Appendix B
Stoplog Design Examples

The opening for the closure in this example is 47 ft, 4 in. wide by 4 ft, 4 in. high. The closure will be designed using aluminum stoplogs (Example B.1.a.) and steel stoplogs (Example B.1.b.).

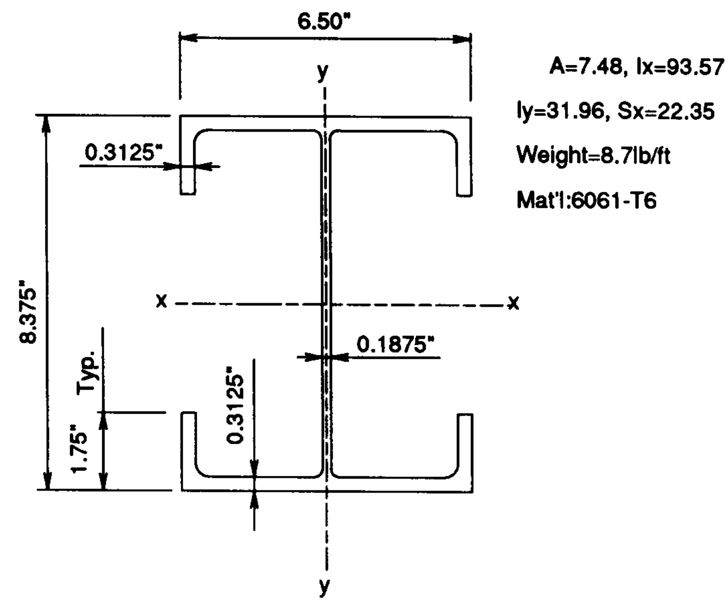
Load Cases:

The load cases given in EM 1110-2-2502 for inland floodwalls were taken into consideration. The only significant case for design was found to be case I2.

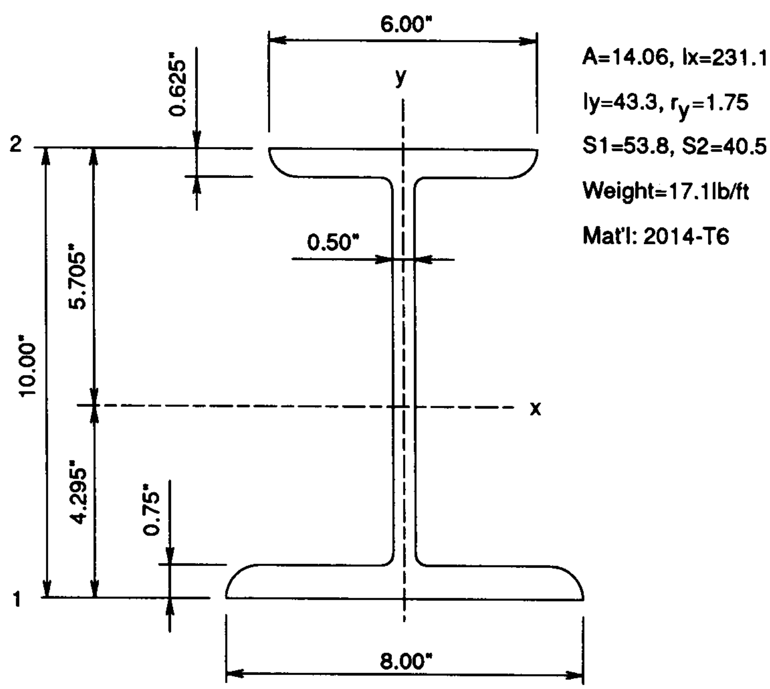
Case I2, Maximum Flood Loading. Stoplogs are in place, water on the unprotected side is at top of closure, water on protected side is at or below the top of sill. Design stresses for aluminum shall not exceed 1.11 times the allowable stresses given in Aluminum Association, Inc. (1986). Design stresses for steel shall not exceed 1.11 times the allowable stresses given in AISC (1989).

