U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of Airport Safety and Standards

800 Independence Avenue, SW,
Washington, DC 20591

April 20, 2021

Ms. Mary Baeten, President
MCB Industries, Inc.
310 N Wisconsin, Suite E
De Pere, WI 54115

Dear Ms. Baeten:

This letter is in response to your December 2020 inquiry regarding Federal Aviation Administration (FAA) Engineering Brief (EB) 83A, titled “In-Pavement Light Fixture Bolts” and your email dated March 2.

Due to contract procurement changes and the challenges for FAA staff to have a physical presence during the COVID-19 pandemic, testing has been delayed, but we anticipate it will begin later this year. One main goal of the research is determining the method and standard in which mu (µ) is measured, particularly on surfaces with limited surface area. It is also important to determine the µ on light cans and light fixtures after they are exposed in an airport environment. The potential ring manufacturers would need to know what surface µ’s they are producing. It is neither reasonable nor economical to determine µ’s through testing as we have previously done. The other goal is to determine the system µ with the insertion of several coated friction rings.

The 0.37 value was back-calculated using the Grade 5 bolt to determine the required fraying surface µ. Moving up to Grade 8 was problematic as there was a risk of damaging the light can/threads at higher torques. The Society of Automotive Engineers (SAE) J429 has a design strength of 75% of the yield strength of 4,941 lbs. and as tested a µ of 0.37. The ASTM F593 has a design strength of 75% of the yield strength of 3,778 lbs. and as calculated a µ of 0.42. To reduce any risks in the system due to uncertainty, we used the bolt with the potential greater clamping force.

Appendix A (paragraph A.1) of EB 83A provides the assumption made on the coefficient of friction, as described below.

*Assumption: The coefficient of friction between the light fixture flange and the light base or the light base extension ring is assumed to be 0.37. The same coefficient of friction is also assumed for the bolt clamping force and torque calculation. This assumed coefficient of friction value can be enhanced by the introduction of friction coatings on faying surfaces between light bases and lights.*

This allows the use of the ASTM F593 stainless steel bolts (for load) if there was a friction coating in place to increase μ to an acceptable value.

As there is no standard design for this situation, the design methodology begins as a standard bolted connection, based on a sustained load. The following factors give us reason to overestimate the results:

1. The presence of anti-lock brakes on the aircraft (minimum chance for a sustained load);
2. Aircraft wander (minimum chance for direct contact);
3. Aircraft speed (load on light is milliseconds in most cases); and
4. All testing components were new/smooth – resulting in a 0.14 μ.

Historically, bolt failures have been in a fatigue/fracture mode and not a yield or deformation failure. In order to minimize movement, a bolt should be selected and torqued with the ability to generate sufficient force to resist the governing aircraft. You claim that our assumption of 0.37 μ versus the 0.14 from the testing is highly detrimental to the connection and fail to hold the bolted joint together. Based on the above factors, we came to a different conclusion. To reduce the risk of fatigue failure, we recommend checking bolt torque (ultimately clamping force) every two months.

The EB provides the ability to design the connection. It is up to the airport sponsor to specify the yield strength based on the load anticipated and bolt selected. Any specific bolts mentioned in the EB are examples for use in the sample calculations. Please note that we have provided methodology in Appendix B of the EB to calculate the clamping force for any aircraft deemed as critical aircraft by the airport and the main property of the bolt specified is its yield strength.

At the airport where you have the project, the key considerations are:

1. The light can and light material;
2. The coefficient of friction of the light can and light material;
3. The intent of the salt fog test of the scuffed bolts to illustrate the importance of bolt inspections especially for reuse in certain environments. Based on the test results, it is not advisable to use a scuffed, coated bolt for installation;
4. The critical aircraft;
5. K factor; and
6. Installation factors.

The FAA is looking forward to commence testing on the fraying surface issue, which will allow us to update EB 83. We thank you for your correspondence, as it will assist us in developing guidance for standard methods for securing light fixtures and hope this addresses all your concerns. If you should need further clarification, please let me know and we can set up a conference call.

Sincerely,

MICHAEL A. MEYERS Digitally signed by MICHAEL A. MEYERS Date: 2021.04.20 12:24:31 -04'00'

Michael A. P. Meyers
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