Status report and future prospects for the BG Consulting Engineers group - 2010 Edition

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REGIONAL ENERGY PLANNING
The City of the Future

INTERVIEW
Gro Harlem Brundtland

“Engineers have a key role to play”
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Population growth and globalisation lead to intensive use of natural resources and an accumulation of waste from processing them. This transformation is spreading throughout the world.

The political, financial and economic leaders who are confronted with this rapidly changing situation must come up with solutions to meet new commercial, environmental and social priorities.

This necessity also applies to the infrastructures society needs to flourish and develop. Taking into account territorial limitations and the increasing requirements and restrictions imposed on investments, it is clear that innovation is becoming a critical factor in providing services that can meet expectations under the best possible conditions.

Appropriate solutions would include rehabilitation of existing infrastructures, use of new high-performance materials, development of new energy-efficient processes, implementation of intelligent systems, and land-use designs that optimise occupancy, amenities and mobility.

Engineers play a major role in implementing these solutions, acting as the link between decision-makers and users. Engineers supply decision-makers with the technical elements that allow them to consider their options more objectively. Engineers are responsible for designing functional, efficient and appropriately-sized facilities that meet users’ needs.

Committed to this ethics of responsibility, the BG group brings its expertise to its clients to design and build the efficient, economic and reliable infrastructures that society needs in order to thrive.

“Engineers are a major link between decision-makers and users”
In response to the question “What does BG do?” one may be tempted to cite structures: tunnels, bridges, wastewater treatment plants or buildings. But in reality, the Group principally provides intellectual services. As an illustration, BG was selected to conduct two risk analyses on the longest tunnel (4.6 km) of the Egnatia Odos highway network in Greece, on the recommendation of France’s Centre d’Etude des Tunnels (CETU). “It’s an honour for us to have earned the trust of both the CETU as well as a Greek operator to conduct these studies, and a testimony to our expertise in risk assessment,” says Raphaël Defert, project manager in Operations and Safety. “The studies aim to evaluate the tunnel’s fire safety and provide a comparative analysis of the risks associated with transporting hazardous materials.”

Paris’ DIRIF (Direction inter-départementale des routes d’Ile de France) has chosen BG to help define, lead and execute a safety project for 15 km of highway in Paris’ La Défense area. “With our assistance, a designer-developer has been chosen,” explains Philippe Pons, who heads BG France’s Infrastructure Unit. “BG will be working with the site manager to monitor the project’s daily progress.” It is an enormous undertaking, as the 15 km underground network is used by an average of 100,000 vehicles every day. “We’re doing our best to keep traffic flowing and above all, attain maximum efficiency. We must not only ensure that performance standards are met, but also that they are met by the deadline and within the budget.”
Project Management

Decontaminating the Givaudan Factory

Following the shutdown of its factory producing raw materials for fragrances located in Lyons’ 8th Arrondissement, the Givaudan France Fragrances company has commissioned BG to supervise site cleanup. “The goal is to remediate the site to allow mixed use of the land, i.e., both tertiary and residential use,” explains Benoît Maréchal, head of the Environment and Polluted Sites Unit. This contract, which runs until 2012, includes defining the nature of the work, preparing specifications, choosing contractors, supervising the work, and finally, verifying that the site is entirely free of pollutants at the end of cleanup operations. “BG will also be using its expertise to help Givaudan negotiate the sale of this 2.5-hectare parcel,” adds Maréchal.

Expert Analyses

BG's specialists are regularly called upon to explain why an unfortunate event — sometimes even a fatal accident — happens. These expert opinions may be required for court cases or in other situations. The public is rarely informed about such analyses, although the incidents leading to them often get substantial media coverage — for example, the fire in the Mont-Blanc Tunnel. BG uses them to extract information and conclusive elements, and draws up recommendations that can be used by clients while ensuring its sources' confidentiality. “These analyses also provide important data for scientific research and engineering education,” adds Laurent Vulliet, the BG group's CEO who is also a professor at the EPFL.

Audit

"Energised" WTPs

Wastewater treatment plants (WTPs) play an essential role in treating wastewater and protecting living space, but they require a great deal of energy. “To change this, we are doing everything possible to improve their energy efficiency,” explains Markus Knöpfli, an energy expert at the Water and Environment Unit in Berne. He is working toward this for the Moossee-Urtenenbach community sewage treatment system in Berne Canton. “Our goal is to reduce energy consumption and make better use of the energy the system generates.” After analysing the situation, BG proposed ten concrete measures for its client to follow that will generate a positive return on investment over a 5- to 30-year period.
BG aims to provide services for a very diverse clientele in both the public and private sectors. Customer satisfaction surveys show that BG’s clients (public administrations, associations of municipal authorities, state-owned companies, cantons and regions as well as industrial, financial and commercial companies) have a very high opinion of the Group. It is therefore no coincidence that L’Oréal chose BG to conduct an audit in 2009. Working in partnership with the Arup company, BG is inspecting the production sites and laboratories of the world’s leading cosmetics company. The programme includes evaluating the quality of existing buildings, including air clearliness and energy management. “We are under contract until 2012, but it may well be renewed,” notes Frank Doppenberg, the project manager in Energy Management. “It is advisable to conduct these types of audits every four years.”

