

RHINO LIFTING FIXTURE

for

MOVING "B" SHIELDING

BLOCKS WITH 5 TON

FORK LIFT.

DATE: 1-21-2001

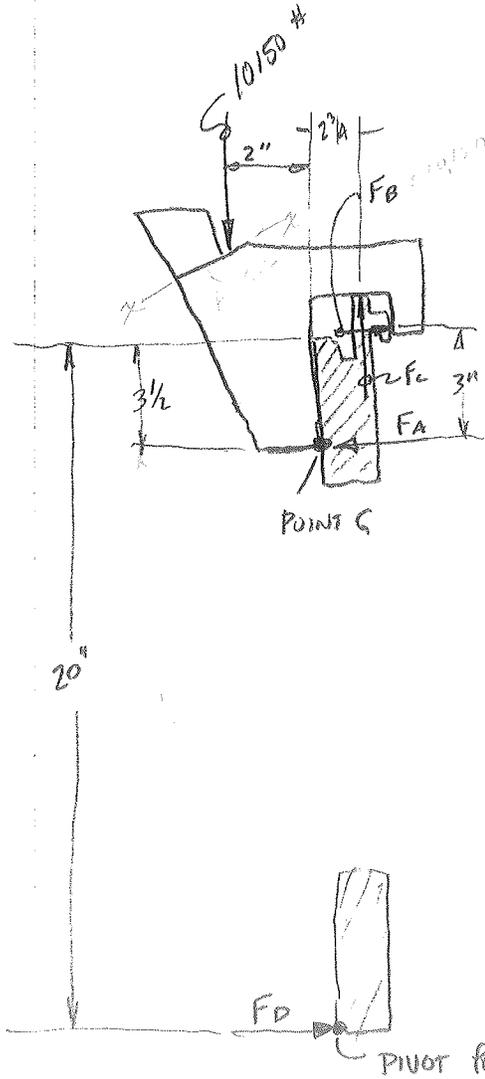
BY: NORM BOSEK

205 BRUCE RD.

LOCKPORT, IL. 60441

SEE CAD DWG.: # RHINO - 1

RHINO - 2



$$\sum M_{\text{pivot point}} = 0$$

$$10150 \times 2 + F_A \times 16.5 - F_C \times 19.5 + F_B \times 2.75 = 0$$

$$16.5 F_A + 2.75 F_B - 19.5 F_C + 20300 = 0$$

$$\sum F_y = 0$$

$$F_C - 10150 = 0$$

$$F_C = 10150$$

$$\sum F_x = 0$$

$$F_A - F_B - F_D = 0$$

$$16.5 F_A + 2.75 F_B - 19.5 (10150) + 20300 = 0$$

$$16.5 F_A + 2.75 F_B = 177625$$

$$\sum M_G = 0$$

$$10150 \times 2 + F_D \times 16.5 + F_C (2.75) - F_B \times 3 = 0$$

$$20300 + 16.5 F_D + 27912.5 - 3 F_B = 0$$

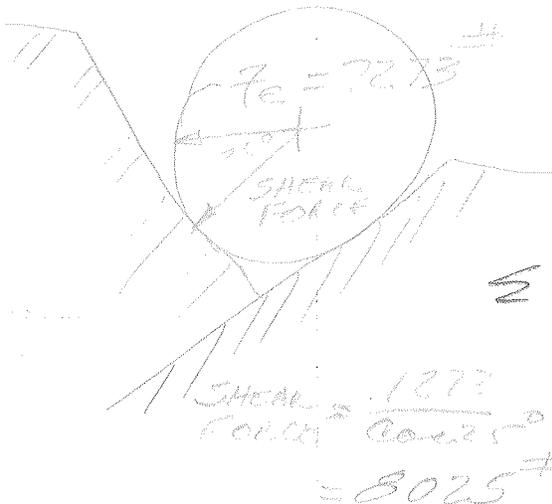
$$16070.83 + 16.5 F_D - F_B = 0$$

$$F_D = .1818 F_B - 2921.97$$

$$F_A - F_B - F_D = 0$$

$$F_A - F_B - .1818 F_B + 2921.97 = 0$$

$$F_A - 1.1818 F_B = -2921.97$$



$$F_v = \frac{8025}{56 \text{ in}^2} = 1433 \text{ psi}$$

$$F_A = 1.1818 F_B - 2921.97$$

$$16.5 F_A + 2.75 F_B = 177625$$

$$16.5 (1.1818 F_B - 2921.97) + 2.75 F_B = 177625$$

$$19.5 F_B - 48212.5 + 2.75 F_B = 177625$$

$$22.25 F_B = 225837.5$$

$$F_B = 10150$$

$$\therefore F_A - 1.1818 F_B = -2921.97$$

