Steel Check Report

Project:: **Lesson2 (C:\DCC\VersaFrame\projects\Lesson2)**
Description:
Date: **01/09/2004 10:27 AM**

Company:
User:
Software: **Digital Canal VersaFrame**

Code Check Results (ASD)

CRITICAL STRESS SUMMARY

ID	Section Name	Status	Governing Criteria	Stress Ratio	Load Combination	Distance (ft)
2	W10x22	OK	Total Deflection Y	0.7837	With_Wind	9.0000
3	W10x49	OK	Axial-Bending	0.1202	Dead_Only	12.000
4	TS4x4x.125	OK	Axial-Bending	0.1474	Just_Wind	10.817
5	TS4x4x.125	OK	Axial-Bending	0.0779	Just_Wind	10.817
6	TS4x4x.125	OK	Axial-Bending	0.1474	Just_Wind	10.817
7	TS4x4x.125	OK	Axial-Bending	0.0779	Just_Wind	10.817

CRITICAL STRESS DETAILS FOR MEMBER 1

Section Name: W10x49 **Status: OK**

	Unit	Actual	Allowable	Ratio	Load Combination	Distance (ft)
Axial	ksi	0.6123	5.0942	0.1202	Dead_Only	12
Bending-X	ksi	0.0000	30.000	0.0000	Dead_Only	12
Bending-Y	ksi	0.0000	37.500	0.0000	Dead_Only	12
Interaction	-	-	-	0.1202	Dead_Only	12
Shear-X	ksi	0.0000	20.000	0.0000	-	0
Shear-Y	ksi	0.0000	20.000	0.0000	With_Wind	12
Total Defl-X	in	0.0000	0.6000	0.0000	-	0
Total Defl-Y	in	0.0000	0.6000	0.0000	With_Wind	4.2
Live Defl-X	in	0.0000	0.4000	0.0000	-	0
Live Defl-Y	in	0.0000	0.4000	0.0000	Just_Wind	4.8

SELECTED LOAD COMBINATIONS

Load Combination	Code Check	Total	Live	Dependent	Conditional
Dead_Only	x				x
With_Wind	x	x		x	
Just_Wind	x		x		

Design Procedure for Member 1: W10x49

Designed according to AISC ASD 9th Edition (1990)

Critical load effect at distance 12 feet under load combination Dead_Only

INPUT

PROPERTIES:

A (in^2)	14.4	b_f (in)	10	K_x	0.97	$S_x(in^3)$	54.6
I_x (in^4)	272	t_f (in)	0.56	K_y	3.02	S_y (in^3)	18.7
I_y (in^4)	93.4	d (in)	9.98	K_z	1	$Z_x(in^3)$	60.4
r_x (in)	4.35	t_w (in)	0.34	L_x (in)	144	$Z_y(in^3)$	28.3
r_y (in)	2.54	k (in)	1.188	L_y (in)	144		
J (in^4)	1.39	x_0 (in)	0	L_b (in)	144		
C_w (in^6)	2070	y_0 (in)	0	C_b	1		
a	0	x_{bar} (in)	5	C_{mx}	1	Welded	No
b	0	y_{bar} (in)	4.99	C_{my}	1	F_y (ksi)	50

LOAD EFFECTS:

P (kips)	M_x (ft-kips)	M_y (ft-kips)	V_x (kips)	V_y (kips)
8.817	2.842e-017	0	0	2.763e-018

SOLUTION

1. CHECK SECTION COMPACTNESS

Description	Formula	Value	Code
$\lambda_{(flange)}$	$b_f / (2t_f)$	8.929	ASD Table B5.1
$\lambda_{p(flange)}$	$65 / F_y^{0.5}$	9.192	ASD Table B5.1
$\lambda_{r(flange)}$	$95 / F_y^{0.5}$	13.44	ASD Table B5.1
$\lambda_{(web)}$	h / t_w	22.37	ASD Table B5.1
$\lambda_{p(web)}$	(for $f_a / F_y <= 0.16$) $640 (1 - 3.74 f_a / F_y) / F_y^{0.5}$	86.36	ASD Table B5.1
$\lambda_{r(web)}$	$760 / (0.66 F_y)^{0.5}$	132.3	ASD Table B5.1

Note:

1). h = d - 2k = 7.605 in

2). k_c = for $h / t_w <= 70$, $k_c = 1.0$ (ASD B5.1) = 1 in

2. CHECK AXIAL ALLOWABLE

(a). Local Buckling

Description	Formula	Value	Code
KL / r	$\max(K_xL_x / r_x, K_yL_y / r_y)$	171.2	
C_c	$C_c = (2 \pi^2 E / (Q F_y))^{0.5}$	107	ASD A-B5.c
Q_s	(for $b / t <= 95 / (F_y / k_c)^{0.5}$) $Q_s = 1.0$	1	
Q_a	(for $b / t < 238 / f^{0.5}$) $Q_a = 1.0$	1	
Q	$Q_s Q_a$	1	ASD A-B5.2c
F_a (ksi)	(for $KL / r > C_c$) $F_a = (12 / 23) E\pi^2 / (KL / r)^2$	5.094	ASD A-B5-12

