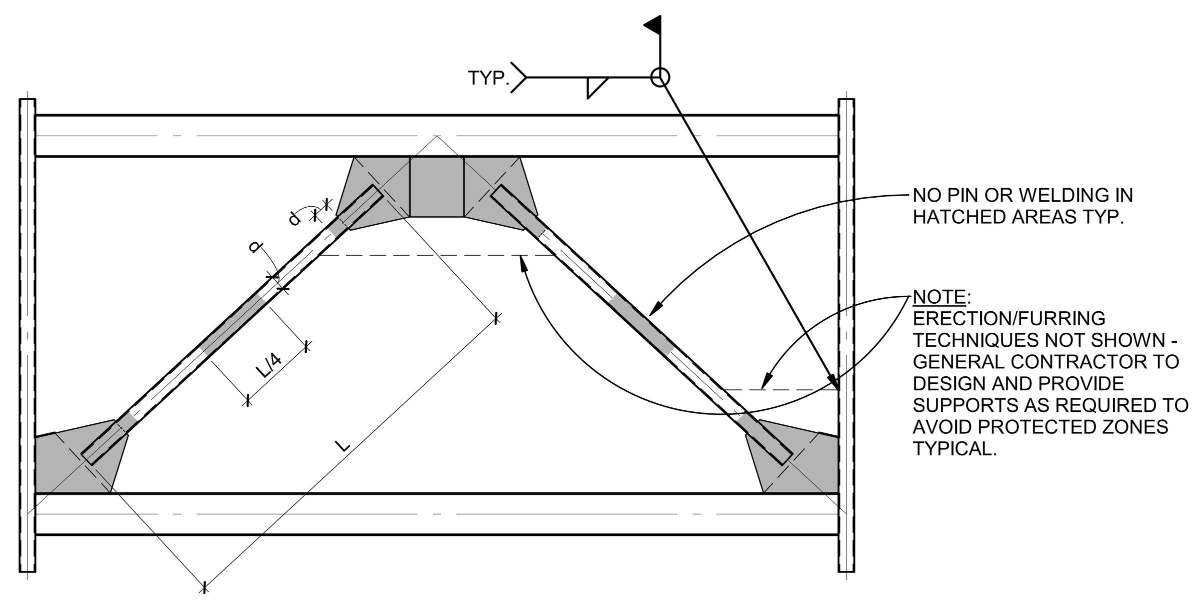
TITLE
STEEL FRAMING DETAILS

SHEET NUMBER
S7.00



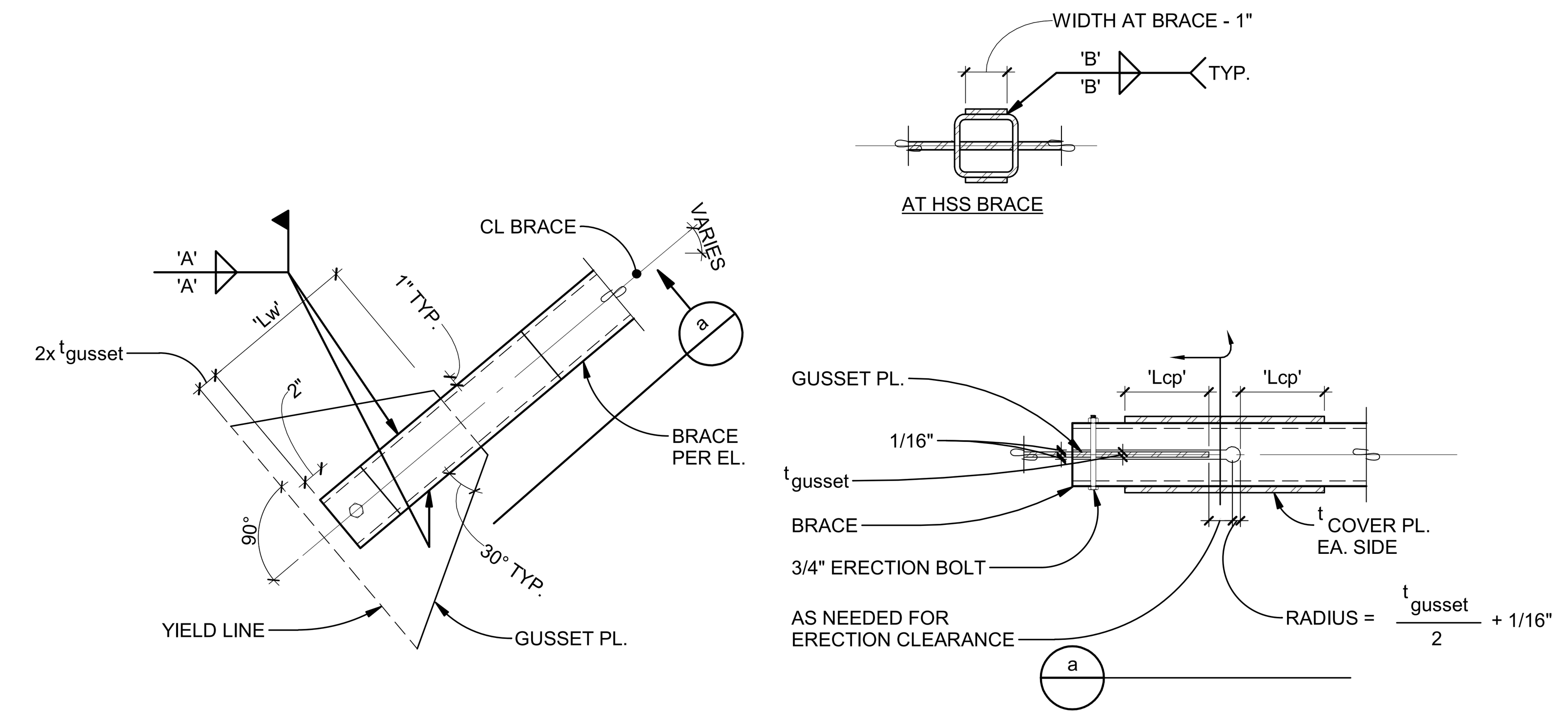
TYPICAL FOUNDATION SLAB BLOCKOUT AT BRACE CONNECTION

1 DETAIL
S7.01 NO SCALE



PROTECTED ZONE OF INVERTED-V BRACED FRAME

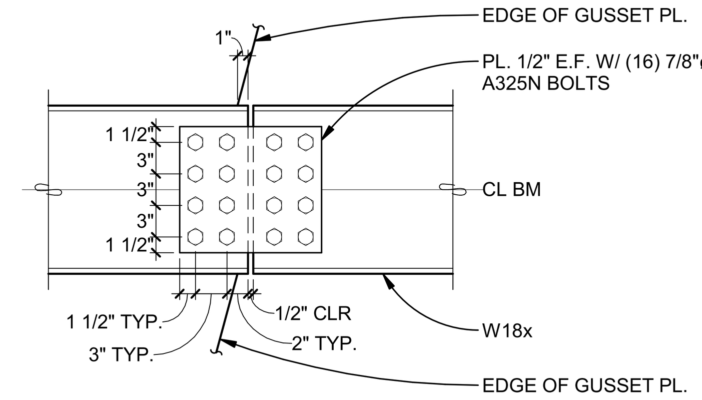
2 SECTION
S7.01 NO SCALE



SCHEDULE						
BRACE SIZE	t_{gusset} (in)	"Lw" (in)	WELD 'A'	t_{COVER} ƒ (in)	'Lcp" (in)	WELD 'B'
HSS 3 1/2x3 1/2	3/4"	16"	5/16	3/8"	10"	1/4
HSS 5-1/2x5-1/2 AND HSS 5x5	3/4"	20"	5/16	1/2"	10"	3/8

PIPE BRACE TO GUSSET PLATE CONNECTION

3 DETAIL
S7.01 NO SCALE



4 DETAIL
S7.01 1" = 1'-0"

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TITLE
STEEL FRAMING DETAILS

SHEET NUMBER
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Design Case E

2018 IBC
Risk Category III
Seismic Design Category D

E.1 Gravity Design

This building is a three-story Educational Facility. The vertical force-resisting system consists of normal-weight concrete slabs, 2-1/2”, over the 3” metal deck with a total slab thickness of 5-1/2” at the second and third floors. The slabs at these floors are supported by a composite steel beam system and wide flange steel columns. The roof deck is comprised of a 2” metal deck with no topping. All steel members (beams and columns) are Grade ASTM A992 steel and are designed using the Load Resistance Factor Design (LRFD) per AISC Steel Construction Manual 15th edition. The deflections were limited to the IBC prescribed limits of L/360 for applied live loads and L/240 for applied total loads.

The calculated design dead load is 75 PSF on the second and third floors and 20 PSF at the roof. The live loads chosen for the floors and roof were provided by 2018 IBC Table 1607.1. It should be noted that the 20 PSF roof minimum snow load controlled the design over the calculated snow load per Chapter 7 of ASCE 7-16.

E.2 Lateral Design

There are two different LFRS in this building. The braced frames resist the lateral loads in the N-S direction, and the moment frames resist the lateral loads in the E-W direction (OMF and IMF are not allowed per Section 12.2-1 ASCE 7-16). The applied wind and seismic loads were determined using Chapters 27 and 12, respectively, from ASCE 7-16. In each case, the seismic design forces controlled the design, most likely due to the increased dead load caused by the concrete slab at two stories or the nature of the geometry of the building. In both directions, the eccentric loading, both calculated and required accidental (5%), was included in determining the applied frame forces at each level. Per Table 12.3-1 of ASCE 7-16 a Type 1a. horizontal torsional irregularity is present for this Seismic Design Category.

The N-S braced frames have a two-story X configuration and utilize ASTM A500 Gr. C HSS steel braces. The braces were designed to maintain the same area of steel at floors, where the upper and lower braces meet at a steel beam to help mitigate the forces that are applied to that steel beam. This is important to help reduce the size of our braced framed beams and the overall tonnage of the building. The beam size of the braced frame is drastically larger than the beam size in Design A because there are more design restrictions and checks that are required to be performed in AISC 360 than in NBC. The "KISS" method was used for force distribution analysis of the connection designs. At the foundations, the anchorage was designed to resist the minimum of the uplift force due to overturning with an applied Ω_o or the expected brace strength. The shear lugs were designed to resist the minimum of the applied shear forces with an applied Ω_o and the expected brace strength.

E-W moment frames have been designed with pre-qualified WUF-W beam to column connections. The moment frames are controlled by building drift limitation in Table 12.12-1 of ASCE 7-16. The frame columns have a typical 'pin' base, and the anchorage was designed to resist the minimum of the uplift force due to overturning with an applied Ω_o. The size and detail of the foundations have not been detailed.

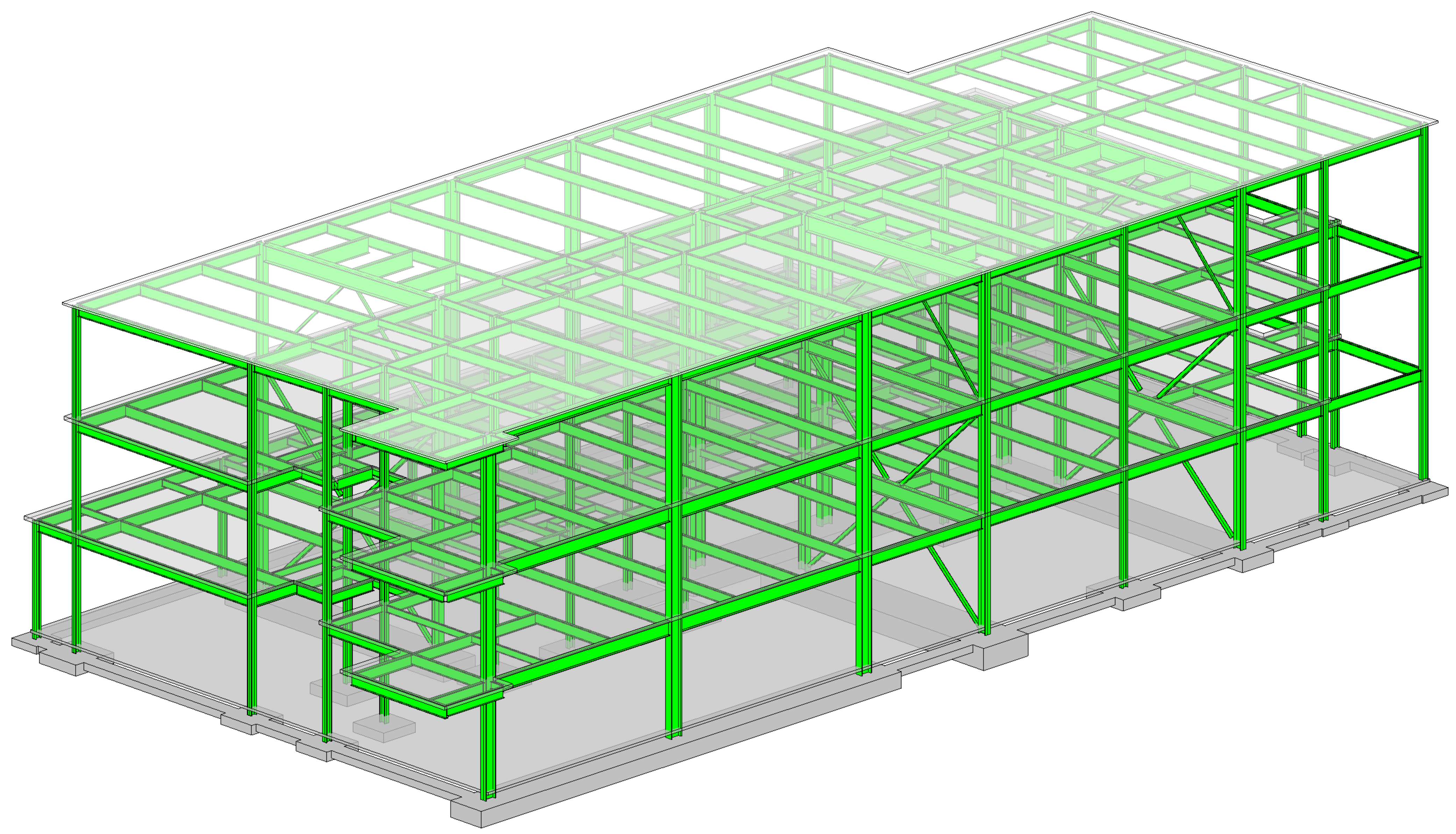
E.3 Steel Tonnage

Total steel tonnage for this design case is calculated as 139 tons.

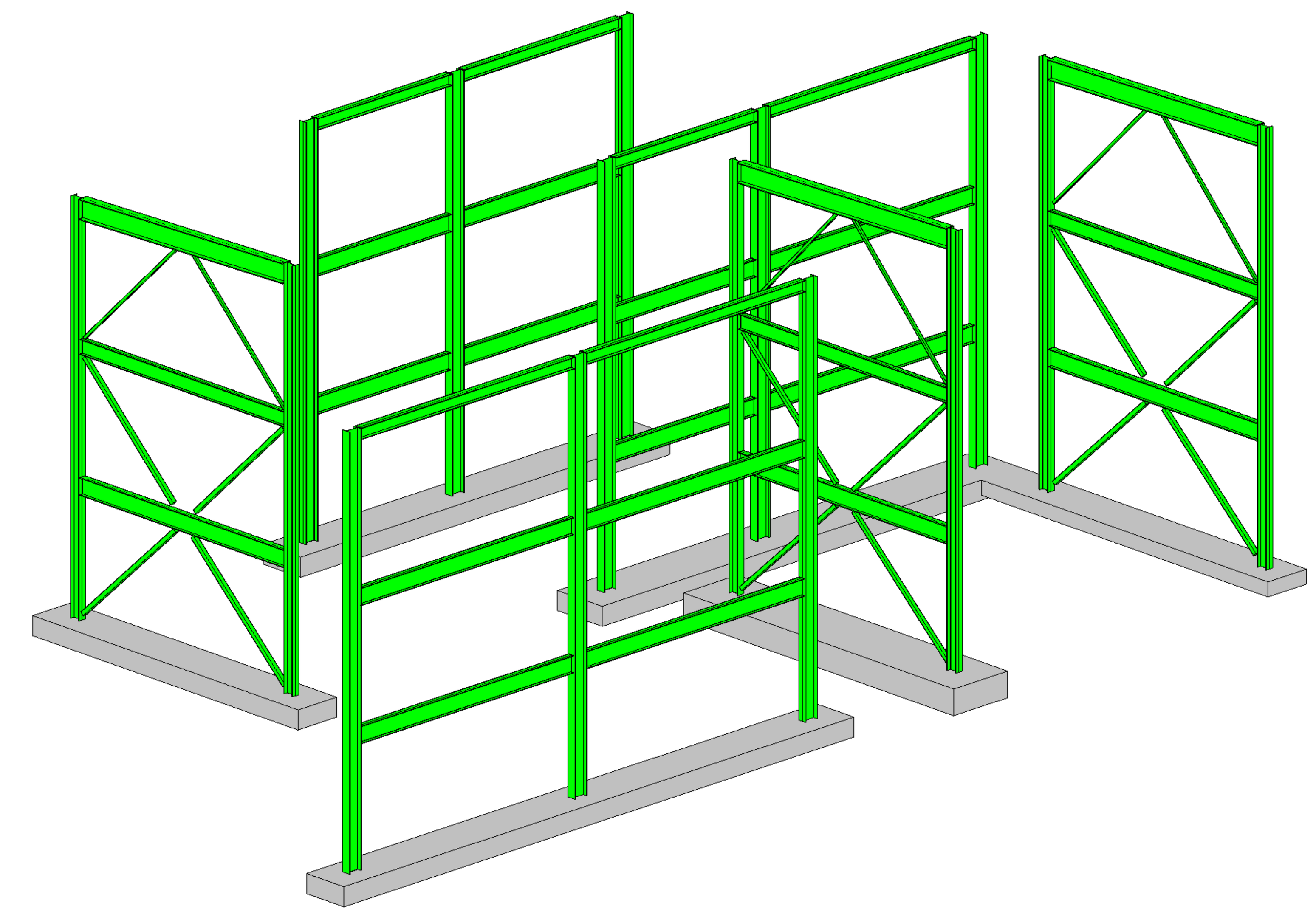
E.4 Structural Drawings

Structural drawings for Design Case E are provided on the following pages.

EDUCATIONAL FACILITY - ST. LOUIS, MISSOURI
DESIGN E - 2018 IBC RISK CATEGORY III



OVERALL FRAMING 3D VIEW



FORCE RESISTING SYSTEM 3D VIEW

DESIGN D: 2018 IBC "RISK CATEGORY III"	
EDUCATION FACILITY, ST. LOUIS MISSOURI	
ITEM	QUANTITY
WF COLUMNS (Fy = 50 KSI)	15 TONS
WF GIRDERS AND JOISTS (Fy = 50 KSI)	64 TONS
MOMENT FRAME WF COLUMNS (Fy = 50 KSI)	21 TONS
MOMENT FRAME WF BEAMS (Fy = 50 KSI)	14 TONS
BRACED FRAME WF COLUMNS (Fy = 50 KSI)	9 TONS
BRACED FRAME WF BEAMS (Fy = 50 KSI)	13 TONS
HSS BRACES (Fy = 50 KSI)	3 TONS
TOTAL	139 TONS

1. STEEL QUANTITIES DO NOT INCLUDE MISCELLANEOUS STEEL, CUT WASTE STEEL, STAIRS, TYPICAL STEEL FRAMING CONNECTIONS, ETC.
2. ON PLANS " ▶ " INDICATES GRAVITY MOMENT CONNECTION WITH (CJP) WELDS AT FLANGES.

STRUCTURAL DRAWING INDEX

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Approved	Approver

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COVER SHEET

SHEET NUMBER

S0.00

GENERAL NOTES

STANDARDS
ALL METHODS, MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE 2018 INTERNATIONAL BUILDING CODE (IBC) AS AMENDED AND ADOPTED BY THE LOCAL BUILDING OFFICIAL OR APPLICABLE JURISDICTION.

STRUCTURAL DRAWINGS PRIMARY STRUCTURAL ELEMENTS ARE DIMENSIONED ON STRUCTURAL PLANS AND DETAILS AND OVERALL LAYOUT OF STRUCTURAL PORTION OF WORK.