In Salah Gas Consortium

Preserving Nature in Algeria

Before developing a gas refinery about 40 km north of the city of In Salah (southern Algeria), the In Salah Gas Consortium — a partnership between Sonatrach, BP and Statoilhydrop — has contracted with BG for an environmental assessment of the site. “Our job is to determine the initial air, soil and groundwater quality,” explains Benoît Maréchal, head of the Environment and Polluted Sites Unit. In Salah Gas’ goal is to compare the data BG obtains with data collected both during the refinery’s operation and once it ceases activities, to ensure that the industrial activity has had no adverse effects on the environment.

AMAG Opens a New Mobility Platform

Automobile Importer

Berne’s Audi Centre opened on September 16, 2009 and is the Audi brand’s third centre in Switzerland. The building was designed and constructed by the GWJ architecture firm, the Marazzi company, and Beyeler Ingenieure (a subsidiary of the BG group), which determined the dimensions of the structure. “We did all the structural engineering on the building, as well as the foundations and fittings for exterior work,” explains Daniel Worbs, a civil engineer and the project manager at Beyeler. Located near Wankdorf Place with a construction cost of CHF 20 million (around €13 million), the Centre was completed in less than twelve months. Audi fans will appreciate the building’s dynamic facades with curves that extend into the showrooms. “It gives the whole structure a great sense of space,” adds Worbs.

Multinational Company L’Oréal

Energy Efficiency: a Top Priority

© Alain Buu

© GWJ Architekten
The clients of BG appreciate its expertise and creativity! The Group has again proven that it has earned this reputation in its work on re-building the Essert-Romand wastewater treatment plant, which processes wastewater from ski resorts including Gets and Morzine-Avoriaz in France. The project was jointly designed with the Malluraz architecture firm for the Syndicat Intercommunal à Vocations Multiples of the Aulps valley, which serves a population of 64,000 resident-equivalents. This project is unusual in that wastewater production levels fluctuate significantly (by a factor of 8) between off seasons and tourist seasons. Hence the water treatment network was equipped to adapt to these variations by introducing biofilters. “The sludge is treated by a digestion and drying process. It is a sustainable method as it greatly reduces the volume of sludge discharged, and the drying process is powered by the bacterial gases produced in digestion. In this case, the by-product is employed for agricultural purposes, but it could easily be used in incineration or composting,” explains Vincent Francheteau, the project manager in the Water-Air-Waste Unit.

5.3 million people have been using drinking water treated in installations to which BG has contributed over the past ten years. 13 million people: within the last ten years BG has helped treat the wastewater produced by a population nearly twice that of Switzerland.

Covering a distance of 57 km, the Gotthard base tunnel is the longest railway tunnel in the world and should be ready for use in 2017. AlpTransit Gotthard, a Swiss Federal Railway subsidiary, has commissioned FMN ingénieurs SA, a subsidiary of the BG group, to provide the project engineering. Along with IUB Berne and IM Maggia Locarno, FMNi is working on drafting, detailing, submitting, and monitoring the progress of the project. “We are doing the cable work and 50-Hz power supply for both tunnel tubes, about 114 km,” says Pierre Roelli, Director of FMN ingénieurs SA.
Algeria

Preventing Deadly Floods

Algeria’s Ministry of Water Resources commissioned BG to study flood protection in the M’Zab Valley. BG plans to build three retention dams in the valley, home to more than 100,000 residents living at the mouth of the M’Zab Wadi which drains a watershed of 1,400 km². “In addition to protecting people and property, these structures permit groundwater recharge, which is crucial to irrigating the M’Zab Valley’s perimeter agricultural areas,” explains BG’s Director in Algeria, Hacène Bekhouche. “Building the first dam resulted in drastically reduced numbers of victims during the flood on October 1, 2008. The two dams currently being built under BG’s supervision will finally provide a long-awaited solution to the M’Zab Valley’s flooding problem.”

French-Speaking Switzerland

85 km Through the Jura’s Historic Areas

BG is actively participating in a colossal construction project, the Transjurane – 85 km of roads and highway tunnels linking the Jura and the Bernese Jura to the French road system. In addition to several civil engineering contracts, the Group has won major contracts in the area of operating and safety equipment. “While we are handling the open-air segments also, tunnels make up 95% of our work,” notes Serge Mame, one of the project leaders and a low-voltage and command-control specialist. Half of the Transjurane project is already up and running; the remainder should be finished by 2017. “We are also responsible for updating the electromechanical installations in existing tunnels. In fact, it’s a never-ending job,” adds Pascal Crétin, another project leader and high-voltage specialist, with a smile.

