PROJECT:
MAINE MEDICAL CENTER – CHARLES ST.
PORTLAND, MAINE

CUSTOMER:
WILLIAM BERRY & SON

STRUCTURAL ENGINEER:
SIMPSON, GUMPERTZ & HEGER, INC.

Project No. 316

STRUCTURAL STEEL CONNECTIONS
FABRICATED STEEL TRUSSES

RECEIVED
AUG 23 2006
Simpson Gumpertz & Heger
Consulting Engineers Inc.

WILLIAM A. BERRY & SON, INC.
REVIEWED IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.

THE SUBCONTRACTOR / VENDOR IS RESPONSIBLE FOR ALL DIMENSIONS, CORRECT FIT AND COORDINATION OF ALL ITEMS TO BE FURNISHED & INSTALLED.

BY: DATE:

JOB #: 04-310-0 JOB NAME: MMC - CHARLES ST.

SUBMISSION #:

SPEC./DRWG. REF.:

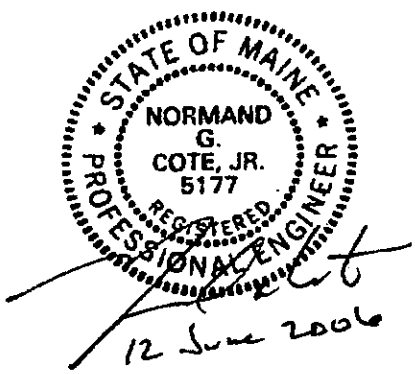
REVIEWED FOR CONSTRUCTABILITY

☒ APPROVED ☐ NOT APPROVED
☐ APPROVED AS CORRECTED
☐ REVISE AND RESUBMIT
☐ RESUBMIT FOR REVIEW
Checking is only for conformance with the design concept of the project and compliance with the information given in the Contract Documents. Contractor is responsible for dimensions to be confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.
BY: MJBolduc
DATE: 24 AUG 06
SIMPSON GUMPERTZ & HEGER INC
41 SEYON ST., BUILDING 1, SUITE 500
WALTHAM, MA 02453

