BASIS OF DESIGN &
STRUCTURAL CALCULATIONS

UITF WORK PLATFORM
60 PSF LIVE LOAD Capacity

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UITF WORK PLATFORM

BASIS OF DESIGN: WORK PLATFORM TO HAVE OVERALL LENGTH OF 19'-8" WITH WIDTH OF 3'-0". PLATFOM WILL SPAN OPENING OF 16'-6". REMOVABLE GUARDRAILS TO BE LOCATED ON EAST AND WEST SIDE OF PLATFORM. PLATFORM SHALL HAVE WORKING LEVEL 2' BELOW ENDS THAT ARE SUPPORTED BY UITF ROOF

LOADING: DEAD LOAD 25 PSF
LIVE LOAD 60 PSF

MATERIALS: FLOOR PLATE 6061-T6 ALUMINUM
HSS STEEL SHAPES ASTM A500 GR.B
MISC STEEL SHAPES & PLATE ASTM A36

CHECK FLOOR PLATE)

SPAN = 1'-9"

DLPL = 10 PSF
LL = 60 PSF
70 PSF

$M_{MAX} = .07 \times 1.75^2/8 = .0268^{k'}/_{ft} = .322^{k''}/_{ft}$

$S_{pl} = \frac{bd^2}{6} = \frac{12 \times .1875^2}{6} = .0703 in^3$

$fb_{pl} = \frac{M}{S} = \frac{.322^{k''}}{.0703} = 4.6^{KSI}$

ALUM 6061-T6

$F_{c_b} = \frac{1.3\,F_{cy}}{\Lambda_y}$ $\quad F_{cy} = 35^{KSI}$ (ALUM DES. MANUAL TABLE 3.3.1)

$\Lambda_y = 1.85$ (ALUM DES. MANUAL TABLE 3.4.1)

$= \frac{1.3 \times 35}{1.85} = 24.59^{KSI} > 4.6^{KSI} \Rightarrow$ OK

CHECK L 3×3×3/16")

$L = 3'$

$M = \frac{wL^2}{8} = \frac{1.75 \times .07^{KSF} \times 3^2}{8} = .138^{K'} = 1.654^{K''}$

FROM MCAD, (SEC P.3-4) UNITY BENDING = .23, UNITY SHEAR = .598 } < 1.0

$\therefore$ L 3×3×3/16" OK

CHECK HSS 8×2×3/16")

SPAN = 16.5'

$W_{OTHER} = 85\,PSF \times \frac{3'}{2} \cdot 127.5\,PCF \Rightarrow$ USE 130 PLF

$M = \frac{wL^2}{8} = \frac{.13 \times 16.5^2}{8} = 4.43^{K'}$

$f_b = \frac{M}{S} = \frac{4.43 \times 12}{5.97} = 8.91^{KSI}$

$L_c = \frac{1200\,b}{F_y}$ $\quad b = 3 - 3 \cdot 3/16 = 2.437S$

$= \frac{1200 \cdot 2.437S}{46} = 63.6' > 21'$

$\therefore$ $F_b = .66F_y = .66 \times 46 = 30.36^{KSI} > 8.91^{KSI} \Rightarrow$ OK

$\Delta = \frac{5wL^4}{384EI} = \frac{5 \times .13 \times 16.5^4 \times 1728}{384 \times 29000 \times 23.9} = .313'' \simeq \frac{L}{633} \Rightarrow$ OK

L3x3x3/16"

COMMISSION_____ SHT_____ OF_____
CLIENT _____
PROJECT: _____
CALCULATED BY _____ DATE_____
CHECKED BY _____ DATE_____

SINGLE ANGLE LINTELS

THIS WORKSHEET IS FOR THE DESIGN OF LATERALLY UNSUPPORTED SINGLE ANGLE LINTELS. ANGLE CAN BE EQUAL LEG OR UNEQUAL LEG WITH LONG LEG VERTICAL. STRESSES ARE TAKEN ABOUT PRINCIPAL AXES AND CHECKED AT TIP OF VERTICAL LEG, HEEL, AND TIP OF HORIZONTAL LEG. DEFLECTION CALCULATIONS APPLY TO EQUAL LEG ANGLES ONLY.

