Using Telecom Hybrid Transmission Towers & Tower Modifications for Collocation
Introduction

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Overview

• Hybrid Transmission Structure
  ✓ Facilitates T-Line & Wireless
  ✓ Up to 200’ Tall
• Ugly on Ugly – Zoning Friendly
• Revenue Stream from Wireless
• Pre-Planned or Replacement
• Flanged Expansion Options
Overview

• PPL Electric Utilities – Modification Case Study
  ✓ Substation pole structure
  ✓ 115 ft – 69 kV transmission Summit Manufacturing pole

• AT&T Co-Location

• Antenna Upgrade & Structural Modifications

• Harrisburg, PA
• AT&T antenna change-out to meet increased demand

<table>
<thead>
<tr>
<th>Mounting Level (feet)</th>
<th>Center Line Elevation (feet)</th>
<th>Number of Antennas</th>
<th>Antenna Manufacturer</th>
<th>Antenna Model</th>
<th>Number of Feed Lines</th>
<th>Feed Line Size (inches)</th>
<th>Note</th>
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<tr>
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<td>116</td>
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<td>CDX723A Diplexers</td>
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<td>Low Profile Platform</td>
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<table>
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<tr>
<th>No. of Antenna</th>
<th>Height (in)</th>
<th>Width (in)</th>
<th>Thickness (in)</th>
<th>Weight (lbs)</th>
<th>Area (ft²)</th>
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Standards

• **TIA-222-G – Mounts & Equipment**

• **NESC – Structure Loads**

• **ASCE 48-11 – Pole Design Standard**
Evaluation

• Overview –
  • First Analysis – Using Standard Criteria (Conservative)
    • Shaft Reinforcement – Base to EL 97’-10”
    • Base Plate Reinforcement
    • Foundation Mat Reinforcement (13’x13’x6’ Eccentric)
  • Utility says OK… But….Uh, Well, Perhaps we should investigate further!!
  • Value Engineering (Actual equipment & Actual wire loads)
    • Base Plate Reinforcement Only! – Easy --- Yeah!

• Modeling program / technique – PLS Pole & Custom Calcs

• Structure components:
  Shaft - 95 %
  Base plate: Unreinforced - 125 % --- Reinforced – 48%
  Anchors - 64 %
  Foundations - 83 %

• Overstress conditions – Base Plate Bending
Modification Design

• Initial Design
  • Bolted shaft reinforcement
  • Base Plate Reinforcement
  • Foundation Reinforcement

• Final Design
  ✓ Install base plate stiffeners
  ✓ Install foot pads
  ✓ Install grout under foot pads
  ✓ Modification Inspection & Close-Out
NOTE: DRAWINGS INCLUDE COLOR-CODED PARTS FOR CLARITY.

### Table

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**NOTES:**

1. DOWELS ITEM #4 ARE 12 1/2" EMBEDDED INTO CAISSON USING RE-500C3 ADHESIVE SYSTEM OR EQUIVALENT. DO NOT DAMAGE EXISTING REINFORCING OR ANCHORS.
2. FOUNDATION SHALL BEAR ON A 6" TO 8" LAYER OF LEVEL COARSE AGGREGATE ENGINEERED BASE FILL OVER NATIVE, UNDISTURBED OR ENGINEERED FILL WITH A MINIMUM ALLOWABLE BEARING PRESSURE OF 11.2 KSF. OVERSIZED PIECES OF ROCK LARGER THAN 3" SHALL BE CRUSHED (REDUCED) IN SITU.
3. PRIOR TO POURING NEW CONCRETE, ROUGHEN SURFACE OF EXISTING CAISSON (1/4" AMPLITUDE). ONCE ROUGHENED, CLEAN AND APPLY AN EPOXY BONDING AGENT MKM S2-HI-MOD.
4. SLOPE TOP OF MAT TO DRAIN AWAY FROM ORIGINAL CAISSON FOUNDATION.

**SECTION A-A**

**ALL DLMS ARE TO OUTSIDE**

**PPL STRUCTURE # 25817 S 5890**

**FOUNDATION**

**F-1**

**SHEET NO. 2 OF 2**
Pre-Construction Inspection

• Perform non-destructive examination of the pole to base plate welded connection
  ✓ Visual examination
  ✓ Magnetic particle examination
  ✓ Ultrasonic testing

• Purpose to verify integrity of base weld connection (toe crack defects)
Construction

• Reinforce base plate
  ✓ Stiffeners
  ✓ Foot pads
  ✓ Grout installation
Construction

- Materials
- Safety
- Welding
- Inspection
- Close-out
Materials

- Stiffeners and foot pads ASTM A572 Grade 65 high strength steel
- Steel material certifications available
- High-strength, non-metallic, non-shrink base plate grout - 8,000 psi
- Parts cut, beveled, and galvanized before shipment
Safety

- Site signage
- Site specific hazards analysis
- Job Safety Analysis (JSA) meeting
- Fire prevention
- Personal protective equipment (PPE)
NO TRESPASSING
CHECK IN FOR SAFETY BRIEFING BEFORE ENTERING SITE

NOTICE
AUTHORIZED PERSONNEL ONLY

DANGER
HARD HAT REQUIRED

CAUTION
RADIO FREQUENCY HAZARD

WARNING
SAFETY GLASSES REQUIRED

DANGER
REPORT ALL INJURIES AT ONCE

NOTICE

DANGER
FALL PROTECTION REQUIRED

CAUTION
CHECK SDS SHEETS ON ALL CHEMICALS BEFORE USING

EMERGENCY
DIAL 911

CAUTION
KEEP OUT FROM UNDER SUSPENDED LOADS

CAUTION
SITE SPEED LIMIT

DANGER
WORKERS ABOVE WATCH FOR FALLING MATERIAL
Welding

• All welding per AWS D1.1

• Qualified welder – welder performance qualification (WPQ)

• Appropriate welding procedure specifications (WPS)
Welding

- Layout
- Proper surface preparation – removal of galvanizing
- Pre-heat per AWS requirements
- Monitor joint fit-up
- Witness welding
Inspection

• 100% continuous weld inspection
• Pre non-destructive weld examination and post non-destructive weld examination – Level II ASNT technician
  ✓ Magnetic particle examination
  ✓ Ultrasonic testing
Finished!
Close-Out

- Engineer of record final review and approval of project documentation
  - Review material certs
  - Review weld inspection reports
  - Review project red-lines
Questions