

Reducing Induced Voltages on Parallel Facilities in Shared Transmission Corridors with Aerial Counterpoise



Basics of Induction

One Slide Intro

Magnetic Induction

Magnetic fields induce a voltage on metallic objects

- Affects parallel/semi parallel objects
- Current and parallel length have a linear effect
 - » Double the current = double the voltage
- Distance is non linear factor

Purpose for Examining Shield/ Neutral Wire Placement

Shield and Neutral Wires

Also have voltages and currents induced

Placement affects magnetic field away from line

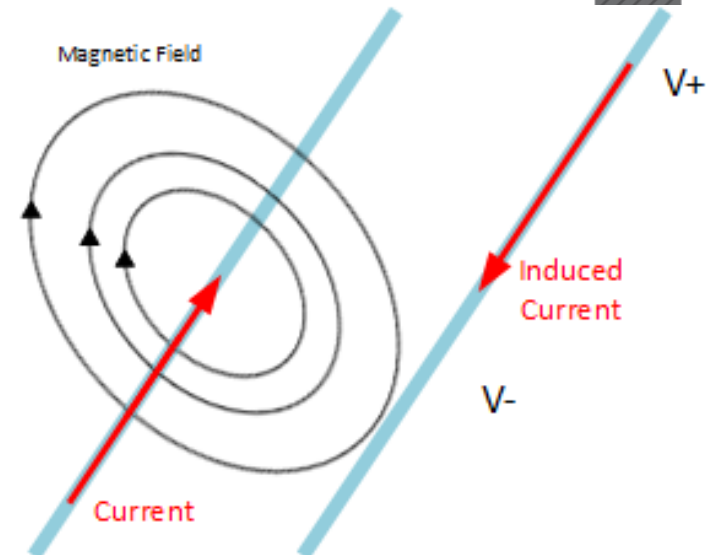
Material also has an effect

Aerial Counterpoise

Commonly used for AC interference

Provides a multi grounded conductor in the magnetic field path

Produces a magnetic field that opposes the line's



Cases Analyzed

Common Variables for Analysis

1,000 amp balanced line loading

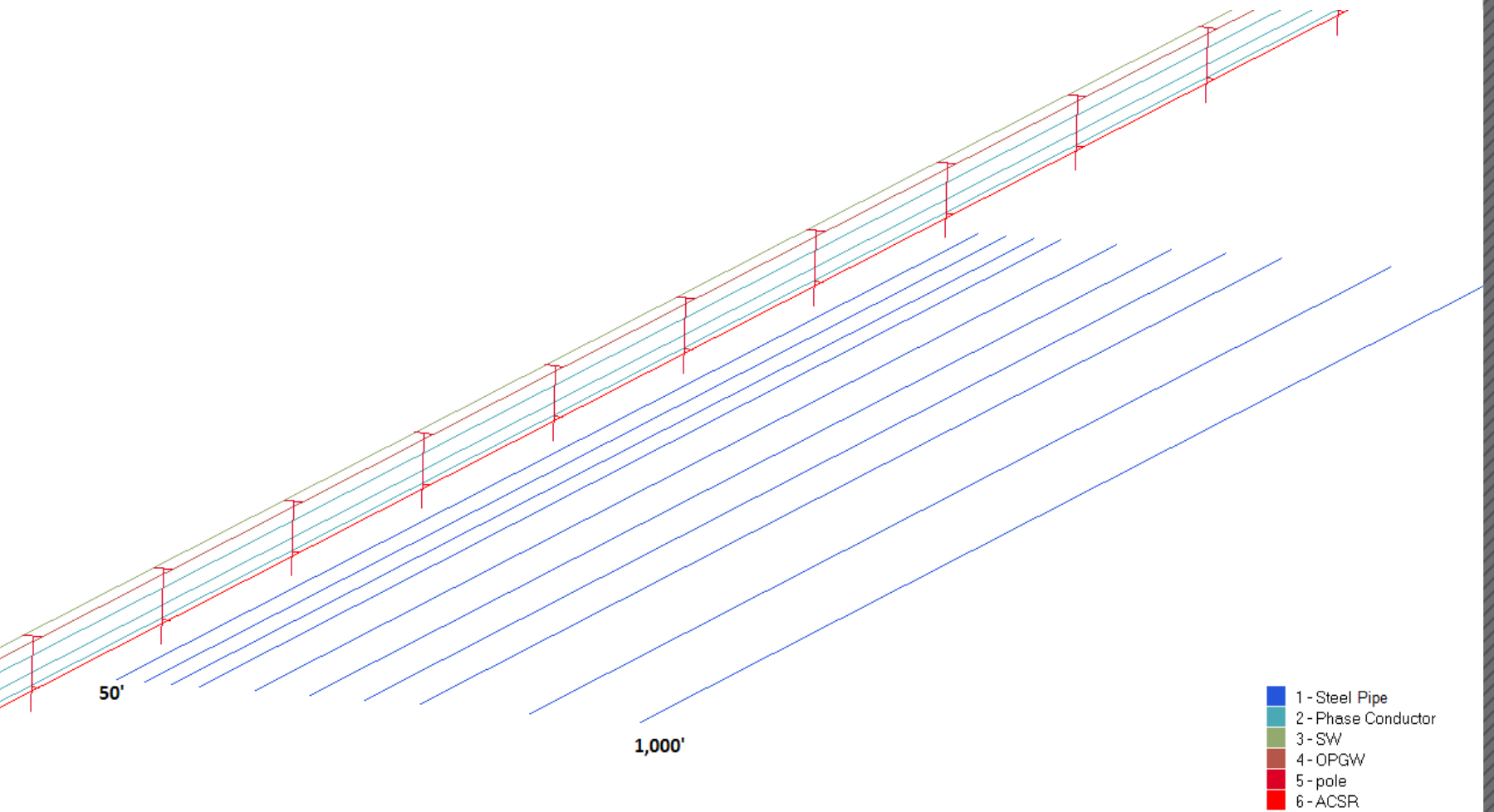
One mile parallel pipe to line

Separation distances 50 to 1,000 feet

Steel shield wires

Aluminum OPGW and ACSR

Model



Configurations Analyzed

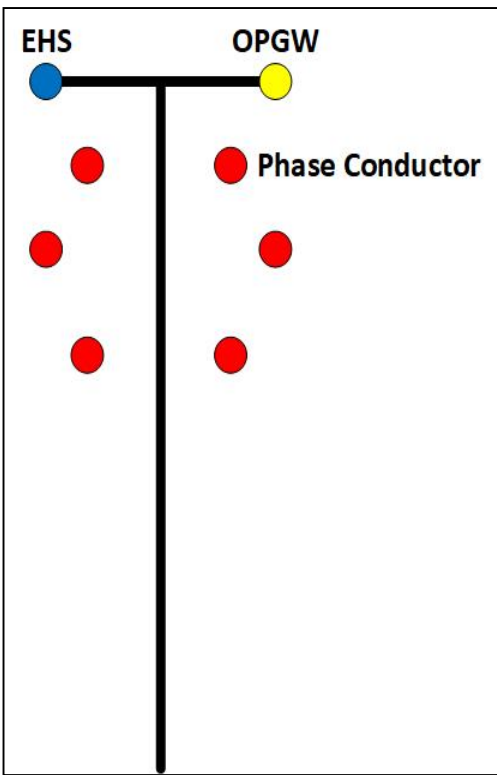
Transmission line base models:

