ANNUAL REPORT

sma optimising railways

2014

To illustrate this year's Annual Report, we set out to find impressive facts and figures from the world of the railway. We found what we were looking for at our customers. The amazing examples come from projects all around the world that SMA was involved in during the year of the report.

Contents

Introduction

Dear readers,

The economic analysis of the development of railway systems and their efficient operation have always been key concerns for SMA. Irrespective of the way in which the networks, the governance structures and the extent of liberalisation are implemented in each specific case, the railway industry is faced with the challenge that productivity and short-term profitability often conflict with the actual investment cycles and long-term maintenance issues. Against the backdrop of a reduction in outlay on the part of many stakeholders, values promoted for almost three decades by SMA, such as sustainability, quality and innovation, are more important than ever. The aim of achieving more with fewer resources does not rule out these values – exactly the opposite is true.

In order to fulfil the needs of our customers and face the realities of our markets more effectively, we have set a strategic and organisational transformation in motion which will enable us to develop from an export company into an international corporation. One of our first steps last year was the establishment of a subsidiary in the USA – SMA Rail Consulting + IT, Corp. in southern California. Thanks to the opening of branches in key markets, we can offer our customers the flexibility they need, while the products and services are still based on our experience and historical identity.

Over the following pages, we would like to share with you various different experiences, points of view and impressions arising from our activities in 2014. In addition to the usual facts and figures, we will also be once again presenting a selection of specific projects – both typical and atypical – which reflect the range of our services and our work over the past year.

We hope you enjoy reading our 2014 Annual Report.

Eric Cosandey
CEO, Head of Consulting

Thomas Bickel
Head of IT

6.32 KILOMETRES

Every person in Switzerland travels an average of 6.32 kilometres by train per day. For the entire Swiss population, this corresponds to 51,442,272 kilometres or 1,284 circumnavigations of the earth.


ZUM POSTBAHNHOF

Increased traffic concentration in urban centres

In rail systems we can see two, partially conflicting, developments. On the one hand, the commissioning authorities and operating companies are primarily striving for increases in productivity – using less material and manpower resources is intended to improve operating profit. However, this often results in suboptimal infrastructure utilisation. On the other hand, infrastructure managers in the urban centres in particular are being confronted with increasingly high-frequency systems and are forced to provide additional capacity. In this context there are two basic options: new infrastructures, which necessitate high levels of investment, and operational optimisation activities, which are comparatively low-cost.

Planning and controlling operations For railways, the interplay of numerous technical and operational components results in an operational concept. Railways are required to organise and run operational workflows in the best possible way, within a specified framework of infrastructure and resources. Below, we will examine three core issues that are to be taken into account to ensure that a railway is operated according to plan: passenger changeover time, timetable vs. interval frequency and incident management.

Where capacity is tight, passenger changeover times are to be minimised. Boarding and alighting a train depends on a series of parameters. The properties of the rolling stock, for example with respect to the number and width of the doors, are a significant factor. With double-decker trains, passenger changeover takes considerably longer. Of similar importance is the design of the station, such as the width of the platforms, the number and design of the entrances and the lighting in the walkways and waiting areas. The quality of passenger information, both visual and audio, also plays an important role, and the great variety of different needs has to be taken into consideration. For example, it may be necessary to deploy staff to assist travellers or even introduce platform gates.

The timetable forms the basis of every railway operation – and the aim is to adhere to it. This works as long as there are no incidents and every train can travel along the path it is assigned to. In very high-frequency systems, such as main RER lines and metro networks, a high train interval frequency may have priority over the timetable. In order to achieve as high a capacity as possible, the trains are then operated at headway distance. In complex situations, objective criteria help train controllers to decide when adhering to the timetable has priority and when efficient headway management is to be used to minimise the effects of an incident. Effective operations planning is absolutely necessary in order to be able to find the ideal solution for high-frequency systems.

Minor irregularities go virtually unnoticed by the passengers. However, major incidents often have far-reaching consequences in high-frequency systems. A crucial issue is rolling stock and staff rostering. It must be ensured that travellers reach their destination within an expedient period of time and that the drivers and rolling stock are in the right place after the incident has been dealt with. Possible causes of incidents and appropriate mitigating actions can be defined well in advance and recorded in great detail in operations and incident scenarios. Checklists specify what the response should be in ongoing operation. In traffic control IT systems, these scenarios can be prepared as backups so that they are available immediately in the case of an emergency. Incident management in high-frequency networks,

where the changeover from timetable to frequency based management takes place, is particularly important. The train control centre must communicate information without delay to the driver, who may have to head to a new destination. The stations and, of course, the passengers themselves must also be informed of route changes and new connections.

New traffic control options thanks to automation A feature that today's control systems all have in common is that the train controllers no longer have to actively operate the points and routes. Instead, current train control systems independently map all trains on the line and ensure that they travel on the right tracks in the right order. This lessens the workload on the train dispatchers, who can then dedicate their entire time to incident management and network-wide coordination. In urban centres in particular, specially adapted systems, such as Communication-Based Train Control (CBTC) and the European Train Control System (ETCS), make it possible to optimise the train headway and also improve the traffic control intervention options.

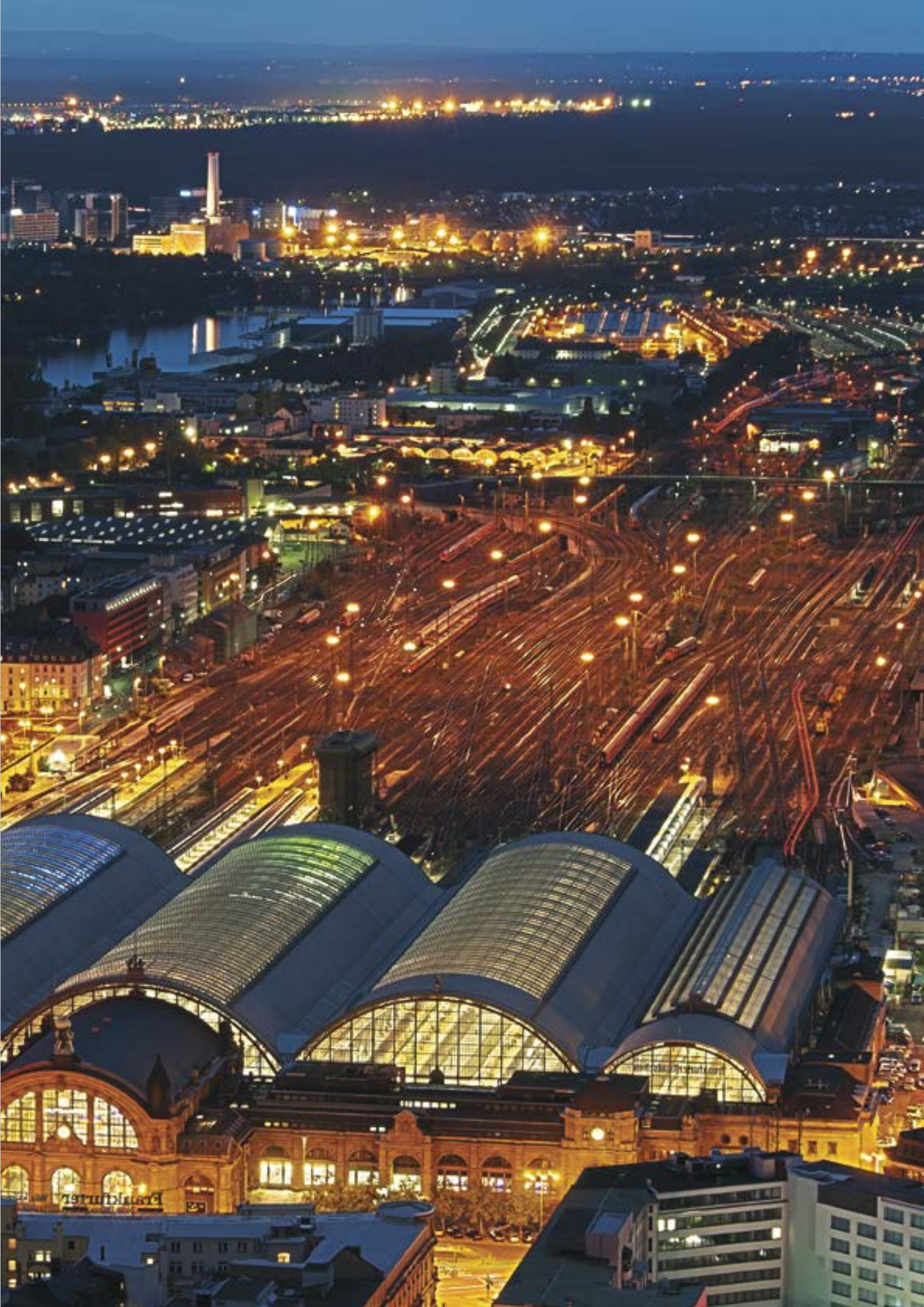
Automatic operation with driverless, computer-controlled trains goes a significant step further. This makes it possible to utilise the technical capabilities of modern signalling systems more effectively and reliability improves overall. Operations management is simplified due to the fact that the train controllers can intervene directly in the trains' movements. Independence from the drivers' operating schedule opens up completely new traffic control options and facilitates significantly more efficient incident management. However, to be able to use these new options, appropriate traffic control and assistance systems are required.