$$F_A = 11995.5 - 2921.97$$

$$F_A = 9073.5$$

$$F_A + F_B - F_D = 0$$

$$9073.5 + 10150 - F_D = 0$$

$$F_D = 19223.5 \#$$

RAVING
BY 100V
↓

Summary:

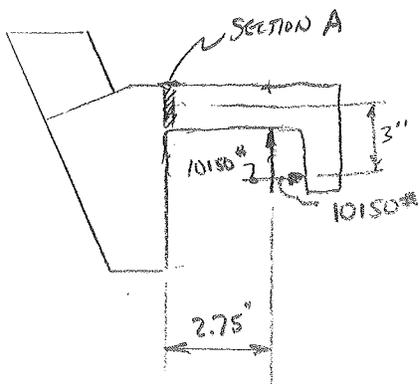
$$F_A = 9073.5 \text{ lb.} \quad \dots \quad 8603 \#$$

$$F_B = 10150 \text{ lb.} \quad \dots \quad 1330$$

$$F_C = 10150 \text{ lb.} \quad \dots \quad 10150$$

$$F_D = 19223.5 \# \quad \dots \quad 7273$$

$$\begin{aligned} \text{MOMENT AT SECT. "A"} &= 10150 \times 2.75 + 10150 \times 2 \\ &= 27912.5 + 20300 = 48212.5 \text{ IN LB,} \end{aligned}$$



MOMENT of INERTIAL of SECTION A

$$I = \frac{bh^3}{12} = \frac{4 \times 1.937^3}{12} = 2.424 \text{ IN}^4$$

$$C = \frac{h}{2} = \frac{1.937}{2} = .968$$

$$\text{BENDING STRESS at A} = F_b = \frac{Mc}{I} = \frac{48212.5 \times .968}{2.424} = 23306 \text{ psi}$$

$$F_b = 23306 \text{ psi}$$

STRESS CONCENTRATION FACTOR

ROARK TABLE XVII
PP. 387
TYPE 9

$$\frac{r}{d} = \frac{1.5}{1.9375} = .774$$

from TABLE XVII : $k = 1.245$ by INTERPOLATION
PP 386

$$\therefore \text{BENDING STRESS at A} = 23306 \times 1.245 = 29020 \text{ psi}$$

$$= 11.9 \times 10^3$$

USE: CONSTRUCTIONAL

ALLOY STEEL PLATE T-1 REGULAR

ASTM A 514 GRADE F

$$Y.S. = 90,000 \text{ psi.} = F_y$$

(100×10^3 K.W. (RVEKSON))