- H-Frame, Delta, Vertical (single / double circuit)
- 115 kV and 345 kV designs

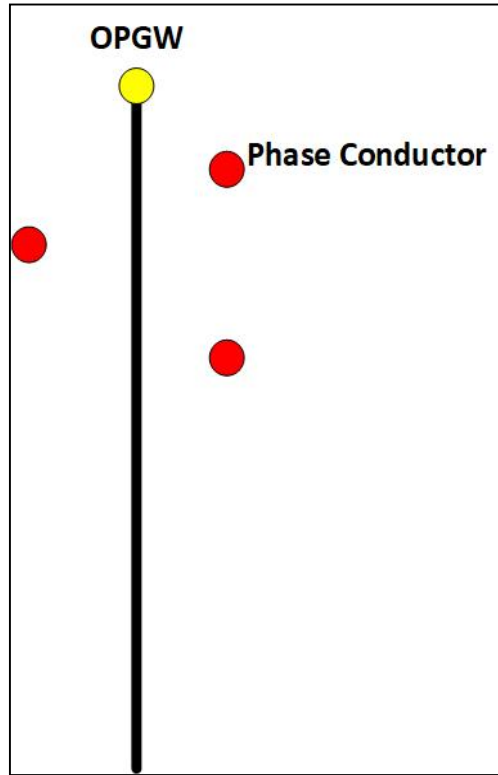
Aerial counterpoise 10 feet below outer conductor

- Case with only added ACSR
- Case with OPGW moved down, steel wire replaced the OPGW

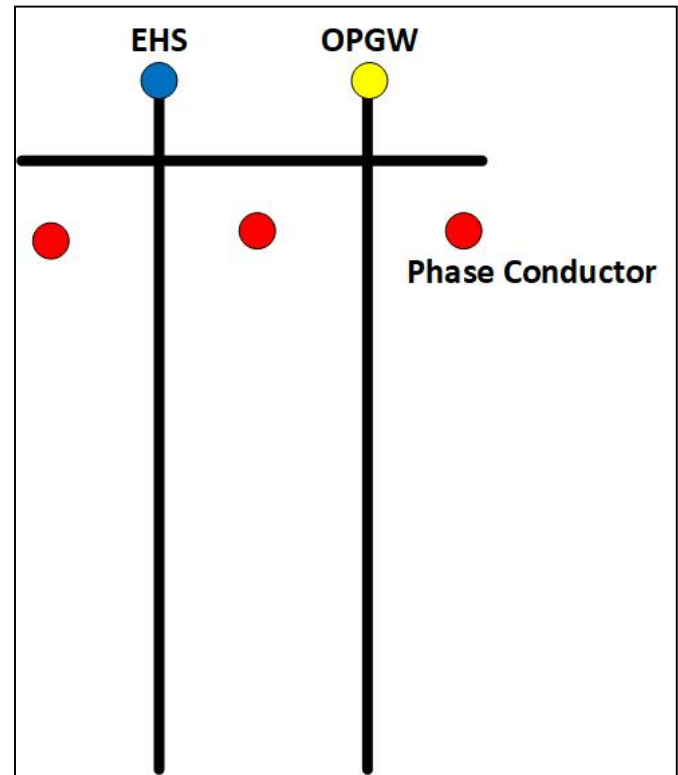
Configurations Analyzed (Base)



