etap
Powering Success

Design
Analyze
Optimize

eTraX™

AC & DC Rail Traction Systems

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

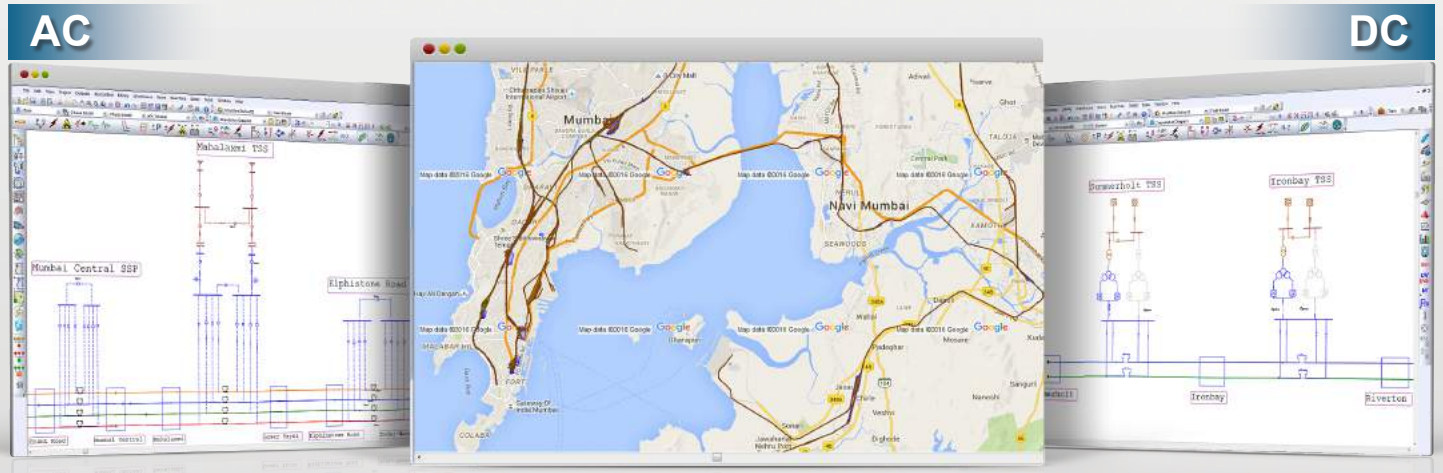
- Tool for analysis and operation of tractions systems
- Model, analyze, evaluate and recommend solutions
- Solve transmission, distribution, traction, and signaling together
- Evaluate substation location and capacity
- Improve reliability of electrical traction power system
- Resolve challenges of unbalanced system operation
- Model unplanned events and future growth
- Integrated protection with impedance relays
- Data exchange with third-party applications and templates
- Unified AC & DC Load Flow
- 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.

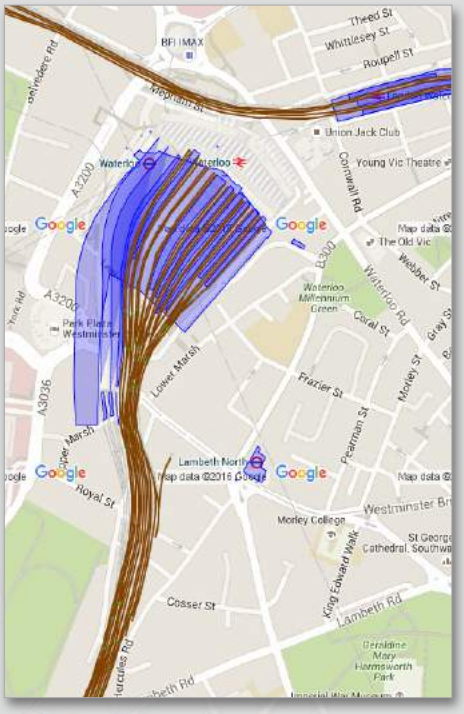
eTraX™ includes the most accurate, user-friendly and flexible software tools for analyzing and managing low and medium voltage AC & DC rail power systems.

The 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.