(b). Flexural Torsional Buckling

Description	Formula	Value	Code
F_e	$F_e = (\pi^2 E C_w / (K_z L_z)^2 + GJ) / (I_x + I_y)$	120.8	LRFD A-E3-5
$(KL/r)_{eff}$	effective $KL/r = \pi (E/F_e)^{0.5}$	48.68	ASD page 3-53
C_c	$C_c = (2 \pi^2 E / (Q F_y))^{0.5}$	107	ASD A-B5.c
Q	$Q_s Q_a$	1	ASD A-B5.2c
F_a (ksi)	(for $KL / r <= C_c$) $F_a = Q F_y (1 - (1 / 2) (KL / (r C_c))^2) / (5 / 3 + (3 / 8) KL / (r C_c) - (1 / 8)(KL / (r C_c))^3)$	24.56	ASD A-B5-11

Allowable axial stress = 5.094 ksi

3. CHECK FLEXURAL ALLOWABLES

(a). F_{bx} - strong axis

Description	Formula	Value	Code
L_c (in)	$L_c = \min(76 b_f / (F_y)^{0.5}, 20000 / (d / A_f) F_y)$	107.5	ASD F1-2
r_T (in)	$r_T = ((0.5 t_f b_f^3 + t_w(d - 2t_f) / 12) / ((d - 2t_f) t_w + 6 b_f t_f))^{0.5}$	2.766	ASD F1.3
F_{bxa} (ksi)	(for $(102000 C_b / F_y)^{0.5} <= L_b / r_T <= (510000 C_b / F_y)^{0.5}$) $F_b = (2 / 3 - F_y (L_b / r_T)^2 / (1530000 C_b))$ $F_y <= 0.60 F_y$	28.9	ASD F1-6
F_{bxb} (ksi)	$F_b = 12000 C_b / (L_b d / A_f) <= 0.60 F_y$	30	ASD F1-8
F_{bx} (ksi)	$\max(F_{bxa}, F_{bxb})$	30	ASD F1.3

Note:

1). For C_b = 1.0, repeat above procedure F_{bx1} = 30 ksi

(b). F_{by} - weak axis

Description	Formula	Value	Code
F_{by} (ksi)	0.75 F_y	37.5	ASD F2-1

4. CHECK AXIAL AND FLEXURAL INTERACTION

Description	Formula	Value	Code
interaction	(for f_a / F_a <= 0.15) f_a / (0.60 F_y) + f_{bx} / F_{bx} + f_{by} / F_{by}	0.1202	ASD H1-3

Note:
1). $f_a = P_u / A$ = 0.6123 ksi; $f_{bx} = M_{ux} / S_x$ = 6.247e-018 ksi; $f_{by} = M_{uy} / S_y$ = 0 ksi

AXIAL-FLEXURAL INTERACTION STATUS: OK

5. CHECK SHEAR ALLOWABLE

Description	Formula	Value	Code
F_{vy} (ksi)	(for h / t_w <= 380 / $F_y^{0.5}$) F_v = 0.40 F_y	20	ASD F4-1
F_{vx} (ksi)	0.4 F_y	20	Not Available

Note:
1). F_{vx} is based on yielding only
2). f_{vx} = 0 ksi; f_{vy} = 8.143e-019 ksi
f_{vy} / F_{vy} = 4.072e-020

SHEAR-Y STATUS: OK

f_{vx} / F_{vx} = 0

SHEAR-X STATUS: OK

6. CHECK TOTAL LOAD DEFLECTIONS (Load Combination: D_x - Not Applicable, D_y - With_Wind)

Description	Formula	Value	Code
Allowable D_x	L/240	0.60	Not Applicable
Allowable D_y	L/240	0.60	Not Applicable

Note:
$D_{x(Act.)} / D_{x(All.)}$ = 0.00 / 0.60 = 0.00

TOTAL LOAD DEFLECTION-X STATUS: OK

$D_{y(Act.)} / D_{y(All.)}$ = 0.00 / 0.60 = 0.00

TOTAL LOAD DEFLECTION-Y STATUS: OK

7. CHECK LIVE LOAD DEFLECTIONS (Load Combination: D_x - Not Applicable, D_y - Just_Wind)

Description	Formula	Value	Code
Allowable D_x	L/360	0.40	Not Applicable
Allowable D_y	L/360	0.40	Not Applicable

Note:
$D_{x(Act.)} / D_{x(All.)}$ = 0.00 / 0.40 = 0.00

LIVE LOAD DEFLECTION-X STATUS: OK

$D_{y(Act.)} / D_{y(All.)}$ = 0.00 / 0.40 = 0.00

LIVE LOAD DEFLECTION-Y STATUS: OK