

Building on Strong and Safe Foundations

A. Foundation Designs

This appendix contains the Case A through Case G drawings originally developed for the July 2006 edition of FEMA 550 and the new Case H drawings developed for this Second Edition of FEMA 550.

Case H drawings did not appear in the First Edition of FEMA 550. The drawings developed for the Case H designs vary in style and format from the original FEMA 550 designs for Cases A through G. Because of the differences in style and format, and the fact that thousands of copies of the July 2006 edition of FEMA 550 have been distributed, the Case H drawings are presented as standalone drawings. Separate title sheets and general notes for the Case H drawings are presented that are not intended to be used with the original drawings for Cases A through G.

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1
T-1

Drawing Index

Foundation Designs
Title Sheet & Drawing Index

DRAWING NO.: T-1 SHEET 1 of 31

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1 General

The use of the foundation designs of this manual are not intended to convey any particular sequence or procedure. The respective builder and/or contractor shall be responsible for taking adequate means and measures to insure the stability of the building and its components during construction. These shall include, but are not limited to; necessary shoring, sheeting, temporary bracing, dewatering, etc. This manual has been provided to assist in the reconstruction efforts after Hurricane Katrina. Builders, architects, or engineers using this manual assume responsibility for the resulting designs.

2 Foundation

Foundation designs are based on minimum values believed to exist in most areas of the Gulf Coast Region. Actual site soil characteristics shall be verified as being in compliance with the assumed values stated and in compliance with local building codes. Parties using the foundation designs may wish to retain the services of a Geotechnical Engineer to verify local conditions and to provide site specific values.

Soil supported foundations are based on a presumptive allowable soil pressure of 1500 pounds per square foot. In non V zones, compacted structural fill may be used. It is recommended that structural fill be placed in maximum 6" layers and compacted to 95% density as measured by the Modified Proctor method. It is also recommended, and may be required by local code, that field compaction tests be performed by a testing agent. Pile supported foundations are based on presumptive values indicated on the detail drawings.

It is advised that the location of all underground utilities be verified prior to commencing any foundation work. Proper care should be taken during any excavation work as uncharted underground utilities may exist in the area.

3 Concrete

All structural concrete, for foundations, slabs on grade, columns and beams, etc., shall be a plant batched ready-mix. The concrete mix shall be of standard weight aggregates able to achieve a 28 day compressive strength of 4000 psi. The use of Calcium Chlorides shall not be permitted. Use of water reducing agents / superplasticizer are recommended. Use of plastic fiber additives for exposed concrete slabs at grade is also recommended.

All concrete work shall comply with the requirements of ASTM Standard C94 for the measuring, mixing, transporting, placing, etc. Concrete tickets should be time stamped when the concrete is batched. The maximum time allowed, from when the mixing water is added to the time the concrete is deposited should not exceed one and one half hours. Use of concrete that is not in compliance with the above can result in significant reduction in concrete strength and performance. Concrete shall be placed with due regard to extreme temperature conditions. Refer to ACI 305 " Hot Weather Concreting" and ACI 306 "Cold Weather Concreting" for guidance in placing concrete during weather extremes.

Refer to ACI 117 and ACI 347R for guidance in planning Form work design and for finish standards and requirements.

A standard hook shall be provided at the termination of all beam top reinforcing bars. Corner bars with full tension laps, matching the size and spacing of the continuous bar shall be provided.

1 General Notes

GN -1

Reinforcing steel shall be of ASTM A615 Grade 60 deformed bars, free from oil, scale and excessive rust. Reinforcing shall be detailed, fabricated and placed in accordance with the typical bending diagrams, placing requirements and details of the latest editions of the American Concrete Institute (ACI) standards and specifications. These publications include ACI 318, ACI 301, ACI 304, ACI 315 and ACI SP-68. Minimum Cover for reinforcing is; 3" for concrete cast against soil and 2" for concrete that is exposed to weather. It is recommended that the owner utilize a concrete testing agent to verify concrete strength. Reinforcing shall be secured in place by the use of metal ties and supported by metal bolsters, chairs, spacers and other devices.

Welded wire fabric shall conform to ASTM A185 and be furnished in flat sheets only.

Standard Lap lengths are as follows:

Bar size	Lap length	Bar size	Lap length
#3	18"	#7	42"
#4	24"	#8	48"
#5	30"	#9	54"
#6	36"	#10	60"

Reinforcement
Lap Splice Table

4 Reinforced Masonry Construction

All concrete masonry unit (CMU) construction shall conform to the recommendations of the "BUILDING CODE REQUIREMENTS FOR MASONRY STRUCTURES", ACI 530-02/ASCE 5-02/TMS 402-02 and ACI 530.1-02 Specifications for Masonry Structures.

All steel reinforcement shall conform to ASTM A615 Grade 60 material.

All steel reinforcement lap lengths shall conform to table shown in SECTION 3.

The compressive strength of masonry, f_m , shall be a minimum of 1500 psi.

All reinforced cells shall be solidly filled with grout. All cells that have anchors, embedded plates, etc., shall be filled with grout. All cells within 8" above grade and all cells below grade shall be filled with grout. Grout shall have a 28-day compressive strength of 3000 psi. and be of pea gravel aggregates.

All CMU shall be laid in a running bond with a full mortar bed.

5 Structural Steel

Structural shapes, anchor bolts, etc. that are indicated to be galvanized, shall be hot dip galvanized after fabrication per ASTM A 368, A123 to G90 standard.

6 Connections

Connections to wood framing are based on lumber having a minimum specific gravity of 0.55. See sheet GN-2 to GN-6 for these details.

7 Driven Piles

Treated Timber Piles shall conform to latest revision of ASTM Specification D-25. Piles shall be of Southern Pine or Douglas Fir clean or rough peeled. Piles also shall have a minimum tip diameter of 8 inches and a minimum butt diameter of 12 inches as measured 3 feet from the end of the pile.

All treated timber piles shall be preservative treated. Preservative retention shall be 0.61 pounds per cubic foot. Pile preservative treatment shall comply with AWPA C3 standards.

Treat cut ends and drilled holes of treated timber piles with the same penetrating preservative as base treatment chemical. All piles shall be uniformly spaced along width and depth of building. Variations of +/- 1' are allowed to address site conditions, provided piles are spaced a minimum of 4 pile diameters unless otherwise noted.

General Notes

DRAWING NO.: GN-1

SHEET 2 OF 31

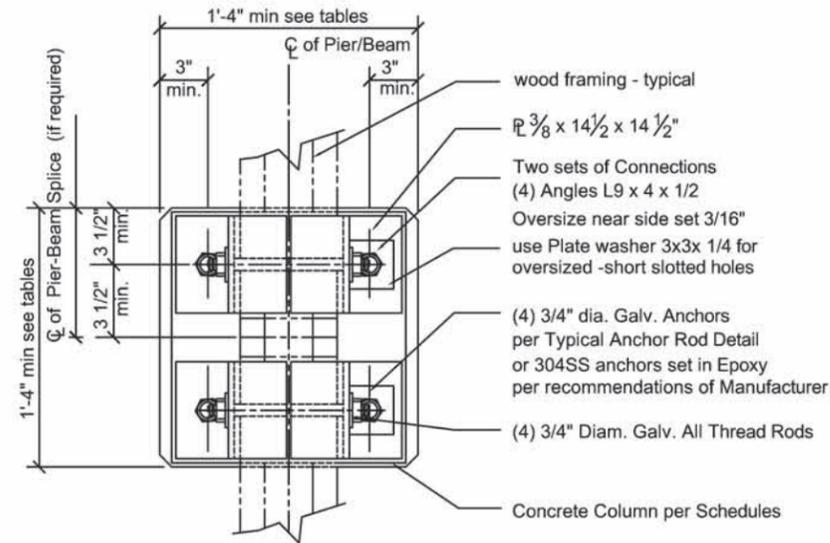
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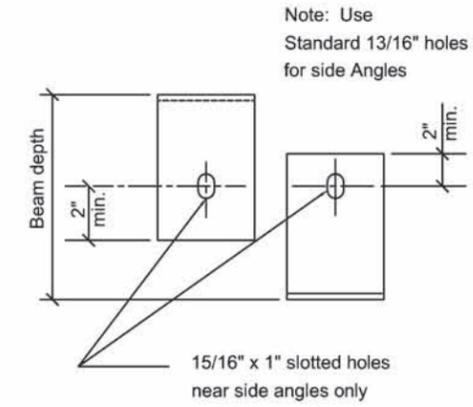
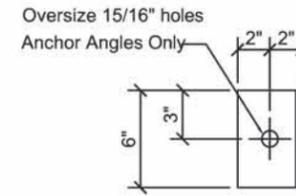


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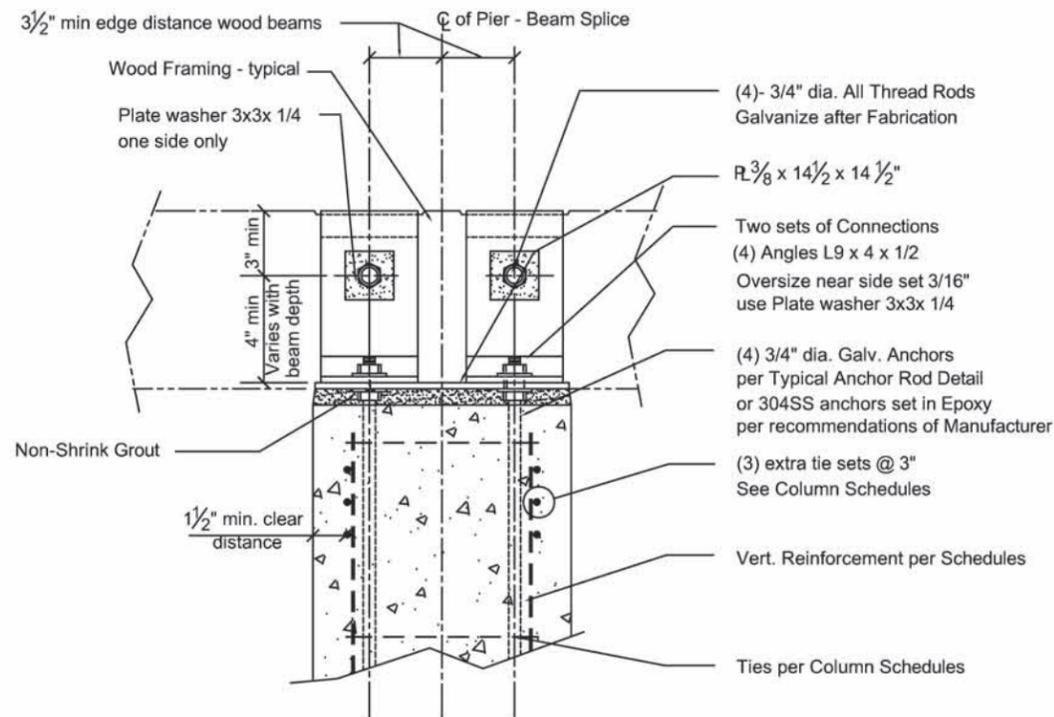
1 Captive-Clamped Beam (CCB) - Typical Connection Plan Detail

GN-2 SCALE: NTS



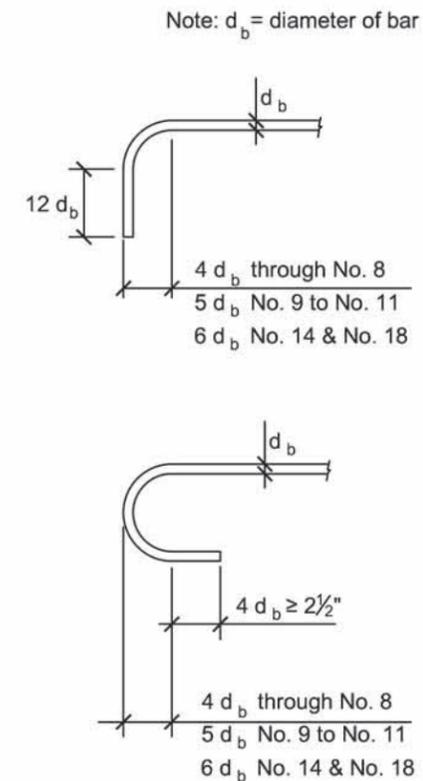
2 Captive-Clamped Beam (CCB) - Typical Connection Angle Detail

GN-2 SCALE: NTS



3 Captive-Clamped Beam (CCB) - Typical Connection Elevation

GN-2 SCALE: NTS



4 Standard Hooks

GN-2 SCALE: NTS

Connection Details

DRAWING NO.: GN-2 SHEET 3 OF 31

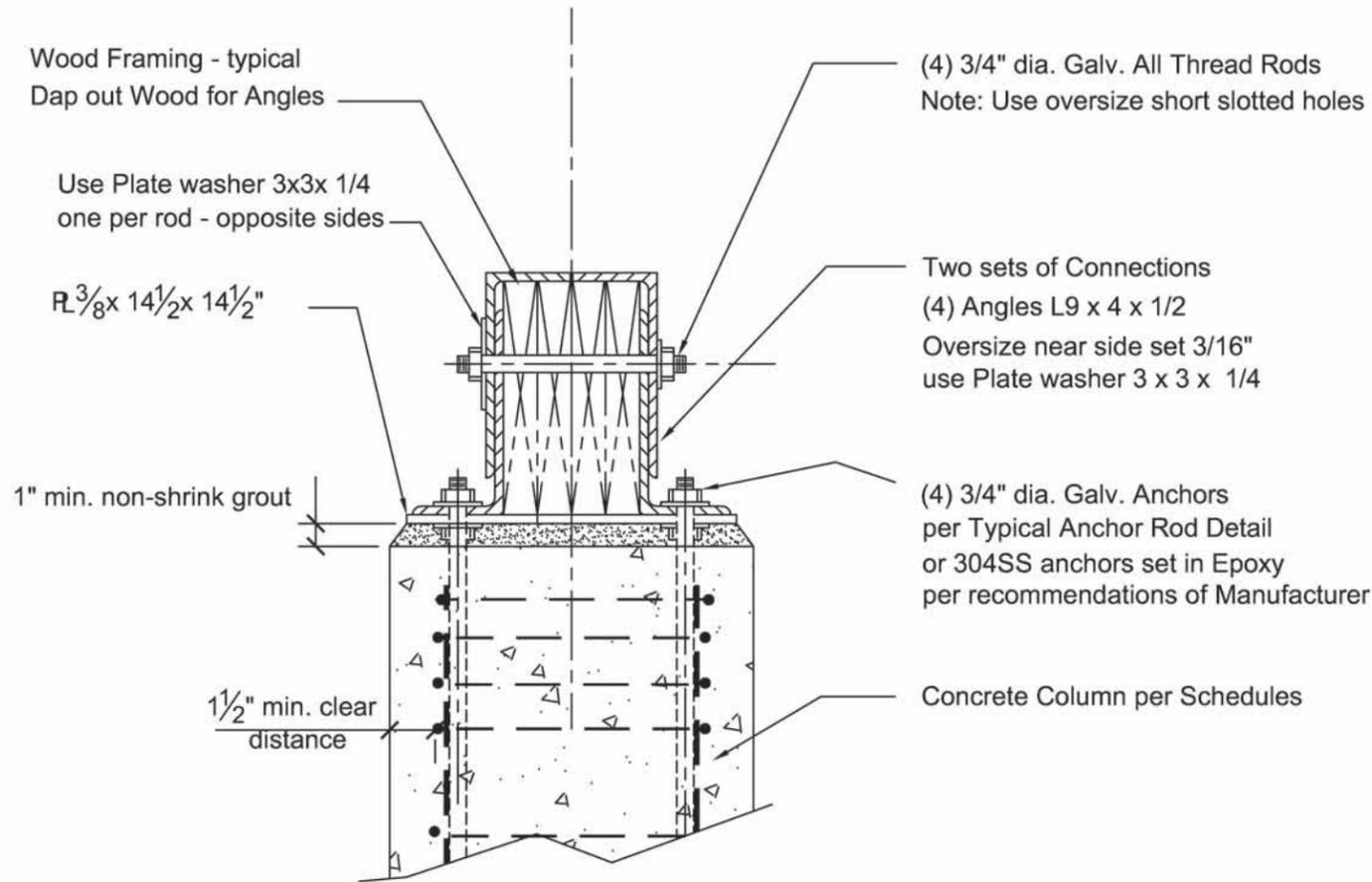
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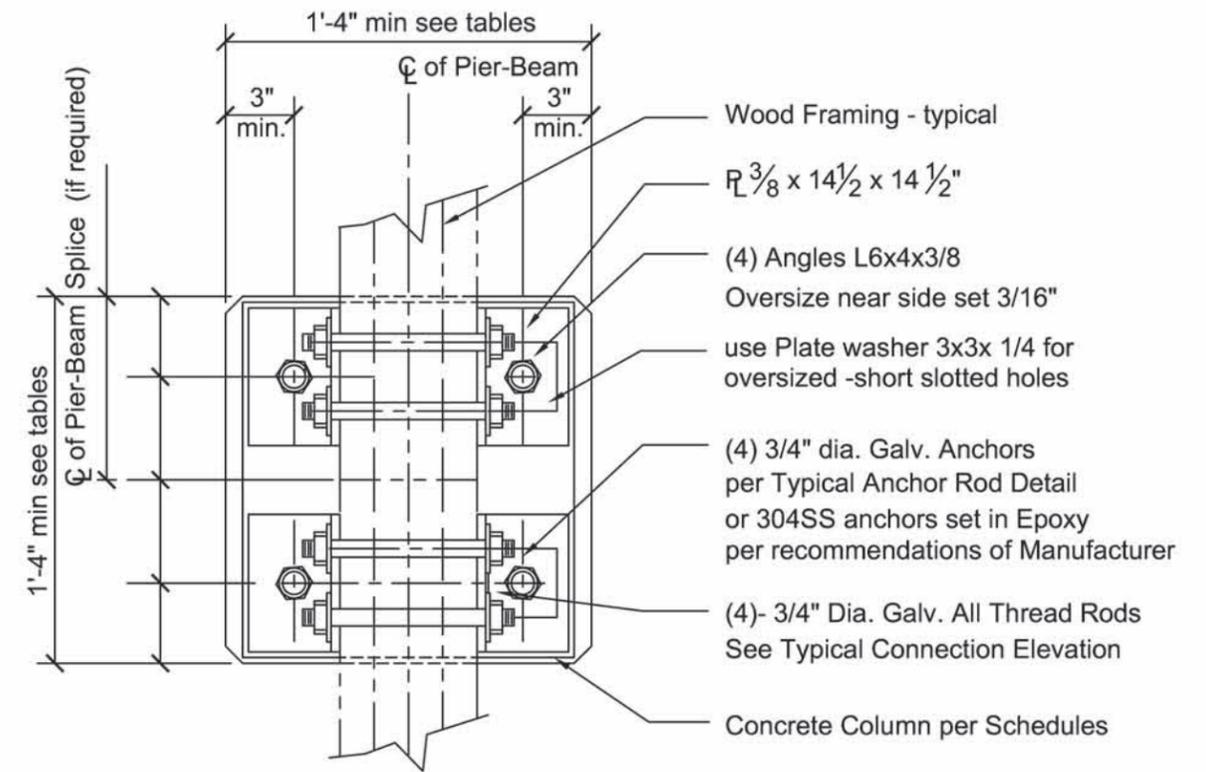


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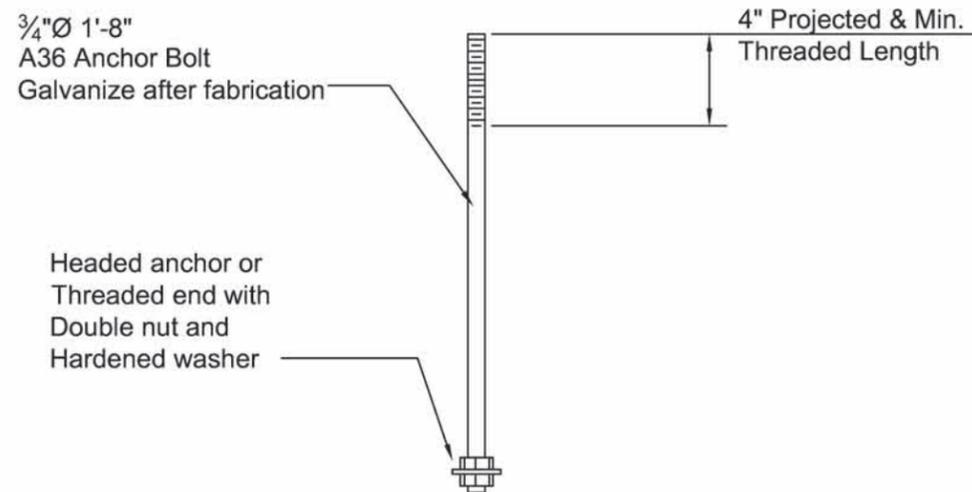
Note: All steel material min. ASTM grade A36 and Galvanized after fabrication u.n.o. Connection design is based on wood species having a specific gravity of at least 55% such as southern yellow pine.



1 Captive-Clamped Beam (CCB) - Typical Connection Section
GN-3 SCALE: NTS



2 Double Angle Beam (DAB) - Typical Connection Plan Detail
GN-3 SCALE: NTS



3 Typical Anchor Rod Detail - Cast-In Place
GN-3 SCALE: NTS

Connection Details

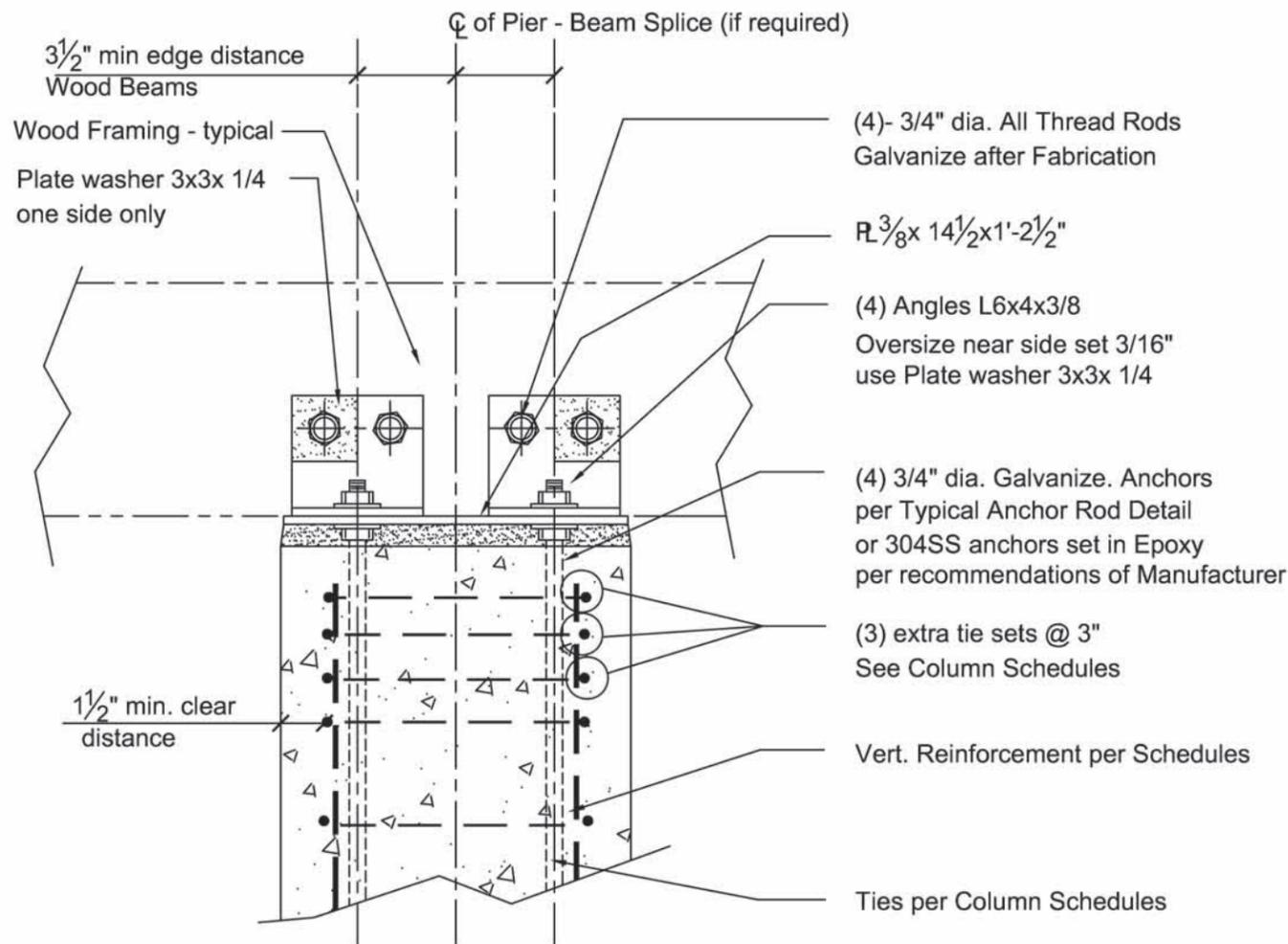
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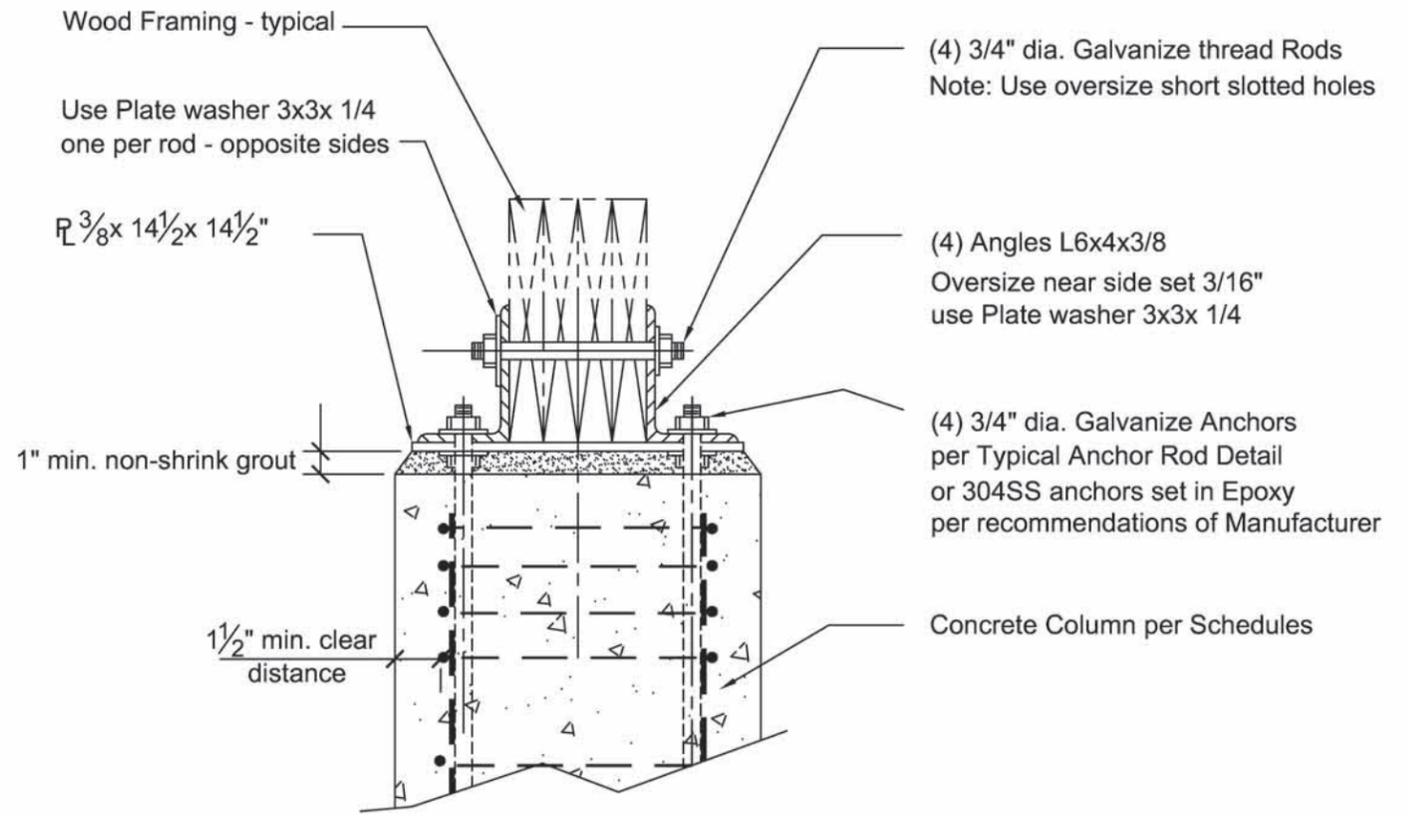
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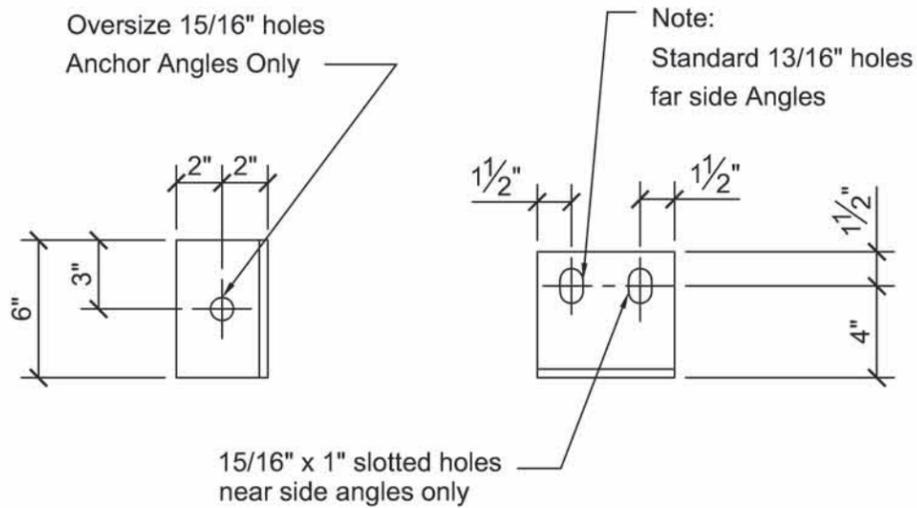
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1 GN-4 Double Angle Beam (DAB) - Typical Connection Section
SCALE: NTS



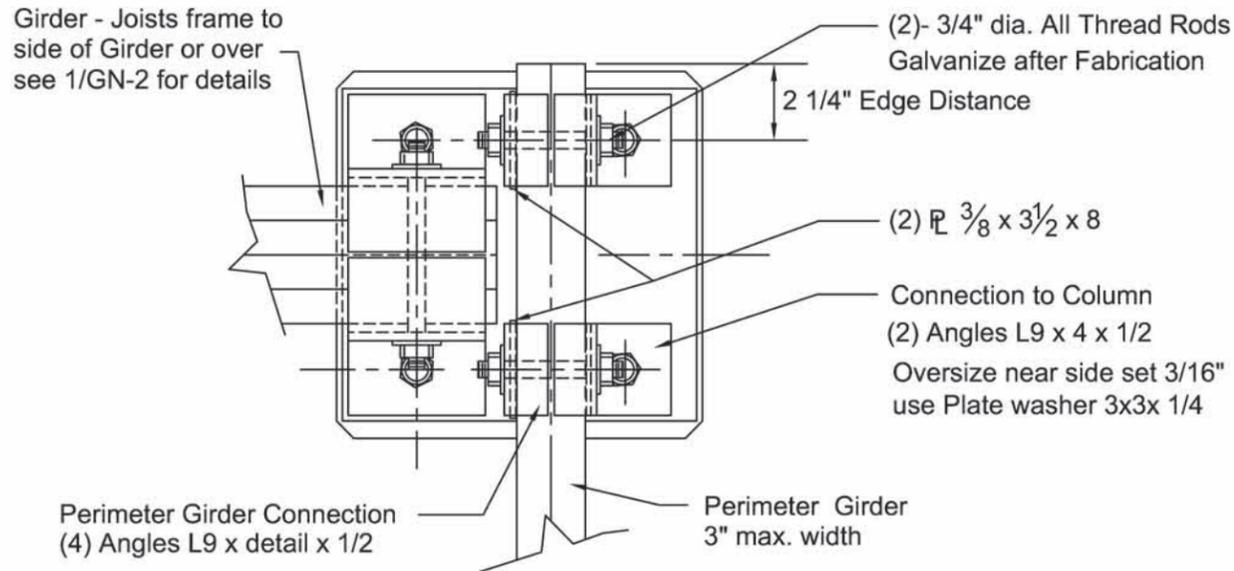
2 GN-4 Double Angle Beam (DAB) - Typical Connection Section
SCALE: NTS



3 GN-4 Double Angle Beam (DAB) - Typical Connection Section
SCALE: NTS

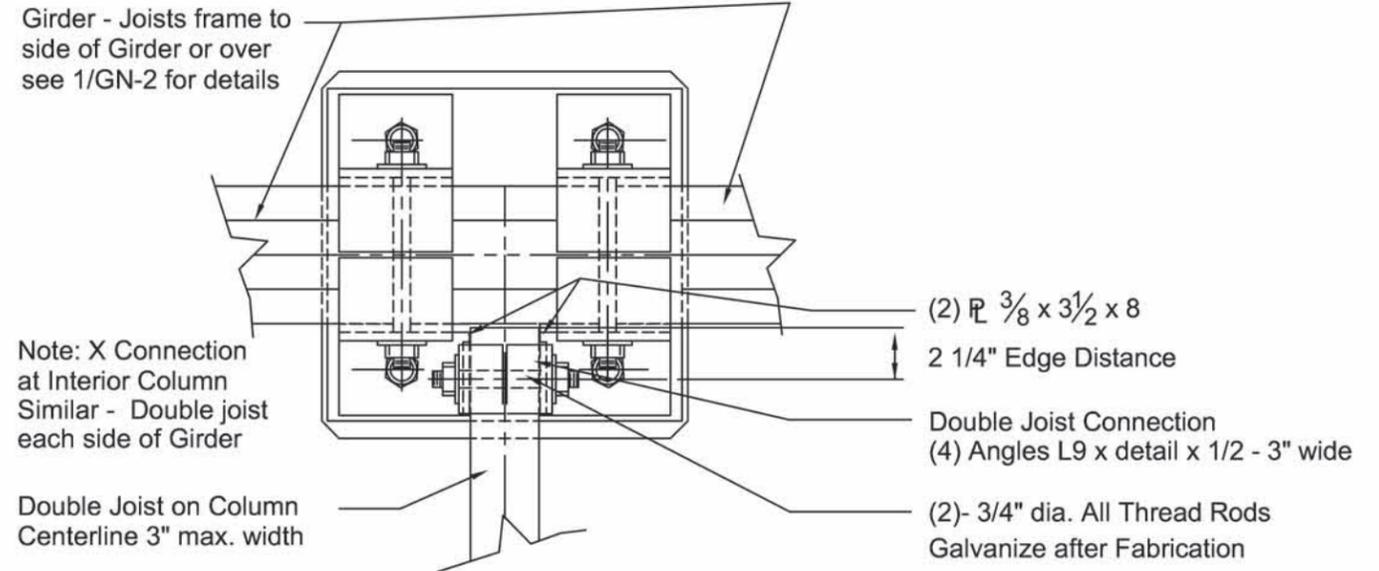
Connection Details	
DRAWING NO.: GN-4	SHEET 5 OF 31
DATE: August 8, 2006	
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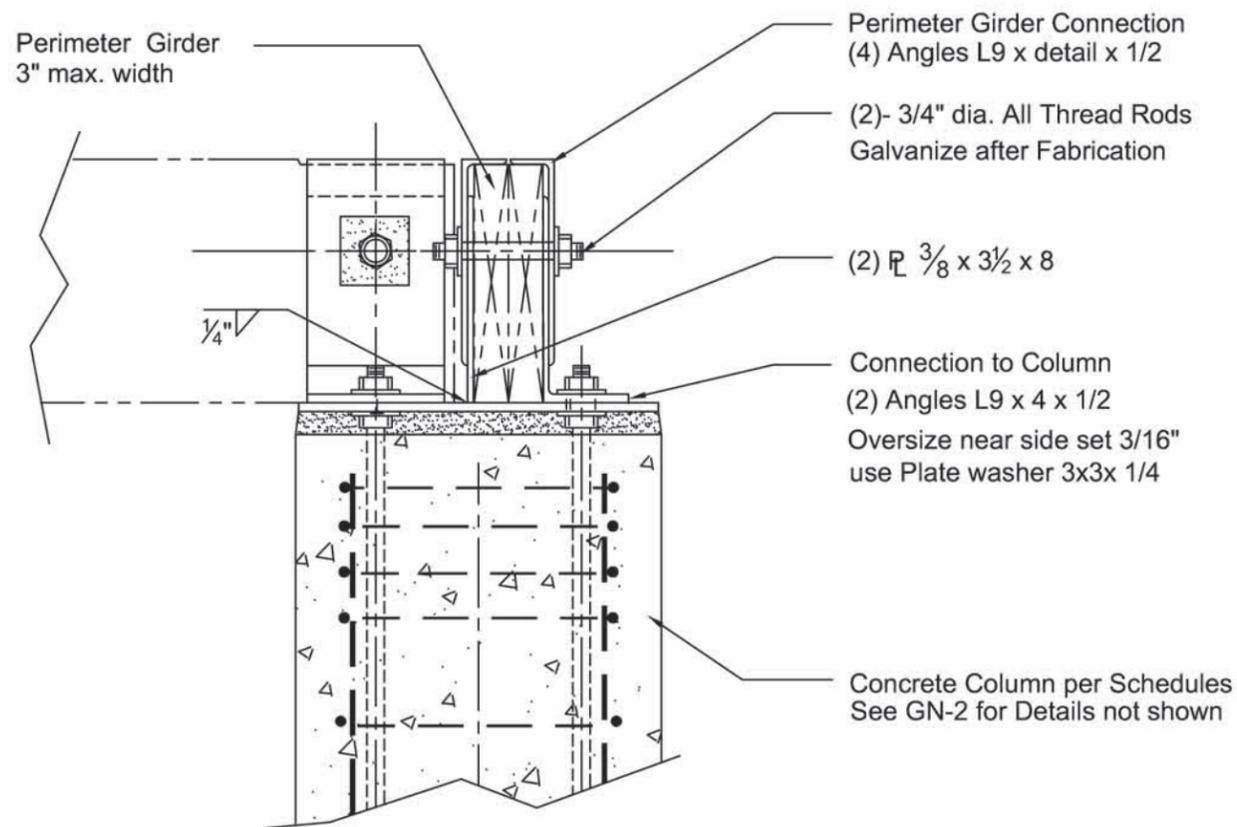
Captive-Clamped Beam (CCB) - Typical
Corner Connection Plan Detail

1
GN-5 SCALE: NTS



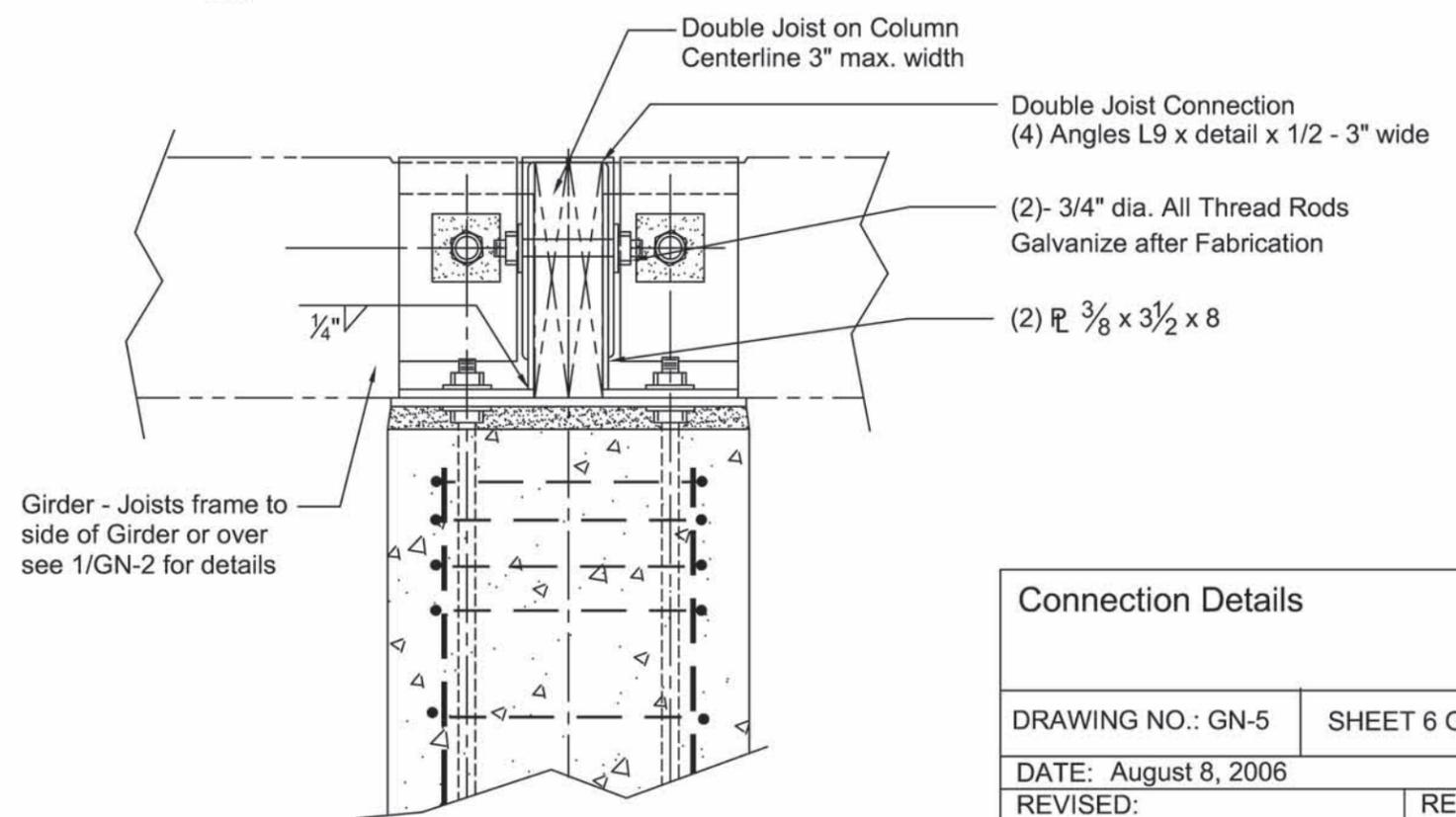
Captive-Clamped Beam (CCB) - Typical
T Connection Plan Detail

3
GN-5 SCALE: NTS



Captive-Clamped Beam (CCB) - Typical
Corner Connection Section

2
GN-5 SCALE: NTS



Captive-Clamped Beam (CCB) - Typical
"T" Connection Section

4
GN-5 SCALE: NTS

Connection Details

DRAWING NO.: GN-5 SHEET 6 OF 31

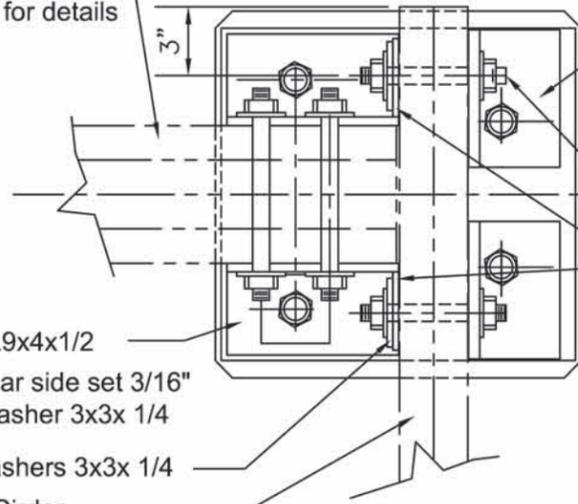
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Girder - Joists frame to side of Girder or over see 1/GN-3 for details



(2) Angles L8x4x1/2 Oversize Plate at far side 3/16"

(4)- 3/4" Dia. Galvanized All Thread Rods See Typical Connection Elevation

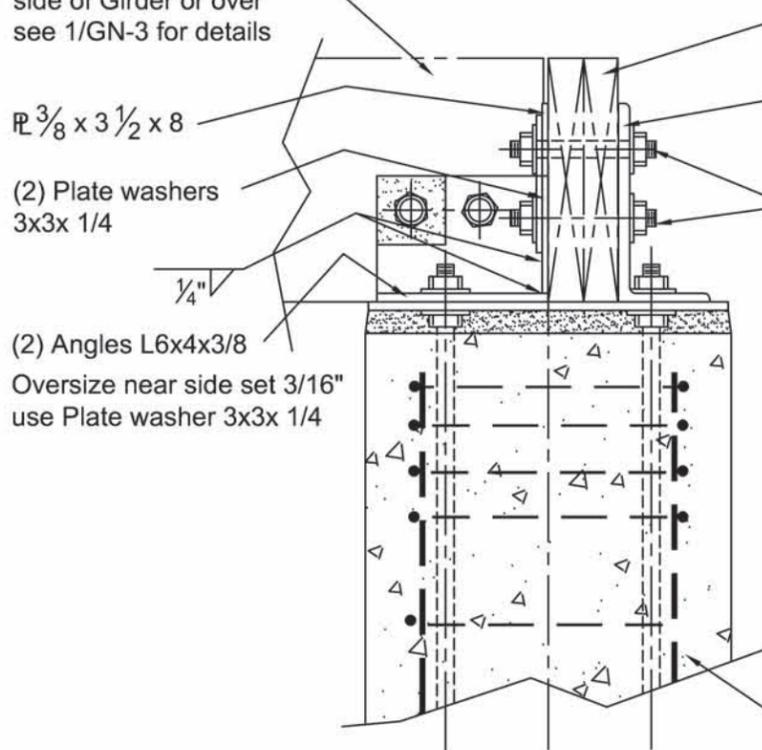
$\text{PL } 3/8 \times 3 1/2 \times 8$

(2) Angles L9x4x1/2 Oversize near side set 3/16" use Plate washer 3x3x 1/4
(2) Plate washers 3x3x 1/4
Perimeter Girder 3" max. width

Double Angle Beam (DAB) Corner Connection Plan

1
GN-6 SCALE: NTS

Girder - Joists frame to side of Girder or over see 1/GN-3 for details



Perimeter Girder 3" max. width

(2) Angles L8x4x1/2 Oversize Plate at far side 3/16"

(4)- 3/4" Dia. Galvanized All Thread Rods See Typical Connection Elevation

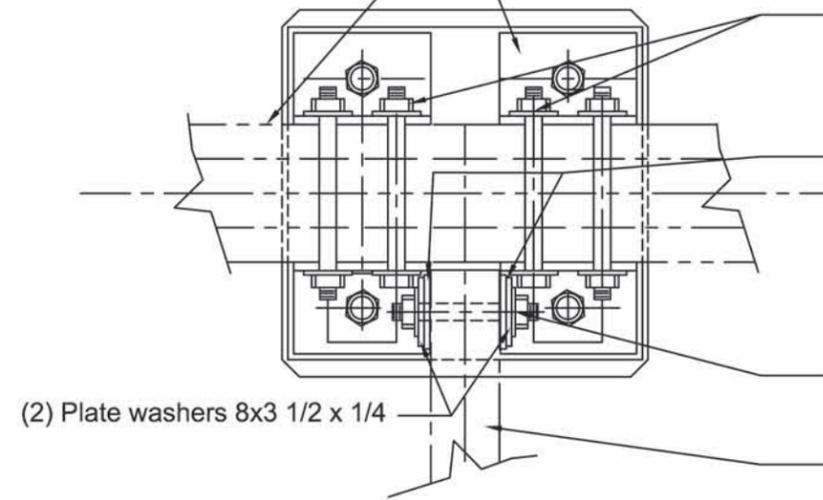
(2) Angles L6x4x3/8 Oversize near side set 3/16" use Plate washer 3x3x 1/4