PROJECT LOCATION

ST. LOUIS, MISSOURI

38.6270 LATITUDE,-90.1994 LONGITUDE

DESIGN CRITERIA

VERTICAL LOADS

AREA	DESIGN DEAD LOAD	LIVE LOAD (1)	CONCENTRATED LOADS
CLASSROOM AND OFFICE	75 PSF	50 PSF	1000#
CORRIDORS ABOVE 1ST FLOOR	75 PSF	80 PSF	1000#
ROOF	20 PSF	20 PSF	-

(1) LIVE LOADS EXCEPT SNOW LOADS ARE REDUCED PER IBC SECTION 1607.11.

SNOW:

Pg = 20 PSF = GROUND SNOW LOAD
Pf = 0.7CeCtIsPg = FLAT ROOF SNOW LOAD
Is = 1.1 Ce = 1.0, Ct = 1.0. Cs = VARIES

VIBRATION DESIGN CRITERIA:

VIBRATION CONSIDERATIONS WERE DESIGNED PER THE RECOMMENDATIONS IN THE GUIDELINES FOR DESIGN AND CONSTRUCTION OF COMPUTER EQUIPMENT RESIDENCES. FOR CLASSROOM FLOORS A VIBRATION VELOCITY LIMIT OF 8000 MICRO INCHES PER SECOND WAS EVALUATED AT A WALKING SPEED OF 75 STEPS PER MINUTE.

LATERAL FORCES

LATERAL FORCES ARE TRANSMITTED BY DIAPHRAGM ACTION OF ROOF AND FLOORS TO BRACED FRAME/MOMENT FRAME. LOADS ARE THEN TRANSFERRED TO FOUNDATION BY BRACED FRAME/MOMENT FRAME ACTION WHERE ULTIMATE DISPLACEMENT IS RESISTED BY PASSIVE PRESSURE OF EARTH AND/OR SLIDING FRICTION. OVERTURNING IS RESISTED BY DEAD LOAD OF THE STRUCTURE.

WIND:

THE BUILDING MEETS THE CRITERIA TO USE THE "ENCLOSED, PARTIALLY ENCLOSED, AND OPEN BUILDING OF ALL HEIGHTS PROCEDURE" PER ASCE 7-16.

- EXPOSURE CATEGORY = B
- BASIC WIND SPEED, (3 SEC. GUST), V_{ULT} = 114 MPH; V_{ASD} = 88 MPH
- RISK CATEGORY PER IBC TABLE 1604.5 = III
- TOPOGRAPHIC FACTOR K_{ZT} = 1.0
- INTERNAL PRESSURE COEFFICIENT (ENCLOSED) = ± 0.18
- BASE SHEAR V= 146 KIPS AT BRACE FRAMES, 64 KIPS AT MOMENT FRAME
- SEE THE FOLLOWING SCHEDULES FOR COMPONENTS AND CLADDING WIND PRESSURES

ROOF SURFACES [1]							
EFFECTIVE WIND AREA	POSITIVE PRESSURES (PSF)			NEGATIVE PRESSURES (PSF)			
	ZONE [2]						
	1	2	3	1'	1	2	3
10 SF	9.7	9.7	9.7	-21.8	-37.9	-50.0	-68.1
20 SF	9.1	9.1	9.1	-21.8	-35.4	-46.8	-61.7
50 SF	8.3	8.3	8.3	-21.8	-32.1	-42.5	-53.2
100 SF	7.7	7.7	7.7	-21.8	-29.6	-39.3	-46.8

WALL SURFACES [1]				
EFFECTIVE WIND AREA	POSITIVE PRESSURE (PSF)		NEGATIVE PRESSURE (PSF)	
	ZONE [2]			
	4	5	4	5
10 SF	23.8	23.8	-25.8	-31.9
20 SF	22.7	22.7	-24.7	-29.7
50 SF	21.3	21.3	-23.3	-26.9
100 SF	20.3	20.2	-22.2	-24.7

1. VALUES SHOWN IN TABLE ARE GROSS ULTIMATE WIND PRESSURES.
2. ZONES ARE AS DEFINED BY FIGURE 30.6-2 IN ASCE 7-16.

SEISMIC: (ASCE 7-16) V = CsW

WHERE $Cs = \frac{S_{DS}}{(\frac{R}{Ie})}$; WITH

Cs MINIMUM = $0.044\, S_{DS} I_E \geq 0.01$
OR
Cs MINIMUM = $\frac{0.5S_1}{\frac{R}{Ie}}$ FOR $S_1 > 0.6g$

Cs MAXIMUM = $\frac{S_{D1}}{T(\frac{R}{Ie})}$ FOR $T \leq T_L$
OR
Cs MAXIMUM = $\frac{S_{D1}T_L}{T^2\,(\frac{R}{Ie})}$ FOR $T > T_L$

SEISMIC IMPORTANCE FACTOR, Ie = 1.25
RISK CATEGORY OF BUILDING PER IBC TABLE 1604.5 = III
SPECTRAL RESPONSE ACCELERATIONS S_S = 0.453 & S_1 = 0.16
SITE CLASS PER TABLE 20.3-1 = D
DESIGN SPECTRAL RESPONSE ACCELERATIONS S_{DS} = 0.434 & S_{D1} = 0.243
SEISMIC DESIGN CATEGORY = D
W = EFFECTIVE SEISMIC WEIGHT OF BUILDING = 2140 KIPS
ANALYSIS PROCEDURE USED = MODAL RESPONSE SPECTRUM ANALYSIS
RESPONSE MODIFICATION FACTOR PER TABLE 12.2-1, R = 8.0 AT SPECIAL STEEL MOMENT FRAMES, R = 6.0 AT SPECIAL CONCENTRICALLY BRACED FRAMES
Cs = 0.047 AT MOMENT FRAMES, Cs = 0.09 AT BRACED FRAMES
DESIGN BASE SHEAR V = 188.4 KIPS AT BRACED FRAMES, 97.62 KIPS AT MOMENT FRAMES

FOUNDATION DESIGN CRITERIA

SOIL BEARING PRESSURE: 4000 PSF (ASSUMED)*

ACTIVE PRESSURE - RESTRAINED: 50 PCF +14H SEISMIC SURCHARGE (ASSUMED)
ACTIVE PRESSURE - UNRESTRAINED: 35 PCF +6H SEISMIC SURCHARGE (ASSUMED)
PASSIVE RESISTANCE: 200 PCF (INCLUDES F.O.S. ≥ 1.5) (ASSUMED)
COEFFICIENT OF FRICTION: .35 (INCLUDES F.O.S. ≥ 1.5) (ASSUMED)
*1/3 INCREASE ALLOWED FOR SEISMIC OR WIND LOADING

ITEM	DESIGN f'c (PSI) (AT 28 DAYS U.N.O.)	MAX. W/C RATIO	MIN. FLYASH OR SLAG (PCY)	AGGREGATE GRADING ASTM AASHTO	NOTES
SLABS ON GRADE - UNO	4000	0.45	100	57 OR 67	1
FOUNDATIONS - UNO	3000	0.50	--	57 OR 67	
STEM WALLS AND OTHER WALLS - UNO	4000	0.50	100	57 OR 67	
ELEVATED DECKS, TOPPING SLABS, AND SLABS ON METAL	5000	0.40	100	57 OR 67	

REINFORCING STEEL

REINFORCING STEEL SHALL CONFORM TO:

ASTM A615, GRADE 60 TYPICAL UNLESS NOTED OTHERWISE.

REINFORCING SPLICE AND DEVELOPMENT LENGTH SCHEDULE, Fy=60 KSI (UNLESS NOTED OTHERWISE)		
BAR SIZE	MINIMUM LAP SPLICE LENGTHS ("Ls")	MINIMUM DEVELOPMENT LENGTHS ("Ld")
#3	1'-6"	1'-3"
#4	2'-0"	1'-7"
#5	2'-7"	2'-0"
#6	3'-1"	2'-4"
#7	4'-6"	3'-6"
#8	5'-2"	3'-11"
#9	5'-10"	4'-6"
#10	6'-6"	5'-0"

STRUCTURAL STEEL

MATERIAL PROPERTIES

WIDE FLANGE SECTIONS: ASTM A992 (Fy = 50 KSI)

OTHER SHAPES AND PLATES: ASTM A36 (Fy = 36 KSI) TYP. U.N.O.; ASTM A572 (Fy = 50 KSI) WHERE INDICATED

HOLLOW STRUCTURAL SECTIONS: RECTANGULAR & SQUARE - ASTM A500, GRADE C (Fy = 50 KSI)

MACHINE BOLTS (M.B.): ASTM A307, GRADE A

HIGH-STRENGTH BOLTS: A325-ASTM F1852, A490-ASTM F2280

ANCHOR BOLTS (A.B.): ASTM F1554, GRADE 36, UNLESS OTHERWISE NOTED, ASTM F1554, GRADE 105 WHERE INDICATED.

WIDE FLANGE STRUCTURAL MEMBERS WHICH ARE ASTM A6 GROUP 3 SHAPES WITH FLANGE THICKNESS 1-1/2" THICK AND THICKER, AND ALL ASTM A6 GROUP 4 AND 5 SHAPES AND PLATE THAT IS 1-1/2" THICK OR THICKER SHALL HAVE A CHARPY V-NOTCH (CVN) TOUGHNESS OF 20 FT-LBS @ 70 DEG F.

GENERAL REQUIREMENTS

HIGH-STRENGTH BOLTS: ALL A325 HIGH-STRENGTH BOLTS (HSB) SHALL BE ASTM F3125, GRADE F1852, UNLESS OTHERWISE DESIGNATED AS A490. ALL HSB DESIGNATED AS A490 SHALL BE ASTM F3125, GRADE F2280. ALL HSB SHALL BE BY "LEJEUNE BOLT COMPANY" OR PRE-APPROVED EQUAL AND SHALL BE INSTALLED PER SECTION 8.2 OF THE "SPECIFICATION FOR STRUCTURAL JOINTS USING HIGH STRENGTH BOLTS", AUGUST 2014 BY THE RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS (RCSC SPECIFICATION). ALL BOLT HOLES SHALL BE STANDARD ROUND HOLES UNLESS NOTED OTHERWISE. THE FAYING SURFACES OF ALL PLIES WITHIN THE GRIP OF SLIP-CRITICAL BOLTS (A325SC OR A490SC) SHALL MEET THE REQUIREMENTS FOR A CLASS A SURFACE PER SECTION 3.2 OF THE RCSC SPECIFICATION.

HEADED STUDS: SHALL BE "S3L SHEAR CONNECTORS" FOR STUDS 3/4" DIAMETER AND LARGER AS MANUFACTURED BY NELSON STUD WELDING, INC. OR PRE-APPROVED EQUAL AND SHALL CONFORM TO AWS D1.1. ALL HEADED STUDS SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS USING A NELSON WELD GUN, UNLESS NOTED OTHERWISE ON DETAILS. ALL WELDS SHALL BE MADE AND INSPECTED IN ACCORDANCE WITH AWS D1.1.

COMPOSITE FLOOR DECK: SHALL CONTAIN THE MINIMUM PROPERTIES SHOWN ON THE STRUCTURAL DRAWINGS AND SHALL BE "FORMLOK" AS MANUFACTURED BY VERCO MANUFACTURING CO., "W COMPOSITE" AS MANUFACTURED BY ASC STEEL DECK, "EPICORE" AS MANUFACTURED BY EPIC METALS, OR PRE-APPROVED EQUAL. THE FLOOR UNITS SHALL BE FORMED FROM STEEL SHEETS CONFORMING TO ASTM A653, AND GALVANIZED PER ASTM A924.

ABBREVIATION LIST			
@	AT	GALV.	GALVANIZED
A.B.	ANCHOR BOLT	GR.	GRADE
ADD'L	ADDITIONAL	HORIZ.	HORIZONTAL
ALT.	ALTERNATE	HSS	HOLLOW STRUCTURAL SECTION
BLD'G	BUILDING	HT	HEIGHT
BM	BEAM	INT.	INTERIOR
B.O.F.	BOTTOM OF FOOTING	JT	JOINT
BOT.	BOTTOM	L	ANGLE
BRG	BEARING	L.F.R.S.	LATERAL FORCE-RESISTING SYSTEM
BTWN	BETWEEN	L.L.	LIVE LOAD
(C=)	CAMBER	LLH	LONG LEG HORIZONTAL
CANT.	CANTILEVER	LLV	LONG LEG VERTICAL
C.J.	CONTROL/CONSTRUCTION JOINT	LOC.	LOCATION
CL	CENTERLINE	MAX.	MAXIMUM
CLR.	CLEARANCE	M.B.	MACHINE BOLT
COL.	COLUMN	MIN.	MINIMUM
CONC.	CONCRETE	MISC.	MISCELLANEOUS
CONN.	CONNECTION	MTL	METAL
CONST.	CONSTRUCTION	N.F.	NEAR FACE
CONT.	CONTINUOUS	N.S.	NEAR SIDE
COORD.	COORDINATE	NTS	NOT TO SCALE
C.P.	COMPLETE PENETRATION	O.C.	ON CENTER
CTR'D	CENTERED	OPN'G	OPENING
C.Y.	CUBIC YARD	OPP.	OPPOSITE
DBL.	DOUBLE	PERP.	PERPENDICULAR
DCW	DEMAND CRITICAL WELD	PL.	PLATE
DIA. OR ø	DIAMETER	P.P.	PARTIAL PENETRATION
DIAG.	DIAGONAL	P.S.F.	POUNDS PER SQUARE FOOT
DIM.	DIMENSION	REINF.	REINFORCING
D.L.	DEAD LOAD	REQ'D	REQUIRED
DWG	DRAWING	SCHED.	SCHEDULE
DWL	DOWEL	SIM.	SIMILAR
(E)	EXISTING	S.O.G.	SLAB ON GRADE
EA.	EACH	SQ.	SQUARE
E.F.	EACH FACE	STD	STANDARD
EL.	ELEVATION	STIFF.	STIFFENER
ELEV.	ELEVATOR	STL	STEEL
ENGR.	ENGINEER	STRUCT.	STRUCTURAL
EQ.	EQUAL	T&B	TOP & BOTTOM
E.W.	EACH WAY	THR'D	THREADED
EXP.	EXPANSION	T.O.F.	TOP OF FOOTING
EXT.	EXTERIOR	T.O.S.	TOP OF STEEL
FDN	FOUNDATION	TYP.	TYPICAL
F.F.	FAR FACE	U.N.O.	UNLESS NOTED OTHERWISE
FLR	FLOOR	U.T.	ULTRASONIC TESTED
F.O.S.	FACE OF STUD	VERT.	VERTICAL
FRM'G	FRAMING	W/	WITH
F.S.	FAR SIDE	W.P.	WORK POINT
FTG	FOOTING	WT	WEIGHT
GA.	GAGE/GAUGE		

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DESIGN E
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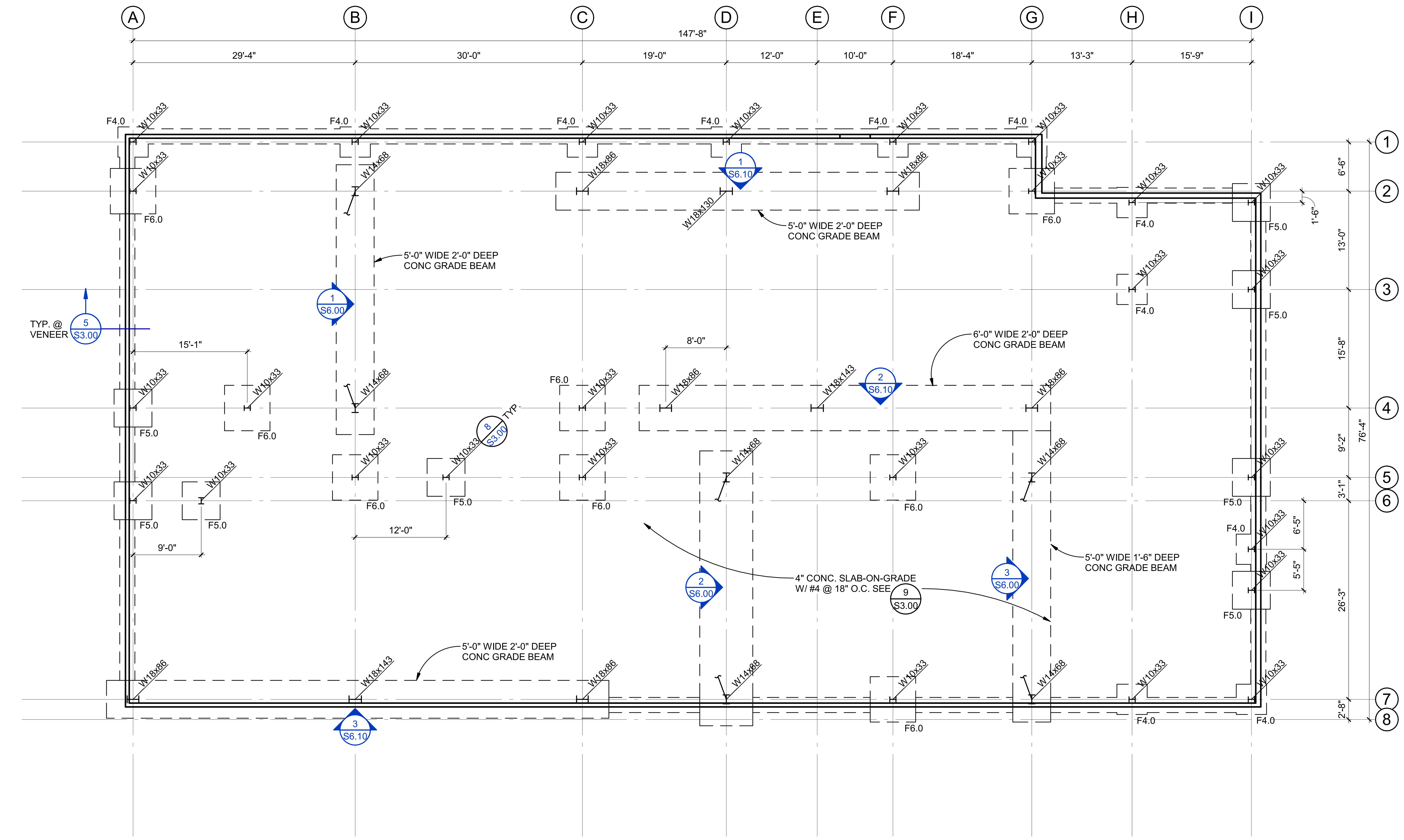
TITLE
GENERAL NOTES

SHEET NUMBER
S0.10



1 FOUNDATION AND GRADE LEVEL FRAMING PLAN

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

NORTH

FOUNDATION NOTES

1. INDICATES COLD FORMED STEEL STUDS.
2. INDICATES CONTINUOUS CONCRETE WALL FOOTING. FOR TYPICAL FOOTING AND FOUNDATION WALL DETAILS SEE SHEET S3.00. FOOTING WIDTH ("W") = 2'-0" UNLESS NOTED OTHERWISE ON PLAN. CENTER FOOTINGS ON CONCRETE STEM WALL.
3. "F_" INDICATES CONCRETE SPREAD FOOTING. FOR SCHEDULE SEE 5/S3.00.
4. X X.XX INDICATES BRACED FRAME OR MOMENT FRAME. FOR ELEVATIONS, MEMBER SIZES AND DETAIL CALLOUTS SEE SHEET S6.00 AND S6.10.
5. W10x45 INDICATES STEEL COLUMNS ORIGINATING AT FOUNDATION LEVEL. ALL COLUMNS ARE CONTINUOUS TO ROOF UNLESS NOTED OTHERWISE. FOR TYPICAL DETAIL SEE 8/S3.00.
6. FOR TYPICAL FOUNDATION AND CONCRETE SLAB-ON-GRADE DETAILS SEE SHEET S3.00.
7. TOP OF FOOTING ELEVATIONS = -1'-0" UNLESS NOTED OTHERWISE ON PLANS AND DETAILS.

