OSP Design Considerations

Are we considering every option?
OSP Design Considerations

AGENDA

✓ Defining “OSP”
✓ Relevant documents
✓ Placement methods- Pros and Cons
✓ An individual look at each pathway method
✓ OSP changes / New ideas / Other thoughts
✓ Questions and answers
Defining “OSP”

ANSI/TIA-758-B Customer Owned Outside Plant Telecommunications Infrastructure Standard

“Telecommunications infrastructure designed for installation exterior to buildings”
Defining “OSP”

BICSI

“Telecommunications infrastructure that is designed and installed externally to buildings and typically is routed into an Entrance Facility”
Defining “OSP”

John C. Adams Jr
FSU Senior and son of your presenter

“OSP can’t mean outside plant because outside is one word. It should be OP”

“A plant located outside. The opposite of an indoor plant”
Relevant Documents

• ANSI/TIA-758-B
  Customer Owned Outside Plant
  Telecommunications Infrastructure Standard
• BICSI OSPDRM
• US Army Information Systems Engineering Command (USAISEC) OSPDPR
  OSP Design and Performance Requirements
Relevant Documents

• American Society for Testing and Materials (ASTM)
• Lucent Technologies Outside Plant Engineering Handbook
• American Association of State Highway and Transportation Officials (AASHTO)
• IEEE C2 National Electrical Safety Code (NESC)
• National Electrical Code (NEC)
OSHA
Occupational Safety and Health Administration

- 29 Code of Federal Regulations (CFR)
  Part 1910  Standard 1910.268
  Telecommunications
- 29 Code of Federal Regulations (CFR)
  Part 1910  Standard 1910.146
  Permit Required Confined Spaces (PRCS)
Relevant Documents

- GTE (General Telephone and Electronics)
  - GTEPs  GTE Practices
- AT&T Outside Plant Manual
- Telcordia
- Lucent
- IEEE (NESC)
- ISO / IEC
- NFPA (NEC)
Relevant Documents

- RDUP/RUS
  Rural Development Utilities Program
  Rural Utilities Services

And the beat goes on and on and on and on
Relevant Documents

PROBLEM\textsc{s}

✓ Contradictions between them
✓ Very few OSP designers have them
✓ Even less have ever read them
✓ And even fewer understand them because they’ve never done the work themselves
THANK YOU

THAT

CONCLUDES TODAY’s SERMON

NEXT SERMON TOPIC

“Dealing with ornery old OSP people”
1. Do designers need to know the requirements of these documents?
1. Do designers need to know these documents?
   YES

Why?
✓ Site surveys (MH inspections, etc.)
✓ Proposed installation conditions
✓ Long term safety
✓ A good designer doesn’t count on records
   He/She verifies the records with field visits
Which OSHA standard should we use for working in our maintenance holes?

29CFR (Code of Federal Regulations)
1910.268 Telecommunications
Sub–paragraph “o”
Underground Lines
OSHA

Using 29 CFR 1910.146
Permit Required Confined Spaces (PRCS)

1. Will cost you more money?
2. Is not required?
3. Requires extensive record keeping by the “owners” of the confined spaces
Placement Methods

What are the main methods of placement?

Sounds like a fairly simple, straightforward question but is it?

Depends on which one of those umpteen relevant documents we spoke of earlier.
Placement Methods

- IEEE C2-2012 Two methods mentioned 
  Overhead and Underground
- BICSI OSPDRM Three mentioned 
  Underground, direct-buried, and aerial
- AT&T OSP handbook- Three mentioned 
  Underground, aerial, and buried
- ANSI TIA-758-B Four mentioned 
  Aerial, direct-buried, underground and tunnels
Placement Methods

Questions you may now have from that slide

1. What’s the difference between buried and direct-buried?

2. What’s the difference between buried and underground? They’re both underground!

3. How did tunnels get slipped into the mix?

4. Are tunnels OSP or ISP?
Placement Methods- Aerial

**PROs**

- Can be inexpensive
- Maintenance can be easier
- Can be constructed very quickly
- No confined space issues
- May be easier to please the environmental people/groups
CONs

✓ Can be expensive (make ready charges)
✓ Clearance problems (roads, driveways)
✓ May need to be relocated at your expense
✓ May violate local restrictions (no aerial)
✓ Subject to environmental issues especially in light storm loading areas (NESC)
Placement Methods- Aerial

**CONs**

You thought you’d see

✓ Unsightly or aesthetically displeasing

Not in the eye of this beholder.