What does SMA offer? SMA has been working with operators of highly complex, high-frequency systems, such as the RER lines in Paris, MTR in Hong Kong and the Santiago Metro, for three decades. Therefore we understand the interaction between the system's stakeholders and can evaluate operation strategies, develop action catalogues and quantify influencing factors. We analyse possible new strategies, processes and technologies with stage-compliant precision and appropriate tools, as no matter how high-frequency and complex a system is, there is always room for optimisation.

1,027,850

LINES OF CODE

The current version of Viriato 8-FF contains 1,027,850 lines of code. With Arial 12 point font, it fits on 16,837 sides of A4 which would stretch out for a length of approximately 5 kilometres if they were printed off and laid one after the other.



The effects of railway liberalisation, based on the example of Germany

In the past twenty years, most European states have liberalised and privatised rail transport in one way or another. As SMA has been advising both the train operating companies and the infrastructure managers and authorities for almost thirty years, we can evaluate this liberalisation plan so far from the point of view of a traffic planner.

Local trains: competition for the market In Germany, rail-based local passenger transport has been the responsibility of the individual federal states since 1996. They organise and commission the appropriate services. The contracting bodies call for tenders to identify the "best" train operating company for each specific network. The regionalisation of the railways can be seen as a success story as far as the range of services and the economic feasibility are concerned. Quality has improved, the services have been expanded, additional lines have been added and passenger numbers have increased. As the provision of services is subject to competition and is up for tender amongst the train operating companies, the prices of the services ordered have actually decreased.

Long-distance services: competition in the market Liberalisation enables each train operating company to offer transportation that is financially self-supporting. However, with respect to long-distance services, the market has not developed as hoped. Changes to service levels are very difficult to implement due to the local train contracts which are fixed on a long-term basis. Although large amounts have been invested in infrastructure projects, there have been no great successes. Passenger numbers have reduced and long-distance services have increasingly pulled out of the regions.

One reason for the decreasing demand are the new long-distance coach services. These are particularly successful in Germany, where the coach operators are subject to virtually no legislative restrictions. They do not pay tolls or any other charges and have a virtually free choice of routes. Journeys are therefore significantly cheaper and, in Germany in particular, lower cost tickets are often preferred in comparison to the higher level of comfort offered by a train.

Deutsche Bahn has now responded to competition from long-distance coaches with a counteroffensive – the new long-distance services strategy, which was presented in March of this year. This includes a significant expansion of the line network, better interchange connections, shorter travel times and cheaper fares that are aimed at enticing passengers back to the railway.

International services International long-distance services are seen as one of the main concerns for European rail policy. Despite the existence of the EU, national borders still have as much impact as before. The only segment to have proven successful is the London–Paris–Brussels–Amsterdam–Cologne system which is linked to the Eurotunnel – however it has only been possible to operate this profitably because the nations involved assumed the debt incurred for the construction. Although the customer pays a high price for the journey, the rail service beats any of its competitors, with its travel time of two hours from London to Brussels.

In the 1990s, there were other highly promising projects in the area of international long-distance services, including the development of Thalys as a joint venture between the national railways. This service links France, Belgium, the Netherlands and Germany. However, Deutsche Bahn has withdrawn from this joint project. Today, it no longer sells tickets for the Thalys and instead operates its own ICE connection to Brussels.

Drawbacks and limitations of liberalisation Due to local train service provision tendering, the system is now determined to a large extent by the contracts with the train operating companies. These no longer see the railway as an overall system but operate as economically as possible and, on the basis of their contractual obligations, they calculate how they can generate income under specified general conditions over many years. If part of this constellation changes, the calculations will not work out as the company planned. Consequently, the provider is not interested in major changes. The market is therefore "frozen" to a certain extent for the duration of the transport contract.

These transport contracts are not only limited with respect to time but also geographically. In Germany, for example, this has led to the problem of incompatible infrastructures and unsatisfactory services being exacerbated. The situation is particularly serious at nodes such as Hamburg, where several states meet. As the federal states involved have totally different transport concepts, and it is not in the interests of any operator to ensure that the trains run non-stop, some trains wait at the main Hamburg station for up to 40 minutes.

Visionary transport policy Long-term transport policy is well worth investigating. The more regions only concern themselves with their own local rail network, the more difficult it will be to find cross-border solutions. Passengers – and also the providers – would benefit from a system that takes all services and all users into account and does not only serve politically separate systems. Stakeholders are required who hold the liberalised rail system together.

Twenty years ago when integrated fixed-interval timetables were introduced in Germany, SMA was able to contribute to changing the railway landscape fundamentally. Today, with an innovative planning approach, we have again identified an opportunity to create the basic framework for successful liberalisation – by introducing methods and tools based on path catalogues, which ensure flexibility for the train operating companies without lessening planning stability for other stakeholders. In the path catalogue, particular slots are pre-constructed and these can be selected and ordered by any train operating company. The infrastructure operator provides the path, not only in terms of construction but also in terms of operation. Thanks to a path matrix pre-defined in this way, the market can be fully liberalised – and the system nevertheless works optimally as an entity. This makes it possible for the advantages of liberalisation – a better service offer with lower costs – to be passed on from the local service network to long-distance services.

90 TRAINS

90 trains travel every hour along the North–South connection in Brussels. Laid one after the other they would reach a length of approx. 20 kilometres – greater than the diameter of the Brussels urban area.


