WPS Make Ready Review and Design Overview

Updated: January 27, 2022

Information Available from WPS

- Navigate – Mapping/GIS
- Construction Standards
- Joint Use Forms

Navigate

- Navigate is our mapping/GIS tool
  - Email: GISHelpDesk@integrysgroup.com
  - A word document of WPS's pole size, class, vintage, wire size/type, equipment type, etc. will be on the report
- Shows Pole Ownership
  - Foreign owned = telephone owned pole

Navigate

- Common acronyms and abbreviations:
  - B CU – Bare copper wire
  - WPCU – Weatherproof Copper wire
  - CW – Copperweld wire
  - AA – All Aluminum
  - ACSR – Aluminum cable, steel reinforced
  - 2c – Duplex wire (or UG primary cable)
  - 3c – Triplex wire
  - 4c – Quadruplex wire

Construction Standards

- New Joint Standards –
  - Use for new pole replacements where replacing more 4 or more poles in a row:
  - https://eroom.wecenergygroup.com/Depts/EDCS/WPS%20Electric%20Distribution%20Standards%20%20SMRPUG/2019/2019%20TOC.pdf
- Historical Standards
  - Some legacy standards not converted yet:
  - Use for pole replacements that are less than 4
  - https://eroom.wecenergygroup.com/Depts/EDCS/WPS%20Electric%20Distribution%20Standards%20%20SMRPUG/ESTD-SP%20TOC.pdf

