MK & Associates

Expert Report

17-095: NACSP Fall Protection System Certification of Testing

Submitted to:

Mr. Ronald Kempker

February 1, 2018

By:

Mark A. M. Ezra, PE
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Descriptive Information

This report has been prepared in compliance with ASTM Designation E 620-04, "Standard Practice for Reporting Opinions of Technical Experts." It was prepared on February 1, 2018, under our file titled "17-095: NACSP Fall Protection System Certification." The opinions contained within have been rendered by Mark A. M. Ezra, PE of MK & Associates, LLC., P.O. Box 460440, St. Louis, Missouri 63146.

The following items have been reviewed and inspected:

1. An exemplar test section 60 foot in length of the subject roof perimeter fall protection system installed on a warehouse roof;
2. 24 photos taken by the author on the date of testing, February 1, 2018, of the 60 foot exemplar test set up for the subject roof perimeter fall protection system, as it was installed for testing;
3. United States Department of Labor OSHA regulation 1926.502 for Construction Fall Protection.
4. United States Department of Labor OSHA regulation 1926.502(b)(3) for Construction Fall Protection load;
5. United States Department of Labor OSHA regulation 1926.502(b)(4) for Construction Fall Protection load;
6. (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (1)(a);
7. (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (1)(b);
8. (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (1)(c); and
9. (SOR) Statutory Orders and Regulations / 86-304 / 2.12 (2);

Persons present during the load testing of the subject fall protection system were Mark A. M. Ezra, PE (author), Mr. Ronald Kempker, and Mr. Thomas Scheppers.

Testing was conducted at a builder facility located at 3807 Route CC, Jefferson City, MO, 65109. The exemplar 60 foot run of exemplar perimeter fall protection system was installed on a flat roofed warehouse structure, located at the above address. We were informed that the warehouse structure was approximately 44 years old at the time of the test.

The purpose of the presence of Mark A. M. Ezra PE, the author, was to certify the load application to the test section of the exemplar perimeter fall protection system during the system conformance tests and the results of the test load application.

Pertinent Facts

When the author arrived at the test site on February 1, 2018, the subject exemplar 60 foot long test section of the roof perimeter fall protection system was already installed. Mr. Kempker supplied a mechanical scale, which was to be used for the required load application during the actual testing of the upper run or rail of the fall protection system. The author, with Mr. Kempker and Mr. Scheppers, proceeded to calibrate the mechanical load scale used for load application by first measuring a load on a previously calibrated digital weigh scale. This calibration load was 210 lbs. This same calibration load was then placed on the mechanical load scale to be used for load application in the testing. The zero set point adjuster of the mechanical scale was then turned in the appropriate direction such that the mechanical load application scale read 210 lbs. This calibrated the mechanical load scale in the range of the test load(s) to be used during the testing of the fall protection system.

Post testing verification of the ***calibrated digital electronic scale*** showed that the electronic digital scale was reading a calibrated 196 lbs. load as 196.2 lbs. Therefore, a small error of ***1/10th of 1% of load*** existed in the calibrated digital scale at this post-testing verification. The calibrated digital scale used at certification testing for the fall protection system is therefore considered accurate since the mechanical scale used for load application could only register to +/- 1 lb. Therefore, a calibration error of 0.2 lb. in 200 lbs. is considered negligible and has been ignored.

Testing

Figures 1 through 24 are photographs of the test set up; Figure 1 shows the complete 60 foot test section. On the left of Figure 1, one of the terminating stanchions is seen, then moving to the right in the photograph the next vertical element is a mid-rail. Further to the right, a standard stanchion is seen. The load during testing was applied in the middle of the section situated between the 1st mid-rail and the second stanchion, seen in Figure 1 of the test set up.

Figure 10 shows the test set up with the feet of the stanchions and mid-rails located on the above mentioned 2"x4" pieces of lumber. These pieces of 2"x4" wood served to protect the roof surface of the warehouse used for testing as well as providing a clean horizontal reference plane for measurements during testing. Figure 8 shows the "come-along" manual winch used to tension the top cable run. The cable is multi-strand ¼ inch diameter steel cable. Figure 9 shows the anchor plate used at one end of the test set up and the two "come-along" manual winches used for all the cable runs.

Figure 16 shows the 39 inch high role tape set up as a "go/no-go gauge" for the maximum deflection of the top cable run. Figure 16 further shows the positioning of the

mechanical load scale used to apply the test load and the manner that the test load will be applied. Figure 18 shows the upper end of the "go/no-go gauge" relative to the top cable run of the perimeter fall protection system prior to load being applied.