Single/Double
Circuit Vertical



Delta
Configuration



H-Frame Configuration

Results

Results – What we're showing

Ground potential rise per mile

115 kV design

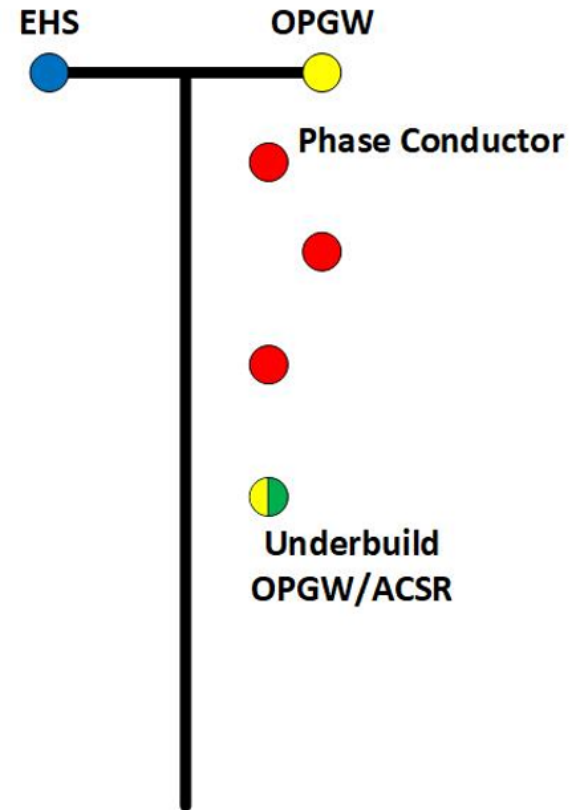
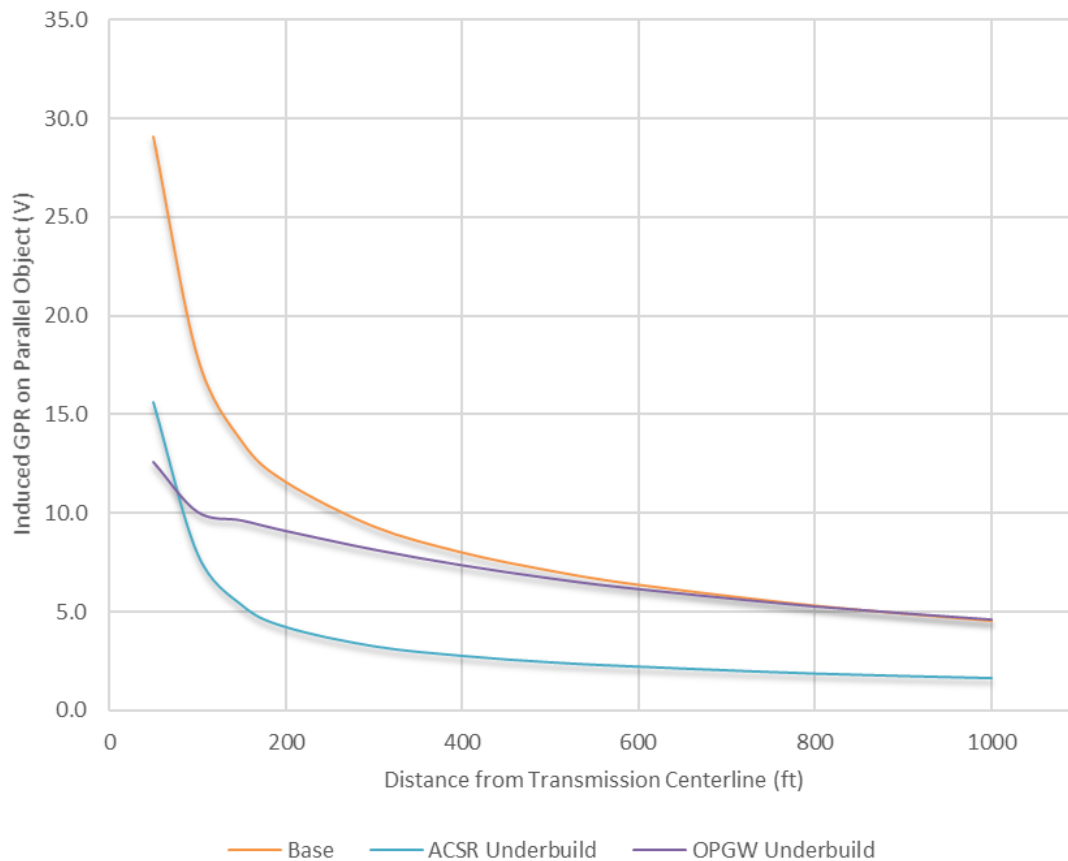
345 kV design is in paper

Configurations:

- » Base
- » ACSR underbuild
- » OPGW underbuild

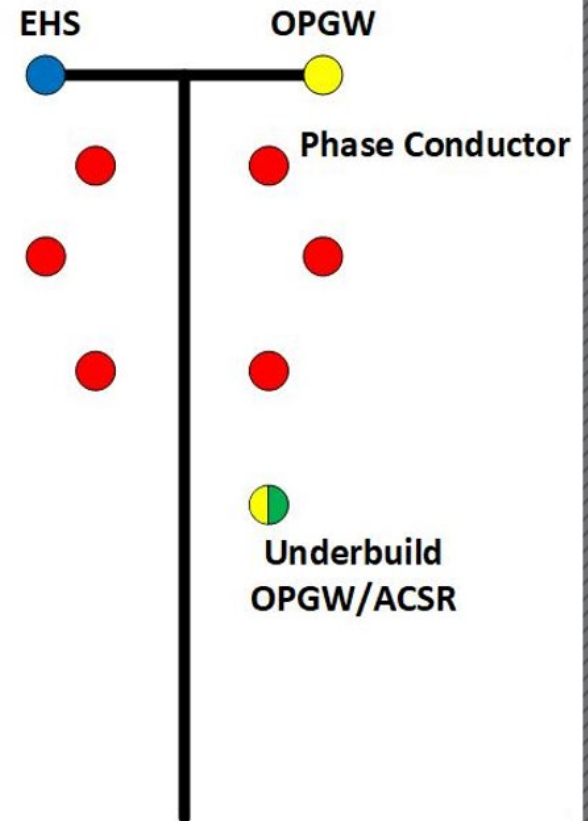
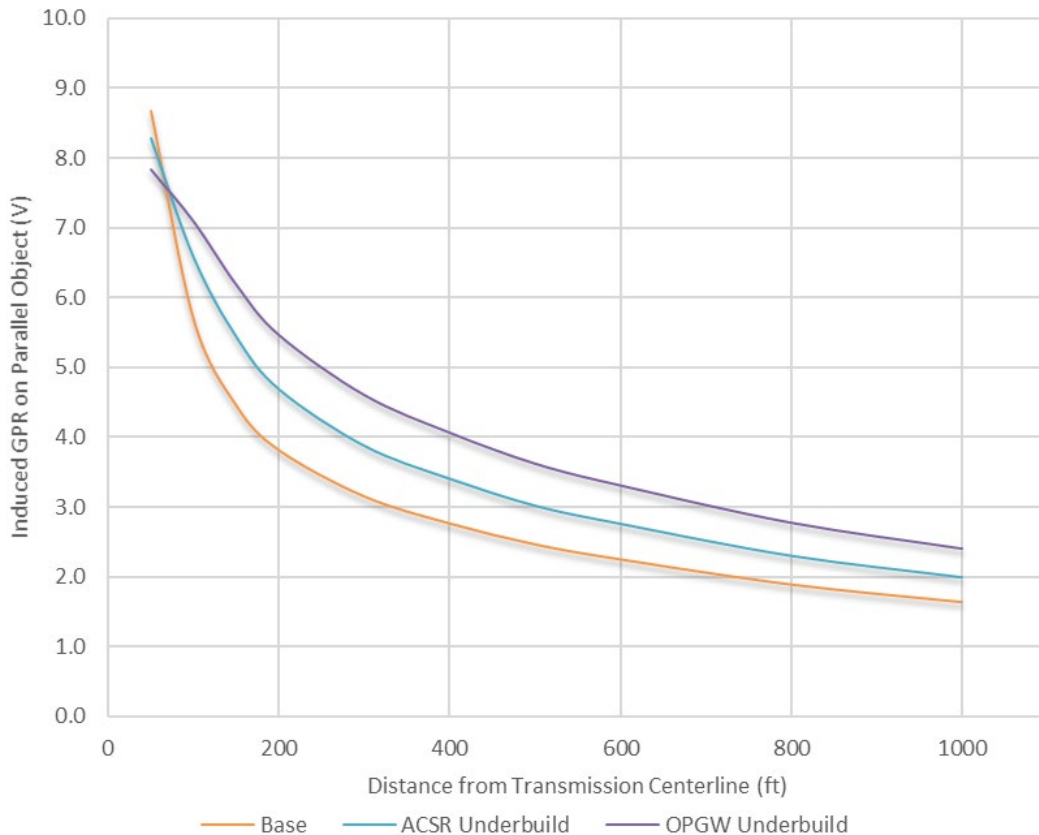
Results – Single Circuit Vertical

