Falko
Design and validation of timetables
Optimized operational planning and control
Transportation Systems
Taking advantage of potential savings, ensuring customer satisfaction

Operational simulation with Falko

Superior offer despite cost pressure
Timetable design and validation with Falko®
Optimised offer and reliability are the two decisive factors for ensuring customer satisfaction in mass transit networks and main-line networks. Only the integration of planning and operations control maximizes the overall performance of mass transit systems and main-line systems.

The following application fields are optimized by Falko:

> Track layout design
> Timetable design
> Timetable validation
> Construction site planning
> Energy management
> Passenger transfer relations

The Falko timetable design and validation takes account of all operationally relevant factors such as:

> vehicle and line parameters
> energy consumption
> passenger flows

The linkage and evaluation of this complex information permits the design of optimal timetables, not only in respect of headways, but also for energy and resource savings.

Sophisticated features

Modular concept of Falko
Falko is based on a modular design concept. Thus, the entire functionality of Falko can be optimally matched to your requirements:

> Timetable design
Easy generation of timetables taking into account all relevant operational factors down to the block occupancy level

> Import of timetables
Import of formats of commercially available timetable design tools

> Route planning
Computation of routes and block occupancies, fully automated in terms of route exclusions and occupancy conflicts

> Global optimisation
Simultaneous optimization of energy consumption and passenger transfer relations of timetables in line networks

> Timetable validation
Validation of timetables by complete operational simulation of operations control, signalling and safety systems, outdoor equipment, trains, etc.; different types of fault conditions can be handled

> Timetable and simulation analysis
Results are displayed in easy-to-read graphics formats

> Energy analysis
Quantitative evaluation of the energy consumption of timetable variants, taking into account energy recovery effects

> Export of timetables
Various exporting formats are available which are especially suitable for Siemens operations control systems

> Falko Geo
Falko features an easy-to-use editor for creating system design variants

> Falko Online
In connection with operations control systems such as Vicos OC 500, Falko offers the possibility of making timetable alterations online during operation.

> Consulting
Siemens Transportation Systems provides support for the creation of operating concepts and the planning of new lines. With Falko, we can find the most efficient solution to suit your needs.
Efficiency and cost-effectiveness

Falko benefits

Traditional timetable compilation offers a considerable potential for cost savings. With Falko, prerequisites for cost savings are:

- **Short compilation times**
  - for trip and vehicle scheduling
- **Short-term planning of alternatives**
  - In the event of faults, alternative solutions can be quickly provided.
- **Savings in rolling stock**
  - by optimization of the vehicle schedule
- **Reduced energy consumption**
  - Timetables generated with Falko enable time reserves on the line to be optimally distributed thus ensuring cost-effective vehicle runs
- **Energy recovery**
  - Timetables are designed in such a way that the energy of braking trains can be instantly taken over by departing trains
- **Passenger transfer optimization**
  - Minimized transfer times of passengers in railway networks
- **Offline timetable validation**
  - Elimination of expensive trial runs and minimization of timetable fault liability
- **Efficient construction site planning**
  - Alterations and associated two-way working can be objectively planned, enabling construction times to be cut and disruptions minimized
- **Adjustment of operative timetables**
  - Simple and efficient
The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.
Falko has been used successfully in both mass transit and main line. For example, the tool is used by Wiener Linien (Vienna Transport Company) for timetable design, timetable validation and construction work planning. Similarly, Falko has also proven itself in numerous consulting projects.

Falko references
Proven worldwide!