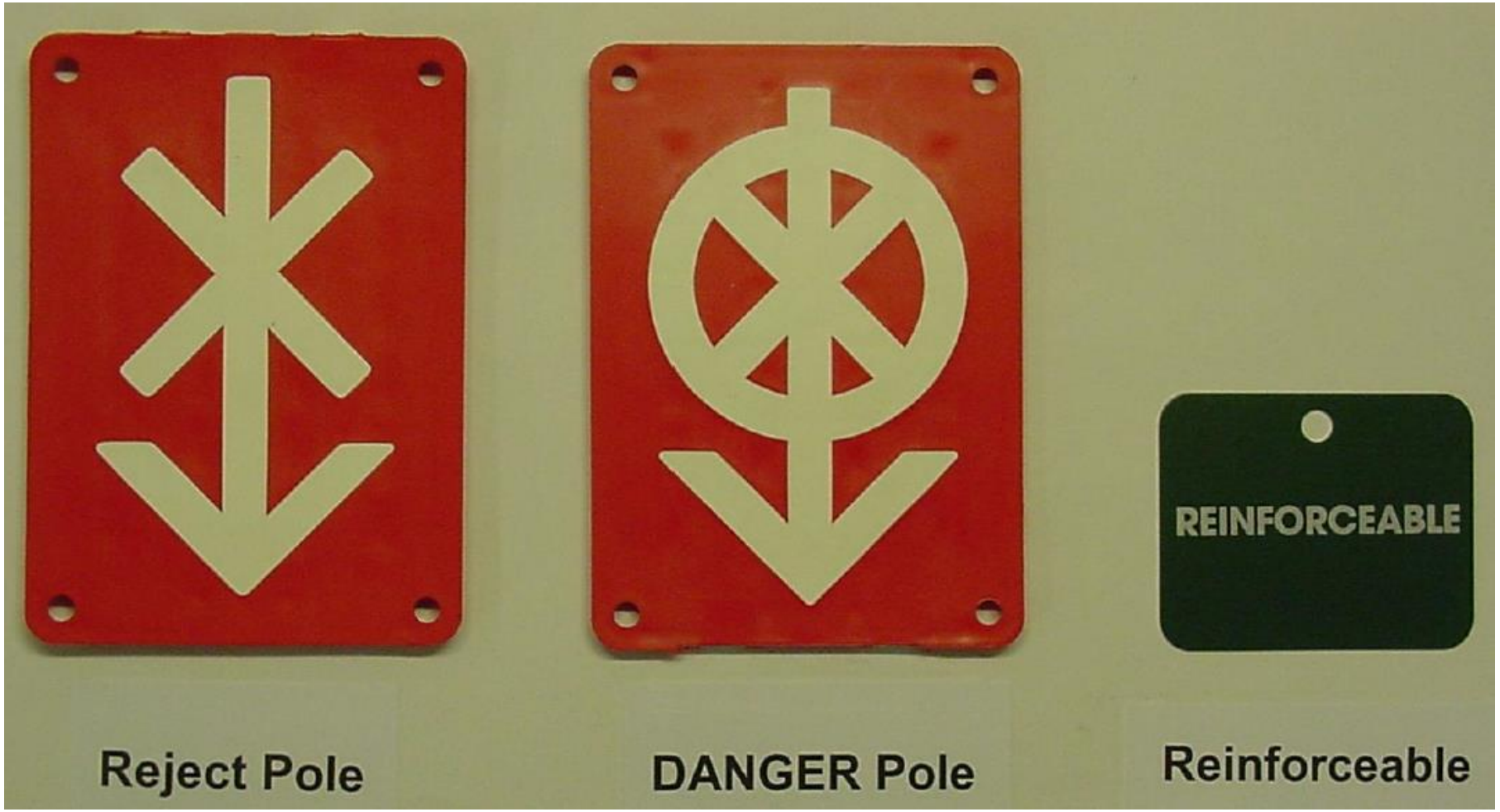
Construction Standards

- A, B,C and F standards are for various pole construction options
  - A – single-phase
  - B – 2-phase
  - C – 3-phase
  - F - secondary
- T standards are for overhead transformers
  - T1 – single-phase overhead transformers
  - T30 – 3-phase overhead transformer bank
- URP standard for primary risers
  - URP1-1 – single-phase primary riser
  - URP3-1 – 3-phase primary riser

Construction Standards

- OSAG – Conductor Sag Tables
  - Sag Table
  - Adder Table – probably not useful for make ready
  - *NOTE* – WPS does not have sag tables for communication attachments
- CL – Clearances
  - Provides overview of NESC and company required clearances
- JU – Joint Use – section JU10 specifically has communication clearance requirements
- G – Guying
  - Provides guying material and options

Danger, Reject Pole Tags



- Square yellow tags were used prior to ~2006

Make Ready Data Review

- The following poles are not allowed to be attached to for make ready:
  - Poles that WPS is not attached
  - Specially designed self-supported poles (rare)
  - Transmission poles (work with ATC)
  - Decorative fiberglass and concrete streetlight poles
  - Private Light poles (governmental lighting poles OK)

Customer Type	Private

Customer Type	Governmental

Make Ready Data Misc FAQ's

- WPS Wire and Cables
  - Verify correct type, span length, attachment height, angle and tension
- Communication Attachments
  - Verify correct type, span length, attachment height, angle and tension
- Guying
  - Guying lead length, angle, guy wire material, attachment height
    - WPS used HS 3/8" guy wire until 2001, EHS 3/8" guy wire used after 2001
  - Anchor type (we instruct make ready firms to assume an 8" single helix)

Clearance Analysis

- The clearance analysis is to insure that the existing pole attachments and new pole attachment will meet the National Electric Safety Code (NESC)
- State of Wisconsin has adopted the 2017 NESC
- Due to new attachment, no “grandfathering” to previous NESC revisions
- WPS doesn’t allow the reduced 9.5’ clearances
  - Only allowed if WPS Application Engineers approves special circumstances

Clearance Analysis

- There are locations that have require additional clearance beyond the NESC:
  - Railroad crossings
  - Limited access highway crossings
  - State highway and some county road crossings
  - Navigable waterways
- A 5’ taller replacement pole will only result in 4.5’ of additional height due to increased burial depth
  - Pre-2012 poles were set at 10% + 1.5’, so net pole height change may only be 4’ for a 5’ taller pole replacement

