COMMERCIAL & RESIDENTIAL GARAGE DOOR DIVISION

DASMA TECHNICAL DATA SHEET

#161

Door & Access Systems Manufacturers Association International

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Connecting Garage Door Jambs to Building Framing

Introduction

The members of DASMA are equally as concerned about connecting garage doors to building framing as they are about the design of garage doors themselves. This Technical Data Sheet provides a series of "Garage Door Frame Connection Schedules", along with some basic detail concepts, for the following fasteners:

A rationale document has also been prepared (pages 3-9) including an explanation of methods used, loads and source data, and calculation methods.

Directions on using the charts, along with other important information, can be found on the next page.

Using The Charts

1. Determine the positive wind load for a particular door, to the nearest 5 pounds per square foot. The positive wind load is the wind load that acts to push the door inward toward the garage and away from the garage door framing. This load determination can be achieved through one of three methods, in order of preference:
    - Use of the relevant DASMA Wind Load Guide (see TDS-155).
    - Job-specific calculation.
    - Conservative design pressure obtained from a local building department.
2. Determine the door width, in feet.
3. If the framing is made of wood, determine the type of lumber being used. The charts include southern yellow pine and spruce-pine-fir.
4. Determine the type of fastener to be used, from the alternatives listed in this Technical Data Sheet.
5. Find the appropriate Schedule to use.
6. For a given door load, door width and jamb type (if applicable), obtain the maximum fastener spacing per jamb from the appropriate Schedule.
7. Review the notes at the bottom of the Schedule used.
8. Review the detail referred to in the Schedule.

Important Information

- The fasteners used may need to be installed in accordance with either manufacturer's instructions or requirements specific to a particular project. A design professional may need to be contacted.
- Some fasteners may not be allowed in garage door applications in some local jurisdictions. The local building department may need to be contacted.
- Please observe the notes included with each Schedule.

Calculations do not apply to doors using vertical posts as a means of reinforcement.

Rationale

Explanation of Methods Used

The jamb attachment information in this document is presented in such a way as to provide a clear and accurate presentation of the connection schedule for wind loads from 10 PSF to 60 PSF for the following anchors as specified:

• 1/4'' diameter by 3'' length Self-Tapping Concrete Anchors	TDS-161a
• 3/8'' diameter by 3'' length Sleeve Anchors	TDS-161b
• 3/8'' diameter by 3-1/2'' length Expansion Anchors	TDS-161c
• 7/16'' diameter by 8'' length "L-Bolt Anchors	TDS-161d
• 3/8'' diameter by 3'' length Lag Screws	TDS-161e
• 16d'' by 3-1/2'' length Common Wire Nails	TDS-161f
• .100" x 1" long fillet weld (E60xx Electrodes Min.)	TDS-161g
• 1/4" diameter by 3/4" length self-tapping screws	TDS-161h

The connection schedule is presented here as the minimum spacing required between anchors for a particular design wind load, as opposed to a minimum number of anchors required for a certain force applied to the jamb. The anchor schedule can be quickly determined by looking up the wind load and door width in the appropriate table for the particular anchor to be used.

All calculations used in determining the connection schedule are provided. All relevant notes from previous drafts of TDS-161 are provided for the attachment schedules. Due to the different format presented here, notes have been added and omitted where necessary.

Loads and Source Data

Information presented in this document is based on the most recent published loads from the fastener manufacturers. However other sources were investigated and it is evident that performance data for an individual anchor type varies greatly among publications. Selected comparisons of published data from manufacturers and test reports for self-tapping concrete anchors and sleeve anchors are included (see Tables 1 and 2) to illustrate the variety of results that can be obtained. When presented with conflicting performance data, the calculations were made using a major fastener manufacturer's general published values.

The information in the following tables is published allowable loads. If only ultimate loads were provided, a safety factor was applied per the referenced source's recommendations, or if no recommendations were supplied, a 4:1 safety factor was used.

Table 1 - Sample Published Data for ¼'' x 3'' Self-Tapping Concrete Anchors – Allowable Load

Publication	3000 psi concrete	C-90 Block
ITW Online Performance Data	380 lb. (4:1 SF)	154 lb. (4:1 SF)
ITW Miami-Dade NOA#02-3111.03	575 lb. (3192 psi; 1-3/4'' embed)	195 lb.
ITW SBCCI Report #9759	349 lb. (wsi); 174 lb. (wosi)	128 lb. (wsi); 64 lb. (wosi)
ITW ICBO Report ER-3370	380 lb. (wsi); 190 lb. (wosi)	N/A
Elco Textron Miami-Dade NOA #02-0503.07	661 lb. (3513 psi; 1-3/4'' emb; 5/16'' dia)	286 lb. (5/16'' dia)
Elco Textron SBCCI Report #2040	424 lb. (wsi); 212 lb. (wosi)	338 lb. (wsi); 169 lb. (wosi)

Table 2 - Sample Published Data for 3/8'' x 3'' Sleeve Anchors – Allowable Load

Publication	2000 psi concrete	C-90 Block
Simpson Strong-Tie Sleeve-All Online Performance Data	336 lb. (3" edge dist.)	435 lb. (min 12'' edge dist.)
Simpson Strong-Tie Sleeve-All Miami-Dade NOA #01-0820.06	406 lb.	N/A
Simpson Strong-Tie Sleeve-All ICBO Report ER-3631	400 lb. (wsi), 220 lb. (wosi)	N/A
Powers Lok/Bolt Online Performance Data	612 lb.	425 lb. (min 4-1/2'' edge dist.)
ITW Trubolt Online Performance Data	530 lb.	N/A
Hilti HLC Sleeve Anchor Online Performance Data	450 lb.	438 lb. (min 2-1/4'' edge dist.)

Calculations

General Formula for Anchor Spacing:

$$\frac{(12\ {}^{in}\!/_{ft})(F\ {}^{lb}\!/_{anchor})}{\frac{1}{2}(P\ {}^{lb}\!/_{ft^2})(W\ ft)} = S\ {}^{in}\!/_{anchor}$$

P = Door Design Load (pressure in PSF)
W = Opening Width (ft.)
F = Allowable Load per Anchor (lb.)
S = Anchor Spacing (in.)

Load Calculations and Reference:

TDS-161a
ITW Ramset/Redhead Tapcon Self-Tapping Concrete Anchors (1-1/2'' Min. Embed)
Ref: www.ramset-redhead.com Performance Data

C-90 Block: F = 615 lb. * ¼ S.F. = 154 lb. Allowable Load
2000 psi min. concrete: F = 1,120 lb. * ¼ S.F. = 280 lb. Allowable Load
3000 psi min. concrete: F = 1,520 lb. * ¼ S.F. = 380 lb. Allowable Load
4000 psi min. concrete: F = 1,600 lb. * ¼ S.F. = 400 lb. Allowable Load

Note: Load calculated for minimum edge distance of 10 diameters or 2-1/2".

TDS-161b
3/8'' x 3'' Simpson Strong-Tie Sleeve-All Sleeve Anchors (1-1/2'' Min. Embed)
Ref: www.simpsonanchors.com Load Tables,
2001 NDS for Wood Construction, p. 22, 26; 2001 NDS Supplement, p. 42

Pullout Force in Concrete per Simpson Strong-Tie Online Performance Data:

2000 psi concrete: F = 400 lb. * .84 (edge distance adjustment factor) = 336 lb. Allowable Load
3000 psi concrete: F = 535 lb. * .84 = 449 lb. Allowable Load
4000 psi concrete: F = 670 lb. * .84 = 563 lb. Allowable Load

Note: Loads calculated for a minimum edge distance of 3''. C-90 Block not an option for Simpson sleeve and expansion anchors due to edge distance requirements (min. 12"). For other brands, see individual manufacturer's specifications for allowable loads.

Bearing on Wood of Washer Provided by Manufacturer (7/8'' O.D. Provided by Simpson Strong-Tie):

Bearing Area, $A = \pi(7/16 \text{ in})^2 - \pi(7/32 \text{ in})^2 = .451 \text{ in.}^2$
Bearing Area Factor, C_b = 1.43 *(NDS p. 22)*
Allowable Load, $F_{All} = F^*C_b$ where $F = F_c{*}A$; therefore $F_{All} = F_c{*}A^*C_b$
Where: F_c = Allowable compression (psi); F = applied force (lb.)

