

ANNUAL REPORT

sma  **optimising railways**



2015

To illustrate this year's annual report, we have looked for unusual perspectives that describe our office locations: five exciting cities, five striking images and five special figures.

Contents

5	Introduction
8	Integrated mobility as the future of rail?
11	Going West: SMA in California
13	Viriato.FF – A Success Story
15	ZLR Running Time Calculator – Versatile use with Various Operating Systems
18	A selection of projects from 2015
36	Events and publications
40	Key figures
41	Publisher's imprint

Introduction

Dear Readers,

Against a backdrop of rapid economic, political and social change in the international arena, defining and implementing a clear business strategy has become a significant challenge. We have taken up this mandate and made strong progress last year in transitioning from an export focussed company to establishing an international presence with global field offices.

In 2014, we reported on the positive experiences recorded by our newly founded Californian subsidiary. Last year, in addition to our offices in Zurich, Lausanne and Santa Ana, we established further subsidiaries in Paris and Frankfurt. Existing employees, transferring to these new locations, bring with them 30 to 40 years of combined experience. The excellence and expertise expected by our clients is assured. Together, our different offices will enhance the development of the SMA brand, which is synonymous with high quality services and products worldwide.

The great deal of positive feedback we receive about our annual reports demonstrates that they are read thoroughly. We are delighted by the interest shown in our company. Once again, we would like to share with you the various experiences, points of view and impressions arising from our activities last year. Finally, to keep you constantly informed about the most recent developments at SMA, our website will be regularly updated with news about our current projects.

We now hope you enjoy reading our 2015 Annual Report.

Eric Cosandey
CEO, Head of Consulting

Thomas Bickel
Head of IT

With more than 2195 trains per day on average, Zurich's main station is now one of the world's busiest railway stations. Each day, 437 000 passengers pass through the station – in a city with a population of 405 000.



Integrated mobility as the future of rail?

The role of the railway in the changing mobility market

A discussion between Eric Cosandey, Frederik Ropelius and Luigi Stähli

Seldom have the circumstances affecting the railways changed so rapidly and extensively as at present. The overall costs of rail systems are increasing with little chance of passing these costs on to the users or the financing institutions. Alternative means of transport are making significant advances in efficiency and productivity, and are becoming competitive with respect to the advantages once unique to rail, for example, safety, environmental friendliness and attractive travel times. However, the current radical social and technological changes also offer great opportunities for the railways.

New competition for rail At first sight, rail systems worldwide appear to be similar in form, however the service planning and railway operations underpinning them differ greatly from one country to another. For example, in some countries timetable planning is strictly based on expected or actual passenger demand while in other countries a supply-driven interval timetable, based on the precept that good service generates the appropriate demand, is used. Despite these differences, the rail operators in many countries are equally aware that competitors of traditional public transportation are becoming stronger and that rail is at risk of losing some of its unique selling points.

Luigi Stähli: "In France, carpooling has gained a significant market share and plays a part in increasing the degree of utilisation per car journey. Long distance buses are now well-established in Germany and France and they are making headway in other countries too. Furthermore, new technologies, such as video conferencing, make some travel unnecessary."

The biggest revolution could be brought about by public autonomous vehicles, especially if they are electrically powered. The current unique selling points of rail – appealing travel times and environmentally-friendly mobility – may also apply to autonomous vehicles in the future. Autonomous vehicles will also offer further benefits, such as door-to-door service without the problem of parking: public autonomous vehicles will drive on to the next user after they have completed a trip. One of the main advantages of rail travel up until now has been that the time spent travelling can be used productively. This advantage may also soon be lost as public autonomous vehicles begin to operate. With no fixed timetables and no waiting times caused by infrequent intervals, public autonomous vehicles could render trains and coaches totally obsolete in rural areas.

Cost increase and individual solutions More stringent demands on infrastructure construction, operational equipment and rolling stock, as well as the push towards standardisation at the European level are increasing the construction and operating costs of rail systems. For example, signalling standardisation has not resulted in the replacement of diverse systems by one uniform system but, instead, the addition of yet another system. In themselves, European standards are both expedient and desirable. However when taken together, all the rules could mean that, at the end of the day, the overall system is difficult for public agencies and the passengers to finance.

Rail costs are also high due to the low level of industry standardisation and the requirement of customization. For example, virtually every competing local rail passenger transport network in Germany procures their rolling-stock in small orders. Cost benefits brought about by ordering standard stock are rarely utilised.

Advantages and opportunities of rail The imminent, radical, social and technological changes do, however, offer unique opportunities for the railways. Rail operation and use are plannable and reliable. Today, transparent timetable information, which is permanently accessible via a smartphone app, is already removing obstacles to rail use. The purchasing of tickets has been significantly simplified as travellers can buy tickets on their mobile phones for the best price at any time.

Furthermore, the railways boast competitive advantages which other means of transport cannot match. In densely populated urban centres where large traffic flows have to be accommodated, railways will continue to be indispensable in the future. It is expected that the S-Bahn and metro networks in the urban centres will generally be expanded. The advantages offered by rail for mass transit will become important and decisive for society in the future.

Rail is also unrivalled when it comes to transportation at high speeds. This applies to intercity travel with distances between cities of 50 to 200 km at speeds of 160 km/h and high-speed travel up to distances of 3-4 hours.

Frederik Ropelius: "In the future, railways will form intelligent networks with other means of transport to offer door-to-door mobility."

However, the greatest potential is in recognising that railways should play to their strengths and complement other means of transport. If rail service is combined with buses and public autonomous vehicles, new, intelligent door-to-door solutions will become possible. Autonomous cars or buses could, therefore, also represent a significant opportunity for railways as they would bridge the gap of the “last mile” conundrum. This also applies to freight transport which could benefit from autonomous vehicles as well.

Eric Cosandey: “When new modes of transport are developed, they must also be viewed as supplementary products for an integrated system, provided that they open up new prospects for public transport. In this context, a strong stakeholder (the state) should not only take on the role of a regulator, but also of a mobility integrator.”

As a part of an integrated system, the railways can concentrate on their strengths and become more efficient by simplifying and systemising service, operations and usage. In other words, railways can use the industrialised concept of automated metro systems as a role model.

Other structural improvements are feasible, such as the simplification of construction regulations as well as the standardisation and homogenisation of rolling stock for local and long-distance services. To achieve this, regulations must be scaled back and simplified in a pragmatic way, in order to improve the efficiency of the entire rail system.

Create networks – plan networks The fact that various countries consider completely different aspects of the railway system to be important shows – contrary to commonly-accepted opinion – how flexible the rail system can be. At SMA, we are very familiar with various railway models and their technical and institutional challenges in Europe and the USA. We identify areas of unnecessary complexity and can offer our clients suitable concepts aimed at simplification and standardisation. Instead of ready-made solutions, an understanding of the system and its unique intricacies is always required.

