

**KEVIN M. FINN, P.E., INC.**

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Goshen, IN 46526

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February 12, 2016

William K. Long, Ed.D.  
Assistant Superintendent  
Center Grove Community Schoold Corpooration  
4800 West Stones Crossing  
Greenwood, IN 46143

Re: Existing Bleacher Stadium – Centergrove

Dear Mr. Kramb:

This is to address the existing condition of the above bleacher framing.

The original design loading conditions for the existing framing system was from 45 years ago. This would have been a lower loading conditions.

During a cost replacement analysis of the existing framing for the above bleachers, some questions were raised on the structural integrity of the 8” C-channel. Attached is an analysis of the apparent C-channel parameters based on current loading standards. This includes the thickness, height, and width of the framing member. The loading conditions (spacing of the framing members, clear span, and the applied load) are all included. As indicated the framing member fails in deflection based on the 100 psf live load and appropriate dead load of 6 psf and causes an issue of safety vs. the required design load for bleachers per the building code loading requirement.

Also, attached is a calculation for a W12 x 14 steel I-beam with the exact same loading conditions. This calculation illustrates that the W12 x 14 beam is acceptable for this framing member design.

Note – It would seem to be difficult engineering, design and construction challenge to change out the existing 8” C-channel stringers to new 12” I-beam stringers to satisfy current load standards. This 4” height differential would create elevation issues would be costly and very difficult to overcome including matching elevations at the joint to rows 16-21 that were added 6 years ago. Also there would be multiple and possibly hundreds of connection issues. New panel angle design and attachment of footboards and seatboards would have to be resolved. Additionally, Row 1 would now be 4” taller requiring new stairs. Per the building code all stairs have to be +/- 3/8”. Any differential greater than 3/8” is out of standard. These are only some of the issues in trying to replace the 8” C-channels

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with 12" stringers. Another big consideration is the cost of decking and seating disassembly and temporarily stored and then reassembled. The side and rear guardrails are attached to the 8" channels would need to be detached and reattached during reassembly. The labor portion would be very costly.

I can't speak for Dant Clayton, but this type of work is somewhat outside the typical bleacher construction work and you would need to consult with them to see if they would be interested in such an undertaking.

Should you have any questions on the above, please do not hesitate to contact the undersigned at the above address.

Sincerely,

Kevin M. Finn, P.E.  
IN P.E. License No. PE-19600032

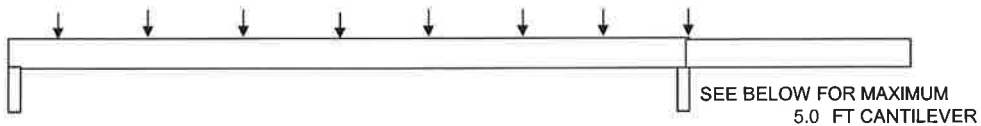


THIS CALCULATION CONSIDERS THE STEEL STRINGER BEAM CARRYING THE TRIBUTARY LOAD TO THE RAKER BEAMS.  
PROJECT REF: CENTER GROVE HS GREENWOOD

STRINGER SPACING = 672 PLF  
LOAD TO STRINGER = 672 PLF

TOTAL BLEACHER DEAD LOAD = 6 PSF  
6 FT O.C.  
LIVE LOAD = 100 PSF  
FOOTBOARD / SEATBOARD SPACING = 2 FT O.C.  
FOOTBOARD / SEATBOARD LOADING = 120 PLF  
NOTE - 120 PLF FOR EACH FOOTBOARD / SEATBOARD  
EQUATES TO 106 PSF - WORST CASE

APPLIED UNIFORM BEAM DEAD LOAD AT BEAM =  $Wd = 14.16$  PLF



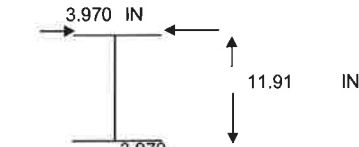
EFFECTIVE CLEAR SPAN OF STRINGER BEAM  $L = 14$  FT

APPLIED BENDING MOMENT TO EACH STRINGER BEAM  $M = Wd^2/8 = 16810.8$  FT-LBS

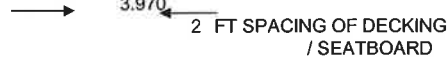
BM DEAD LOAD = 14.15556 PLF

STRINGER BEAM = USE W12 X 14 I-BEAM

$I_o = 88.6$  in<sup>4</sup>     $t = 0.200$  IN  
 $S_x = 14.88$  in<sup>3</sup>     $d = 11.91$  IN  
 $A = 4.16$  in<sup>2</sup>    width = 3.970 IN  
 $F_y = 36$  ksi    LDF = 1



RESULTANT BENDING STRESS =  $f_b = M/S_x = 13558.70$  psi  
 $F_b' = 21.6$  PSI



CHECK DEFLECTION  $\delta = 5WL^4/384EI = 0.214$  IN @ CENTER OF STRINGER BEAM

VS. ALLOWABLE DEFLECTION =  $L/360 = 0.4667$  IN

WIND UPLIFT @ 90 MPH - 12.5 PSF - NET AFTER SUBTRACTING APPLICABLE DEAD LOAD

UPLIFT REACTION = 1050.000 LBS - FOUR 5/8" x 2" BOLTS A-325 - OK

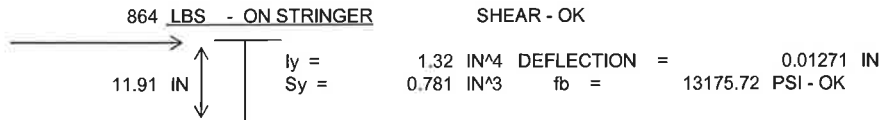
HORIZONTAL SHEAR - BASED ON 18 PSF x 10.75 FT HT./2 = 6