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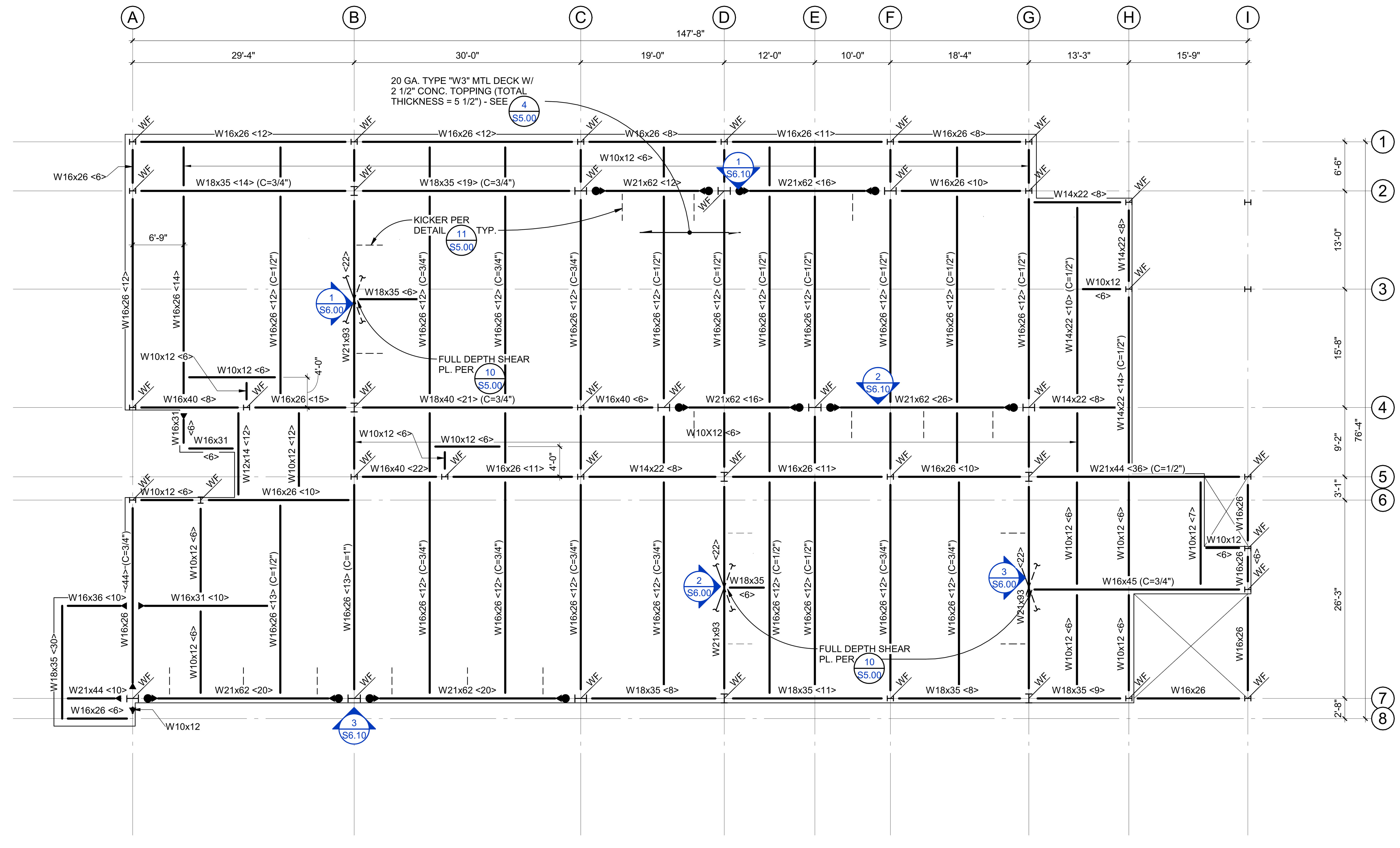
FOUNDATION AND GRADE LEVEL FRAMING PLAN

SHEET NUMBER

S2.00



T.O.S. = 13'-3 1/2"

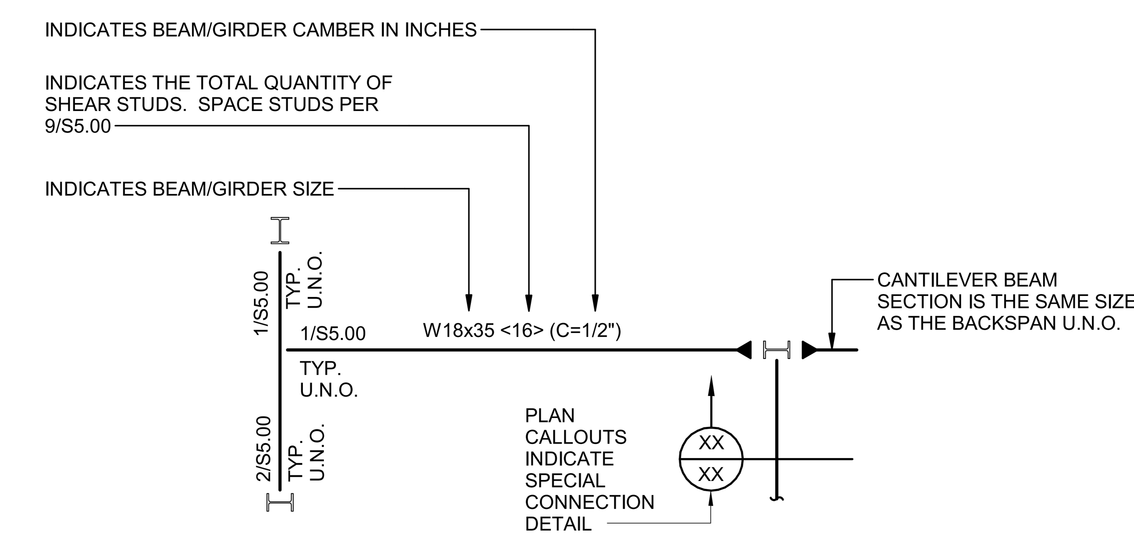
NORTH

1 / S2.10 FRAMING PLAN - LEVEL 2

1/8" = 1'-0"

FLOOR FRAMING NOTES

1. INDICATES BRACED FRAME. FOR ELEVATIONS, BRACE SIZES AND DETAIL CALLOUTS SEE SHEET S6.00. ALL BEAMS THAT ARE PART OF A BRACED FRAME SHALL BE CONSIDERED "COLLECTOR" BEAMS. ALL MEMBERS AND CONNECTIONS THAT ARE PART OF A BRACED FRAME SHALL BE CONSIDERED PART OF THE LATERAL-FORCE RESISTING SYSTEM.
2. INDICATES STEEL COLUMN CONTINUOUS TO FLOOR/ROOF ABOVE.
3. INDICATES PENETRATION IN FLOOR STRUCTURE. FOR TYPICAL REINFORCING AROUND OPENINGS SEE 5/S5.00.
4. FOR TYPICAL COMPOSITE BEAM AND METAL DECK DETAILS SEE SHEET S5.00.
5. INDICATES DIRECTION OF SPAN FOR METAL DECK.
6. FOR TYPICAL STEEL CONNECTION DETAILS SEE SHEET S5.00.



7. STEEL MEMBERS ARE EQUALLY SPACED BETWEEN DIMENSION POINTS UNLESS NOTED OTHERWISE.
8. INDICATES MOMENT FRAME. FOR ELEVATIONS AND DETAIL CALLOUT SEE SHEET S6.10. ASSOCIATED MEMBERS AND CONNECTIONS ARE PART OF THE LATERAL-FORCE RESISTING SYSTEM.

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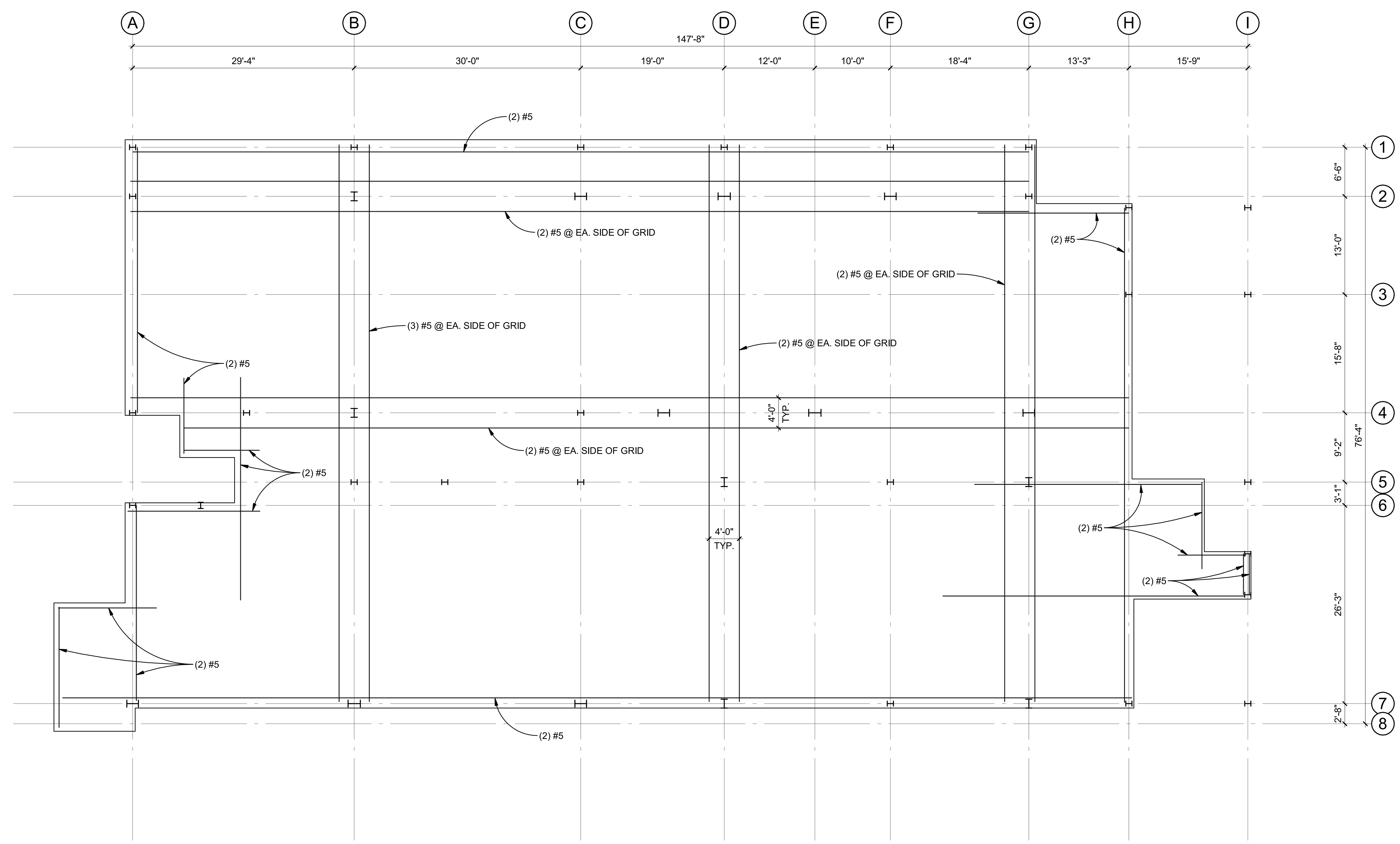
FRAMING PLAN - LEVEL 2

SHEET NUMBER
S2.10



1 S2.10R SLAB REINFORCING PLAN - LEVEL 2

1/8" = 1'-0"

SLAB PLAN NOTES:

1. PROVIDE #4 24" O.C. EACH WAY AT SLAB ON METAL DECK - TYPICAL OVER ENTIRE FLOOR.
2. SLAB REINFORCING SHOWN IN THE PLAN IN ADDITION TO TYPICAL REINFORCING NOTED ABOVE.
3. SPLICE ALL REINFORCING PER GENERAL NOTES.
4. PROVIDE STANDARD HOOK AT ALL BARS WHICH CANNOT BE EXTENDED.
5. STAGGER ALL LAP SPLICES.

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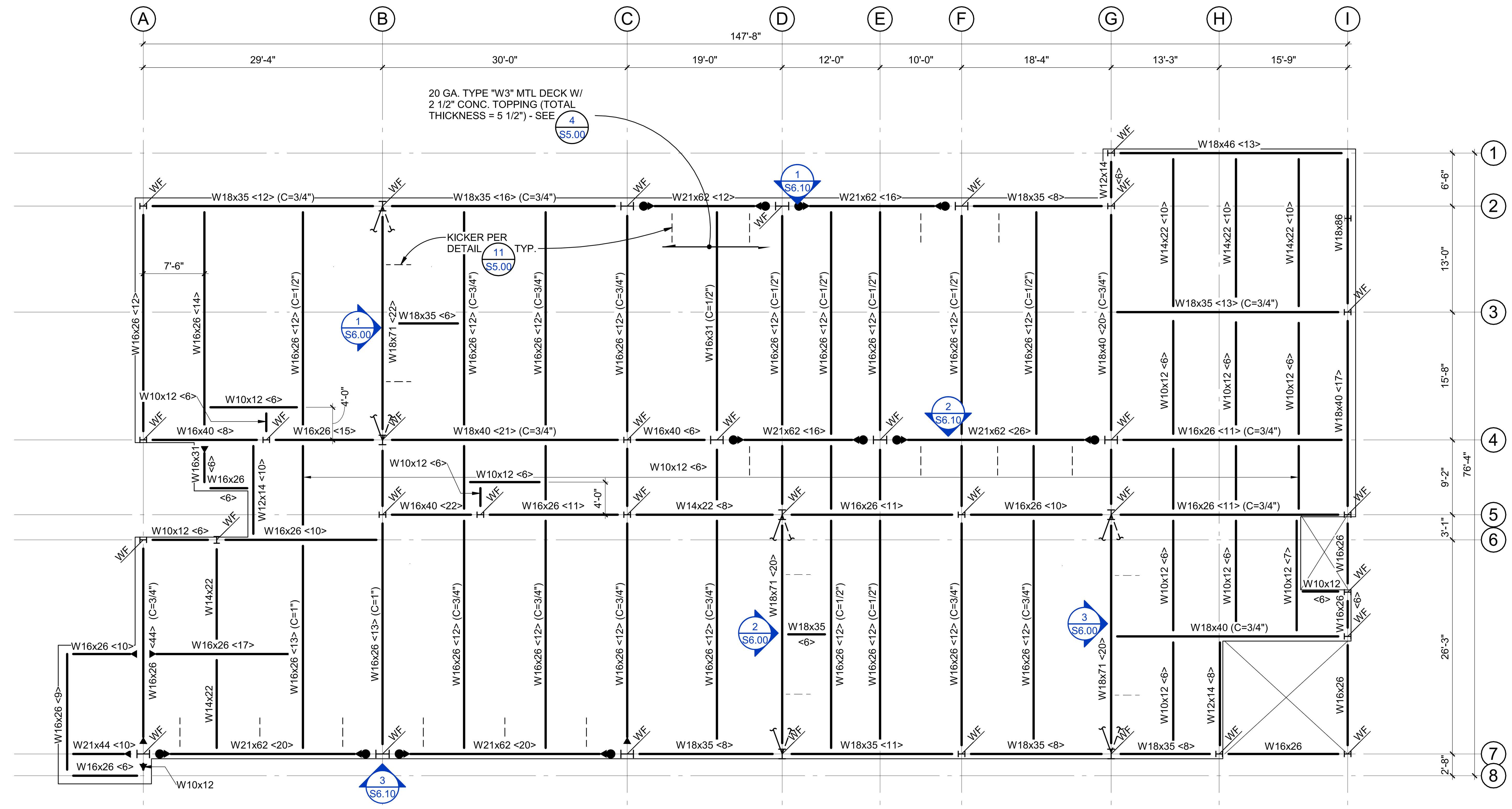
LEVEL 2 SLAB REINFORCING PLAN

SHEET NUMBER

S2.10R



T.O.S. = 27'-0 1/2"

FOR FRAMING NOTES SEE S2.10

FRAMING PLAN - LEVEL 3

1 S2.20 1/8" = 1'-0"

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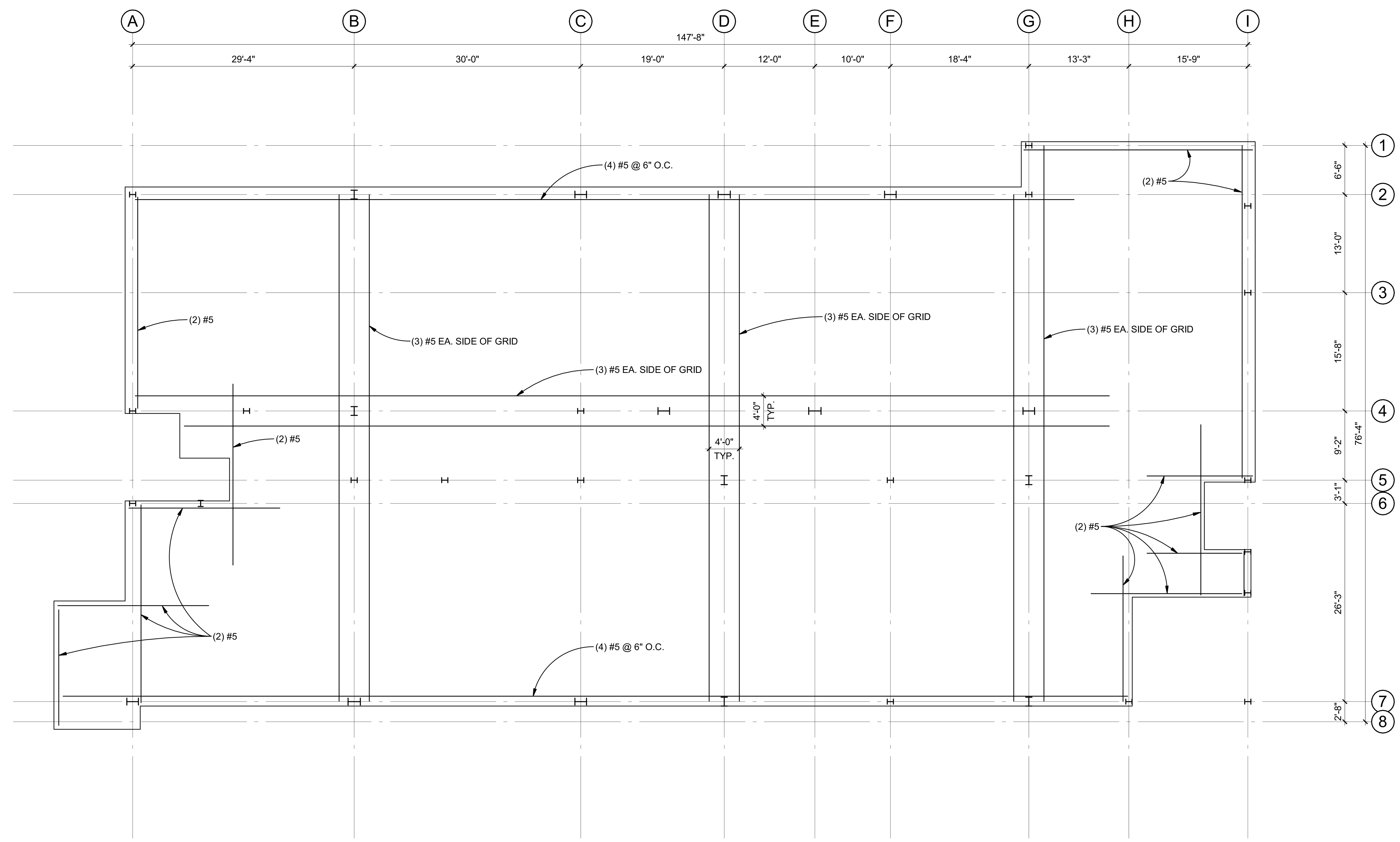
FRAMING PLAN - LEVEL 3

SHEET NUMBER

S2.20



FOR SLAB PLAN NOTES SEE S2.10R

NORTH

1 / S2.20R **SLAB REINFORCING PLAN - LEVEL 3**

1/8" = 1'-0"

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TITLE

LEVEL 3 SLAB REINFORCING PLAN

SHEET NUMBER

S2.20R

T.O.S. = 41'-0 1/4"