MARKETS

+17% growth on the French market in 2009.

27% of turnover came from business done in the German-speaking part of Switzerland in 2009.
In May 2009, the LTF company (Lyon Turin Ferroviaire) commissioned BG to head up a group of engineering firms to resume work on the Italian component of a preliminary project designed to facilitate French-Italian railway connections. “The previous project faced local opposition, as some parties were concerned that the planned route didn’t sufficiently take into account the region’s opportunities and limitations,” explains Philippe Pons, who heads BG France’s Infrastructure Unit. The Group is working on two of the three components of the feasibility study. The first concerns civil engineering, geology, the environment and overall project coordination, while the second focuses on safety. “Up through January 2010 we were analysing the options and a route for the preliminary project has now been selected,” Pons says. “If it is accepted, studies will continue through 2012 and construction could begin in 2013.”

**From One Swiss Canton to Another**

**250 Buildings Audited**

In partnership with Signa-Terre SA, a company that specialises in eco-solutions for construction, BG is conducting “ImmoDiag” energy audits on 250 buildings owned by various real-estate agencies in Geneva. These “light” audits are used as a basis for deciding whether to initiate further study and full energy renovation. “The client receives a report including the building’s thermal balance and recommendations for meeting ‘Minergie’ renovation standards. The associated savings is quantified in terms of both energy and financial gains, and priorities are assigned,” explain ImmoDiag developers Jérôme Arendse and Mario Germano. The project has been so successful that Vaud Canton is beginning to follow in Geneva’s footsteps.

**Sport to the Tune of CHF 260 Million**

BG is an enthusiastic sports fan. Following BG subsidiary Beyeler Ingenieure’s construction of the Stade de Suisse in Berne, the firm ARP André Rotzetter + Partner AG (a member of the BG group) is participating in Lucerne’s Sportarena project. Construction on the complex began in 2007 with a CHF 260 million budget (more than € 170 million). The Sportarena features a stadium conforming to UEFA specifications, two 80-metre high towers, and a gym, pool and fitness centre. ARP has been tasked with the preliminary design, the building project, and monitoring construction progress on the arena, which is expected to open in 2013.
Interview of Gro Harlem Brundtland for BG-21.com

By Laurent Vulliet, Professor at the EPFL and CEO of BG Consulting Engineers

“Engineers have a key role to play”

By publishing her famous report on the state of the planet, “Our Common Future” in 1987, former Norwegian Prime Minister Gro Harlem Brundtland succeeded in imposing the theme of sustainable development on the international political scene. Over twenty years later, she confides her vision of the current situation to BG-21.com magazine.

Laurent Vulliet: What was your first reaction when the U.N. Secretary-General, Javier Pérez de Cuéllar, asked you in 1983 to propose a programme to ensure sustainable development for our planet beyond the year 2000?

Gro Harlem Brundtland: Honestly, I was quite reluctant. My big question was whether I could really cope with this challenge, with such a work. At the time, I was leader of my party in Norway (editor’s note: the Labour party) and more importantly the leader of the opposition. Because of these activities, I doubted whether I could devote myself to such a complex enterprise.

To convince me, Javier Pérez de Cuéllar said, “But you are the only environment minister that has been appointed Prime Minister!” I knew he was right and that this kind of experience and attitude were required.

L.V.: Today, more than twenty years after submitting your report “Our Common Future,” how do you judge the actions of the international community?

G.H.B.: In many areas, the work done during the last twenty years has been positive. There are real signs of global awareness. Indeed, even in developing countries and emerging markets, the States have taken steps, though voluntary and not mandatory ones, to limit their greenhouse gas emissions. The problem, in my opinion, remains the fact that the international community is taking too long to implement real change.

L.V.: According to you, what will be the key elements that will assure “our common future,” by 2030?

G.H.B.: Twenty years from now, some technological advances that already exist today will have spread throughout the world. Among them, and not least, in the key field of energy.

However, I think the issue of competition rules related to the WTO (World Trade Organisation) will represent an ongoing challenge, given the widely differing interests among the key countries.

L.V.: How might the current international financial crisis affect sustainable development?

G.H.B.: Of course, the economic crisis has had an impact on sustainable development ambitions and has changed them.
But it has also led to positive results. To boost their economies, States have focused on green technologies. Most have increased public funding in this area.

L.V.: We engineers are working actively to contribute to sustainable development.