Southern Yellow Pine (F_c = 565 psi): F_{All} = 565 lb/in^2 * .451 in^2 * 1.43 = 364 lb. Allowable Load
Note: Published allowable load for S.Y.P. will be will be limited to 336 lb. (max. for 2000 psi concrete).

Spruce Pine Fir (F_c = 425 psi): F_{All} = 425 lb/in^2 * .451 in^2 * 1.43 = 274 lb. Allowable Load
Note: Tabulated values for F_c *(NDS Supplement p. 42, Table 4C)* are species group average values associated with a deformation of 0.04'' per ASTM D2555, D245.

TDS-161c
3/8'' x 3-1/2'' Simpson Strong-Tie Wedge-All Expansion (Wedge) Anchors (1-3/4'' Min. Embed)
Ref: www.simpsonanchors.com Load Tables, 2001 NDS for Wood Construction, p. 22, 26; 2001 NDS Supplement, p. 42

Pullout Force in Concrete per Simpson Strong-Tie Online Performance Data:

Allowable loads increased by a 33.3% adjustment factor for short term loading (see Simpson Strong-Tie online data).

2000 psi concrete: F = 390 lb. * .90 (edge dist. factor) * 1.333 (adjustment factor) = 468 lb. Allow. Load
3000 psi concrete: F = 555 lb. * .90 * 1.333 = 666 Allowable Load
4000 psi concrete: F = 720 lb. * .90 * 1.333 = 864 lb. Allowable Load

Note: Loads calculated for a minimum edge distance of 3''. C-90 Block not an option for Simpson sleeve and expansion anchors due to edge distance requirements (min. 16"). For other brands, see individual manufacturer's specifications for allowable loads.

Bearing on Wood of Washer Provided by Manufacturer (7/8'' O.D. Provided by Simpson Strong-Tie):

Bearing Area, $A = \pi(7/16 \text{ in.})^2 - \pi(7/32 \text{ in.})^2 = .451 \text{ in.}^2$
Bearing Area Factor, C_b = 1.43 *(NDS p. 22)*
Allowable Load, $F_{All} = F^*C_b$ where $F = F_c{*}A$; therefore $F_{All} = F_c{*}A^*C_b$
Where: F_c = Allowable compression (psi); F = applied force (lb.)

Southern Yellow Pine (F_c = 565 psi): F_{All} = 565 lb/in^2 * .451 in^2 * 1.43 = 364 lb. Allowable Load
Spruce Pine Fir (F_c = 425 psi): F_{All} = 425 lb/in^2 * .451 in^2 * 1.43 = 274 lb. Allowable Load

Note: Tabulated values for F_c *(NDS Supplement p. 42, Table 4C)* are species group average values associated with a deformation of 0.04'' per ASTM D2555, D245.

TDS-161d
7/16'' x 8'' Galvanized "L-Bolt" Anchors
ASTM A307, Grade C with 1-5/8'' min. O.D. Washers
Stress area, A = .1063 in.^{2}; tensile yield, σ = 36 ksi, Safety Factor, s = 4
Allowable Load, $F = \sigma * A / s$ = (36,000 lb/in.^{2})(.1063 in.^{2})/4 = 957 lbs./L-bolt

Note: Load calculated for minimum edge distance of 6 diameters or 2-3/4".

TDS-161e
3/8'' x 3'' Lag Screws (1-1/2'' Min. Embed)
Ref: 2001 NDS for Wood Construction, p. 9, 59, 68, 74, 76, 166

Pullout force $W' = (W)(C_D)(C_M)(C_t)(L)$, where
W = lag screw withdrawal design value (lbs./in.) *(see NDS p. 68, Table 11.2A)*
C_D = load duration factor = 1.6 for wind load *(p. 9)*
C_M = wet service factor for dry conditions = 1.0 *(p. 59)*
C_t = temperature factor for <125^{O}F = 0.8 *(p. 9)*
L = actual thread penetration = 1.5 in. nominal length - .219 in. ineffective thread = 1.281 in. *(p. 166)*

Southern Yellow Pine (Specific Gravity = 0.55):
W' = (352 lb./in)(1.6)(1.0)(0.8)(1.281 in.) = 577 lb. Allowable Load
Spruce Pine Fir (Specific Gravity = .42):
W' = (235 lb./in)(1.6)(1.0)(0.8)(1.281) = 385 lb. Allowable Load

Note: safety factor of 5:1 used to calculate nominal withdrawal values provided in the NDS.
Note: Load calculated for minimum edge distance of 4 diameters or 1-1/2".

TDS-161f
16d (.162'' Dia.) x 3-1/2'' Common Wire Nails (2'' Min. Embed)
Ref: 2001 NDS for Wood Construction, p. 9, 59, 70, 74, 168

Pullout force $W' = (W)(C_D)(C_M)(C_t)(L)$, where
W = nail withdrawal design value (lbs./in.) *(see NDS p. 70, Table 11.2C)*
C_D = load duration factor = 1.6 for wind load *(p. 9)*
C_M = wet service factor for dry conditions = 1.0 *(p. 59)*
C_t = temperature factor for <125^{0}F = 0.8 *(p. 9)*
L = length of embedment

Southern Yellow Pine (Specific Gravity = 0.55):
W' = (50 lb./in)(1.6)(1.0)(0.8)(2 in.) = 128 lb. Allowable Load
Spruce Pine Fir (Specific Gravity = .42):
W' = (26 lb./in)(1.6)(1.0)(0.8)(2 in.) = 67 lb. Allowable Load

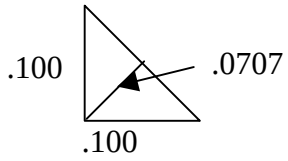
TDS-161g
.100" x 1" Long Fillet Weld (E60xx Electrodes Min.)
Ref. AISC Manual of Steel Construction Allowable Stress Design (9th Edition)

Design criteria from AISC manual:

1) The effective area of fillet welds shall be taken as the effective length times the effective throat thickness. (p. 5-67)
2) The effective length of fillet welds, except fillet welds in holes and slots, shall be the overall length of full-size fillets. (p. 5-67)
3) The effective throat thickness of a fillet weld shall be the shortest distance from the root of the joint to the face of the diagrammatic weld. (p. 5-67)
4) Maximum size of fillet weld (if welded along edge(s) of connecting parts) shall be not greater than the thickness of the material. (p. 5-67)
5) Allowable fillet weld shear stress (based on effective area) = 30% of nominal tensile strength of weld metal. (p. 5-70, Table J2.5)

Assumptions:

1) 0.100" (12 gauge) steel angle attached to steel jambs of at least greater thickness.
2) Use E60xx Electrode minimum. This electrode has a yield strength of 60 ksi.



Calculation:
Effective throat thickness: $(0.100^2 + 0.100^2)^{1/2}/2 = 0.0707$ in
Effective length of fillet weld: 1.00 in
Effective area of weld: (0.0707 in)(1.00 in) = 0.0707 in^2
Allowable fillet weld stress: F = (60,000 lb/in^2)(30%)(0.0707 in^2) = 1,272 lb.

