



ATLANTA, GA
OCTOBER 11-14

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UNLEASH THE POWER OF LIMITLESS CONNECTIVITY



**2021 Fall
Technical Forum**
SCTE • NCTA • CABLELABS



Wireline Access Network

Water Can Run, But It Can't Hide

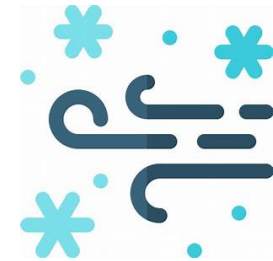
Kathy Fox

VP, XOC
Comcast

As long as cable has existed, there have been forces attacking it!



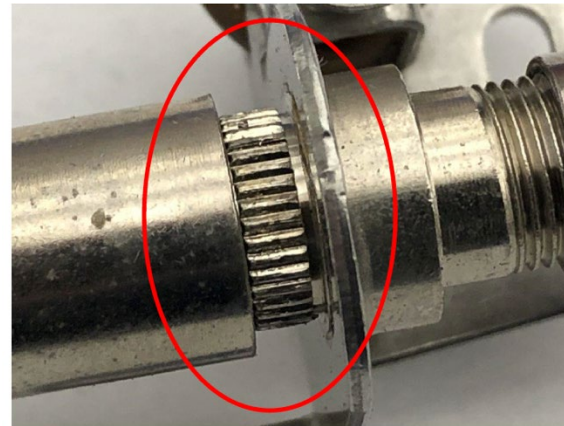
Every bite, hole, ding, or cut in the cable is an opportunity for water to enter...*and travel.*



