

Investigation of Flexural Behaviour of Channel Section with and Without Web Openings by Using Cold Form Steel

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ABSTRACT: The future head cold forming steel (CFS) in structure is use more by his advantages compare to hot rolled form steel. The cold form steels thickness is smaller than the any other steels. In our projects experimental study and the theoritical study of flexural behaviour of the channel section beam by using cold form steel sheets having the thickness of 2mm easily buying of steel market at adoptable price compare to other steel materials. We are comparing the flexural behaviour of the channel sections one is face to face channel section with lips without the perforations and another is face to face channel section with lips and with the rectangular web openings. The experimental study of the beam is tested by the two points load test as to find the flexural strength and to check the local buckling on the beam during flexure. The comparision of deflection due to the ultimate load on the sample beams of plain webs and with web openings on the beam as to be tested. In experimental study the beam length is 1.2 m and the sample dimensions are 150×80×2 mm and having the lip size of 15mm. the web opening dimension is based on the steel behaviour studies as the reference is 100×70 mm as rectangular opening with 100mm spacing on the beam and the supports to opening to provide 250mm spacing on both support ends. In the web opening beams to reduce the area of steels as 15.6% as compare to without web opening beam. The experimental study is similarly same as to the theoritical study in flexural behaviour of the beams.

KEYWORDS: cold form steel channel section, cold roll perforation channel, CR web openings.

I.INTRODUCTION

The cold forming steel or the cold rolling steel members are use in construction widely on many countries so the members are having nominal thickness so in future they replace all the steel member as the advantage of workability. The cold form steel is thin sheet extensively used in construction industries as purlins of roof sheet and as a supporting beam. This light gauge steel sections are used in basic construction work by his advantage the trends may improve and future as leed of all steel sheets. The manufacturing of steel is without heat the cold formation may done so the thickness of cold roll steel is 1 to 3 mm and also be increase the steel thickness as requirement as formed pre galvanising material. The steel strength of the cold form steel is 280 N/mm² and also it may use 230 N/mm². Web openings of the cold form steel is suitable as advantage of high strength. As the channel section is having lips may give high strength and the area of the section may depend the strength of the section. Perforation dimensions are based on the depth of the CR member and the cold form steel depth is increase means of strength may higher.

A. Advantages

- strength properties as to be improved
- Lightness in weight
- Accuracy of dimension
- Heating required is neglect.

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B. Disadvantages

- Ductility is lesser in cold form steel
- More power equipment is required for fabrication.
- Higher force required for deformation.
- Strain hardening is occurred.

Objective

- The aim of the project is how to behave the flexural strength of web opening beam compare to without opening beam by using cold form steel.
- Beams are having lipped channel sections in that with perforations so reduce of steel area.
- Cold form steel have light weight with high strength so reduction of steel 15.6% how to behave the strength.
- The lipped channels helps to counteract the failure in local buckling and the distortional buckling.