ASTM A36
STEEL COULD
HAVE BEEN USED

AISC CODE 1.5.1.4.3

$$\text{MAX ALLOWABLE BENDING STRESS} = F_{\text{ALLOW}} \leq 0.75 F_y$$

$$\therefore F_{\text{ALLOW}} \leq 67,500 \text{ psi.}$$

UNDER THE HOOK LIFTING DEVICES CODE

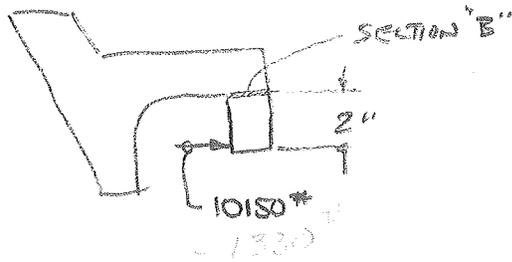
20-1.2.2

$$F_{\text{ALLOW}} = \frac{F_y}{3} = \frac{90,000}{3} = 30,000 \text{ psi}$$

USE SMALLEST VALUE OF F_{ALLOW}

$$\text{BENDING at "A"} = 11.9 \times 10^3 \text{ psi} < 30,000 \text{ psi.}$$

\therefore RHINO CONFIGURATION AT POINT "A" IS "OK"



BENDING ACROSS SECTION "B"

$$\text{MOMENT} = P \times d = 10150 \times 2 = 20300 \text{ IN. LB.}$$

$$\text{MOMENT OF INERTIA} = \frac{bh^3}{12} = \frac{4 \times 1.250^3}{12} = .651 \text{ IN}^4$$

$$\text{BENDING STRESS} = F_b = \frac{Mc}{I} = \frac{20300 \times 1.250}{.651} = 19489 \text{ psi}$$

