

Reliability-Based Dynamic Line Rating System

Next generation transmission line dynamic rating and forecasting system using real-time measured conductor data combined with reliability-based methods

The SMARTLINE™ dynamic line rating (DLR) system uses reliability-based rating and forecasting techniques, and real-time conductor and weather data. Compared to conventional dynamic line rating (DLR) methods, SMARTLINE ratings are developed by actively learning how the conductor behaves with regard to conductor temperature, weather, current, and the conductor's exact clearance-to-ground. Using reliability-based methods, SMARTLINE's ratings demonstrate clearance compliance in addition to traditional thermal limit compliance. The result are true capacity limits and reliable capacity forecasts. SMARTLINE eliminates fixed-capacity transmission assets, and replaces them with a living set of transmission pathways whose capacities reflect real-time conditions. SMARTLINE is key to a true "smart" transmission

DLR based uniquely on Measured Conductor Clearance, Temperature and Load

Unlike other DLR techniques, SMARTLINE utilizes actual, simultaneously measured values of conductor clearance, temperature and load. This data is calibrated to IEEE Standard 738's relationship between load, conductor temperature and actual weather data. This provides an accurate and intelligent basis for determining thermal and clearance based line ratings under all conditions. In comparison, other methodologies interpolate values from look-up tables, relying on data such as vibration to infer critical span sag. SMARTLINE works just as well on bundled as well as single conductors.

SMARTLINE Ratings

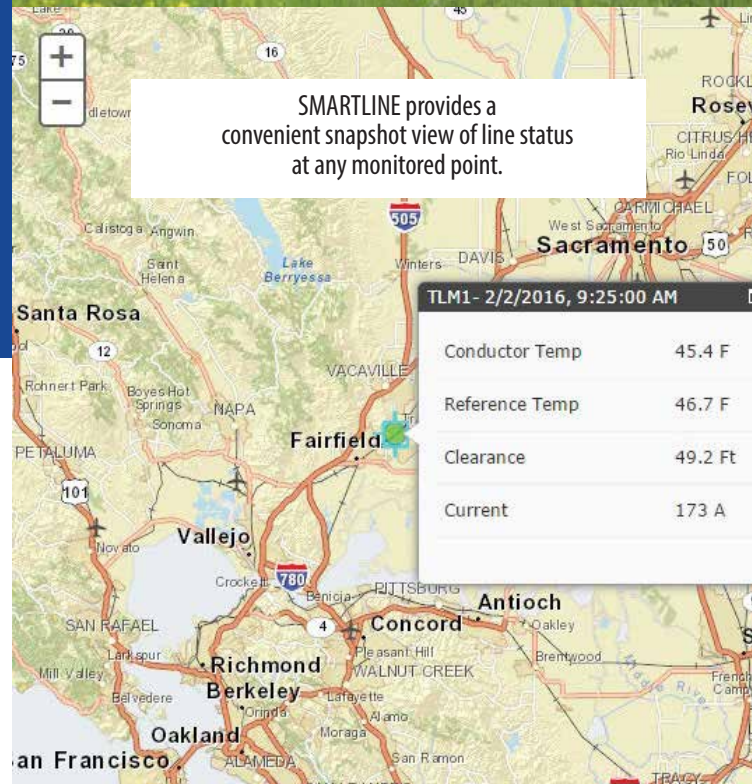
SMARTLINE provides a variety of transmission line ratings:

SMARTLINE DLR

Dynamic line rating has always had one meaning: A line's maximum instantaneous current carrying capacity while ensuring no thermal damage occurs. SMARTLINE can provide either this traditional, basic, DLR or a more operationally useful clearance-enhanced DLR. This improved DLR rating results when Lindsey TLM™ LiDAR-based conductor monitors are installed on clearance-limited spans. The use of clearance-limited spans ensures clearance requirements are not violated while also eliminating risk of conductor thermal damage. If the selection of monitored spans is given no consideration as to clearance limit monitoring, SMARTLINE provides basic DLR, consistent with traditional DLR solutions.

SMARTLINE RBR – A Reliability Based Rating Alternative to Static Ratings

Instantaneous by nature, dynamic line ratings change constantly, and can appear quite erratic. Unique to SMARTLINE, the Reliability Based Rating (RBR) is a statistically stabilized DLR rating. This



SMARTLINE provides a convenient snapshot view of line status at any monitored point.

stabilized value can act as a reduced risk line rating alternative. SMARTLINE RBR is designed for operators to ensure, with a 98% or greater confidence factor, the transmission line is operating over time within both clearance and thermal parameters.

SMARTLINE RBF – Reliability Based Forecasts for Dispatch Applications

SMARTLINE's Reliability Based Forecast (RBF) ratings are SMARTLINE RBR line capacity ratings adjusted for forecasted future weather conditions. Available for any timeframe for which weather forecasts are available, SMARTLINE RBF ratings are tailored to address energy dispatch and trading needs. SMARTLINE line capacity forecasts are available for periods ranging from hours, to days, ahead.

