



# Anchor Rod and Bolt Tightening for High Mast Light Towers and Cantilever Sign Structures

**Western Bridge Engineers' Seminar  
2011**

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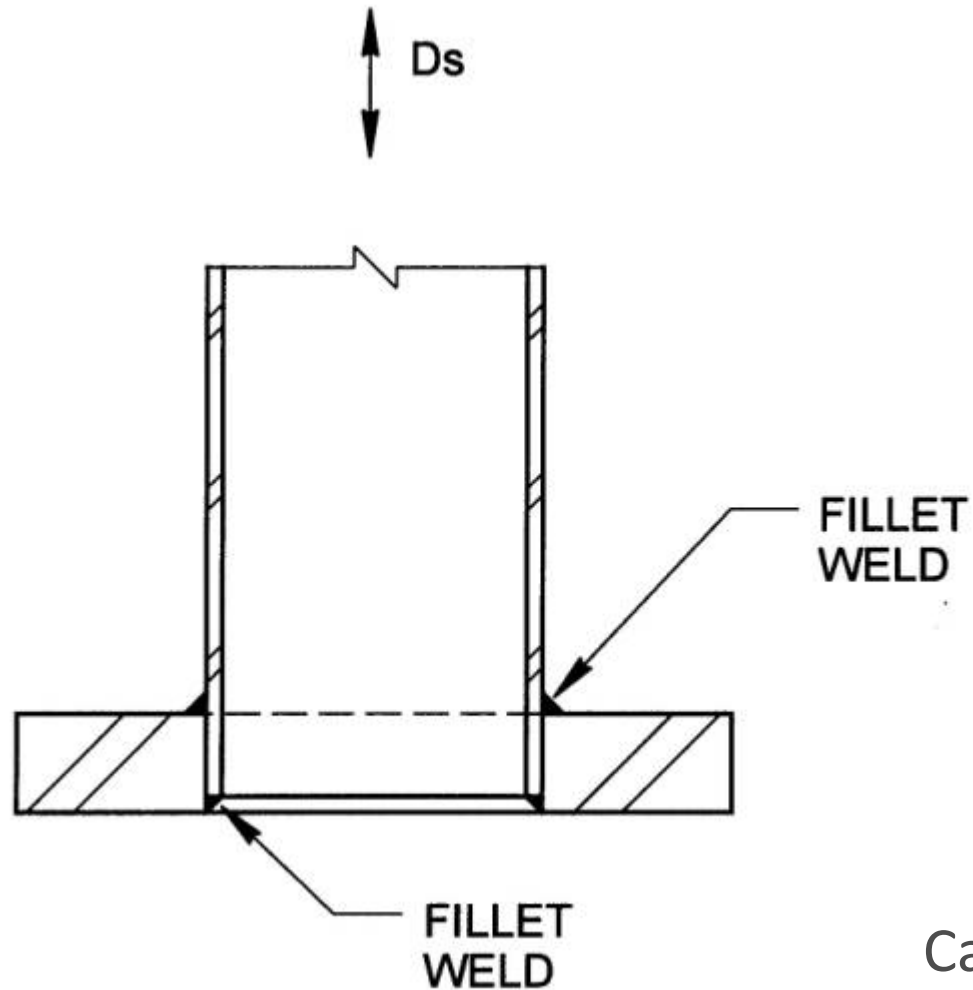