BOZAR EXPO
CY TWOMBLY
PHOTOGRAPHS 1951 - 2010
01.02 > 29.04.2012
Retrospective
Per Kirkeby
10.02 > 20.05.2012

Improving capacity planning and allocation

The current capacity planning process does not take all the specific needs of suppliers and consumers of rail capacity into account. SMA has developed methodologies and tools using a path catalogue that allows infrastructure managers (IM) to support the longer-term requirements of train operating companies, while preserving the short-term flexibility required by freight operators in a single timetabling process.

Different requirements The path request period typically ends in April, a full eight months before the entry into service of the new timetable. Freight operators need greater flexibility than this in order to manage the inherent market volatility of their businesses. One of the major challenges for them is to anticipate their commercial requirements, as planning one year ahead is far too early for them. Typically they submit their capacity requests through the "last minute" process for allocating the residual capacity, as this is more aligned with the reality of the freight transport market. The "last minute" allocation process usually starts several days prior to the specific operating day, and offers paths from the remaining unplanned capacity.

While freight train operators need maximum flexibility, passenger train operators require long-term capacity planning. The "last minute" allocation is obviously too late for passenger train operating companies (TOCs), regardless of the degree of market liberalization, as they need greater visibility and security of allocation. Their role may even involve procurement of new rolling stock, recruitment and training of staff and the certification and regulatory requirements when commencing new services.

Capacity management is one of the tasks of an infrastructure manager – in addition to maintenance and line upgrades. They have to respond to both passenger and freight TOC requests and their differing operational needs, while anticipating conflicts that may arise between these requests.

Institutional process First, a European Directive specifies the use of a framework agreement that defines the required and offered capacity of the infrastructure over a period of time, in principle up to five years. It does not normally specify train paths in detail; however, it is possible to define some key functions it has to fulfil. The framework agreement provides benefits to both parties, as it enables the TOCs to prepare for the operation of their services (including any required investments) and to plan their core economic services, while helping the IM in their capacity planning and infrastructure works processes. Nevertheless, because it does not precisely define each path the framework agreement cannot provide sufficient reassurance for the TOCs. Hence, there is a step missing between this agreement and the current path request period that allows more precise capacity planning.

A Memorandum of Understanding (MoU) then formalises the relationship and intentions between parties. Ideally the IM could develop a path catalogue that is published sufficiently in advance of operations. They enable TOCs to invest in assets such as rolling stock procurement and to generally plan for the operation of their services. For the IM the MoU allows them to anticipate the capacity allocation decisions between paths and engineering works.

Even though the tools presented above help to structure the interactions before the annual capacity planning and path allocation process, the current process itself does not fully support the requirements of the TOCs because it comes too late for the passenger operators and too early for freight business.

Dynamic path allocation based on a pre-constructed path catalogue The solution could be a capacity planning process comprising a separate passenger path allocation sub-process, followed at a later stage by a related freight path allocation sub-process. An anticipated passenger path allocation sub-process, beginning perhaps two years before the commencement date of the timetable, would standardise the whole process with each requestor of passenger paths working simultaneously with the same rules. The link between the two sub-processes (passenger and freight path allocation) should be fixed through the creation of a single passenger and freight path catalogue.

How can the freight capacity planning be integrated into a previously planned path catalogue while maintaining the freight operator's short-term needs? The methodology developed by SMA together with DB Netz in the "neXt" project is a dynamic path allocation process based on a pre-constructed passenger and freight path catalogue. In this path catalogue the capacity available for freight services is reserved by multiple short sub-paths which can be assembled later into full freight paths during an optimisation process using an allocation algorithm. Passenger and engineering work capacity allocation is planned within a separate sub-process using the same path catalogue.

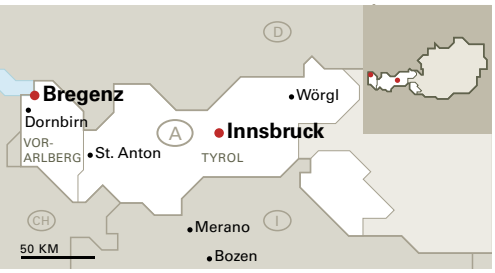
This new planning methodology, using a path catalogue as the basis for protecting the fair allocation of capacity between different types of railway stakeholders, combines the requirements of long and medium-term capacity planning (primarily for passenger TOC's and the IM's infrastructure projects) with flexibility for the variable short-term freight market. The path catalogue brings flexibility for freight traffic through the short-term dynamic freight path allocation sub-process, which does not interfere with the longer-term passenger path allocation process. Thus, the path request period no longer has to be compromised by the conflicting requirements of the passenger and freight planning needs.

1,000,000 WAGON LOADS

In 2014, BNSF in North America transported more than 1 million wagon loads of agricultural raw materials. This is enough grain to supply 900 million people with bread for a whole year.

Source: www.bnsf.com

A selection of projects from 2014



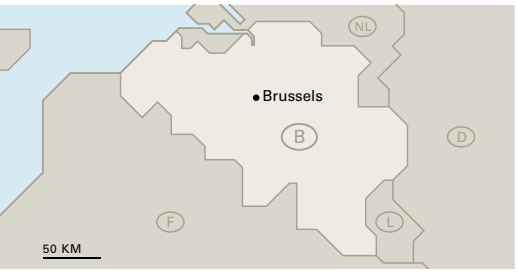
Line linking in west Austria Long-distance services on the Vienna–Salzburg–Innsbruck–Zurich/Bregenz line via the Arlberg are to be expanded into an hourly system from 2017 in order to link west Austria to the other parts of the country more effectively.

The Tyrol and Vorarlberg states commissioned SMA to create and test several variants. For the long-distance Railjet train, we based our study on various stop patterns and an hourly interval, and investigated various approaches to shortening the travel time between Vorarlberg and Salzburg. A target status with 202X as the horizon was defined for the service plan. In both federal states, the 202X horizon assumes further structuring and an additional expansion of the local train services, and it includes minor infrastructure activities on a timetable-specific basis. Furthermore, we also investigated integration of the transport in the neighbouring states, in order to identify improvements in this area as well.

Consultation activities aimed at ensuring a coordinated concept for both states are currently in progress, where we are comparing and evaluating the feasible variants with respect to a variety of criterion. As soon as the concept has been agreed on with ÖBB, preliminary stages for 2017/18 are to be developed.

Viriato.Enterprise at SNCB The Belgian train operating company Société Nationale des Chemins de fer Belge (SNCB) has, for many years, been using Viriato for long-term studies and for creating the annual timetable. In order to cover all planning phases during the course of a year, including short-term planning, it is putting its faith in the new Viriato.Enterprise solution. This provides a flexible train model with which the daily deviations within the transport period and the changes at different times of day can be mapped in a train family. Furthermore, the solution can also map the development of the available infrastructure, train paths with connections as well as the portioning and coupling of trains. Due to the new functions of Viriato.Enterprise, SNCB is able to perform all timetable creation steps with a single system and therefore to validate and optimise its entire offer to customers.

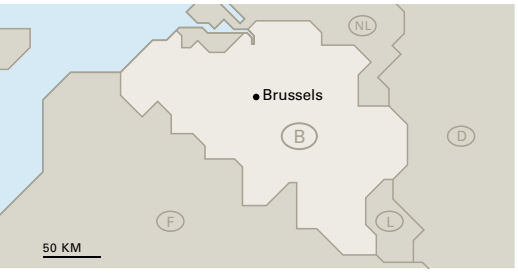
The company also plans to integrate the solution into the SNCB timetable creation chain by means of a newly developed interface, to enable it to request paths from the Infrabel infrastructure manager and to compare the network data with Infrabel. This integration is aimed at improving the consistency between the requested paths and the paths actually provided by the infrastructure manager.



