Stanley Consultants INC.

NESC Wind and Ice Load Effects on Wood Distribution Pole Design

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Purpose of Discussion

Most distribution structure design only considers NESC load cases

2/3 of the load cases in the NESC do not apply to structures and facilities less than 60’ tall

Considering all NESC load cases may increase costs of new line

Structural Load Cases

Rule 250B – Combined Ice and Wind

- **Referred to as District loading**
- **Added to the NESC in 1916**
- **Revised several times including along state borders**
- **Continental U.S. divided into 3 districts**
  - Light: 9psf wind, no ice
  - Medium: 4psf wind, ¼” ice
  - Heavy: 4psf wind, ½” ice

Structural Load Cases

Rule 250C - Extreme Wind Load

- **Based on ASCE 7-05 for 50 year return period**
- **Based on exposure category C**
- **Basic Wind speed varies from 85 mph to 150 mph**
- **Does not apply to structures and facilities below 60’**
- **Load factors change based on grade of construction**

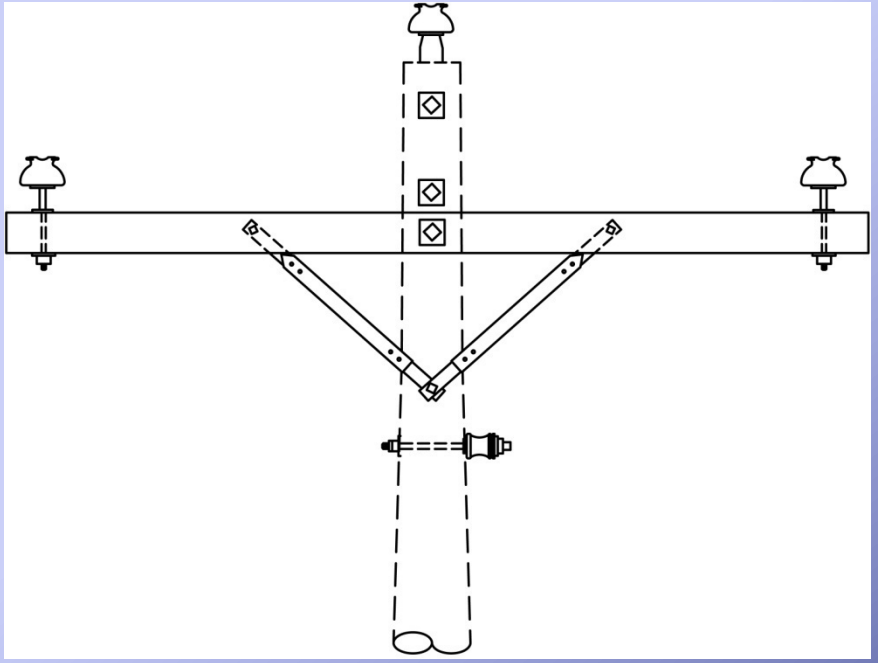
Structural Load Cases

Rule 250D - Extreme Ice with Concurrent Wind

- **Added for 2007 NESC**
- **Based on ASCE 7-05 for 50 year return period**
- **Ice thickness varies from 0” to 1 ¼”**
- **Wind speed varies from 30 mph to 60 mph**
- **Does not apply to structures and facilities below 60’**
- **Ice thicknesses may be reduced for Grade C construction**