The stoplogs are designed as simple beams spanning the openings between posts and the openings between walls and posts. Intermediate posts are designed as cantilever beams fixed at the sill.

EXAMPLE B.1.a.(ALUMINUM).

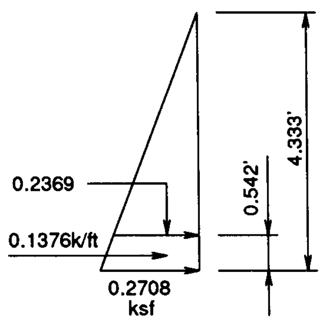


STOPLOG SECTION



POST SECTION

EXAMPLE B.1.a.(ALUMINUM)



STOPLOG:

W=0.1376k/ft, L=Post Spacing=12.00'

$M=WL^2/8=2.477$k-ft=29.724k-in

V=WL/2=0.1376x12/2=0.826k

All Specifications Listed Below Are From Table 3.3.27 Of Aluminum Association, Inc. (1986).

Specification 1: Flexural Tension Allowable=19.00ksi

(Nonwelded Member)

Note: The Allowable Stress For Welded Aluminum Is About 50% Less Than The Nonwelded Member

Specification 15: Compression In Flange Lips.

b/t=(1.75-0.3125)/0.3125=4.6 <6.8, F_{bc}=21ksi

Specification 16: Compression In Flange, Both Edges Supported.

b_L=1.75-0.3125=1.4375", b_f=(6.5-2x0.3125-0.1875)/2=2.844"

b_f/3=0.948"<b_L o.k.

b_f/t=2.844/0.3125=9.1<21, F_{bc}=21ksi

Specification 18: Compression In Web.

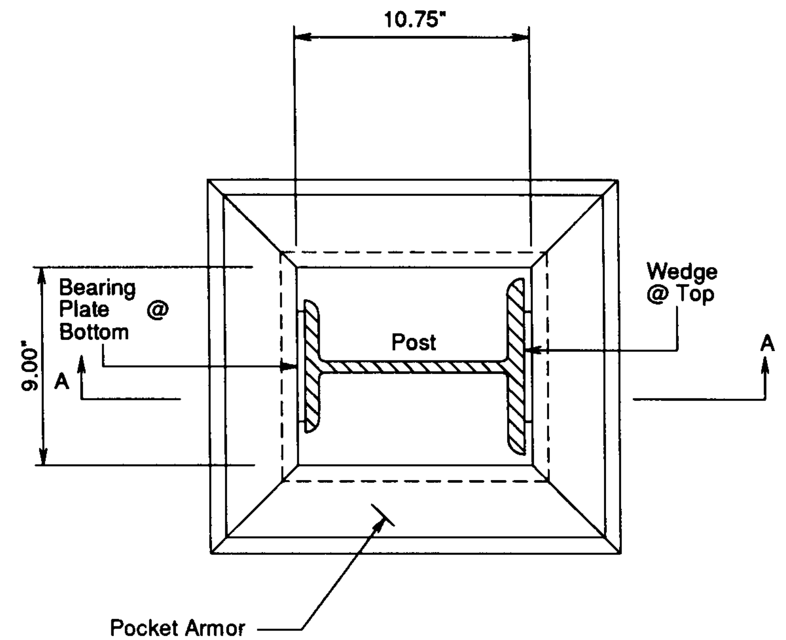
h/t=(8.375-2x0.3125)/0.1875=41.33<46, F_{bc}=28ksi

f_b=M/Sx=29.724/22.35=1.33ksi, F_b=1.11x19=21.09ksi>f_b o.k.