Some countries and regions already act as showcases for integrated mobility. However, the intensity of the integration depends on political will and technological possibilities. For many years, SMA has worked at the interface between the means of transport and their stakeholders. The company not only takes on the role of the planning partner, but also that of the mediator between those with a stake in the system and a catalyst for positive change.

“Create networks – plan networks” was SMA’s motto approximately 20 years ago and it is now more relevant than ever as the basis for integrated mobility.

Going West: SMA in California

When imaging California, visions of palm trees and endless beaches spring to mind. However, few people realise that California is also the most populous state in the USA with one in every eight Americans living there. Its population of 39 million people is expected to grow by a further seven million over the next two decades. California is an important economic centre, which when compared globally, ranks in seventh place ahead of Italy, Russia and Brazil. This is not surprising as the State is home to Silicon Valley, Hollywood and 80% of the global almond production.

In 2014 SMA opened its first US office in Santa Ana, Southern California. The interest in our specific know-how with respect to railway operations and long-term network planning is particularly pronounced in this densely-populated, highly-congested, poly-centric urban area. Southern California is not currently associated with high-performance public transportation. On the contrary, inhabitants in and around Los Angeles have little choice but to travel by car for most journeys. Since the 1950s, 500 miles of highways have been at the disposal of car drivers in Los Angeles County alone, but being able to enjoy the ultimate driving experience, which motorists presumably once did, is now a rarity.

On average, drivers in Los Angeles spend more than 80 hours in traffic jams every year. During rush hour, journeys take approximately 40 percent longer than when traffic is flowing freely. This figure is as high as 57 percent on the highways. In a 2014 study, researchers at Texas A&M Transportation Institute concluded that to reliably arrive on time, commuters needed to schedule 3.75 times the best possible journey time for a trip in Los Angeles. Mobility restricted to such a degree is unacceptable for one of the largest and most dynamic economic areas in the world. To combat growing congestion, ten years ago the region began the arduous effort of upgrading the public transportation system with a focus on railways. SMA advises operators, authorities and engineering offices in California in this context. Our planning methods, which have been tried-and-tested in Europe, have been adapted for the requirements of the USA; they facilitate targeted and expedient deployment of the resources available to upgrade and operate the railways. In southern California, where various passenger rail operators and freight rail companies share the rail network, SMA plays a part in ensuring that timetables are coordinated and built robustly. We are also supporting the state's Department of Transportation with long-term planning for the year 2040 in order to create a coordinated network with connecting nodes. We are proud that terms like "pulsed system" and "time points" are now used in the USA. SMA is even drawing up analyses and concepts for improving operation for the freight rail company BNSF.

Going west was the right decision for SMA. We are delighted to be able to support California in creating a world-class public transport network.

Viriato.FF – A Success Story

From the Vision to the Model In the autumn of 2009, due to the market demands for an increasingly customised service coupled with an upturn in construction activities, Deutsche Bahn's Long-Distance Services (DB Fernverkehr) division forecasted a four-fold rise in the number of train schedule modifications to be planned in the coming years. In response to this, the DB team responsible drafted a vision concerning how schedule planning will be dealt with in the future, taking into consideration the expected increased load.

Implementing this vision necessitated shifting away from the previous focus on a conceptual research tool to a fully-scalable and high integrity real-time system for 75 to 100 users involved in multi-year, annual and sub-annual scheduling.

It was soon evident that the Viriato application, which had been in use since 1999, would no longer be able to support this vision at the model level. The conceptual research tool was based too heavily on a fully fixed-interval timetable. As is the case with other IT systems, organic development over many years had caused Viriato to become too complex to allow for a complete change of the underlying model.

Concurrently, due to the anticipated end of the software lifecycle of Viriato, SMA had already completed the planning for fully refactoring the system, and the company began the appropriate implementation measures at the beginning of 2009. Furthermore, a fundamentally new model was devised which facilitates the mapping of a day-specific timetable and in which the fixed-interval model is now only an exceptional case. The second basic innovation at model level involved support for infrastructure versions and parallel variants, both with limited and unlimited timeframes.

This new model was implemented within the Viriato.Enterprise product and the tried-and-tested Viriato concepts were retained. As a result, it became evident that Viriato.Enterprise complied with the requirements of the DB «Timetable revision» (FF) long-distance services vision in virtually every respect.

Successful Implementation Together with DB Fernverkehr and DB Systel as the integrator, SMA began to implement the Viriato.FF system in spring 2012. Over a three year period, this team successfully guided the Viriato.FF project with its five releases, three of which went into production. The entire system went live in April 2015. Since then, just one critical error has necessitated a prompt fix. Without Viriato.FF, it would have no longer been possible for DB Fernverkehr to manage the expected increase in schedule planning.

The project lasted approximately 36 months and took up a total working time of around sixty person-years. At times, more than thirty employees were working on the project at SMA, and the average figure was 22 throughout the duration of the project – developers, architects, business analysts, testers, documentation authors, trainers and release managers.

A particular challenge resulted from the interplay between DB Systel's traditional waterfall project model and SMA's agile development process. This interface brought cultural differences to light which, however, were overcome through the shared desire to run a successful project and the professional conduct of all parties involved.

Basis for the Future The complete refactoring of Viriato and the integration of Viriato. Standard and Viriato. Enterprise at the model level has proven time consuming and complex. Achieving two milestones – Viriato.FF going live in the spring of 2015 and the completion of the new releases of Viriato. Standard and Viriato. Enterprise in autumn 2015 – constituted the successful culmination of this process last year.

The required investment and the numerous difficulties to be overcome could well be the reason why many other producers of capacity planning and capacity management software have not yet ventured down this path. With the successful completion of the Viriato transformation, SMA is well positioned for future challenges.

ZLR Running Time Calculator – Versatile use with Various Operating Systems

The running time calculator (ZLR) developed by SMA is deployed at SBB and Infrabel as a key element of the RCS traffic control system. ZLR acts as a service for the traffic control system and other client systems. It is integrated either via the high-performance Tibco messaging system or via the commonly-used SOAP/HTTP protocol.

The increasing demands on the performance of RCS have demonstrated that more time is needed for transporting the queries than for the actual running time calculation. Therefore the operational management of RCS requested that ZLR be run on a Linux system, as is network.

The advanced level of maturity of Mono, an open source implementation of the .NET Framework by Microsoft, enabled SMA to run ZLR on Linux. A Java wrapper was developed for the ZLR so that RCS, also developed in Java, could access it. ZLR can therefore be flexibly run under Java, C++ and Mono on Linux servers.

The deployment of the agile scrum development method facilitated implementation with short iterations.

50
PERCENT

Half of the 10,000 students studying at the Swiss Federal Institute of Technology in Lausanne come from overseas. This makes the EPFL the world's most international university.

