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# Ruling Span Vs. Finite Element: Real World Case Study

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# What is Ruling Span?

## Ruling Span Assumptions:

- Constant Horizontal Tension – assumed equal for all spans within a tension section, regardless of length variation
- Free Movement of Insulators – frictionless, free swing movement longitudinally to equalize tension
- Consistent Loads & Temperatures – wind/ice loading and temperature assumed to be uniform across entire tension section
- Uniform Span Alignment – spans are relatively equal with little variation in elevation changes between structures
- **Neglects Structure Flexibility – in general, deflection of poles/towers under uneven loads is ignored**

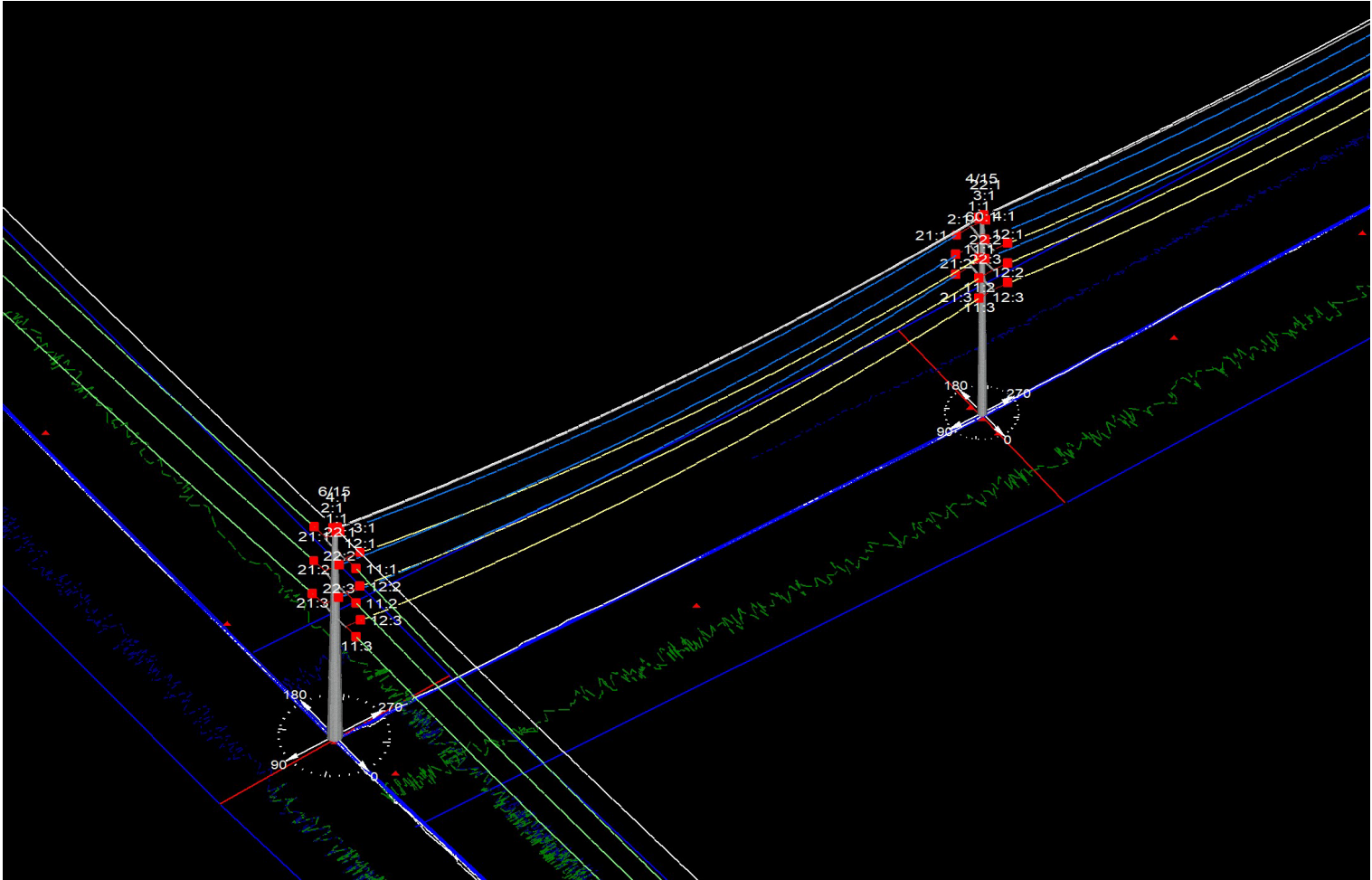
# The Project

## Southwest Power Pool Notice-To-Construct

- Upgrade existing circuit capacity to 3000A (via 1926.9 ACSS-TW)
- Convert existing single circuit to double circuit
- Add new bay at Westmoore Substation