115 kV Vertical - Induced Voltage



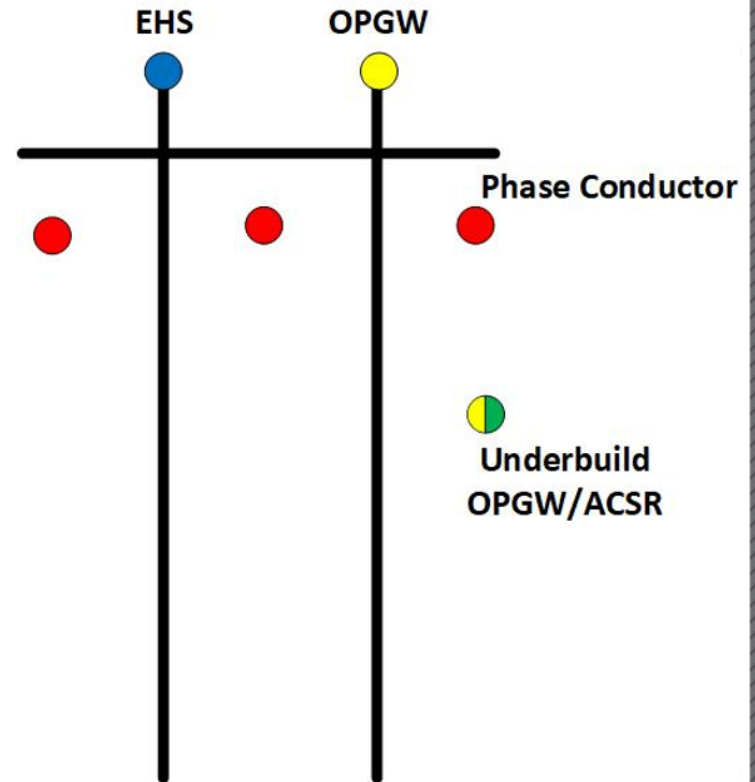
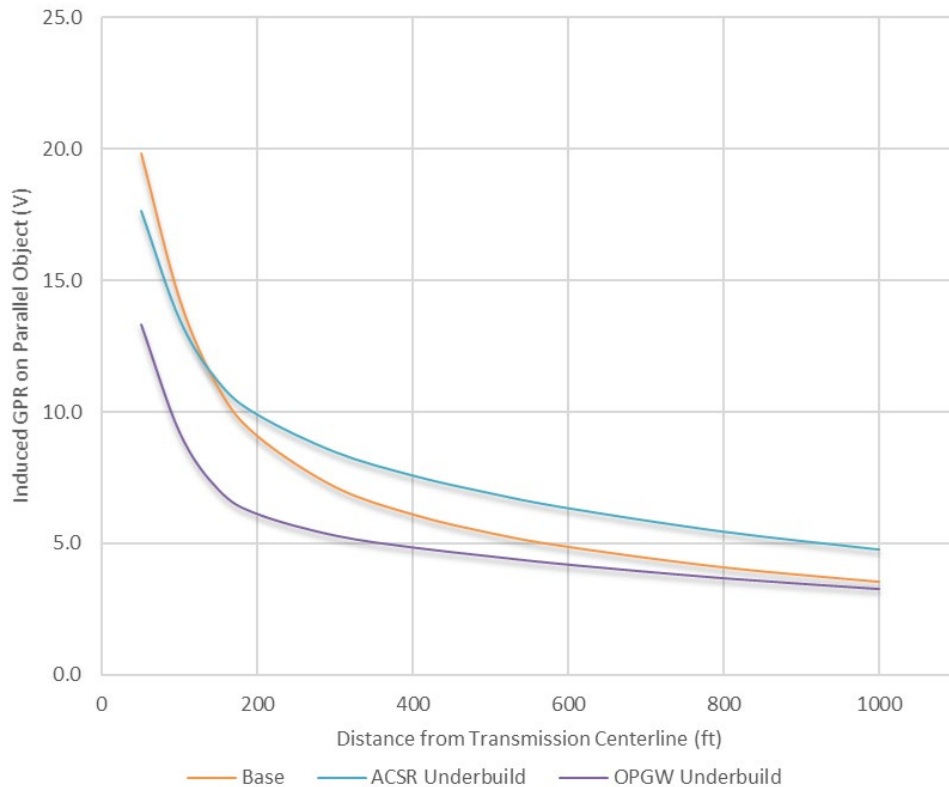
Results – Double Circuit Vertical