= 580.5 LBS - TWO 3/4" ANCHOR BOLTS - OK

REVIEW SWAY - 10 PLF LOAD PERPENDICULAR TO ROW OF BLEACHERS - REACTION = 360 LBS  
LESS THAN WIND REACTION  
WIND REACTION = 767.55 LBS

REVIEW SWAY PARALLEL TO ROWS OF BLEACHERS = 24 PLF x 6 ROWS x 6 FT

REACTION = 864 LBS - OKAY FOR TWO 3/4" BOLTS PER ABOVE



NOTE - ACCEPTABLE DEFLECTION = 0.0330833 IN - OK

CANTILEVERED LENGTH = 5 FT     $f_b = 6917.703$  PSI    OVERHANGING DEFLECTION = 0.149109448 IN  
VS. ALLOWABLE =  $2L/360 = 0.333333$  IN - OK

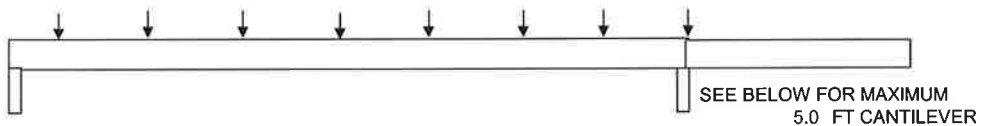


THIS CALCULATION CONSIDERS THE STEEL STRINGER BEAM CARRYING THE TRIBUTARY LOAD TO THE RAKER BEAMS.  
PROJECT REF: CENTER GROVE HS GREENWOOD

STRINGER SPACING = 6 FT O.C.  
LOAD TO STRINGER = 672 PLF

TOTAL BLEACHER DEAD LOAD = 6 PSF  
LIVE LOAD = 100 PSF  
FOOTBOARD / SEATBOARD SPACING = 2 FT O.C.  
FOOTBOARD / SEATBOARD LOADING = 120 PLF  
NOTE - 120 PLF FOR EACH FOOTBOARD / SEATBOARD  
EQUATES TO 106 PSF - WORST CASE

APPLIED UNIFORM BEAM DEAD LOAD AT BEAM =  $Wd = 11.50$  PLF



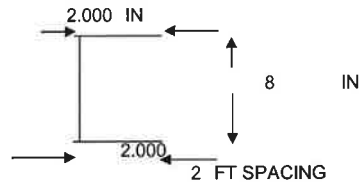
EFFECTIVE CLEAR SPAN OF STRINGER BEAM  $L = 14$  FT

APPLIED BENDING MOMENT TO EACH STRINGER BEAM  $M = Wd^2/8 = 16745.8$  FT-LBS

BM DEAD LOAD = 11.50139 PLF

STRINGER BEAM = USE C-CHANNEL 8 X 11.5

$I_o = 32.6$  in<sup>4</sup>     $t = 0.500$  IN  
 $S_x = 8.15$  in<sup>3</sup>     $d = 8$  IN  
 $A = 3.38$  in<sup>2</sup>    width = 2.000 IN  
 $F_y = 36$  ksi    LDF = 1



RESULTANT BENDING STRESS =  $f_b = M/S_x = 24656.37$  psi  
 $F_b' = 21.6$  PSI

CHECK DEFLECTION  $\delta = 5WL^4/384EI = 0.581$  IN @ CENTER OF STRINGER BEAM

VS. ALLOWABLE DEFLECTION =  $L/360 = 0.4667$  IN

WIND UPLIFT @ 90 MPH - 12.5 PSF - NET AFTER SUBTRACTING APPLICABLE DEAD LOAD

UPLIFT REACTION = 1050.000 LBS - FOUR 5/8" x 2" BOLTS A-325 - OK

HORIZONTAL SHEAR - BASED ON 18 PSF x 10.75 FT HT./2 = 6

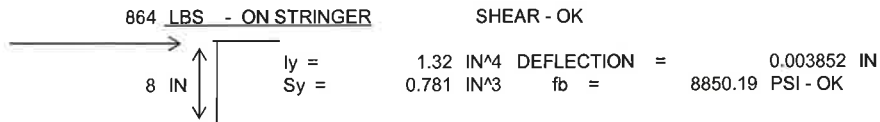
= 580.5 LBS - TWO 3/4" ANCHOR BOLTS - OK

REVIEW SWAY - 10 PLF LOAD PERPENDICULAR TO ROW OF BLEACHERS - REACTION = 360 LBS

LESS THAN WIND REACTION  
WIND REACTION = 767.55 LBS

REVIEW SWAY PARALLEL TO ROWS OF BLEACHERS = 24 PLF x 6 ROWS x 6 FT

REACTION = 864 LBS - OKAY FOR TWO 3/4" BOLTS PER ABOVE



NOTE - ACCEPTABLE DEFLECTION = 0.0222222 IN - OK

CANTILEVERED LENGTH = 5 FT     $f_b = 3144.945$  PSI    OVERHANGING DEFLECTION = 0.403680808 IN  
VS. ALLOWABLE =  $2L / 360 = 0.333333$  IN - OK



NOTE - THE ABOVE CALCULATION CERTIFIES THAT THE C8 X 11.5 C-CHANNEL FAILS IN BENDING AND DEFLECTION BASED ON THE INDICATED PARAMETERS.