Transportation Systems
Excerpt from our reference list:

Mass Transit
> ISAP, Athen, Greece
> RET, Rotterdam, Netherlands
> VAG Nuremberg, Gernany
> Wiener Linien GmbH & Co KG, Vienna, Austria
> Delhi Metro Corporation, New Delhi, India
> Beijing Subway, Beijing, China
> Guangzhou Metro Corporation, Guangzhou, China
> Kowloon-Canton Railway Corporation, Hong Kong, China
> Nanjing Metro Cooperation, Nanjing, China
> Shenzen Metro Operation Company, Shenzen, China
> KRTC, Kaohsiung, Taiwan
> MRT, Manila, Philippines
> Metrorrey, Monterrey, Mexico

Main Line
> DB AG, Schoenebeck, Germany
> ESKO, Finland
> RENFE, Madrid-Sevilla, Spain
> Chinese Ministry of Railways, Beijing-Shanghai, China
> Chinese Ministry of Railways, Jin Jing Line, China

Transrapid
> Shanghai Maglev Transportation Development Company (SMTDC), Shanghai, China

Cargo
> BHP Billiton Iron Ore, Australia
Falko Online is a variant of Falko and used in connection with the Vicos OC 500 control system. Falko Online features two central functions:

**Timetable management for Vicos**
Falko Online manages timetables for the Vicos system. To this effect, it functions as the interface between a "normal" Falko system and the Vicos operations control system.

The timetables are designed and validated using Falko. After exporting, they are automatically passed on to Falko Online.

If the versions in Falko Online are more up-to-date than those in Vicos, the relevant files are sent to Vicos. Timetable management and interaction with Falko Offline and Vicos are fully automatic and independent of user input.

**Dispatching of the current Vicos timetable**
If a fault is encountered in current operation of the Vicos system or if the timetable which is active in Vicos is to be modified for other reasons, this current Vicos timetable can be edited using Falko Online in order to minimise the effects of the fault.

For this purpose, the current Vicos timetable is edited and validated using Falko Online. After editing, the edited timetable is sent to Vicos where it can be implemented.

Operational planning is the major step for Falko for dispatching the current timetable since its strategies permit simple and rapid modification of the timetable.

### Falko Online

**Timetable management for the Vicos system**
System requirements
The same system requirements apply for Falko Online as for Falko Offline. In addition, Siemens supplies the Vicos Network Coupling Unit program which implements interaction between Falko Online and the Vicos system.

Performance features
> Modification, input and deletion of vehicle runs
> Notepad approach combined with scripting language
> Easy-to-operate user management
> Re-use of existing offline functions (e.g. simulation)

Range of functions
> Falko Online is used for dispatching existing timetables which already exist as vehicle schedules.
> The current list of scenarios which Falko Online manages for the Vicos system can be output, showing not only the scenario name but also the version number and the corresponding Vicos name of the relevant timetable.
> Additional shortcuts enable rapid access to the functions frequently used during dispatching.
> The user interface of Falko Online is similar in design to that of Falko Offline.

System design – integration of Falko and Vicos
Timetable design is performed using the combined representation of the track layout and a symbolic timetable. First of all, the symbolic timetable is specified and then an operative timetable is generated.

Timetable specification

Defining and linking lines
In the track layout display, the lines are entered with the stopping points. The lines can be combined serially (following each other) or in parallel.

Specifying trips
For the defined lines, trips are entered; the time range, headway and trip type (with/without a payload) are determined at the same time.

Entering depots
Depot parameters such as vehicle capacity and minimum dwell time can be entered.

Entering vehicle data
When the vehicles are specified, train type, train number, minimum number of vehicles and relevant information for the depot can be selected.

Timetable generation

Expanding the timetable
The first step in the generation of an operative (actual) timetable is timetable expansion. Here, the specified symbolic timetable is expanded into individual trips.

Generating the vehicle schedule
In multi-depot vehicle scheduling, individual vehicles are assigned to various trips. The objective is to minimize the resources used.

Performing operational planning
In operational planning, the vehicle schedule is refined down to the level of station tracks, taking account of reversal and stopping as well as pull-in and pull-out strategies.

Routing
The routing function creates an operative timetable from the running orders. It takes all relevant route exclusions into account.
Timetable export
Every timetable can be converted into various exporting formats. This allows a continuous workflow from planning to control of operations.

Timetable import
External timetables are automatically converted into internal vehicle schedules.