LAUSANNE – THE INTERNATIONAL STRONGHOLD OF SCIENCE AND ENGINEERING



PEUGEOT LAUSANNE
DEMEURAGE
Ave rue de la concorde 24
CH AVANNE PRES-RENNES
021423-11-11

A Selection of Projects from 2015



Processes and IT Systems Audit for RNE SMA und Partner AG was commissioned by RailNetEurope (RNE) to carry out an audit on the Path Coordination System (PCS). This audit was divided into five work packages (WP) that cover the software development process of PCS in addition to the international timetabling coordination process.

Work package	Topic	Description
1	Interfaces	Analysis of the interfaces with national systems
2	Technical Framework	Analysis of the technical architecture of the PCS system focusing on performance, scalability, data model and availability
3	Software Development	Analysis of the software development process, including system test cases and software evolution, test processes and a high level source code review
4	Timetabling Process	Analysis of the strategic plans and processes for harmonising national and international processes and sub-processes
5	Alignment of Future Timetabling Requirements With PCS	Analysis of the structure of the delivered requirements and determines if they are implementable in the PCS system

The main method for assessing the different work packages was through structured interviews with PCS stakeholders lasting approximately one hour. Additionally SMA conducted a high level source code review of the new PCS Next Generation platform and a one day on-site visit to the development team in Skopje, Macedonia.

The audit found examples of significant improvements in the processes used at RNE regarding the development processes of the PCS during the last few years. In addition, the report identified areas for improvement in the software development process.



Harmonisation of the Cross-border Planning Processes and Models Between DB Netz and SNCF Réseau In addition to maintenance and operation, managing the network capacity is one of the main functions of an infrastructure manager (IM). In doing this, the IM not only has to take the different requirements of passenger transport and freight traffic companies into account, but also those of companies involved in the construction and maintenance of the network.

Whereas freight traffic requires maximum flexibility with respect to times, the passenger transport companies must ensure long-term planning of their service plan. However, how can freight traffic capacities be integrated into an existing catalogue of passenger transport paths, under consideration of the short-term requirements on international corridors? To answer this question, DB Netz and SNCF Réseau (before the start of a pilot project on the Mannheim–Paris corridor) commissioned SMA to organise and lead workshops on the harmonisation of the schedules and processes, as well as the planning and capacity management models.

With the help of these workshops, DB and SNCF were first able to determine the time-frame and the geographical scope of the pilot project, as well as draw up an initial draft of a joint process for planning paths and construction work. After this, a high-level object model, the terminology and the shared principles were defined and intensive dialogue took place concerning the tools and data required. Finally, on the basis of the outcomes of the workshops, an initial schedule for the pilot project was outlined in preparation for a joint declaration of intent.

Thanks to the support from SMA, the two companies were able to better understand their individual challenges and processes; a healthy basis for the harmonisation and coordination of cross-border processes.



NS International: Multisystem Locomotives on the Amsterdam–Berlin Route

NS International is studying how the attractiveness of the Amsterdam–Berlin intercity route can be improved. Several possibilities are currently being evaluated, and one of them is the opportunity to dispense with changing locomotives at the border, saving about 10-15 minutes of travel time.

The IC Amsterdam–Berlin runs on a domestic IC route as part of the Dutch timetable, which minimises the operational costs for NS. A timetable change in the near future (2017) provides the opportunity to integrate this issue into the ongoing planning process.

In this context, NS International asked SMA to identify an “optimal” route on the Dutch side of the border without this locomotive change integrated into the Dutch domestic timetable, linking the route with Amsterdam Central Station (CS).

The study was organised into two main phases: the definition of service structures and a timetable study of the three most interesting options. The first phase gave good insights into the possible travel time improvements and the constraints of the planned 2017 timetable. The second phase was able to show the effects of new or adapted routes in the most heavily used part of the Dutch network (Amsterdam/Schiphol area).

The evaluation of the three scenarios pinpointed the advantages and disadvantages of each in terms of travel times, route integration, operational costs and a qualitative evaluation of the service robustness.

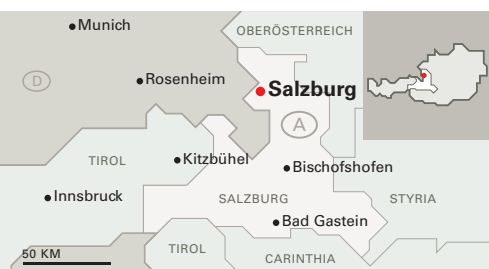
The final part of the study consisted of an initial assessment of these results on the German side of the border. SMA was able to identify the most important structural changes that have the most positive impact on the Amsterdam – Berlin service. All the results have been shared with DB Fernverkehr.



SBB Passenger Division and BAV: East-west Axis and EC Biel–Zurich–Munich

The STEP 2025 upgrade phase benchmark concept provides for modification of the long-distance services timetable concept on the “Jurasüdfuss”. In addition to this, the Munich–Zurich EC route is to be extended past the Zurich node to Biel at intervals integrated into the Swiss long-distance network. The room for manoeuvre and for modifications on the heavily used SBB network is relatively small and not all the goals can yet be implemented in the benchmark concept.

SMA investigated various optimisation approaches on behalf of the passenger division of SBB and the BAV. The study took into account desired improvements to the stopping policy; feasible modifications to the infrastructure during the plan’s timeframe; new through-services and more practical rolling stock utilisation plans. These concepts also had to comply with operational requirements concerning vehicle capacity. SMA carried out a detailed timetable-based study that identified, evaluated and proposed modifications to both the timetable and infrastructure.

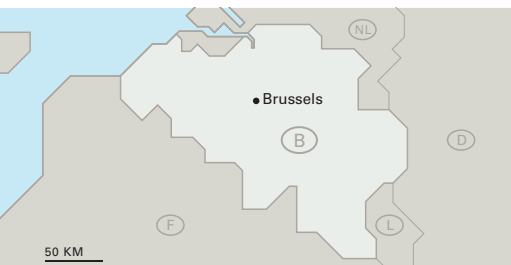


Salzburg State/ÖBB Infrastruktur: Pinzgau S-Bahn From 2010 to 2012 SMA worked on the “Salzburg fixed-interval timetable 2014” project for the state of Salzburg. The results were several service proposals for the various state regions.

As a result of this work, SMA was commissioned by the state of Salzburg and ÖBB Infrastruktur to review the existing service concepts for the southern state region for the medium- and long-term. Based on the existing Salzburg fixed-interval timetable plans, an enhanced service is foreseen in the Pinzgau region. This has been prompted by the concept of a Pinzgau S-Bahn and the realignment of long-distance services on the Tauern axis. In addition to the changes to long-distance services, the new variants also provide additional station stops.

Detailed daily timetables were drawn up for the preferred variants. This process was closely coordinated with the neighbouring state of Tyrol and was used as the basis for rostering the rolling stock and estimating the train kilometres per timetable variant. A third party company working as a partner in the project identified the level of demand.

The state of Salzburg is currently taking advice on their further course of action for implementing the preferred variant.



