

August 10th, 2020

Town Manager Town of Bowdoinham 13 School Street, Bowdoinham, ME 04008

RE: Bowdoinham Recycling Building Modifications

To whom it may concern,

This memo is to address the modifications required for the Bowdoinham Recycling center building.

Calderwood Engineering inspected the Bowdoinham Recycling center on June 24th, 2020. Calderwood Engineering had previously inspected the building on August 21st, 2013, and noted several areas of the building that required modification to bring the building up to code. During the inspection on June 24th, 2020, Calderwood Engineering noted that none of the proposed changes had been made. Attached to this Memo are the details and memo provided in 2013. All of the changes outlined in that memo, as well as the modifications below must be performed to bring the building up to code. The only part of the existing memo that no longer applied is the cost estimate, which does not reflect 2020 prices. In addition to the existing modifications, Calderwood Engineering found the following issues.

On the 1^{st} floor, there are (4) columns located under a set of Lally columns placed on the 2^{nd} floor. Currently, (1) column is located off center and leaves the beam on top of the columns with 1" of bearing. This column must be repositioned to have a minimum of 2.5" of bearing length.

On the Northeast corner of the building, the wall next to existing door frame is not connected to the foundation. Calderwood Engineering has designed a connection between the existing timber wall frame to the concrete footing by installing a sill plate and connecting this to the existing door frame. See the attached details.

On the Southeast corner of the building, several of the 2x4's in the exterior wall have deteriorated and must be replaced. Calderwood Engineering noted at least (11) that must be replaced, however the exact number must be determined in the field. These 2x4's have been exposed to the elements due to the lack of sheathing or any type of facing on the exterior of the building. As noted in the attached memo from 2013, ¹/₂" plywood/OSB should be added to all exterior wall that are not covered by plywood or by planking.



Attached are the supporting calculations, details, and the memo and details provided in 2013.

Should you have any further questions please feel free to contact us directly.

Respectfully Submitted

EA L

Thad D. Chamberlain, EI



Project: 11-Town of Bowdoinham-20; 01-Recycling Center-20 **Client**: Town of Bowdoinham

Construction Engineering Design: Calderwood Engineering Design Computations by: Thad Chamberlain, El Design Check by: Eric Calderwood, PE



Project Notes:

Check Bowdoinham Recycling Building, determine capacity of additional members not addressed in the calculations and details dated December 2013.

References: NDS 2012, ASCE 7-14, IBC 2009

| j zko s at single spa | In between addition | | |
|--|--|---|--|
| b _{beam} ≔ 1.5 in | $d_{beam} \coloneqq 7.25$ | in | |
| L _{beam} ≔12 ft | spacing betw | veen columns | |
| $w_1 \coloneqq 3 \text{ ft} + 2 \text{ in}$ | distance fror | n center of colur | nn to center of exterior column |
| $w_2 := 8 \text{ ft} + 10.25$ | in distance from | n center of colur | nn to center of interior column |
| $\sigma_{LL} := 125 \text{ psf}$ | light storage | warehouse (Fro | m Table 4-1, ASCE 7) |
| $\sigma_{floor} \coloneqq 5 \text{ psf}$ | timber frami | ing, assume 5psf | (see pg 6 of 93 of original calculations) |
| Iculate total load a | pplied by beam: | | |
| | | | |
| $w_{beam} := (\sigma_{LL} + \sigma_f)$ | $\left(\frac{w_1}{2} + \frac{w_2}{2}\right) +$ | 45 pcf•(4•b _{bea} | $_{am} \cdot d_{beam}) = 794.948 \text{ plf}$ |
| $w_{beam} := (\sigma_{LL} + \sigma_f)$ $P_{beam} := \frac{w_{beam} \cdot L}{2}$ | $\left(\frac{w_1}{2} + \frac{w_2}{2}\right) + \frac{beam}{2} = 4.77 \text{ kip}$ | 45 pcf•(4•b _{bea} | am • d _{beam}) = 794.948 plf This is the reaction load at the end of the beam |
| $w_{beam} := (\sigma_{LL} + \sigma_f)$ $P_{beam} := \frac{w_{beam} \cdot L}{2}$ | $\left(\frac{w_1}{2} + \frac{w_2}{2}\right) + \frac{beam}{2} = 4.77 \text{ kip}$ | 45 pcf•(4•b _{bea} | $a_{am} \cdot d_{beam}$ = 794.948 plf This is the reaction load at the end of the beam |
| $w_{beam} := (\sigma_{LL} + \sigma_f)$ $P_{beam} := \frac{w_{beam} \cdot L}{2}$ $P_{corr} := 335 \text{ psi}$ | $(1000) \cdot \left(\frac{W_1}{2} + \frac{W_2}{2}\right) + \frac{1000}{2} = 4.77 \text{ kip}$ | 45 pcf•(4•b _{bez} | am • d _{beam}) = 794.948 plf This is the reaction load at the end of the beam SPF No.2 South, Ref. NDS 2012 |
| $w_{beam} := \left(\sigma_{LL} + \sigma_{f}\right)$ $P_{beam} := \frac{w_{beam} \cdot L}{2}$ $P_{culate beam in beam}$ $F_{cperp} := 335 \text{ psi}$ $l_{bear} := 2.5 \text{ in}$ | $\left(\frac{w_1}{2} + \frac{w_2}{2}\right) + \frac{beam}{2} = 4.77 \text{ kip}$ | 45 pcf•(4•b _{bea} | am • d_{beam}) = 794.948 plf This is the reaction load at the end of the beam SPF No.2 South, Ref. NDS 2012 length of bearing |
| $w_{beam} := \left(\sigma_{LL} + \sigma_{f}\right)$ $P_{beam} := \frac{w_{beam} \cdot L}{2}$ Solculate beam in b | $ hoor) \cdot \left(\frac{w_1}{2} + \frac{w_2}{2}\right) + $ $ \frac{beam}{aring:} = 4.77 \text{ kip} $ $ C_t := 1.0 $ | 45 pcf \cdot (4 \cdot b _{bea} C _i := 1.0 | am • d_{beam}) = 794.948 plf This is the reaction load at the end of the beam SPF No.2 South, Ref. NDS 2012 length of bearing NDS 4.3.3/4/8 |
| $w_{beam} := \left(\sigma_{LL} + \sigma_{f}\right)$ $P_{beam} := \frac{w_{beam} \cdot L}{2}$ elculate beam in beat F _{cperp} := 335 psi l _{bear} := 2.5 in C _m := 1.0 $C_{b} := \frac{l_{bear} + 0.375}{l_{bear}}$ | $\frac{(w_1)}{2} + \frac{(w_2)}{2} + $ | 45 pcf · $(4 \cdot b_{bea})$ C _i := 1.0 | am • d_{beam}) = 794.948 plf This is the reaction load at the end of the beam SPF No.2 South, Ref. NDS 2012 length of bearing NDS 4.3.3/4/8 NDS 3.10-2 |
| $w_{beam} := \left(\sigma_{LL} + \sigma_{f}\right)$ $P_{beam} := \frac{w_{beam} \cdot L}{2}$ $P_{beam} := \frac{w_{beam} \cdot L}{2}$ $P_{cperp} := 335 \text{ psi}$ $P_{cperp} := 1.0$ $P_{cperp} := P_{cperp} \cdot C_{p}$ | $ \begin{array}{l} \text{loor} \end{pmatrix} \cdot \left(\frac{w_1}{2} + \frac{w_2}{2} \right) + \\ \\ \frac{\text{beam}}{2} = 4.77 \text{ kip} \\ \\ \text{aring:} \\ \\ C_t := 1.0 \\ \\ \\ \frac{5 \text{ in}}{2} = 1.15 \\ \\ \\ \\ m \cdot C_t \cdot C_i \cdot C_b = 385.2 \end{array} $ | 45 pcf•(4•b _{bea} C _i := 1.0 25 psi | am • d_{beam}) = 794.948 plf This is the reaction load at the end of the beam SPF No.2 South, Ref. NDS 2012 length of bearing NDS 4.3.3/4/8 NDS 3.10-2 NDS Table 4.3.1 |