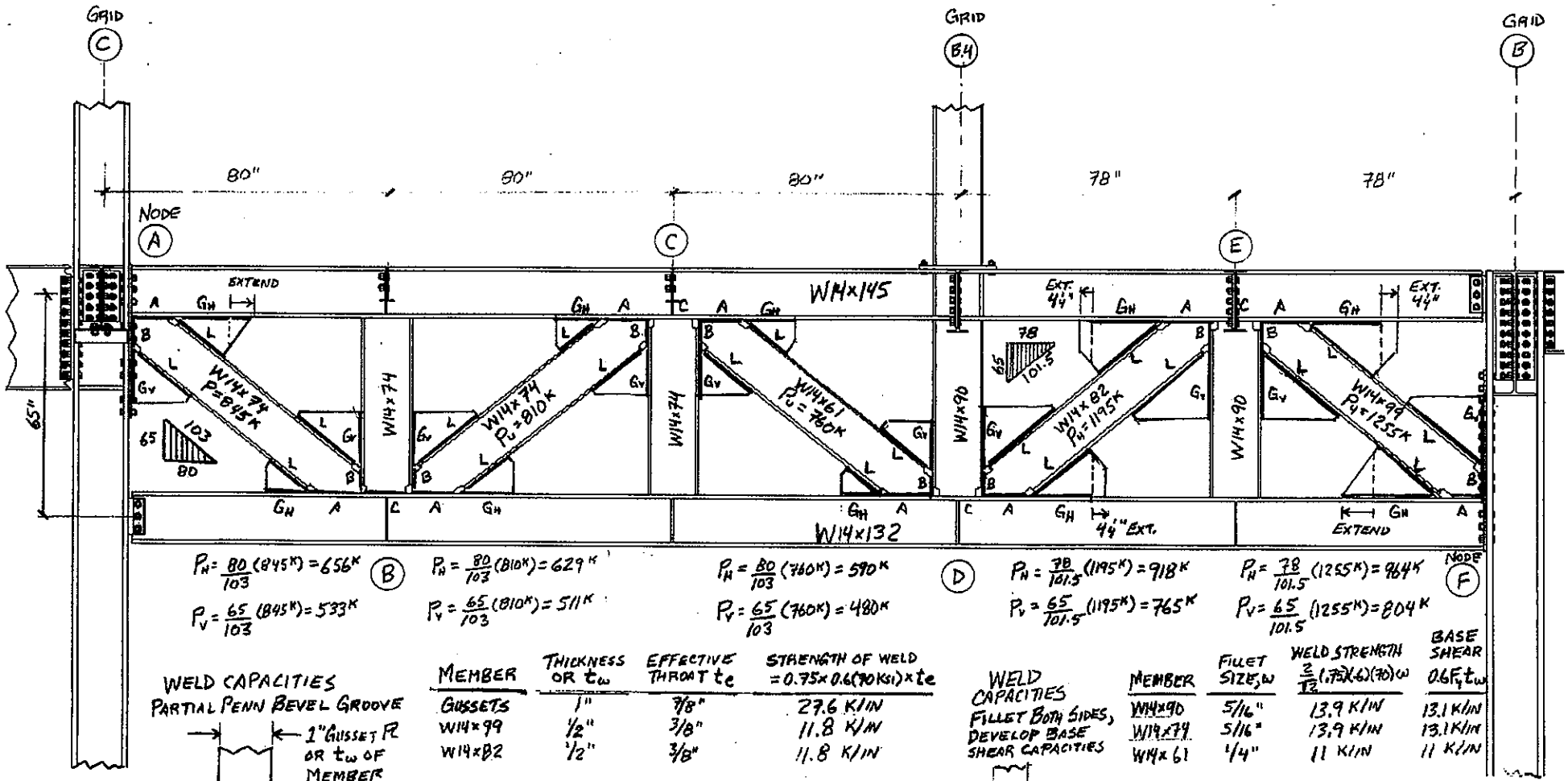
This Submittal Consists Of Design Details and Calculations For Typical Truss Panel Point and Truss-to-Column Connections.

Novel Iron Works, Inc.
250 Ocean Road
Greenland, NH 03840

This stamp is to comply with the contract specification requirements that structural steel connections be designed by a licensed structural engineer. No responsibility for the adequacy of the overall structural system shown on the contract drawings is intended or implied.



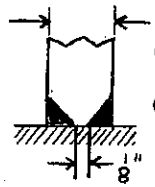
DESIGN CALC'S - TRUSS A ON LINE 2



$P_H = \frac{80}{103}(845^K) = 656^K$ (B) $P_H = \frac{80}{103}(810^K) = 629^K$ $P_H = \frac{80}{103}(760^K) = 590^K$ (D) $P_H = \frac{78}{101.5}(1195^K) = 918^K$ $P_H = \frac{78}{101.5}(1255^K) = 964^K$ NODE F

$P_V = \frac{65}{103}(845^K) = 533^K$ $P_V = \frac{65}{103}(810^K) = 511^K$ $P_V = \frac{65}{103}(760^K) = 480^K$ $P_V = \frac{65}{101.5}(1195^K) = 765^K$ $P_V = \frac{65}{101.5}(1255^K) = 804^K$

WELD CAPACITIES
PARTIAL PENN BEVEL GROOVE



MEMBER	THICKNESS OR t_w	EFFECTIVE THROAT t_e	STRENGTH OF WELD $= 0.75 \times 0.6(70\,KSI) \times t_e$
GUSSETS	1"	$\frac{7}{8}$"	27.6 K/IN
W14x99	$\frac{1}{2}$"	$\frac{3}{8}$"	11.8 K/IN
W14x82	$\frac{1}{2}$"	$\frac{3}{8}$"	11.8 K/IN