Global optimization
Powerful functions allow the minimization of energy consumption and passenger transfer times in complex railway networks simultaneously. Operational features such as cost-effective running, runtime reserves and departure times can be flexibly adapted.
For the planning of new lines, it is useful to be able to simulate various variants in order to select the optimal solution. For this purpose, Falko offers the additional module Falko Geo.

Falko Geo is an editor for creating track layout design variants. It can be used to create and configure:

- routes
- stations
- changes in gradients
- crossings
- overpasses
- entire signaling and safety systems

Not only trackside elements can be easily entered in Falko Geo; overlaps and routes can also be automatically generated or individually created or deleted. Using the zoom function, complex track layouts spanning distances of many kilometres can be viewed down to the very last detail.

An undo/redo function makes the planning of projects easier.

Possible applications
Falko Geo is a program for editing track topologies for railway systems.

The track layouts are represented by means of a graph model consisting of nodes and edges. Falko Geo can be used to create the configuration data required for the Falko timetable design and validation system within a short period of time.

For configuration of the desired signaling and safety system, you can finally edit insulated block joints, loop margins, signals, routes, overlaps, speed profiles and gradient profiles by means of user-friendly entries. Using a series of graphical analysis functions, such as speed and gradient profiles or properties of paths (lengths, runtimes), for example, the configuration can be finally checked.
Falko Geo allows all topology objects to be easily entered with the project editor and also features an interface for importing speed and gradient profiles from a file. This means that a track topology can be configured and modified even faster. Of course, all topology components can be freely opened and closed on a visual basis to enable the graphical representation to be adjusted depending on the application involved.
Detailed testing
Precise timetable validation
The simulation of various signaling and safety systems (e.g. electronic interlockings, continuous automatic train control, automatic train control systems or the European Train Control System), control systems and other factors, such as passenger flows and energy consumption, enables operational sequences to be realistically simulated.

The operational feasibility of a timetable can thus be validated in detail. The possibility of activating different types of fault conditions enables the timetable’s susceptibility to faults to be tested and minimized:
> Speed restriction sections
> Point and signal faults
> Vehicle and door faults
> Delayed entry movements

As in real life
Animated timetables
The train runs in a timetable can be animated using a dynamic simulation. During the animation, the moving trains are shown in the track layout display. The trains can be simulated with their true length. The following states are additionally indicated:
> Current signal colors
> States of track vacancy detection elements (clear/occupied)
> Route states (set/not set)
> Overlap states (set/clear)
> Flank protection zones (active/inactive)
Numerous analysis options and easy operator control

Efficient operational planning with Falko

> Diagrams provide an overview
> Timetable analysis in the form of graphs and diagrams

Besides the statistics for headways, line timings, train turn-arounds, etc., Falko offers easy-to-use analysis options by way of graphical representations.

Support all along the line

User-friendly and available in other languages

Falko is based on the Windows® operating system and features a simple-to-use graphical user interface. Web-based detailed online help provides further support.

English and German versions of Falko are available and can be easily localized into other languages.
Our consulting services
We support you in the planning and analysis of your system and operational issues and provide advice ranging from the design of timetables through to the planning of new lines.

Our range of services comprises ...
> timetable design and verification
> capacity planning
> planning of new lines
> review of operations on the basis of the planned infrastructure prior to construction of the system
> timetable optimization spanning several lines
> determination and verification of runtime reserves
> analysis of the effects of fault situations and alterations on timetable operation
> modelling of passenger flows
> energy management
> operational consulting (number of trains, headways, etc.)
> support in the selection of optimum signalling and safety systems

Our approach
> Determination of the actual situation and operational issues
> Input of data in Falko
> Analysis of operational issues and investigation of possible solutions
> Processing and presentation of results

Our staff is available for consulting services in order to come up with efficient solutions for your individual terms of reference. Our customers profit from our many years of experience in this field. In addition, Falko innovations provide optimum responses to your operational queries.

Our services range from analysis of simple crossings and complete line networks through to complex stations.

Use our know-how, our many years of project experience and our competence in planning and optimizing your operations.
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