| $f_{cperp} := \frac{P_{beam}}{A_1 \cdot 4} = 317.979 \text{ psi}$ | |
|---|--|
| $Check := if f_{max} < F_{max}' = "i$ | Ok for hearing" |
| "Ok for bearing" | |
| else | |
| "Check" | |
| 2.5 inches of bearing is required for th or install additional 6x6 column. | ne 2x8's, shift column as required to provide enough bearing for each be |
| Check concrete blocks under Truss co | lumns: |
| Existing 7"x7"x5" concrete blocks in co | ompression: |
| $P_{vert} := 19440 \ lbf = 19.44 \ kip$ | See page 84 of 94 of previous design calculations This is the factored load in the columns supporting the truss |
| f'c:=2 ksi | no information on existing concrete blocks, assume 2ksi |
| b _{conc} ≔ 6 in | concrete block dimension (7" square block, assume some section loss to 6" square block) |
| $t_{conc} := 5$ in | thickness of concrete block |
| $A_1 \coloneqq b_{conc} \cdot b_{conc} = 36 \text{ in}^2$ | bearing area on concrete block |
| $B_n := 0.85 \cdot f'_c \cdot A_1 = 61.2 \text{ kip}$ | unfactored bearing capacity of block (ACI 318, Table 22.8.3.2) |
| $\phi_{\text{bearing}} \coloneqq 0.65$ | (ACI 318, Table 21.2.1) |
| $\phi B_n := \phi_{bearing} \cdot B_n = 39.78 \text{ kip}$ | |
| $Check := if P_{vert} \le \phi B_n$ | = "Concrete Ok for Bearing" |
| Concrete Ok for Bea | ring" |
| else "Check" | |
| Concete blocks are ok for bearing, sho | buld be monitored for section loss |
| | |
| | |
| | |



Capacities of Tapcon Blue Anchors:



PERFORMANCE TABLES BLUE, WHITE, AND STAINLESS

ULTIMATE TENSION AND SHEAR VALUES (LBS/KN) IN CONCRETE

| ANCHOR | MIN DEPTH OF | f' c = 2000 P | SI (13.8 MPa) | f' c = 3000 P | SI (20.7 MPa) | f' c = 4000 P | SI (27.6 MPa) | f' c = 5000 PSI (34.5 MPa) | | |
|----------------|----------------------|----------------------|--------------------|----------------------|--------------------|----------------------|--------------------|----------------------------|--------------------|--|
| DIA In.(mm) | EMBEDMENT in.(mm) | TENSION Lbs. (kN) | SHEAR Lbs. (kN) | TENSION Lbs. (kN) | SHEAR Lbs. (kN) | TENSION Lbs. (kN) | SHEAR Lbs. (kN) | TENSION Lbs. (kN) | SHEAR Lbs. (kN) | |
| 3/16 (4.8) | 1 (25.4) | 600 (2.7) | 720 (3.2) | 625 (2.8) | 720 (3.2) | 650 (2.9) | 720 (3.2) | 800 (3.6) | 860 (3.8) | |
| | 1-1/4 (31.8) | 845 (3.7) | 720 (3.2) | 858 (3.8) | 720 (3.2) | 870 (3.9) | 720 (3.2) | 1,010 (4.5) | 860 (3.8) | |
| | 1-1/2 (38.1) | 1,090 (4.8) | 860 (3.8) | 1,090 (4.8) | 860 (3.8) | 1,090 (4.8) | 860 (3.8) | 1,220 (4.8) | 860 (3.8) | |
| | 1-3/4 (44.5) | 1,450 (6.5) | 870 (3.9) | 1455 (6.5) | 870 (3.9) | 1,460 (6.5) | 990 (4.4) | 1,730 (7.7) | 990 (4.4) | |
| 1/4 (6.4) | 1(25.4) | 750 (3.3) | 900 (4.0) | 775 (3.4) | 900 (4.0) | 800 (3.6) | 1,360 (6.1) | 950 (4.2) | 1,440 (6.4) | |
| | 1-1/4 (31.8) | 1,050 (4.7) | 900 (4.0) | 1,160 (5.2) | 900 (4.0) | 1,270 (5.6) | 1,360 (6.1) | 1,515 (6.7) | 1,440 (6.4) | |
| | 1-1/2 (38.1) | 1,380 (6.1) | 1,200 (5.3) | 1,600 (7.2) | 1,200 (5.3) | 1,820 (8.1) | 1,380 (6.1) | 2,170 (9.7) | 1,670 (7.4) | |
| | 1-3/4 (44.5) | 2,020 (9.0) | 1,670 (7.4) | 2,200 (9.8) | 1,670 (7.4) | 2,380 (10.6) | 1,670 (7.4) | 2,770 (12.3) | 1,670 (7.4) | |

