

# ***Implementing a Comprehensive Plan for In-pavement Lighting Reliability Improvements***

**Jim Heitmann**  
General Manager, Airport Redevelopment

**Lisa Gardner**  
Asst. General Manager, Operations and Regulatory  
Compliance

**October 25, 2016**

# Regional Transportation System – Port Authority of New York and New Jersey



## Airports (5)

- Newark Liberty International (EWR)
- John F. Kennedy International (JFK)
- LaGuardia (LGA)
- Teterboro (TEB)
- Stewart International (SWF)

## Marine Terminals (4)

## Interstate Tunnels and Bridges (6)

## Commuter Rail System (1)

## Bus Terminals (3)

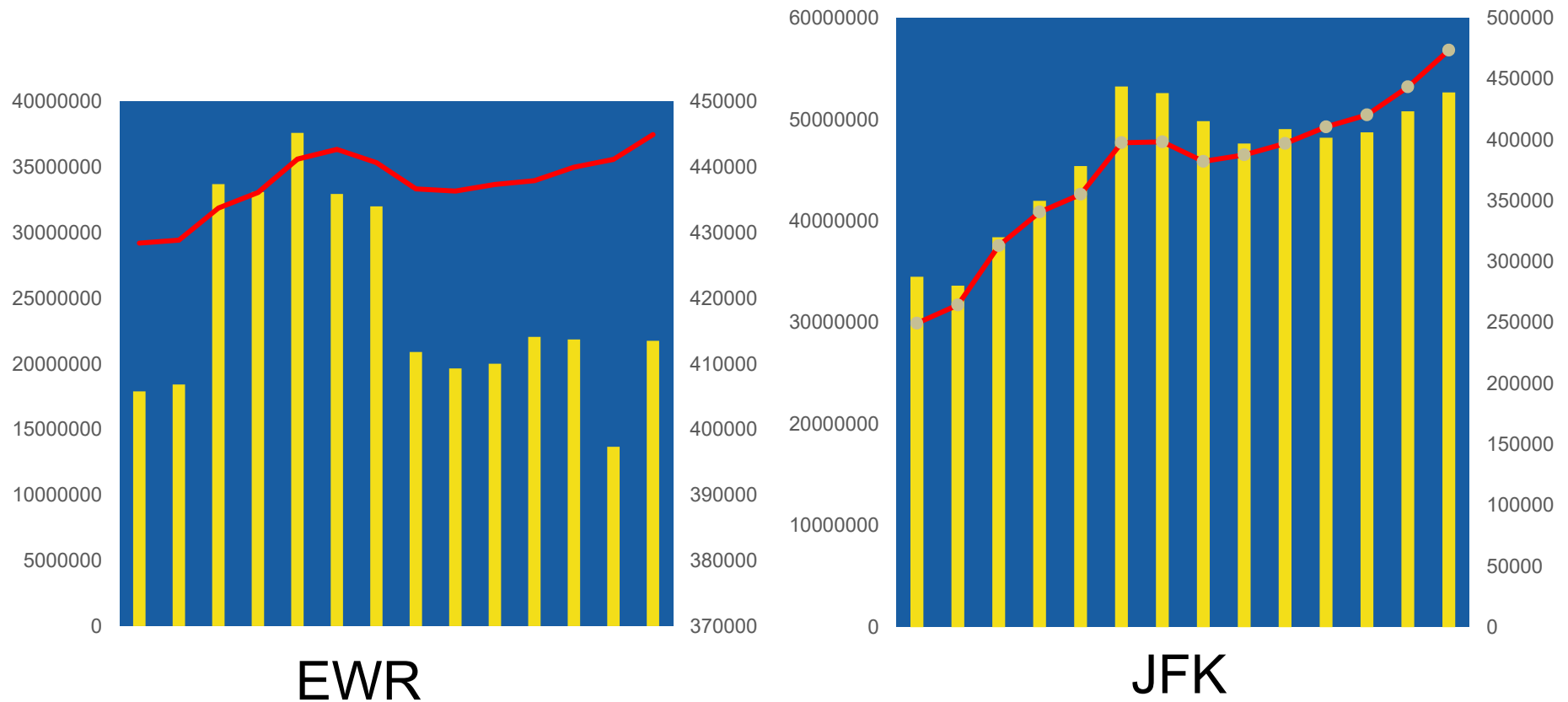
## World Trade Center



## Regional Passenger Demand

-

# OVER TIME, LARGER/HEAVIER AIRCRAFT: PASSENGER INCREASE RELATIVE TO OPERATIONS



**Red Line** shows increasing number of total passengers  
**Yellow Bars** show total operations decreased (EWR)  
or moderate increase (JFK)



# ***An integrated airport system is required to meet the regional demand***

---

John F. Kennedy  
International  
**International Gateway  
For Passengers & Cargo**



Stewart  
International  
**Gateway to the  
Hudson Valley**



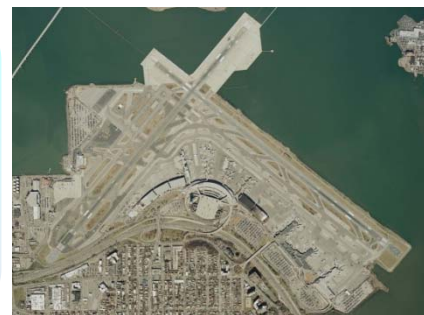
Newark Liberty  
International  
**Int'l/Transcontinental  
& Small-Package Hub**



Atlantic City  
International  
**Gateway to Southern  
New Jersey**



LaGuardia  
**Premier Short-Haul  
Domestic Airport**



Teterboro  
**Corporate Reliever**



## ***As activity has grown over the years, the number of bolt failures have increased***

---

**JFK – December 2000 – MALSR fixture struck a DC-9**

**EWR – November 2009 – MALSR fixture ingested Boeing 737**

**JFK – April 2014 – Fixture struck Boeing 737**

**EWR – April 2014 – Fractured bolts**

**JFK – May 2014 – Fixture embedded in Boeing 747 fuselage during take-off**

**LGA – October 2014 – Loosening bolts**

**EWR – Feb 2015 – Fixture dislodged, found during inspection - snow plow impact**

**JFK – Feb 2015 – Raised centerline fixture – ovalized base can, found during inspection**

**EWR – May 2016 – Fixture dislodged, found during inspection**

**EWR – October 2016 – Fractured bolt found, found during inspection**

## ***In 2014, the Aviation Director Initiated Airfield Electrical Maintenance Improvement Program***

---

1. Completion of Corrective Maintenance Backlog
2. Standardize and update preventive and corrective maintenance using the existing Computerized Maintenance Management System (CMMS)
3. Conduct maintenance audits
4. Implement a new state-of-the-art CMMS, Maximo, using mobile technology
5. Engineering analysis of system/component failures
6. Update construction oversight standards
7. Update engineering design standards

Preliminary output of the engineering analysis modified, maintenance practices along with design and construction standards.

## *The review of existing procedures by consultant (LPI) resulted in revised criteria for bolt installation*

---

In order to maximize the achieved clamping force:

- Mounting base holes must be degreased, cleaned, and dried prior to bolt installation. *Best maintenance practice*
  - All mating surfaces from the base to the fixture must be degreased, cleaned and dried prior to installation. *Improved friction connection - No silicone*
  - Apply marine grade antiseize (K=.18) *Maximize bolt pre-load*
  - Torque bolts with a calibrated torque wrench in a “star” pattern.\*
  - Immediately re-torque the bolts in the same “star” pattern. \*
  - Re-torque bolts within 2-weeks of the initial installation. \*
- \* *Best maintenance practices for bolt tightening*





**LPI, Inc.** Consulting Engineers

*Advanced Analysis & Fitness for Service  
Failure & Materials Evaluation  
Nondestructive Engineering*

# Performance of In-pavement Runway Light Fixture Assemblies

IESALC Fall Technology Meeting 2016

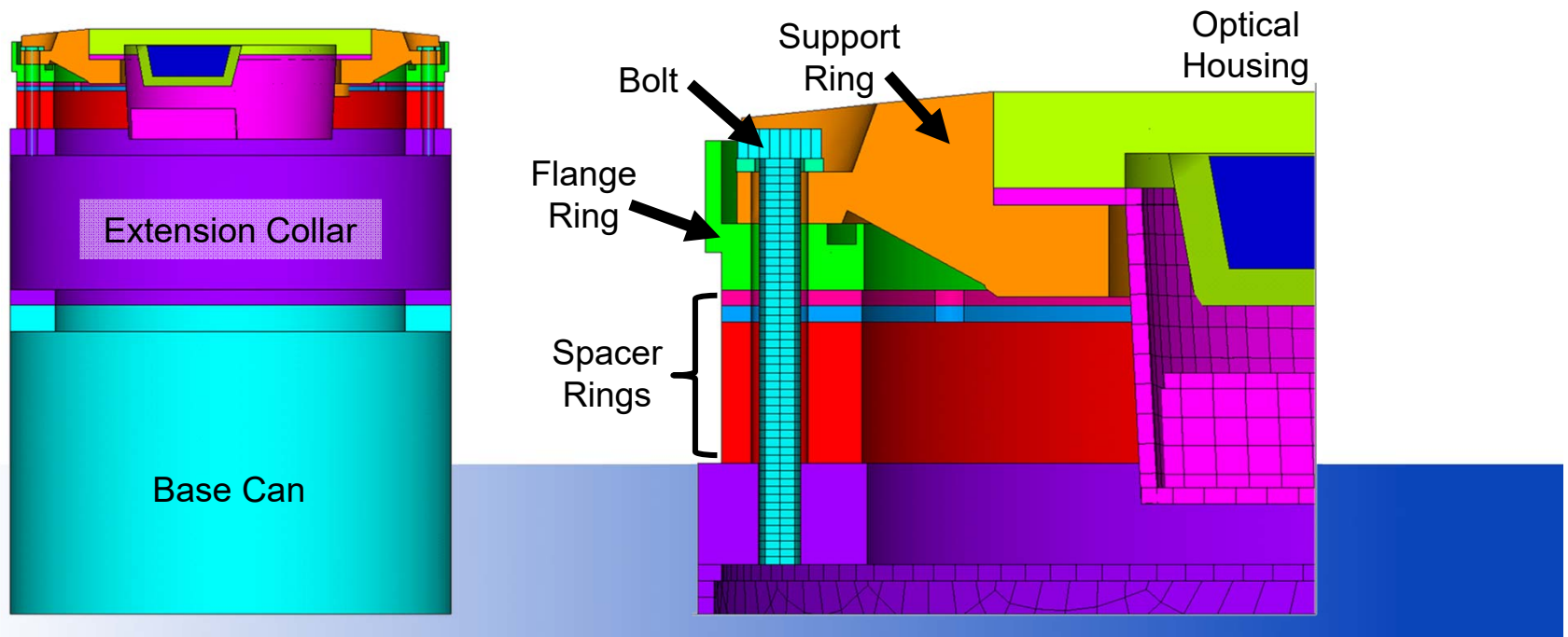
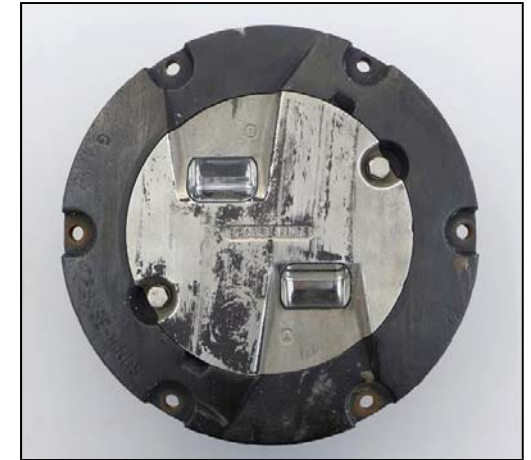
October 25, 2016

Eric Cheifet

Senior Engineer

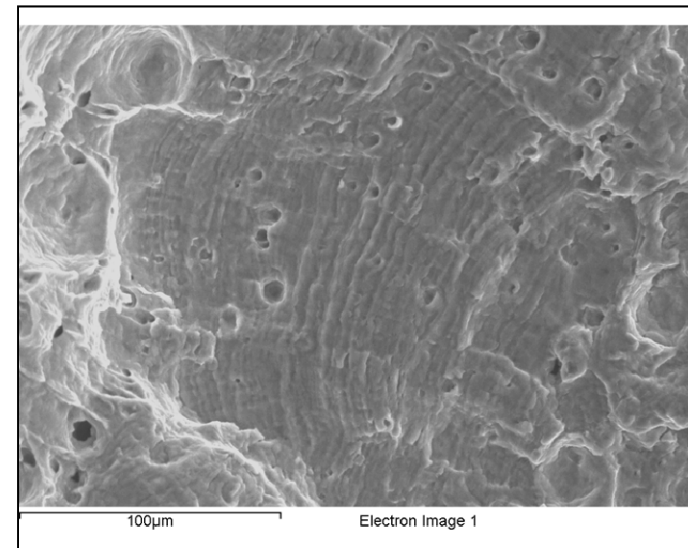
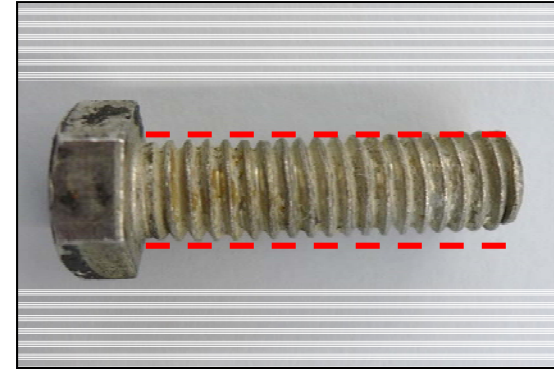
# Background

- Incidents involving dislodged in-pavement runway light fixtures
- Comprehensive engineering assessment performed to mitigate future fixture issues




# Light Fixture Failure Analysis

- Thread impressions in fixture clearance holes
- Bent bolts and bolt fatigue failures



Evidence of repeated excessive lateral movement of light fixture

# Bolt Preload and Proof Load

- Preload – The tension created in a fastener as it is tightened
  - Proof Load – The maximum load a bolt can take before it yields
  - Rule of Thumb – Preload should be 75% of proof load
- 