WELD CAPACITIES
FILLET BOTH SIDES, DEVELOP BASE SHEAR CAPACITIES

MEMBER	FILLET SIZE, ω	WELD STRENGTH $\frac{2}{\sqrt{2}}(.75)(.6)(70)\omega$	BASE SHEAR $0.6F_y t_w$
W14x90	5/16"	13.9 K/IN	13.1 K/IN
W18x79	5/16"	13.9 K/IN	13.1 K/IN
W14x61	1/4"	11 K/IN	11 K/IN

TRUSS ON LINE 2 (TRUSS "A") WELDED GUSSET CONNECTIONS

NODE A: $P_u = 845^K$

$P_H = 656^K$

REQ'D $L = (845^K/2) \div 27.6\ K/IN = 15\frac{3}{8}"$

PROVIDE $15\frac{7}{8}"$ LL

CHECK GUSSET & DIAGONAL TO TRUSS CONN

LINE $G_H = 428^K$ @ $15\frac{1}{2}"$

LINE $G_V = 428^K$ @ $15\frac{1}{2}$

LINE A = 156^K @ $11\frac{7}{8}"$

LINE B = 113^K @ $8\frac{5}{8}"$

1125^K

$1125^K > P_u = 845^K$ (OK)

CALCULATE G_H LENGTH REQ'D TO RESIST P_H (IGNORING LINES G_V, A, & B)

REQ'D $G_H = 656^K \div 27.6\ K/IN = 23\frac{3}{4}"$

EXTEND PLATE HORIZONTALLY TO TRANSFER ALL OF P_H TO TOP CHORD

NODE B $P_u = 845^K$

$P_H = 656^K$

PROVIDE $L = 15\frac{7}{8}"$ (SAME AS NODE A)

CHECK GUSSET & DIAGONAL TO TRUSS CONN.

LINE $G_H = 428^K$ @ $15\frac{1}{2}"$

LINE $G_V = 459^K$ @ $16\frac{5}{8}"$

LINE A = 172^K @ $13\frac{1}{8}"$

LINE B = 100^K @ $7\frac{5}{8}"$

1159^K

$1159^K > P_u = 845^K$ (OK)

CHECK HORIZONTAL SHEAR

TOTAL $P_H = 656^K + 629^K = 1285^K$

LINES $G_H = 856^K$ @ $2 \times 15\frac{1}{2}"$

LINES A = 344^K @ $2 \times 13\frac{1}{8}"$

LINE C = 185^K @ $14\frac{1}{8}"$

1385^K

$1385^K >$ TOTAL $P_H = 1285^K$ (OK)

NODE C: $P_u = 810^K$

$P_H = 590^K$

USE SAME GUSSETS AT NODE B

CHECK HORIZONTAL SHEAR

TOTAL $P_H = 629^K + 590^K = 1219^K$

LINES G_H 856^K @ $2 \times 15\frac{1}{2}"$

LEFT LINE A 174^K @ $13\frac{1}{4}"$

RT. LINE A 143^K @ $13"$

LINE C 185^K @ $14\frac{1}{8}"$

1358^K

$1358^K >$ TOTAL $P_H = 1219^K$ (OK)

NODE D: LEFT $P_u = 760^K$, $P_H = 590^K$

RT. $P_u = 1195^K$, $P_H = 918^K$

LEFT SIDE: USE SAME CONN AS FOR NODE C

RIGHT SIDE: USE SAME CONN AS FOR NODE E

CHECK HORIZONTAL SHEAR WHEN BOTH PLATES ARE SIZED.

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CUSTOMER: WILLIAM BERRY & SON		WELD U.N.O. E70XX	DRAWN BY RJE
NOVEL IRON WORKS, OCEAN ROAD, GREENLAND, N.H. 03840, (603) 436-7950	CERTIFIED AISC CATEGORY III	PAINT	DATE
		CHK'D BY NC	SHEET NO.