ZLR at Infrabel In 2013, Infrabel launched an important project for the introduction of a new operations management system which is based on the RCS (Rail Control System) solution, developed and operated by SBB. Within the framework of this project, which is being implemented for the most part by the IT company CSC Belgium, SMA supplied the ZLR running time calculator as the core element of the system. The SBB traffic control system also uses an identical component, thus ensuring trouble-free integration into the new Infrabel traffic control system.

In addition to providing the software, SMA supported the specialists at Infrabel with the parameterisation of the running time calculator, whereby the special characteristics of the Belgian network had to be taken into account. Infrabel also commissioned us to create a rolling stock database containing all the vehicles deployed by SNCB, in consultation with SNCB. By using the same vehicle data and an analogous calculation algorithm, the running times calculated by SNCB match those of the infrastructure manager well.

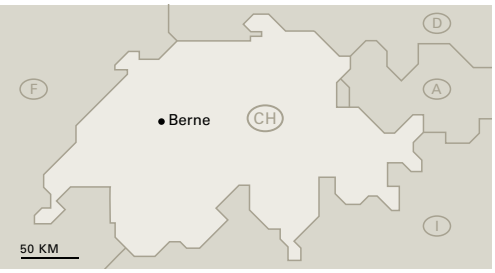
The feasibility of the new traffic control system was verified at the end of 2014. Integration and the system launch will take place in the next two years. SMA will continue to have a consulting role in a variety of areas and therefore play a part in the success of the project.



2013–2025 multi-year investment plan for SNCB Transport As the multi-year investment plan of SNCB Transport was expiring, SMA carried out studies beginning in 2013 which revealed that the targeted scope of services cannot be achieved without additional infrastructure, over and above those contained in the investment plan. To optimise productivity, SNCB Transport commissioned SMA to investigate the service plan and the possible timetable in detail, taking only the implemented infrastructures of the multi-year investment plan into account.

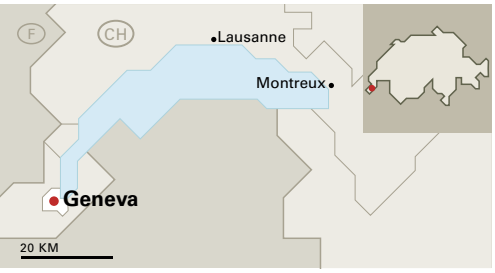
The aim of this study was to determine the extent to which the services could be expanded with the planned upgrades in order to meet increasing demand. SMA developed two scenarios for the entire Belgian network to enable them to find out which trains can be provided and the reason why some cannot, and to identify where the weaknesses of the future design of the network lie. The systematic intervals and the optimisation of numerous connections also played their part in achieving travel time reductions and extending them to the entire network.

A comparison with the new transport plan from December 2014 also led to optimisation of both scenarios by analysing the travel time and the connections in comparison with the current timetable.



Introduction of Viriato 8 at SBB SBB have been using Viriato for service and operation concept planning for many years. The medium to long-term studies and timetables are created with this system. The selected variants are integrated into the downstream NeTS path system, where they act as the basis for the detailed annual timetable.

Viriato's main characteristic is that it facilitates an efficient, detailed comparison of a large number of timetable variants. In order to continue to be able to benefit from this flexibility, SBB has decided to introduce version 8 of Viriato, migrated onto the .NET platform. With a group of Viriato users, SMA defined and then implemented the functions required at SBB over and above the standard product scope. Focus was placed on the rules for calculating the railway timetable times, the use of train dispatch times and linking Viriato with the downstream NeTS system. Due to the regular delivery of interim versions, we were able to ensure that the developed functions were in line with the user requirements and therefore met with a high degree of acceptance. Furthermore, it was also important that the new version replaced the old system without data being lost or production being interrupted.



Studies for optimising the service, operation and construction phases for the Geneva underground station For the 2025 upgrade phase as part of the STEP project, the city and canton of Geneva, SBB and the Swiss Federal Office of Transport (FOT) declared themselves in July 2013 to be in favour of an underground station for Geneva. Since then, various studies concerning the infrastructure and operation have been carried out in order to determine the feasibility and the costs of the project.

SMA was commissioned to verify the compatibility between the service plan and the infrastructure for the 2025 horizon and thereby to optimise the infrastructure required. The planned services and operation within the station, including shunting between the platforms and the sidings and maintenance facilities, were to be safeguarded.

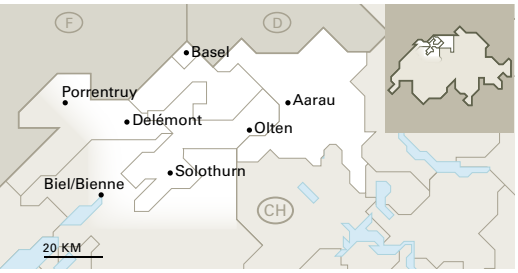
The individual construction phases were investigated in detail in order to meet the service level goals of the partners involved as far as possible. The study was intended to ensure operational feasibility and to determine realistic stages for the construction phases on the basis of the information provided by SBB and the engineering agencies.

SMA also investigated upgrade phases extending beyond 2025, and identified opportunities for upgrading the infrastructure in line with the required service development.

FOT: Biel–Basel/Olten line Within the framework of the construction activities at the Lausanne node, which are part of the Léman 2030 and ZEB (later the STEP) project, SBB and the Swiss Federal Office of Transport drafted a basic timetable for the period from 2016 to 2025. This timetable provides for a half-hourly interval on the "Jurasüdfuss" route, where the Lausanne–Biel–Basel ICN is shifted by 30 minutes. This has consequences for north-western Switzerland, in particular for the structure of the services between Biel and Basel. From 2016, a shorter shuttle train will travel on the Basel and Biel section, with a connection in Biel in the direction of Geneva.

On behalf of the FOT, SMA investigated various possible timetables for this "shift" variant (changing the entire Biel–Basel structure by means of a half-hour shift of the Basel–Biel–Lausanne ICN), accompanied by the creation of an additional, fast Delémont–Basel service integrated into the Basel 00 node, in order to comply with the wishes of the partners.

SMA helped the partners to agree on the best variant. On the one hand, this takes into account the basic framework and the interdependencies between the rolling stock, service plans and construction activities on the track and in Basel. On the other hand, it allows for the integration of other paths, especially those of the S-Bahn and international freight traffic, in the Basel node in the most effective way.

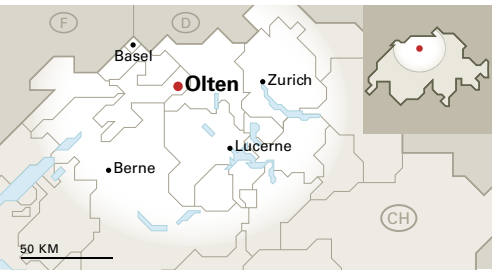


Northwestern Switzerland planning region: support for submission for the 2030 STEP Upgrade Phase The Swiss Federal Office of Transport requested the Swiss planning regions to submit their targets for local services as part of the planning process for the 2030 STEP Upgrade Phase. SMA supported the Northwestern Switzerland planning region (NWCH), which includes the cantons of Aargau, Basel-Landschaft, Basel-Stadt, Bern, Jura and Solothurn, with devising the service targets and creating the documentation.

