RESILIENT STRUCTURES

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RECOGNIZED INNOVATION

Resilient Structures won the 2005 Award for Composite Excellence from the American Composites Manufacturers Association for the most creative application and innovative use of composites materials.

Resilient Structures won the 2005 Innovation in Manufacturing Process Award.

Supporting responsible use of forest resources.

NOV 2024

RESILIENT STRUCTURES

Composite Utility Poles

ENGINEERED RELIABILITY

Grid hardening T&D infrastructure solutions

Case Study:
Innovative Materials & Design
The RS pole was chosen for Southern California Edison's "Circuit of the Future" – a project that utilized the most advanced, reliable utility products on the market.

High performance modular composite provide the most cost effective and resilient solution in the pursuit of hardened, reliable overhead lines. RS poles have an 80 year service life and are covered by a 41 year limited warranty.

Engineered Pole Technology

Resilient Structures answers the growing demand for reliable grid infrastructure products with a modular composite pole solution. Composite poles are safer to work with and offer unique benefits when compared to traditional steel, wood and concrete poles for overhead lines including being lightweight, non-conductive, resilient in powerful storms and require no scheduled maintenance.

The Resilient Structures Pole Solution

Resilient Structures composite utility poles are constructed from combinations of standard-sized, tubular modules to create poles with heights ranging from 20 ft. [6.1m] to 155 ft. [47.2 m] that use standard industry hardware. RS poles will cost less than traditional pole materials when used:

Where Traditional Poles Do Not Last as Long as They Should

For example, wood poles installed in hurricane or fire prone regions and woodpecker areas or steel poles installed near the coast or other highly corrosive areas.

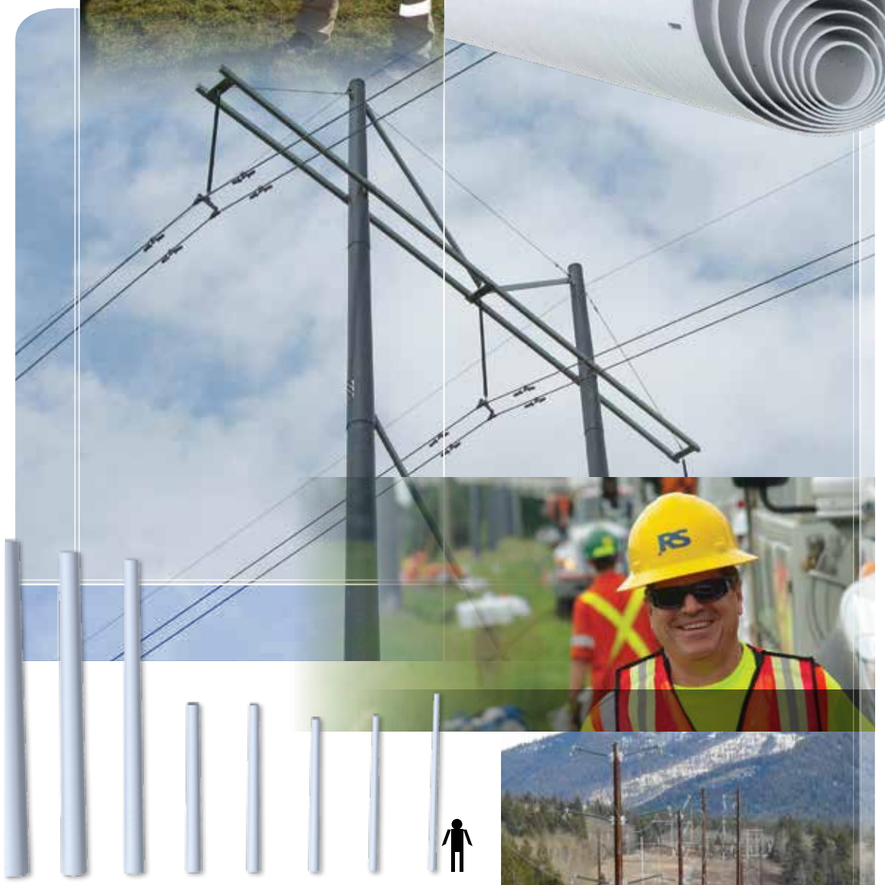
Where Structure Installation Cost is Higher Than Average

For remote installation locations, direct embed RS poles will have the lowest installed cost. This includes mountainous regions, wetlands, backyards and tight urban locations. Hand installation with a gin pole is an option.

