

## **Appendix 3B – Illustrations of Transmission Line Structure Types**

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### 345-kV TRANSMISSION LINE STRUCTURE TYPES

Transmission line structures, which are typically the element of an electric transmission system that are most apparent to the public, support the conductors (wires) that are used to transport electric power from generation sources to customer load centers.<sup>7</sup> Three 345-kV transmission line structure families have been identified for use on the proposed Project or as configuration options to certain segments of the proposed Project:

- H-Frame
- Delta Steel Pole
- Vertical Steel Pole

Each of these structure families includes different functional types of structures. Where and how a particular type of structure is used along a transmission line depends on a variety of factors, such as availability of ROW, load requirements<sup>8</sup>, terrain (topography), and magnetic field management preferences. In each structure family, the basic types of structures commonly used along a transmission line are described as follows:

- **Tangent structure.** Tangent structures are the type most commonly used on a transmission line and are used on relatively straight portions of the transmission line. Because the conductors are in a relatively straight line passing through them, tangent structures are designed only to handle small line angles (changes in direction) of 0 to 2 degrees. Tangent structures are usually characterized by suspension (vertical) insulators, which support and insulate the conductors and transfer wind and weight loads to the structure.

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<sup>7</sup> The conductors proposed for the Project are aluminum with a steel core for strength; these conductors are connected to the transmission line structures by insulators (typically made of porcelain) that must be strong enough to support tensile forces and the weight of the conductors while preventing electrical contact between the conductors and the structure. Shield wires, which are connected directly to the structures, are installed above the conductors to protect the conductors from direct lightning strikes.

<sup>8</sup> Each structure must be designed for both the loads imposed on it by the weight of the conductors and dynamic loads resulting from factors such as wind and ice accumulation.

- **Angle structure.** Angle structures are used where transmission line conductors change direction. These types of structures are designed to withstand the forces placed on them by the change in direction. Angle structures may be: (1) similar to tangent structures, using suspension insulators to attach the conductors and transfer wind, weight, and line angle loads to the structure; or (2) similar to strain or dead-end structures, using insulators in series with the conductors to bring wind, weight, and line angle loads directly to the structure.
- **Dead-end structure.** A dead-end structure is typically used where transmission line conductors turn at a wide angle or end. Compared to tangent structures, a dead-end structure is designed to be stronger and often is a larger structure. Typically, insulators on a dead-end structure are in series with the conductors (horizontal) to bring wind, weight, and line angle loads directly to the structure. A dead-end structure is designed to resist the full unbalanced tension that would occur if all conductors were removed from one face of the structure.
- **Strain structure.** A strain structure is similar in appearance and design strength to a tangent structure. The difference in appearance is the conductor attachment hardware. The conductor attachment hardware is the same as a deadend or large angle, where the insulator bells are in line with the conductor. Whereas a dead-end structure is designed to withstand the full unbalanced tension that would occur from the loss of all conductors from one face of the structure, a strain structure is designed to withstand only unbalanced tensions associated with the loss of a single phase (bundle of two conductors) on one face of the structure.