Double Angle Beam (DAB) Corner Connection Section

2
GN-6 SCALE: NTS

Concrete Column per Schedules See GN-4 for Details not shown

Note: X Connection at Interior Column Similar - Double joist each side of Girder



Girder - Joists frame to side of Girder or over see 1/GN-3 for details

Note: Use Headed Bolt for clearance with Double Joist Connection Bolts

(2) $\text{PL } 3/8 \times 3 1/2 \times 8$

(2)- 3/4" Dia. Galvanized All Thread Rods See Typical Connection Elevation

Double Joist on Column Centerline 3" max. width

(2) Plate washers 8x3 1/2 x 1/4

Double Angle Beam (DAB) T Connection Plan

3
GN-6 SCALE: NTS

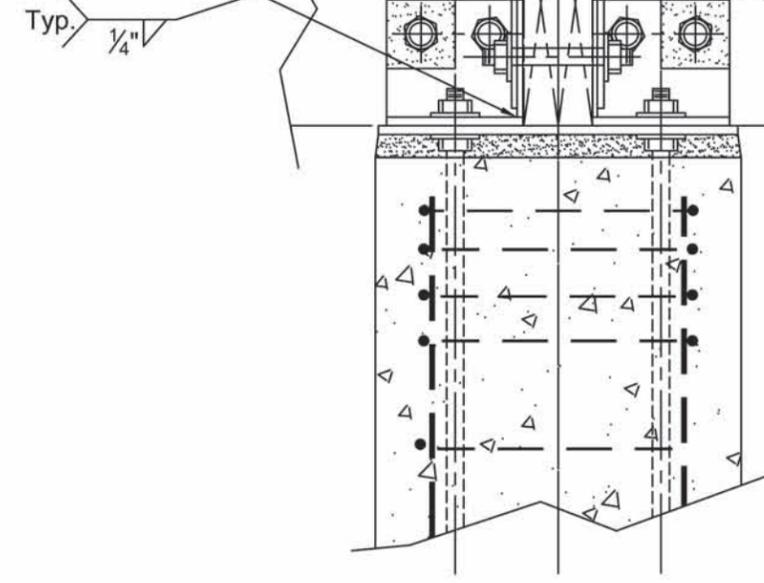
(2) $\text{PL } 3/8 \times 3 1/2 \times 8$

(2) Plate washers 8x3 1/2 x 1/4

Typ. 1/4"

Double Joist on Column Centerline 3" max. width

(2)- 3/4" Dia. Galvanized All Thread Rods See Typical Connection Elevation



Double Angle Beam (DAB) T Connection Section

2
GN-6 SCALE: NTS

Connection Details

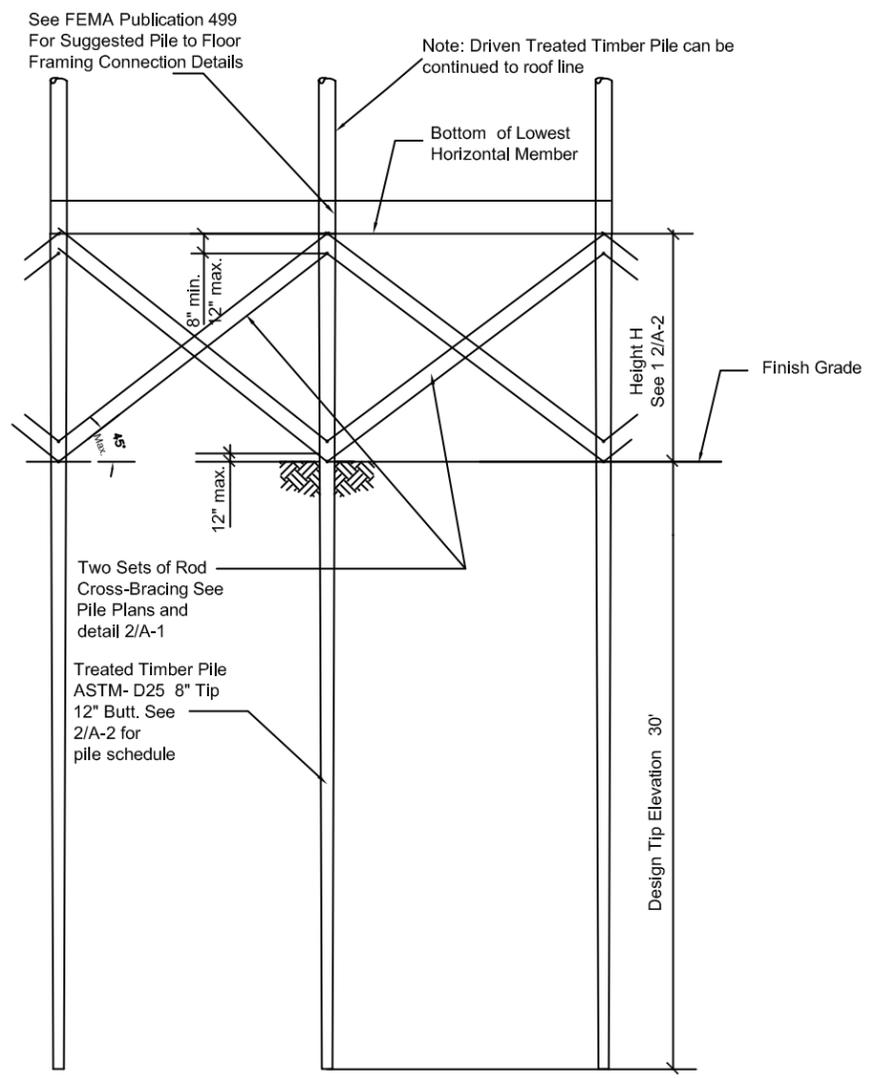
DRAWING NO.: GN-6 SHEET 7 OF 31

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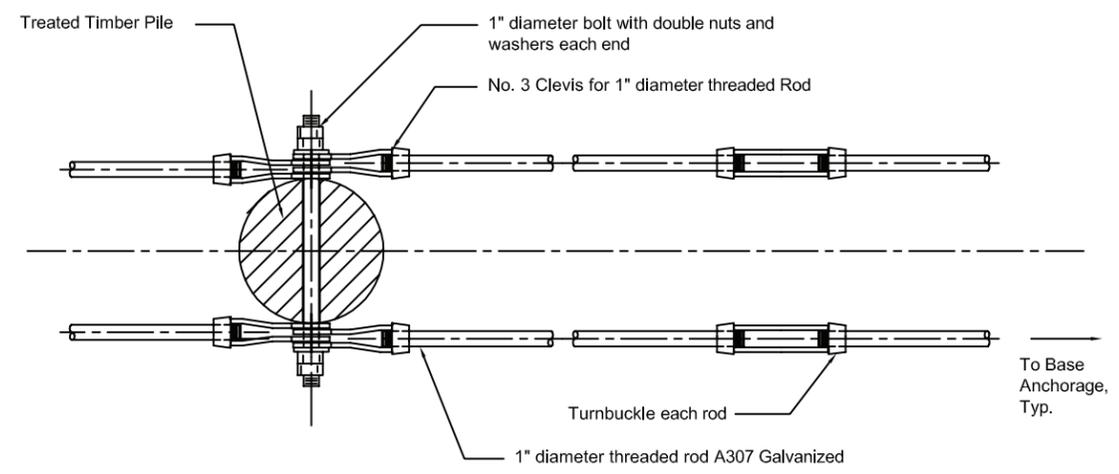


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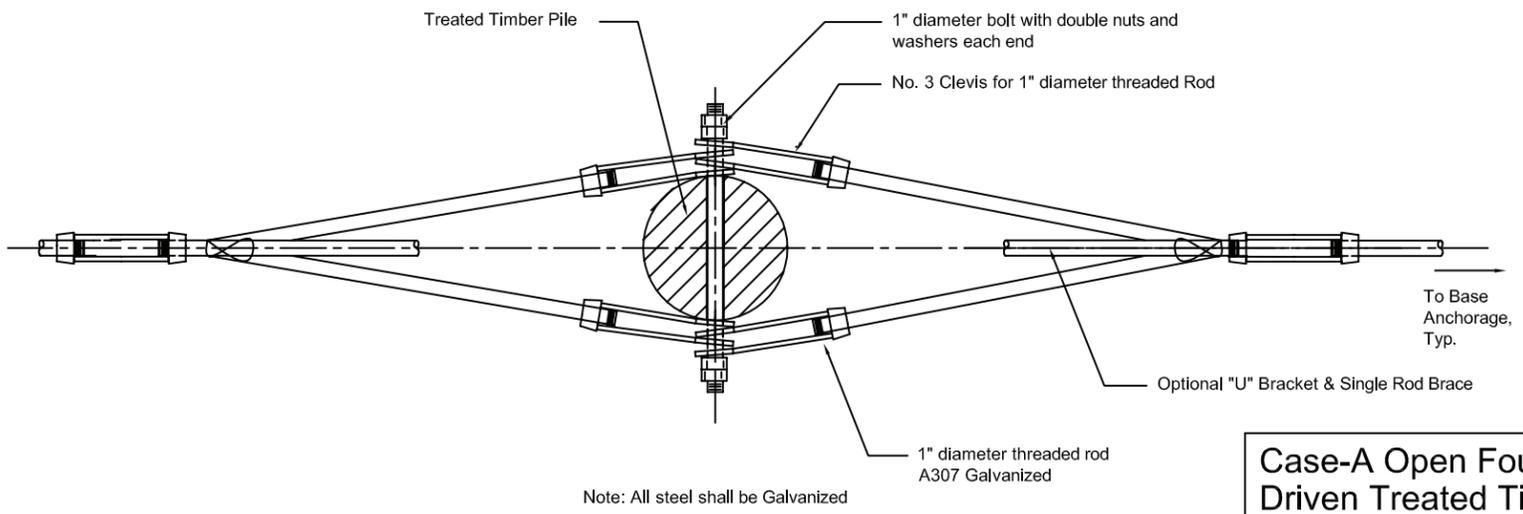


Case A Open Foundation - Driven Treated Timber Pile
Pile Profile - Double Rod Cross Bracing Shown
 SCALE: NTS

Piles are assumed to have the following capacities:
 Compression 14000 pounds
 Tension 9300 pounds
 Lateral 4000 pounds



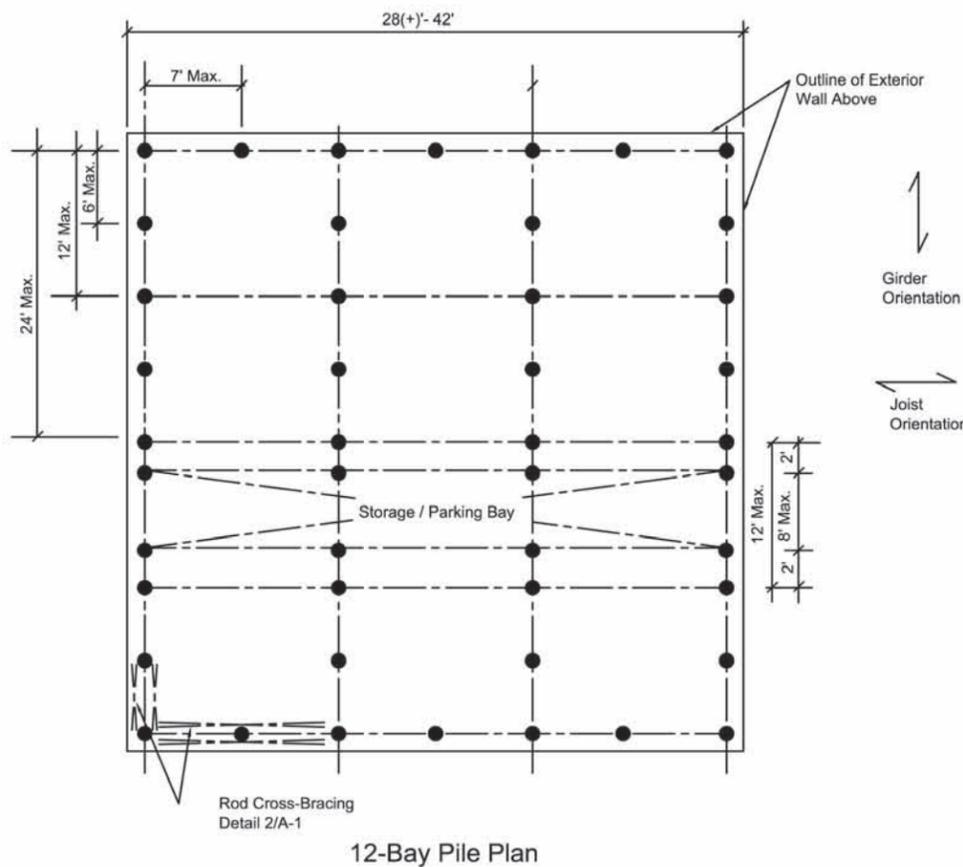
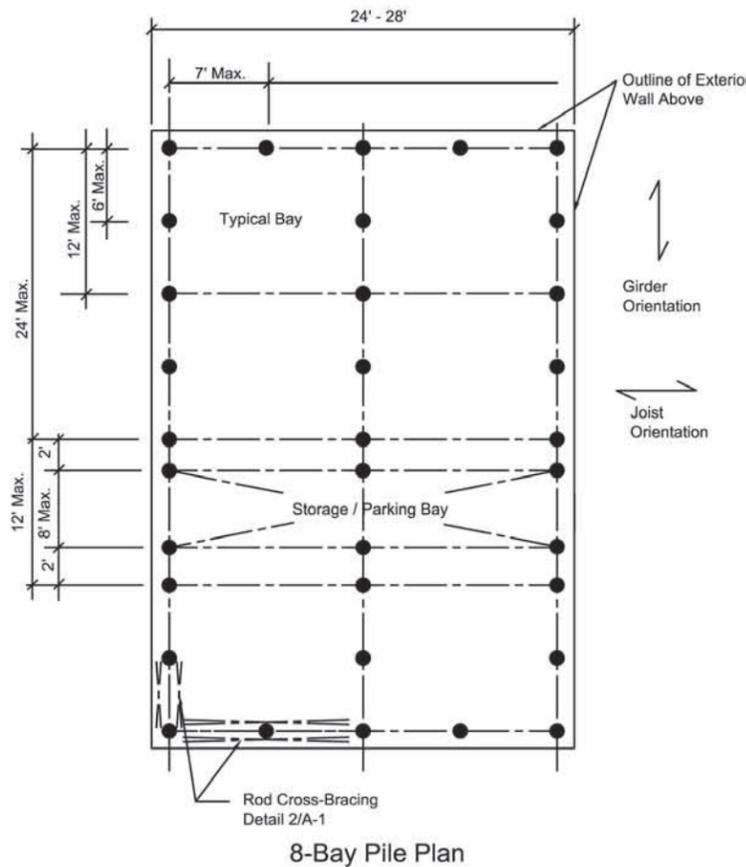
Case A Open Foundation - Driven Treated Timber Pile
Rod Bracing Detail
 SCALE: NTS



Case A Open Foundation - Driven Treated Timber Pile
Rod Bracing Detail (Alternate)
 SCALE: NTS

Case-A Open Foundation Driven Treated Timber Pile	
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1 Case A Open Foundation - Driven Treated Timber Pile
 A-2 Pile Plan - 1
 SCALE: NTS

Braced Timber Pile Foundation				
Pile Schedule - One Story Structures				
"H"	Wind Speed			
	150 mph	140 mph	130 mph	120 mph
< 6 ft	Pile Plan 1	Pile Plan 1	Pile Plan 1	Pile Plan 1
8 ft	Pile Plan 1	Pile Plan 1	Pile Plan 1	Pile Plan 1
10 ft	Pile Plan 1	Pile Plan 1	Pile Plan 1	Pile Plan 1

Braced Timber Pile Foundation				
Pile Schedule - Two Story Structures				
"H"	Wind Speed			
	150 mph	140 mph	130 mph	120 mph
< 6 ft	Pile Plan 1	Pile Plan 1	Pile Plan 1	Pile Plan 1
8 ft	Pile Plan 1	Pile Plan 1	Pile Plan 1	Pile Plan 1
10 ft	Pile Plan 2	Pile Plan 2	Pile Plan 2	Pile Plan 2

Note:
 1) Pile Bracing shall not be installed in areas where pile diameter is less than 8 inches
 2) See Drawing A-3 for bracing schedule.

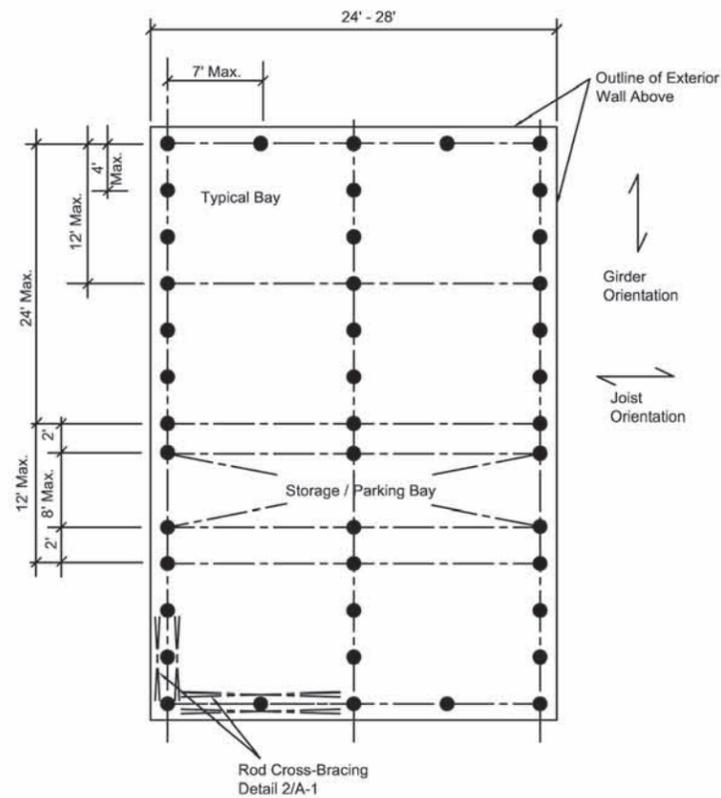
2 Case A - Table 1 Treated Timber Pile
 A-2 Pile Plan Schedule

Case-A Open Foundation
 Driven Treated Timber Pile

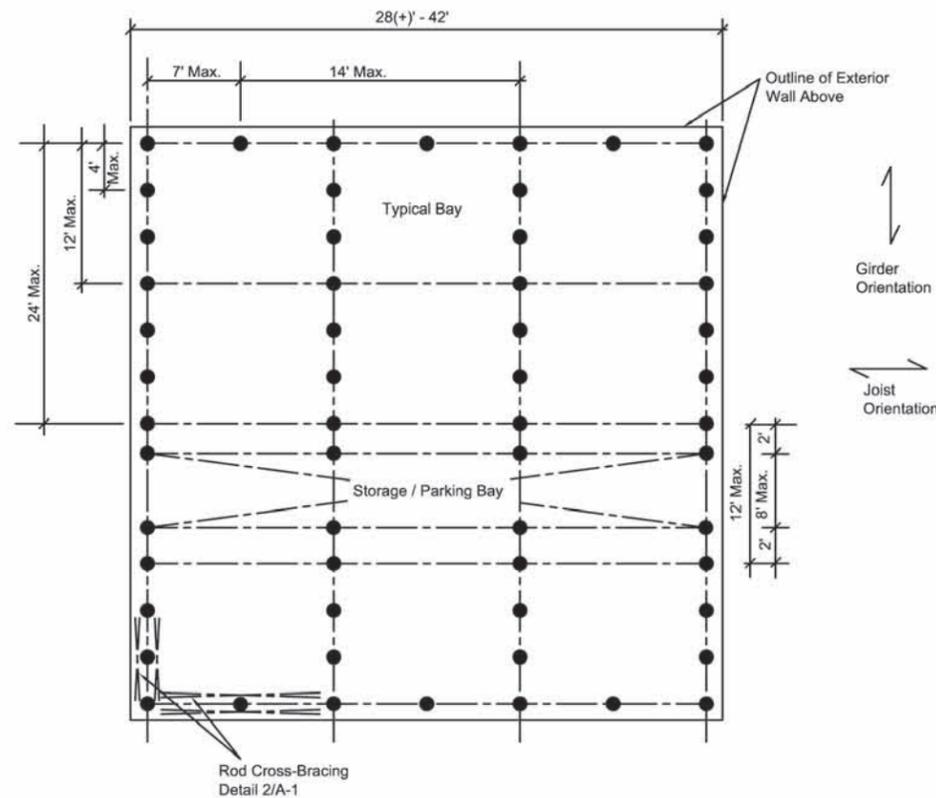
DRAWING NO.: A-2	SHEET 9 of 31
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8-Bay Pile Plan



12-Bay Pile Plan

Braced Timber Pile Foundation				
Bracing Schedule - One Story Structures				
"H"	Wind Speed			
	150 mph	140 mph	130 mph	120 mph
< 6 ft *	12	11	10	10
8 ft	14	12	12	11
10 ft	16	14	14	13

Braced Timber Pile Foundation				
Bracing Schedule - Two Story Structures				
"H"	Wind Speed			
	150 mph	140 mph	130 mph	120 mph
< 6 ft *	18	17	16	15
8 ft	20	19	18	17
10 ft	25	24	23	22

1 Case A Open Foundation - Driven Treated Timber Pile
A-3 Pile Plan - 2
 SCALE: NTS

2 Case A - Table 1 Driven Treated Timber Pile
A-3 Pile Bracing Schedule

Bracing Notes:

- 1) Bracing quantities shown in Table 1 are for "pairs" of 1 inch diameter braces required for each 24 feet of home. Each brace pair shall be installed to form an "X" as shown on Detail 1/A-1 and connected to the pilings with 1 inch through bolts.
- 2) Bracing quantities shown in Table 1 shall be installed in both directions (across width and length of home). All corner piles and piles adjacent to framed openings in the first floor shall be braced. Bracing in other areas shall be uniformly distributed. Bracing in only one direction can be placed in other areas of the home to create storage/parking areas provided the total number of braces specified is installed.
- 3) Bracing shall be scaled for homes with other dimensions by the factor $(N/24) \times L$ where N is the number of braces shown in Table 1 and L is the dimension of the home perpendicular to the braces. For example: a 32' by 24' wide one story home located in a 130 mph wind speed zone and elevated 8' requires 20 braces perpendicular to the 32' dimension $((32'/24') \times 12 \text{ braces})$ and 12 braces perpendicular to the 24' dimension.
- 4) Rod shall be installed at a maximum angle of 45 degrees to the horizontal and shall be connected to the top of the pile within 12" of the bottom girder and within 12" of exterior grade.
- 5) Each rod in the brace pairs shall be connected to a single bolt in the piling to create a double shear connection.
- 6) Up to two braces can be connected to a single pile (in both directions). Brace connection points shall be offset vertically 8" (min) to 12" (max).
- 7) Provide a tensioning turnbuckle for each rod brace.
- 8) Two rods and turnbuckles in a brace pair may be substituted with a single rod, turnbuckle and two "U" brackets. U brackets must have an inside diameter of no more than 1 inch greater than pile diameter at the brace point, must be capable of resisting a 7,500# working load without yielding and must transfer loads to the piling without creating torsion forces.
- 9) Pile Bracing shall not be installed in areas where pile diameter is less than 8 inches
- 10) * No bracing is required for H < 4 ft.

**Case-A Open Foundation
 Driven Treated Timber Pile**

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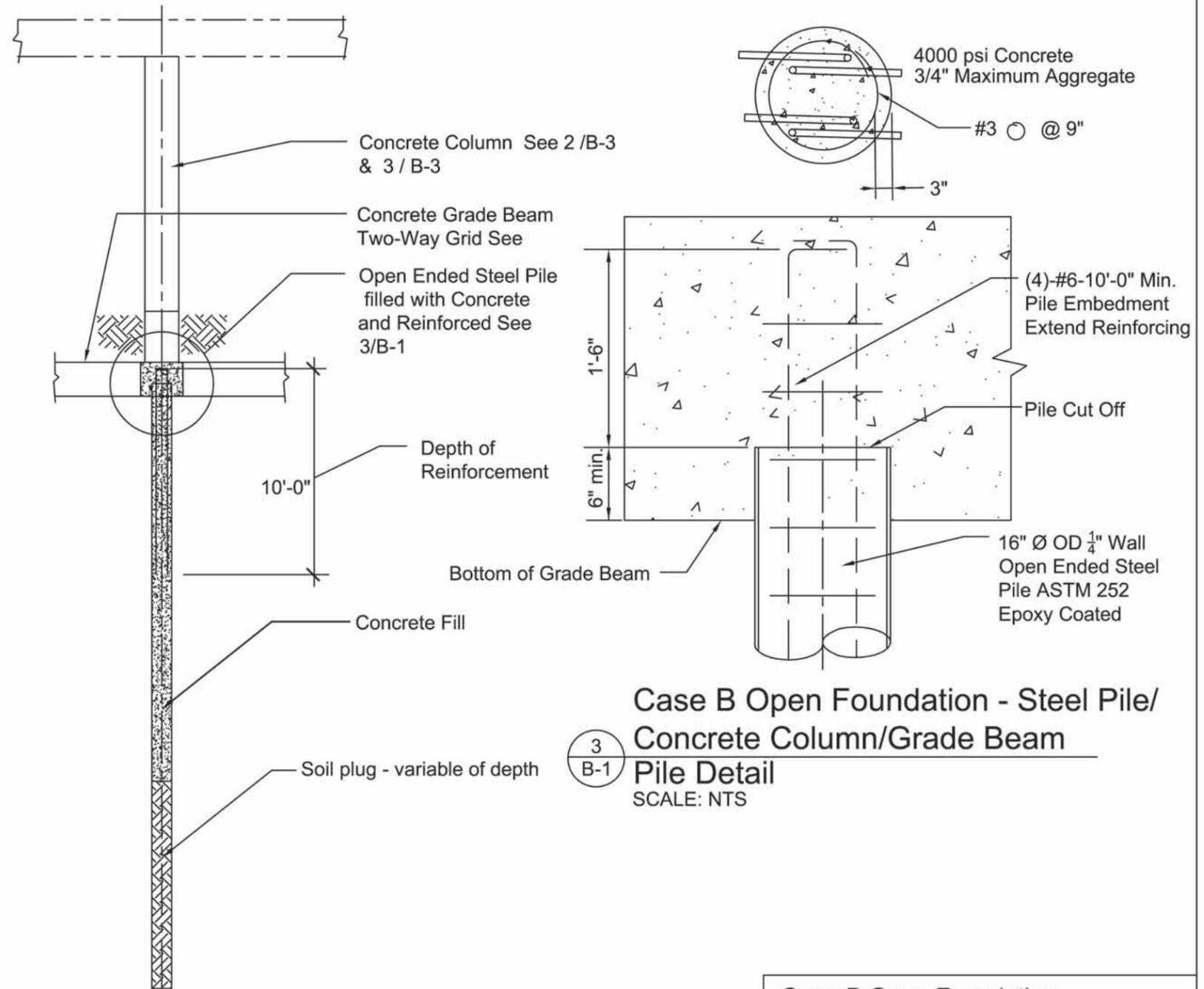
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Square Column Size & Reinforcement Schedule								
One Story								
"H"	150 mph		140 mph		130 mph		120 mph	
	Size (sq)	Reinforcing						
8 ft	16"	A	16"	A	16"	A	16"	A
10 ft	16"	C	16"	C	16"	B	16"	B
12 ft	18"	D	18"	D	16"	D	16"	D
15 ft	20"	A	20"	A	18"	D	18"	C

Square Column Size & Reinforcement Schedule								
Two Story								
"H"	150 mph		140 mph		130 mph		120 mph	
	Size (sq)	Reinforcing						
8 ft	16"	B	16"	B	16"	B	16"	A
10 ft	16"	D	16"	C	16"	C	16"	B
12 ft	18"	D	18"	C	18"	C	18"	B
15 ft	20"	A	20"	A	18"	D	18"	D

Notes:

- See Table 2, 3/B3 sheet for Column size and reinforcement details



**Case B Open Foundation - Steel Pile/
Concrete Column/Grade Beam**

2
B-1
Pile Detail
SCALE: NTS

Piles are assumed to have the following capacities:
 Compression 20,000 lbs.
 Tension 13,400 lbs.
 Lateral 8,000 lbs.

**Case B Open Foundation - Steel Pile/
Concrete Column/Grade Beam**

3
B-1
Pile Detail
SCALE: NTS

Case-B Open Foundation
Steel Pipe Pile with Concrete Column
and Grade Beam

DRAWING NO.: B-1 SHEET 11 OF 31

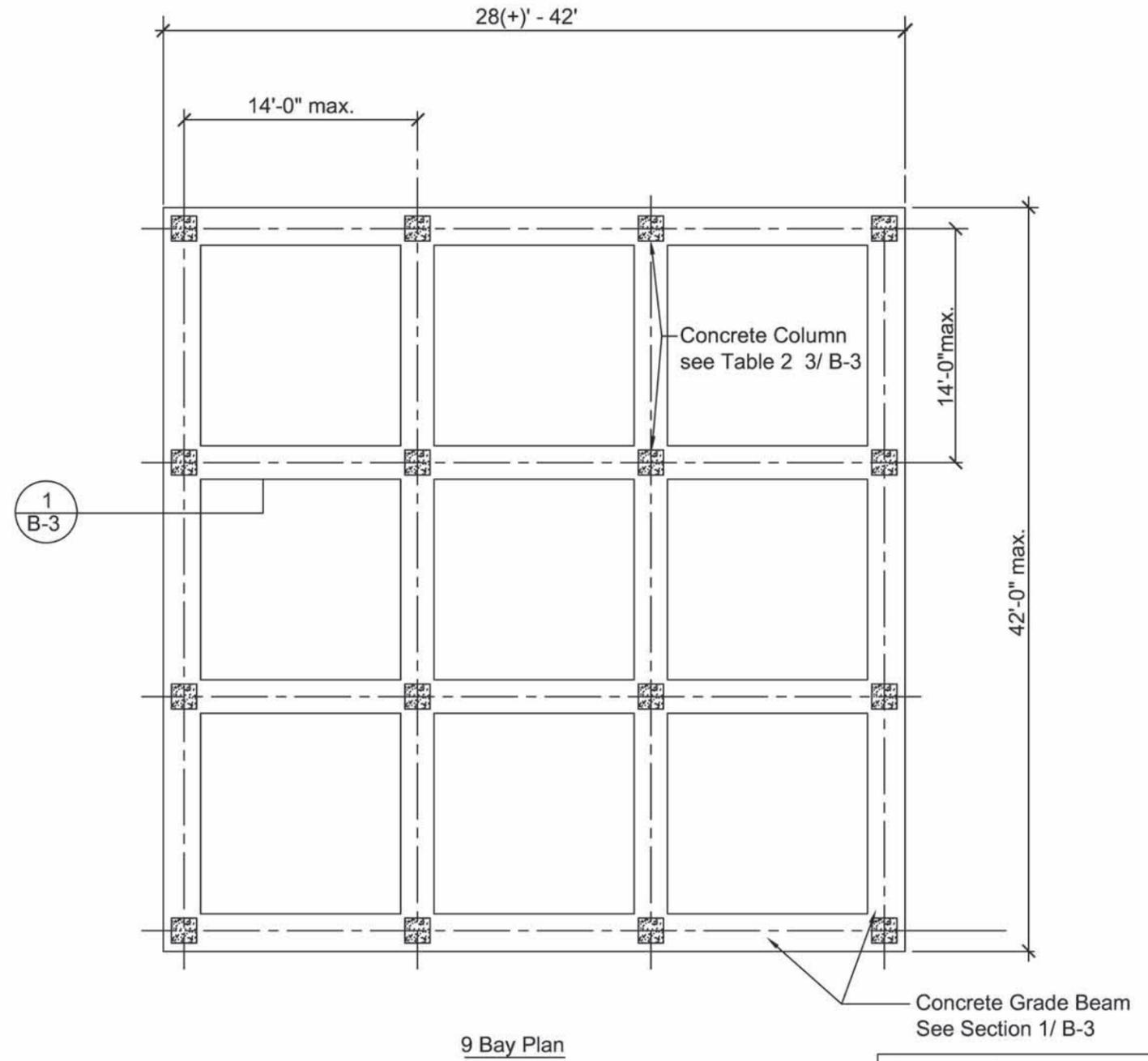
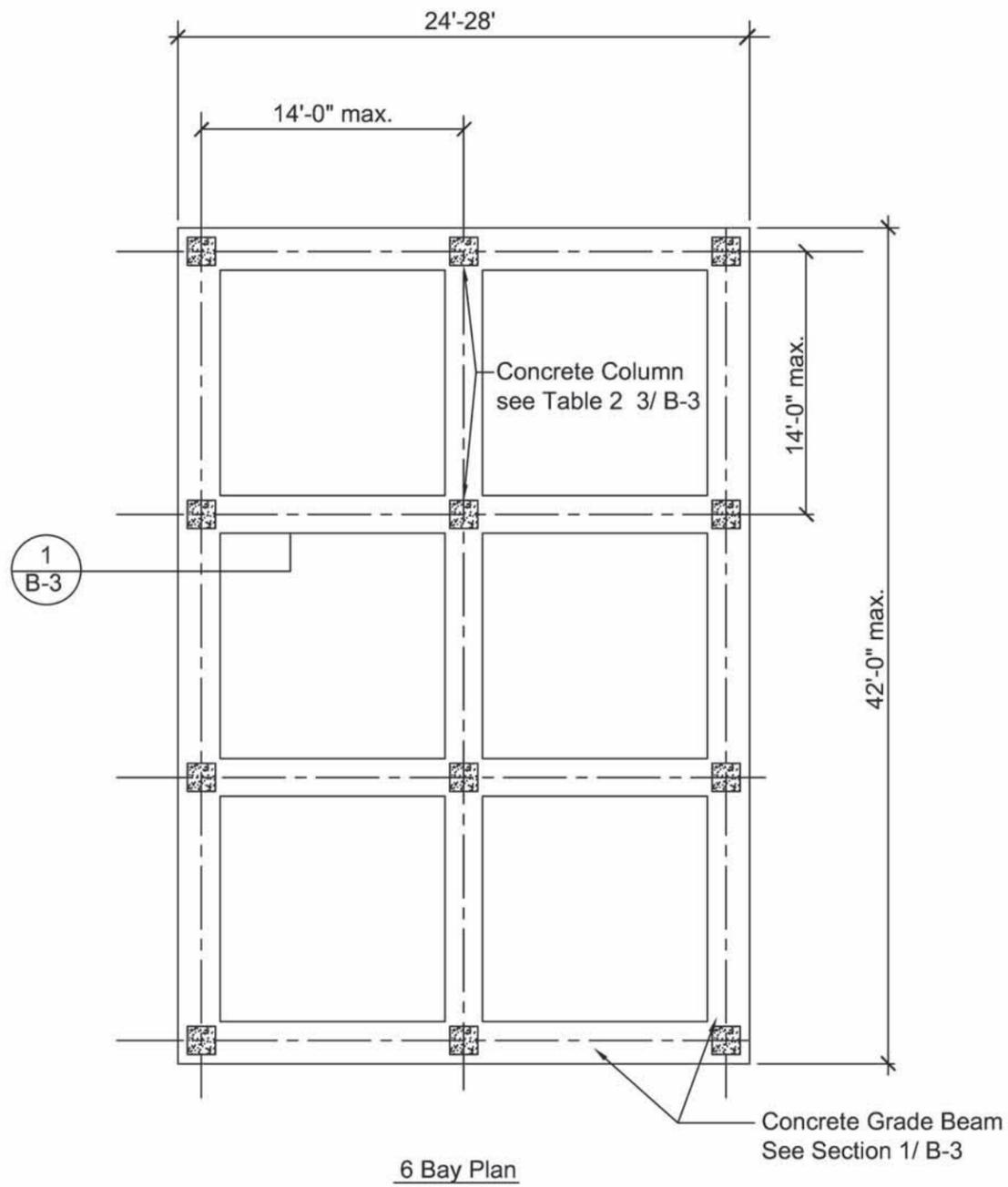
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1
B-1
Case B Open Foundation - Steel Pile/Concrete Column/Grade Beam
Table 1 Column Schedule



Case-B Open Foundation
Steel Pipe Pile with Concrete Column
and Grade Beam

DRAWING NO.: B-2 SHEET 12 OF 31

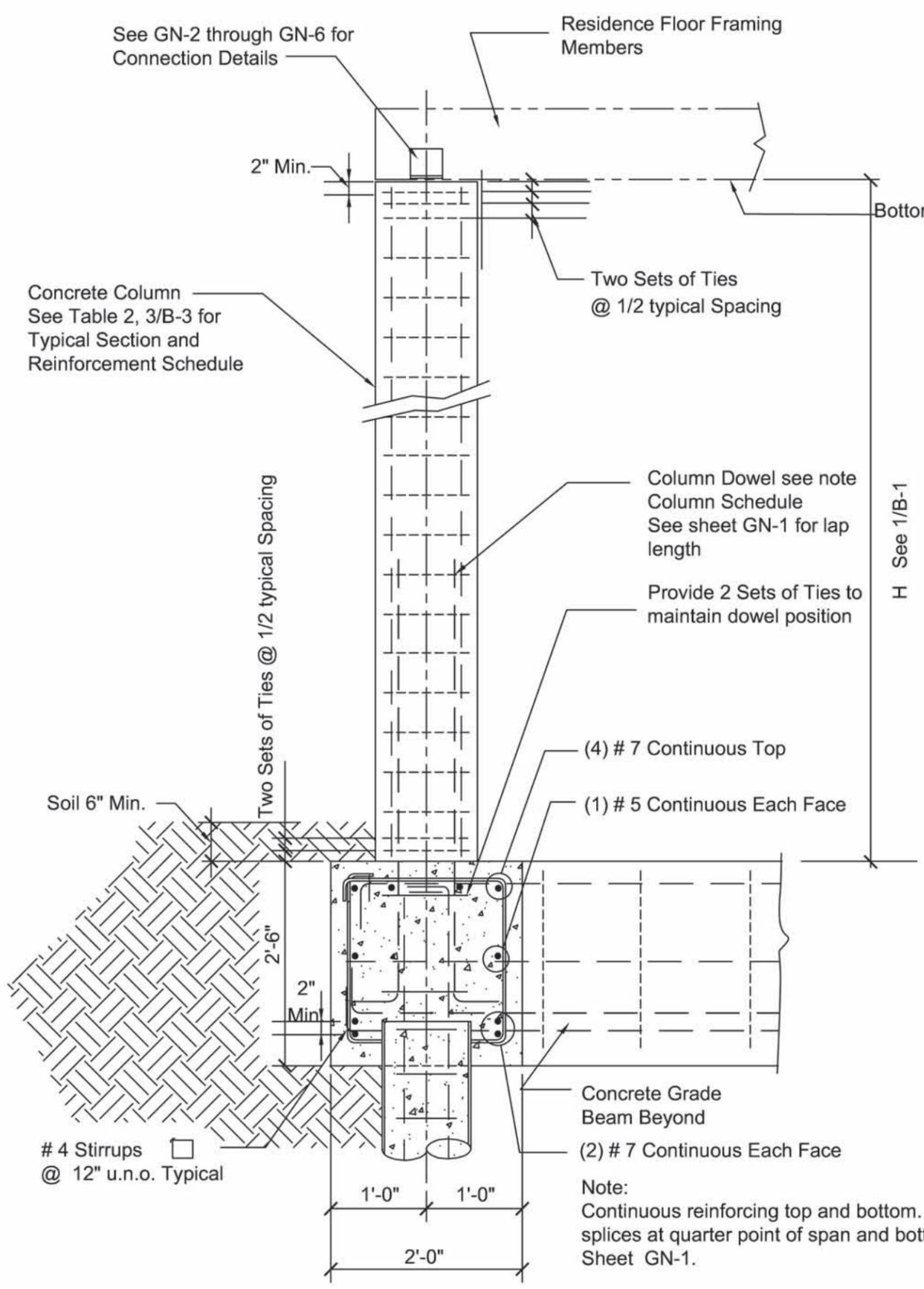
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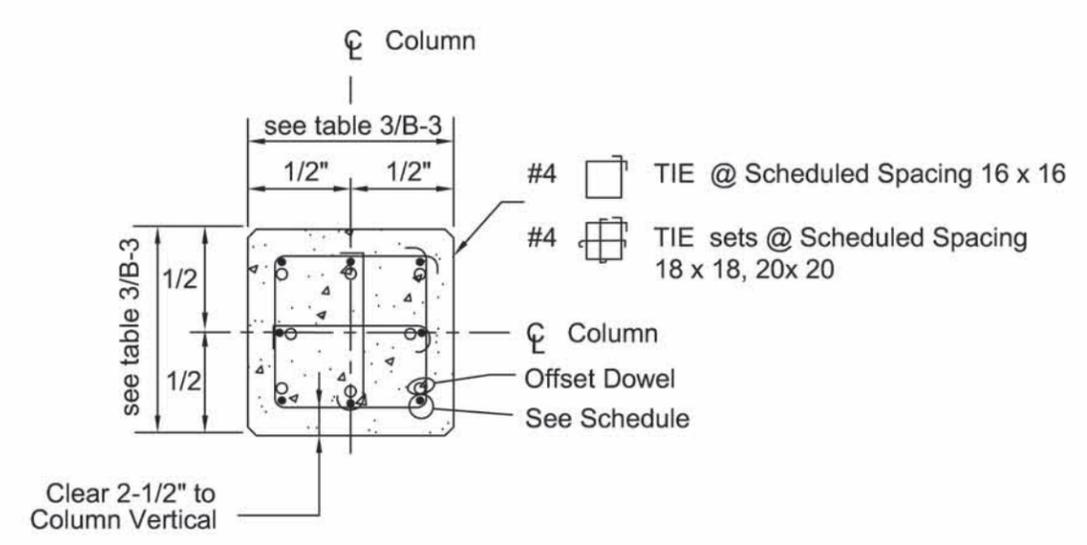
1
B-2 Open Foundation - Column & Grade Beam
SCALE: NTS



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1
B-3 Case B Open Foundation - Steel Pile/Concrete Column/Grade Beam
Column & Grade Beam Section
SCALE: NTS



2
B-3 Case B Open Foundation - Steel Pile/Concrete Column/Grade Beam
Typical Column Section
SCALE: NTS

Size	16" x 16"	18" x 18"	20" x 20"
A	Verts (4) # 9 #4 Ties @ 16"	X	Verts (8) # 10 #4 Ties @ 18"
B	Verts (8) # 7 #4 Ties @ 14"	Verts (8) # 8 #4 Ties @ 16"	X
C	Verts (8) # 8 #4 Ties @ 16"	Verts (8) # 9 #4 Ties @ 18"	X
D	Verts (8) # 9 #4 Ties @ 16"	Verts (8) # 10 #4 Ties @ 18"	X

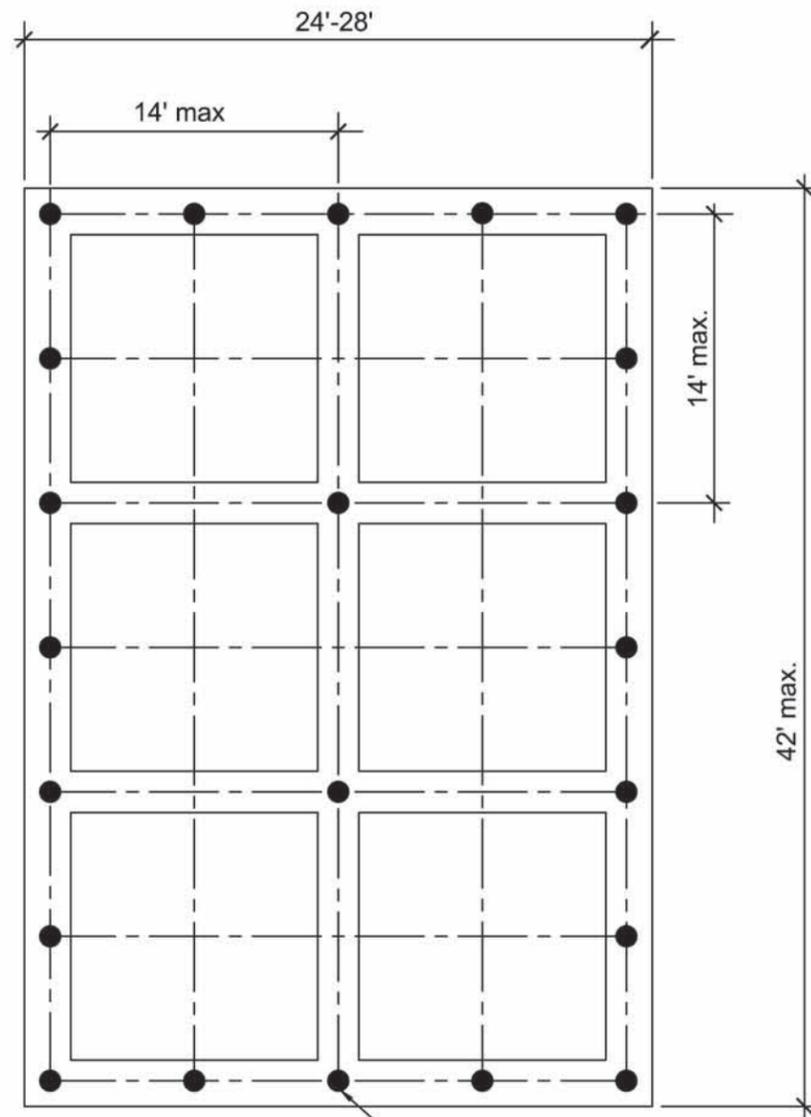
Notes:
1) Provide same number and size of dowels as main reinforcing. See splice table on Sheet GN-1.

3
B-3 Case B Open Foundation - Steel Pile/
Concrete Column/Grade Beam
Table 2 - Column Reinforcement
Schedule

Note:
Continuous reinforcing top and bottom. Use longest bar lengths practical. Place top bar splices at quarter point of span and bottom bar splices at columns. See splice table on Sheet GN-1.