In close cooperation with the cantons, SBB and the numerous private railways, SMA drew up extensive information. For example, we identified the demand to be expected in the future for the lines of the private railway companies. On the basis of a detailed analysis of the strengths, weaknesses and future requirement, the target services for the 2030 upgrade phase were defined, which also had to be coordinated with the regional development planning and the long-term service targets of the Federation. The key issue for submission to the FOT was to provide extensive justification of the practicability of the more than 50 precisely described service targets and the approximately 30 new stops. From the viewpoint of the region, the key activities include through lines for the tri-national Basel regional S-Bahn, the provision of services to the central city, additional capacities and higher-frequency services in the Biel–Olten–Aarau–Zurich and Biel–Delémont–Basel areas.

The planning region placed a great deal of importance on an optimal local service network and coordination with the long-distance services and the targets of the neighbouring regions. An issue that should be highlighted in particular was the construction and target-oriented coordination between the contracting bodies and the transport companies involved, through which it was possible to complete the documents for submission to the Federation within a demanding timeframe.

In addition to extensive submission documentation for the FOT, SMA has edited an information brochure about the target service levels for 2030, designed for the general public.



Outline corridor plan at SBB Under the title STEP 2030, the service concept and the infrastructures required for this concept for the 2030 time horizon are currently being coordinated and defined under the direction of the Swiss Federation. At the same time, studies for the subsequent time horizon are already underway at SBB Infrastructure. These "outline corridor plans" are aimed at identifying the infrastructure requirements in their individual regions, extending beyond the 2030 time horizon. In these plans, infrastructure activities that are necessary to manage the potential quantities determined for passenger and freight traffic based on a detailed service concept are defined. These outcomes developed as "guiding principles" form the basis of the infrastructure development and are used to evaluate all the future infrastructure projects with regard to their compatibility.

SMA supported SBB with the iterative development of service concepts, the analysis of capacity bottlenecks and defining functional infrastructures to rectify them. The starting point for this is the structure of passenger and freight traffic which is derived from population and freight forecasts. SBB has defined a set of known and new infrastructure elements for each corridor on the basis of these figures. The first concepts were based on this infrastructure and they link the timetable structures of the individual corridors into a single network.

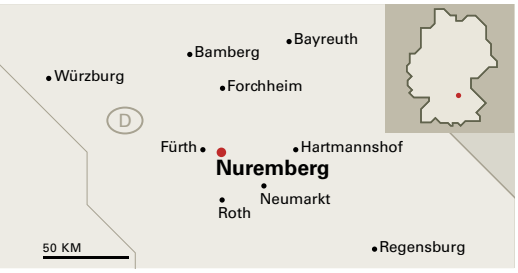
Local infrastructure requirements (e.g. grade separation at junctions) as well as the necessary, primary capacity elements (e.g. an additional double track between two junctions) can be derived from the drafts of these concepts. In order to ensure that these infrastructure activities will be adequate for the required capacity, numerous different service plans with the highest possible degree of variability are being investigated. However, it appears that the targeted maximum utilisation of the suggested infrastructures and guaranteeing a respectable service quality (evenly distributed, minimum timetable-related additional buffer times, etc.) limit the possible variants significantly.

Viriato migration, DB Regio DB Regio and DB Fernverkehr have been using the Viriato planning system since 1998 as a shared, standardised IT system for timetable planning. From 2015, the Viriato.FF project will ensure that DB Fernverkehr will be using an IT system which has significantly more functionality and which is tailored to the specific needs of long-distance services. As the timetable planning requirements for long-distance services and the local service network increasingly diverge, DB Regio has decided not to adopt Viriato.FF. Instead, a dedicated migration of the Viriato system to the new .NET platform has been performed, including the required DB-specific functions and interfaces from the previous system.

At DB Regio, Viriato plays a central role in the process chain. In addition to communication with the contracting bodies and commissioning authorities and planning within the framework of tenders, it functions in particular as a central data platform for supplying downstream IT systems such as resource planning. Furthermore, it is also used for communication with the DB Netz TPN path portal in the annual and sub-yearly timetable.

The migration was carried out with a lean project structure and a very tight schedule. Thanks to the agile development methodology, SMA was able to provide regular interim releases which were exhaustively reviewed by means of block tests with selected power users. These tests also provided valuable feedback with respect to acceptance and user-friendliness.

Path requests for the 2015 annual timetable were performed partly with the new system and it was used for the entire process for the outline agreement capacities for the 2016–2020 period. In April 2016, the more than 100 DB Regio Viriato users will, for the first time, plan the entire annual timetable, involving approximately 30,000 train requests from DB Netz, using the new Viriato 8 Regio.

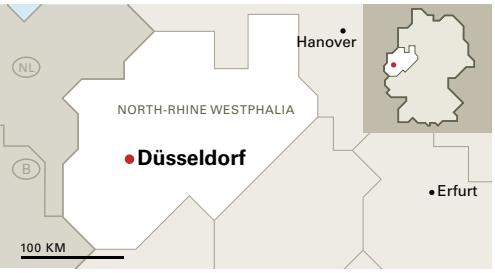


BEG: tender documents for the Nuremberg S-Bahn tender project In 2014, the Bayerische Eisenbahngesellschaft (BEG) put the Nuremberg S-Bahn transport up for tender and awarded it to National Express to start operation at the end of 2018. The Nuremberg S-Bahn has 224 kilometres of lines and a planned annual volume of 7 million kilometres of train travel. To prepare this tender, SMA carried out extensive studies on three subject areas on behalf of BEG.

First of all, an investigation was carried out to determine whether the 20-minute interval for the Nuremberg S-Bahn is the correct interval during the planned term of the new transport contract, or whether a 15/30-minute interval (15 minutes in the core zone, 30 minutes in the outer zone) would meet demand more effectively. The infrastructure constraints on various sections do not allow the S-Bahn intervals to be changed.

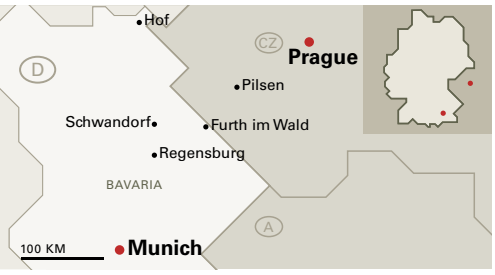
Finally, it was important to further develop the S-Bahn timetable, especially with respect to the infrastructure upgrade on the Fürth–Forchheim section, and therefore to also take into account changes in long-distance services. A new line concept for lines 1, 2 and 3, with the eastern line branches shifted by 10 minutes in comparison to today's timetable, was developed as the target variant. The target concept facilitates precise 20-minute intervals on all line branches and creates a new service between Bamberg and Neumarkt (Opf), as well as between Roth and Hartmannshof.

As the tender was divided into lots, another component involved devising an incident concept for the Nuremberg S-Bahn and coordinating this with the infrastructure manager. Depending on the location and the extent of the incident, the concept specifies how traffic is best dispatched and, in particular, which lines run with which alterations. The main purpose of this concept is to govern incident handling if, as is possible, two train operating companies operate the Nuremberg S-Bahn in the future.



