

The ultimate solution

to many of your challenges



CATO brings advanced mathematical modeling, calculations, simulation and optimization into train operations. CATO provides efficient interactivity between dispatchers and drivers. This technology creates a new era in railway operations.

Minimizing

- ▶ Energy/fuel consumption
- ▶ Operational costs
- ▶ Environmental emissions
- ▶ Requirement for resources
- ▶ Wear of rolling stock and infrastructure
- ▶ Specific operational problems

Maximizing

- ▶ Punctuality
- ▶ Capacity of the infrastructure

Short description

The CATO-system consists of two core parts, a module at the control centre (CATO-TCC) and a module on board each leading locomotive (CATO-TRAIN).

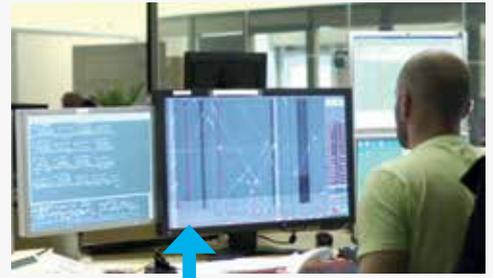
CATO-TCC is linked to the dispatching system at the control centre and continuously receives updated information on the plan of the dispatcher including track work dispositions, temporary speed restrictions etc. The plan of the dispatcher is communicated by CATO-TCC to each train.

CATO-TRAIN calculates the optimum speed profile so that the train will reach its destination on time. The optimized speed profile always targets the given schedule, but also takes other aspects into account, such as minimizing energy consumption, reducing wear on train and track etc.

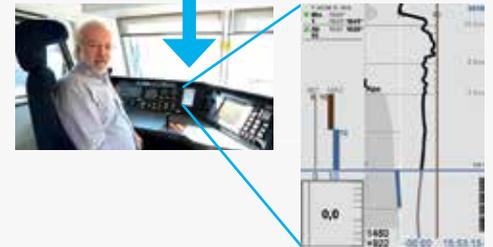
The optimal speed profile is displayed in the driver's CATO interface and is advisory. The advice is intuitive, ergonomic and simple to follow. The training of drivers has proven to be smooth.

CATO-TRAIN may in principle be used as a stand-alone Driving Advisory System (DAS) without connection to the dispatching system. CATO-TCC is optional but strongly recommended since it provides a much enhanced functionality for traffic management as well as for the DAS.

CATO TCC



CATO Train



Driver's interface to CATO, displaying among other things the optimal speed profile.

Significant savings with short pay-back

Since the train modelling and optimization method of CATO is general and without constraints, the savings with CATO should in any situation be the best that DAS systems can give.

The unique CATO concept of real time interaction with the dispatching system brings further substantial benefits. The trains can run according to real-time traffic information rather than just the static schedule. The dispatcher is informed on problems when they arise and may change the plan. The new plan triggers CATO to give re-optimized driver advice. This means that trains can always run optimal and in accordance with the actual traffic situation.

CATO enables the traffic management to control the train movements more accurately than conventional traffic management and signalling systems.



15-25%
ENERGY/FUEL REDUCTION



5-15%
INCREASED LINE CAPACITY



20-30%
REDUCED WEAR



“The drivers can take part in my planning. They can adapt the speed according to my plan. Trains arrive on time, which reduces the stops and starts. That saves a lot of energy.”

Mats Johansson
Train dispatcher
Control center in Boden.

“This type of system will be in our future plans.”

Björn Östlund
Deputy Director General
National Railway Administration (today Swedish Transport Administration).

“Punctuality increases since we can plan the journey according to crossing trains. We always know the actual plan and where and when we will cross.”

Stian Solli Nilsen
Train driver
the iron ore line

Winner of UIC Global Research & Innovation Award

Nominated by a jury of the International Railway Research Board (IRRB)
CATO won the Global Research & Innovation Award 2012, category Sustainable Development, of the International Union of Railways (UIC)

Possibility to handle complex situations

The CATO-solution allows any complexity as regards the models of the train, locomotive, line profile, route etc. The models can be as detailed as necessary in any specific customer situation and can be handled by the optimizing algorithms.

- ▶ CATO is designed for both electric and diesel traction.
- ▶ Multiple or distributed locomotives of different types may be used in the train.
- ▶ CATO may be used for advice on switching traction units on or off depending on traction demand.
- ▶ In-train forces in long and heavy trains are taken into consideration.
- ▶ Power supply restrictions can be imposed.
- ▶ The effects of rail friction, curve speeds etc are other parts of the models.
- ▶ Customer specific driving strategies may be used.

Customized optimization

Users of CATO may choose the optimization criteria. The optimization may be set to optimize punctuality, energy or fuel savings, regeneration, power loads, mechanical braking or any combination of these or other parameters. This optimization may also be dynamically changed during the day, seasonally or dictated by the production system generating transport demands.

Train control integration

CATO-TRAIN can share information with other onboard systems giving enhanced performance and/or make use of existing devices and systems, e.g.:

- ▶ Automatic Train Operation, ATO: CATO can be used either as an advisory system for manual driving or, depending on the train control system, be used in an automatic mode.
- ▶ ATP integration: CATO has been designed for possible integration with existing and future ATP systems, for example the ERTMS/ETCS or CBTC systems.
- ▶ Adhesion: CATO can use the train control system information on occurring slip and slide to adjust the advice. Weather data may be utilized.





Short about Transrail Sweden AB

Transrail Sweden (TRS) is a provider of Consultancy Services and IT Solutions for the Trains and Railways Systems of the Future. TRS aims to contribute with efficient solutions to the challenges of the railways.

TRS services span all aspects and the full life cycle of rail, metro and light-rail systems. TRS focuses on ability to support clients to develop their competence, strategies, systems and management.

Our services are based on a comprehensive approach where different areas of competence interact in creating efficient and attractive solutions.

Competence

In the context of the CATO system, it is worth mentioning that Transrail provides world class technical knowledge in train dynamics, railway systems engineering and train energy issues. This ensures competent development support and solving of possible problems. Transrail is involved in ongoing international research and development projects in this area, ensuring state of the art consultancy and information technology (IT).

CATO is based on a Train Performance Calculation system (TRAINS) with versatile library functions. TRAINS is a modular software tool developed by Transrail containing various detailed and sophisticated models and algorithms for calculation of train movements, train controls, traffic control, capacity, energy supply etc. Modules of the TRAINS software system are used in many of Transrail's software products, not only CATO.

The CATO software architecture and library of models cover the full range of train services; heavy-haul freight, freight, high-speed passenger, inter-city, suburban, metro etc.

"ERTMS will provide information about the signals, but not give us the accuracy we need to run on time. CATO can help us optimize how we operate the trains."

Oystein Risan
Director of Traffic
NSB (Norwegian State Railways)

"We expect to save 20% of our traction energy costs. We judge that CATO will also have a major impact on the capacity. With CATO the loaded trains may run on a "green wave" from the mine to the port."

Thomas Nordmark
Head of logistics development
LKAB (Swedish state owned mining company).

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