# Fillet Welded Socket Connections



# Dye Penetrant Testing

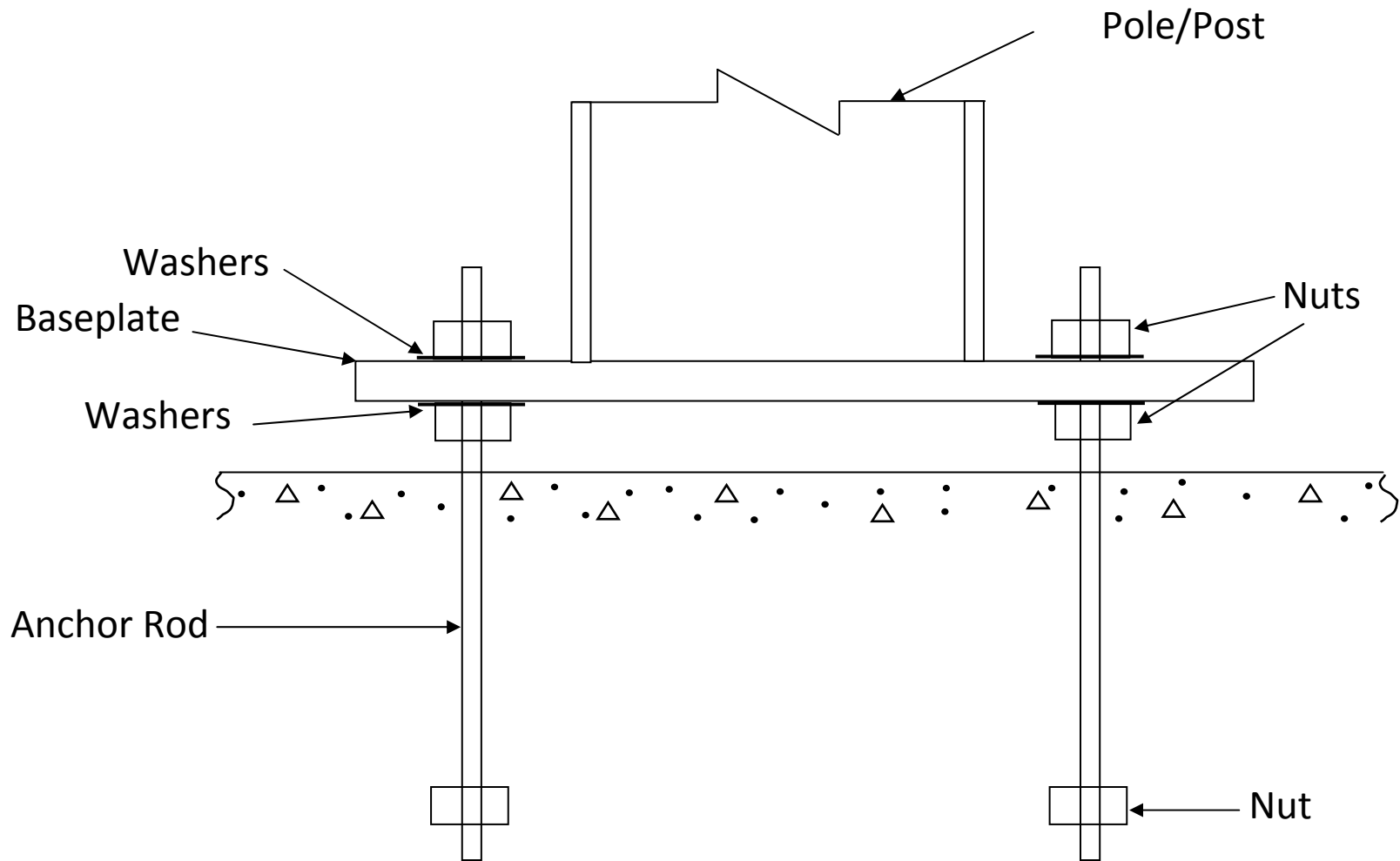


# Cracks at Bend Points





# Double-Nut-Moment Joints



# Double-Nut -Moment Joints

- Washers required at each nut (top, bottom)
- Beveled washers if bolt misaligned greater than 1:40
- Leveling nut to concrete less than one anchor rod diameter
- Pretension improves fatigue resistance
- Base plate thickness



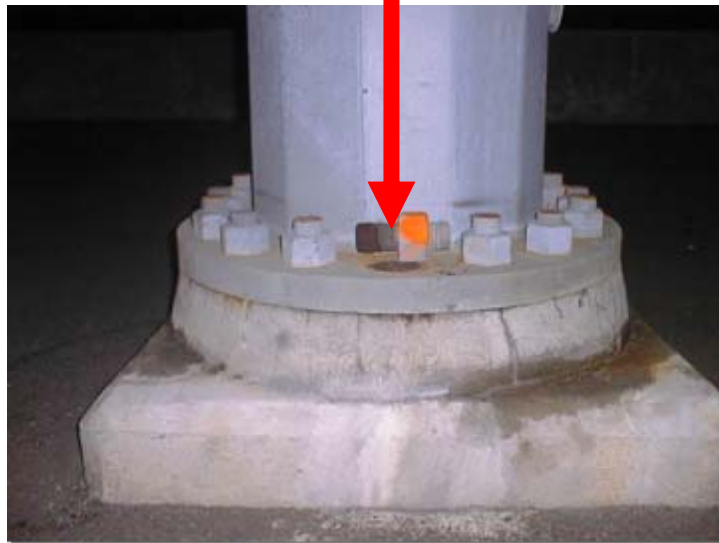
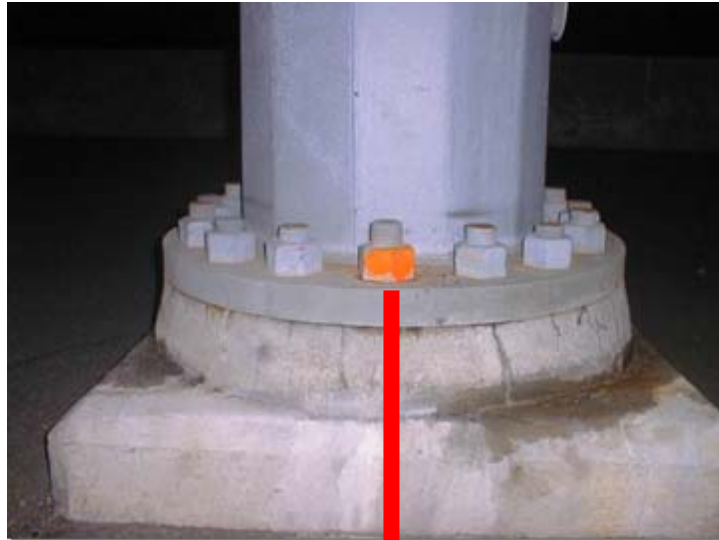
# Anchor Rods' Nuts Obviously Loose



