POWERTRUSION PRODUCTS
Manufactured by Creative Pultrusions, Inc.
www.powertrusion.com

"GREEN TECHNOLOGY FOR TODAY AND TOMORROW"

POWERTRUSION INTERNATIONAL, Inc.
UTILITY POLE MATERIAL COMPARISON

Introduction

Composite utility poles offer numerous major advantages over wood, steel and concrete poles. Powertrusion offers the only pultruded composite distribution pole in the United States. This comparison analysis is based on a standard 40-ft distribution utility pole.

Pultruded Fiber Reinforced Composite Utility Poles

Powertrusion PFRC

Advantages

Weight -	Lightest utility pole on the market - Average weight of 40' pole = 368 lbs.
Installed Cost -	Simple, quick and affordable – the industry's best value
Environmental -	Doesn't contaminate soil, air or water; No hazardous handling issues
Limited Access -	Ideal for remote and limited access area installations due to lightweight
Construction -	Continuous filament fibers provide superior strength-to-weight ratio plus flexibility
Strength -	Engineered material provides excellent load transfer with variation at less than 5%
Life Expectancy -	Up to 80 years
Safety -	Non-conductive – no special handling or safety procedures required
Quality -	Engineered and controlled dimensional tolerances and constant wall thickness
Appearance -	Aesthetically pleasing – receives consistent praise from utility companies

Disadvantages

Unit Cost	More expensive than wood, although price differential varies regionally

Wood Utility Poles

Advantages

Unit Cost	Least expensive unit cost

Disadvantages

Weight -	Average weight 40' pole = 1100 lbs.
Installed Cost -	High labor and equipment costs due to pole weight
Environmental -	Unfriendly due to multiple levels of contamination
Limited Access -	Much more costly and difficult to transport and install than composite poles
Construction -	Inconsistent due to inherent natural voids in the wood
Strength -	Inherently inconsistent with variation at 20% - deteriorates with age
Life Expectancy -	Average 25-30 years if properly maintained and monitored
Safety -	Somewhat conductive – sometimes contains contaminants
Quality -	No consistency – varies considerably – subject to deterioration and rot
Appearance -	Functional but undesirable – changes color – twists and curves

POWERTRUSION PRODUCTS

"A Better Way to Deliver Power"

Steel Utility Poles

Advantages

Unit Cost -	Favorably priced relative to wood poles
Environmental -	Does not contaminate soil, air or water
Life Expectancy -	Average 50-60 years
Quality -	Engineered constant wall thickness

Disadvantages

Weight -	Average weight 40' pole = 650 lbs.
Installed Cost -	Installation hazards result in expensive safety precautions
Limited Access -	Increased labor and equipment costs for remote/limited access installs due to pole weight
Construction -	Superior strength and consistency, but at the cost of heavier weight
Strength -	Strong, but deteriorates and degrades with age due to corrosive issues
Safety -	Most dangerous product to install in a live-wire installation as material is conductive
Appearance -	Aesthetically pleasing until protective coating ages and steel rusts

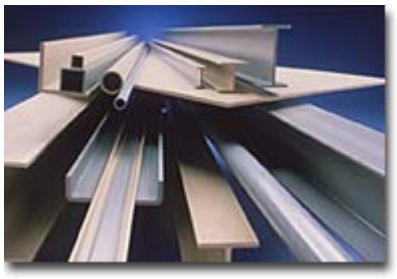
Concrete Utility Poles

Advantages

Unit Cost -	Favorably priced relative to wood poles
Environmental -	Does not contaminate soil, air or water
Life Expectancy -	Average 45-50 years
Quality -	Engineered quality consistency

Disadvantages

Weight -	Average weight 40' pole = 4000 lbs.
Installed Cost -	Highest installation cost due to heavy equipment and handling requirements
Limited Access -	Not suitable for remote or limited access installations due to weight
Construction -	Must be larger and heavier to satisfy class requirements
Strength -	Strong, but deteriorates and degrades with age
Safety -	Somewhat conductive – requires extra precautions due to heavy weight
Appearance -	Looks good at first but deteriorates in color and texture



PULTRUSIONS ***vs.*** **STRUCTURAL TIMBER**

Pultruded glass fiber reinforced structural shapes and plates have a number of significant advantages over timber in many structural applications. Pultruded fiberglass will not rot or decay and is not susceptible to insect attack. Unlike wood, fiberglass requires no environmentally unfriendly preservatives or repellants, does not absorb any significant amount of water and is consistent in strength and appearance piece-to-piece (no culling). Pultruded fiberglass is stronger, more rigid and lighter weight than structural timber.