1. DESIGN DATA :

$L := 3$	FEET	$Fy := 36$	KSI
$bs := 3.0$	SHORT LEG, In.	$bl := 3$	LONG LEG, In.
$A := 1.09$	In.^2	$t := .1875$	INCHES
$Ix := .962$	In.^4	$Iy := .962$	In.^4
$rx := 0.939$	INCHES	$ry := 0.939$	INCHES
$y := .82$	INCHES	$x := .82$	INCHES
$rz := .596$	INCHES	$E := 29000$	KSI
$Mmax := .138$	KIP-FEET	$\alpha' := 1.0$	TAN(α)
$W := .368$	TOTAL LOAD ON LINTEL, KIPS		

2. PRINCIPAL AXES PROPERTIES :

$\alpha := \text{atan}(\alpha')$ $\quad \alpha = 0.785$ RADIANS

$Mw := 12 \cdot Mmax \cdot \cos(\alpha)$ $\quad Mw = 1.171$

$Mz := 12 \cdot Mmax \cdot \sin(\alpha)$ $\quad Mz = 1.171$

$Iz := A \cdot rz^2$ $\quad Iz = 0.387$ $\quad Iw := Ix + Iy - Iz$ $\quad Iw = 1.537$

$Cza := \left(bl - y - \frac{x}{\alpha'}\right) \cdot \sin(\alpha)$ $\quad Cza = 0.962$ $\quad Cwa := (bl - y + x \cdot \alpha') \cdot \cos(\alpha)$ $\quad Cwa = 2.121$

$Czb := (x + y \cdot \alpha') \cdot \cos(\alpha)$ $\quad Czb = 1.16$ $\quad Cwb := bl \cdot \cos(\alpha) - Cwa$ $\quad Cwb = 0$

$Czc := bs \cdot \cos(\alpha) - Czb$ $\quad Czc = 0.962$ $\quad Cwc := \frac{y}{\cos(\alpha)} + Czc \cdot \alpha'$ $\quad Cwc = 2.121$

3. DETERMINE PRINCIPAL AXES STRESSES :

$fza := \frac{Mz \cdot Cza}{Iz}$ $\quad fza = 2.908$ Tension $\quad fwa := \frac{Mw \cdot Cwa}{Iw}$ $\quad fwa = 1.616$ Tension

$fzb := \frac{Mz \cdot Czb}{Iz}$ $\quad fzb = 3.507$ Comp. $\quad fwb := \frac{Mw \cdot Cwb}{Iw}$ $\quad fwb = 0$ Comp.

$fzc := \frac{Mz \cdot Czc}{Iz}$ $\quad fzc = 2.908$ Tension $\quad fwc := \frac{Mw \cdot Cwc}{Iw}$ $\quad fwc = 1.616$ Comp.

4. DETERMINE ALLOWABLE BENDING STRESSES :

MAJOR AXES BENDING

$K1 := \frac{76}{\sqrt{Fy}}$ $\quad K2 := \frac{155}{\sqrt{Fy}}$ $\quad K3 := \frac{bs}{t}$ $\quad K4 := \frac{bl}{t}$ $\quad K5 := 1.34 - .00447 \cdot K3 \cdot \sqrt{Fy}$

$K6 := 1.34 - .00447 \cdot K4 \cdot \sqrt{Fy}$ $\quad K7 := \frac{15500}{Fy \cdot K3^2}$ $\quad K8 := \frac{15500}{Fy \cdot K4^2}$ $\quad K9 := .66 \cdot Fy$ $\quad K10 := .6 \cdot Fy$

$Q'c := \text{if}(K3 \le K1, 1.0, K5)$ $\quad Qc := \text{if}(K3 \ge K2, K7, Q'c)$

$Q'a := \text{if}(K4 \le K1, 1.0, K6)$ $\quad Qa := \text{if}(K4 \ge K2, K8, Q'a)$

$K11 := .6 \cdot Qc \cdot Fy$ $\quad K12 := .6 \cdot Qa \cdot Fy$

TABLE C5.1 βw Values for Angles

Angke Size	9x4	8x6	8x4	7x4	6x4	6x3.5	5x3.5	5x3	4x3.5	4x3	3.5x3	3.5x2.5	3x2.5	3x2	2.5x2
βw (In.)	6.54	3.31	5.48	4.37	3.14	3.69	2.40	2.99	0.87	1.65	0.87	1.62	0.86	1.56	0.85

Note : For Equal Leg Angles, βw = 0.00

$\beta w' := 0$ FROM TABLE $\quad \beta w := -\beta w'$

$K13 := \frac{143100 \cdot Iz \cdot Cwc}{Iw \cdot (L \cdot 12)^2} \cdot \left[\sqrt{\beta w^2 + .052 \cdot \left(\frac{12 \cdot L \cdot t}{rz}\right)^2} + \beta w\right]$ $\quad K14 := \frac{143100 \cdot Iz \cdot Cwa}{Iw \cdot (L \cdot 12)^2} \cdot \left[\sqrt{\beta w^2 + .052 \cdot \left(\frac{12 \cdot L \cdot t}{rz}\right)^2} + \beta w\right]$