Case-B Open Foundation Steel Pipe Pile with Concrete Column and Grade Beam	
DRAWING NO.: B-3	SHEET 13 OF 31
DATE: August 8, 2006	
REVISED:	REV. 9





6 Bay Pile Plan

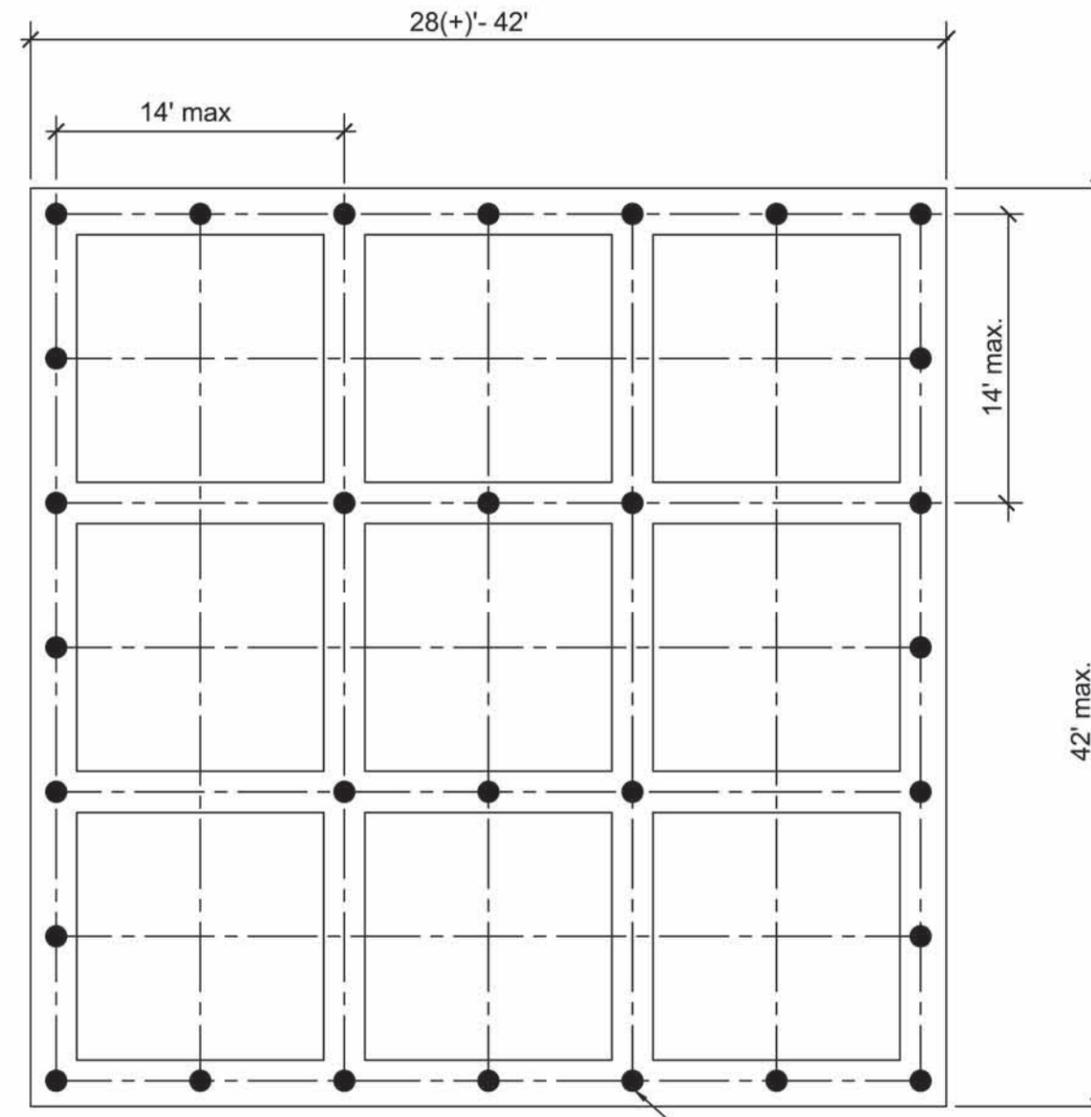
OESP Pile See details
2/B-1 and 3/B-1

One Story and Two Story Residences Height H up to 12' - for winds up to 150 mph

**Case B Open Foundation - Steel Pile/
Concrete Column/Grade Beam**

1
B-4

22 Piles
SCALE: NTS



9 Bay Pile Plan

OESP Pile See details
2/B-1 and 3/B-1

One Story and Two Story Residences Height H up to 15' - for winds up to 150 mph

**Case B Open Foundation - Steel Pile/
Concrete Column/Grade Beam**

2
B-4

30 Piles
SCALE: NTS

Case-B Open Foundation
Steel Pipe Pile with Concrete Column
and Grade Beam

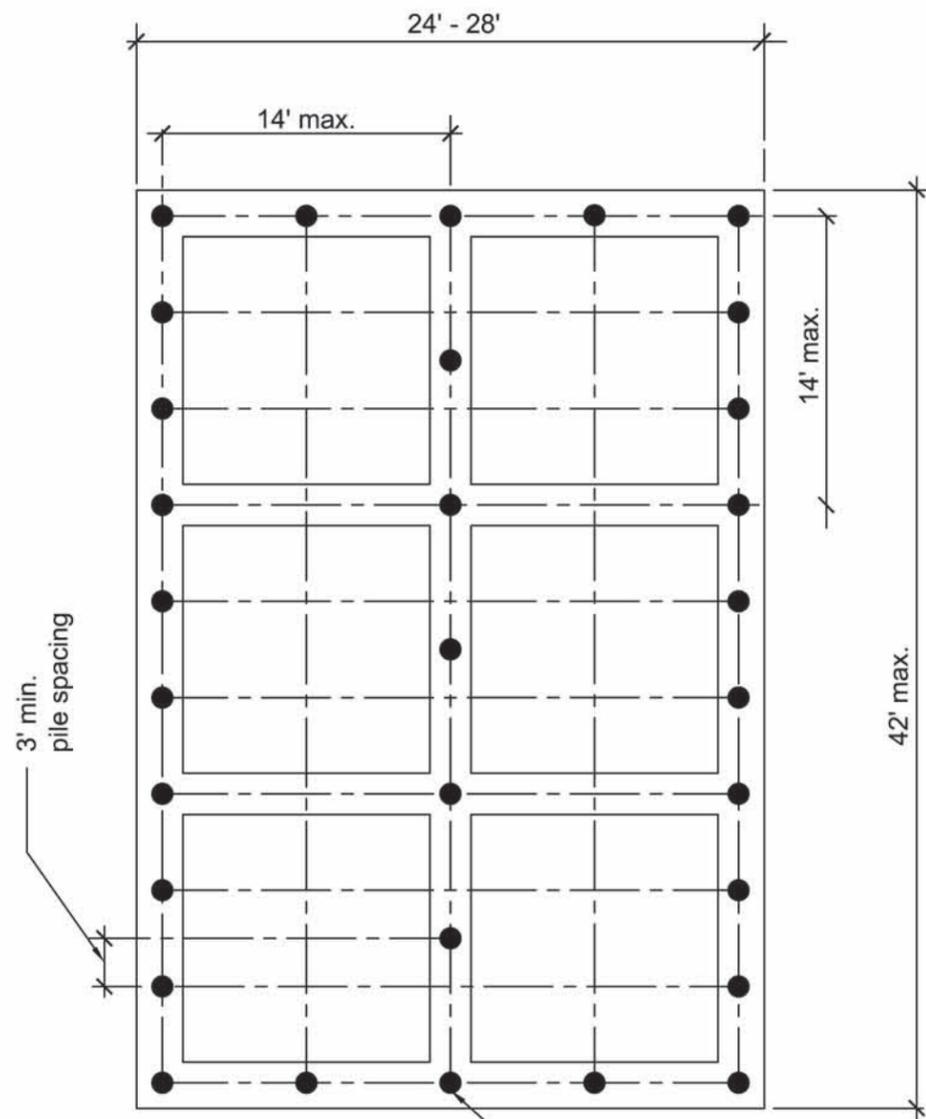
DRAWING NO.: B-4 SHEET 14 OF 31

DATE: August 8, 2006

REVISED: REV. 9



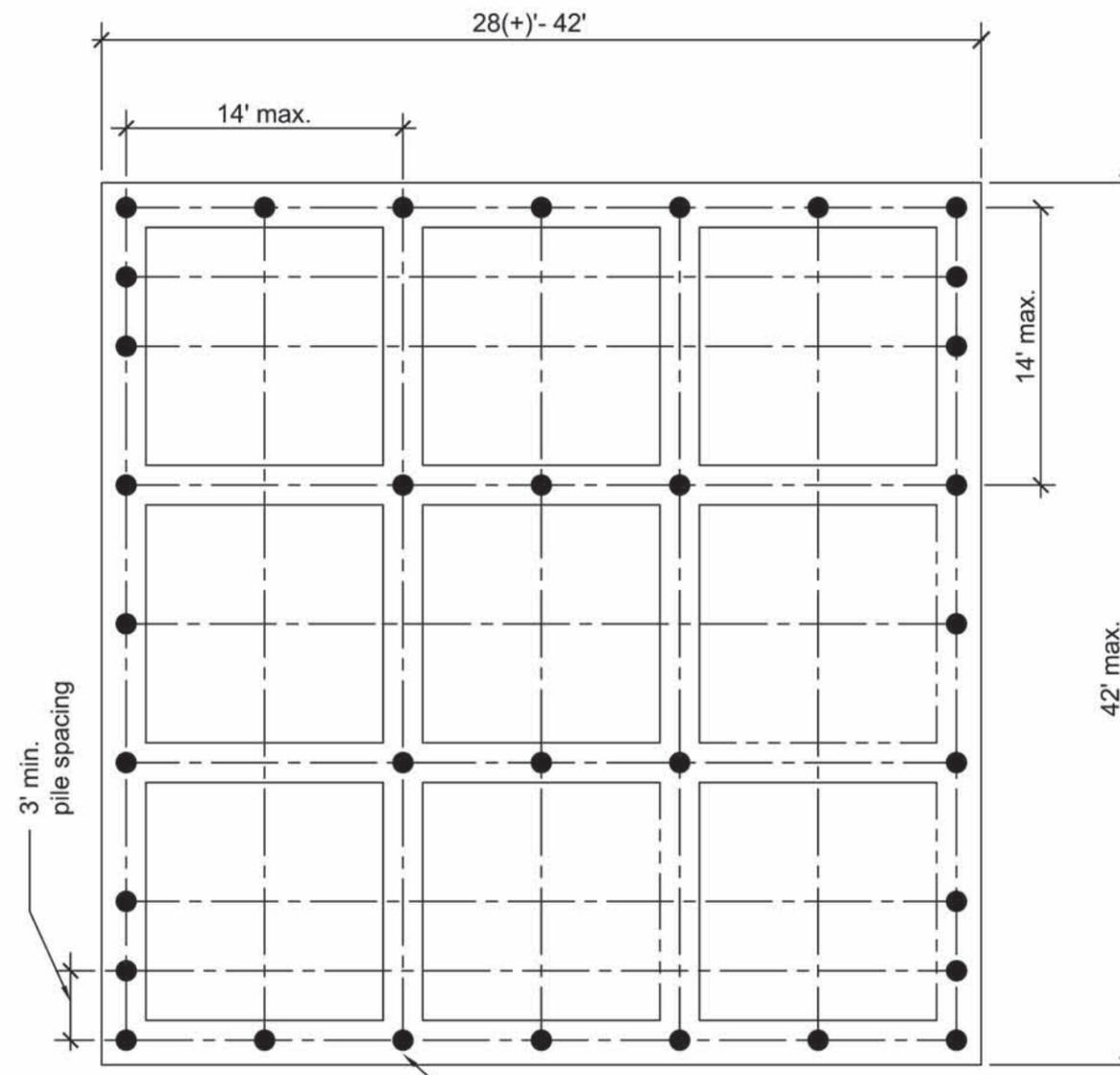
FEMA



OESP Pile See details
2/B-1 and 3/B-1

6 Bay Pile Plan

One Story and Two Story Residences Height H up to 12' - for winds up to 150 mph



OESP Pile See details
2/B-1 and 3/B-1

9 Bay Pile Plan

One Story and Two Story Residences Height H up to 15' - for winds up to 150 mph

1
B-5

**Case B Open Foundation - Steel Pile/
Concrete Column/Grade Beam**

31 PILES
SCALE: NTS

2
B-5

**Case B Open Foundation - Steel Pile/
Concrete Column/Grade Beam**

36 PILES
SCALE: NTS

Case-B Open Foundation
Steel Pipe Pile with Concrete Column
and Grade Beam

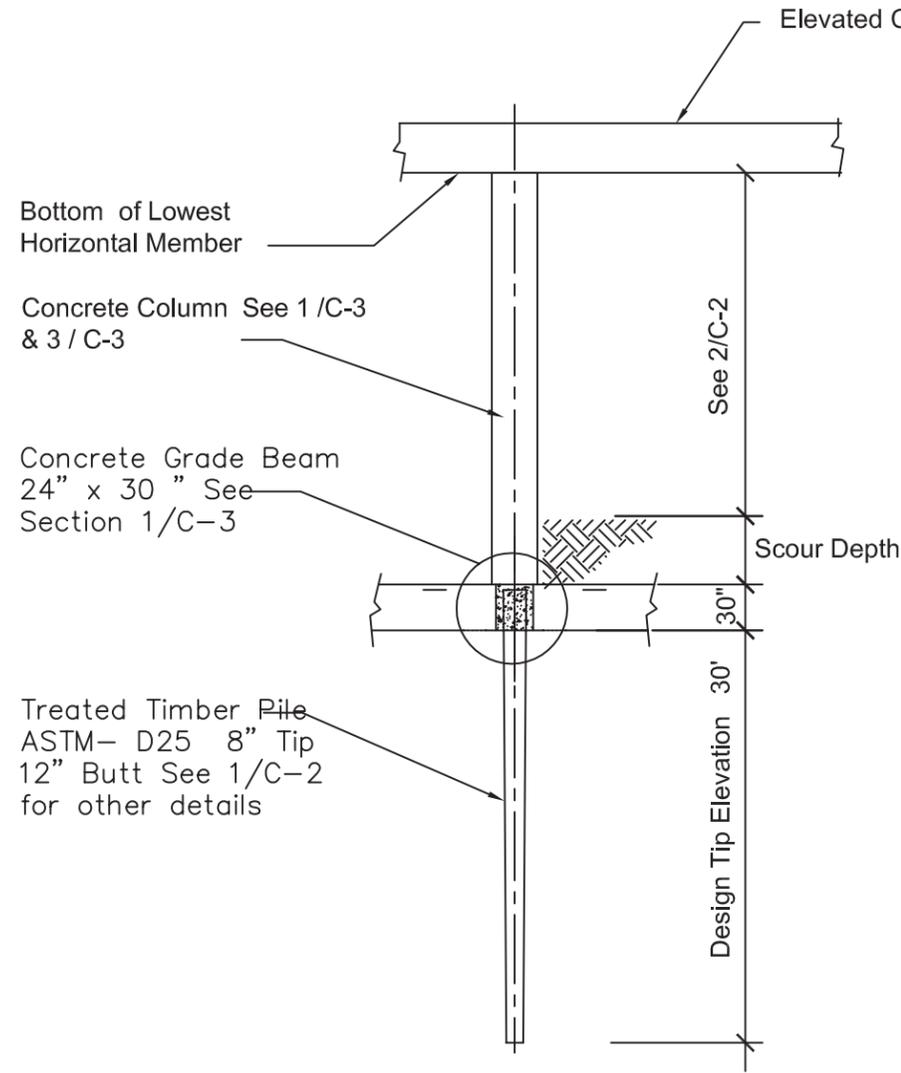
DRAWING NO.: B-5 SHEET 15 OF 31

DATE: August 8, 2006

REVISED: REV. 9

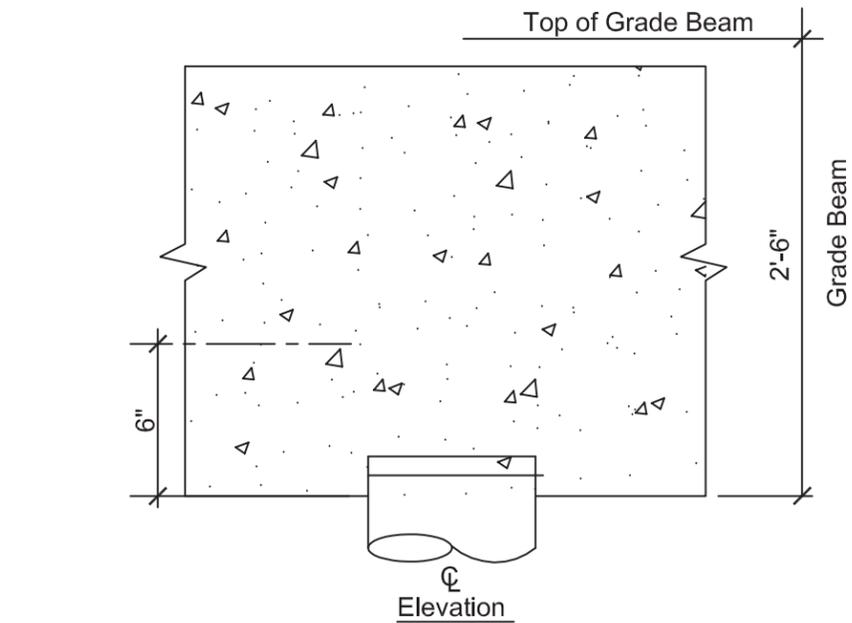
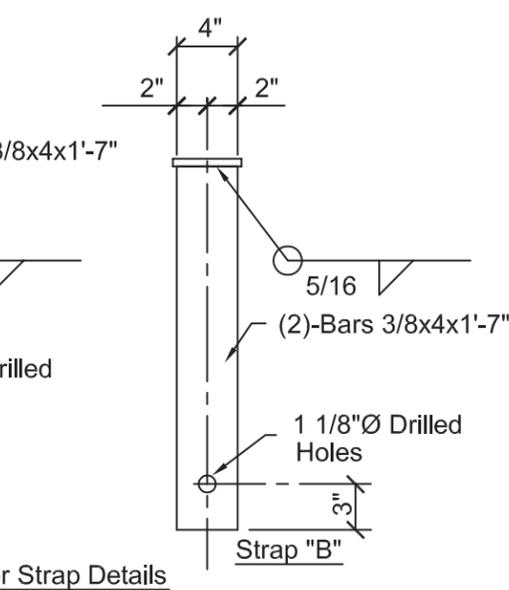
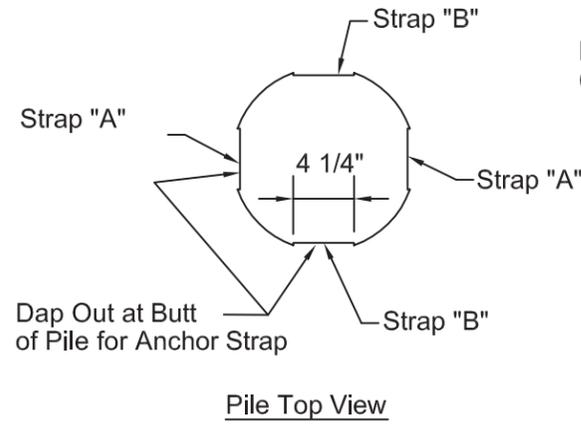


FEMA

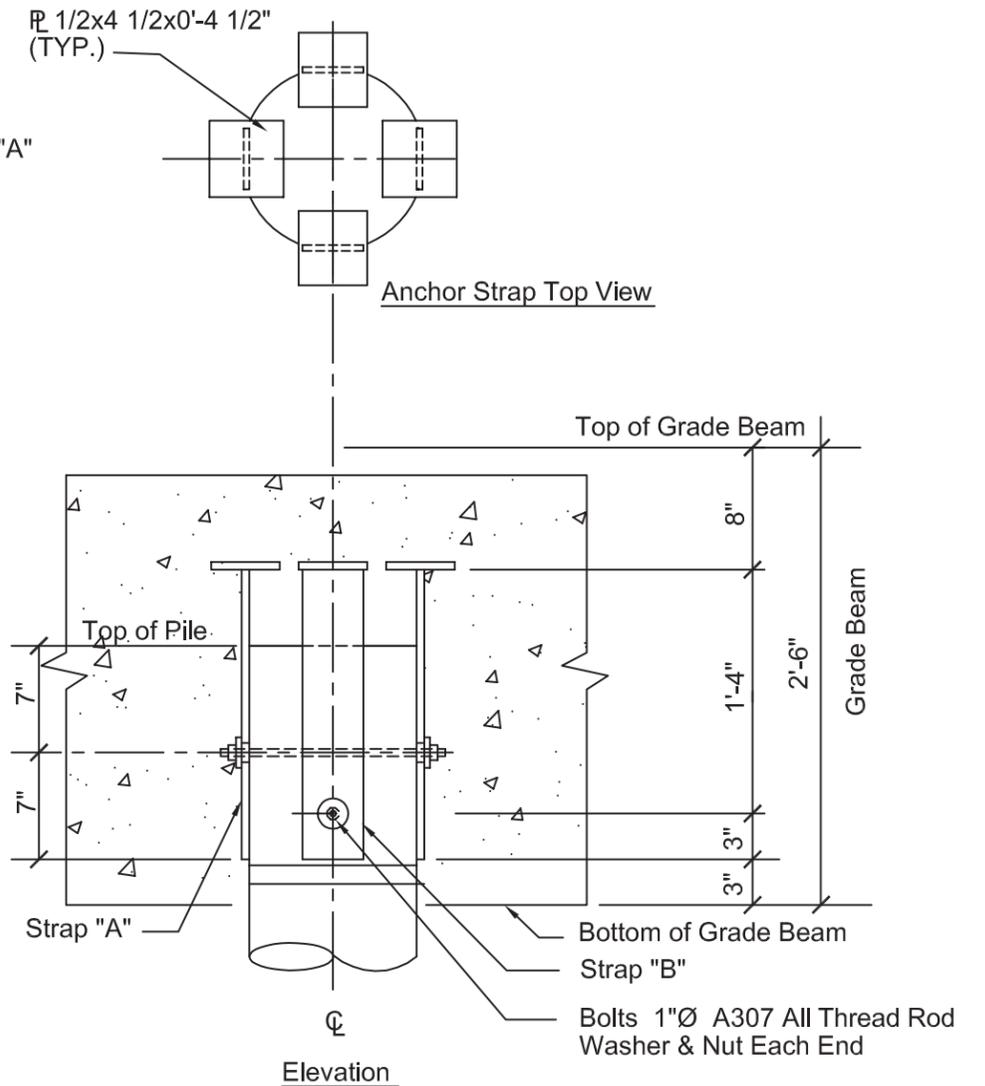


Case C Open Foundation - Concrete Column / Driven Treated Timber Pile Profile
 SCALE: NTS

Piles are assumed to have the following capacities:
 Compression 14000 pounds
 Tension 9300 pounds
 Lateral 4000 pounds



Pile / Grade Beam Section
Pile Detail
 SCALE: NTS



Pile / Grade Beam Section
Connection Details
 SCALE: NTS

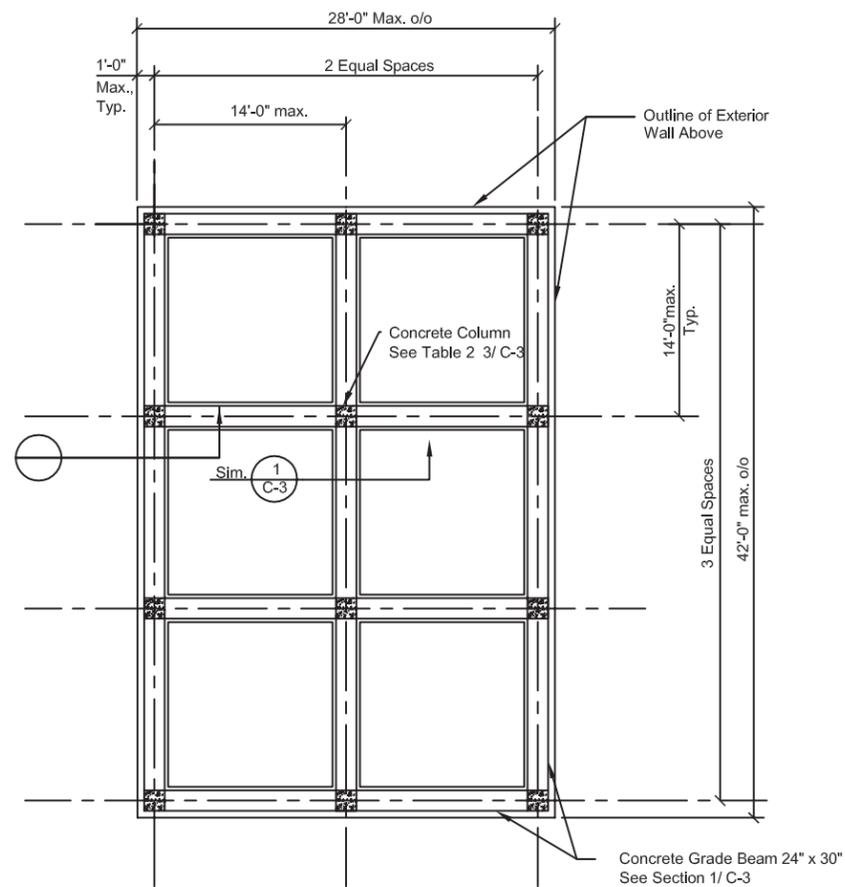
Note: Grade Beam not shown for clarity
 See Plan for Required Locations

Case - C Open Foundation
 Timber Pile with Concrete Column
 and Grade Beam

DRAWING NO.: C-1	SHEET 16 OF 31
DATE: June 16, 2006	
REVISED:	REV. NO.

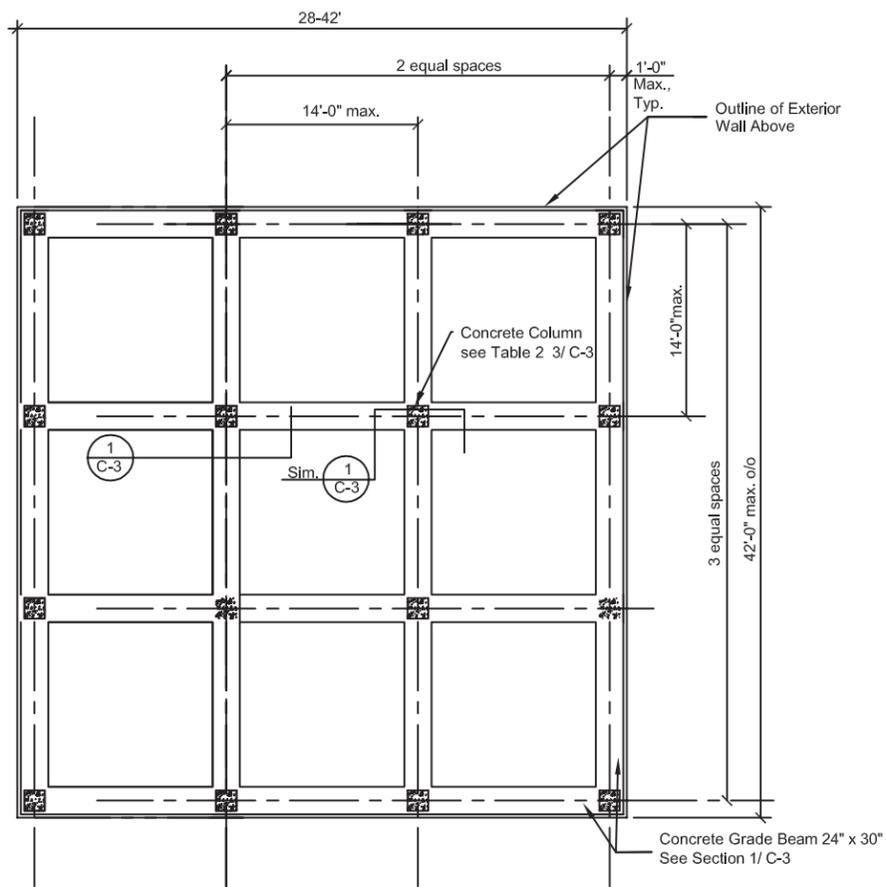


FEMA



6 - Bay Foundation Column and Beam Plan

○ Case C - Open Foundation - Column & Grade Beam Plan - 1
SCALE: NTS



9 - Bay Foundation Column and Beam Plan

○ Case C - Open Foundation - Column & Grade Beam Plan - 2
SCALE: NTS

"H"	150 mph		140 mph		130 mph		120 mph	
	Size (sq)	Reinforcing						
8 ft	16"	A	16"	A	16"	A	16"	A
10 ft	16"	C	16"	C	16"	B	16"	B
12 ft	18"	D	18"	D	16"	D	16"	D
15 ft	20"	A	20"	A	18"	D	18"	C

"H"	150 mph		140 mph		130 mph		120 mph	
	Size (sq)	Reinforcing						
8 ft	16"	B	16"	B	16"	B	16"	A
10 ft	16"	D	16"	C	16"	C	16"	B
12 ft	18"	D	18"	C	18"	C	18"	B
15 ft	20"	A	20"	A	18"	D	18"	D

○³ Case B - Table 1 Column Size & Reinforcement Schedule

Notes:

- 1) See Table 2, 3/B3 sheet for Column size and reinforcement details

Case- C Open Foundation Concrete Timber Pile with Concrete Column and Grade Beam

DRAWING NO.: C-2 SHEET 17 OF 31
DATE: June 16, 2006
REVISED: REV. NO.



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See GN-2 for Connection Detail

Concrete Column
See 2, 2/C-3
and 2, 3/C-3 for
Typical Section and Column
Reinforcement Schedule

Bottom of Lowest Horizontal Member

Height "H" See 2/C-2

Column Dowel See Note
Column Schedule and
See Sheet GN-1 for Full
Tension Lap Splice Length

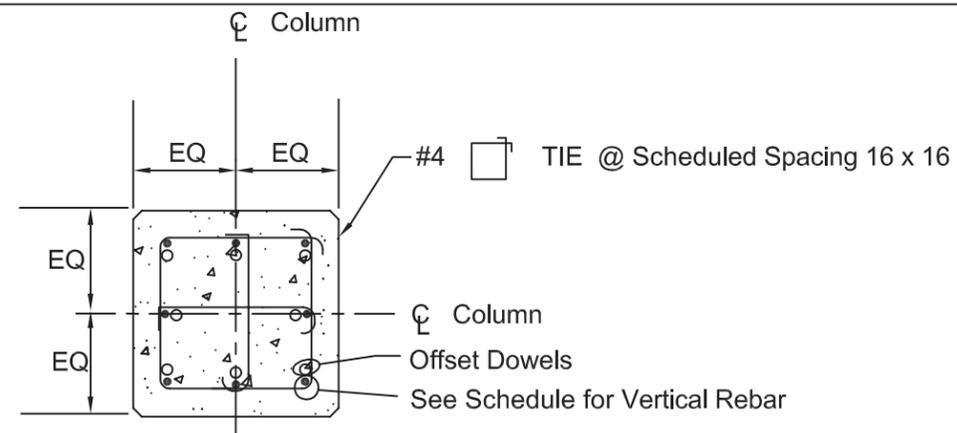
Provide 2 Tie Sets to
maintain dowel position

Depth of
Scour

2" Min.

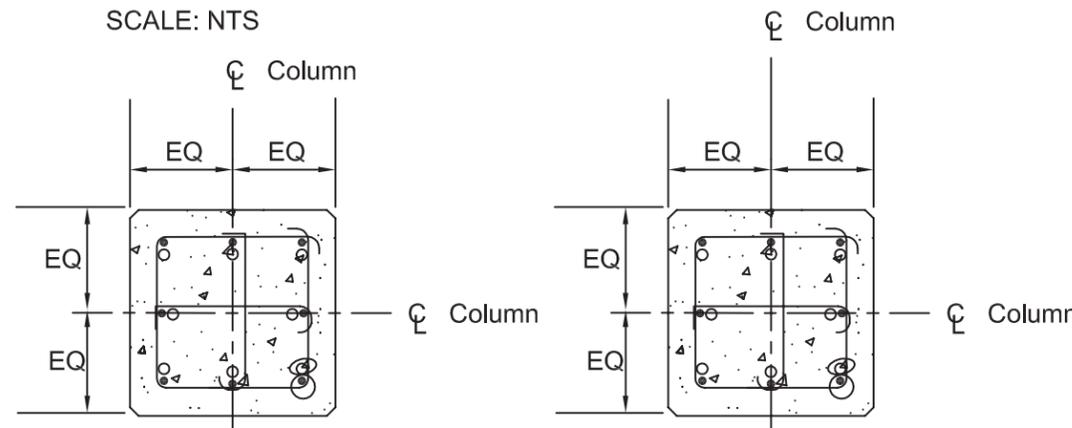
Concrete Grade
Beam

See 2/C-1 for
Tension Connection
See Plans for Locations



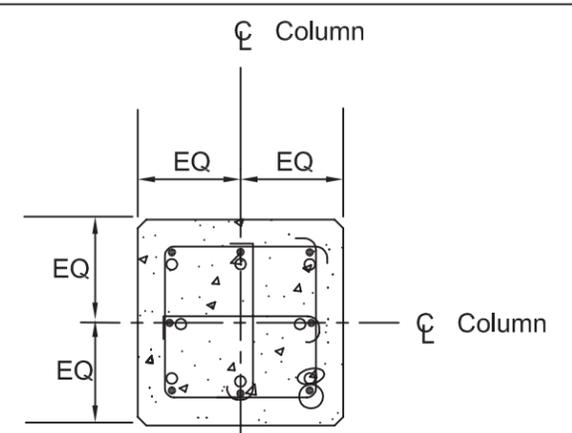
Case C Open Foundation - Concrete Column Sections
Typical Column Section

SCALE: NTS

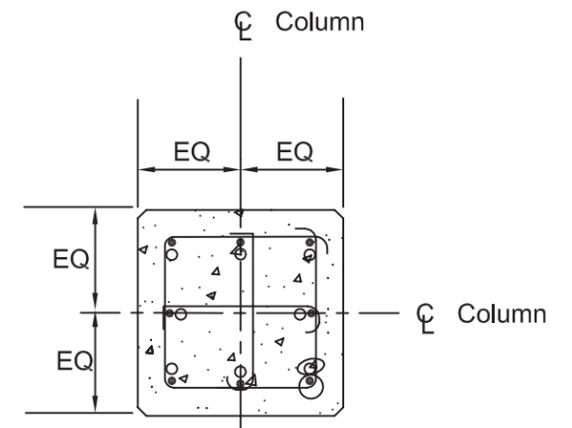


Column Detail : C-2

Column Detail : C-3



Column Detail : C-1



Column Detail : C-4

Size	16" x 16"	18" x 18"	20" x 20"
A	Verts (4) # 9 #4 Ties @ 16"	Verts (8) # 7 #4 Ties @ 14"	Verts (8) # 10 #4 Ties @ 18"
B	Verts (8) # 7 #4 Ties @ 14"	Verts (8) # 8 #4 Ties @ 16"	
C	Verts (8) # 8 #4 Ties @ 16"	Verts (8) # 9 #4 Ties @ 18"	
D	Verts (8) # 9 #4 Ties @ 16"	Verts (8) # 10 #4 Ties @ 18"	

Notes:

1) Provide same number and size of dowels as main reinforcing. See splice table on Sheet GN-1.

Case- C Open Foundation Concrete
Timber Pile with Concrete Column
and Grade Beam

DRAWING NO.: C-3

SHEET 18 OF 31

DATE: June 16, 2006

REVISED:

REV. 1

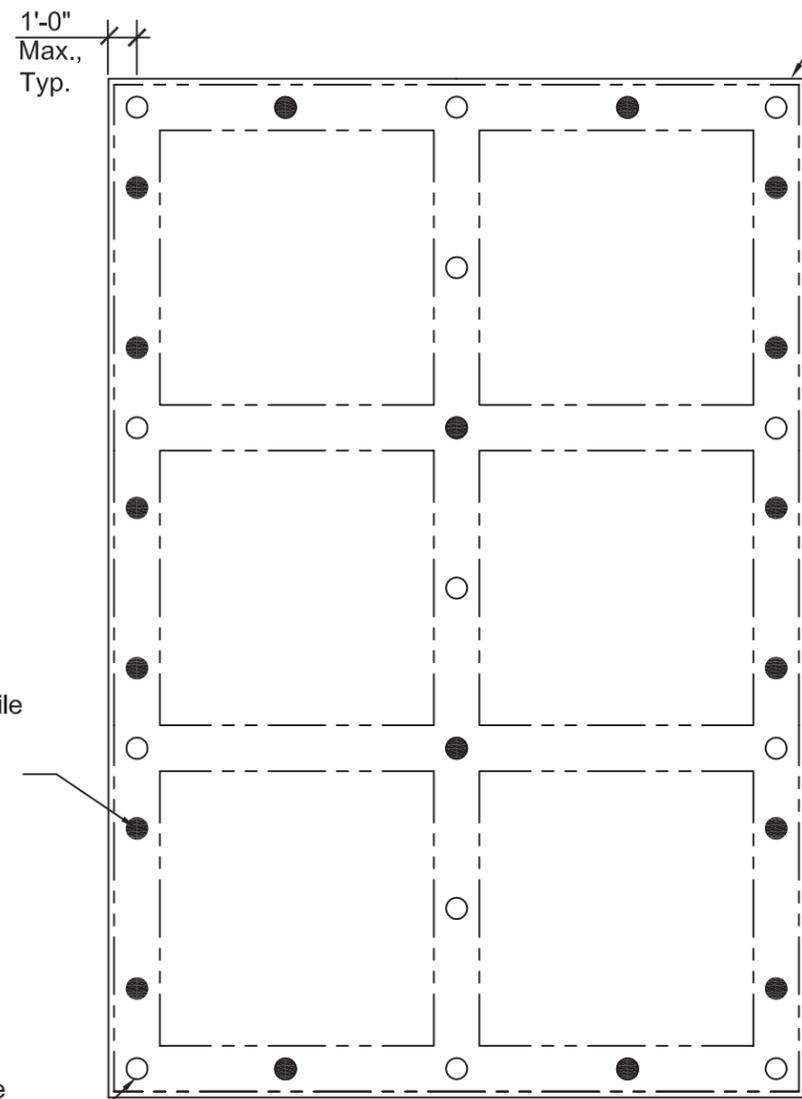


FEMA

Case C Open Foundation - Concrete Column/ Timber Pile Foundation
Typical Exterior Section

SCALE: NTS

Case C Open Foundation - Table 2
Column Reinforcement Schedule



Treated Timber Pile
See 1/C-1 for pile
profile and 2/C-1
for Tension Conn.
Detail 3'-0" min.
pile spacing

Treated Timber Pile
See 3/C-1 for pile
profile and Detail
3'-0" min. pile spacing

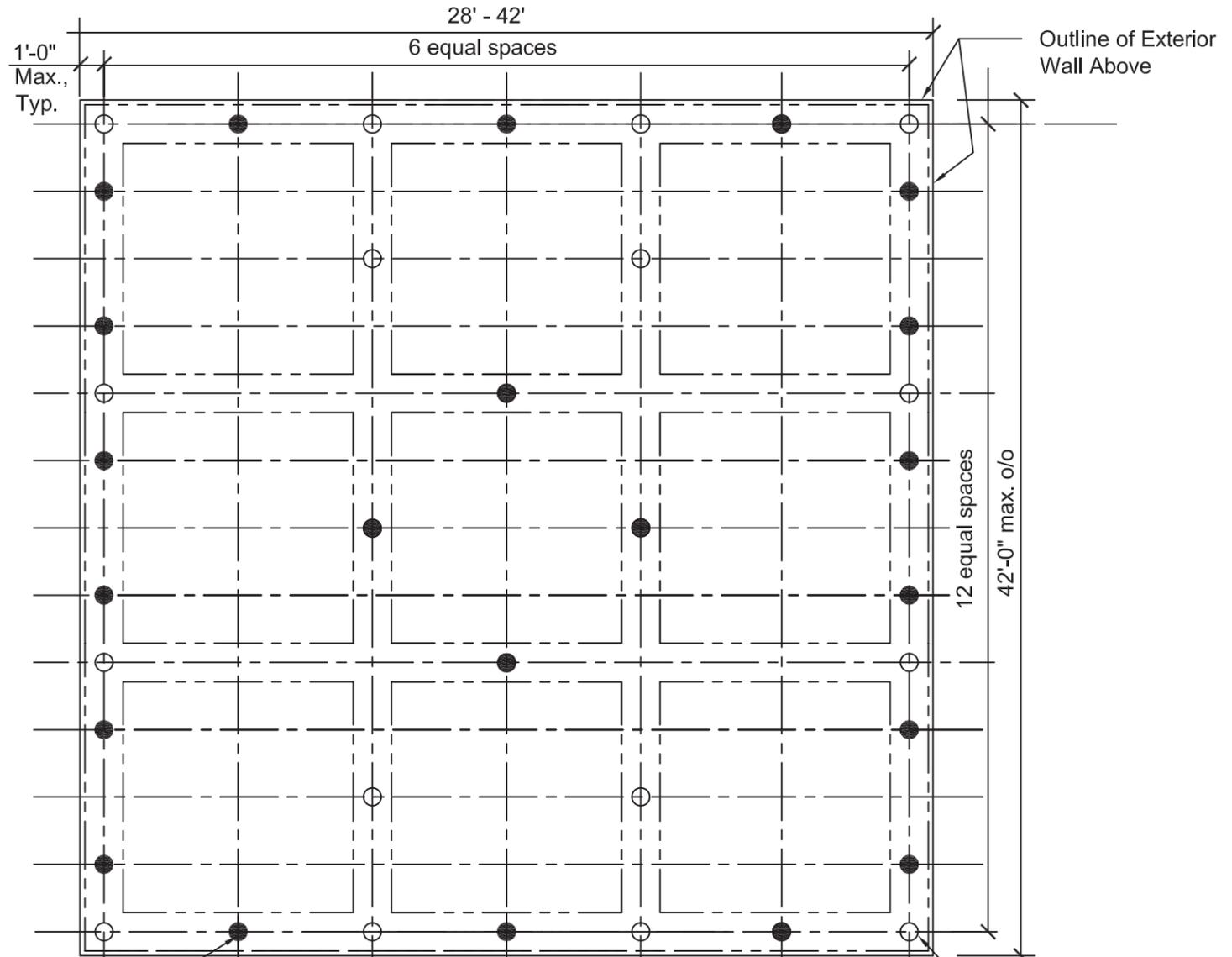
6 - Bay Foundation 31 Pile Plan

LEGEND

- Tension Pile--See 2/C-1
- Non-Tension Pile--See 3/C-1

○ **Open Foundation- Case C Pile Plan - 2**
31 PILES
SCALE: NTS

Outline of Exterior
Wall Above



Treated Timber Pile
See 1/C-1 for pile
profile and 2/C-1
for Tension Conn.
Detail 3'-0" min.
pile spacing

Treated Timber Pile
See 1/C-1 for pile
profile and Detail
3'-0" min. pile spacing

9 Bay Pile Plan

LEGEND

- Tension Pile--See 2/C-1
 - Non-Tension Pile--See 3/C-1
- One and Two Residences Height H up to 10' - for winds up to 140 mph

○ **Open Foundation- Case C Pile Plan - 2**
38 PILES
SCALE: NTS

**Case- C Open Foundation Concrete
Timber Pile with Concrete Column
and Grade Beam**

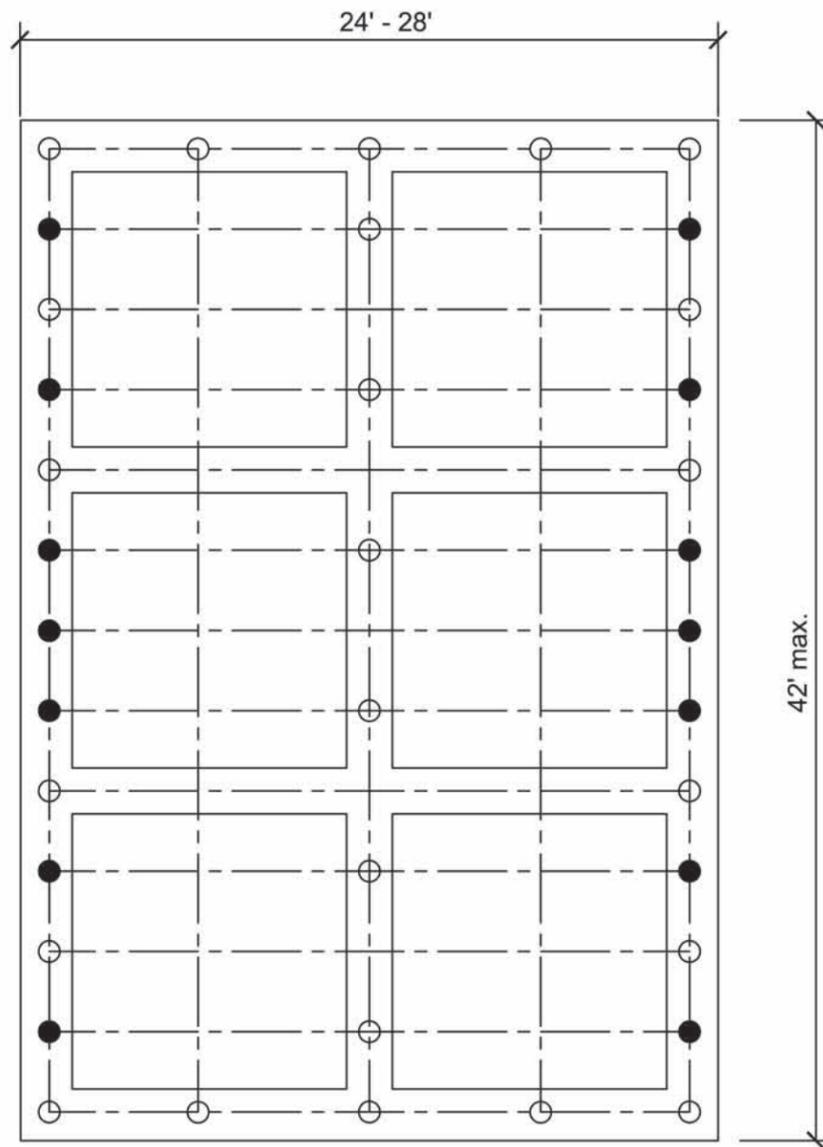
DRAWING NO.: C-4 SHEET 19 OF 31

DATE: June 16, 2006

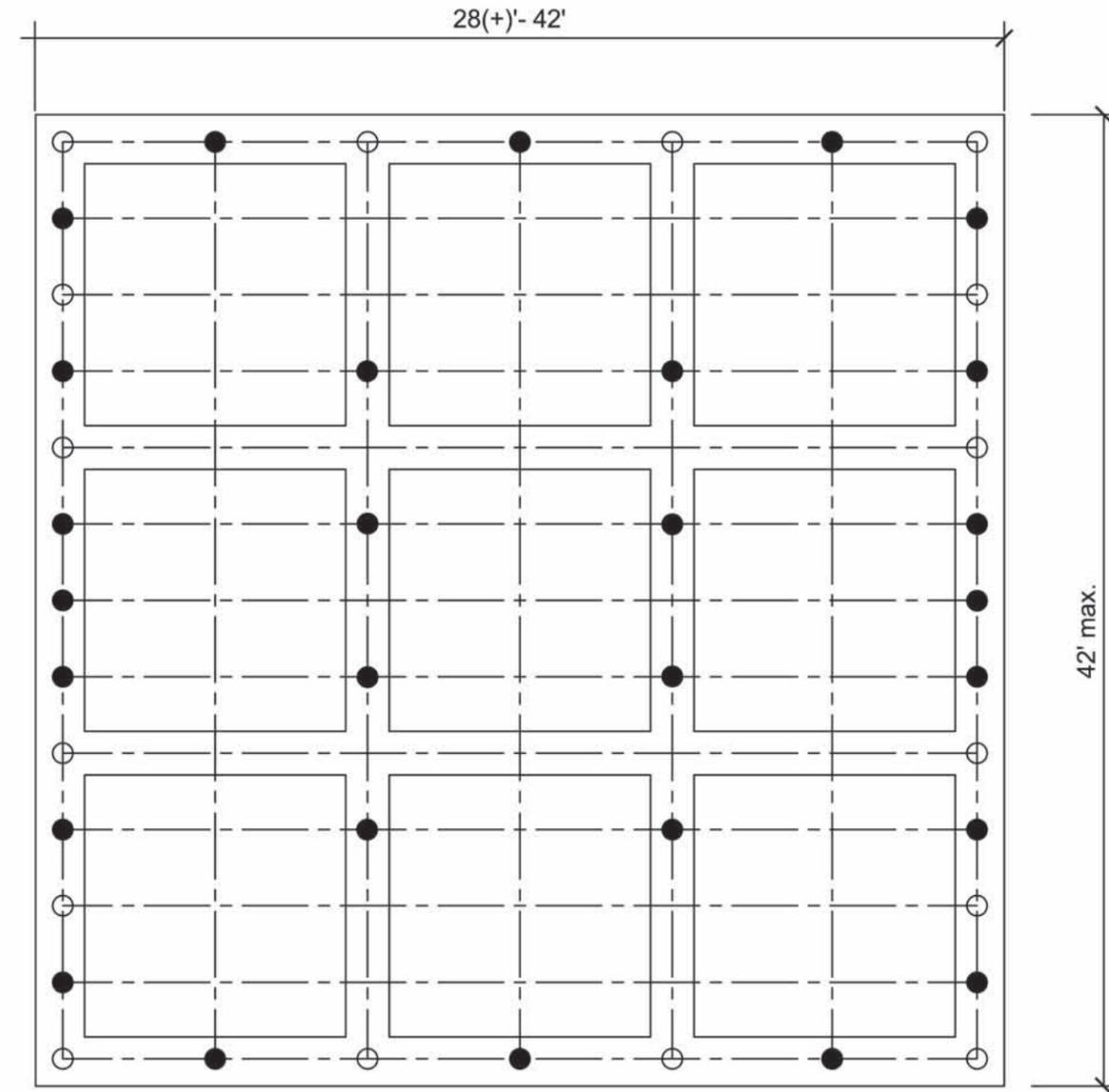
REVISED: REV. NO.