Solution Benefits

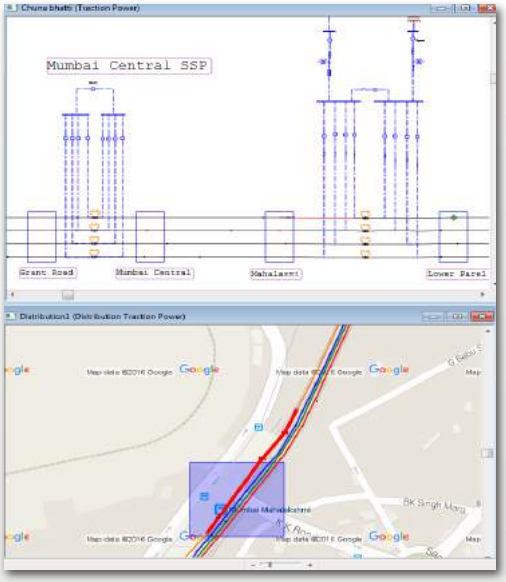
- Data Centralization – GIS, Planning, Protection and Operations
- Synchronized geospatial & intelligent one-line visualization
- AC & DC traction power supply design and equipment ratings
- Traction power equipment templates
- Train performance calculation
- Impact of unplanned events on electrical 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
- Integrates with eSCADA for Real-Time Predictive Simulation
- Utilize Real-Time data for Energy Forecasting & Switching Management



Visualize & Analyze Traction Systems Using Geospatial & Logical Views

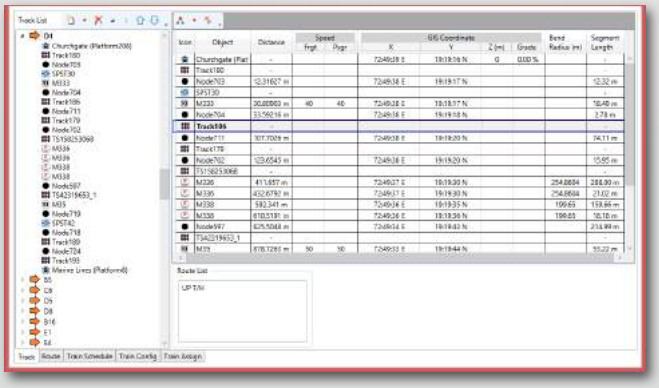
Geospatial Track Modeling

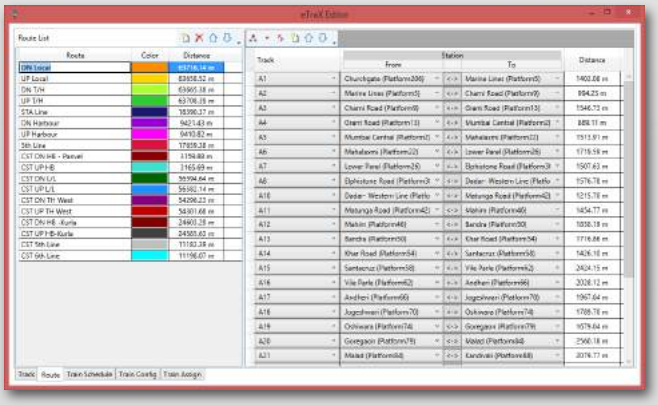
- User-friendly environment for creating and managing the traction power system network model
- Import track and station location from web sources such as OpenStreetMap™
- Geospatial railway network modeling and visualization
- Fast and simple tools to build a geospatial track layout
- Generate and maintain a synchronized electrical geospatial and one-line diagram
- Create and utilize templates for OCS, TSS, SSP, etc.
- Built in auto-layout function with multiple spacing options
- Graphical results and train animation on geospatial and electrical one-line diagram