Viriato.Enterprise at SNCB: From Path Request Module to Book-in Module (phase 2)

The Belgian railway operator SNCB has been using Viriato for a number of years. In 2014, the company decided to deploy the new Viriato.Enterprise solution to cover all planning stages: long-term capacity studies, drawing up annual and sub-annual timetables and building short-term modifications. To simplify path requesting at Infrabel, the Viriato.Enterprise version used by SNCB already integrated specific train organisation modules, in accordance with the key SNCB sub-connection concept. These functions are a component part of a customer-specific module which maps the process and its requirements for exchanging data between SNCB and Infrabel – the Viriato book-in gateway for path requesting.

With this module, the users export their path requests in an official format directly from Viriato to Infrabel, for an entire sub-connection or for individual paths. They can then trace the status of the request in a status diagram (being checked, sent, confirmed, rejected etc.). Thanks to the new Viriato.Enterprise train model, the replies, comments and proposals from Infrabel are imported directly into Viriato and the changes made by the infrastructure manager to the train and the transport days are identified automatically. The planned Viriato enhancements for change management (short-term timetable) and for requesting other path types (freight traffic, transfers etc.) will also be compatible with the module.

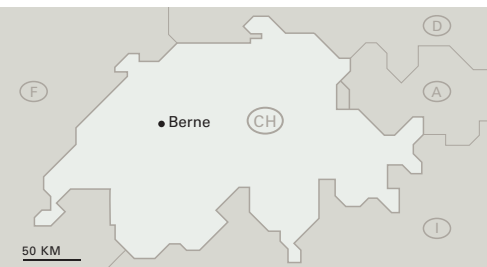
The integration of synchronisation with the infrastructure data from Infrabel, which is subject to an on-going change process, is planned for 2016. This is aimed at making the exchanged data more coherent and at providing the user with a more efficient and more ergonomic requesting process.



Geneva canton: New Lancy–Bernex service The Geneva urban area, which stretches across the canton of Geneva, a part of the Vaud canton and across the French Rhône-Alpes region, is undergoing a phase of extremely rapid development. Due to the high level of predicted population growth by 2030, the relevant urban area programme is based on a multipolar urban development process. The radial structure of the public urban transport network and the restricted operating speeds of the tram in the Bernex–Bel-Air and Palettes–Plainpalais sectors have a negative impact on the quality of service between these different centres.

SMA was commissioned to investigate the need for expansion of the public transport network, in coordination with the urban planning bodies, in order to make it possible to identify and reserve the land needed by future transport infrastructure. Our partner in this project, BG, examined the civil engineering issues arising from this context.

The study resulted in four service concepts which were explored in terms of demand, service and infrastructure. On the basis of a multiple-criteria decision analysis, two concepts were selected for further development. For each of these concepts a system timetable was defined and infrastructure and necessary land were identified on this basis. A feasibility study and cost estimate completed the investigation. This made it possible to evaluate the effects of the development in service on the capacity of the rail network and identify the additional infrastructure required.



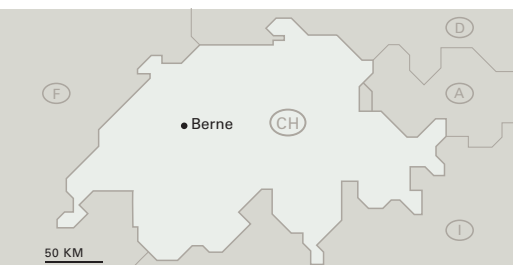
Support for Various Private Railways with the Integrated Overall Plan for the 2030 Upgrade Phase

Within the framework of the strategic rail infrastructure development programme (STEP), the planning regions have submitted various service targets for the networks of the private railways to the Swiss Federal Office of Transport (BAV) for the 2030 upgrade phase. The private railways were requested to identify the infrastructure upgrades needed for the further development of service as well as the key infrastructure, operation and demand figures to serve as the basis of an analysis. SMA supported various private railways with this integrated overall planning of service and helped them to produce the documentation to be submitted to BAV.

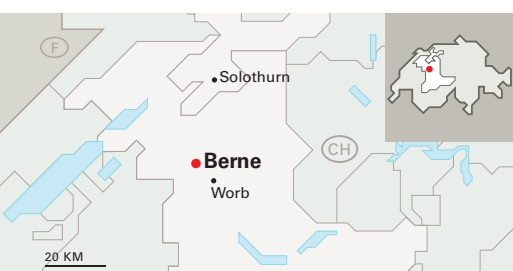
Based on the benchmark concept for the STEP 2025 upgrade phase, SMA developed timetable concepts from which it derived the infrastructure measures for the 2030 upgrade phase. The focus of this process was the optimisation of a demand-based service concept with a practical infrastructure build that allows for additional future capacity and the flexibility to use current or newly procured rolling stock.

With the private railways that expect a significant increase in demand – such as BDWM, RBS and WSB – the different initial situations made it necessary to devise integrated medium- and long-term development scenarios. For the mainly tourist-related transport systems such as MG Bahn and TMR, their special characteristics were taken into account and coordinated with the service concept, as was the feasibility of new infrastructures in mountainous terrain. Even with primarily regional railways with single-track lines, such as CJ and MBC, it was possible to implement the service targets in concepts using iterations between the service offer, infrastructure and rolling stock.

SMA working together with partner companies on this project, developed the deliverables from the fact- and data-sheets needed for this analysis, cost estimates for the infrastructure upgrades through to the overall documentation in accordance with the specifications of the BAV.



SBB Infrastruktur: Support for the STEP 2030 Upgrade Phase SBB, together with the BAV, are currently devising the concept for the 2030 upgrade phase within the framework of the strategic rail infrastructure development programme (STEP). The investment required for the implementation of service targets in connection with long-distance services, local trains and freight traffic, and the socio-economic benefits generated need to be evaluated with the help of processes known as modules. SMA is helping SBB to perform capacity analyses for the sometimes complex modules. The service targets will be implemented in terms of timetabling work based on the benchmark concept of the STEP 2025 upgrade phase where conflicts will be identified, and any infrastructure measures required to develop a conflict-free timetable and any additional rolling stock requirements will be derived. The work is being closely coordinated with SBB and BAV and will continue until end of 2016.



RBS: Horizon 2020, 2025 and 2030 Provision Concepts In the next few years Regionalverkehr Bern-Solothurn (RBS) will be upgrading various infrastructure elements in their network. These improvements will facilitate an upgrade in services through the deployment of longer trains and faster RE journey times from Bern to Solothurn. In addition, more powerful rolling stock will be available for individual lines.

A concept for the 2025 horizon was initially devised which took into account the various changes to the parameters for the entire RBS network. The outcome of this work on the 2025 horizon demonstrated that, due to the parameters which had changed compared to those in earlier studies, the double track upgrade at two locations is presently no longer needed.

Based on the 2025 concept, a concept was also developed for the 2030 horizon, ensuring the upwards compatibility between the two plans in terms of infrastructure and service. In addition to the concepts for the entire RBS network, in-depth topics (e.g. the need for points) for individual areas were also investigated.