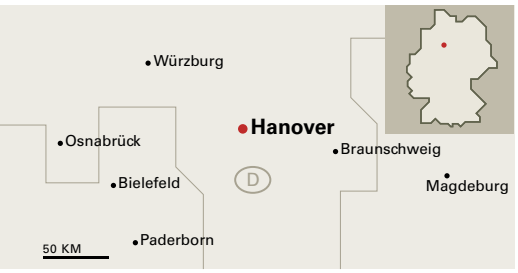
NRW outline agreement This year, SMA has once again closely supported the state of North-Rhine Westphalia, the ITF NRW Competence Centre and its commissioning authorities with respect to the further development of the integrated NRW interval timetable. The key focal points were optimisation of the tender networks, incident scenarios and options for modifying the services in selected corridors, including the quality of the customer offer. It was also important to continue planning for a 15/30-minute interval for the Rhine/Ruhr S-Bahn. This involved the possibility of combining both groups of intervals as well as the optimisation and detailed planning of the favoured variant.

Planning has now progressed and has reached the decisive coordination phase within the Rhine-Ruhr transport network. The concept provides for planning modifications in the central and northern Ruhr area and, in addition to new direct services, facilitates higher-frequency intervals in areas where demand is particularly high. The timetable plan can respond flexibly to the fluctuations in demand arising throughout the day. In addition to the plans, roster design and possible workshop locations were also considered within the framework of the project.



BEG: study on decreasing the time between Munich–Regensburg–Schwandorf–Hof/Prague To cover the distance between Munich and Prague by train – 300 kilometres as the crow flies – you currently need approximately six hours, which cannot compete with coach services or private transport. On the Czech side of the border, infrastructure upgrades which will reduce the travel time are being planned or are already under construction. A study commissioned by the Bayerische Eisenbahngesellschaft was designed to investigate whether and how minor infrastructure upgrades on the Bavarian side of the border could noticeably reduce the travel time from Munich to Regensburg, Hof, Pilsen and Prague. The long-term re-launch of a long-distance service between Munich–Prague/Hof with a target travel time of four hours is an important transport policy goal of the Bavarian state government, due to its inter-regional significance.

To improve quality, the service provision in the Munich–Regensburg–Furth im Wald–Prague and Munich–Regensburg–Hof corridor was revised. In cooperation with Schüßler-plan, an integrated service planning and infrastructure study was created based on various rolling stock combinations. The timetable-related study was aimed at identifying the feasibility of various concepts, considering appropriate train concepts, and deriving and planning the required infrastructure activities based on this. The main outcome of the study was a catalogue of minor infrastructure activities that will be required depending on the services offered and rolling stock variant utilised. This includes line refurbishment, including subconstruction, "faster" point motors, adapting track superelevations in order to achieve faster cornering speeds, station upgrades and the removal of cross-track platform access points. The costs and benefits (i.e. shortening the journey time) of each activity were identified in order to be able to prioritise the suggested upgrades.

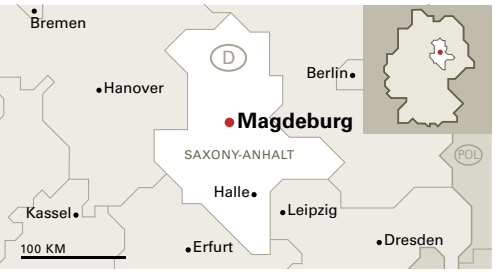


Scientifically-based railway operation study of the large network node Hanover

The large network node Hanover has a crucial location within the German railway network as this is where the high-frequency north-south and east-west axes cross. The corridors are already highly utilised by the long-distance services and the greatly increased amount of freight traffic. Furthermore, local trains use the lines meeting in Hanover, where faster RE lines overlap with the network of the Hanover S-Bahn which covers the local services. Due to this high level of utilisation, the Hanover node is constantly one of the most major bottlenecks in the German rail network in terms of service design and operational implementation.

As part of an operational study, several variants will first be devised on the basis of a macroscopic plan using Viriato. These variants contain additional services and concept modifications required by the commissioning authorities in connection with the corridors that meet in Hanover, and take the expected developments in long-distance services and freight traffic into account. Any necessary infrastructure activities will be derived on the basis of the concepts.

VIA-Consulting & Development GmbH will then investigate the microscopic feasibility using asynchronous simulation with LUKS. The work will be carried out jointly by the VIA-Con/SMA consortium.



Strategic service design, Saxony-Anhalt 2030 In the new German federal states, infrastructure renewal and the tendering of local passenger rail transport services is extremely dynamic. In a joint project with DB Netz AG, SMA has developed a state-wide integrated interval timetable for the 2030 time horizon for the state of Saxony-Anhalt. This service concept is used as the basis for the strategic focus of rail traffic and for the evaluation/prioritisation of infrastructure activities.

During the course of the project, an infrastructure list containing 85 activities was drawn up. Some of these activities had already been decided upon and for others it was necessary to determine the extent to which they are required for the 2030 service concept. It was possible to derive individual activities from the concept development and they facilitate optimisation within the service provision/rolling stock/infrastructure planning triangle.

The state of Saxony-Anhalt and its commissioning authority (NASA) used this opportunity to devise and examine alternative line/corridor-related timetable concepts. Many of these ideas have been discussed for a number of years and they were put on paper as part of the study and evaluated using concrete facts and data. Some of the alternative approaches eventually found their way into the final version of the 2030 strategic service concept for Saxony-Anhalt.

With the 2030 Saxony-Anhalt strategy, NASA boasts a concept that forms a solid, timetable-related basis for planning rail traffic in the coming years.

Extension of the RER E to the west – EOLE – operational studies Starting in 1999, line E of the Paris RER has been put into operation in stages between the east of Paris and Haussmann-Saint-Lazare, in the midst of Paris's business district.

A new project (EOLE West), which aims to meet the new requirements, has been launched to replace the originally planned western extension featuring connection to the tracks between the stations at Saint-Lazare and Pont-Cardinet. This includes an upgrade to services resulting from higher demand, an expansion of the La Défense connection by means of local public trains and a downstream service between Val-de-Seine and La Défense. This new project comprises a newly-constructed section from Haussmann-Saint-Lazare, which will initially serve La Défense and then the Nanterre-La-Folie district, before it connects with the existing tracks from Saint-Lazare towards Mantes-la-Jolie and Normandy.

Interestingly NExTEO, a new signalling and operations control system based on CBTC technology, will be used on this route for the first time.

SMA was commissioned to carry out the operational study during the project phase. It was important to provide detailed information on the studies from earlier phases in order to verify the robustness of the intended timetable. The effects on the transport company's resources, such as rolling stock rosters and the expected driver requirement, were also to be identified. Finally, the interfaces with other traffic in the direction of both Normandy and Champagne had to be coordinated.

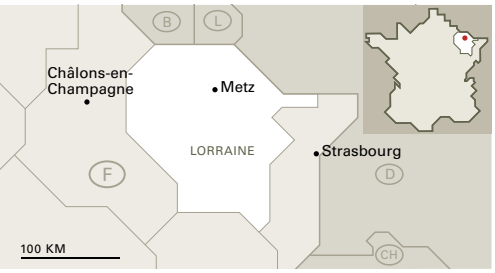
The study was carried out to investigate the extension of the tunnel in Nanterre-La-Folie and the scenario of a connection to the "Groupe V" from Saint-Lazare (launch of the western services), where a variety of variations were tested.