115 kV Double Circuit - Induced Voltage



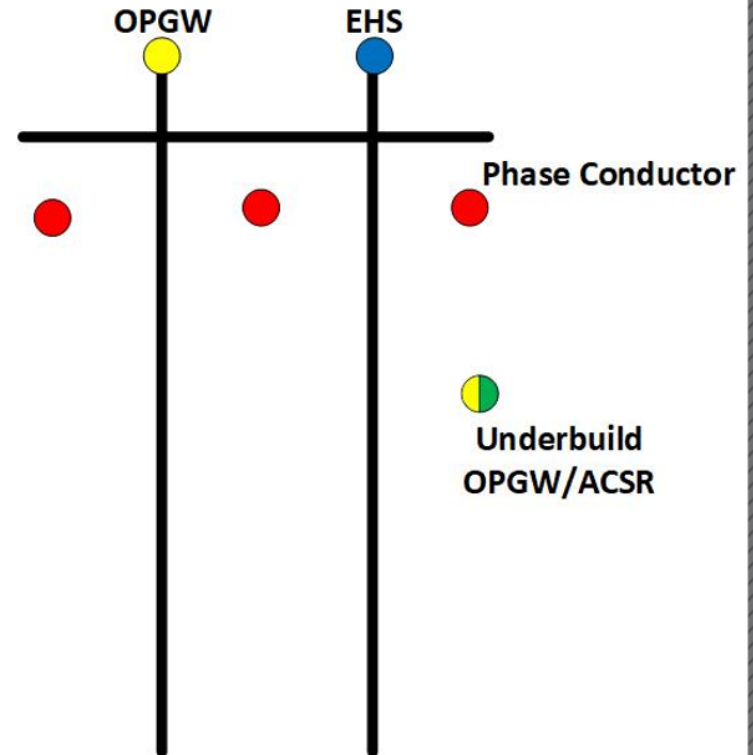
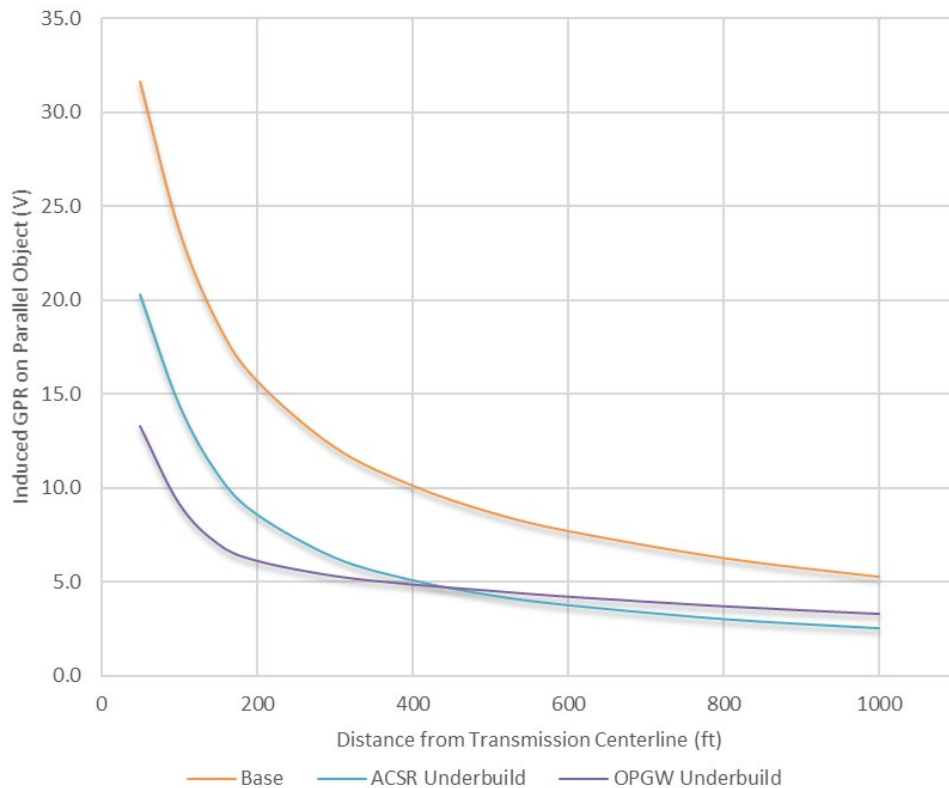
Results – H-Frame Circuit