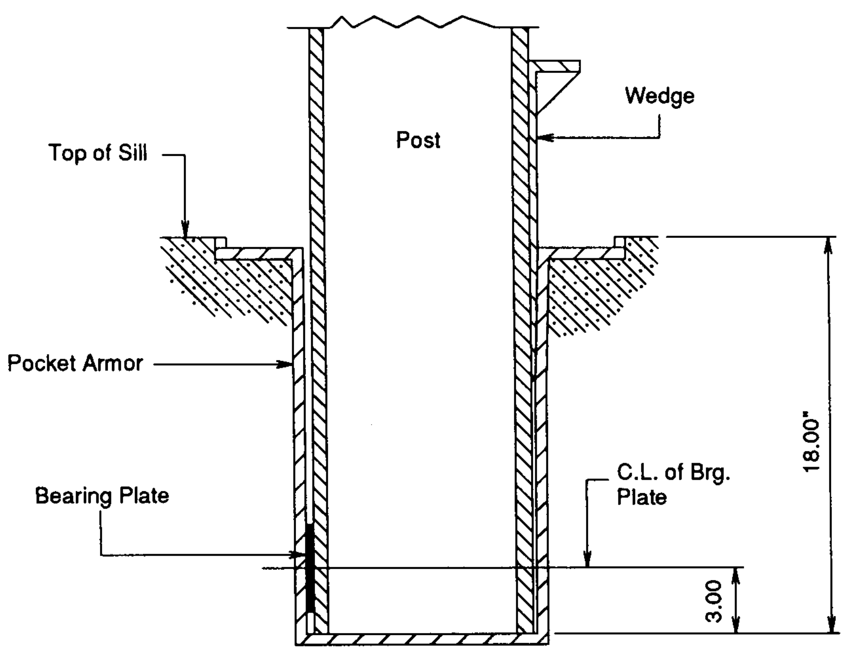
f_s=0.826/(8.375x0.18375)=0.526ksi Shear Is Negligible.

THIS STOPLOG SECTION PROVIDES AN OVERDESIGN. HOWEVER, IT IS AVAILABLE FROM THE USING AGENCY'S INVENTORY AND CAN BE EASILY INSTALLED BY MANUAL LABOR. IT WILL BE USED.

EXAMPLE B.1.a.(ALUMINUM)

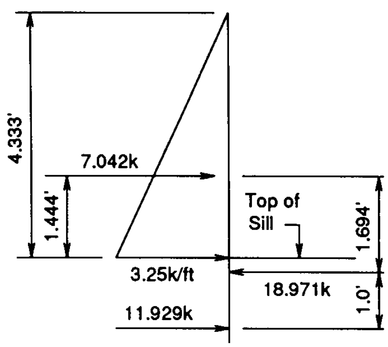


PLAN-POST IN POCKET



SECTION A-A

EXAMPLE B.1.a.(ALUMINUM)



POST LOADING

INTERMEDIATE POST:

M=7.042x1.694=11.93k-ft=143.16k-in

V=11.929k

All Specifications Listed Below Are From Table 3.3.8 of Aluminum Association, Inc. (1986).

Specification 1: Flexural Tension Allowable=25ksi

Specification 11: Flexural Compression.

L_b=4.333+1.25=5.583'=67", L_b/r_y=67/1.75=38>19

F_{bc}=36.3-0.23x38=27.56ksi

Specification 18: Compression in Web.

h=10", t_w=0.50", h/t_w=20<43, F_{bw}=41ksi

Specification 20: Web Shear.

h/t_w=20<32, F_s=19ksi

f_b=M/S2=143.16/40.5=3.53ksi, F_b=1.11x25=27.75ksi>f_b o.k.

f_s=11.929/(10x0.5)=2.386ksi, F_s=1.11x19=21.09ksi>f_s o.k.

THIS POST SECTION PROVIDES AN OVERDESIGN. HOWEVER, IT IS AVAILABLE FROM THE USING AGENCY'S INVENTORY AND CAN BE EASILY INSTALLED BY HAND. IT WILL BE USED.

