

RECOMMENDED RESIDENTIAL CONSTRUCTION
FOR THE GULF COAST

*Building on Strong and
Safe Foundations*

A. Foundation Designs

Drawing	Drawing Number	Sheet Number	Revision Number
Title Sheet & Drawing Index	T-1	1 of 31	1
General Notes	GN-1	2 of 31	1
Wood Beam Connections to Concrete Columns	GN-2 to GN-6	3 to 7 of 31	1
Case A - Open Foundation Driven Treated Timber Pile	A-1 to A-3	8 to 10 of 31	1
Case B - Open Foundation Open Ended Steel Pile	B-1 to B-5	11 to 15 of 31	1
Case C - Open Foundation Driven Timber Pile & Concrete Pile	C-1 to C-6	16 to 21 of 31	1
Case D - Open Foundation Continuous Footing & Concrete Column	D-1 to D-3	22 to 24 of 31	1
Case G - Open Foundation Coastal Grade Beam/ Waffle	G-1, G-2	25 to 26 of 31	1
Case E - Closed Foundation Crawl Space Foundation	E-1 to E-3	27 to 29 of 31	1
Case F - Closed Foundation Backfilled Stemwall Foundation	F-1, F-2	30 to 31 of 31	1

1
T-1
Drawing Index

Foundation Designs
Title Sheet & Drawing Index

DRAWING NO.: T-1 SHEET 1 of 31

DATE: August 8, 2006

REVISED: REV. 9



FEMA

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

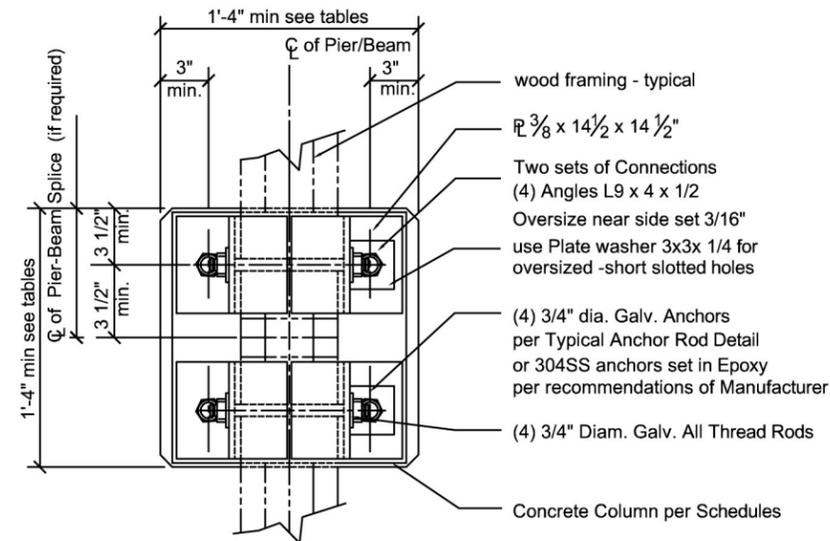
DATE: August 8, 2006

REVISED:

REV. 9

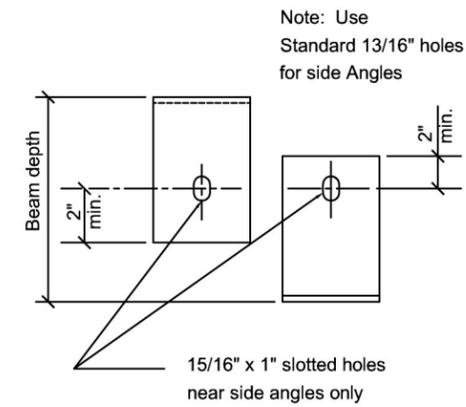
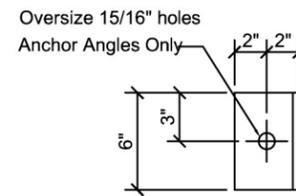


FEMA



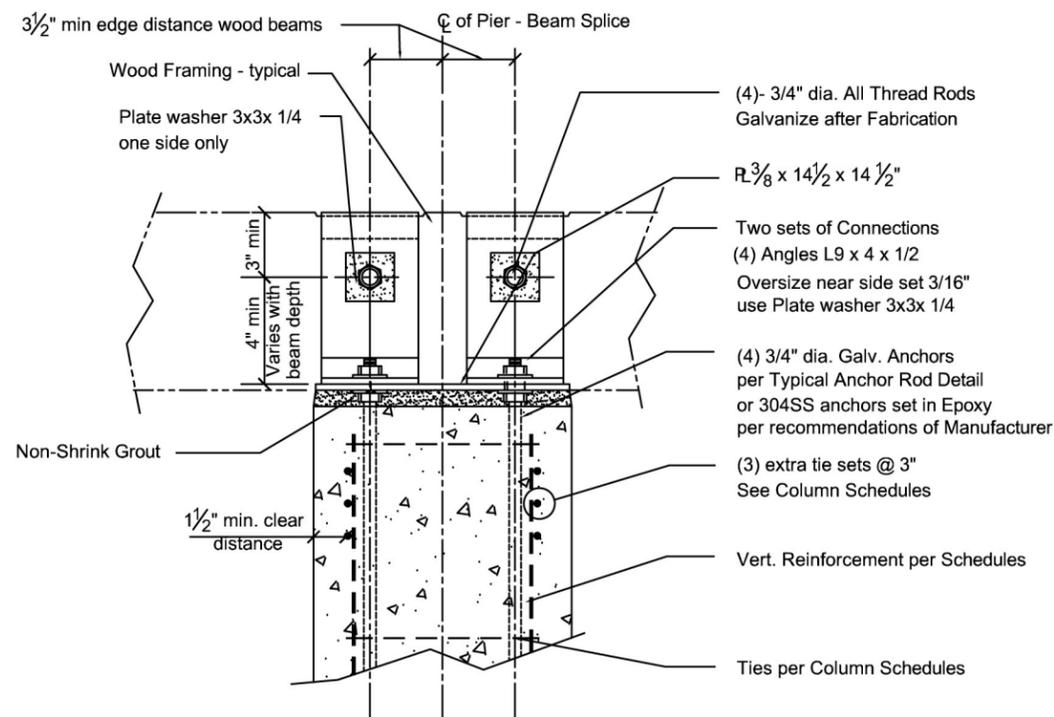
1 Captive-Clamped Beam (CCB) - Typical Connection Plan Detail

GN-2 SCALE: NTS



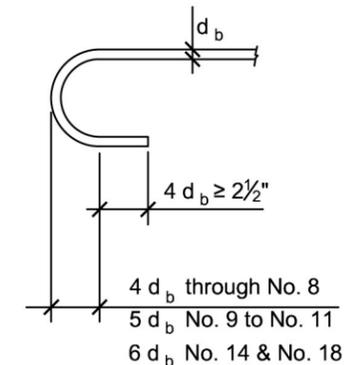
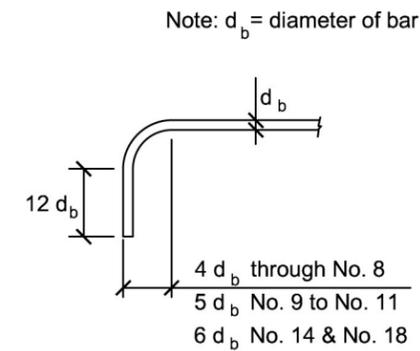
2 Captive-Clamped Beam (CCB) - Typical Connection Angle Detail

GN-2 SCALE: NTS



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

GN-2 SCALE: NTS



4 Standard Hooks

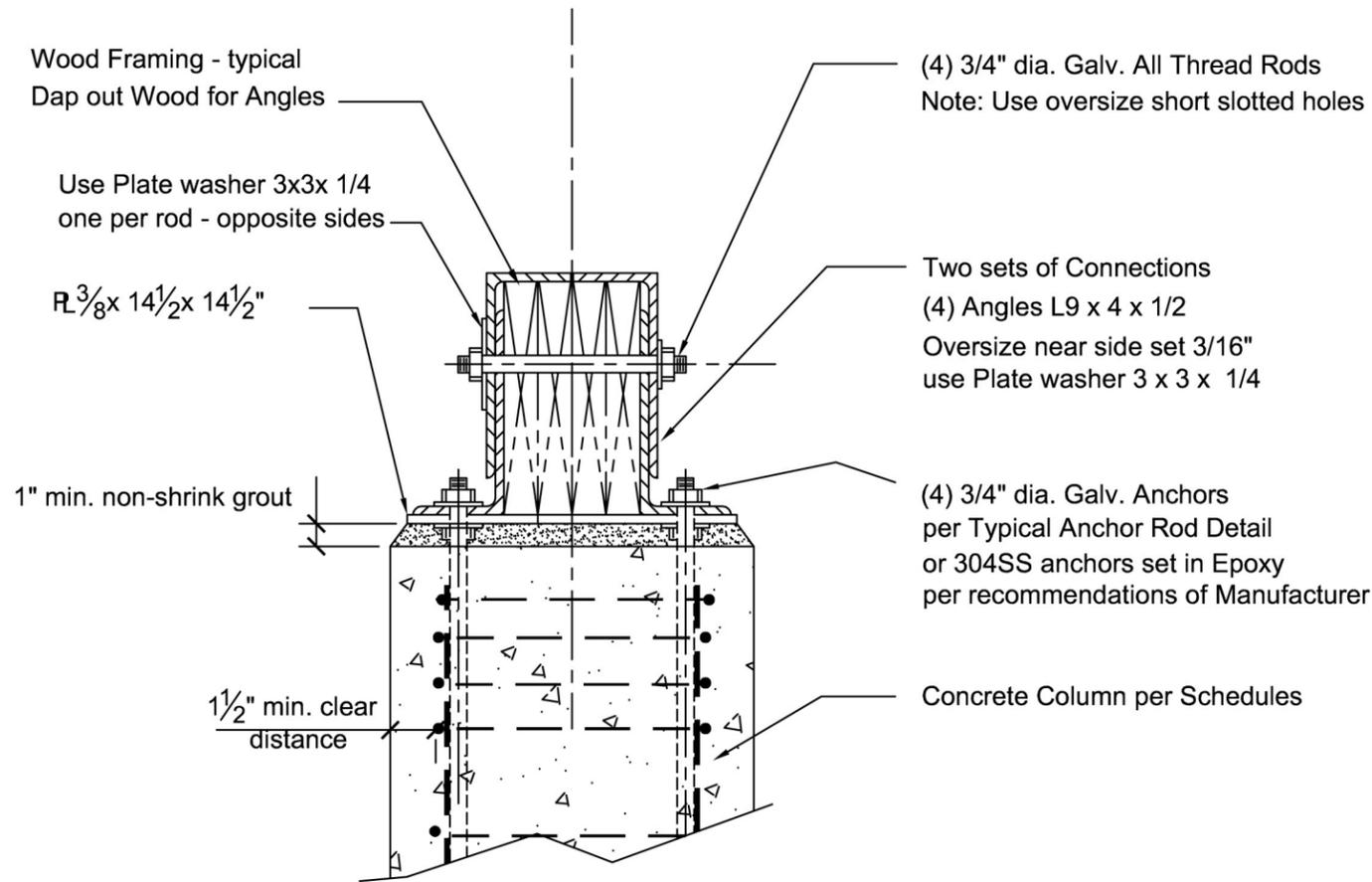
GN-2 SCALE: NTS

Connection Details	
DRAWING NO.: GN-2	SHEET 3 OF 31
DATE: August 8, 2006	
REVISED	REV. 9

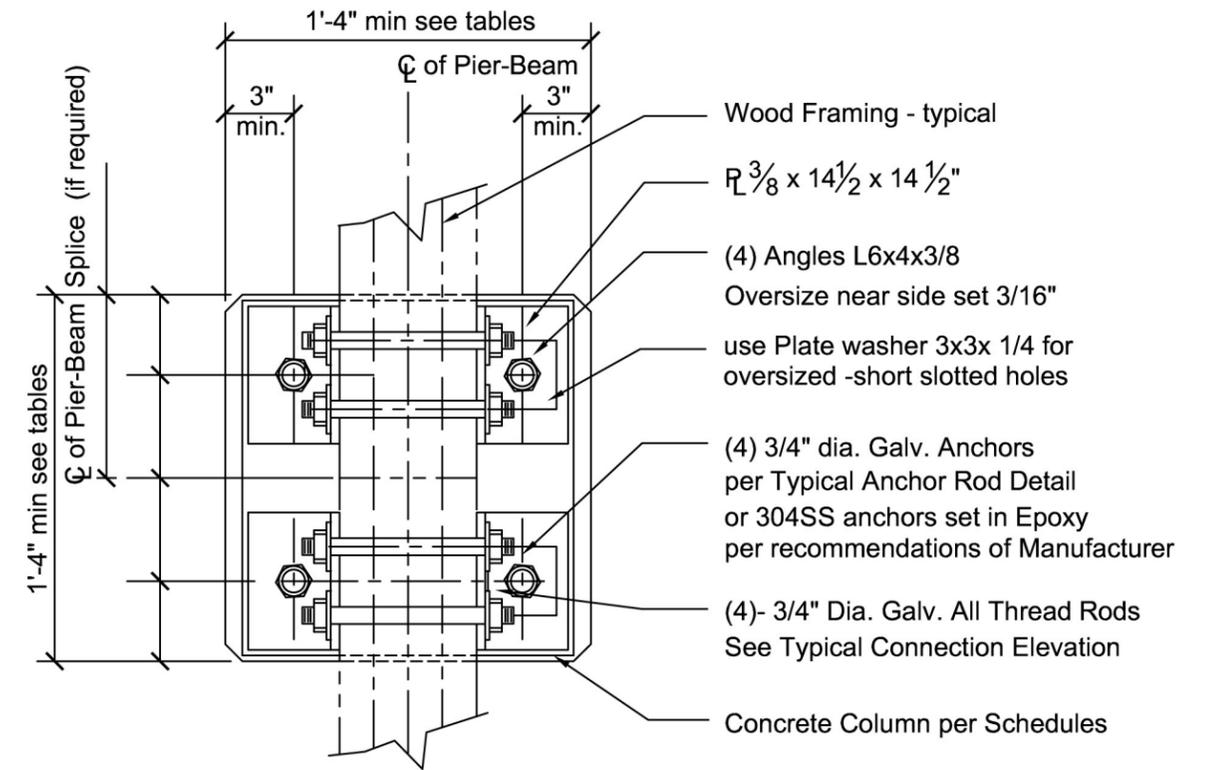


FEMA

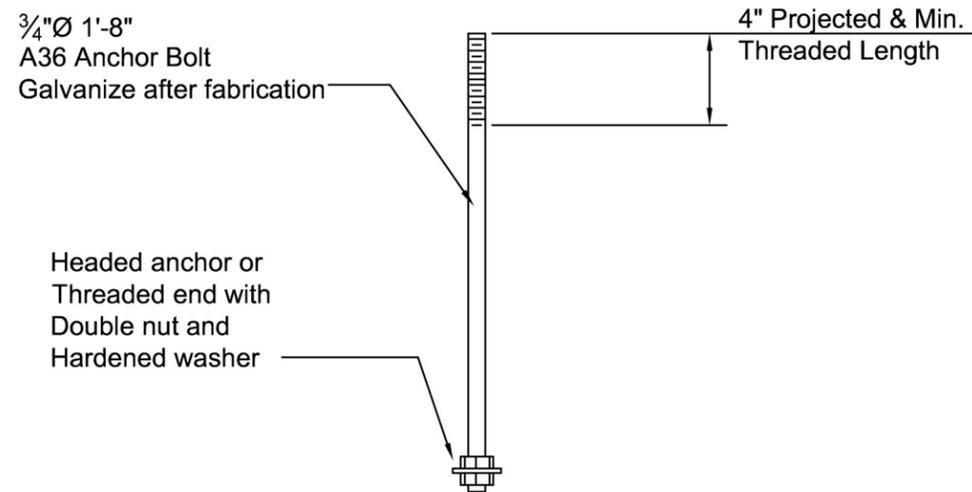
Note: All steel material min. ASTM grade A36 and Galvanized after fabrication u.n.o. Connection design is based on wood species having a specific gravity of at least 55% such as southern yellow pine.