Safe working loads for single installation under static loading should not exceed 25% of the ultimate load capacity.

ULTIMATE TENSION AND SHEAR VALUES (LBS/KN) IN HOLLOW BLOCK

| ANCHOR | ANCHOR | LIGHTWEIG | HT BLOCK | MEDIUM WEIGHT BLOCK | | | | |
|----------------|----------------------|----------------------|--------------------|----------------------|--------------------|--|--|--|
| DIA In.(mm) | EMBEDMENT In.(mm) | TENSION Lbs. (kN) | SHEAR Lbs. (kN) | TENSION Lbs. (kN) | SHEAR Lbs. (kN) | | | |
| 3/16 (4.8) | 1(25.4) | 220 (1.0) | 400 (1.8) | 340 (1.5) | 730 (3.2) | | | |
| 1/4 (6.4) | 1 (25.4) | 250 (1.1) | 620 (1.8) | 500 (2.2) | 1,000 (4.4) | | | |

Safe working loads for single installation under static loading should not exceed 25% of the ultimate load capacity. NOTE: 3/16" Tapcon requires 5/32" bit, 1/4" Tapcon requires 3/16" bit.

ALLOWABLE EDGE AND SPACING DISTANCES

| PARAMETER | ANCHOR | NORM | AL WEIGHT CONC | RETE | CONCRE | TE MASONRY UNIT | S (CMU) |
|-------------------|-----------------|--|--|-----------------------------|--|---|-----------------------------|
| | DIA. In.(mm) | FULL CAPACITY (Critical Distance Inches) | REDUCED CAPACITY (Minimai Distnce Inches) | LOAD REDUCTION FACTOR | FULL CAPACITY (Critical Distance Inches) | REDUCED CAPACITY (Minimal Distance Inches) | LOAD REDUCTION FACTOR |
| Spacing Between | 3/16 | 3 | 1-1/2 | 0.73 | 3 | 1-1/2 | 1.00 |
| Anchors - Tension | 1/4 | 4 | 2 | 0.66 | 4 | 2 | 0.84 |
| Spacing Between | 3/16 | 3 | 1-1/2 | 0.83 | 3 | 1-1/2 | 1.00 |
| Anchors - Shear | 1/4 | 4 | 2 | | 4 | 2 | 0.81 |
| Edge Distance - | 3/16 | 1-7/8 | 1 | 0.83 | 3 | 2 | 0.91 |
| Tension | 1/4 | 2-1/2 | 1-1/4 | 0.82 | 4 | 2 | 0.81 |
| Edge Distance - | 3/16 | 2-1/4 | 1-1/8 | 0.70 | 3 | 2 | 0.93 |
| Shear | 1/4 | 3 | 1-1/2 | 0.59 | 4 | 2 | 0.80 |

For St 1 inch = 25,4 mm



| etermine applied load: | |
|--|---|
| $w_{gap} := 2.5 ft$ | width of section not connected to floor |
| $h_{gap} \approx 15 \text{ ft} + 3 \text{ in}$ | height of section not connected to floor |
| /ind load on this section | ı of wall: |
| V _{wind} ≔115 mph | wind speed (ASCE 7-16, Figure 26.5-1b) Category 2 building |
| k _d := 0.85 | ASCE 7-16, Table 26.6-1 |
| $k_z := 0.85$ | ASCE 7-16, Table 26.10-1 (less than 15ft above ground level) |
| k _e := 1.00 | ASCE 7-16, Table 26.9-1 |
| k _{zt} := 1.0 | ASCE 7-16, 26.8.2 |
| $q_z \coloneqq 0.00256 \cdot k_z \cdot k_{zt}$ | • $k_d \cdot k_e \cdot \left(\frac{V_{wind}}{mph}\right)^2$ • psf=24.461 psf ASCE 7-16, 26.10-1 |
| G := 0.85 | Gust effect factor, ASCE 7-16, 26.11.1 |
| $Gcp_i := -0.18$ | ASCE 7-16, Table 26.13-1 |
| C _p :=0.8 | ASCE 7-16, Figure 27.3-1 |
| $\mathbf{P}_{\text{wind}} \coloneqq (\mathbf{q}_z \cdot \mathbf{C}_p \cdot \mathbf{G} - \mathbf{q}_z)$ | $h_z \cdot Gcp_i$ · $\frac{h_{gap}}{2} \cdot w_{gap} = 0.401 \text{ kip}$ ASCE 7-16, 27.3-1 |
| his is the wind load reac Istall nail plate (2x4) into olumn and nail column t | tion at each end of the wall section, design connection to footing to carry this applied o concrete slab with concrete screws, install 4x4 block under existing end wall to block, and block to nail plate. |
| esign Nail Plate: | |
| x Nail plate, calculate nu | umber of concrete anchors required to carry wind loads: |
| 2) 1/4" Tapcon Blue Con | crete Screws or equivalent: |
| N _{screw} := 3 | $\phi_{\text{screw}} \coloneqq 0.25$ in |
| V | assuming 1" of embedment into 2ksi concrete |
| $f_{red spacing} \coloneqq 0.82$ | Reduction for 2in spacing (minimum allowable) |
| $f_{red_edge} := 0.59$ | Reduction for 1-1/2" edge distance (Minimum allowable) |
| $V_{allow} := V_{screw} \cdot f_{red_space}$ | $_{acing} \cdot f_{red_edge} = 0.435 \ kip$ |
| | $P_{wind} = $ "Screws Ok for applied loads" |
| $Check \coloneqq if N_{screw} \bullet V_a$ | |
| Check := if $N_{screw} \cdot V_a$ $ \ "Screws ($ | Ok for applied loads" |