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NODE E: $P_U = 1255^K$

$P_H = 964^K$

REQ'D $L = (1255^K/2) \div 27.6^{K/IN} = 22\frac{3}{4}"$

PROVIDE $L = 23\frac{1}{4}"$

CHECK GUSSET & DIAGONAL TO TRUSS CONN.

LINE $G_H = 580^K$ @ 21"

LINE $G_V = 587^K$ @ $21\frac{1}{4}"$

LINE A = 153^K @ 13"

LINE B = 90^K @ $7\frac{5}{8}"$

1410^K

$1410^K > P_U = 1255^K$ (OK)

CHECK HORIZONTAL SHEAR:

TOTAL $P_H = 964^K + 918^K = 1882^K$

LINES $G_H = 1160^K$ @ 2×21"

LINES A = 306^K @ 2×13"

LINE C = 183^K @ 14"

1649^K

$1649^K <$ TOTAL $P_H = 1882^K$ (NG)

ADDITIONAL G_H REQ'D TO MEET SHEAR LOAD:

$(1882^K - 1649) \div 2$ LINES $\div 27.6^{K/IN} = 4\frac{1}{4}"$

EACH LINE G_H WILL NOW = $21 + 4\frac{1}{4} = 25\frac{1}{4}"$

NODE D: LEFT $P_U = 760^K$, $P_H = 590^K$

RIGHT $P_U = 1195^K$, $P_H = 918^K$

CHECK FOR HORIZONAL SHEAR

NODE C GUSSETS ON LEFT SIDE

NODE E GUSSETS ON RIGHT SIDE

TOTAL $P_H = 590^K + 918^K = 1508^K$

LINE C = 183^K @ 14"

LEFT LINE $G_H = 428^K$ @ $15\frac{1}{2}"$

LEFT LINE A = 143^K @ 13"

RIGHT LINE A = 153^K @ 13"

RIGHT LINE $G_H = 697^K$ @ $25\frac{1}{4}"$

1604^K

$1604^K >$ TOTAL $P_H = 1508^K$ (OK)

NODE F: $P_U = 1255^K$

$P_H = 964^K$

REQ'D L SAME AS NODE E = $23\frac{3}{4}"$

CHECK DIAGONAL & GUSSET TO TRUSS CONN.

LINE $G_H = 593^K$ @ $21\frac{1}{2}"$

LINE $G_V = 583^K$ @ $21\frac{1}{8}"$

LINE A = 134^K @ $11\frac{3}{8}"$

LINE B = 106^K @ 9"

1416^K

$1416^K > P_U = 1255^K$ (OK)

CHECK HORIZONTAL SHEAR

NOTE: CONN. AT NODE F IS DESIGNED FOR VERTICAL SHEAR ONLY, ALL HORIZONTAL SHEAR MUST REMAIN INTERNAL TO TRUSS, IE NO HORIZ. FORCE IN DIAGONAL MUST BE RESISTED BY BOTTOM CHORD.

LINE G_H + LINE A = $593^K + 134^K = 727^K$

$727^K < P_H = 964^K$ (NG)

INCREASE G_H:

REQ'D $G_H = (964^K - 134^K) \div 27.6^{K/IN} = 30"$

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TRUSS TO COLUMN SHEAR CONN'S:

BOLT CAPACITIES, 1" Ø A490N
= 35.3 K/BOLT

COLUMN @ C-2

$P_V = 533^K$

REQD NO. BOLTS = $\frac{533^K}{35.3^K/BOLT} = 15$ BOLTS

NO. BOLTS PROVIDED = 18 > 15 (OK)

COLUMN @ B-2

$P_V = 804^K$

REQD NO. BOLTS = $\frac{804^K}{35.3^K/BOLT} = 23$ BOLTS

NO. BOLTS PROVIDED = 24 > 23 (OK)