Is pultruded fiberglass a better choice for your application? Consider the point-for-point comparison below.

NOTE: Properties shown for pultruded fiberglass structural shapes are approximate for typical off-the-shelf structural pultrusions.

COMPARE!	**Pultruded Fiberglass Structural Shapes**	**Structural Timber Douglas Fir**
CORROSION RESISTANCE	Superior resistance to a broad range of chemicals. Unaffected by moisture or immersion in water if ends are properly sealed. Surfacing veil and UV additives create excellent weatherability.	Can warp, rot and decay from exposure to moisture, water and chemicals. Coatings or preservatives required to increase corrosion or rot resistance can create hazardous waste and/or high maintenance.
INSECT RESISTANCE	Unaffected by insects.	Susceptible to insect attack (marine borers, termites, etc.). Coatings to increase resistance to insects can be environmentally hazardous.
STRENGTH	Pultruded fiberglass is stronger, and has higher flexural strength than timber. Ultimate flexural strength (Fu) LW = 30,000 psi, CW = 10,000 psi. Compression strength is 30,000 psi.	Extreme fiber bending = up to 2800 psi.* Compression parallel to grain = up to 1800 psi.*
STIFFNESS	Pultruded fiberglass is approximately 1-1/2 times as rigid as wood. Modulus of elasticity LW = 2.5 x 10^6 psi, CW = .8 x 10^6 psi.	Modulus of elasticity = up to 1.8 x 10^6 psi.*
ELECTRICAL CONDUCTIVITY	Non-conductive - high dielectric capability.	Timber can be conductive when it is wet.
WEIGHT	Specific gravity = 1.7 Pultruded fiberglass has significantly higher strength-to-weight ratio.	Specific gravity = .51 (oven dried).*
FINISHING AND COLOR	Pigments added to the resin provide color throughout the part. Special colors available. Composite design can be customized for required finishes.	Must be primed and painted for colors. To maintain color, repainting may be required.
COST	Lower maintenance, longer product life often equals lower overall costs.	Lower initial cost.

*Surface dry at 19% max moisture content. *Design Values for Wood Construction*, National Design Specification for Wood Construction.

Source: Pultrusion Industry Council

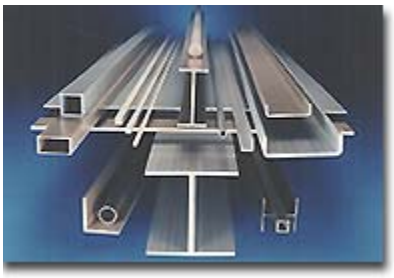
PULTRUSIONS ***VS.*** **STEEL**

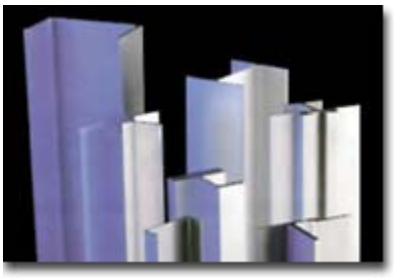
Unlike Steel which will rust when exposed to weathering and chemicals, fiberglass structural shapes are highly corrosion resistant. Features of both pultrusions and steel structural shapes are compared on a point-for-point basis below.

NOTE: Properties for pultruded fiberglass structural shapes are approximate for typical off-the-shelf structural pultrusions.