Clearance Analysis

- Other clearances to consider include:
  - Buildings
  - Traffic signals
  - Lighting (both on the pole and to stand-alone poles)
  - Billboards and business signs
  - Swimming pools
  - Flag poles
  - Transmission line crossings
  - Crossings not on the same structure
  - Clearances of Power and Communication service drops
    - Common to see communication J-hooks to “cheat up” on a pole

Clearance Analysis

- Do not design to bare minimum or within a few inches of minimum due to numerous variables:
  - Pole length variability (-3” to +6” allowable per spec.)
  - Terrain changes
  - Incorrect installation embedment depth of pole
  - Incorrect installation tension of wires and cables
  - Sag table variability as spans deviate from ruling span
  - Incorrect measurements (not formally surveyed)
  - Incorrect installation (tension, attachment height)
  - Decreased clearances due to snow/ice accumulation

Clearance Analysis – Code Violation Mitigation

- The make ready engineering firm provides suggestions to mitigate code violations.
- Many of these suggestions cannot be implemented due to various reasons.
- WPS usually cannot raise power attachments and meet our construction standards
  - For existing poles, we won't force our new standards to be met, but we also will not decrease clearances further than they already are

Clearance Analysis – Code Violation Mitigation

- Common request – "*pull sag out of span*"
  - Lines can be re-sagged to proper tension, but it is required to be done "deadend to deadend"
  - Service drops have limited tension maximums so attachment point is damaged at the customer
- Common request – "*lower communication attachment height to meet mid-span clearance to power secondary/neutral or make space for new attacher*"
  - Will lowering existing communication attachment height create new ground clearance violations, especially service drops?

Clearance Analysis

- Clearances need to be calculated for worst case scenario, not “as measured”
- For ground clearance, worst case sags could be under two conditions:
  - High operating temperature – 200 degrees F / 90 degrees F ambient
  - Ice loading – 32 degrees with ½” of radial ice
- For mid-span clearance between lowest power facility and highest communication facility (both options need to be calculated and choose the worst case):
  - Lowest power at 200 degrees and highest comm. at 90 degrees **OR**
  - Lowest power at 32 degrees with ½” radial ice and comm. at 32 degrees with **NO ICE**

Table I

Vertical clearance of wires, conductors, and cables above ground roadway, rail, or water surfaces. (Voltages are phase to ground for effectively grounded circuits and phase to phase for unigrounded wye and delta circuits.)