# Bolt Torque Testing

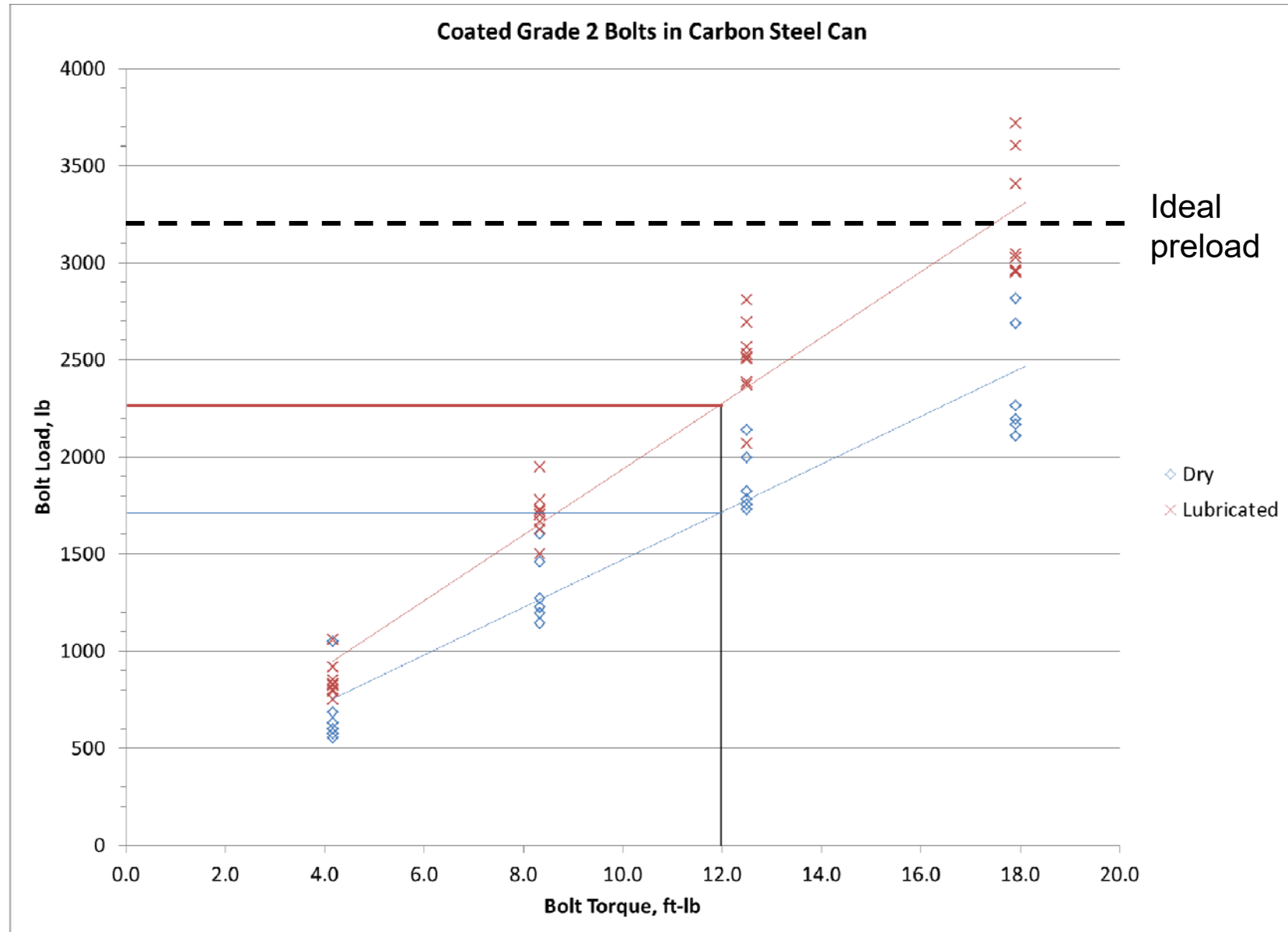
- Bolt torque vs. bolt preload testing performed utilizing instrumented bolts
- Recommended manufacturer torque values do not ensure bolt is at ~75% of proof load
- Documented that scatter is inherent in achieved preload

$$T_{in} = F_P \times D \times K$$

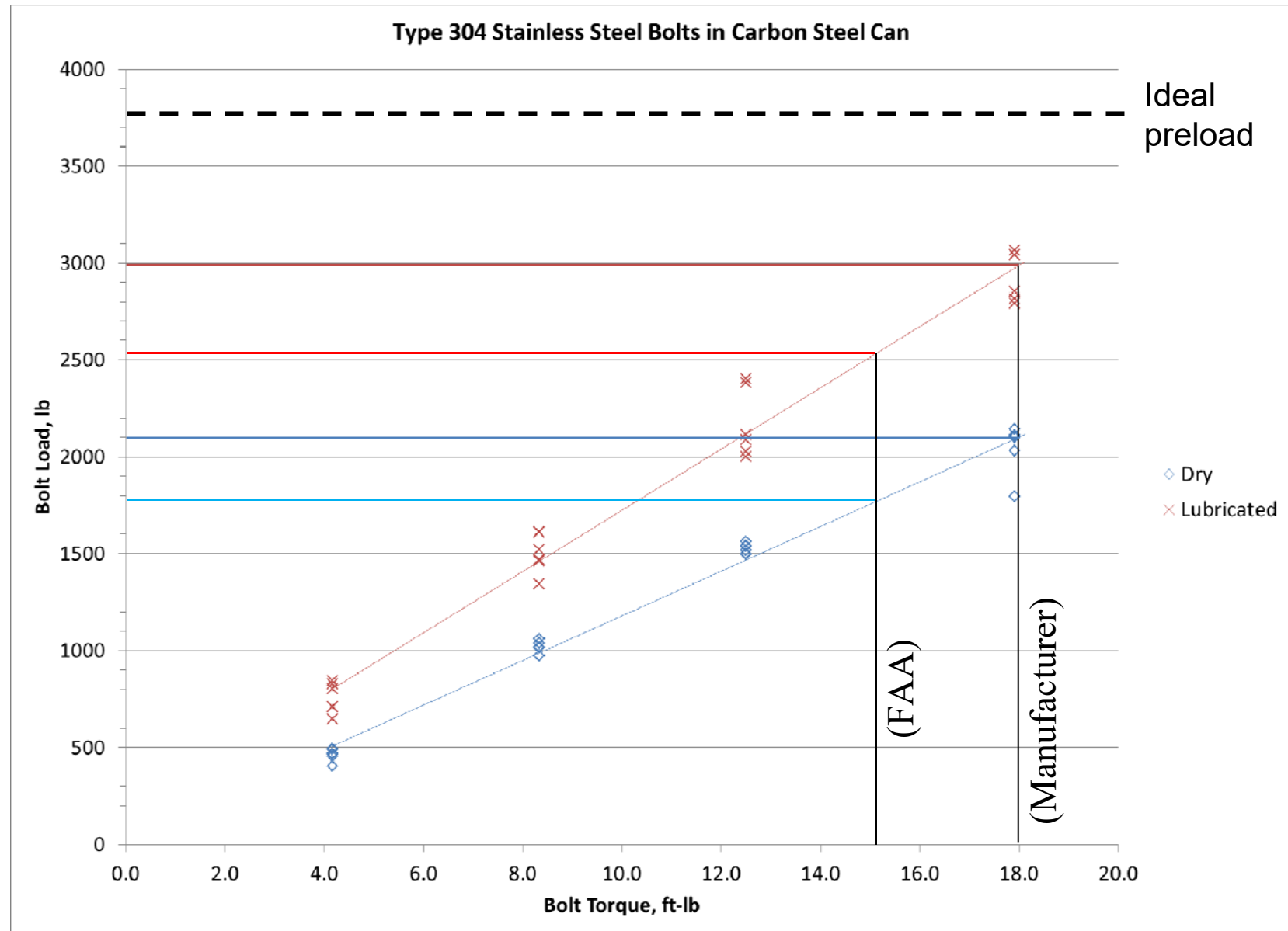
where  $T_{in}$  = input torque (in.-lb)  
 $F_P$  = achieved preload (lb)  
 $D$  = nominal diameter (in.)  
 $K$  = nut factor



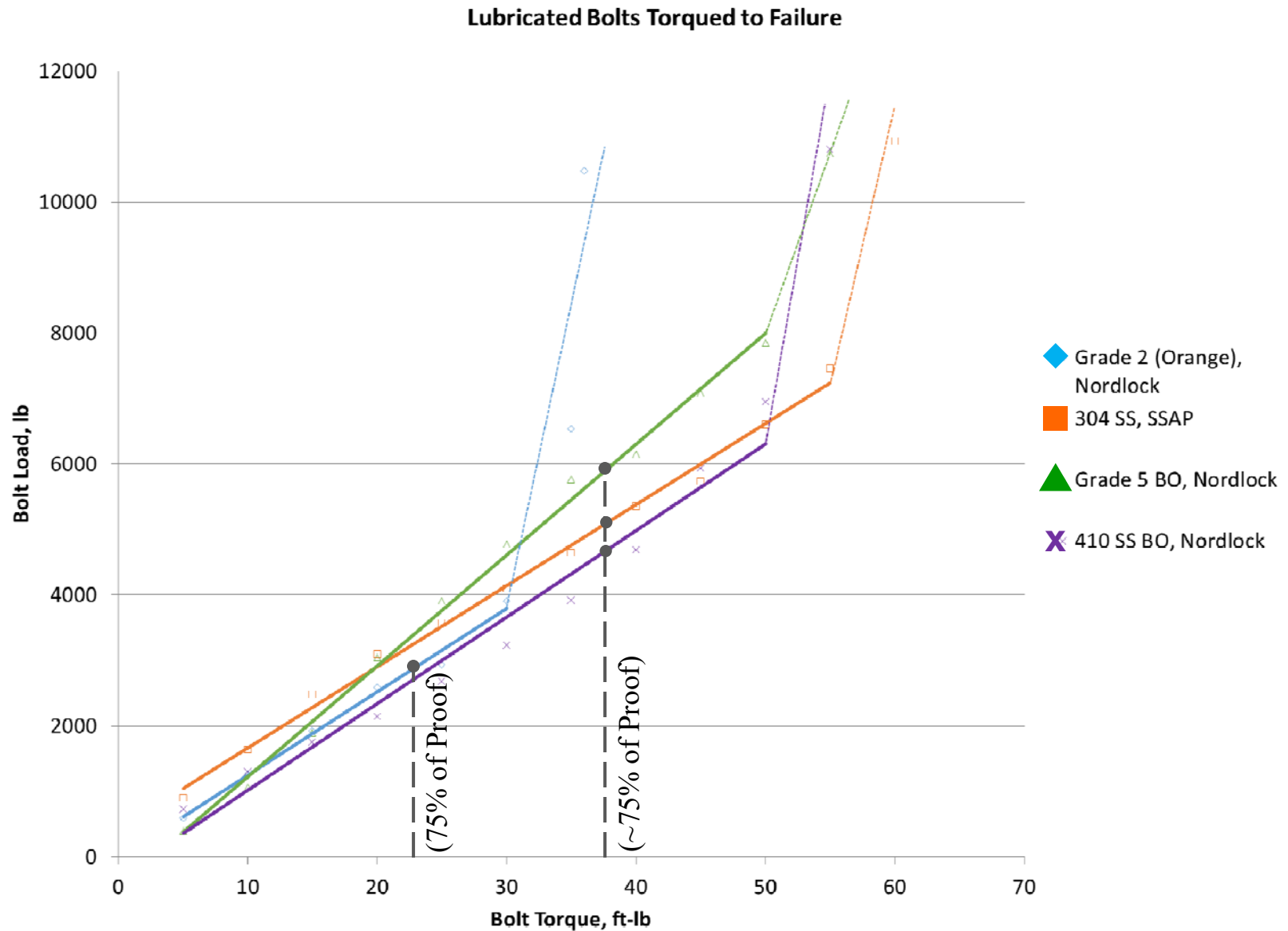
# Torque Test Results – Coated Grade 2



# Torque Test Results – Type 18-8 SS



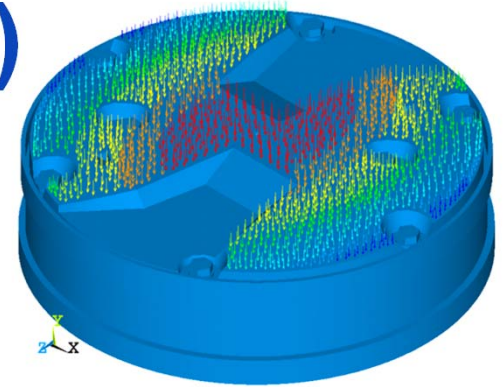
# Torque Testing to Yield



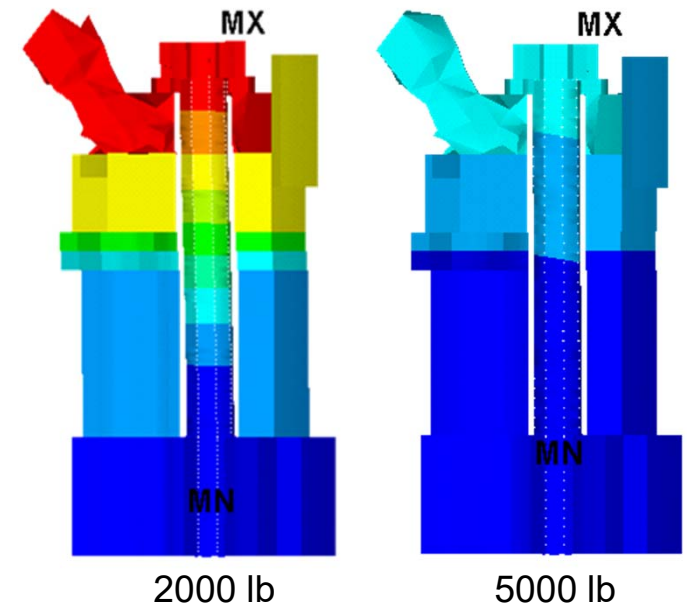


# Finite Element Analysis (FEA)

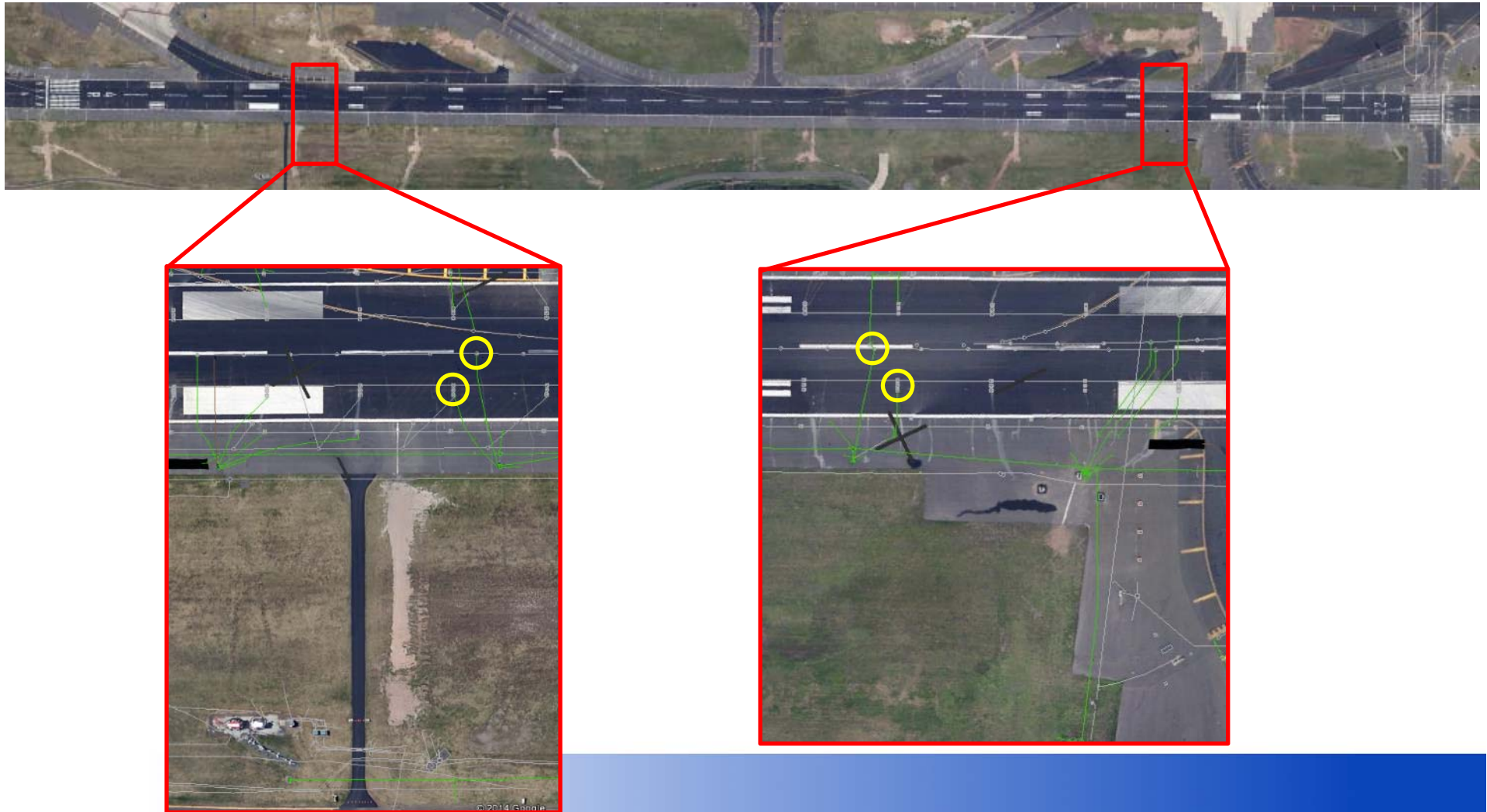
- Evaluate aircraft wheel roll-over
- Loads derived from Aircraft Characteristics documents
- Low preload allows slip at Support Ring / Flange Ring / Spacer Ring interfaces and bending of bolts