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6 Bay Pile Plan



9 Bay Pile Plan

LEGEND

- Tension Pile--See 2/C-1
- Non-Tension Pile--See 3/C-1

One and Two Story Residences Height H up to 10' - for winds up to 150 mph

Case C Open Foundation - Timber Pile with Concrete Column & Grade Beam

1
C-5
Pile Plan
38 PILES
SCALE: NTS

LEGEND

- Tension Pile--See 2/C-1
- Non-Tension Pile--See 3/C-1

One and Two Story Residences Height H up to 10' - for winds up to 150 mph

Case C Open Foundation - Timber Pile with Concrete Column & Grade Beam

2
C-5
Pile Plan
44 PILES
SCALE: NTS

Case- C Open Foundation Timber Pile with Concrete Column and Grade Beam

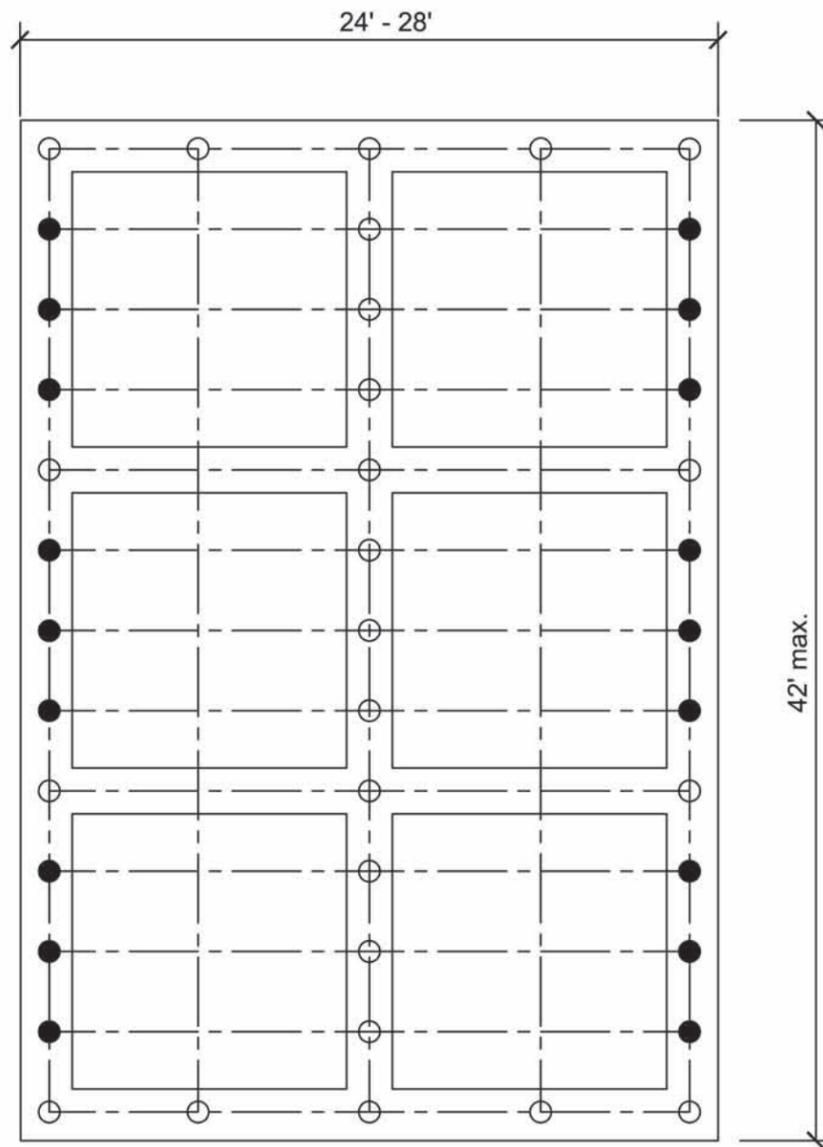
DRAWING NO.: C-5 SHEET 20 OF 31

DATE: August 8, 2006

REVISED: REV. 9



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6 Bay Pile Plan

LEGEND

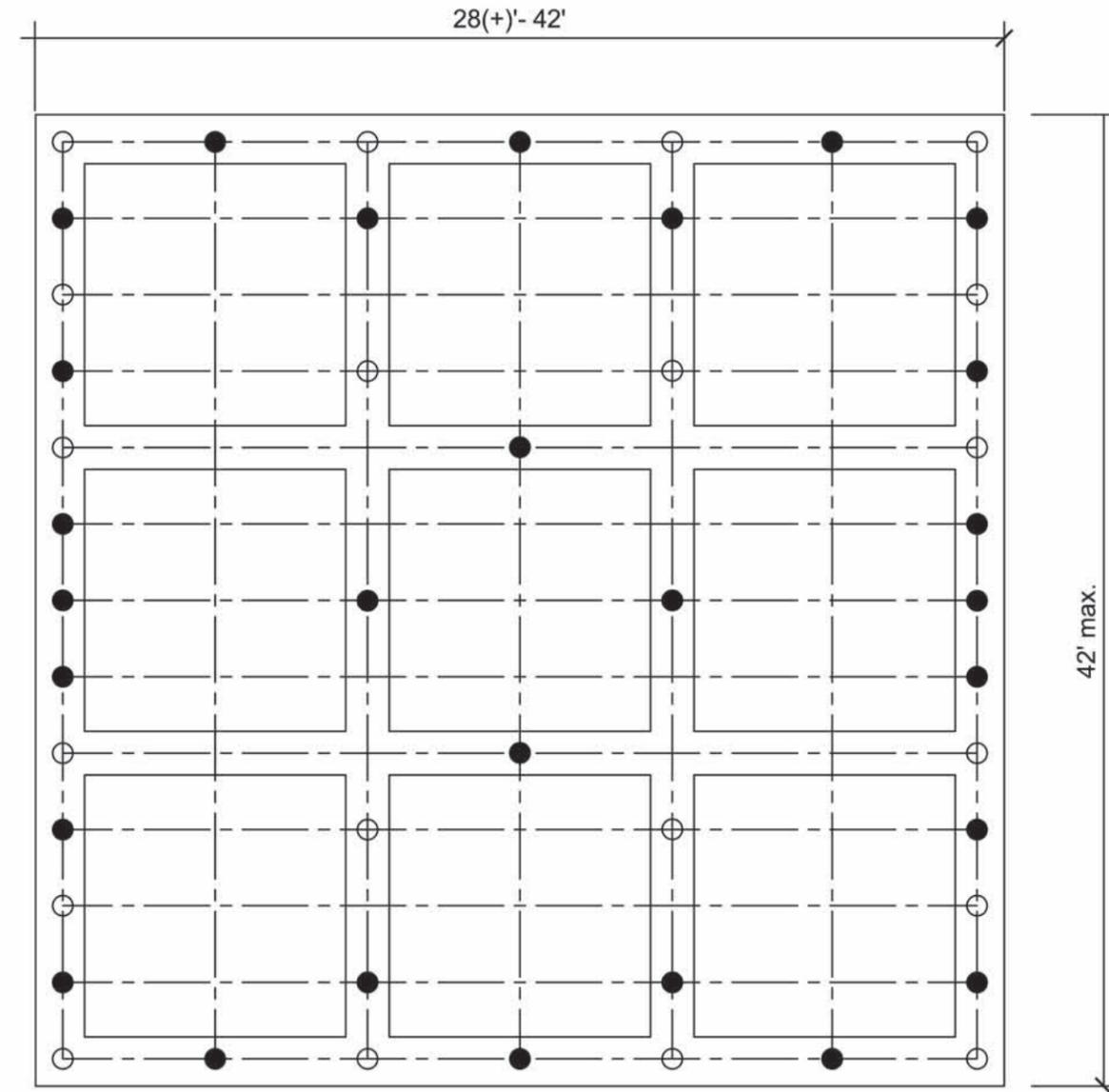
- Tension Pile--See 2/C-1
- Non-Tension Pile--See 3/C-1

One Story & Two Story Residences Height H
up to 15' - for winds up to 150 mph

1
C-6

**Case C Open Foundation - Timber Pile
with Concrete Column & Grade Beam**

Pile Plan
43 PILES
SCALE: NTS



9 Bay Pile Plan

LEGEND

- Tension Pile--See 2/C-1
- Non-Tension Pile--See 3/C-1

One Story & Two Story Residences Height H
up to 15' - for winds up to 150 mph

2
C-6

**Case C Open Foundation - Timber Pile
with Concrete Column & Grade Beam**

Pile Plan
48 PILES
SCALE: NTS

**Case- C Open Foundation Timber
Pile with Concrete Column
and Grade Beam**

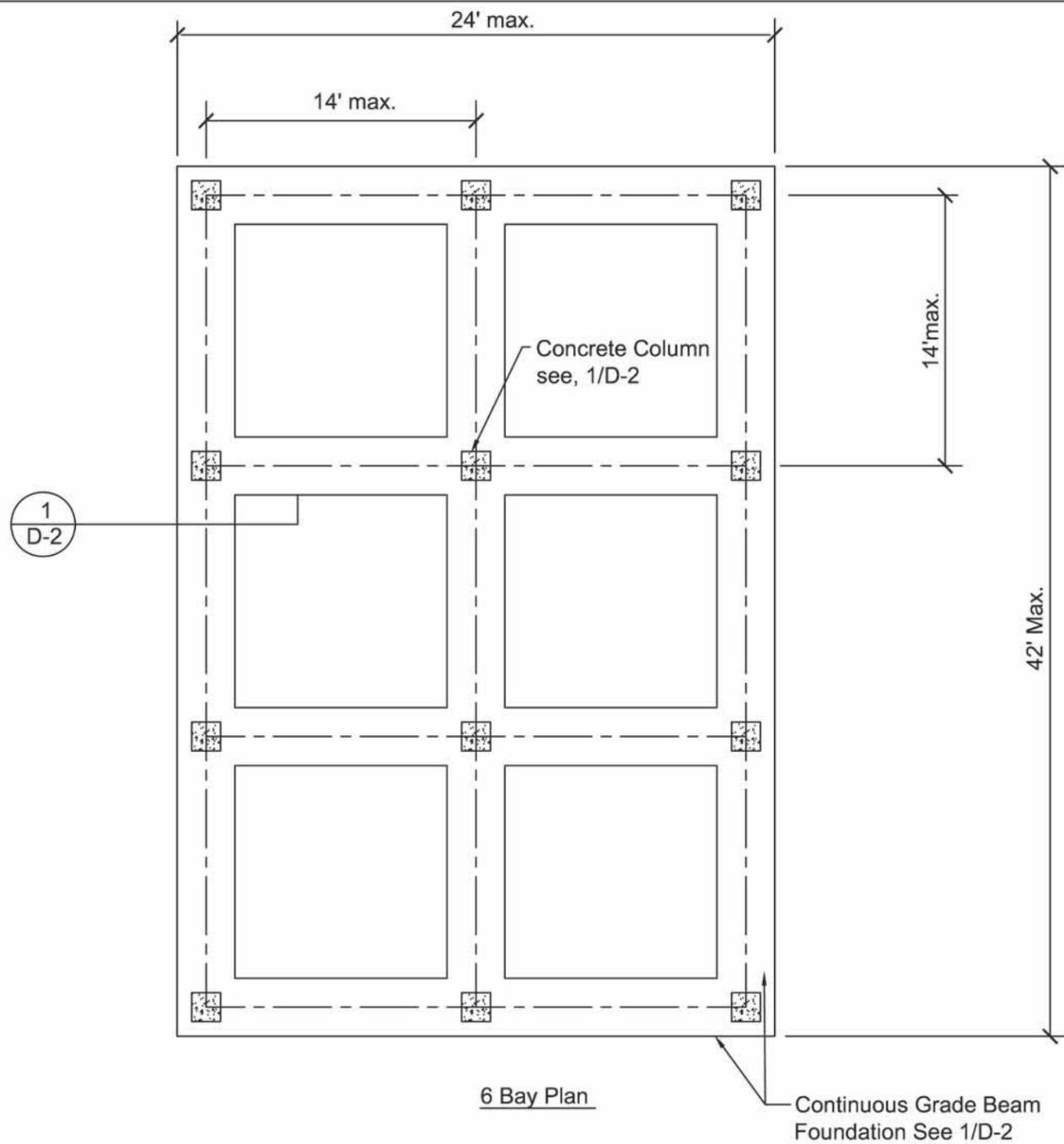
DRAWING NO.: C-6 SHEET 21 OF 31

DATE: August 8, 2006

REVISED: REV. 9

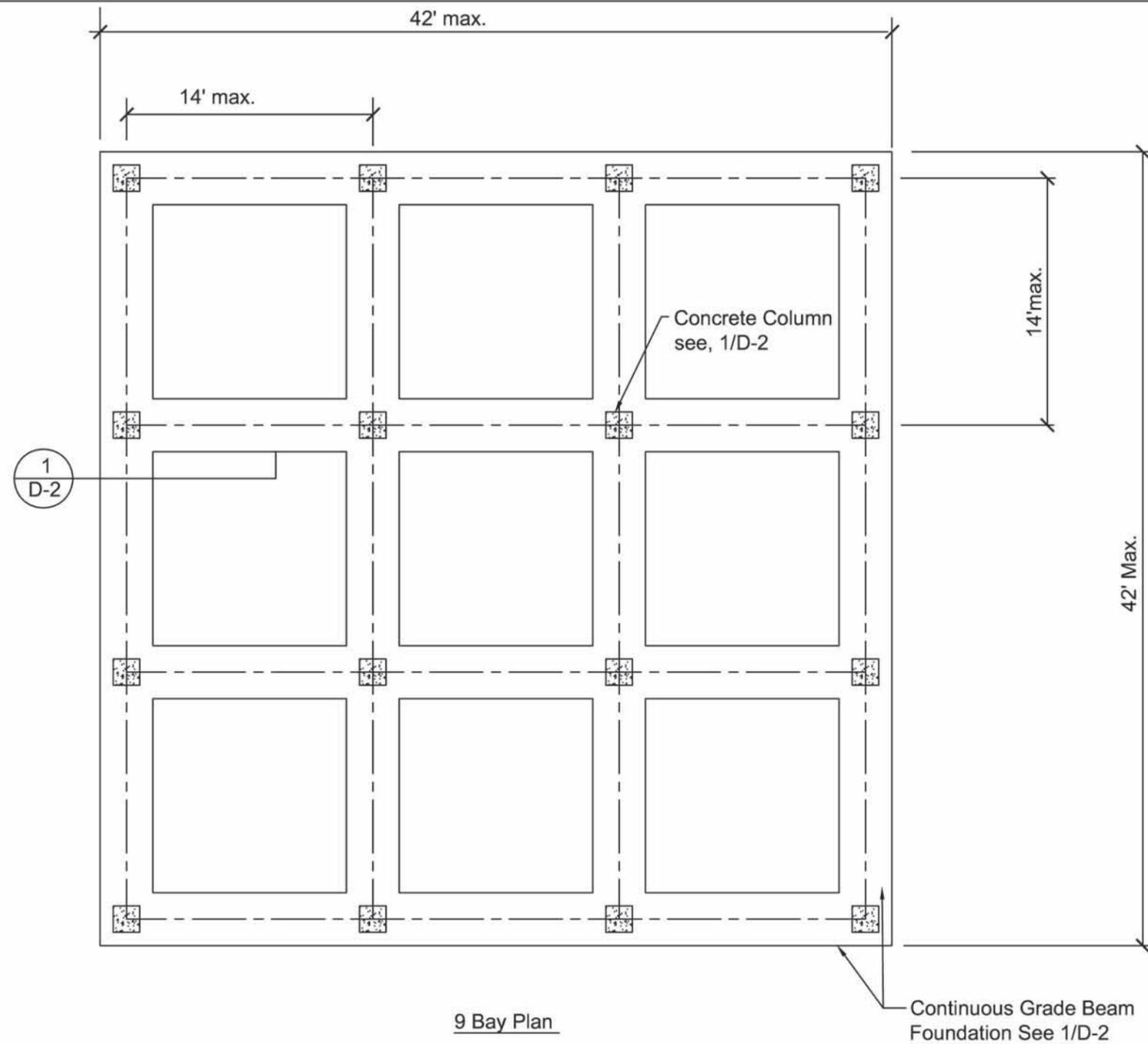


FEMA



6 Bay Plan

Continuous Grade Beam Foundation See 1/D-2



9 Bay Plan

Continuous Grade Beam Foundation See 1/D-2

1 Case D - Open Foundation Concrete Column & Grade Beam
D-1 SCALE: NTS

2 Case D - Open Foundation Concrete Column & Grade Beam
D-1 SCALE: NTS

Case D - Open Foundation Concrete Column and Grade Beam

DRAWING NO.: D-1	SHEET 22 OF 31
DATE: August 8, 2006	
REVISED:	REV. 9

See Sheet GN -1 through GN-6 for General Notes



Wind Speed (mph)				
One Story				
Height H	150	140	130	120
5'	2'-6" x 2'-0" (4) - # 6 Column 16 x 16 A	2'-3" x 2'-0" (4) - # 6 Column 16 x 16 A	2'-0" x 2'-0" (4) - # 6 Column 16 x 16 A	2'-0" x 2'-0" (4) - # 6 Column 16 x 16 A
6'	2'-9" x 2'-0" (5) - # 6 Column 16 x 16 A	2'-6" x 2'-0" (4) - # 6 Column 16 x 16 A	2'-3" x 2'-0" (4) - # 6 Column 16 x 16 A	2'-0" x 2'-0" (4) - # 6 Column 16 x 16 A
8'	3'-3" x 2'-0" (5) - # 6 Column 16 x 16 B	2'-6" x 2'-0" (4) - # 6 Column 16 x 16 B	2'-3" x 2'-0" (4) - # 6 Column 16 x 16 A	2'-0" x 2'-0" (4) - # 6 Column 16 x 16 A
Two Story				
5'	3'-6" x 2'-3" (6) - # 6 Column 16 x 16 A	2'-9" x 2'-3" (5) - # 6 Column 16 x 16 A	2'-6" x 2'-0" (5) - # 6 Column 16 x 16 A	2'-6" x 2'-0" (4) - # 6 Column 16 x 16 A
6'	4'-0" x 2'-3" (5) - # 7 Column 16 x 16 A	3'-0" x 2'-3" (6) - # 6 Column 16 x 16 A	3'-0" x 2'-0" (6) - # 6 Column 16 x 16 A	2'-6" x 2'-0" (4) - # 6 Column 16 x 16 A
8'	4'-0" x 2'-3" (5) - # 7 Column 16 x 16 B	3'-3" x 2'-3" (5) - # 6 Column 16 x 16 B	3'-0" x 2'-0" (5) - # 6 Column 16 x 16 A	2'-6" x 2'-0" (5) - # 6 Column 16 x 16 A
Height H	150	140	130	120
Wind Speed (mph)				

1 Case D - Open Foundation Concrete Column & Grade Beam
D-2 Table 1 Continuous Grade Beam Size and Concrete Column Schedule

Notes:

- 1) Continuous reinforcing top and bottom. Use longest bar lengths that are practical. Place top bar splices at quarter point of span and bottom bar splices at columns.
- 2) See Table 3/D3 for reinforcement schedule.
- 3) Legend: 2'-6"x2'-0" - Footing Size A (width) x B (height)
(4) - #6 - Footing Rebar, top & bottom
Column 16 x 16 B - Column Size; see 1/D-2

Case D - Open Foundation
Concrete Column and Grade Beam

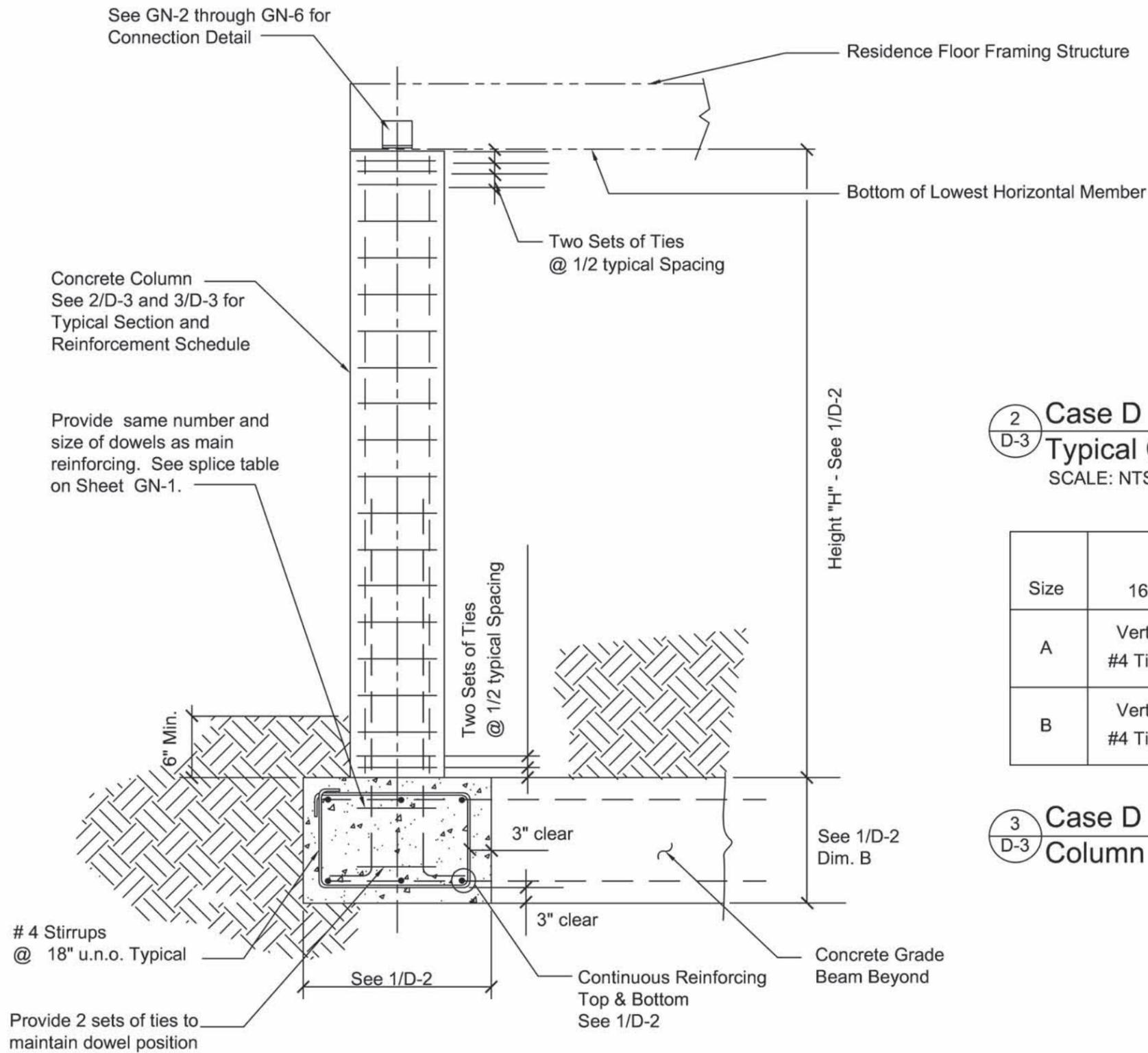
DRAWING NO.: D-2 SHEET 23 OF 31

DATE: August 8, 2006

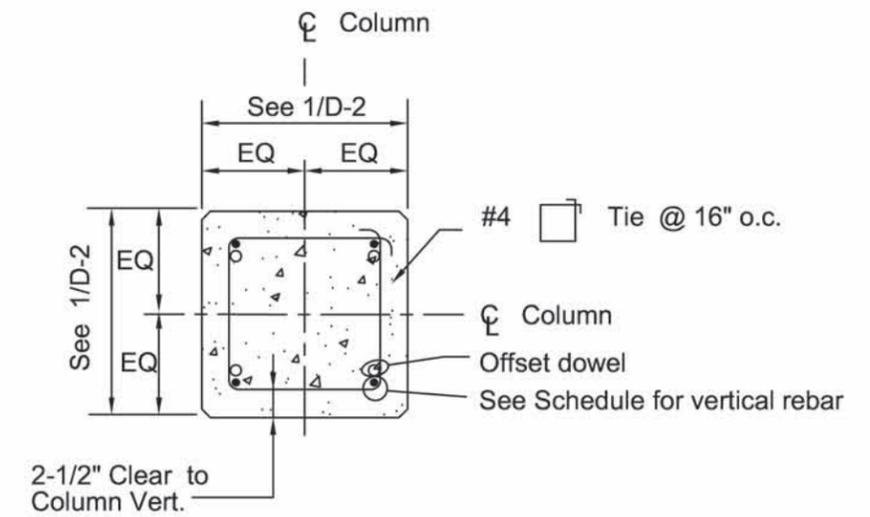
REVISED: REV. 9



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1 Case D Open Foundation - Concrete Column & Grade Beam
 Typical Exterior Section
 SCALE: NTS



2 Case D Open Foundation - Concrete Column & Grade Beam
 Typical Column Section
 SCALE: NTS

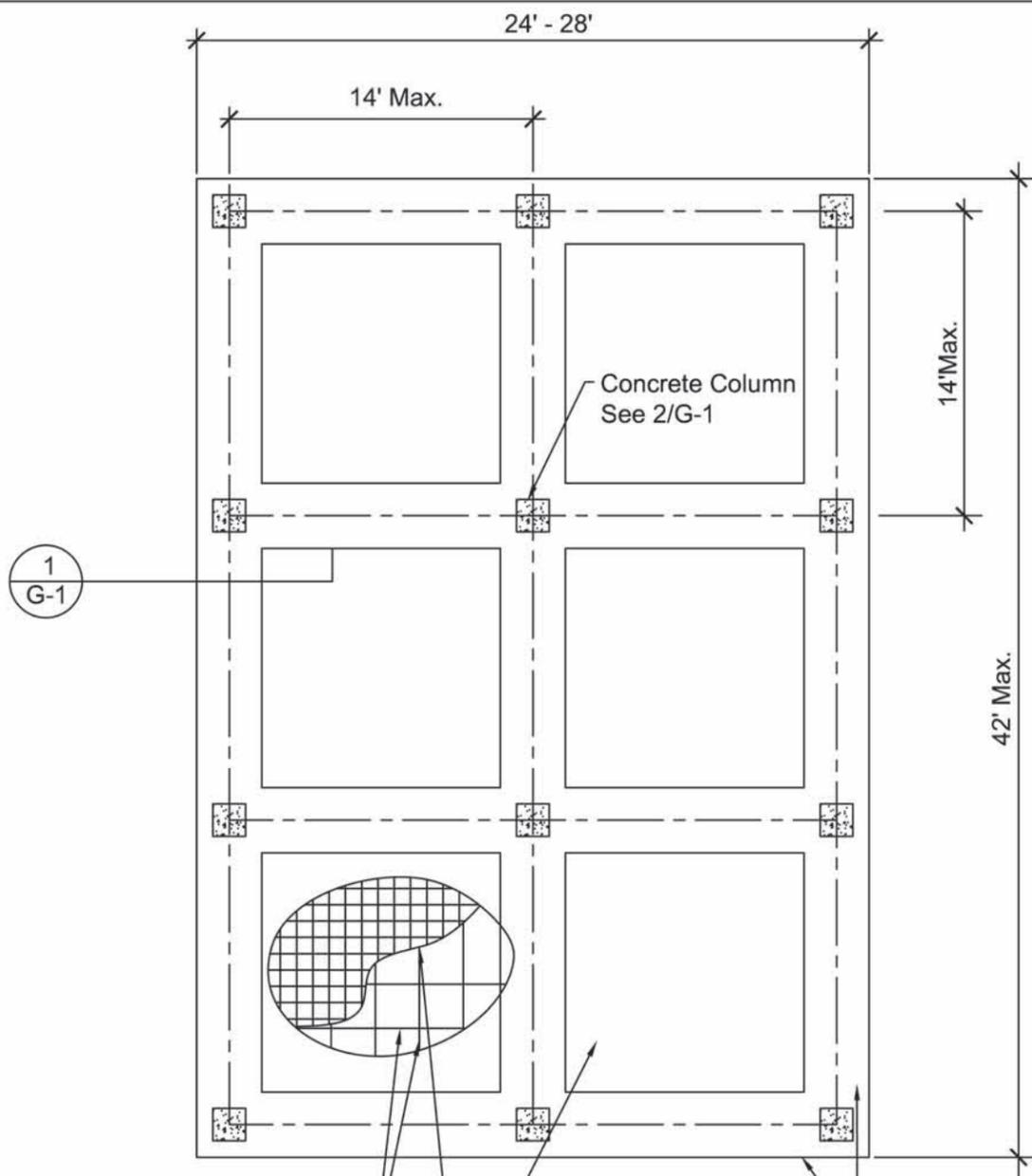
Size	16" x 16"
A	Verts (4) # 8 #4 Ties @ 16"
B	Verts (4) # 9 #4 Ties @ 16"

3 Case D Open Foundation - Concrete Column & Grade Beam
 Column Reinforcement Schedule

Case D - Open Foundation
 Concrete Column and Grade Beam

DRAWING NO.: D-3	SHEET 24 OF 31
DATE: August 8, 2006	
REVISED:	REV. 9





#3 @ 24" E.W., Typ.
Mid-height of Slab

Continuous Grade Beam Portion of
Mat Foundation See 2/G-1

Reinforced with 6x6 - W4.0 x W4.0
Welded Wire Fabric
(Placed over Deformed Bars)

6 Bay Plan

**Case G - Open Foundation Concrete
Column & Grade Beam with Slab**

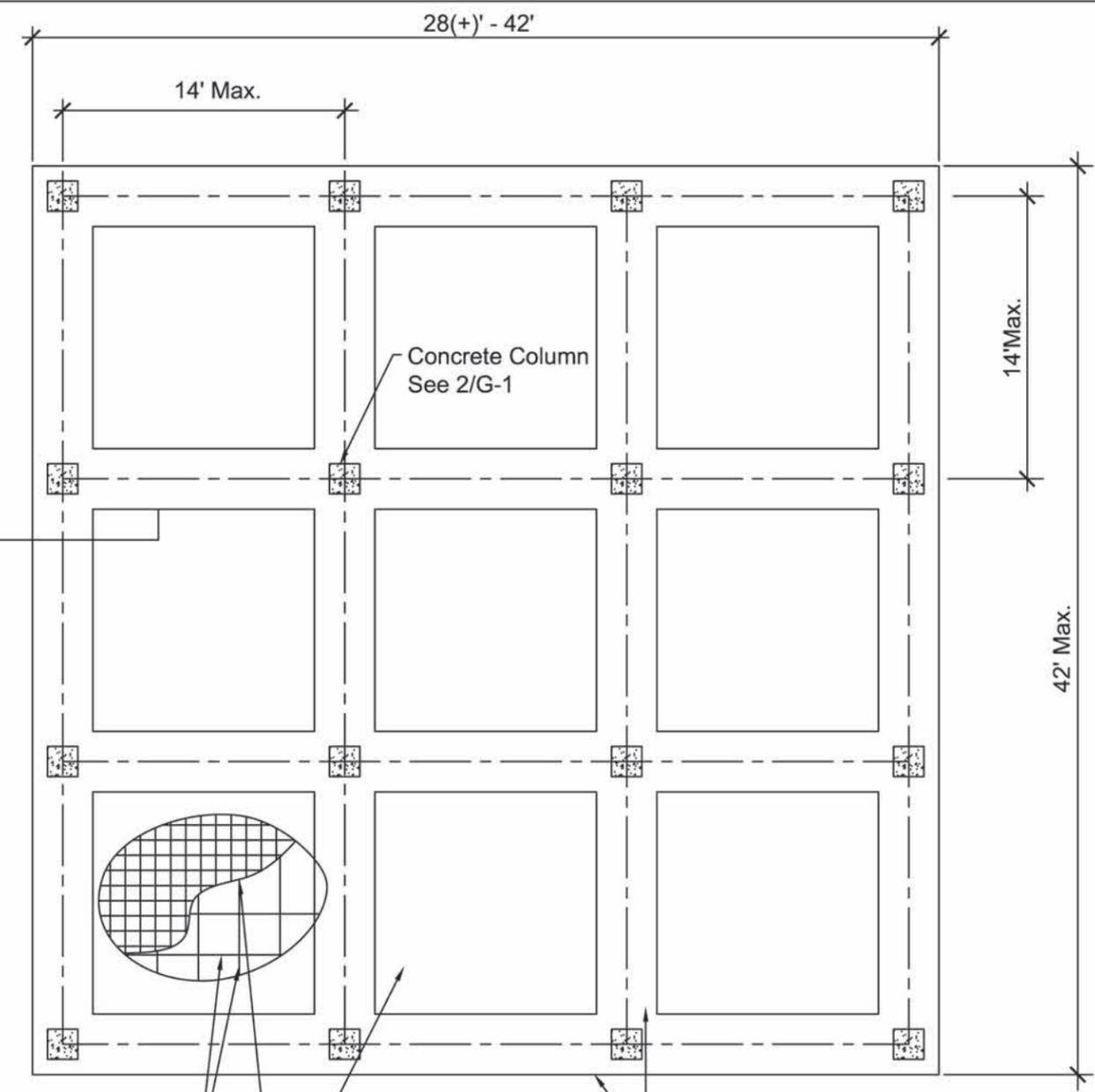
1
G-1

Plan

SCALE: NTS

Notes:

- 1) Continuous reinforcing top and bottom. Use longest bar lengths that are practical. Place top bar splices at quarter point of span and bottom bar splices at columns.
- 2) See 3/G-2 for reinforcement details.



#3 @ 24" E.W., Typ.
Mid-height of Slab

Continuous Grade Beam Portion of
Mat Foundation See 2/G-1

Reinforced with 6x6 - W4.0 x W4.0
Welded Wire Fabric
(Placed over Deformed Bars)

9 Bay Plan

**Case G - Open Foundation Concrete
Column & Grade Beam with Slab**

2
G-1

Table 1 Continuous Grade
Beam Size and Concrete Column
Schedule

**Case G - Open Foundation
Concrete Column and Grade Beam
with Slab**

DRAWING NO.: G-1 SHEET 25 OF 31

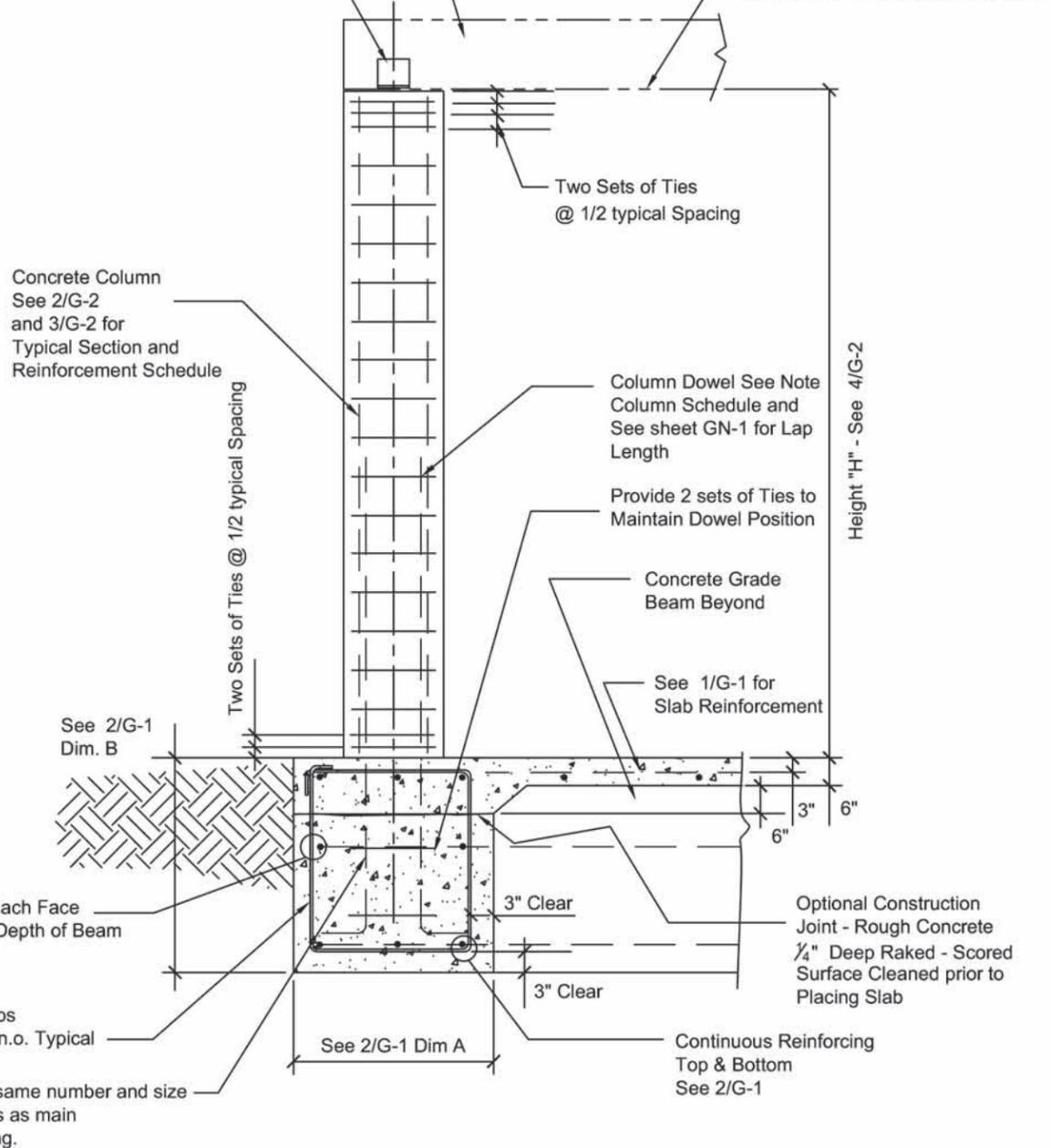
DATE: August 8, 2006

REVISED: REV. 9

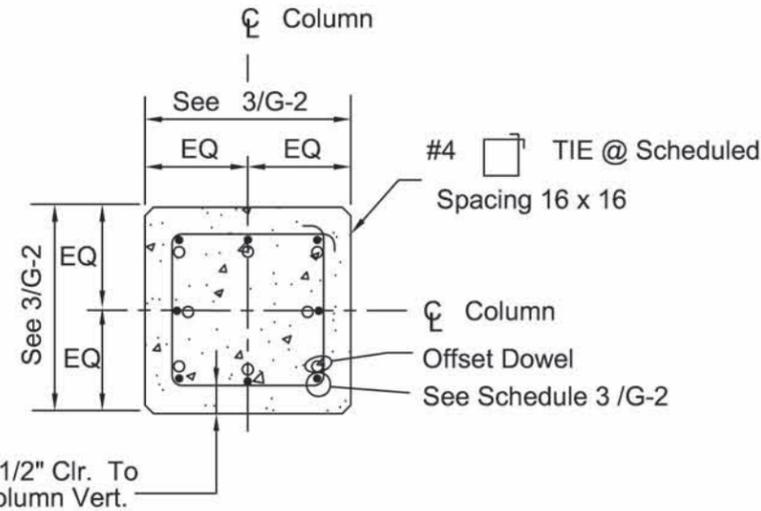


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See GN-2 through GN-6 for Connection Detail
Elevated Structure Floor Framing
Bottom of lowest horizontal member



Case G - Open Foundation Concrete Column & Grade Beam with Slab
1
G-2 **Typical Exterior Section**
SCALE: NTS



Case G Open Foundation Concrete Column & Grade Beam
2
G-2 **Typical Column Section**
SCALE: NTS

Size	16 16" x 16"
A	Verts (4) # 8 #4 Ties @ 16"
B	Verts (8) # 7 #4 Ties @ 14"
C	Verts (8) # 8 #4 Ties @ 14"

Case G - Open Foundation Column and Grade Beam
3
G-2 **Column Reinforcement Schedule**

Height H	Wind Speed mph			
	One Story			
	150	140	130	120
8'	2'-6" x 4' (4) - # 6 Column 16 x 16 A	2' x 4' (3) - # 6 Column 16 x 16 A	2' x 4' (3) - # 6 Column 16 x 16 A	2' x 4' (3) - # 6 Column 16 x 16 A
10'	2'-9" x 4' (4) - # 6 Column 16 x 16 A	2' x 4' (3) - # 6 Column 16 x 16 A	2' x 4' (3) - # 6 Column 16 x 16 A	2' x 4' (3) - # 6 Column 16 x 16 A
12'	3' x 4' (4) - # 6 Column 16 x 16 B	2'-3" x 4' (3) - # 6 Column 16 x 16 B	2' x 4' (3) - # 6 Column 16 x 16 A	2' x 4' (3) - # 6 Column 16 x 16 A
15'	3'-6" x 4' (5) - # 6 Column 16 x 16 C	2'-9" x 4' (4) - # 6 Column 16 x 16 B	2'-3" x 4' (3) - # 6 Column 16 x 16 B	2' x 4' (3) - # 6 Column 16 x 16 B
	Two Story			
8'	3' x 4' (4) - # 6 Column 16 x 16 B	3' x 4' (4) - # 6 Column 16 x 16 A	2'-3" x 4' (3) - # 6 Column 16 x 16 A	2' x 4' (3) - # 6 Column 16 x 16 A
10'	4'-3" x 4' (5) - # 6 Column 16 x 16 B	3'-6" x 4' (5) - # 6 Column 16 x 16 B	2'-6" x 4' (4) - # 6 Column 16 x 16 B	2' x 4' (3) - # 6 Column 16 x 16 B
12'	4'-6" x 4' (4) - # 7 Column 16 x 16 C	4' x 4' (5) - # 6 Column 16 x 16 C	2'-9" x 4' (4) - # 7 Column 16 x 16 B	2'-3" x 4' (3) - # 6 Column 16 x 16 B
Height H	150	140	130	120
	Wind Speed mph			

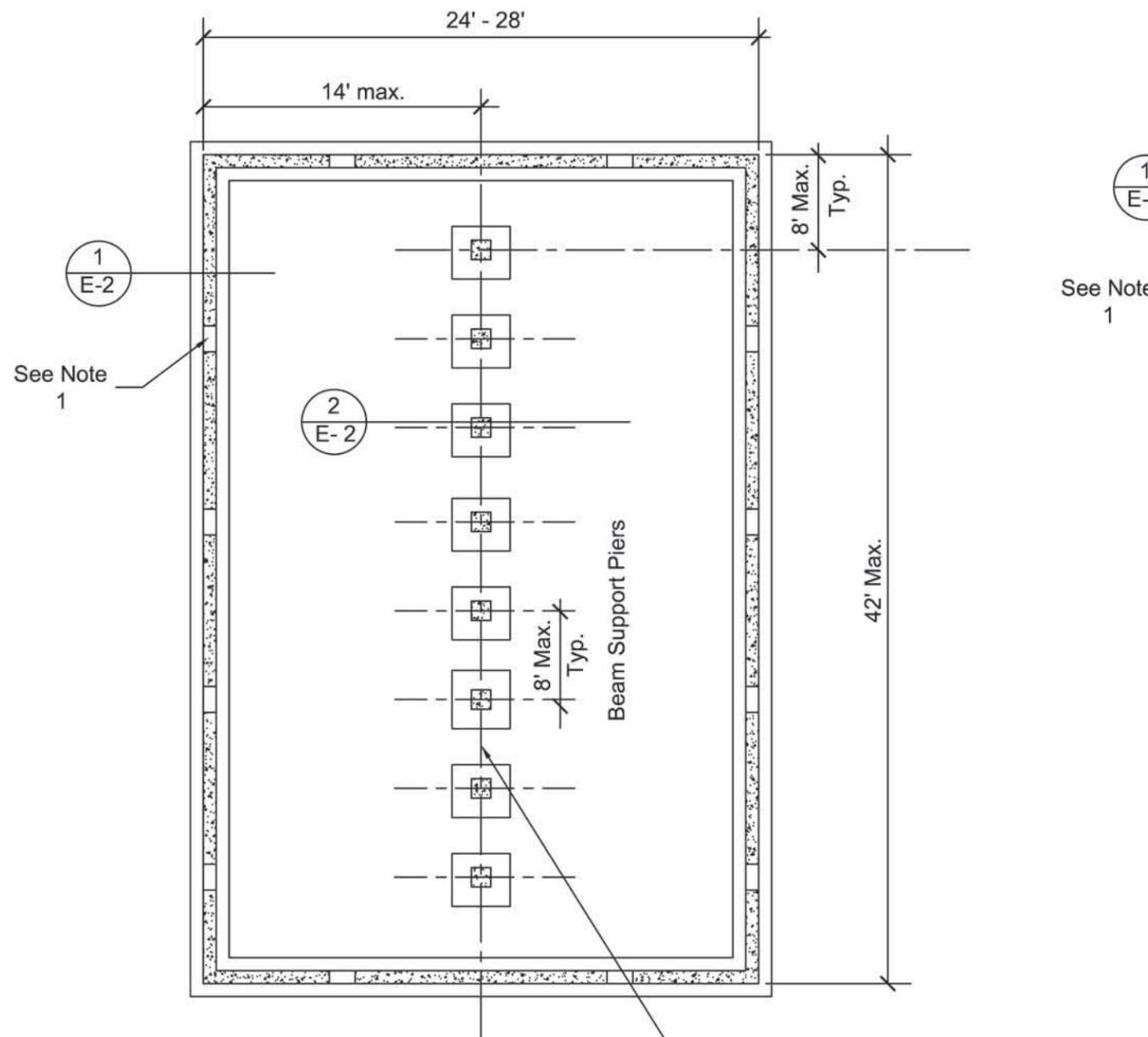
Legend:
2'-6"x4' - Footing Size A (width) x B (height)
(3) - #6 - Footing Rebar, Top & Bottom
Column 16 x 16 A - Column Size; see 3/G-2

Case G - Open Foundation Concrete Column & Grade Beam with Slab
4
G-2 **Table 1 Continuous Grade Beam Size and Concrete Column Schedule**

Case G - Open Foundation Concrete Column and Grade Beam with Slab

DRAWING NO.: G-2	SHEET 26 OF 31
DATE: August 8, 2006	
REVISED:	REV. 9

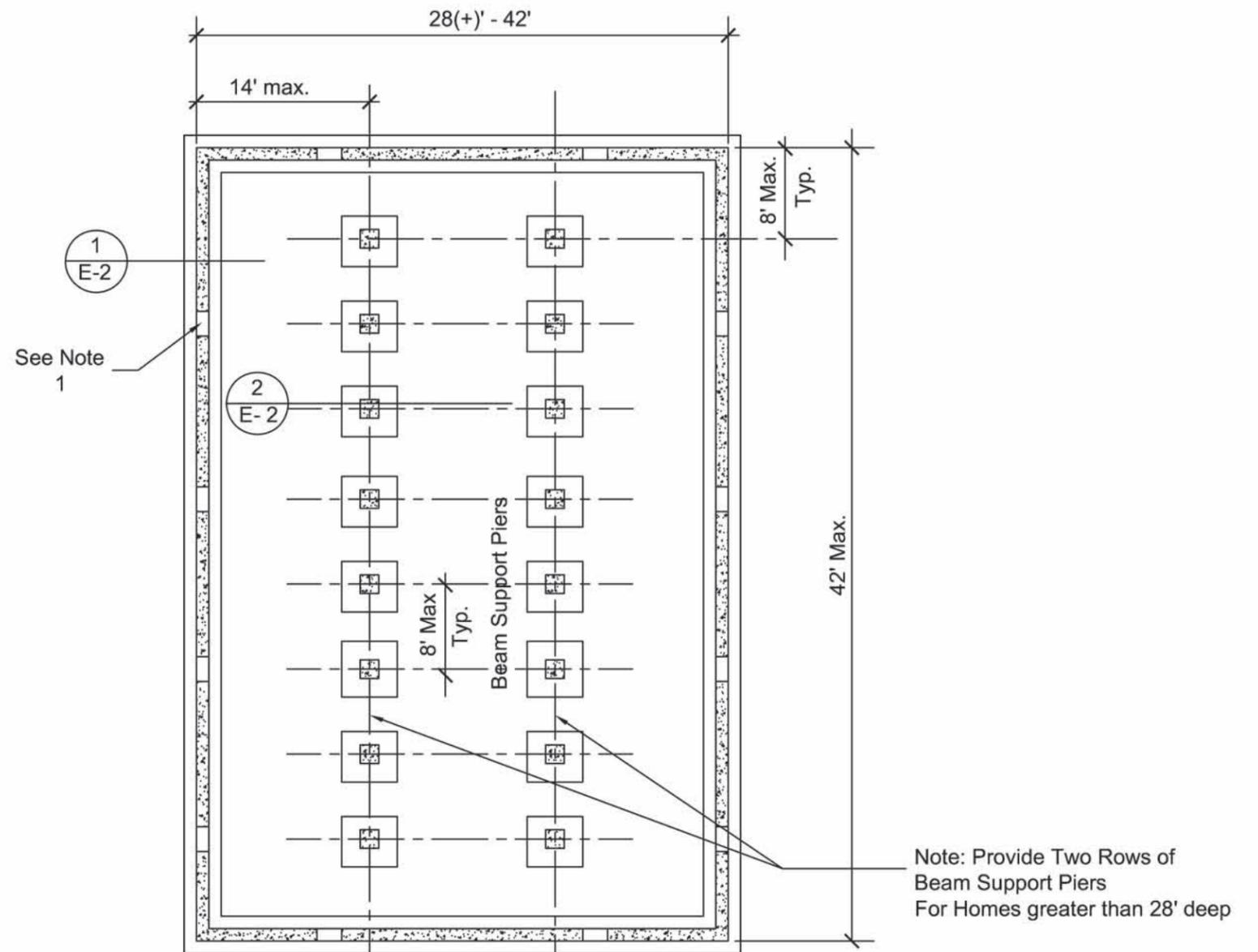




Case E - Closed Foundation Reinforced Masonry Foundation - Crawlspace

1
E-1

Typical Module Plan
SCALE: NTS
See Sheet GN-1 for General Notes



Case E - Closed Foundation Reinforced Masonry Foundation - Crawlspace

2
E-1

Typical Module Plan

SCALE: NTS
See Sheet GN-1 for General Notes

Note 1:

- 1) Total area of all Flood Relief Openings shall be a minimum of 1 square inch per square foot of floor area.
- 2) Bottom of Flood Relief Opening shall be located no more than 1' above adjacent grade.
- 3) Flood Relief Opening shall comply with NFIP Standards.