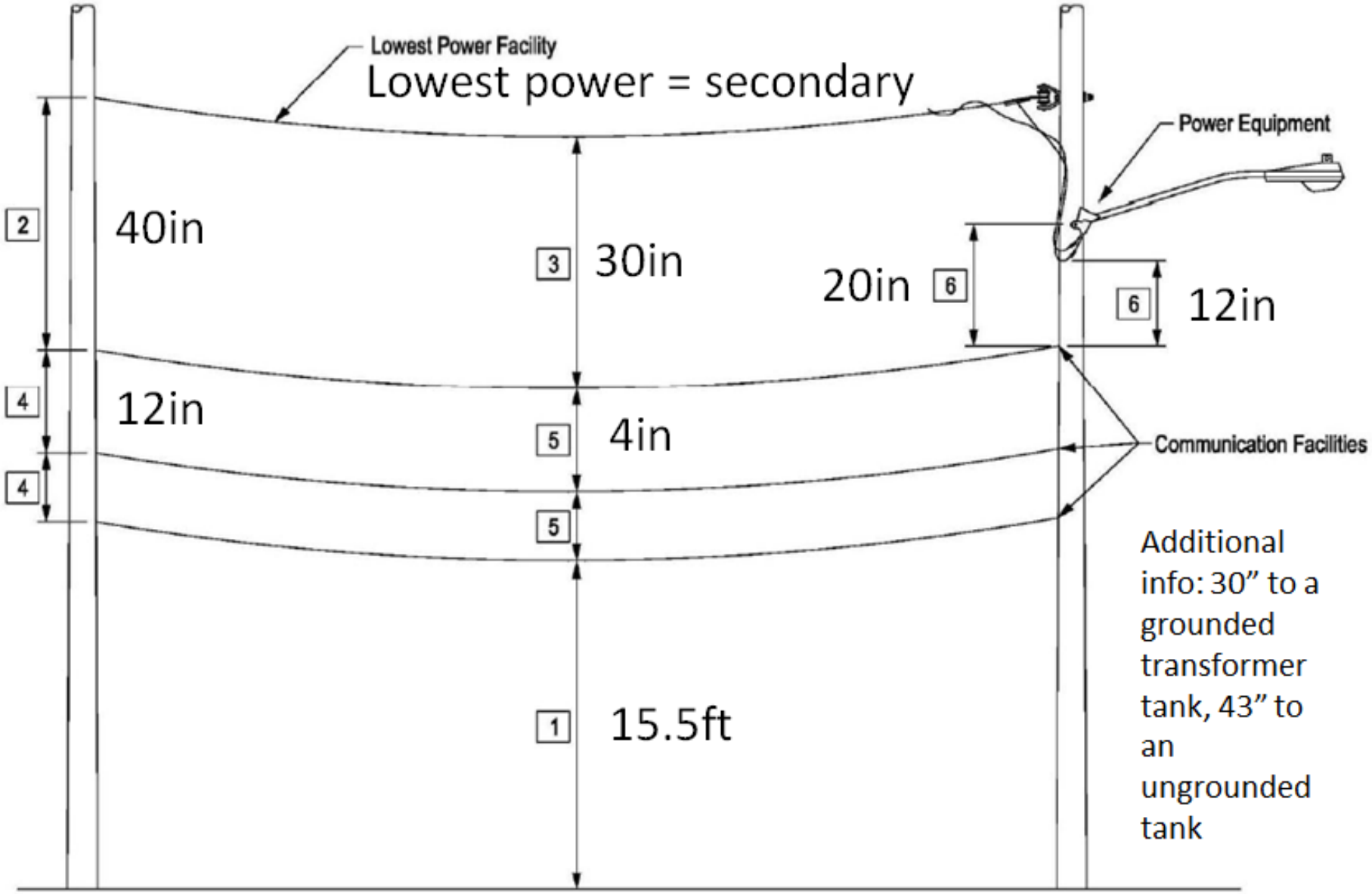
	[11][15] Insulated communication conductors and cable; messengers; surge protection wires; grounded guys; neutral conductors	Non-insulated communication conductors; supply cables (triplex and quadruplex) of 0 to 750V [27][34]	Supply cables over 750V [28] open supply conductors 0 to 750V [14][27][34]	Open supply conductors, over 750V to 22KV [14][27]
Nature of surface underneath wires, conductors, or cables	(Ft.)	(Ft.)	(Ft.)	(Ft.)
Where wires, conductors, or cables cross over or overhang				
1. Track rails of railroads (except electrified railroads using overhead trolley conductors. [2][16][22][30]	23.5	24.0	24.5	26.5
2. Roads, streets, and other areas subject to truck traffic. [23][27][31]	15.5	16.0	16.5	18.5
3. Driveways, parking lots, and alleys. [23][32]	15.5 [7][13]	16.0 [7][13]	16.5 [7]	18.5
4. Other land traversed by vehicles, such as cultivated, grazing, forest, orchard, etc. [26]	15.5	16.0	16.5	18.5
5. Spaces and ways subject to pedestrians or restricted traffic only. [9]	9.5	12.0 [8]	12.5 [8]	14.5
6. Water areas not suitable for sailboating or where sailboating is prohibited. [21]	14.0	14.5	15.0	17.0