Operational study and phasing-in of the upgrade measures on the Paris–Villeneuve axis and in Paris Gare de Lyon Headed by SNCF and RFF and supported by the state, the Île-de-France region and the STIF agency responsible for urban transport, several preliminary studies for upgrading the Paris Gare de Lyon–Villeneuve axis were carried out. The studies were aimed at identifying activities for expanding the services of various train operating companies at Paris-Lyon and Paris-Bercy stations. Furthermore, they also gave the project stakeholders of the R, RER D and LN 1 lines who are responsible for developing service plans the information they needed concerning the challenges at this complex railway node.

In an operational study, SMA identified the upgrade activities required for the planned long-term service level expansions. Splitting these activities into interim stages made it possible to determine an optimal implementation sequence.

The first part of the operational study uncovered the effects of the currently valid operational regulations on platform occupancy at the Paris-Lyon and Paris-Bercy stations, and demonstrated how operational process times can be optimised and additional capacity can be achieved at the station. On the basis of new operational regulations and with the aid of the QuaiOps tool from RFF, nominal platform occupancy diagrams over a period of 24 hours were created for the study's scenarios.

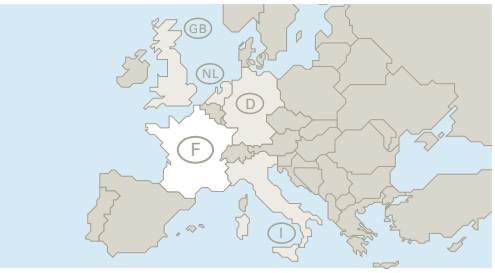
The calculation of the separation times for the various arrival and departure paths at the two stations also facilitated determination of the capability of the technical systems. With this data, it was also possible to apply a statistical approach to investigating the station's operation in the event of incidents.



Lorraine Regional Council: support for the project management As part of the revision of the agreement between the Lorraine Region and SNCF, the Lorraine Regional Council required detailed insight into the costs for services in the year 2014, in order to be able to compare this information with the quotation from SNCF. As a subcontractor of CFTA, SMA investigated all the services on the basis of the available data on the timetable and the rolling stock. Dialogue was then entered into with SNCF about their quotation for the services for 2014 and about the differences identified, as well as the preparation for the second project phase which provides for the introduction of interval services in the 2016 timetable requiring a fundamental realignment of the timetable structure.

In this context, SMA created new versions of all the Lorraine TER timetables and the rosters for rolling stock and staff, in order to ensure the operational feasibility of the interval timetable before it was submitted to SNCF Réseau for validation. To make it possible to take full advantage of the optimisation potential of the interval timetable, SMA also proposed improved timetable intervals on the basis of which significant increases in productivity can be achieved and more train kilometres can be created with the same contribution from the region. The results were produced during an iterative process with SNCF and the TER customers within the framework of several public events.

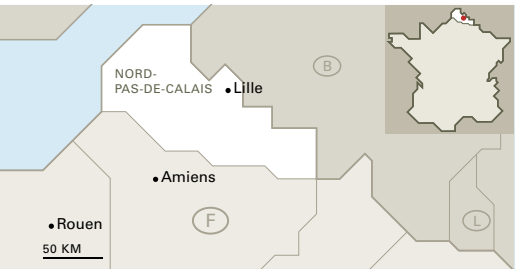
This brief also enabled us to address the issues of engineering work timetables and operational stability in various tests performed for the region, and to investigate them in detail. The Regional Council teams also received training.



Comparative study on path allocation in Europe The French Railway Regulatory Body (ARAF) commissioned SMA with a detailed review and benchmarking study of capacity allocation of rail traffic in four European countries (Germany, Italy, the Netherlands and Great Britain) and a comparison with France, in order to gain insight and identify recommendations for the French system.

The experts from SMA surveyed the most important stakeholders in the four countries (infrastructure managers, national and private train operating companies for passenger and freight traffic, regulatory bodies, universities, etc.). This analysis involved, for example, the process for creating the annual timetables (submission, outcomes, methods and planning calendars, etc.), planning construction activities, distributing the path capacity and construction activities, short-term timetable modifications and allocating any remaining capacity. Information from the SMA experts made it possible to identify the difference between theoretical principles and actual practices, the extent of which differed depending on the country.

Finally, a study of the European regulations and the political environment provided the background information for the comparative analysis of the processes in the four countries and their comparison with France. From this, service factors could be determined which can be applied to the French system and recommendations for its improvement were derived.



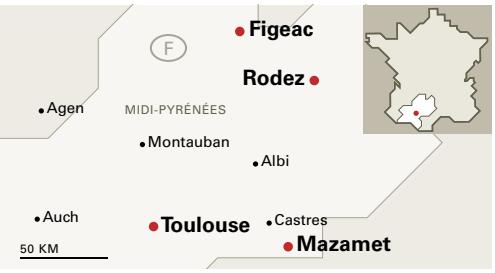
Forecast study for the Nord-Pas-de-Calais railway network 2020–2030 This study, which was carried out jointly by the Nord-Pas-de-Calais area management team of SNCF Réseau (previously RFF), the Nord-Pas-de-Calais region and the state (DREAL), investigated the future development of the rail network in Nord-Pas-de-Calais after the project contract between the state and the region (CPER) has expired. The long-term strategic aim is to configure the future network in line with the quantity and quality-based goals of the partners and the financial capabilities of the stakeholders and local authorities. Next year, the study is intended to result in an investment plan with appropriate further studies as part of the aforementioned CPER.

The preliminary work carried out under the auspices of the study in 2014 facilitated a detailed analysis of the present status and the limitations that exist within the network. This resulted in six regional service scenarios which take into account the various different service development forecasts for rail traffic and its organisation. The partners devised and investigated these scenarios on the basis of the outcomes from various discussions which SMA had held with the commissioning authorities for regional and local train services (general councils, municipal authorities, various SNCF Mobilités departments and the ministry of transport).

Operational study on the RER E and the P roadmap The traffic forecasts for the RER P and E lines in Paris predict a significant growth in average utilisation at peak times and a correspondingly greater demand for seats. Furthermore, the socio-economic development will also be accompanied by a series of important projects which will have an impact on the RER P and E lines (extension of the RER E to the west, new stations, connections to new metro lines, the extension of tram lines, etc.).

As part of the further development of the network structure in this area, SMA was commissioned to draw up the operating conditions of a variety of future service scenarios in order to determine the required investment.

With the aid of the scenarios investigated, it was possible to identify the conditions for the extension of the RER E from Villiers-sur-Marne to Roissy-en-Brie for a transitional period after start-up of the western extension, to determine the additional infrastructure required, to analyse the timetable stability and to quantify the vehicle requirement on the basis of rostering. Furthermore, timetable frameworks for additional development scenarios were created which form the basis for coherent further development of infrastructure and service plans.



Operational study in the north-eastern sector of the Midi-Pyrénées Region
SNCF Réseau commissioned SMA to perform an operational study in the north-eastern sector of the Midi-Pyrénées region. This comprises three, mainly single-track routes that connect Rodez, Figeac and Mazamet with Toulouse. The background to the study was sensitive, as at the end of 2013 new systems were put into operation which were financed as part of CPER 2007–2013 and Plan Rail and which, contrary to all expectations, led to poorer service and punctuality levels. This was mainly due to new, restrictive path construction rules.