EXAMPLE B.1.a. (ALUMINUM)

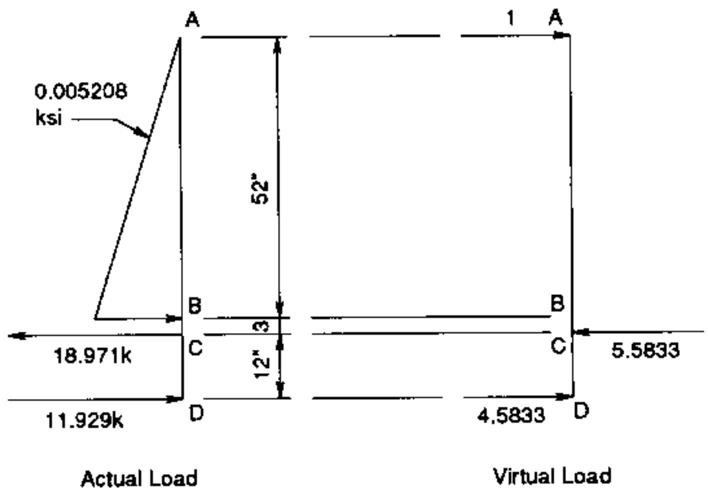
STOPLOG DEFLECTION:

$\Delta = 5WL^4/384EI$, W=0.1376/12=0.011467k/in, E=10800ksi

I=93.57 , $\Delta = 5x0.011467(12x12)^4/(384x10800x93.57) = 0.064"$

Δ /L=1/2250<1/200 o.k.

POST DEFLECTION:



M=Moment Due To Actual Load   m=Moment Due To Virtual Load

$\Delta A = \sum \int Mmd_y /EI$

From A To B: $M=0.000868y^3$, m=y, $Mm=0.000868y^4$

$\int_0^{52} Mmd_y = 66003$

From D To C: M=11.929y, m=4.5833y, $Mm=54.6742y^2$

$\int_0^{12} Mmd_y = 31493$

From C To B: M=143.148-7.042y, m=55-y

$Mm=7873.14-530.458y+7.042y^2$

$\int_0^{3} Mmd_y = 21296$

$\Delta A = (66003+31493+21296)/(10800x231.1) = 0.048"$ Δ/L=1/1396
o.k.

EXAMPLE B.1.b. (A36 STEEL) All Equation Numbers In Parentheses Are From The Specification In AISC (1989)

STOPLOG:

Trial Section S4x7.7, Ix=6.08, Sx=3.04, b_f =2.663" =0.2219'

W=Load On Bottom Log=0.5[2x0.2708-0.0625x0.2219](0.2219)

W=0.0586k/ft , M=0.0586(12)^2/8=1.055k-ft=12.66k-in

f_b=M/Sx=12.66/3.04=4.164ksi

F_b=0.66F_y=24ksi (F1-1)

Δ=5(0.0586/12)(12x12)^4/(384x29000x6.08)=0.155"

Δ/L=1/929<1/200 o.k.

INTERMEDIATE POST:

Post Pocket Details Will Be Similar To Those Used In Example B.1.a.

Trial Section W8x10, Ix=30.8, Sx=7.81, b_f =4" , r_T =0.99

L_b=67", L_c=76x4/6=50.67<67 (F1-2)

L_b/r_T=67/0.99=68

F_b=[2/3-36(68)^2/(1530x10^3)]x36=20.08ksi (F1-6)

M=143.16k-in (Same As Example B.1.a.)

f_b=M/Sx=143.16/7.81=18.33ksi

1.11F_b=22.31ksi>f_b o.k.

Δ(From Example B.1.a.)=0.048"

Δ(For Steel Post)=0.048(10800/29000)(231.1/30.8)=0.134"

Δ/L=0.134/67=1/500<1/200 o.k.

USE S4x7.7 STOPLOGS AND W8x10 POSTS