Case E - Closed Foundation Reinforced Masonry Foundation - Crawlspace

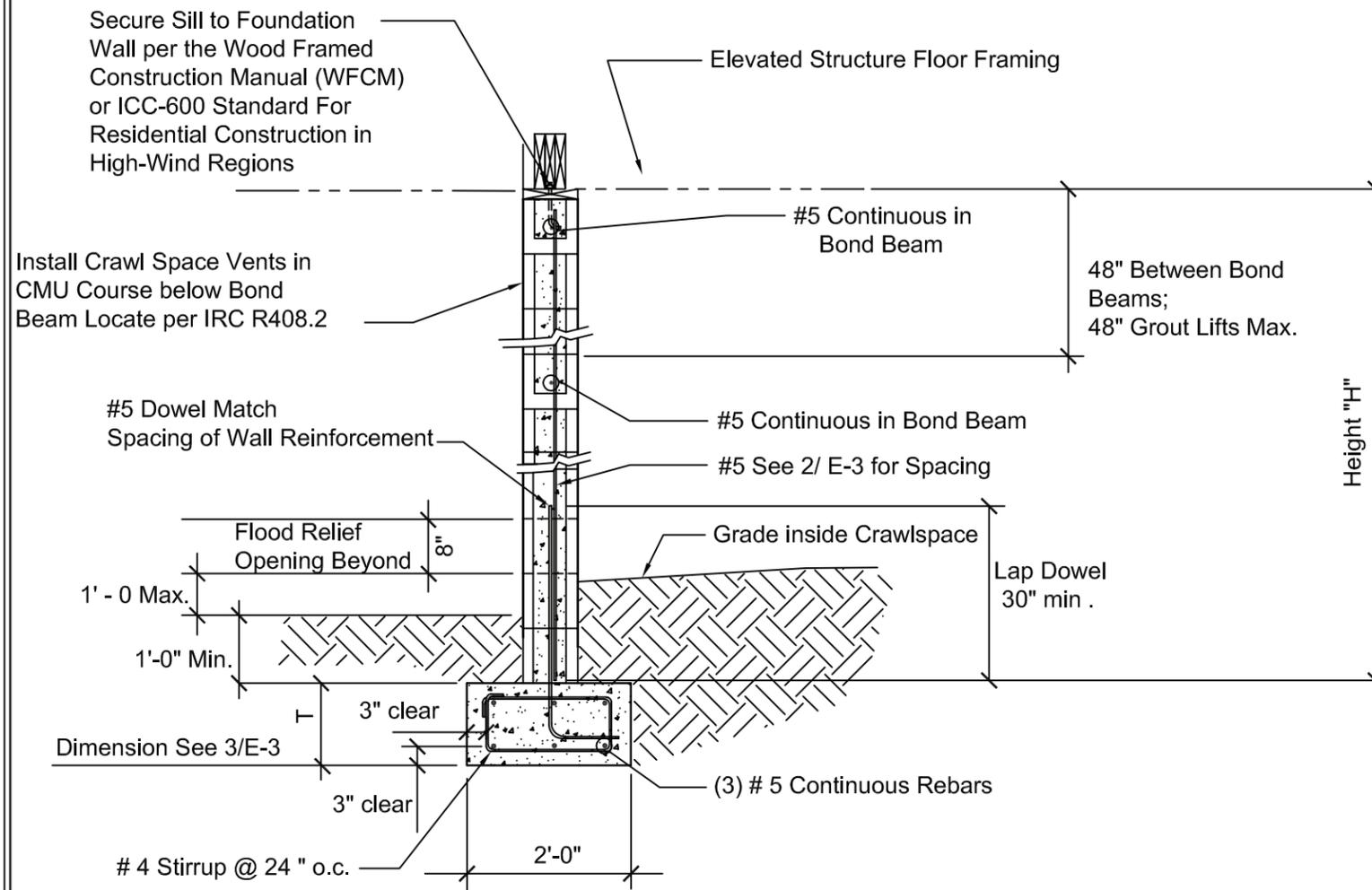
DRAWING NO.: E-1 SHEET 27 OF 31

DATE: August 8, 2006

REVISED: REV. NO.

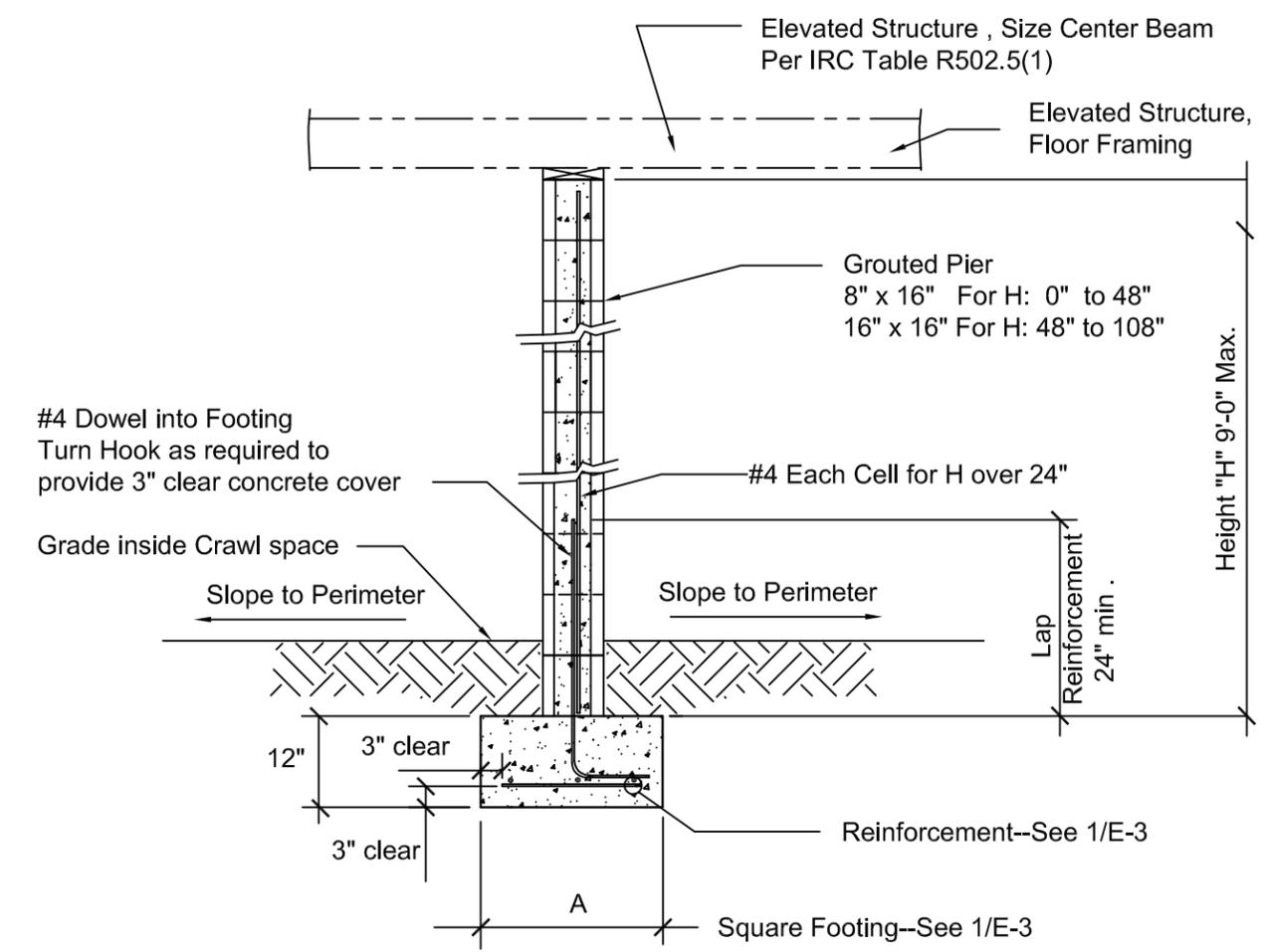


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Case E - Closed Foundation Reinforced Masonry Foundation - Crawlspace

1
E-2
Typical Section
SCALE: NTS



Case E - Closed Foundation Reinforced Masonry Foundation - Crawlspace

2
E-2
Typical Pier & Footing Section
SCALE: NTS

- Note 1:**
- 1) Total area of all Flood Relief Openings shall be a minimum of 1 square inch per square foot of floor area.
 - 2) Bottom of Flood Relief Opening shall be located no more than 1'-0" above adjacent grade.
 - 3) Flood Relief Opening shall comply with NFIP Standards.

Case E - Closed Foundation Reinforced Masonry Foundation - Crawlspace	
DRAWING NO.: E -2	SHEET 28 OF 31
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REVISED:	REV. 9
FEMA	

Column Spacing	Single Story		Two Story	
	Footing Size - A	Reinf. Size	Footing Size - A	Reinf. Size
4'-0"	24"	(3) # 4	30"	(3) # 4
5'-0"	26"	(3) # 4	32"	(3) # 4
6'-0"	28"	(3) # 4	34"	(3) # 4
7'-0"	28"	(3) # 5	36"	(3) # 5
8'-0"	30"	(3) # 5	38"	(3) # 5

1
E-3 Case E - Closed Foundation Reinforced Masonry Foundation - Crawlspace Size and Reinforcement Schedule

Wall Height	Wind Speed (mph)			
	150	140	130	120
0'-8"	40"	32"	24"	18"
1'-4"	38"	30"	24"	16"
2'-0"	36"	28"	22"	16"
2'-8"	34"	26"	22"	14"
3'-4"	34"	26"	22"	12"
4'-0"	32"	24"	20"	12"
6'-0"	28"	20"	18"	12"
8'-0"	24"	12"	14"	12"

Notes:

- 1) Grout all cells in foundations for homes placed in 140 mph and 150 mph wind zones and all cells in foundations that are 4 feet tall or greater.
- 2) In 120 mph and 130 mph wind zones, grout all cells containing rebar in crawl space foundations

3
E-3 Case E - Closed Foundation Reinforced Masonry Foundation Crawlspace Table 2 Perimeter Footing Thickness (T) Required to Resist Uplift

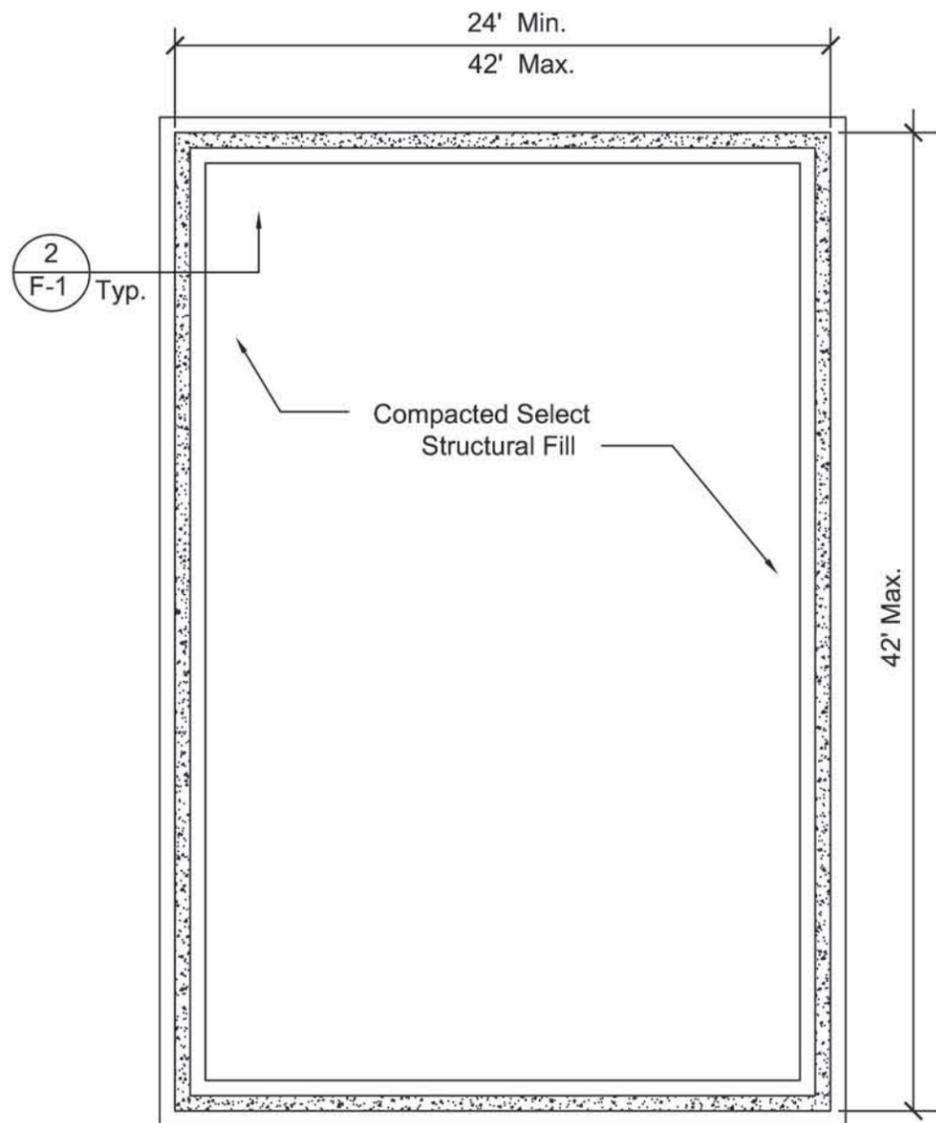
Wall Height	Single Story		Two Story	
	8" CMU	12" CMU	8" CMU	12" CMU
2'-0"	72"	72"	56"	72"
4'-0"	56"	72"	48"	56"
6'-0"	40"	48"	32"	40"
8'-0"	24"	32"	24"	32"

2
E-3 Case E - Closed Foundation Reinforced Masonry Foundation - Crawlspace Spacing (Vertical Bars) Crawl Space Foundation Wall #5 bars

Case E - Closed Foundation Reinforced Masonry Foundation - Crawlspace	
DRAWING NO.: E -3	SHEET 29 OF 31
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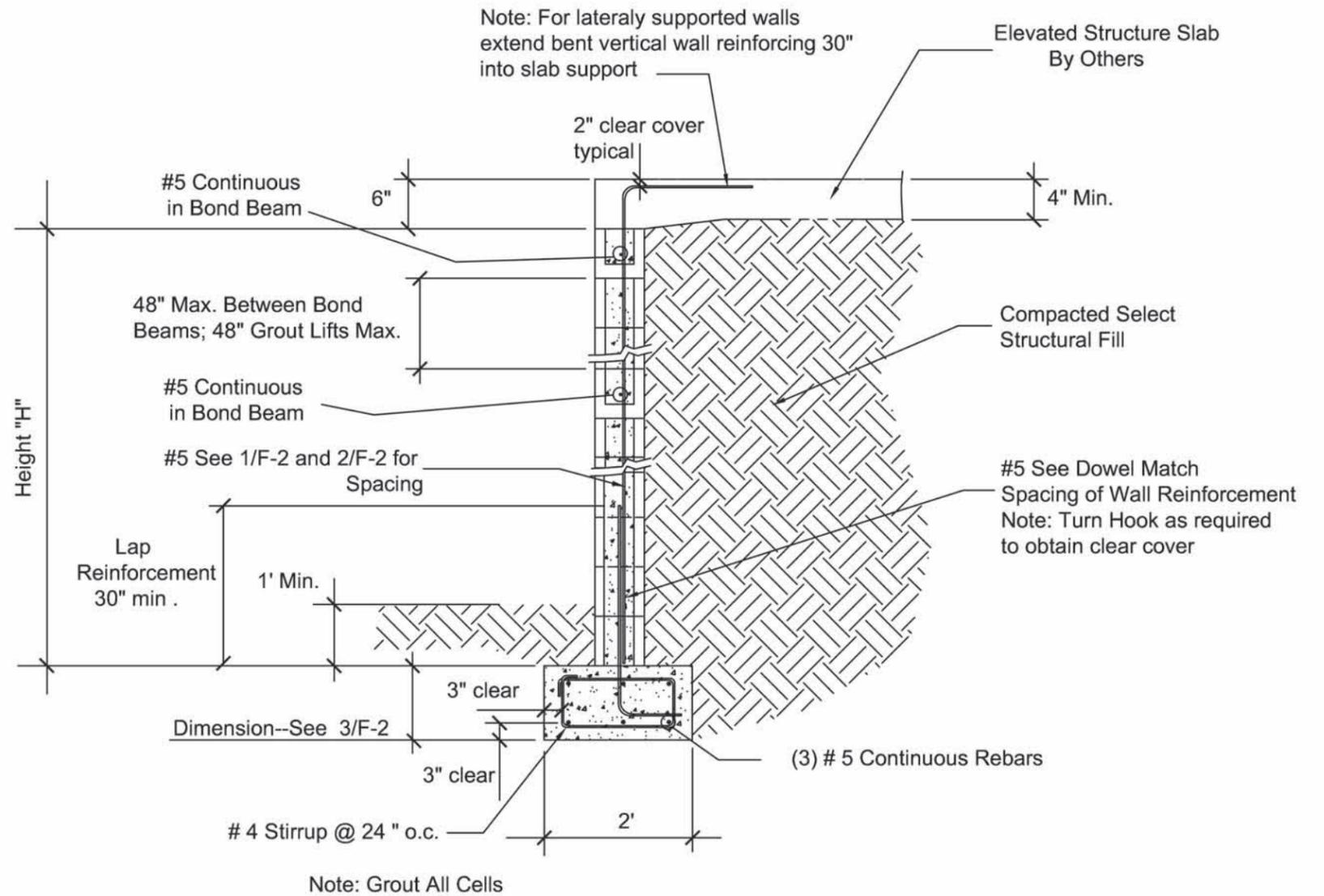
FEMA



See Sheet G-1 for General Notes

Note :

- 1) Provide lateral bracing to wall during placement and compaction of fill until slab is installed and cured except as noted in 1/F-2.



2 F-1 Case F - Closed Foundation Reinforced Masonry Foundation - Stem Wall
Typical Section
 SCALE: NTS

Case F - Closed Foundation
 Reinforced Masonry Foundation -
 Stem Wall

DRAWING NO.: F-1 SHEET 30 OF 31

DATE: August 8, 2006

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1 F-1 Case F - Closed Foundation Reinforced Masonry Foundation - Stem Wall
Backfilled Typical Plan
 SCALE: NTS



	Single & Two Story	
Wall Height	8" CMU	12" CMU
1'-0"	48"	48"
2'-0"	32"	48"
3'-0"	24"	32"
4'-0"	8"	16"

Note:
Use for Foundation Wall not tied into Floor Slab

Case F - Closed Foundation Reinforced Masonry Foundation - Stem Wall

1
F-2 **Table 1 Wall Reinforcement Spacing**
Backfilled - Unbraced Construction - Stem Wall #5 bars

Wall Height	Single & Two Story 8" CMU
1'-0"	48"
2'-0"	48"
3'-0"	48"
4'-0"	48"

Note:
Use for Foundation Wall that is tied into Floor Slab

Case F - Closed Foundation Reinforced Masonry Foundation - Stem Wall

2
F-2 **Table 2 Wall Reinforcement Spacing**
Backfilled - Laterally Supported at Top of Stem Wall #5 bars

	Wind Speed (mph)			
Wall Height	150	140	130	120
0'-8"	40"	32"	24"	18"
1'-4"	38"	30"	24"	16"
2'-0"	36"	28"	22"	16"
2'-8"	34"	26"	22"	14"
3'-4"	34"	26"	22"	12"
4'-0"	32"	24"	20"	12"
6'-0"	28"	20"	18"	12"
8'-0"	24"	12"	14"	12"

Case F - Closed Foundation Reinforced Masonry Foundation - Stem Wall

3
F-2 **Table 3 Perimeter Footing**
Thickness Required to Resist Uplift

Case F - Closed Foundation Reinforced Masonry Foundation - Stem Wall	
DRAWING NO.: F-2	SHEET 31 OF 31
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REVISED:	REV. 9



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CASE H

OPEN FOUNDATION TIMBER PILES, REINFORCED CONCRETE (RC) GRADE BEAMS, RC COLUMNS, RC FIRST FLOOR BEAMS

DRAWING	DRAWING NUMBER	SHEET NUMBER	REV. #
Title Page	H-S-000	1 of 26	0
General Notes	H-S-001	2 of 26	0
Three Bay Plans			
Foundation & Pile Plans	H-S3-101	3 of 26	0
Ground Floor Column Plans	H-S3-102	4 of 26	0
First Floor Framing Plans	H-S3-103	5 of 26	0
Six Bay Plans			
Foundation & Pile Plans	H-S6-101	6 of 26	0
Ground Floor Column Plans	H-S6-102	7 of 26	0
First Floor Framing Plans	H-S6-103	8 of 26	0
Nine Bay Plans			
Foundation & Pile Plans	H-S9-101	9 of 26	0
Ground Floor Column Plans	H-S9-102	10 of 26	0
First Floor Framing Plans	H-S9-103	11 of 26	0
Building Details	H-S-201	12 of 26	0
Building Details	H-S-202	13 of 26	0
Three Bay 10 Foot High Systems	H-S-203	14 of 26	0
Three Bay 15 Foot High System With Spliced Bars	H-S-204	15 of 26	0
Three Bay 15 Foot High System With Minimal Splices	H-S-205	16 of 26	0
Six Bay 10 Foot High Systems	H-S-206	17 of 26	0
Six Bay 15 Foot High System With Spliced Bars	H-S-207	18 of 26	0
Six Bay 15 Foot High System With Minimal Splices	H-S-208	19 of 26	0
Nine Bay 10 Foot High Systems	H-S-209	20 of 26	0
Nine Bay 15 Foot High System With Spliced Bars	H-S-210	21 of 26	0
Nine Bay 15 Foot High System With Minimal Splices	H-S-211	22 of 26	0
Column Sections	H-S-212	23 of 26	0
Beam Sections	H-S-213	24 of 26	0
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Wood Connection Details	H-S-215	26 of 26	0



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CASE H

Title Page

DATE: **June 2009**

REVISED: ----

REV. **0**

DWG NO.: **H-S-000**

SHEET **1** OF **26**

1. GENERAL

The use of the foundation designs of this manual are not intended to convey any particular sequence or procedure. The respective builder and / or contractor shall be responsible for taking adequate means and measures to insure the stability of the building and it's components during construction. These shall include, but are not limited to; necessary shoring, sheeting, temporary bracing, dewatering, etc. This manual has been provided to assist in Coastal Region construction efforts. Builders, architects, or engineers using this manual assume responsibility for the resulting designs.

2. FOUNDATION

Foundation designs are based on minimum values believed to exist in most Coastal Regions. Actual site soil characteristics shall be verified as being in agreement with the assumed values stated and in compliance with local building codes. Parties using the foundation designs may wish to retain the services of a Geotechnical Engineer to verify local conditions and to provide site specific values.

Soil supported foundations are based on a presumptive allowable soil pressure of 1500 pounds per square foot. In non V zones, compacted structural fill may be used. It is recommended that structural fill be placed in maximum 6" layers and compacted to 95% density as measured by the Modified Proctor method. It is also recommended, and may be required by local code, that field compaction tests be performed by a testing agent. Pile supported foundations are based on presumptive values.

It is advised that the location of all underground utilities be verified prior to commencing any foundation work. Proper care should be taken during any excavation work as unrecorded and/or mislocated underground utilities may exist in the area.

3. CONCRETE

All structural concrete, for foundations, slabs on grade, columns and beams, etc., shall be a plant batched ready-mix. The concrete mix shall be of standard weight aggregates able to achieve a 28 day compressive strength of 4000 psi. The use of Calcium Chlorides shall not be permitted. Use of water reducing agents / superplasticizer are recommended.

All concrete work shall comply with the requirements of ASTM Standard C94 for the measuring, mixing, transporting, placing, etc. Concrete tickets should be time stamped when the concrete is batched. The maximum time allowed, from when the mixing water is added to the time the concrete is placed should not exceed one and one half hours. Use of concrete that is not in compliance with the above can result in significant reduction in concrete strength and performance. Concrete shall be placed with due regard to extreme temperature conditions. Refer to ACI 305 "Hot Weather Concreting" and ACI 306 "Cold Weather Concreting" for guidance in placing concrete during weather extremes.

Refer to ACI 117 and ACI 347R for guidance in planning form work design and for finish standards and requirements.

A standard hook shall be provided at the termination of all beam top reinforcing bars. Corner bars with full tension laps, matching the size and spacing of the continuous bar shall be provided.

All hoops, stirrups and splice confinement bars shall use 135° "Seismic" hooks. All splices are to be Class "B" tension lap splices. Bundled bars are used to assist in bar handling and placement.

Reinforcing steel shall be of ASTM A615 Grade 60 deformed bars, free from oil, scale and excessive rust. Reinforcing shall be detailed, fabricated and placed in accordance with the typical bending diagrams, placing requirements and details of the latest editions of the American Concrete Institute (ACI) standards and specifications. These publications include ACI 318, ACI 301, ACI 304, ACI 315 and ACI SP-68. Minimum Cover for reinforcing is: 3" for concrete cast against soil and 2" for concrete that is exposed to weather. It is recommended that the owner utilize a concrete testing agent to verify concrete strength. Reinforcing shall be secured in place by the use of ties and supported by bolsters, chairs, spacers and other devices.

Welded wire fabric shall conform to ASTM A185 and be furnished in flat sheets only. Standard lap lengths are as follows:

Bar Size	Lap Length	Standard 90 & 135 deg. Hook			Bar Size	Lap Length	Standard 90 & 135 deg. Hook		
		Embed	Leg Length	Bend Dia.			Embed	Leg Length	Bend Dia.
#3	24"	6"	6"	2-1/4"	#7	70"	12"	14"	5-1/4"
#4	32"	7"	8"	3"	#8	80"	14'	16"	6"
#5	40"	9"	10"	3-3/4"	#9	91"	15"	19"	9-1/2"
#6	48"	10"	12"	4-1/2"	#10	102"	17"	22"	10-3/4"

4. STRUCTURAL STEEL

Structural shapes, anchor bolts, etc. that are indicated to be galvanized, shall be hot dip galvanized after fabrication per ASTM A 368, A123 to G90 standard.

5. CONNECTIONS

Connections to wood framing are based on lumber having a minimum specific gravity of 0.55. See sheet 19 for these details.

6. DRIVEN PILES

Treated Timber Piles shall conform to latest revision of ASTM Specification D-25. Piles shall be of Southern Pine or Douglas Fir clean or rough peeled. Piles also shall have a minimum tip diameter of 8 inches and a minimum butt diameter of 12 inches as measured 3 feet from the end of the pile.

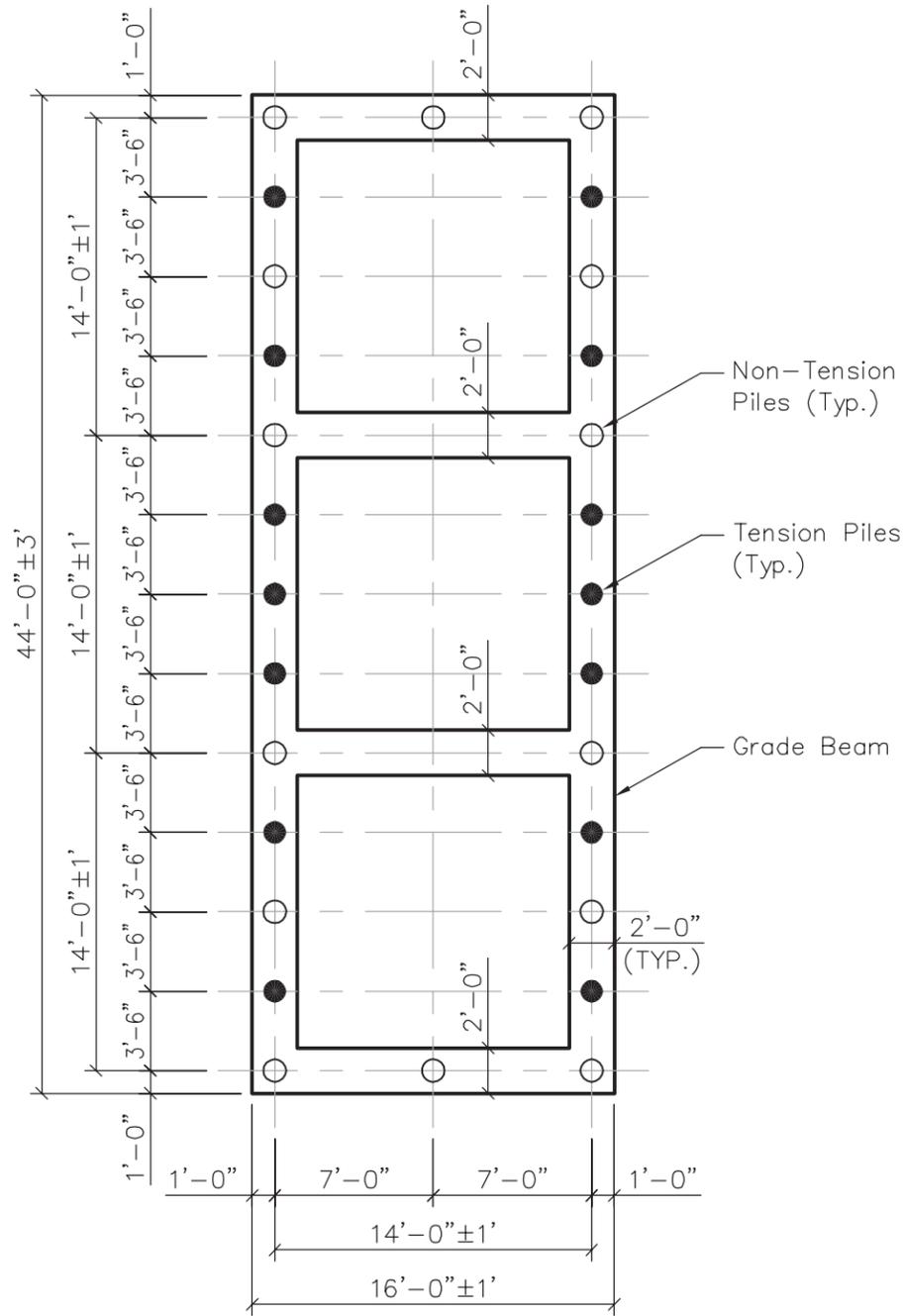
All treated timber piles shall be preservative treated. Preservative retention rate shall be in accordance with AWWA Guidelines for the chemical used. Pile preservative treatment shall comply with AWWA C3 standards.

Treat cut ends and drilled holes of treated timber piles with the same penetrating preservative as base treatment chemical. All piles shall be uniformly spaced along width and depth of building. Variations of ±1' are allowed to address site conditions, provided pile spaces are a minimum of 4 pile diameters unless noted otherwise. (U.N.O.)

Piles are required to have the following capacities:

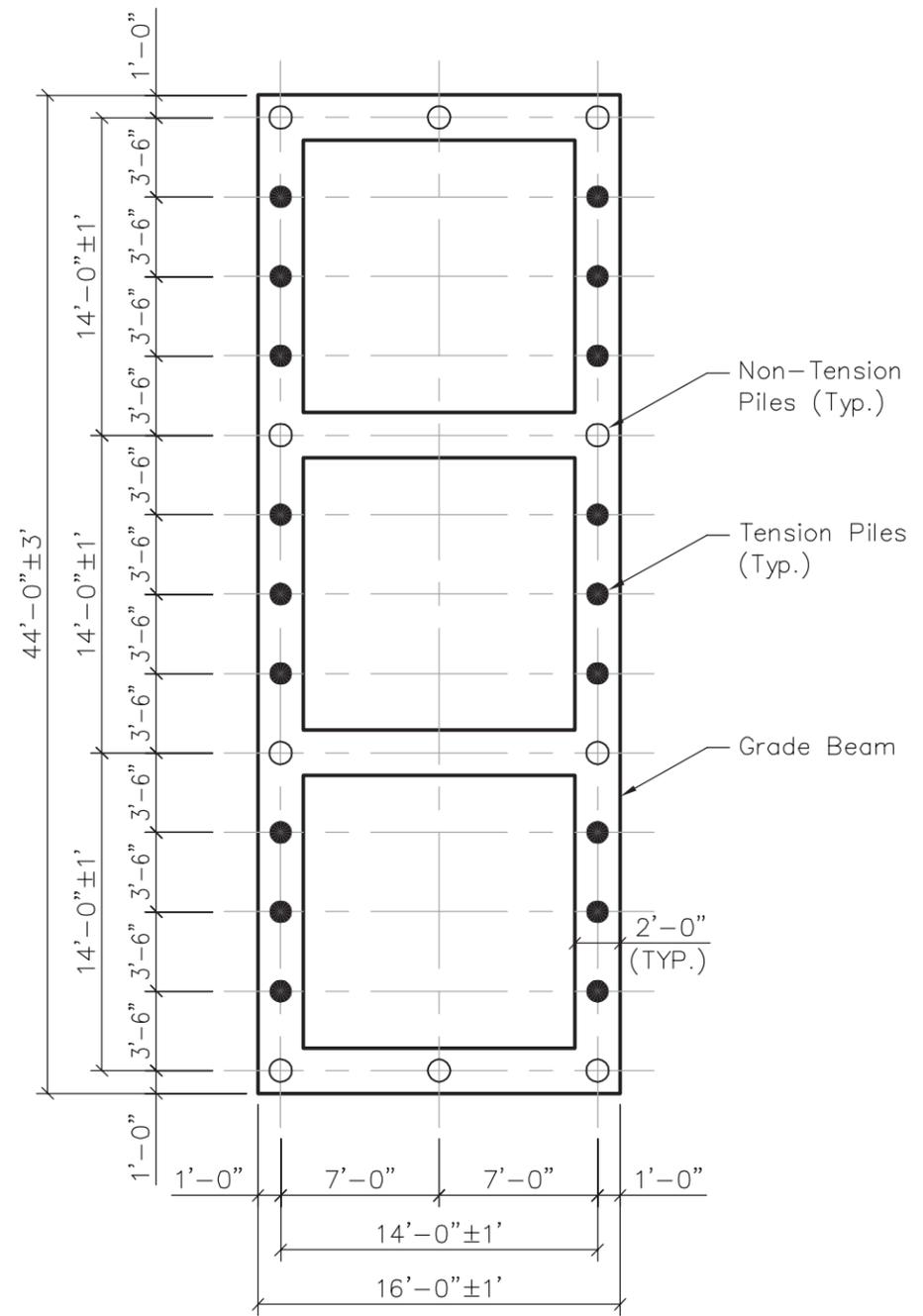
- Compression 14,000 pounds
- Tension 9,300 pounds
- Lateral 4,000 pounds

 FEMA	CASE H	
	General Notes	
	DATE: June 2009	REV. 0
	DWG NO.: H-S-001	SHEET 2 OF 26



3 Bay - 28 Pile Plan

One and Two Story Residences Height $H \leq 10'$.
Wind Speeds ≤ 150 mph



3 Bay - 28 Pile Plan

One and Two Story Residences Height $H \leq 15'$.
Wind Speeds ≤ 150 mph



LEGEND

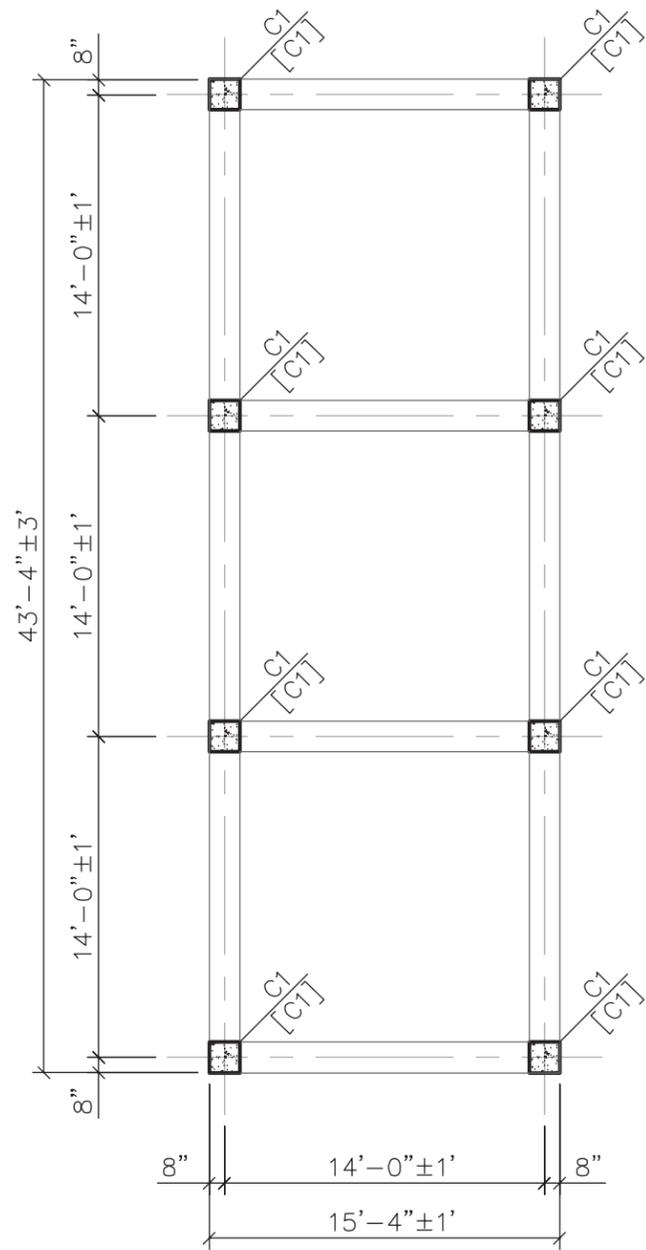
- Tension Pile – See Detail 1, Sheet 25
- Non-Tension Pile – See Detail 2, Sheet 25



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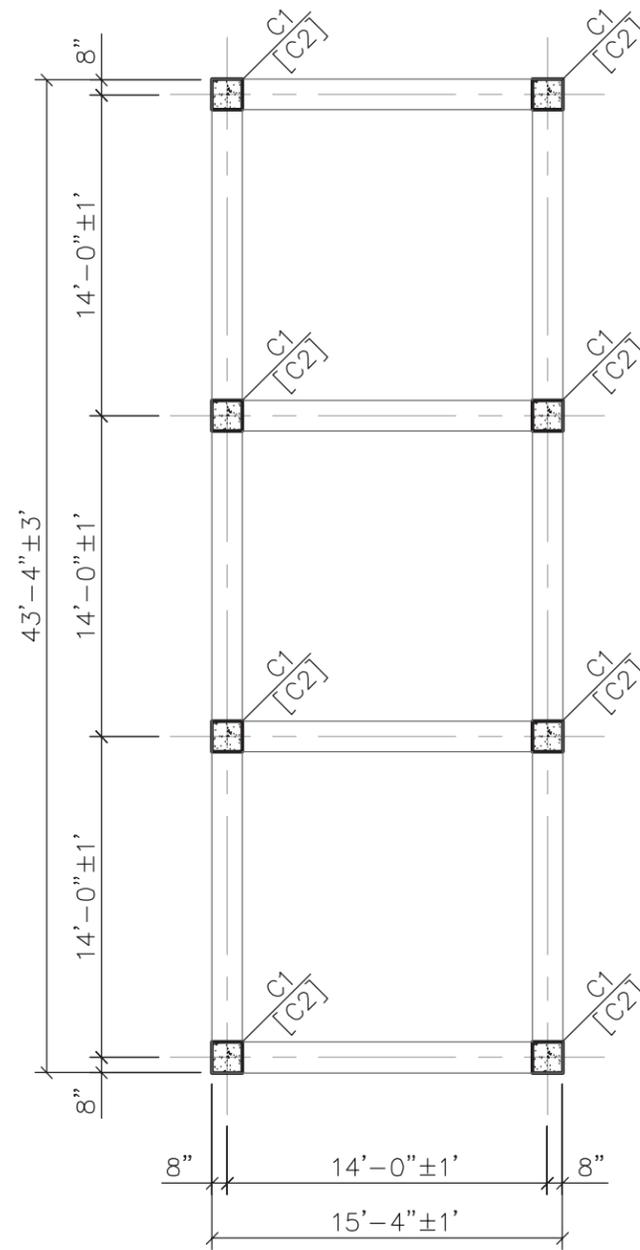
CASE H
Three Bay
Foundation & Pile Plans

DATE: June 2009	
REVISED: ----	REV. 0
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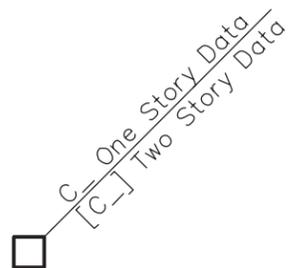
3 Bay - Ground Floor Column Plan

One and Two Story Residences Height $H \leq 10'$.
Wind Speeds ≤ 150 mph



3 Bay - Ground Floor Column Plan

One and Two Story Residences Height $H \leq 15'$.
Wind Speeds ≤ 150 mph



LEGEND

C_ - ONE STORY
[C_] - TWO STORY
See Sheet 23 For Column Details



Information Displayed Above The Tag Line Is To Be Used For One Story Design, Information Displayed Below The Tag Line, Contained In [] Square Brackets, Is To Be Used For Two Story Design.