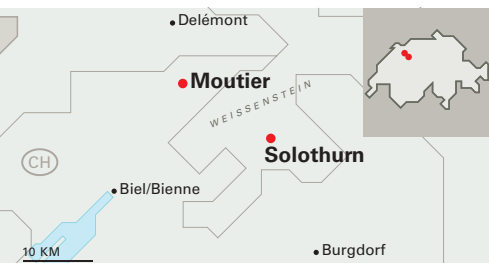
A network-wide concept was devised for an exceptional case on this network. During the construction phase of the new RBS station in Bern, at times only one track will be available for the approach to the station. It is therefore only possible to manage the maximum number of lines with high frequencies of trains in the approach to the station and using short turning times in Bern.

The concepts devised for 2025 and 2030 acted as benchmark and planning cases for the analysis of three modules within the framework of module processing for the STEP 2030 upgrade phase by the Swiss Federal Office of Transport (BAV). From the concepts and additional data sources, the key figures required by BAV with respect to operation, demand and the economic effects of the individual modules were identified.

81
PERCENT

At the turn of the millennium there were 107 441 parking places in Los Angeles' Central Business District. If all these parking places were to be placed side by side they would occupy 81 percent of the total city area. This makes central Los Angeles the city with the world's highest "parking footprint".

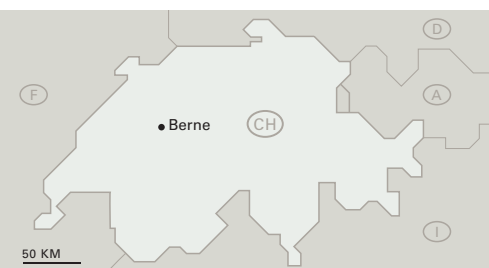




BAV, Solothurn and Bern cantons: Study on the future of the Solothurn-Moutier railway through the Weissenstein tunnel The Weissenstein tunnel on the Solothurn–Moutier railway path (SMB) is in poor condition and, for safety reasons must undergo extensive reconstruction work if it is to remain in use. BLS AG estimates the cost of this work at 170 million francs. As the revenue-to-cost ratio of this railway line is less than 30 percent, the federal state was obliged to carry out an economic feasibility study in connection with this comparatively large investment.

SMA undertook this study on behalf of BAV and the Solothurn and Bern cantons, in cooperation with Infras. As the basis of the development and evaluation of possible service variants, the first step was to analyse the current demand on the SMB and the importance of the rail route for the region. Next, the requirements on future capacities that must be provided by public transport systems in this corridor were derived from a demand forecast. In the second step, possible variants for the “tunnel reconstruction” and “tunnel closing” scenarios were developed.

The method used for the evaluation of these variants was based on a comparative value analysis using the 2016 timetable as the benchmark. The cost effectiveness was evaluated using a dynamic investment appraisal in accordance with the net cash value method, which makes it possible to compare payment flows (costs and revenue) occurring at various points in time. The results of the study provided the basis of extensive involvement of the areas and cantons affected. A decision from BAV as to whether the Weissenstein tunnel will remain open is expected at the end of 2016.



SBB: ZLR toolbox The ZLR (“Running Time Calculator”) toolbox application, used by SBB, provides numerous analysis and evaluation options. Among other things, it facilitates planning of speed restrictions with identification of the braking distances required, and it analyses their effects through the comparison of journey times.

Another functional aspect is the planning and calculation of distances between signals in order to optimise the line speeds on the basis of the required braking distances. The associated results from this analysis, which were previously created with old Excel macros, have now been integrated into the ZLR toolbox. At the same time, we revised the design of the signal planning log.

A safety-related topic which requires specialist knowledge, which was previously hard to access and poorly documented has now been consolidated into a single technical solution without external dependencies.

This also provided an opportunity for the implementation of a long list of existing user requests and new technical enhancement requirements. The introduction of speed profiles for ETCS and new tilting rolling stock are now included.



German Federal Ministry of Transport and Digital Infrastructure: Middle Rhine axis, Cologne–Rhine/Main–Rhine/Neckar–Karlsruhe Corridor The freight path along the Rhine is one of the most frequently used rail paths in Europe. It is the route for freight trains travelling between the major sea ports of Rotterdam and Genoa. In terms of passenger transport, the Frankfurt to Mannheim section of this line is the most heavily used section of the entire ICE network. Furthermore, a significant rise in traffic is expected for the corridor between Cologne and Karlsruhe in the next few years.

The capacity of the rail paths in this corridor is to be increased in order to clear this bottleneck in the European rail transport network.

Together with Intraplan and BVU, SMA has devised several timetable and infrastructure variants. The key outcome of the study is the construction of a new, shared transport line between Frankfurt and Mannheim for express passenger long-distance services during the day and freight traffic at night. The new line is designed to absorb the growing volume of traffic and ensure significantly shorter journey times. At the same time, capacity will be freed up on the existing lines for an enhancement to the local train service. The new line also facilitates faster local service between Darmstadt, Frankfurt Airport and Wiesbaden.

Furthermore, SMA has investigated diversionary routes aimed at relieving the load on the rail lines in the Middle Rhine Valley. Some of the traffic can be routed along the Rhine/Ruhr-Sieg axis Hagen/Cologne–Siegen–Giessen–Hanau.

Thanks to our detailed planning work, SMA was also able to verify the necessity for a number of more minor measures for increasing capacity in the Middle Rhine corridor.



DB Fernverkehr: Timetable Planning Support SMA has been supporting DB Fernverkehr AG with their timetable planning for many years. In 2015, one of the focal points of the work was designing the services which are to be implemented throughout Germany from 2019 as part of their long-distance service drive. Based on the requirements for long-distance services, SMA determined the impact on local services and on journeys using the long-distance network, and planned alternative timetable concepts for the affected corridors.

Within the framework of this planning process, various alternatives were drawn up and the interplay with the existing local train networks identified and evaluated. In discussions with the commissioning authorities and DB Netz AG, feasible timetable solutions adapted to suit all stakeholders were found and they will be integrated into future DB Fernverkehr AG plans. During the planning phase, additional importance was placed on timetable stability and the allocation of time buffers and reserves were optimised and their effects evaluated with DB AG.

This work, including the timetable stability planning, will be continued with other lines.



MVG: Analysis of the Robustness of the Munich Metro Timetable In order to be able to cope with the further rise in demand during rush hour, an increase in service frequencies from a 2.5 to a two minute interval is planned for the Munich metro. The requirements in terms of timetable stability are therefore also more demanding. On behalf of the Münchner Verkehrsgesellschaft (MVG), SMA was commissioned to identify the incident density and durations at which point the planned timetable would become unstable. The timetables analysed were based on the two-minute interval concept on the core sections of the U1/U2/U7 and U3/U6 lines.