| - | ail Plate | e: | | | | | | | | | | |
|--|---|---|---|--|--|--|---|--|--------------------------------------|-----------|----------|-----|
| Check de | sign wit | h Powder | actuated | nails: | | | | | | | | |
| | | | | | | | | | | | | |
| V _{nail} : | =166 l | bf | This is t | the shea | r strength | of a sir | ngle Pow | der Actu | ated nai | l, with 1 | " of emb | edm |
| | | | (assum | ing using | g the 1516 | SDC wi | th 2-1/2 | ' overall | length, i | n 2ksi c | oncrete) | |
| N _{nail} : | = 3 | | Numbe | r of nails | 5 | | | | | | | |
| Check | <≔ if _(| N _{nail} • V _{nai} | $\rangle \ge P_{wind}$ | = "Ok f | or Shear" | | (3 |) Nails R | equired | | | |
| | 6 | Ok for Sh | ear" | | | | | | | | | |
| | else | e | | | | | | | | | | |
| | | Check" | | | | | | | | | | |
| <u> </u> | | | (2) 4546 | | | | | - | | | | |
| Contracto | or may | use either | (3) 15165 | SDC Pow | der Actuat | ed nai | ls or 1/4 | Tapcon | Blue Co | ncrete s | crews | |
| | JOBSITE SP | EED | | | PERF | ORMA | NCE/SUE | MITTAL | | | | |
| Roma et fe et | | he encoified | hu thair tura | ar actalar | number to est | linder fank | | manta | | | | |
| | eners may | be specified | by their type | or catalog | number to sat | isiy tasu | ning require | intents. | . 11 | | | |
| PIN SPECIFIC Made from AISI 1 | CATIONS 1060-1065 steel. | Austempered to a core | hardness of 52-56 l | API Rc • IC | PROVALS/LISTI C Evaluation Servic | NGS æ, Inc. | | | 11 | | | |
| Typical tensile st | rength: 270,000 | psi | | # | SR-2690 Sill Plate | | | | | | | |
| Typical shear str STANDARD FINI | ength: 162,000 p SHES | G | | # • Ci | SR-1799 Powder Pi ity of Los Angeles | ins & Clips | ICC _ | | | | | |
| Proprietary black Mechanical zinc | ¢ plate to a minim | um thickness of .0002 | meets requirements | # | R-22668 Powder pi | ins | ĈĒ | S | | | | |
| of ASTM B695- | -Class 5 Type 1 | | • | | | | | 0 / | | | | |
| FASTENER | S IN NOR | MAL WEIGHT | CONCRETE | | | | | | FAS | | | |
| | SHANK | MINIMUM | | INST/ | ALLED IN STONE AG | GREGATE CO | NCRETE | _ | TENE | | | |
| DADT | UIIAIIA | minimon | | | OTIONAL OVINT THE | SIVE STREN | GTH | | 24 | | | |
| NUMBER SERIES | DIAMETER (INCH) | PENETRATION (INCH) | 200 | 0 PSI | ALLOWABLE LOAD 4000 P | - Ultimate Lo SI | GTH ad 600 | 0 PSI | RS IN I | | | |
| NUMBER SERIES | DIAMETER (INCH) | PENETRATION (INCH) 3/4 | 200 TENSION (LBS) 50 655 | 0 PSI SHEAR (LBS) 66 739 | ALLOWABLE LOAD 4000 P TENSION (LBS) \$ 100 511 | - Ultimate Lo SI SHEAR (LBS) 104 552 | GTH ad 600 TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORM | | | |
| NUMBER SERIES | 0.145 | PENETRATION (INCH) 3/4 1 1-1/4 | 200 TENSION (LBS) 50 655 152 943 159 1078 | 0 PSI SHEAR (LBS) 66 739 166 1229 265 1665 | ALLOWABLE LOAD 4000 P TENSION (LBS) \$ 100 511 157 937 179 1043 | - Ultimate Lo SI SHEAR (LBS) 104 552 182 1342 267 1538 | GTH ad TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL W | | | |
| NUMBER SERIES 1500/1600 SERIES SP SERIES | 0.145 0.150 | PENETRATION (INCH) 3/4 1 1-1/4 1-1/2 3/4 | 200 TENSION (LBS) 50 655 152 943 159 1078 154 1450 | 0 PSI SHEAR (LBS) 66 7.39 166 1229 265 1665 340 2027 | ALLOWABLE LOAD 4000 P TENSION (LBS) S 100 511 157 837 179 1043 209 1357 150 803 | - Utimate Lo SI SHEAR (LBS) 104 552 182 1342 267 1538 342 1712 105 786 | GTH ad TENSION (LBS) | 0 PSI SHEAR (LBS) 82 454 | RS IN NORMAL WEIGHT | | | |
| NUMBER SERIES 1500/1600 SERIES SP SERIES SP SERIES | 0.145 0.150 0.150 | PENETRATION (INCH) 3/4 1 1-1/4 1-1/2 3/4 1 1-1/4 1-1/4 | 200 TENSION (LBS) 50 655 152 943 159 1078 154 1450 154 1043 207 1553 | 0 PSI SHEAR (LBS) 66 739 166 1229 265 1665 340 2027 200 1173 230 1636 | ALLOWABLE LOAD 4000 P TENSION (LBS) \$ 100 511 157 837 179 1043 209 1357 150 803 243 1307 298 1749 209 216 | - Wilmate Lo SI SHEAR (LBS) 104 552 182 1342 267 1538 342 1712 105 786 175 1097 218 1471 201 1057 | 600 TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL WEIGHT CONC | | | |
| NUMBER SERIES 1500/1600 SERIES SP SERIES SP SERIES 1900 SERIES | 0.145 0.150 0.145 0.150/180 | PENETRATION (INCH) 3/4 1 1-1/4 1-1/2 3/4 1 1-1/4 1-1/2 3/4 | 2000 TENSION (LBS) 500 655 152 943 159 1078 154 1450 | 0 PSI SHEAR (LBS) 66 739 166 7229 265 1665 340 2027 | ALLOWABLE LOAD 4000 P TENSION (LBS) \$ 100 571 157 837 179 1043 209 1357 150 803 243 1307 298 1749 304 2126 101 685 | - Utimate Lo SI SHEAR (LBS) 104 552 182 1342 267 1538 342 1712 105 786 175 1037 218 1471 391 1957 9 627 | ad ENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL WEIGHT CONCRETE | | | |
