FEASIBILITY OF USING COLD FORMED STEEL SECTIONS FOR MEDIUM SPAN PORTAL FRAMES IN SRI LANKA

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Declaration

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Abstract

Cold formed and thin walled steel (CFS) sectional members are used in building industry in many fields around the world. CFS sectional members are combined and used as a primary load bearing members on medium span structures. However use of combined CFS members on medium span portal frames in Sri Lanka is limited due to lack of knowledge.

This research is to design and analyze the feasibility of using back to back CFS lipped channels on industrial portal framed building. There were 16 nos. models selected with varying spans of 6m, 9m, 12m and 15m, heights 4m and 6m and bay distance 4m and 6m. The models were first analyzed with computer analysis software called PROKON and optimum sections of back to back combined CFS lipped channels were selected so that it's serviceability conditions were satisfied. Further the selected section sizes were revised until it's combined moment and compression overall buckling criteria $\left(\frac{F}{P_c}\right) + \left(\frac{M}{M_c}\right) \leq 1.0$ is satisfied. The major feasibility was carried through cost analysis with compared to hot rolled sectional portal frames are being constructed in Sri Lanka's western region. Therefore the wind speed kept as constant of 140 km/hr (Maximum wind speed in western region). Out of 16 nos. models 14 nos. models shows cost effective ad saving on cost varied from 14% to 21.5% and an average of 12.5%. 4m bay distance is economical than 6m bay distance. 12m span is found to be the most economical span in these models.

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Contents

NOTATIONS

f_{yb}	- Yield strength of cold formed steel coils
f_u	- Tensile strength of cold formed steel coils
s	- Spacing between two interconnections
r_{cy}	- Radius of gyration of one channel
F_s	- Shear force on interconnections
Q	- 2.5% of design axial force plus any load due to self weight or wind load
L_E	- Effective length of compound member
r_1	- Radius of gyration of compound section about the axis parallel to web
G_k	- Dead load
Q_k	- Live load
W_k	- Wind Load
W	- Design load on frames
V	-Wind Speed
Vs	- Design Wind Speed
S_1	- Topography Factor
S_2	- Ground roughness and building size factor
S_3	- Statistical concept factor
q	- Wind pressure
I_x, I_y	- Second moment of area of single cross section about x and y axes respectively
I_{xx}, I_{yy}	- Second moment of area of combined cross section about x and y axes respectively
Z_x, Z_y	- Elastic modulus of single cross section about x and y axes respectively
Z_{xx}, Z_{yy}	- Elastic modulus of combined cross section about x and y axes respectively
Z_c	- Compression modulus of section in bending
$\underline{x}$	- Distance from the shear centre to centroid of the combined half section measured along axis of symmetry

r_x, r_y	- Radii of gyration of single section about the x and y axes respectively
r_{xx}, r_{yy}	- Radii of gyration of combined section about the x and y axes respectively
r_{cy}	- Radius of gyration of a channel about its centroidal axis parallel to the web
e	- Distance between a load and a reaction
L_E	- Effective length of a member
Y_s	- Nominal yield strength of steel
Y_{sa}	- Average yield strength of a cold formed section
Y_{sac}	- Modified average Yield Strength
N -	- No. of full 90 bends with radius < 5t
p_y	- Design Strength of steel
Us	- Nominal ultimate tensile strength of steel
p_0	- Limiting compressive stress in a flat web
D_w	- Equivalent depth of a stiffened web
M_c	- Moment capacity of a cross-section
P_v	- Shear capacity or shear buckling resistance of a member
M_E	- Elastic lateral buckling moment of a beam
E	- Modulus of elasticity of steel
D	- Overall web depth
C_b	- Coefficient defining the variation of moments on a beam
t	- Net material thickness
M_Y	- Yield moment of a section
∩	- Perry coefficient
p_{cr}	- Local buckling stress of an element
P_{cs}	- Short strut capacity
P_E	- Elastic flexural buckling load (Euler load) for a column
A	- Cross sectional area of section
A_{eff}	- Effective area
x_o	-Distance from the shear centre to the centroid of a section measured along the x axis of symmetry

r_o - Polar radius of gyration of a section about the shear centre

β - Ratio of end moments in a beam or Constant

P_{EX}, P_{EY} - Elastic flexural buckling load (Euler load) for a column about x and y axes respectively

C_W - Warping constant of a section

d - Flat depth of a section

b_L - Lipped height

H_p - Heated perimeter

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