NRC·CNRC Construction

Cladding Deflection Evaluation for Wayne Building Products Lux Panel

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A Report for:

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Final Client Report

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Executive summary

This report details the cladding deflection evaluation completed for the Wayne Building Products Inc. Lux panel, conducted by NRC Canada. The evaluation consists of subjecting the client constructed 2.44m x 2.44m cladding assembly to a cladding deflection test protocol consisting of static pressures of positive and negative 0.5kPa, dynamic cyclic pressures of positive and negative pressures of 1555 Pa, and one time gust pressures of positive and negative 2321 Pa. The test protocol was conducted in the NRC wind load aging test apparatus. The specific test protocol was derived from the CCMC Wind loading protocol from *CCMC Technical Guide Master Format 01 46 45.01, for Evaluation of "Lap Siding/Panel Siding"*. Deflections of the cladding, studs and OSB sheathing board were monitored throughout the test to determine the net deflection of the cladding itself when subjected to the loading protocol described. At the conclusion of the testing the wall specimen was visually inspected for damage to the cladding, cladding fasteners, stud and OSB sheathing. Through both before and after measurements and visual inspection, it was determined that no permanent deflection or visually apparent degradation was observed in the cladding.

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1 Purpose

The purpose of the wind load testing will is to provide information that will serve as a performance indicator for Wayne Building Products Inc. Lux panels and demonstrate the ability of these panels to withstand simulated cladding wind loads up to and including loads as might be found on the exterior of an 18 storey building in Alberta, Canada.

2 Approach

The test evaluation was conducted in accordance with ASTM E330[1], Procedure B, to the loading protocol as provided in the *CCMC Technical Guide* [2] and in the section entitled: "Wind Loading protocol". The pressure levels at which the panels were tested in this evaluation were determined based on information provided by the client for a 51.25 m tall building located in Calgary, Alberta (provided in Appendix A), and load levels specified from the CCMC technical guide[1].

2.1 Specimen construction

The specimen used in the evaluation was constructed by the client and shipped to NRC; it was received on January 5, 2016. It measured 2.44m by 2.44m (8-ft. x 8-ft.) and consisted of non-load bearing steel studs spaced at 400 mm (16-in.) on center, with OSB as the sheathing board. The OSB sheathing was butt jointed at the vertical centre of the wall (1.22 m, 4-ft.). The specimen is shown in Figure 1.

Figure 1: Photos of cladding deflection test specimen showing exterior (left) and interior (right)

[1] ASTM E330 ASTM E330 / E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference, ASTM International, West Conshohocken, PA, 2014.
[2] CCMC Technical Guide Master Format 01 46 45.01, for Evaluation of "Lap Siding/Panel Siding"

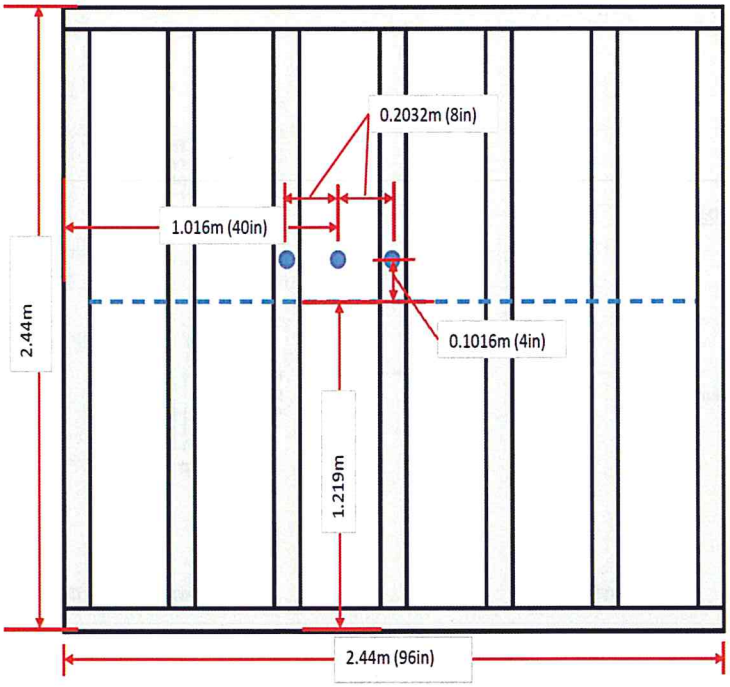

Figure 3: Displacement sensor locations.