<i>Bolt Preload (lb) →</i>	<u>2000</u>	<u>5000</u>
<u>Bending Stress [ksi]</u>	181.2	33.6
<u>Bolt Lateral Disp. [in.]</u>	.0398	.0070



# Instrumentation and Analysis

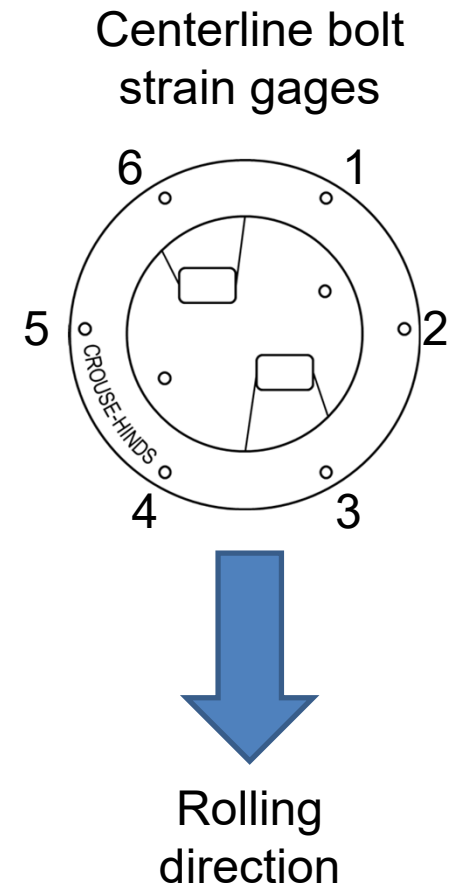
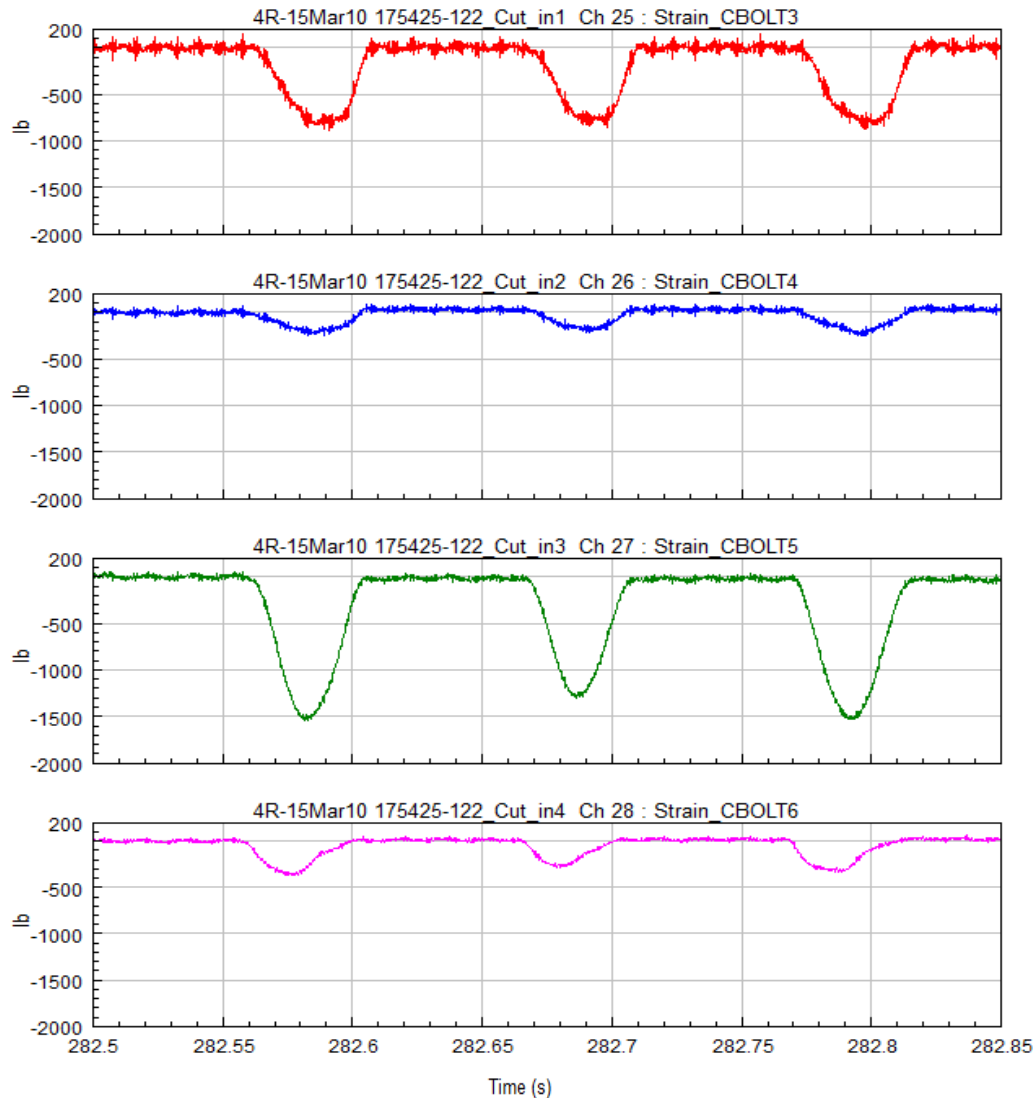


# Instrumentation and Analysis

- Bolts repeatedly experience significant relaxation/unloading
- Results indicate aircraft **does not** have to contact light fixture in order to induce cyclic strain response
  - No indication of direct impact, but good results obtained from “rolling end” of runway

# Instrumentation and Analysis

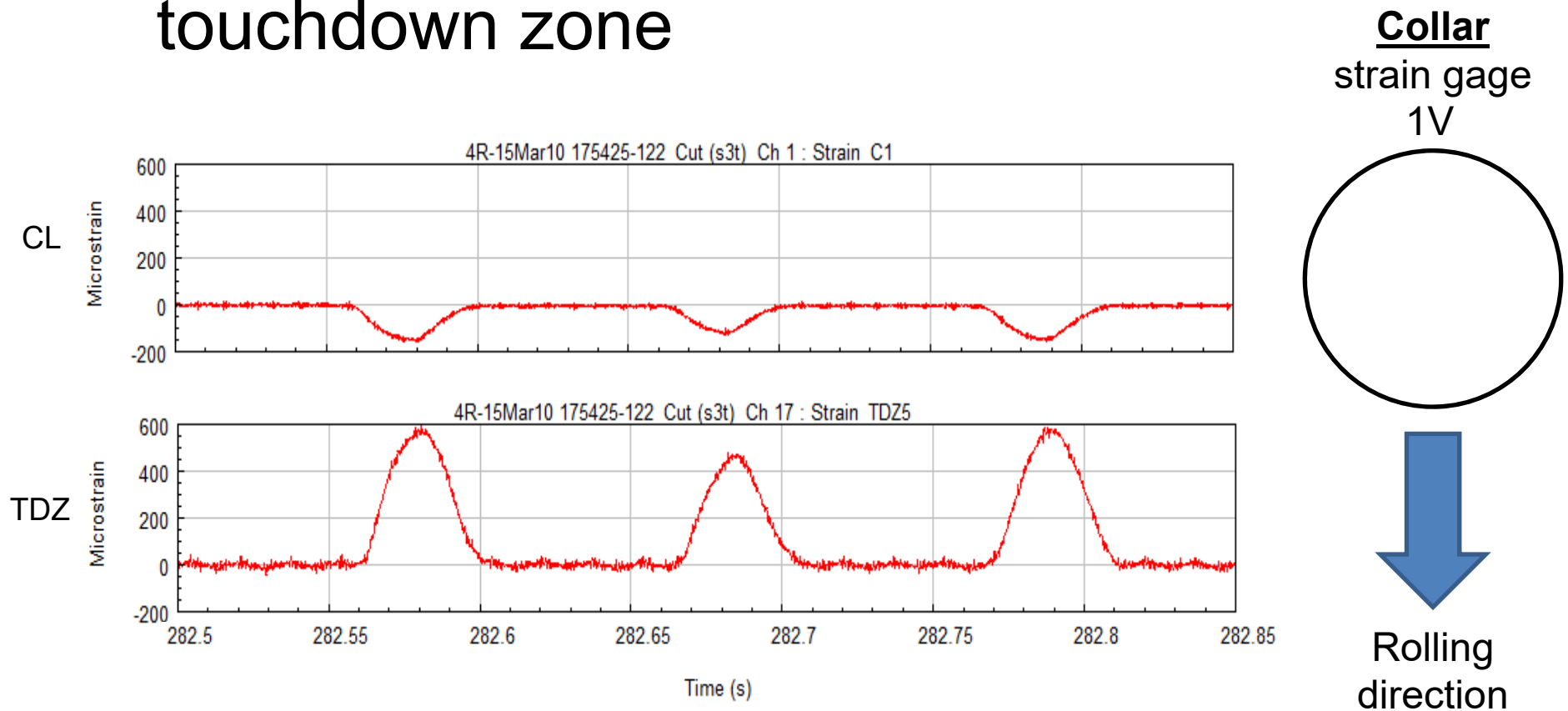
- 777 after landing (all wheels down)





# Instrumentation and Analysis

- Simultaneous response at centerline and touchdown zone



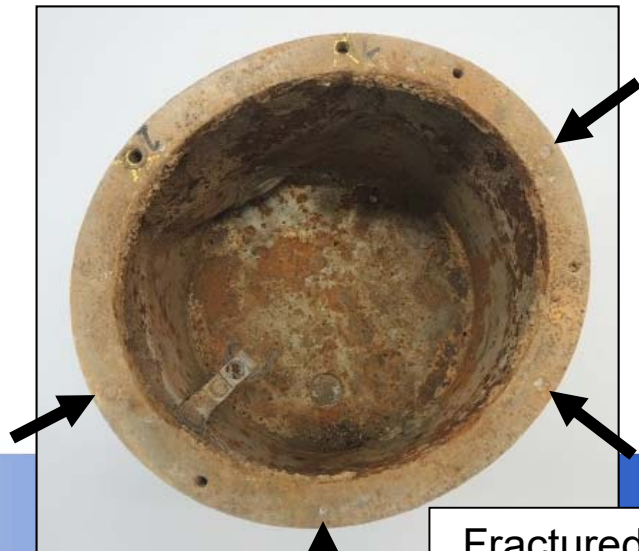
# High-speed Turn-off Analysis

- Additional type of incident highlighting influence of pavement / light fixture interaction
- High-speed turn-off fixtures experience braking forces and lateral turning forces



# High-speed Turn-off Analysis

- Numerous lead-off light fixture assemblies for high-speed taxiways discovered with:
  - Cracked / fractured extension collars
  - Ovalized base cans
  - Severely deformed / cracked / fractured bolts

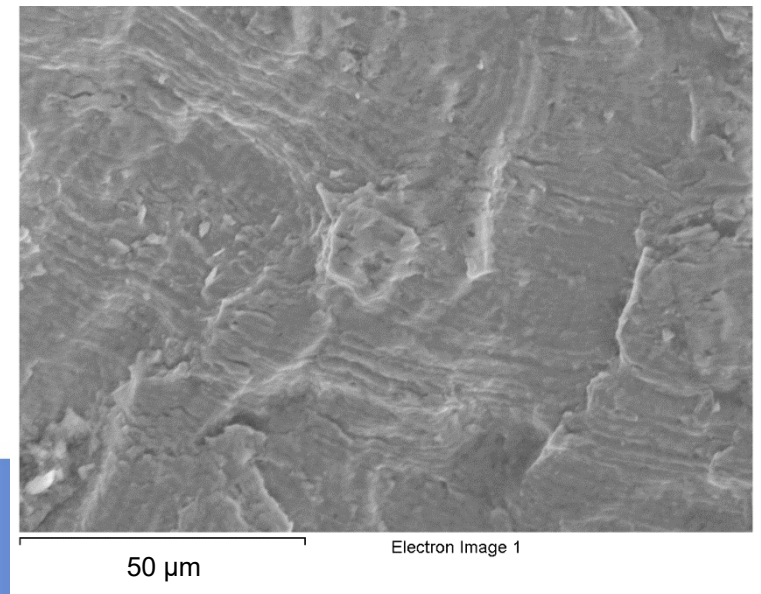


Fractured bolts



# High-speed Turn-off Analysis

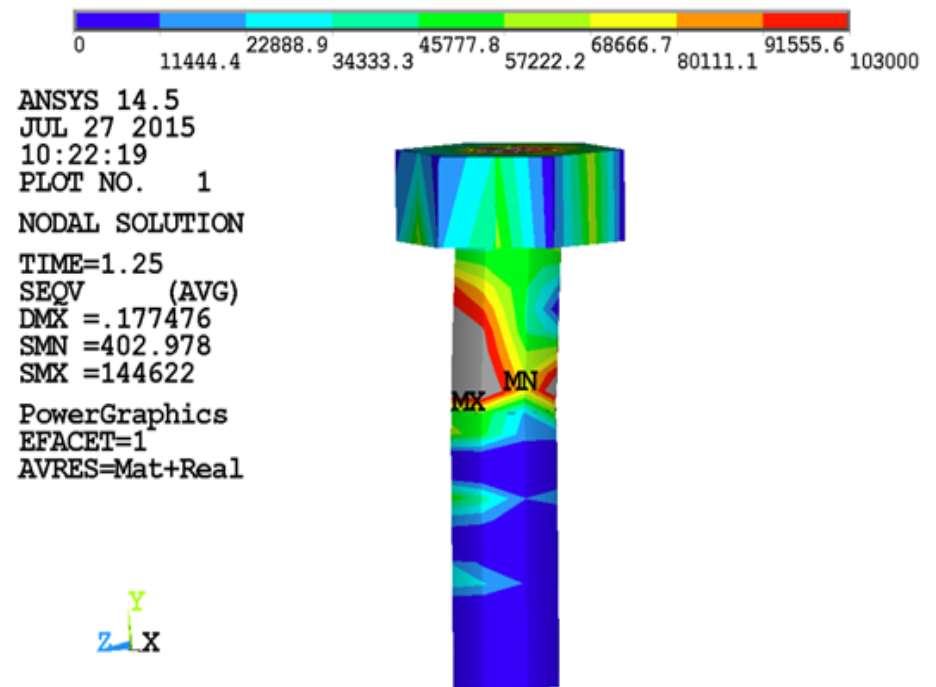
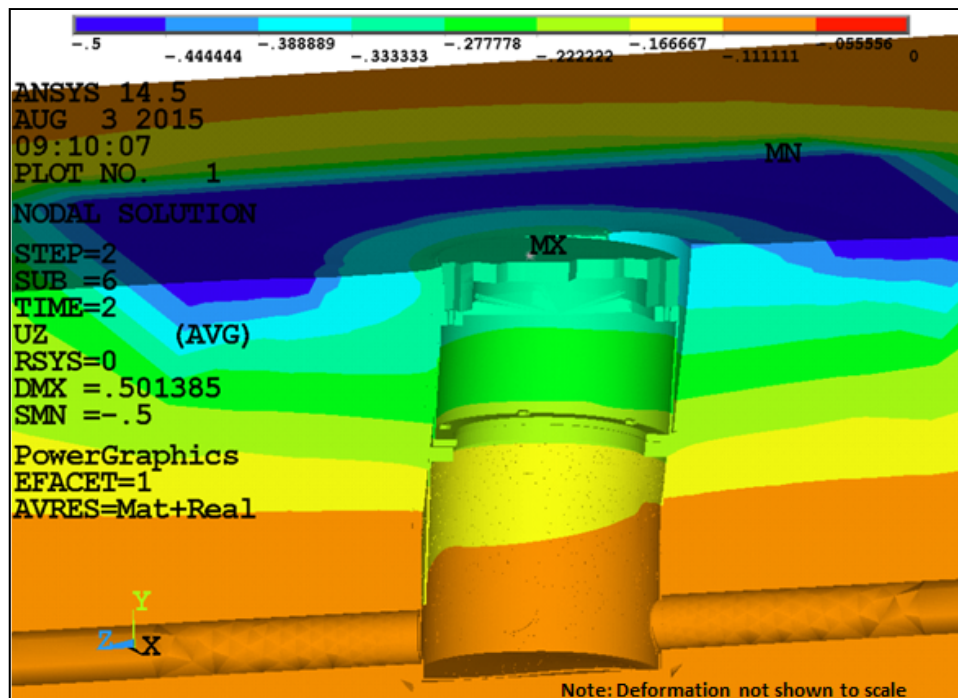
- Extension collar exhibited evidence of fatigue cracking at lower flange
- Bolt segments in base can exhibit evidence of bending fatigue





