clear

clc

%calculate allowed stress

stressU = 50000;

FS = 1.67;

stressA = stressU/FS;

%imports the s beam data

%Designation † A, in 2 d, in. b f , in. t f , in. t w , in. I x , in 4 S x , in 3 r x , in. I y , in 4 S y , in 3 r y , in.

%(n,1) height, (n,2) lb/ft, (n,9) S

Sbeam = xlsread('SBeam.xlsx');

beamsTested = size(Sbeam, 1);

%other constants needed

LB = 30;

Liveload= 50;

Deadload = 130;

Load = Liveload + Deadload;

ResultA = zeros(beamsTested,5);

%loop to calculate each spacing and weight

for n=1:beamsTested

ResultA(n,1)=Sbeam(n,1);%beam depth

ResultA(n,2) = Sbeam(n,2); %beam lb/ft

%max distance between beams

ResultA(n,3) = stressA \* 8 \* 12 \* Sbeam(n,9) /( Load \* (12\*LB)^2);

%if statements to round to factor of 30 and weight

if ResultA(n,3) >= 15

ResultA(n,4) =15;%spacing

ResultA(n,5) = LB\*LB\*ResultA(n,2)/15;%weight

elseif ResultA(n,3) >= 10

ResultA(n,4) =10;

ResultA(n,5) = LB\*LB\*ResultA(n,2)/10;

elseif ResultA(n,3) >= 6

ResultA(n,4) =6;

ResultA(n,5) = LB\*LB\*ResultA(n,2)/6;

elseif ResultA(n,3) >= 5

ResultA(n,4) =5;%spacing

ResultA(n,5) = LB\*LB\*ResultA(n,2)/5;%weight

elseif ResultA(n,3) >= 3

ResultA(n,4) =3;%spacing

ResultA(n,5) = LB\*LB\*ResultA(n,2)/3;%weight

elseif ResultA(n,3) >= 2

ResultA(n,4) =2;%spacing

ResultA(n,5) = LB\*LB\*ResultA(n,2)/2;%weight

elseif ResultA(n,3) >= 1

ResultA(n,4) =1;%spacing

ResultA(n,5) = LB\*LB\*ResultA(n,2)/1;%weight

else %spacing smaller than a foot is useless.

ResultA(n,4) =NaN;%spacing

ResultA(n,5) = NaN;%weight

end

end

disp(ResultA)

%search data for lowest weight and display result.

low =1;

for n=1:15

if ResultA(n,5) < ResultA(low,5)

low=n;

end

end

%prints out the results.

fprintf('The least steel used is %g lbs\n', ResultA(low,5))

fprintf('S beams used: S%g x %g \n', ResultA(low,1), ResultA(low,2))

fprintf('At a spacing of %g feet.\n', ResultA(low,4))

%the program will now calculate the lightest girder possible

LG = 30;

WG = ResultA(low,5)/LG + Load\*LG;

%smallest S allowed

SG = (WG/12) \* (12\*LG)^2 /(stressA \* 8);

%import girder properties

Wgirder = xlsread('girder.xlsx');

%counts the girders to be tested

Gcount = size(Wgirder, 1);

lowG =1;%sets the lowest weight as the first girder

for i=1:Gcount

if SG <= Wgirder(i,9)

if Wgirder(i, 9) < Wgirder(lowG, 9)

lowG = i;

end

end

end

%displays the lightested girder strong enough

fprintf('Girder used: W%g x %g \n', Wgirder(lowG,1), Wgirder(lowG,2))

)

Results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S (depth) | Lbs/ft | Min spacing (ft) | Spacing (ft) | Steel weight (lbs) |
| 12 | 50 | 6.23444469086518 | 6 | 7500 |
| 12 | 40.8 | 5.55678765924940 | 5 | 7344 |
| 12 | 35 | 4.69431507355659 | 3 | 10500 |
| 12 | 31.8 | 4.46021537172569 | 3 | 9540 |
| 10 | 35 | 3.62238485990981 | 3 | 10500 |
| 10 | 25.4 | 3.03097508686331 | 3 | 7620 |
| 8 | 23 | 1.99600798403194 | 1 | 20700 |
| 8 | 18.4 | 1.77422931913950 | 1 | 16560 |
| 6 | 17.2 | 1.07685862842217 | 1 | 15480 |
| 6 | 12.5 | 0.904364111283606 | NaN | NaN |
| 5 | 10 | 0.603730809984968 | NaN | NaN |
| 4 | 9.5 | 0.416451048520243 | NaN | NaN |
| 4 | 7.7 | 0.373327419235603 | NaN | NaN |
| 3 | 7.5 | 0.239028116606294 | NaN | NaN |
| 3 | 5.7 | 0.205761316872428 | NaN | NaN |

The least steel used is 7344 lbs for each 30’ x 30’ section

S beams used: S12 x 40.8

At a spacing of 5 feet.

WG = 5644.80 lb/ft

SG = 254.52 in^3

Girder used: W24 x 104