2.3 Wind load cladding deflection test protocol

The wind load cladding deflection test protocol was conducted in accordance with ASTM E330 Procedure B[1] to wind loads calculated from information provided by the client (Appendix A) and load tables provided in the § on the Wind Load Resistance protocol of the *CCMC Technical Guide*[2]. The wind load aging protocol as well as the pressure levels tested are described in Figure 4 and Table 1. To be considered a pass, the cladding must be capable of resisting the positive and negative forces generated by the design wind loads without any fracture or permanent deterioration of the surfaces resulting from such design loads.

3 Test results

As previously described in the section on *Instrumentation*, cladding deflection was determined at the centre of the stud cavity, and at the stud. The net cladding deflection was determined at each location (centre of stud cavity and stud) by subtracting the deflection of the stud and sheathing board from the total wall deflection.

During the portion of the test where negative cyclic loads acted on the test specimen , the steel studs on one side of the specimen buckled in their center height at approximately -800 Pa pressure. To complete the cladding deflection test, these studs were thereafter reinforced with plywood horizontal strapping. As the purpose of this evaluation was determining cladding deflection under loads, and not deflections of the test specimen, no assumptions are made regarding the performance of this wall configuration under field loading conditions. However, care should be taken to ensure that the steel stud gauge is properly selected for the expected wind loads in a full scale wall design. Photos of the buckled steel studs and plywood strapping that were used in the test are shown in Appendix B. Through visual observation the buckled studs did not have any effect on the cladding.

The cladding deflection at the stud locations was averaged and the deflection results for Phase 1 (static) load profile are presented in Table 2.

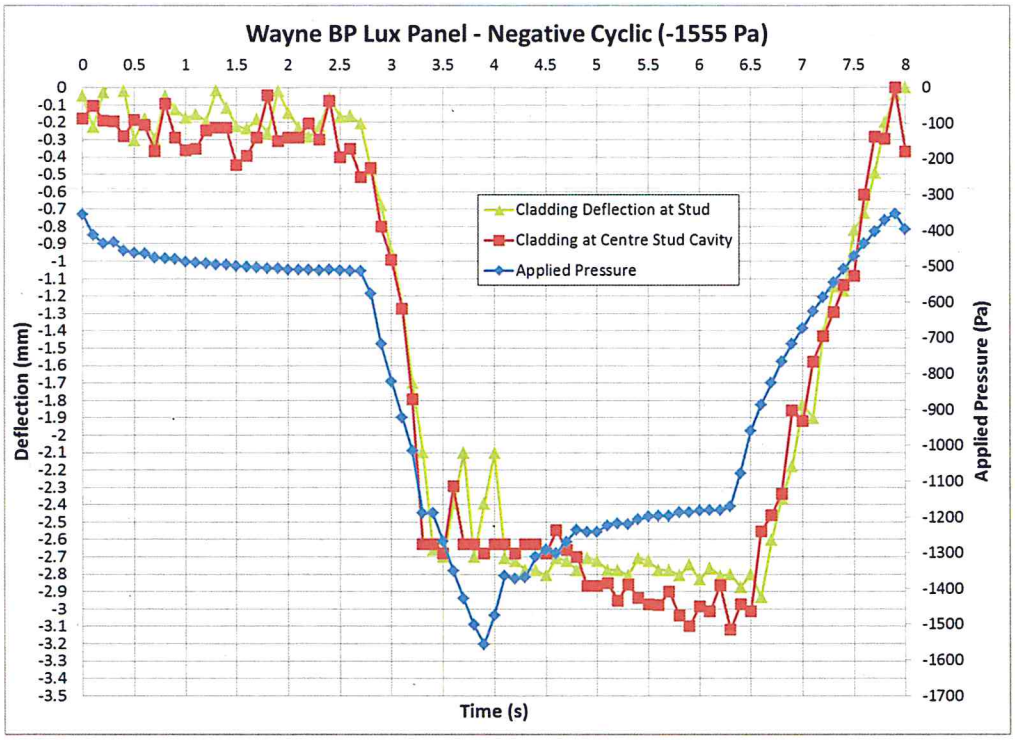

Figure 6: Representative cladding deflection test results during the negative cyclic applied pressure.

Cladding deflection profile during the Phase III loading protocol is shown in Figure 7 and 8 for the positive and negative loading protocols. The maximum deflection during the test is given in Table 3.