TDS-161h
1/4” x 3/4” self-tapping screws into 12 gauge or 3/16” steel
Ref: www.itwbuildex.com Performance Data

For 1/4” self-tapping screws the ultimate pullout ranges from 1678 lb. to 1858 lb. for 12 gauge steel and from 3554 lb. to 4693 lb. for 3/16” steel. Use the least pullout value and an 8:1 safety factor.
12 gauge steel: F = (1678 lb.)/8 = 209 lb. Allowable Load
3/16” steel: F = (3554 lb.)/8 = 444 lb. Allowable Load

TDS-161A
1/4'' x 3'' Self Tapping Concrete Anchors (1-1/2'' Embed)

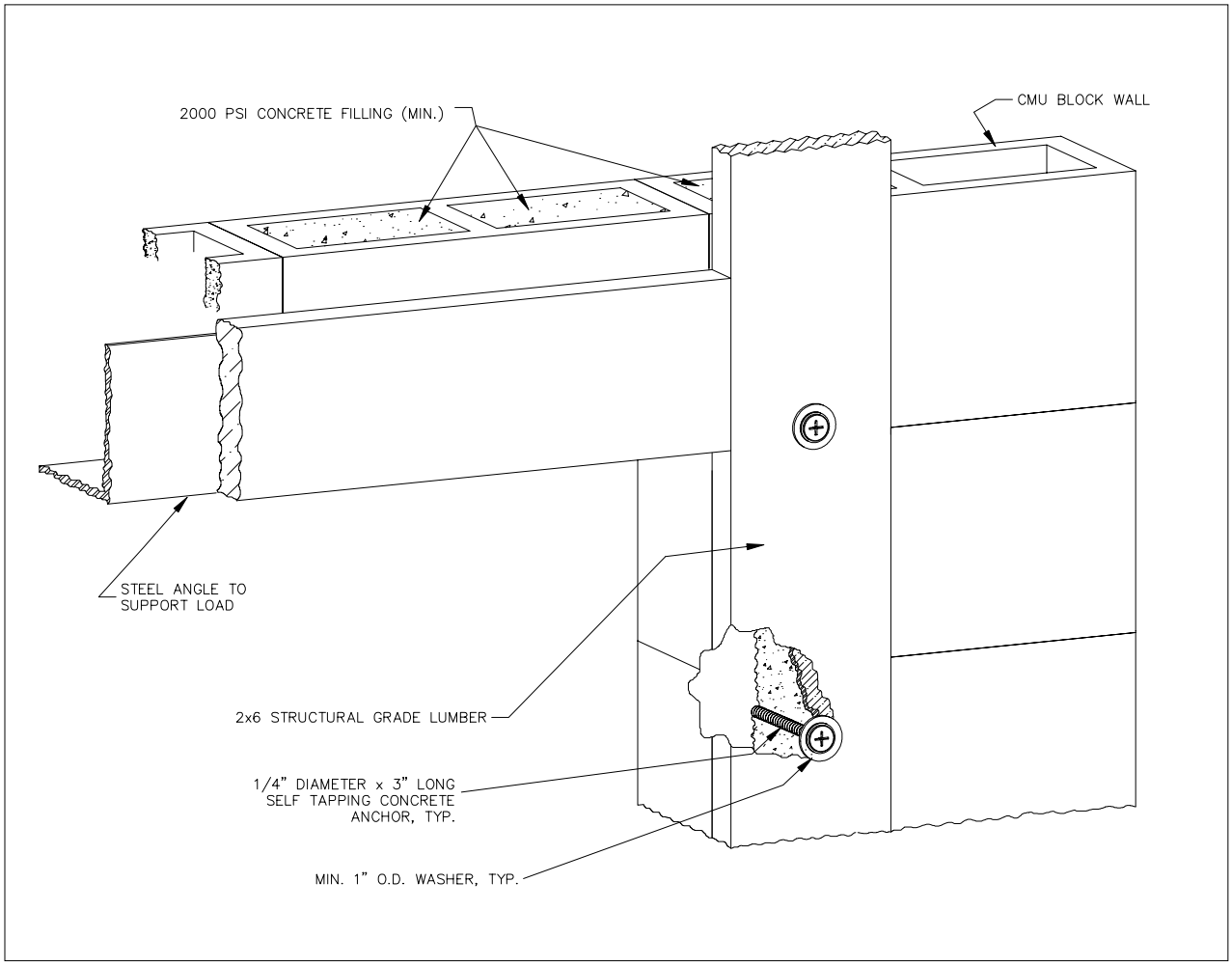


FIGURE 161a

Notes:

- Alternate design may be approved by a registered professional engineer.
- 2x6 wood jambs may be counterbored up to 1/2" deep at each self tapping concrete anchor location to provide a flush mounting surface.
- Self tapping concrete anchors shall have a minimum edge distance of 2-1/2" for maximum holding power.
- Spring Pad Connection Not Included

1/4'' x 3'' Self Tapping Concrete Anchors (1-1/2'' Embed)
Reference: ITW Ramset/Redhead Tapcon Online Performance Data, www.ramset-redhead.com

Grout-Filled CMU Block (1-1/4" Max. Embed for CMU Block)
154 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	24	24	24	24	23	21	18
15 PSF	24	24	21	18	15	14	12
20 PSF	21	18	15	13	12	10	9
25 PSF	16	15	12	11	9	8	7
30 PSF	14	12	10	9	8	7	6
35 PSF	12	11	9	8	7	6	5
40 PSF	10	9	8	7	6	5	5
45 PSF	9	8	7	6	5	5	4
50 PSF	8	7	6	5	5	4	4
55 PSF	7	7	6	5	4	4	3
60 PSF	7	6	5	4	4	3	3

Min. 2000 PSI Concrete
280 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	22
20 PSF	24	24	24	24	21	19	17
25 PSF	24	24	22	19	17	15	13
30 PSF	24	22	19	16	14	12	11
35 PSF	21	19	16	14	12	11	10
40 PSF	19	17	14	12	11	9	8
45 PSF	17	15	12	11	9	8	7
50 PSF	15	13	11	10	8	7	7
55 PSF	14	12	10	9	8	7	6
60 PSF	12	11	9	8	7	6	6

SEE NOTES ON PAGE 13

Min. 3000 PSI Concrete
380 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	23
25 PSF	24	24	24	24	23	20	18
30 PSF	24	24	24	22	19	17	15
35 PSF	24	24	22	19	16	14	13
40 PSF	24	23	19	16	14	13	11
45 PSF	22	20	17	14	13	11	10
50 PSF	20	18	15	13	11	10	9
55 PSF	18	17	14	12	10	9	8
60 PSF	17	15	13	11	9	8	8

Min. 4000 PSI Concrete
400 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	24
25 PSF	24	24	24	24	24	21	19
30 PSF	24	24	24	23	20	18	16
35 PSF	24	24	23	20	17	15	14
40 PSF	24	24	20	17	15	13	12
45 PSF	24	21	18	15	13	12	11
50 PSF	21	19	16	14	12	11	10
55 PSF	19	17	15	12	11	10	9
60 PSF	18	16	13	11	10	9	8

SEE NOTES ON PAGE 13

Notes:

1. Anchors to be evenly spaced between the header and the floor.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Minimum edge distance of 2.5" required.
4. Anchor spacing calculated from loads per ITW Ramset/Redhead online performance data.
5. Doorframe shall be minimum 2 x 6 structural grade lumber.
6. Use with 1" min. O.D. washers.
7. See figure for detail.
8. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
9. Safety factor of 4:1 used to calculate allowable load per anchor.
10. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.

TDS-161b

3/8'' x 3'' Sleeve Anchors (1-1/2'' Embed)