115 kV H-Frame - Induced Voltage



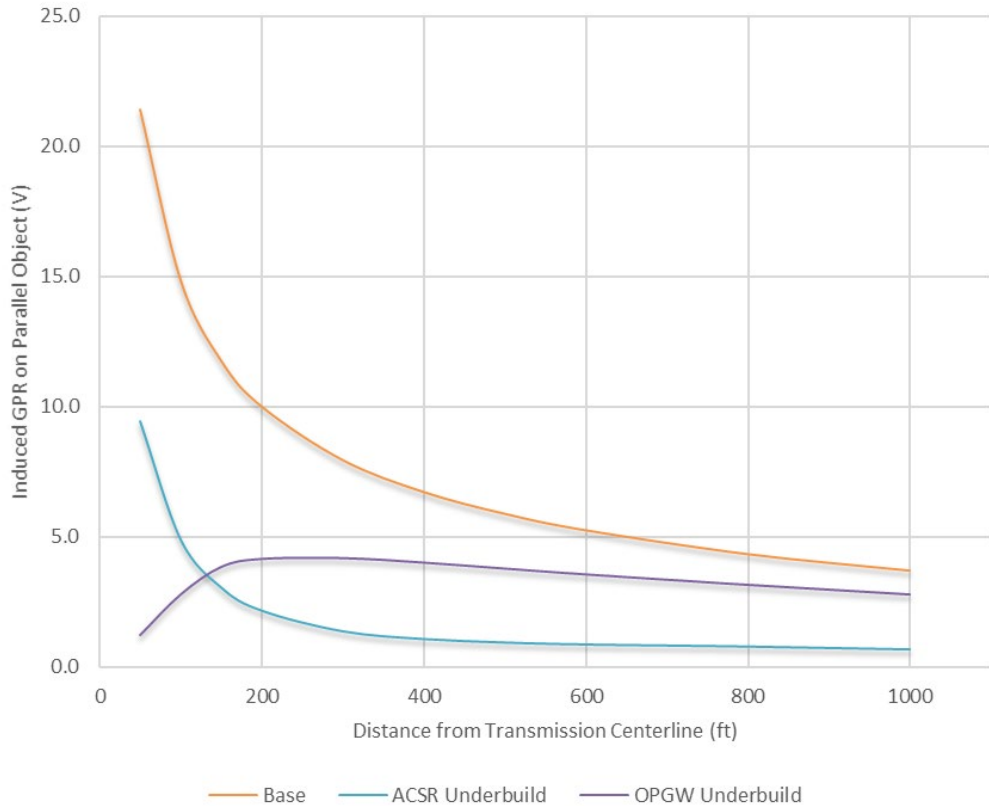
Results – H-Frame – Alternate OPGW

115 kV H-Frame Alternate - Induced Voltage



Results – Delta Configuration

115 kV Delta - Induced Voltage



OPGW



Phase Conductor



Underbuild
OPGW/ACSR



Configuration Summary

Single circuit vertical benefits for close parallel

Delta structures benefit

H-frame benefits for close parallel

Location of OPGW vs SW matters

Double circuit (both lines in service / cross-phased)
gets worse

Conclusions

No one size fits all application

Ideal solution depends on configuration and distance

Substantial reductions can be achieved

Benefits

Aerial can be 10-20% of the buried cost

Cost for additional structure strength is low

Requires little maintenance

Installation controlled by the electric utility

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