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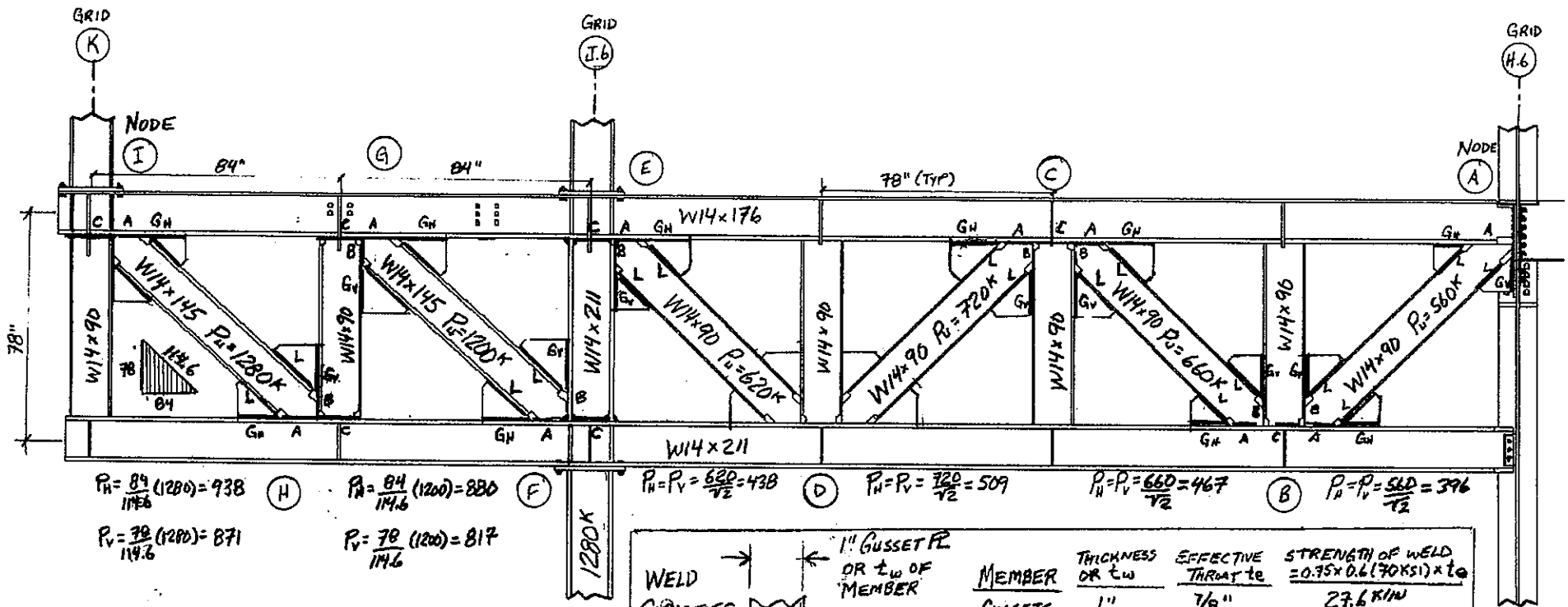
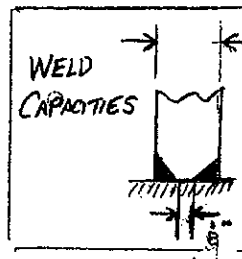
1026

DESIGN CALC'S - TRUSS B & TRUSS C ON LINES 8 & 9



$P_H = \frac{84}{114.6}(1280) = 938$ (H) $P_H = \frac{84}{114.6}(1200) = 880$ (F) $P_H = P_V = \frac{620}{\sqrt{2}} = 438$ (D) $P_H = P_V = \frac{720}{\sqrt{2}} = 509$ $P_H = P_V = \frac{660}{\sqrt{2}} = 467$ (B) $P_H = P_V = \frac{560}{\sqrt{2}} = 396$