Water Will Run...*and damage peripheral components*



Water coming out of the end of the connector at the ground block



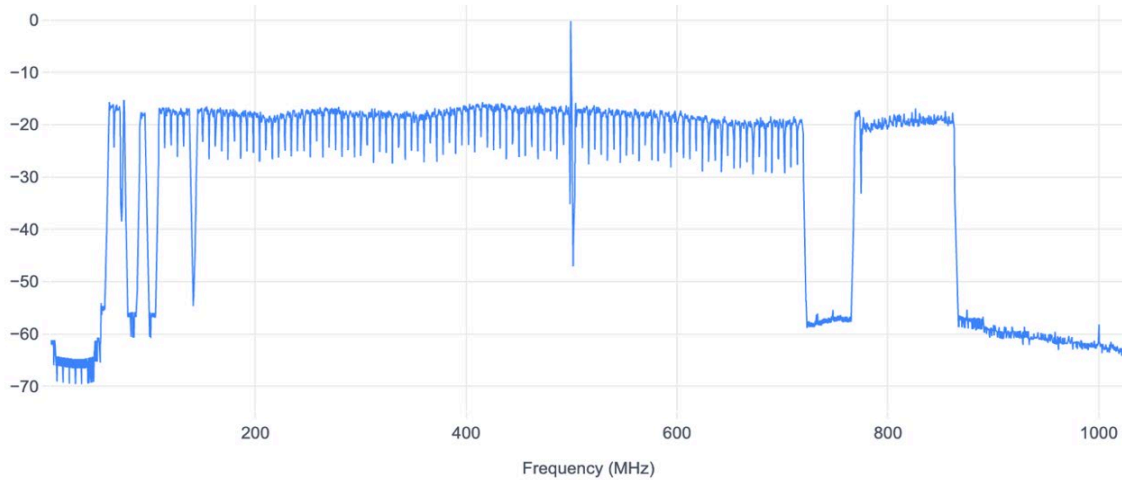
Housing Separated



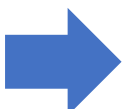
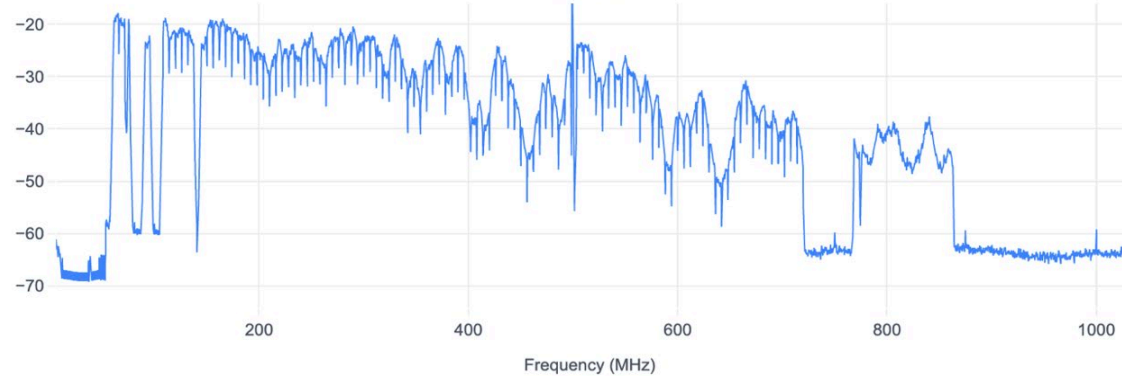
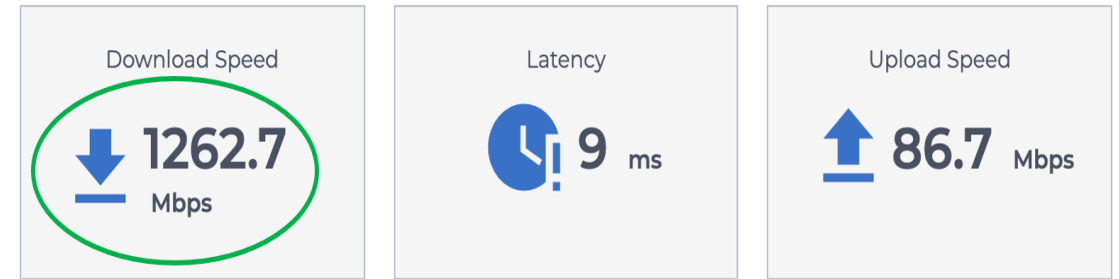
Water-soaked tap faceplate, water droplets visible

When this happens, multiple problems can become compounded and worsen. Most often impacted are taps, splitters, splices, block splices and all the different filters and pads installed in the drop network

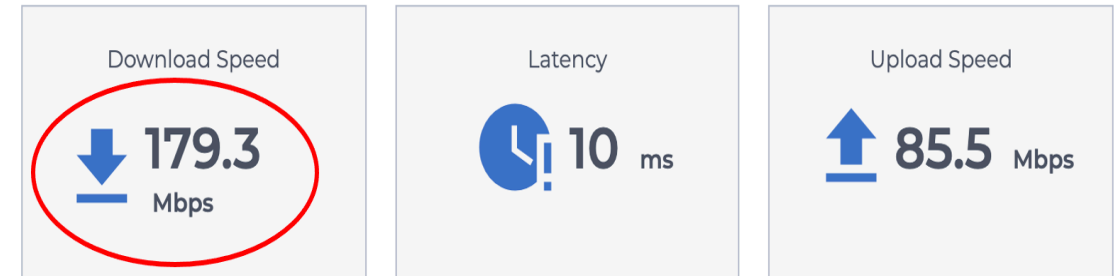
Water-Soaked Cable vs. New Drop Cable



Speed Test of the 95 Foot New RG6 Drop Cable



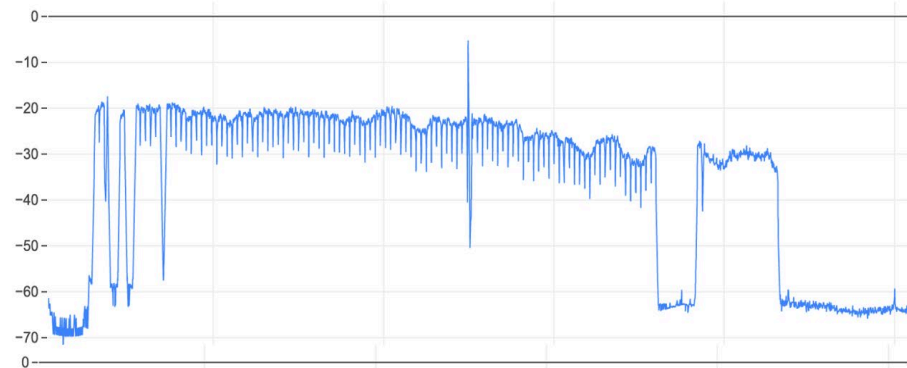
Speed Test of the 95 Foot Water-Soaked Drop Cable



