Experiment Study on Wind Resistant Performance of Standing Seam Roof System with Anti-wind Clip

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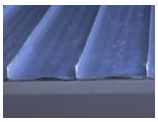
Abstract

Wind uplift accidents frequently occur in the standing seam roof system, which is used as the envelope of large-span roofs. Although the application of the standing seam roof system is early in abroad, systematic experiments and numerical simulation studies have been carried out on the wind resistance performance, and a standard test method for wind resistance of the roof system has been proposed[1]. But, considering that there is a big difference in the shape of the standing seam roof system between China and abroad, see figure 1, relevant research results cannot be directly adopted, so it is necessary to carry out independent research. At present, most of the experimental and numerical studies in China have not considered the influence of anti-wind clip on the wind resistance performance of roof system.

a) Roofing system in China



b) Roofing system in abroad

Fig.1. The comparison of standing seam roof system in China and abroad

Table 1 Experiment conditions

NO.	Plates width(m)	Clip spacing (m)	Anti-wind clip	Loading method
1	0.3	1.0	without	reverse ststic
2	0.3	1.0	with	reverse ststic
3	0.4	1.0	with	reverse ststic
4	0.4	0.5	with	reverse ststic
5	0.3	1.0	with	dynamic
6	0.4	1.0	with	dynamic

The reverse static loading and dynamic loading experiment was carried out, the conditions are shown in table 1. The strain gauge is used to collect the stress changes in various areas of the roof system during the loading process.At the same time, the lateral displacement of the joints of roof plates is recorded by means of the laser displacement meter.

The results show that (i) with anti-wind clip can obviously improve the bearing capacity of roof system more than double. When there is no anti-wind clip, roof plate separation occurs at the joints of the roof plates, resulting in the occlusion failure. but the stress of the roof plate is lower than the yield strength. For the roof system with anti-wind clip, the anti-wind clip improves the occlusal strength of the joints, and makes the stress of the roof plate near the anti-wind clip increase rapidly to the ultimate strength, and then causes tearing failure. (ii) The capacity of the roof system is increased by the installation of anti-wind clips, the reduction of plate width and the spacing between the clips. (iii) The failure mode of roof system mainly depends on the maximum stress of roof plate and the lateral displacement of joints. When the maximum stress of the roof exceeds the ultimate strength first, the tearing failure occurs. When the lateral displacement of the roof plate at the joints reaches 2mm first, the occlusion failure occurs.(iv) Dynamic loading will reduce the bearing capacity of roof system and change the failure mode.

References

[1] ANSI/FM 4474-2004,Test Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and Negative Differential Pressures[S].USA,2004.