

# How the timetable is born.

From initial studies to the daily  
timetable.

April 2014

# The art of creating a timetable – the foundation of the world's densest rail network.



The Swiss are world champions in rail travel: About 10,000 trains use the country's 3,175 or so kilometres of track each day, taking over a million passengers to their destinations safely and on time. In addition, about 200,000 tonnes of freight are transported by SBB on its network each day. These impressive figures are unequalled anywhere in the world. Coping with these volumes on a daily basis is a major challenge. The demands placed on SBB's timetable planners – among many others – are consequently very high. The continuous expansion of passenger rail services and the constantly growing demand for freight capacity mean that train paths are in increasingly short supply. To meet this rising demand, SBB Infrastructure relies on a highly sophisticated timetabling system. With their know-how and experience, it is the timetabling and product planning staff who enable this complex interplay to function.

We would like to explain here what it takes to produce a timetable with sufficient stability to enable trains to run on time. Overleaf you will find an overview of timetabling activities at SBB Infrastructure. For further information on this topic, please see the enclosed folder.

We at SBB Infrastructure set the signals to green: we plan, build, operate and maintain Switzerland's rail network.

**SBB – We keep Switzerland moving.  
Travel in comfort. Get there on time.**

A stylized, handwritten signature in black ink, appearing to read 'Gauderon'.

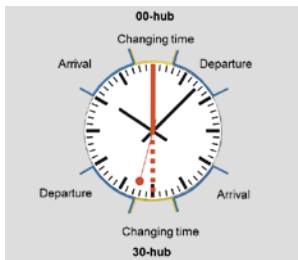
Philippe Gauderon  
Head of SBB Infrastructure  
Member of the Management Board

# Timetabling terms and tools.



## What is a train path?

A train path, rather like a slot in aviation, is the entitlement for a train (of defined length, weight, loading gauge and speed) to use a specific section of the rail network at fixed times.



## Symmetrical timetable.

In Switzerland, symmetry is on the hour (00 minutes). The “symmetry points” at which trains pass each other are always at the same place. Transfer times and changes to other services are always the same in both directions. It is thus easy for passengers to work out their train’s departure time for the return journey. An integrated, regular interval (“clockface”) timetable is feasible provided that all connecting lines – including buses, boats and privately operated railways – have the same symmetrical times. This facilitates connections in a number of different directions.



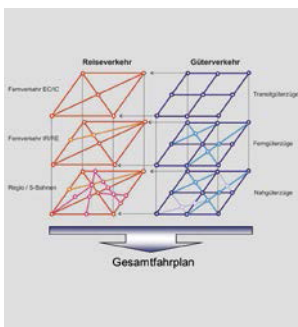
## Customers.

Railway undertakings (RU).

40 RUs operate freight or passenger trains on the SBB network. They receive close support from ten customer advisors – the first port of call for the RUs at SBB Infrastructure.

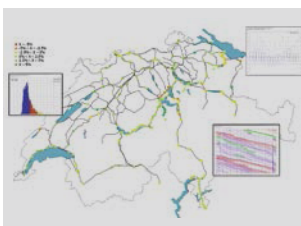
Cantons.

It is the cantons that commission regional rail or suburban/urban rapid transit services. In the long-term timetable planning process they work closely together with the eight Key Account Managers (KAM) at SBB Infrastructure.



## Timetable design, and the tools used.

The annual timetable is planned in accordance with the regulatory framework stipulated by the Federal Office of Transport (FOT). The timetable planners observe the following hierarchy: first, they timetable the long-distance and transit freight trains. Then the interregional passenger offering is worked into the timetable along with the delivery network for wagonload freight services. And finally the regional services, i.e. suburban or rapid transit trains and short-distance freight services are integrated. The various electronic tools used in the process include route diagrams, track occupancy diagrams, network graphics and the NeTS planning tool (stands for Netzwerkweites Trassen System – or “network-wide train path system”).



## Timetable analysis tools.

Before being taken into service, a timetable is thoroughly checked for stability risks.

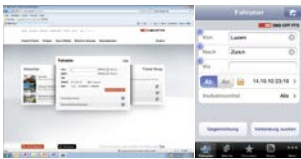
The two IT systems OpenTrack (for simulations) and OnTime (for statistical calculations) are used to identify and deal with any weaknesses in advance. After the introduction of the new timetable, the planners use the Open Timetable programme to continuously check its stability. Only in this way is it possible to add to or improve the dense timetable.