- Remove Penn Switch and replace with new double circuit dead-end structure (**must re-utilize existing foundation**)
- Re-utilization of the existing foundation will require a tension change structure directly to the North of the Penn Switch location



# The Project



# The Problem



# The Problem

- **Ruling Span** sag provided to installation crew: 3958 lb @ 60F between STR 6/15 (new double circuit dead-end structure) and STR 4/15 (tension change structure)
- STR 6/15 was visibly being pulled towards STR 4/15 at this tension
- Three gauges, all calibrated recently, all calibrated by different calibration outlets
- Field fix: release conductor tension, re-plumb STR 6/15, set conductor using mid span sag (eyeball guesstimate) and return wave times
- Tension observed after field fix: approximately **1800 lb**



# The Problem



# The Solution



# The Solution

Step 1: **CALL TIM CASHMAN**

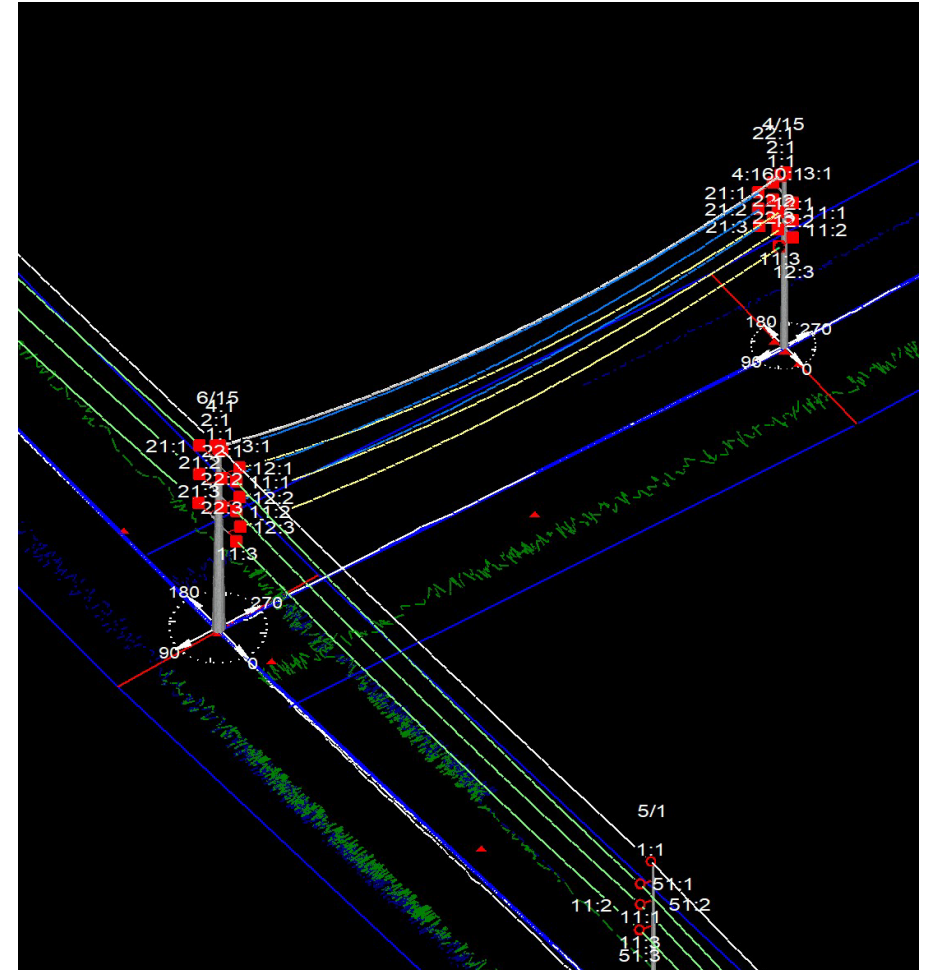
Step 2: Model system as it currently exists in the field (tension change structure was not strung and tensioned on the North side)