Discussion of Opinions and Basis Thereof

The exemplar perimeter fall protection system, whose testing was witnessed by the author on February 1, 2018, is to be marketed under the name "Fall-Ban," manufactured by North American Construction and Safety Products, LLC. This general concept of fall protection by placing a temporary guard rail at the edge of a roof surface during work being performed on a roof, is standard industry practice. In the United States of America, such temporary work guarding is required by OSHA regulation. Similar workplace requirements exist in Canada. The purpose of the witnessed testing on February 1, 2018 of the Fall-Ban design of a perimeter fall protection system is to certify that it conforms with both United States Department of Labor OSHA regulation 1926.502 as well as the Canadian regulation SOR/86-304 section 2.12 (1)(a).

It should be noted that a complete assembled 60 foot section of the "Fall-Ban" system was tested on an actual roof as it would be installed if the test roof were being worked on. Therefore, the testing witnessed represented "real life" conditions of installation and not a testing laboratory set up, which often lacks any direct relationship to "in-use" system set up.

Both the United States Department of Labor OSHA regulation 1926.502, as well as the Canadian regulation SOR/86-304 section 2.12 (1)(a), require that the top run or rail of a guard rail system withstand a load of 890 N load (200.08 lbs.). The OSHA regulation explicitly states that under such a load application the upper rail shall not deflect to a height of less than 39 inches above the base plane on which the guardrail is mounted. The testing witnessed that both

the test loads applied, sequentially and in orthogonal directions, were in excess of the regulation required 890 N/200 lbs. test loads. Further, the deflection of the upper cable run of the Fall-Ban perimeter fall protection system did not, under the vertical test load, deflect to a height less than 39 inches above the horizontal reference surface on which the exemplar Fall-Ban perimeter fall protection system was mounted. No failure of the upper cable run or other components of the exemplar Fall-Ban occurred. It was further noted that upon removal of the 890+ N/200+ lbs. test load, the Fall-Ban system returned immediately to its original unloaded shape and position without the need for any remedial tightening of cables or adjustment of the test installation.

After the vertical load testing to 890+ N / 200+ lbs. was completed and without adjusting or re-tensioning the system, an outward load at 90 degrees to the vertical load and in the direction of the drop-off side of the roof was performed. The system did not fail or buckle and upon removal of the outward load, the Fall-Ban system returned immediately to its original unloaded shape and position without the need for any remedial tightening of cables or adjustment of the test installation.

After the vertical load testing to 890+ N / 200+ lbs. was completed and without adjusting or re-tensioning the system, an upward load was applied in the same place, but in the opposite direction to the vertical downward test load. The system did not fail or buckle and upon removal of the outward load, the Fall-Ban system returned immediately to its original unloaded shape and position without the need for any remedial tightening of cables or adjustment of the test installation.

Test Results:

1. Vertical loading to **205 lbs./911.8 N** resulted in the top cable run descending to a height of ***39.5 inches*** above the reference horizontal measuring plane; and

2. **Outward loading of 210 lbs./934.1 N** at 90 degrees to the vertical test loading direction was fully supported by the Fall-Ban system with no permanent deformation of the system being observed upon load removal.
3. **Upward loading of 210 lbs./934.1 N** in line with the vertical test loading application point was performed; This upward test load was fully supported by the Fall-Ban system with no permanent deformation of the system being observed upon load removal.

Opinions and Conclusions

It is our opinion within a reasonably degree of engineering certainty, that:

1. The testing conducted on the exemplar Fall-Ban perimeter fall protection system shows that the system meets and exceeds the vertical load requirements of both the United States Department of Labor OSHA regulation 1926.502, as well as the Canadian regulation SOR/86-304 section 2.12 (1)(a); and
2. The testing conducted on the exemplar Fall-Ban perimeter fall protection system shows that the system meets the outward loading requirements of both the United States Department of Labor OSHA regulation 1926.502, as well as the Canadian regulation SOR/86-304 section 2.12 (1)(a).

Signature

Opinions given by:

Mark A. M. Ezra

Mark A. M. Ezra, Professional Engineer, Missouri License, No. E 2002003156

M.E.

17-095.mae

EXHIBIT A

State of Missouri

Department of Economic Development
Division of Professional Registration
The Missouri Board for
Architects, Professional Engineers, and Professional Land Surveyors

hereby certifies that

Mark A.M. Ezra

is duly registered and authorized to practice as a

Professional Engineer

by law in the State of Missouri while this certificate remains unrevoked or unexpired. In Witness Whereof, we have affixed our hands and the Seal of the Board, this 14th day of February, 2002.

