UNC CHARLOTTE
The WILLIAM STATES LEE COLLEGE of ENGINEERING

Sustainable Alternatives for Fiber Optic Cable Disposal

COMMS_OPTICS
Senior Design I
January 2021

COMMSCOPE®

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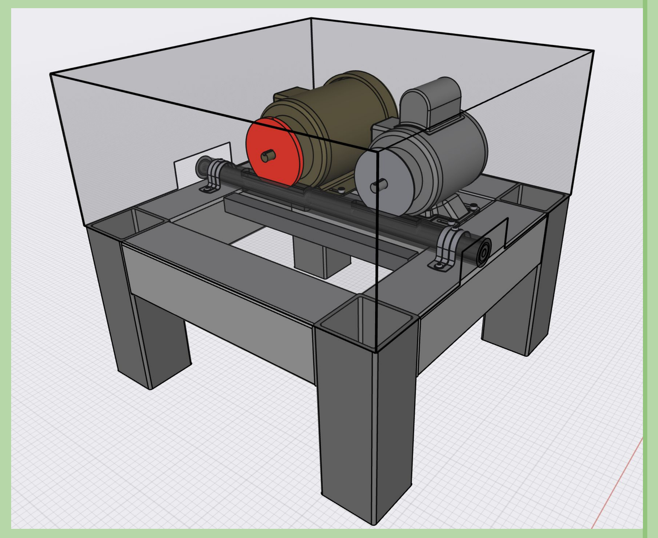
Identifying methods to reuse, repurpose, or reallocate waste fiber optic cable generated by CommScope's manufacturing methods as well as worn or old cable generated by the industry.

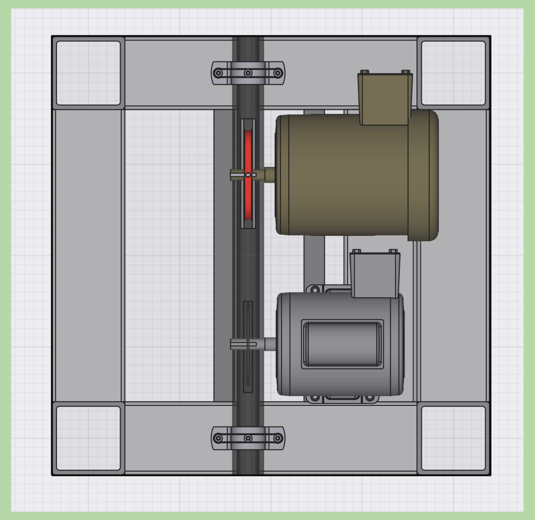
Mechanical Separation

- This device allows for the cutting of fiber optic cable in a continuous, automated process.
- This design is inexpensive to maintain, and when implemented, will cost less to operate than it does to dump the cable.



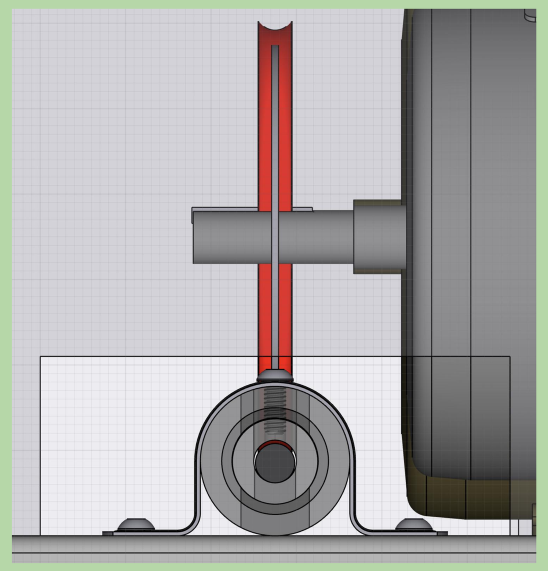
- The design implements the use of two motors, one for the feeding mechanism and the other for the cutting mechanism
- The feeding motor is a VFD motor to allow for feed rate to be adjusted. The cutting motor has a blade system that utilizes a saw blade to cut through material and can also be replaced with ease.
- An interchangeable boot system was implemented to allow for variable diameter cables to be cut by the same machine.