STRESS CONCENTRATION FACTOR

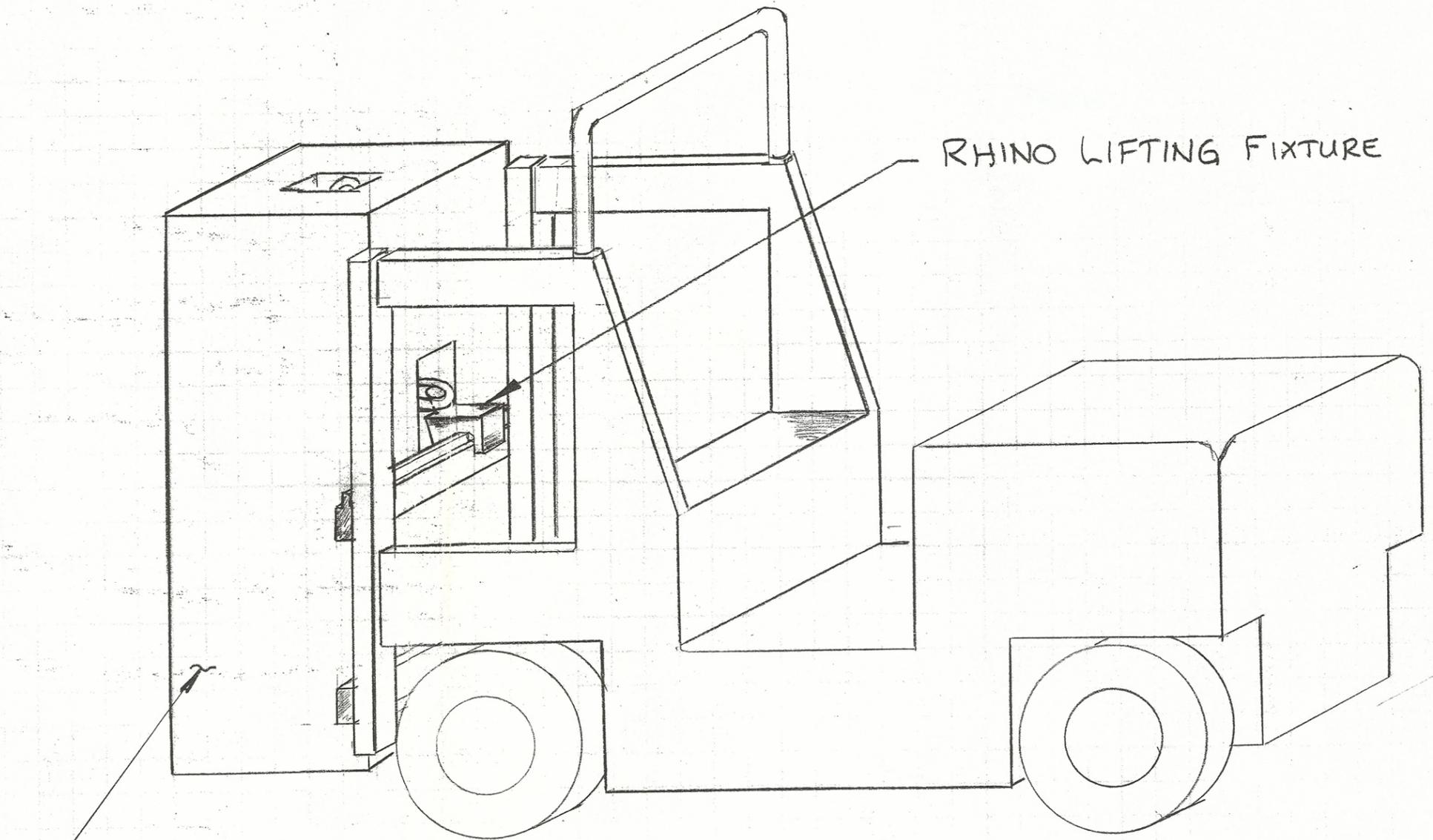
$$\frac{r}{d} = \frac{.5}{1.250} = .4$$

$$\therefore k = 1.53$$

$$\therefore \text{BENDING STRESS AT B} = 19489 \times 1.53 = 29818 \text{ psi.}$$

$$29818 \text{ psi} < 30,000 \text{ psi.}$$

\therefore ROUND GEOMETRY IS OK



TYPE "B" CONCRETE
SHIELDING BLOCK
10150 LBS.

5 TON FORK LIFT

LIFTING FIXTURE FOR
MOVING "B" BLOCKS

DWN BY: N. BOSEK 2-17-01

/cadwhw/home01/ms_villegas/concrete_lftg_block.mfl

RESULTS: 2- B.C. 1, STRESS_2, LOAD SET 1
STRESS - VON MISES MIN: 7.07E+00 MAX: 1.55E+04
DEFORMATION: 1- B.C. 1, DISPLACEMENT_1, LOAD SET 1
DISPLACEMENT - MAG MIN: 1.77E-06 MAX: 5.02E-03
FRAME OF REF: PART