Paul R Mungo
Chair of the Board

Donald L. Viatte
Chair of the Engineering Division

Cheri J. Leija
Member

Josephine L. Emrick
Member

Registration No. E-2002003156

FIGURES

Figure 1

Figure 2

Figure 3

Figure 4

Figure 11

Figure 12

Figure 13

Figure 14

Figure 15

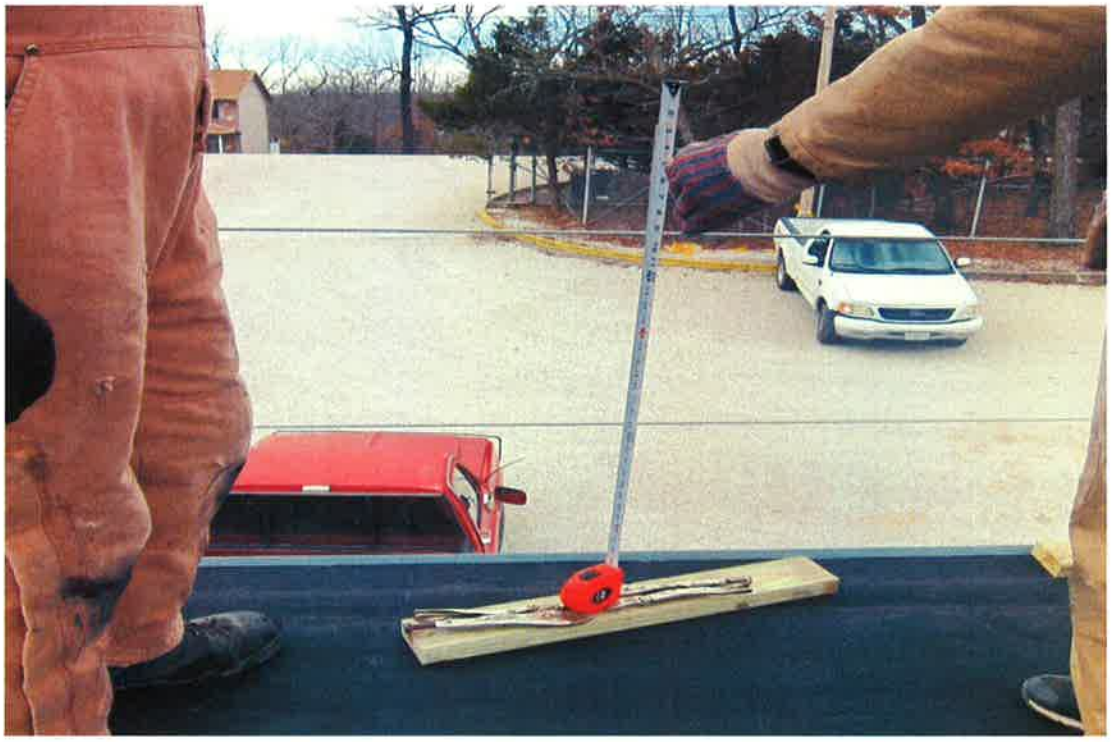

Figure 16

Figure 17

Figure 18

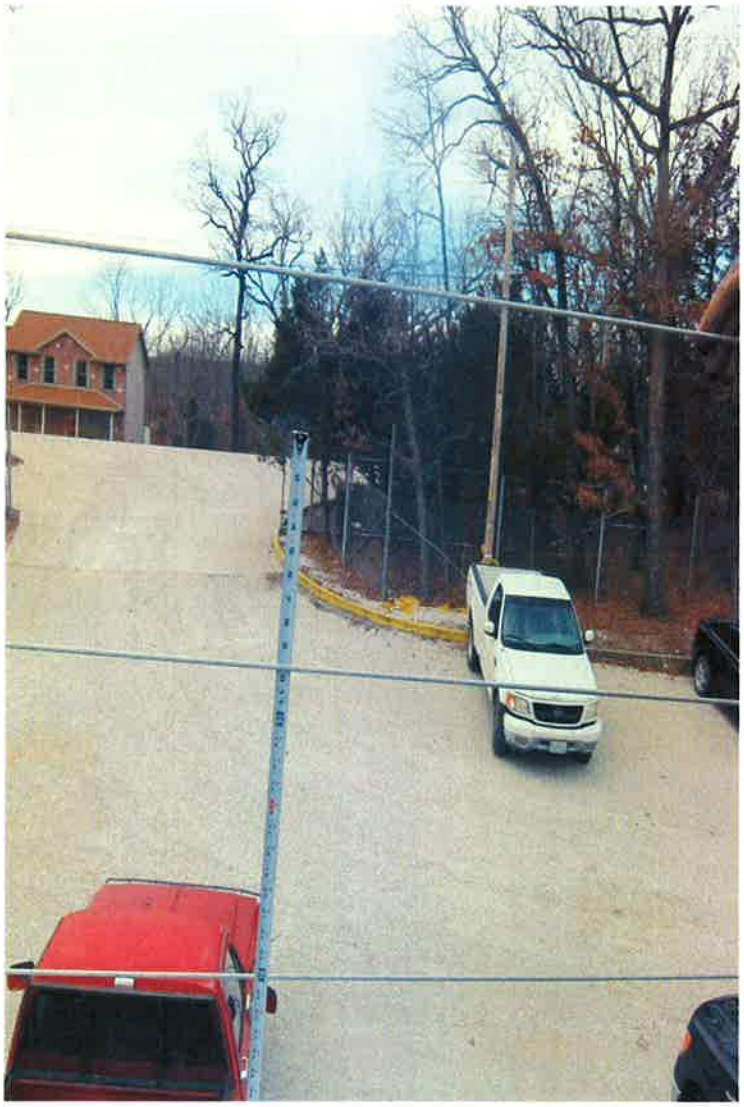

Figure 19

Figure 20

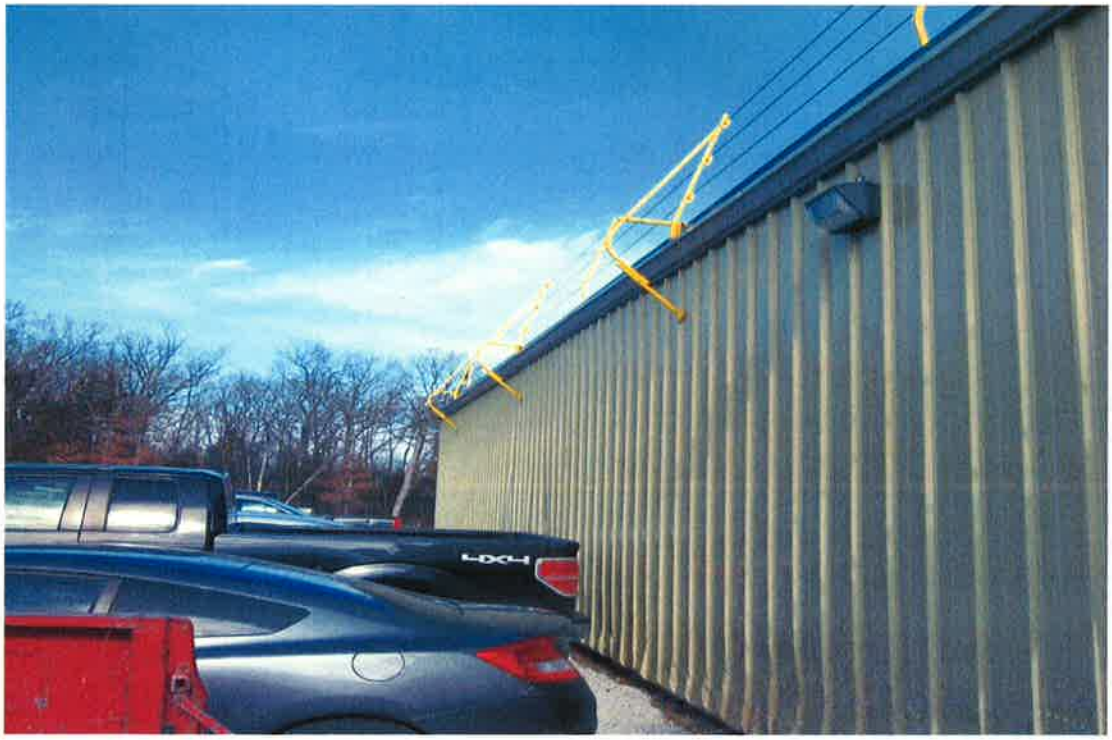

Figure 21

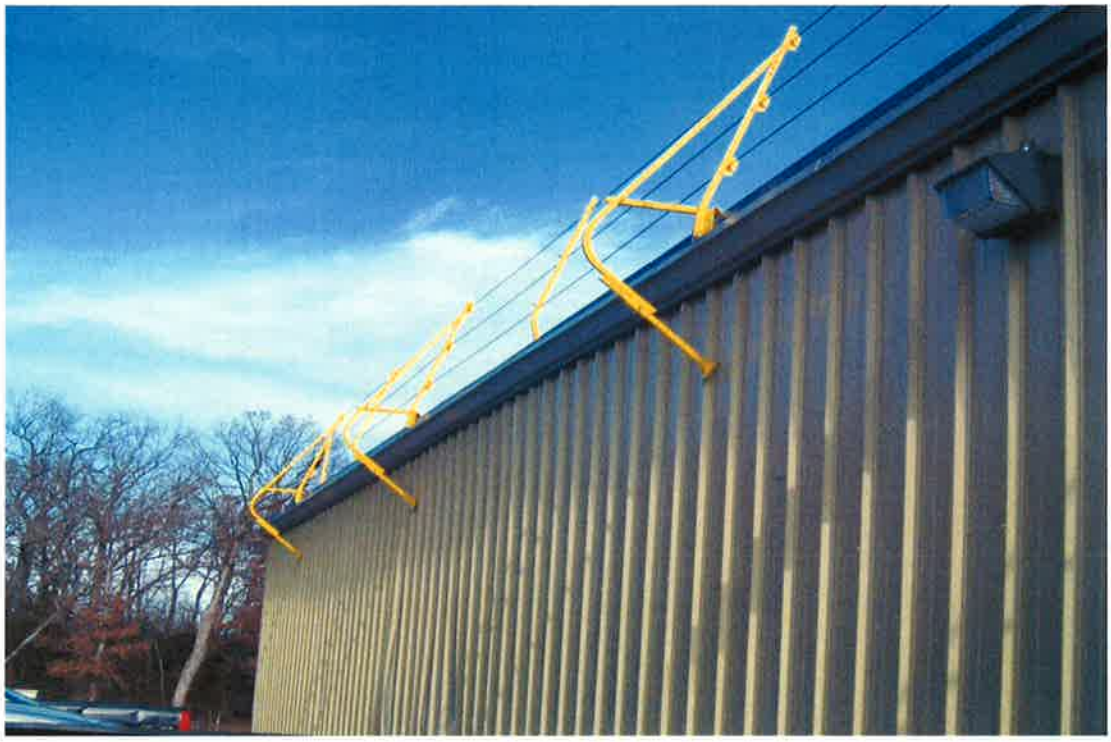

Figure 22

Figure 23

Figure 24

Certificate of Compliance

as of February 1, 2018

Product/Area Analyzed:

Three Cable Fall-Ban System / A temporary or permanent fall protection structure erected on rooftops

Regulations In Compliance:

United States Department of Labor OSHA regulation 1926.502 for Construction Fall Protection

Canadian regulation SOR/86-304 section 2.12 (1)(a) for Construction Fall Protection

Reviewing Entity:

MK & Associates, LLC
