



TransWest Express Transmission Project Transmission Line Structures



Outline

- Introduction
- DC Straight Line Tangent Structures
- Specialty DC Structures
- AC Straight Line Structures
(System Alternatives 2 and 3)



Introduction

Typical Engineering Considerations

- In general: minimize structure count, disturbance areas, construction weights and costs.
- Minimize crossings for reliability and minimize use of heavy and larger structures.
- Develop alignments with long straight runs to minimize angle structures.
- Use taller structures to maximize tower spans.
- Use guyed structures where applicable.

About This Presentation

- Structure characteristic and application data from Project Description Technical Report , July 2011.
- Straight Line structures are referred to as “tangent” structures in the PDTR.
- Transmission line engineers sometimes refer to angle points along a line route as “PI” (point of intersection) locations.
- Structure counts, typical and average weight and cost data are from TWE Project cost estimates.
- The cost estimates include the material and installation costs for the structure and the foundation. Costs for the conductor, insulators and hardware are in addition to these costs.
- These are approximate estimates for typical structures and costs per mile for straight line runs.

DC Self Supporting Lattice Structure (Straight Line)

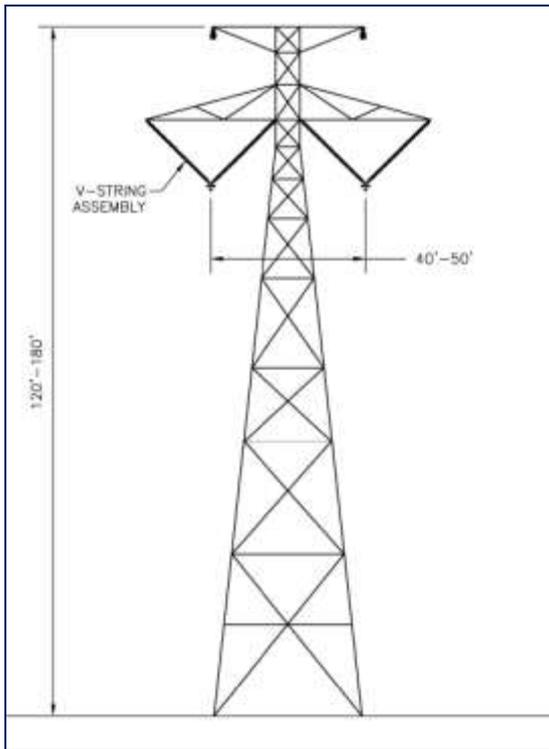
Characteristics

- Typical Height: 120' to 180'
- Structures per mile: 3 to 4
- Long Term Land Disturbance:
900 square feet
(30 x 30 feet tower base)
- Average Weight: 30,000 lbs.
(requires more structure haul equipment and heavier cranes than guyed structures.)
- Foundation: Four 3 to 4 foot diameter by 12 to 25 foot deep, reinforced cast-in-place concrete drilled piers
(requires heavy concrete trucks)

Application

Steep to mountainous terrain (with steep side hill), agriculture and urban areas

(up to approx. 50% of tangents, about 1,250 structures max in total)