G.H.B.: We’re all in this together! Transcending all borders and professions, everyone is concerned about the future of our planet. Engineers have a key role to play in this context. They must ensure the development and implementation of sustainable technologies, so that we can face the future in a safer and more responsible way.

A Committed Woman

Current efforts to counter global warming owe much to Gro Harlem Brundtland. By publishing her famous report on the state of the planet, “Our Common Future” in 1987, Dr. Brundtland achieved the feat of taking the subject out of scientific circles and placing it on the international political stage.

Born in 1939 in Oslo, this medical doctor by training worked about ten years for the Norwegian public health system. Appointed Minister of the Environment in 1974, in 1981 she became Norway’s youngest Prime Minister at age 41 — a position she occupied for more than ten years.


In January 1998, the Executive Board of the World Health Organisation nominated Dr. Brundtland for the position of Director-General. On May 13, 1998, she was elected to this position by the World Health Assembly and held it until 2003.
ALAIN BUCHER, ANDRÉ STAHLI AND FRITZ BIERI As safety experts, they made sure user feedback was taken into account when planning for the brand new training facility in Balsthal.
Fire in the tunnel! In Balsthal and Lungern, firefighters and other response teams from Switzerland and abroad train for emergencies at Europe’s most modern training facilities.
hoking black smoke pours from the tunnel entrance. Fire-fighters are on the scene, along with the police and ambulance crews. Amongst howling sirens and blinking lights, rescue personnel run, shout and wave their arms as the bleeding wounded stagger about, screaming. Total chaos prevails. The fire crew's incident commander assesses the situation. What happened? A head-on collision between a heavy truck and a tour bus led to a multiple-vehicle pileup. Where was the accident? About a kilometre from the tunnel entrance. Are there still people in the tunnel? It must be assumed that there are. Any other special circumstances? An unknown liquid has escaped and survivors show symptoms of poisoning.

The commander must act — and quickly, because here time can make the difference between life and death. How many men will go into the tunnel? Will they advance through the main tunnel or the safety tunnel? Will they start rescue operations first, or put out the fire? Experience is important in making these decisions — but so are intuition and flexibility because in a tunnel, every incident is different. The commander gives his orders and the men jump into action, loaded with 40 kilogrammes of equipment: helmet, fireproof protective clothing, breathing apparatus, hoses, infrared camera, search equipment, and more. They know what awaits them: extreme temperatures and zero visibility.

Cut! This particular scene has been staged — fortunately. But this scenario or a similar one could really happen. That is why it is being practised at IFA, the Intercantonal Fire Brigade Training Centre. IFA is Switzerland’s largest training centre for fire brigades and incident response teams. And since early 2010, it has had the use of two training tunnels, in Balsthal and Lungern, where training for fire-fighting in underground traffic infrastructures can be provided under realistic conditions. These facilities were built on behalf of the Federal Roads Office (FEDRO) and the Swiss Federal Railways (SBB) at a cost of CHF 38 million (about € 25 million).

The Balsthal facility is used mainly for basic and leadership training. Its centrepiece is a 260-metre-long combined road and railway tunnel having single- and double-lane sections. The facility is equipped with dummy vehicles — passenger vehicles and heavy trucks, tour buses and railway cars — that can be lighted with gas to simulate any conceivable incident. It also has an underground railway station and a multi-storey parking garage. The Lungern tunnel is 130 metres long and has a cross tunnel and a safety tunnel. It is used for intensive training covering extremely difficult situations.

"A tunnel that allows efficient interventions can remain closed for a shorter period of time if an event occurs"
Interview with Urs Kummer

“Consult Intervention Experts Early”

Intervention forces should be consulted during planning of tunnel facilities, says IFA managing director Urs Kummer.

**BG: What is the importance of the new training facilities in Balsthal and Lungern to tunnel safety?**

**Urs Kummer:** There are no comparable training facilities anywhere, inside or outside of Switzerland. So IFA — the competence centre for intervention in underground transportation infrastructures — is of international significance.

**BG: Who uses the two facilities?**

**U.K.:** In addition to cantonal and foreign fire-fighters, tunnel operators and civil defence organisations also use our facilities.

**BG: In the tunnel training facilities, you can simulate any conceivable accident. How did the fire-fighters train before this facility opened?**

**U.K.:** They trained in existing tunnels, either before the tunnels opened or during overhauls, renovations and modifications, though the available windows of time were always too short to prepare realistic accident scenarios. And no real fire-fighting exercises could be done. So the training took place in a real environment, but with no traffic, fire or smoke.

**BG: Building safe tunnels is the engineer’s job. Are experts from the intervention side also included in planning?**

**U.K.:** Unfortunately, that is not always the case. The chances for a successful intervention could be improved if rescue services’ needs were incorporated during planning. Another advantage is that a tunnel that allows efficient interventions can remain closed for a shorter period of time if an event occurs.