FOR FRAMING NOTES SEE S2.10

NORTH

1 S2.30 ROOF FRAMING PLAN

1/8" = 1'-0"

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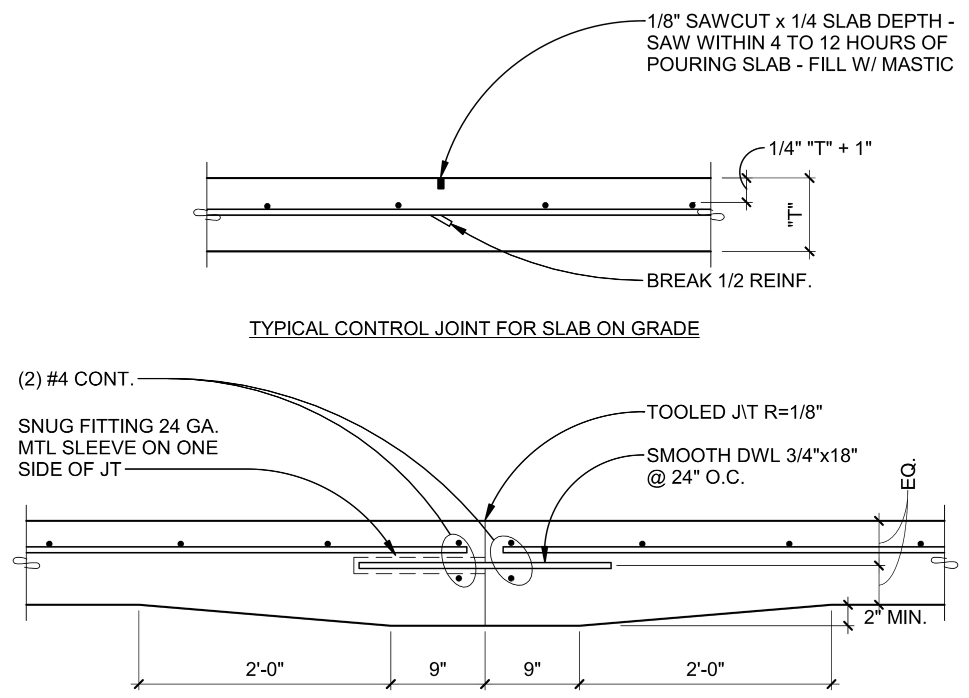
ROOF FRAMING PLAN

SHEET NUMBER

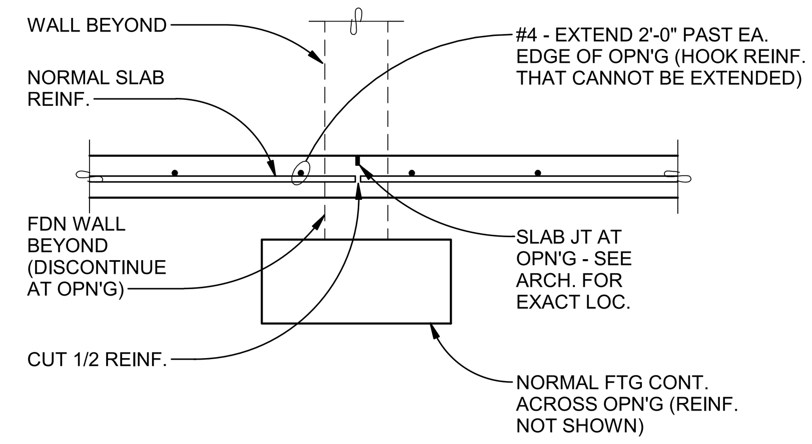
S2.30



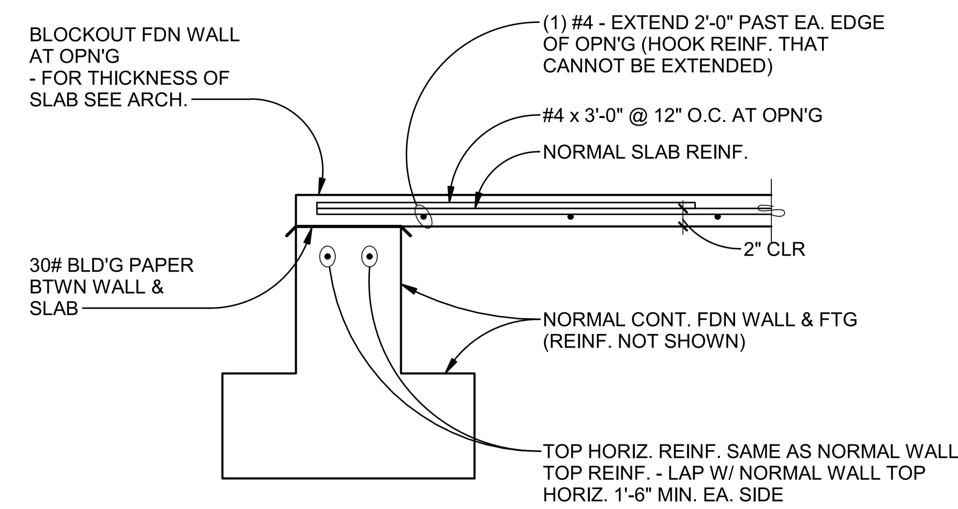
TYPICAL CONTROL JOINT FOR SLAB ON GRADE

TYPICAL CONSTRUCTION JOINT FOR SLAB ON GRADE

1 S3.00 **SECTION**
NO SCALE

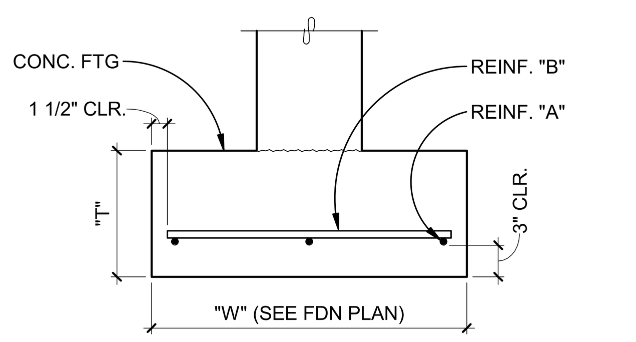


2 S3.00 **SECTION**
NO SCALE



TYPICAL SLAB AT EXTERIOR OPENING

3 S3.00 **SECTION**
NO SCALE

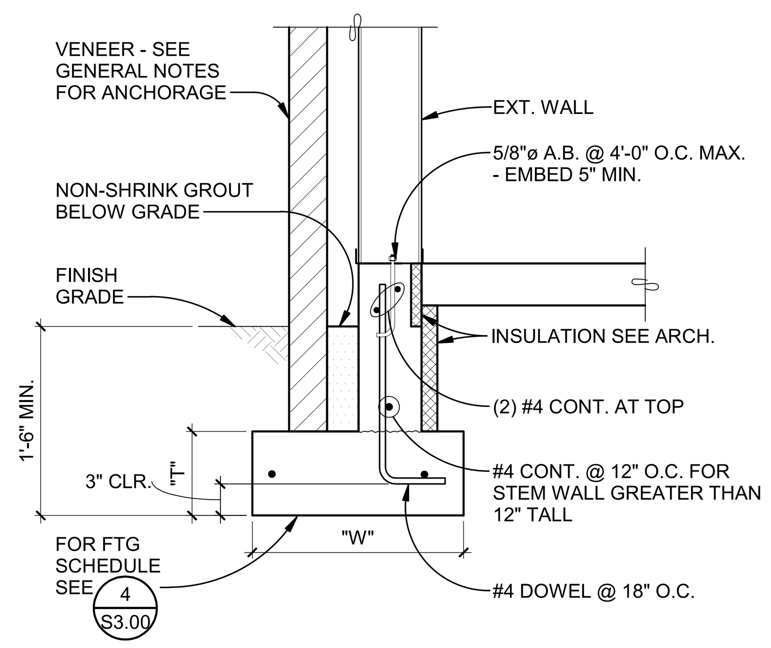


WIDTH "W"	"T"	REINF. "A" CONT.	REINF. "B"
2'-0"	11"	(2) #5	---

NOTES:
1. FOOTINGS SHALL BEAR ON UNDISTURBED OR COMPACTED MATERIAL - SEE GENERAL NOTES.
2. EXTEND FOOTINGS 6" MIN. PAST ENDS OF WALL UNLESS OTHERWISE NOTED.
3. WHERE FOOTINGS CHANGE WIDTHS LAP REINFORCING "A". "**Ls**" PER GENERAL NOTES.

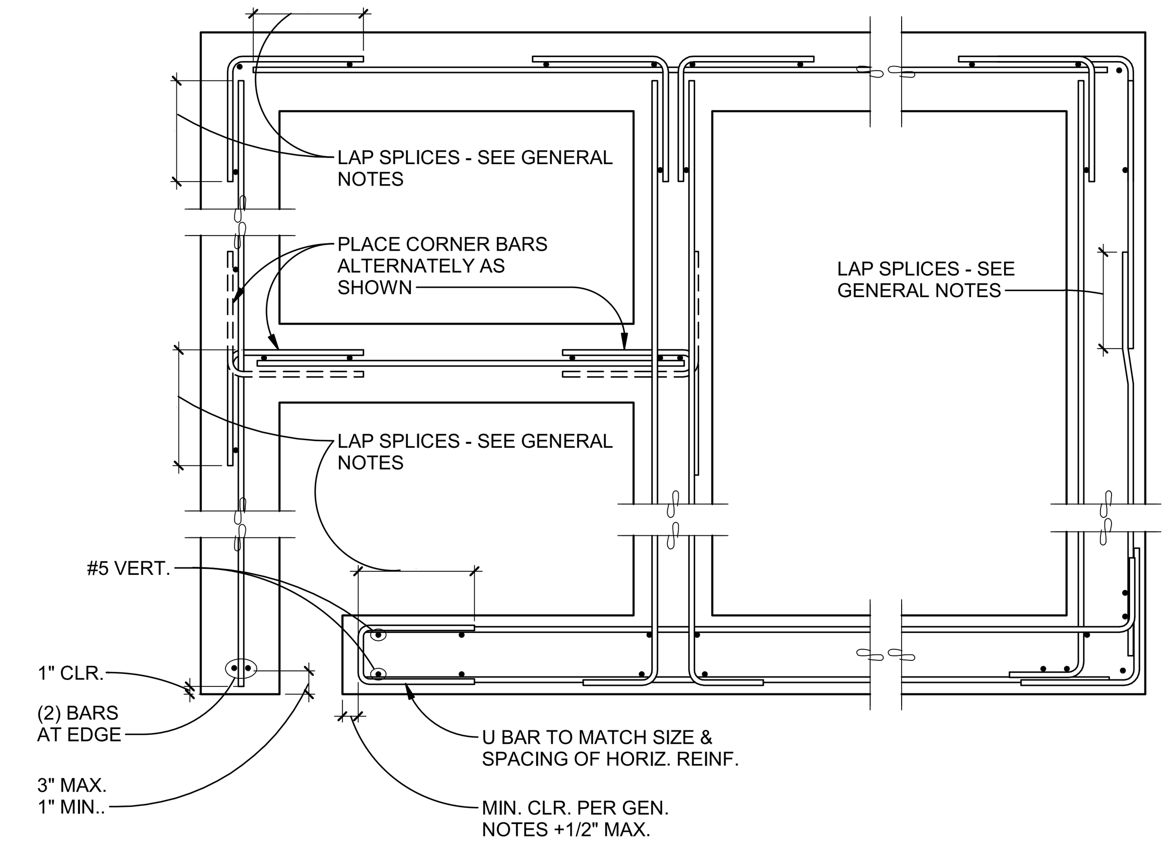
TYPICAL CONTINUOUS FOOTING DETAIL

4 S3.00 **SECTION**
NO SCALE



TYPICAL FOUNDATION AT EXTERIOR WALL WITH VENEER

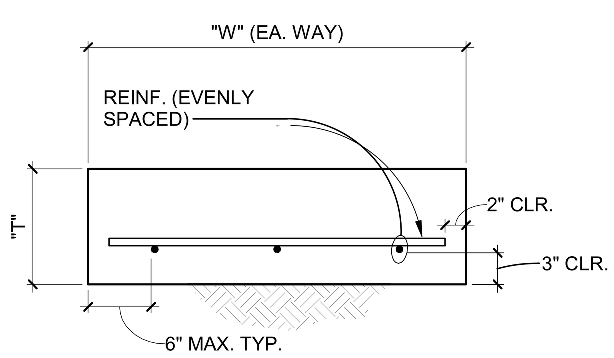
5 S3.00 **SECTION**
NO SCALE



NOTES:
1. VERT. REINF. SHOWN IS ADD'L IF NORMAL STEM WALL REINF. IS NOT IN PROPER LOCATION.
2. CORNER BARS ARE SAME SIZE & SPACING AS HORIZ. REINF.
3. 90° STD HOOK MAY BE SUBSTITUTED FOR CORNER BARS. SEE NOTE #5.
4. REINF. AT ALL CORNERS, ENDS, & INTERSECTIONS OF WALLS SHALL BE PLACED IN ACCORDANCE W/ APPROPRIATE DETAIL SHOWN.
5. USE 90° STD HOOK FOR EMBEDMENT LESS THAN 24" PAST FACE OF WALL.

TYPICAL REINFORCING PLACEMENT FOR CAST IN PLACE CONCRETE WALLS AND STEM WALLS

6 S3.00 **DETAIL**
NO SCALE



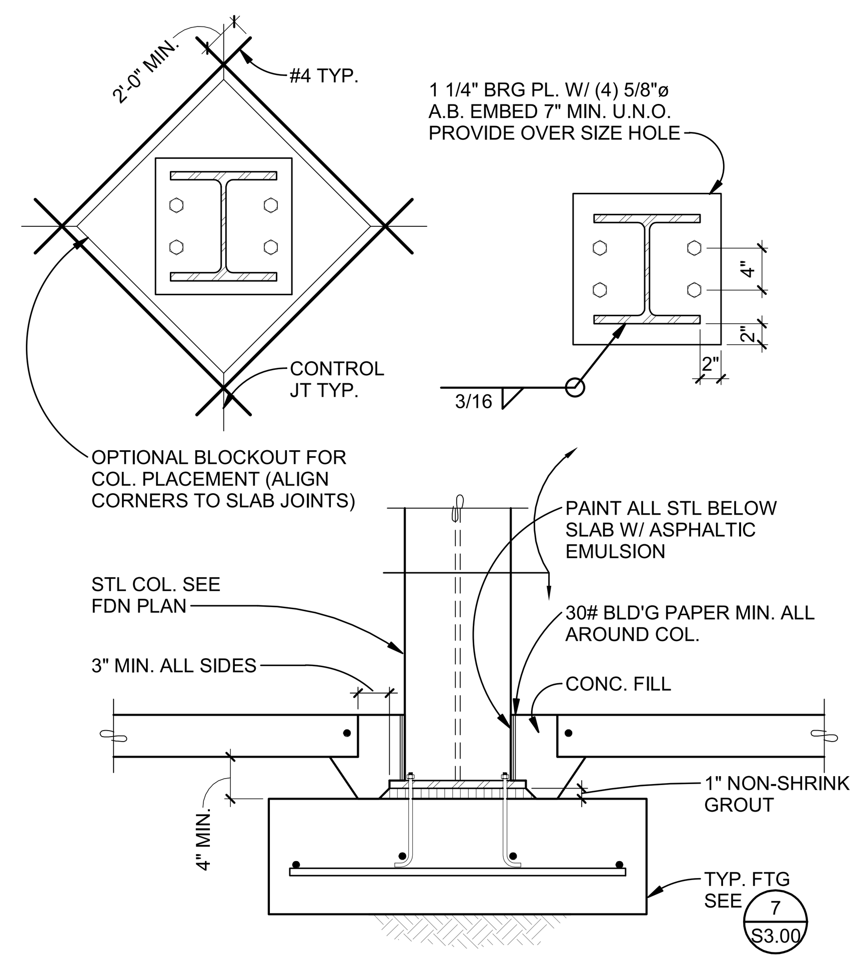
MARK	DIMENSIONS "W"	DIMENSIONS "T"	REINF. EA. WAY
F4.0	4'-0"	11"	(4) #5
F5.0	5'-0"	14"	(5) #6
F6.0	6'-0"	16"	(6) #7

SECTION

NOTES:
1. CENTER ALL FOOTINGS ON COLUMN ABOVE EXCEPT AS SHOWN OTHERWISE.
2. FOOTINGS SHALL BEAR ON UNDISTURBED OR COMPACTED MATERIAL, SEE GENERAL NOTES. DESIGN BEARING PRESSURE IS 4000 PSF.

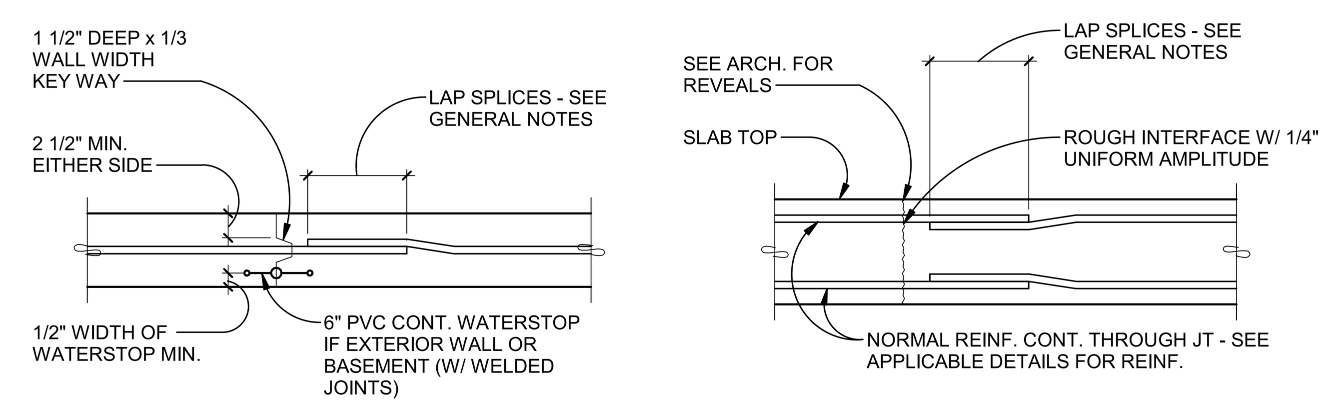
TYPICAL CONCRETE SPREAD FOOTING DETAILS

7 S3.00 **SECTION**
NO SCALE



TYPICAL STEEL COLUMN AT SPREAD FOOTING

8 S3.00 **SECTION**
NO SCALE



TYPICAL AT VERTICAL WALL JOINTS

TYPICAL AT CONCRETE GRADE BEAMS & FOOTINGS

NOTE:
OBTAIN APPROVAL OF ENGINEER FOR LOC. OF ANY C.J.