Scope

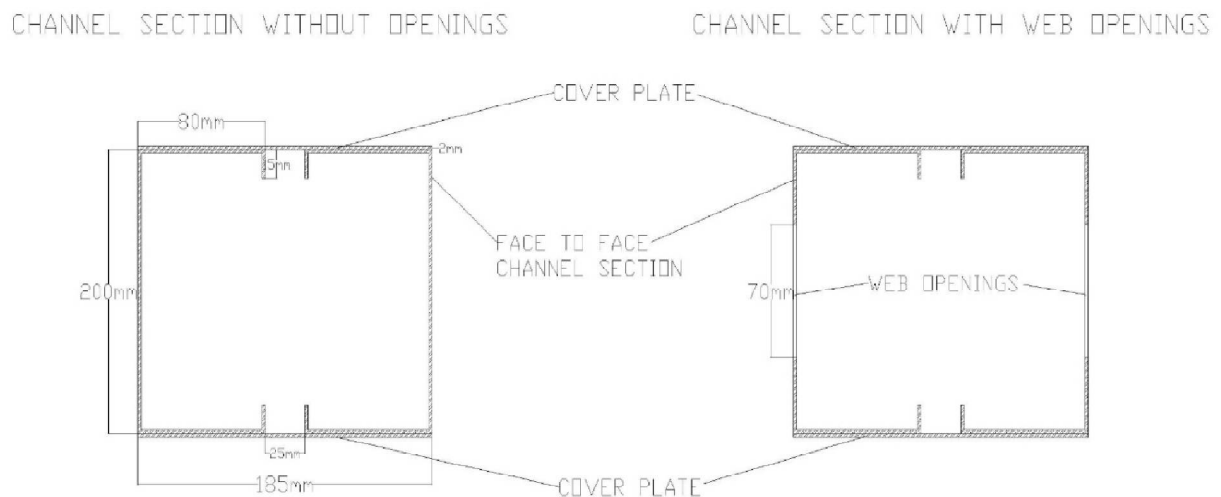
- The comparison experimental study and the theoretical study of the channels sections beam.
- To attain the same strength in the web openings provided beams to usefull of future development.
- The face to face channel sections having more strength and having adoptable shape so providing openings in web area slight change of behaviour of strength seen by the experimental study.

II. SPECIAL PERFORMANCE COLD FORM STEEL SECTION

- 1) weight is lighter than any other steel
- 2) The loading capacity is high
- 3) High strength and stiffness
- 4) Easy to prefabrication and handling
- 5) Fast and easy to installation and erection
- 6) Non shrinkage and non-creeping at ambient temperature
- 7) It as Easy to transporting
- 8) Uniform quality
- 9) It as recyclable material
- 10) It as Non combustibility

III. FRABICATION OF COLD FORM STEEL SECTION

The materials of this project is cold form steel of thickness of 2mm and there are two specimen one is face to face channel section with lips and also top and bottom of cover plate without the web openings on the C sections and another sample is face to face channel sections with lips and web openings. The channel sections beams lengths are 1.2m and having the dimension of 150×80×2mm and the lips size are 15mm then the web opening is provided as the rectangular in shape and the dimensions is having the size of 100×70mm and the spacing between the two openings are 100mm and the end supports to the opening is 250mm as spacing based on the shear higher in the supports.



The channel sections are placed face to face with 25mm spacing and the connections of cover plate and channel sections is by welding connections with 100mm spacing based on the design criteria.

WEB OPENINGS

The web openings in the beams is based on the shear concept so the shear force is in lower area to reduce the steel area by rectangular perforations(web openings). The end supports to having the higher shear so if provide opening leads to shear failure so the spacing of openings to supports is to provide two times of depth of the beam. The rectangular openings is provided with the dimensions of 100×70mm is based on the steel behaviour studies so the length of the opening is 0.67 times of depth and the width is 0.47 times of depth. The spacing between two openings are 100 mm according to should excess the depth of the beam.

Name of the specimen	Face to face Closed builtup channel section
Beam section	L x B x D x Lips
Depth, d (mm)	200
Width, b (mm)	80
Lips (mm)	15
Thickness of cover plate ,t (mm)	2
Design strength, f_y (N/mm ²)	350
Length of beam (mm)	1000
Type of weld	Intermediate weld
Total length of weld (mm)	500
Weld spacing (mm)	100

IV.EXPERIMENTAL STUDY OF CR STEEL SECTION

The study of cold form steel channel sections is tested as two samples they are without perforation and with perforation beam samples.the flexural strength of both the type of the beam as to notice and find the difference of compression stress on the beams.

There are two samples

- Without perforation
- With perforation

The samples are to be tested on the single point flexural strength test machine to know the load capacity.

WITHOUT PERFORATION

The beam is one metre long in that there is no web openings so the beam is full covered as the hollow. The flexural capacity of the beam is 86.37 N/mm² as to be achieved as the stress.

