LIFTING DEVICE

DEVICE NAME: PW8 : 1 Ton Chain Hoist

ENGINEERING NOTE NUMBER: ID # 50

DRAWING NUMBER:

APPLICABLE STANDARD: AISC 9th Edition

RATED LOAD: 1 TON

TEST LOAD: 2500 lbs

TEST LOAD PERCENT: 125 %

LAST LOAD TEST DATE:

COLOR: Non-Painted Steel

STRESS CALCULATIONS:

Done by: Donald V. Mitchell

Date: 8-19-92

Reviewed by: Zhujing Tang

Date: 9-1-92

REMARKS:

IDENTIFICATION:

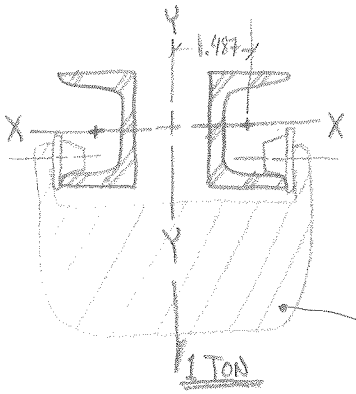
Engineering Note Number & Rated Load Must be Clearly Marked On a Conspicuous Surface.

1 Ton & 3 Ton Chain Hoist systems

8-20-92

1 Ton, 69" Chain Hoist/rail system

8-20-92



C6 x 10.5

Area = 3.078 in^2

$I_{x_{cg}}$ = 15.074 in^4

$I_{y_{cg}}$ = .8123 in^4

d_{org} = 1.487 in

McCollum 1 Ton Chain Hoist

$I_{x_{org}} = (15.074)(2) = 30.148\ in^4$

$I_{y_{org}} = (2)[.8123 + (3.078)(1.487)^2] = 15.236\ in^4$

Look at simply supported case for the worst stress:

$M_{max} = \frac{F \cdot L}{4} = \frac{(2500\#)(69")}{4} = 43{,}125\ in\text{-}lb$

$\sigma_{max} = \frac{Mc}{I} = \frac{(43{,}125\ in\text{-}lb)(3")}{30.148\ in^4} = 4{,}291\ psi$ OK

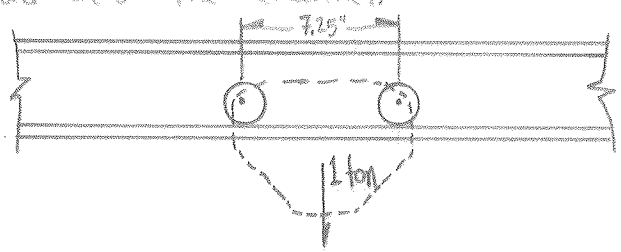
allowable stress = 19,957 psi

** see attached MathCad worksheets **

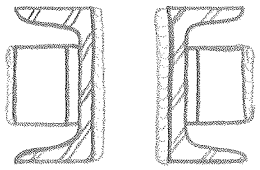
The edge stress on the channel was found to be 16,821 psi.

** See attached finite element documentation **

The stress is induced by the rollers of the hoist applying a point load onto the channel.



PW8: Lifting Hoist (1 Ton)	Weld Analysis	Don Mitchell x4710 8/20/92



1/4" weld on each end as shown in this sketch.

The shear load at each end is 1,250 lbs.

There is 20 inches of 1/4" fillet weld at each end of the composite beam.

The shear load per inch of weld is 62.5 #/in

a 1/4" weld (E70) can carry 3,710 #/in.

Therefore, the end welds are adequate.

Beam Type: C6x10.5 Simple Support Center Load — Don Mitchell — 8/18/92

$E := 29000000$ $I := 15.2$ $S := 5.06$ $l := 70$ in $x := 0 \,..\, \frac{l}{2}$

$F := 1250$ lbs $bf := 2.034$

$z := 8.59$ (z = d/Af)

$rt := .01$ (let rt = .01 for channels) $mid := \frac{l}{2}$

$Lb := 70$ (unsupported Length)

Moment Calculation:

$$M_x := \frac{F \cdot x}{2}$$

Max Moment:

$M_{mid} = 21875$

Deflection Calculation:

$$y_x := \frac{F \cdot x}{48 \cdot E \cdot I} \cdot \left[4 \cdot x^2 - -3 \cdot l^2\right]$$

$$ymax := \frac{-\left[F \cdot l^3\right]}{48 \cdot E \cdot I}$$

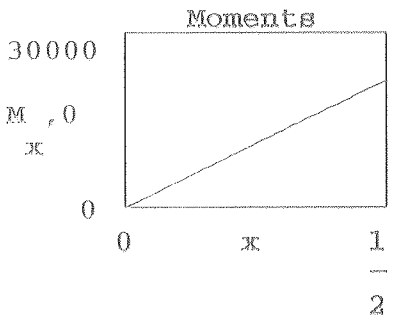
$ymax = -0.02026$

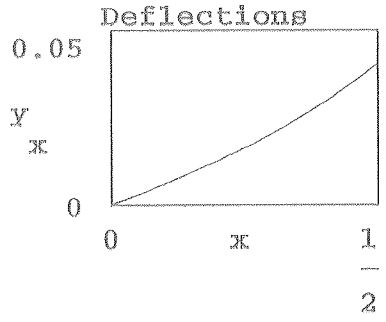
Stress Calculation:

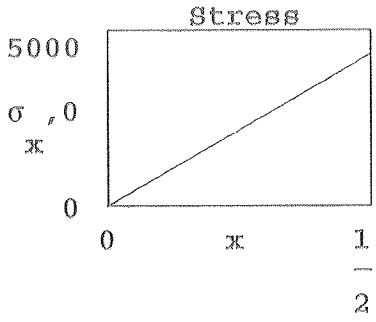
Max Stress:

$\sigma_{mid} = 4323.12253$ psi

$$\sigma_x := \frac{M_x}{S}$$







Calculate the Allowable Stress for the Steel Beam

$Fy := 36$ KSI (yield strength of steel) $\qquad Fb := .66 \cdot Fy$

Calculate the Lc value (max unsupported length such that Fb = .66 Fy)

$$Lc1 := \frac{76 \cdot bf}{\sqrt{Fy}} \qquad Lc2 := \frac{20000}{z \cdot Fy} \qquad Lc := \begin{bmatrix} Lc1 \\ Lc2 \end{bmatrix} \qquad Lc := sort(Lc)_{0,0}$$

$Lc = 25.764$

$Lb = 70$

If Lb < Lc, then
Fb = .66 Fy

if so, Fb = 23.76 Ksi

Three Equations are given to calculate the allowable stress. Given the criterion, the value of Fb can be found. Equation F1-8 will be used when finding the allowable stress for steel channels.

Equation F1-6:

IF:

$$\sqrt{\frac{102000}{Fy}} = 53.22906 \quad < \quad \frac{Lb}{rt} = 7000 \quad < \quad \sqrt{\frac{510000}{Fy}} = 119.02381$$

THEN: $\qquad Fb1 := \left[\frac{2}{3} - \frac{Fy \cdot \left[\frac{Lb}{rt}\right]^2}{1530000}\right] \cdot Fy \qquad Fb1 = -41481.88235 Ksi$

Equation F1-7:

IF:

$$\frac{Lb}{rt} = 7000 \quad > \quad \sqrt{\frac{510000}{Fy}} = 119.02381$$

THEN: $Fb2 := \frac{170000}{\left[\frac{Lb}{rt}\right]^2}$ $Fb2 = 0.00347$ Ksi

Equation F1-8: (Also to be used for ALL Channels)

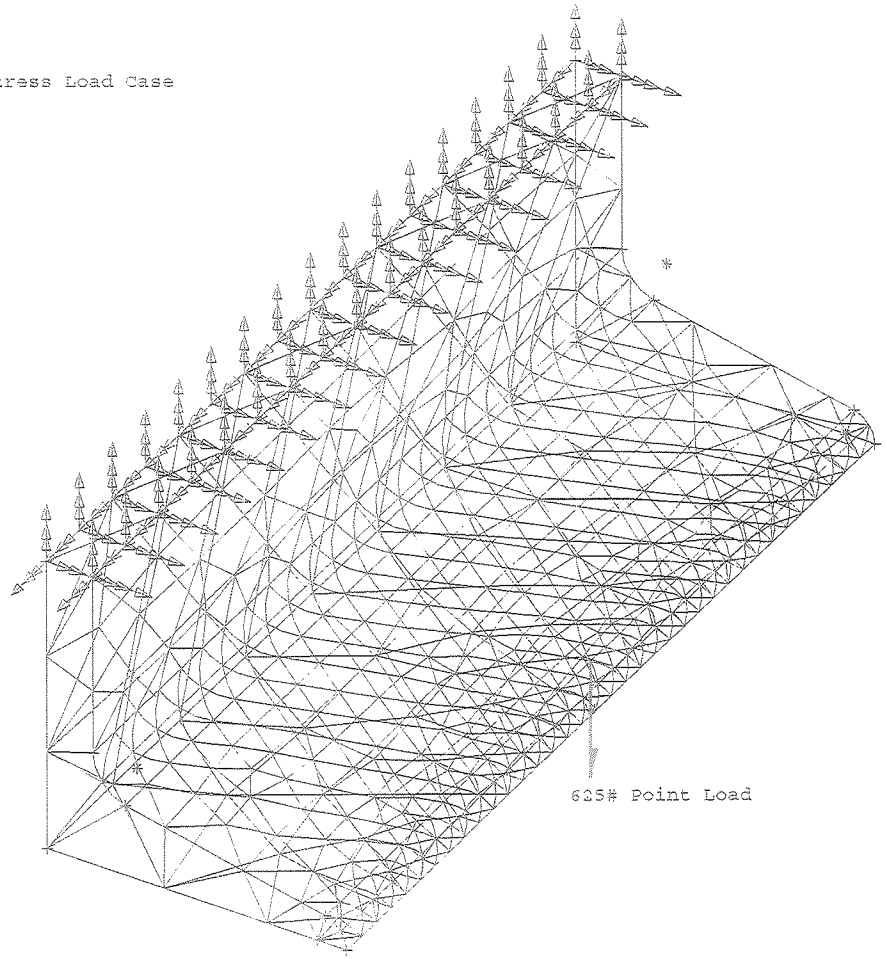
For any value of Lb/rt:

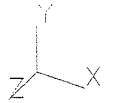
$$Fb3 := \frac{12000}{Lb \cdot z} \qquad Fb3 = 19.95676 \text{ Ksi}$$

But it cannot be more than .60 Fy !

$.6 \cdot Fy = 21.6$ Ksi

C6x10.5 Flange Stress Load Case





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Database: channel Units : IN
View : none, none Display : none, none
Task: Post Processing Model Bin: 1-MAIN
Model: 3-FE MODEL3 Associated Workset: 4-WORKING_SET4