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

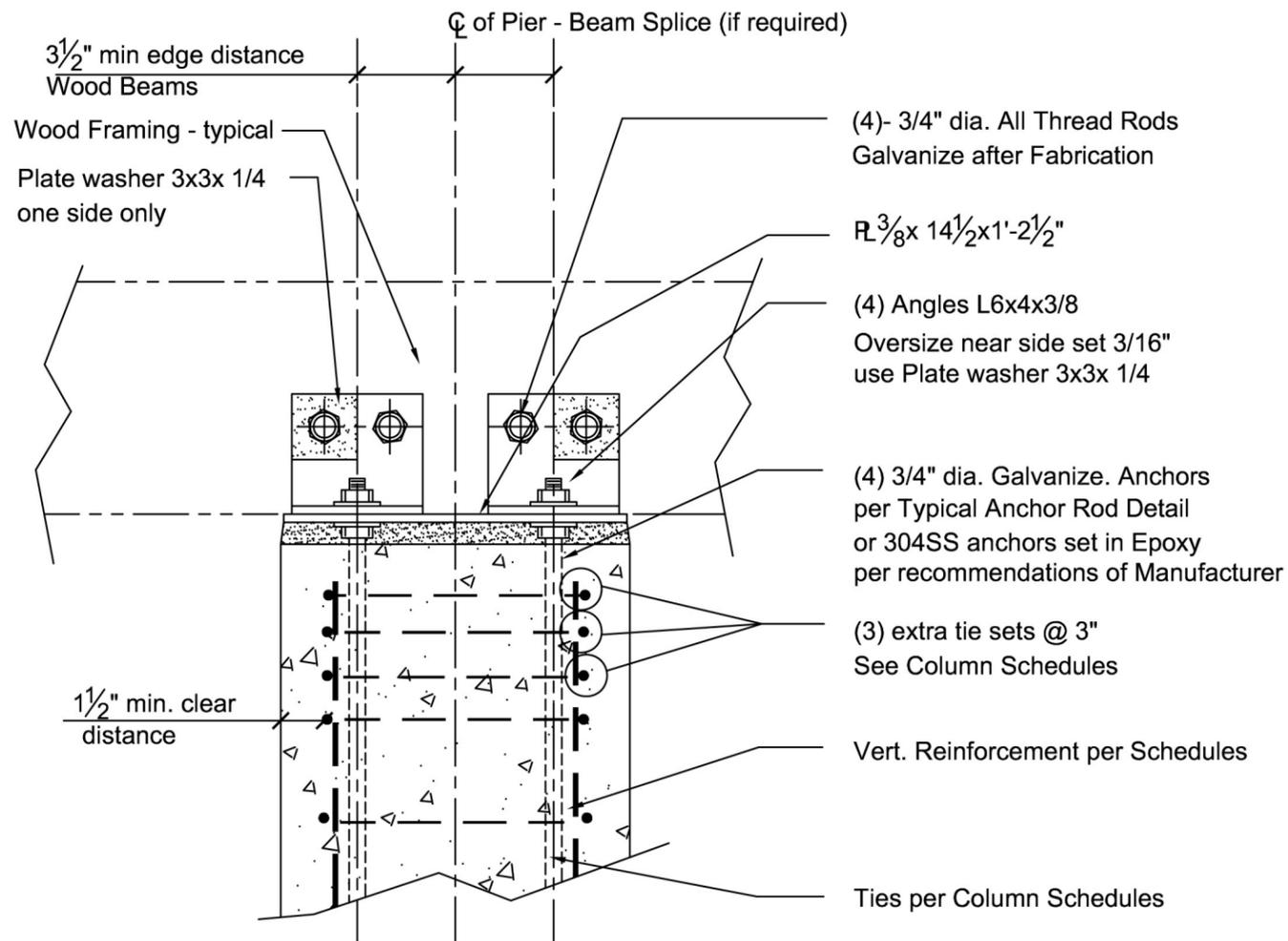
DRAWING NO.: GN-3 SHEET 4 OF 31

DATE: August 8, 2006

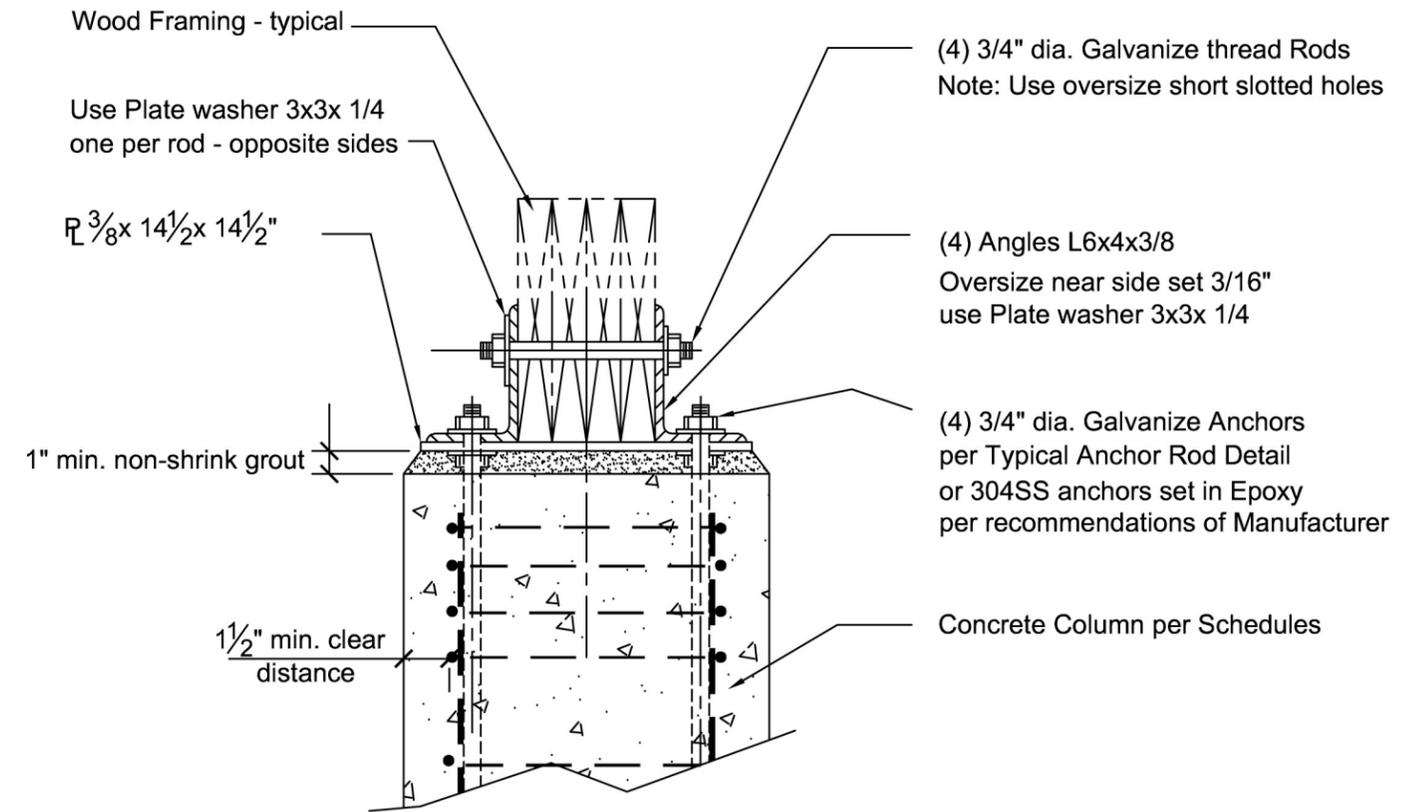
REVISED: REV. 9



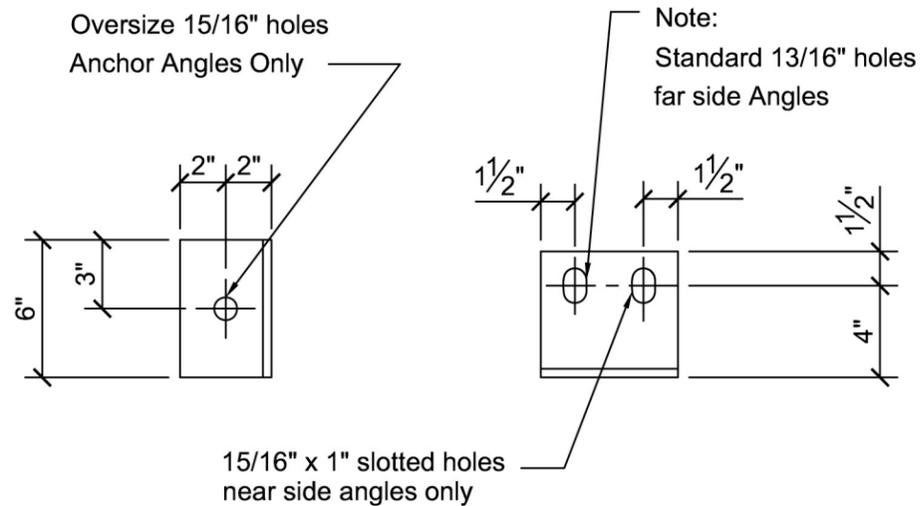
FEMA



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



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



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

Connection Details

DRAWING NO.: GN-4 SHEET 5 OF 31

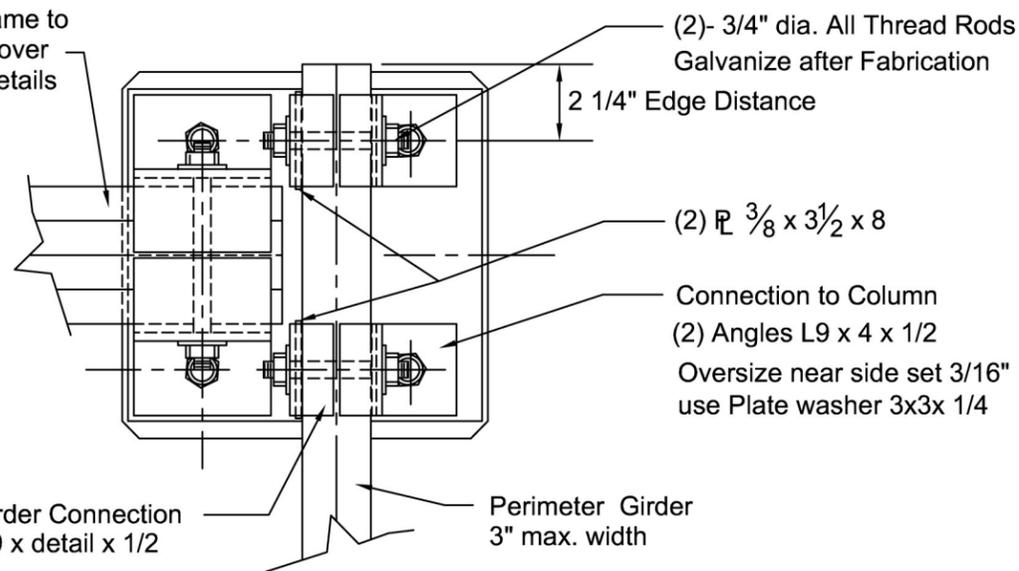
DATE: August 8, 2006

REVISED: REV. 9



FEMA

Girder - Joists frame to side of Girder or over see 1/GN-2 for details



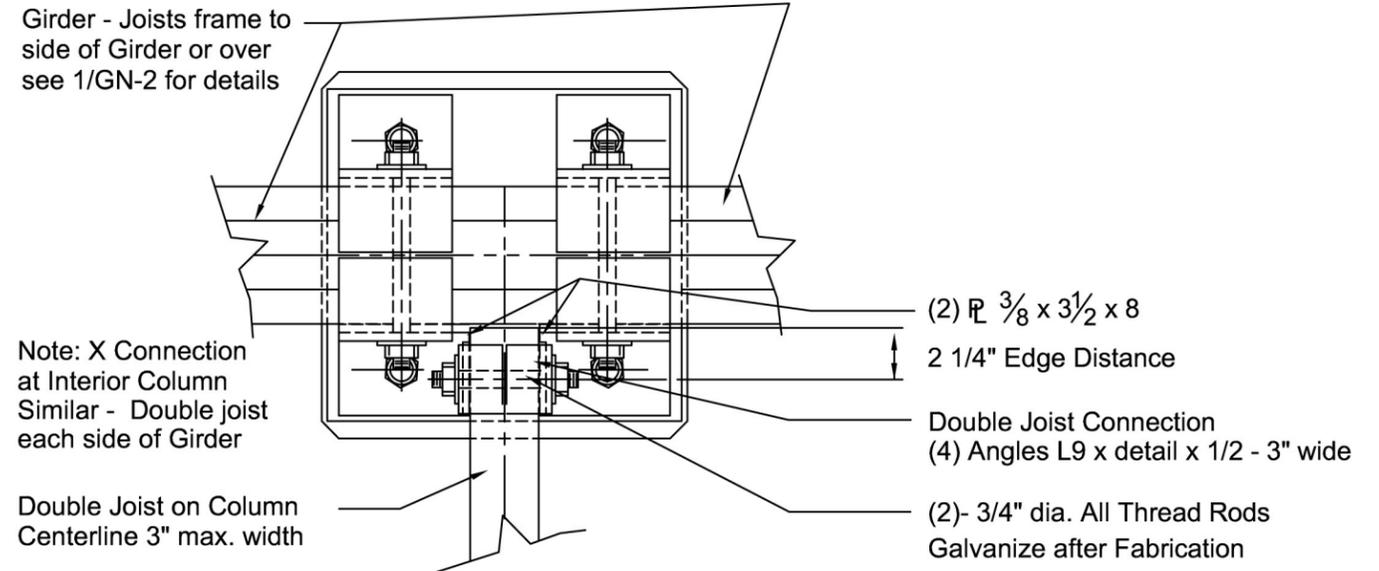
Perimeter Girder Connection
(4) Angles L9 x detail x 1/2

Perimeter Girder
3" max. width

**Captive-Clamped Beam (CCB) - Typical
Corner Connection Plan Detail**

1
GN-5 SCALE: NTS

Girder - Joists frame to side of Girder or over see 1/GN-2 for details



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

Double Joist on Column Centerline 3" max. width

(2) 3/8 x 3 1/2 x 8
2 1/4" Edge Distance

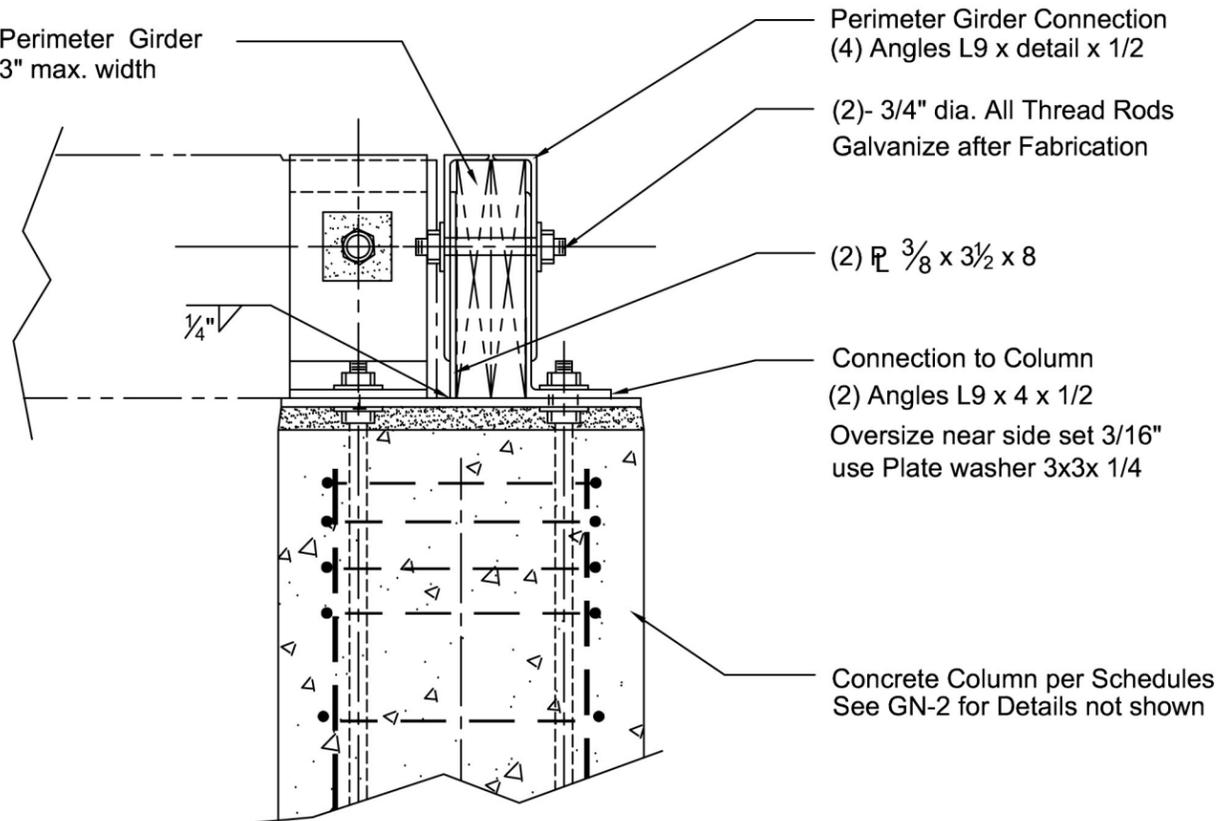
Double Joist Connection
(4) Angles L9 x detail x 1/2 - 3" wide

(2)- 3/4" dia. All Thread Rods
Galvanize after Fabrication

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

3
GN-5 SCALE: NTS

Perimeter Girder
3" max. width

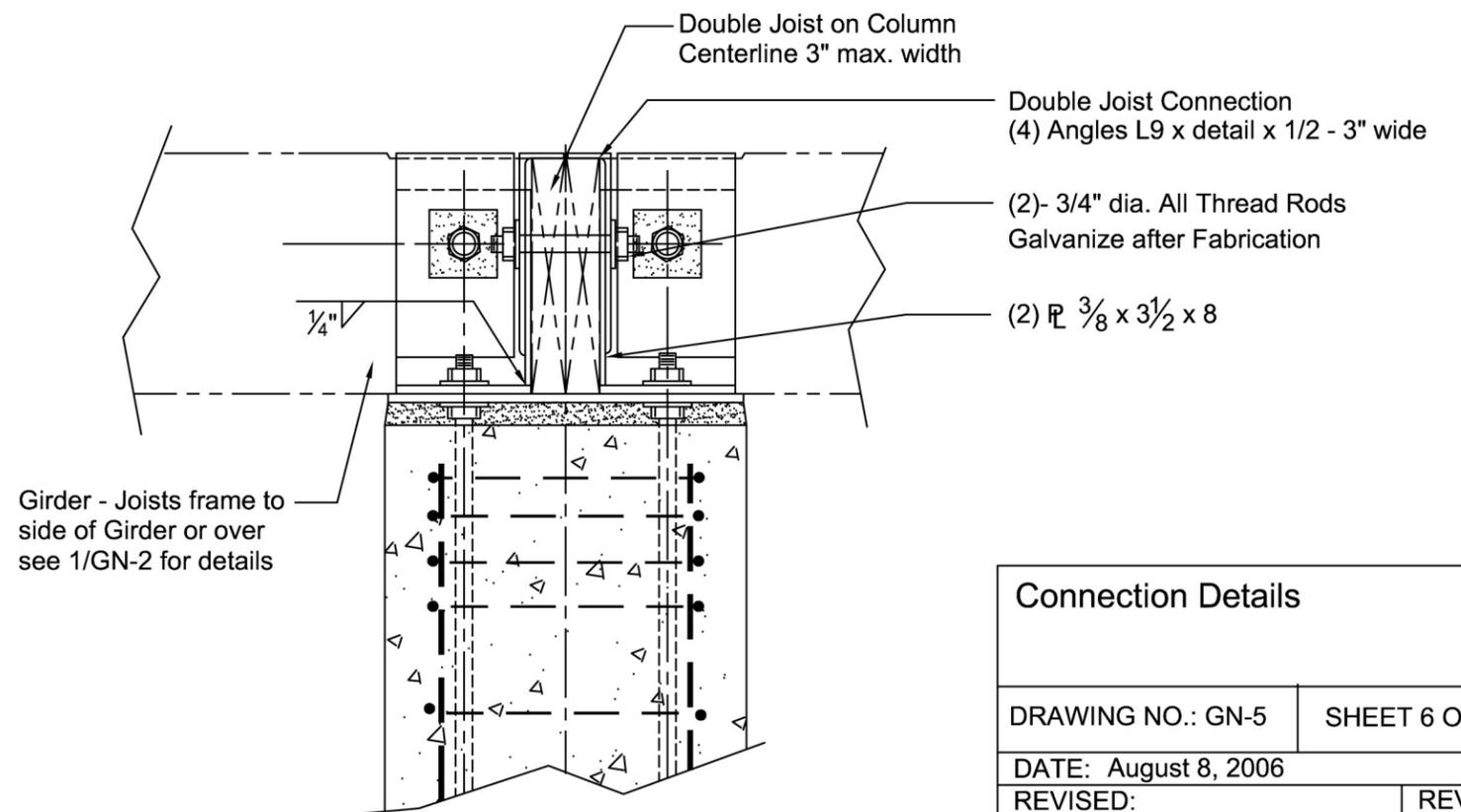


Concrete Column per Schedules
See GN-2 for Details not shown

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

2
GN-5 SCALE: NTS

Girder - Joists frame to side of Girder or over see 1/GN-2 for details



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

4
GN-5 SCALE: NTS

Connection Details

DRAWING NO.: GN-5 SHEET 6 OF 31

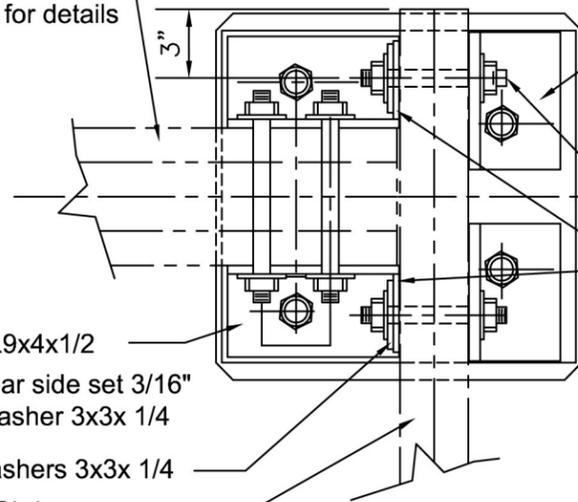
DATE: August 8, 2006

REVISED: REV. 9



FEMA

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

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

(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

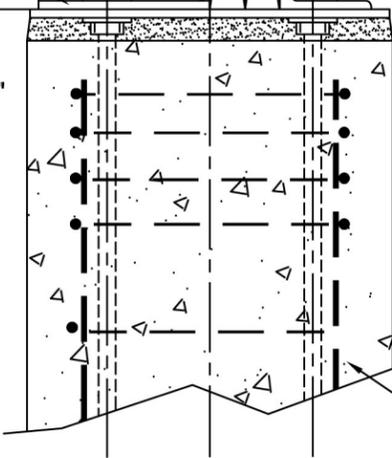
Girder - Joists frame to side of Girder or over see 1/GN-3 for details

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

(2) Plate washers 3x3x 1/4

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

1/4"



Perimeter Girder 3" max. width

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

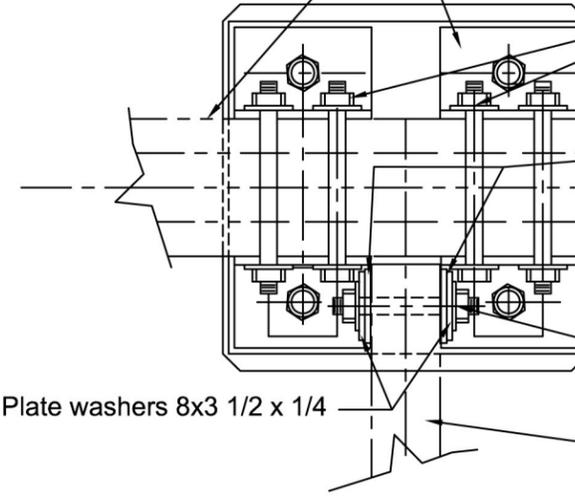
(4)- 3/4" Dia. Galvanized All Thread Rods See Typical Connection Elevation

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

Double Angle Beam (DAB) Corner Connection Section

2
GN-6 SCALE: NTS

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

(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

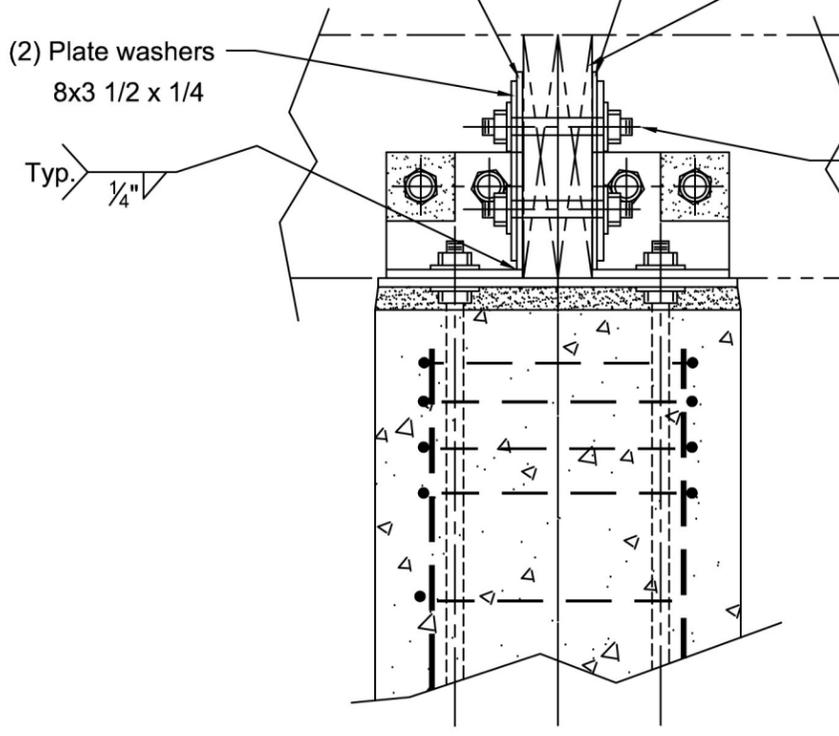
(2) $\text{PL } 3/8 \times 3 \frac{1}{2} \times 8$

(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

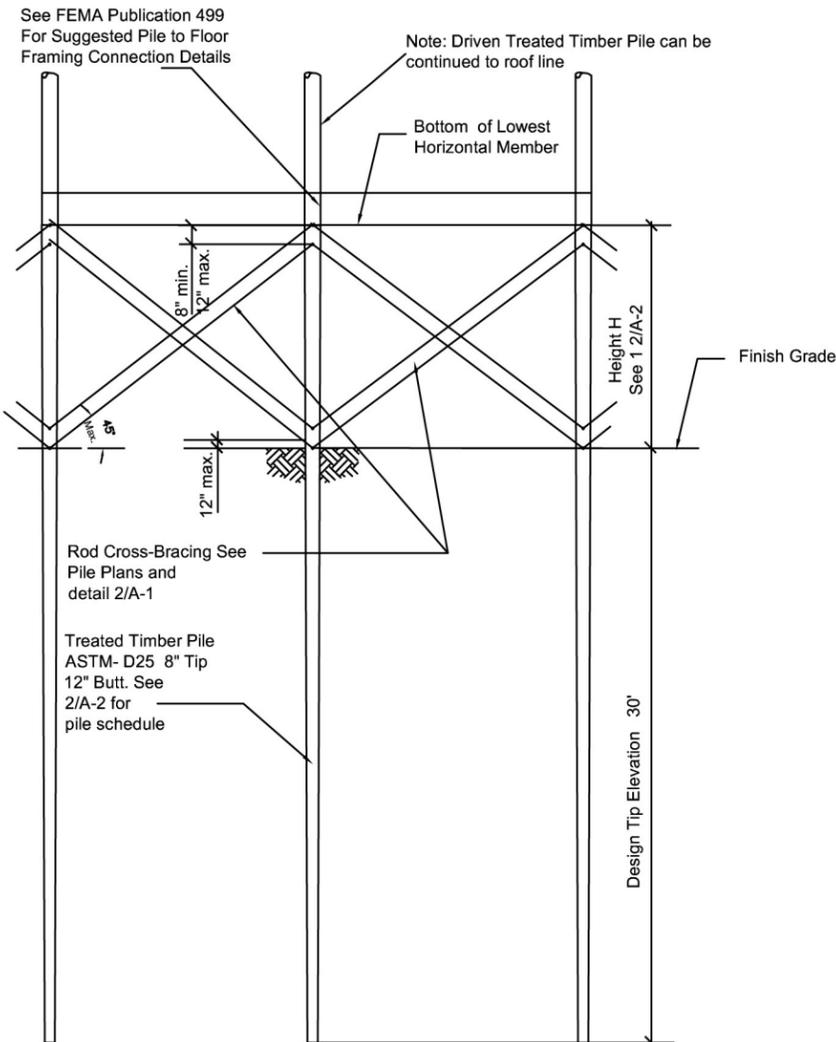
DATE: August 8, 2006

REVISED:

