Hendrix Spacer Cable

**Covered Conductor**
- Withstands temporary branch contact
- Eliminates temporary faults
- Protects wildlife
- Less clearance issues

**Compact Configuration**
- Multiple Circuits
- Substation Exits
- Long Runs/less voltage drop

**Messenger**
- Mechanical Strength
- Long Spans
- Physical Shield
- Lightning Shield Wire
- System Neutral

**Greater Reliability—Less Tree Trimming**
4 Reasons to use Spacer Cable

- Lower Project Costs
- Lower O&M Costs
- Public Relations and “Green” Initiatives
- Hendrix Support Services
Lower Project Costs: Under builds

**Bare wire under build**
- Change out every pole – cost of $3k each
- Taller poles – cost $200 additional each
- Transfer existing – cost of $50k/mile
- Transfer communications – cost $10k/mile

**Spacer under build**
- NO pole change outs
- NO Transfer costs
- Savings of $75 - $175k/mile
Double circuit Bare Wire Transmission under build
- 1 or 2 intermediate poles per span at cost of $3k each
- Intermediate poles require additional R/W requirements – cost ??$
- Some Transmission pole change outs – cost $10k each

Double circuit spacer transmission under build
- NO intermediate poles
- NO transmission pole change outs
- NO R/W requirements
- SPACER cable option is $75 - $100k less per mile than bare wire
Lower Project Costs: Back up feed to Hospital

- URD – directional boring, Road crossings, urban obstacles – cost $2MM
- Bare Wire: Not an option, narrow route through heavily treed/park areas.
- Spacer: Savings $1.5MM
Lower Project Costs: Substation Exits

**Bare wire exit**
- Separate pole line for each circuit
- 1 acre additional real estate
- Reliability risk at feeders
- Dip poles in sub for clearance issues

**Spacer Cable Exit**
- 3 circuits on one pole line
- No dip poles
- Less real estate
- Reliable feeders
- Cost Savings = $75 - $150k
Lower Project Costs: Additional Sub exit

- Bare wire cost estimate $300k (converting to triple circuit)
- Spacer Cable Under build: Project came in at < 30% of original budget
Lower Project Costs: Improving Reliability

- Worst performing circuit even after converting to “tree” wire.
- **Option 1** – URD – cost $2MM – heavy tree casualties
- **Option 2** – tree trimming - $600k – short term fix with public resistance

- **Option 3**: Spacer Cable
  - NO tree trimming
  - Good Public relations
  - Total cost < $500k
  - Now – best performing circuit
Lower Project Costs: Improving Reliability

Poor performing circuit along busy, narrow road with little R/W space

- Option 1 – URD
  - Cost $1MM

- Option 2 – Spacer Cable, Significant improvement in reliability
  - Cost $300k
Lower Project Costs: Power Plant

- 12 circuits
- Cost: $2MM
- URD option: $7MM
Lower Project Costs: Power plant exits in urban setting

- Bare Wire not feasible
- Triple circuit through alleyway
- Savings over URD option = several million $$
Lower Project Costs: 4kV conversion to 15kV

- Bare wire presented NESC clearance issues
- URD estimate = $4MM
- Spacer = $300k total
  - Converted in 4 weekends
Lower Project Costs: lake crossing

- **Option 1**
  - Submarine cable
  - Cost: $1MM

- **Option 2** – build around shoreline
  - Cost: $800k

- **Option 3** - Spacer cable
  - 1,600’ span
  - Cost: $75k
Lower Project Costs

The cost of covering the cable can be easily offset with real world concerns such as ROW acquisition concerns, project approval costs, reduced need for poles, less clearance issues, and more direct routes.
Lower O&M Costs
Lower O&M Costs: Reduced Outages

- Temporary Tree contact does not cause outages
- System strength keeps the circuit operating
- Wildlife will not “short out” the system
Lower O&M Costs: reduced outages

Spacer Cable reduces non equipment related outages by 75%
Lower O&M Costs: Less Tree Trimming

Conventional Bare Wire

Hendrix Spacer Cable

Compact construction, placement flexibility, and the ability to withstand temporary ground contact reduces the amount of branches that must be trimmed and extends trim cycles. Savings = 50%-80%
Lower Operating Costs: Voltage Drop Problem

- Long run – start up voltage problem with large electric motor
- Option 1 - re conductor with 954 kcmil bare wire –
  - Voltage fluctuation = 6.97%
  - Minimum Voltage = 112.7
- Option 2 – spacer
  - Voltage fluctuation = 4.79%
  - Minimum voltage = 116.9
Lower O&M costs: Reduced Voltage Drop

The close spacing of the phase conductors results in lower total line impedance and reduced voltage drop.