# Loose Leveling Nuts



# Anchor Rod Failure



Broken Due to  
Corrosion

# Identify Loose Bolts



# Anchor Rod Tensioning

- Install and level the leveling nuts
- Place the base plate
- Install the top nuts and snug them
- Snug the leveling nuts
- Tension the top nuts utilizing the required rotation
- Verify minimum torque



# Turn-of-Nut Pretensioning

Anchor Rod Diameter, In.	Nut Rotation from Snug-Tight Condition	
	F1554 Grade 36	F1554 Grades 55 and 105 A615 and A706 Grade 60
1 1/2	1/6 turn	1/3 turn
> 1 1/2	1/12 turn	1/6 turn

# Anchor Rod Verification Torque

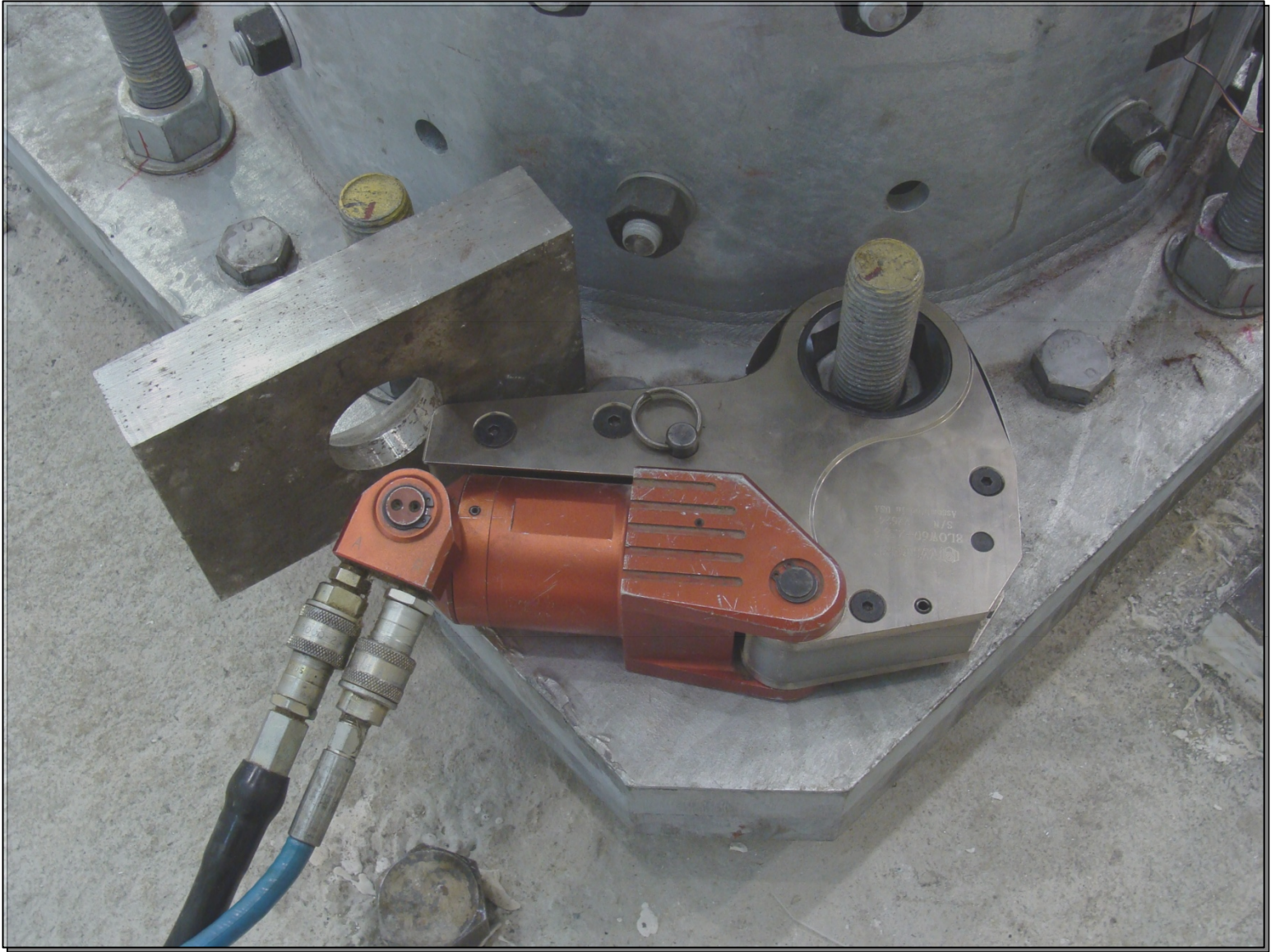
$T$  = required verification torque =  $0.12 P D$  (KN-mm/in-k)