TYPICAL FOR CAST IN PLACE CONCRETE WALLS, GRADE BEAMS AND FOOTINGS

9 S3.00 **CONSTRUCTION JOINTS**
NO SCALE

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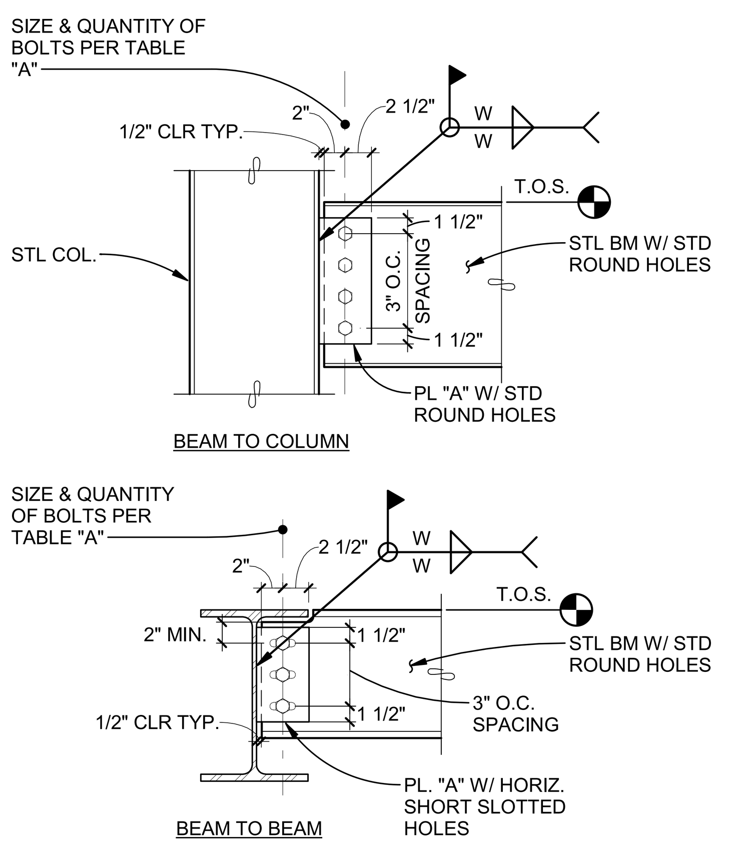
TITLE
FOUNDATION DETAILS

SHEET NUMBER
S3.00



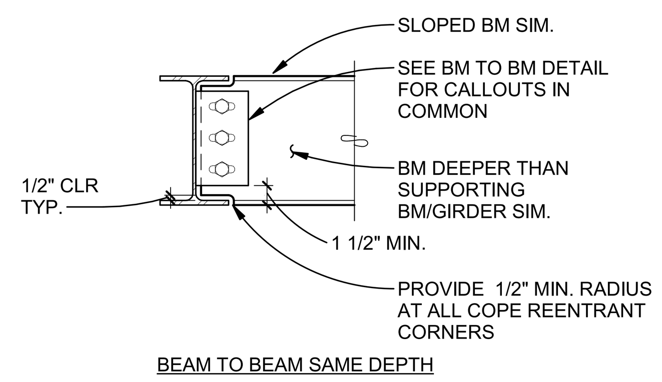
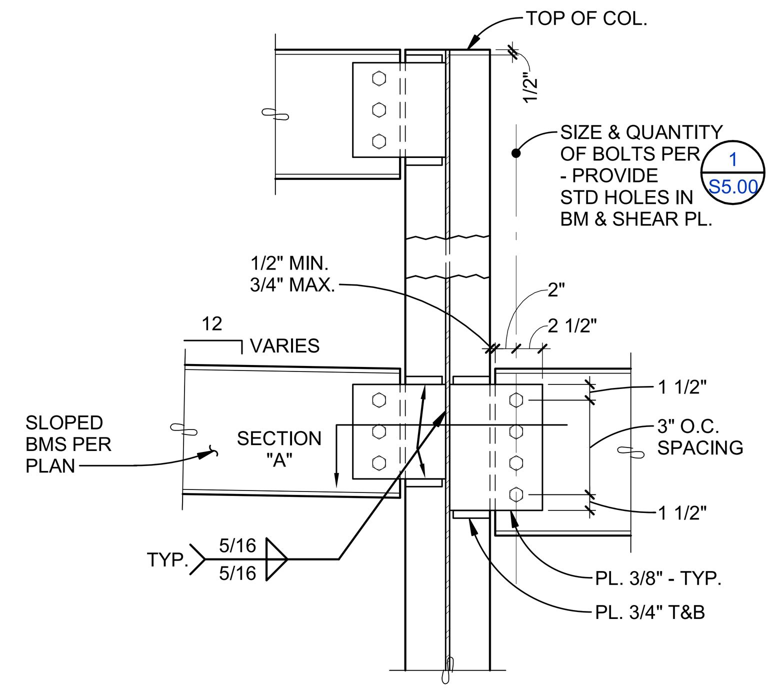
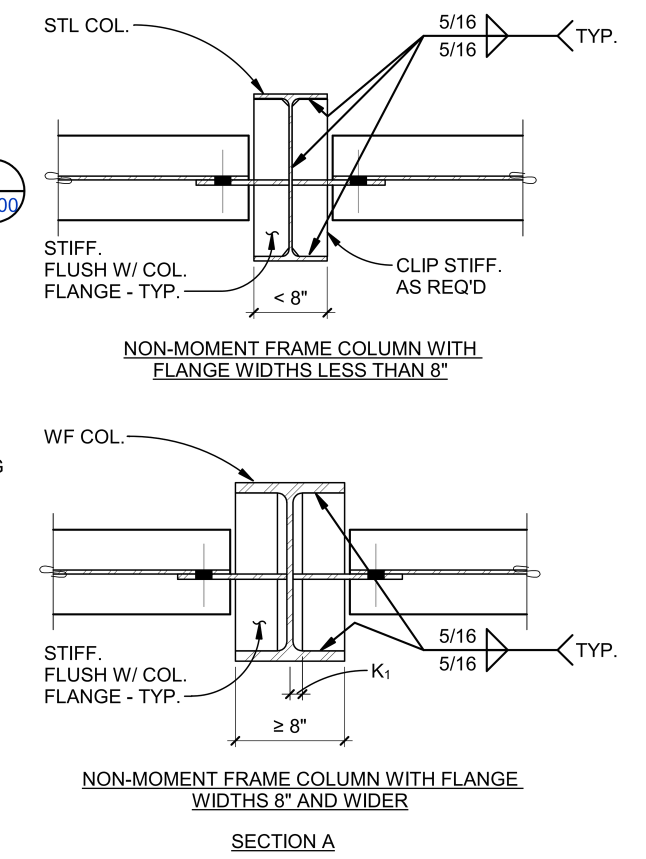


TABLE A			
SUPPORTED BEAM SIZE	QUANTITY OF 7/8"ø A325N BOLTS	SHEAR PLATE THICKNESS "A"	WELD "W" NOTE 1.
W10	2	3/8"	5/16"
W16, W18	4	3/8"	5/16"
W21	5	3/8"	5/16"

TYPICAL STEEL DETAIL

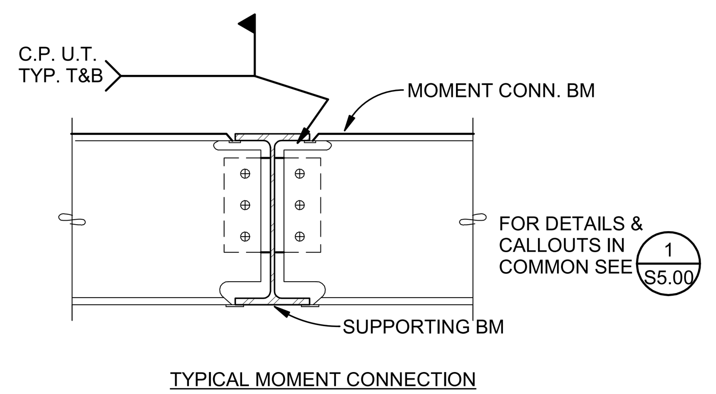
1 S5.00 **DETAIL** NO SCALE

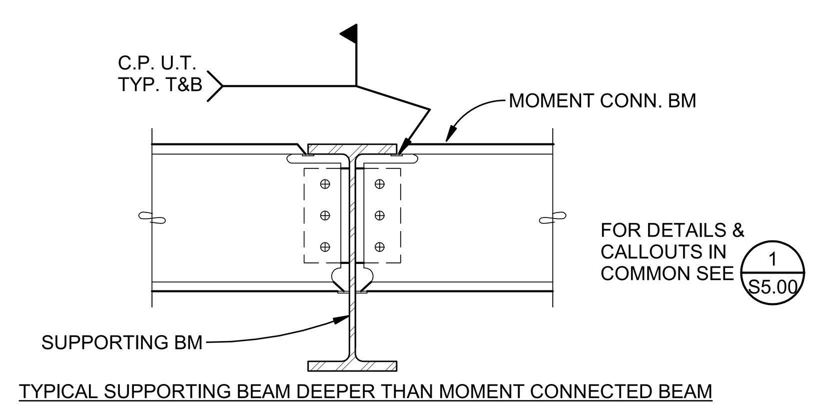




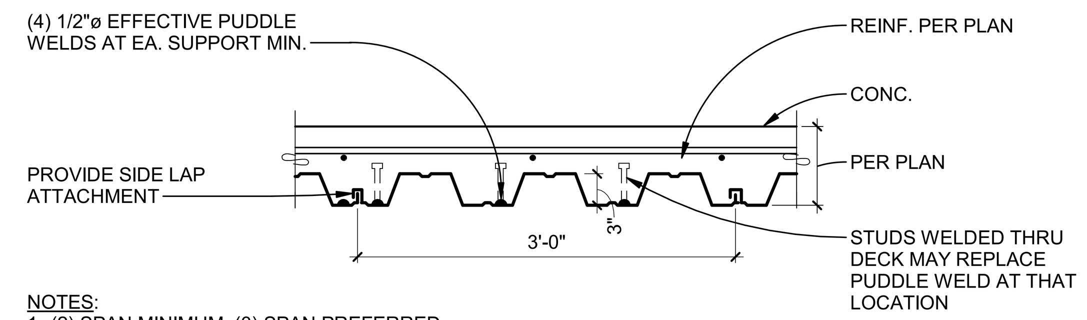
TYPICAL BEAM/COLUMN FRAMING INTO WEB

2 S5.00 **DETAIL** NO SCALE



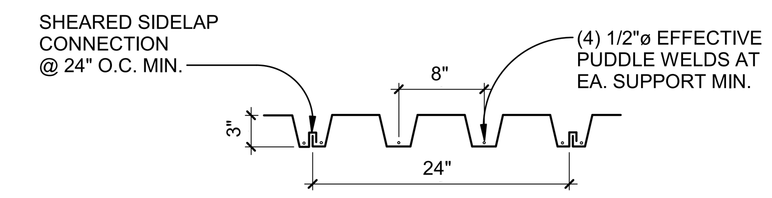


3 S5.00 **DETAIL** NO SCALE



NOTES:
1. (2) SPAN MINIMUM, (3) SPAN PREFERRED.
2. AT SUPPORTS PARALLEL TO CORRUGATIONS, PROVIDE PUDDLE WELDS @ 24" O.C. MAXIMUM.

TYPICAL COMPOSITE FLOOR DECK

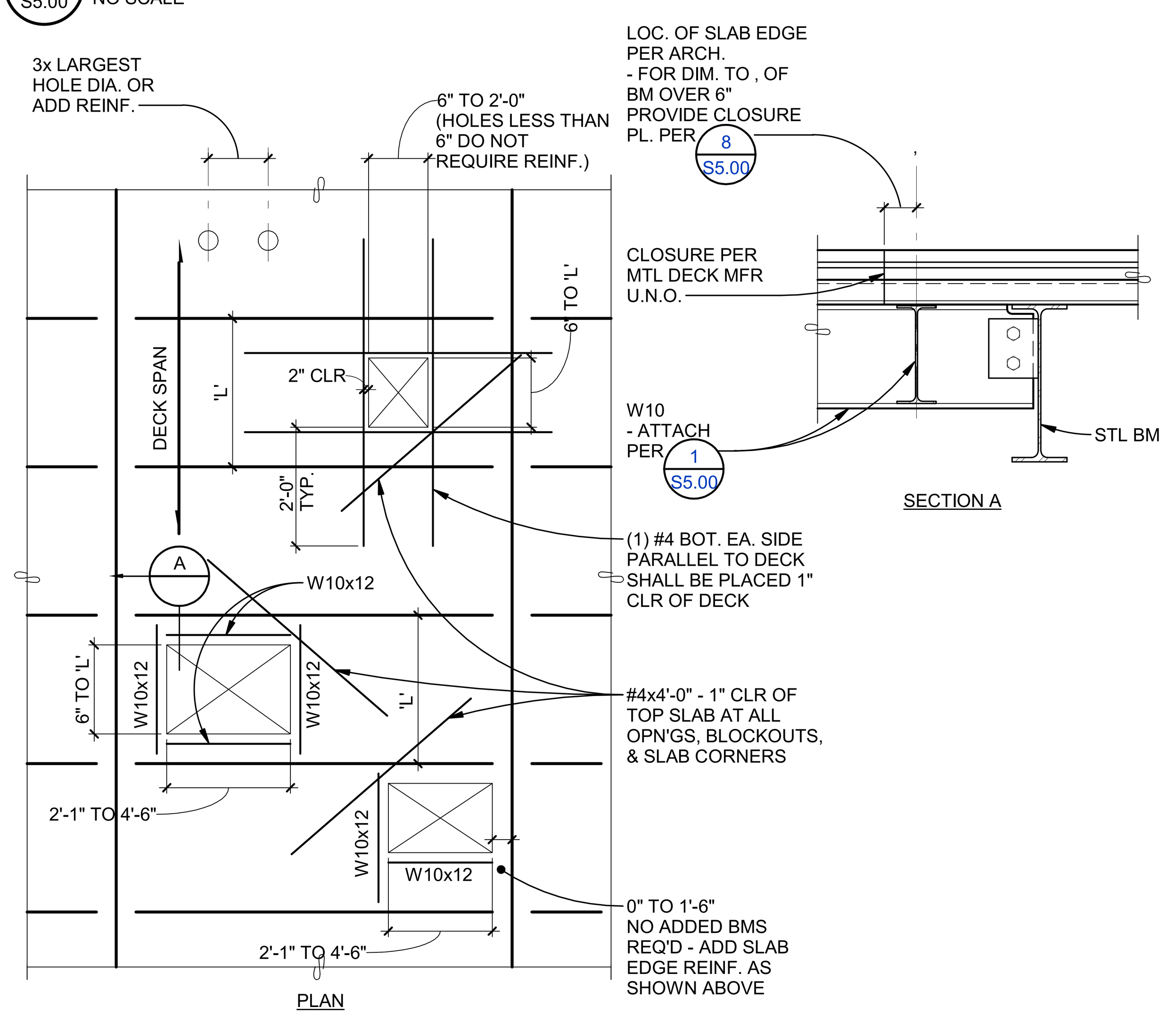


TYPE "N" MIN. DECK PROPERTIES		
GAUGE	I = (in.⁴/ft.)	+S/-S = (in.³/ft)
20	.837	.508/.562

NOTES:
1. (2) SPAN MIN., (3) PREFERRED.
2. AT SUPPORTS PARALLEL TO CORRUGATIONS, PROVIDE PUDDLE WELDS @ 24" O.C. MAX.

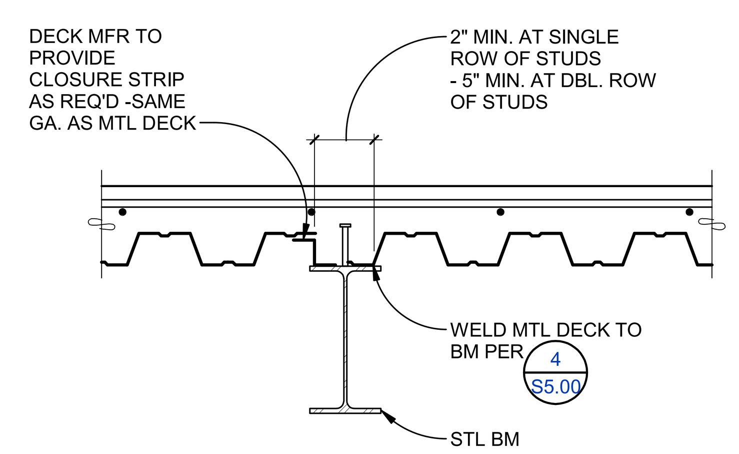
TYPICAL ROOF METAL DECK

4 S5.00 **DETAIL** NO SCALE



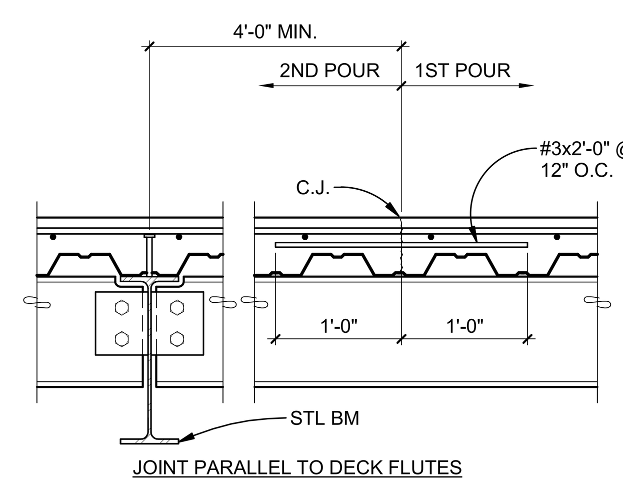
TYPICAL FLOOR PENETRATION REINFORCEMENT

5 S5.00 **DETAIL** NO SCALE

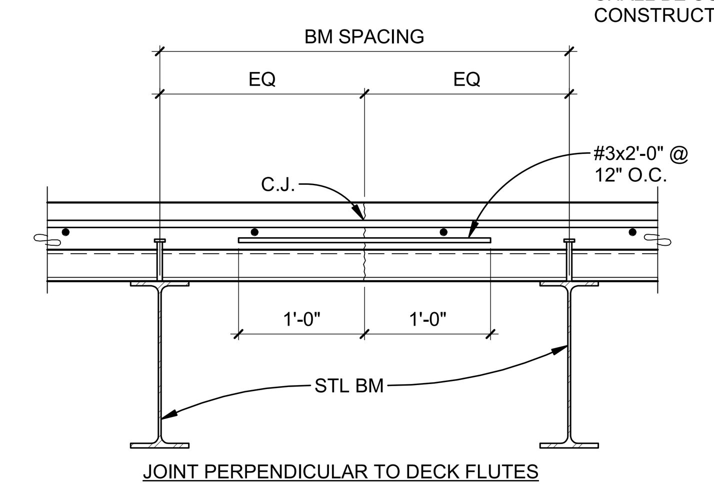


TYPICAL AT METAL DECK PARALLEL TO BEAM

6 S5.00 **SECTION** NO SCALE

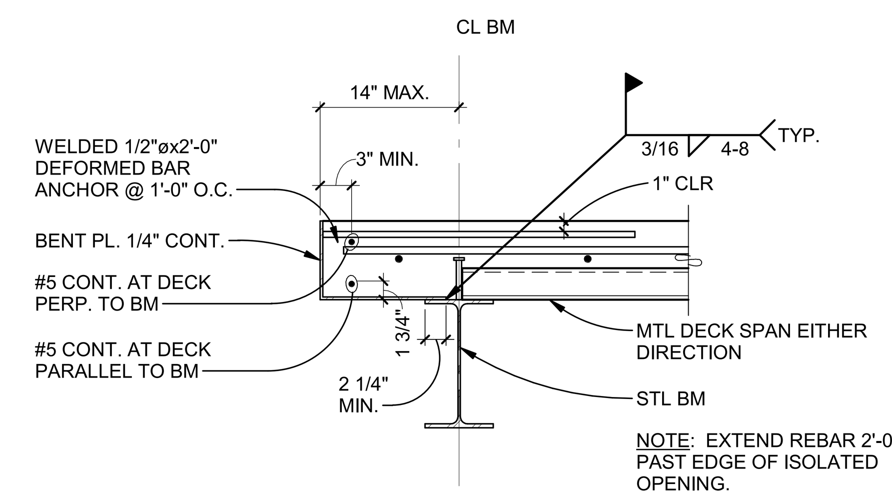


NOTE: ALL REINFORCEMENT SHALL BE CONTINUOUS THRU CONSTRUCTION JOINT



TYPICAL COMPOSITE DECK CONSTRUCTION JOINT

7 S5.00 **SECTION** NO SCALE

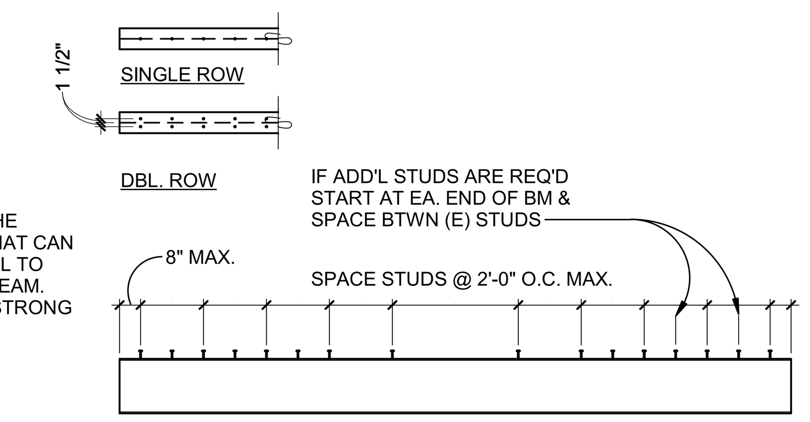


NOTE: EXTEND REBAR 2'-0" PAST EDGE OF ISOLATED OPENING.