COMPARE!	**Pultruded Fiberglass Structural Shapes**	**Steel A-36 Carbon**
CORROSION RESISTANCE	Pultrusions are available in either polyester or vinyl ester resin for resistance to a broad range of chemicals. Painting required only when exposed to direct sunlight.	Subject to oxidation and corrosion. Requires painting or galvanizing for many applications.
WEIGHT	Lightweight - weighs 75% less than steel. 1/2" thick plate = 4.7 lbs./sq. ft.	Could require lifting equipment to move and place. 1/2" thick plate = 20.4 lbs./sq. ft.
CONDUCTIVITY	Does not conduct electricity. Low Thermal Conductivity 4 (BTU/SF/HR/F°/IN).	Conducts electricity. Grounding potential. Thermal Conductivity 260-460 (BTU/SF/HR/F°/IN).
STRENGTH	Pultrusions have a high strength-to-weight ratio, and pound-for-pound are stronger than steel in the lengthwise direction. Ultimate flexural strength (Fu) LW = 30 ksi CW = 10 ksi	Homogeneous material. Yield strength (Fy) 36 ksi
STIFFNESS	Modulus of elasticity: Will not permanently deform under working load. LW = 2.5 x 10^6 psi CW = .8 x 10^6 psi	Modulus of elasticity 29 x 10^6 psi
IMPACT RESISTANCE	Glass mat in pultruded parts, distributes impact load to prevent surface damage even in sub-zero temperatures. Will not permanently deform under impact.	Can permanently deform under impact.
EMI/RFI TRANSPARENCY	Transparent to EMI/RFI transmissions.	Can interfere with EMI/RFI transmissions.
VERSATILITY	Pigments added to the resin provide color throughout the part. Special colors available.	Must be painted for color. To maintain color and corrosion resistance, repainting may be required.
EASY FIELD FABRICATION	Pultruded fiberglass can be field fabricated using simple carpenter tools with carbon or diamond tip blades. Lightweight for easier erection and installation.	Often requires welding and cutting torches. Heavier material requires special handling equipment to erect and install.
COST	Lower installation and maintenance costs in industrial applications often equal lower lifecycle costs.	Lower initial material cost.

Source: Pultrusion Industry Council





PULTRUSIONS ***VS.*** **ALUMINUM**

Pultruded glass fiber reinforced structural shapes and plates have a number of significant advantages over aluminum extrusions. Pultrusions are electrically and thermally non-conductive, impact resistant, highly corrosion resistant and EMI/RFI transparent.

Is pultruded fiberglass the best material choice to meet the needs or requirements of your application? Features of both pultruded fiberglass structural shapes and aluminum extruded shapes are compared on a point-for-point basis below.

NOTE: Properties shown for pultruded fiberglass structural shapes are approximate for typical off-the-shelf structural pultrusions.

COMPARE!	**Pultruded Fiberglass Structural Shapes**	**Aluminum Extruded Shapes**
CORROSION RESISTANCE	Superior resistance to a broad range of chemicals. Surfacing veil and UV additives improve weatherability.	Can cause galvanic corrosion. Corrosion resistance can be increased through anodizing or other coatings.
WEIGHT	Very lightweight - about 70% the weight of aluminum on a density basis.	Lightweight - about 1/3 that of copper or steel.
ELECTRICAL CONDUCTIVITY	Non-conductive - high dielectric capability.	Conducts electricity - grounding potential.
THERMAL CONDUCTIVITY	Insulates - low thermal conductivity, 4 (BTU/SF/HR/F°/IN); low thermal coefficient of expansion 4.4 (IN/IN/F°)10^6.	Heat conductor - high thermal conductivity. 150 (BTU/SF/HR/F°/IN); thermal coefficient of expansion 11-13 (IN/IN/F°)10^6.
STRENGTH	Ultimate flexural strength (Fu) LW = 30 ksi CW = 10 ksi. Pultruded fiberglass has 86% of the yield strength of aluminum and, pound-for-pound's, stronger than aluminum in the lengthwise direction.	Flexural strength (Fu) 35 ksi. Homogeneous material.
FINISHING AND COLOR	Pigments added to the resin provide color throughout the part. Special colors available. Composite design can be customized for required finishes.	Silver color. Other colors require prefinishes, anodic coatings and paints. Mechanical, chemical and electroplated finishes can be applied.
EMI/RFI TRANSPARENCY	Transparent to radio waves, EMI/RFI transmissions; used for radar and antennae enclosures and supports.	Highly reflective.
FABRICATION	Easy field fabrication with simple carpenter tools - utilizes adhesive bonding and/or mechanical joining. No torches or welding.	Good machinability - welding, brazing, soldering or mechanical joining.
COST	Slightly higher tooling costs; price per lineal foot marginally higher.	Extrusion tooling is relatively inexpensive. Part price comparable or slightly lower.
IMPACT RESISTANCE	Glass mat in pultruded fiberglass distributes impact load to prevent surface damage even in sub-zero temperatures. Will not permanently deform under impact.	Easily deforms under impact.

Source: Pultrusion Industry Council