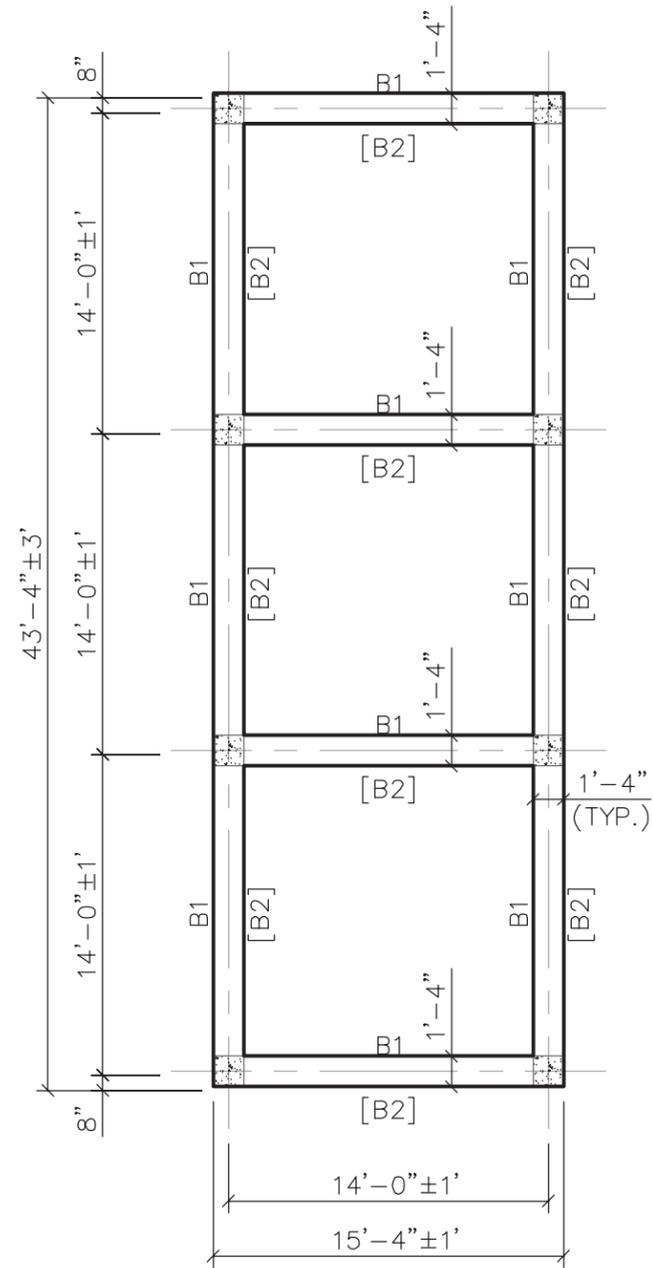


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CASE H

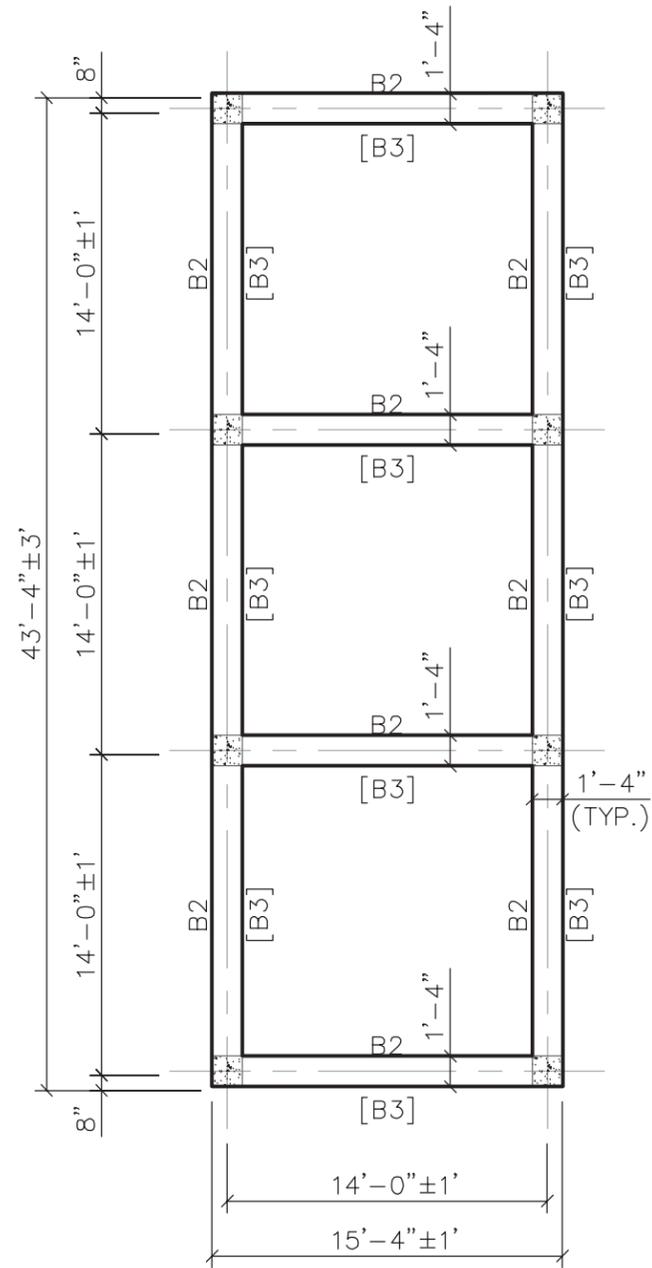
**Three Bay
Ground Floor Column Plans**

DATE: June 2009	
REVISED: ----	REV. 0
DWG NO.: H-S3-102	SHEET 4 OF 26



3 Bay - First Floor Reinforced Concrete Beam Framing Plan

One and Two Story Residences Height $H \leq 10'$.
Wind Speeds ≤ 150 mph



3 Bay - First Floor Reinforced Concrete Beam Framing Plan

One and Two Story Residences Height $H \leq 15'$.
Wind Speeds ≤ 150 mph



LEGEND

B_ - ONE STORY
[B_] - TWO STORY
See Sheet 23 For Beam Details



FEMA

CASE H

Three Bay First Floor Framing Plans

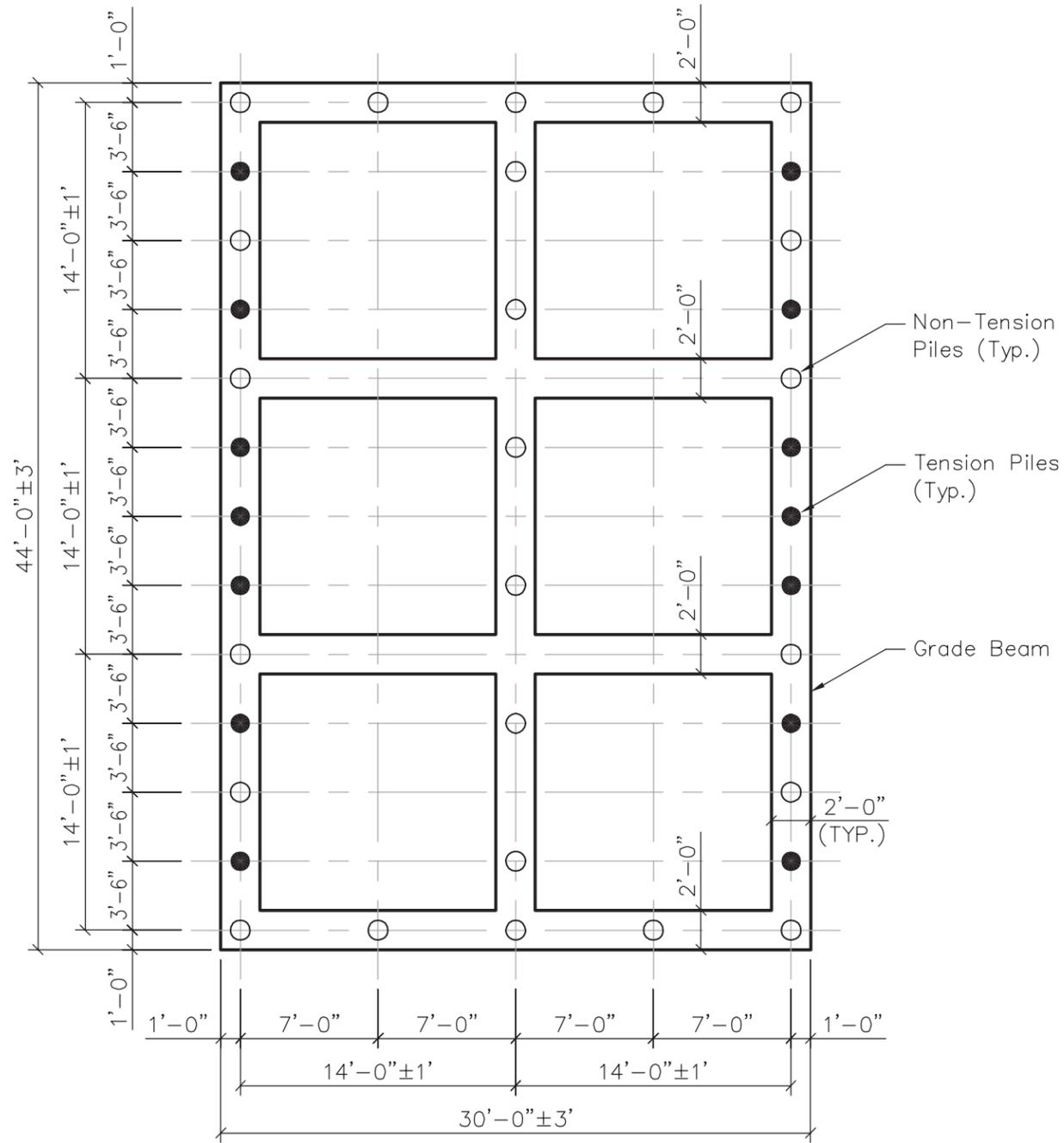
DATE: **June 2009**

REVISED: ----

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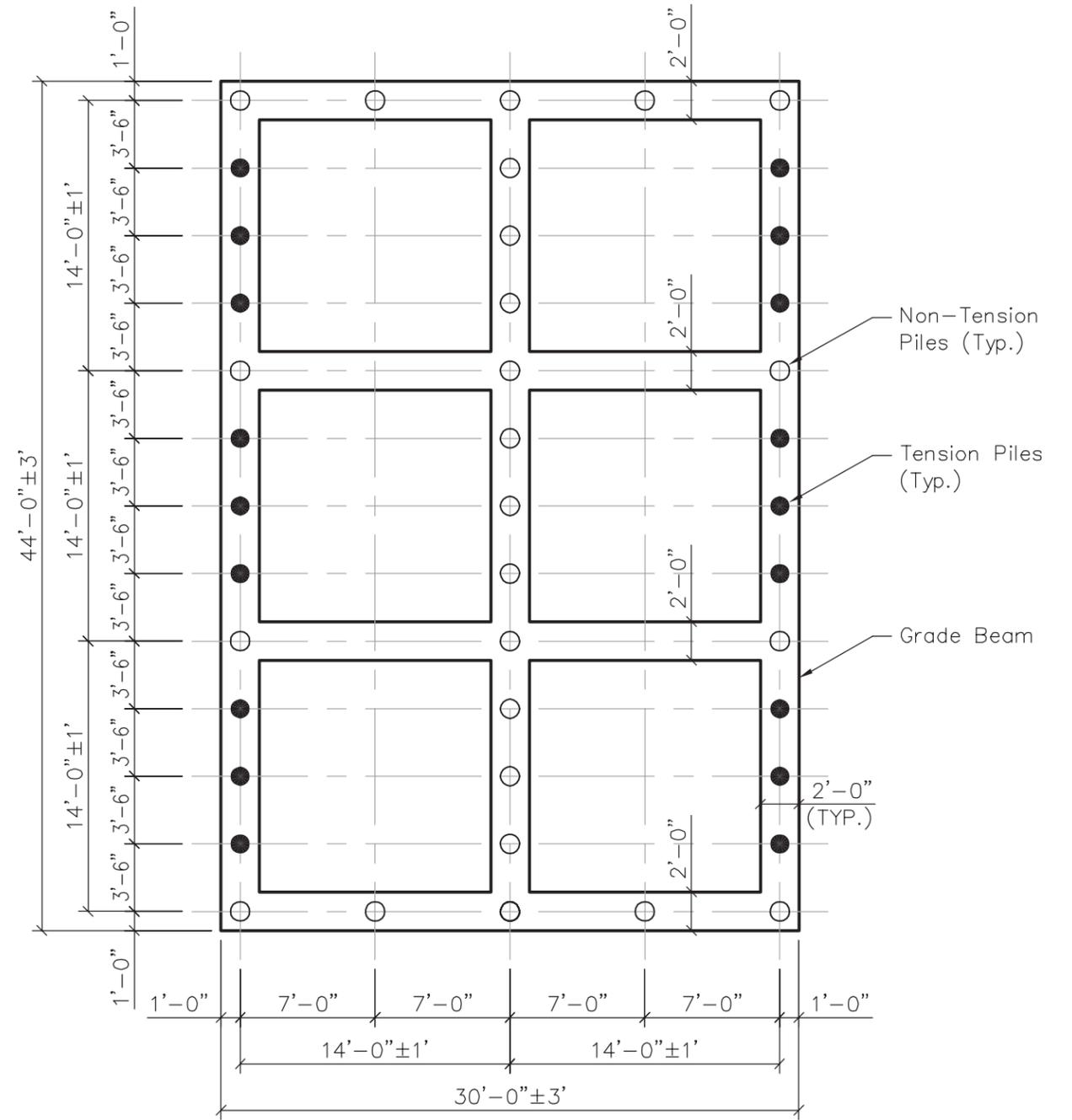
DWG NO.: **H-S3-103**

SHEET **5** OF **26**



6 Bay - 38 Pile Plan

One and Two Story Residences Height $H \leq 10'$.
Wind Speeds ≤ 150 mph



6 Bay - 43 Pile Plan

One and Two Story Residences Height $H \leq 15'$.
Wind Speeds ≤ 150 mph



LEGEND

- Tension Pile – See Detail 1, Sheet 25
- Non-Tension Pile – See Detail 2, Sheet 25

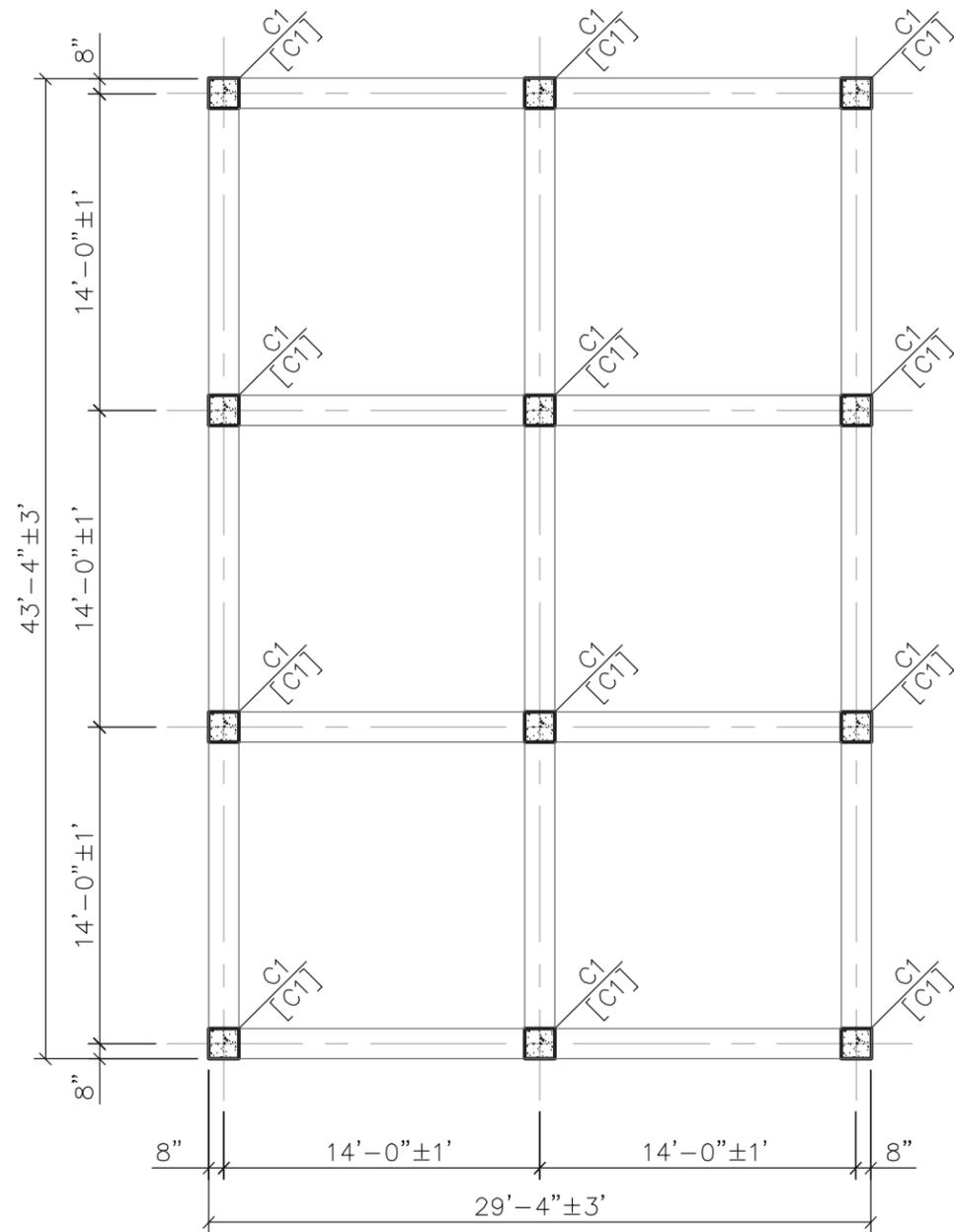


FEMA

CASE H

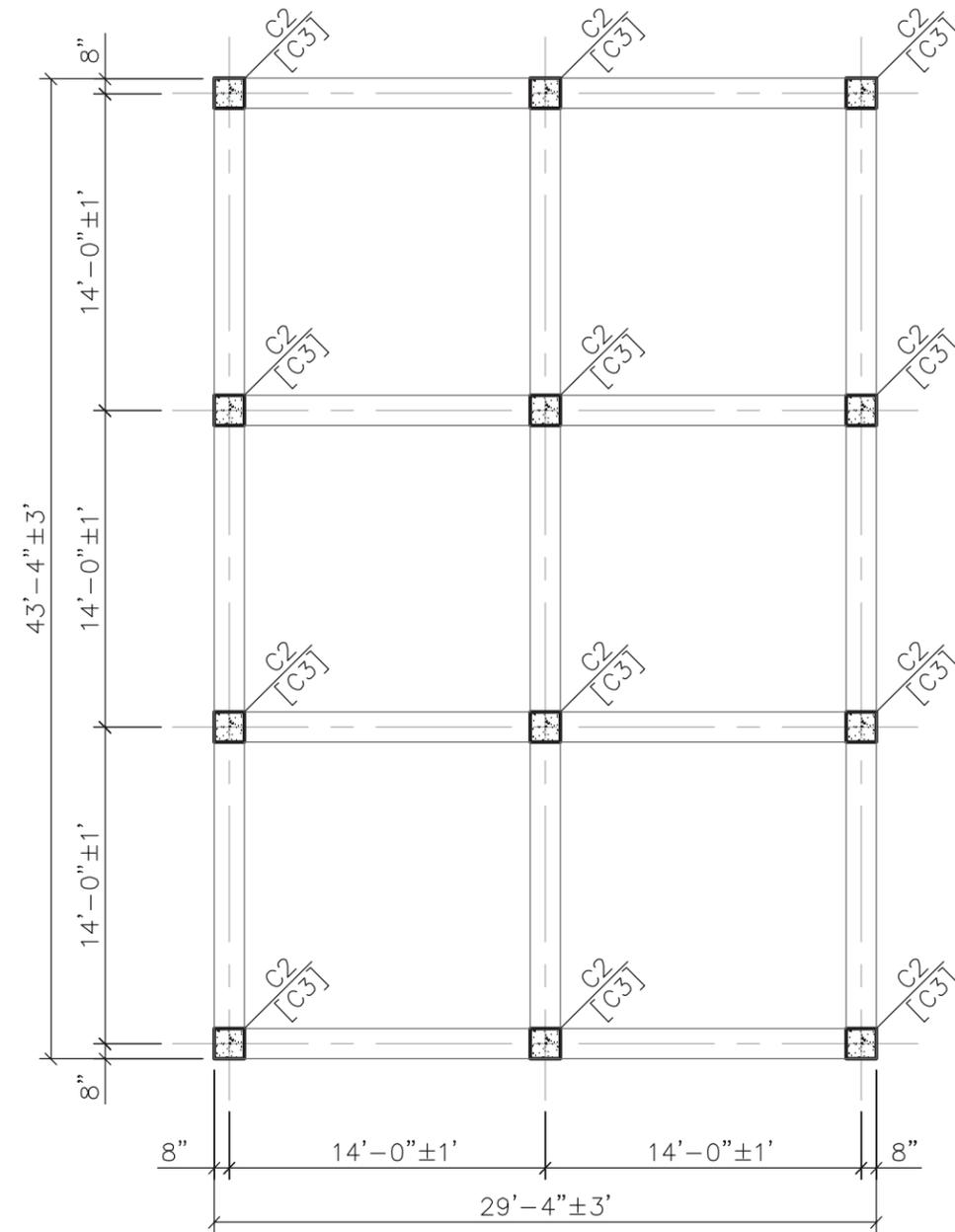
**Six Bay
Foundation & Pile Plans**

DATE: June 2009	
REVISED: ----	REV. 0
DWG NO.: H-S6-101	SHEET 6 OF 26



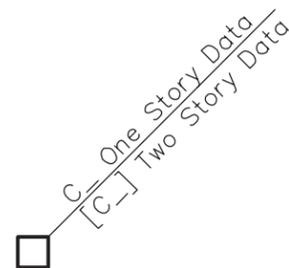
6 Bay - Ground Floor Column Plan

One and Two Story Residences Height $H \leq 10'$.
Wind Speeds ≤ 150 mph



6 Bay - Ground Floor Column Plan

One and Two Story Residences Height $H \leq 15'$.
Wind Speeds ≤ 150 mph



LEGEND

C_ - ONE STORY
[C_] - TWO STORY
See Sheet 23 For Column Details



Information Displayed Above The Tag Line Is To Be Used For One Story Design, Information Displayed Below The Tag Line, Contained In [] Square Brackets, Is To Be Used For Two Story Design.

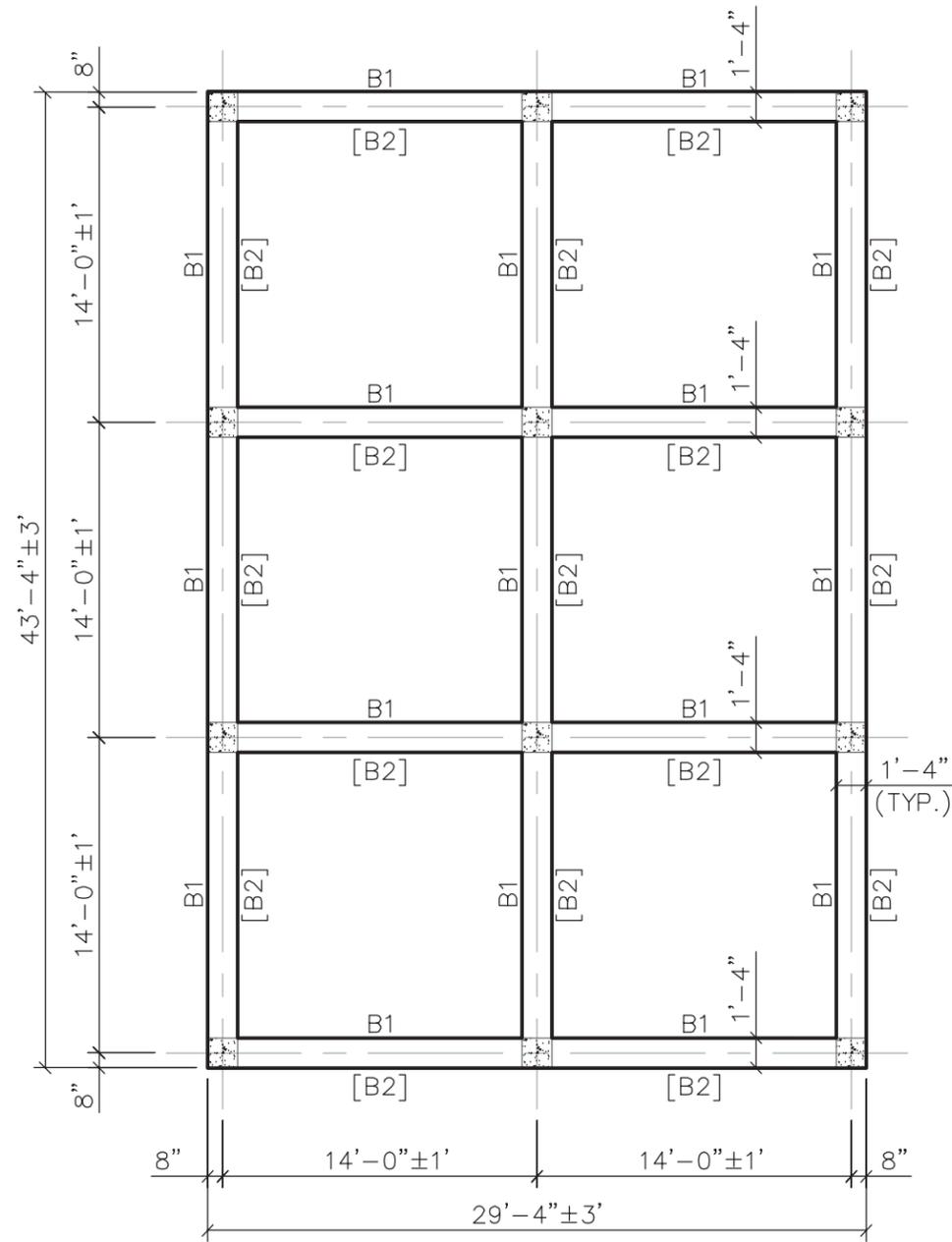


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CASE H

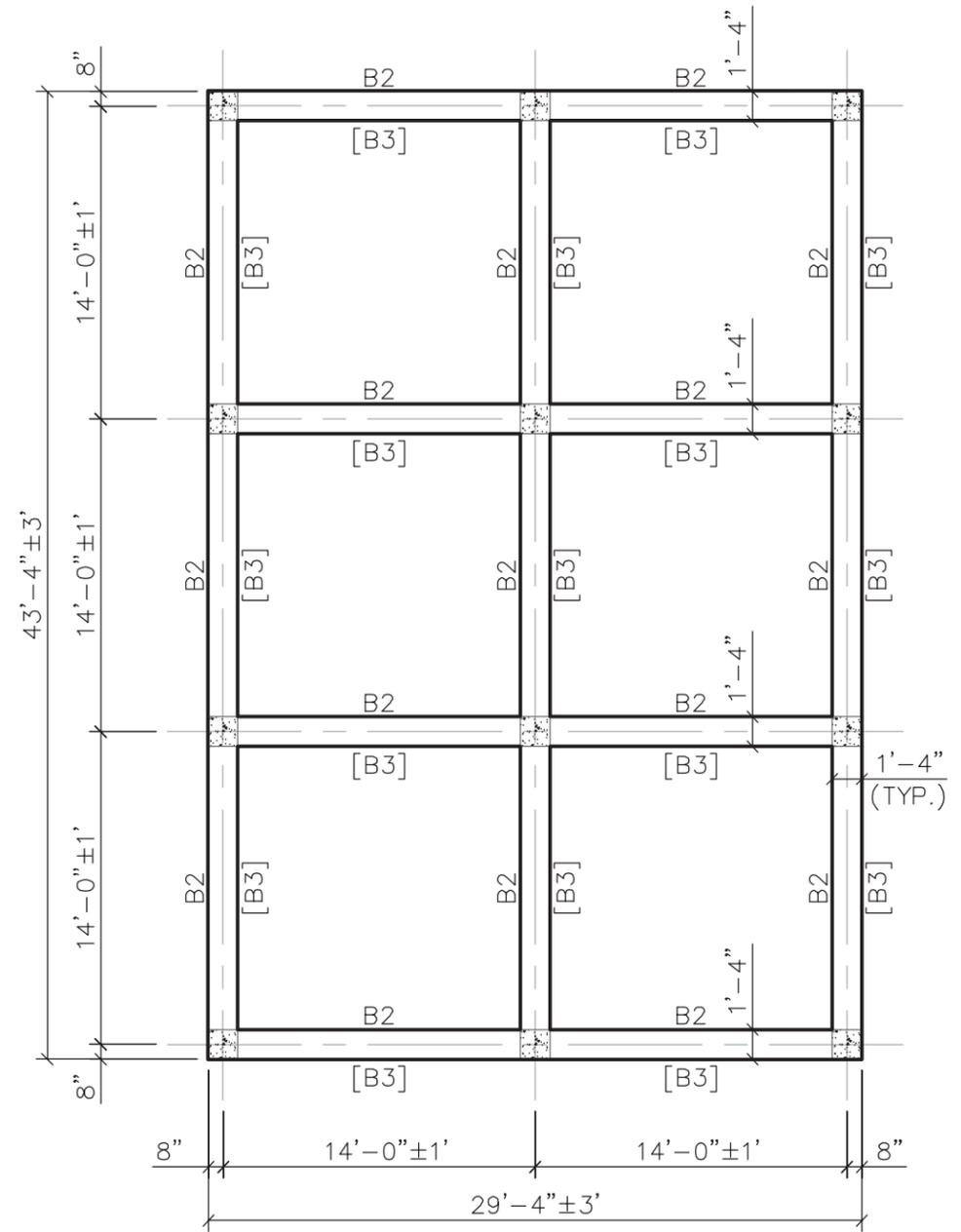
**Six Bay
Ground Floor Column Plans**

DATE: June 2009	
REVISED: ----	REV. 0
DWG NO.: H-S6-102	SHEET 7 OF 26



6 Bay - First Floor Reinforced Concrete Beam Framing Plan

One and Two Story Residences Height H ≤ 10'.
Wind Speeds ≤ 150 mph



6 Bay - First Floor Reinforced Concrete Beam Framing Plan

One and Two Story Residences Height H ≤ 15'.
Wind Speeds ≤ 150 mph



LEGEND

B_ - ONE STORY
[B_] - TWO STORY
See Sheet 23 For Beam Details



FEMA

CASE H

Six Bay First Floor Framing Plans

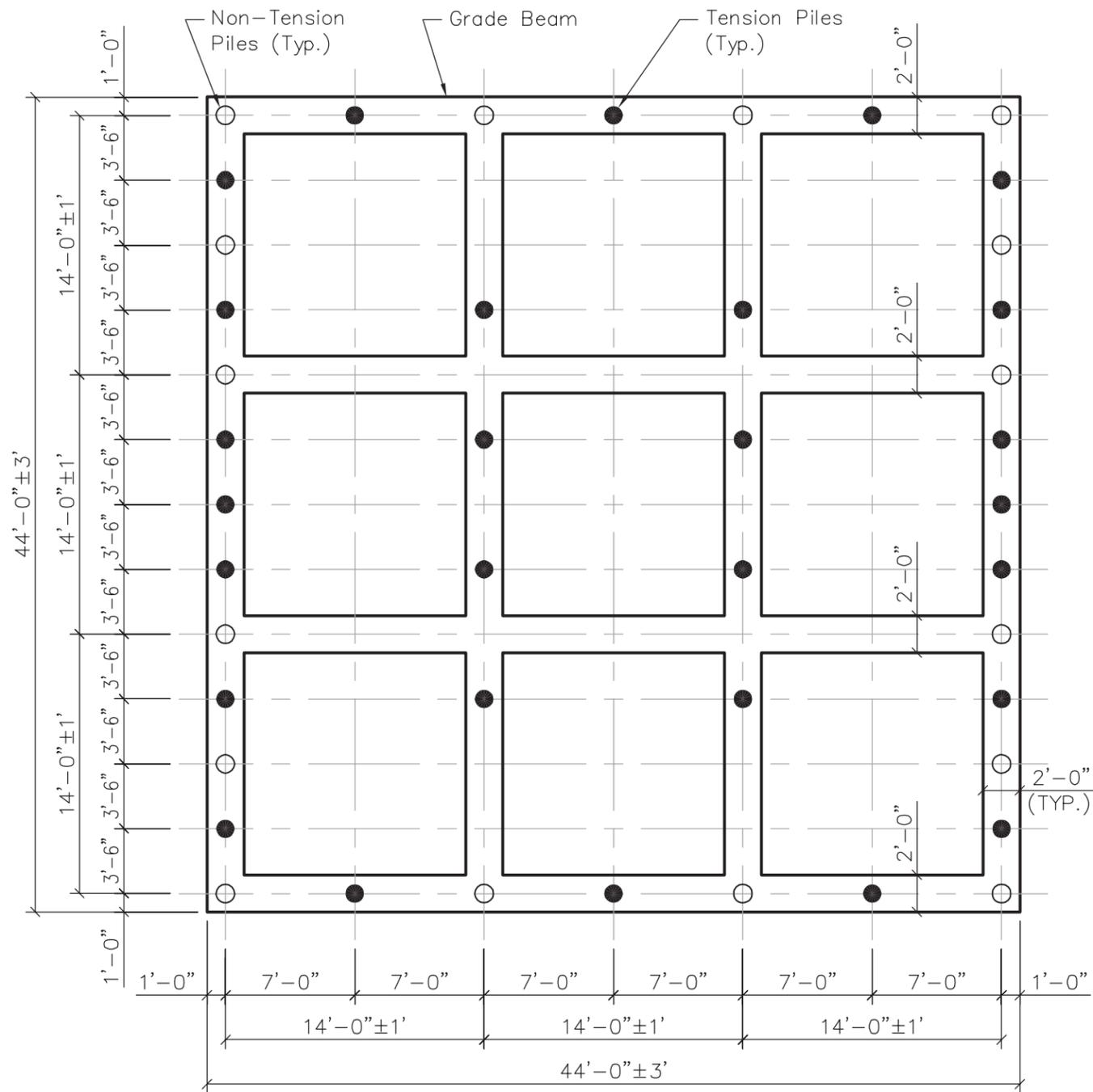
DATE: **June 2009**

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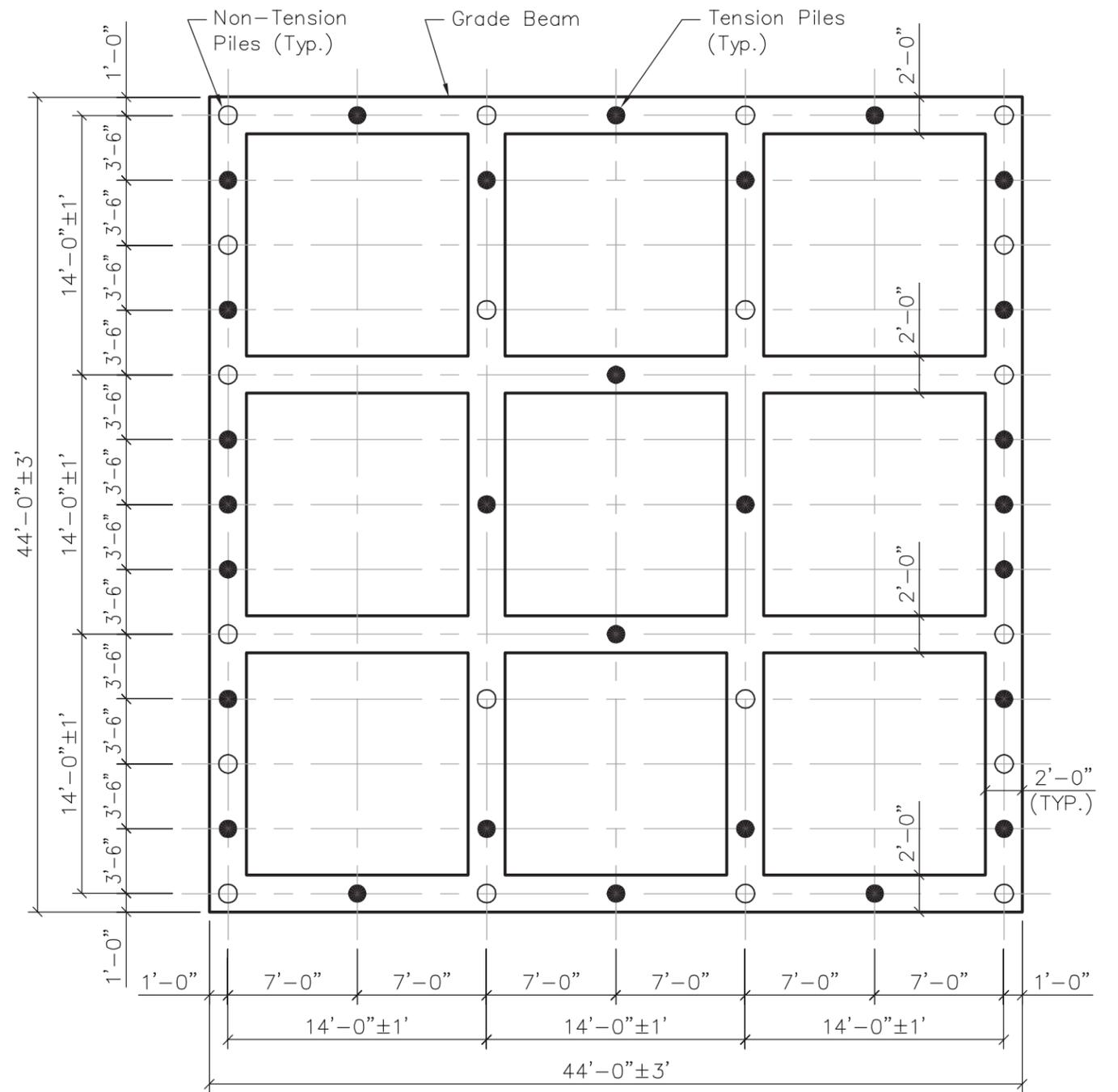
DWG NO.: **H-S6-103**

SHEET **8** OF **26**



9 Bay - 44 Pile Plan

One and Two Story Residences Height H ≤ 10'.
Wind Speeds ≤ 150 mph



9 Bay - 48 Pile Plan

One and Two Story Residences Height H ≤ 15'.
Wind Speeds ≤ 150 mph



LEGEND

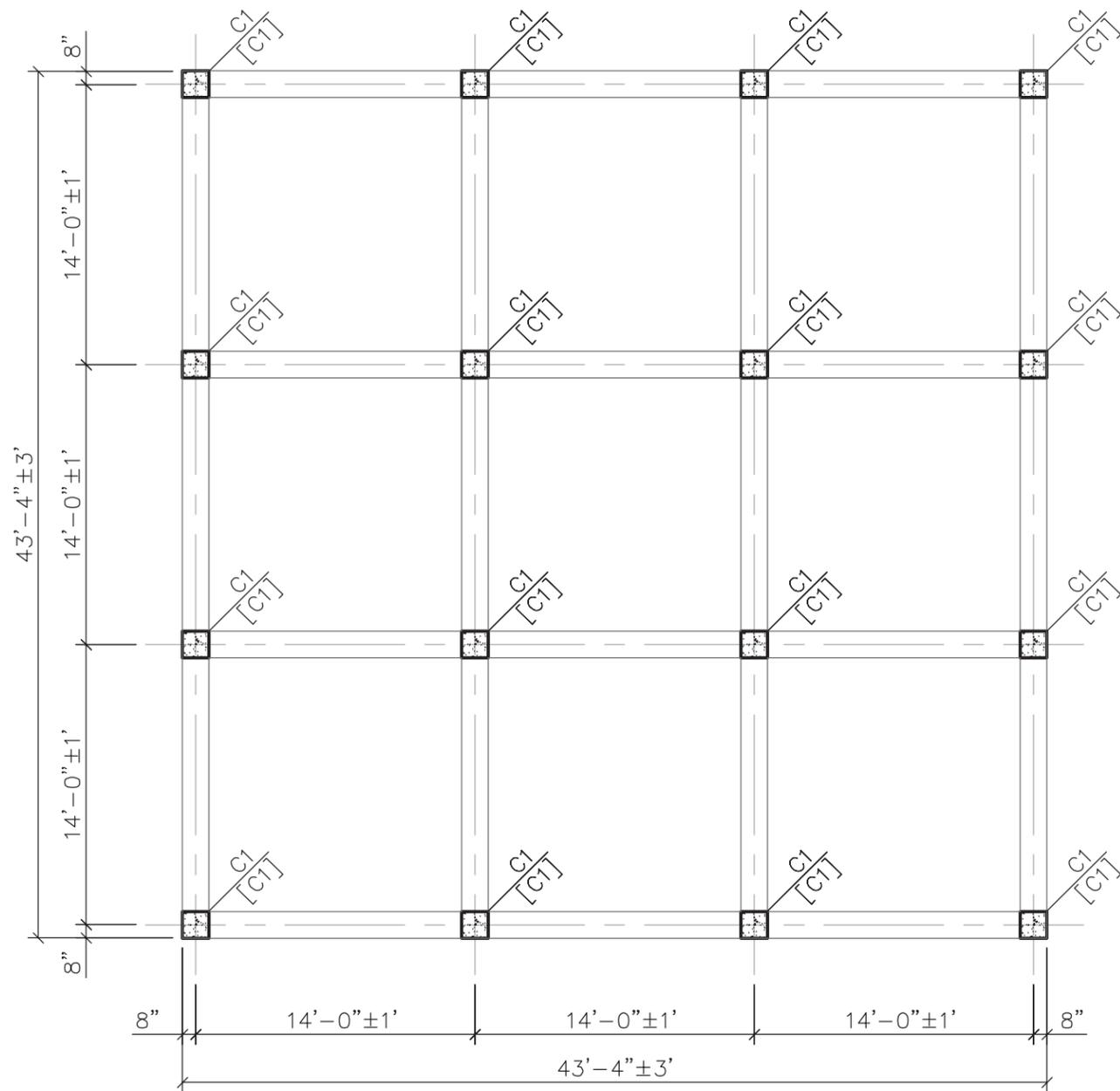
- Tension Pile – See Detail 1, Sheet 25
- Non-Tension Pile – See Detail 2, Sheet 25



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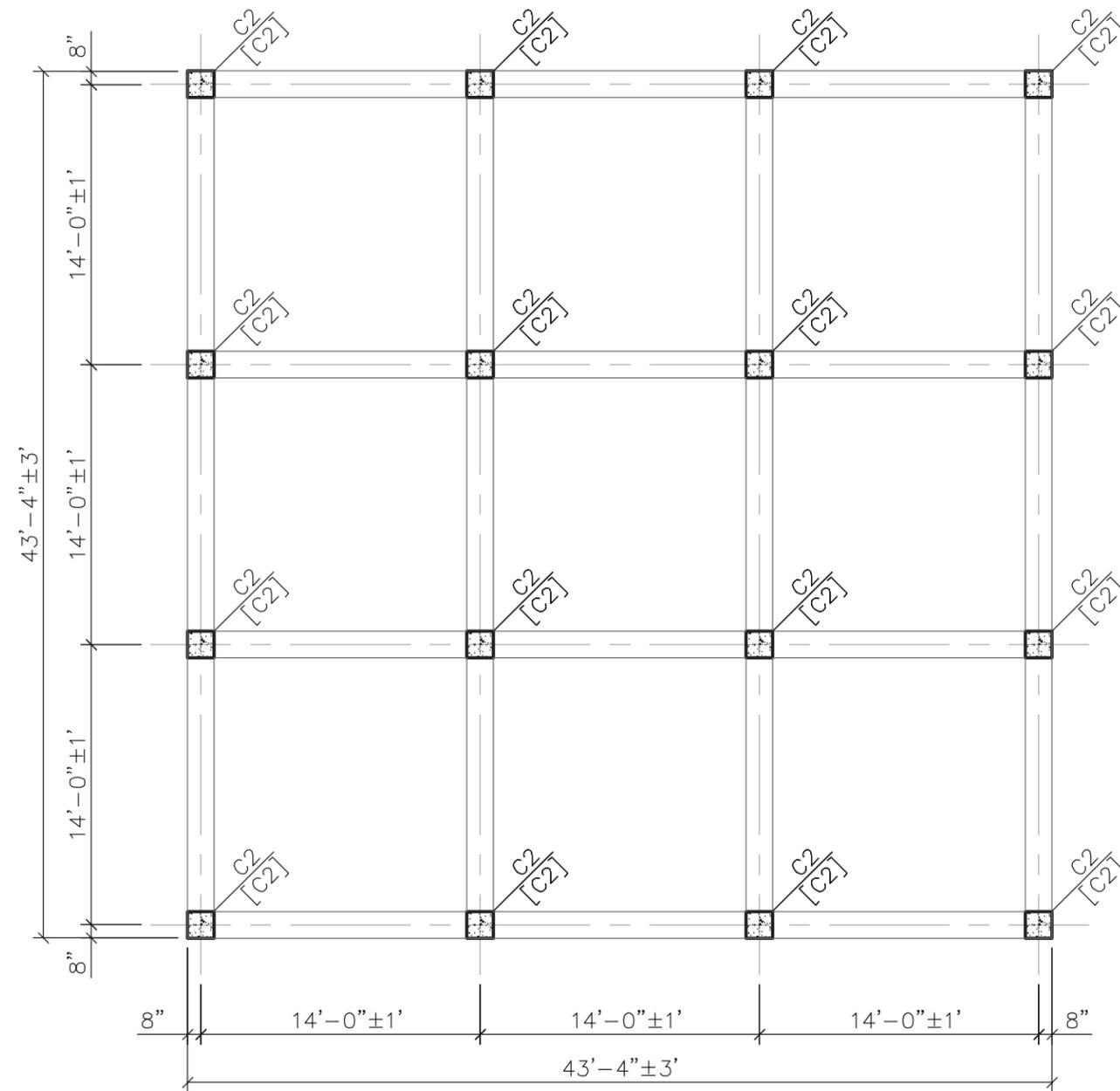
CASE H
Nine Bay
Foundation & Pile Plans

DATE: June 2009	
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DWG NO.: H-S9-101	SHEET 9 26



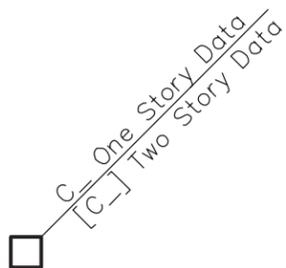
9 Bay - Ground Floor Column Plan

One and Two Story Residences Height $H \leq 10'$.
Wind Speeds ≤ 150 mph



9 Bay - Ground Floor Column Plan

One and Two Story Residences Height $H \leq 15'$.
Wind Speeds ≤ 150 mph



LEGEND

C_ - ONE STORY
[C_] - TWO STORY
See Sheet 23 For Column Details

Information Displayed Above The Tag Line Is To Be Used For One Story Design, Information Displayed Below The Tag Line, Contained In [] Square Brackets, Is To Be Used For Two Story Design.