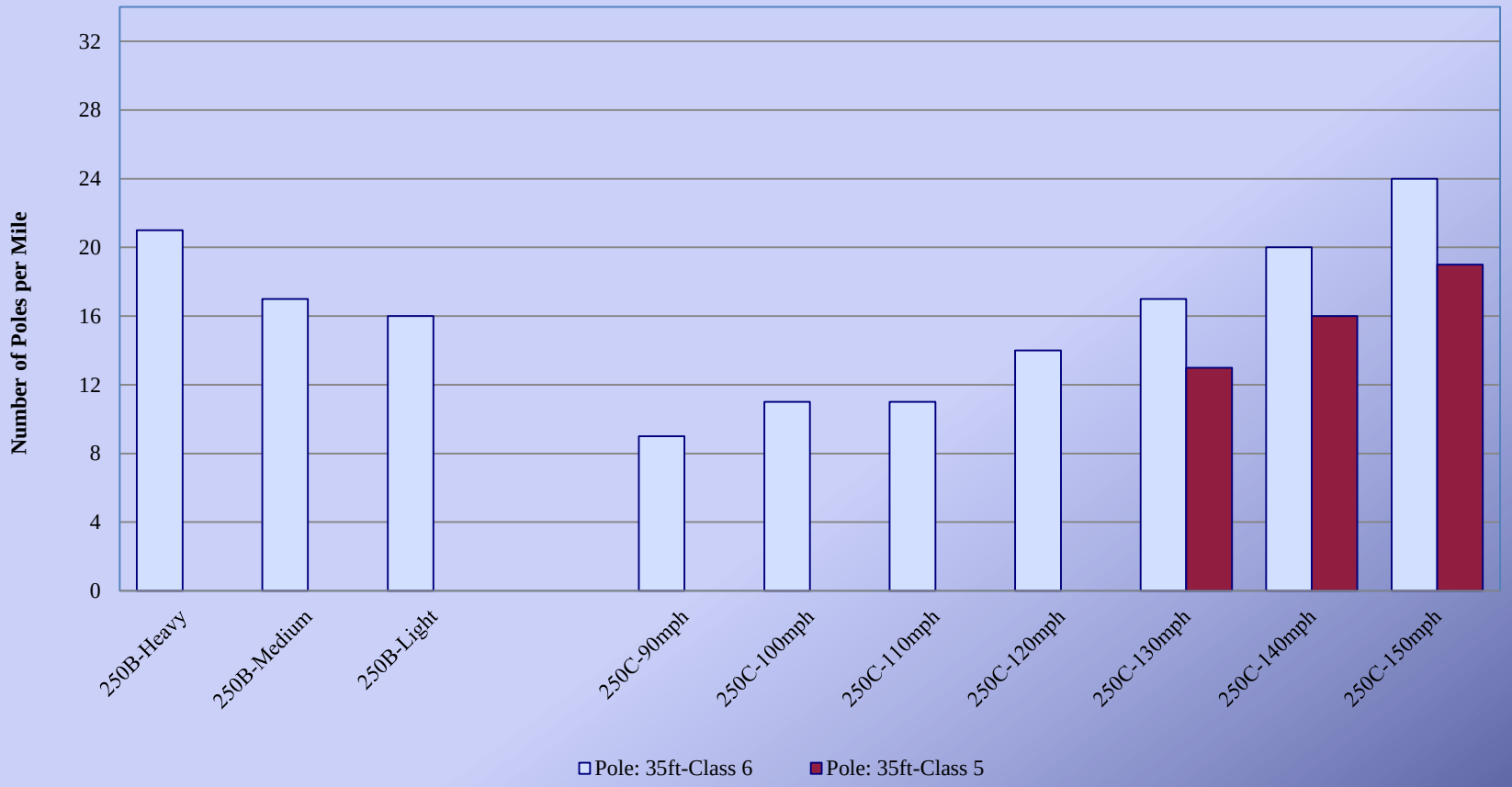
Analysis Assumptions

- 1 mile sample line
- Single Circuit, 3 phase
- C1.11 Pole Top
- All tangent structures
- No taps or underbuild
- #2 ACSR, 4/0 ACSR, 556 ACSR considered