$\rightarrow 1.005''$

$f_v = 8.8 \times 10^3 \text{ psi}$

VALUE OPTION: ACTUAL

1.55E+04

1.40E+04

1.24E+04

1.09E+04

9.33E+03

7.78E+03

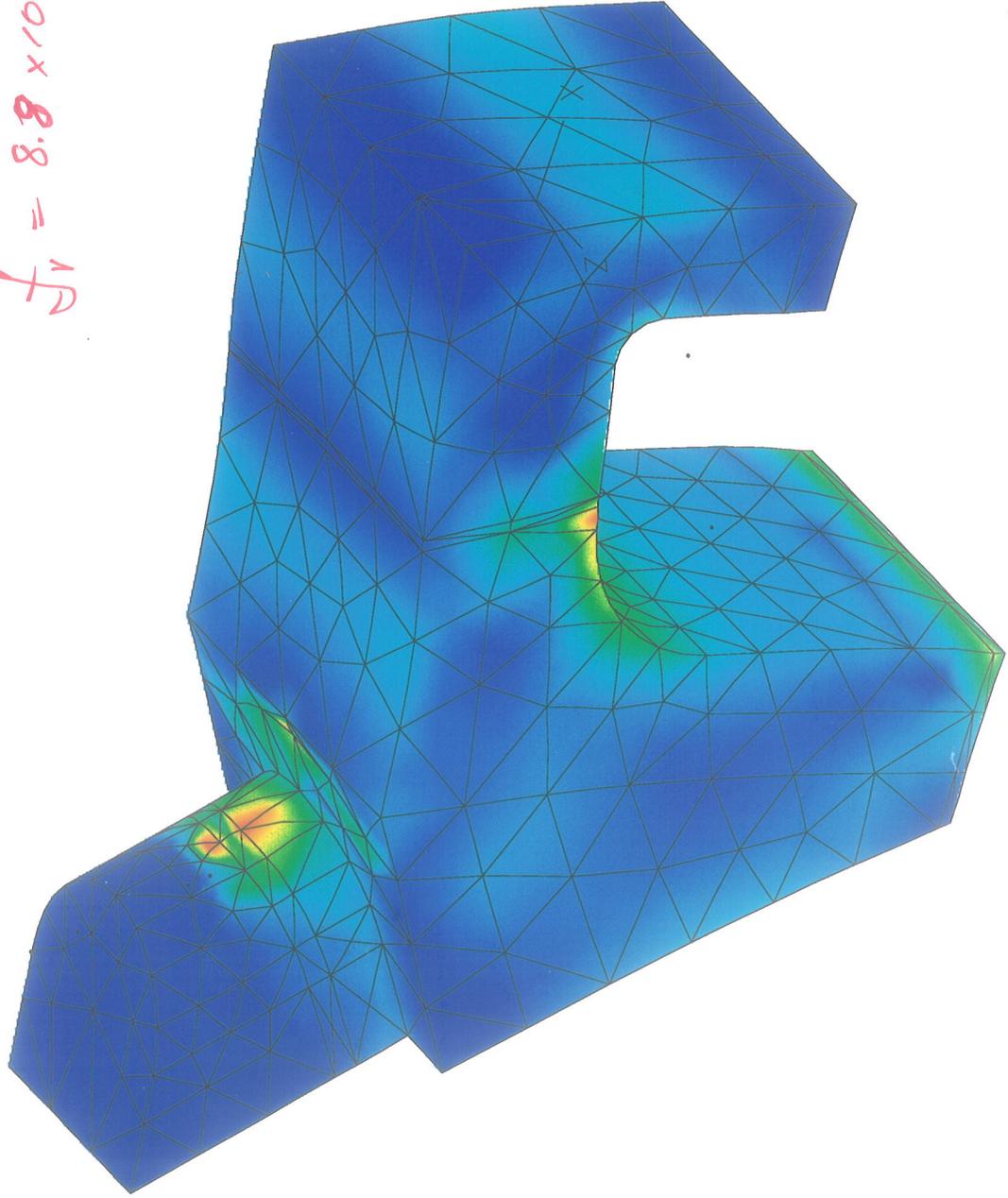
6.22E+03

4.67E+03

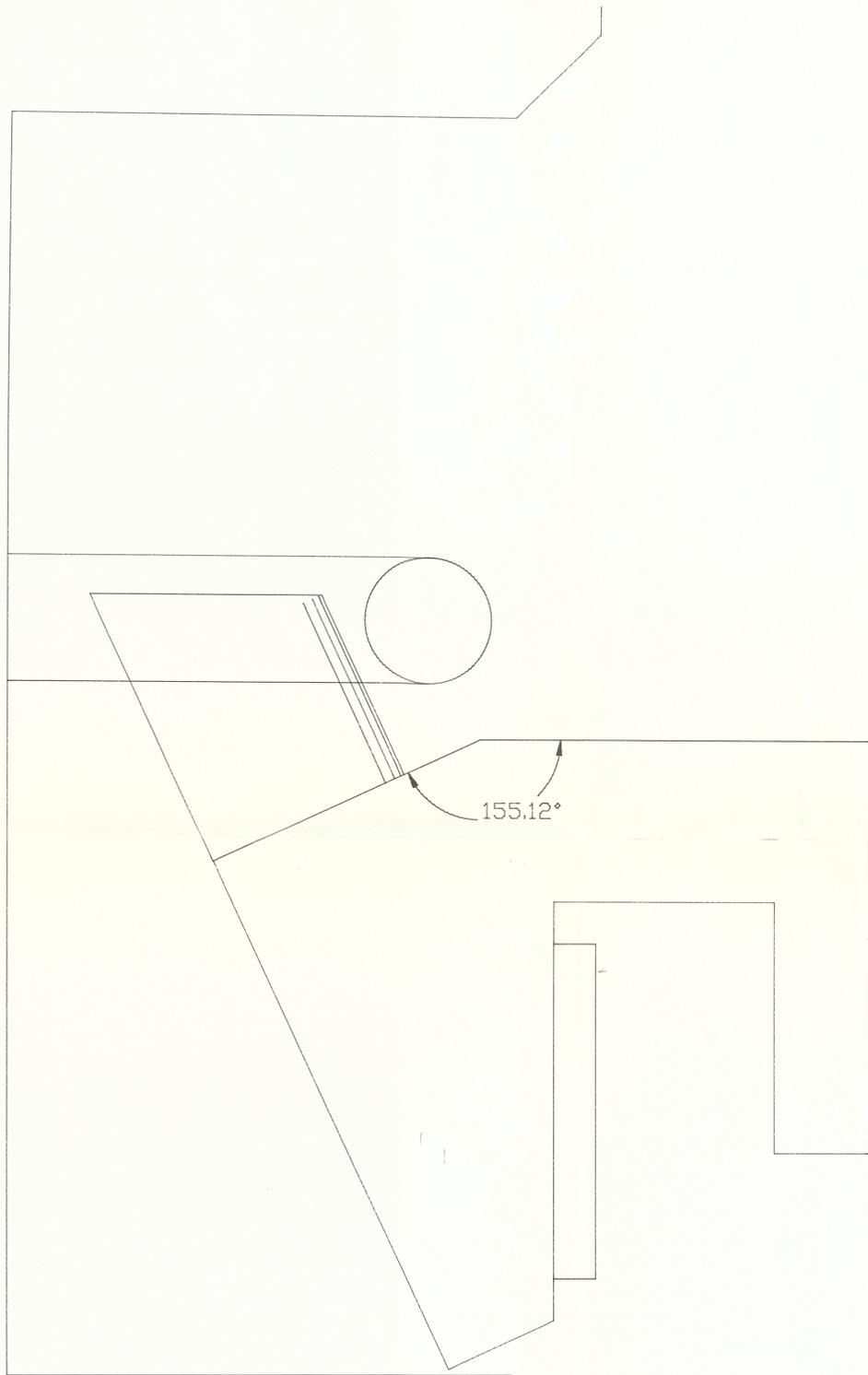
3.11E+03

1.56E+03

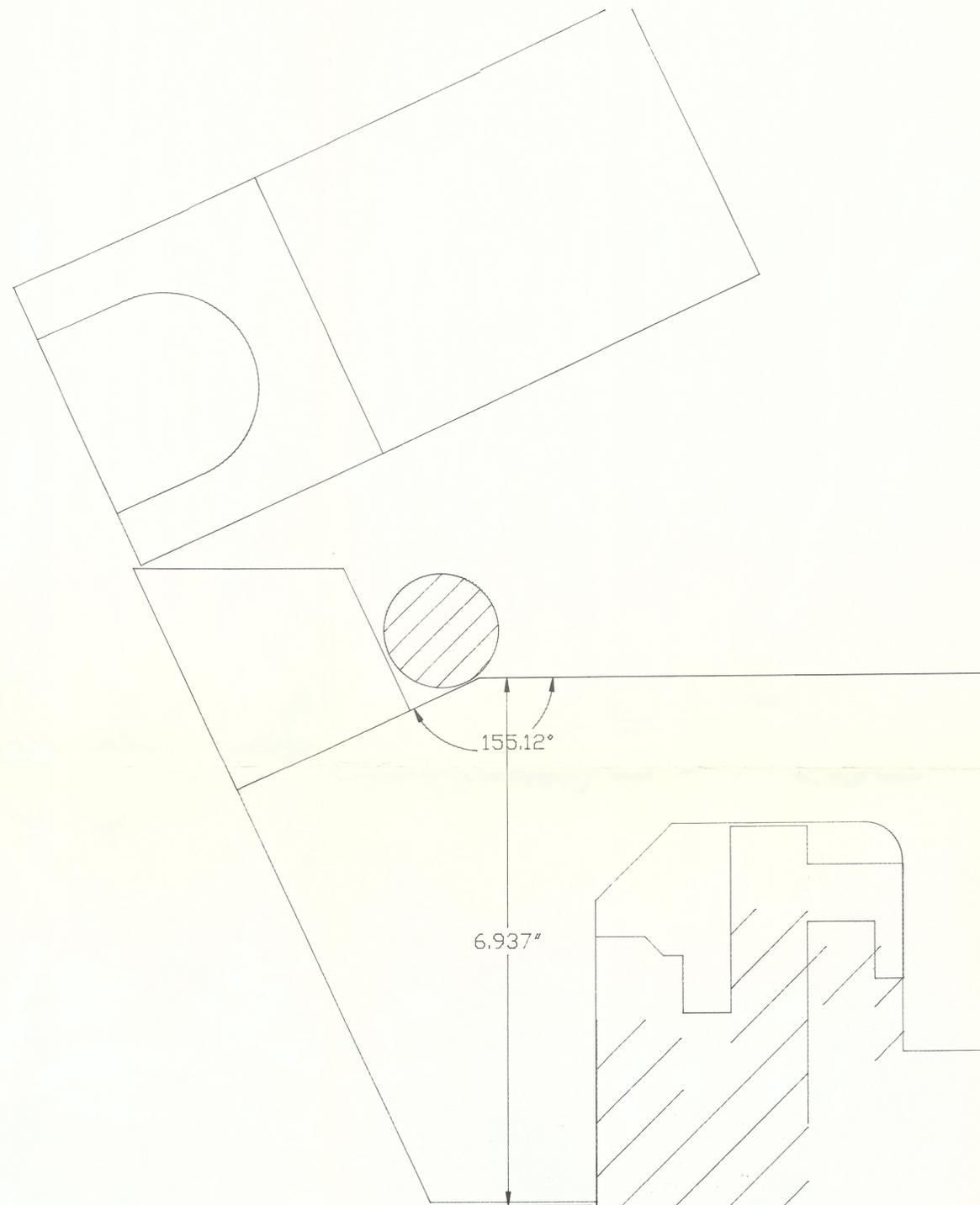