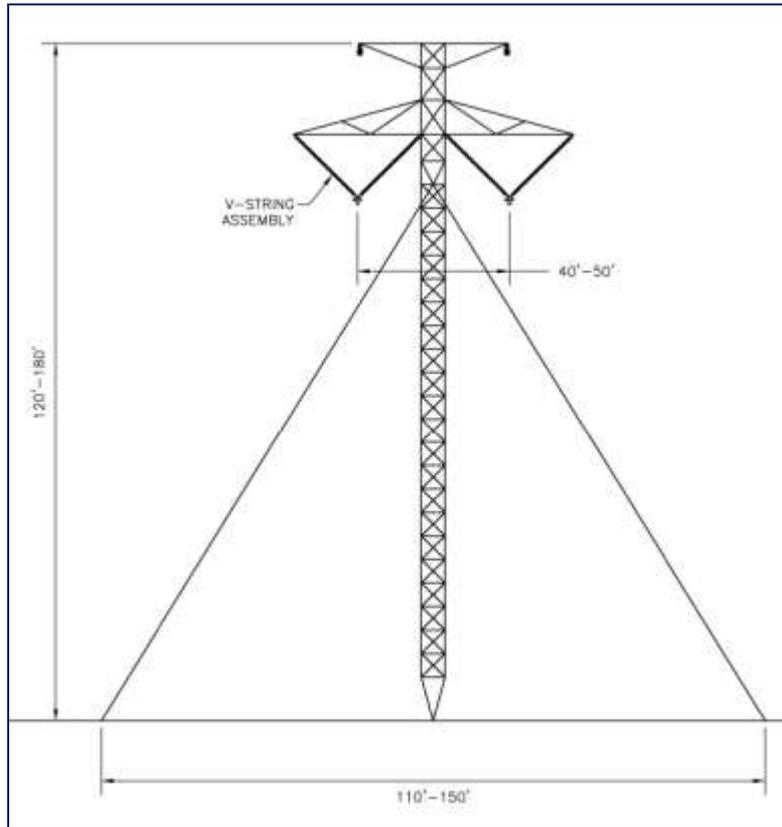


Installed Cost

- \$150k-\$170k/structure
- \$600k-\$900k/mile



DC Guyed Lattice Structure (Straight Line)



Application

Flat to rolling terrain, open areas

(at least 50% of tangents, a minimum of approx. 1,275 structures in total)

Characteristics

- Typical Height: 120' to 180'
- Structures per mile: 3 to 4
- Long Term Land Disturbance: 500 square feet
(100 sq. ft. mast foundation + 4 x 100 sq. ft. for anchors)
- Average Weight: 18,000 lbs.
(40% less than self supporting)
- Foundation: One 3 to 4 foot diameter by 4 to 6 foot deep, precast concrete support pedestal
(no concrete trucks)
- Guys: Four guys with plate or rock anchors with guy markers for increased visibility for wildlife and human avoidance

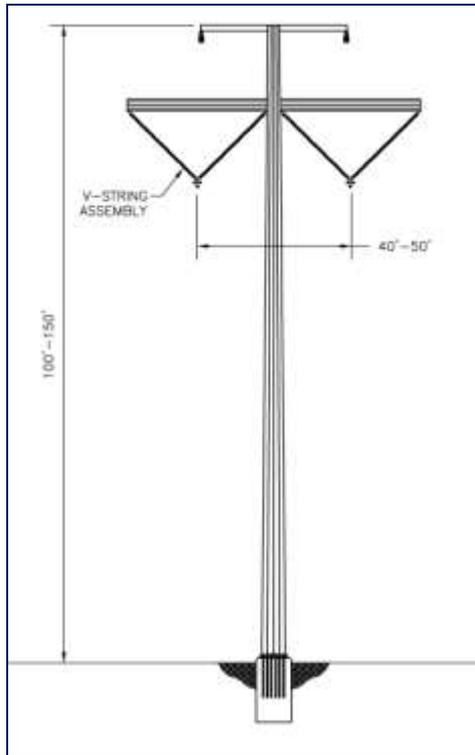


Installed Cost

- \$110k-\$130k/structure
- \$450k-\$700k/mile



DC Tubular Steel Pole (Straight Line)



Characteristics

- Typical Height: 100' to 150'
- Structures per mile: 5 to 6
- Long Term Land Disturbance:
40 square feet
(7-foot diameter foundation)
- Average Weight: 45,000 lbs.
(50% more than self supporting)
- Foundation: One 6 to 10 foot diameter by 20 to 60 foot deep, reinforced cast-in-place concrete drilled piers
(requires heavy concrete trucks)

Application

- Urban and other highly constrained ROWs
- “Dead-end” version used for crossings

Installed Cost

- \$190k-\$230k/structure
- \$900k-\$1,550k/mile



DC Self Supporting Lattice Structure (Line Angle)

Characteristics

- Typical Height: 120' to 140'
- Long Term Land Disturbance:
1,225 square feet
(35 x 35 feet tower base)
- Average Weight: 38,500 lbs.
- Foundation: Four 3 to 4 foot diameter
by 15 to 25 foot deep, reinforced cast-
in-place concrete drilled piers

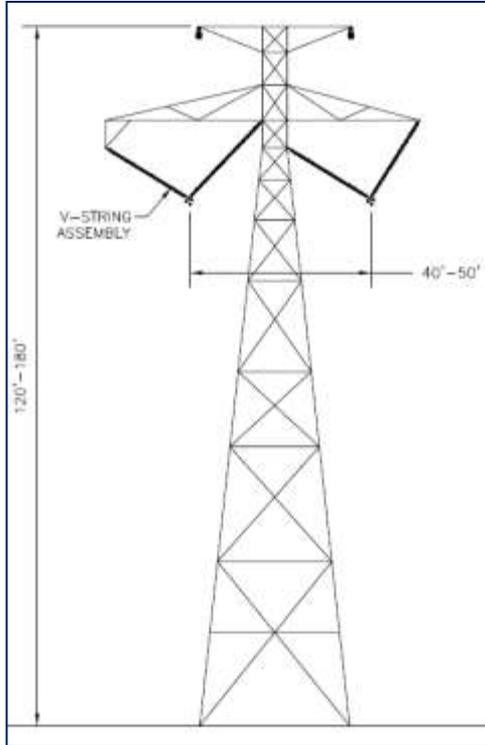
Application

PI locations ($>2^\circ$ angles, typically
light angles)