TYPICAL SLAB EDGE CONDITION - OVER 6" OVERHANG

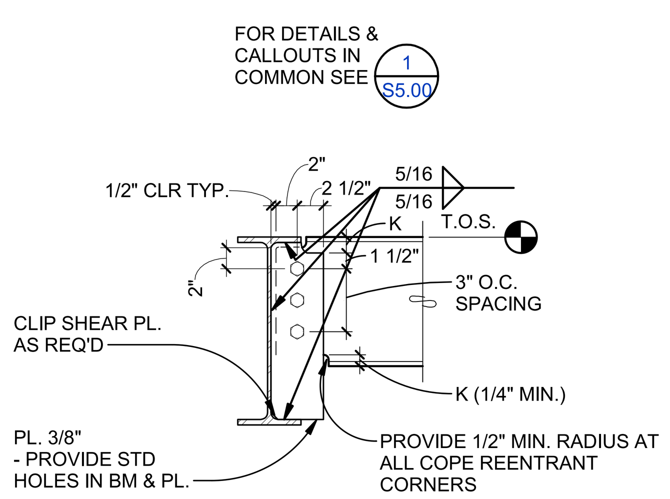
8 S5.00 **SECTION** NO SCALE

NOTES:
1. LOCATE STUDS AT CENTER OF BEAM FLANGE.
2. STUDS ARE 3/4"ø x 4 1/2" LONG AFTER WELDING.
3. SEE FRAMING PLANS FOR NUMBER OF STUDS.
4. ALL BEAMS WITH STUDS ARE COMPOSITE STEEL BEAMS.
5. PROVIDE A DOUBLE ROW OF STUDS AT BEAMS WHERE THE REQUIRED NUMBER OF STUDS EXCEEDS THE NUMBER THAT CAN FIT IN A SINGLE ROW AT 6" ON CENTER AT DECK PARALLEL TO BEAM OR 12" ON CENTER AT DECK PERPENDICULAR TO BEAM. STUDS SHOULD BE LOCATED IN DECK FLUTES PER AISC STRONG POSITION.



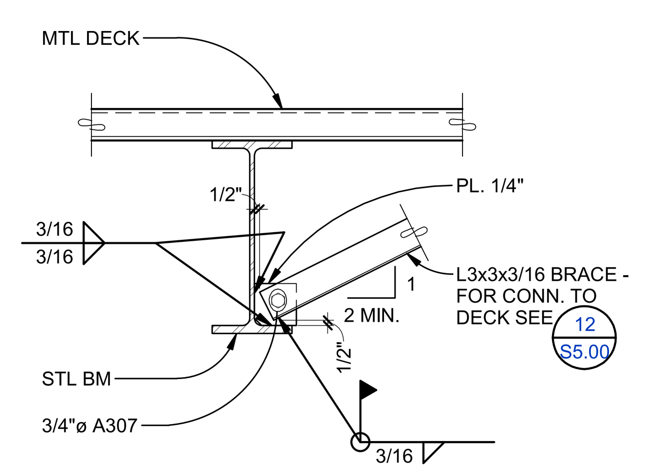
TYPICAL COMPOSITE BEAM DETAIL

9 S5.00 **DETAIL** NO SCALE



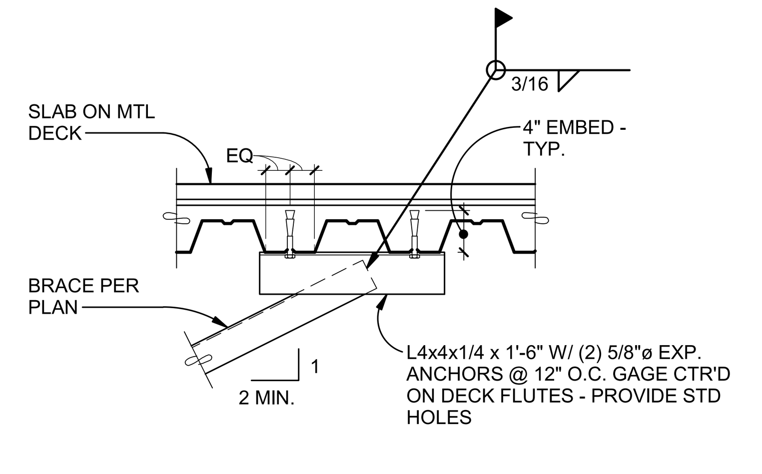
TYPICAL BEAM FRAMING AT FULL DEPTH SHEAR PLATE

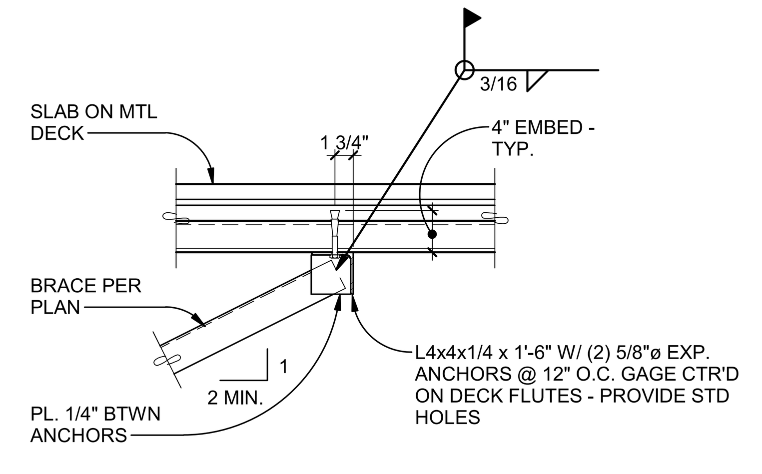
10 S5.00 **DETAIL** NO SCALE

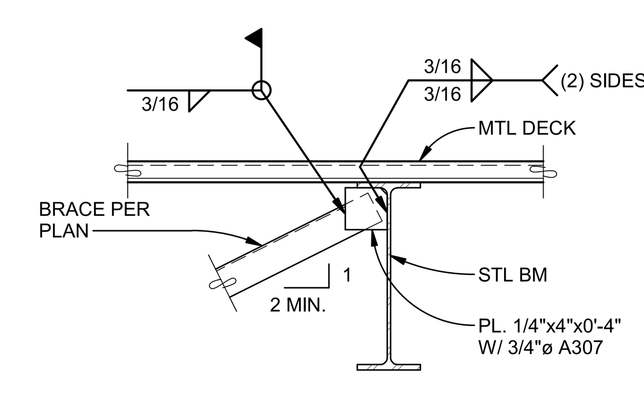


BEAM BRACING

11 S5.00 **SECTION** NO SCALE







12 S5.00 **SECTION** NO SCALE

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PCS STRUCTURAL SOLUTIONS
DESIGN E
2018 IBC WITH RISK CATEGORY III

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DRAWINGS
30 SEPTEMBER, 2021

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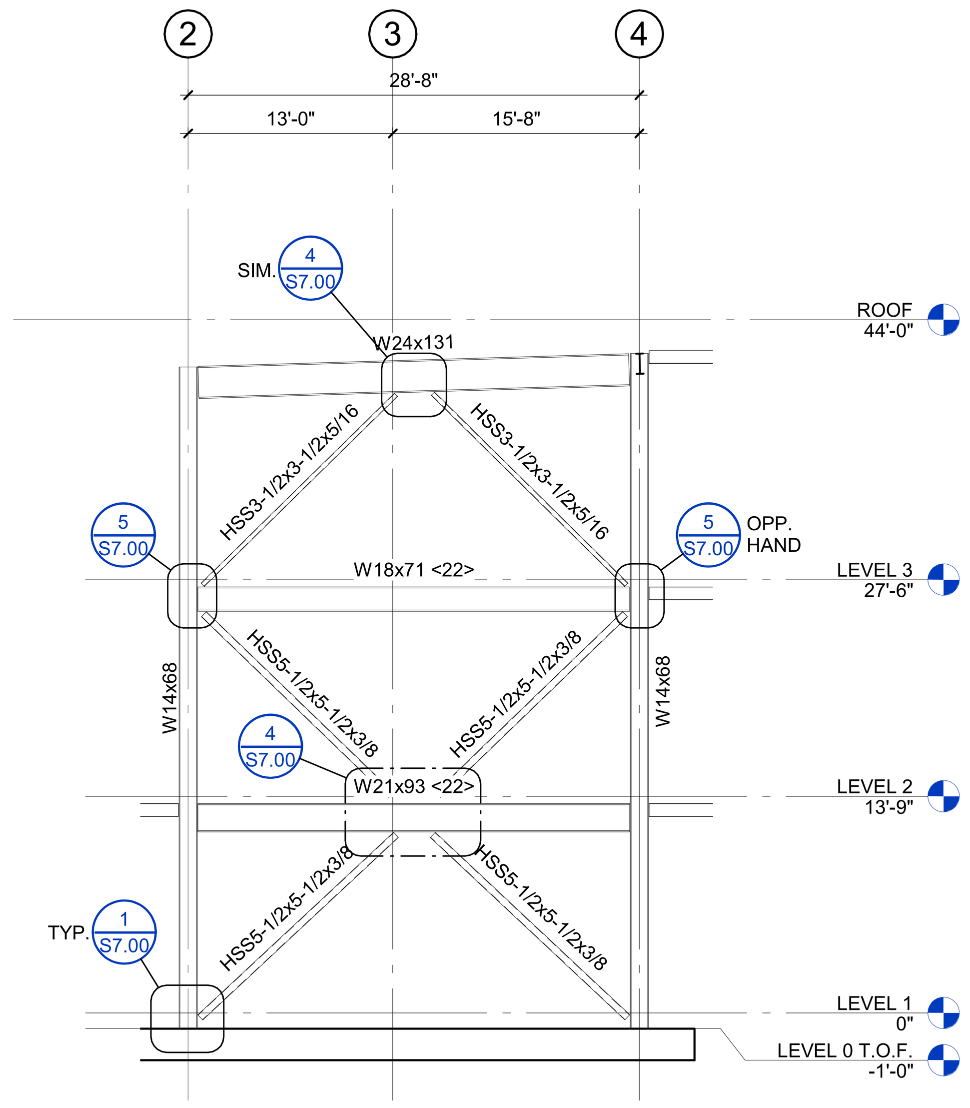
Approved	Approver

TITLE
STEEL DETAILS

SHEET NUMBER
S5.00

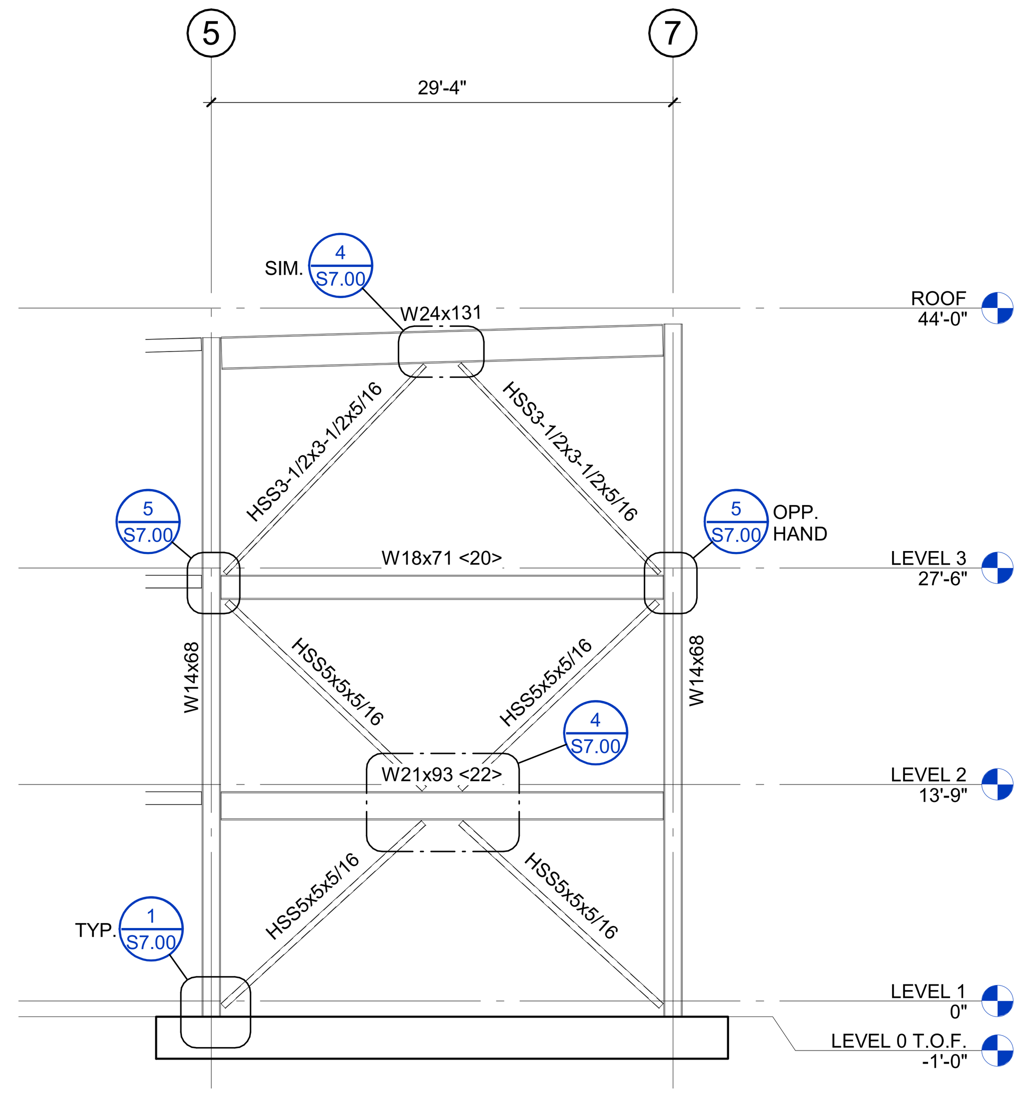


NOTE: SEE 2/S7.01 FOR PROTECTED ZONE

AT GRID B

1 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"

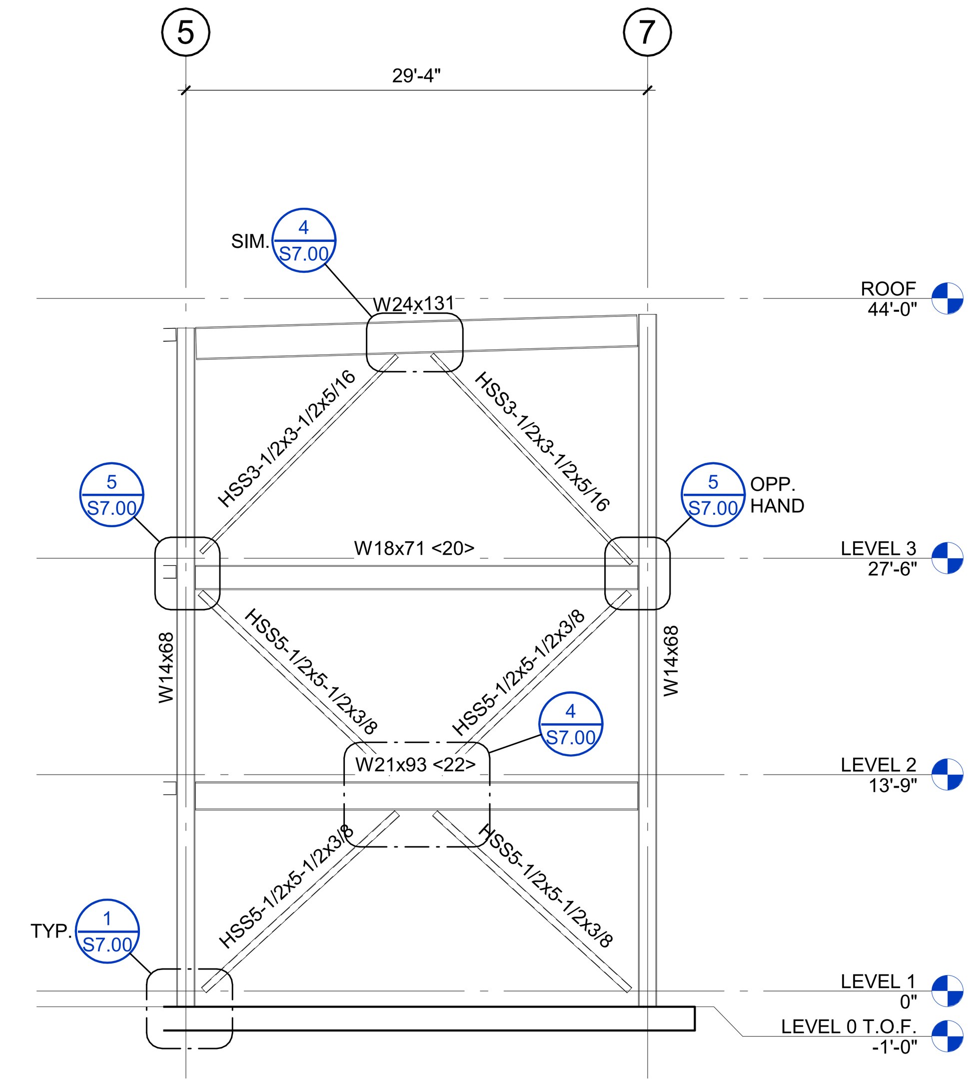


NOTE: SEE 2/S7.01 FOR PROTECTED ZONE

AT GRID D

2 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"



NOTE: SEE 2/S7.01 FOR PROTECTED ZONE

AT GRID G

3 S6.00 BRACED FRAME ELEVATION

1/8" = 1'-0"