Track & Route Editor

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

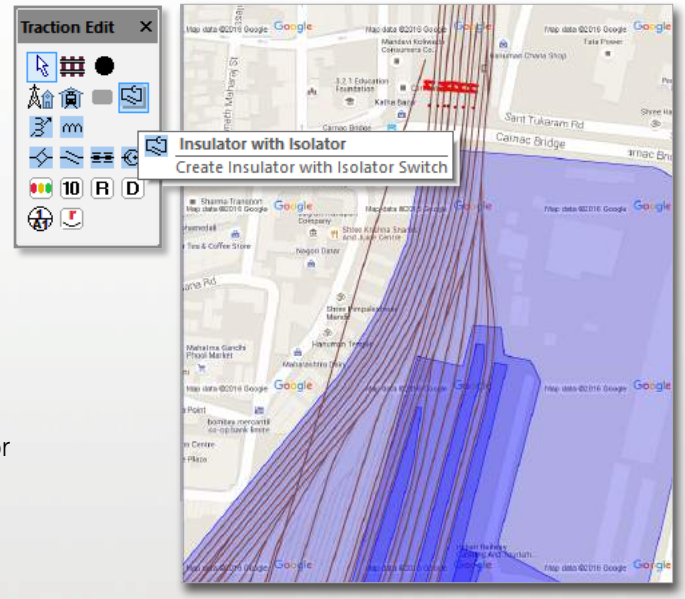




Train Rolling Stock Library

- Detailed rolling stock library including locomotives, passenger wagons, freight, etc.
- User customizable library including documentation and photo links of rolling stock
- Includes performance curves for tractive effort versus speed
- Includes braking characteristics such as braking effort versus speed
- Defines voltage-dependent tractive effort calculation based on traction motor circuit model

Traction Equipment Modeling



Traction specific equipment modeling:

- Overhead Catenary System
- Track Resistance
- Traction Transformers - Auto, Booster, Scott-T, etc.
- Elevation, Bend Radius and Speed Limits
- Insulators, Isolators, neutral section, etc.
- Traction Substation (TSS) and Switching Station (SSP)
- Traction Rectifier - Controlled & Uncontrolled

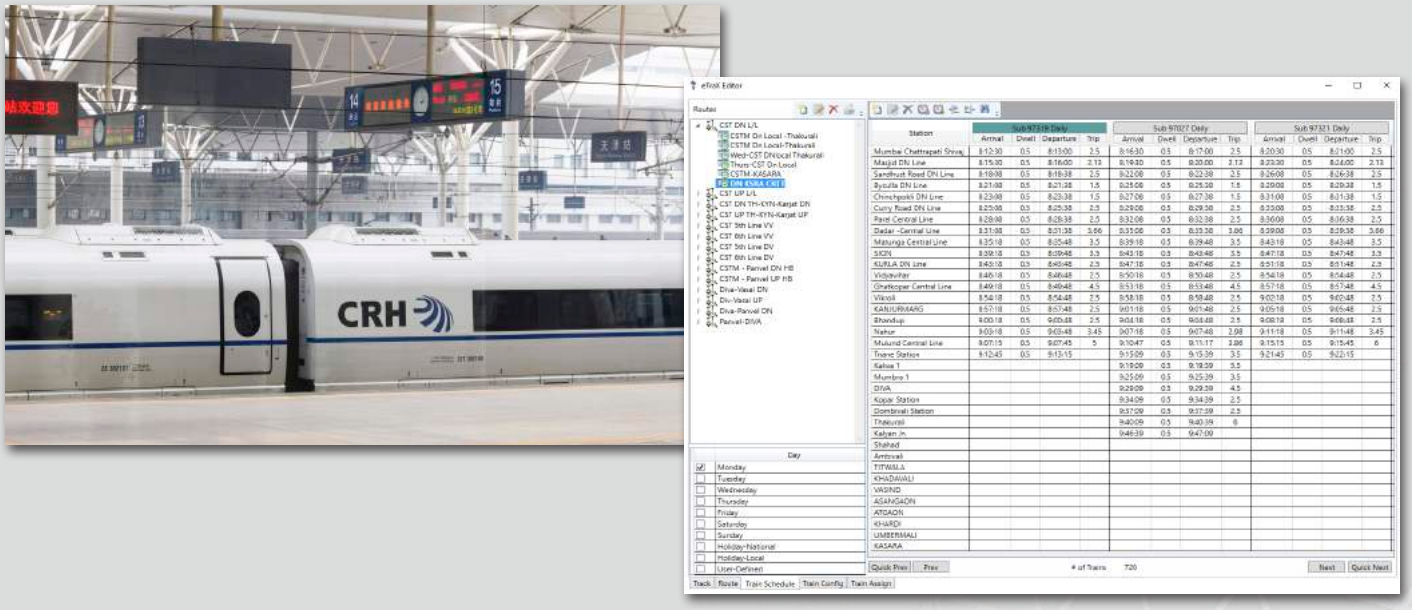
- Model any voltage level and frequency
- Typical electrical traction distribution configurations:
  - 1 x 25 kV without booster transformers
  - 1 x 25 KV with booster transformers and return conductor
  - 2 x 25 kV with autotransformers
  - Mixed AC & DC system