(about 120 structures in total)

Installed Cost

- \$210k-\$260k/structure



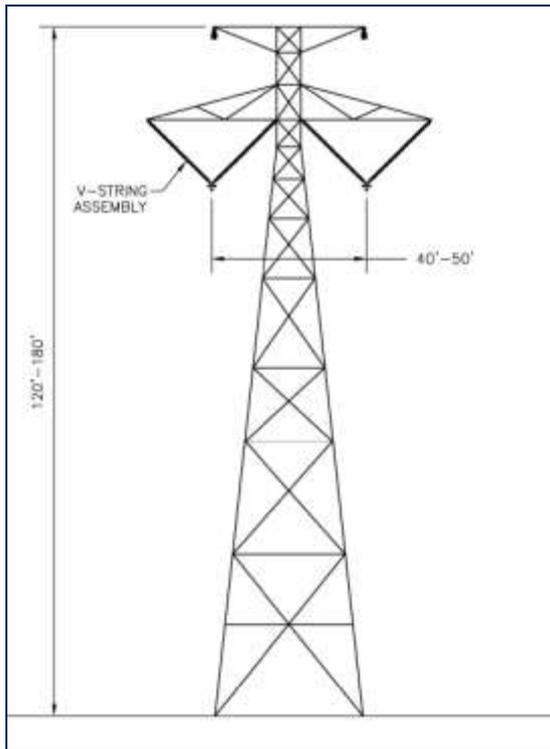
Self Supporting Lattice Structure (Dead-End)

Characteristics

- Typical Height: 120' to 140'
- Long Term Land Disturbance: 1,600 square feet
(40 x 40 feet tower base)
- Typical Weight: 95,000 lbs.
- Foundation: Four 3 to 4 foot diameter by 15 to 25 foot deep, reinforced cast-in-place concrete drilled piers

Application

- Heavy angle locations (3 ° to 90 °)
- Every 4 to 6 miles on long straight runs to avoid cascade toppling (failure) of more than a 4 to 6 mile segment of structures
- near terminals
(about 160 structures in total)

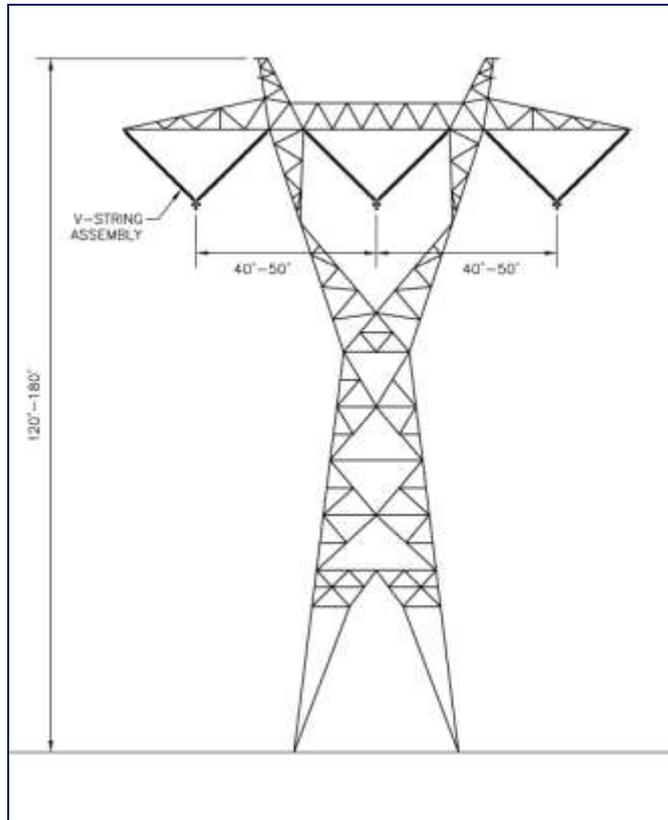


Installed Cost

- \$450k-\$550k/structure



AC Self Supporting Lattice Structure (Straight Line)