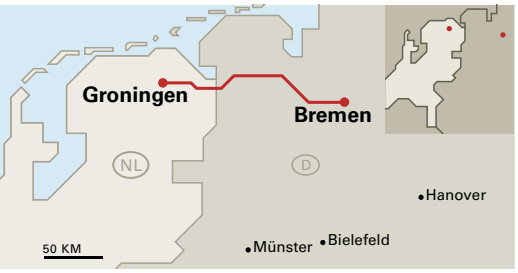
The study was commissioned to develop a proposal for a new timetable structure which, on the one hand, was to meet the original expectations concerning volume, frequency and travel time and, on the other hand, would increase the reliability of the timetable. An analysis and renewed investigation of the original service goals resulted in these being split into two categories: regular services distributed throughout the day and specific plans related to a certain point in time. This made it possible to create a basic timetable structure for the entire day which is supplemented by additional, systematic service at specific times of the day. The resulting 24 hour prediction met the requirements of the partners.

The study was completed with the agreement of all the partners involved on the choice of a scenario which will be pursued in the upcoming planning phases for the 2017 annual timetable.

Development of an OpenTrack data model for MTR Hong Kong The line network of the Hong Kong metro comprises 10 lines with 88 stations. Every day, the operator MTR (Mass Transit Railway) transports approximately 2.5 million passengers on its network. It is therefore one of the highest-frequency metro networks in the world. Many lines are operating at breaking point – further upgrades are planned, deeming it necessary to simulate operations in a virtual railway laboratory in order to be able to test possible changes.

MTR Corporation has commissioned SMA to create a microscopic simulation model for the entire metro network, including planned upgrades such as the South Island Line. We are modelling the approximately 200 kilometre network in the OpenTrack simulation tool and calibrating the model so that simulated incidents match real life situations with only a small deviation tolerance. Future upgrades or new operating strategies can then be verified by the program and assessed for their feasibility.

Intensive training at the customer in Hong Kong for the users who will work with the software and the data model in the future guarantees successful deployment of the model.



Wunderline – reduction of the travel time Groningen–Bremen The current travel time between Groningen and Bremen is 2 hours and 43 minutes. The Wunderline project aims to reduce the journey to less than 2 hours. The province of Groningen has commissioned SMA to examine 48 existing variants, to identify the most effective and to implement them in timetable concepts.

Our analysis presented the strengths and weaknesses of each variant and demonstrated the potential of the most promising variants. The timetable concepts take numerous factors into account: the achievable travel time, associated infrastructure activities, freight paths and integration into the long-term planning on both sides of the border. Various rolling stock concepts demonstrate how the local networks in Germany and the Netherlands are to be linked with a direct service.

The timetable concepts have shown that the Wunderline can benefit from the planned infrastructure activities and may therefore also be able to speed up other projects. In the study, we also analysed variants for interim stages in order to monitor the implementation of short-term activities, and we identified that the travel time can already be reduced by approximately 15 minutes.

The outcomes of this study are six different timetable concepts. They differ in terms of alignment, infrastructure activities and local timetable variants in the Netherlands and in Germany. It is now the turn of the politicians to make a strategic choice for more detailed investigation.

New Viriato licenses

New customers

- Herzog Transit Services Inc., Irving (USA)
- CNAM Conservatoire national des Arts et Métiers, Paris (FR)
- Parsons Brinckerhoff, Baltimore (USA)
- ZHAW Zurich University of Applied Sciences, Winterthur (CH)

Migration to Viriato.Enterprise

- DB Fernverkehr AG, Frankfurt (DE)
- SNCB/NMBS Société Nationale des Chemins de Fer Belges, Brussels (BE)

1,140,000

PASSENGERS

The RER A line in Paris carries 1,140,000 passengers every day. This is the same number of people as live in the entire Zurich urban area.

Events and publications

InnoTrans 2014 The tenth InnoTrans, which was held in Berlin from 23rd to 26th September 2014, attracted more exhibitors and visitors than ever before. Almost 140,000 experts from more than 100 countries visited the trade fair. InnoTrans was, of course, a highlight of the year for us as well. In a new hall, the CityCube, SMA was on show in the direct vicinity of Europe's largest railways and enjoyed visits from a large number of interested parties.

Publications

EURAILmag, March 2014	"Vanquish Myopia – From Investment to Sales in Timetable Production" Dr. Thomas Bickel, Eric Cosandey
SER 01/2014	"Schweizer Taktfahrplan und Netzgrafik 2014" Georges Rey, Werner Stohler
SER 12/2014	"Netzgrafik auf Basis von Viriato 8" Dr. Pierre Robyr, Matthew Holliday
Der Takt, winter 2014	"Zukunftskonzept Rheinland-Pfalz-Takt 2015 – Expertenkommentar" Georges Rey
ER International 11/2014	"Die Zukunft der Bodenseegürtelbahn" Michael Frei

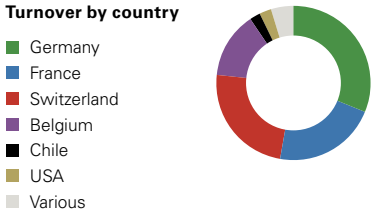
Key figures

Staff	
Employees (end 2014)	70
Equivalent full-time employees	61
Students	8 in Zurich
	4 in Lausanne

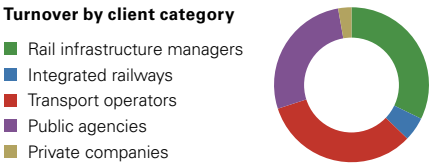
In comparison with last year, our turnover decreased slightly as a result of budget cut-backs at most of our European clients and significant investment – in particular in the development of Viriato. However, the 2014 fiscal year enabled us to further consolidate the position of SMA in our core markets and simultaneously to gain a foothold in new markets and services. The future will show whether this slight downturn has given us new impetus for a leap forwards.

Key figures in millions of Swiss francs	**2014**	2013
Gross turnover	**11.83**	12.50
Turnover/colleague (61 full-time positions)	**0.19**	0.20

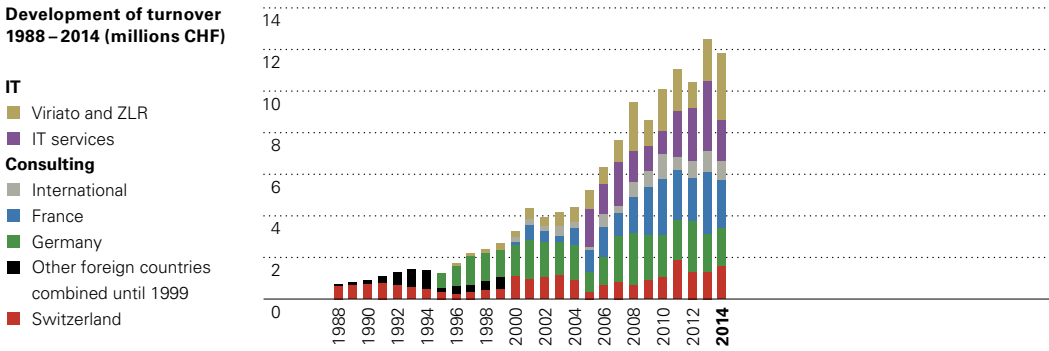
Turnover by country



Turnover by client category



Development of turnover 1988 – 2014 (millions CHF)



6.5 PASSENGERS

At the Metro de Santiago, 6.5 passengers per square metre is the declared target with regard to comfort. This corresponds to 46,410 people on one football field.

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