Train Configuration & Assignment

- Define and model train consist and rolling stock sequence 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

- Automatically generate train timetable based on number of trains, head-way, dwell time, etc.
- Easily utilize train schedules from third-party programs for electrical calculations
- 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
- Define unlimited train schedules per route

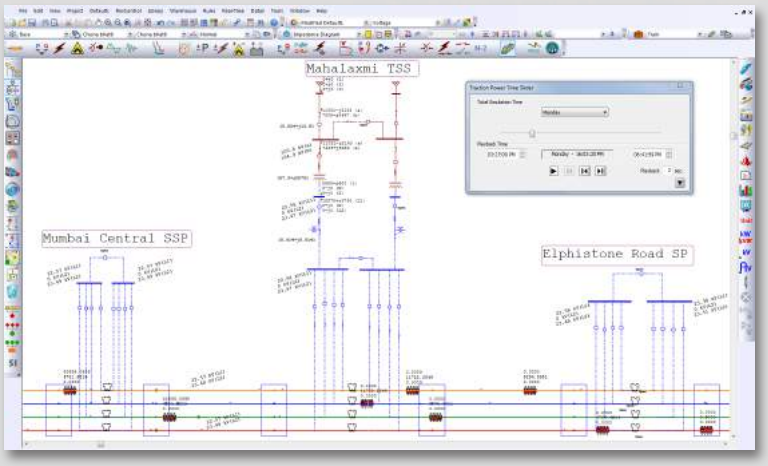


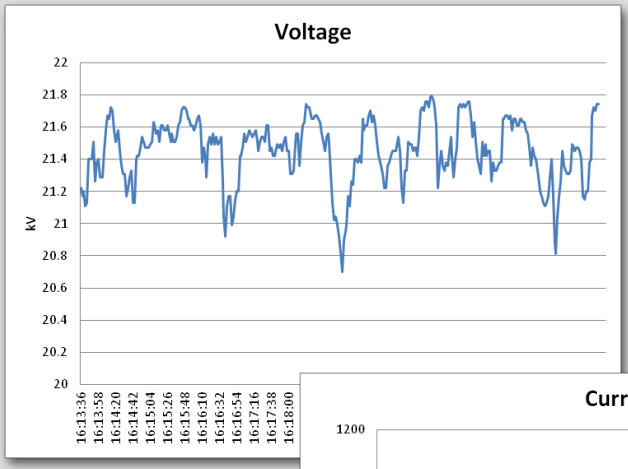
Train Performance Calculations

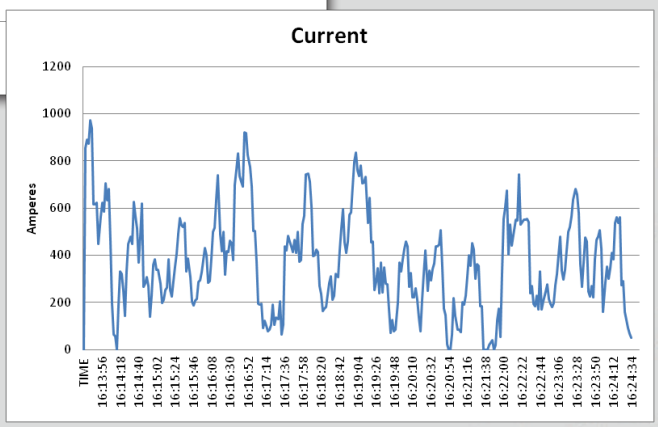
- Considers track profile such as grade, curvature, speed limits, etc.
- Determines tractive effort based on train performance
- Considers rolling, acceleration and drag resistance
- Analyze train trip times
- Calculate train movement patterns
- Identify power supply inadequacies / pinch points
- Train power consumption / demand
- Simulate rolling stock retrofits / upgrades
- Impact of regenerative braking
- Voltage dependent locomotive modeling including motor circuit model, power converters, etc.