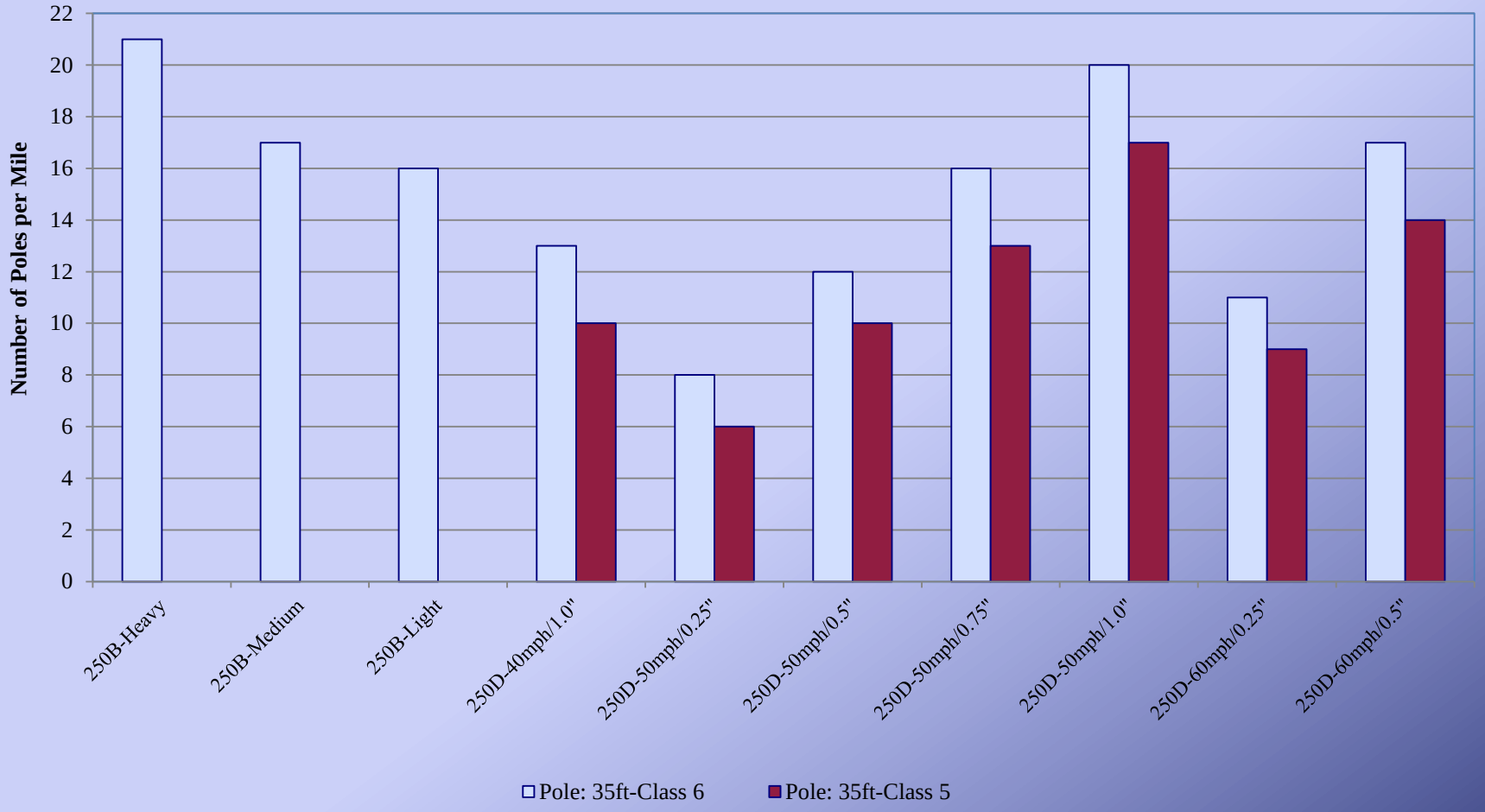


Three Phase, Type C1.11, Pole Top

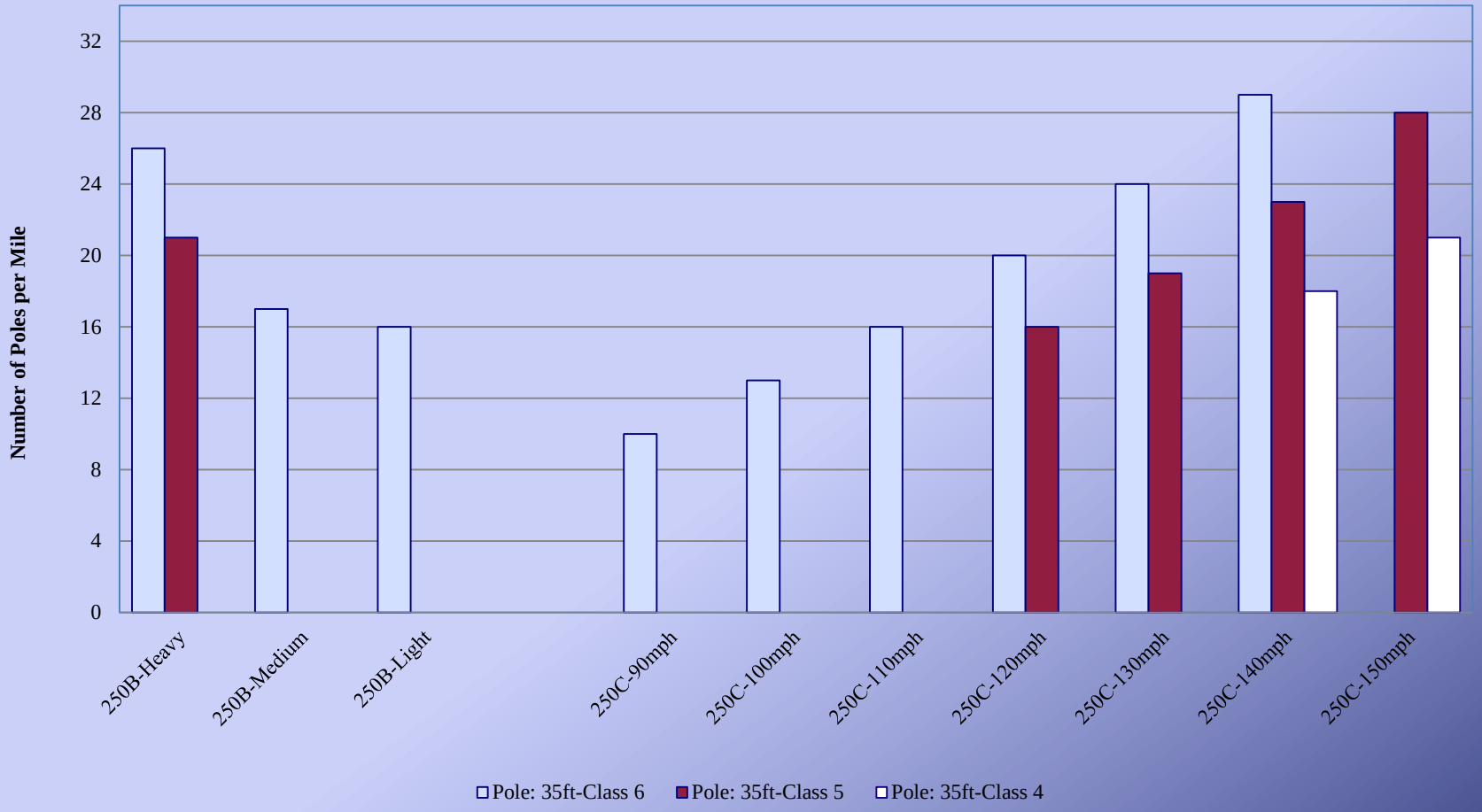
250B vs. 250C Pole Requirements #2 ACSR, Grade C Construction