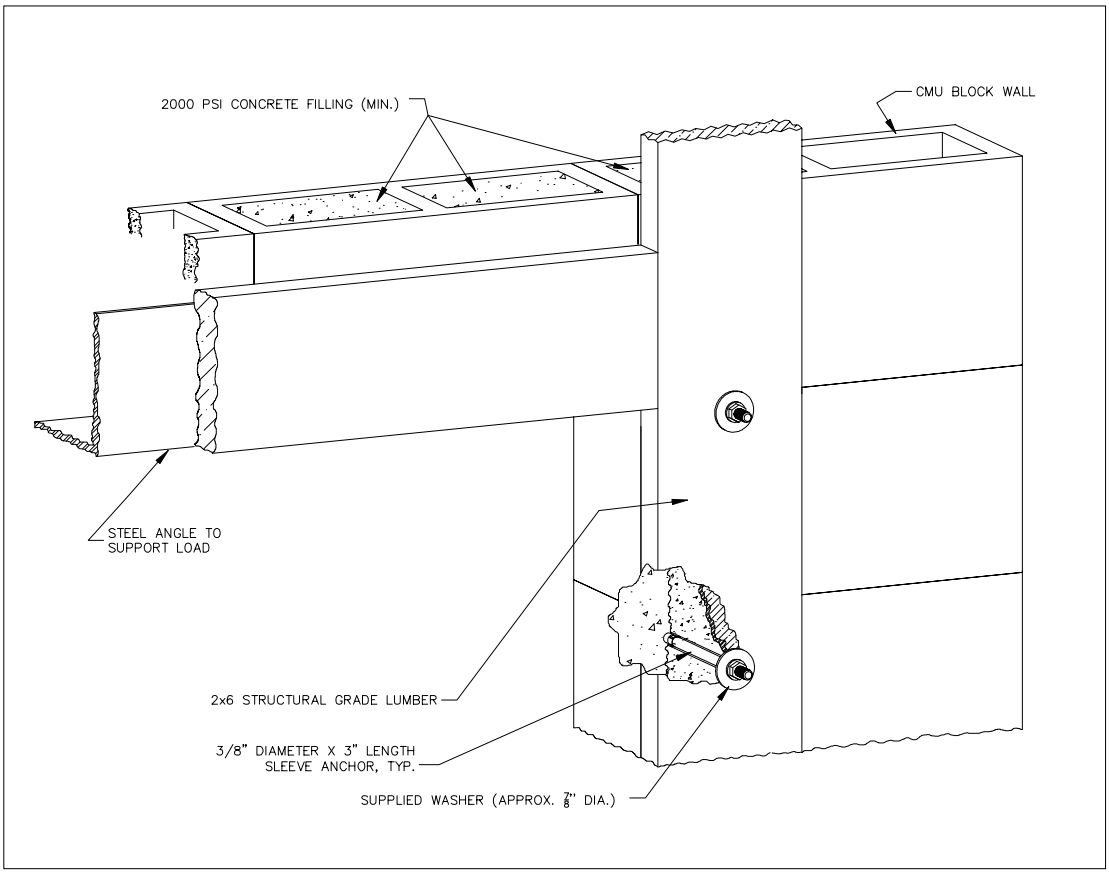


FIGURE 161b – CMU Wall

Notes:

- Alternate design may be approved by a registered professional engineer.
- 2x6 wood jambs may be counterbored up to 3/4” deep at each sleeve anchor location to provide a flush mounting surface.
- Sleeve anchors shall have a minimum edge distance of 3” for maximum holding power.
- Spring Pad Connection Not Included

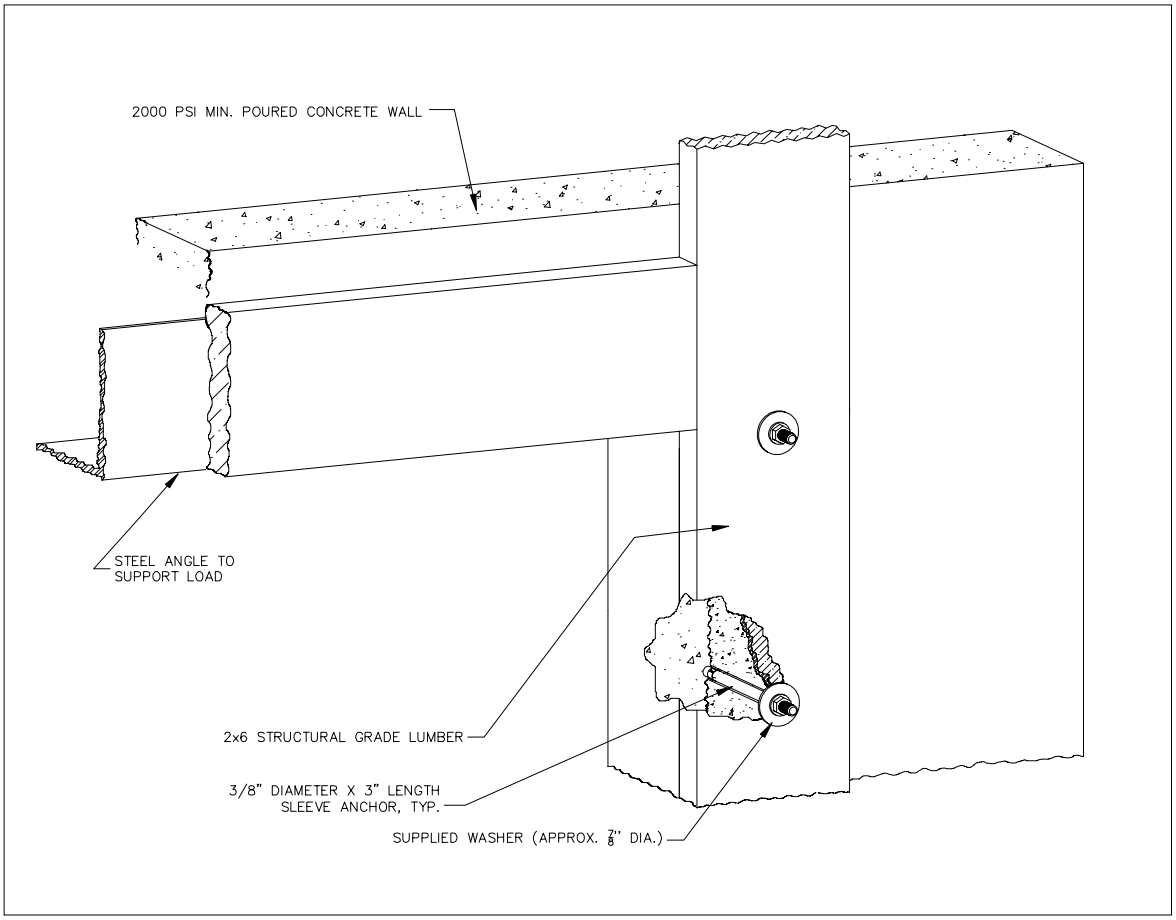


FIGURE 161b – Poured Concrete Wall

Notes:

- Alternate design may be approved by a registered professional engineer.
- 2x6 wood jambs may be counterbored up to 3/4" deep at each sleeve anchor location to provide a flush mounting surface.
- Sleeve anchors shall have a minimum edge distance of 3" for maximum holding power.
- Spring Pad Connection Not Included

3/8'' x 3'' Sleeve Anchors (1-1/2'' Embed)
Reference: Simpson Strong-Tie Online Load Tables, www.simpsonanchors.com,
2001 NDS for Wood Construction, p. 8, 59, 68, 74, 166

Southern Yellow Pine Jamb (Specific Gravity = 0.55), 2000 psi Min. Concrete
336 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	22	20
25 PSF	24	24	24	23	20	18	16
30 PSF	24	24	22	19	17	15	13
35 PSF	24	23	19	16	14	13	12
40 PSF	22	20	17	14	13	11	10
45 PSF	20	18	15	13	11	10	9
50 PSF	18	16	13	12	10	9	8
55 PSF	16	15	12	10	9	8	7
60 PSF	15	13	11	10	8	7	7

Spruce Pine Fir Jamb (Specific Gravity = 0.42), 2000 psi Min. Concrete
274 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	22
20 PSF	24	24	24	23	21	18	16
25 PSF	24	24	22	19	16	15	13
30 PSF	24	22	18	16	14	12	11
35 PSF	21	19	16	13	12	10	9
40 PSF	18	16	14	12	10	9	8
45 PSF	16	15	12	10	9	8	7
50 PSF	15	13	11	9	8	7	7
55 PSF	13	12	10	9	7	7	6
60 PSF	12	11	9	8	7	6	

SEE NOTES ON PAGE 17

Notes:

1. Anchors to be evenly spaced between the header and the floor.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Min edge distance of 3" required.
4. Anchor spacing calculated from loads per Simpson Strong-Tie online performance data and AF&PA 2001 NDS for Wood Construction.
5. Doorframe shall be minimum 2 x 6 structural grade lumber.
6. Use washers provided by sleeve anchor manufacturer.
7. See figure for detail.
8. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
9. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.
10. **SPACING LESS THAN 6 INCHES NOT RECOMMENDED**

TDS-161c

3/8'' x 3-1/2'' Expansion (Wedge) Anchors (1-1/2'' Embed)