Step 3: Set everything to FE (in Structure Loads Criteria)

Step 4: Check RS sag, then check FE sag  
RS sag – 3958 lb FE sag – **1804 lb** (middle phase)

Step 5: Realize you took RS assumptions for granted, re-create sag charts based on FE sags and give to installation crew ASAP

Step 6: Project concludes without issue



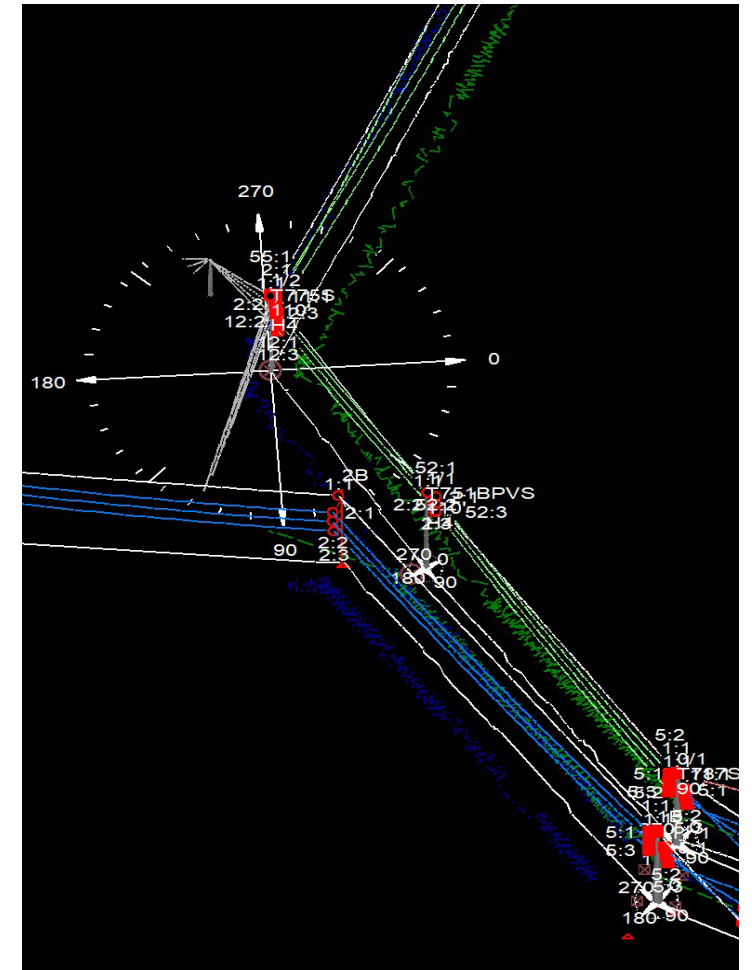
# Lessons Learned

## Classen – Douglas Tap Notice-To-Construct:

- Installation crew was about to string conductor
- Checked RS sag and FE sag (@ 60F):
  - RS sag – 6190 lb
  - FE sag – 3430 lb
- Updated sag charts with FE sag and provided to installation crew

## Theoretical Convergence:

- Created fake line to check for RS and FE sag convergence
- Self-supporters and exotic guying configurations tested
- Exact spans between structures
- Convergence at approximately 1 mile



# Questions?