REV. 9



FEMA



Case A Open Foundation - Driven Treated Timber Pile

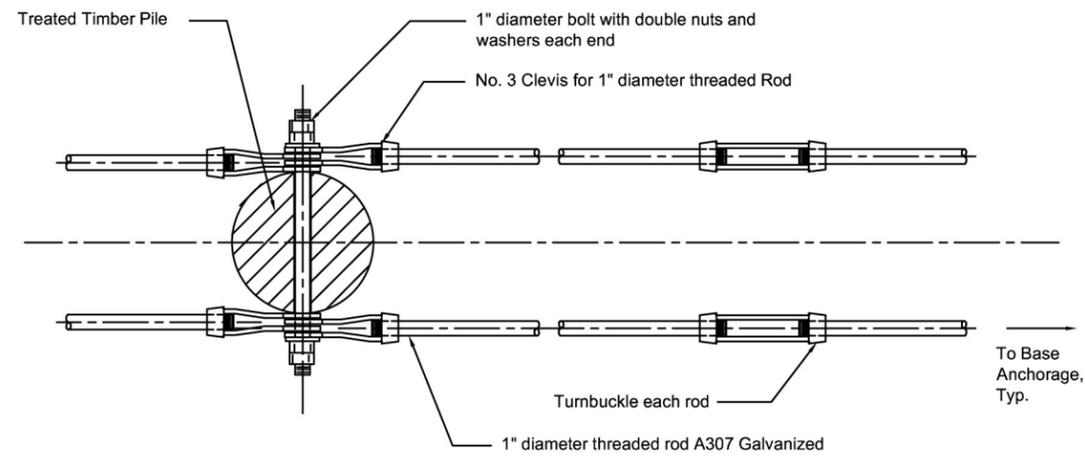
1
A-1

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

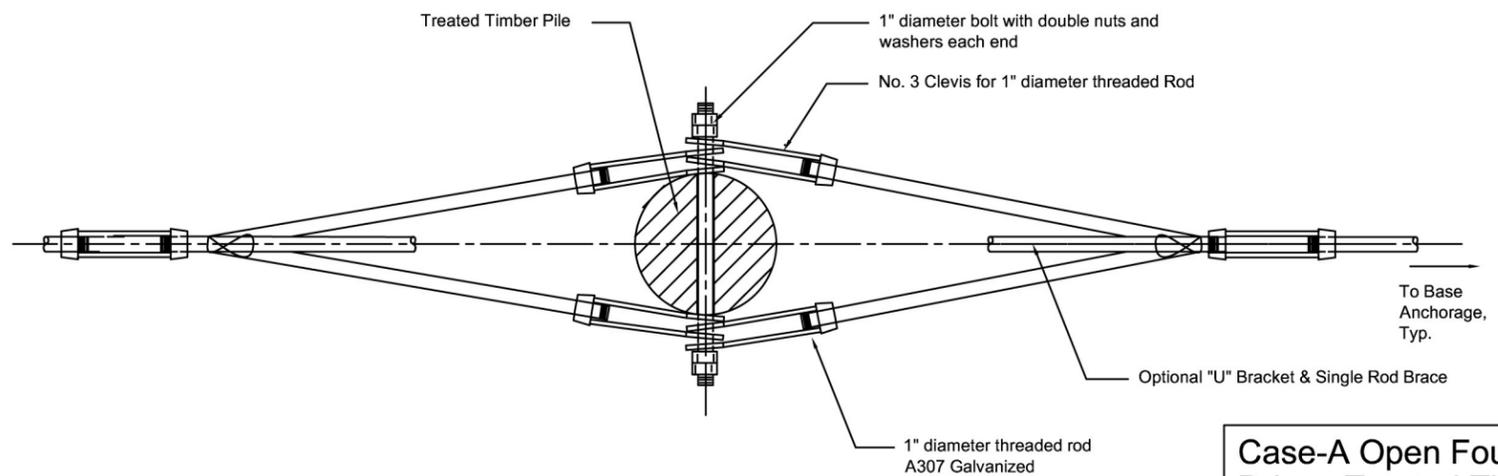


2
A-1

Case A Open Foundation - Driven Treated Timber Pile

Rod Bracing Detail

SCALE: NTS



Note: All steel shall be Galvanized

3
A-1

Case A Open Foundation - Driven Treated Timber Pile

Rod Bracing Detail (Alternate)

SCALE: NTS

Case-A Open Foundation Driven Treated Timber Pile

DRAWING NO.: A-1

SHEET 8 OF 31

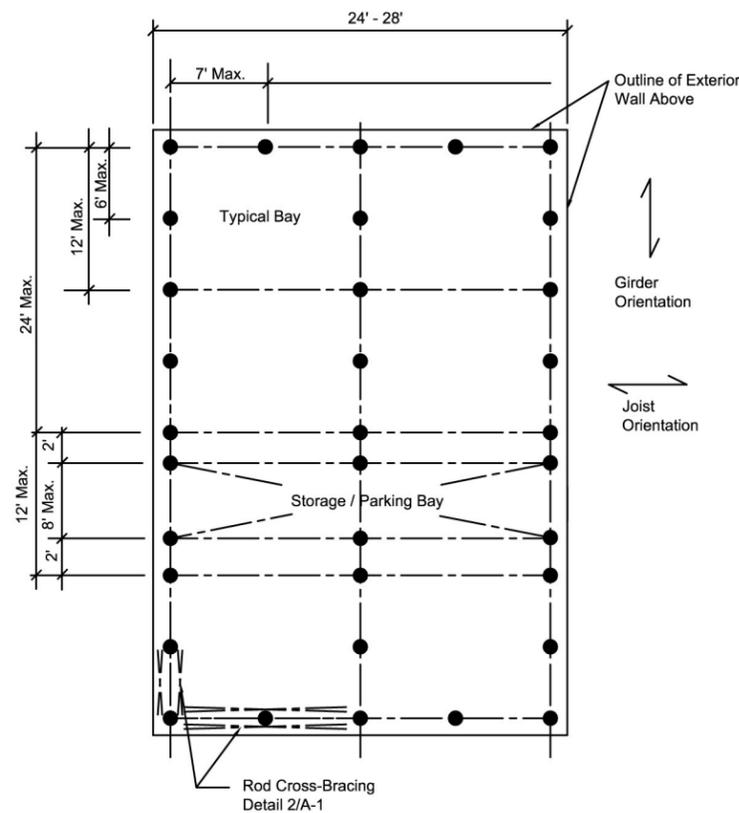
DATE: August 8, 2006

REVISED:

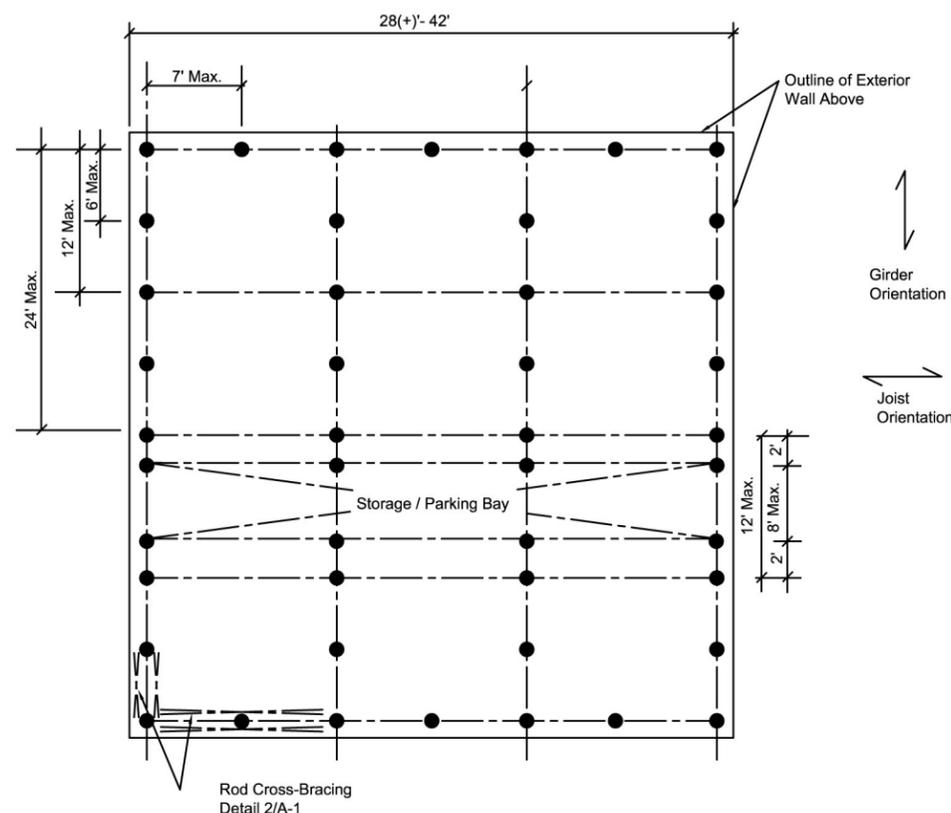
REV. 9



FEMA



8-Bay Pile Plan



12-Bay Pile Plan

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

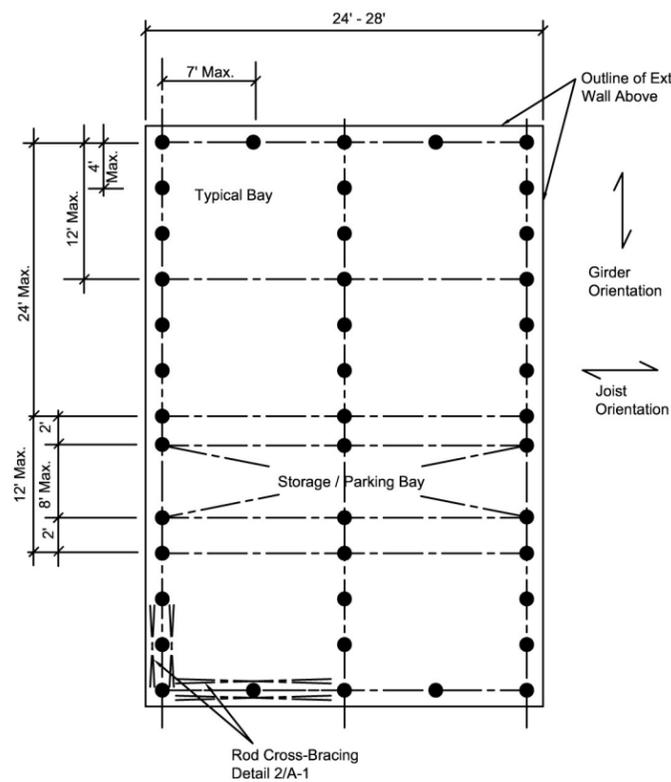
DRAWING NO.: A-2 SHEET 9 of 31

DATE: August 8, 2006

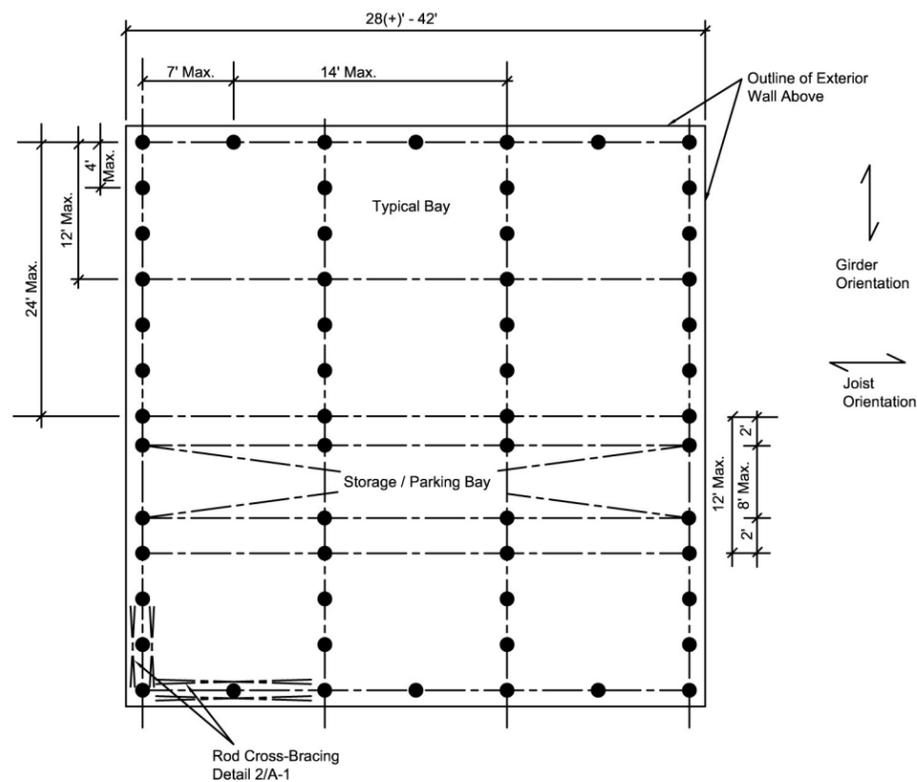
REVISED: REV. 8



FEMA



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 $((32'/24') \times 12$ 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**

DRAWING NO.: A-3 SHEET 10 OF 31

DATE: August 8, 2006

REVISED: REV. 9



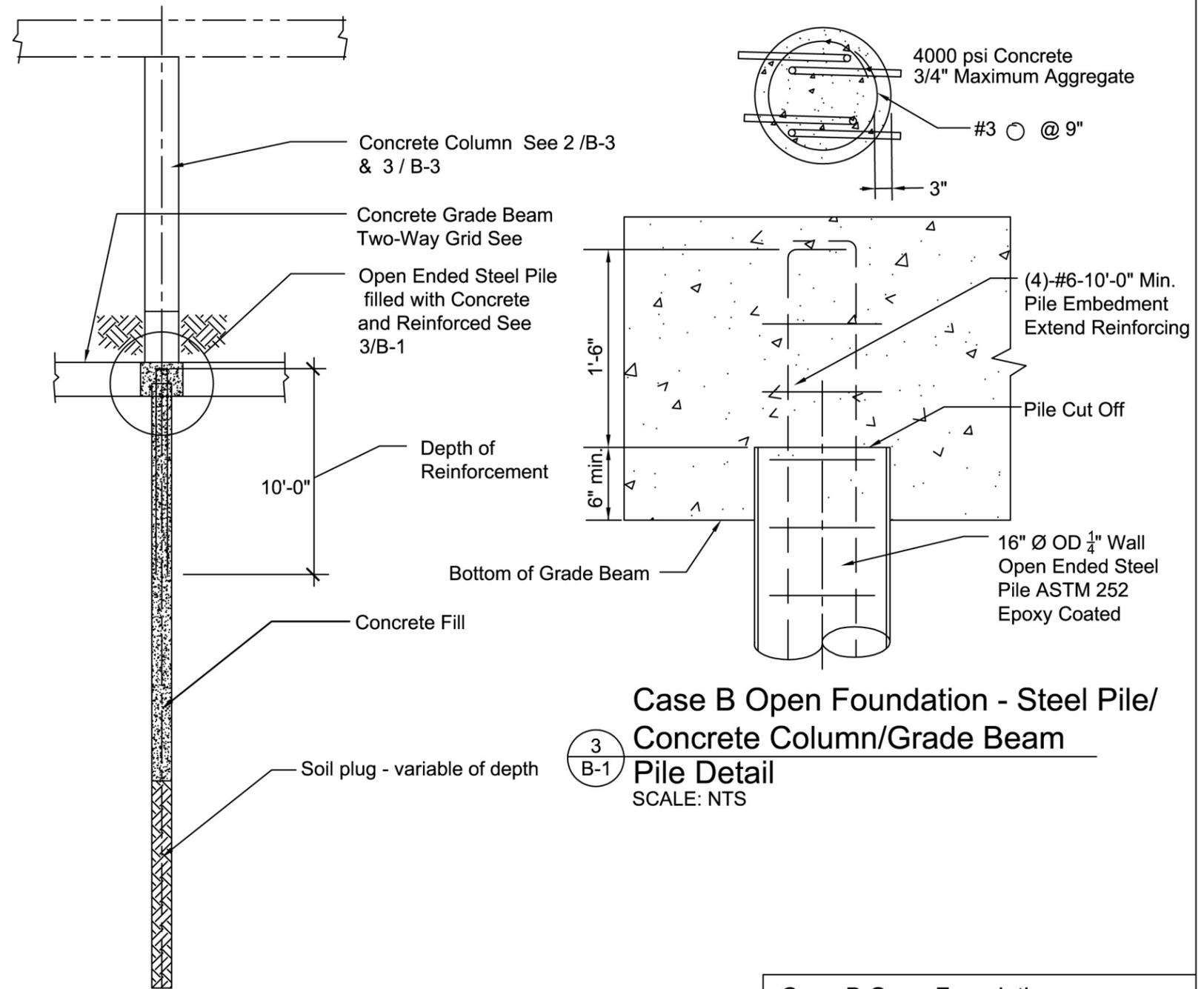
FEMA

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

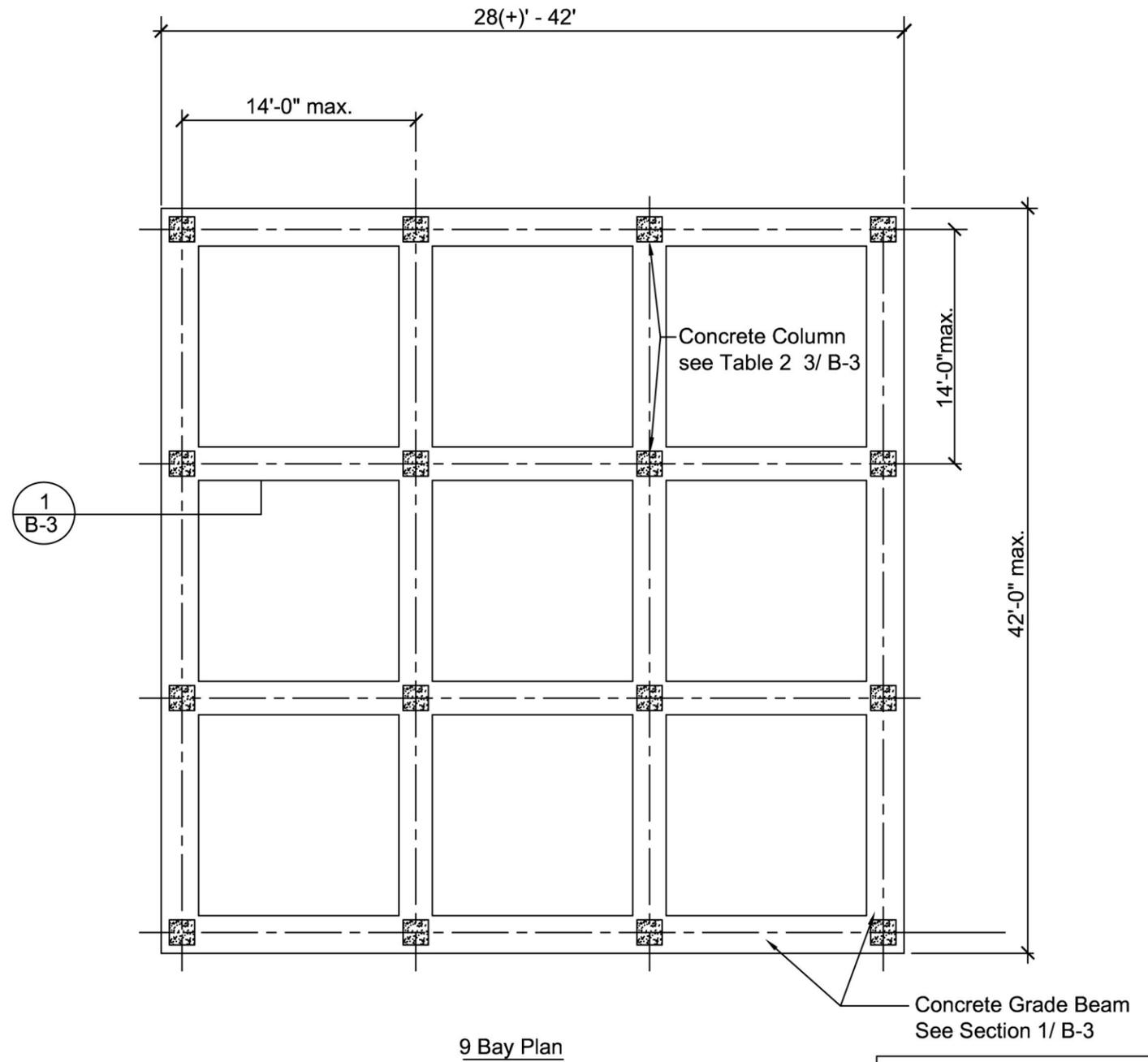
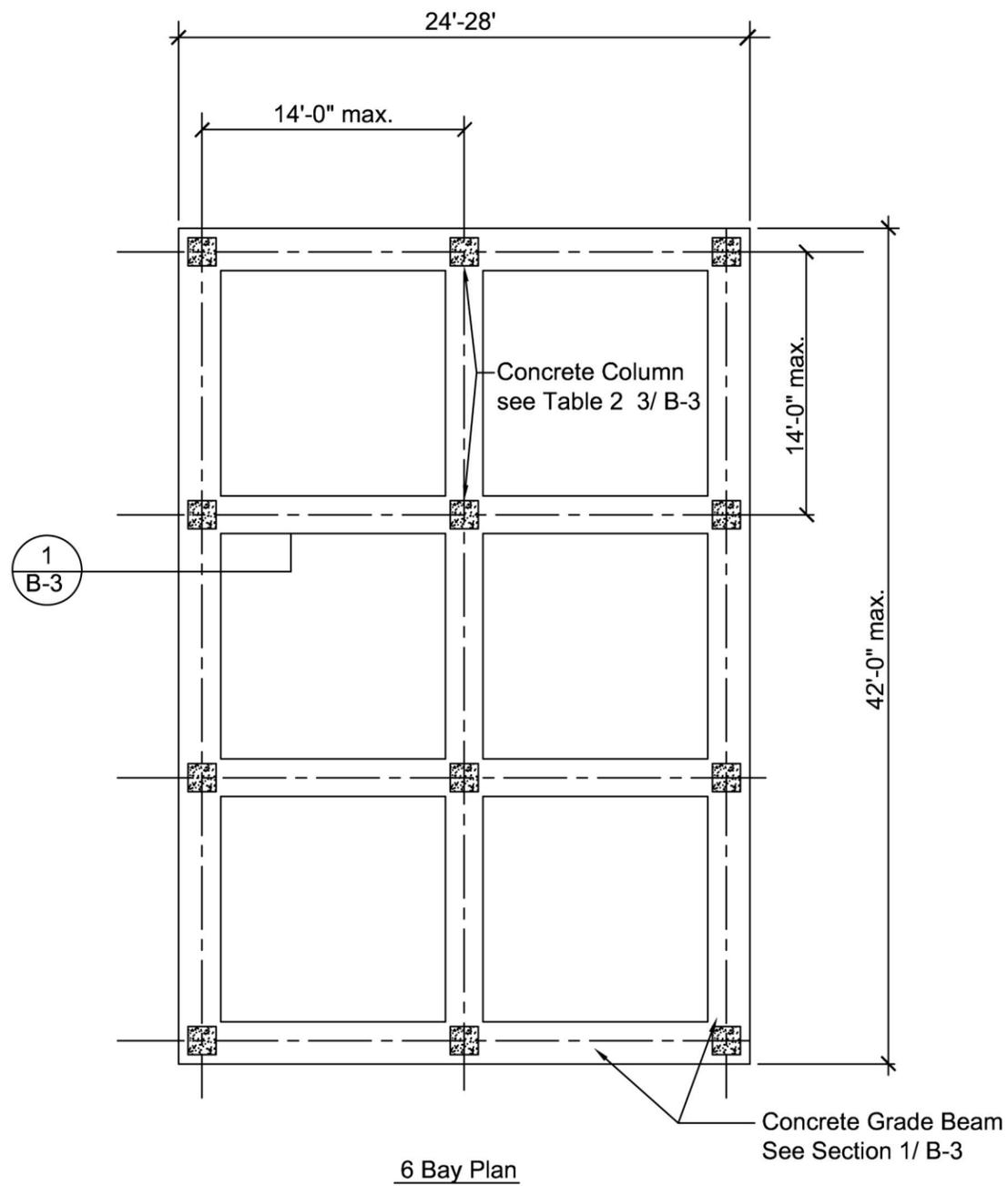
DATE: August 8, 2006