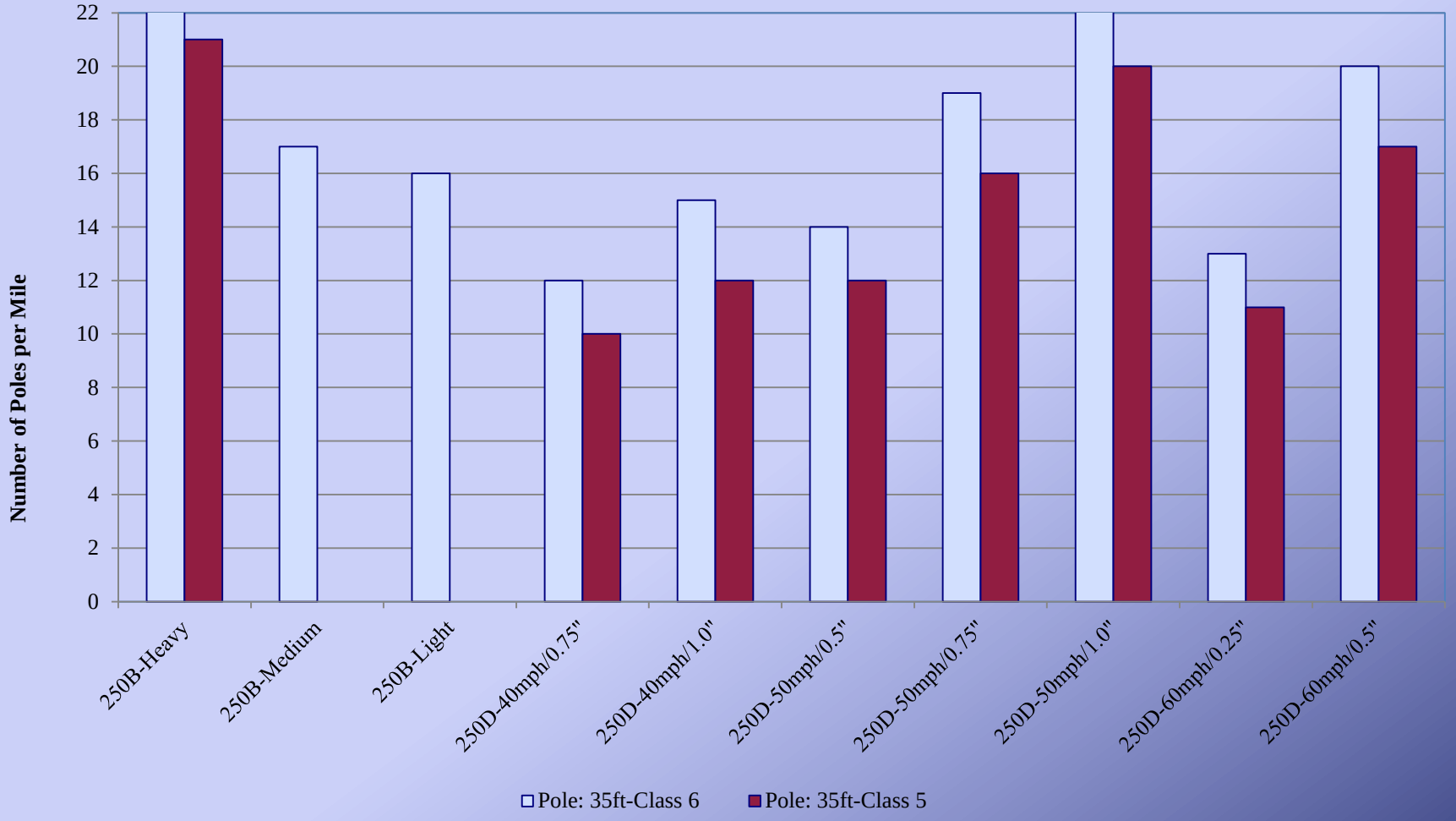
250B vs. 250D Pole Requirements #2 ACSR, Grade C Construction