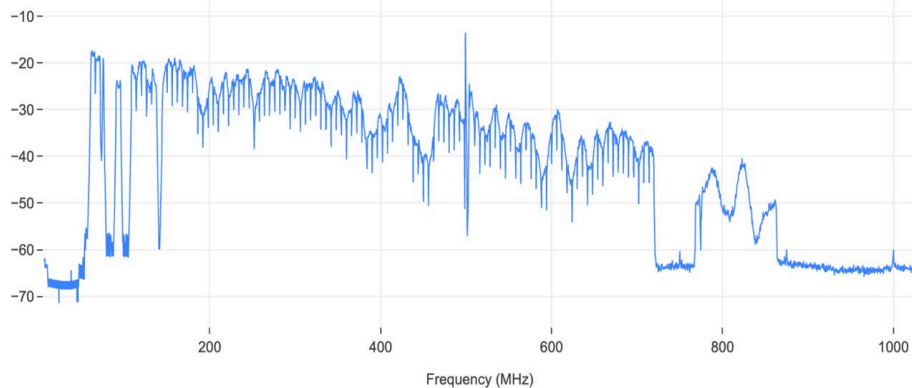
Severe attenuation is shown in water-soaked drop cable (bottom) compared with the same type and length of new, unimpaired cable (top), which results in significant impacts shown in the speed tests (over 100 cables used in testing)

Water vs. Ice

95' RG6 Frozen
Water-Soaked Drop
Cable

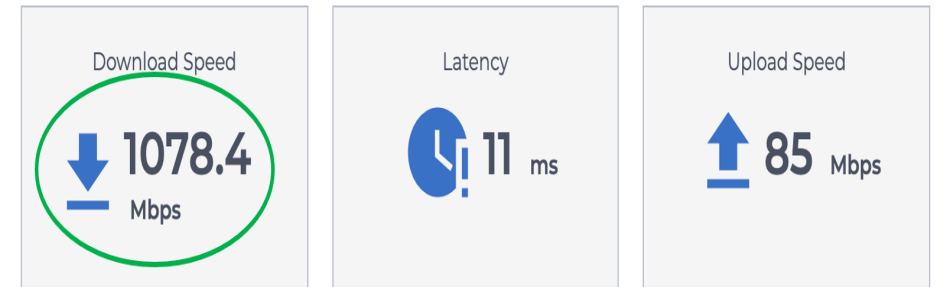


95' RG6 Thawed
Water-Soaked Drop
Cable

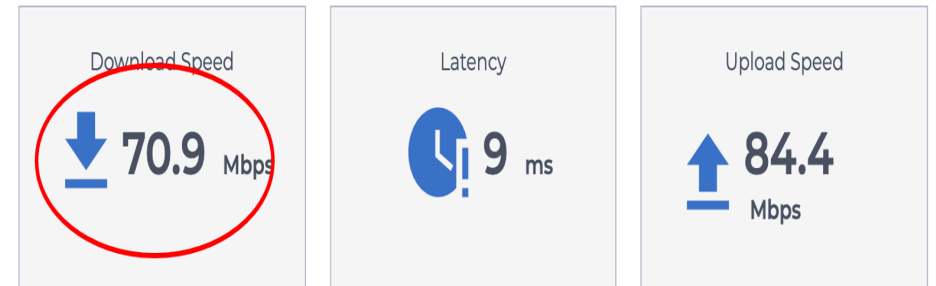


Frozen (top) compared to thawed (bottom) frequency response

Speed Test of the 95 Foot Frozen Water-Soaked Drop Cable



Speed Test of the 95 Foot Thawed Water-Soaked Drop Cable



Frozen (top) compared to thawed (bottom) speed test

Finding Water Your Way

Our paper evaluated several methods to detect water

Tom's IFFT Method

CableLabs' Tom Williams suggested a simple IFFT of the spectrum data, then to manually look for the clear difference in the time domain data. Group delay in the wet cable should reveal more energy later.