The timetable robustness was analysed using the OpenTrack simulation software and a model which covered the entire Munich metro system. The first step involved an investigation into the effects of selected individual incidents on the planned timetable. Next, a total of 25 simulations were performed, each with fifty random incidents occurring throughout the day and spread across the entire Munich metro network. The number and duration of the incidents (e.g. door defects, people on the track or signal problems) were specified by the client on the basis of their analysed operational data. The incidents in the simulation were modelled with the aid of a probability calculation in accordance with the number of occurrences in relation to the total number of stops during the entire day. The simulation of the base case (i.e. operation without any incidents) served as the benchmark for the analysis.

The study provided the client with valuable information to ensure operational stability.



DB Fernverkehr and DB Regio: New Train Operating Company Interface/PCS/TAP TSI

In the next few years, the interface between the German train operating companies and the DB Netz path portal will be replaced. Communication via the new interface will be implemented in accordance with TAP TSI (Telematics Applications for Passenger Services Technical Specifications for Interoperability). This specification has been approved by the EU commission and its implementation is mandatory for all member states. Using a common interface for data exchange and coordination between all the stakeholders involved is aimed at simplifying cross-border transport within Europe.

The interface to the DB Netz path portal is a key element of the Viriato process which is used by both DB Fernverkehr and DB Regio for timetable planning. The coming changes not only affect direct use of the interface but also the way in which trains are organised and scheduled in Viriato. TAP TSI defines a series of rules concerning the structure and identification of a train. In close cooperation with DB Fernverkehr and DB Regio, the TAP TSI specifications were analysed and methods for integrating them into Viriato were pinpointed. The system will be implemented step by step over the next few years.

In addition to the new train operating company interface to DB Netz, an interface to the European Path Coordination System (PCS) is also to be implemented in the context of TAP TSI. In the future, international trains are not only to be registered with DB Netz via the path portal but also data is to be exchanged with PCS directly from Viriato.

Work on a Viriato enhancement which complies with the TAP TSI specifications will be continued in 2016 in a process of on-going dialogue with DB Fernverkehr and DB Regio.



Generalitat de Catalunya: Study into Improving the Local Rodalies Rail Traffic

Provision The regional government of Catalonia (Generalitat de Catalunya) commissioned SMA to carry out a study aimed at providing the necessary basic technical framework the authority could use to overcome a number of imminent challenges.

In particular, this work focuses on an improvement of the quality of the service provision in relation to mobility requirements, optimisation of the efficiency and the reliability of the railway operation and control of the operating costs to be borne by the authority. Furthermore, the regional government of Catalonia wanted to see a coherent distribution of the positive effects of the high-speed line across the entire region.

This study covered all local and S-Bahn transport in Barcelona, Girona and Tarragona operated by Renfe, and was divided into two stages. The first involved diagnosing the current transport services and proposing two scenarios (long- and short-term) based on the potential for improvement identified in the diagnosis. As part of a systematic multi-disciplinary approach, the demand, service, operations, operating costs and model of the contract between the authority and the train operating company were investigated.

The study was viewed as a pioneering project in Catalonia. It has brought the primary stakeholders in the Catalan rail traffic network together: Generalitat de Catalunya (authority), Renfe (train operating company) and Adif (rail infrastructure company). All those involved were extremely eager to work together. The study will be completed in 2016; after which the region and all other stakeholders will have a concrete action plan for the coming year.



SNCF Réseau: Capacity Study for the Avignon Region and the Western Part of Bouches-du-Rhône

In the Provence-Alpes-Côte d'Azur region (PACA), the lines between Marseilles and the western urban areas of the region (Avignon, Arles, Salon-de-Provence, Istres etc.) are subject to demanding requirements with respect to passenger transport and freight traffic, as well as in terms of the function of ensuring access to the region. These lines act as the gateway to the PACA region and are therefore a fundamental connecting link to the national rail transport network.

Although it only marginally affects the west of the Bouches-du-Rhône department, the Provence-Alpes-Côte d'Azur new line project (LNPCA, formerly LGV PACA) has facilitated an integrated approach to planning both local and inter-regional rail traffic. The strategic planning method, based on the coordinated development of service and transport infrastructure, will now be applied to the technical studies for the PACA region.

SNCF Réseau commissioned a team consisting of SMA and BG to carry out a capacity study of both Rhône valley lines between the north of Avignon and Marseilles. The main aim of this study was to identify any infrastructure investments that were necessary for the development of operations in this region and which are appropriate for the increases in traffic identified by the demand studies carried out in parallel.

The service quality of the development projects was determined and optimised. A key factor was the rush hour timetable, which was structured on the basis of various growth scenarios for the path provision with respect to passenger transport and freight traffic, as well as on the basis of the analysis of current potential. In this way, how to deal with the network bottlenecks by means of a targeted increase in capacity on the main railway nodes and paths could be demonstrated and the threshold effects between provision and infrastructure became evident.



SNCF Réseau: “Emergence” Study – Preliminary Study of the Rail System in Normandy

Over the next decade various changes are expected in the rail network of Normandy due to the merger of regions as well as the implementation of several restructuring projects, including the modernisation of the Rouen-Rive-Droite station, launch of the EOLE extension in the west and the new Paris–Normandy line (LNPN). This study, carried out on behalf of the regional management of SNCF Réseau, the Upper Normandy and Lower Normandy regions and the State, was aimed at defining development scenarios with respect to the three interlinked issues of infrastructure, operations and rolling stock. The time horizon corresponds to the development stages until 2025, i.e. covering several stages until the launch of the new line.

Thanks to the analyses carried out in 2015, it was possible to draw up a new regional benchmark timetable for 2019. This integrated the expected developments in services and the infrastructure projects which have already been committed in the form of a flexible system timetable (morning and evening rush hours as well as non-rush hour periods), as well as a 24-hour version for a benchmark working day. Developing the timetable, and comparing various scenarios, highlighted the conditions relevant to a short-term increase in service in the suburbs of Rouen and to an improvement of the services between the two regional capitals.

This study will be continued in 2016 and will investigate the changes to service in the period between 2020 and 2025 based on the results of a demand study which will be carried out at the same time.



Rhône-Alpes Region: Technical Expertise Concerning the Operations Contract for Local Services Within the framework of the renewal of the operations contract covering local services (TER), the Rhône-Alpes region wanted to identify and evaluate operating costs based on defined service goals to compare them with the proposals made by SNCF. In order to achieve this, the Rhône-Alpes region awarded CFTA, with SMA working on the project as a subcontractor, the task of determining the operating costs for 2016. SMA analysed the entire TER service plan for 2016 (including timetable, route, type and amount of rolling stock) using Viriato and determined the required rolling stock rosters and operating volumes (fleet, rosters, days of service, number of engineers and conductors). CFTA was able to calculate the operating costs on the basis of this information.

This model revealed inconsistencies in the data of certain rolling stock types as well as sub-optimal deployment of individual stock on particular routes. Various optimisation options, in particular with relation to stock allocation, were proposed by the project. These can be investigated in more detail as part of subsequent study phases. The operations contract was extended and will be reformulated for 2017.