# High-speed Turn-off Analysis

- Finite element analysis validated findings under scenarios of asphalt pavement displacement



# LPI Evaluation Findings

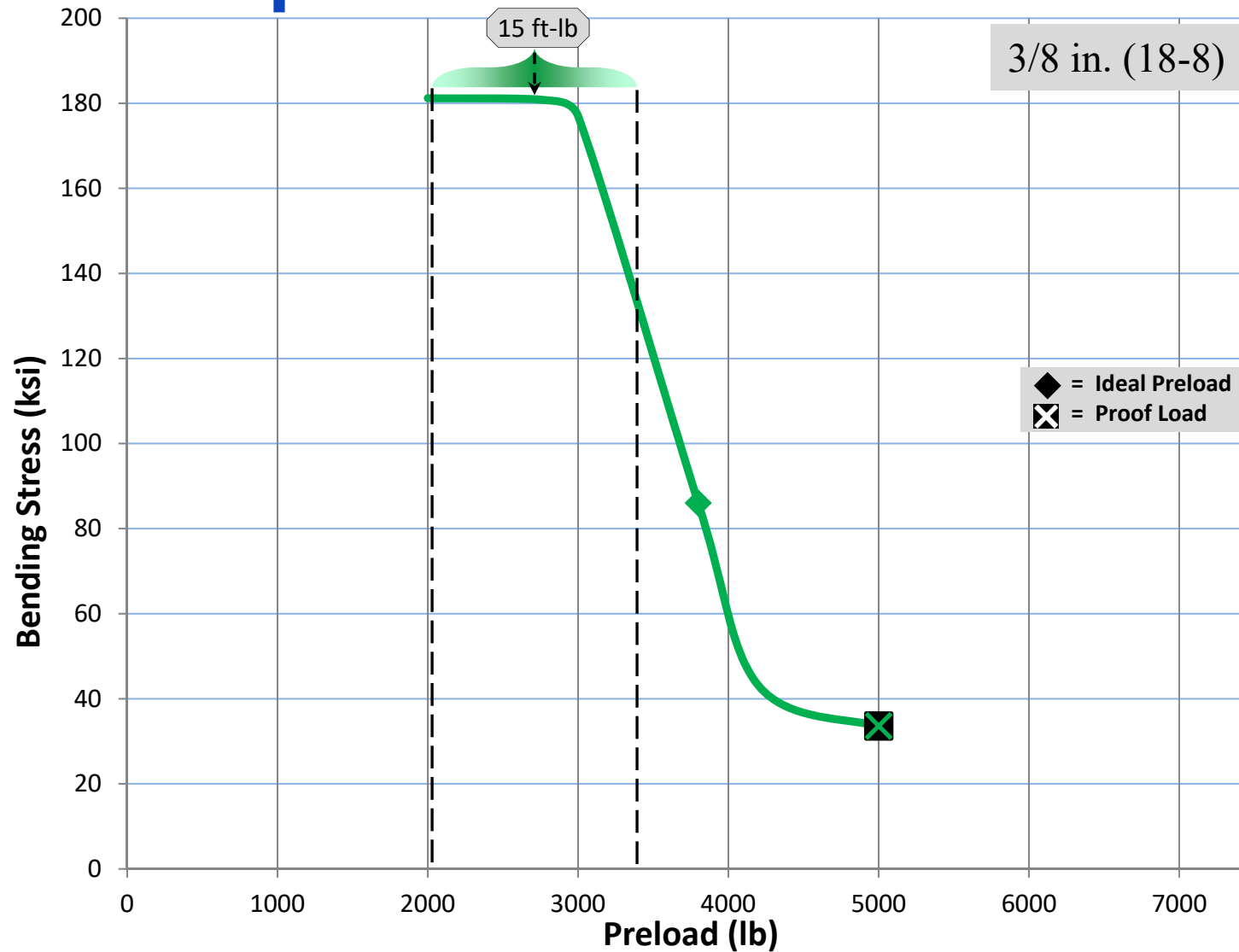
- Bolts experience **repeated** unloading cycles due to pavement acting as a system
- Current torque levels **are not sufficient** to prevent movement due to passing aircraft
- High-speed turn-off fixtures experience unique pavement / fixture loading interactions



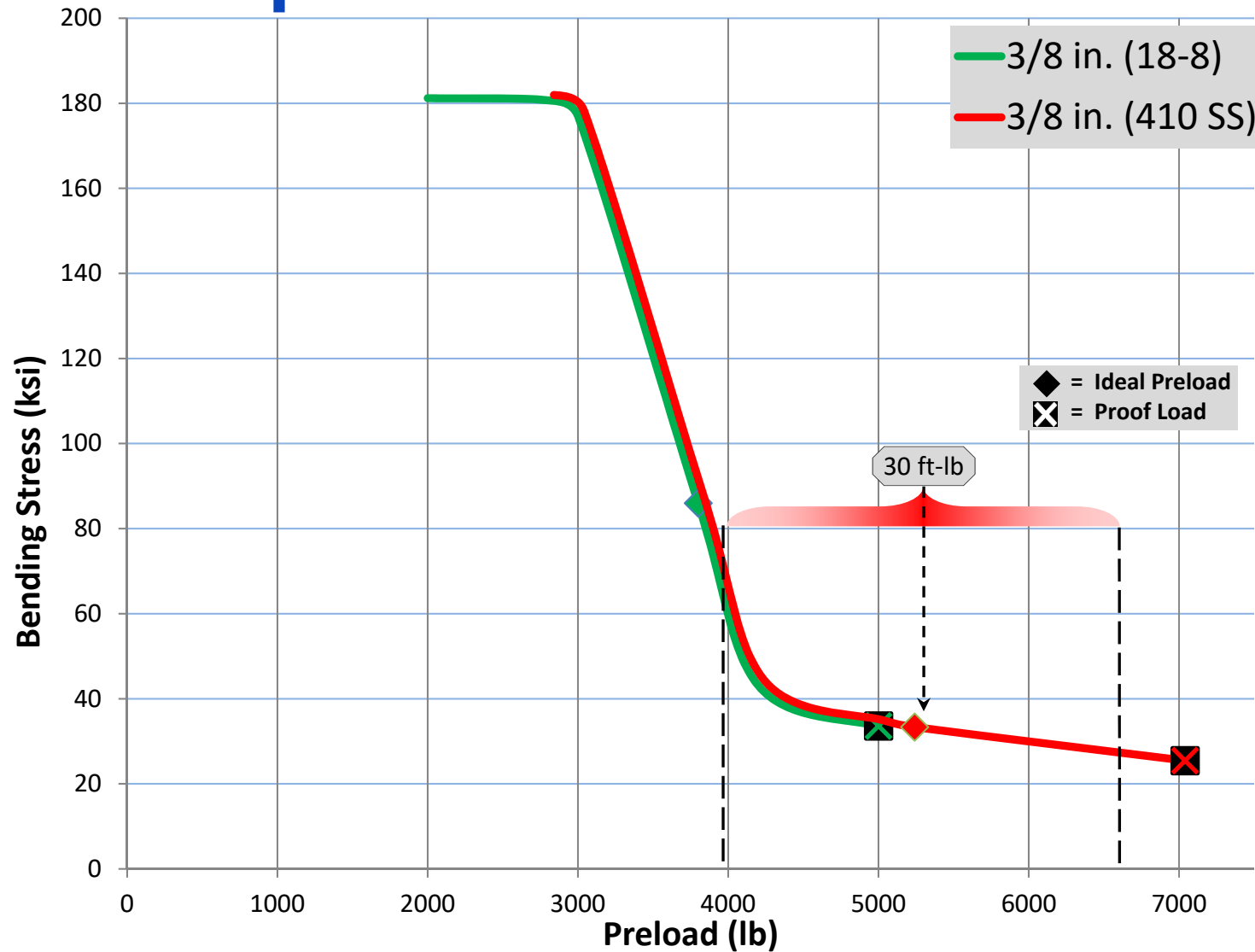
# LPI Bolt Recommendations

- Interim recommendation
  - Type 410 stainless steel bolts (ASTM F593P)
  - 30 ft-lb
  - Loctite marine grade anti-seize
  - Two-piece lock washer (wedge-locking style)
- Next phase recommendation
  - Further increase possible clamping force
  - Feasibility study: Increase bolt size to 7/16 in.
  - Modify existing infrastructure

# Torque Effect on Bolt Stress

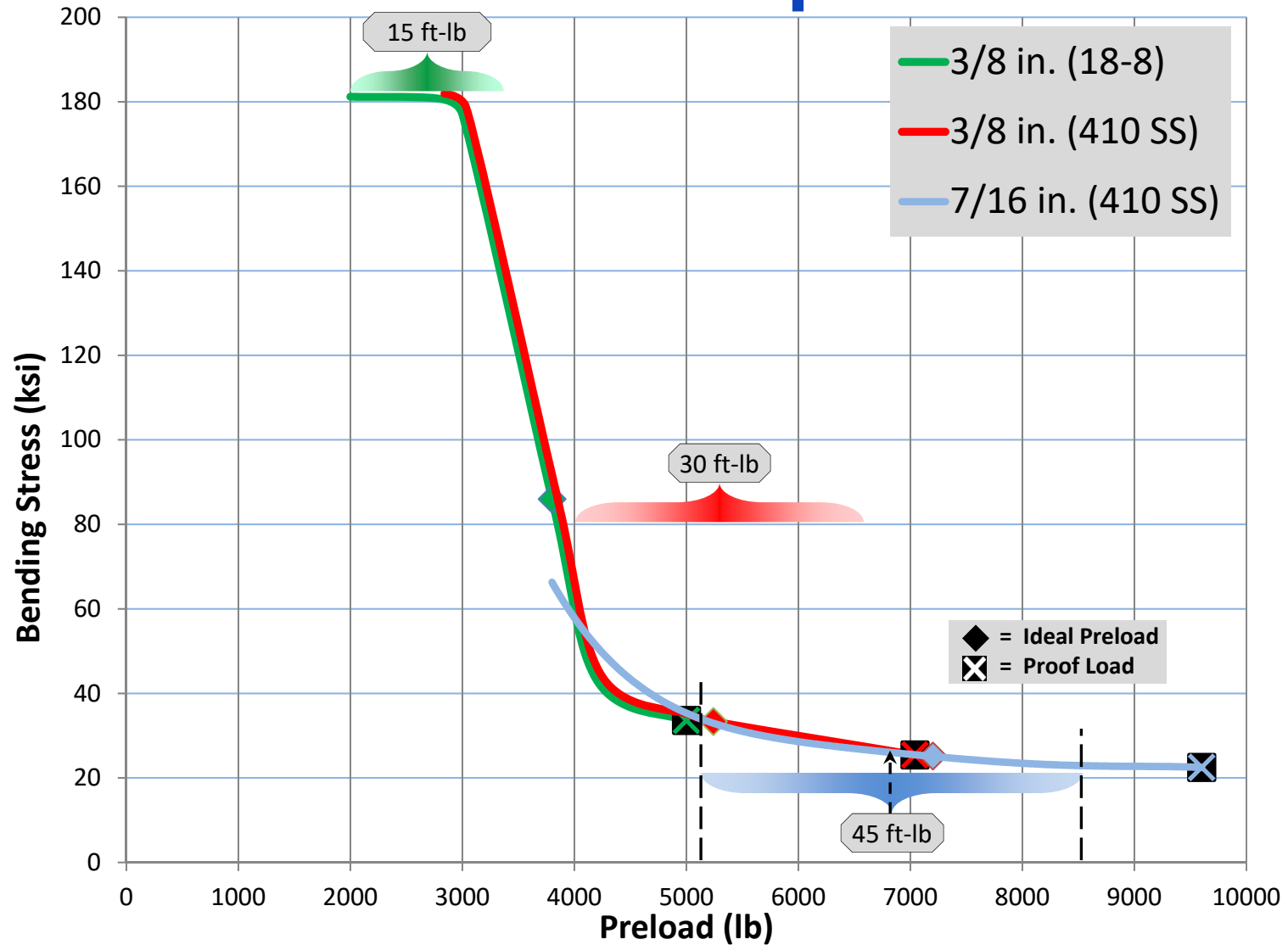


# Torque Effect on Bolt Stress





# Bolt Size Comparison



# Future Work

- Field instrumentation and analysis of modified 7/16 in. light fixtures
  - One asphalt runway, one concrete runway
  - Same fixtures as previously instrumented
- Validation of finite element analysis
- Help determine torque maintenance requirements





## **LPI, Inc.** *Consulting Engineers*

---

*Advanced Analysis & Fitness for Service  
Failure & Materials Evaluation  
Nondestructive Engineering*

*Lucius Pitkin – established 1885  
304 Hudson Street • New York, NY 10013 • 212.233.2737*

*New York • Boston • Richland • Sydney • [www.lpiny.com](http://www.lpiny.com)*

*Ensuring the integrity of today's critical infrastructure for tomorrow's world.*

## ***Based on these findings by LPI, this Improvement Program became Phase I***

---

1. Completion of Corrective Maintenance Backlog
2. Standardize and update preventive and corrective maintenance using the existing Computerized Maintenance Management System (CMMS)
3. Conduct maintenance audits
4. Implement a new state-of-the-art CMMS, Maximo, using mobile technology
5. Update construction oversight standards
6. Engineering analysis of system/component failures
7. Update engineering design standards

## ***Phase II recommendation includes bolt replacement program with 3/8" - 410 stainless bolts***

---

- Use fully threaded, 3/8-16, 410 Stainless Steel, black oxide coated bolts with a hardness range of 20-30 HRC with two-piece lock washer (wedge-locking style). **Maximize bolt strength and avoid “gall”**
- Mounting base holes must be degreased, cleaned, and dried prior to bolt installation.
- All mating surfaces from the base to the fixture must be degreased, cleaned and dried prior to installation.
- Apply marine grade antiseize (K=.18)
- Torque bolts to 30 ft-lbs with a calibrated torque wrench in a “star” pattern. **Adjust for 75% of proof load**
- Immediately re-torque the bolts in the same “star” pattern.
- Re-torque bolts within 2-weeks of the initial installation.