250B vs. 250C Pole Requirements #2 ACSR, Grade B Construction

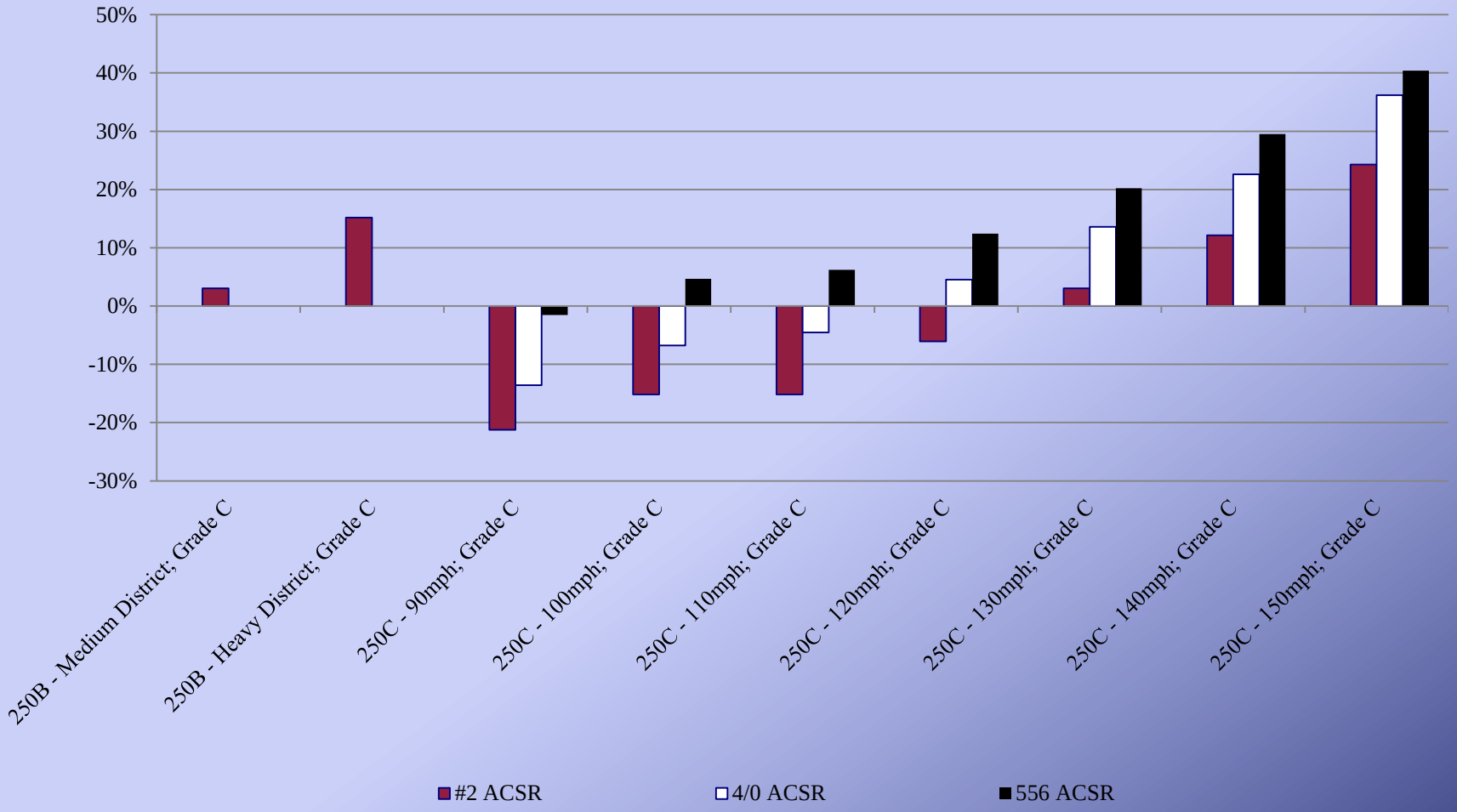


250B vs. 250D Pole Requirements #2 ACSR, Grade B Construction



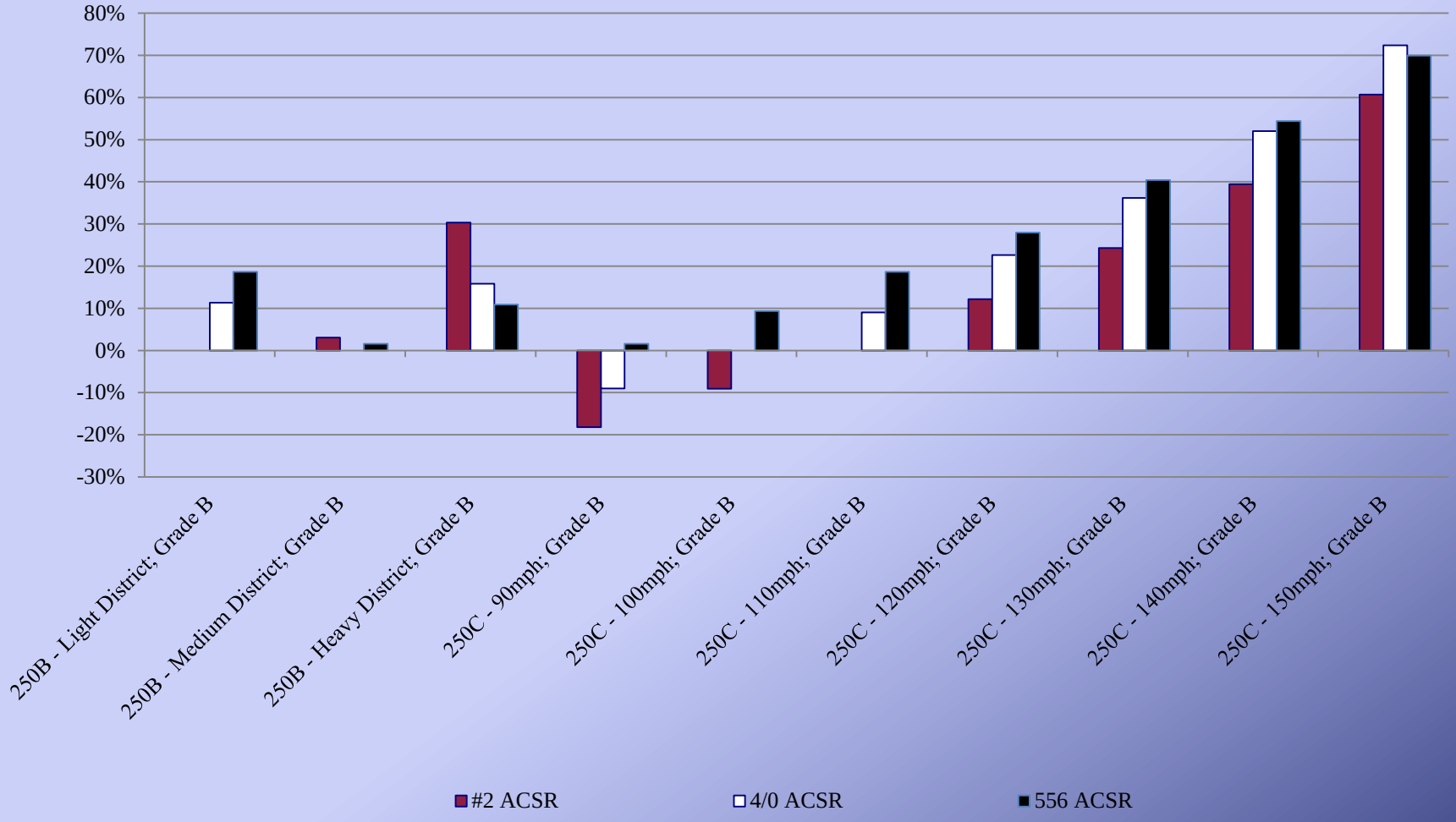
250C Cost Comparison

Grade C, Compared to Light Loading



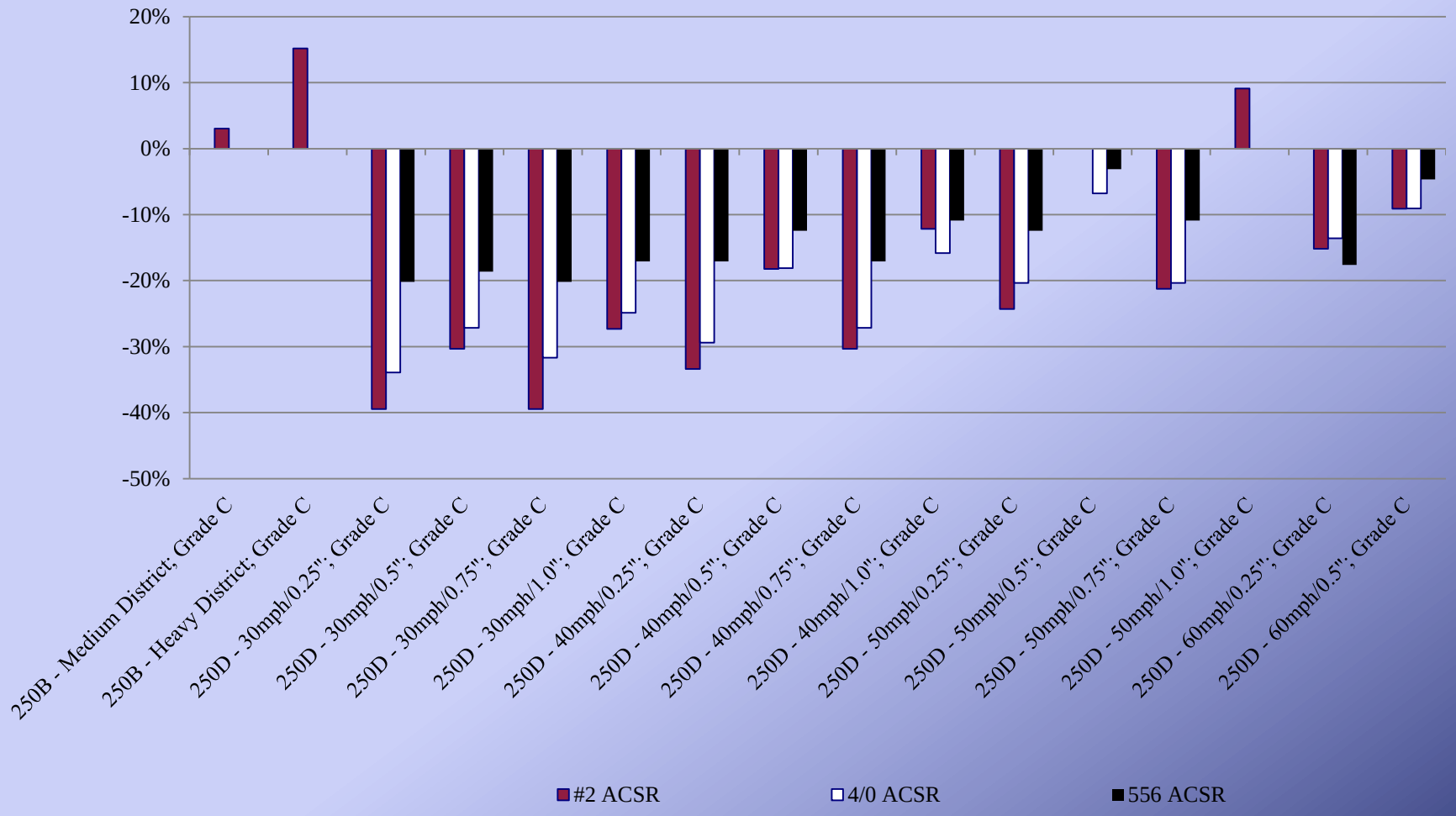
250C Cost Comparison

Grade B, Compared to Grade C Light Loading



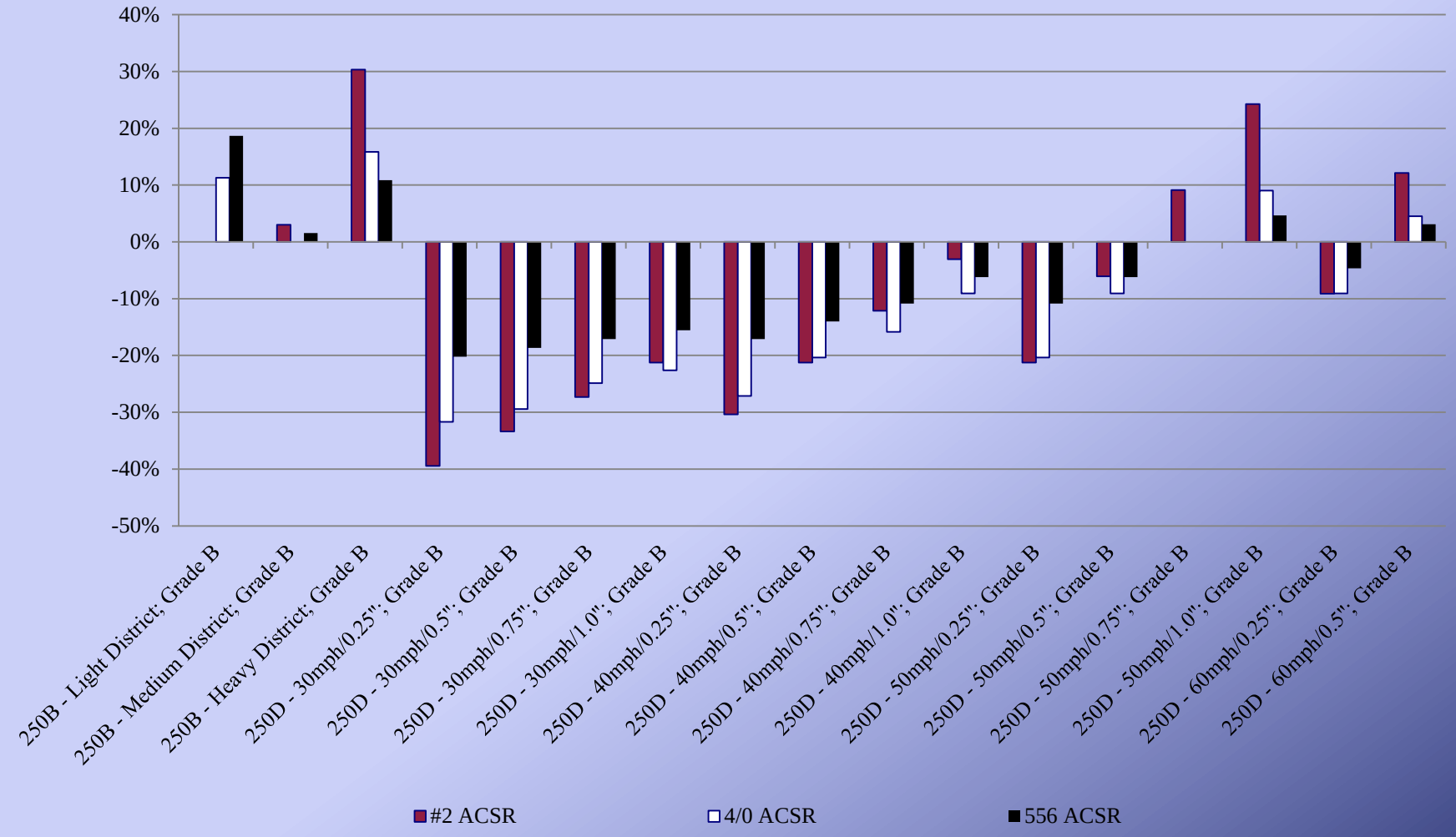
250D Cost Comparison

Grade C, Compared to Light Loading



250D Cost Comparison

Grade B, Compared to Grade C Light Loading



Conclusions
Heavy Loading District