**BG: In concrete terms, what contributions can intervention experts make to increasing tunnel safety?**

**U.K.:** Today, planners do their utmost to build safe tunnels. But they don’t have the “intervention perspective.” Usually, a great deal can be done for intervention at minimal cost. For example, if an event occurs, additional access points or bulkheads can be worth their weight in gold. So clients and engineers would be well advised to include intervention experts early in the process.

In terms of tunnel safety, an experienced rescue service is the final link in the chain. Safety begins earlier, namely with prevention and therefore with tunnel construction and operation. A safe tunnel is equipped with a monitoring and early warning system; it has safe refuges and escape routes as well as smoke vents and fire-fighting equipment. It also has a safety plan with clear instructions for acting in case of an incident, and well-trained safety personnel. BG provides comprehensive support for tunnel builders and operators through all phases from planning through construction to operation.

Prevention and intervention are two sides of the same coin. When they are found together, safety in the tunnel can be greatly increased. The tunnel training facilities at Balsthal have both. The facility’s energy supply, ventilation, electrical installations, automation and computer systems were all provided by BG.

Core Expertise: Tunnel Safety

Tunnel safety is one of BG’s core areas of expertise, which it has employed in the following projects, among others: Maurice Lemaire tunnel: renovation of France’s longest road tunnel. Loetschberg base railway tunnel, cutting through the Swiss Alps: from preliminary study to commissioning. Monaco A500 highway tunnel: complete renovation. Glion tunnel, north of Montreux in Switzerland’s Vaud Canton: complete renovation of freeway tunnel on route A9.
The Adolphe Bridge in Luxembourg is a jewel, but has been weakened by age. It needs treatment by specialists to restore it to youthful health. Jean-Luc Palle of Tonello Consulting Engineers is responsible for prescribing the treatment that will give it a new lease on life.
what caused the condition? Jean-Luc Palle has studied the patient’s history in depth: “There are many possible causes. But the most important thing is that we find a cure.” This 46-year-old engineer, who works for Tonello Consulting Engineers — a subsidiary of the BG group based in Aix-les-Bains —, is leading the effort to save the patient. Like the head physician in a hospital, he coordinates the work of the specialists and orders the required tests and examinations before formulating his recommendations. His objective? A complete recovery. And the prognosis is good.

In this case, the “patient” is over one hundred years old. The Adolphe Bridge, which crosses the idyllic valley of the Petrusse River in the heart of the city of Luxembourg, has an internal disorder. In 1995 cracks were discovered in its two main arches, which are built of three layers of sandstone blocks. These symptoms of aging needed to be monitored and controlled. In 2004 the arches were strengthened by a temporary reinforcement system consisting of 258 rods with a total clamping force of 20,000 metric tonnes. But in February 2005, a rod gave way and fell to the valley floor. It was time to find a permanent solution.

So “Doctor Tonello,” otherwise known as Jean-Luc Palle and his team, was called in. On behalf of the Grand Duchy of Luxembourg — the client and contracting authority — the “doctor” managed the studies for the Adolphe Bridge repair. The work was commissioned in 2008; currently the project is in the pilot study stage, which will be followed by the actual restoration. Once the project is complete, the bridge’s arches will have been permanently reinforced and the structure will be able to handle current traffic loads. In the future, a tram will probably use the Adolphe Bridge.

In order to determine the appropriate treatment plan, Jean-Luc Palle and his team had to undertake a series of targeted examinations. The bridge was equipped with sensors inside and above the arches, allowing any internal micro-movements to be followed almost in real time. BG’s analysis of the sensor measurements showed how effective the temporary reinforcements were. So emergency treatments were avoided, but permanent repair is necessary.

The patient underwent a full medical check-up — X-rays, sampling, and endoscopic examinations — so an appropriate treatment could be prescribed. For example, the doctors examined the arches internally using ground-penetrating radar, core sampling and mini-cameras. Then they sent water under pressure through the cracks in the arches to obtain information about the masonry’s porosity. After some tests had been completed, an injection material was selected for optimal filling of the cracks. However, the structure will not be completely revitalised until later, with the addition of permanent armature and the construction of a new, larger deck.

Moreover, the restoration will make practically no changes to the appearance of the Adolphe Bridge, which will continue enchanting both the citizens of Luxembourg and tourists far into the future. Jean-Luc Palle says, “For me, being able to help save this prestigious monument is an honour and a challenge.”