## ***A three phase plan was developed to enhance safety and improve reliability***

---

Phase I – Update the AOA Electrical preventive maintenance program

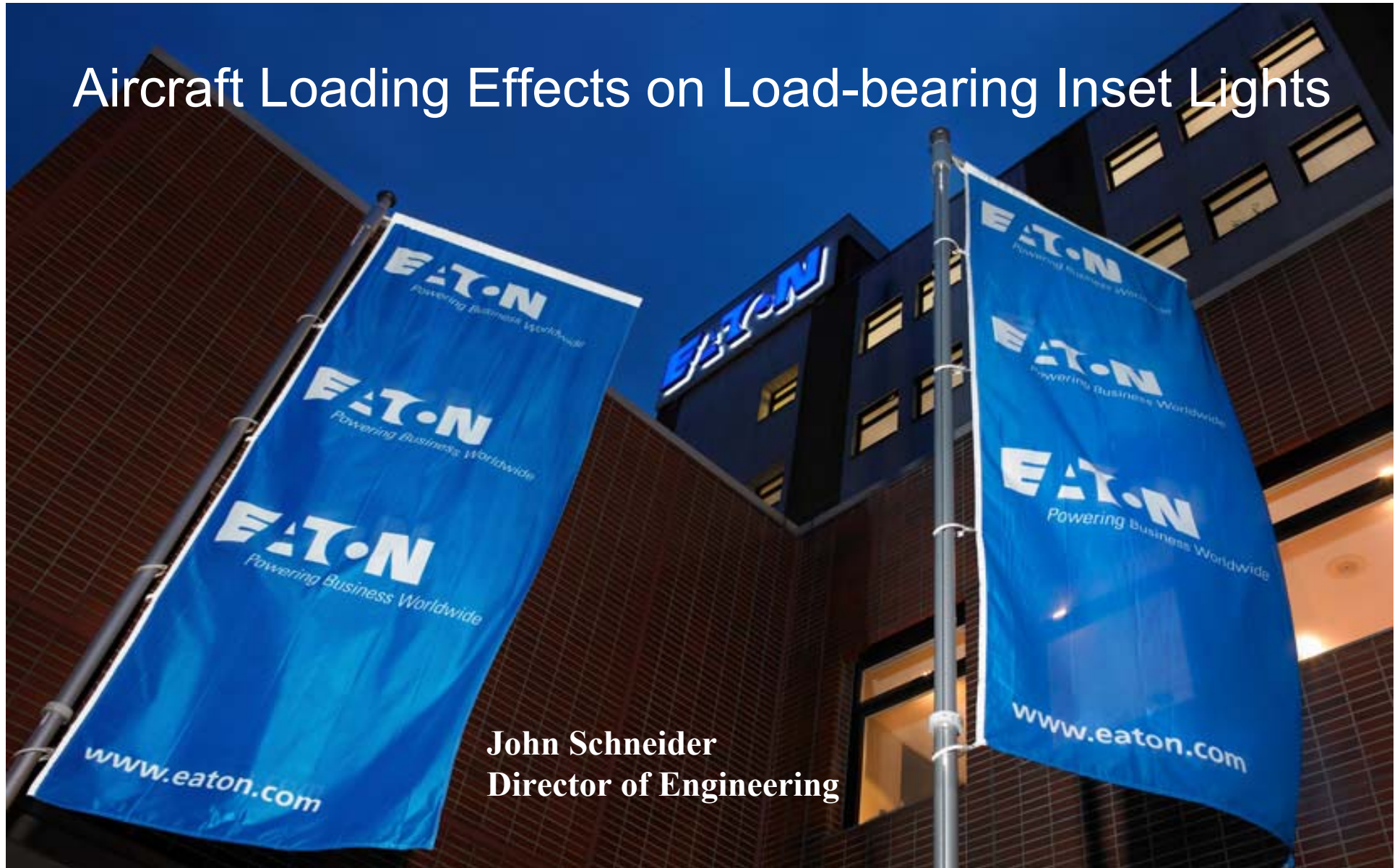
Phase II – Maximize clamping force with existing light fixtures

- LPI Recommendation: 410 Stainless – black oxide torqued to 30ft-lbs
- C-H Adjustment: 410 Stainless – localized stress on fixture limited torque to 23ft-lbs

Phase IIA – Adapt fixtures to upgrade to larger bolts

Phase III – Promote redesign of the entire assembly

# Aircraft Loading Effects on Load-bearing Inset Lights

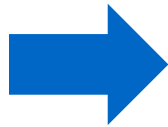


**John Schneider**  
**Director of Engineering**

# Goal

---

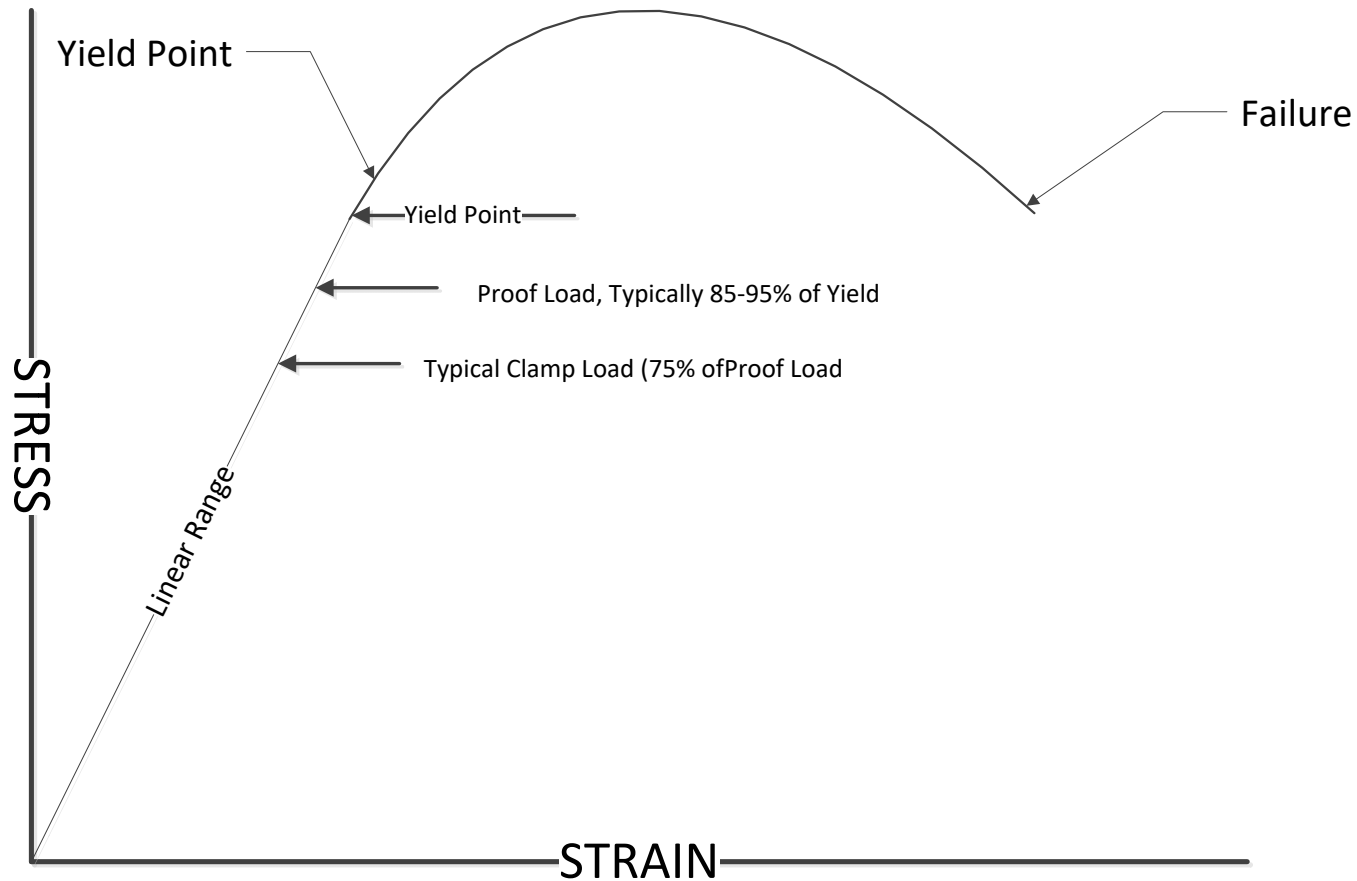
To understand the effects of aircraft loading (instantaneous braking) on inset fixtures.



*Are six 3/8" 18-8 bolts sufficient?*



# Assumption: 75% proof-load tensile limit<sup>[7]</sup>



# Assumption: full main-gear contact

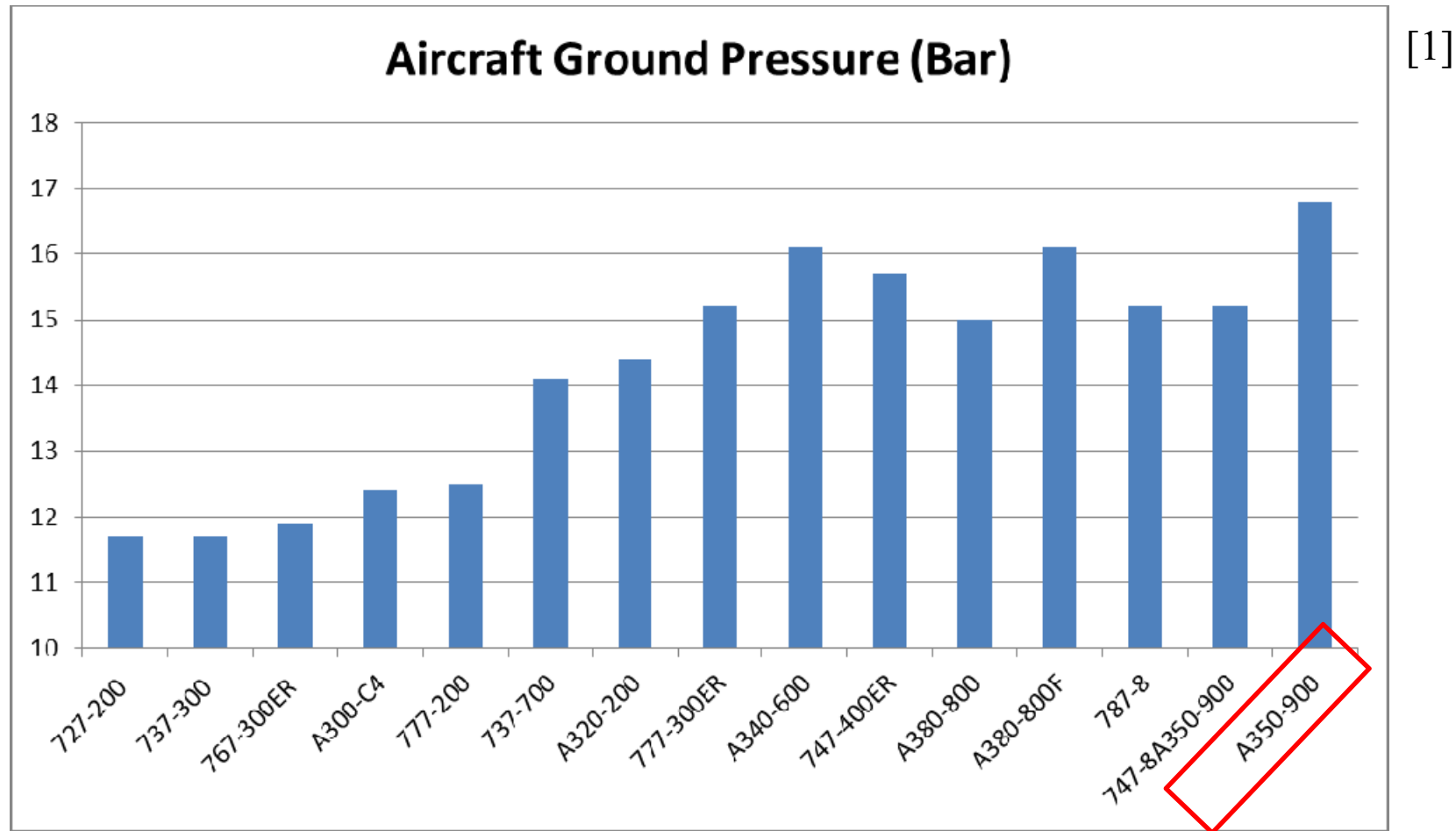
---

[Click](#) for video of cross-wind landings<sup>[3]</sup>.





# Aircraft Pavement Contact Pressure



# A350-900 Main Strut Data (each)<sup>[2]</sup>

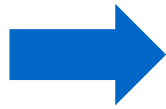


Max Static Load (lbs)	Instantaneous Braking Force (lbs)
277,700	222,150

# Analysis Case General Assumptions

---

So, for the main strut of a A350-900 aircraft<sup>[2]</sup>



69,500 lb downforce per tire



55,600 lb horizontal (shear) force per tire

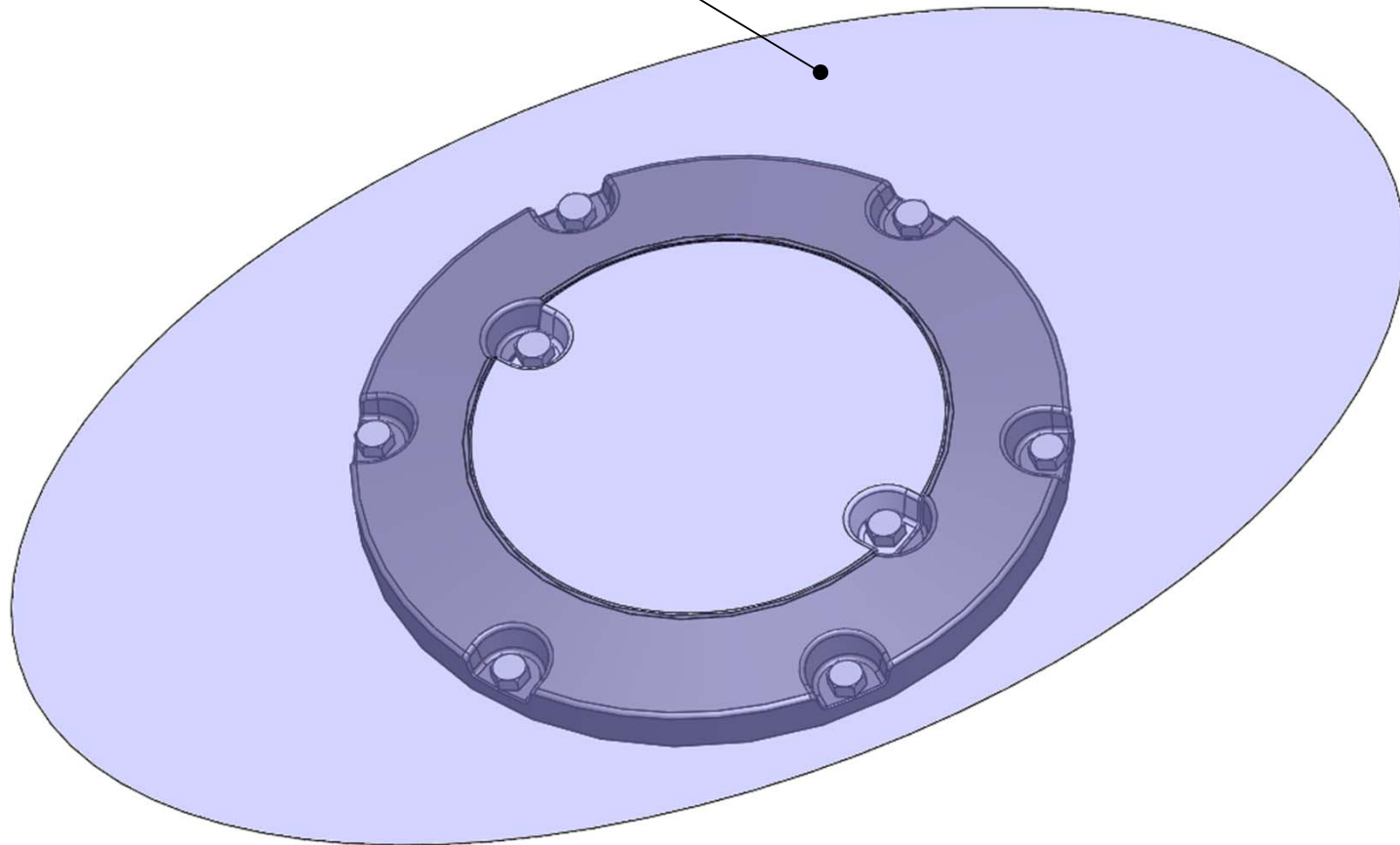
[13]