### Train-path ordering process.

The railway undertakings want to have equal access to the Swiss rail network. Trasse Schweiz AG (Swiss Train Paths Ltd) ensures that the planning, allocation and optimisation of this track access (i.e. train paths) is performed impartially.



### Official timetable, online timetable and app.

The completed annual timetable supplies the data for approximately 60 different products or systems. The traditional printed timetable is one of these, while others include the new electronic media such as the online timetable and the mobile timetable application (app) available for smartphones. Within SBB, the data are fed into numerous production systems.



### Special trains.

About 500 special trains are scheduled each year for major events (such as the national Swiss wrestling tournament, the football cup final or Circus Knie performances) as well as for large shipments of sugarbeet or works trains.

## The timetable.

Here are some facts and figures about the timetable.



### The people.

About 120 timetable planners in Lausanne, Berne, Zurich and Lucerne are responsible for drawing up timetables covering various planning horizons. Their challenge is the daily balancing act between capacity and stability. The most heavily used section of route, between Rapperswil and Lenzburg, carries 550 trains per day.

### The planning process involves:

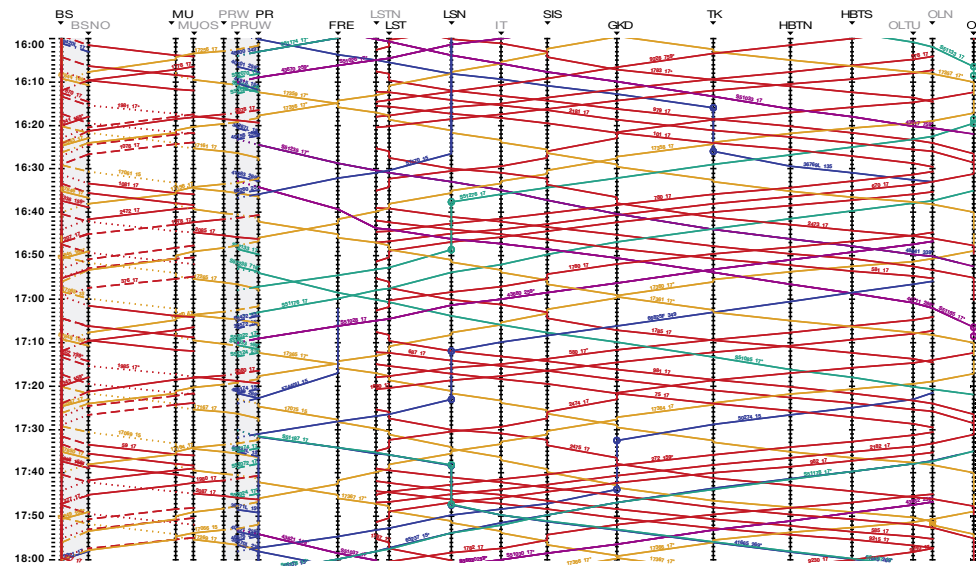
- 3,175 route kilometres (SBB/Sensetbahn/Thurbo/ZB)
- 2,383 operating points
- 40 railway undertakings (RU) requesting train paths
- 583 power units
- 15,000 train-path orders
- 170 m train-path km sold
- 8,153 passenger trains and 1,854 freight trains per day
- 11,000 scheduled track closures, and  
1,300 speed restrictions per year across the SBB network.

# How your timetable is born.



## Timetable diagram

This extract from the timetable diagram for the Basel SBB–Olten section shows the high density of services on the SBB network. Each line on the time-and-path line diagram represents a train.



## Timetable preparation at SBB Infrastructure



### 1. Undertake timetable study

With the demand for travel rising, rail infrastructure has to be constantly expanded. SBB Infrastructure receives mandates from the federal and cantonal governments to undertake a timetable study and deliver a cost-benefit forecast. To this end, the timetable planners draw up a plan featuring different planning timescales. Timetable and operational simulations are used to define the requisite infrastructure upgrades.



### 2. Develop future rail service offering

A number of detailed discussions are held between the federal transport ministry (FOT), the cantons and the rail companies (RUs) on the one and SBB Infrastructure on the other hand to define the target timetable, the corresponding infrastructure expansions/upgrades, the rolling stock requirements and the sources from which the necessary funding will be obtained. The ultimate goal is always a solution with the best cost-benefit ratio. A dispatch (message) containing the necessary financing plans is then transmitted to the Federal Parliament. This iteration step creates a picture of the future timetable and the associated financing requirements.