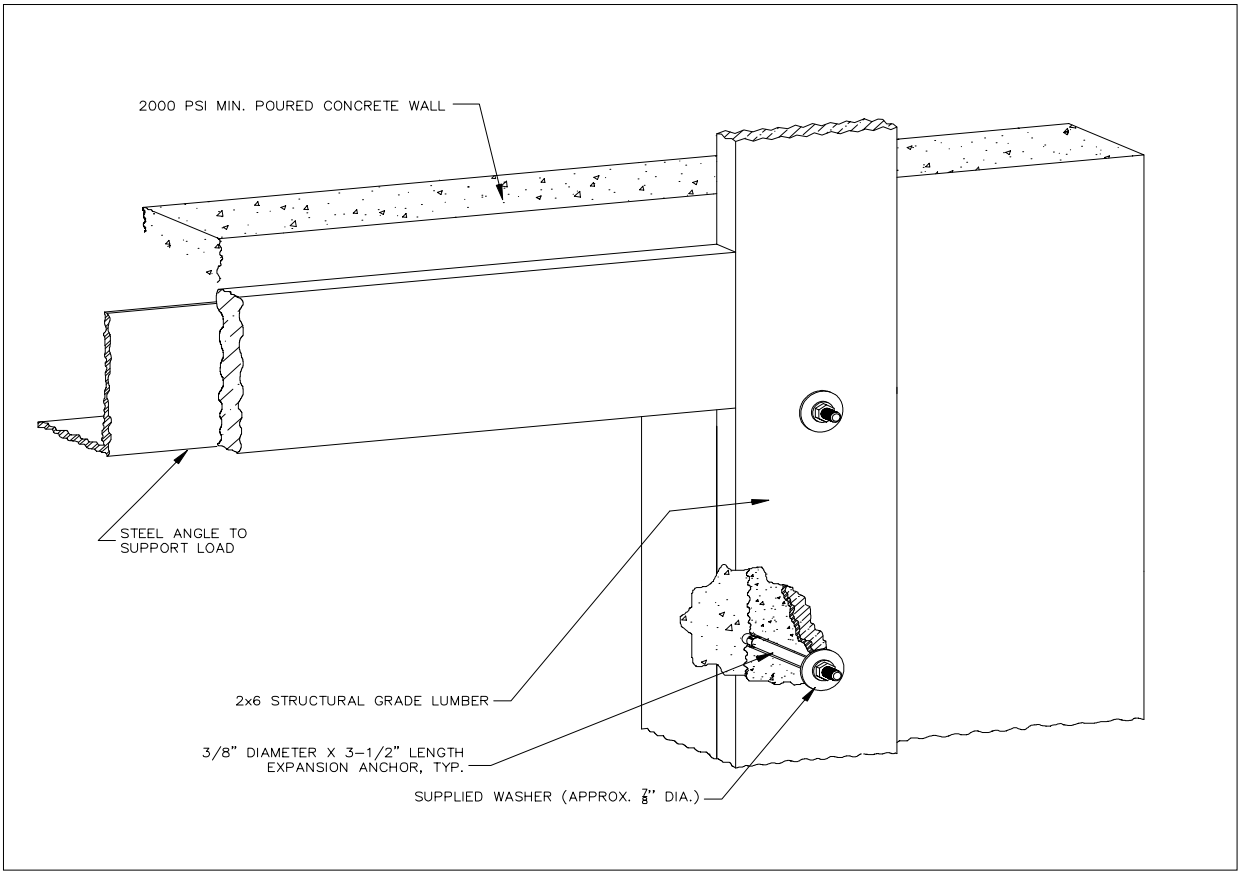


FIGURE 161c

Notes:

- Alternate design may be approved by a registered professional engineer.
- 2x6 wood jambs may be counterbored up to 3/4” deep at each wedge anchor location to provide a flush mounting surface.
- Wedge anchors shall have a minimum edge distance of 3” for maximum holding power.
- Spring Pad Connection Not Included

3/8'' x 3-1/2'' Expansion (Wedge) Anchors (1-1/2'' Embed)
Reference: Simpson Strong-Tie Online Load Tables, www.simpsonanchors.com, 2001 NDS for Wood Construction, p. 8, 59, 68, 74, 166

Southern Yellow Pine Jamb (Specific Gravity = 0.55), 2000 psi Min. Concrete
364 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	22
25 PSF	24	24	24	24	22	19	17
30 PSF	24	24	24	21	18	16	15
35 PSF	24	24	21	18	16	14	12
40 PSF	24	22	18	16	14	12	11
45 PSF	22	19	16	14	12	11	10
50 PSF	19	17	15	12	11	10	9
55 PSF	18	16	13	11	10	9	8
60 PSF	16	15	12	10	9	8	7

Spruce Pine Fir Jamb (Specific Gravity = 0.42), 2000 psi Min. Concrete
274 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	22
20 PSF	24	24	24	23	21	18	16
25 PSF	24	24	22	19	16	15	13
30 PSF	24	22	18	16	14	12	11
35 PSF	21	19	16	13	12	10	9
40 PSF	18	16	14	12	10	9	8
45 PSF	16	15	12	10	9	8	7
50 PSF	15	13	11	9	8	7	7
55 PSF	13	12	10	9	7	7	6
60 PSF	12	11	9	8	7	6	

SEE NOTES ON PAGE 20

Notes:

1. Anchors to be evenly spaced between the header and the floor.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Min edge distance of 3" required.
4. Anchor spacing calculated from loads per Simpson Strong-Tie online performance data and AF&PA 2001 NDS for Wood Construction.
5. Doorframe shall be minimum 2 x 6 structural grade lumber.
6. Use washers provided by expansion anchor manufacturer.
7. See figure for detail.
8. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
9. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.
10. **SPACING LESS THAN 6 INCHES NOT RECOMMENDED**

TDS-161D
7/16'' X 8'' GALVANIZED L-BOLT ANCHORS

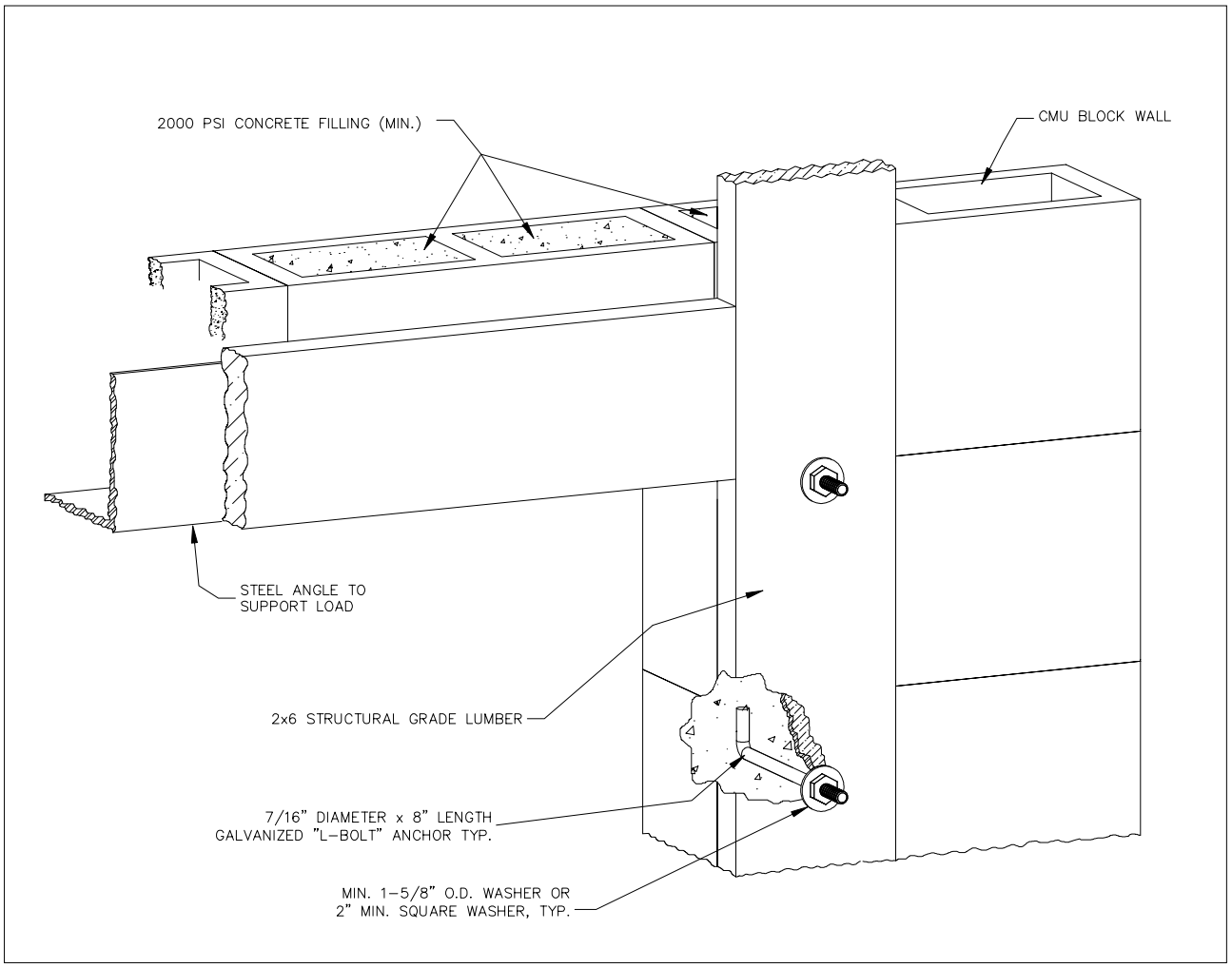


FIGURE 161d

Notes:

- Alternate design may be approved by a registered professional engineer.
- L-bolts shall have a minimum edge distance of 2-3/4" for maximum holding power.
- Spring Pad Connection Not Included

7/16'' x 8'' Galvanized L-Bolt Anchors
Reference: 2001 NDS for Wood Construction, p. 22, 74

957 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	36	36	36	36	36	36	36
15 PSF	36	36	36	36	36	36	36
20 PSF	36	36	36	36	36	36	36
25 PSF	36	36	36	36	36	36	36
30 PSF	36	36	36	36	36	36	36
35 PSF	36	36	36	36	36	36	33
40 PSF	36	36	36	36	36	32	29
45 PSF	36	36	36	36	32	28	26
50 PSF	36	36	36	33	29	26	23
55 PSF	36	36	35	30	26	23	21
60 PSF	36	36	32	27	24	21	19

Notes:

1. Anchors to be evenly spaced between the header and the floor.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Minimum of 3 anchors per jam allowed.
4. Anchor spacing calculated from loads per ASTM A307 and AF&PA 2001 NDS for Wood Construction.
5. 8" CMU block walls shall be of sufficient strength to resist loads.
6. L-bolts shall be anchored in poured concrete wall (2000 psi min.), or CMU block filled with 2000 psi concrete.
7. Use with 1-5/8" min. O.D. or 2'' min. square washers.
8. See figure for detail.
9. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
10. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.
11. 7/16" diameter mounting holes to be drilled in 2 x 6 to match bolt pattern

TDS-161e

3/8'' x 3'' Lag Screw w/ 1-1/8” Dia. Washer (1-1/2'' Embed)

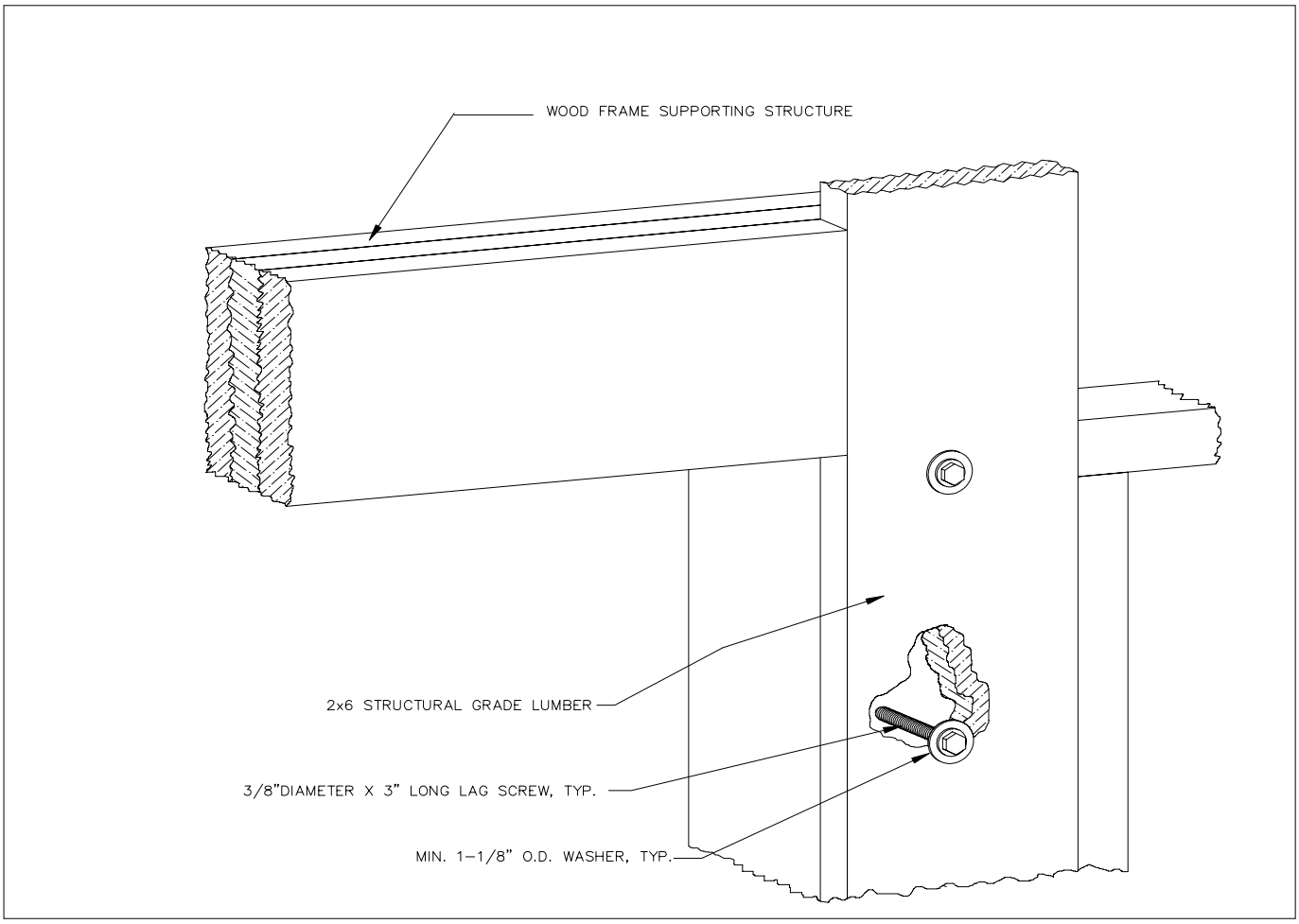


FIGURE 161e

Notes:

- Alternate design may be approved by a registered professional engineer.
- 2x6 wood jambs may be counterbored up to 1/2” deep at each lag screw location to provide a flush mounting surface.
- Lag screws shall have a minimum edge distance of 1-1/2” for maximum holding power.
- Spring Pad Connection Not Included

3/8'' x 3'' Lag Screw W/ 1-1/8'' Dia. Washer (1-1/2'' Embed)
Reference: 2001 NDS for Wood Construction, p. 8, 59, 68, 74, 166

Southern Yellow Pine, Specific Gravity = 0.55
577 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	24
25 PSF	24	24	24	24	24	24	24
30 PSF	24	24	24	24	24	24	23
35 PSF	24	24	24	24	24	22	20
40 PSF	24	24	24	24	22	19	17
45 PSF	24	24	24	22	19	17	15
50 PSF	24	24	23	20	17	15	14
55 PSF	24	24	21	18	16	14	13
60 PSF	24	23	19	16	14	13	12

Spruce Pine Fir, Specific Gravity = 0.42
385 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	23
25 PSF	24	24	24	24	23	21	18
30 PSF	24	24	24	22	19	17	15
35 PSF	24	24	22	19	17	15	13
40 PSF	24	23	19	17	14	13	12
45 PSF	23	21	17	15	13	11	10
50 PSF	21	18	15	13	12	10	9
55 PSF	19	17	14	12	11	9	8
60 PSF	17	15	13	11	10	9	8

SEE NOTES ON PAGE 25

Notes:

1. Anchors to be evenly spaced between the header and the floor or between jambs.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Minimum end distance of 1.5" required.
4. Anchor spacing calculated from loads per 2001 AF&PA NDS for Wood Construction.
5. Doorframe shall be minimum 2 x 6 structural grade lumber.
6. Use with 1-1/8" min. O.D. washers.
7. See figure for detail.
8. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
9. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.
10. Pre-drill 1/4" dia. holes.
11. Lag screws must conform to ANSI/ASME Standard B18.2.1.