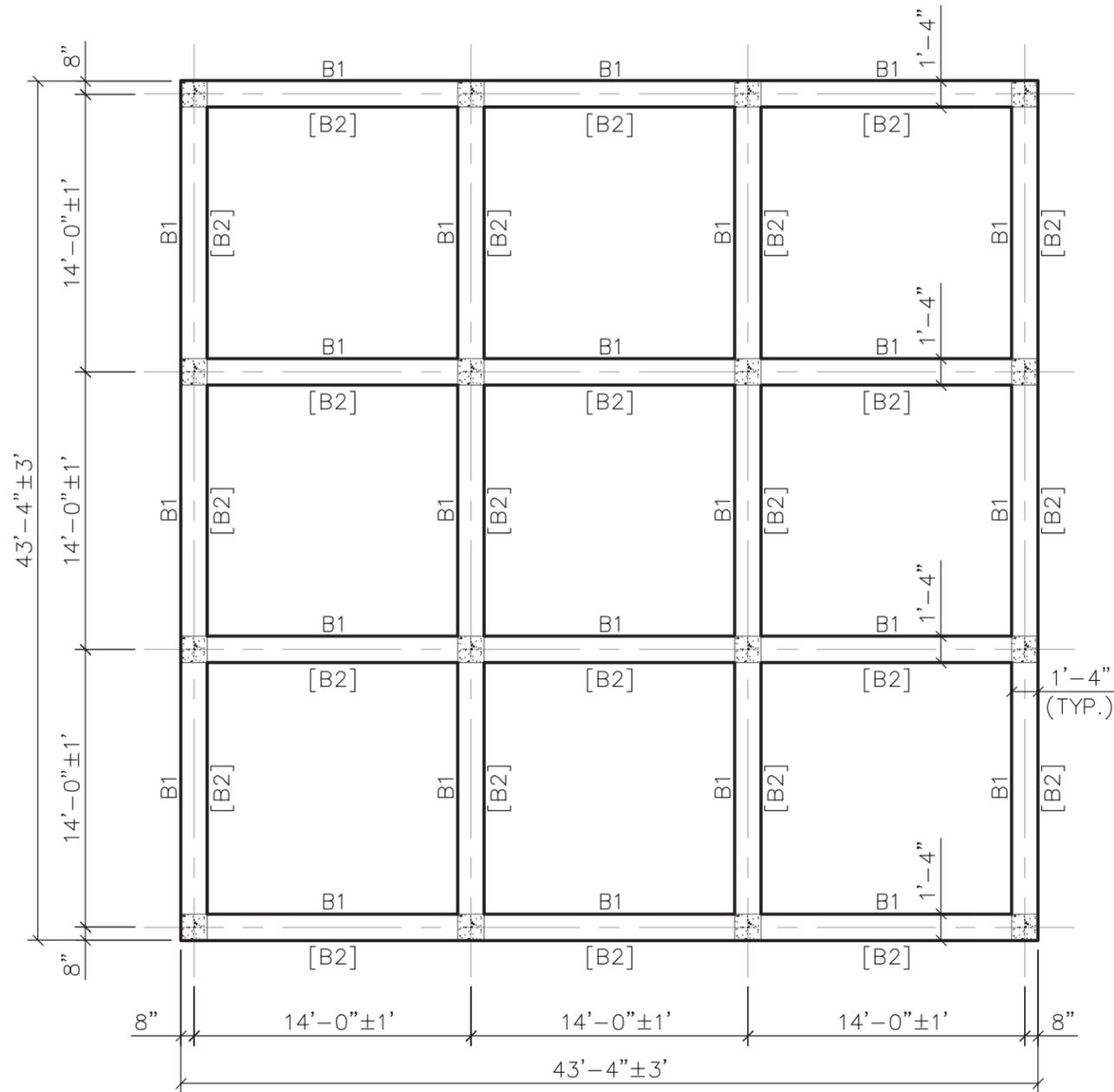


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CASE H

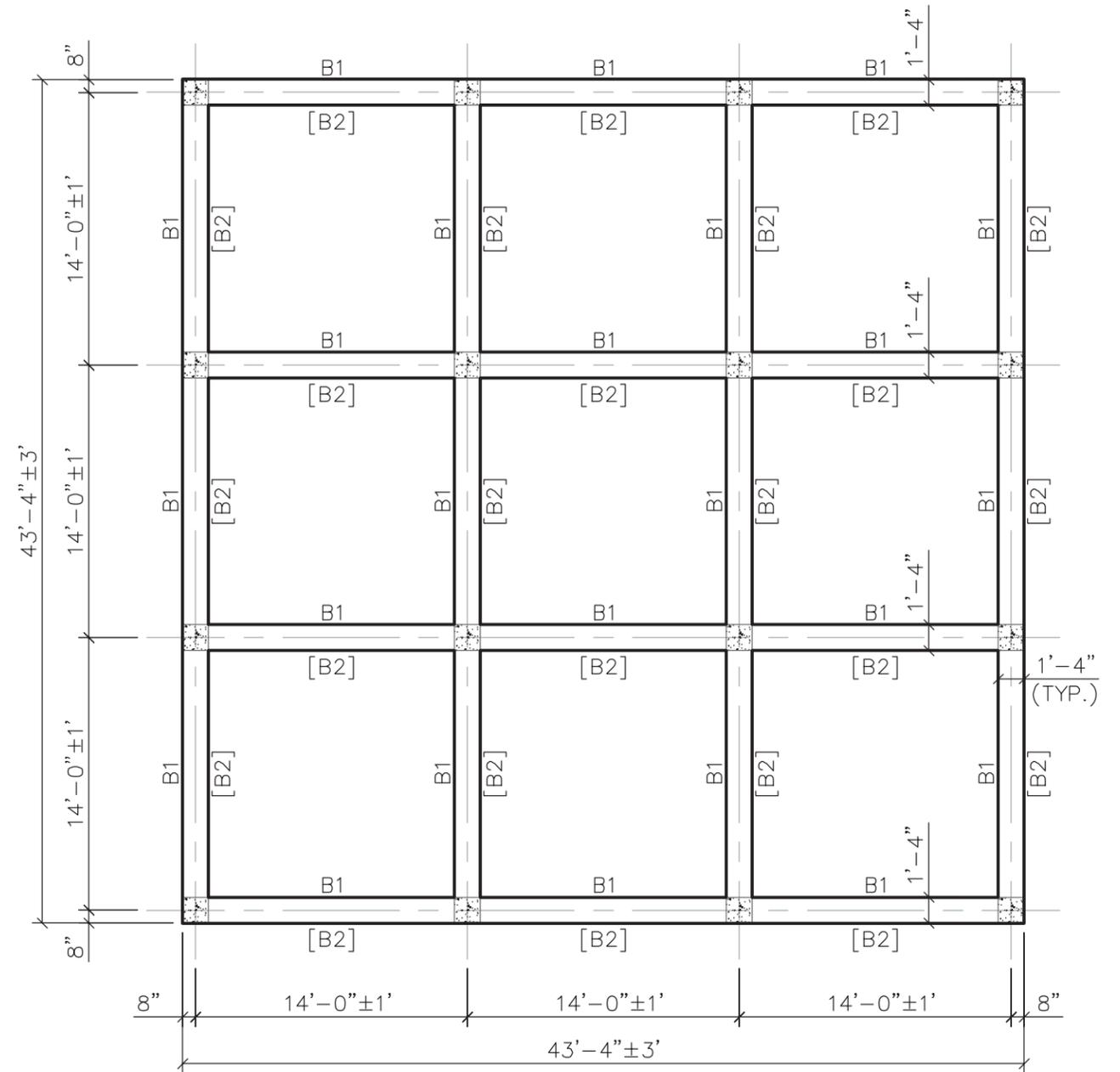
**Nine Bay
Ground Floor Column Plans**

DATE: June 2009	
REVISED: ----	REV. 0
DWG NO.: H-S9-102	SHEET 10 OF 26



9 Bay - First Floor Reinforced Concrete Beam Framing Plan

One and Two Story Residences Height $H \leq 10'$.
Wind Speeds ≤ 150 mph



9 Bay - First Floor Reinforced Concrete Beam Framing Plan

One and Two Story Residences Height $H \leq 15'$.
Wind Speeds ≤ 150 mph



LEGEND

B_ - ONE STORY
[B_] - TWO STORY
See Sheet 23 For Beam Details



FEMA

CASE H

Nine Bay First Floor Framing Plans

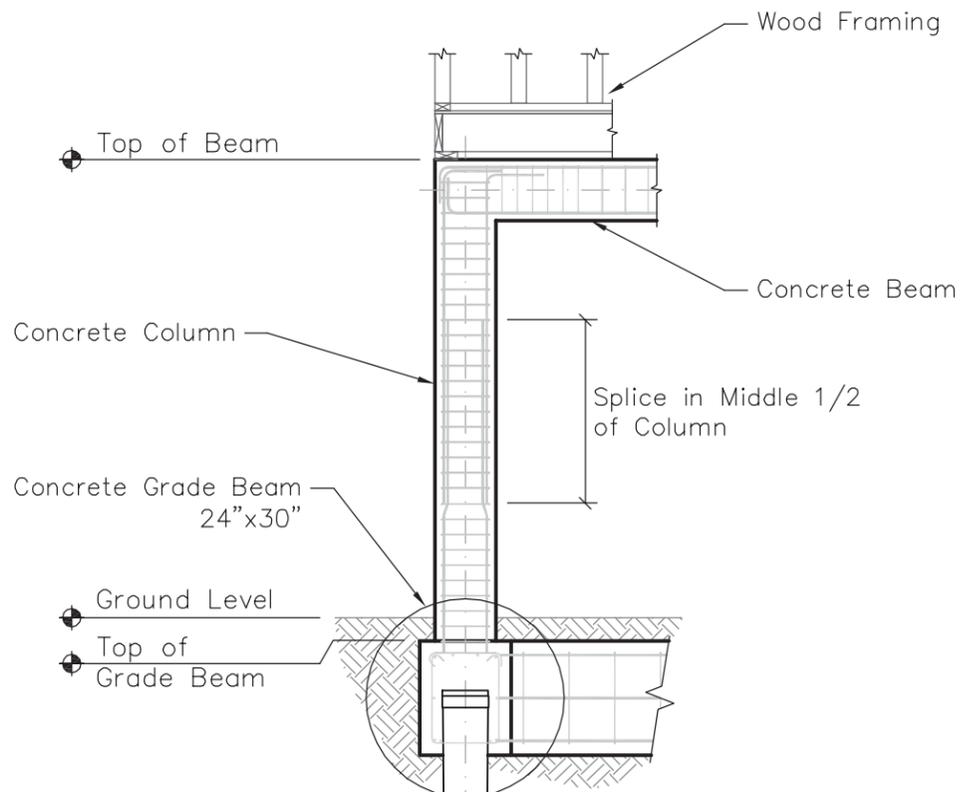
DATE: **June 2009**

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REV. **0**

DWG NO.: **H-S9-103**

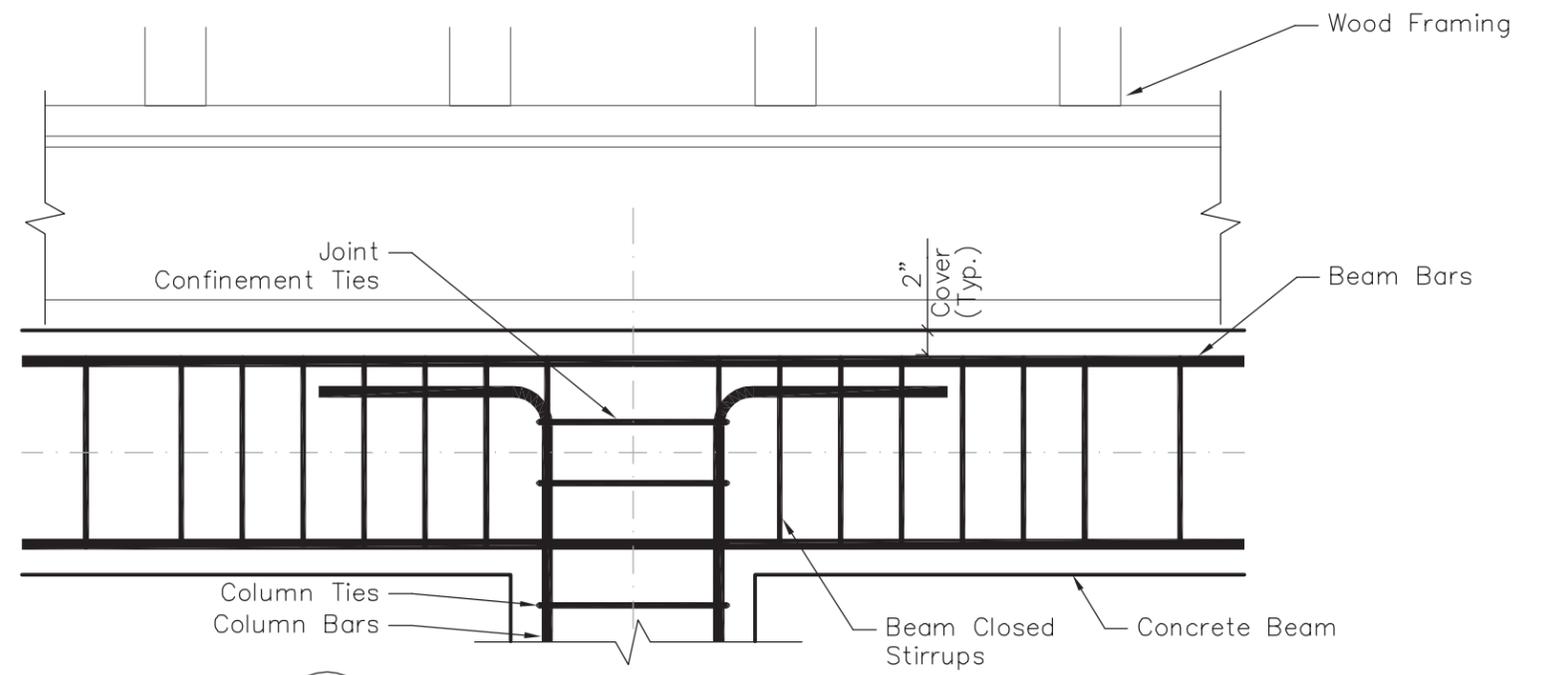
SHEET **11** OF **26**



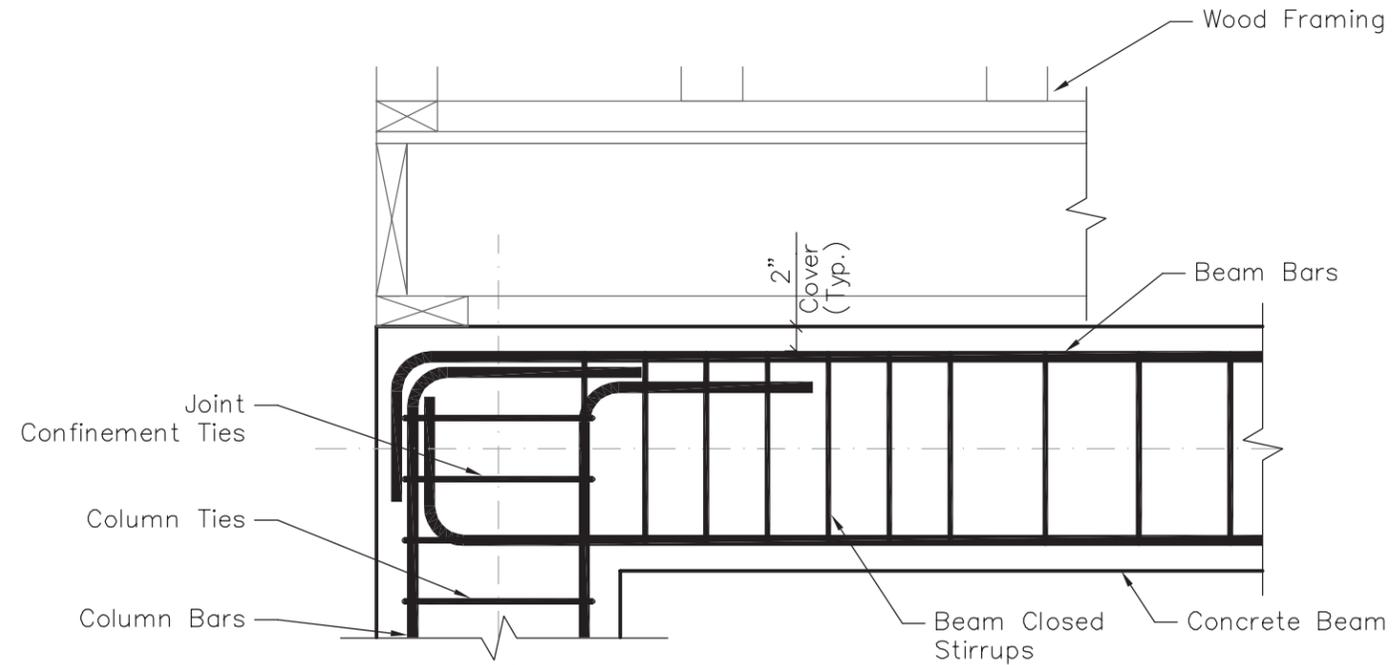
Treated Timber Pile
 ASTM-D25 8" Tip 12" Butt
 Length Per Geotechnical
 Engineer

Bottom of Pile
 EL (-) 25'-0" Min.

1 Concrete Column / Driven Treated Timber Pile
 H-S-201
 0 1' 2' 4'
 0 12" 24" 48"

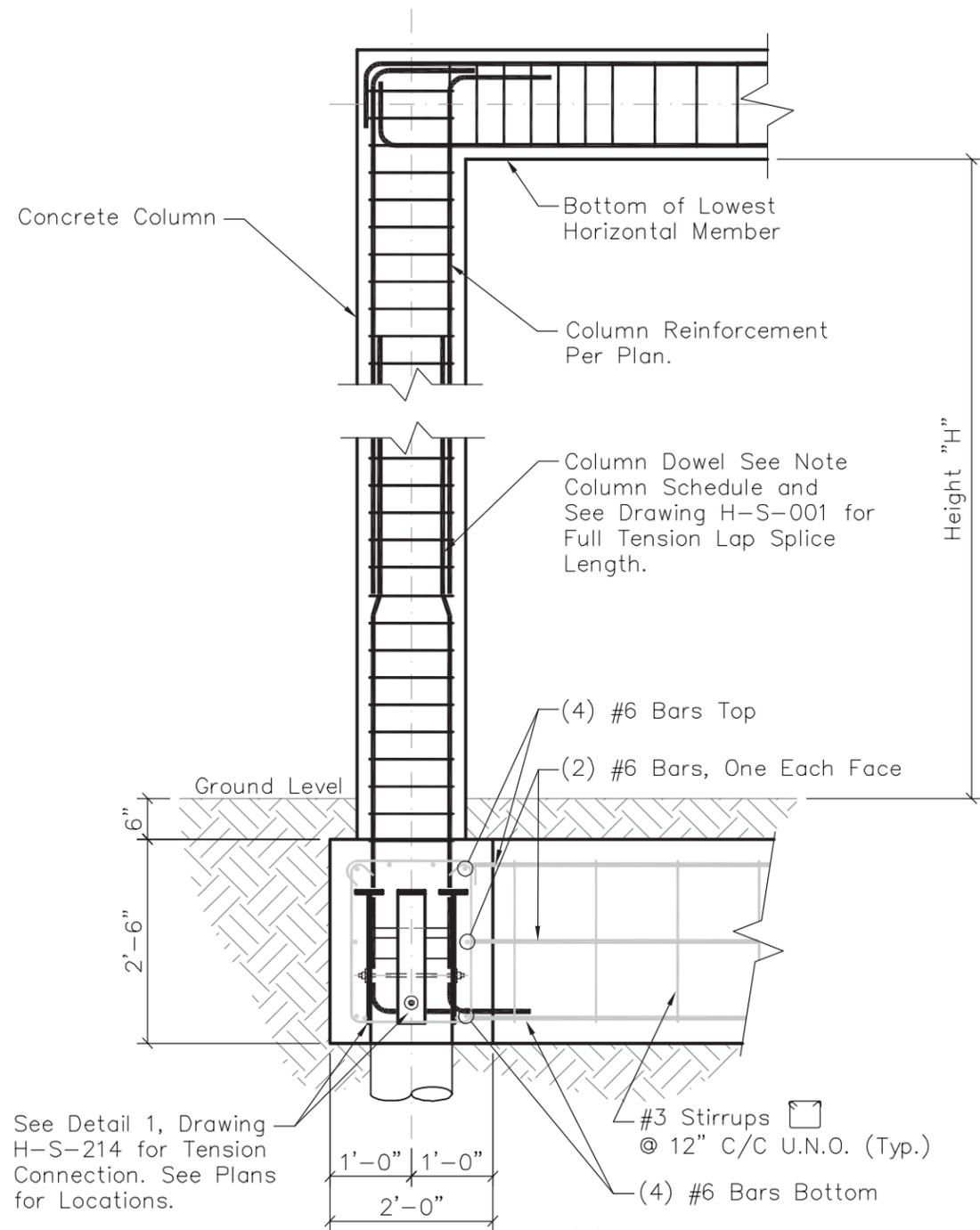


2 Typical Interior Joint Reinforcement
 H-S-201
 0 .25' .5' 1'
 0 3" 6" 12"
 4" Spacing Within 2'-0" Of Joint
 6" In The Field



3 Typical Exterior Joint Reinforcement
 H-S-201
 0 .25' .5' 1'
 0 3" 6" 12"
 4" Spacing Within 2'-0" Of Joint
 6" In The Field

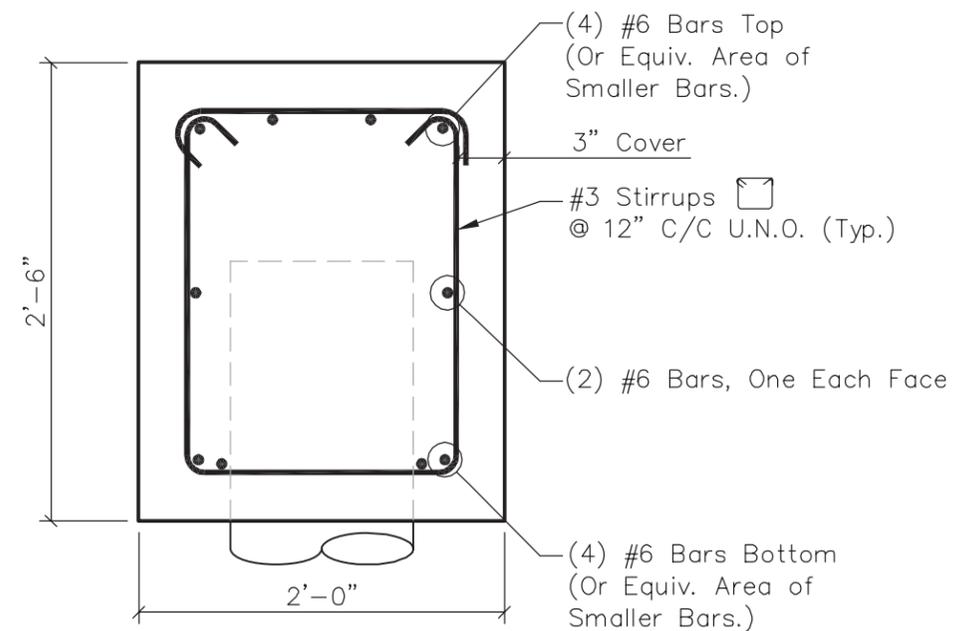
 FEMA	CASE H	
	Building Details	
	DATE: June 2009	REV. 0
	DWG NO.: H-S-201	SHEET 12 OF 26



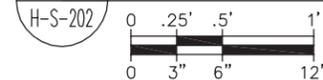
See Detail 1, Drawing H-S-214 for Tension Connection. See Plans for Locations.

Note
 Continuous reinforcing top and bottom. Use longest bar lengths practical. Place top bar splices at quarter point of span and bottom bar splices at columns.

1 Column & Grade Beam Section
 H-S-202



2 Grade Beam Section



FEMA

CASE H

Building Details

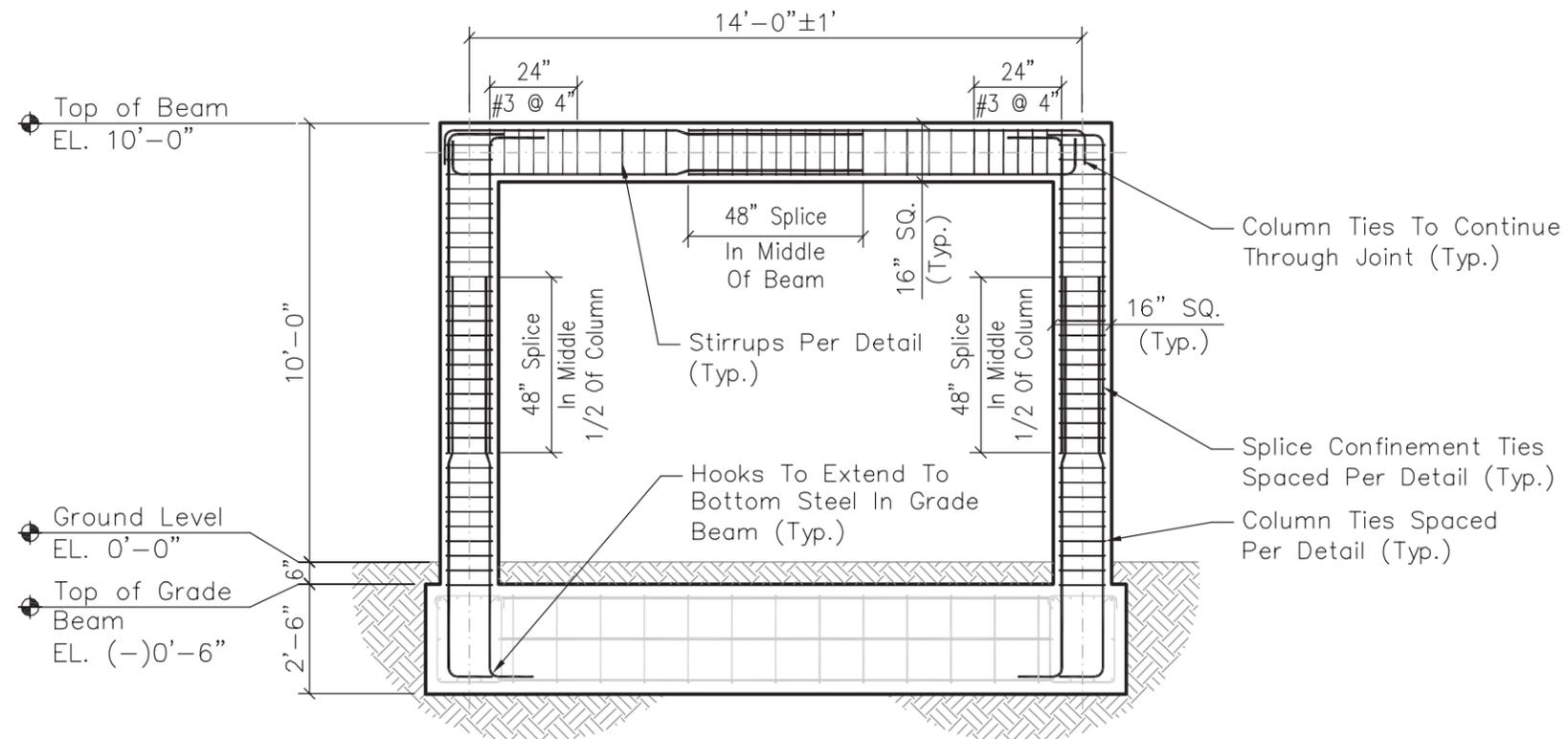
DATE: **June 2009**

REVISED: ----

REV. **0**

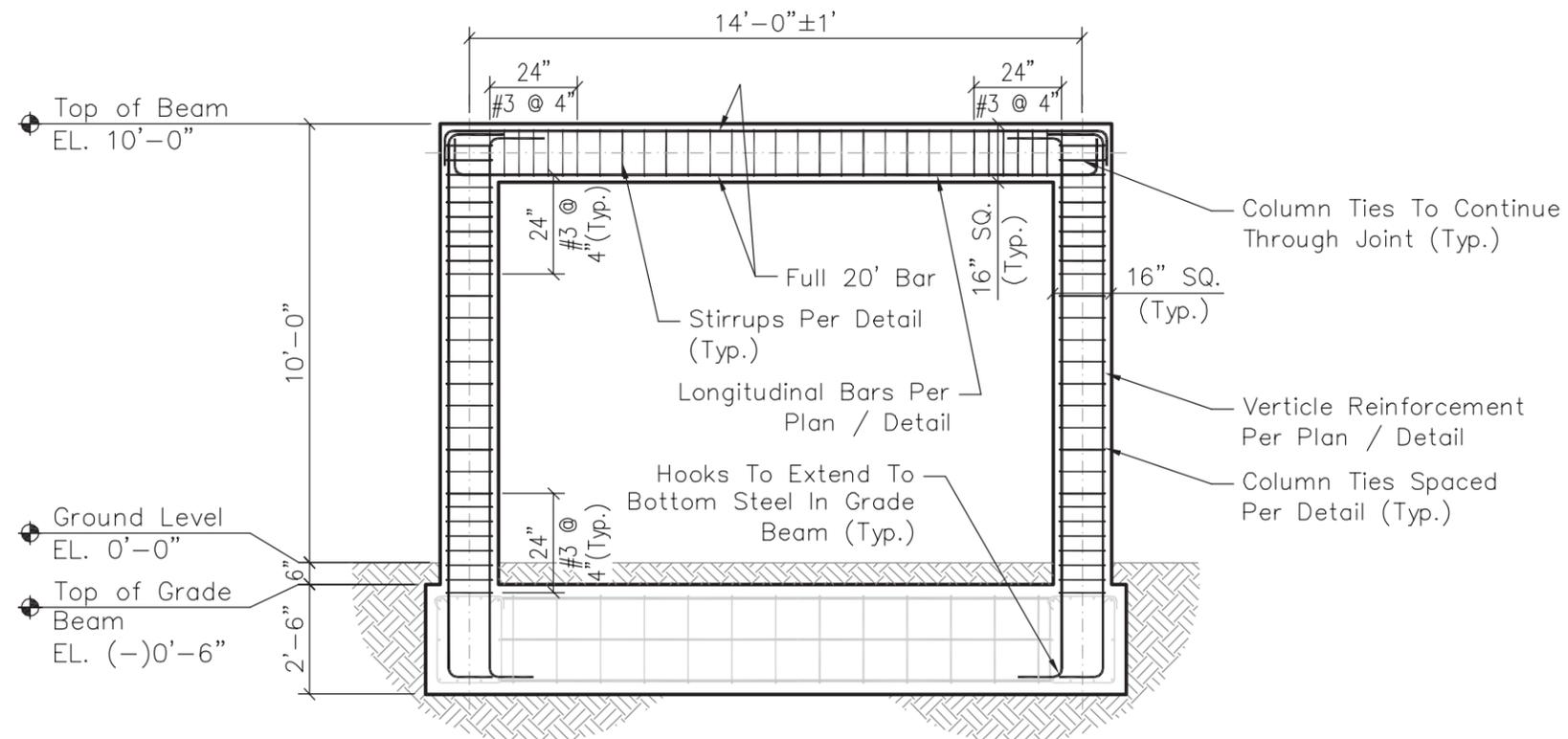
DWG NO.: **H-S-202**

SHEET **13** OF **26**



Three Bay 10 Foot High System With Spliced Bars

Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



Three Bay 10 Foot High System With Minimal Splices

Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



FEMA

CASE H

**Three Bay
10 Foot High Systems**

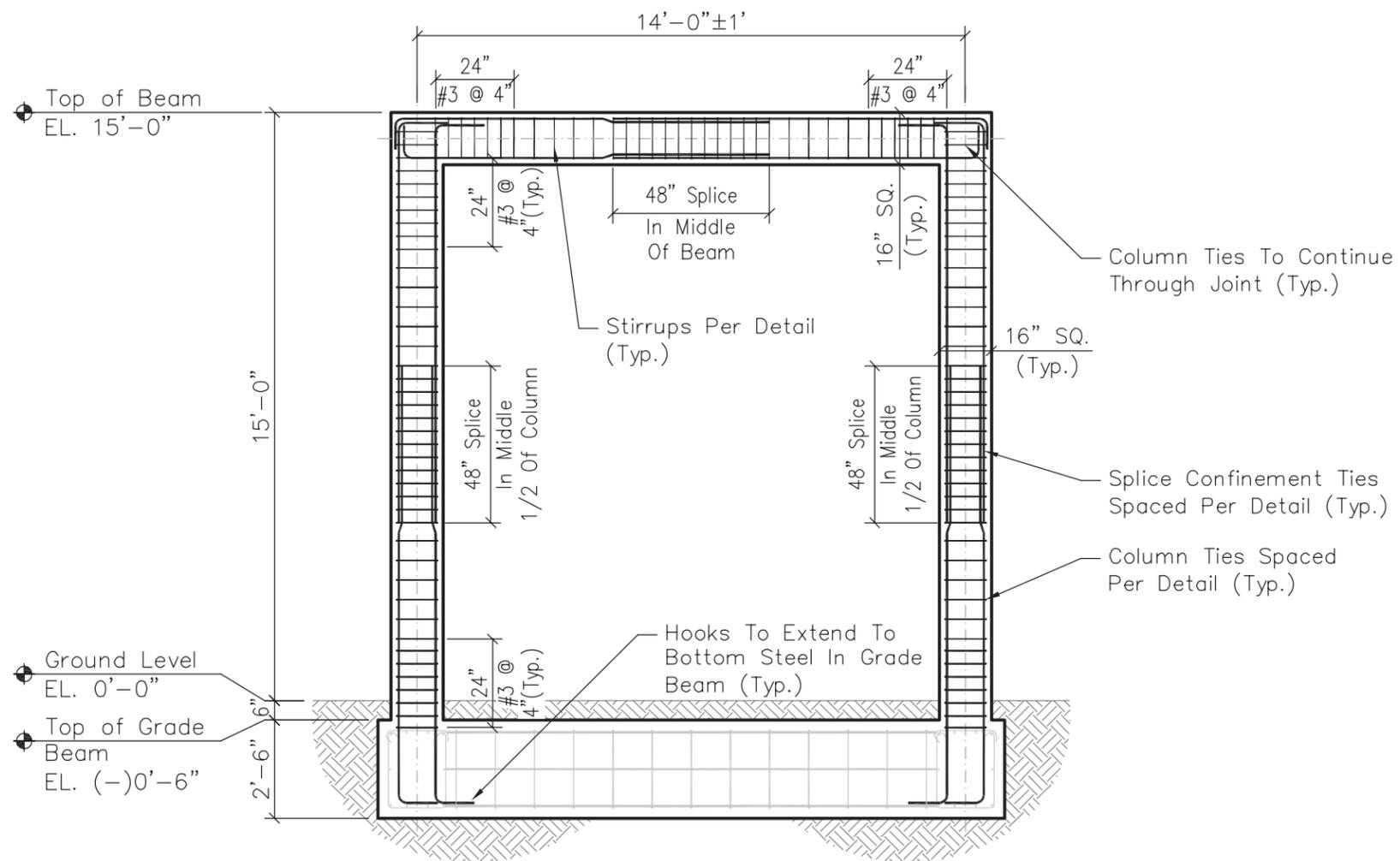
DATE: **June 2009**

REVISED: ----

REV. **0**

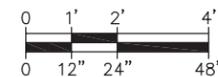
DWG NO.: **H-S-203**

SHEET **14** OF **26**



Three Bay 15 Foot High System With Spliced Bars

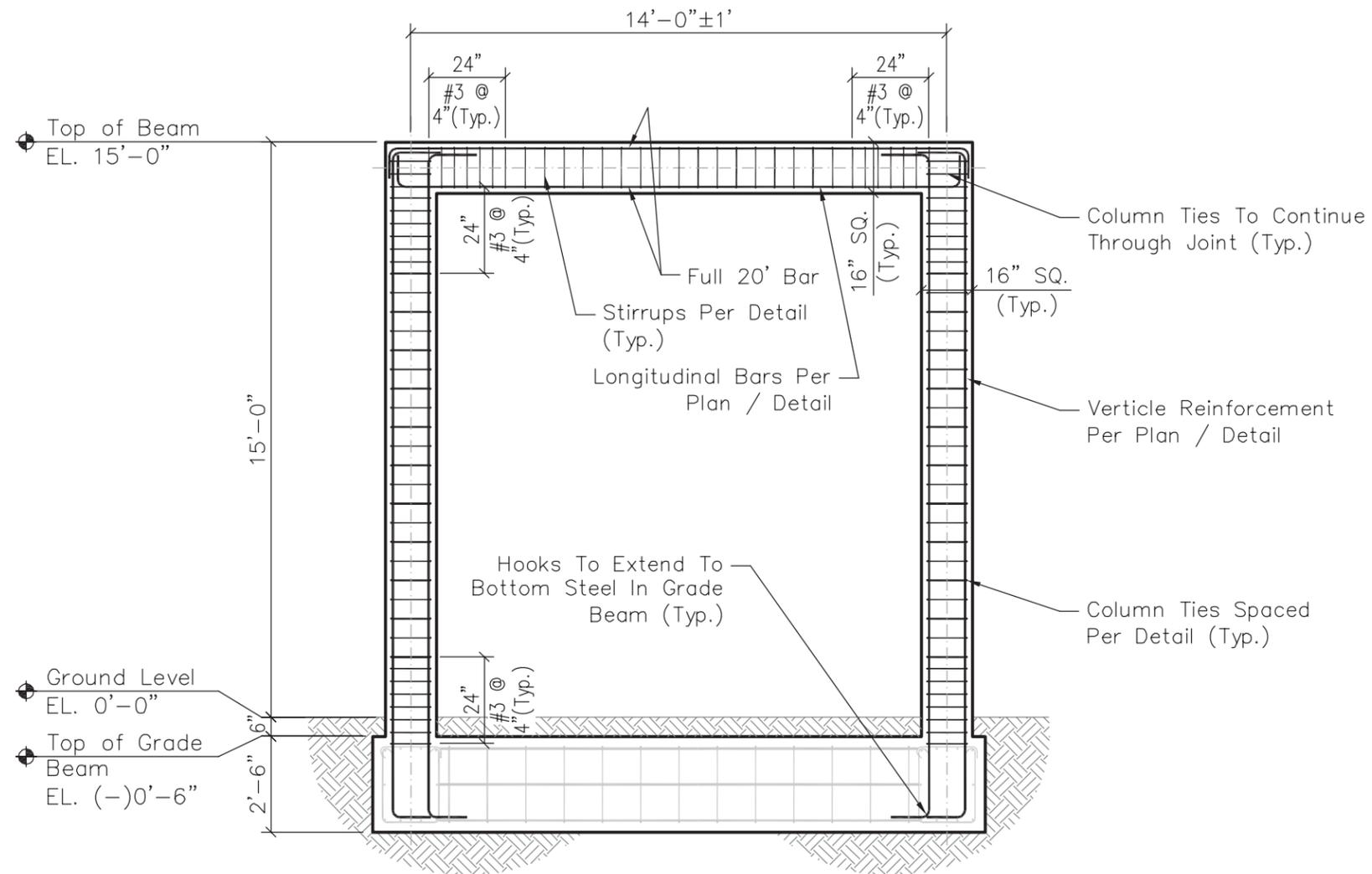
Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



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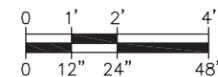
CASE H
Three Bay 15 Foot High System With Spliced Bars

DATE: June 2009	REV. 0
REVISD: ----	
DWG NO.: H-S-204	SHEET 15 OF 26



Three Bay 15 Foot High System With Minimal Splices

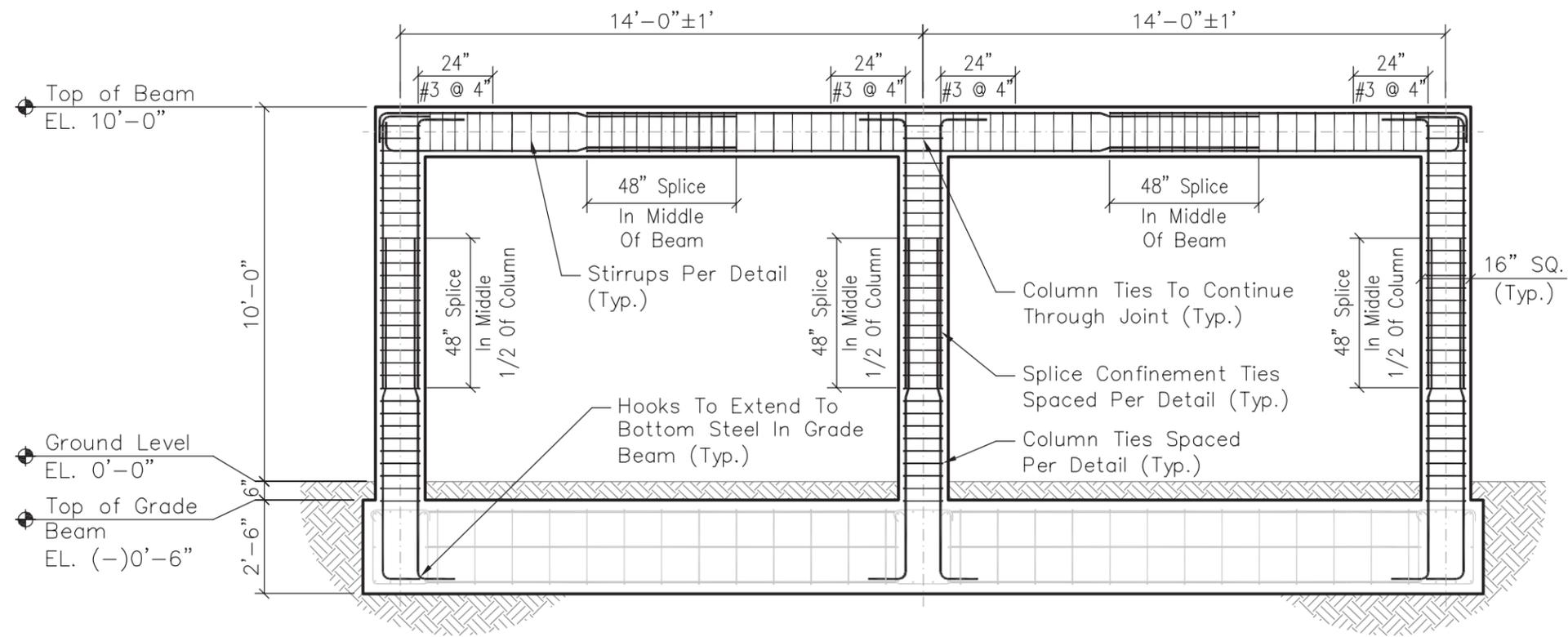
Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



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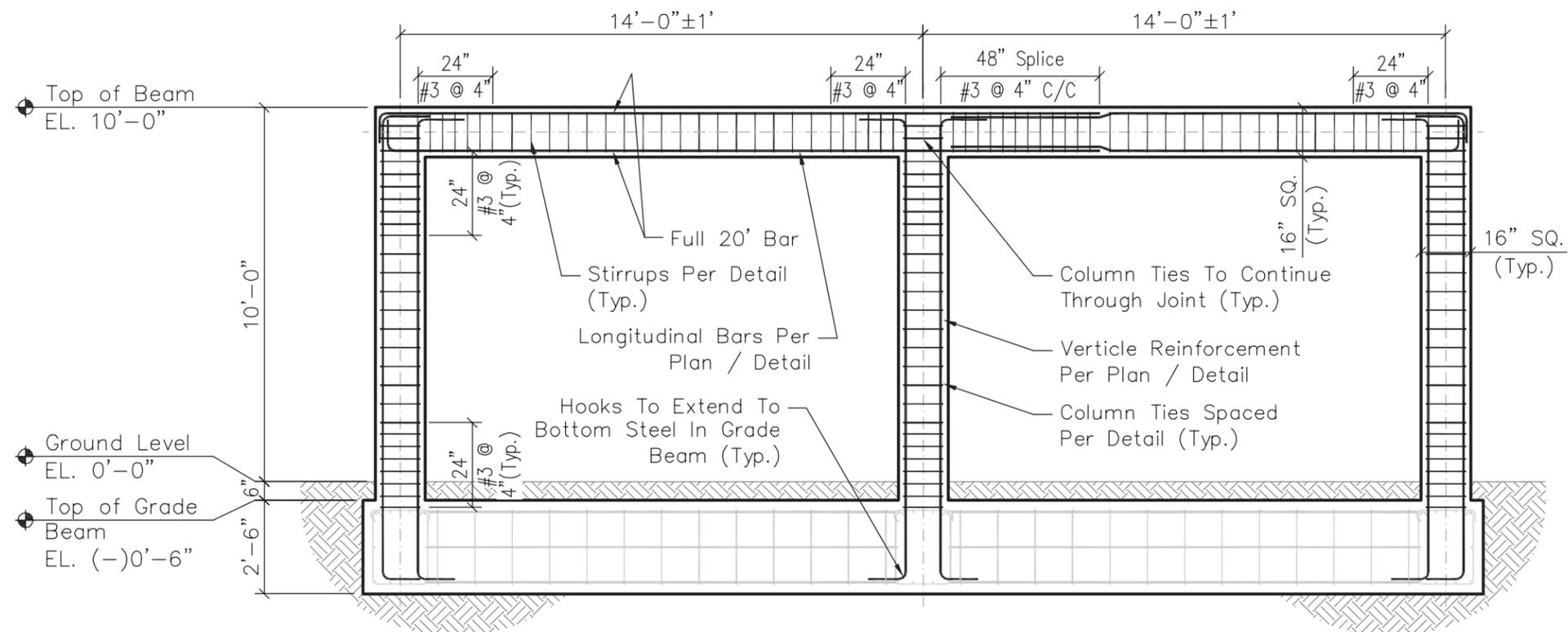
CASE H
Three Bay 15 Foot High System With Minimal Splices

DATE: June 2009	REV. 0
REVISID: ----	
DWG NO.: H-S-205	SHEET 16 OF 26



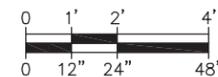
Six Bay 10 Foot High System With Spliced Bars

Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



Six Bay 10 Foot High System With Minimal Splices

Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



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CASE H

**Six Bay
10 Foot High Systems**

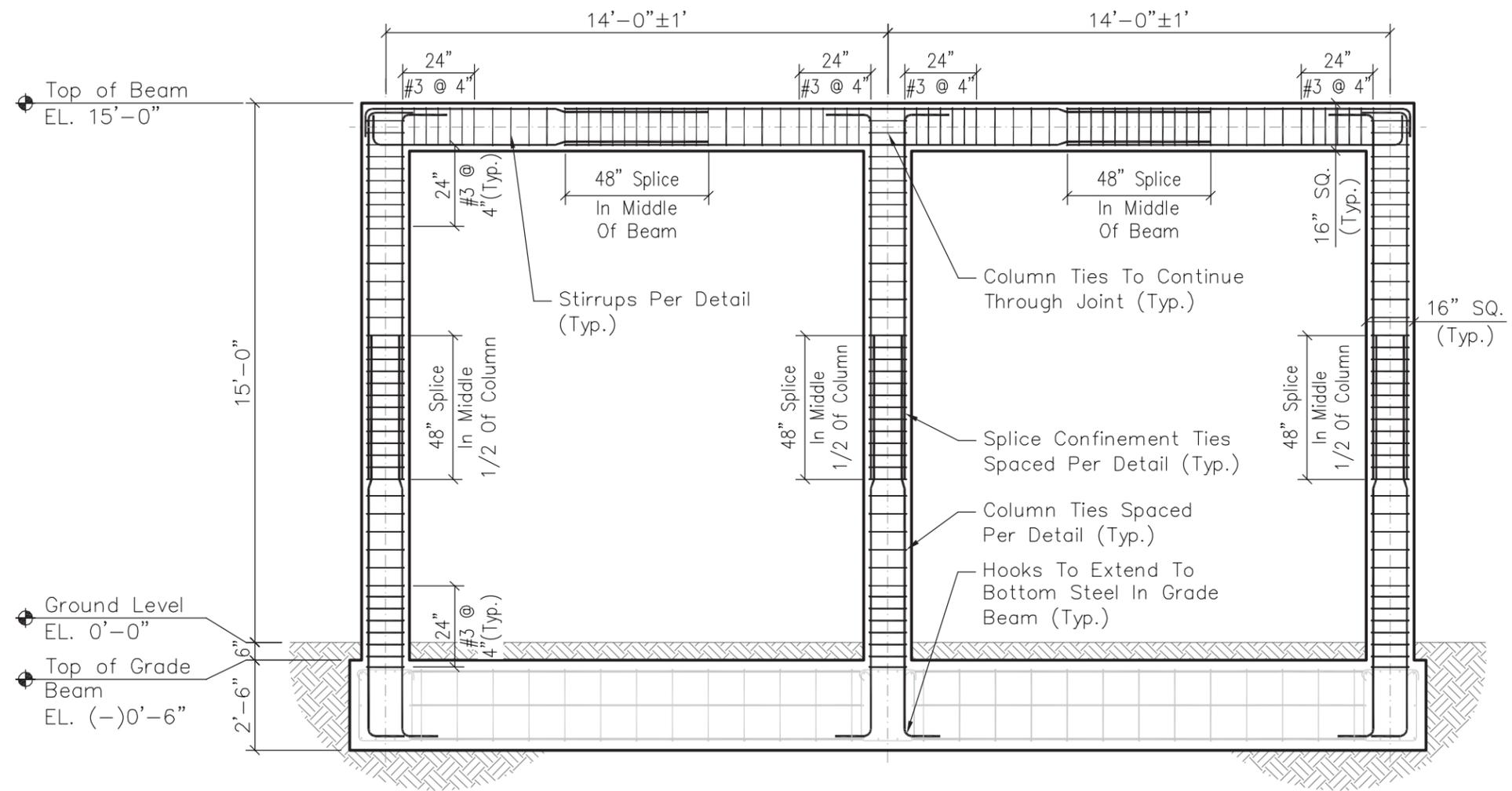
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REVISED: ----

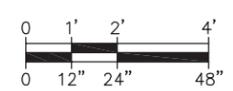
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DWG NO.: **H-S-206**

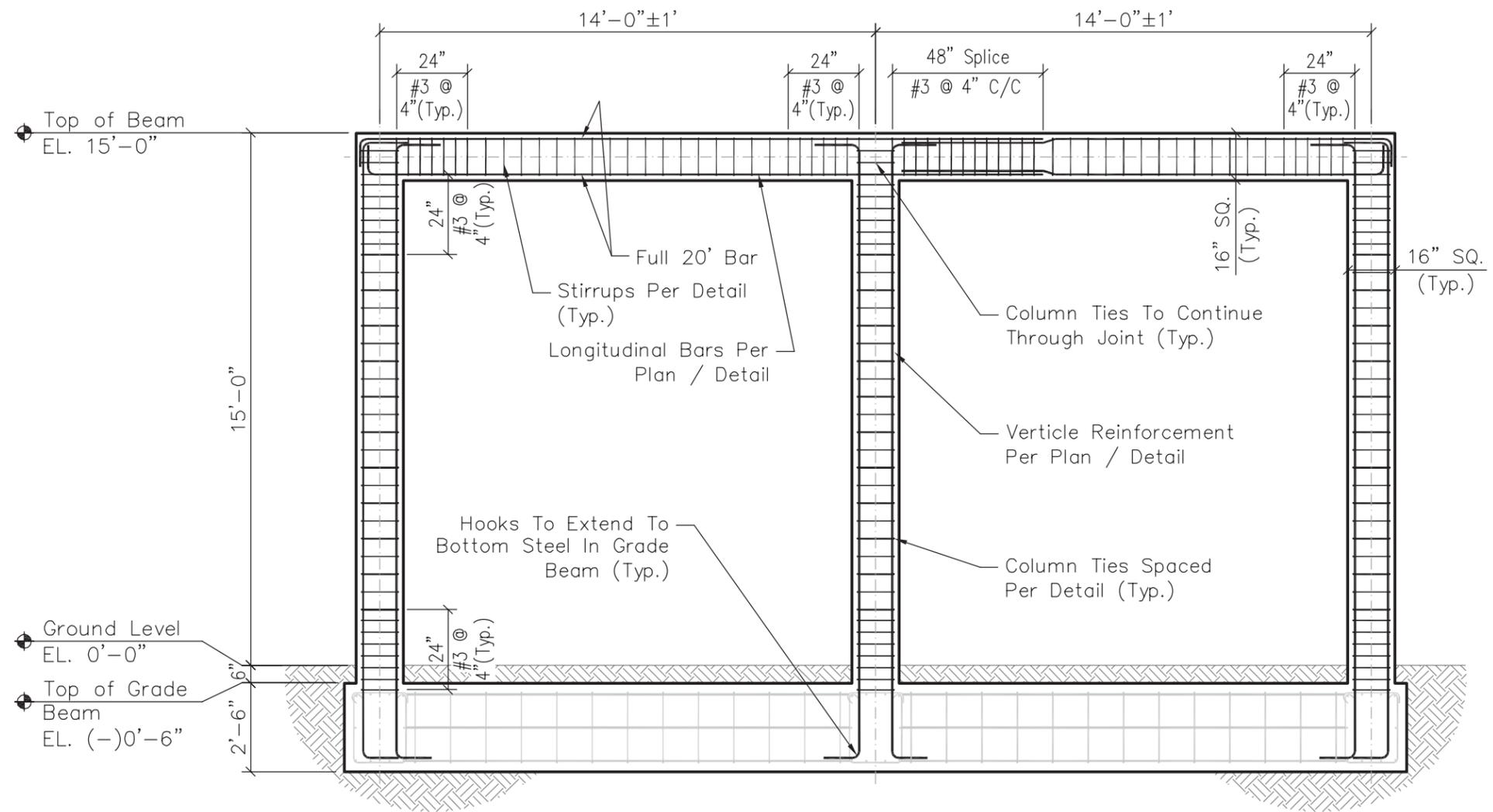
SHEET **17** OF **26**



Six Bay 15 Foot High System With Spliced Bars
 Pilings Omitted For Clarity.
 For Pile Information See Pile Plans.