- **In general, construction costs for most lines that are currently designed for heavy load districts would vary a minimal amount when Rules 250D and 250C are considered.**
- **The impacts to lines in the heavy load district appear to be primarily along the coastal areas of New England where extreme wind speeds reach up to 120 mph.**
- **These impacts are greater for larger diameter conductors.**

Conclusions
Medium Loading District

- **In the medium loading district the mid-Atlantic coastal area would be significantly impacted by the addition of the extreme wind loading condition.**
- **For the extreme wind case (Rule 250C), larger conductor diameters may be impacted at 90 mph (40 m/s), while lines with smaller conductors may not be impacted until wind speeds exceed 110 mph (49 m/s).**
- **There is minimal impact in the Rule 250B designs analyzed due to the addition of the extreme ice and concurrent wind (Rule 250D) loading condition.**

Conclusions
Light Loading District

- **For the light loading district, coastal areas in the hurricane prone southeastern United States are significantly impacted by Rule 250C.**
- **Generally, throughout the light load district the Rule 250D loads do not control line design.**

Conclusions
General

- **The addition of the extreme wind and extreme ice with concurrent wind cases does control some line designs. For many utilities in the light and heavy loading districts the additional load cases minimally impact overhead distribution line design. Meanwhile, in the medium load district and coastal areas with high winds such as hurricanes, costs of the overall line could increase as much as 70 percent above base line design.**

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