### 3. Draw up medium-term timetable

Once the financing issue has been resolved and the necessary upgrades are under way, planning and computer simulation work for the medium-term timetable and the associated infrastructure requirements commences. Time windows for the necessary maintenance and renewal work are worked into the timetable. The timetable studies are put into a more concrete form and detailed concepts drawn up.



### 4. Perform supply iterations

The RUs operating in the passenger and freight sectors meet with SBB Infrastructure and the FOT to agree on the specifics: rolling stock deployment is defined, schedules drawn up for commissioning new installations, construction sites for maintenance and renewal work coordinated, and the timetable fixed.



### 5. Prepare the annual timetable

Two years before implementation, the timetable planners start planning the annual timetable accurately and over a 24-hour timescale. The defined supply concepts are taken over into the annual timetable. A "train path catalogue" is issued for freight services. Now the actual ordering of train paths by RUs can begin.



### 6. Hold customer workshop

SBB Infrastructure's customers – passenger and freight RUs – meet up at a timetable workshop. Offering concepts are coordinated and put into a concrete form. At this point, requests for short-term changes are checked for feasibility and integrated into the ongoing planning process.



### 7. Launch ordering process

To ensure non-discriminatory access to the rail network for all RUs, the latter submit their train-path requests to the independent body Swiss Train Paths Ltd. As far as feasible, train paths are allocated provisionally. The RU now has the opportunity to evaluate which paths it definitely wants to order. To this end, it confers with its customers. In the freight segment, these may include container shippers. In regional services, it is the cantons that order timetable availability. If two RUs request the same path, Swiss Train Paths Ltd is responsible for allocating it. If no agreement can be reached, a bidding process is launched.



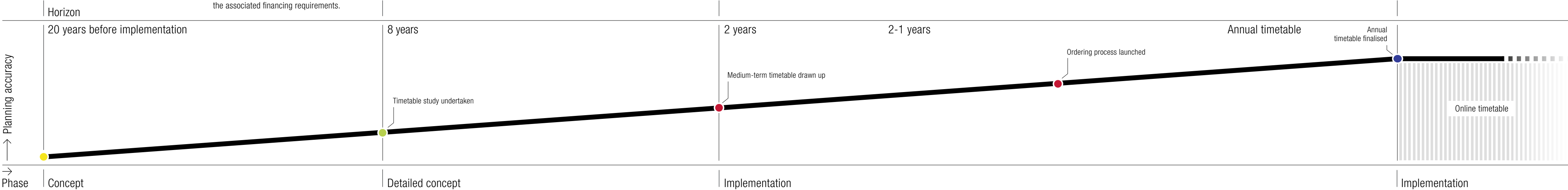
### 8. Conclude annual timetable and implement timetable change

Detailed planning of the timetable has been completed, so it can be passed on to the SBB's operational units. The service offering is published in the online timetable and the official (printed) timetable.



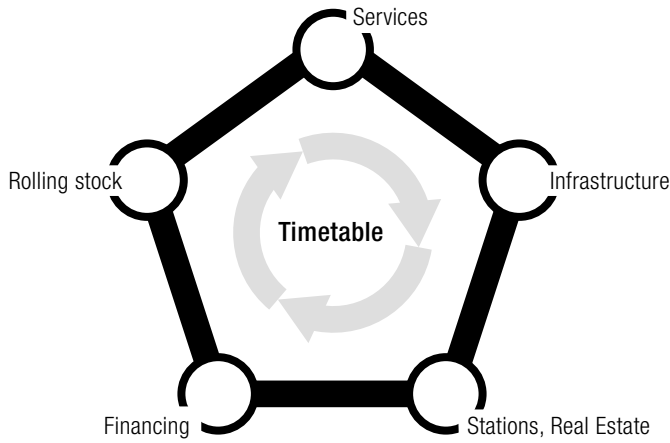
### 9. Generate daily timetable

The last remaining gaps in the current timetable are filled with special trains for events (such as the national Swiss wrestling tournament, transport of sugar beet or a tour by Circus Knie), with works trains (e.g. for engineering works or measuring runs) or with international special trains. The timetable's stability is monitored continuously. Opportunities for improvements are identified and implemented in the next timetable.



## Timetable planning in five dimensions

Demand forecasts determine the services offered. The offering and the timetable determine the functional requirements in terms of infrastructure and rolling stock. The necessary finance is then sought, as availability of funds ultimately determines the timing of implementation.



## The hub concept

Travel times between the defined hubs (or nodes) is under one hour. Trains from all directions converge on the nodes before the full hour and depart from them just after the full hour. This results in short transfer times and good connections for passengers.