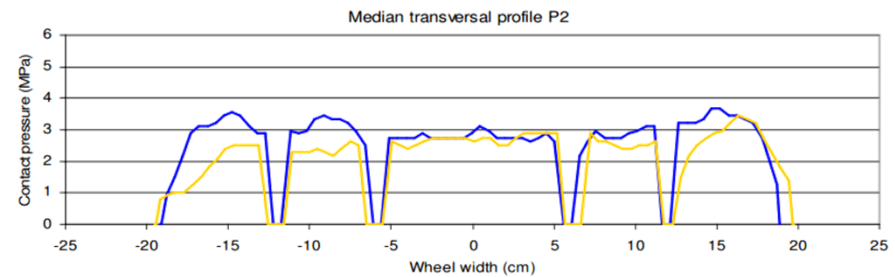
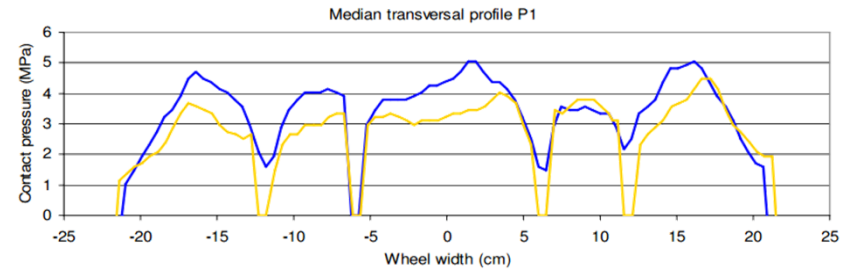
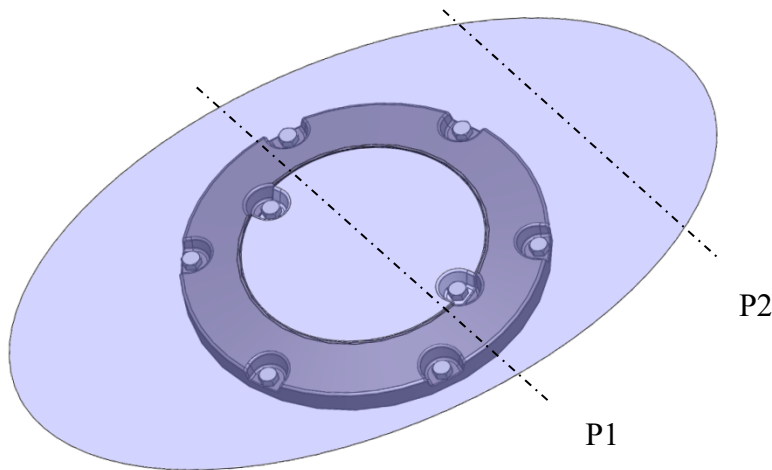
# Assumption: full main-gear contact

---

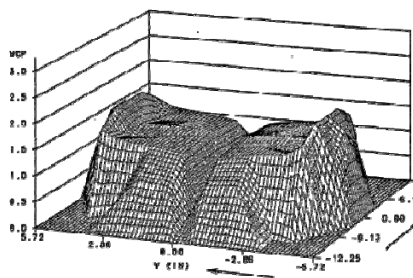
A350-900 Tire Contact Patch, 290in<sup>2</sup> [4]



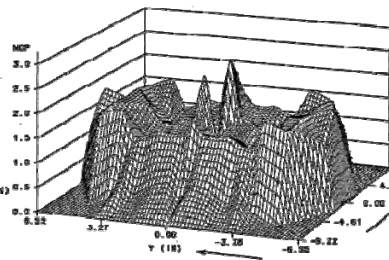
# Assumption: 150% x average loading



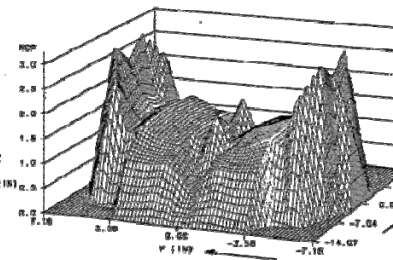
Normalized contact pressure - C-5B tire  
(13500 LB LOAD, 175 PSI INFLATION)  
(NORMALIZED TO INFLATION PRESSURE)



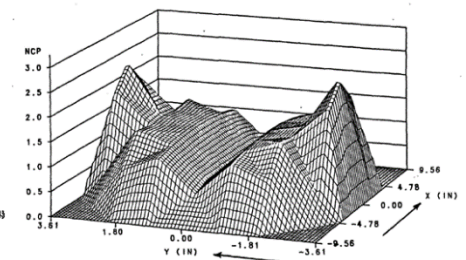
Normalized contact pressure - B-1B tire  
(13500 LB LOAD, 200 PSI INFLATION)  
(NORMALIZED TO INFLATION PRESSURE)



Normalized contact pressure - C-130 tire  
(14500 LB LOAD, 175 PSI INFLATION)  
(NORMALIZED TO INFLATION PRESSURE)

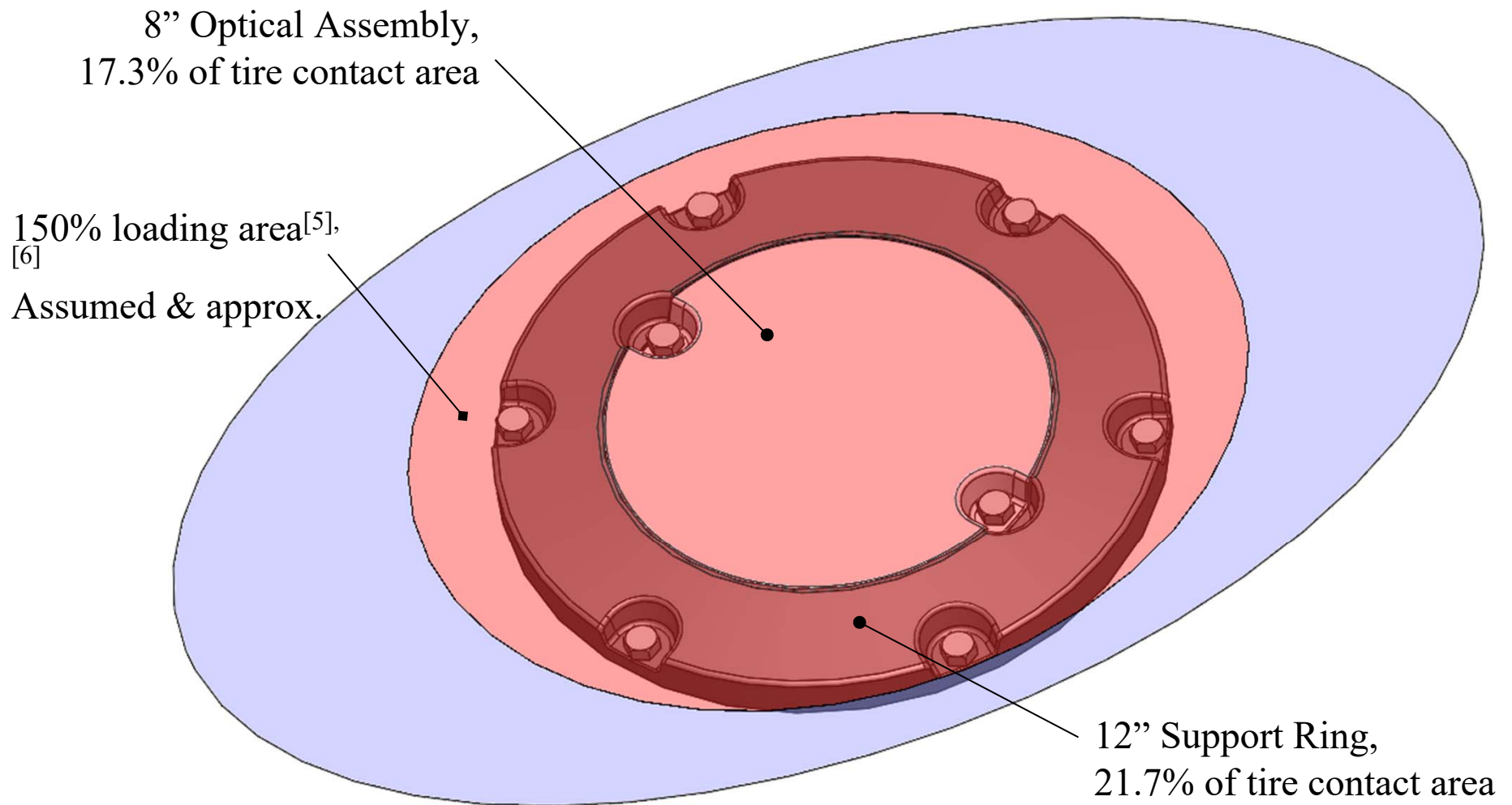


Normalized contact pressure - F-15E tire  
(12500 LB LOAD, 305 PSI INFLATION)  
(NORMALIZED TO INFLATION PRESSURE)



Boeing and Airforce test data<sup>[5] [6]</sup> (above) shows uneven contact pressure distribution across the length of an aircraft tire patch

# Fixture contact area





## Remaining Assumptions

---

- ➡ Maximum instantaneous vertical and horizontal (shear) forces<sup>[2]</sup> occur simultaneously
- ➡ 0.45 coefficient of friction on fixture-to-base mating surfaces<sup>[9]</sup> (from FAA brief EB83), actual COF may vary
- ➡ Controlled bolted-joint K value of .18 (marine grade anti-seize)<sup>[10]</sup>

# A350-900 Minimum Required Bolt Tensile Load Calculations

## A350-900 Braking Shear Load on 12" fixture

Shear load applied to fixture w/ support ring =

$$(222,150 \text{ lb} / 4) \times 150\%^{[5], [6]} \times (17.3\% + 21.7\%) = 32,489 \text{ lb}$$

## A350-900 Down Force on 12" fixture

A350-900 down-force applied to 12" fixture =

$$(277,700 \text{ lb} / 4) \times 150\%^{[5], [6]} \times (17.3\% + 21.7\%) = 40,614 \text{ lb}$$

## A350-900 Self-applied Shear Resistance on 12" fixture

$$40,614 \text{ lb} \times .45_{\text{COF}}^{[9]} = 18,276 \text{ lb shear resistance}$$

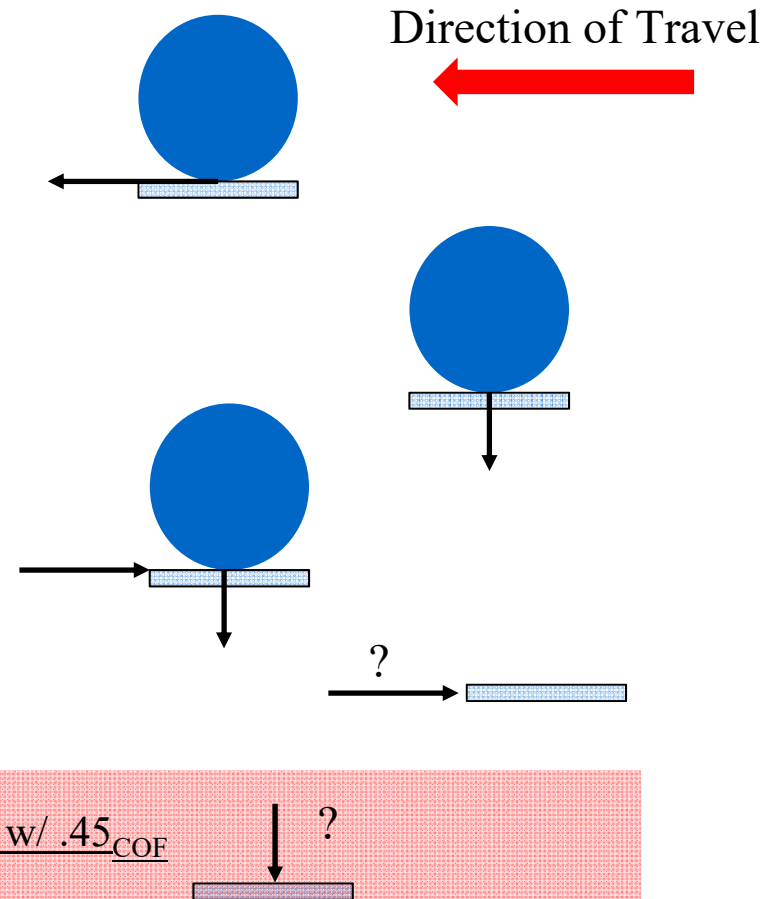
## Minimum Required Bolting Shear Resistance for 12" fixture

$$32,489 \text{ lb} - 18,276 \text{ lb} = 14,212 \text{ lb min}$$

## Minimum Required Bolt Clamp Load to Resist 14,212 lb Shear w/ .45<sub>COF</sub>

$$14,212 \text{ lb} / .45_{\text{COF}}^{[9]} = 31,584 \text{ lb min total clamp load}$$

$$31,584 \text{ lb} / 6 \text{ bolts} = 5,264 \text{ lb min clamp load per bolt}$$



# Current FAA Certification Requirements (AC...46E)

## Current FAA Certification Requirements (AC...46E):

### **4.5.1.3. Horizontal Shear Test.**

This test simulates the shearing load applied to the top of any in-pavement fixture by a braking aircraft tire.

- a. A bar must be attached (welded) to the top of the fixture so it is parallel to the runway centerline when the light is installed.
- b. The ends of the bar should extend beyond the edges of the fixture to facilitate loading.
- c. The light fixture, attached to a base receptacle or facsimile, and torqued to manufacturer's specifications, must be installed in a press with the attached bar in line with the piston of the press.
- d. A load of 3,000 pounds (1,360.70 kg) must be applied to the end of the bar by the press. The load must be applied and release 20 times to each end of the bar.
- e. Any structural damage, movement of any part, or loosening of fasteners must be cause for rejection.

[11]

## Worst case A350-900 analysis (i.e. this analysis):

### Minimum Required Bolting Shear Resistance for 12" fixture

$$32,489 \text{ lb} - 18,276 \text{ lb} = 14,212 \text{ lb min}$$

# Current FAA Recommendations (EB83)

## 1.0 Recommended Industry Best Practice.

[9]

a. A **maximum of 185 in lbs.** of torque for a **dry 18-8 bolt** is recommended. A torque of 185 in. lbs. **should not** be used for a 18-8 bolt with anti-seize compound applied to the threads. With anti-seize compounds and coated bolts, less torque is required to achieve the clamping forces required to offset fixture movement in the presence of opposing forces. Always consult the light fixture manufacturer's installation instructions for proper bolt torque.

## 2.1.1 Determination of Clamp Force from Bolt Torque.

[9]

If the light fixture manufacturer's recommended torque of 185 in. lbs. is used, the clamping force of the light fixture to the light base can be verified. Algebraically solving the equation in 2.1 for  $F_p$  and using a dry bolt ( $K = 0.2$ ):

**NOTE:** The friction coefficient  $K$  will be explained in later text.

$$F_p = T / K * D$$

Substituting the numbers:

$$F_p = 185 \text{ in. lbs.} / 0.2 * 0.375 = 185 / 0.075 = 2,466 \text{ lbs. clamping force}$$

It then follows that the total clamping force for a light fixture to a light base is 6 times 2,466 lbs. (six bolts in the light fixture) or 14,796 lbs.