Top Down View



- The feeding wheel is shown in red in this image and is powered by the brown motor
- The blade is below the feeding wheel and is powered by the gray motor
- The cables will run from feeding wheel, into the blade

Front View



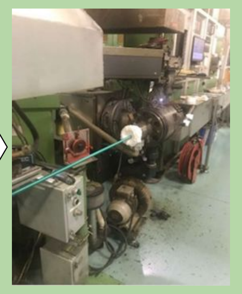
- The inner boot is fastened inside of the outer boot using a set screw
- The outer boot is fastened to the frame using a bracket

Procedural Steps

Production

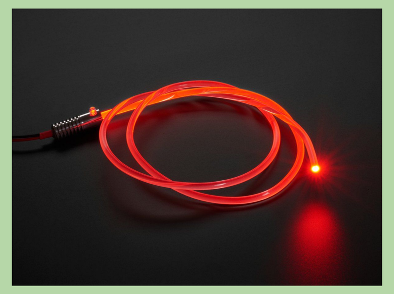
Buffering

Stranding



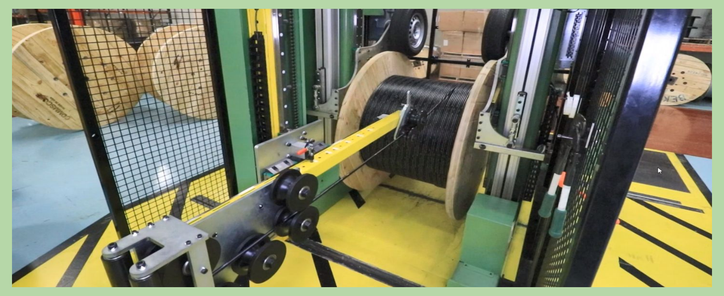
Jacketing

Testing



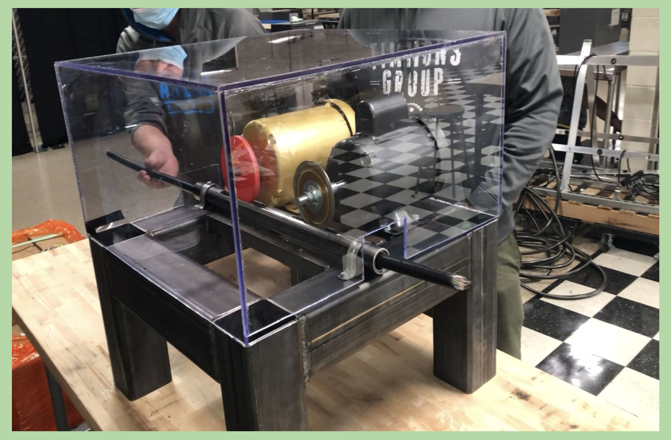
Testing involves checking Max Attenuation, Max Point Loss, and Refractive Index

Spooling



Cables that fail testing are spooled and taken to the scrapping area.

Remove Outer Jacket



Once in the scrapping area, the spool will be run through the separator, to remove the outer jacket.

Take-Up

Once separation takes place, the inner core will be taken up onto another spool, and the outer jacket will be collected