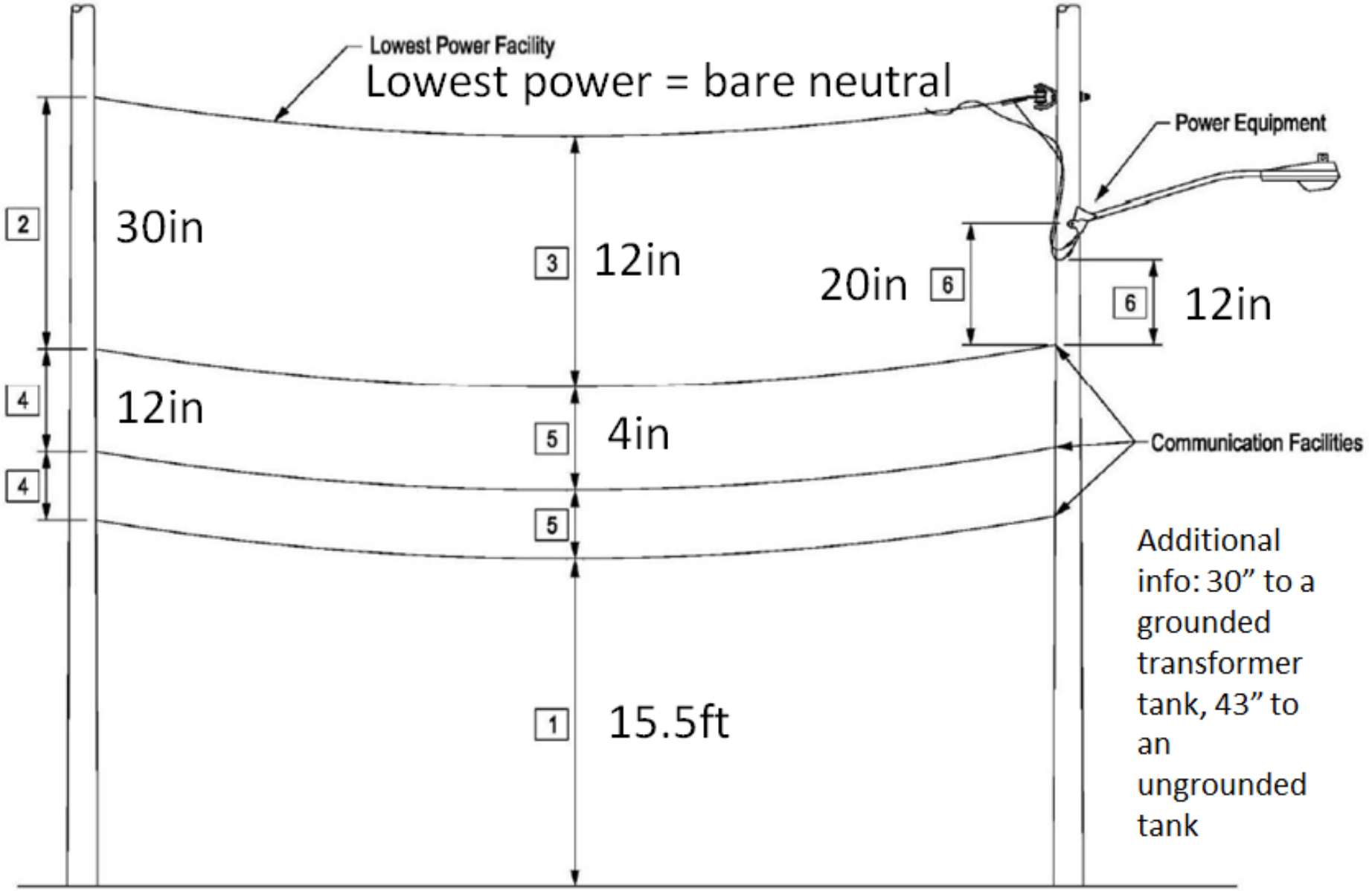
Clearance Analysis – Power Service Drops

- Code allows for reduced clearances for services if attachment height on the building doesn't allow for higher clearances