| 1500/1600 SERIES SP SERIES SP SERIES 1900 SERIES 1900 SERIES Note 1: ALLOWABLE & ASTM E1190. M | 0.145 0.145 0.150 0.150 0.145 10ads are show ose a: Safety Tac are for the fast | PENETRATION (INCH) 3/4 1 1-1/4 1-1/2 3/4 1 1-1/2 3/4 n In the Large BOLD tris are based on co ner only. Connector | 200 TENSION (LBS) 50 655 182 943 159 1078 154 1450 | 0 PSI SHEAR (LBS) 66 739 166 1229 285 1665 340 2027 | ALLOWABLE LOAD 4000 P TENSION (LBS) 1 100 511 117 837 179 1043 209 1357 150 833 243 1307 298 1749 384 2128 101 685 fer faci Cotti, hole 2: thi CoZro, the sath | - Ultimate Lo SI SHEAR (LBS) 104 552 182 1342 267 1538 342 17/2 105 786 175 1037 218 1471 391 1957 99 627 Testing conducty reliance | 6TH ad 600 TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL WEIGHT CONCRETE / ST | | | |
| 1500/1600 SERIES 1500/1600 SERIES SP SERIES 1900 SERIES 1900 SERIES 1900 SERIES Nobe 1: ALLOWABLE ASTIM E1190. Ne shown in concrete shown in concrete otherwise approved | 0.145 0.145 0.150 .150/.180 0.145 loads are show be 3: Safetly fact are for the fast rent safetly fact d. Note 8: For S | PENETRATION (INCH) 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 1 1 1 1 1 1 1 1 1 1 1 1 1 | 200 TENSION (LBS) 50 655 152 943 159 1078 164 1450 154 1450 155 694 105 695 105 695 10 | 0 PSI SHEAR (LBS) 66 739 166 1229 265 1665 340 2027 | ALLOWABLE LOAD 4000 P TENSION (LBS) \$ 100 511 107 407 179 1043 200 1357 150 403 243 1307 238 1749 384 2726 101 685 ter Anic forth. twole 2: th ICX AC70, the saft rataby, twole 5: Cyclic, crual job site values. | - Wimab Lo SI HEH - Wimab Lo SI - Wimab Lo SHEAR (LBS) 104 552 182 1342 267 1538 342 1712 105 786 175 1037 218 1471 391 1957 99 627 Testing conducted by factor will fatigue, shoc Note 7: Minir | 67H ad TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL WEIGHT CONCRETE / STEEL | | | |
| 1500/1600 SERIES SP SERIES SP SERIES SP SERIES 1900 SERIES 1900 SERIES Note 1: ALLOWABLE & ASTM E1190. W shown in concrete may require a diffe otherwise approver INSTALLE | DIAMETER (INCH) 0.145 0.150 1.50/.180 0.145 1.50/.180 0.145 1.50/.180 0.145 1.50/.180 0.145 0.045 are show be s. Safely fac are for the fact are for the fact of . Note FOT S D IN CON | PENETRATION (INCH) 344 1 1-1/4 1-1/2 3/4 1 1-1/2 3/4 n In the Lakes BOLD tris are based on co- near only. Connecter or, Note e: Job site is 1:10 ff = 4.448 N, 11 CRETE - CON | 200 TENSION (LBS) 50 655 112 943 159 1078 154 1450 | 0 PSI SHEAR (LBS) 66 739 166 1229 265 1665 340 2027 200 1173 200 1173 200 1536 01173 21458 214 458 215 458 216 4599 216 4599 217 4598 216 4599 216 45999 216 4599 216 4599 216 4599 216 4599 216 4 | ALLOWABLE LOAD 4000 P TENSION (LBS) S 100 571 157 827 179 1043 157 827 150 833 243 1307 298 1749 384 2128 101 685 677 482 301 685 677 49 384 2128 101 685 677 49 384 2128 101 685 677 49 384 2128 101 685 101 | SIVE 5 I REN - Wämate Lo SI SHEAR (LBS) 104 552 105 786 1712 105 786 175 1037 218 1471 391 1957 799 627 Testing condu by 627 Testing condu by 627 Testing condu by 627 Testing condu | Ad 600 TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL WEIGHT CONCRETE / STEEL | | | |
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| ISTALLEE PART NUMBER SP SERIES SP SERIES 1900 SERIES | DIAMETER (INCH) 0.145 0.150 0.150 0.145 0.145 0.145 0.145 0.145 0.145 0.145 0.145 0.157 0.157 0.157 0.157 | PENETRATION (INCH) 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1 1/2 1 1 1 1 1 1 1 1 1 1 1 1 1 | 200 TENSION (LBS) 50 655 152 943 156 1073 154 1050 155 594 155 694 155 694 155 694 155 694 156 694 165 694 165 694 165 694 165 694 166 504 167 317 12 479 07 STIEEL 3/16 sion Shear | 0 PSI SHEAR (LBS) 66 739 166 1229 265 1665 340 2027 | ALLOWABLE LOAD 4000 P TENSION (LBS) 2 TENSION (LBS) 2 TO 511 157 837 179 1043 209 1357 170 1043 209 1357 170 043 243 1307 243 1307 243 1307 243 1307 244 2126 101 685 Ber Anic font, Nobe 2: th ICK AC70, bit saft th ICK AC | SNUE 3 I REH - Ulimate Lo SI SHEAR (LBS) IO4 552 ID4 552 ID4 552 ID5 786 ID5 | BTH 600 TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL WEIGHT CONORETE / STEEL | | | |
| ISON I CONTRACTOR SERVICES ISON I CONTRACTOR SERVICES ISON SERVICES ISON SERVICES ISON SERVICES ISON SERVICES ISON SERVICES ISON SERVICES ISON SERVICES INSTALLEE PART NUMBER SERVICES IE SERVICES INSTALLEE PART NUMBER SERVICES INSTALLEE PART NUMBER SERVICES INSTALLEE INSTALLEE PART NUMBER SERVICES INSTALLEE PART NUMBER SERVICES INSTALLEE PART NUMBER SERVICES INSTALLEE PART NUMBER SERVICES INSTALLES INSTA | DIAMETER (INCH) 0.145 0.150 0.150 0.145 0.150/180 0.145 150/180 0.145 DIN CON SHANK DIA 0.157 0.157 DIN A36 SHANK DIA | PENETRATION (INCH) 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1.1/2 3/4 1 0.010 0.010 0.011 2 1.1/2 2 1.1/2 2 1.1/2 2 1.1/2 2 1.1/2 2 1.1/2 2 1.1/2 2 7/8 2 SHAIN TYPE Ten KNURLED 3 | 200 TENSION (LBS) 50 655 152 9.43 159 1078 154 1043 207 155.3 | 0 PSI SHEAR (LBS) 66 739 166 1229 265 1665 340 2027 | ALLOWABLE LOAD 4000 P TENSION (LBS) 5 TENSION (LBS) 5 100 571 157 827 179 1043 179 1043 179 1043 179 1043 179 1043 180 803 243 1307 298 1749 384 2128 101 685 | SNUE 3 I REN - Wämate Lo SI SHEAR (LBS) 104 552 105 786 175 1037 277 107 786 175 1037 218 1471 301 105 786 105 | Advector 600 TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL WEIGHT CONCRETE / STEEL | | | |