Characteristics

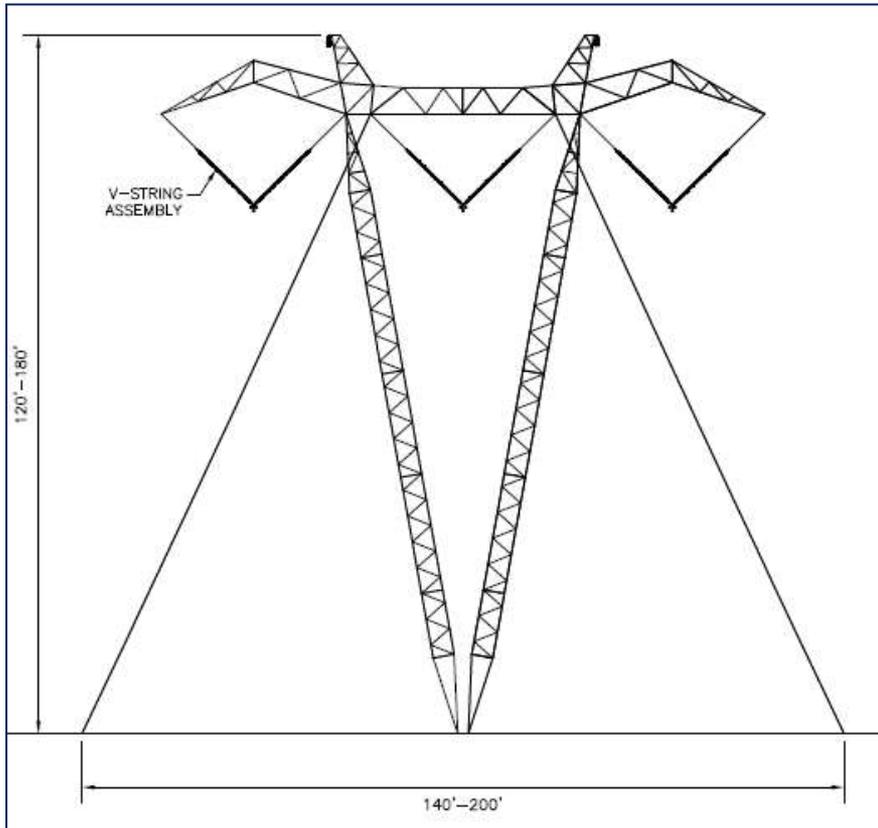
- Typical Height: 120' to 140'
- Structures per mile: 3 to 4
- Long Term Land Disturbance:
900 square feet
(30 x 30 feet tower base)

Application

Steep to mountainous terrain,
agriculture and urban areas



AC Guyed Lattice Structure (Straight Line)



Characteristics

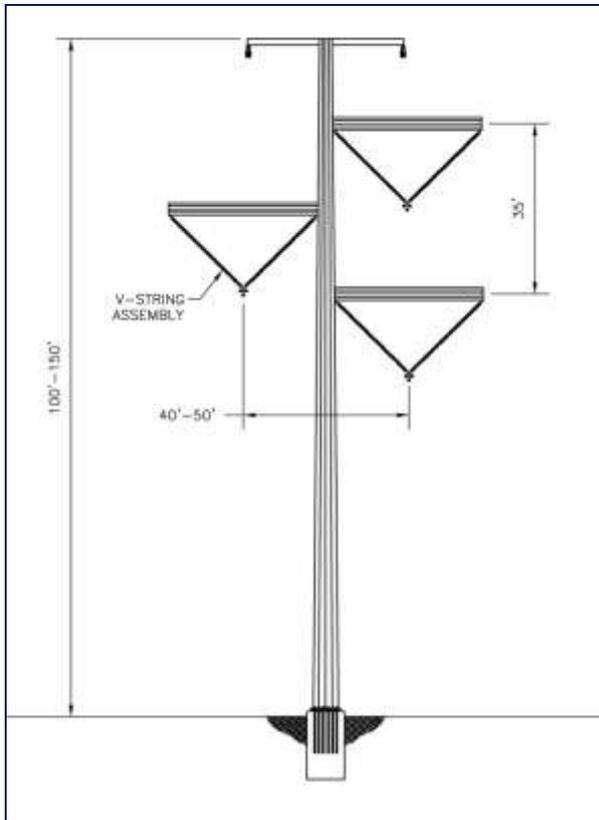
- Typical Height: 120' to 140'
- Structures per mile: 3 to 4
- Long Term Land Disturbance:
500 square feet
(100 square feet mast foundation
+ 4 x 100 square feet for anchors)

Application

Flat to rolling terrain, open areas



AC Tubular Steel Pole (Straight Line)



Characteristics

- Typical Height: 100' to 150'
- Structures per mile: 5 to 6
- Long Term Land Disturbance:
40 square feet
(7-foot diameter foundation)

Application

Highly constrained ROWs



Questions?