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A Monument and a Symbol

When the Adolphe Bridge was built between 1900 and 1903 from plans by French engineer Paul Séjourné (1851–1939), it held the world record for the span of an arched stone structure. Also called Nei Bréck (New Bridge), this structure is not only a monument to the engineer’s art, but also a striking symbol of the city of Luxembourg — and an important part of the traffic corridor between the railway station district and the upper level of the city. The upper city and its ancient fortifications are a UNESCO World Heritage site.
The mountain is docile, but the conditions are difficult. During construction of the Serrières Tunnel near Lake Neuchâtel, good coordination is needed. A job for BG engineer J.-F. Vullioud.

With an ear-splitting noise, the rotating head of the cutting drum grinds through the rock, centimetre by centimetre, a few metres per day. “The mountain is solid,” shouts Jean-François Vullioud. But fine cracks in the yellow Hauterive limestone are a reminder that it also contains karstic cavities associated with the risk that the loose-packed material will collapse. And the surface is not far away! Only a few metres of stone separate the tunnel construction site from the foundations of the homes above!

But, as previously noted, the mountain is docile and in terms of structural engineering, building the two tunnel shafts for the Serrières bypass is relatively uncomplicated. The same applies to the sections that are below the level of nearby Lake Neuchâtel. Jean-François
With the Serrières bypass, the last missing piece of route A5 between Yverdon-les-Bains (Vaud Canton) and Biel (Berne Canton) will have been completed. The goal is to separate through traffic from local traffic; currently both follow the same route. This will be made possible by the construction of a bypass highway consisting of two tunnel shafts with covered entrances at each end. The old A5 will revert to cantonal road status. This will make the “barrier” between the residential areas and the shoreline more permeable. The quality of life in this heavily used zone at the gateway to Neuchâtel will be significantly improved.

So the greatest difficulties at the construction site lie in the lack of space, heavy traffic and urban environment. Between the lake and the steep slopes run a tram line, a pedestrian walkway and a four-lane road that serves as both the A5 highway and a cantonal road. Added to these are local access roads for the industrial zone and the residential area on the slope. Traffic flow here is measured at about 45,000 per day, with 4,500 vehicles during peak hours. The bypass tunnel will relieve congestion beginning late in 2013, but the traffic must be able to flow unhindered until then. So at both tunnel entrances, the four-lane road must be replaced – though it passes only centimetres from the construction site.

The lack of space and heavy use require detailed construction-site planning and logistics. BG is part of the consortium that the client, Neuchâtel Canton, has entrusted with local site supervision among other missions. Jean-François Vullioud explains his mission. “I coordinate the work of the contractors; I plan, manage and supervise.” The quality of the work must be inspected, and adherence to the safety plan, deadlines and costs checked. The engineer is constantly in contact with all participants, regularly discussing the construction plans and implementation concepts with them – usually bilaterally, but also on a regular basis at meetings where everyone is updated and problems are discussed. Managing the excavated materials and supporting residents are also part of the job. Vullioud says, “We plan the work in such a way that the public is disrupted as little as possible. And we inform as best as we can.” Of course, inquiries and complaints cannot be completely avoided.

So is the on-site construction manager like an orchestra conductor, with everyone following his baton? Jean-François Vullioud modestly waves off this idea. “I am only one of many people responsible for this major project. This site is like a complicated motor. Sometimes I add a few drops of lubricating oil so it can run smoothly.”

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<th>330,000 m³</th>
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<th>800 metres</th>
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<td>excavated material</td>
<td>new roadway</td>
<td>tunnel</td>
</tr>
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Vullioud says, “Water could reach the tunnel through cracks, but we can stop up the leaks with no problems.” The engineer is more worried about other things. “The times when we transfer the traffic management system are tricky. A few sporting challenges are still waiting for us there.”

Lack of Space The construction of the Serrières Tunnel is above all a logistical challenge.
A Tricky Mission in Unknown Territory

Construction of the Gautrain railway line between Pretoria, Johannesburg and the OR Tambo international airport is a quantum leap forward in public transportation for South Africa. For BG engineer Xavier Guigas, it has meant a big challenge and new experiences.
Johannesburg is halfway around the world from Lausanne, but for Xavier Guigas the eleven-hour flight has become a habit. Since 2004 he has been to South Africa about two dozen times, sometimes for one day, sometimes for two weeks. “In the evening you get on the plane. In the morning you arrive and go straight off to work.” So Xavier Guigas leads a commuter life on an intercontinental scale. It is part of his job always to be flying off to the other side of the world to advance “his” project – Gautrain.

The 42-year-old engineer is the project manager for a mission BG is doing for the Bombela international consortium led by Bouygues. Gauteng Province would like Gautrain, the new Y-shaped railroad connecting Pretoria, Johannesburg and the OR Tambo airport, to permanently improve mobility in this gigantic conurbation. Once it becomes fully operational at the end of 2010 the local train, which can travel up to 180 km/h, will redistribute the tremendous volume of commuter traffic. This should reduce vehicle travel by nearly 600,000 kilometres per day and also positively affect economic development. This mega-project, which Bombela is undertaking for the province through a public-private partnership, will cost about CHF 3 billion (€ 2 billion).