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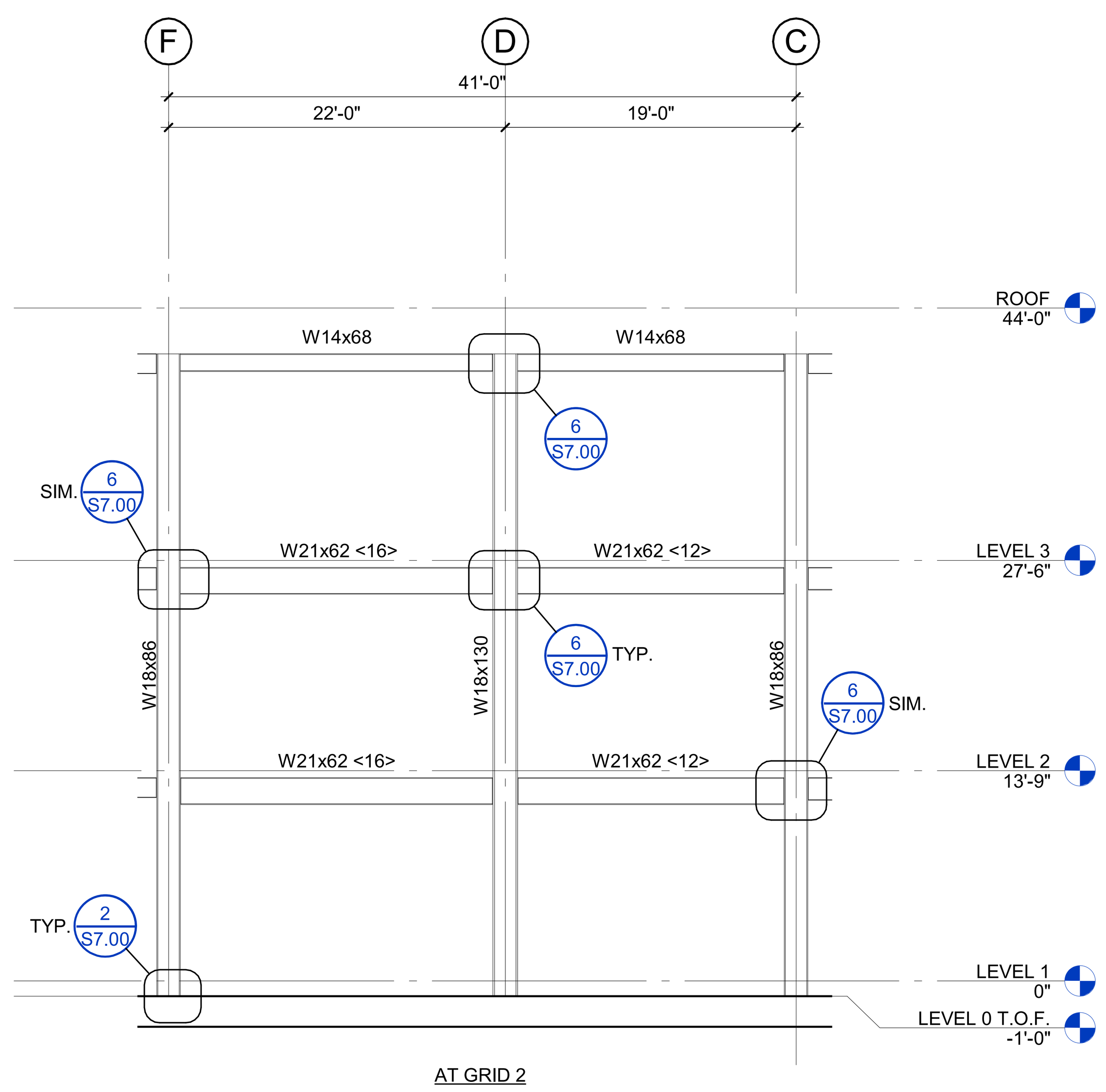
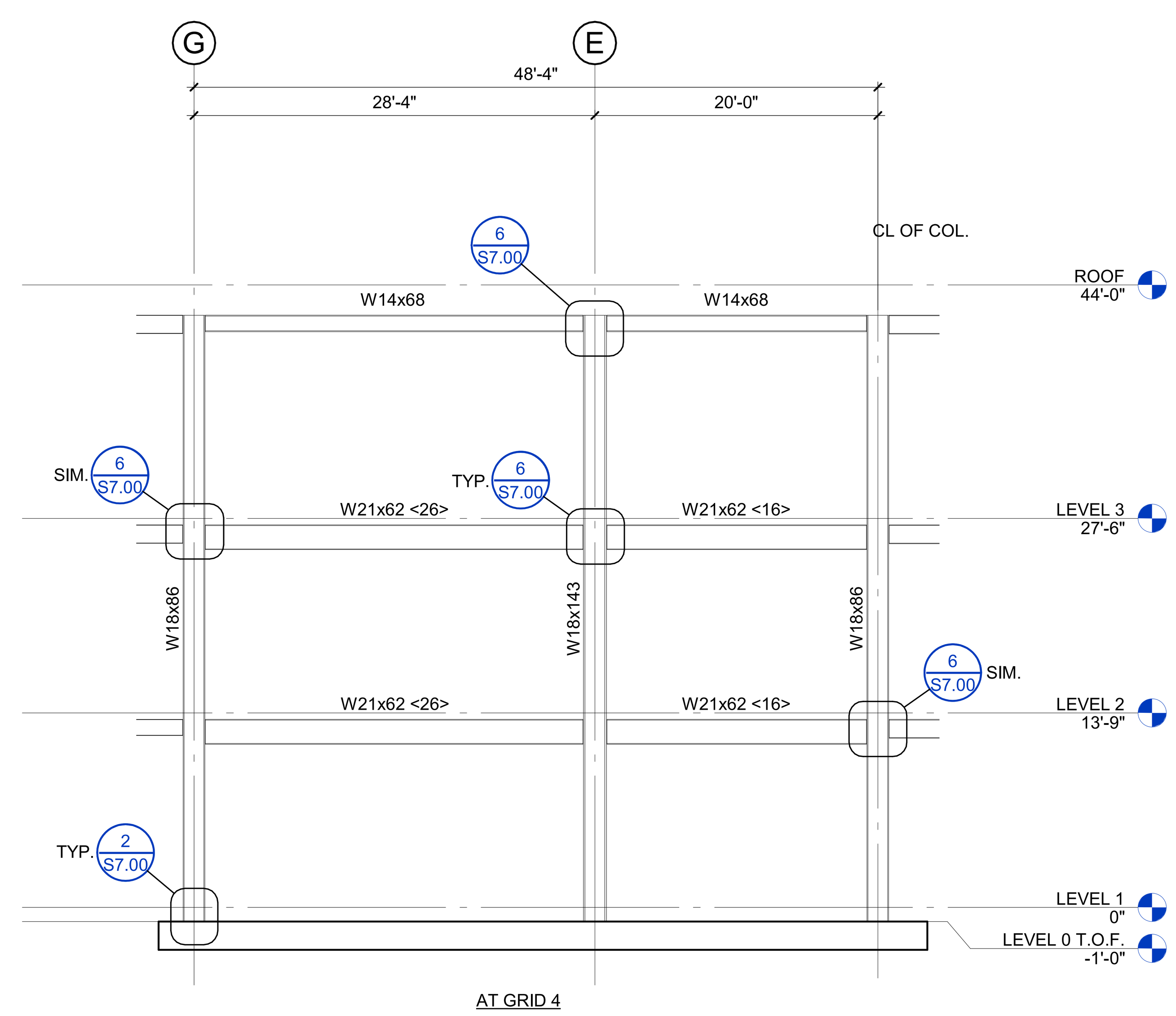
BRACED FRAME ELEVATIONS

SHEET NUMBER

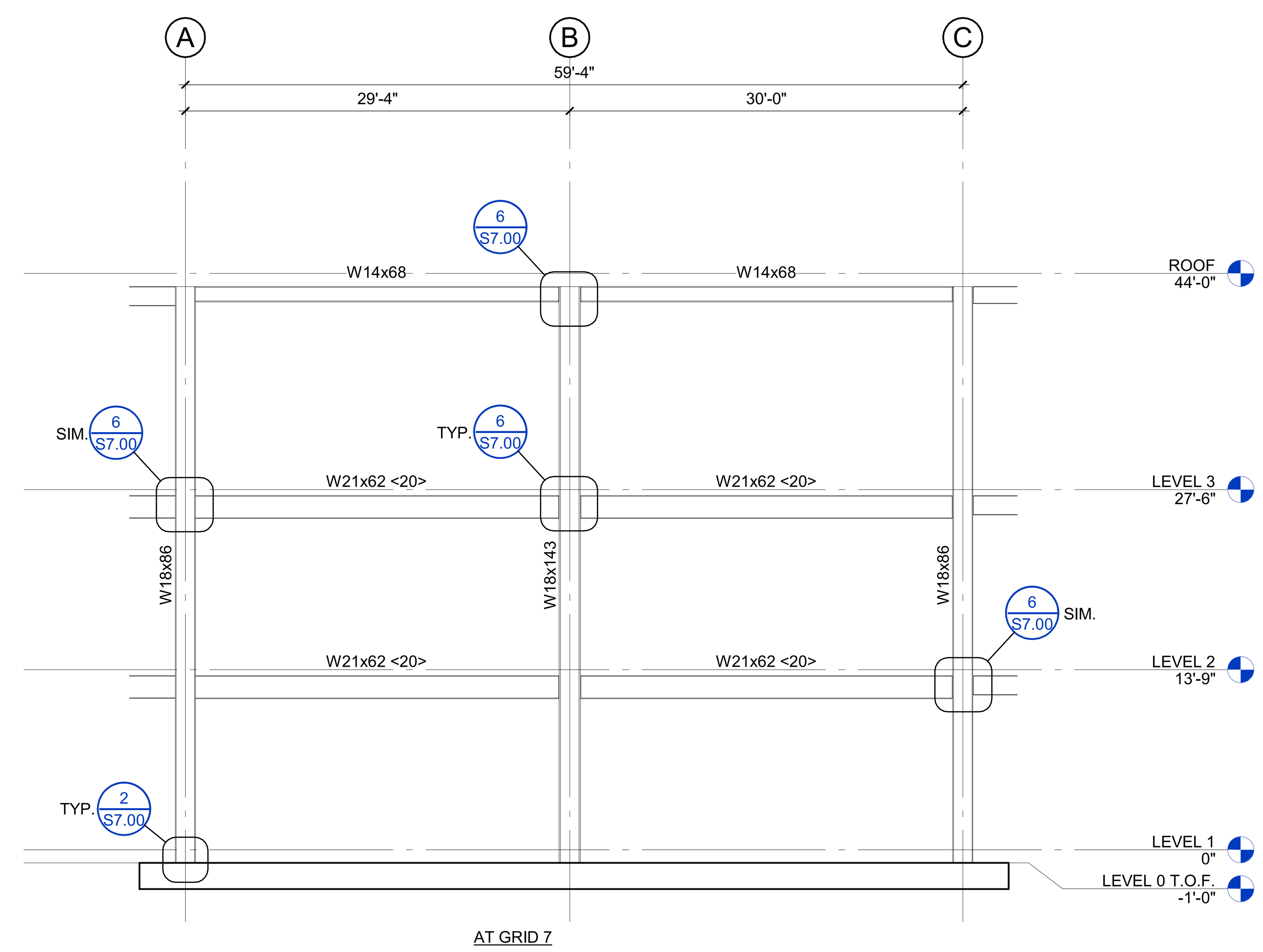
S6.00



1
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"



2
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"



3
S6.10
MOMENT FRAME ELEVATION
1/8" = 1'-0"

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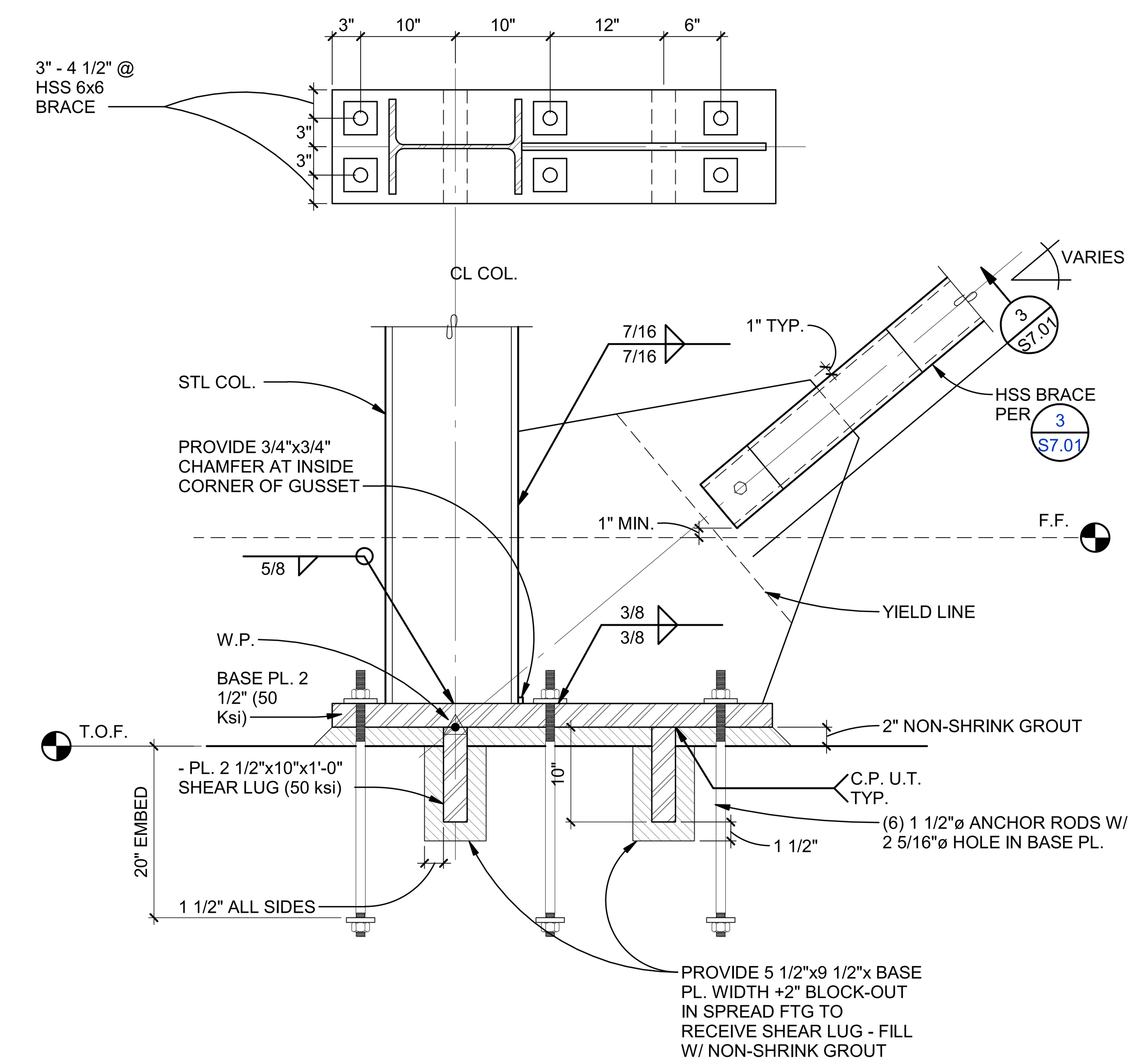
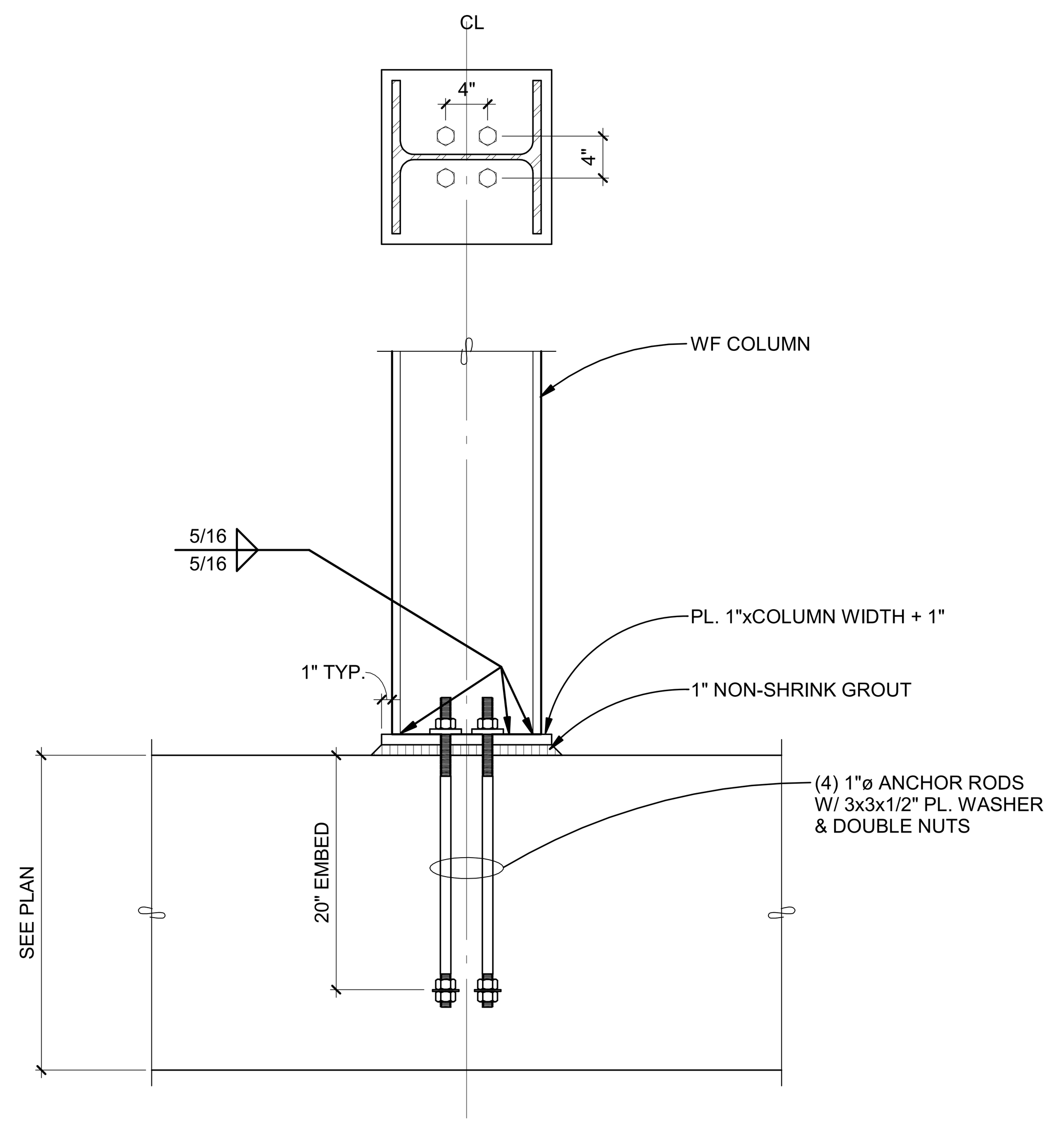
MOMENT FRAME ELEVATIONS

SHEET NUMBER
S6.10

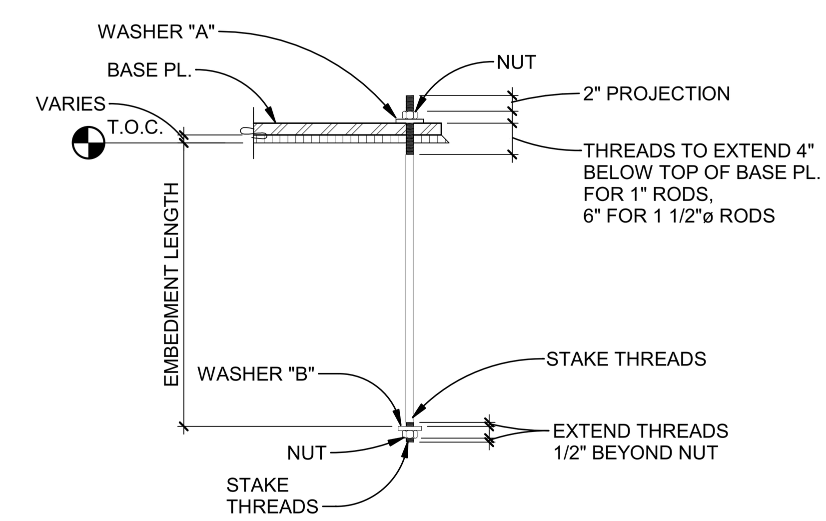


TYPICAL BASE PLATE AT BRACED FRAME

1 S7.00 SECTION
NO SCALE



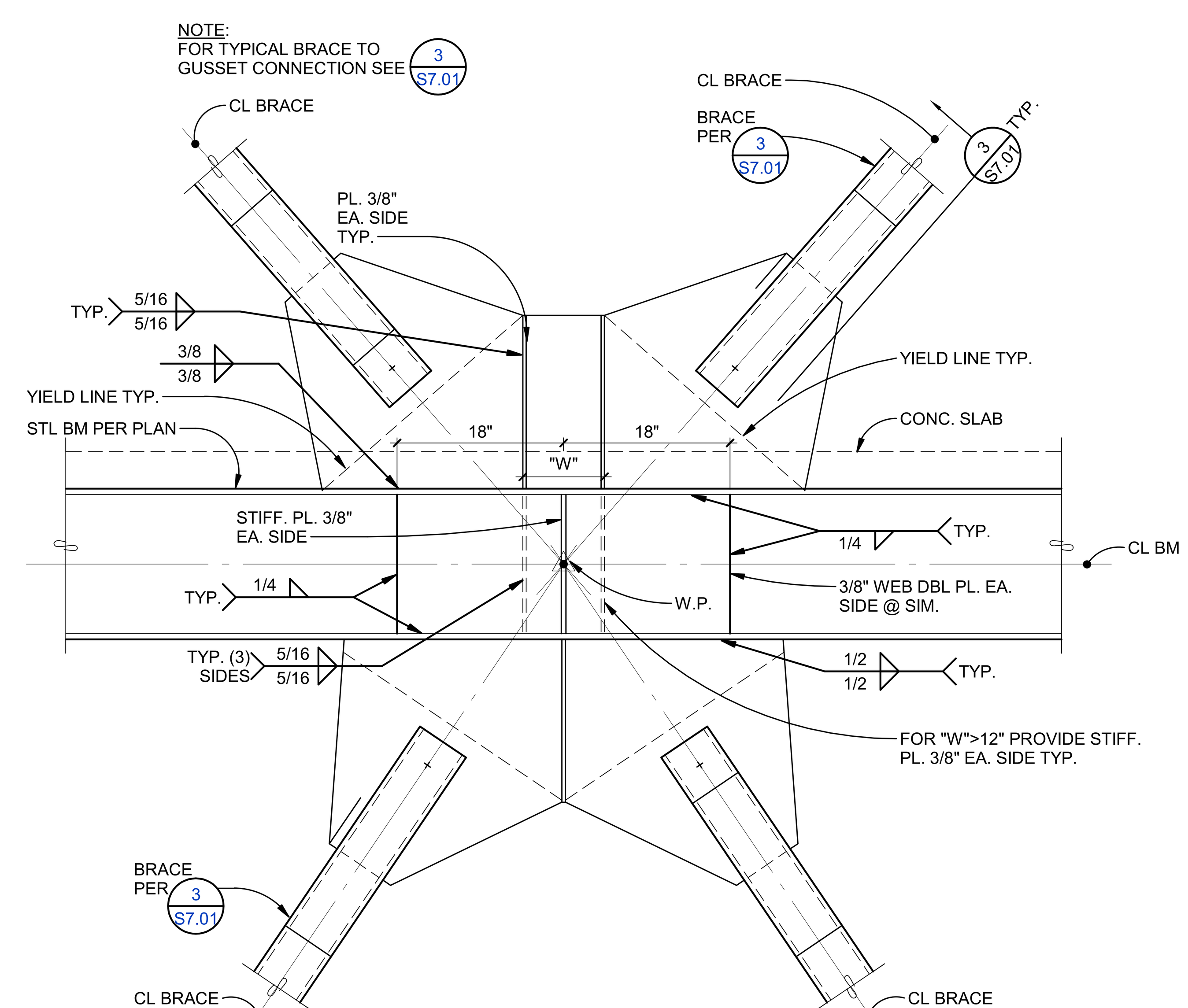
2 S7.00 SECTION
NO SCALE



ANCHOR ROD		WASHER		NUT
SIZE	MATERIAL	TYPE	SIZE	
1 1/2"ø	F1554 GRADE 105	A	PL. 1/2"x3 1/2"x0'-3 1/2" W/ 1 9/16"ø HOLE CTR'D	A563 GRADE DH HEAVY HEX
		B	ASTM F844 CARBON FLAT WASHER	