SNCF Mobilités: Restructuring the Local Service Provision in the PACA Region The local service (TER) in the Provence–Alpes–Côte d’Azur region (PACA) is subject to a variety of special circumstances which currently critically impacts the quality, reliability and the productivity of its services. For example, its on-time performance is significantly worse than the national average. In the past few months, extensive construction activities have begun and will continue for the next years, which further complicates operations. Combined, these issues make it critical to employ a systematic approach to the traffic management situation at the Marseilles.

The PACA region is seeing rising demand for local services. Although welcomed, it necessitates a modification to the service provision in order to meet the expectations of the transport authority. Furthermore, operational obstacles are expected as a result of an increase in traffic.

SMA was asked to undertake a study aimed at producing an objective analysis of the current situation and pinpointing operational difficulties and reasons for delays. In this study, SMA examined the actual on-time performance data in detail and compared it with on-site observations, held discussions with those responsible for operations and conducted an exhaustive investigation into the timetable and the vehicle rosters.

Through this process SMA was able to identify a series of complex causes of on-time performance problems. The findings from these interrelationships made it possible to explain how the problems arose. Suggestions for improvement and implementation deadlines were defined in the form of an action plan. On the basis of this, SNCF drew up the schedule for implementing the proposed solutions.



SNCF Mobilités: Restructuring the Local Service in the Bourgogne-Franche-Comté region

The regional rail traffic network (TER) in Bourgogne-Franche-Comté (BFC) has undergone a difficult phase of extensive construction activities on the main transport axis between Dijon and Besançon. This activity has led to worsening travel times and a decrease in quality, as well as to a reduction in demand between 2012 and 2013. Due to the current financial situation in the region, it is not possible to compensate for the decreased TER income by increasing the contribution made by the regional authority. A reduction in service is not considered a viable long-term solution for this situation. Only an improvement in production efficiency and the quality of local services can give new impetus to rail traffic between Burgundy and Franche-Comté. Furthermore, the fundamental importance of this transport axis will also increase due to the merger of the Burgundy and Franche-Comté regions.

With the aim of restructuring the transport provision on the Besançon –Dijon axis, SNCF Mobilités asked SMA to provide a proposal for operations optimisation and an increase in productivity.

An analysis of the current rail provision (transport services, network integration, and production organisation) revealed the gaps in and the critical nature of the local services (TER). In cooperation with SNCF Mobilités improvement options were identified. One scenario provided for an extension to the service offer by means of the creation of a fast, regular, fixed-interval service between the largest stations. This would be complemented by improved connections to other stations as the result of additional services.

As part of a further investigation, SMA drafted a series of recommendations for improving the regional connections and operational stability. In a following step the technical and economic feasibility of shuttle bus services is to be examined in order to improve the connections to the main commuting centres of Besançon and Dijon.



SNCF Voyages: Supporting the SNCF Voyages Mediator during the Consultation Process for the Service on the LGV SEA High-speed Line

In July 2017, the new high-speed line between Tours and Bordeaux (LGV SEA) will start operation. It is to be run as a concession awarded to Lisea (Vinci Group). The line has been financed by the concessionaire, the state, Réseau ferré de France (now “SNCF Réseau”) and more than 30 local authorities from the south-west of France (Grand quart sud-ouest). In 2015, during the final phase before the opening of this line, the future TGV service plan was worked out and negotiations were held with the local authorities in the entire area covered by the project, i.e. along the entire Atlantic side of France.

SNCF, with the agreement of the Ministry of Transport, appointed the former Minister for Transport, Mr. Jean Auroux, as the mediator for this delicate task. His remit was to find a consensus between all the parties (the operator, concessionaire, investing local authorities and the authorities responsible for local services). SMA was commissioned with supporting the mediator with this task, which involved devising and evaluating technical proposals in consultation with the operator, SNCF Voyages.

The project lasted 4 months; an alternative proposal was drawn up for the timetable and this was presented to all the regions involved. Optimal deployment of the operator's resources helped to enhance services, especially in the towns along the route. Thanks to this proposal and to the dialogue conducted in this context, the parties involved were able to continue negotiations in order to determine the final service plan for the opening of the LGV.



FTA: Audit of an Operational Simulation of the Helsinki Rail Node The track section between Helsinki main station and the Pasila station, located three kilometres to the north, is the most frequently used section of the Finnish railway network. The Finnish Transport Agency (FTA) is planning a variety of upgrades to this section and the northern approaches to it. FTA commissioned a microscopic operations simulation model to assist with this planning using the OpenTrack tool from an engineering consultancy.

SMA performed an in-depth audit on behalf of the FTA of this modelling work for Helsinki and the surrounding area, and also evaluated the methods and planning tools used. In addition to auditing the infrastructure, timetable and simulation data from a technical point of view, SMA also assessed the simulation study methodology.

After our recommendations were incorporated in the simulation model, we were able to certify that both the approach used and the model were in line with the current best practice, and that the simulation was therefore capable of being used by FTA for analysis studies.

Regarding study methodologies, we suggested that for future projects and upgrades that it is more efficient if initially the timetable and infrastructure concepts are designed at a high level, and only after this step should the detailed work of a microscopic simulation be undertaken if this level of evaluation precision is justified by the complexity and cost of the proposed new investments in upgrades.

New Viriato Licenses

- FART Ferrovie Autolinee Regionali Ticinesi, Locarno (CH)
- Generalitat de Catalunya, Barcelona (ES)
- University of Zilina, Zilina (SK)

Over 600 internet service providers and other organisations from over 60 countries are connected to the DE-CIX in Frankfurt, the largest internet exchange point in the world. In December 2015 DE-CIX reached a new data throughput peak of 5 terabits per second!



Events, Publications and Presentations

IT15.rail Initially conceived as a conference for Viriato users, the IT05.rail, IT08.rail, IT10.rail and IT13.rail series has developed into a well-attended, international benchmark event. IT15.rail was another milestone in this series. The event was held from the 11th to 13th of June 2015 under the title of “The Industrialised Railway – Harvesting the Economies of Scale in Planning and Production”. The conference was once again run jointly by the four organisers IVT (the Institute for Transport Planning and Systems at the ETH in Zurich), OpenTrack Railway Technology GmbH, systransis AG and SMA. More than 230 participants from 21 countries met at the ETH campus on Zurich’s Höggerberg.

The event began on the Thursday with a symposium at which experts from the railway sector and other industries that are subject to comparable parameters shared their knowledge. Experiences with respect to the subjects of new design, migration and integrated control from other industries were compared with those from the railways, and new solutions were thus investigated from an unfamiliar perspective.

The activities on the Friday were based on the motto of “Application and Innovation”. Through a series of presentations, the speakers invited by SMA addressed the capacity allocation process from three different points of view. In the morning, the perspective of the infrastructure managers and the regulatory aspects were presented and, in the afternoon, the speakers focused on the viewpoint of train operating companies and the economic issues.