TDS-161f

16D X 3-1/2'' COMMON WIRE NAILS (2'' MIN. EMBED)

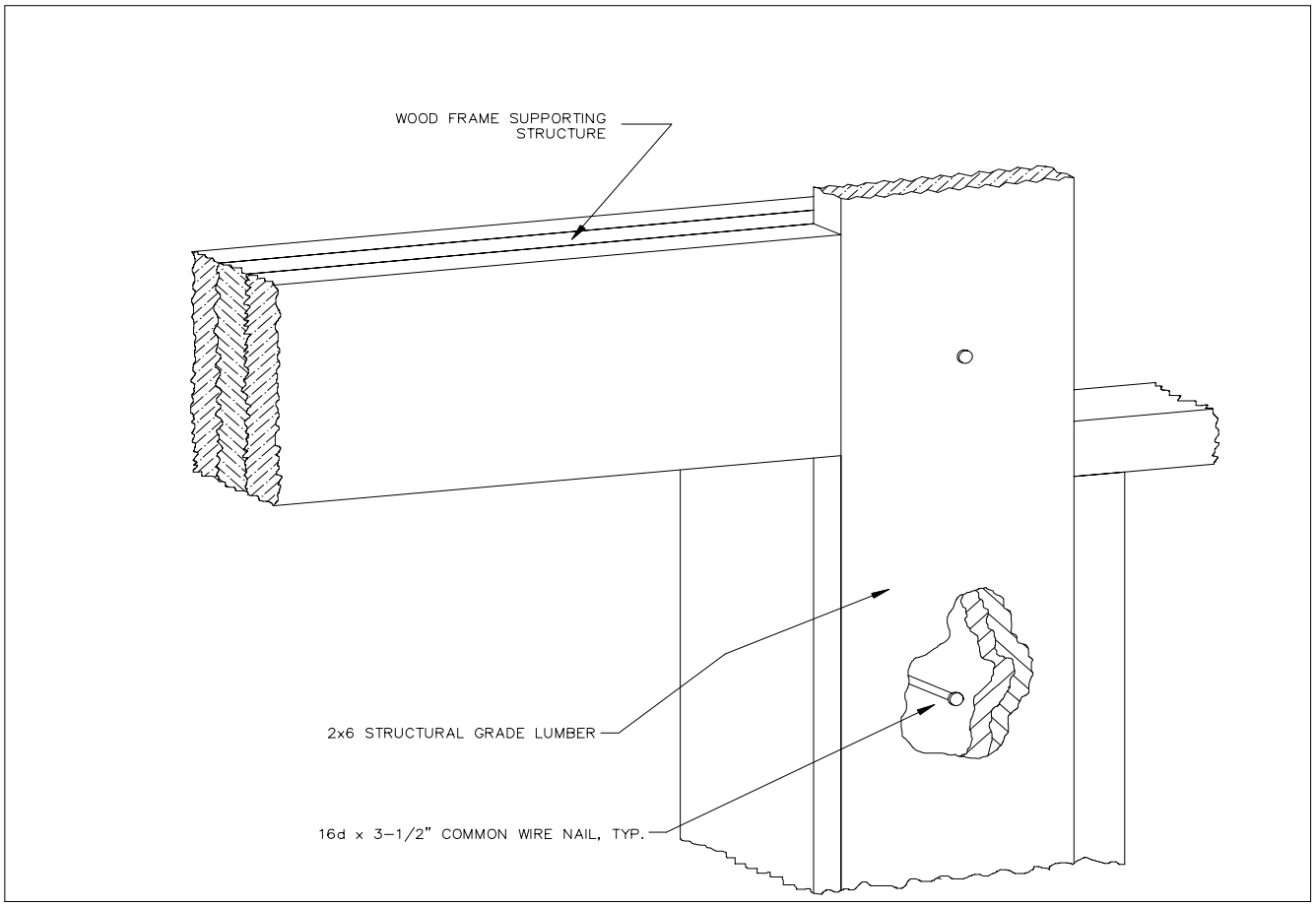


FIGURE 161f

Notes:

- Alternate design may be approved by a registered professional engineer.
- Nails shall be centered in 2x6 wood for maximum holding power.
- Spring Pad Connection Not Included

16d x 3-1/2'' Common Wire Nails (2'' Min. Embed)
Reference: 2001 NDS for Wood Construction, p. 8, 59, 70, 74, 168

Southern Yellow Pine, Specific Gravity = 0.55
128 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	24	24	24	22	19	17	15
15 PSF	23	20	17	15	13	11	10
20 PSF	17	15	13	11	10	9	8
25 PSF	14	12	10	9	8	7	6
30 PSF	11	10	9	7	6	6	
35 PSF	10	9	7	6			
40 PSF	9	8	6				
45 PSF	8	7	6				
50 PSF	7	6					
55 PSF	6	6					
60 PSF	6						

Spruce Pine Fir, Specific Gravity = 0.42
67 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0''	10'-0''	12'-0''	14'-0''	16'-0''	18'-0''	20'-0''
10 PSF	18	16	13	11	10	9	8
15 PSF	12	11	9	8	7	6	
20 PSF	9	8	7	6			
25 PSF	7	6					
30 PSF	6						
35 PSF							
40 PSF							
45 PSF							
50 PSF							
55 PSF							
60 PSF							

SEE NOTES ON PAGE 28

Notes:

1. Anchors to be evenly spaced between the header and the floor.
2. First (bottom) anchor starting at no more than half of the maximum on-center distance. Highest anchor installed at least as high as the door opening.
3. Anchor spacing calculated from loads per 2001 AF&PA NDS for Wood Construction.
4. Doorframe shall be minimum 2 x 6 structural grade lumber.
5. See figure for detail.
6. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
7. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.
8. Nails must conform to ASTM F1667.
9. **SPACING LESS THAN 6 INCHES NOT RECOMMENDED**