REVISED: REV. 9



FEMA

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



1
B-2

Open Foundation - Column & Grade Beam

SCALE: NTS

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

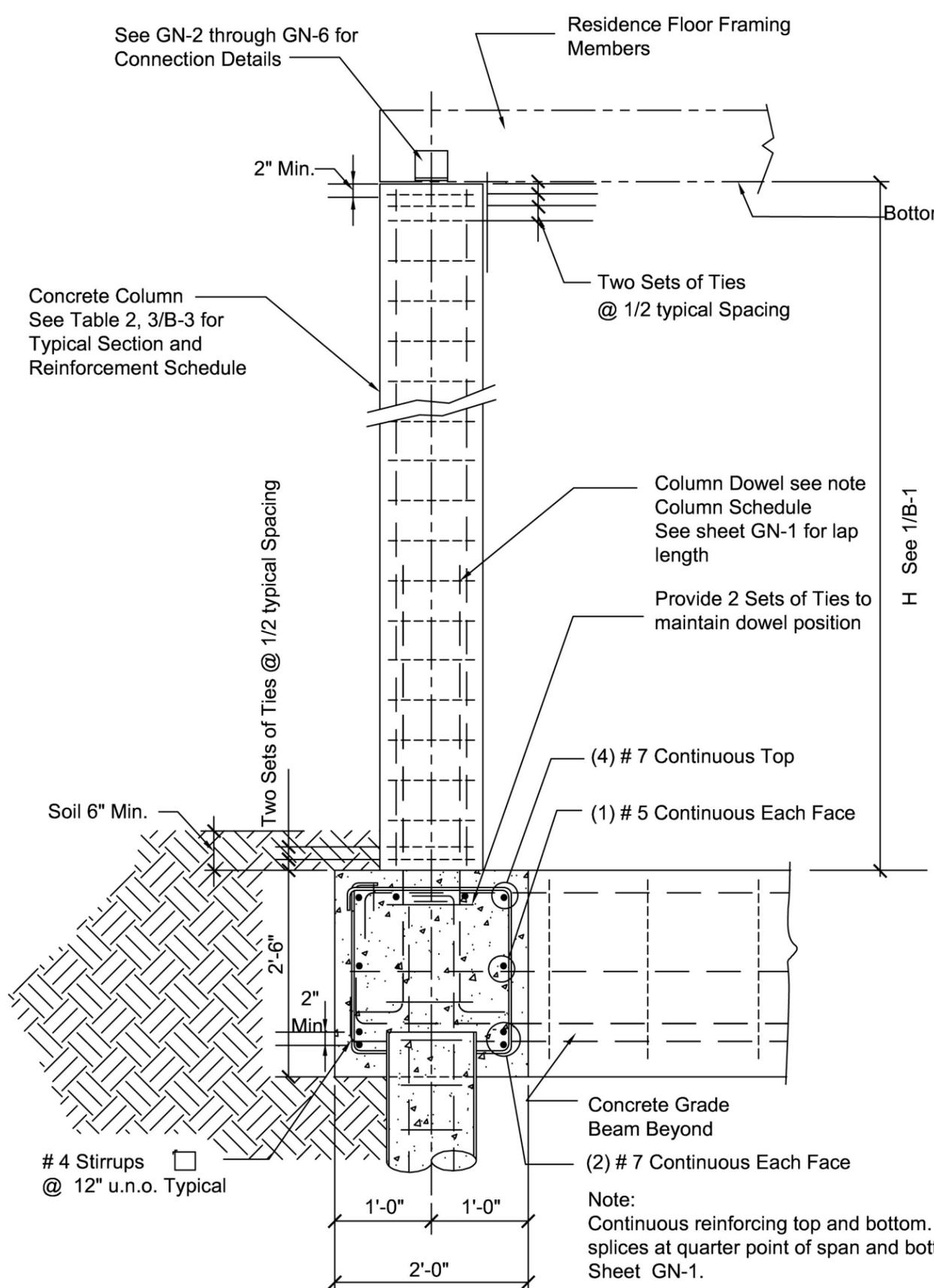
DRAWING NO.: B-2 SHEET 12 OF 31

DATE: August 8, 2006

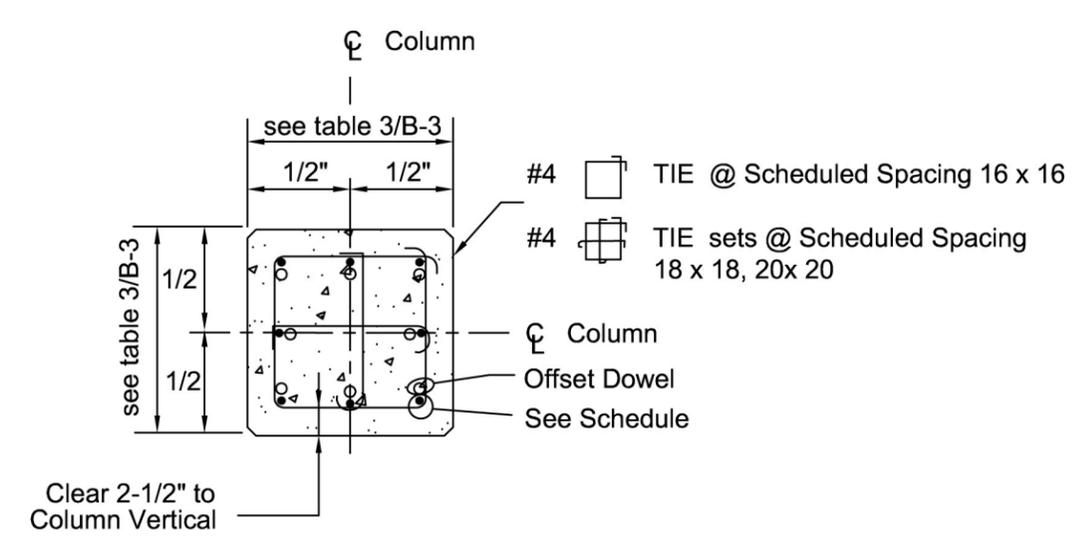
REVISED: REV. 9



FEMA



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

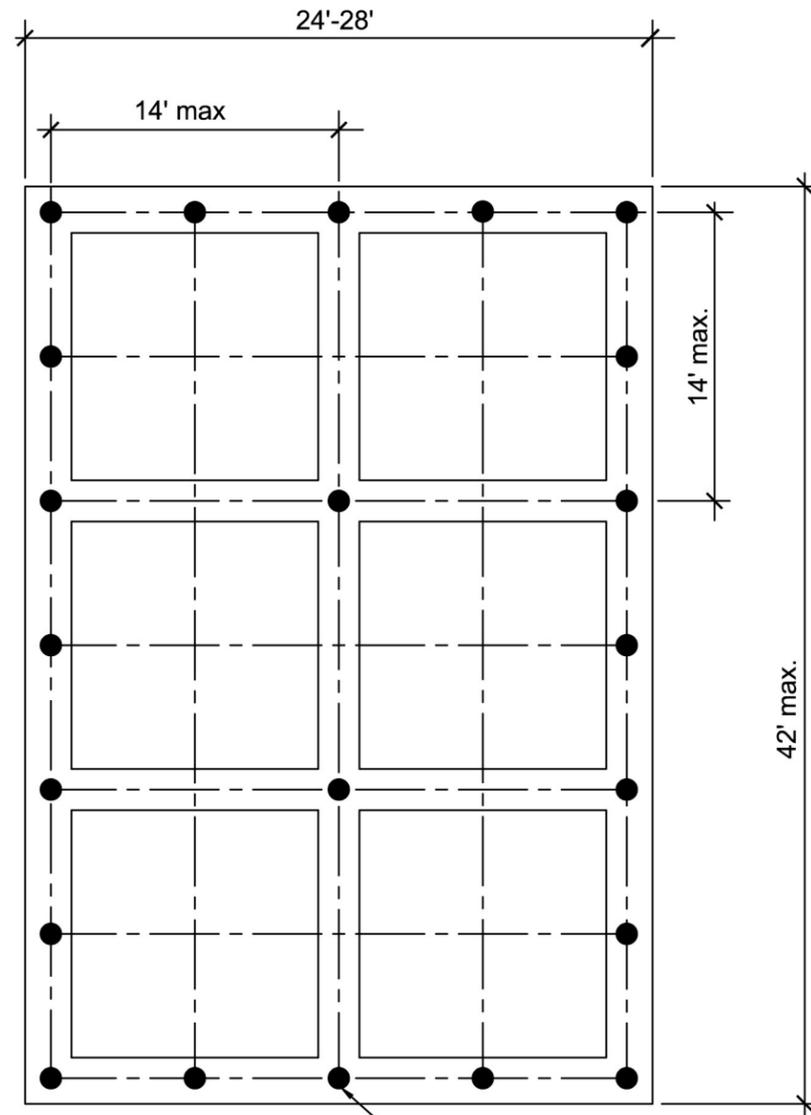
Size	16" x 16"	18" x 18"	20" x 20"
A	Verts (4) # 9 #4 Ties @ 16"	X	Verts (8) # 10 #4 Ties @ 18"
B	Verts (8) # 7 #4 Ties @ 14"	Verts (8) # 8 #4 Ties @ 16"	X
C	Verts (8) # 8 #4 Ties @ 16"	Verts (8) # 9 #4 Ties @ 18"	X
D	Verts (8) # 9 #4 Ties @ 16"	Verts (8) # 10 #4 Ties @ 18"	X

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

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

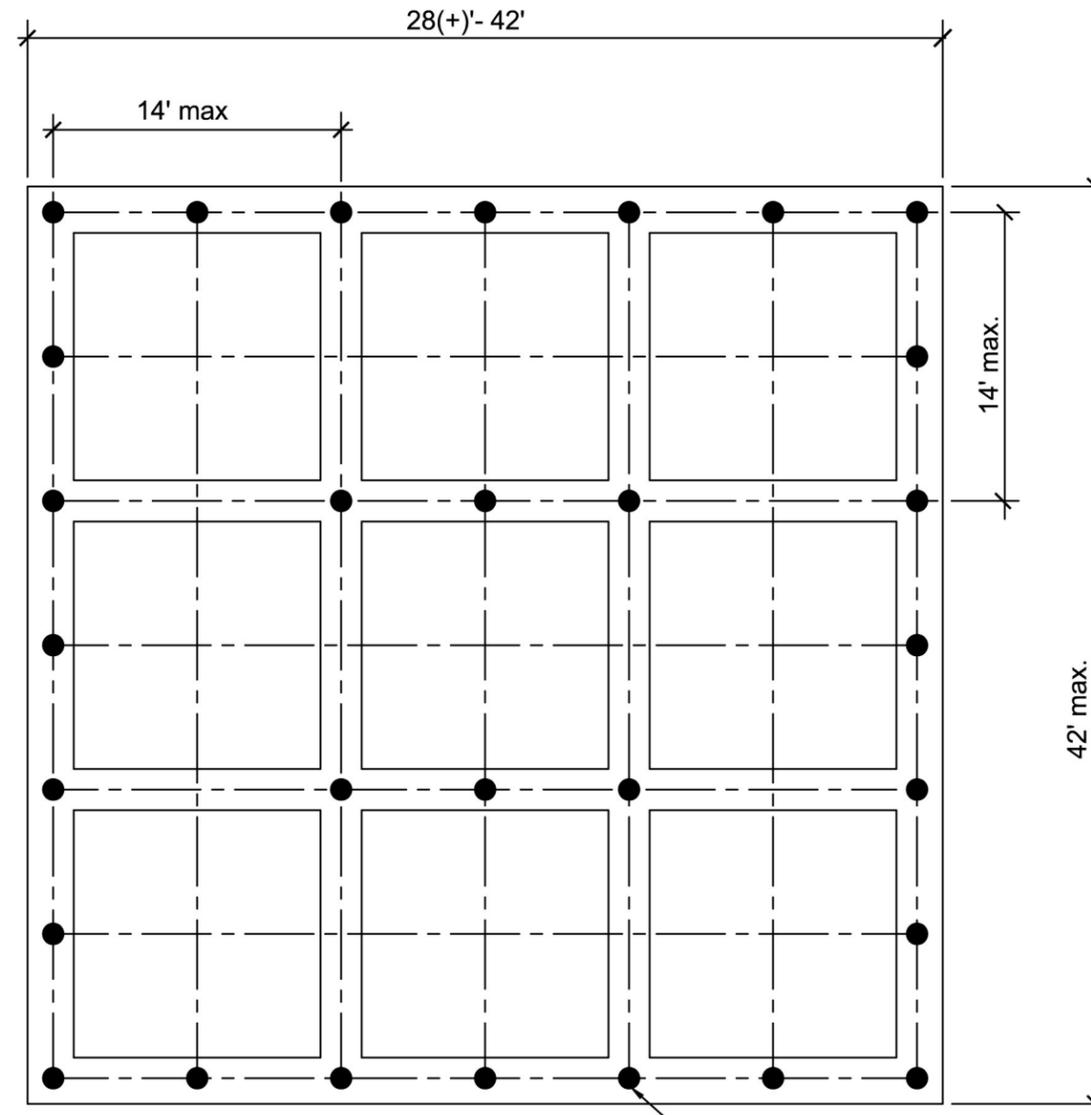
OESP Pile See details
2/B-1 and 3/B-1

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

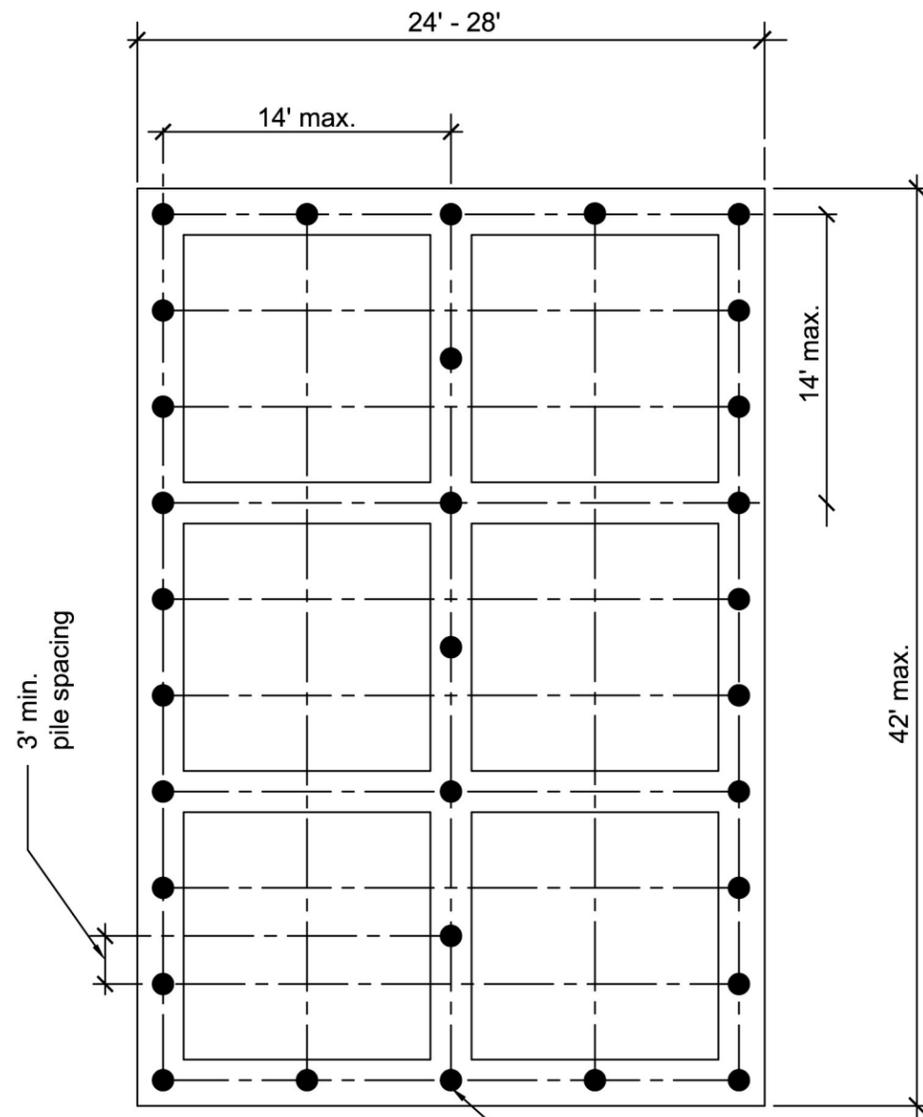
DATE: August 8, 2006

REVISED:

REV. 9



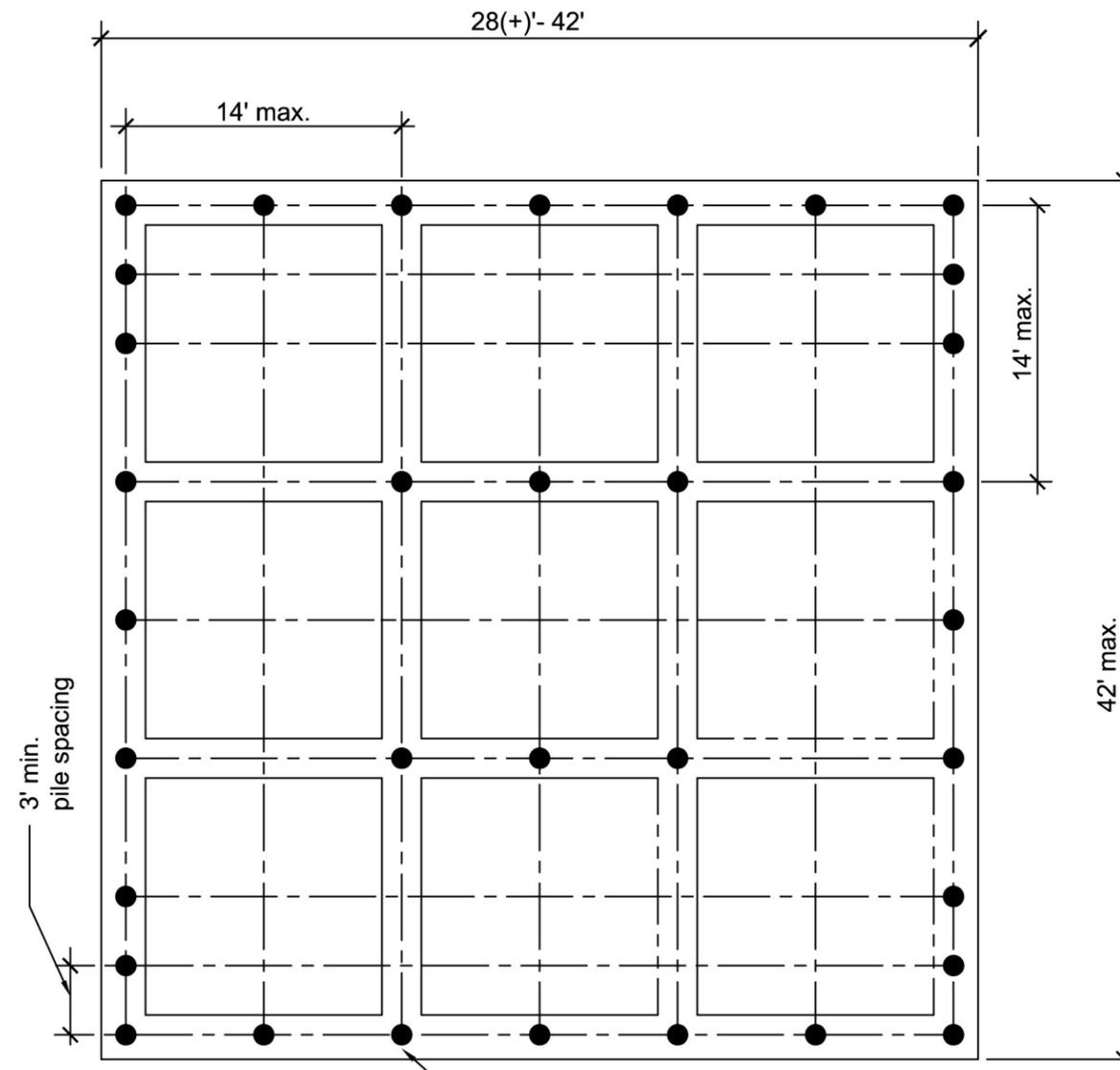
FEMA



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

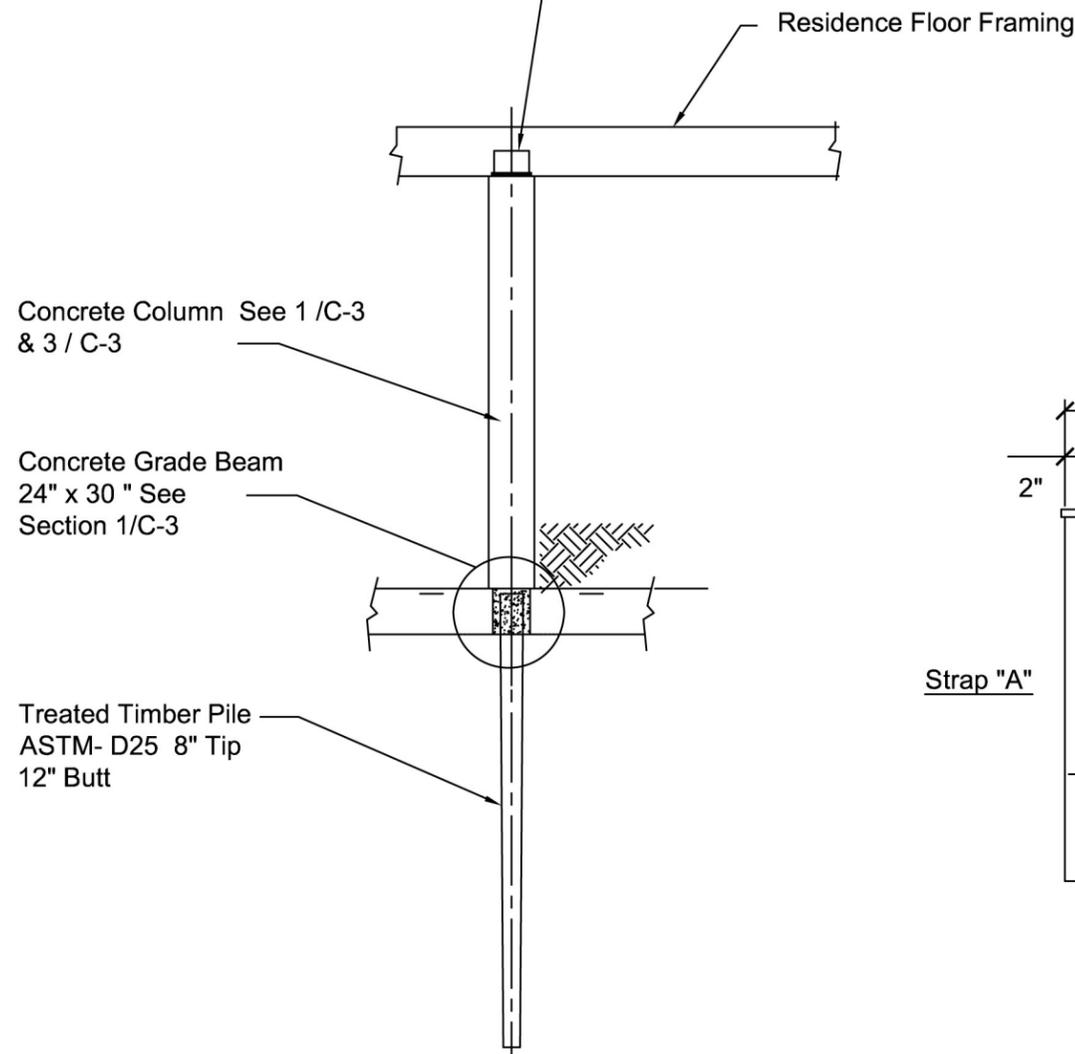
DATE: August 8, 2006

REVISED: REV. 9



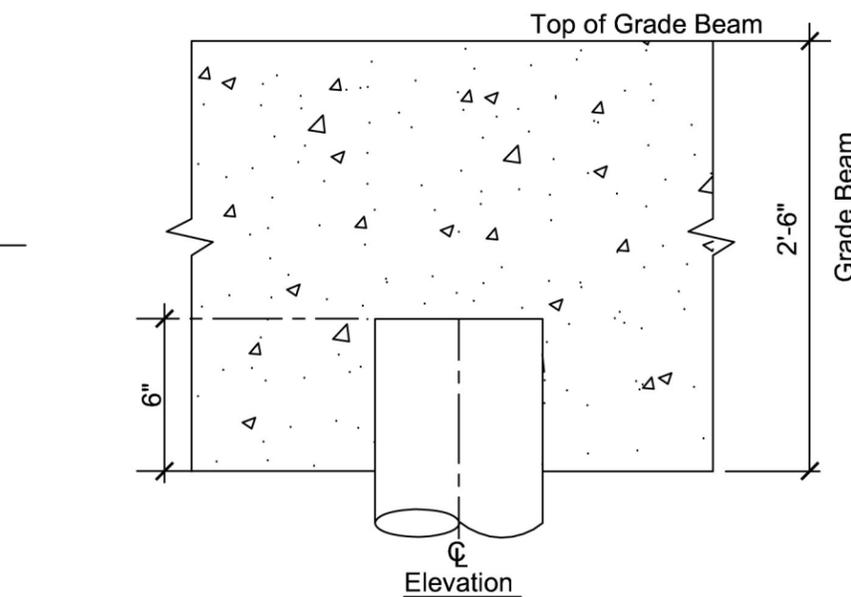
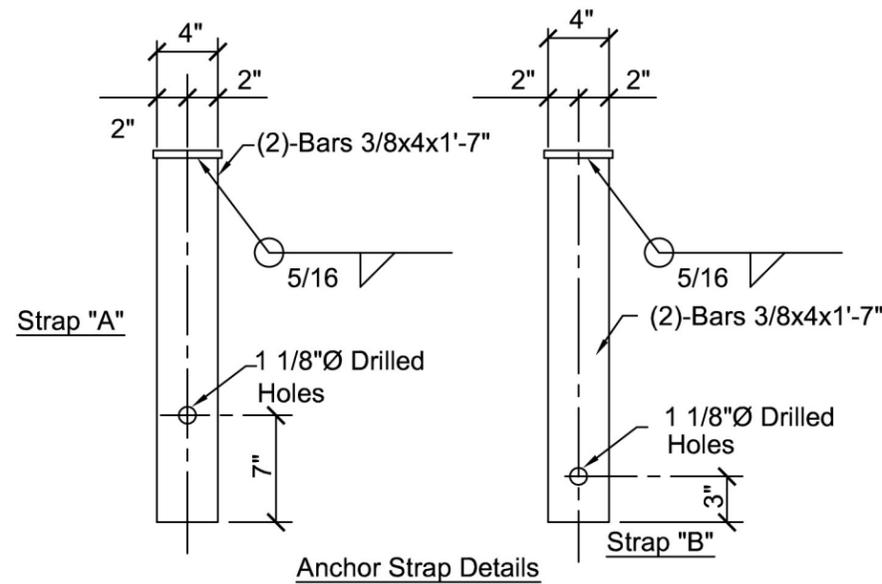
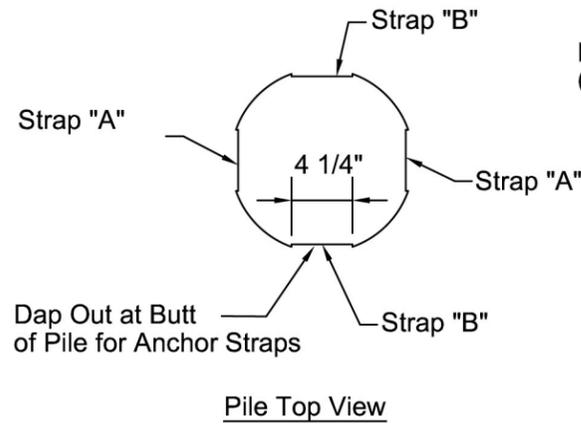
FEMA

See GN-2 through GN-6 for Suggested Column to Floor Framing Connection Details

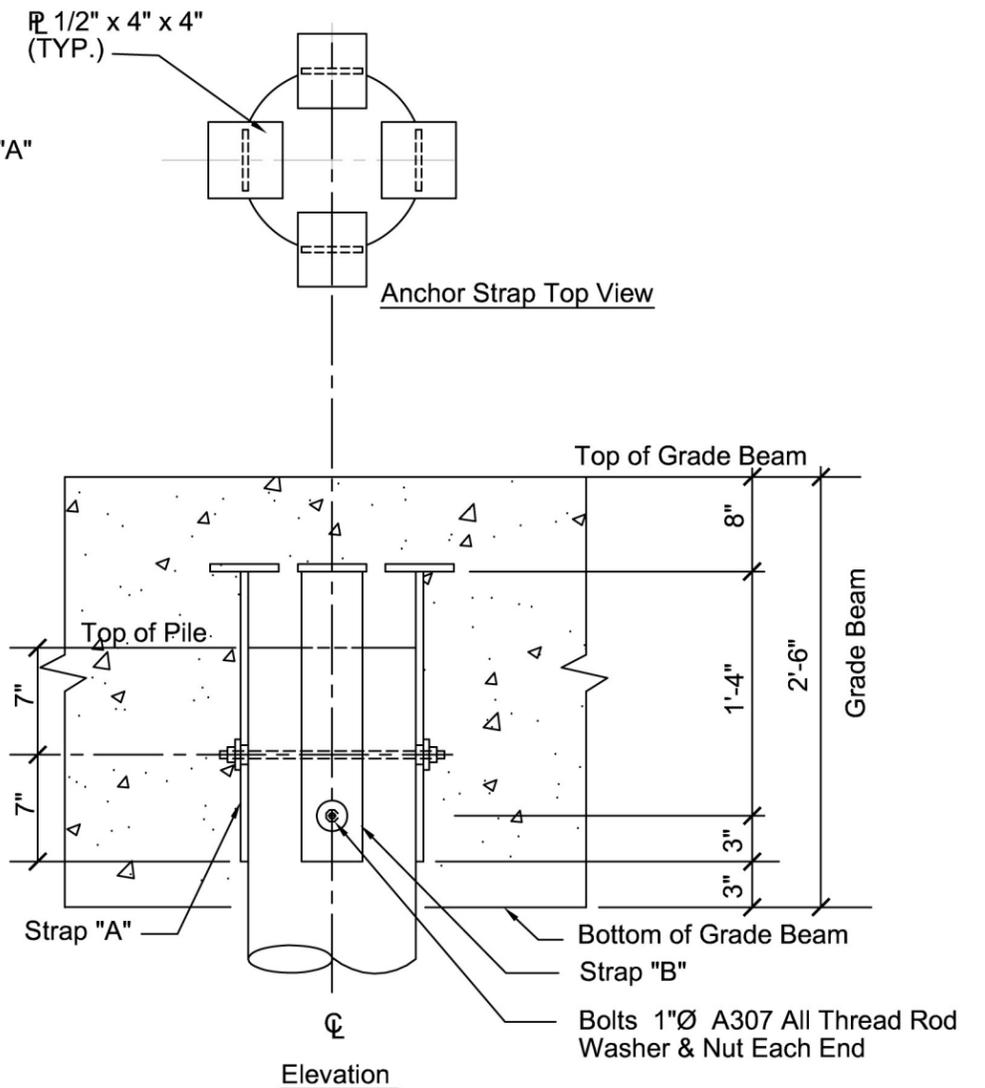


1
C-1
Case C Open Foundation - Concrete Column / Driven Treated Timber Pile Profile
SCALE: NTS

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



3
C-1
Case C Open Foundation - Timber Pile with Concrete Column & Grade Beam Non-Tension Pile Detail
SCALE: NTS



2
C-1
Case C Open Foundation - Timber Pile with Concrete Column & Grade Beam Tension Connection Details
SCALE: NTS

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

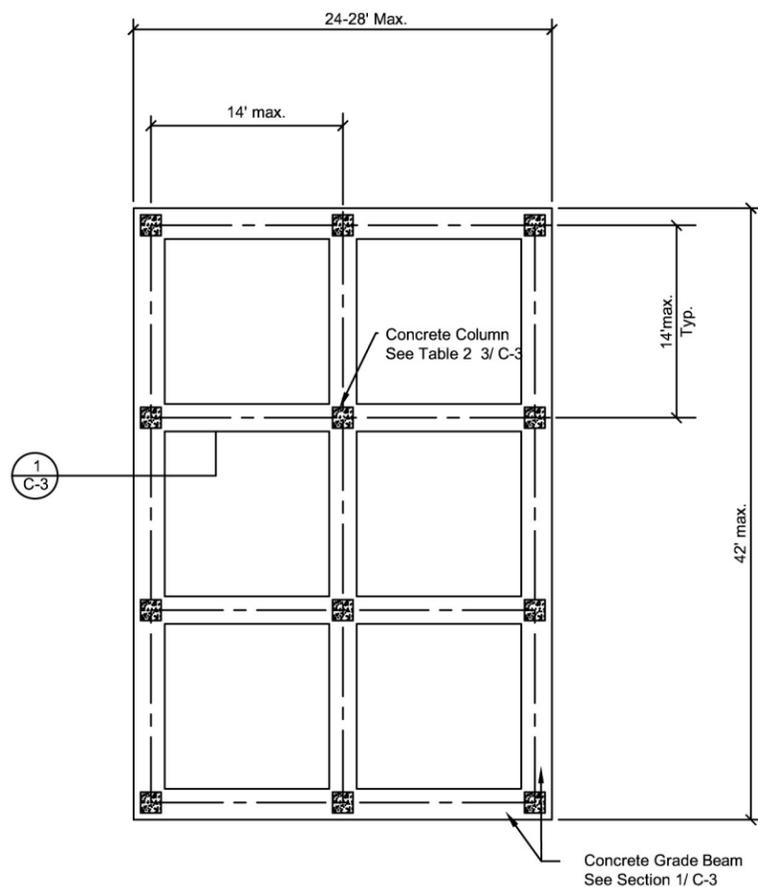
DRAWING NO.: C-1 SHEET 16 OF 31

DATE: August 8, 2006

REVISED: REV. 9



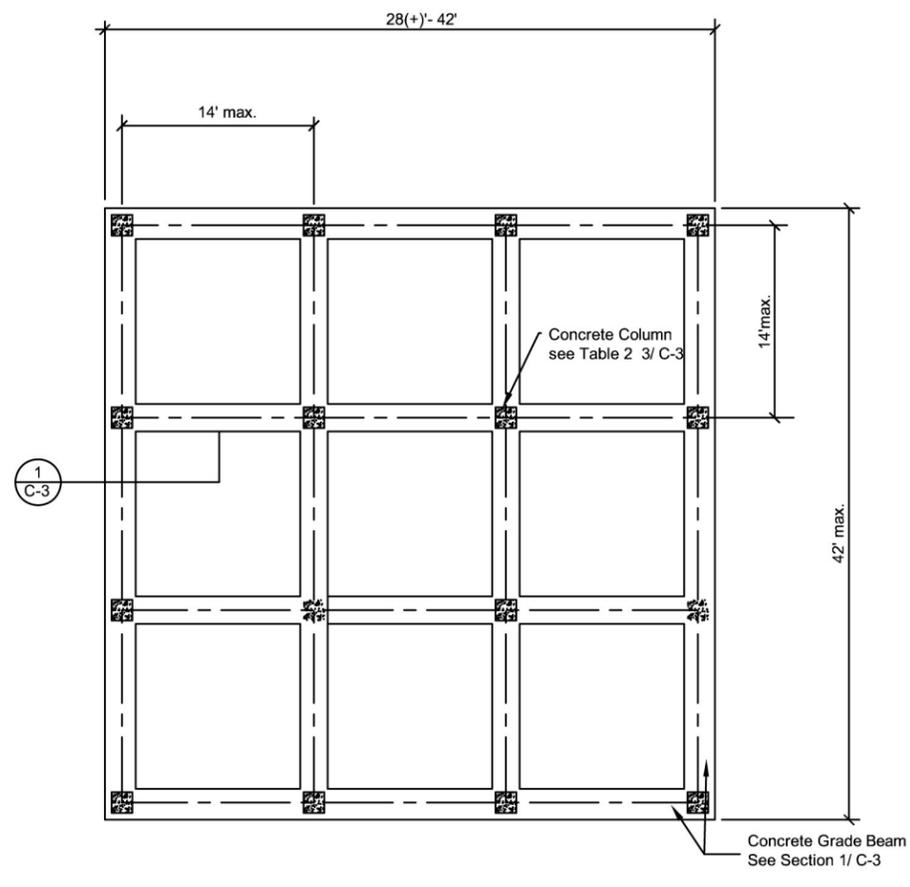
FEMA



6 Bay Column Plan

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

1
C-2
Plan
SCALE: NTS



9 Bay Column Plan

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

2
C-2
Plan
SCALE: NTS

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

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

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

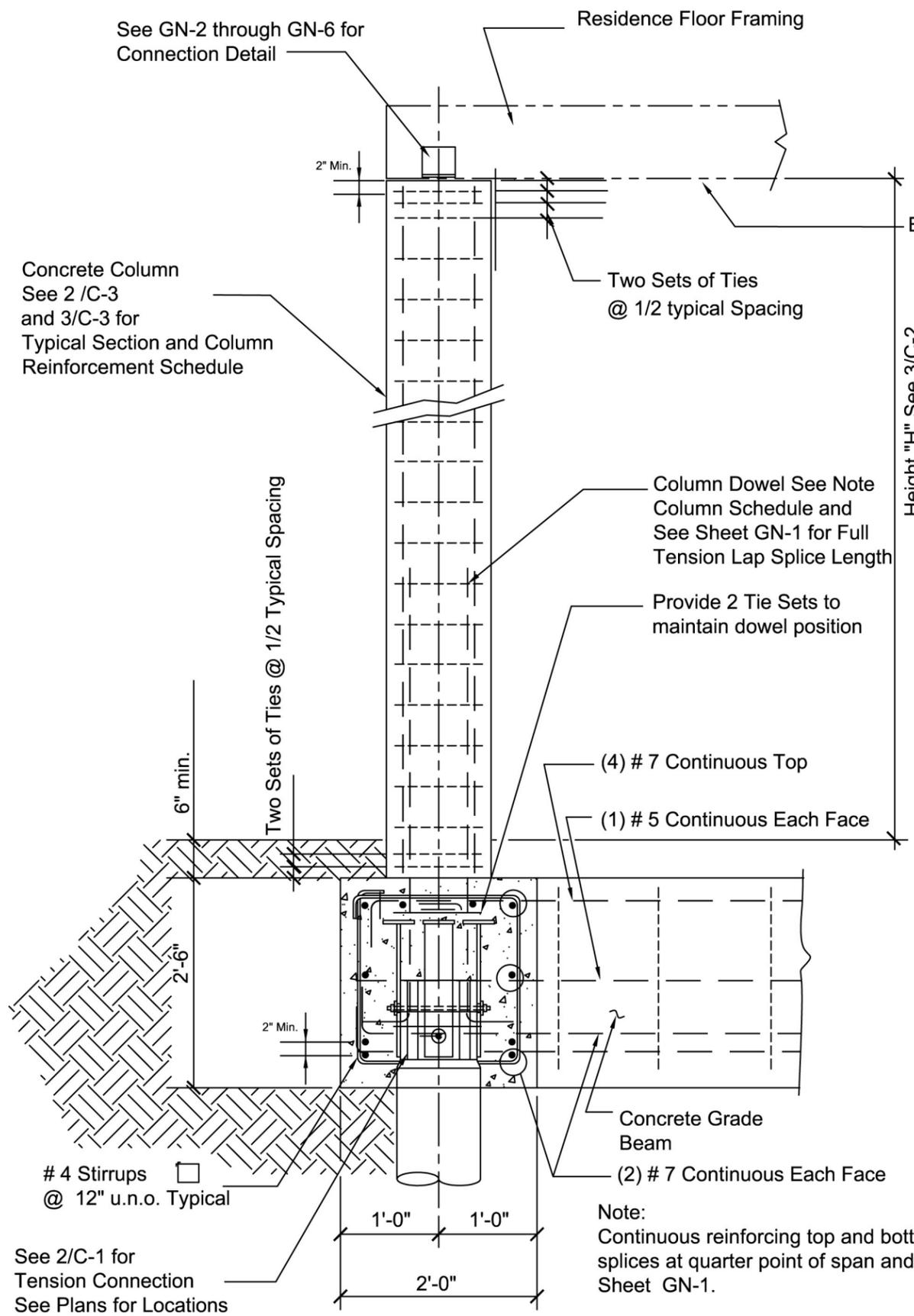
3
C-2
Schedule

Notes:
1) See Table 2, 3/C3 sheet for Column size and reinforcement details

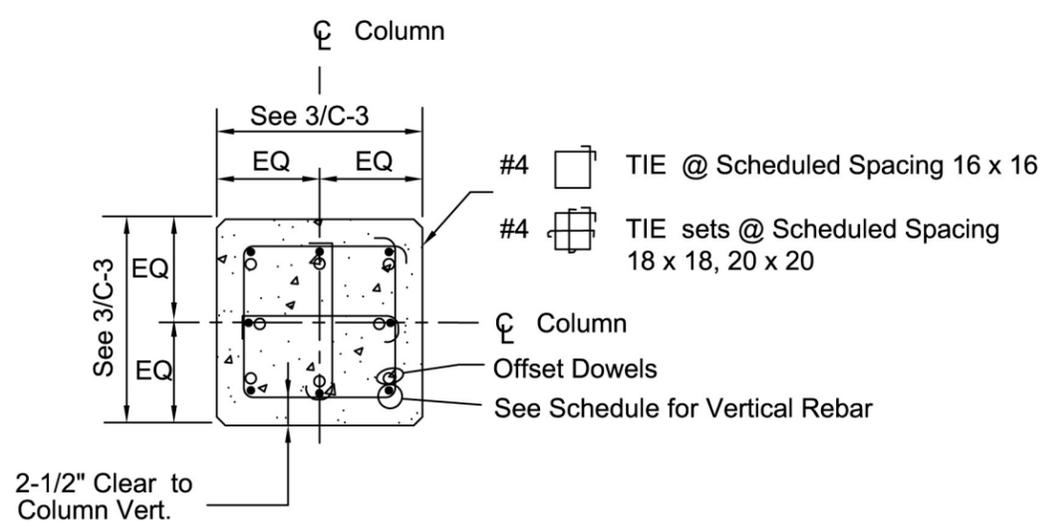
Case- C Open Foundation
Timber Pile with Concrete Column
and Grade Beam

DRAWING NO.: C-2 SHEET 17 OF 31
DATE: August 8, 2006
REVISED: REV. 9





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



2
C-3 Case C Open Foundation - Concrete Column/ Timber Pile Foundation
Typical Column Section
SCALE: NTS

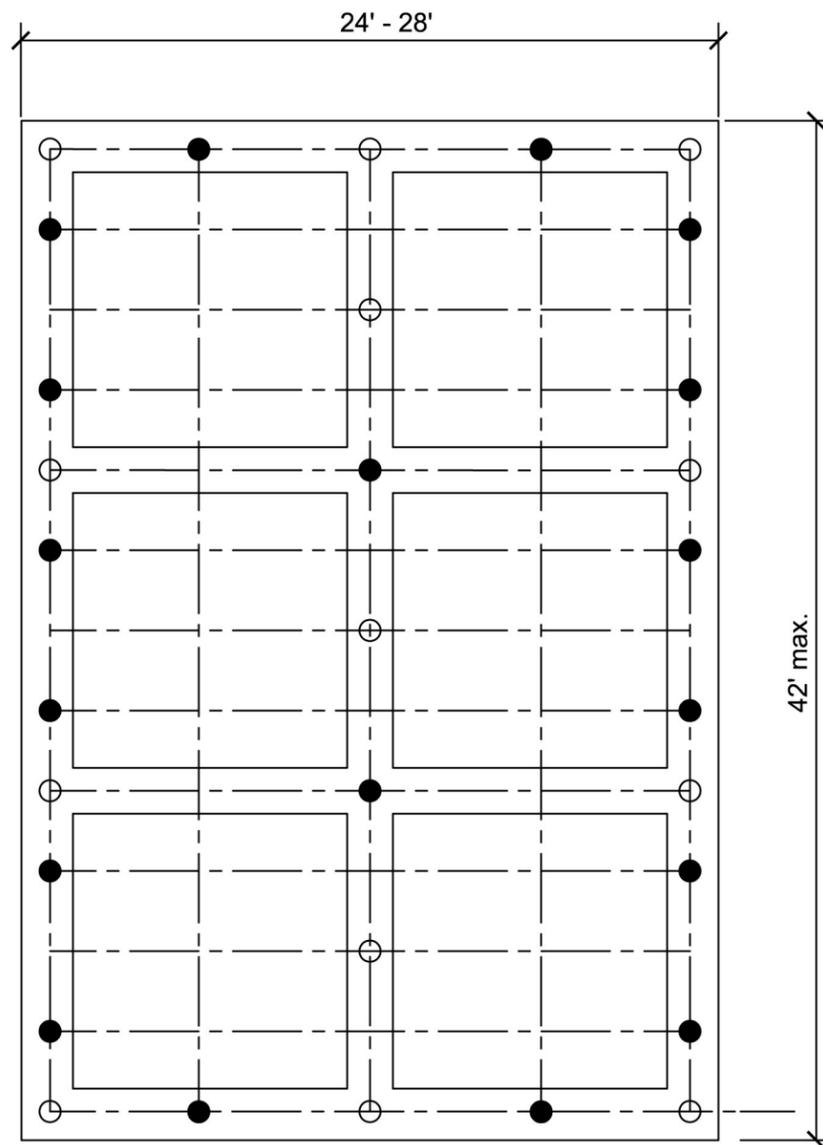
Size	16" x 16"	18" x 18"	20" x 20"
A	Verts (4) # 9 #4 Ties @ 16"	X	Verts (8) # 10 #4 Ties @ 18"
B	Verts (8) # 7 #4 Ties @ 14"	Verts (8) # 8 #4 Ties @ 16"	X
C	Verts (8) # 8 #4 Ties @ 16"	Verts (8) # 9 #4 Ties @ 18"	X
D	Verts (8) # 9 #4 Ties @ 16"	Verts (8) # 10 #4 Ties @ 18"	X