Aerial and ugly aren’t always synonymous
Placement Methods - Underground

**PROs**

✓ Easier to add, remove, replace than some other placement methods

✓ Aesthetically pleasing

✓ Provide physical protection
Placement Methods - Underground

CONs

- High initial cost
- Require a more detailed route plan
- Provides a possible pathway for gas, water, and/or insects into a building
Placement Methods - Direct Buried

PROs

✓ More aesthetically pleasing
✓ Lower installation cost
✓ Easy to bypass obstructions
Placement Methods - Direct Buried

**CONs**

- Not flexible for future changes, adds, etc.
- No physical protection for cables
- May be difficult to locate
- May provide a pathway for gas, water, and insects into a building
Placement Methods

WHICH METHOD TO CHOOSE?
Considerations

MONEY

✓ Do you have an idea how much money your customer can afford? What can you afford?
✓ Should you give them a recommendation plus options (grocery list)?
✓ Are you competent/confident enough to explain cost vs. benefits and be believable?
Considerations

Environment

 ✓ Bodies of water
 ✓ Topography
 ✓ Soil type (or lack thereof)
 ✓ Swamps, wetlands, etc.
 ✓ Local restrictions
 ✓ Weather
Considerations

**Customer**

- Techies? Non-techies?
- Future plans (buildings, land purchase)
- Private road improvements
- Buildable land on their property
- Past experiences (good and bad)
- Their preference (what a novice idea)
Placement Method

Let’s now assume they’ve made up their mind or you’ve made it up their mind for them.

What should we consider now for each placement method?
Aerial Placement

POLES (owned by others)

1. Who owns the poles?
2. Will they let you use them?
3. Make ready charges
   This can mean “make your wallet ready”
4. Annual fees for attachments
5. Moves/rearrangements (costs, disruption, )
Concrete Utility Poles
Aerial Placement

POLES (new)

✓ Height for clearances (NESC, local rules, etc.)
  30’, 35’, 40’, and 45’ will be 99% of your poles
✓ Class (4, 5, 6, 7 will be 99% of your poles)
✓ Wood species (cedar, pines, firs...)
✓ Treatments acceptable to the EPA
  pentachlorophenol, creosote, chromated arsenicals, others
POLES (new)

✓ Steel poles
   Up to 1” walls, 200 ft. high, and 8’ diameter

✓ Concrete poles
   25, 30, 35, 40, 45’ readily available
   Rated breaking strength not as high as wood

✓ These poles can be “beautified” with paint
Aerial Placement

Guying
✓ Overhead, dead-end, corner, sidewalk
✓ Slack span
✓ Push braces
✓ Strand sizes
✓ Guy guards
✓ Guy termination devices
✓ Lead to height ratio
Aerial Placement

Anchors (which depend on soil types)

✓ Swamp
✓ Expansion
✓ Screw
✓ Concrete
✓ Plate
✓ Cone
Aerial Placement

Strand (messenger)

- Size: 6M, 6.6M, 10M, 16M, and 25M
- Rated breaking strength
- Termination devices

Notes: “M” doesn’t mean 1000

6.6M is smaller but stronger than 6M
Aerial Placement

Other considerations

• Depth of pole (usually 10% plus 2 feet)
• Storm loading districts (new ones added)
• Grade of Construction (B, C, N)
• Pole spacing
• Attachment spacing (vertically)
• Pole line hardware
Underground Placement

Maintenance Holes (not manholes)
✓ Size 6’ x 7’ x 12’ (38Y or Y38) very common
✓ Size 6’ x 7’ x 8’ or 10’ cost savings?
✓ Splayed or center window debate
✓ How many conduits in and out?
✓ Material (fiberglass, concrete)
✓ Traffic ratings (H-5, H-10, H-20)

This may be written as HS-20 etc.
Underground Placement

Maintenance Holes
- Use existing MHs?
- Overbuild or rebuild existing?
- Storing slack (how much slack to leave)

Another debate
- Grounding / Bonding provisions
- Racking (how many?)
- Frames, covers, collars
Underground Placement