Xavier Guigas and his team have been entrusted with a central mission: they are responsible for safety over the entire route, especially for the underground section of the track, including tunnel ventilation – all of which fall under BG’s core competencies. Their safety plan includes prevention, damage control, evacuation provisions, tunnel ventilation, rescue and training – in other words, both construction and operational aspects. Fire aboard a train or a collision are the most serious contingencies the plan must cover. If there is an accident on the underground section of the track, which runs as deep as one hundred metres, the lives of hundreds of people will depend on whether refuge areas offer real protection, whether the ventilation system efficiently removes smoke, and whether fire and medical crews can arrive through the nearest rescue access tunnel and evacuate people.

Xavier Guigas found non-technical aspects of this mega-project to be the biggest challenge. “Above all, integrating ourselves into the complex surroundings was an exacting task.” And, a bit more concretely, “There is no comparable underground rail line in South Africa. The issues were new to the authorities and rescue services.” He says it took a great deal of convincing before it was accepted that the strict European safety standards absolutely had to be used for this project.

Xavier Guigas admits that he still has not seen much of the country. Naturally he has noticed the social distinctions, the contrasts between the glitter of downtown Johannesburg and the townships a mere ten kilometres away. But of course South Africa has much more to offer. “My work on Gautrain will end around 2011. But later I may take a vacation here and explore the country – or work for another South African project…”

The Y-shaped Gautrain railroad should improve mobility in the Gauteng Province

airport, to permanently improve mobility in this gigantic conurbation. Once it becomes fully operational at the end of 2010 the local train, which can travel up to 180 km/h, will redistribute the tremendous volume of commuter traffic. This should reduce vehicle travel by nearly 600,000 kilometres per day and also positively affect economic development. This mega-project, which Bombela is undertaking for the province through a public-private partnership, will cost about CHF 3 billion (€ 2 billion).

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The “Rainbow Nation” Emerges

The Republic of South Africa is an ethnically diverse country with a population of 49 million (about 80 percent black and barely 10 percent white) and no fewer than eleven official national languages. Since apartheid was finally abolished in 1994, the country also known as the Rainbow Nation has succeeded in breaking out of its international isolation and initiating rapid development. Today, South Africa is the continent’s leading economic power. Gauteng Province alone, with a population of over 9 million, generates about 9 percent of Africa’s gross national product. However, enormous social problems remain: poverty, AIDS and crime are daily realities for many in the conurbation’s townships.
“BG is the Ideal Partner for Us”

Zug-based engineering firm ARP André Rotzetter + Partner AG joined the BG group in November 2009. For Managing Director André Rotzetter, this was a groundbreaking decision, both personally and strategically.

BG: Mr. Rotzetter, you had your company join the BG group. Why?
A.R.: Twenty years ago I had already resolved to settle my company’s future in a timely manner. I never wanted to wait until after I turned 55. I have kept this resolution. BG is the ideal partner for us, because we cultivate a similar company culture and optimally complement each other both geographically and in terms of what we do. Our analysis showed that the companies fit together like two puzzle pieces.

BG: How did your employees react to the decision?
A.R.: My father used to say, “The way you start is important, but it’s on the way you finish that you’re judged.” There is no question for ARP’s employees that we have made a responsible decision for the company’s long-term future.

“A soup simply tastes better if it is seasoned with several different herbs”

BG: What can BG and ARP do better together than alone?
A.R.: The future will belong to companies that can offer one-stop shopping. Together, that is possible in terms of the services we provide and the geography. We are established in both western Switzerland and the German-speaking part of the country, and by combining our expertise we can cover the whole range of services for our profession. The advantage to our clients is that they have just one contact and one person accountable for everything.

BG: When two profitable companies decide to work together, it is for strategic reasons. What goals are you pursuing?
A.R.: Joining BG should strengthen our market position. In Switzerland we are now among the sector leaders, and we want to grow more. To do that, we must optimally cover our customers’ needs.

BG: You were ARP’s owner and Managing Director. Is it hard for you not to be the only master of the house any longer?
A.R.: Not as hard as I expected. Perhaps that is because I never was a “boss” in the traditional sense. While it is true that the company belonged to me, we have always cultivated a
flat hierarchy and shared responsibility. BG is very similar. That is why I feel very comfortable with BG. We also enjoy a great deal of autonomy within the BG group. The ARP name will not disappear from the market.