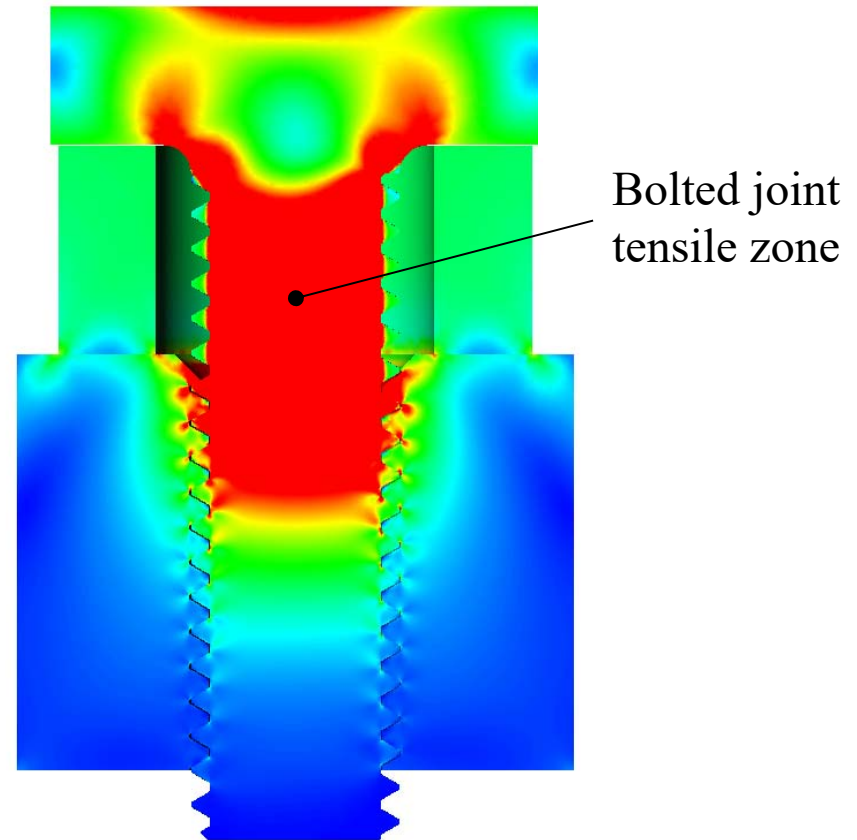
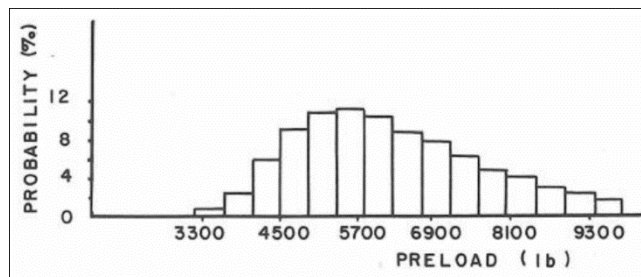
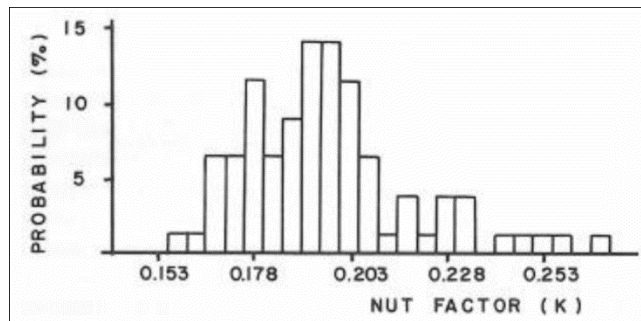
## Worst case A350-900 analysis (i.e. this analysis):

Minimum Required Bolt Clamp Load to Resist 14,212 lb Shear w/ .45<sub>COF</sub>

$$14,212 \text{ lb} / .45_{\text{COF}}^{[9]} = 31,584 \text{ lb min total clamp load}$$

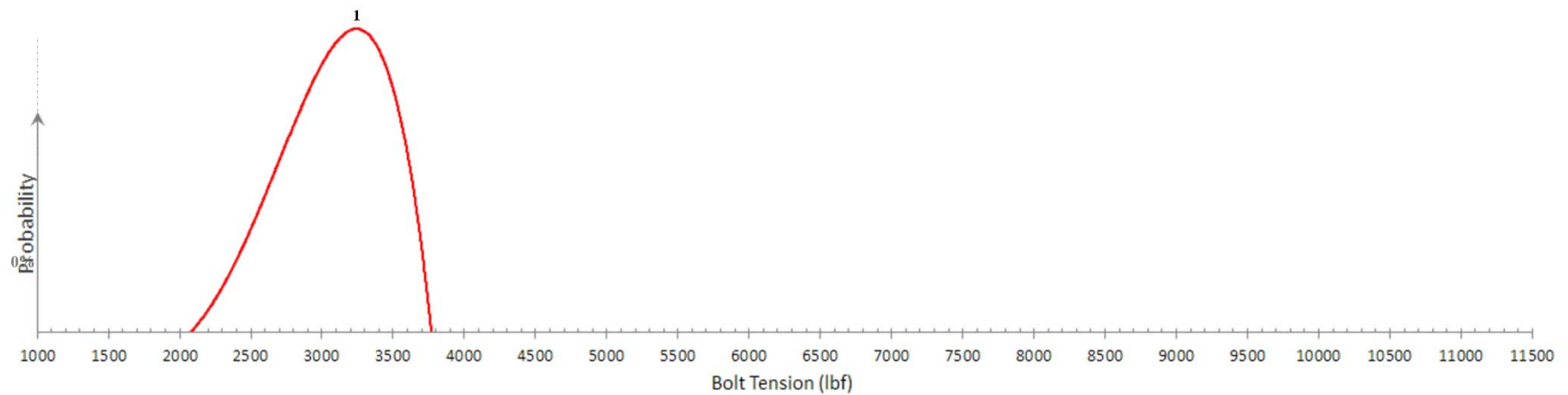
$$31,584 \text{ lb} / 6 \text{ bolts} = 5,264 \text{ lb min clamp load per bolt}$$

# Assumption: $\pm 25\%$ tensile load uncertainty<sup>[8]</sup>



# Torque & Probable Bolt Tension<sup>[8]</sup>, $K=.18$ <sup>[10]</sup>

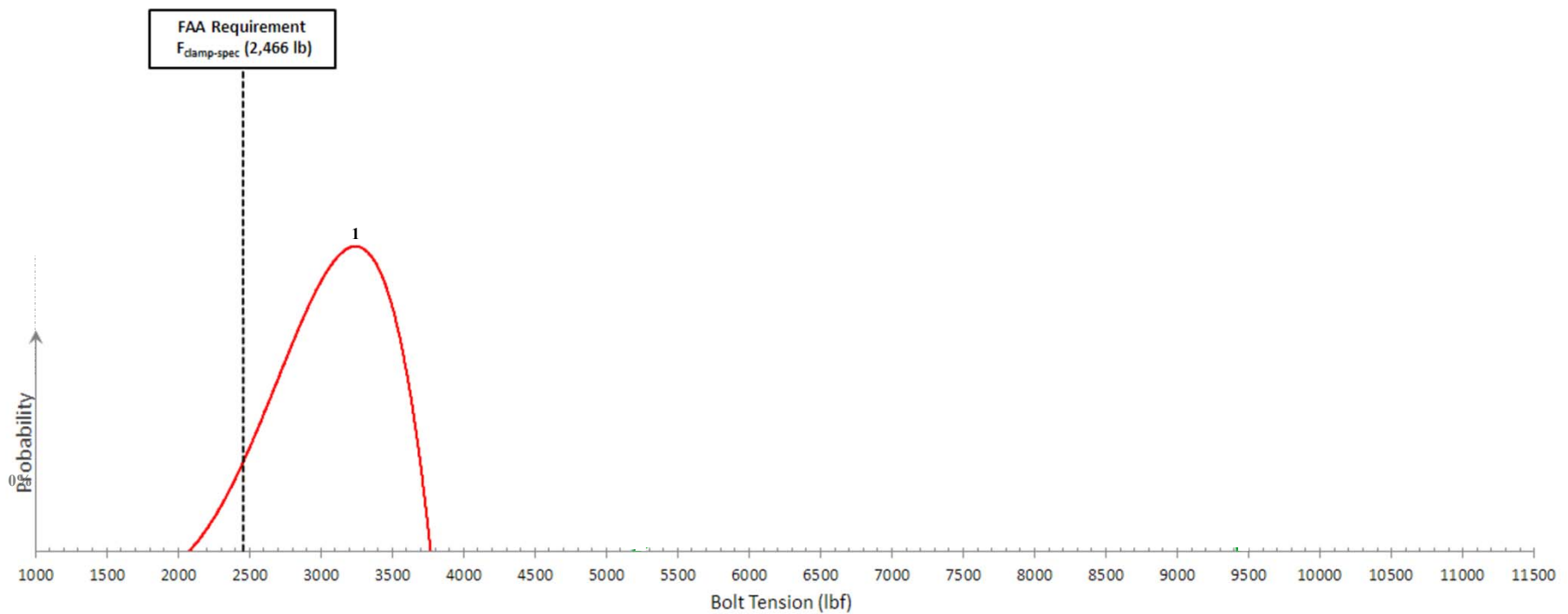
1 — Poly. (3/8-16 bolt @ 185 in-lb (15.4 ft-lb), FAA spec)





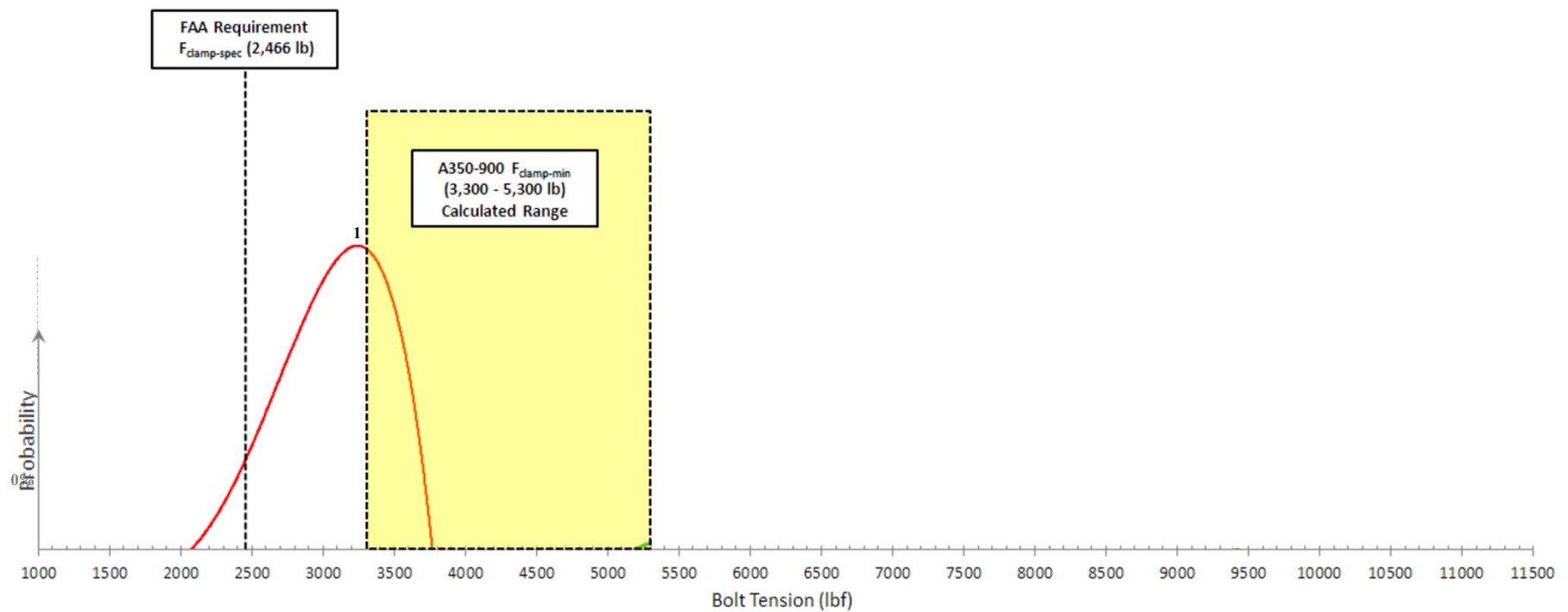
# Torque & Probable Bolt Tension<sup>[8]</sup>, $K=.18$ <sup>[10]</sup>

1 — Poly. (3/8-16 bolt @ 185 in-lb (15.4 ft-lb), FAA spec)



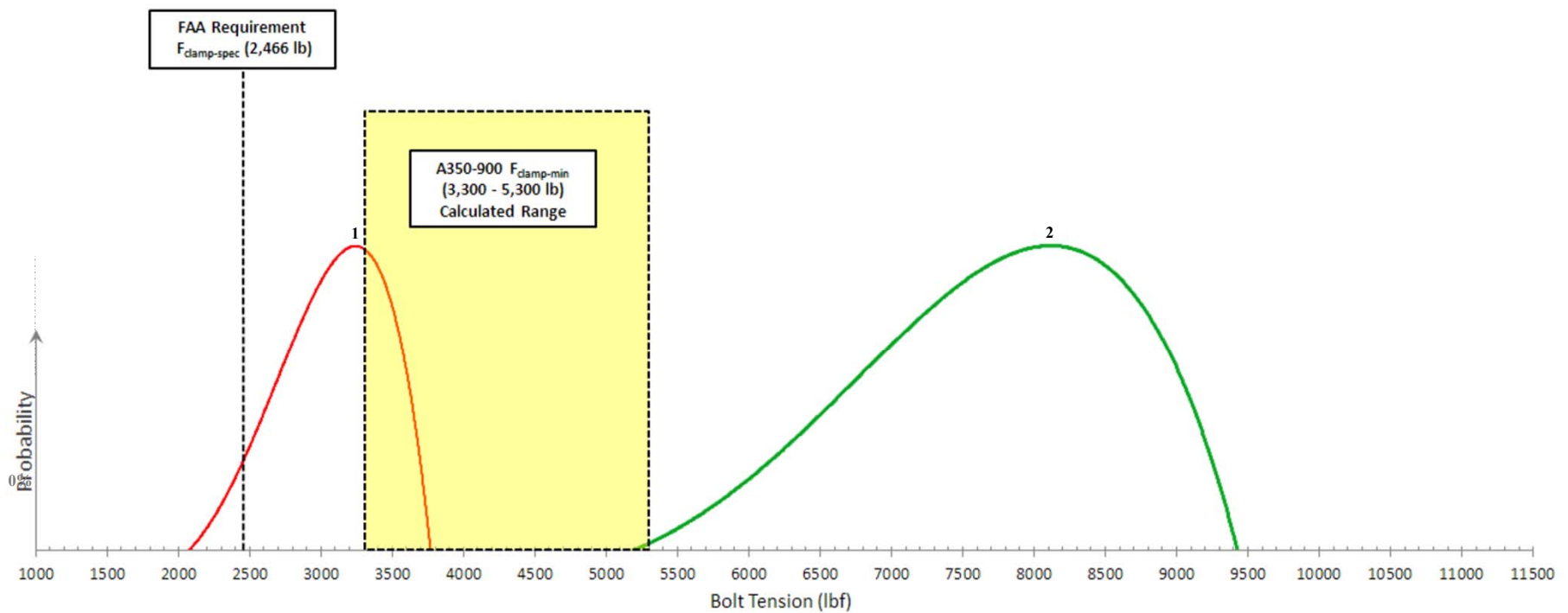
# Torque & Probable Bolt Tension<sup>[8]</sup>, $K=.18$ <sup>[10]</sup>

1 — Poly. (3/8-16 bolt @ 185 in-lb (15.4 ft-lb), FAA spec)