$P_V = \frac{78}{114.6}(1280) = 871$ $P_V = \frac{78}{114.6}(1200) = 817$



MEMBER	THICKNESS OR t_w	EFFECTIVE THROAT t_e	STRENGTH OF WELD = 0.75x0.6(70KSI) x t_e
GUSSETS	1"	7/8"	27.6 K/IN
W14x211	1"	7/8"	27.6 K/IN
W14x145	11/16"	9/16"	21.7 K/IN
W14x90	7/16"	5/16"	9.84 K/IN

CAPACITY OF 5/16 FILLET = $0.75 \times 0.6(70) \times \frac{5}{16} \times \frac{1}{\sqrt{2}} = 6.96$ K/IN
(AT W14x211 VERTICAL ON GRID J.6)

TRUSSES ON LINE 8 (TRUSS "B") & LINE 9 (TRUSS "C")

CONNECT WEBBING TO CHORDS USING 1" THK GUSSET PLATES (GR. 50)

BEVEL PREP BOTH EDGES LEAVING 1/8" LANDING FOR PARTIAL PEN WELD. EFFECTIVE THROAT = 7/8"

STRENGTH OF WELD:

$0.75 \times 0.6(70\text{KSI}) \times \frac{7}{8}" = 27.6^{K/IN}$

NODE A: $P_U = 560^K$

$P_H = P_V = 396^K$

REQ'D $L = (560^K / 2) / 27.6^{K/IN} = 10\frac{1}{8}"$

PROVIDED $L = 10\frac{3}{4}"$

PROVIDED $G_H = 10\frac{3}{4} > L$ (OK)

PROVIDED $G_V = 12\frac{3}{4} > L$ (OK)

CHECK HORIZONTAL SHEAR

REQ'D $G_H = 396^K / 27.6^{K/IN} = 14\frac{3}{8}"$

(INCREASE G_H, LINE K BELOW)

NODE B: $P_U = 660^K$

$P_H = P_V = 467^K$

REQ'D $L = (660/2)/27.6 = 12"$

PROVIDE $12\frac{1}{2}"$ MIN

PROVIDED $G_H = 12" = L$ (OK)

PROVIDED $G_V = 12\frac{3}{8}" > L$ (OK)

(LINES A, B, & C PROVIDE ADDITIONAL CAPACITY)

CHECK HORIZONTAL SHEAR

TOTAL $P_H = 467^K + 396^K = 863^K$

COMPARE WITH WELD STRENGTH:

LINES $G_H = 662^K$ @ $2 \times 12"$

LINES A $= 212^K$ @ $2 \times 10\frac{3}{4}"$

LINE C $= 138^K$ @ $14"$

1012^K

$1012^K > 863^K$ (OK)

NODE C: MAX $P_U = 720^K$

MAX $P_H = P_V = 509^K$

REQ'D $L = (720^K / 2) / 27.6^{K/IN} = 13"$

PROVIDE $L = 13\frac{1}{2}"$

CHECK GUSSET & DIAGONAL TO TRUSS CONN

LINE $G_H = 352^K$ @ $12\frac{3}{4}"$

LINE $G_V = 369^K$ @ $13\frac{3}{8}"$

LINE A $= 103^K$ @ $10\frac{1}{2}"$

LINE B $= 92^K$ @ $7\frac{7}{8}"$

916^K

$916^K > 720^K$ (OK)

CHECK HORIZONTAL SHEAR

TOTAL $P_H = 509^K + 467^K = 976^K$

LINES $G_H = 704^K$ @ $2 \times 12\frac{3}{4}"$

LINES A $= 206^K$ @ $2 \times 10\frac{1}{2}"$

LINE C $= 138^K$ @ $14"$

1048^K

$1048^K > 967^K$ (OK)

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NODE D: MAX P_U = 720^K
MAX $P_H = P_V$ = 509^K