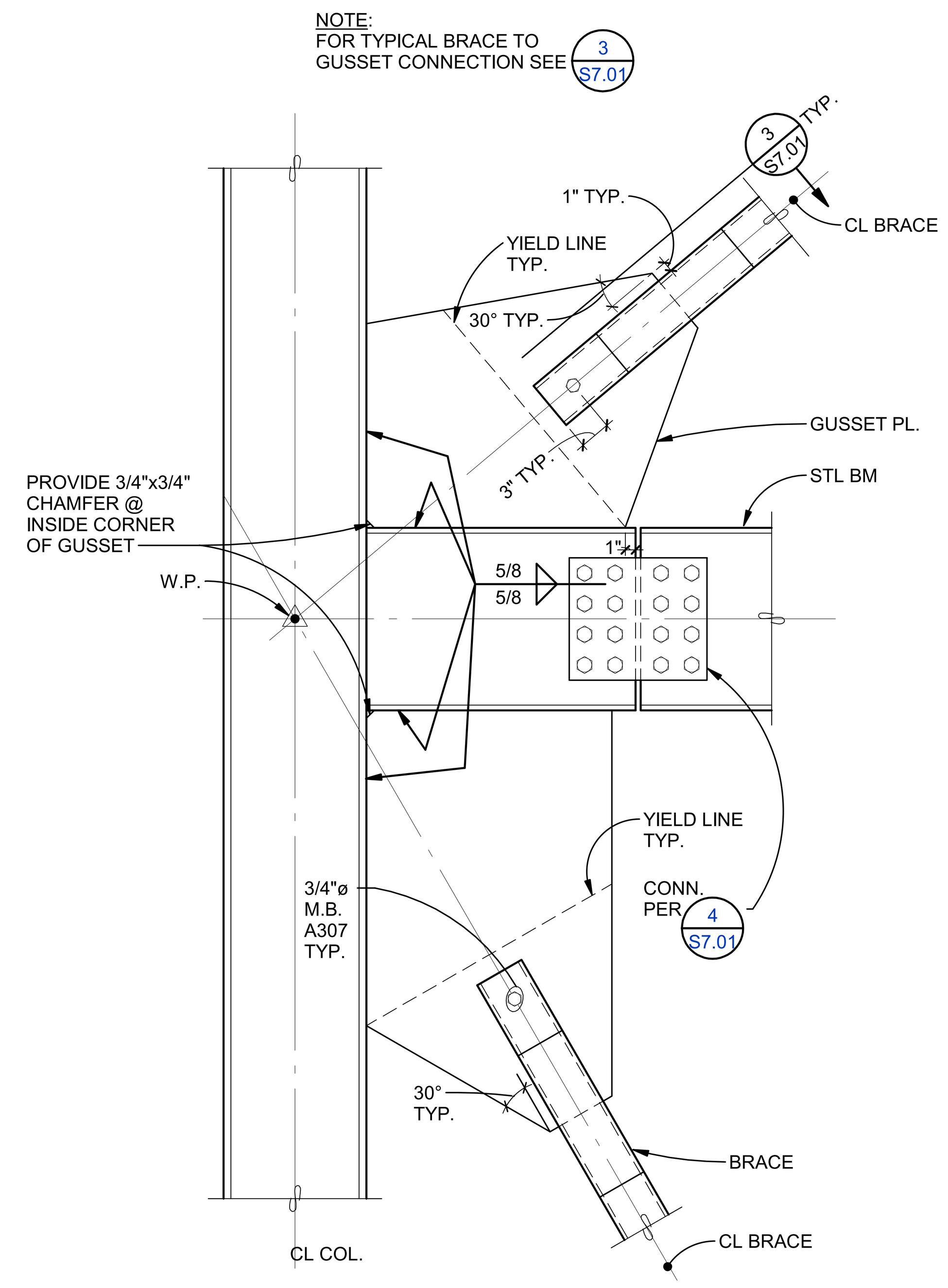
TYPICAL ANCHOR ROD/BOLT DETAIL AT BRACED FRAMES

3 S7.00 DETAIL
NO SCALE

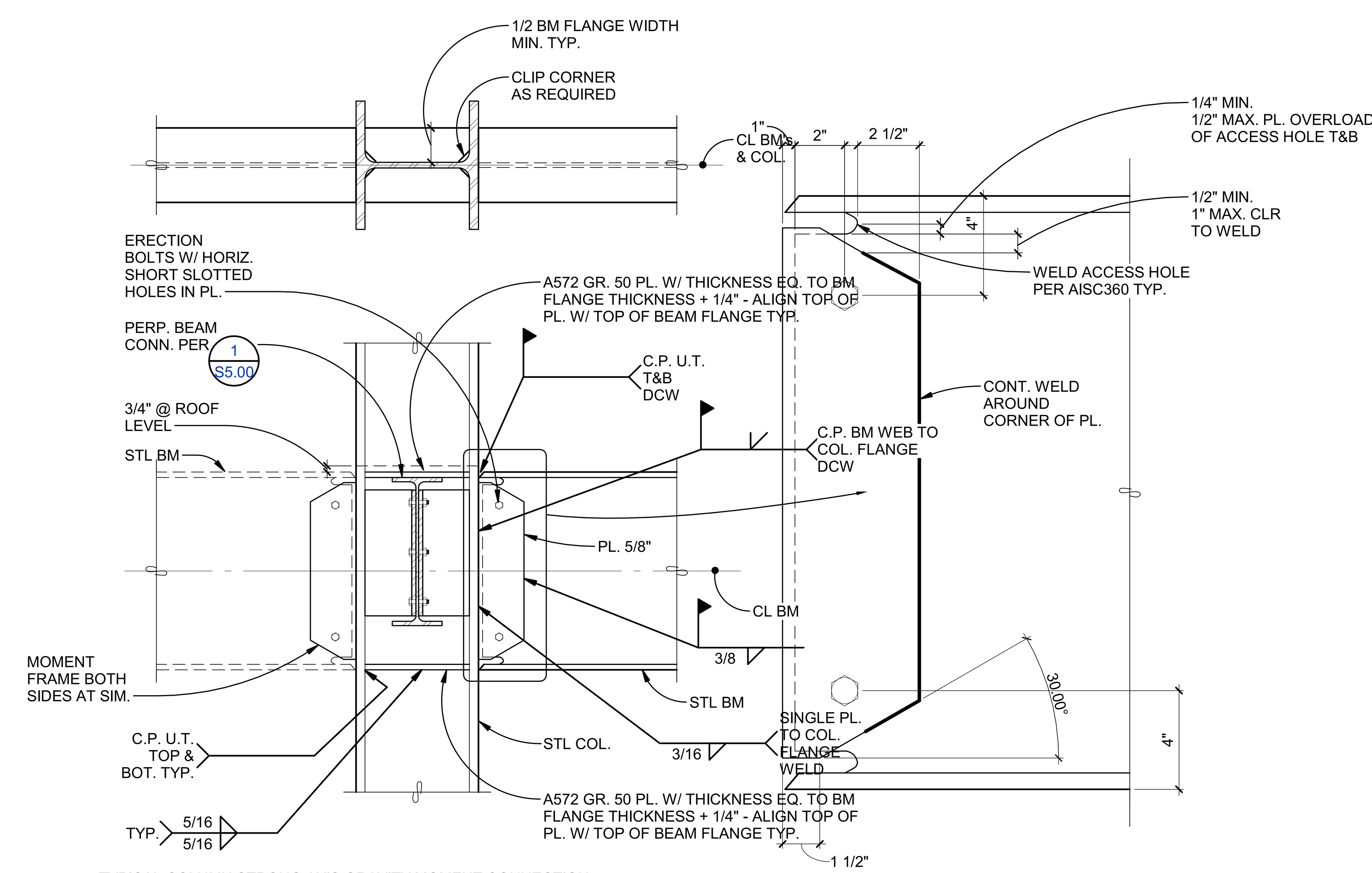


TYPICAL AT SIMILAR BRACE ANGLES

4 S7.00 SECTION
NO SCALE



5 S7.00 SECTION
NO SCALE



TYPICAL COLUMN STRONG AXIS GRAVITY MOMENT CONNECTION

6 S7.00 DETAIL
NO SCALE

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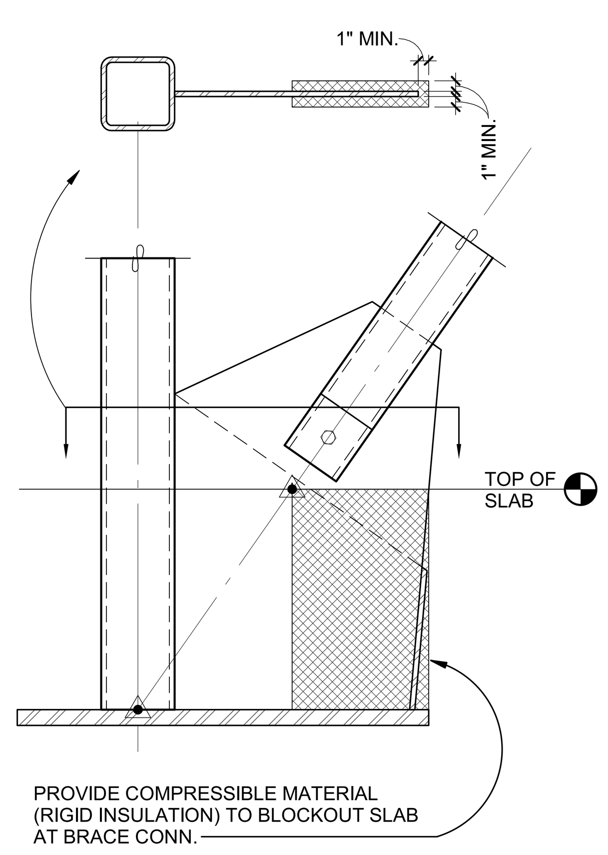
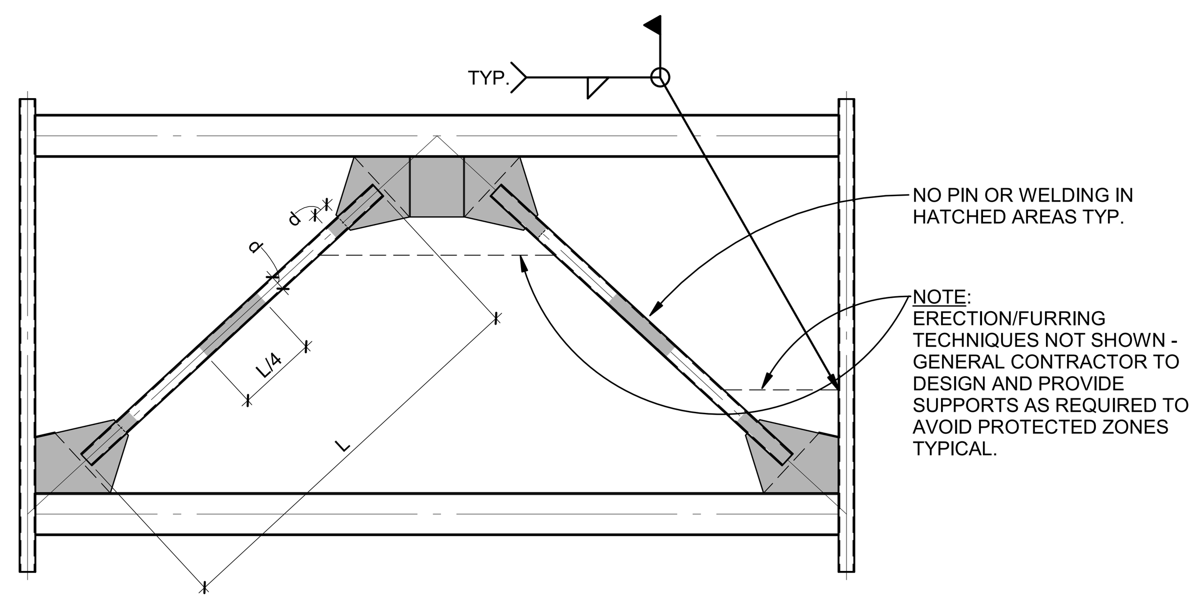
STEEL FRAMING DETAILS

SHEET NUMBER
S7.00



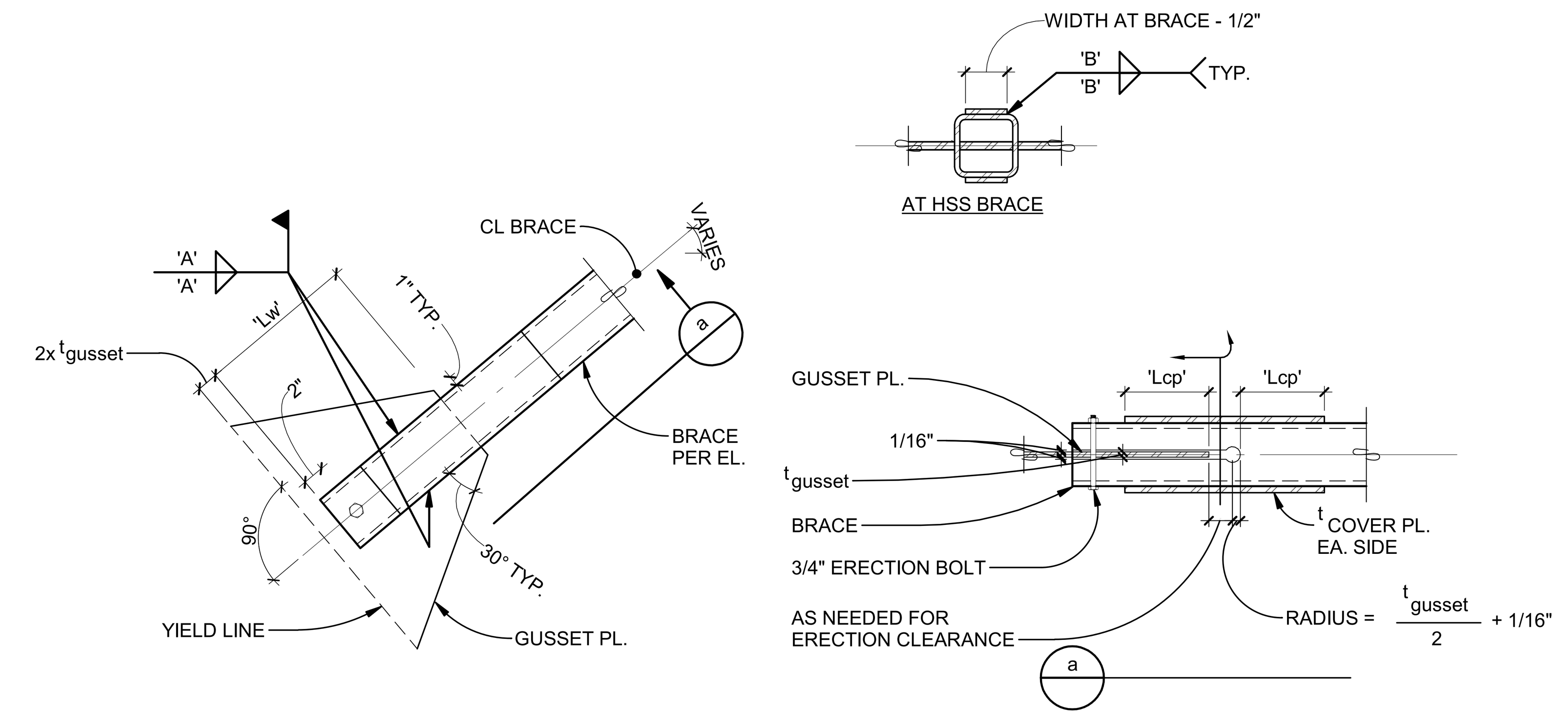
TYPICAL FOUNDATION SLAB BLOCKOUT AT BRACE CONNECTION

1 S7.01 DETAIL
NO SCALE



PROTECTED ZONE OF INVERTED-V BRACED FRAME

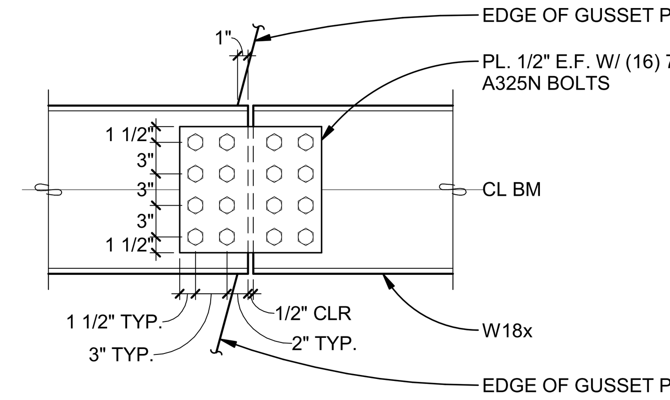
2 S7.01 SECTION
NO SCALE



SCHEDULE						
BRACE SIZE	t_{gusset} (in)	"Lw" (in)	WELD 'A'	t_{COVER} ƒ (in)	'Lcp" (in)	WELD 'B'
HSS 3 1/2x3 1/2	3/4"	16"	5/16	3/8"	10"	1/4
HSS 5x5 AND HSS 5 1/2x5 1/2	3/4"	20"	5/16	1/2"	10"	3/8

PIPE BRACE TO GUSSET PLATE CONNECTION

3 S7.01 DETAIL
NO SCALE



4 S7.01 DETAIL
1" = 1'-0"

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STEEL FRAMING DETAILS

SHEET NUMBER
S7.01

9/27/2021 10:31:16 AM
C:_Revit Models\BUILDING 3 - ATC BLDG 3 IBC 2018 SDC D RC3 v2020 (Central)_dhome@pcs-structural.com.rvt