TDS-161G

0.100" x 1" Long Fillet Weld (E60xx Electrodes Min.) Into 1/8" Min. Steel Jambs

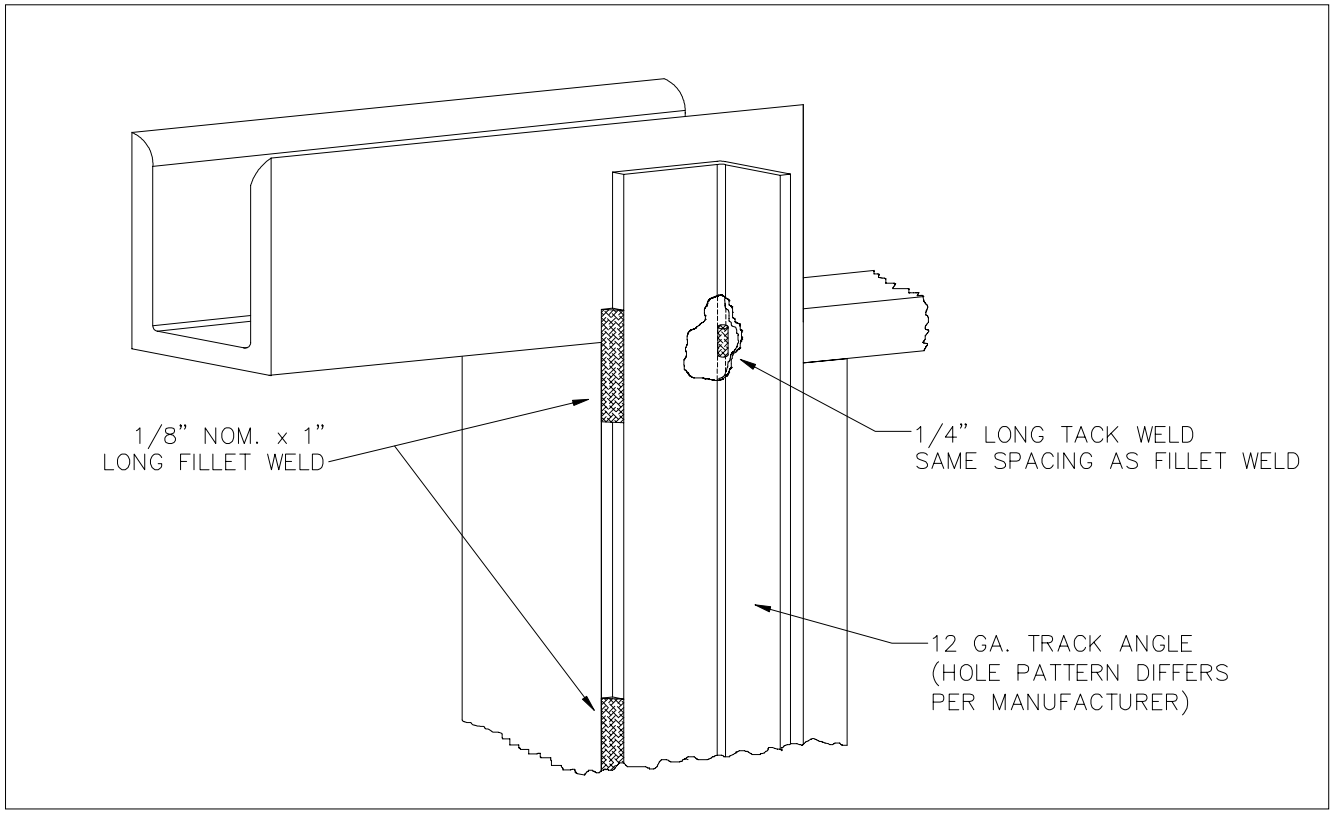


FIGURE 161g

Note:

- Alternate design may be approved by a registered professional engineer.
- Spring Pad Connection Not Included

.100" x 1" Long Fillet Weld (E60xx Electrodes Min.)
Reference: AISC Manual of Steel Construction Allowable Stress Design (9th Edition) p. 5-67, 5-70.

1,272 lb/anchor allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	24
25 PSF	24	24	24	24	24	24	24
30 PSF	24	24	24	24	24	24	24
35 PSF	24	24	24	24	24	24	24
40 PSF	24	24	24	24	24	24	24
45 PSF	24	24	24	24	24	24	24
50 PSF	24	24	24	24	24	24	24
55 PSF	24	24	24	24	24	24	24
60 PSF	24	24	24	24	24	24	24

Notes:

1. **Most garage door industry track is galvanized steel. Use all necessary precautions when welding galvanized steel.**
2. Welds to be evenly spaced between the header and the floor.
3. First (bottom) weld starting at no more than half of the maximum on-center distance. Highest weld at least as high as the door opening.
4. All welds should be performed by a Certified Welder or inspected by a Certified Welding Inspector to verify the integrity of the welds.
5. Fillet welds to have a straight or convex face surface.
6. Tack weld toe of angle at same spacing to prevent rotation of track angle.
7. Cracks and blemishes shall be ground to a smooth contour and checked to ensure soundness.
8. See figure for detail.
9. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
10. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.

TDS-161h

1/4" x 3/4" Self-Tapping Screws into Steel

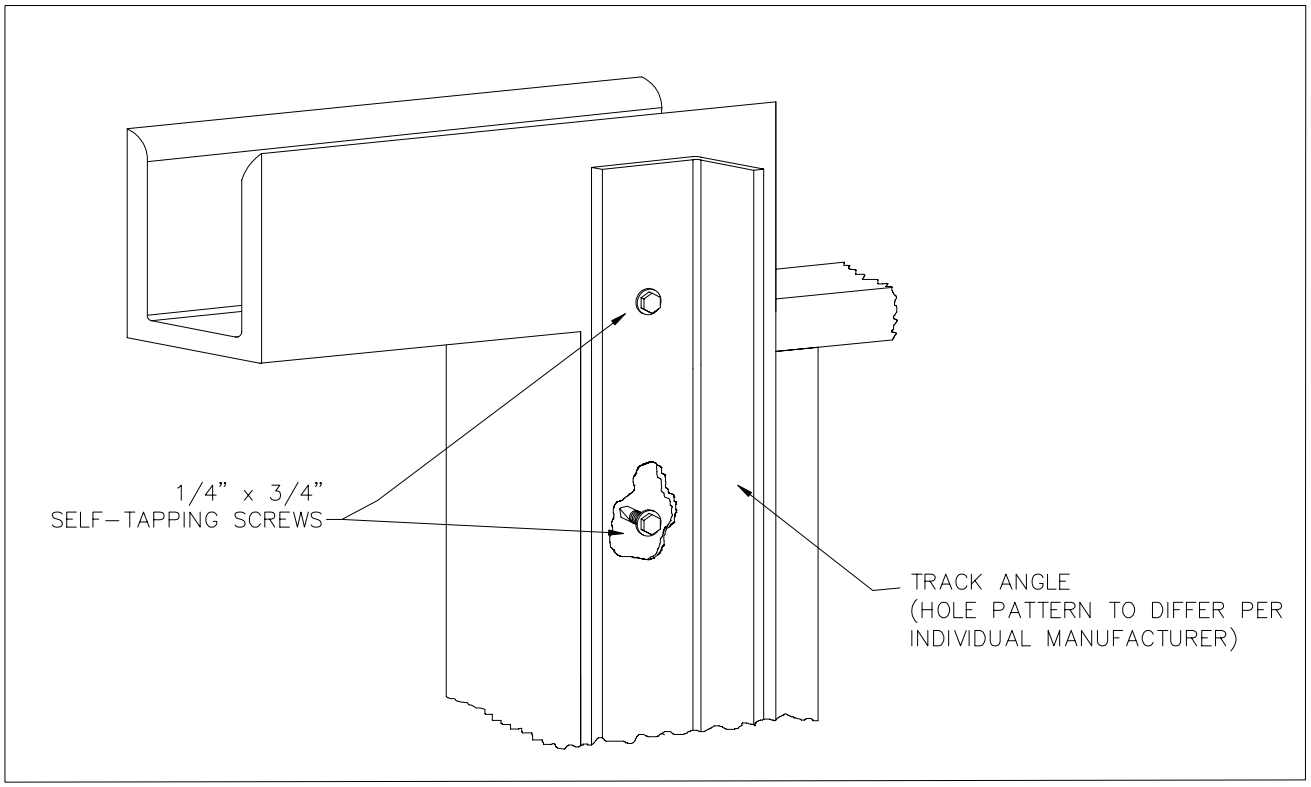


FIGURE 161h

Note:

- Alternate design may be approved by a registered professional engineer.
- Spring Pad Connection Not Included

1/4" x 3/4" Self-Tapping Screws
Reference: ITW Buildex Online Performance Data, www.itwbuildex.com

12 ga. Steel Jambs
209 lb/screw allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	21	19	17
20 PSF	24	24	21	18	16	14	12
25 PSF	22	20	17	14	12	11	10
30 PSF	19	17	14	12	10	9	8
35 PSF	16	14	12	10	9	8	7
40 PSF	14	12	10	9	8	7	6
45 PSF	12	11	9	8	7	6	6
50 PSF	11	10	8	7	6	6	5
55 PSF	10	9	8	6	6	5	5
60 PSF	9	8	7	6	5	5	4

3/16" Steel Jambs
444 lb/screw allowable load

	Maximum Spacing (INCHES)						
Door Width (ft) => Design Load	9'-0"	10'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
10 PSF	24	24	24	24	24	24	24
15 PSF	24	24	24	24	24	24	24
20 PSF	24	24	24	24	24	24	24
25 PSF	24	24	24	24	24	24	21
30 PSF	24	24	24	24	22	20	18
35 PSF	24	24	24	22	19	17	15
40 PSF	24	24	22	19	17	15	13
45 PSF	24	24	20	17	15	13	12
50 PSF	24	21	18	15	13	12	11
55 PSF	21	19	16	14	12	11	10
60 PSF	20	18	15	13	11	10	9

SEE NOTES ON PAGE 33

Notes:

1. Screws to be evenly spaced between the header and the floor.
2. First (bottom) screw starting at no more than half of the maximum on-center distance. Highest screw installed at least as high as the door opening.
3. See figure for detail.
4. Special requirements for garage doors with center post systems. See manufacturer instructions for details.
5. Supporting structural elements shall be designed by a registered professional engineer for wind loads in addition to other loads.