[7] Where the height of attachment to a building or other installation does not permit service drops to meet these values, the clearances may be reduced to the following (feet) (cables are triplex and quadruplex):

a.	Insulated supply service drops limited to 300V to ground.	12.5
b.	Insulated drip loops of supply service drops limited to 300V to ground.	10.5
c.	Supply service drop cables limited to 150V to ground.	12.0
d.	Drip loops only of service drop cables limited to 150V to ground.	10.0
e.	Insulated communication service drops	11.5


Lowest Power Facility
Lowest power = secondary
Power Equipment
2
40in
3
30in
20in
6
6
12in
4
12in
5
4in
Communication Facilities
4
5
1
15.5ft
Additional info: 30” to a grounded transformer tank, 43” to an ungrounded tank


Lowest Power Facility
Lowest power = bare neutral
Power Equipment
2
30in
3
12in
20in
6
6
12in
4
12in
5
4in
Communication Facilities
4
5
1
15.5ft
Additional info: 30” to a grounded transformer tank, 43” to an ungrounded tank

Pole Strength Analysis

- All poles are required to meet NESC pole strength requirements
  - Heavy Loading Zone – ½” radial ice and 4 lbs. wind
    - Verify Strength and Load factors are accurate for the Grade of construction
- Make ready pole strength analysis performed using O-Calc Pro
- NESC Grade C construction OK in most cases
- NESC Grade B construction required for:
  - Limited access highway crossings
  - Navigable waterway crossings
  - Railroad crossings

Pole Strength Analysis – Soils

- Soil Classification
  - Default to soil class 5
  - May increase soil class if field conditions warrant

Soil Class	Description
0	Sound hard rock, unweathered
1	Very dense and/or cemented sands; coarse gravel and cobbles
2	Dense fine sands; very hard silts and clays (may be preloaded)
3	Dense clayey sands and gravel; hard silts and clays
4	Medium dense sandy gravel; very stiff to hard silts and clays
5	Medium dense coarse sands and sandy gravels; stiff to very stiff silts and clays
6	Loose to medium dense fine to coarse sands; firm to stiff clays and silts
7	Loose fine sands; Alluvium; loess; soft-firm clays; varied clays; fill
8	Peat, organic silts; inundated silts, fly ash; very loose sands; very soft to soft cla

Pole Strength Analysis - Tensions

- Conductor Tensions
  - Typically, use maximum guying tensions in OSAG
  - Service drops – model at 400 lbs. of tension
    - Some secondary (pole to pole) can be modeled at 400 lbs. if it is obviously just a tangent attachment, continuing to the service
    - Communication service drops – model at 50 lbs.
  - Slack Spans – model at 500 lbs. of tension per wire

Pole Strength Analysis - Guying

- Guy Wire – 3/8” HS guy wire used until 2001, 3/8” EHS guy wire used after 2001
- Anchor – Make Ready instructed to assume 8” single helix anchor. No record of anchors other than looking back at historical work requests
- Only WPS should be attached to WPS anchors
- If communication companies attached to existing WPS anchors, they must be insulated

Pole Strength Analysis – Head Guys

- Head Guys AKA Span Guys
- To properly model, pole that creates tension on the head guy needs to be modeled
- From the output of the head guy model, insert the applied tension to the guy-stub pole head-guy tension

Miscellaneous Information

- Majority of WPS primary system is 14.4/24.9 kV
- Wisconsin is in the NESC Heavy Loading area
- Pole embedment depth standard:
  - Prior to 2012 – WPS typically 10% + 1.5’
  - 2012 to present – 10% + 2’
- Common to see bare neutral with duplex/triplex secondary strung underneath
  - Replacing with a shared neutral 3c1/0 ACSR secondary may be a viable mitigation option
- Older copper wires have weatherproof coating – it is usually deteriorating and isn’t considered insulation

Miscellaneous Information

- Vertical open wire secondary:
  - Neutral is usually in the top position
  - The two 120V wires are usually middle and bottom
- Some poles may require discussion with existing communication companies:
  - CATV power supplies
  - Very large risers
  - Splice box placement in relation to new pole position