Voltage Drop Comparison

- 336 kcmil 15 kV bare wire on crossarms
- 336 kcm 15 kV Spacer Cable
- Aluminum conductors, 90 % PF
## Lower O&M Costs: $/mile

<table>
<thead>
<tr>
<th></th>
<th>Total System</th>
<th>Worst 20% of the circuits</th>
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</thead>
<tbody>
<tr>
<td>Tree Trimming</td>
<td>$600</td>
<td>$2400</td>
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<tr>
<td>Outages</td>
<td>$750</td>
<td>$3000</td>
</tr>
<tr>
<td>Voltage drop (20% load)</td>
<td>$430</td>
<td>$430</td>
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<tr>
<td>Reliability penalties</td>
<td>$?</td>
<td>$?</td>
</tr>
<tr>
<td><strong>Total Annual Savings</strong></td>
<td><strong>$1780</strong></td>
<td><strong>$5830</strong></td>
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</tbody>
</table>
Public Relations and “Green” Initiatives

- Less vegetation removal
- Reduced Tree trimming
- Less outages
- Improved Aesthetics

Improved power quality
Wildlife protection
Avoiding sensitive areas
Lower Carbon Footprint
Recyclable material
Public Relations: Power Quality

Cable covering protects circuit from momentary outages
Green Initiatives: Avoiding sensitive areas

The ability to span long distances makes it easy to cross freeways, lakes, marshes, gorges, etc.

Poles can be placed to minimize disruption to the environment.
Green Initiatives: Protecting raptors and wildlife

Cable covering eliminates areas where animals can be electrocuted between phases or phase and ground.
Green Initiatives:

Reducing your right of way clearance by 20 feet for one mile can result in up to 6.5 tons of carbon dioxide being removed from the atmosphere every year.

All Hendrix polymer components are made of 100% No.2 HDPE Recyclable Plastic.
Hendrix Support Services
Hendrix will kit cable and accessories for shipment to the jobsite.

• Cut to length cable saves installation time and reduces scrap, saving 10% or more on project costs.
• Inventory and warehousing costs can be eliminated, saving up to 17% of the cost of the material.

Spacer Cable Accessory stock is maintained at Hendrix

Spacer Cable installation equipment is available for rental or sale—free to first time users
Hendrix Support Services

Design Support: Hendrix will work with your Engineers to help design your Spacer Cable System-free. Conductor sizing, pole loading, layout, sag and tension, guying, protection, BOM, cost estimates, and installation equipment needs.

Training and Advisory Services. We will work with your planners, designers, line crews or contractors-on line, in the classroom, or in the field. First time users are provided with on site installation advisory services free of charge.
Hendrix Support Services

**Application Flyers:** Helps determine where Spacer Cable can add the most value on your system

**Product Catalog:** Details on each component

**Design Guide:** Technical information for the System Design Engineer

**Installation Guides and Video:** Step by step instructions on how to install a Spacer Cable System

**Construction Drawings:** Standard pole top drawings with layout dimensions and bill of material-for putting directly into your standards.
Hendrix Support Services
Design-Build – full turnkey capabilities

- Site evaluation
- System design
- Construction Management
- Quality Assurance
- Project Management

Take advantage of Hendrix 50+ years of Spacer Cable design, application, and installation knowledge
Hendrix Spacer Cable

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Support documentation

- **Voltage drop:** See Brian Trager for calculations of voltage drop savings. He used the conductor size in the chart and assumed a 20% load—note that the calculation is based on amperage so savings will go up with the square of the current.

- **Tree Trimming:** Assumes $1200/mile and a 50% savings

- **Outages:** Assumes a $2000 cost per outage (office, truck and crew prep, travel, on site, etc). Assumes 0.5 outages per mile per year and a 75% reduction in outages