Other High Performance Applications

Whether you need a non-conductive pole, a safer pole for motor vehicle impacts, no scheduled maintenance or simply resilient infrastructure to stand up heavy weather, RS poles are the solution.

"The *highest performing* ***Utility Pole*** on the Market"



RS poles have been used by over 500 utilities in 30 countries including installations in North America, Scandinavia, Europe, Australia, South America, Asia and the Caribbean.

COMPOSITE MATERIALS

Resilient Structures poles are made from an advanced composite material with integrated UV protection that combines an ultra strong polyurethane resin and E-glass fiber rovings. RS poles can also be pre-drilled and pre-assembled.

MODULAR DESIGN

The RS pole's unique tapered design enables the modules to be nested in compact bundles allowing for maximized efficiencies in storage and transportation. The eight module system can be configured to build virtually any pole class up to 155 ft. [47.2 m], which lowers the lead time for deliveries, reduces inventory requirements and simplifies transportation, handling and installation.

ADVANTAGES

Hardware Compatibility

Smooth surfaced hardware are without cleats or sharp edges of contact should used with RS poles and is commonly available for round cross-sectioned steel and concrete poles. Solutions like steel bearing plates can be supplied by Resilient Structures to enable the use of existing hardware.

Superior Temperature Performance

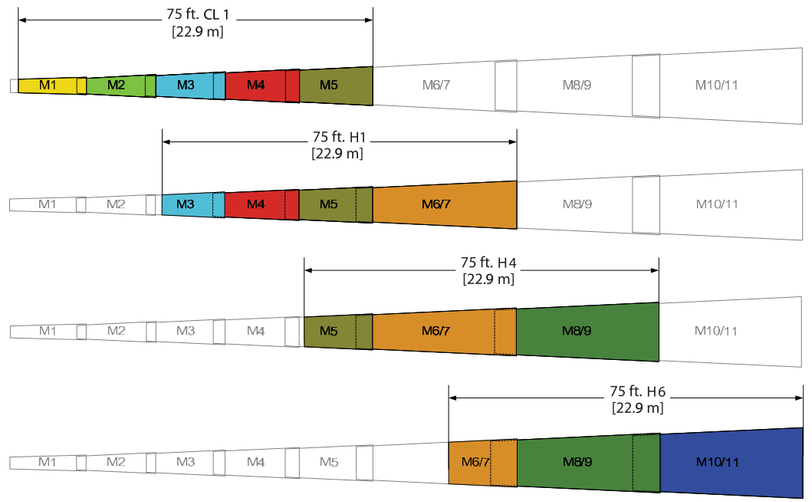
Resilient Structures composite material performs well in both hot and cold environments. The established temperature range is -76°F to +167°F [-60°C to +75°C].

Fast Assembly

RS pole slip joints assemble in approximately 10 minutes each, or with the assistance of assembly racks, entire poles can be completed in 15 minutes with a crew of four. Poles can be pre-drilled for specific framing patterns and/or pre-assembled prior to shipping to reduce installation time.

Modularity

Custom length and strength poles are created from standard sized modules for ultimate flexibility. Below are different module combinations to build a 75 ft. [22.9 m] pole:



Case Study:
Inventory Advantage
"Having the ability to build a variety of pole lengths and classes from just eight modules gives utilities faster deployment time for emergency outages."

Utility Products, November 2006

LOWEST LOGISTICS COST

The RS pole's modular design offers the fastest delivery and lowest logistics cost of any utility pole, from the time the order is placed to the time the pole is installed.