Results & Plots

- Graphical power flow and voltage drop values throughout the electrical network and catenary system
- Phase and sequence power flows and voltages
- Display results graphically on the one-line and geospatial views
- Traction power calculation time slider
- Train animation playback showing calculated values, train position & voltage violations
- Graphical plots using Plot Manager
  - Rail energy consumption including maximum, peak & average rolling demand
  - Trip profiles - acceleration, speed, elevation, etc.
  - Substation power flows and voltages
  - Train power flows and voltages per route
  - Rail voltage, track potential
- Alerts based on EN 50163 & EN 50329

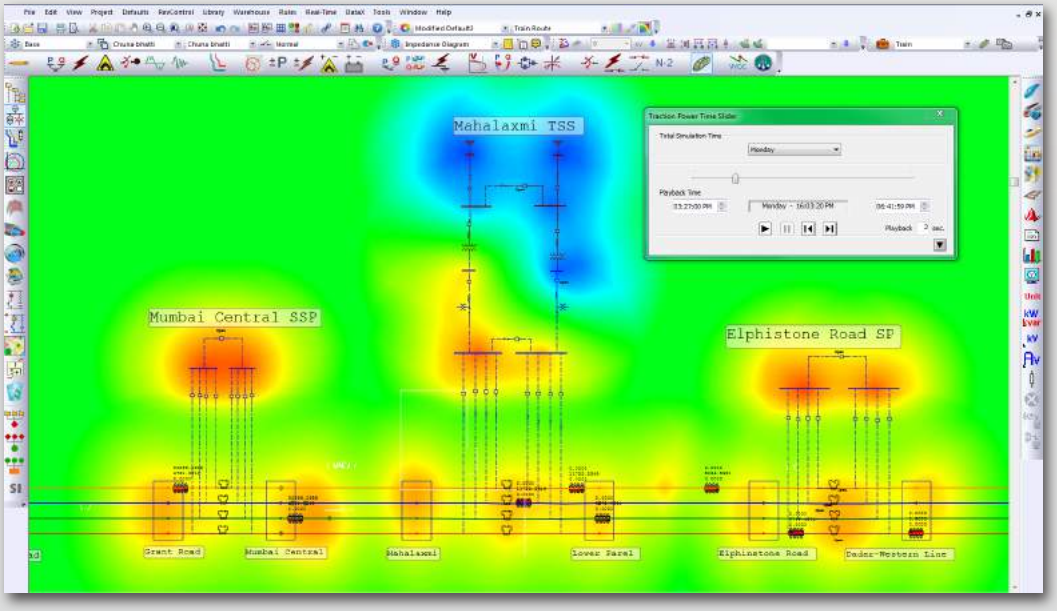






Traction Unbalanced Power Flow

- Single-phase and unbalanced 3-phase modeling
- Unified AC & DC power flow solution
- Unbalanced branches and nonlinear load modeling
- Phase and sequence voltage, current, and power
- Voltage and current unbalance factors
- Automatic device evaluation
- 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
- Auto-adjust Transformer load tap changers (LTC / regulators)
- Phase-shifting transformers
- Current-injection method
- Conduct unlimited “what if” studies within one database 100,000+ bus capability



Traction Unbalanced Short Circuit

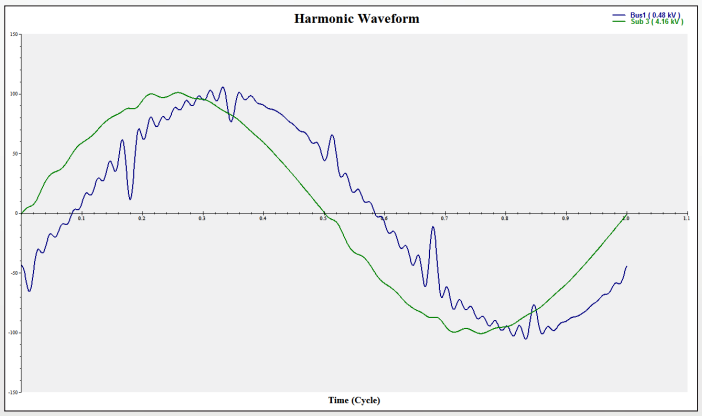
ETAP Unbalanced Short Circuit is the most comprehensive unsymmetrical system short circuit software available in the market today. With the ability to model shunt, series and sliding faults for transmission and traction networks, you will not need any other short circuit program in your planning and 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

Power Quality

Traction system harmonic load flow simulates harmonic current and voltage sources, identifies harmonic problems, reduces nuisance trips, designs and tests filters, and reports harmonic voltage and current distortion limit violations