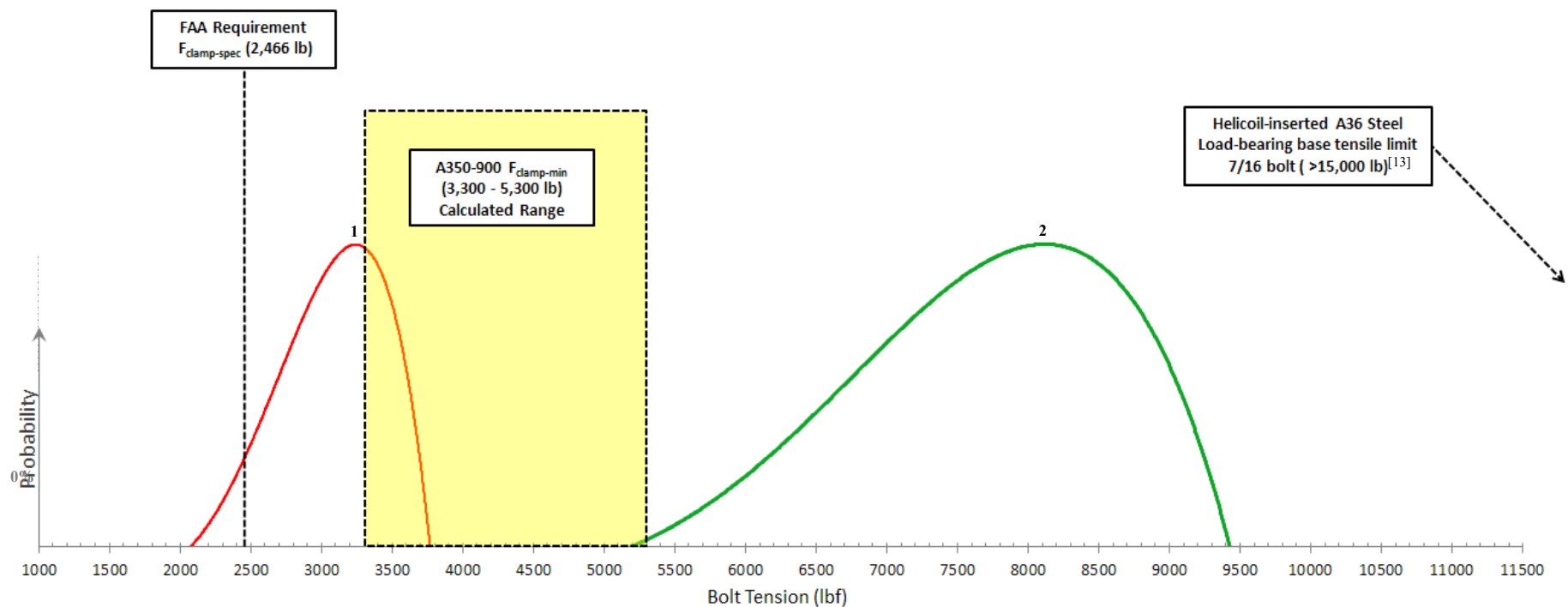
# Torque & Probable Bolt Tension<sup>[8]</sup>, $K=.18$ <sup>[10]</sup>

- 1 — Poly. (3/8-16 bolt @ 185 in-lb (15.4 ft-lb), FAA spec)
- 2 — Poly. (7/16-14 bolt @ 540 in-lb (45.0 ft-lb), HT spec)

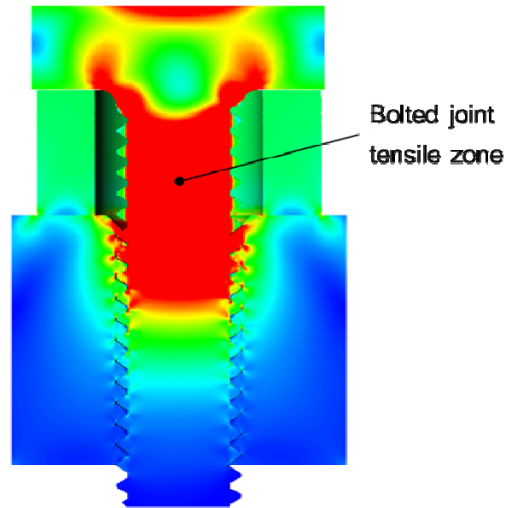


# Torque & Probable Bolt Tension<sup>[8]</sup>, $K=.18$ <sup>[10]</sup>

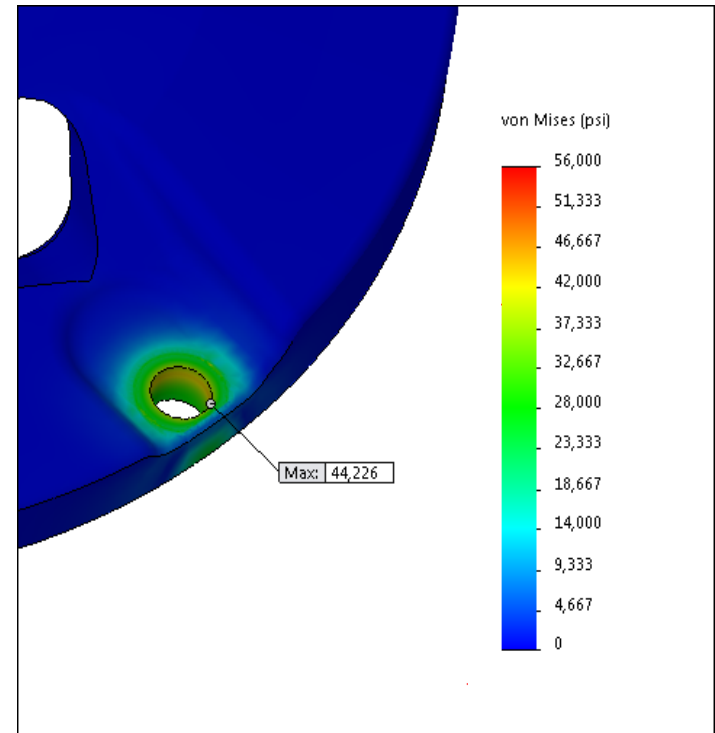
- 1 — Poly. (3/8-16 bolt @ 185 in-lb (15.4 ft-lb), FAA spec)
- 2 — Poly. (7/16-14 bolt @ 540 in-lb (45.0 ft-lb), HT spec)



# Bolt System Considerations (3/8" & 7/16")



- Bolt yield
- Fixture compression
- Base can pull out
- Lock washer loading
- (Threaded insert) pull-out strength



# Options & Recommendations

Approach	Pro's	Con's
6 x 3/8" 18-8 Stainless, increased torque (40+ ft-lb)	<ul style="list-style-type: none"> <li>• Uses existing hardware</li> <li>• No change to current configuration</li> <li>• Provides required clamp load (but no margin)</li> </ul>	<ul style="list-style-type: none"> <li>• Will statistically create bolt stresses in the range of ultimate tensile stress. Safety issue.</li> <li>• May overload optical housing.</li> </ul>
12 x 3/8" 18-8 Stainless (15 ft-lb)	<ul style="list-style-type: none"> <li>• Uses existing hardware</li> <li>• No changes to base cans</li> </ul>	<ul style="list-style-type: none"> <li>• Doubles the amount of hardware</li> <li>• Light fixtures need redesign</li> <li>• Offers slightly less than required clamp force</li> </ul>
6 x 3/8" Grade 8 (130ksi) Coated Steel (40+ ft-lb)	<ul style="list-style-type: none"> <li>• No changes to light fixtures or base cans</li> </ul>	<ul style="list-style-type: none"> <li>• Coated bolts susceptible to abrasion/flaking and corrosion</li> <li>• May overload lock washers</li> <li>• May overload aluminum housings</li> </ul>
7/16" Stainless (90ksi) (45 ft-lb)	<ul style="list-style-type: none"> <li>• Provides required clamp load (but no margin)</li> <li>• Minimal changes to light fixtures (enlarged clearance holes)</li> </ul>	<ul style="list-style-type: none"> <li>• Need to re-tap (or install inserts) base-cans, or replace can extensions</li> <li>• Requires new hardware</li> </ul>
1/2" Stainless (90ksi) (68 ft-lb)	<ul style="list-style-type: none"> <li>• Exceeds required clamp load with sufficient margin (&gt;30%) for the foreseeable future</li> </ul>	<ul style="list-style-type: none"> <li>• System redesign (light fixture and base-can)</li> </ul>
Add shear pins?		



# Automotive Approach

1/2 Ton Chevy Truck → Six 7/16" Lugs



Inputs		
Calculated		
		units
Curb Weight =	3300	lb
Load capacity =	0.5	ton
# of wheels =	4	n/a
# of bolts per wheel =	5	n/a
Acceleration/Deceleration =	3	g
Shear force per wheel =	3225	lbf
Shear force per bolt =	645	
COF =	0.45	n/a
Min required clamping force =	1433.3	lbf/bolt
Typical 7/16 lug nut torque =	85	ft-lb
Min 7/16 lug nut clamp =	8000	lbf
Clamp Factor of Safety =	5.6	

Time for a system upgrade?

# Summary

---

Airports should work with the FAA to determine the best path forward and obtain approval if it deviates from specifications until the next generation solution is defined.

# References

---

- [1] **Aircraft Pavement Load:** *Airport Compatibility, Opportunities and Challenges* <http://www.aci-na.org/static/entransit/Cohen-Nir.pdf>
- [2] **A350-900 Maximum Pavement Loads:** Airbus A350-900 Aircraft Characteristics, *Airport & Maintenance Planning*, Rev Jun 01/13
- [3] <https://youtu.be/FAGtkesvR-w>
- [4] **Tire contact area:** *Calculation Tire Contact Area* <http://www.boeing.com/assets/pdf/commercial/airports/faqs/calctirecontactarea.pdf>
- [5] **Tire Pressure Distribution:** *Full-Scale Aircraft Tire Pressure Tests* <http://www.airporttech.tc.faa.gov/ATT2010/Pavements/Session9a/Fabre-Full%20Scale%20Aircraft%20Tire%20Pressure%20Tests.pdf>
- [6] **Tire Pressure Distribution:** *Aircraft Tire/Pavement Pressure Distribution*, AD-A279 100, Department Of The Air Force, 1989
- [7] **Tensile Stress-Strain Diagram:** Fastenal Bolted Joint Design <https://www.fastenal.com/content/feds/pdf/Article%20-%20Bolted%20Joint%20Design.pdf>
- [8] **Preload Uncertainty:** NSTS 08307 NASA Space Shuttle Criteria For Preloaded Bolts, Rev A
- [9] **Coefficient of friction, Recommended Industry Best Practice, Determination of Clamp Force from Bolt Torque:** Engineering Brief 83 [http://www.faa.gov/airports/engineering/engineering\\_briefs/media/eb-83.pdf](http://www.faa.gov/airports/engineering/engineering_briefs/media/eb-83.pdf)
- [10] **Anti-seize K Factor:** [https://tds.us.henkel.com/NA/UT/HNAUTTDS.nsf/web/6BD116165490B5A0852577450068FB29/\\$File/MARGASL-EN.pdf](https://tds.us.henkel.com/NA/UT/HNAUTTDS.nsf/web/6BD116165490B5A0852577450068FB29/$File/MARGASL-EN.pdf)
- [11] **Horizontal Shear Test:** AC150-5345-46D [http://www.faa.gov/documentLibrary/media/advisory\\_circular/150-5345-46D/150\\_5345\\_46d.pdf](http://www.faa.gov/documentLibrary/media/advisory_circular/150-5345-46D/150_5345_46d.pdf)
- [12] **Helicoil Assembly Tensile Strength:** *Tensile Strength of Threaded Insert Assembly*, Technical Bulletin 68-2
- [13] **A350 landing:** <http://www.airbus.com/presscentre/pressroom/high-res-photos/filter/a350-xwb-family/cache/0/>



*Powering Business Worldwide*

## ***Implementation of Phase IIA is more complex for a number of reasons.***

---

Modification of multiple fixture assembly components

- Base cans
- Spacers
- Fixtures

Clear departure from FAA Circulars that prescribe 3/8" bolts

Two Conditions: Retrofit and New

## *The retrofit alternative required has to compare modification or replacement of extension collar*

Replacement of the extension collar with 3/8" bolt holes on the bottom flange and 7/16" bolt holes on the top.

Modification of the base can or extension collar in place will require a tool to drill out existing bolt holes.





## ***The target schedule for the Phase IIA 7/16” bolt alternative is March, 2017***

---

1. LPI will perform field testing with instrumented cans and bolts at JFK; 1<sup>st</sup> with 3/8” followed by 7/16”.
2. LPI updating the finite element analysis and performing additional lab testing of the bolts, inserts, extension collars, and base cans.
3. PA will be submitting findings by LPI and Eaton, requesting concurrence that the proposed plan meets or exceeds applicable circular criteria.
4. Installation work will begin in 2017 prioritizing: 1.High-speed turn-offs, 2. Balance of runways, 3. Taxiways
5. Where possible, work will be timed with planned capital projects with the balance being performed by in-house staff.

## ***Airport operators and manufacturers should evaluate their programs for similar reliability enhancements***

---

Improve Installation QA/QC

Update PM program

Develop customized implementation plan to increase clamping force considering:

- Fixture assembly materials (carbon steel vs. stainless)
- Bolt material and target preload (evaluate gall risk)
- Evaluate light fixtures, extension collars, and base cans for higher stresses (avoid moving the problem)
- Prepare implementation plan based on: risk-based priorities, scheduled capital projects, and resource constraints

## ***Engaging Airport Industry to Date & Future Plan***

---

### Advisory Circular (AC) Comment Process

9/16/2015 – PANYNJ commented on AC 150/5345-42G  
“Specification for Airport Light Bases, Transformer  
Housings, Junction Boxes, and Accessories”(replaced by  
42H)

### FAA Atlantic City Tech Center Meetings

### Engagement with Airport Associations

11/21/2016 – AAAE North East Chapter Webinar

3/28-30/2017 – 2017 Airports Conference, Hershey, PA

Winter 2016/17 – AAAE National/World Webinar

Winter 2016/17 – ACI National/World Webinar

# ***Moving Forward – Key Elements to a Successful Improvement Program***

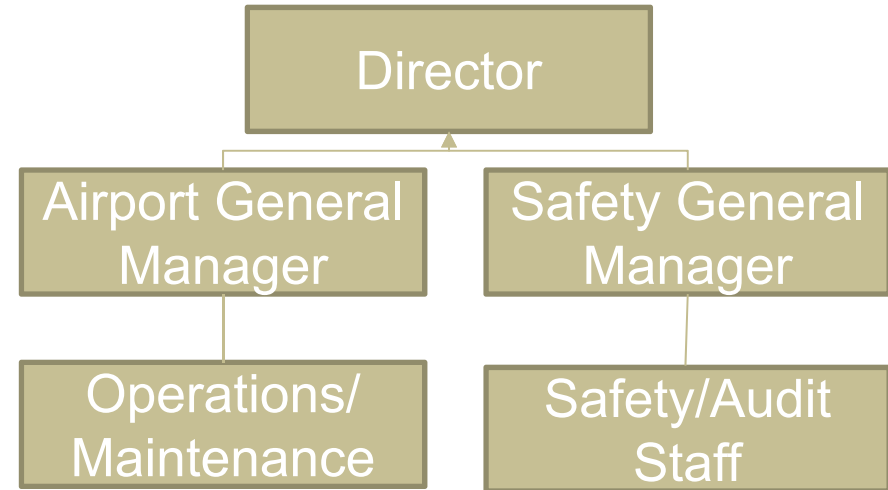
---

## Safety Assurance

- Independent from airport
- Audit procedures & reports
- Follow-up

## Safety Promotion

- Defined job responsibilities
- Training (classroom, manufacturer and OJT)
- Meetings and communication
  - Scheduled (quarterly, weekly)
  - Immediate (email new findings)



## *Questions?*

---