Industry Best Lead Times

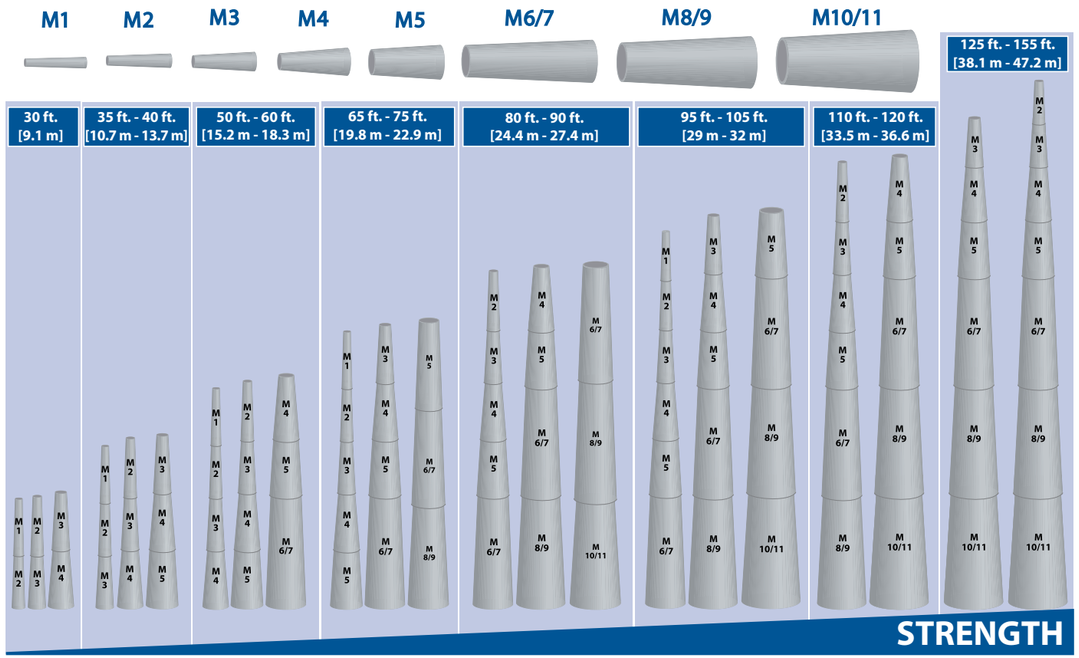
Resilient Structures maintains a large inventory of modules and hardware which enables even large custom pole orders to be shipped within weeks. On demand production capability ensures Resilient Structures has the pole inventory utilities require.

Minimal Inventory

Dynamic module sets take up a fraction of the yard space required by static, single application one piece poles and even enable faster transportation to the installation site. A major contributor to an effective sparing strategy, Resilient Structures modular system keeps minimal inventory on hand, quickens turnover cycles and reduces safety stock inventory costs while effectively meeting day-to-day and emergency requirements. Downtime from structure/pole damage is significantly reduced because Resilient Structures modules can be quickly configured to build almost any pole class up to 155 ft. [47.2 m].

> "***One Set of Modules*** can build ***262 Different poles***"

Resilient Structures Modular Pole Combination Sampling



RS RESILIENT STRUCTURES

Pole Capabilities From One Set of Resilient Structures Modules

Pole Length	30 ft. 9.1 m	35 ft. 10.7m	40 ft. 12.2 m	45 ft. 13.7 m	50 ft. 15.2 m	55 ft. 16.8 m	60 ft. 18.3 m	65 ft. 19.8 m	70 ft. 21.3 m	75 ft. 22.9 m	80 ft. 24.4 m	85 ft. 25.9 m	90 ft. 27.4 m	95 ft. 29 m	100 ft. 30.5 m	105 ft. 32 m	110 ft. 33.5 m	115 ft. 35.1 m	120 ft. 36.6 m	125 ft. 38.1 m	130 ft. 39.6 m	135 ft. 41.1 m	140 ft. 42.7 m	145 ft. 44.2 m	150 ft. 45.7 m	155 ft. 47.2 m
NESC Grade B Pole Class H6	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔								
H5	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔							
H4	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔						
H3	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔				
H2	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	
H1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
2	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
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4	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
5	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
# of Pole Capabilities	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	10	9	9	8	8	7	7	6

Total Pole Capabilities = 262

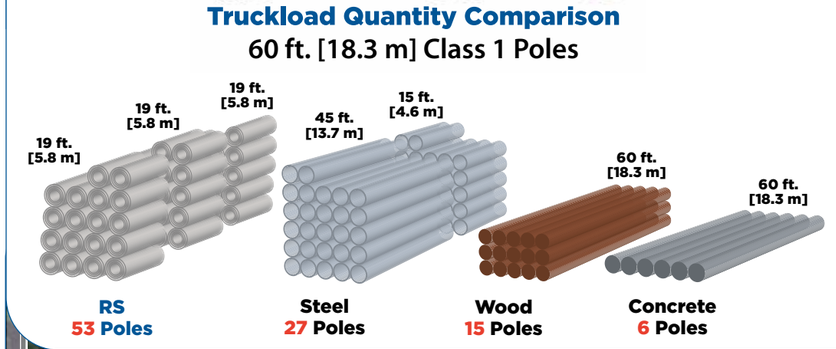
Case Study:
Transportation Advantage
"Compared to other transmission poles we evaluated, the RS pole was the most cost effective. Transportation, assembly and installation was easier and less expensive than that of traditional poles."