**Handholes** (holes for your **hands** only)

- ✔ Material (fiberglass, concrete)
- ✔ Sizes 4’ x 4’ x 4’ (ANSI) 4’ x 6’ and others
- ✔ Conduits in and out (ANSI says three max.)
- ✔ Lids / Covers
- ✔ Splices are now allowed (use common sense)
- ✔ Not recommended for making turns
Underground Placement

Conduit

✓ Us old people got used to terra cotta, wood, and concrete

✓ You young people should consider using other recognized conduits frequently used in the telecommunications business today
Underground Placement

Conduit

- Multi-duct (usually 3, 6, or 9 way)
- EB-20 and EB-35 NEMA TC 6&8 (encase)
- DB60, DB100, DB120 NEMA TC 6&8
- SCH40 and SCH80 NEMA TC 2
Underground Placement

Conduit

Why do contractors choose one over the other?

1. The specifications call for it
2. The almighty dollar calls for it
3. Car load sale (as in train car load)
Underground Placement

Innerduct Choices- plastic, fabric mesh, or multi cell

- Plastic has been around forever
- Fabric mesh seems to be taking over due to better utilization of all the internal conduit space rather than just some of it
- Multi cell has a lot of limitations
Maximizing Conduit Space

Using four one inch innerducts to place four cables

Using fabric innerduct to place six cables
Underground Placement

Backfill Requirements

Once again, sounds easy doesn’t it?
Backfill is backfill! Dirt is dirt, right?
Underground Placement

Backfill Requirements

Possible scenarios to meet “backfill” specs

✓ ¾ aggregate
  (could be known as select backfill)

✓ Native soil placed in layers (or tiers)

✓ Compacted to various psi at multiple levels

✓ Slurry (flowfill, “cheap concrete”, etc.)
Underground Placement

Concrete

That’s an easy design spec to write, correct?

No, it’s not easy. Lots to think about
Underground Placement

Concrete

- ✔ PSI rating (3000 to 4000)
- ✔ Spacing between pipes
- ✔ Side wall, top and bottom thickness
- ✔ Cap only (how thick?)
- ✔ Slump
- ✔ Vibrated
- ✔ Tie down method if required
Underground Placement

Other Considerations

- Hard surface cuts, bores, or casing
- Landscaping (nightmare if not done correctly)
- Other UG obstacles
- NESC clearances
- EPA issues
- Confined spaces
Direct Buried Placement

Which direct buried method to choose?

- Machine trencher
- Backhoe
- Wheel trencher
- Plow (vibratory, static, rip)
- Hand digging
- Auger bores
Direct Buried Placement

Which direct buried method to choose?
Most of these are the same for UG placement
1. Normally the designer doesn’t get to choose the method of placement
2. You can choose depth, restoration, boring method, backfill, etc.
3. How many other utilities are buried or UG?
4. Topography and soil conditions
Direct Buried Placement

What’s the cost of each method?
Obviously this depends on a lot of things
➢ Soil
➢ Other utilities
➢ Topography
➢ How hungry are the subs?
➢ Total footage to place
Direct Buried Placement

Other Considerations

✓ Historical areas
✓ EPA issues
✓ Topography
✓ Working space for equipment
✓ Permit restrictions (railroads, etc.)
✓ Adequate depth (additional protection?)
Other Thoughts / Ideas

- Cement blocks for conduit placement
CONDUIT SPACE RECOVERY
Take this situation of a “full conduit”
Conduit Space Recovery
To this scenario
CONDUIT SPACE RECOVERY
and finally to this scenario
Other thoughts / Ideas

✓ Smaller maintenance holes (6’ x 7’ x 8’)
✓ Consider, once again, center wall MHs (reduce costs)
✓ Reduce the number of conduits due to Passive Optical Networks (PONs)
  Better usage of conduit internal space
  Dramatic reduction in large copper cables
Micro Trenching / Slot Trenching
MICRODUCT
Air Blown Fiber
Other thoughts / Ideas

- Place conduit deeper to eliminate or reduce the necessity of concrete encasement
- Understand that your design can affect the safety of the contractors, customer employees, and maintenance people
- Understand OSHA confined space rules
- Understand the NEC 50 foot rule
Final Thoughts

The “ideal” OSP engineer has done, or completely understands, all facets of OSP installation and maintenance. If you’re weak in a particular area, find out how and where to improve that weakness.

“OSP is inherently dangerous”
THANK YOU FOR YOUR TIME AND ATTENTION

Questions ??