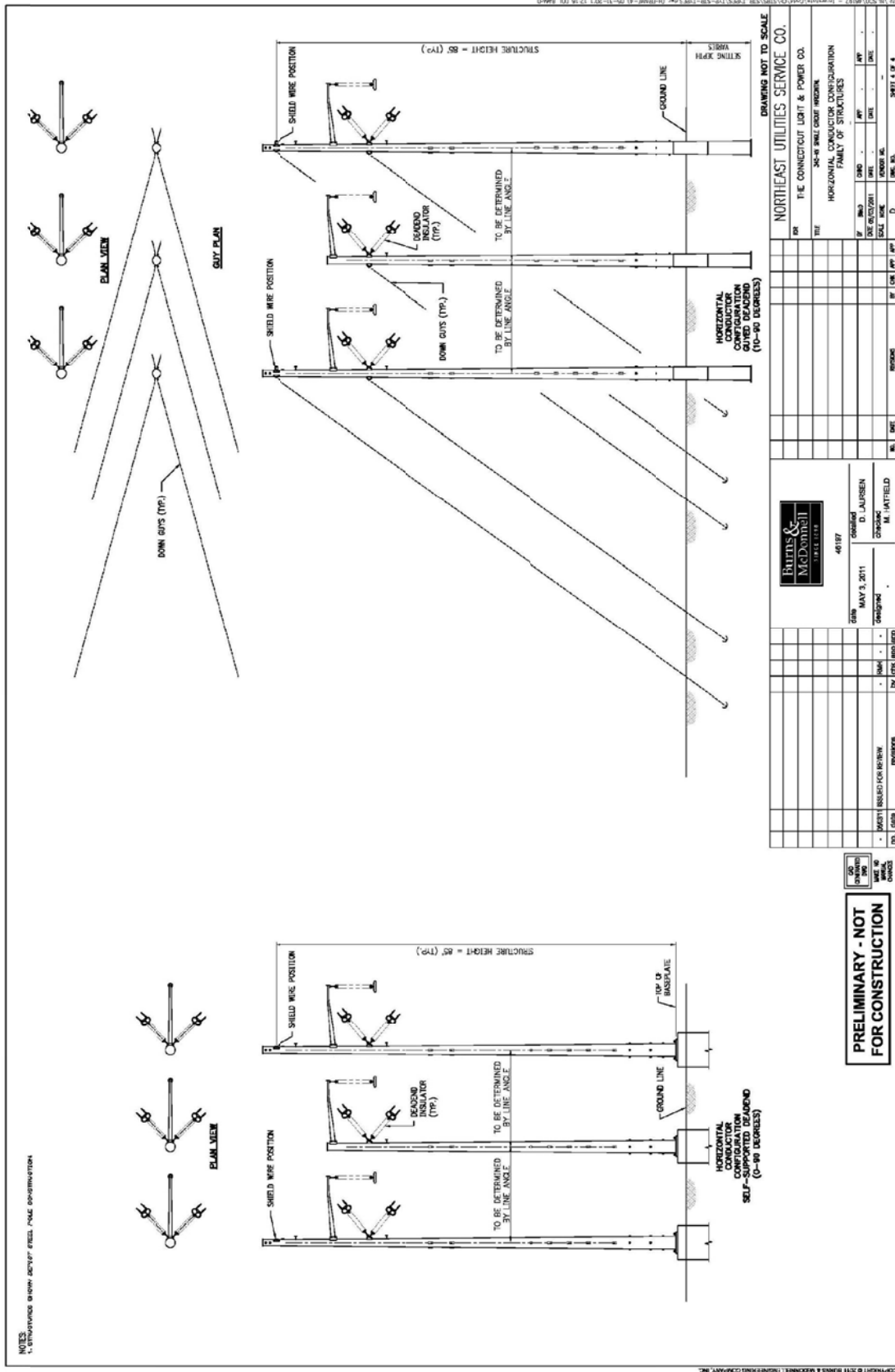
As illustrated in this appendix, structures may be self-supported or guyed and may include different insulator configurations (e.g., horizontal, vertical).