Shawn Woon, Manager, Midlite Powerline Construction

Efficient Transportation

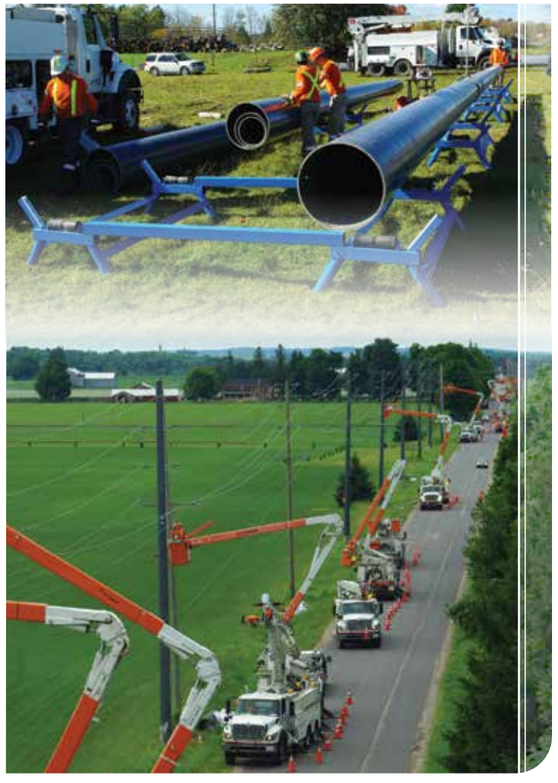
The RS pole's nesting modules mean even the longest RS poles only require standard length trailers and they eliminate the need for slow and expensive long load permits. See the Truckload Quantity Comparison below to review the significant shipping efficiencies that can be realized with RS poles. Depending on pole size, Resilient Structures modules can also be shipped and stored in 20 ft. [6.1 m] or 40 ft. [12.2 m] intermodal containers for international deliveries and quick deployment after natural disaster damage to the grid. Lightweight RS poles have been air freighted in bulk quantities in emergencies.

Truckload Quantity Comparison
60 ft. [18.3 m] Class 1 Poles



Installation Flexibility

When setting the pole, in addition to using lighter duty machinery, modularity allows for installation sequencing options. The entire pole can be assembled on the ground and then installed. Alternatively, the base can be installed first and the remaining top modules added at a later time either one at a time or as a pre-assembled unit. RS can pre-assemble poles and pre-drill to reduce on site installation time. On-the-fly line design changes to pole height and class are easily accomplished by simply adding or removing the desired module. Pole modularity also provides for simple circuit height adjustments, future system expansion and revenue generating joint use potential. Compared to traditional pole materials, smaller helicopters can be used to lift fully constructed H-frames for challenging location drops. RS poles are easily cut and drilled in the field. RS poles are also used in communication, SCADA, siren and radio frequency (RF) metering applications. RS poles can be installed by hand with the RS gin pole tool.



Case Study:
Installation Advantage
Norwegian utility NTE has calculated that the installed cost of RS poles is about 10% less than wood when span lengths are optimized and helicopters are used for installation.

Case Study:
Reliability
Rio Grande EC had just finished installing a 34.5kV line when a tornado touched down. "We lost eight 40 ft. [12.2 m] Class 3 wooden poles. RGEC Operations reported that the RS composite poles that we installed in this area 'did not budge at all'."

Dan Laws
Rio Grande EC

Case Study:
Non-Conductivity
RS poles were proven by test lab Kinectrics in Ontario, Canada to pass the test for a hot stick, making them one of the safest poles on the market.

Case Study:
Environmental Advantage
"RS poles do not need to be coated with Penta, arsenic or creosote. As a result, these poles are the most environmentally friendly ones available in the market place."

NWPPA Bulletin, January 2006

LOWEST LIABILITY

High performance RS poles reduce the risks and costs associated with managing utility infrastructure and increase grid reliability.