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

3
C-3 Case C Open Foundation - Table 2
Column Reinforcement Schedule

Case- C Open Foundation Timber Pile with Concrete Column and Grade Beam	
DRAWING NO.: C-3	SHEET 18 OF 31
DATE: August 8, 2006	
REVISED:	REV. 9





6 Bay Pile Plan

LEGEND

● Tension Pile--See 2/C-1

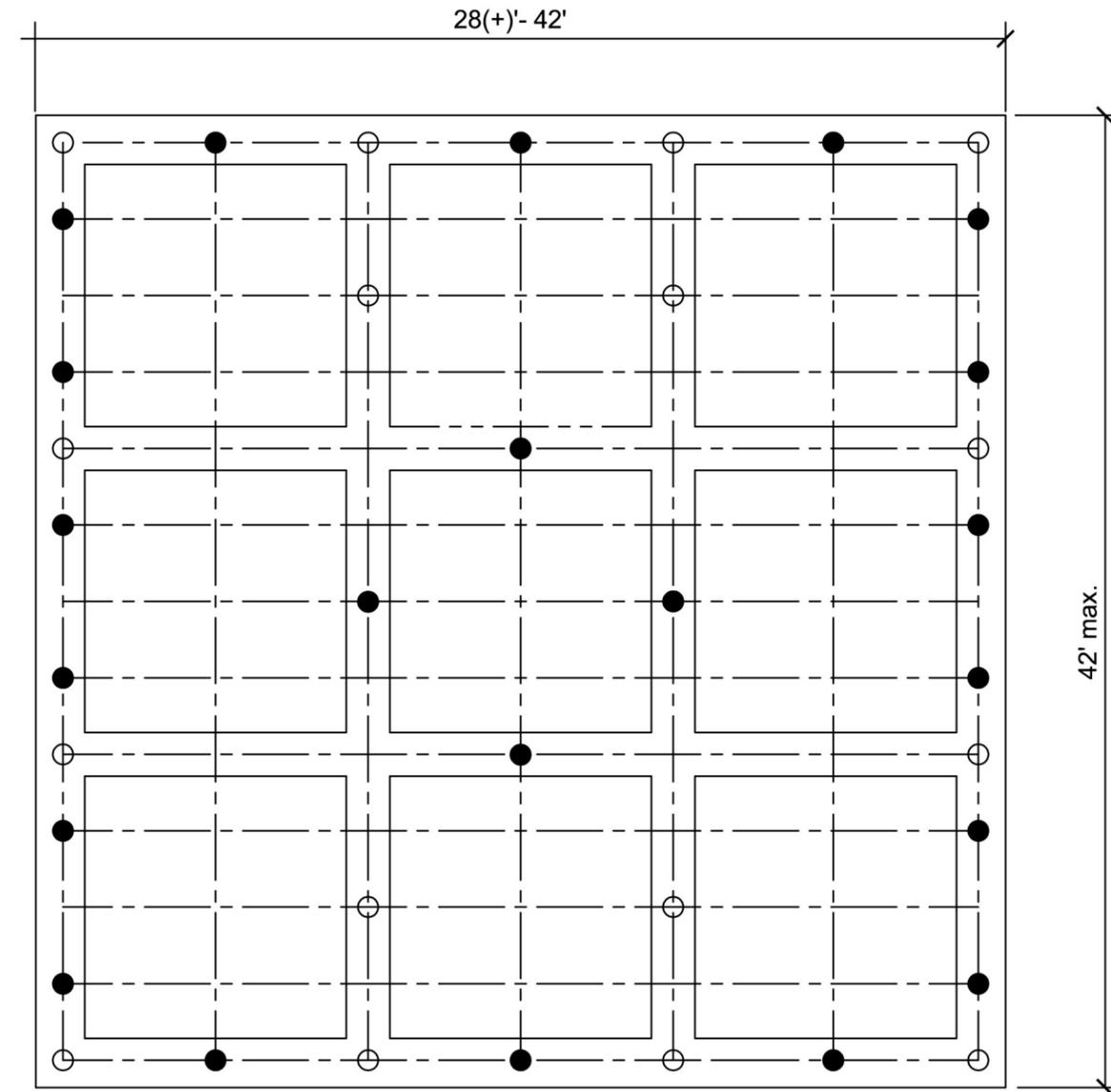
○ Non-Tension Pile--See 3/C-1

One and Two Story Residences Height H up to 10' - for winds up to 140 mph

1
C-4

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

Pile Plan
31 PILES
SCALE: NTS



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 140 mph

2
C-4

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

Pile Plan
38 PILES
SCALE: NTS

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

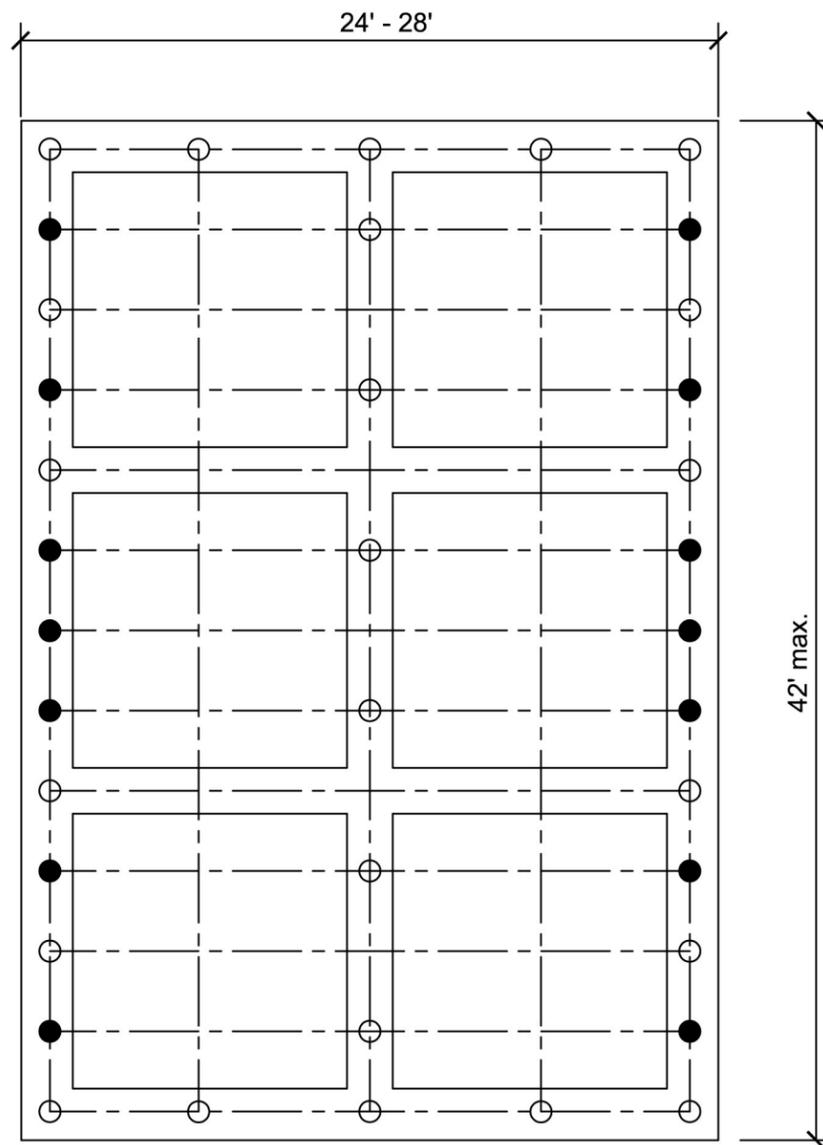
DRAWING NO.: C-4 SHEET 19 OF 31

DATE: August 8, 2006

REVISED: REV. 9



FEMA



6 Bay Pile Plan

LEGEND

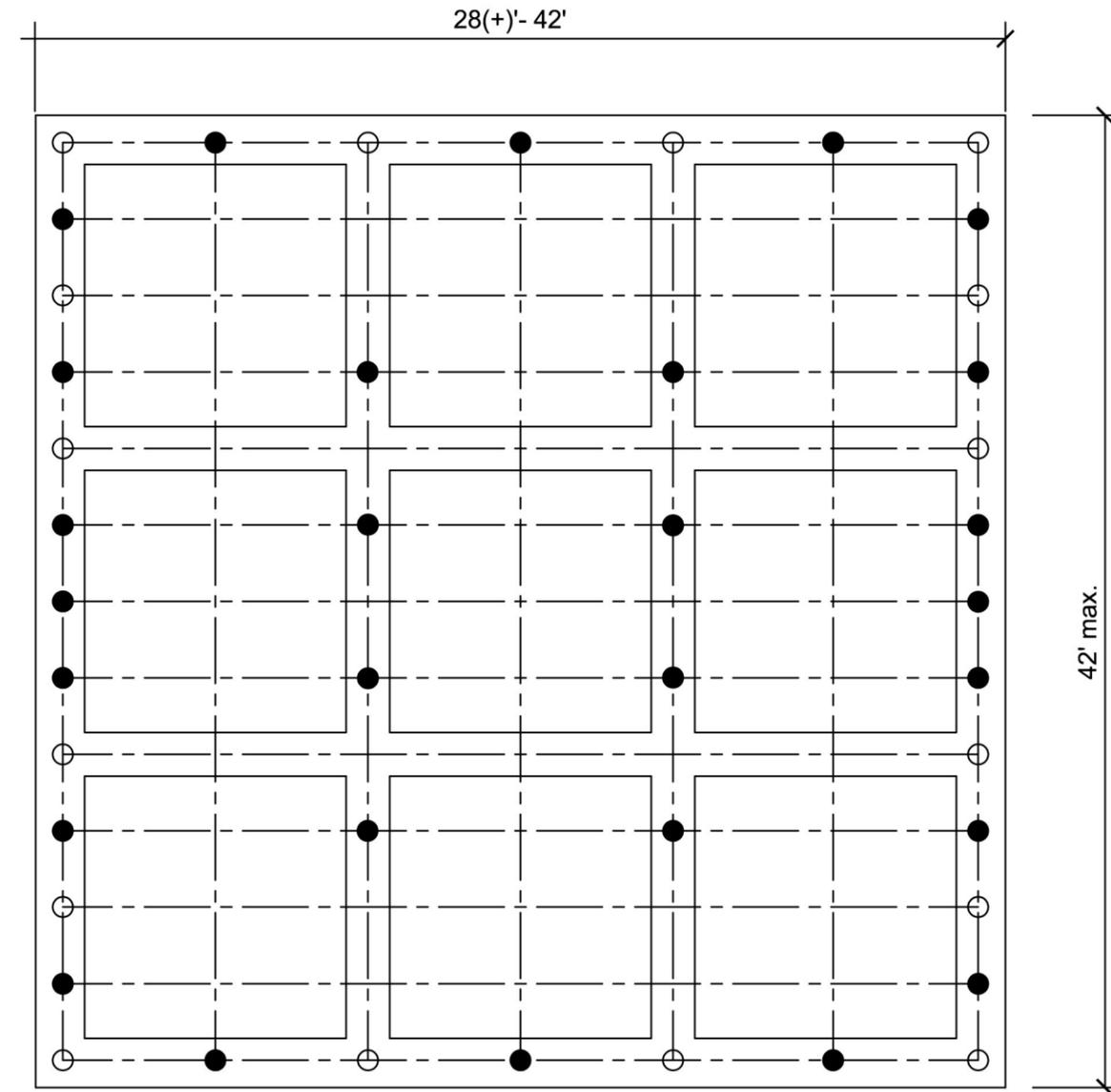
- Tension Pile--See 2/C-1
- Non-Tension Pile--See 3/C-1

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



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

2
C-5

Pile Plan
44 PILES
SCALE: NTS

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

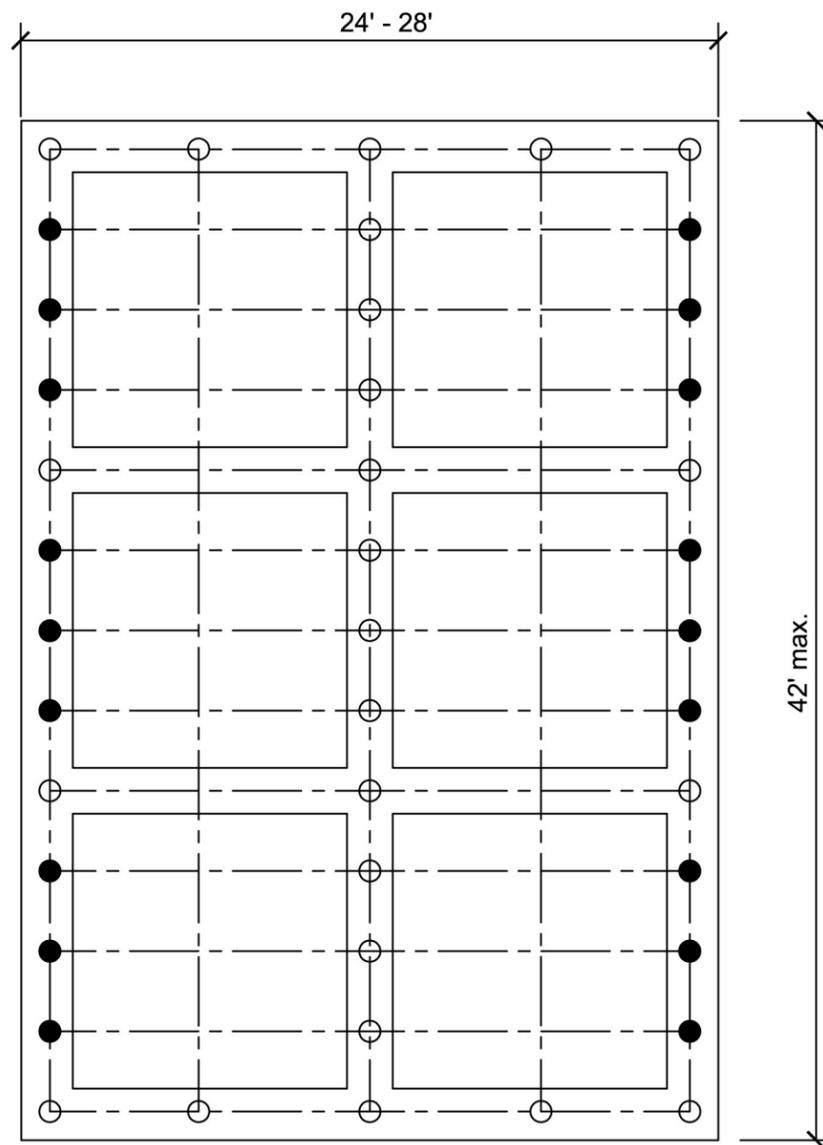
DRAWING NO.: C-5 SHEET 20 OF 31

DATE: August 8, 2006

REVISED: REV. 9



FEMA



6 Bay Pile Plan

LEGEND

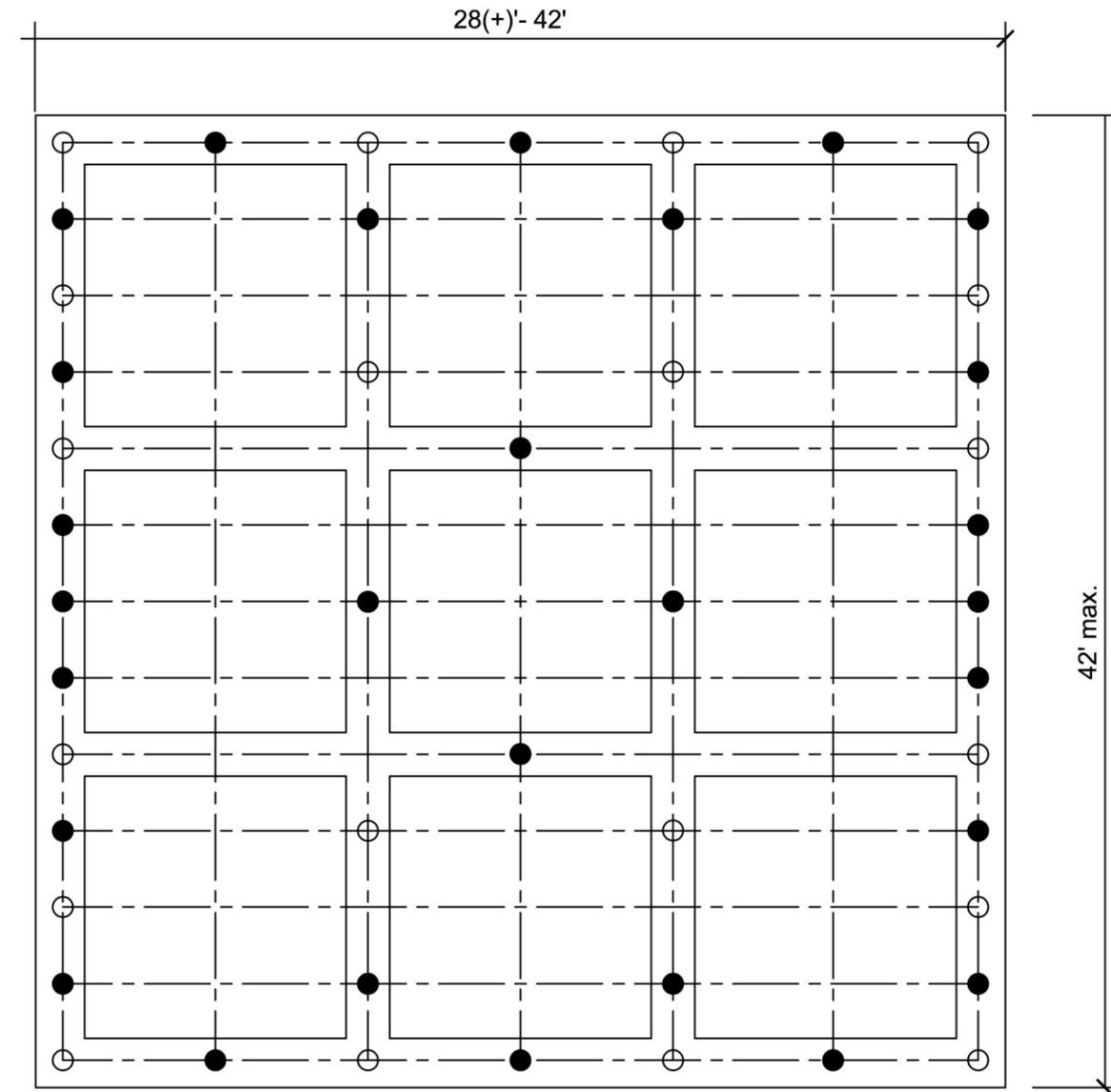
- Tension Pile--See 2/C-1
- Non-Tension Pile--See 3/C-1