As has now become a tradition, an excursion on Saturday brought IT15.rail to an end. In groups, more than 60 participants visited three locations where they heard presentations on the subject of rail transport around Zurich and how it has been affected by the construction work in and around Zurich main station.

From the point of view of the organisers, IT15.rail was once again a resounding success. Thanks to the high-calibre speakers, participants picked up interesting information from various industries and fields, and new approaches were discussed. There was also plenty of time for individual participants to share their experiences at the traditional conference dinner on Thursday evening.

Publications

EURAILmag,
March 2015

The path catalogue in the capacity planning process

Olivia Anders, Eric Cosandey,
Matthew Holliday, Luigi Stähli (all from SMA)

Bundesamt für Verkehr BAV,
Eidgenössisches Departement für Umwelt,
Verkehr, Energie und Kommunikation UVEK,
Forschungsprojekt SVI 2011/034
auf Antrag der Schweizerischen Vereinigung
der Verkehrsingenieure (SVI),
March 2015

Längere Umsteigezeiten und Haltestellen-aufenthaltszeiten – Auswirkungen und Massnahmen

Raphael Karrer, Patricia Kottmann,
Daniel Wipf, Georges Rey (all from SMA) and
Graciela Christen, Yves Gasser,
Reto Vollenweider (all from Rapp Trans AG,
Basel)

Mobilité et motilité : mode d'emploi,
Ausgabe Alphil Presses universitaires
suisses,
November 2015

**Étude de la pertinence du cadencement
en France à partir de l'analyse de la
motilité**

Prof. Vincent Kaufmann (LASUR- EPFL),
Luigi Stähli (SMA) und Regina Witter

Schweizer Eisenbahn-Revue, Eisenbahn-
Revue International (Deutschland-Ausgabe)
und Eisenbahn Österreich,
June 2015

**25 Jahre Zürcher S-Bahn – Entwicklung
von Angebot und Nachfrage**

Dominik Brühwiler (ZVV), Werner Schurter
(SBB), Georges Rey (SMA) und Theo Weiss

Presentations

Transportation Research Board Intercity
Rail Committee Workshop,
Los Angeles, January 2015

**Designing an Integrated Public
Transportation Service Offering**

Ulrich Leister

3rd International workshop on new railway
technologies,
Bilbao, February 2015

**Session: Operation on High performances
railway lines**

**El Sistema ferroviario suizo, una red
metropolitana? (Swiss railway network,
a metropolitan network?)**

Lydia Alonso

ITiCSE '15 Proceedings of the 2015 ACM
Conference on Innovation and Technology
in Computer Science Education,
Vilnius (Lithuania), July 2015

**An Incremental Hint System For
Automated Programming Assignments**

Paolo Antonucci (SMA), Christian Estler,
Durica Nikolić, Marco Piccioni, Bertrand Meyer

Fachtagung Forschung SVI,
Olten, September 2015

**Längere Umsteigezeiten und Haltezeiten –
Auswirkungen und Massnahmen**

Raphael Karrer

Foro de Movilidad CAPV,
Bilbao, September 2015

**El sistema de movilidad suizo
(Swiss mobility system)**

Lydia Alonso

Federal Railroad Administration's Rail
Program Delivery Conference,
Washington D.C., October 2015

**Coordinated Planning on the Surfliner
Corridor**

Royce Gotcher, Ulrich Leister (SMA) and
DJ Mitchell (BNSF)

ETH Zürich:
"System- und Netzplanung" presentation,
December 2015

Angebotsplanung für die S-Bahn München

Georges Rey

2015 California Transportation Planning
Conference,
Los Angeles, December 2015

**Overall Rail Modernization to Improve
Mobility for California, Panel Discussion**

Ratna Amin, Till Chang, Melissa DuMond,
Ulrich Leister (SMA) und Sheldon Peterson

ENTPE (École Nationale des travaux
Publics de l'État) in Lyon (Vaulx-en-Velin),
December 2015

**Le cadencement dans l'exploitation
ferroviaire**

Luigi Stähli

PARIS – THE MAGNET FOR VISITORS FROM AROUND THE WORLD

VISITORS

Each year more than 47 million visitors from home and abroad visit Paris (Île-de-France). This influx of visitors results in 184 million overnight stays, thus making Paris the world's most visited city.



Key figures

SMA's 2015 turnover increased slightly over previous years. The decline observed in our long-standing European sales was off-set in part by developments in new markets, most notably the USA, but also by the intensification of our activities in Switzerland. At first sight the turnover figures present a trend that seems to be stagnating. However, this conclusion is misleading as the figures are recorded in Swiss francs (CHF). With around 75% of sales being made in euros or dollars and despite a strong Swiss franc, which has risen by approximately 25% against these currencies, SMA's financial results actually show healthy and steady growth.

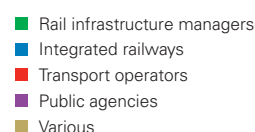
Key figures* in millions of Swiss francs	2015	2014
Gross turnover	12.01	11.83
Full-time employees	64	61
Turnover/colleague	0.19	0.19

*incl. subsidiaries

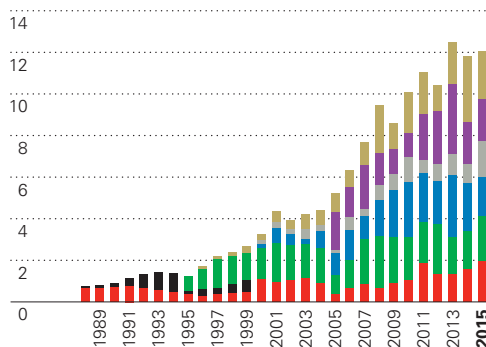
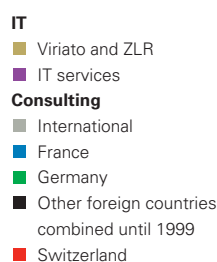
Turnover by country



Turnover by client category



Development of turnover 1988 – 2015 (millions CHF)



Editorial services

SMA und Partner AG, Zurich
science communications GmbH, Zurich

Visual concept

Eggmann-Design, CH-Wernetshausen

Printing

Linkgroup, Zurich

Photo credits**Cover**

Urs Villiger

Page 7

David Kündig | www.davidkuendig.com

Page 17

Peter Stoick

Page 25

Panthermedia

Page 35

Ariane Coerper | www.photografikart.de

Page 39

Panthermedia

Head Office

SMA und Partner AG
Gubelstrasse 28
8050 Zurich, Switzerland

Branch Office

SMA et associés SA
Avenue de la Gare 1
1003 Lausanne, Switzerland

Subsidiaries

SMA Rail Consulting+IT, Corp.
2677 North Main Street, Suite 825
Santa Ana, CA 92705, USA

SMA (Deutschland) GmbH
Stresemannallee 30
60596 Frankfurt, Germany

SMA (France) SAS
45/47 Rue d'Hauteville
75010 Paris, France

info@sma-partner.com
www.sma-partner.com