- Harmonic evaluation of systems based on worst-case operating demand
- Harmonic voltage and current distortion evaluation (THD & IHD)
- Harmonic telephone influence factors (TIF & I*T)
- Automatic alerts of harmonic violations
- Typical and user definable harmonic sources library including traction rectifiers
- Size harmonic filters to shift resonance points to less harmful frequencies
- Select types of components for plotting

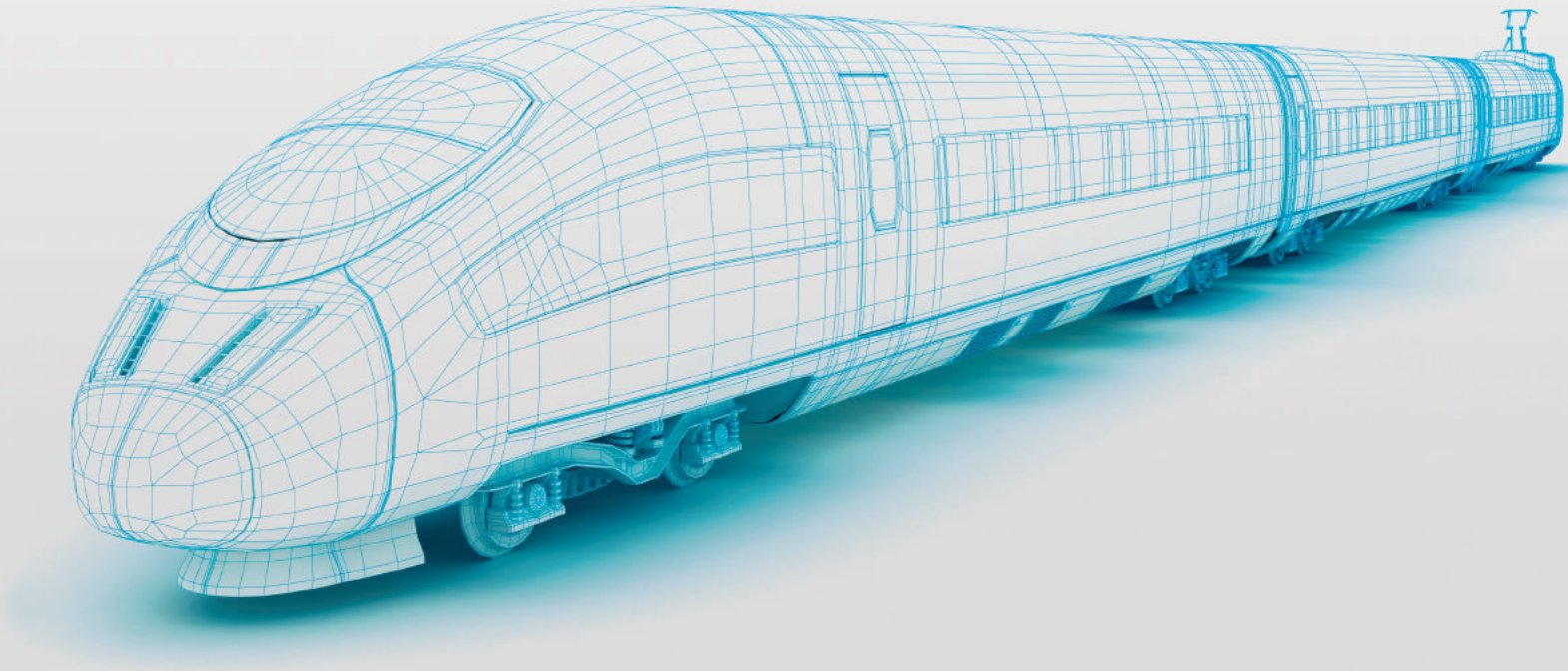


eSCADA & Traction Power Management System

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
- 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 sequence & work order management
- Automatic download of waveforms and Sequence of Events files
- Event Playback identifies operating condition of the system for ‘root cause and effect’ analysis
- Short-term energy forecasting & accounting
- Web-based thin client visualization and customizable HMI graphics

Solution for Analysis & Operation of Rail Traction Systems



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Quality Assurance Commitment

ETAP is Verified and Validated (V&V) against field results, real system measurements, established programs, and hand calculations 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. ETAP Quality Assurance program is specifically dedicated to meeting the requirements of:

Registered to ISO 9001:2008

Certification No. 10002889 QM08

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

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