USE SAME GUSSET CONN.'s AS USED FOR NODE C

NODE E: P_U = 620^K
$P_H = P_V$ = 438^K

REQ'D L = (620^K/2) / 27.6$^{K/IN}$ = 11 1/4"
PROVIDE L = 11 3/4"

CHECK GUSSET & DIAGONAL TO TRUSS CONN

LINE G_H = 324^K @ 11 3/4"
LINE G_V = 317^K @ 11 1/2"
LINE A = 95^K @ 9 5/8"
LINE B = 100^K @ 10 1/8"
836^K

836^K > 620^K (OK)

CHECK HORIZONTAL SHEAR

WELD LINE "C" IS 5/16 FILLET ALL AROUND
W14x211, LENGTH ≈ $4b_f + 2T$
= 4(15 3/4") + 2(11 1/4") = 85 1/2"

P_H = 509^K

LINE G_H = 324^K @ 11 3/4"
LINE A = 95^K @ 9 5/8"
LINE C = 595^K @ 85 1/2"
1014^K

1014^K > 509^K (OK)

NODE F: P_U = 1200^K
P_H = 880^K

REQ'D L = (1200^K/2) / 27.6$^{K/IN}$ = 21 3/4"

CHECK GUSSET & DIAGONAL TO TRUSS

LINE G_H = 531^K @ 19 1/4"
LINE G_V = 549^K @ 19 7/8"
LINE A = 250^K @ 11 1/2"
LINE B = 206^K @ 9 1/2"
1536^K

1536^K > 1200^K (OK)

CHECK HORIZONTAL SHEAR

P_H = 880^K

LINE G_H = 531^K @ 19 1/4"
LINE A = 250^K @ 11 1/2"
LINE C = 595^K @ 85 1/2"
1376^K

1376^K > 880^K (OK)

NODE G: P_U = 1200^K
P_H = 880^K

USE SAME GUSSETS AS FOR NODE F

CHECK FOR GUSSET & DIAGONAL TO TRUSS: SAME AS NODE F CALC.

CHECK HORIZONAL SHEAR

LINE G_H = 531^K @ 19 1/4"
LINE A = 260^K @ 12"
LINE C = 138^K @ 14"
929^K

929^K > 880^K (OK)

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NODE H: $P_u = 1280^K$

$P_H = 938^K$

REQ'D L = $(1280^K/2) \div 27.6^{K/IN} = 23''$

CHECK GUSSET & DIAGONAL TO TRUSS CONN

LINE G_H = 555^K @ $20\frac{1}{8}''$

LINE G_V = 580^K @ $21''$

LINE A = 266^K @ $12\frac{1}{4}''$

LINE B = $\underline{190^K}$ @ $8\frac{3}{4}''$

1591^K

$1591^K > 1280^K$ (OK)

CHECK HORIZONTAL SHEAR

LINE G_H = 555^K @ $20\frac{1}{8}''$

LINE A = 266^K @ $12\frac{1}{4}''$

LINE C = $\underline{138^K}$ @ $14''$

959^K

$959^K > 938^K$ (OK)

NODE I: $P_u = 1280^K$

$P_H = 938^K$

USE SAME GUSSET CONN.
AS FOR NODE H

CHECK HORIZONTAL SHEAR:

CONN WILL BE STRONGER THAN NODE H.
G_H AND A ARE ESSENTIALLY THE SAME, AND THE WELD LINE AT C IS MUCH STRONGER (5/16 FILLET ALL AROUND W14×90 VERTICAL)

∴ OK

TRUSS TO COLUMN SHEAR CONNECTION @ H.6-8 & H.6-9

BOLT CAPACITY, 1" ϕ A490N
$= 35.3^{K/BOLT}$

$P_V = 396^K$

REQ'D NO. BOLTS = $\frac{396^K}{35.3^{K/BOLT}} = 12$ BOLTS

NO. BOLTS PROVIDED = 18 > 12 (OK)

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