$D$  = rod diameter (mm/in)

$P$  = rod tension (KN/kips)

$P_{\text{final}} > 60\%$  of tensile strength







# Follow-Up Retightening Using Torque

- Retighten after 48 hours
- Torque wrench used to verify torque
- Torque to 110% of verification torque

# Retightening

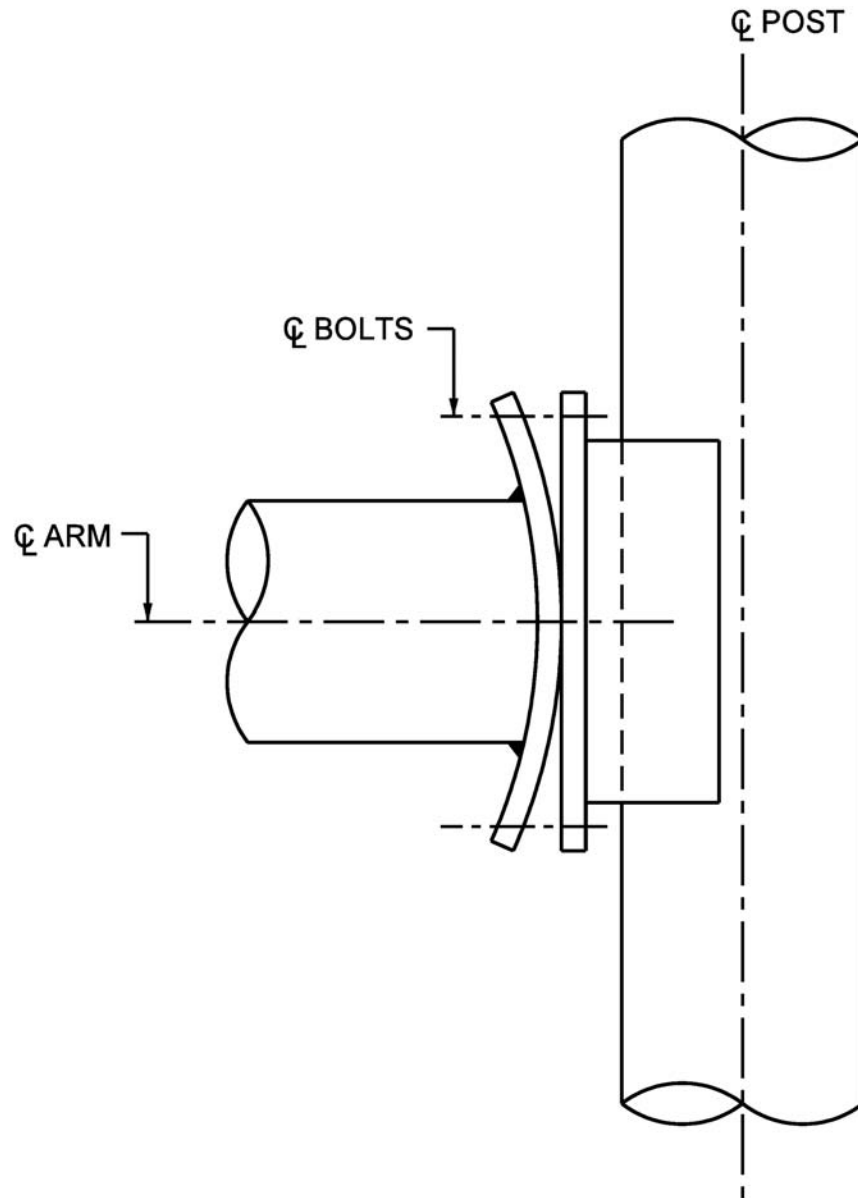
- Remove nut
- Clean and lubricate
- Install new (reuse) nut
- Turn-of-nut?
- Torque?
- Load indicator washers

# Fillet Welded Mast-Arm-To-Column Connections



Category E'





# Installation

- Washers between plates
- Finger shims
- Proper bolt pretension

# Suggestions

- Owner specifications
- Manufacturer's instructions
- Better construction inspection

# Questions