7.07E+00



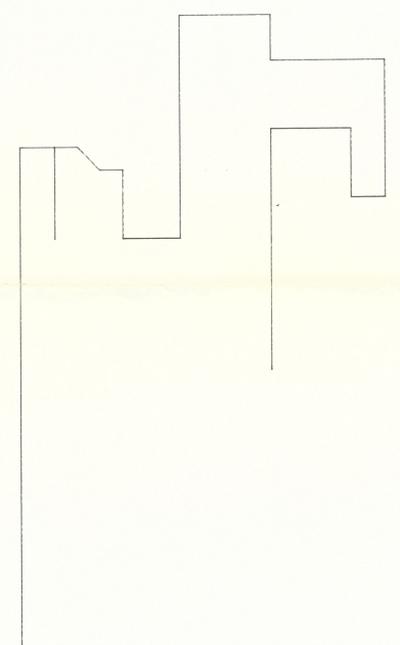
SUPPLEMENTARY ANALYSIS



Present Version



*Proposed
Higher Capacity*



UNLESS OTHERWISE SPECIFIED: FRACTIONS +/- 1/64 DECIMALS TWO PLACE (.00) +/- .01 THREE PL. (.000) +/- .005 ANGLES +/- 1/4 deg.		ORIGINATOR	
REMOVE ALL BURRS AND BREAK ALL SHARP EDGE 1/64 MAX.		DRAWN	N. BOSEK 1-16-01
USED ON	MATERIAL	CHECKED	
		APPROVED	
		APPROVED	
BOSEK ENGINEERING LOCKPORT, ILLINOIS (815) 838-0352			
TITLE 5-TON FORKLIFT HOOK FOR MOVING B-BLOCKS			
SCALE	SHEET	DRAWING NUMBER	REV.
FULL	1	RHINO-1	

2-12-01