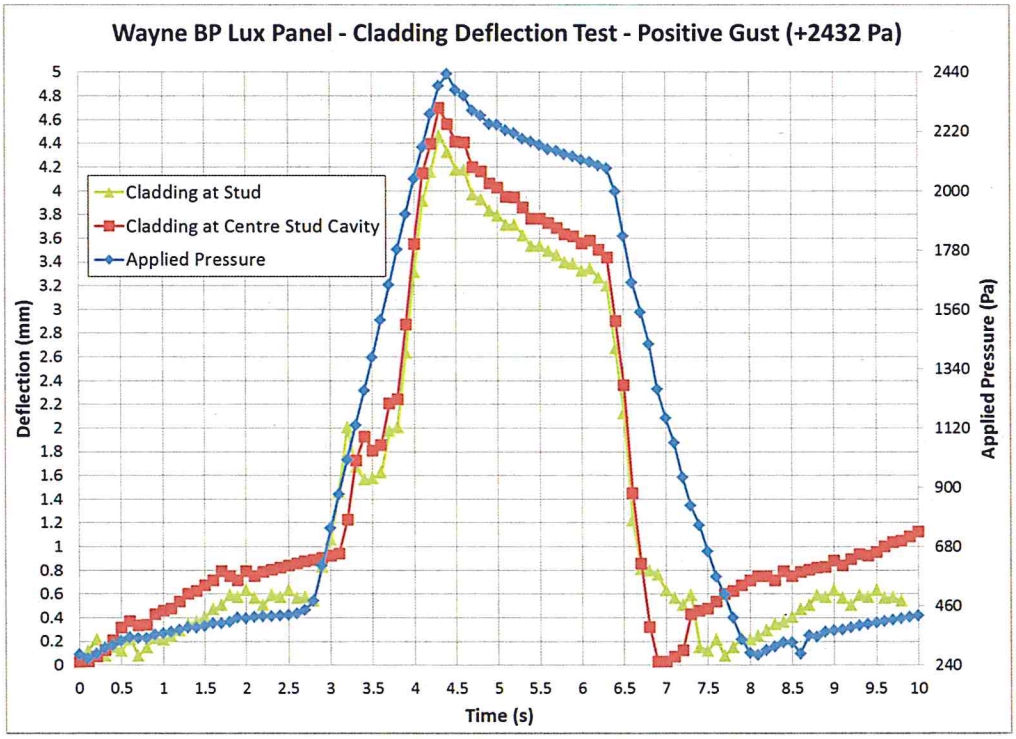

Figure 7: Representative cladding deflection profile during a positive gust loading

locations. Visual and measurement results of the cladding after testing showed that no permanent deterioration or fracture of the cladding occurred during testing. The measured deflection results showed that the maximum cladding deflection during testing was 4.70mm. It should be noted that although the cladding suffered no permanent deflection or visually apparent degradation during testing, this was not the case for the steel studs. During negative load testing the steel studs on one side of the specimen buckled at their center, and subsequently required support of horizontal plywood strapping to complete the cladding deflection testing.

Care should be taken when using this wall configuration in the field to ensure that the stud gauges are properly sized for the intended use.

Appendix B – Photos of Buckled studs and plywood strapping

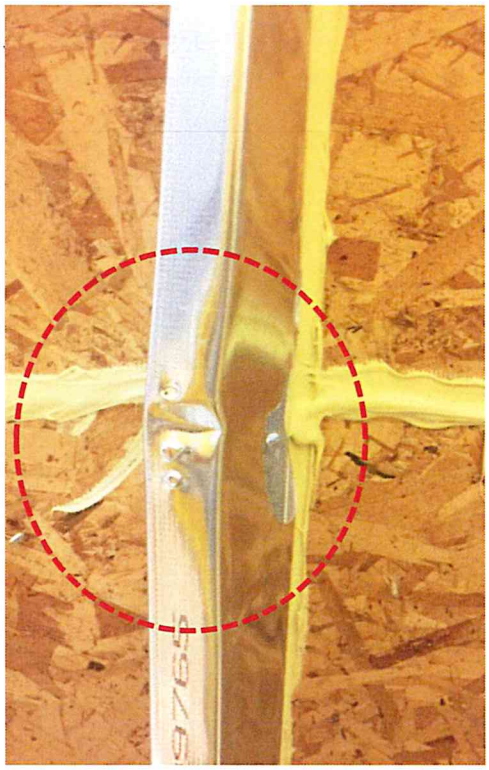

Figure 9: Photo of one buckled stud. This occurred during the negative cycling at approximately -800Pa.

Figure 10: The buckled studs were straightened and reinforced with 3/4in plywood strapping so that the cladding deflection tests could be completed.