ETAP Rail Traction Power software includes the most accurate, user-friendly and flexible software tools for analyzing and managing low and medium voltage rail power systems.

eTraX™ Rail Traction Power software is utilized by railway owners, operators and engineering consultants as an integrated traction power system design and management system. Using advanced geospatial asset information, eTraX allows for the modeling, simulation, prediction and optimization of rail infrastructure.

- Tool for analysis and operation of tractions systems
- Model, analyze, evaluate and recommend solutions
- Solve transmission, distribution, traction, and signaling together
- Evaluate substation location and capacity
- Improve reliability of electrical traction power system
- Resolve challenges of unbalanced system operation
- Model unplanned events and future growth
- Integrated protection with impedance relays
- Data exchange with third party applications and templates
- Mobile data entry
- Developed under ETAP quality assurance program
- Verified & Validated (V&V) against benchmarks
eTraX Traction Power Solution

ETAP offers a suite of fully integrated electrical engineering software solutions that integrates a graphical user-friendly power system design and modelling platform with advanced suite of traction power applications and train performance calculations.

Solution Benefits

- Data Centralization – GIS, Planning, Protection and Operations
- Traction power overhead catenary system (OCS) design
- Intelligent one-line diagram and virtual modeling
- Geospatial Asset Visualization
- Traction power supply design and equipment ratings
- Traction power equipment templates
- Train performance calculation
- Impact of unplanned events on electrical demand
- Eliminate guesswork using real-time data
- Analyze impact of various rolling stock
- Root cause analysis for events or failures
- Utilize a product that is the global standard in the power systems
- Conceptual design and study to system integration and operation
- Evaluate substation capacity for existing or planned train operations
- Determine power flows and voltage drops using multiple timetables
- Use one software solution for traction power and LV signaling systems
- Communication with eSCADA for Real-Time Predictive Simulation

Visualize & Analyze Traction Systems
Using Geospatial & Logical Views
**Geospatial Track Modeling**

- User-friendly environment for creating and managing the traction power system database
- Import track and station location from online sources such as OpenStreetMap
- Geospatial railway network modeling and visualization
- Fast and simple tools to build a geospatial track layout
- Generate and maintain a synchronized electrical single-line diagram
- Utilize or create single-line diagram templates for OCS, TSS, SSP, etc.
- Built in auto-layout function with multiple choice of spacing
- Graphical results and train animation on geospatial and electrical views

**Track & Route Editor**

- Graphical selection and automatic identification of possible routes
- Tabular track and route editor displays selected connectivity with route details
- Automatic tools allow user to define and build end-to-end routes quickly and efficiently
- Apply theme colors such as route based coloring

**Train Rolling Stock Library**

- Detailed rolling stock library including locomotives, passenger wagons, freight, etc.
- User customizable library including documentation and photo links of rolling stock
- Include performance curves for tractive effort versus speed
- Include braking characteristics such as braking effort versus speed
Traction Equipment Modeling

- Traction specific equipment modeling:
  - Overhead Catenary System (OCS)
  - Track Resistance
  - Auto Transformer
  - Booster Transformer
  - Elevation, Bend Radius and Speed Limits
  - Traction Substation (TSS) and Switching Station (SSP)
- Model any single phase voltage level and frequency
- Typical electrical traction distribution configurations:
  - 1 x 25 kV without booster transformers
  - 1 x 25 KV with booster transformers and return conductor
  - 2 x 25 kV with autotransformers

Train Configuration & Assignment

- Define and model train consist and order of rolling stock
- User-definable train consist including locomotives, passenger, freight or mixed arrangements
- Quickly assign train schedules to train configurations
- Integrates with train rolling stock library
- User-defined acceleration and braking limits

Train Schedule

- Define unlimited train schedules per route
- Define different train schedules for weekdays, weekends and holidays
- Auto create train schedule for a given number of trains per day
- Import train schedule from MS Excel format for faster data entry
- Define train arrival times, dwell time or departure times
- Easily utilize train schedules from 3rd party programs for electrical calculations
Train Performance Calculations