## **H-Frame Family**

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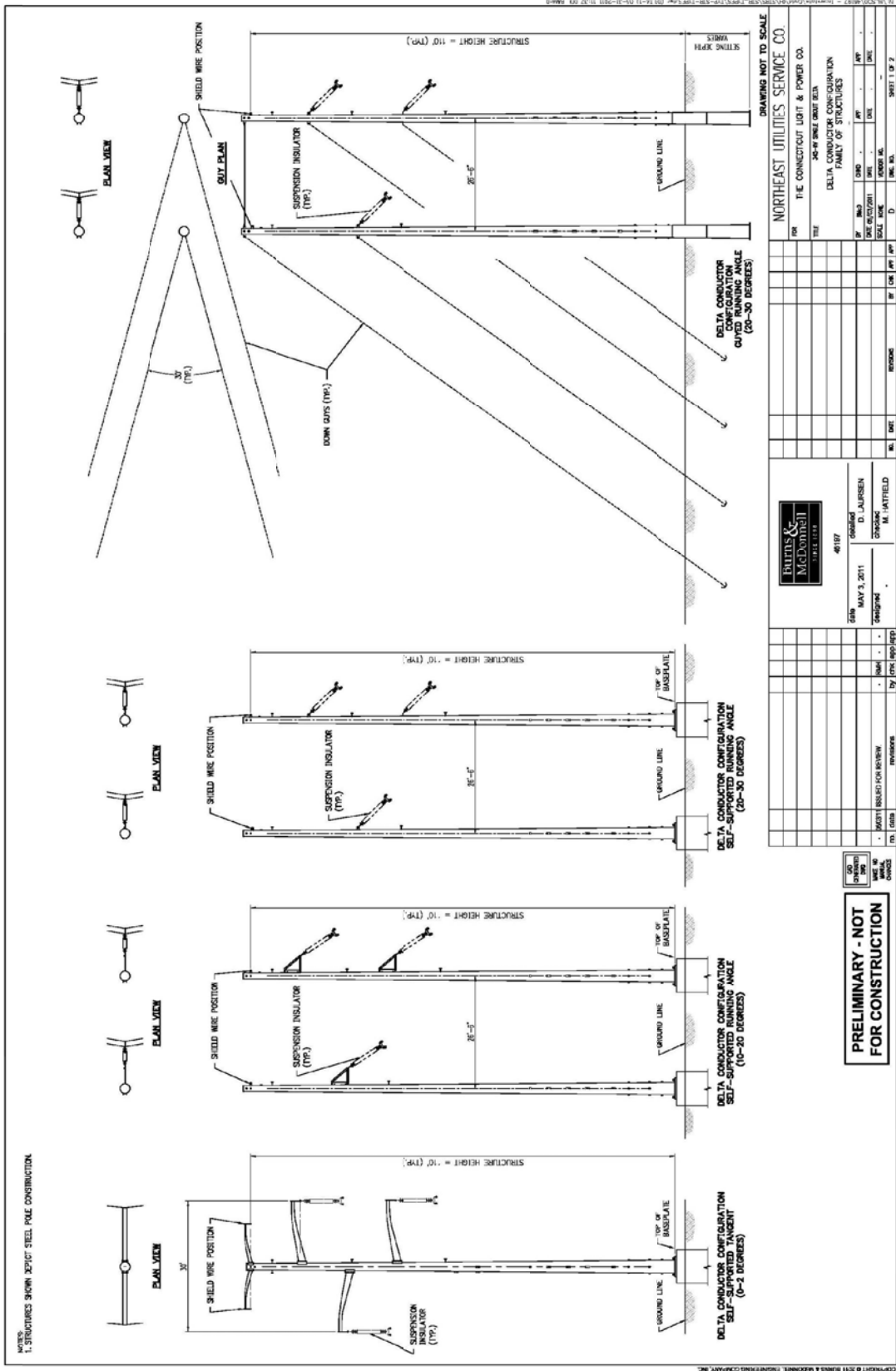




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## **Delta Steel Pole Family**

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NORTHEAST UTILITIES SERVICE CO.

FOR THE CONNECTICUT LIGHT & POWER CO.

DELTA CONDUCTOR CONFIGURATION FAMILY OF STRUCTURES

DATE	BY	CHKD	APP
MAY 3, 2011	D. LAURSEN		
DESIGNED	CREATED	DATE	DATE
M. LATTIELD	M. LATTIELD	06/27/2011	06/27/2011
SCALE	SCALE	SCALE	SCALE
D	D	D	D
NO. 1	NO. 2	NO. 3	NO. 4
REVISED	REVISED	REVISED	REVISED

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DESIGNED BY: M. LATTIELD

DATE: MAY 3, 2011

CREATED BY: D. LAURSEN

DATE: 06/27/2011

SCALE: D

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NO. 1

NO. 2

NO. 3

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BY: CML/MLP/SLP

**PRELIMINARY - NOT FOR CONSTRUCTION**



## **Vertical Steel Pole Family**

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