Conductor Ampacity Analysis

PowerComm Engineering offers conductor ampacity analyses to assist clients with determination of appropriate and justifiable static thermal rating parameters.

Static thermal conductor ratings depend on a variety of ambient conditions, including temperature, wind speed, wind angle, solar radiation and elevation. Historically, static thermal rating parameters have been based on high temperature, low wind speed conditions selected based on local weather data, resulting in conservative ampacity ratings.

Often, rating parameters are based on independent analysis of the individual weather parameters rather than coincident measurement of all weather parameters.

Data Availability
Modern weather station deployments have provided the opportunity for enhanced analysis of weather data.

Solar Radiation
In the past, weather stations often included only a relative measure of cloud cover. Modern stations include direct measurement of the incident solar radiation, potentially eliminating a major assumption associated with ampacity computations.

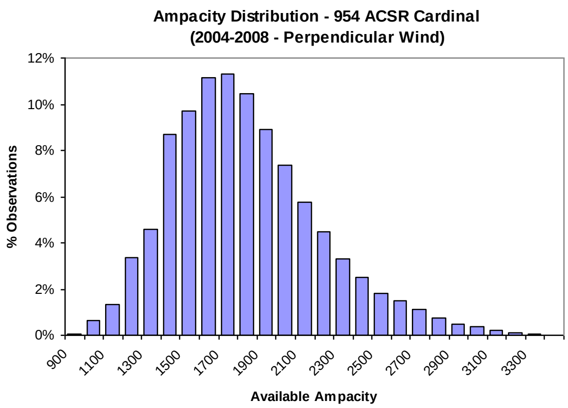
Ultrasonic Wind Speed Measurement
Mechanical anemometers that were historically used for wind speed measurement often required a minimum wind speed in order to register a non-zero reading due to the inertia of the mechanical components. Modern ultrasonic wind speed sensors are capable of measuring any air movement since they are not composed of mechanical parts.

Observation Frequency
Measurements are often taken several times each hour at modern weather stations, providing data with a frequency on a scale similar to typical conductor time constants. This measurement frequency can provide additional confidence that adverse conditions persist for only brief periods.

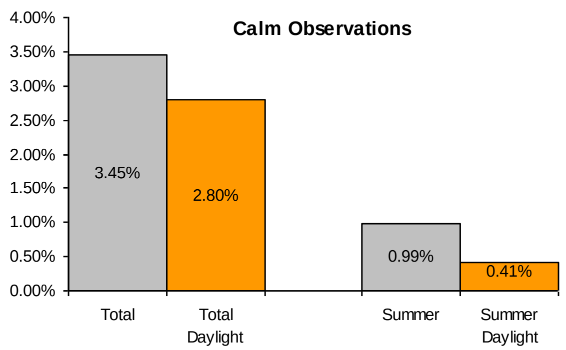
Localized Weather Conditions
Modern weather station deployments (often under the supervision of state climatological office or agricultural extension offices) provide localized weather data that may provide more accurate depictions of climatological variations than weather stations located at major airports.

Enhanced climatological data available from modern weather stations allows assessment of available conductor ampacities with fewer assumptions and greater accuracy to support selection of ratings parameters.

Weather Parameter Correlation / Variability
A key factor often overlooked when assessing individual parameters is that one adverse parameter may be partially or wholly offset by other favorable parameters. As a result, it is important to assess the coincident time-stamped sets of climatological parameters, rather than combinations of adverse parameters that may not be realistic if considered on a coincident basis. This approach provides a distribution of ampacities over the time period analyzed. For example, the figure below represents a distribution of available ampacities for 954 ACSR Cardinal with a perpendicular wind angle, and absorbtivity and emissivity of 0.5.



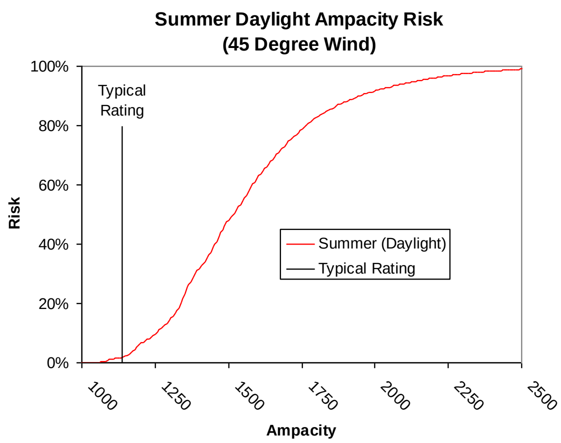
Additionally, weather observations can be correlated in unexpected ways, affecting the validity of static thermal ampacity assumptions. For example, calm observations (wind speeds less than 0.5 miles per hour) may occur more often during darkness, resulting in lower available ampacities than during daylight hours.



The combination of available ampacity distributions and assessment of climatological correlations provides critical guidance in the selection of rating parameters.

Verification and Justification

Cumulative distributions of available ampacities for each conductor, based on computations for each measurement interval, provide a basis for selection of ampacity parameters. Further, the cumulative distribution allows the risk associated with any given set of parameters to be assessed versus historic climatological data, providing justification that is not possible when parameters are assessed individually. For example, the cumulative ampacity distribution for 954 ACSR Cardinal over a ten-year period of weather observations is shown below.



Finally, the time-stamped sequence of climatological data allows assessment of the duration of any periods that result in adverse ampacities for comparison with conductor time constants. These time-series comparisons allow further quantification of the potential conductor ampacity.

Conductor ampacity analyses give utilities a valuable tool for making decisions concerning the allowable loading of power delivery assets. PowerComm's approach provides proven and justified static rating parameters for thermal conductor ampacity, allowing utilities to get the most from their systems.

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