Reliable Grid Hardening

The ultra strong Resilient Structures composite pole can absorb significant elastic strain energy in high-load situations like hurricanes, tornados, ice storms and seismic events. This capability delivers infrastructure reliability far beyond the expected performance of conventional utility pole materials. The exceptional load carrying capacity combined with the RS pole's light weight reduces the potential for cascade failures. Excellent fracture toughness protects against crack initiation and propagation. Additionally, RS poles are self-extinguishing and maintain the initial published pole strength values from full scale bend tests conducted after exposure to fire tests simulating moderate to severe wildfires.

Increased Safety

Manufactured with a non-conductive and hydrophobic material, RS poles reduce the risk of second point of contact injuries, eliminate electrical tracking and help prevent arcing due to lightning or switching. RS poles pass the 100 µA test for a hotstick which makes live-line installations safer. Lightweight RS modules decrease the probability of worker injury and equipment fatigue. Hollow RS poles allow ground wires to be run internally to reduce theft potential.

Environmentally Responsible

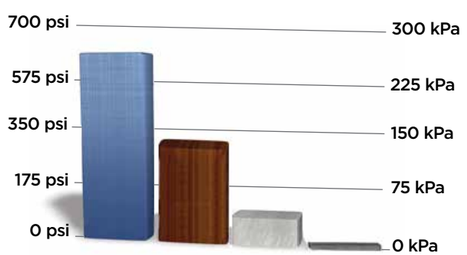
RS poles are free of toxic preservatives common to wood poles and as a result they do not leach chemicals into the ground or water table. Soil remediation is never required. To confirm they are inert, RS poles have been tested to ASTM C1308-08 Leach Test and the water used in the test subsequently passed both Canadian and US drinking water safety standards. The RS manufacturing process releases no volatile organic compounds (VOC) or hazardous airborne pollutants (HAP).

Public Satisfaction

Resilient Structures controlled manufacturing process ensures a consistent lifetime aesthetic. RS poles are available in either grey or brown to match existing wood and steel poles or to blend in with the scenery. Custom colors are available. The surface of the RS pole is easily cleaned of graffiti and poster glue and is resistant to staples.

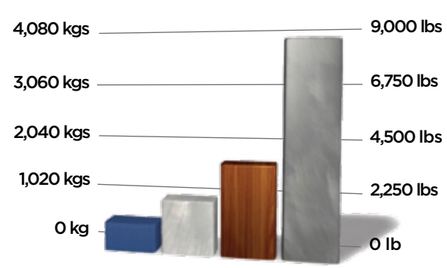
Specific Strength Comparison

- RS poles: 630 psi.ft³/lb [271 kPa.m³/kg]
- Wood (Douglas Fir): 272 psi.ft³/lb [117 kPa.m³/kg]
- Steel: 119 psi.ft³/lb [51 kPa.m³/kg]
- Concrete: 7 psi.ft³/lb [3 kPa.m³/kg]



Weight Comparison

- RS poles: 1,181 lbs [536 kg]
- Steel: 2,190 lbs [993 kg]
- Wood: 3,695 lbs [1,676 kg]
- Concrete: 8,500 lbs [3,856 kg]



75 ft. [22.9 m] Class 1 Pole

LONGEST LIFE

Manufactured with integrated UV protection and a durable composite material, RS poles have a longer service life than any other pole alternative.

Excellent Weathering and UV Protection

High performance RS poles are engineered for an 80 year service life that requires no scheduled maintenance. This extended life expectancy, tested to ASTM G154 for 14,000 hours, is achieved from a single step manufacturing process which creates a monolithic laminate with an imbedded layer of aliphatic UV protection that cannot be scratched or flaked off. RS poles retain their hydrophobic qualities over their entire service life ensuring that the poles continue to be self-washing and maintain their high dielectric strength. RS poles are covered by a 41 year limited warranty – see the Resilient Structures Limited Warranty for complete details.

Corrosion, Rot and Pest Resistant

RS poles will not rot or corrode and are resistant to salt, soil pH levels and chemicals. This allows for excellent wet area and coastal performance. RS poles are impervious to woodpeckers, termites and other pests. These performance advantages dramatically increase the pole service life and reliability of the grid.