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**

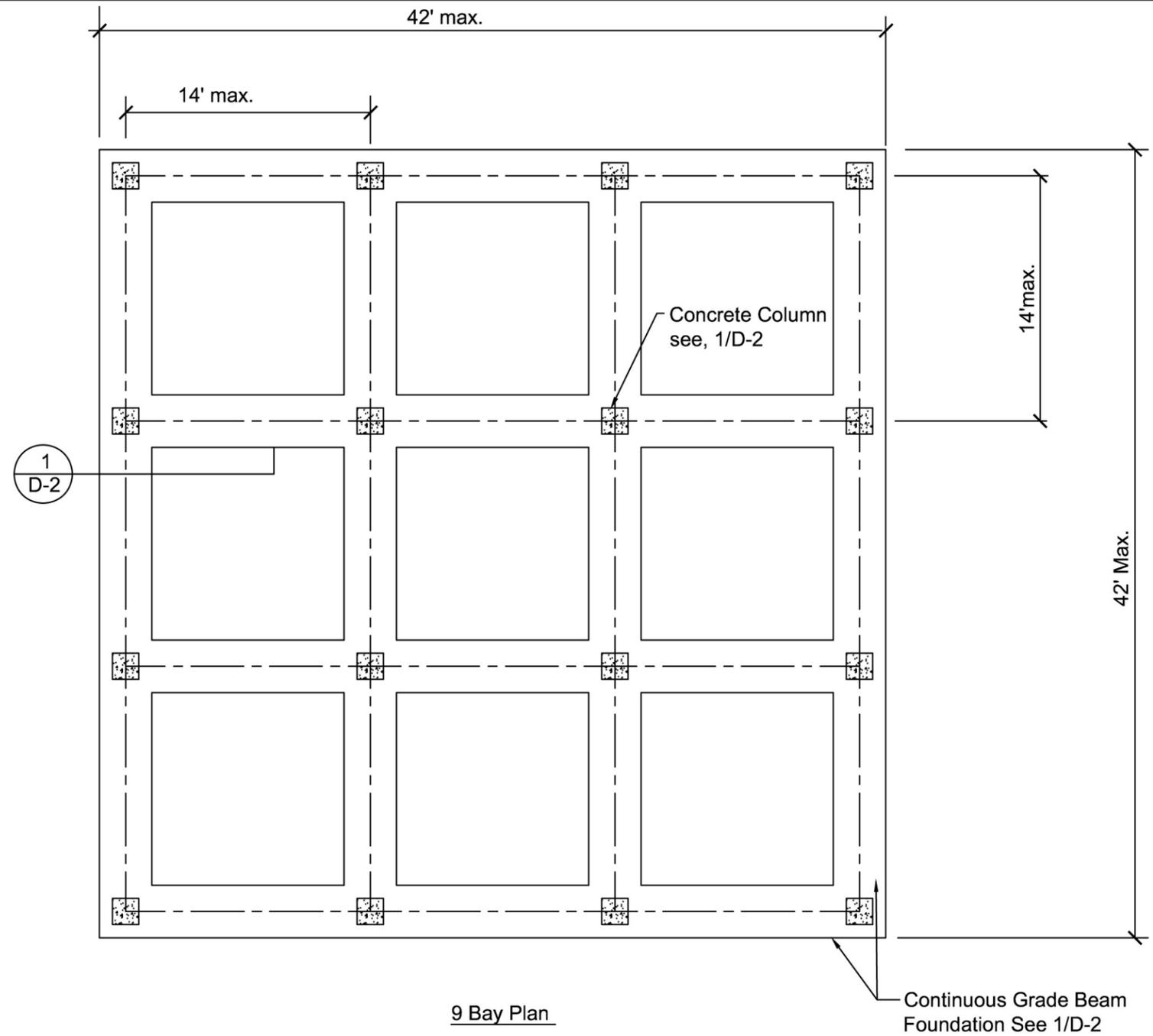
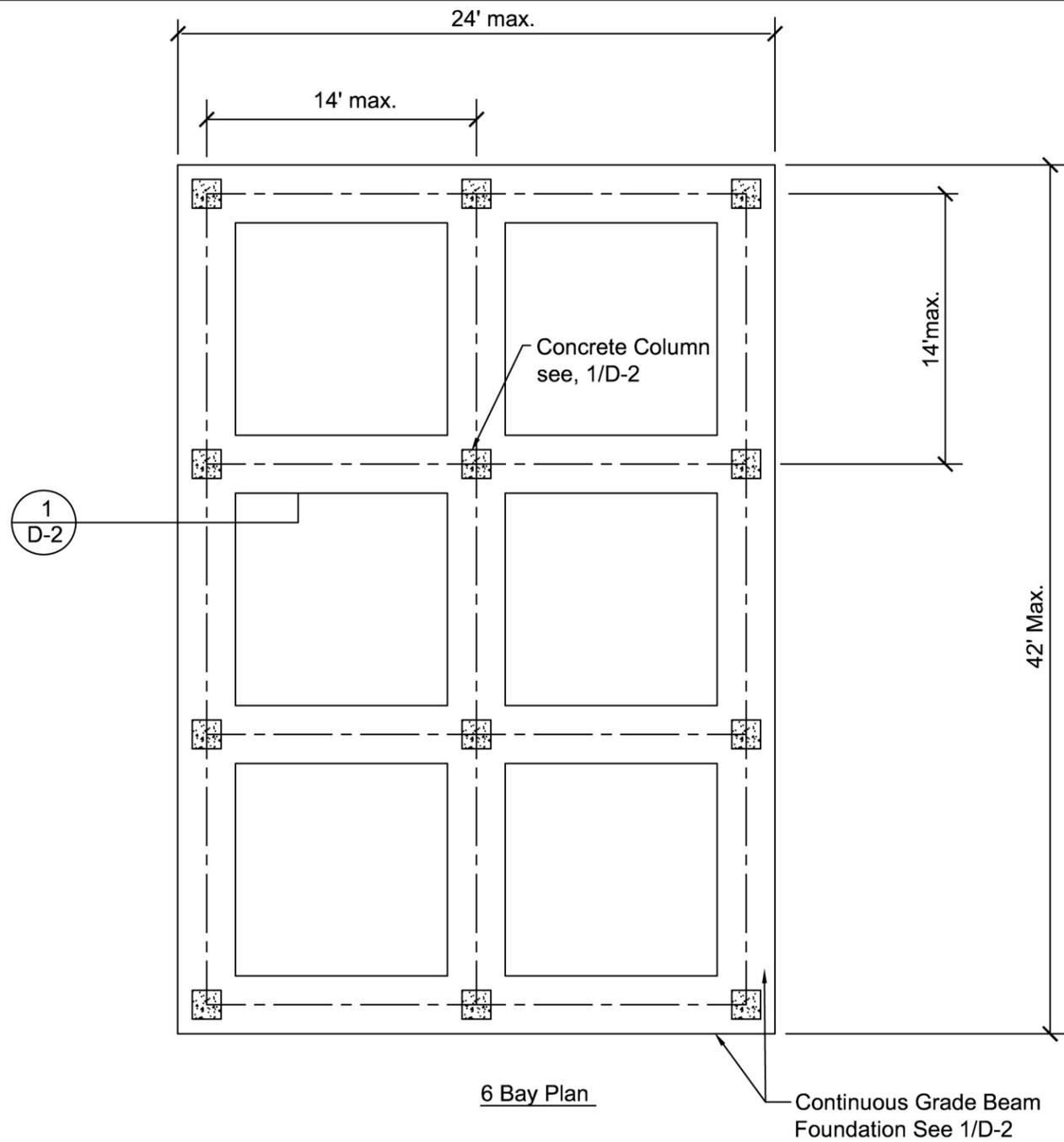
DRAWING NO.: C-6 SHEET 21 OF 31

DATE: August 8, 2006

REVISED: REV. 9



FEMA



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



FEMA

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

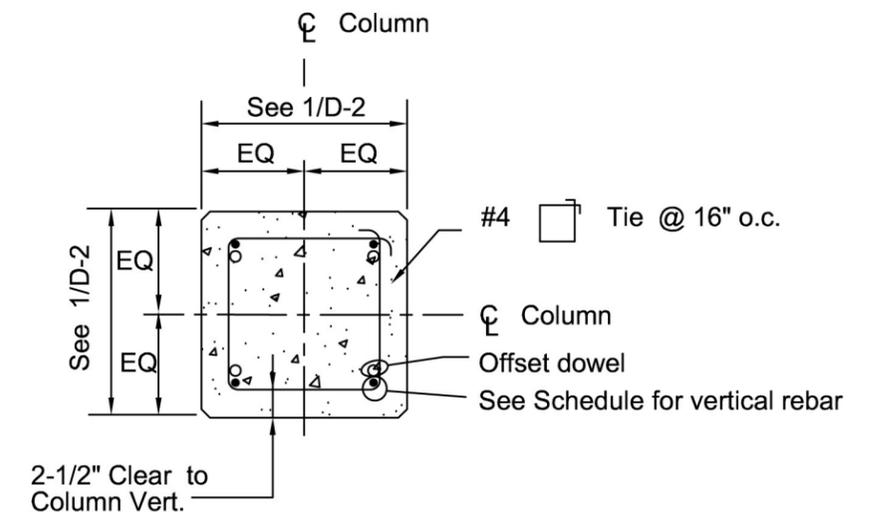
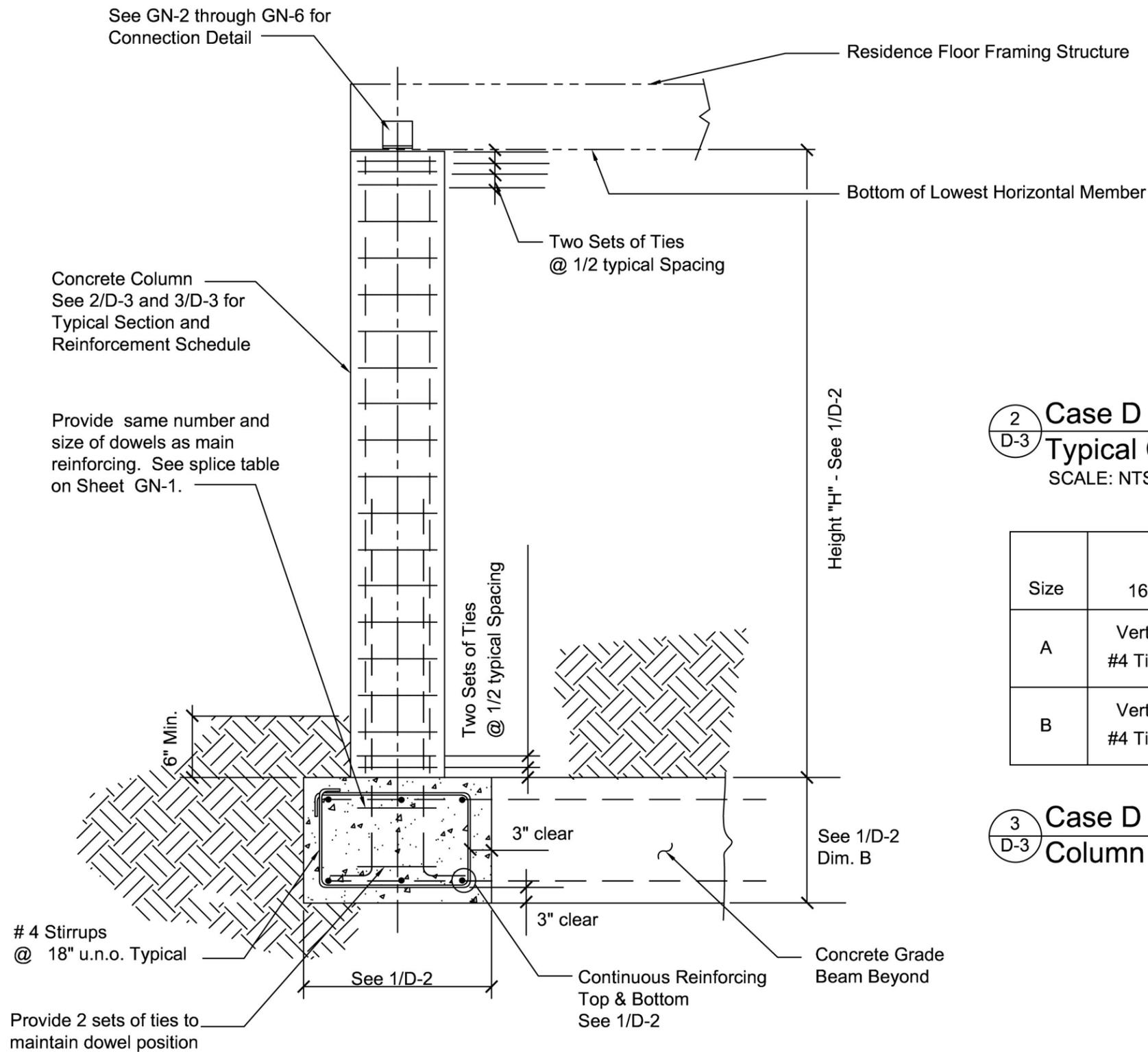
DATE: August 8, 2006

REVISED:

REV. 9



FEMA



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

1 Case D Open Foundation - Concrete Column & Grade Beam
D-3 Typical Exterior Section
 SCALE: NTS

Case D - Open Foundation
 Concrete Column and Grade Beam

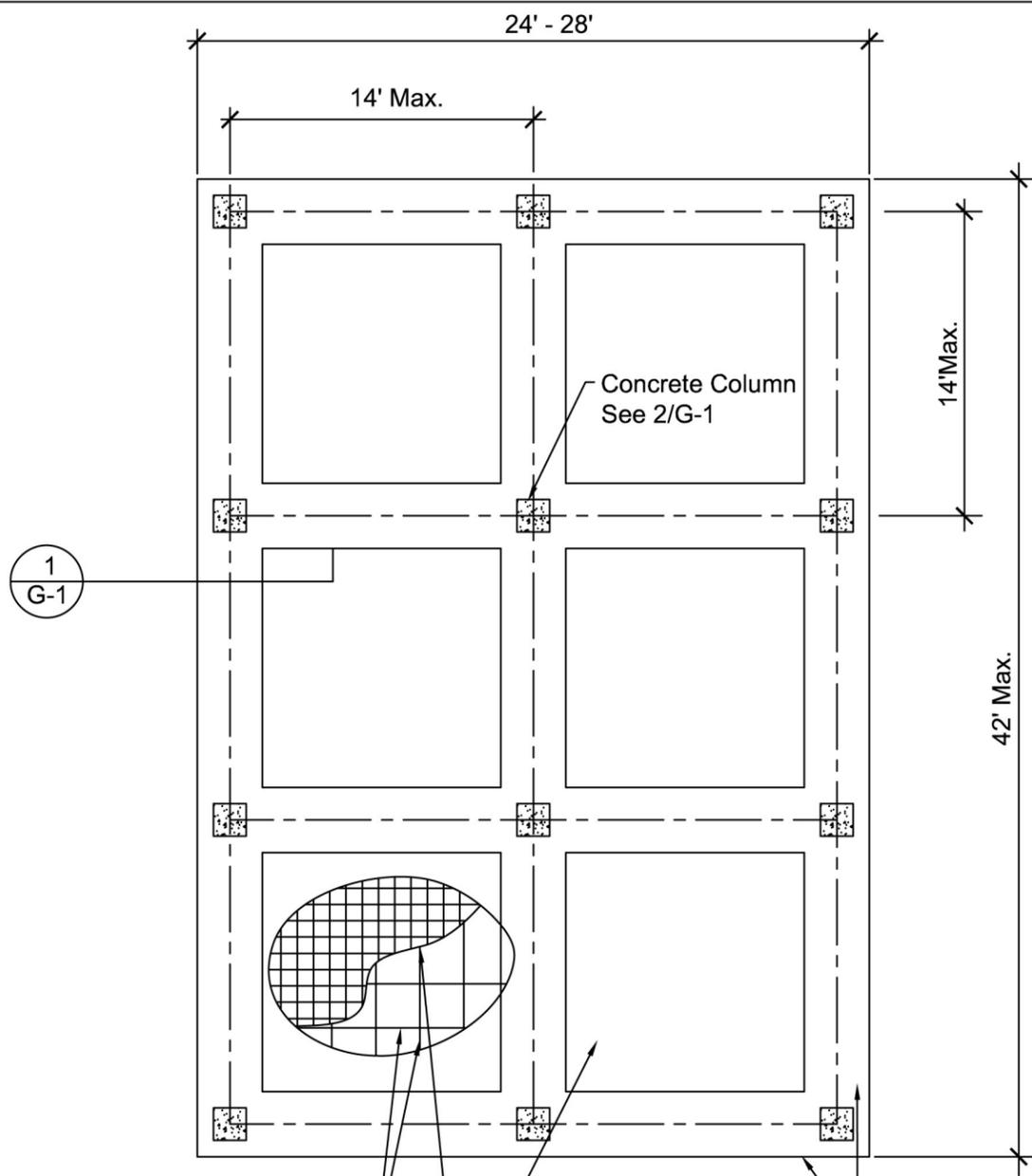
DRAWING NO.: D-3 SHEET 24 OF 31

DATE: August 8, 2006

REVISED: REV. 9



FEMA



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

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

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

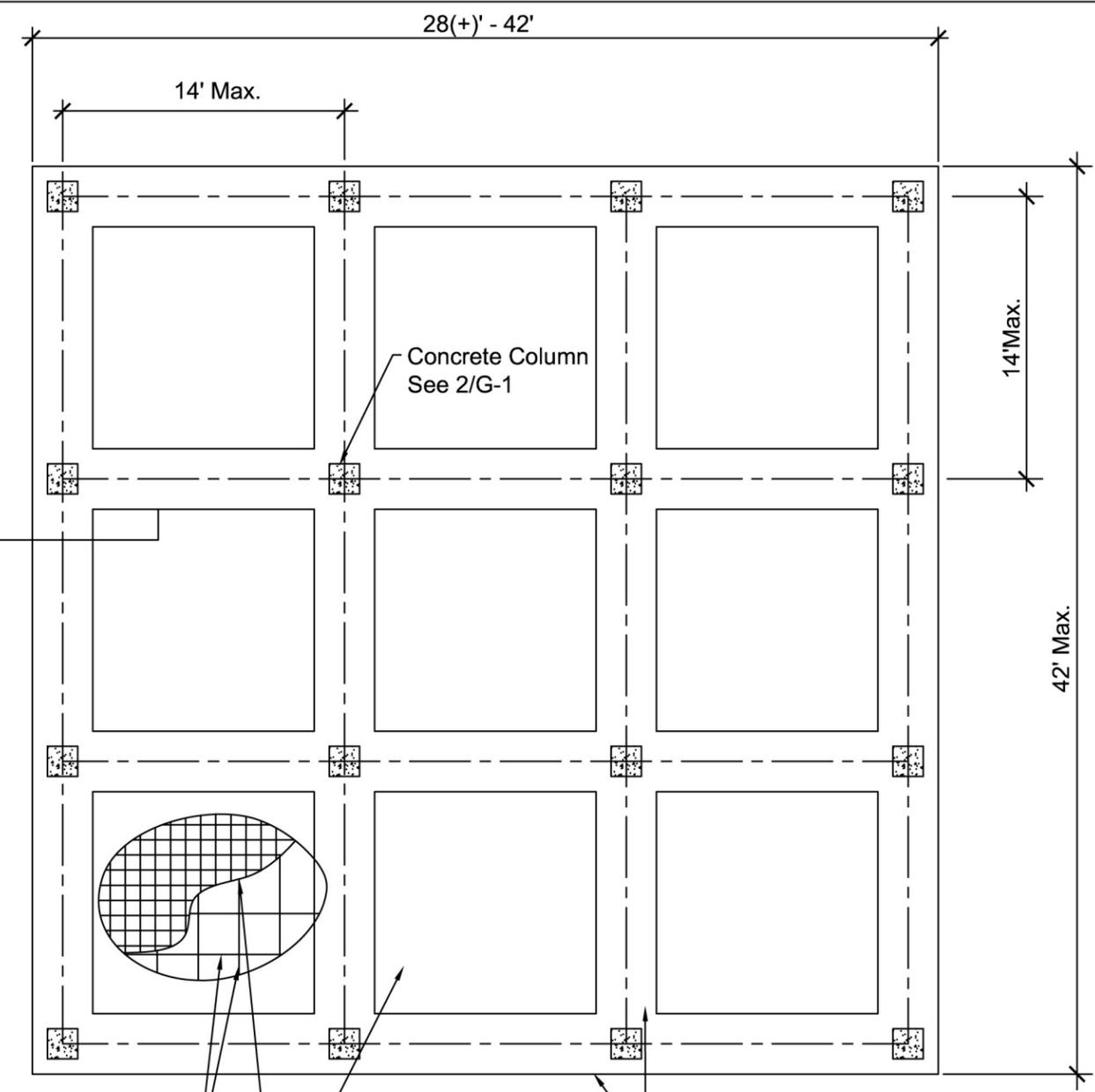
6 Bay Plan

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

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

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

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

9 Bay Plan

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

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

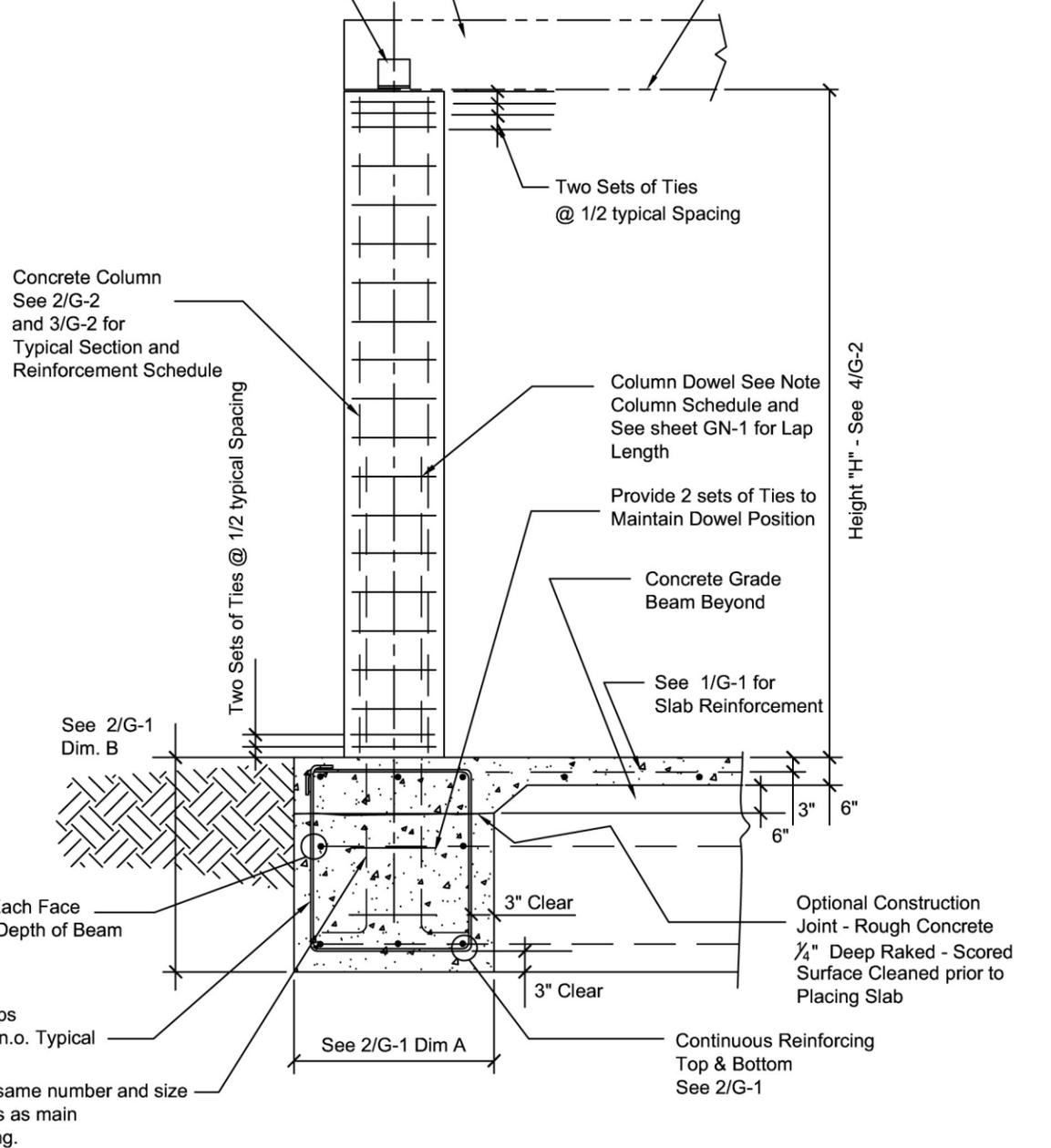


FEMA

See GN-2 through GN-6 for Connection Detail

Elevated Structure Floor Framing

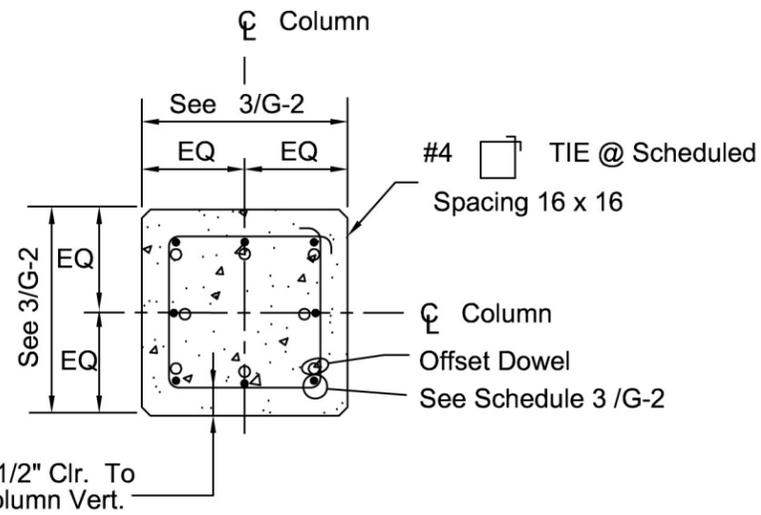
Bottom of lowest horizontal member



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			

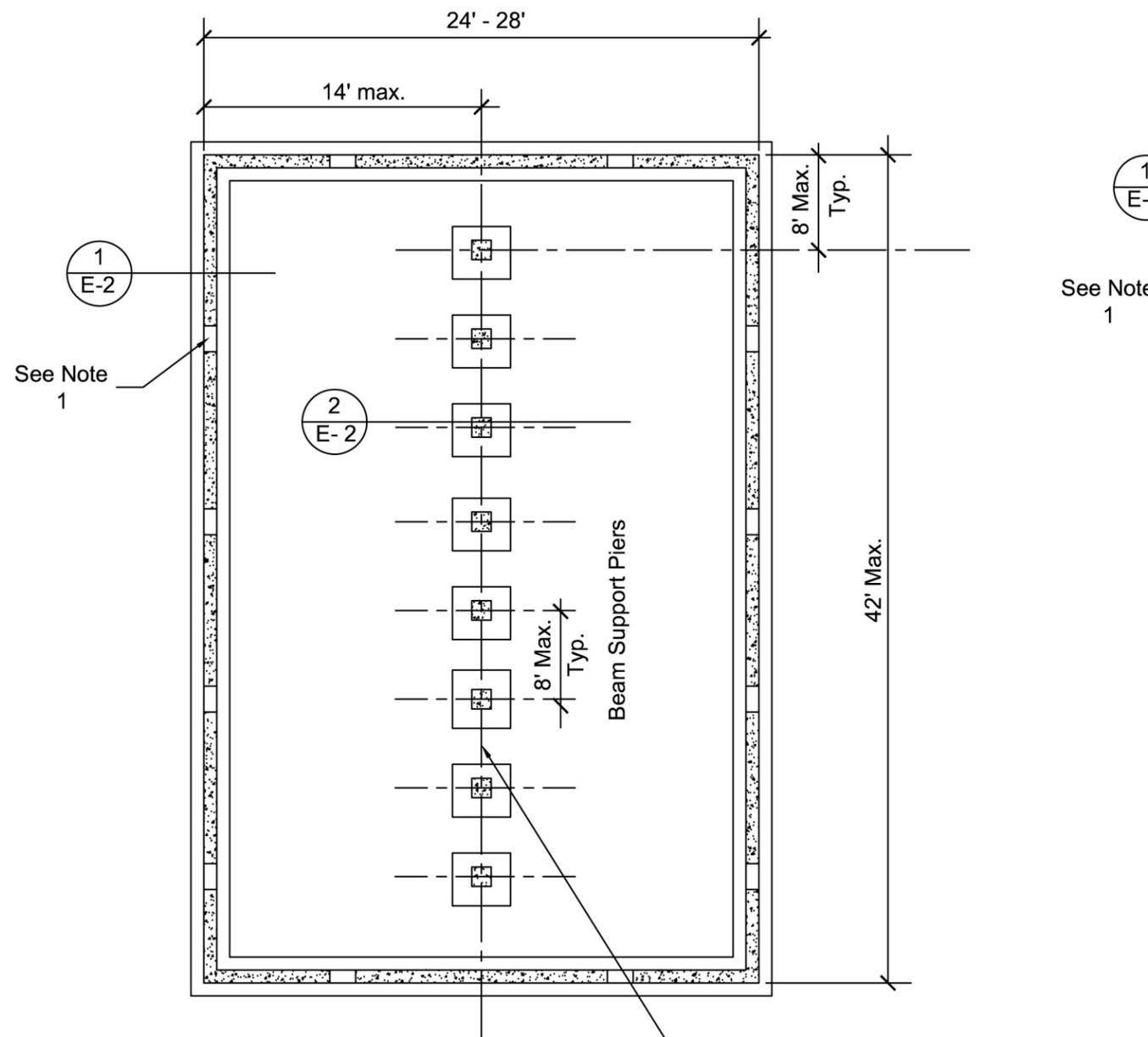
Legend:
2'-6"x4' - Footing Size A (width) x B (height)
(3) - #6 - Footing Rebar, Top & Bottom
Column 16 x 16 A - Column Size; see 3/G-2

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

4
G-2
Table 1 Continuous Grade Beam Size and Concrete Column Schedule

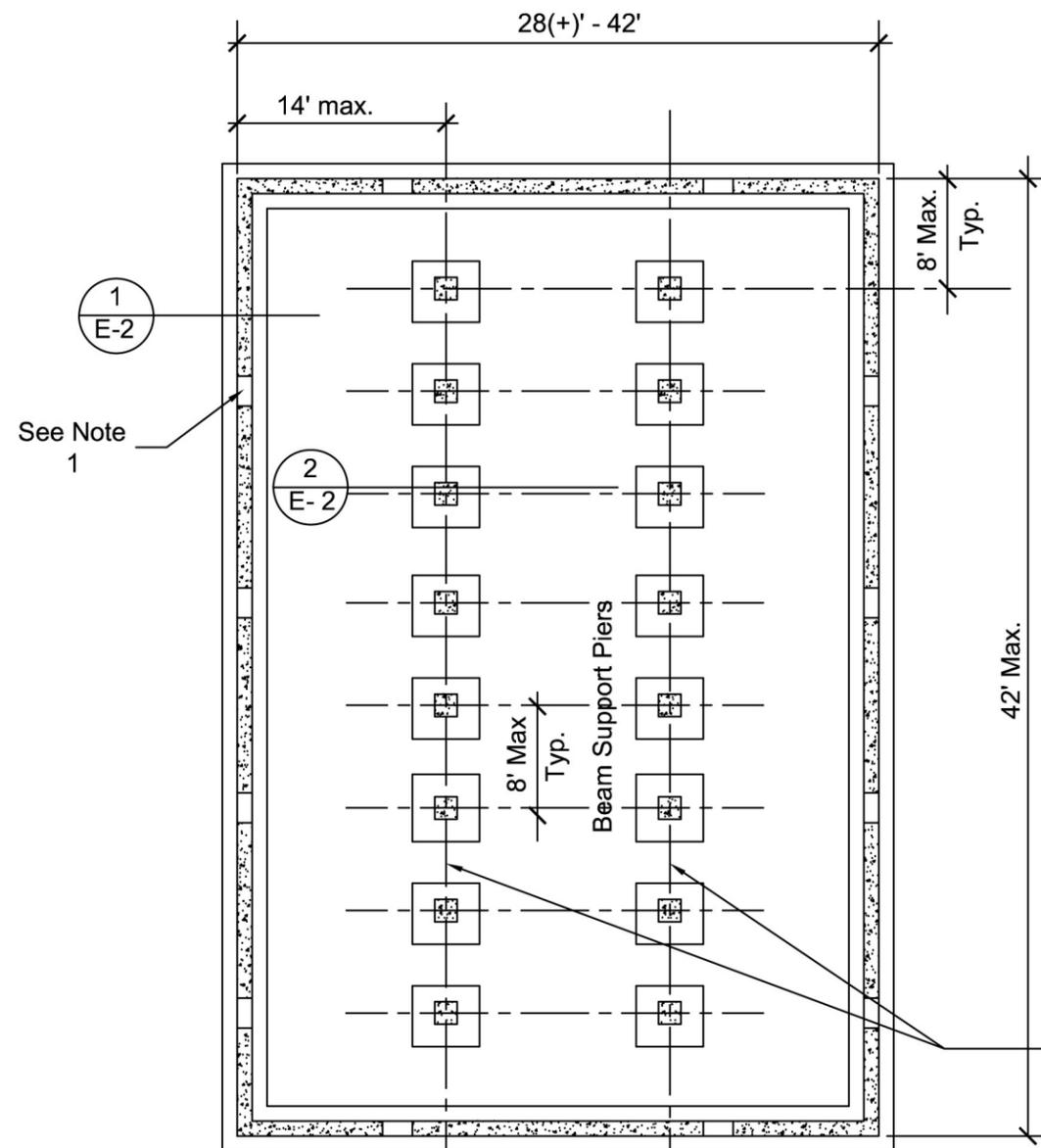
Case G - Open Foundation Concrete Column and Grade Beam with Slab	
DRAWING NO.: G-2	SHEET 26 OF 31
DATE: August 8, 2006	
REVISED:	REV. 9





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.

Note: Provide Two Rows of Beam Support Piers For Homes greater than 28' deep

Case E - Closed Foundation Reinforced Masonry Foundation - Crawlspace

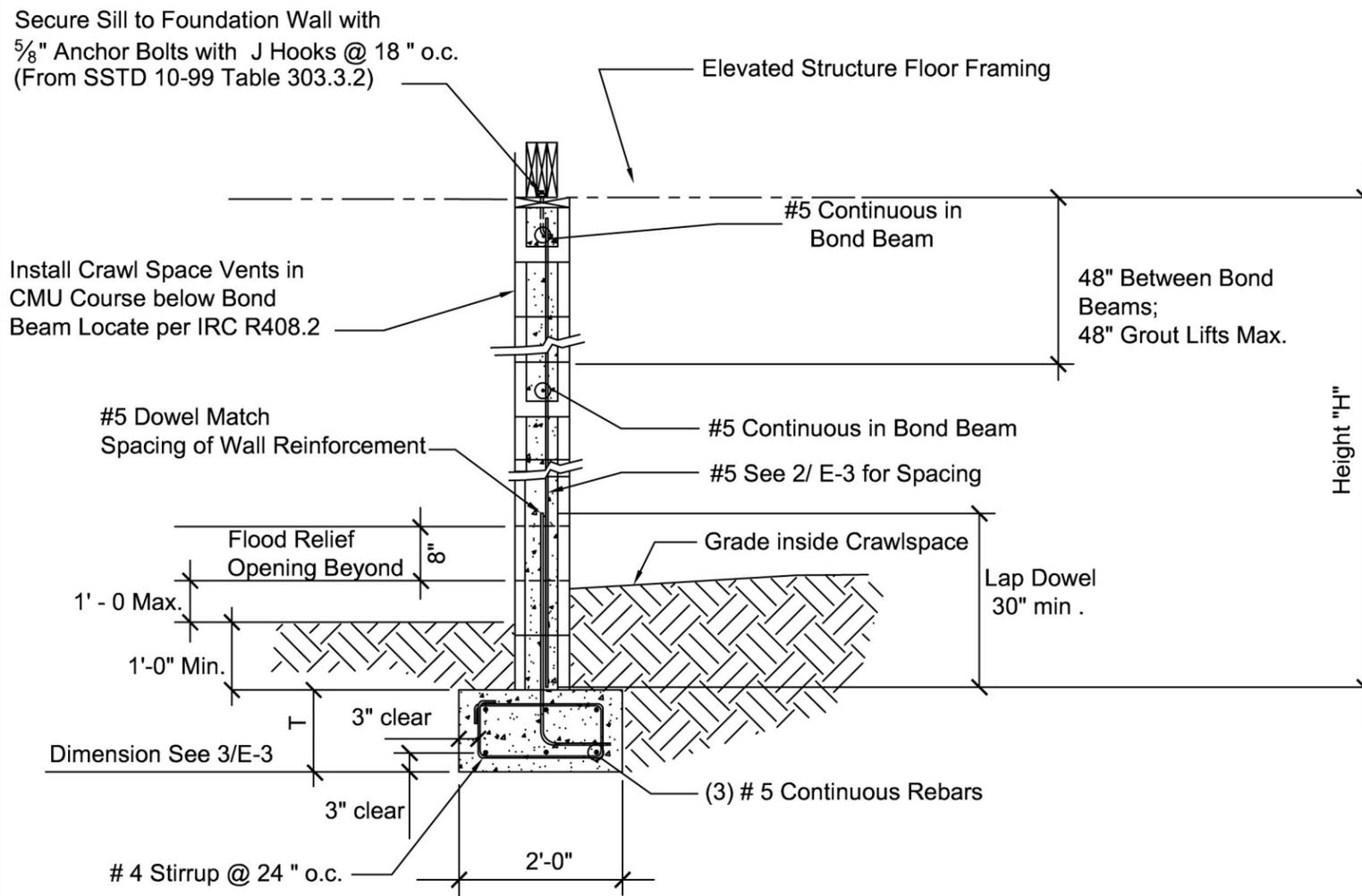
DRAWING NO.: E-1 SHEET 27 OF 31

DATE: August 8, 2006

REVISED: REV. NO.

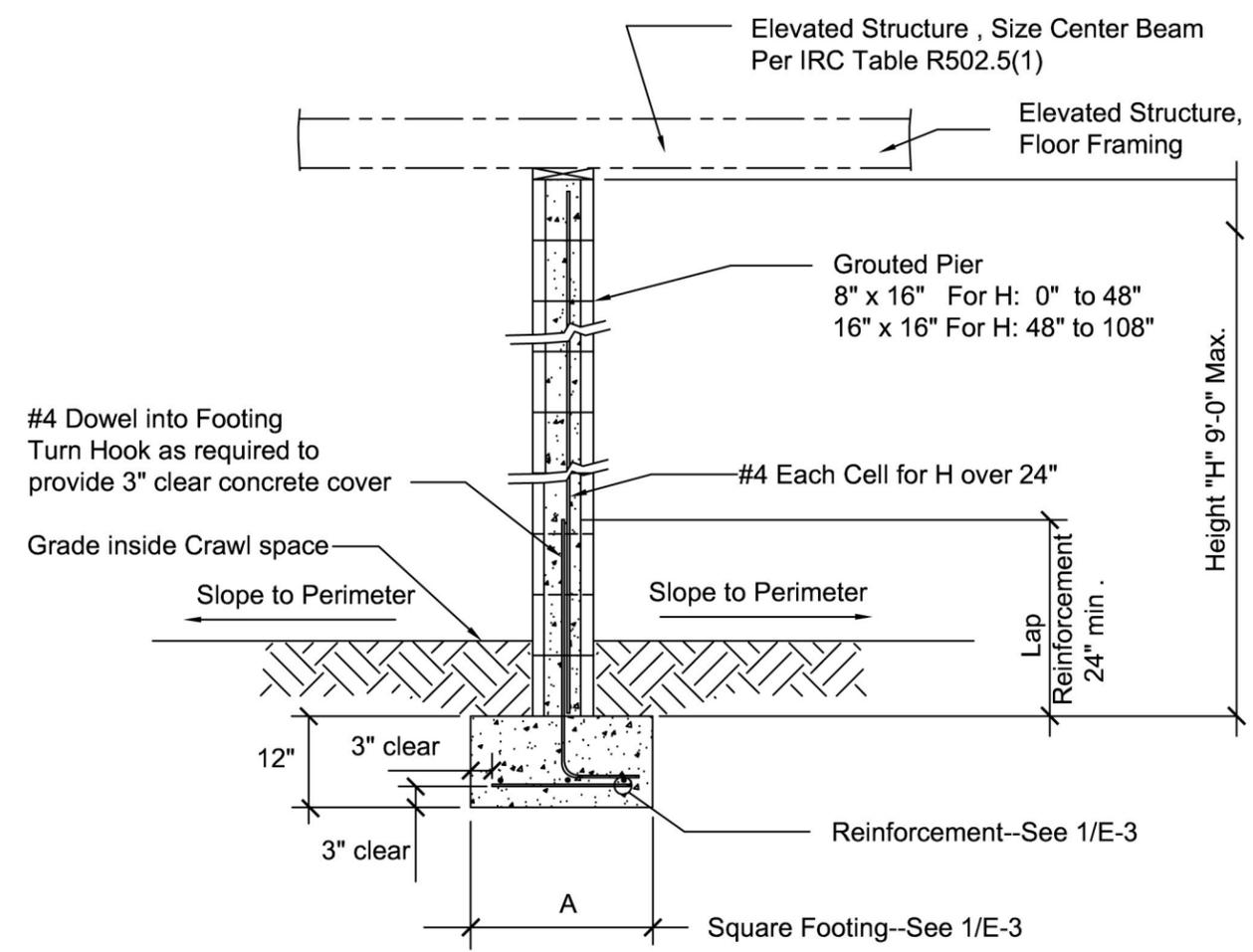


FEMA



**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

DATE: August 8, 2006

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

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"

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**

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

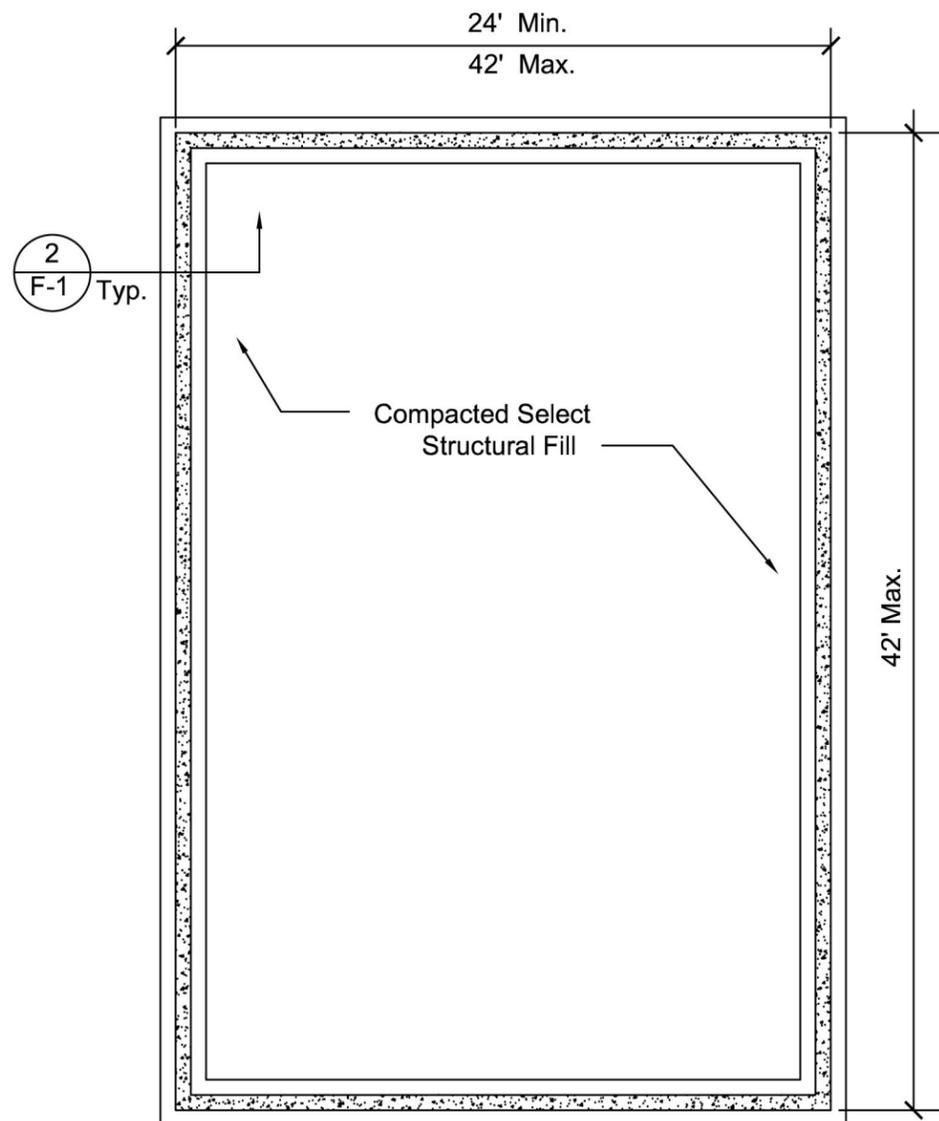
DRAWING NO.: E -3 SHEET 29 OF 31

DATE: August 8, 2006

REVISED: REV. 9



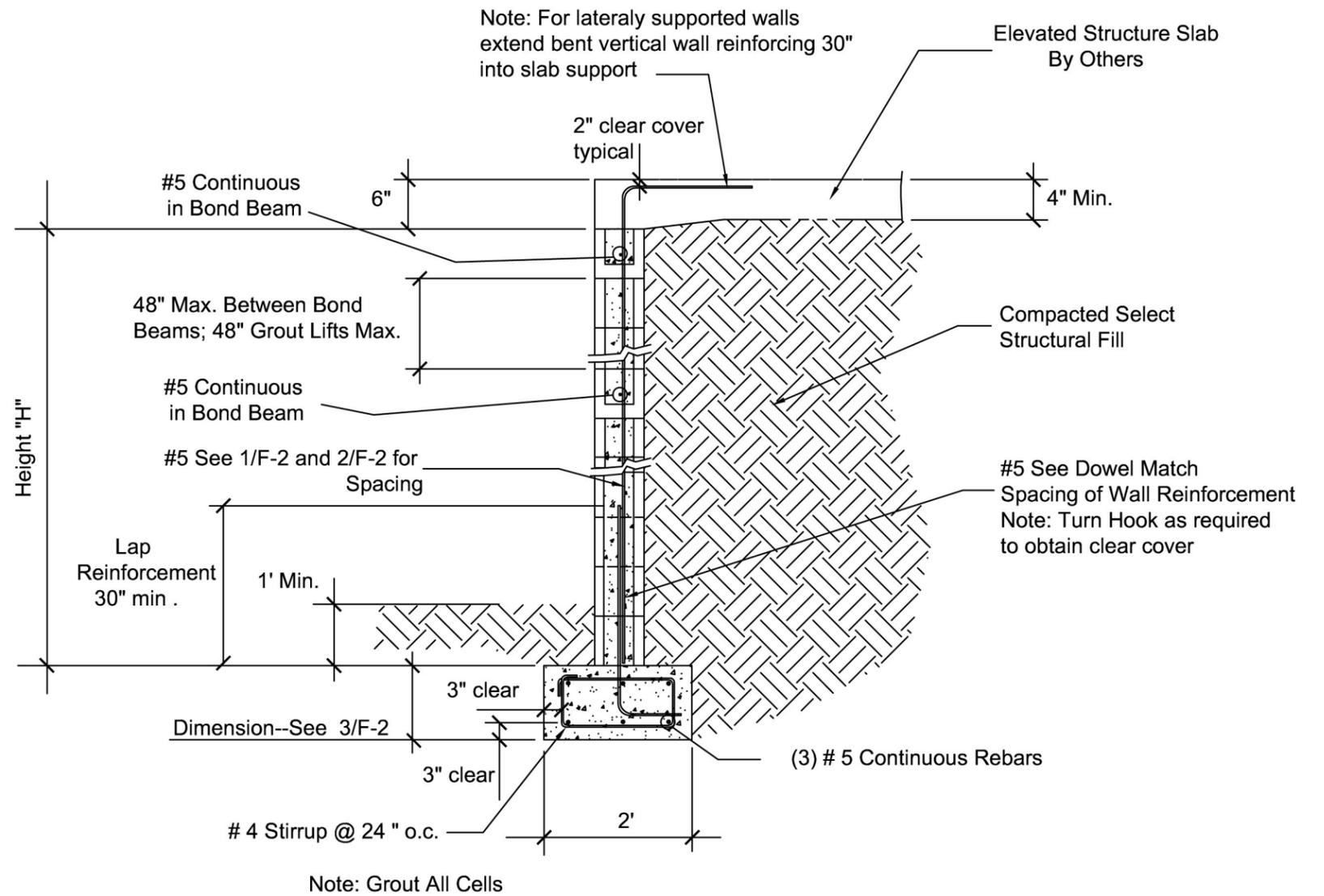
FEMA



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

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

Case F - Closed Foundation Reinforced Masonry Foundation - Stem Wall

DRAWING NO.: F-1 SHEET 30 OF 31

DATE: August 8, 2006

REVISED: REV. 9



FEMA

	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
DATE: August 8, 2006	
REVISED:	REV. 9



FEMA