- Determine tractive effort based on train performance
- Considers track profile such as grade, curvature, speed limits, etc.
- Considers rolling, acceleration and drag resistance
- Analyze Train Trip Times
- Trip Stops and Stopping Pattern
- Identify power supply inadequacies / pinch points
- Train power consumption / demand
- Simulate Rolling Stock retrofits / upgrades
- Impact of Regenerative Braking

Results & Plots

- Graphical power flow and voltage drop values throughout the electrical network and OCS
- Phase and sequence power flows and voltages
- Display results graphically on the single line and geospatial view
- Traction power calculation time slider
- Train animation playback showing calculated values and train position
- Graphical plots using Plot Manager
  - Substation power flows and voltages
  - Train power flows and voltages per route
  - Track profile, speed, elevation, etc.
Traction Unbalanced Power Flow

- Single-phase and unbalanced 3-phase modeling
- Unbalanced and nonlinear load modeling
- Phase and sequence voltage, current, and power
- Voltage and current unbalance factors
- Automatic device evaluation
- Unbalanced loads and branches
- Machine internal sequence impedances
- Machine / transformer various grounding types
- Modeling of transformer winding connections
- Transmission line coupling between phases of one line and multiple lines
- Transformer load tap changers (LTC / regulators)
- Phase-shifting transformers
- Auto-adjust voltage regulator settings
- Current-injection method
- Conduct unlimited “what if” studies within one database 100,000+ bus capability

Traction Unbalanced Short Circuit

ETAP provides unbalanced short circuit is the most comprehensive unbalanced short circuit module available in the market today. With the ability to model shunt, series, sliding and simultaneous fault calculation for transmission and distribution networks, you will not need any other short circuit program in your planning and operations toolbox.

- Simultaneous fault
- 3-phase to ground fault
- 3-phase fault
- Line-to-ground fault – Phase A, B or C
- Line-to-line-to-ground fault
- Open-circuit – Phase A, B or C
Reliability Assessment

Traction system reliability assessment deals with the availability and quality of power supply at each TSS. In order to evaluate the severity or significance of a system outage, expanded sets of indices listed below must also be calculated.

- Model reliability characteristics of each component
- Implement user-defined parameters and settings
- Calculate bus and load point reliability indices
- Calculate system reliability indices
- Calculate reliability energy cost indices
- Rank element contributions to energy cost indices
- Calculate effect of simultaneous faults
- Select types of components for plotting

eSCADA & Traction Power Management System

eTraX applications are modular and include intelligent power monitoring, real-time predictive simulation and eSCADA. eTraX provides a state-of-the-art design and management solution for the electrical network life-cycle of the rail traction power system.

- Utilize common model for design, planning and real-time operations
- Built-in native SCADA communication protocols
- Automatic download of waveforms and Sequence of Events files
- Integrated historian for data and events
- Integrated alarm and event management
- Built-in redundancy – Centralized and Distributed
- Advanced Monitoring with State Estimation
- Predictive system response based on operator actions
- Switching sequence allows for switching work order management
- Event Playback to identify operating condition of the system for ‘root cause and effect’ analysis
- Introduce real-time signaling information for ‘what-if’ and impact analysis
- Web-based thin client visualization and customizable HMI graphics
ETAP Quality Assurance

ETAP’s quality assurance is specifically dedicated to meeting the requirements of:

- ISO 9001:2008
- 10 CFR 50 Appendix B
- 10 CFR Part 21
- 10 CFR Part 50.55
- ANSI / ASME N45.2
- ASME NQA-1
- ANSI / IEEE 730.1
- CAN / CSA-Q396.1.2
- ANSI N45.2.2

ETAP is Verified and Validated (V&V) against field results, real system measurements, established programs, and hand calculations in order to ensure its technical accuracy. Each release of ETAP undergoes a complete V&V process using thousands of test cases for each and every calculation module and library data.

Certificate No. 10002889 QM08
Registered to ISO 9001:2008

ETAP is a high impact software qualified for use within nuclear, military and mission critical facilities and operations.

Solution for Analysis & Operation of Rail Traction Systems