Jason & Jay's Method

CableLabs' Jason Rupe and Jay Zhu, purposely working independently from Tom Williams with a different method, developed a method very similar to Tom's method and extended it to better enable computer programs to differentiate between the two impairment types, relying on proven machine learning and statistical methods to identify that the spectrum data shows an impairment.






Larry's Method

One of most common methods for field technicians to validate the presence of water is by use of a time domain reflectometer (TDR). It is common for a TDR to transmit a fixed-width impulse and capture the reflected response, or echo. The response can be analyzed, in conjunction with the known parameters of the cable and typically display the fault distance(s). In the case of water reflections, the time domain impulse response shows a distinctive signature compared to a singular point of damage.

Operational Best Practices



Considerations

-  Materials Selection
-  Installation Practices
-  Inspection for Damage
-  Repair vs Replace
-  Cable Handling and Storage

Build it Right to Keep it Tight

RF Cable – Selection will vary depending on aerial or underground. Use RF cable ANSI/ SCTE 74 2011 Specification for Braided 75 Ohm Flexible RF Coaxial Drop Cable

Flooding Compound – for both aerial and underground cable, flooding compound will help preserve against rapid degradation due to corrosion

Connectors – Use the 360-degree compression style with integrated weather seals to limit water migration. The other components needed to maintain a weather tight, moisture-proof, drop cable network include weather seals for RF port connections. These port seals may be integrated as part of the connector or a separate piece. Use the proper seals whenever the connection may be exposed to outside elements or fluctuations in temperature or areas of high moisture (basements, garages, crawl spaces, pedestals, lock boxes, house boxes etc.)

Ensure the integrity of your drop system for years to come

Jacket Preparation – Tool selection and use is important to not damage the jacket. Start with proper fitting, preparation, and installation. Using the correct prep tool for the cable size and fitting style. Use a solid, correct compression tool for the fitting being used. A visual inspection of the compression will ensure that there is a complete and even compression of the fitting to the cable. Attachments such as clips, and hangers should not have hard or sharp edges that could damage the jacket during installation. *If the jacket is damaged during installation, replace it!*

RF Port Seals – Make certain the seal extends past the threads of the RF port and contacts the smooth portion of the barrel connection. If the seal is not integrated with the connector, the seal should be installed so that the leading edge of the connector is in direct contact with the seal. The seal does not need to be compressed between the connector and the body of the component of the barrel connector to be properly installed.

Drip Loops – should also be used to ensure that any connections or drop components are always higher than the lowest point of the cable. Utilize gravity to keep all moisture away from connections and components.

Protective Barriers – When installing aerial cable, the pathway of the cable should not be in contact with objects that could wear against the jacket. If it cannot be avoided, use of a protective barrier such as tree guards or conduit (underground).

Find it and Fix it

We should always be performing a visual and tactile inspection of the cable

Be on the lookout for cable that does not look or feel right and complete further inspection when that occurs

Address any nicks or cuts in the cable jacket

Flooding compound is not meant to be a self-repair method. Whenever you see physical signs that water has entered the cable, this may be corrosion, discolored center conductor or moisture, the cable and/or components must be considered compromised and correctly remedied

When in doubt, swap it out

Replacing the damaged section of the drop system is preferred

Repairing or splicing of the damaged section does not ensure that moisture does not still exist, and if the moisture is still there, it will create issues

Handle with Care

How we store the cable prior to use can also have a significant impact on its performance