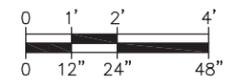


		CASE H	
		Six Bay 15 Foot High System With Spliced Bars	
		DATE: June 2009	REV. 0
		DWG NO.: H-S-207	SHEET 18 OF 26



Six Bay 15 Foot High System With Minimal Splices

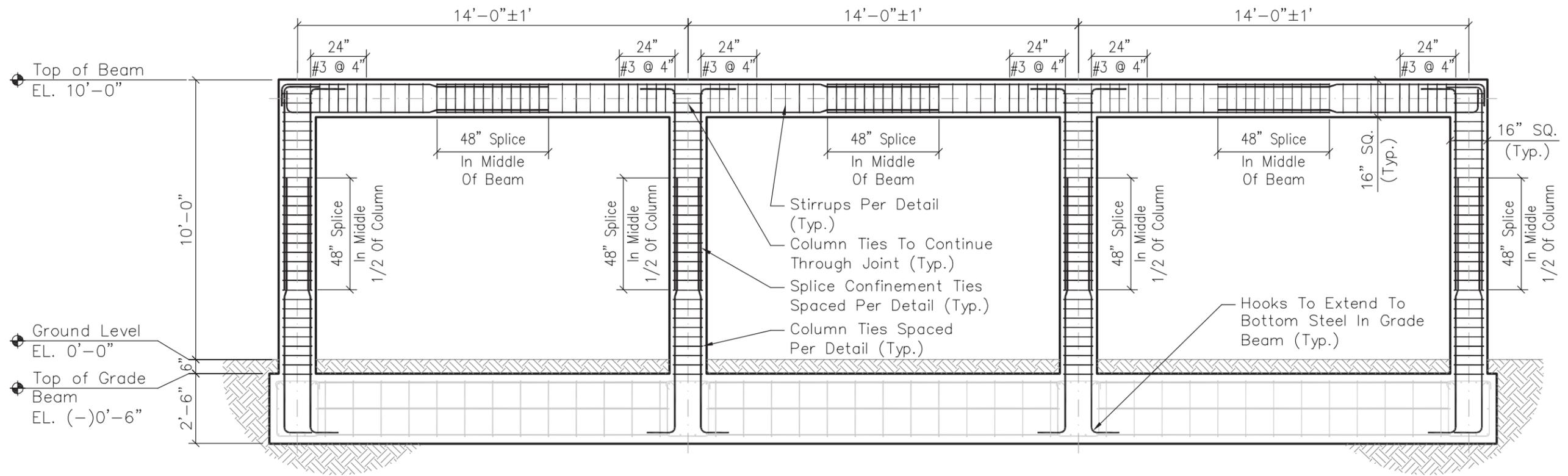
Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



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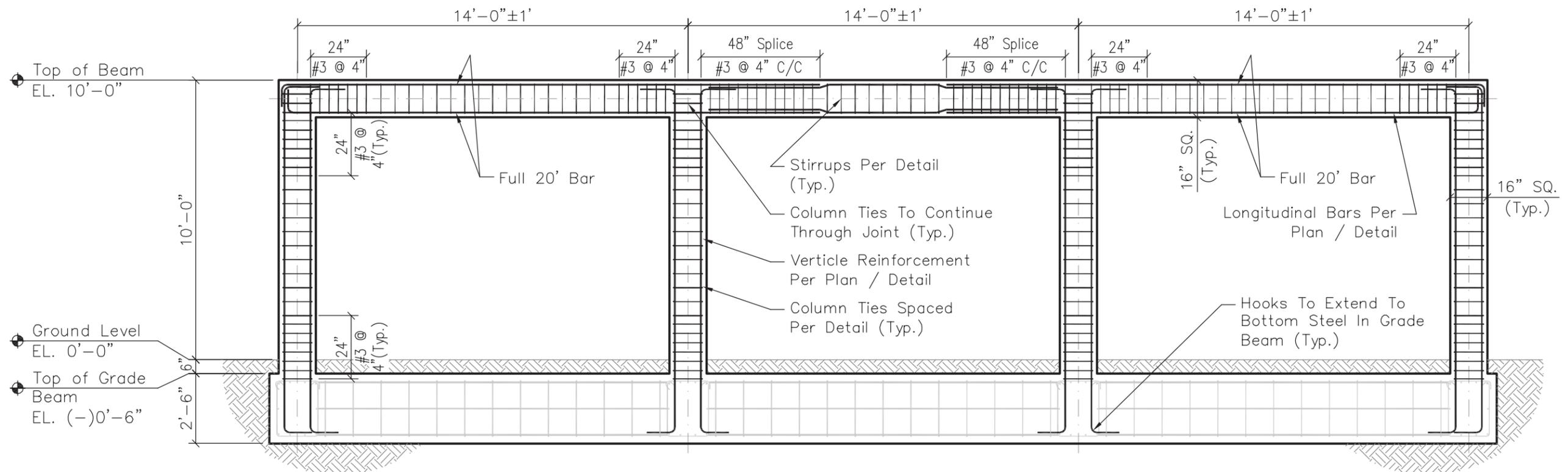
CASE H
Six Bay 15 Foot High System With Minimal Splices

DATE: June 2009	REV. 0
REVISID: ----	
DWG NO.: H-S-208	SHEET 19 OF 26



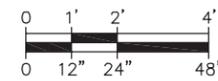
Nine Bay 10 Foot High System With Spliced Bars

Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



Nine Bay 10 Foot High System With Minimal Splices

Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



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CASE H

**Nine Bay
10 Foot High Systems**

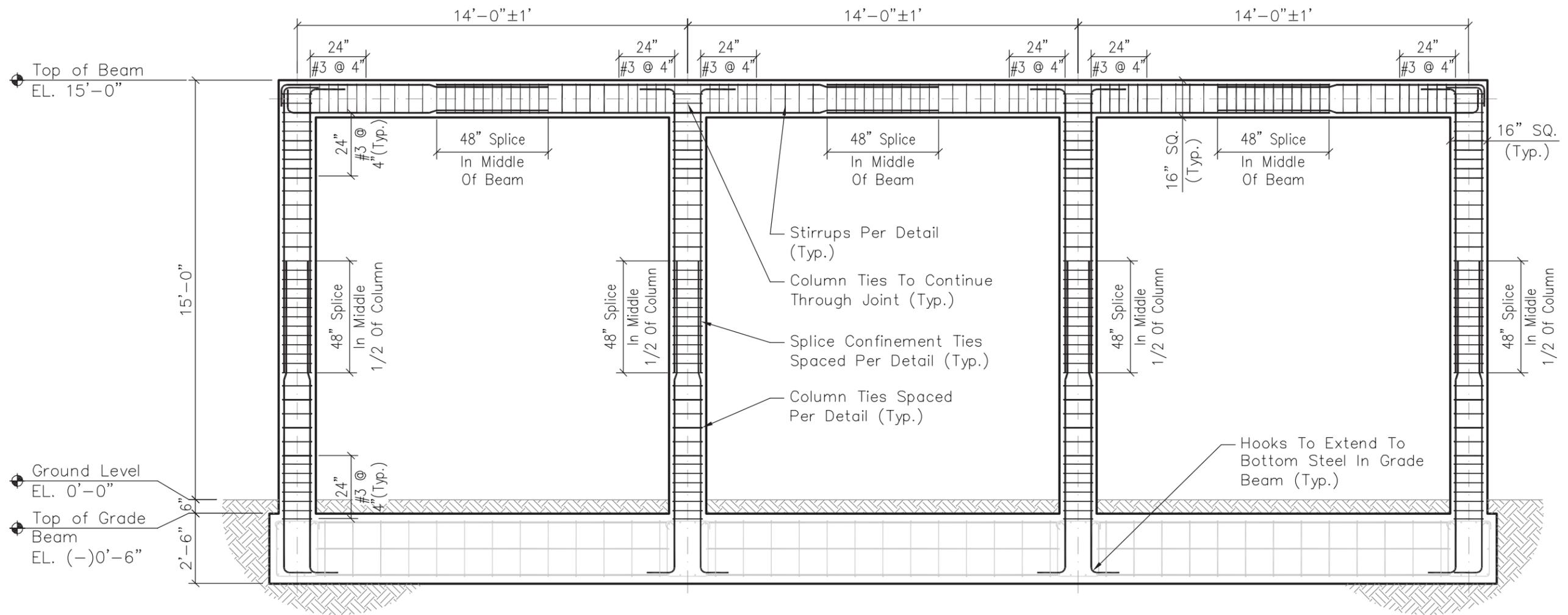
DATE: **June 2009**

REVISED: ----

REV. **0**

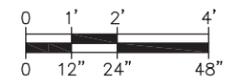
DWG NO.: **H-S-209**

SHEET **20** OF **26**



Nine Bay 15 Foot High System With Spliced Bars

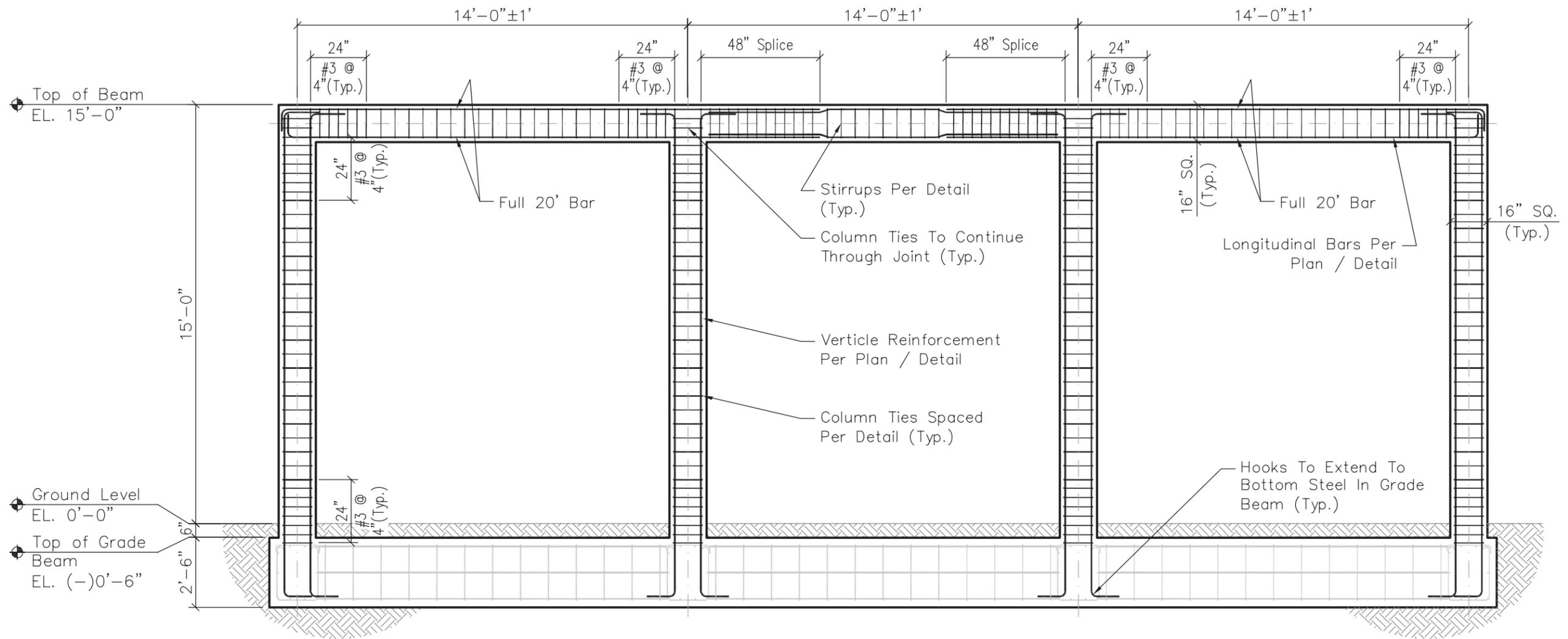
Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



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CASE H
Nine Bay 15 Foot High System With Spliced Bars

DATE: June 2009	REV. 0
DWG NO.: H-S-210	SHEET 21 OF 26



Nine Bay 15 Foot High System With Minimal Splices

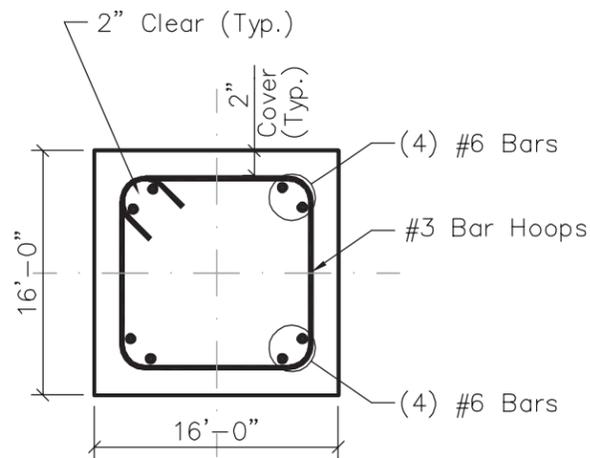
Pilings Omitted For Clarity.
For Pile Information See Pile Plans.



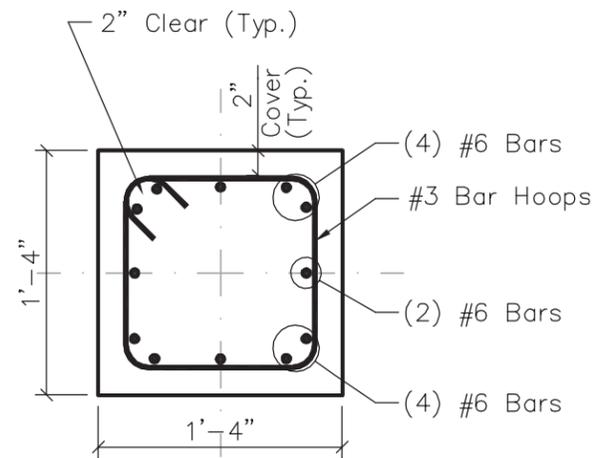
FEMA

CASE H
Nine Bay 15 Foot High System With Minimal Splices

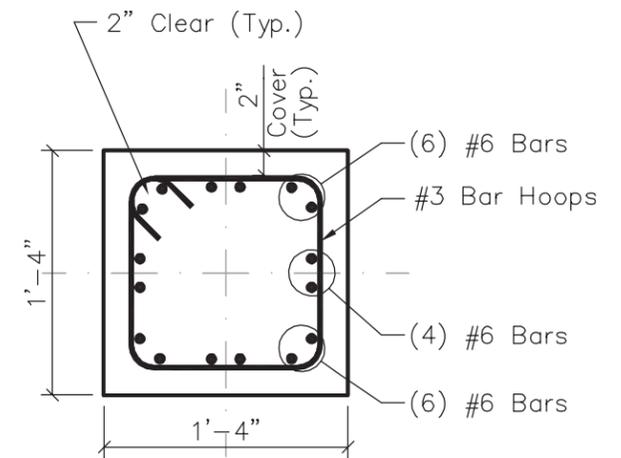
DATE: June 2009	REV. 0
REVISED: ----	
DWG NO.: H-S-211	SHEET 22 OF 26



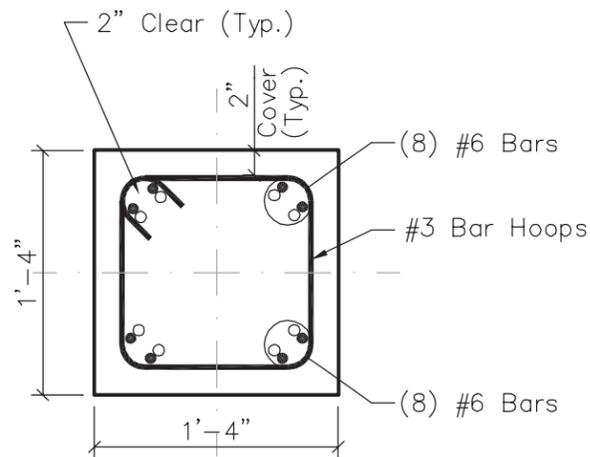
Column - C1



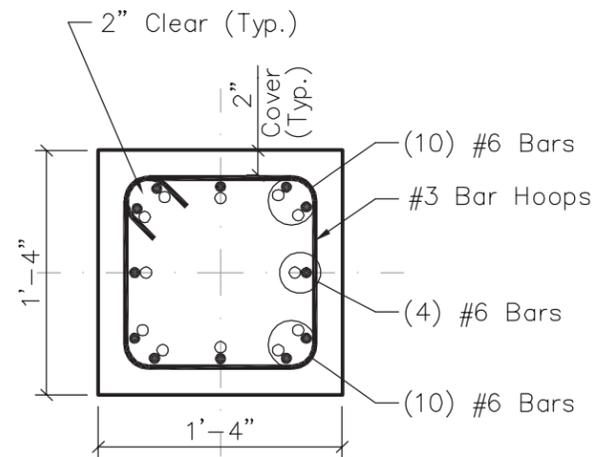
Column - C2



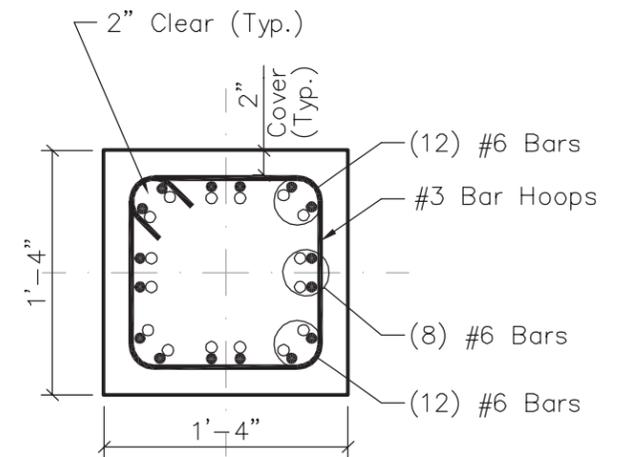
Column - C3



Column Splice - C1



Column Splice - C2

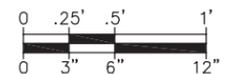


Column Splice - C3

- Base Bar
- Splice Bar

Notes

- Gap Between Bars In Groups To Be 2" To Permit Full Bond Development.
- Splices To Use Class "B" Tension Lap Splice.
- Splices Within Joint Are to Be Avoided.
- Hoops & Stirrups To Be Used @ 6" C/C Typ.
- Hoops & Stirrups To Be Used @ 4" C/C At Splices & Within 2 Feet of Each Beam & Column Intersection.

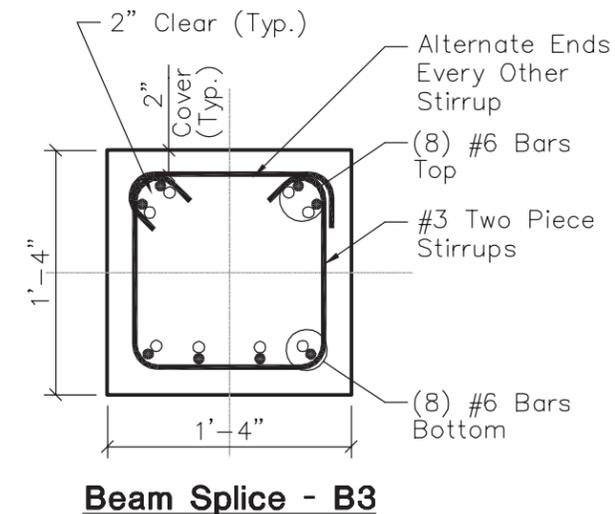
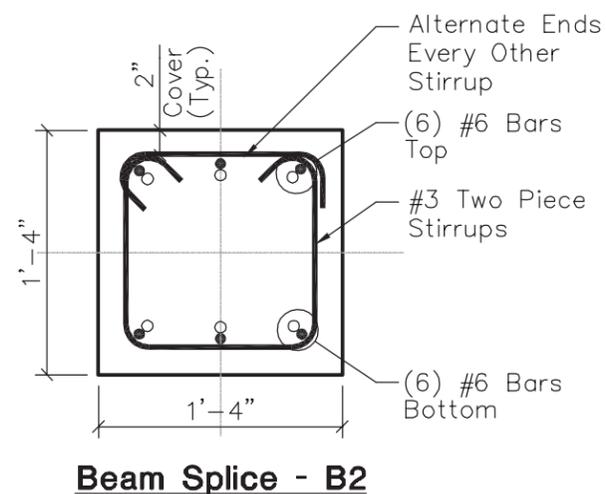
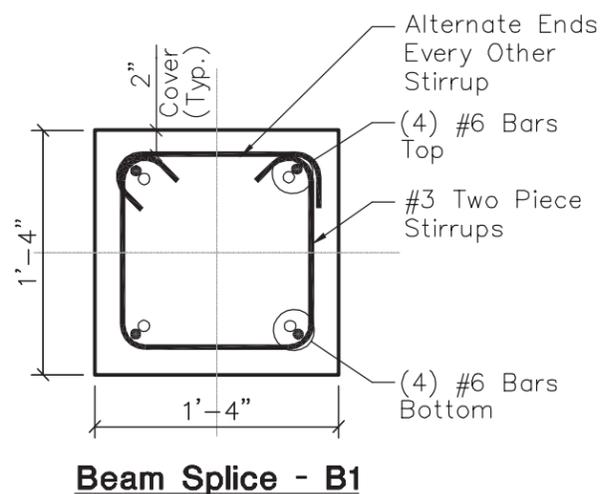
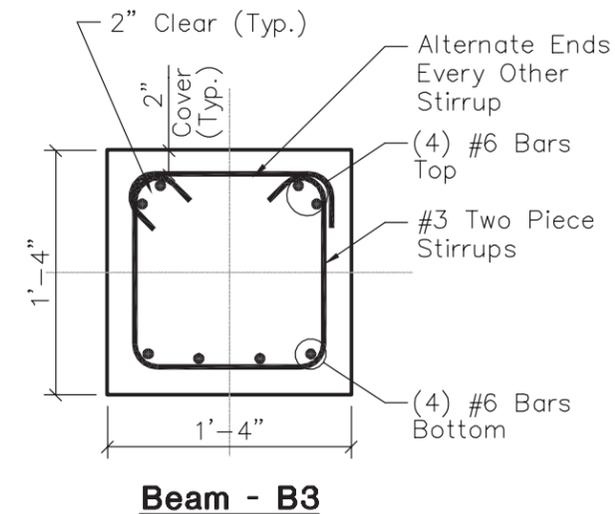
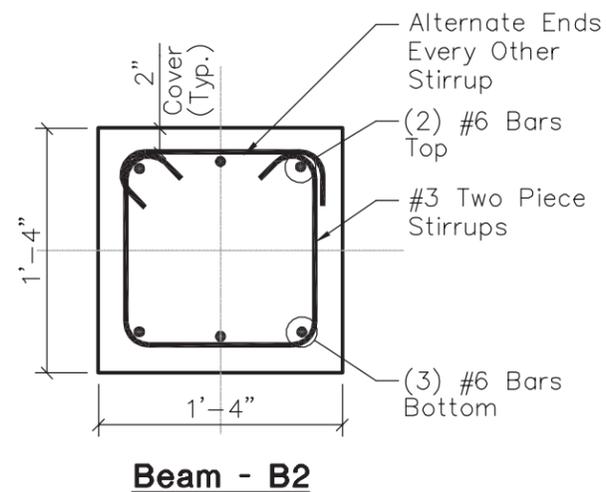
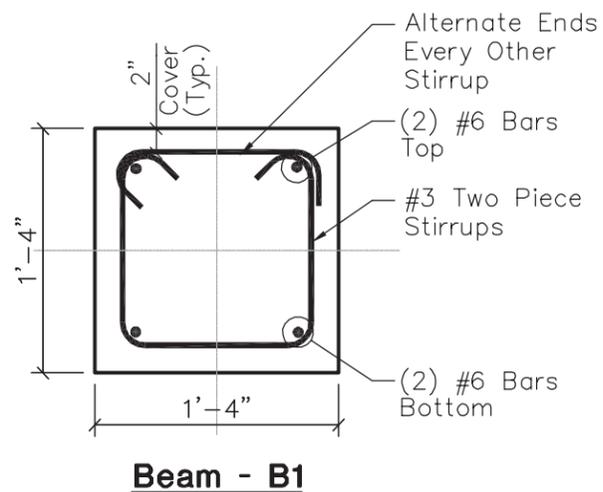


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CASE H

Column Sections

DATE: June 2009	
REVISED: ----	REV. 0
DWG NO.: H-S-212	SHEET 23 OF 26



- Base Bar
- Splice Bar

Notes

- Gap Between Bars In Groups To Be 2" To Permit Full Bond Development.
- Splices To Use Class "B" Tension Lap Splice.
- Splices Within Joint Are to Be Avoided.
- Hoops & Stirrups To Be Used @ 6" C/C Typ.
- Hoops & Stirrups To Be Used @ 4" C/C At Splices & Within 2 Feet of Each Beam & Column Intersection.

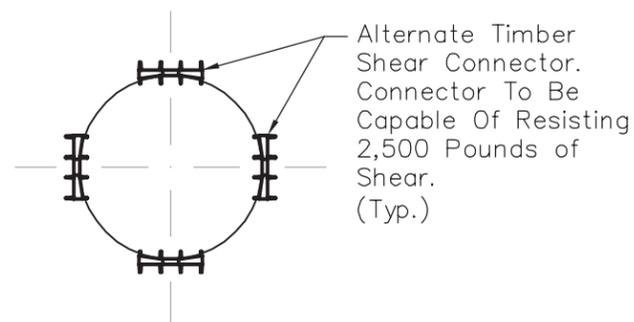


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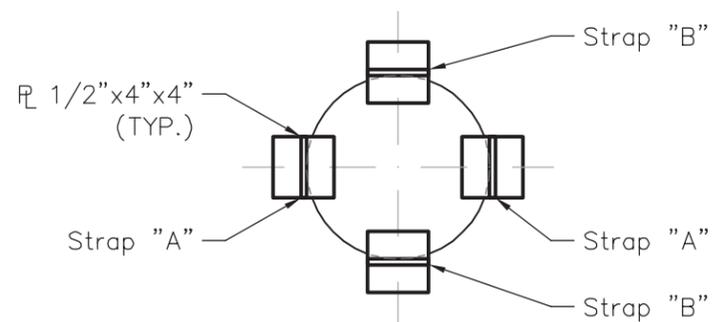
CASE H

Beam Sections

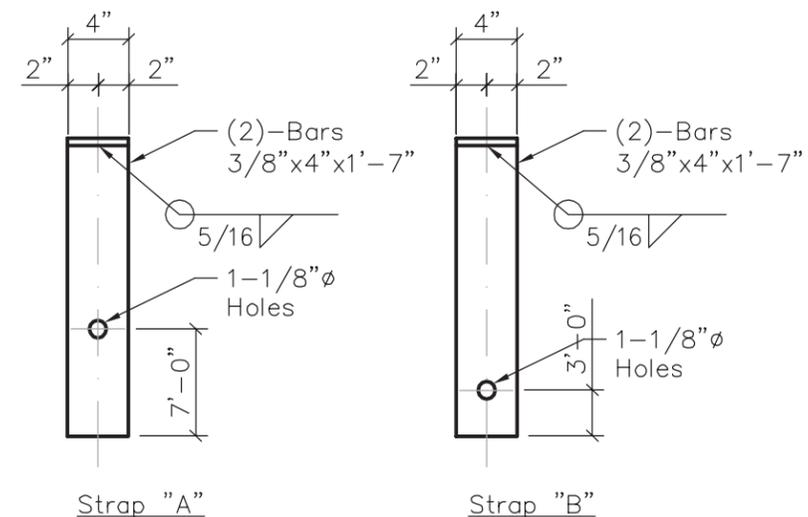
DATE: June 2009	
REVISED: ----	REV. 0
DWG NO.: H-S-213	SHEET 24 OF 26



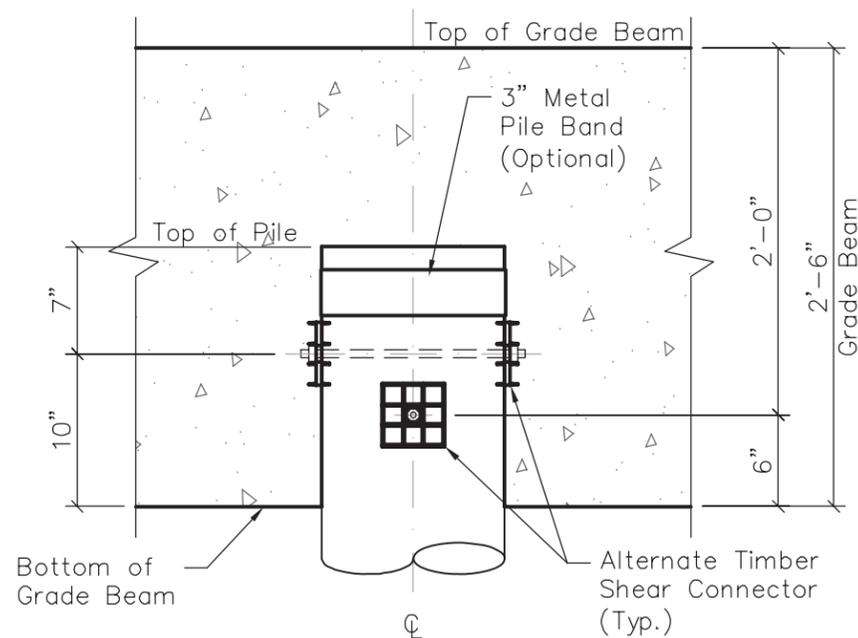
Timber Shear Connector & Pile Top View



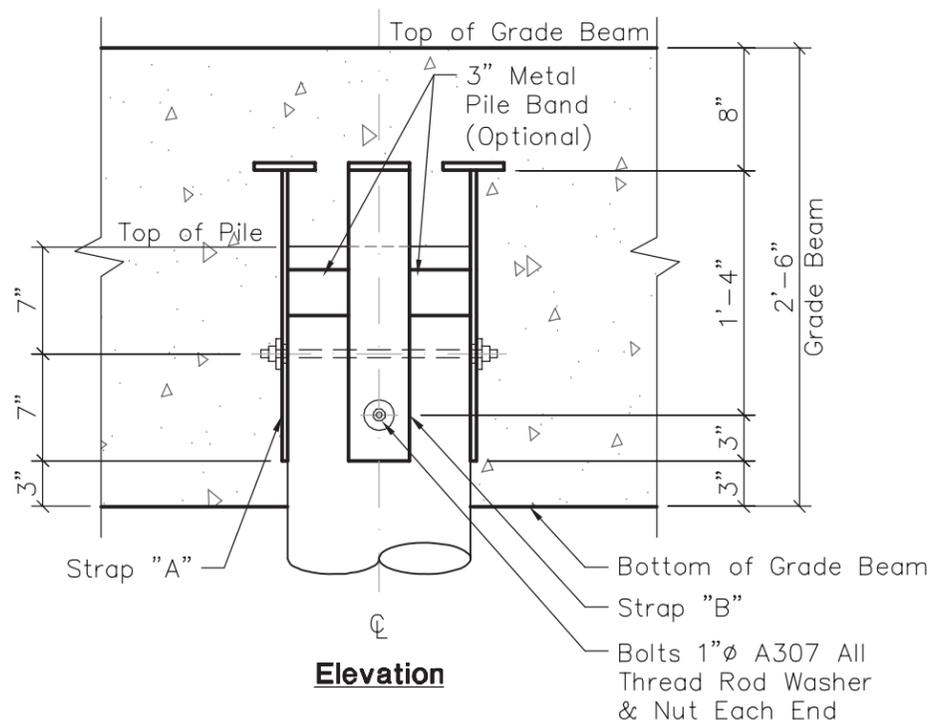
Anchor Strap & Pile Top View



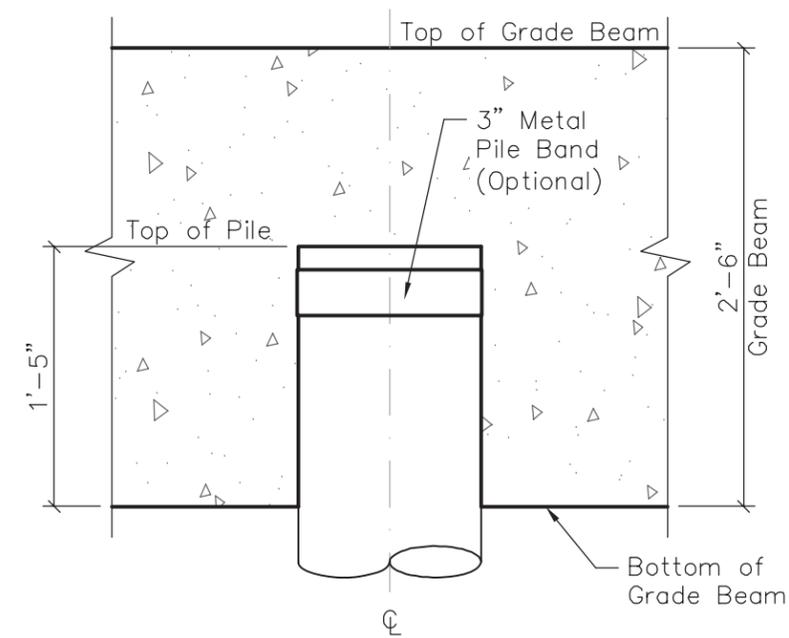
Anchor Strap Details



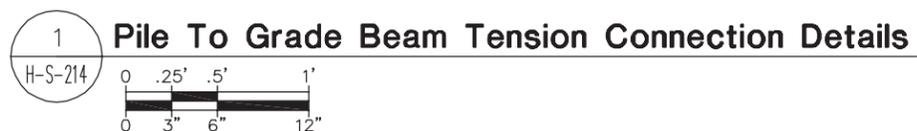
Alternate Elevation



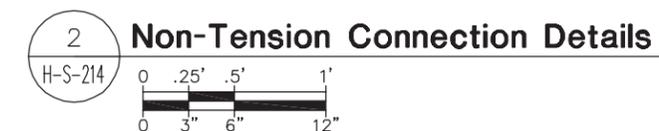
Elevation



Elevation



Pile To Grade Beam Tension Connection Details



Non-Tension Connection Details

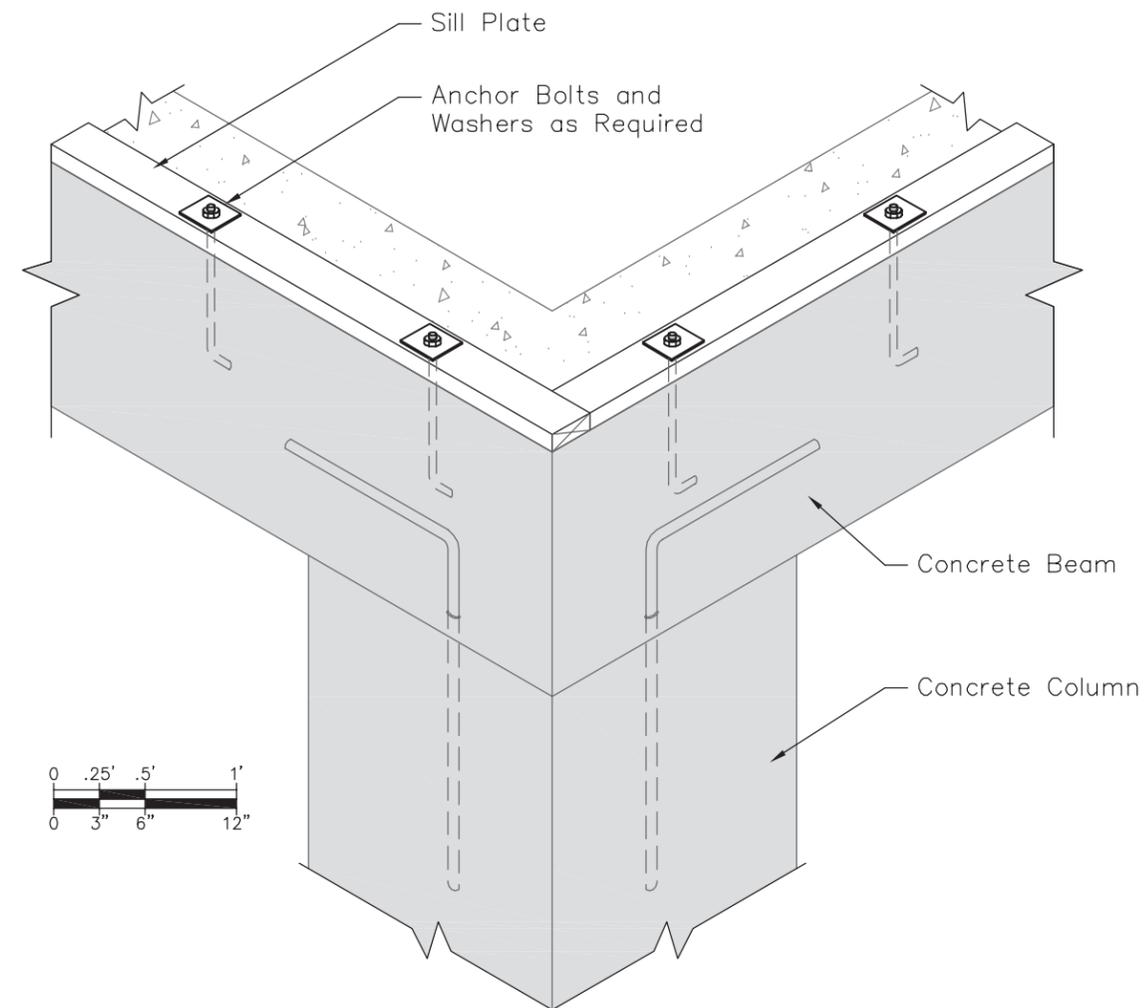
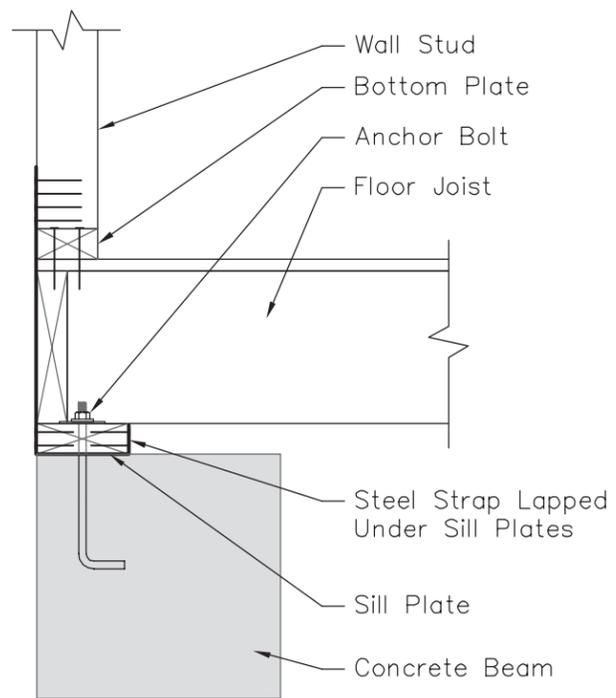
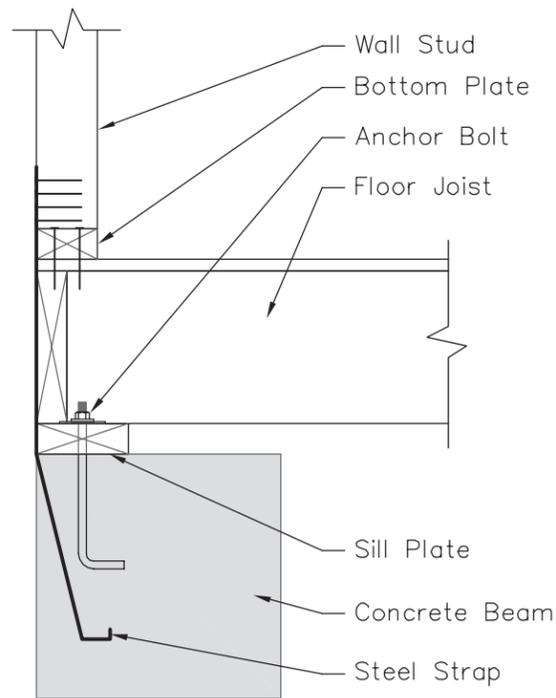


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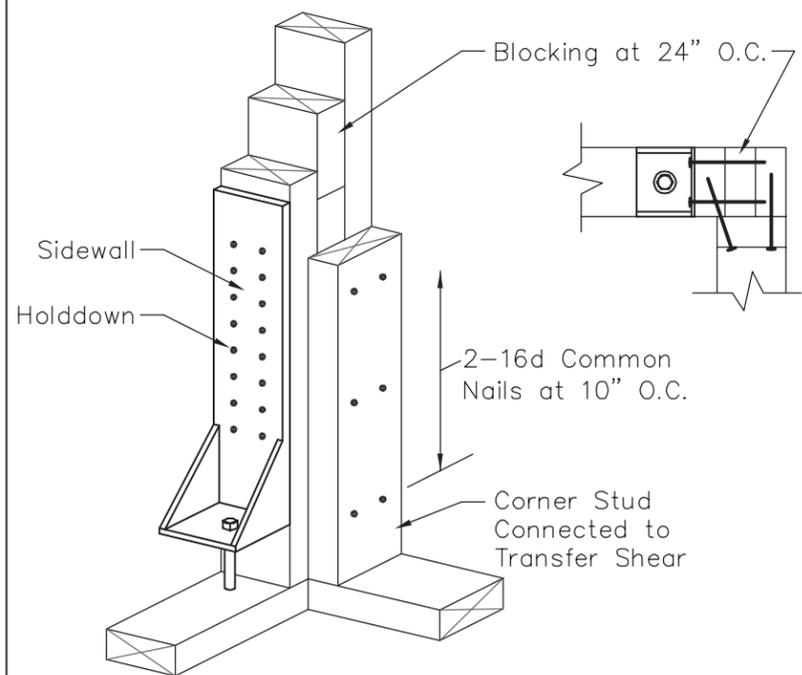
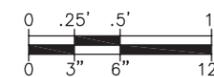
CASE H

Pile Details

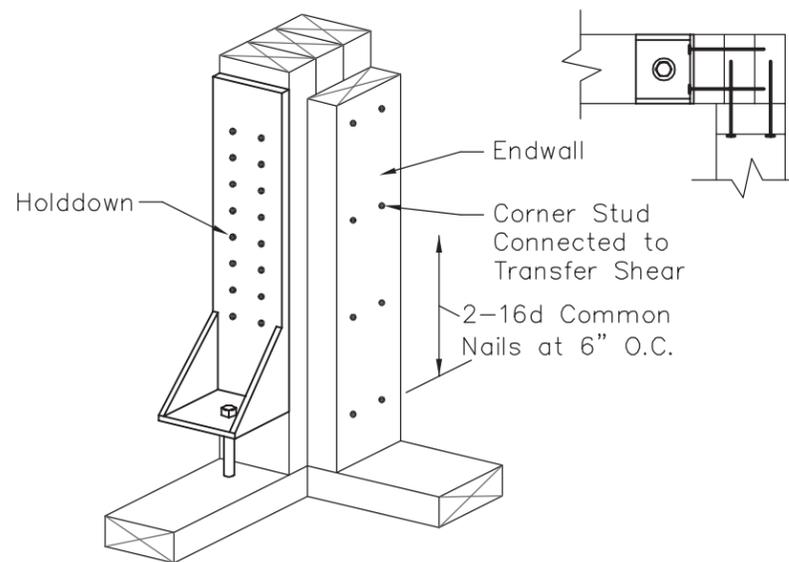
DATE: June 2009	REV. 0
REVISED: ----	
DWG NO.: H-S-214	SHEET 25 OF 26



1 **Sill Plate Anchorage to Concrete Beam**
Per: WFCM (Wood Framed Construction Manual)

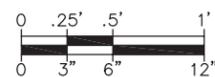


3 Studs With Blocking



4 Studs

2 **Corner Stud Holddown Details**
Per: WFCM (Wood Framed Construction Manual)



Notes

- The Foundation Connection Details Shown Are Schematic In Nature And Are Intended To Depict Methods Used To Attach an Elevated Structure To A FEMA 550 Case H Foundation.
- For Size, Spacing And Types Of Connections, Refer To The IRC, The Wood Framed Construction Manual (WFCM) Or ICC-600 Standard For Residential Construction In High-Winds Regions.



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CASE H

Wood Connection Details

DATE: June 2009	
REVISED: ----	REV. 0
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