Experiment of comparing coldformed steel shear connection using 2 self drilling screw and sikadur 31cf normal adhesive

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Abstract. Screw connection is prefered used by applicator because of it’s simple. Type of screw usually used is Self Drilling Screw (SDS). This type of screw will become fix as it’s screwed by the applicator until its head, almost all applicator able to make this connection and do not need some course or sertificate to become an applicator, does not like applicator of High Tension Bolt, HTB. But this type of connection has some disadvantages, for example it’s connection doest not suit to dynamic loading. The experiment results that galvalume material has Yeilding Force, fy = 580 Mpa and Ultimate Force, fu = 590 Mpa. Connection of 2 SDS screw vertically configured fail on about tension loading 6000 N less than horizontally configured that fail on about 7500 N. Displacement of 2 SDS screw vertically configure on about 0.6 mm less than horizontally one that fail on displacement 0.85 mm. For adhesive of Sikadur CF 31 connection fail on loading about 6000 N tension loading but its displacement is less than 0.5 mm when it fail, for 2 type of connection configured.

1. Introduction
The development of material invention in building structure grows so fast. Many demand on cheaper material dan faster application produced many inventions. Galvalume, one of newest solution to build a cheap, relatively good fire resistantance and fastly applicated. Its can predicted that, in the future, the wood position as a roof material structure and ceilling structure in the future will be replaced by galvalume. Especially in indonesia house building.

2. Material and Method
Material properties of material galvalume got from experimental and the adhesive got from its brochure. The Brochure of sikadur 31 cf normal mention all the material properties as needed.
2.1 Galvalume Tension Test
This type of test using universal testing machine, to investigate the mechanical properties of material galvalume. Galvalume of Profile C75 cuted as mentioned in ASTM A 370-03a as the figure 1. bellow.
the four specimens the average value of the yeilding stress and the test object was taken out. Obtained
Fy = 587 mpa and Fu = 598 mpa. The modulus of elatisitas is showed in Table 4 as follows.

3. Result and Discussion
From the manual calculation, it is found that the test object will yeild when the load is 468 kg and fail
at 516 kg load. As for the detailed calculation of yeilding and ultimate load is as follows.

Table 1. Coding The Specimen

| No | coding | Specimen configuration          |
|----|--------|---------------------------------|
| 1  | S2H    | Specimen with 2 screws Horisontally |
| 2  | S2V    | Specimen with 2 screws vertically |
| 3  | L2H    | Specimen adhesive 2 Horisontally |
| 4  | L2V    | Specimen adhesive 2 vertically   |
| 5  | GALV   | Specimen of galvalume            |

Source : Author

Coding of the specimen as in the Table 1 above. In this experiment used diameter df = 4.22 mm, then
the minimum distance between the screw centers is 3 x 4.22 = 12.66 mm. For that use the screw
connection model as shown in Figure 3.
Figure 3. Connection Screw with Horizontal Configuration and Vertical Configuration

it can be predicted that the connection will fail first before the failure of the connected material (galvalume). The test results of adhesive connection (L2H) can be viewed in the table and graph below.

Figure 4. The result of horizontal adhesive connection test

The result of testing of horizontal adhesive connection (L2H) shows that the adhesive connection capacity is 640 kg. Smaller than the predicted load capacity manually reaching 950 kg. So when examined the adhesive capacity is not able to reach 10 N / mm2 as stamped on brochure specification of adhesive Sikadur 31 Cf Normal.
Figure 5 shows that the adhesive connection reach the tensile capacity about 600 kg, and the displacement before it fails about 0.4 mm. While compared to the adhesive connection with the horizontal configuration (L2H) with vertical configuration (L2V) it is seen that the connection with the horizontal configuration could receive a larger tensile load (up to 640 kg) than the adhesive configuration adhesive joint (which is only 600 kg) as shown in figure 6.

Figure 6. Comparison graph of screw connection results
Horizontal-vertical

From figure 6 we can take a note that comparing connection adhesive configured horizontal versus vertical, the horizontally configuration has a bigger capacity and bigger displacement before it fail. Horizontal configuration fail at loading value about 650 kg, but the vertical configuration just about 600 kg. Its may because of the horizontally configuration realtively work simultan, such as the screw
connection (see figure 7). Figure 7 shows that the horizontally configuration has a bigger capacity and displacement both for adhesive and for screws.

Figure 7. Comparison graph of screw connection vs adhesive connection results
Comparation between connection screw and adhesive sikadure 31 cf normal can be seen on figure 7. Adhesive connections have a lower capacity and shorter displacement than the screw connections. The horizontal configuration, for screw and adhesive connection, has a bigger tension load because the connection works simultaneously. For example screw connection, the 2 screw work together against the load.
Screw connection for 2 screws has a bigger capacity than the adhesive connection and longer displacement, as shown in figure 7. More ductile fail model shown in the screws connection, and the brittle fail model shown in the adhesive connection. That's why the adhesive of sikadur 31 cf normal is not recomend for the galvalume roof structure connection. Although for other case its may has a bigger capacity but the non-ductile connection is not suit for the roof or ceiling structure.

4. Conclusion
The Experiment result that the screw connection has a relatively bigger capacity than adhesive, sikadur cf normal. The experimental of 2 screw test result that the 2 screw horizontally connection reach the load over 700 kg as the adhesive just reach around 600 kg both of horizontal and vertically connection.
The experimental test result that the displacement of screw configured horizontally reach the value about 1 mm. This is bigger than the both of adhesive connection, vertical and horizontal, that just reach about the half of it. Its describe that the screw connection is more ductile than the adhesive, sikadur 31 cf normal, connection.
This experiment result is not recomend to use adhesive, sikadur 31 cf normal, for galvalume roof structure connection because of its sudden fail. People who are in the building has no time to escape if its connection fail.

5. References
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