PO Box 460440
St. Louis, MO 63146

Mark A. M. Ezra, PE
PE Number: E 2002003156

This certificate is based on observations made of conformance testing of an exemplar of **"Fall-Ban Model No.: 20180201"**. The exemplar was tested on February 1, 2018 and observed during testing by Mark A.M. Ezra, Missouri PE

Certificate of Compliance

as of February 1, 2018

Product/Area Analyzed:

Two Cable Fall-Ban System / A temporary or permanent fall protection structure to be erected on rooftops

Regulations In Compliance:

Canadian regulation SOR/86-304 section 2.12 (1)(a) for Construction Fall Protection

Reviewing Entity:

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Certificate of Compliance

as of February 1, 2018

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Regulations In Compliance:

Canadian regulation SOR/86-304 section 2.12 (1)(a) for Construction Fall Protection

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December 13, 2018

Mr. Ron Kempker
FallBan North American Sales Manager
1328 Aerotech Drive,
Jefferson City, MO 65109

RE: **Addendum for Expert Report 17-095: NACSP Fall Protection System Certification**

Dear Mr. Kempker:

At your request the undersigned, Mark Ezra, PE, has reviewed the requirements of OSHA standards 1910.29(b)(2) through1910.29(b)(9) and compared these requirements to the certification test results reported to you on February 1, 2018 in the form of an **Expert Report**.

Taking into account the requirements of OSHA standards 1910.29(b)(2) through1910.29(b)(9) and the note to be added to the FallBan Product Manual regarding the availability of a vinyl screen system:

We are able to certify that the FallBan system meets all of the requirements of: OSHA standards 1910.29(b)(2) through1910.29(b)(9)

Please add this certification addendum to our Expert Report of February 1, 2018.

Mark Ezra

Mark Ezra, PE No. 2002003156