Maintenance Free Poles

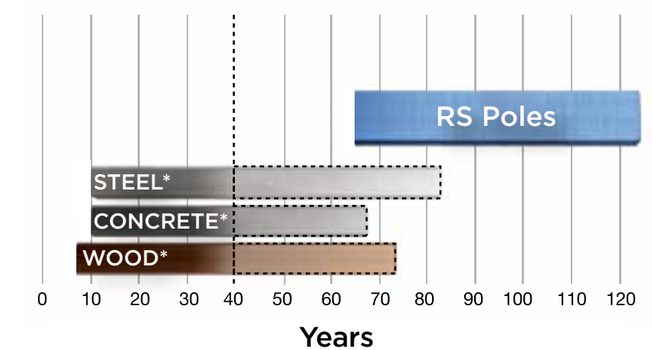
RS poles require no scheduled maintenance, like preservative treatments or repainting, resulting in significant operational savings. Inspections are fast and non-invasive. Typical pole replacement frequencies are cut in half.

Installed Cost and NPV Advantage

The RS pole delivers the lowest total ownership cost based on Net Present Value (NPV) calculations. For installations with challenging terrain, long length poles, remote locations or helicopter lifts, RS poles can provide the lowest installed cost. Move beyond the material cost comparison and find out how much wood poles truly cost. A tailored analysis for your grid can be completed by Resilient Structures.

LOWEST TOTAL OWNERSHIP COST

Expected Service Life

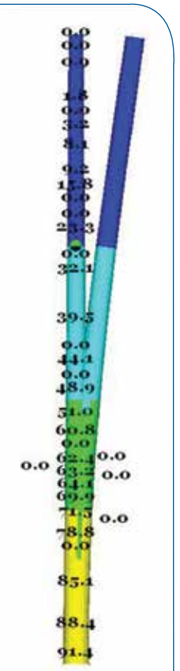


*Grid infrastructure replaced at 2.5% annually
(100/2.5 = 40 year typical service life for traditional pole materials)

Case Study:
Reliability
"You can't beat the warranty. We like to use RS poles to harden our infrastructure in critical, high value locations."

Steve Coltharp
West Kentucky EC

Case Study:
Grid Hardening
A major Canadian utility replaced a 400 pole feeder line to an automotive assembly plant with RS poles to achieve the highest reliability and eliminate wood pole failures in storms.



WORLD CLASS CUSTOMER SUPPORT

Resilient Structures is the world leader in composite utility poles. Our dedicated and qualified team of experienced engineers and technical service representatives work with you from preliminary planning to line completion.

Design Support

The Resilient Structures technical department is involved throughout the entire process to ensure you chose the right RS pole for your application. Our design support includes structural analysis or PLS-POLE™ and PLS-CADD™ where your loading requirements are reviewed and a report is generated detailing the performance of the RS pole in your application. RS poles can also be analyzed independently using the FRP library files available from Power Line Systems (PLS) or SPIDA Calc software.

Technical Binder

All RS technical information, available upon request and on the RS website, is compiled into a single package containing:

- Resilient Structures Pole Data from 30 ft. [9.1 m] to 155 ft. [47.2 m]
- Structural Design Guide
- Hardware Guide
- Maintenance and Inspection Guide
- Technical Specification
- Module Testing and Quality Assurance Overview (MTQAO)
- Assembly and Installation Guide
- Frequently Asked Questions

Application and Installation

Resilient Structures engineers will assist with project planning and assessment and are available to answer questions and provide support. Prior to commencing a project, Resilient Structures can complete a full hardware review and provide the necessary recommendations to ensure a long lasting, successful installation. On-site field support is provided during installation to ensure your field crews receive thorough RS pole training.

LAB TESTED, FIELD PROVEN

The controlled Resilient Structures manufacturing environment produces consistent pole modules each and every time for measured, reliable performance in your grid. You can count on it.

Quality Assurance

Resilient Structures is ISO 9001:2015 certified and maintains a stringent quality focus throughout the entire manufacturing process. From material inputs to production to order preparation, each step is carefully monitored to ensure you receive the best pole on the market.

Testing

RS poles have been thoroughly full scale tested and verified to all relevant ASTM, ASCE, ANSI and IEEE standards.

Line Installations

Current installations are subject to extreme temperatures, corrosive environments, pest attacks, heavy loading and severe weather. All poles continue to deliver superior, predictable performance, without a non-vehicular failure in over a decade of RS pole installations.

Case Study:
Hardware
Non-cleated, flat surfaced hardware is required for RS poles. In most cases, existing hardware that is compatible with concrete and round steel poles can be used on RS poles.