| ISTALLE PART NUMBER SP SERIES SP SERIES SP SERIES 1900 SERIES 1900 SERIES 1900 SERIES 1900 SERIES 1900 SERIES ASTM E1190, W Shown in concreb ASTM E1190, W Shown in concreb away require a diffe otherwise approver INSTALLE PART NUMBER SERIES TE SERIES TE SERIES TE SERIES TE SERIES | DIAMETER (INCH) 0.145 0.150 1.50/.180 0.145 0.045 are show as Safely are show as a Safely are show as Safely are show are for Si D IN CON SHANK DIA 0.157 D IN A36 SHANK DIA 0.157 D IN A572 | PENETRATION (INCH) 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1 1 2 1 1 1 2 1 1 1 2 1 1 1 2 1 1 1 2 1 1 1 2 2 1 1/4 3/4 1 2 1 1 1 2 2 1 1/4 3/4 1 2 2 1 1 1 2 2 7/8 2 2 STRUCTURA SNANK TYPE Ten KINRED 3 3 2 2 - CRED 5 1 2 2 - CRED 5 2 - CRED 5 - CON 2 - CON 2 - CON 2 - CON 2 - CON 2 - CON 2 - CON 2 - CON 2 - CON 2 - CON 2 - CON 2 - CON 2 - CON 2 - CON 2 - CON - CON - CON - CON - CON - CON - CON - CON - CON - CON - CON - CON - CON - CON - CON - CON - - CON - - - - - - - - - - - - - | 200 TENSION (LBS) 50 65 152 843 159 107 154 154 154 109 107 154 154 103 207 155 152 105 694 107 Ummarb loads 105 694 107 Ummarb loads 105 694 107 Ummarb loads 105 694 101 137 7 8 216 7 317 4 24 479 07 LSTEEL 3/16 Sion Shear 1 137 7 8 20 606 CTURAL ST | 0 PSI SHEAR (LBS) 66 739 166 1229 285 1665 340 2027 | ALLOWABLE LOAD 4000 P TENSION (LBS) \$ 100 571 157 837 179 1043 200 1357 150 803 243 1307 268 1749 384 2136 101 685 101 685 101 685 101 685 101 685 STRENGTH 1W 2000 LLWt or Lower F ear Tension 152 49 164 106 152 49 164 164 164 164 164 164 164 164 164 164 | Silves in Kerk -Uliamate Lo Sil Silves | GTH 600 TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL WEIGHT CONCRETE / STEEL | | | |
| ISON'IGON SERIES SP SERIES SP SERIES SP SERIES 1900 SERIES 1900 SERIES 1900 SERIES 1900 SERIES 1900 SERIES ASTM E1190. Ne shown in concrebe ASTM E1190. Ne shown in concrebe otherwise approved INSTALLE PART NUMBER SERIES TE SERIES TE SERIES TE SERIES TE SERIES TE SERIES TE SERIES TE SERIES TE SERIES TE SERIES TE SERIES | DIAMETER (INCH) 0.145 0.150 0.145 0.150 0.145 0.145 0.145 0.145 0.145 0.145 0.157 D IN CON SHANK DIA 0.157 D IN A36 SHANK DIA 0.157 D IN A572 SHANK DIA | PENETRATION (INCH) 344 1 1-1/2 344 1 1-1/2 344 1 1-1/2 344 1 1-1/2 344 1 10/7 344 10/7 10/7 344 10/7 10/7 20/7 20/7 20/7 21/7 22/7 23/4 23/4 1 2 3/4 1 2 7/8 2 STRUCTURA SHANK TYPE Tent KNURLED SHANK TYPE Tent KNURLED | 200 TENSION (LBS) 50 655 152 9.43 154 1078 154 1043 207 155. 155 694 font, Ummare loads 105 105 694 font, Ummare loads 105 fort, Ummare loads 105 fort, Ummare loads 105 fort, Ummare loads 107 fort, Ummare loads 107 fort, Ummare loads 107 fort, Groups 1077 fort, Groups 216 sion Shear 3/16 506 CTURAL ST 3/16 sion Shear g2 6/76 | 0 PSI SHEAR (LBS) 66 739 166 729 165 7265 340 2027 | ALLOWABLE LOAD 4000 P TENSION (LBS) 1 100 571 1 157 487 179 1043 209 1357 150 483 209 1357 150 483 243 1307 243 1307 243 1307 248 1749 284 2125 101 685 arrate fort. Note 2: thin IC3 A270, the sent fort and the | SNUE 3 INEH CONTROL CONTRUCA CONTRUCA CONTRUCA CONTROL CONTROL CONTROL CONTROL CONTROL CONTRU | Adv 600 TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL WEIGHT CONCRETE / STEEL | | | |
| ISON I CONTRACTORIO DE CONTRAC | DIAMETER (INCH) 0.145 0.150 1.50/.180 0.145 0.345 0.345 0.345 0.345 0.345 0.345 0.345 0.345 0.345 0.157 0.157 0.157 0.157 0.157 0.157 0.157 0.157 0.157 | PENETRATION (INCH) 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1-1/2 3/4 1 1.1/2 3/4 1 1.1/2 3/4 1 1.1/2 3/4 1 1.1/2 7. Note 6: Job Ja's Ic EMBED 4000 Ten 3/4 1 2 1-1/4 3 1-1/2 2 1-1/4 3 1-1/2 2 7/8 2 SHAIN TPE KNURLED 3 -GRS50 STRU SHAIN TYPE Ten KNURLED | 200 TENSION (LBS) 50 655 152 9.43 158 1078 154 1043 207 155.3 | 0 PSI SHEAR (LBS) 66 739 166 1229 285 1665 340 2027 | ALLOWABLE LOAD 4000 P TENSION (LBS) S TENSION (LBS) S 100 571 157 807 179 1043 157 807 179 1043 157 807 150 803 243 1307 258 1749 384 2126 101 885 101 | View of the second | Adv 600 TENSION (LBS) | 0 PSI SHEAR (LBS) | RS IN NORMAL WEIGHT CONCRETE / STEEL | | | |