Cost Effective Alternative to Reconductoring

SMARTLINE RBR can quickly document 10-25% additional capacity availability on existing lines, allowing for deferral or elimination of reconductoring projects.

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Recognize Extreme Events

Extreme events, such as severe ice loading or emergency loading conditions, are recognized and the resulting changes in conductor behavior are automatically incorporated in SMARTLINE's ratings.

Eliminate Transmission Constraints & Congestion

SMARTLINE ratings can be used to eliminate or reduce congestion costs. The combination of actual conductor measurements and learning over time produce ratings that are reliable and dependable.

Critical Span Measurements

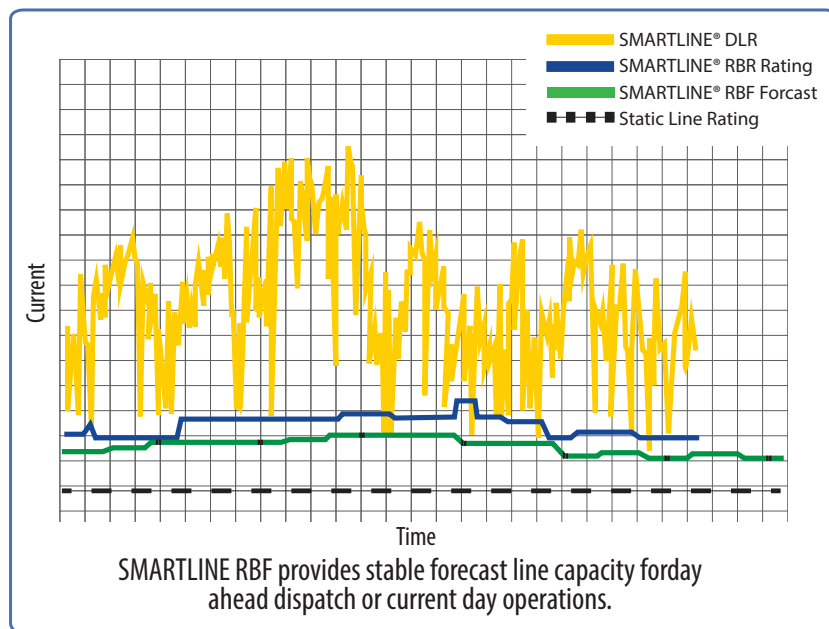
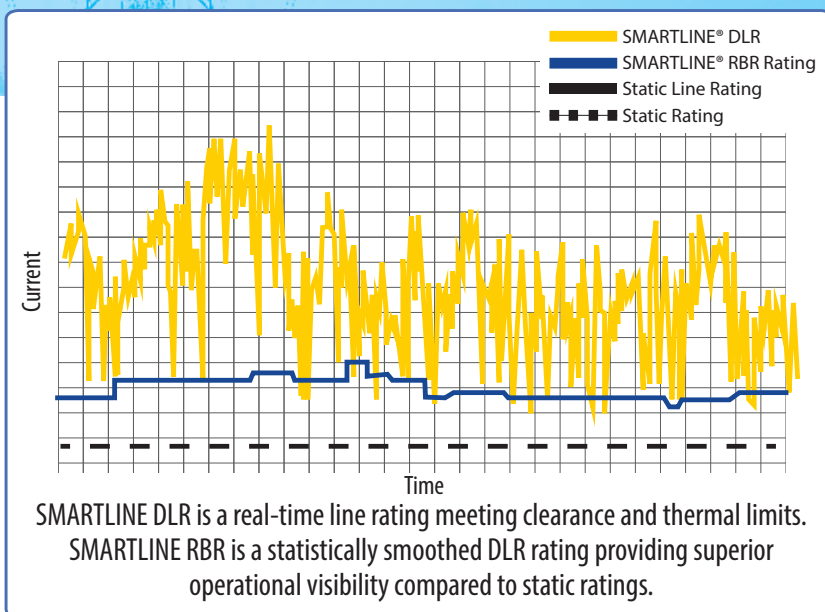
The SMARTLINE system uses data from Lindsey TLM conductor monitors which maybe placed on all critical spans on a transmission line. The measurement of actual critical span clearance makes obsolete the need to use data from several spans away to infer critical span clearance.

Clearance Monitoring

The SMARTLINE system is the first and only ratings solution based on directly monitored clearances by the Lindsey TLM conductor monitor. SMARTLINE ratings are based on continuous geospatial clearances; a requirement of legal and safety standards. Clearance compliance to standards is directly monitored and conductor behavior is learned and understood.

Computing Requirements

The SMARTLINE system supports flexible hosting options. Host in a secured virtual environment, or integrate into an existing IT environment.



Lindsey Manufacturing
760 N. Georgia Avenue
Azusa, CA 91702 USA
Tel. 626-969-3471

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