$K15 := \frac{28250}{\left(\frac{12 \cdot L}{t}\right)}$ $K16 := \left(.55 - \frac{.1 \cdot K15}{Fy}\right) \cdot K15$ $K17 := \left(.95 - .5 \cdot \sqrt{\frac{Fy}{K15}}\right) \cdot Fy$

$K18 := if(K17 \le K9, K17, K9)$ $K19 := if(K15 \le Fy, K16, K18)$ $K20 := \left(.55 - \frac{K14}{Fy}\right) \cdot K14$

$K21 := \left(.95 - .5 \cdot \sqrt{\frac{Fy}{K14}}\right) \cdot Fy$ $K22 := if(K21 \le K9, K21, K9)$ $K23 := if(K14 < Fy, K20, K22)$

$K24 := \left(.55 - \frac{.1 \cdot K13}{Fy}\right) \cdot K13$ $K25 := \left(.95 - .5 \cdot \sqrt{\frac{Fy}{K13}}\right) \cdot Fy$ $K26 := if(K25 \le K9, K25, K9)$

$K27 := if(K13 < Fy, K24, K26)$ $K28 := if(bs = bl, K19, K23)$ $K29 := if(bs = bl, K15, K27)$

$K30 := if(K4 > K1, K12, K10)$ $K31 := if\left(K4 \le \frac{65}{Fy}, K9, K30\right)$ $K32 := if(K3 > K1, K11, K10)$

$K33 := if\left(K3 \le \sqrt{\frac{65}{Fy}}, K9, K32\right)$ $Fwa := if(K31 \le K28, K31, K28)$ $Fwb := K9$ $Fwc := if(K33 \le K29, K33, K29)$

$Fwa = 19.675$ $Fwb = 23.76$ $Fwc = 19.675$

ALLOWABLE BENDING STRESSES ABOUT MAJOR PRINCIPAL AXES AT :
POINT A - TIP OF VERTICAL LEG
POINT B - HEEL OF ANGLE
POINT C - TIP OF HORIZONTAL ANGLE

MINOR AXES BENDING

$Fza := K31$ $Fzb := K9$ $Fzc := K33$

$Fza = 19.675$ $Fzb = 23.76$ $Fzc = 19.675$

ALLOWABLE BENDING STRESSES ABOUT MINOR PRINCIPAL AXES AT POINT A, B & C

5. *BIAXIAL BENDING UNITY CHECK :*

AT TIP VERT. LEG, POINT A : $\frac{fwa}{Fwa} + \frac{fza}{Fza} = 0.23$

AT HEEL OF ANGLE, POINT B : $\frac{fwb}{Fwb} + \frac{fzb}{Fzb} = 0.148$

AT TIP HORIZ. LEG, POINT C : $\frac{fwc}{Fwc} + \frac{fzc}{Fzc} = 0.23$

IF ALL UNITY CHECKS ARE LESS THAN OR EQUAL TO 1.0, STRESSES ARE OK !!!

6. *CHECK SHEAR*

$Vb := \frac{W}{2}$ $Mt := W \cdot \left(\frac{bs}{2}\right)$ $fv := \frac{1.35 \cdot Vb}{bs \cdot t} + \frac{3 \cdot Mt}{A \cdot t}$ $fv = 8.544$

$\frac{fv}{.4 \cdot Fy} = 0.593$

UNITY CHECK FOR SHEAR, MUST BE LESS THAN OR EQUAL TO 1.0 !!!

7. *CHECK DEFLECTION, EQUAL LEG ANGLES ONLY :*

$w := 8 \cdot \frac{Mmax}{L^2}$ $w = 0.123$

$\delta := \frac{5 \cdot w \cdot L^4 \cdot 1728}{384 \cdot E \cdot Ix}$ $\delta = 0.008$ $\delta v := 1.56 \cdot \delta$ $\delta v = 0.013$ *VERT. DEFLECTION, In.*

$\delta h := .94 \cdot \delta$ $\delta h = 0.008$ *HORIZ. DEFLECTION, In.*

$\delta mv' := \frac{L \cdot 12}{180}$ $\delta mv := if(\delta mv' > .3, .3, \delta mv')$ $\delta mv = 0.2$ *MAXIMUM ALLOWABLE VERT. DEFLECTION, In.*