| N 2 | | | |
|---|---|--|--|
| $N_{screw} := 3$ | | | |
| W := 82 $\frac{lbf}{in}$ | Table 11 | L.2b, NDS 2012 withdra | awal of #8 wood screws |
| $Z := 78 \frac{\text{lbf}}{\text{in}}$ | Table 12 membe | LL, NDS 2012 for #8 wo r thickness (conservati | od screws with 1in side vely) |
| $C_{\rm D} := 1.6$ | NDS Tal | le 2.3.2, wind load fac | tor |
| $C_{M} := 1.0$ | C _t := 1.0 | $C_{g} := 1.0$ | $C_{\Delta} \coloneqq 1.0$ |
| $C_{eg} := 1.0$ | $C_{di} := 1.0$ | $C_{tn} := 1.0$ | Toe nail factor for screws is 1.0 |
| $\mathbf{Z}' := \mathbf{Z} \boldsymbol{\cdot} \mathbf{C}_{\mathbf{D}} \boldsymbol{\cdot} \mathbf{C}_{\mathbf{M}} \boldsymbol{\cdot}$ | $\cdot C_{t} \cdot C_{g} \cdot C_{\Delta} \cdot C_{eg} \cdot C_{di} \cdot$ | $C_{tn} = 124.8 \frac{lbf}{in}$ | Table 10.3.1, NDS 2012 |
| $W' := W \cdot C_D \cdot C_t$ | $t \cdot C_{eg} \cdot C_{tn} = 131.2 \frac{lb}{in}$ | <u>1</u> | Table 10.3.1, NDS 2012 |
| $W_{applied} \coloneqq \frac{1}{\cos(1)}$ | $\frac{P_{wind}}{(45 \text{ deg})} = 567.109$ | lbf total with | ndrawal force |
| L _{embed} ≔1.5 in | = 1.5 in | this is the required | embedment depth into the nail plate, at a 45deg a |
| $W_{\text{resist}} := (W' \cdot I)$ Check := if W_{are} | L_{embed}) • $N_{screw} = 590$ $pplied \le W_{resist}$ = | .4 lbf = "Ok for Withdrawal" | |
| | | | |
| else "Ch | neck" | | |
| $Z_{resist} := (Z' \cdot L_{er})$ | 1eck" _{nbed}) • N _{screw} = 561.6 | lbf | |
| | neck" nbed) • N _{screw} = 561.6 $nd \le Z_{resist}$ = "Ok for c for Shear" | lbf or Shear" | |
| $Z_{resist} := (Z' \cdot L_{er})$ $Check := if P_{win}$ $\ "Oher of the set of t$ | neck" nbed) · N _{screw} = 561.6 $nd \le Z_{resist}$ = "Ok for k for Shear" neck" | lbf or Shear" | |
| else else "Ch $Z_{resist} := (Z' \cdot L_{er}$ Check := if P_{win} "Oh else "Ch else "Ch 3) #8 wood screws crews, these do no | neck" $nbed$) $\cdot N_{screw} = 561.6$ $nd \le Z_{resist}$ = "Ok for shear" neck" s required to carry aport split the wood and | lbf or Shear" plied wind loads, conse are stronger than woo | ervatively use GRK-RSS 1/4" Diameter od screws. |
| else li "Ch Z _{resist} := (Z' • L _{er} Check := if P _{wir} "Oh else "Ch 8) #8 wood screws crews, these do no | neck" $_{mbed}$) \cdot N _{screw} = 561.6 $_{nd} \leq Z_{resist}$ = "Ok from the seck" = "Ok from the seck" = s required to carry apolic the solution of the seck of the seck of the sector of the s | lbf or Shear" plied wind loads, conse are stronger than woo | ervatively use GRK-RSS 1/4" Diameter od screws. |