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WITH PERFORATION ON BEAM WEB

The beam is having the web openings and the openings is based on the shear concept so the loads may with stand as 84.43 N/mm^2



V. TESTED RESULTS

The beams samples are to be tested and find the difference of the loads carrying capacity of the beam. The beam without perforation may fail on the lateral buckling on the load of 33.51 KN than they decreased. The beam having perforation is also may give equal strength or slight down fail in lateral on the load of 32.76 KN so by the reduction of 13.5 % of steel in the beam may also give the strength as compare to the sample beam of without perforation.

WITHOUT PERFORATION		WITH PERFORATION	
DEFLECTION (MM)	LOAD (KN)	DEFLECTION (MM)	LOAD (KN)
2.409	33.477	1.675	27.557
2.428	33.511	1.694	27.467
2.485	33.507	2.003	24.544
2.56	33.482	2.457	24.215

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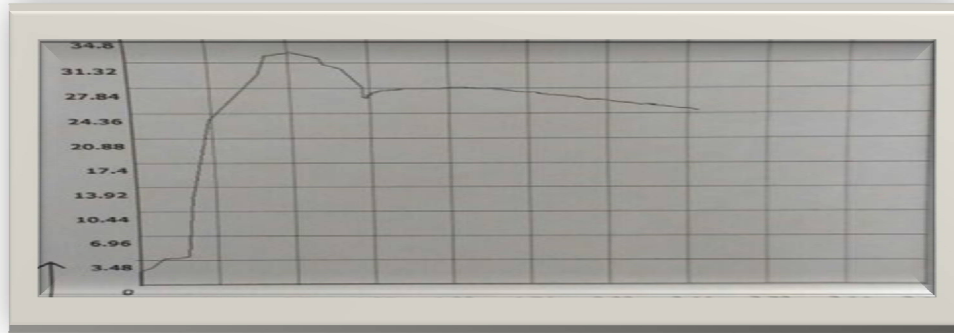
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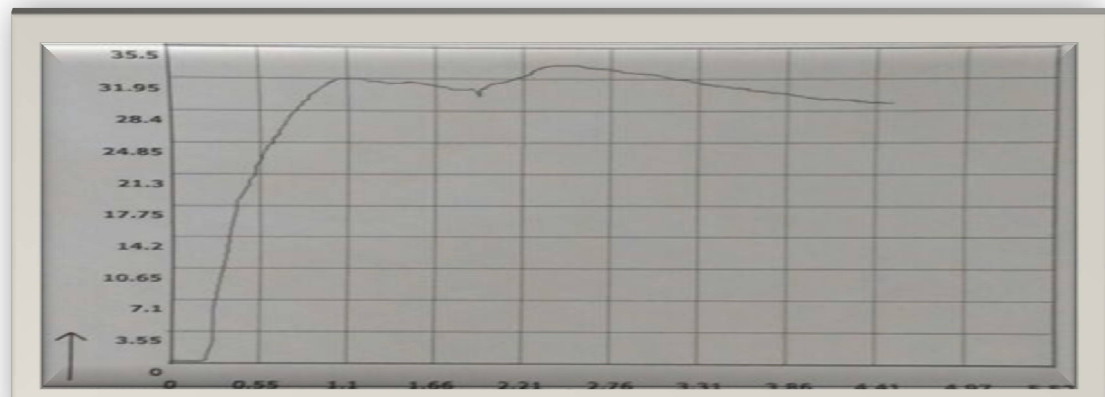
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WITH PERFORATION



WITHOUT PERFORATION

VI. CONCLUSION

The cold form steel section is use more in the construction field as the result the beam is having the openings is may also stable the load applied on it and there is reduction of steel as 13.5 % as the result similar difference on the beams with and without perforation. The steel member is having the strength but the reduction of steel may not affect the strength of the steel in the web openings member as to give the slightly reduce of strength to compare to the without perforstion beam.

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