Stored inside of the vehicle prior to use

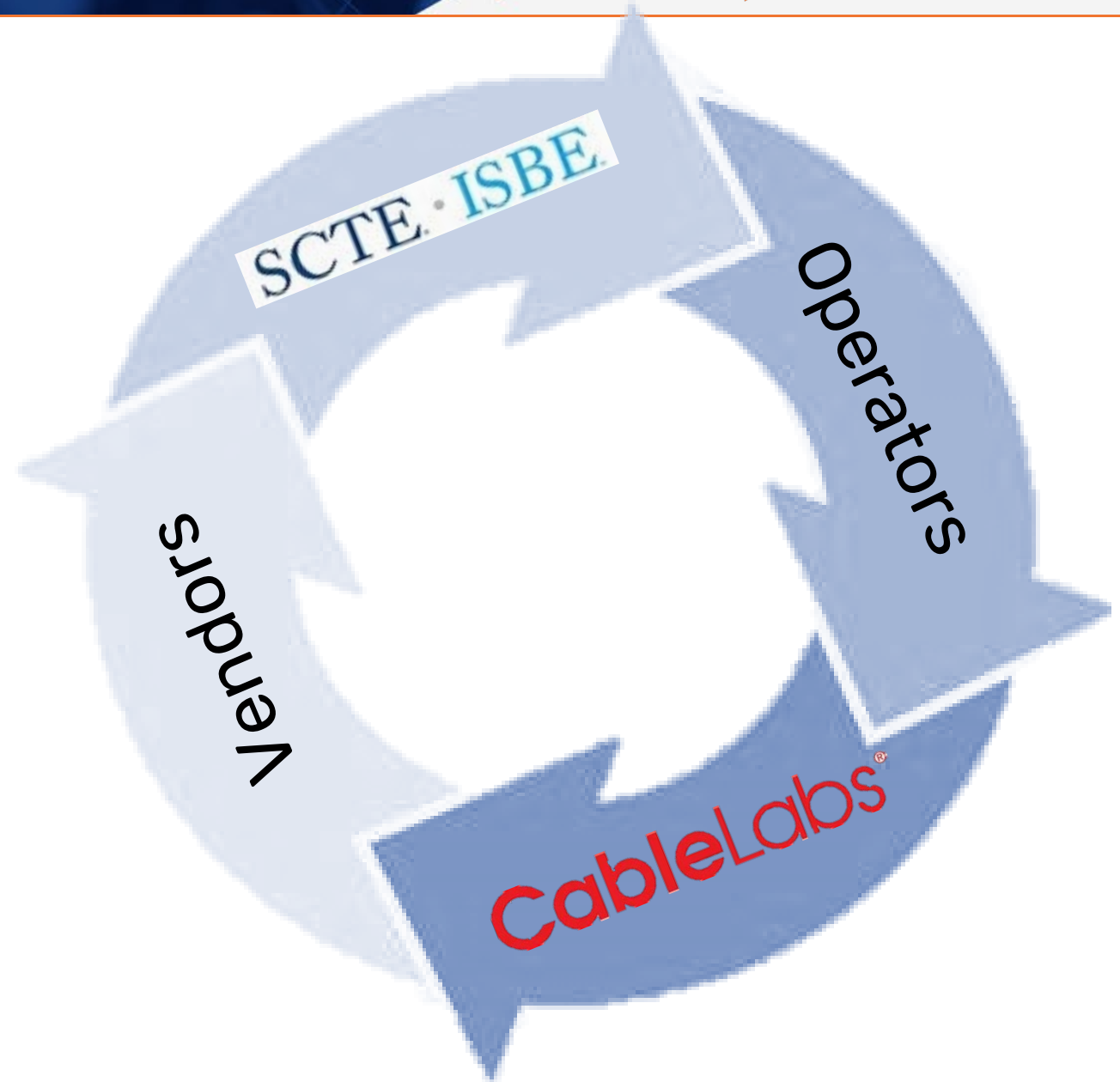
Properly protect the cut end of the cable from taking on moisture as it is exposed to the environment

Protected cable from unintended damage from other items stored around it



Industrial Collaboration:

- CableLabs algorithms and detection methods
- SCTE Operational Practices
- Vendors to recommend material selection
- Operators testing & creating operational practices



- ✓ Select the right materials and tools for installation
- ✓ Store cable appropriately before use to avoid damage
- ✓ Install correctly to avoid damage during and after installation
- ✓ Know how to find water, don't let it hide
- ✓ Inspect and replace when issues are found



Jason Rupe, Principal Architect, CableLabs

Tom Williams, Distinguished Technologist, CableLabs

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Thank You!

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