RSS™ Technical Data

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RSS[™] Rugged Structural Screws: Ideal for anywhere you would use a traditional lag screw and more. High tensile torque and shear strength means a 5/16" diameter RSS[™] screw has the same strength as a 1/2" lag screw. Available from #10 up to 3/8" diameters in lengths from 1-1/2" to 16". Approved for use in all applications that include treated lumber. Also available in *PHE*INOX[™] Stainless Steel, RSS[™] JTS used for joists and trusses, RSS[™] LPS for structural insulated panel systems and RSS[™] LTF designed for log home and timber frames.

| D | FASTENER ESIGNATION | OVERALL LENGTH ¹ | LENGTH OF THREAD ² | MINOR THREAD | SHANK DIAMETER ³ | OUTSIDE THREAD | ALLOWAE | BLE STEEL S | TRENGTH | ╞╪ |
|-----|------------------------|--------------------------------|----------------------------------|-----------------------------------|--------------------------------|-----------------------------------|--|--------------------|--------------------|----------|
| | | (inches) | (inches) | DIAMETER ³ (inches) | (inches) | DIAMETER ³ (inches) | Bending Yield | Tensile (psi) | Shear (psi) | |
| | | | | | | | Strength ⁴ F _{yb} (psi) | [pounds] | [pounds] | ł |
| | 1/4 x 2 1/2" | 2 3/8 | 1 1/2 | | | | | 188,301 | 127,792 | 1 1 |
| | 1/4 x 3 1/8" | 3 1/8 | 2 | 0.150 | 0.169 | 0.239 | 170,427 | [3.336] | [2.264] | ₽ |
| | 1/4 x 3 1/2" | 3 1/2 | 2 3/8 | | | | | [0,000] | [2,204] | 1 1 |
| | 5/16 x 2 1/2" | 2 3/8 | 1 1/2 | | | | | | | E |
| | 5/16 x 2 3/4" | 2 3/4 | 1 3/4 | | | | | | | |
| | 5/16 x 3 1/8" | 3 1/8 | 2 1/8 | | | | | 178.051 | 123,592 | |
| | 5/16 x 3 1/2" | 3 1/2 | 2 1/2 | 0.174 | 0.199 | 0.280 | 190,920 | [4.247] | [2.948] | μĭ |
| | 5/16 x 4" | 3 7/8 | 2 3/4 | | | | | 1., | 12,0101 | 1 1 |
| | 5/16 x 5 1/8" | 5 | 3 1/2 | | | | | | | <u>×</u> |
| SS | 5/16 x 6" | 5 7/8 | 3 7/8 | | | | | | | 1 |
| ĉ | 3/8 x 3 1/8" | 3 1/8 | 2 1/8 | | | | | | | I . |
| | 3/8 x 4" | 3 7/8 | 2 3/4 | | | | | | | I . |
| | 3/8 x 5 1/8" | 5 1/8 | 3 1/2 | | | | | | | I . |
| | 3/8 x 6" | 5 7/8 | 4 | 1 | | | | | | I . |
| | 3/8 x 7 1/4" | 7 | 4 1/2 | 0.191 | 0.223 | 0.310 | 178.080 | 203,809 | 129,305 | I . |
| | 3/8 x 8" | 7 7/8 | 4 3/8 | 0.101 | U.LLU | 0.010 | 110,000 | [5,824] | [3,695] | I . |
| | 3/8 x 10" | 9 3/4 | 5 | | | | | | | I . |
| | 3/8 x 12" | 11 7/8 | 5 7/8 | | | | | | | I . |
| | 3/8 x 14 1/8" | 14 1/8 | 5 7/8 | 1 | | | | | | I . |
| | 3/8 x 16" | 15 5/8 | 5 3/4 | | | | | | | |
| LPS | 1/4 x 8* | 7 7/8 | 2 7/8 | 0.152 | 0.172 | 0.238 | 172,620 | 172,950 [3,155] | 109,635 [2,000] | |
| | 3/8 x 8" | 7 7/8 | 3 7/8 | | | | | 170 200 | 114 525 | 1 |
| Ë, | 3/8 x 10" | 9 7/8 | 3 7/8 | 0.191 | 0.220 | 0.310 | 167,580 | 179,390 | 114,525 | 1 |
| - | 3/8 x 12" | 11 3/4 | 3 7/8 | | | | | [0,144] | [3,204] | |
| _ | 1/4 x 2 1/2" | 2 3/8 | 1 1/2 | 0.152 | 0.170 | 0.237 | 111,460 | 103,799 [1,886] | 90,260 [1,640] | |
| ô | 5/16 x 2 1/2" | 2 3/8 | 1 5/8 | | | | | | | 1 |
| 1 | 5/16 x 3 1/8" | 3 1/8 | 2 1/8 | | | | | 104 767 | 96 990 | 1 |
| H | 5/16 x 4" | 3 7/8 | 2 1/2 | 0.171 | 0.195 | 0.276 | 118,360 | 12 4101 | 12 0061 | 1 |
| - | 5/16 x 5 1/8" | 5 1/8 | 3 3/8 | | | | | [2,413] | [2,000] | 1 |
| | 5/16 x 6" | 5 7/8 | 3 7/8 | | | | | | | |
| | 1/4 x 3 3/8" | 3 3/8 | 1 3/8 | | | | | 100.000 | 100 101 | 1 |
| E | 1/4 x 5" | 5 | 1 5/8 | 0.153 | 0.173 | 0.240 | 226,373 | 180,999 | 126,131 | 1 |
| ~ | 1/4 x 6 3/4" | 6 3/4 | 1 1/2 | 1 | | | | [3,312] | [2,306] | 1 |