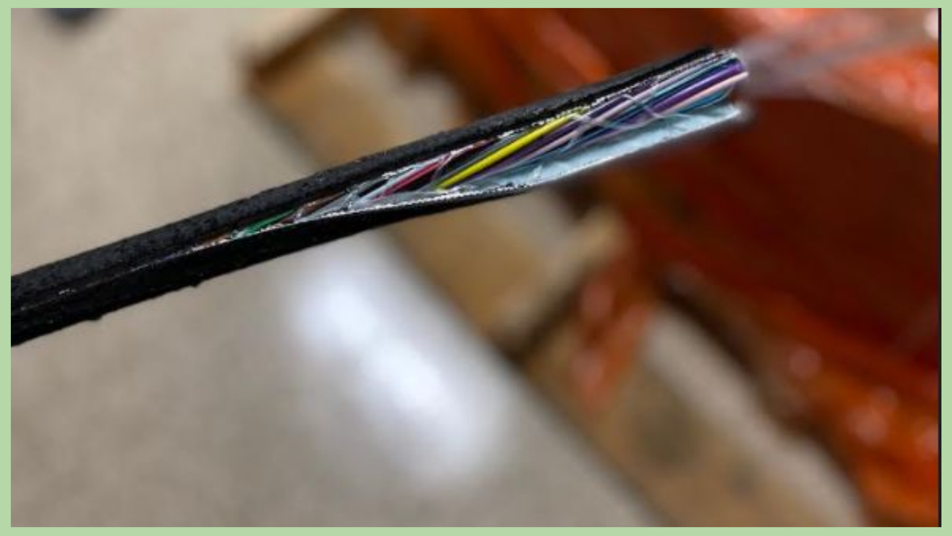
Recycle

The isolated outer jacket is then taken to a recycler, capable of recycle Medium Density Polyethylene (MDPE)

Results and Conclusions

- Our testing involved varying the frequency setting of the feeding wheel, to determine the optimally speed of cutting through the cable.
- Additionally, the depth of the blade into the boot had to be adjusted using spacers, in order to ensure the blade was completely cutting through the outer jacket of the cable.
- From our tests, we found that 39.9 hertz was the ideal frequency for the feeding wheel, in order to slice through the outer jacket, without damaging any of the central components of the cables.
- The necessary cutting depth to fully separate the outer jacket is 0.124 inches.

Hz of Machine	Depth of Cut (in)
0	0 - Test of machine
17	0.051
25.8	0.081
30.7	0.097
39.9	0.124 – Successfully cut though outer jacket without damaging interior parts



Chemical Separation

- A significant portion of Fiber Optic Cables recycling possibilities are hampered by a industrial gel that coats the inner components
- Our team experimented with ways to remove this involving:
  - Control (no solution)
  - Tap Water
  - Hexane
    - The solution was 70% n-Hexane and 30% other Mixed isomers
  - Vinegar (75% grade)
  - KOH (Potassium Hydroxide)
    - The solution was created used pure KOH tablets mixed with water
  - D'Gel
    - PT Technologies Part # 330X200, Model 61232

½ in Cable

Scale of 0-10, 0 being fully dissolved and 10 being undissolved

	5 Minutes	10 Minutes	15 Minutes
Control (Nothing)	10	10	10
Tap Water	10	10	10
Hexane	9	9	9
Vinegar (75%)	10	10	10
KOH	9	9	9
D'Gel	9	9	9

Solo Gel Dissolving

	5 Minutes	10 Minutes
Control (Nothing)	No visible change	No visible change
Tap Water	No visible change	No visible change
Hexane	Small, but insubstantial change	Small, but insubstantial change
Vinegar (75%)	Small, but insubstantial change	Small, but insubstantial change
KOH	Small, but insubstantial change	Small, but insubstantial change
D'Gel	Small, but insubstantial change	Small, but insubstantial change

Conclusions

- Based on the chemical experiment, none of the above chemicals would be recommended
- Each solution proved highly ineffective when compared to the control
- Further potential options of study:
  - Acetone and Acetic Acid were not used due to their flammability and the difficulty of being implemented on an industrial scale.
  - Supercritical CO2 was not used due to its expensive nature and inability for the team to afford to test it.
  - It is unlikely CommScope would be able to implement such a chemical solution without great cost.
  - From the team's discussion with Dr. Merket of the UNCC chemistry department and our own observations, we must conclude that these cables should be ignored for now by CommScope and research begun to reengineered the gel with the mindset of end-of-life operations such as recycling.

Budget

Chemical Total: $143.44
Mechanical Total: $1264.49
Electrical Total: $801.89
Full Expenditures: $2209.82