**BG: BG comes from French-speaking Switzerland and ARP from the German-speaking part of the country. How do the two cultures get along?**

A.R.: I experience the encounter between different cultures as enrichment. A soup simply tastes better if it is seasoned with several different herbs and not just with salt. If we treat each other with tolerance, if we see our differences as a challenge through which we can grow, then the cooperation between the two cultures will develop into a strength for the BG group. Switzerland serves as a successful model of how this works.

**ARP in a Nutshell**

ARP André Rotzetter + Partner AG was founded in 1957. The company is headquartered in Baar (Canton of Zug) and has branch offices in Schwyz and Zurich. It has about one hundred employees. Its areas of activity are engineering structures, structural design and engineering, road/rail/water infrastructure, costs/controlling/excavation, and urban infrastructure. ARP joined the BG group in November 2009.

**Key Projects:** Allmend sports arena in Lucerne, Zug ice rink, Rothenburg and Emmen A2 motorway interchanges (Canton of Lucerne), renovation of Reuss river dam and environmental upgrading (Canton of Zug).

**MORE INFORMATION** [www.arpinfo.ch](http://www.arpinfo.ch)
MARION BOURGEOS, age 26, studied environmental engineering at the Swiss Federal Institute of Technology in Lausanne. In 2005, she came to BG as an intern. Now she is a project engineer and is working on the Rhone 3 project, mainly in the areas of simulations, hydraulic calculations and cartography.

KHALID ESSYAD, age 45, studied hydraulics in Grenoble. After five years as an assistant lecturer at the Swiss Federal Institute of Technology in Lausanne, he joined BG as a hydraulics specialist in 1996. He is one of the designers of the Rhone 3 project and the creative mind for good solutions.
“Rhone 3 is a Gigantic Project”

The third Rhone correction is a once-a-century kind of project. Marion Bourgeois and Khalid Essyad of BG are working assiduously to make it a reality. A conversation about the project’s size and the engineers’ vision.
BG: Khalid Essyad, Marion Bourgeois: When was the last time you were on the Rhone’s banks?
Khalid Essyad: A few weeks ago. I went there to get an overview of the state of immediate flood protection measures.
Marion Bourgeois: This morning! I live in Villeneuve with a view straight out over the Rhone.

BG: For both of you, what is noteworthy about the Rhone 3 project?
M.B.: It is a gigantic project affecting 160 kilometres of the river, from Upper Valais to Lake Geneva. And the Rhone is not just any river, it is the main artery for the entire region.
K.E.: It is also an ambitious project. We want to landscape the Rhone in such a way that it no longer endangers people or property, yet can still meet all vital economic, environmental and social needs.

BG: Do you have a concrete vision, a goal that you want to achieve?
K.E.: Yes, we want to develop a sound, well-thought-out solution. For project development, we are taking into account not only the hydraulic aspects but also all issues that arise in connection with this river.
M.B.: We are not necessarily choosing the most technically outstanding solution; rather, we are selecting the one that best fits into the overall picture, that is appropriate to the needs and conditions.
K.E.: It is also important to me that things are not done halfway. We are sticking to the goals, even if there are difficulties. The idea is to mainstream the problems into the project and continue its development accordingly.

BG: How would you describe the Rhone 3 project? Is there something that is typical of it?
K.E.: This project definitely has certain idiosyncrasies. It develops only in those areas where goals have been set first. For example, we demonstrated how, within the framework of the project, we could revitalise the lowland riparian forests or create a delta. Today, these aspects are among the project’s main goals.
M.B.: It is also interesting that certain decisions are made very quickly while others take a great deal of time. But that depends directly on the solutions. If the suggestion is convincing and well thought out, it is quickly accepted. If not, that means it is not yet the optimal solution.
K.E.: Right. It is our job to work out optimal solutions. After all, the project affects a whole region and many people.

“It is important to me that things are not done halfway. We are sticking to the goals, even if there are difficulties”

BG: Marion Bourgeois, I read that you have already written your master’s thesis on the third Rhone correction. How old will you be when the project is finished?
M.B.: The project will be finished circa 2040. A quick calculation leads me to believe I will still be working then. But I might already be thinking occasionally about what I will do after retirement.
K.E.: For me, it naturally looks more critical. But the end of the project is not so crucial. At any rate, I will still be there when the central elements are implemented. I am pleased about that.

BG: What do you think: Will our descendants be proud of the steps that are being taken now?
M.B.: The goals will change, naturally. That is why revision phases are planned into the project every ten years. But I am convinced that the integrated approach, where planning takes into account all aspects of a watercourse, is the right one and will remain so.
K.E.: Generally speaking, engineers should be more open to requests and advice from a wide variety of sources. We work on water, so already it is clear that we have to be flexible. BG recognised that early on. And we have been working as interdisciplinary teams for years.
Third Rhone Correction General Project

Main Objective: Flood protection that includes all relevant factors and interests. Client: Rhone 3 Project Organisation, supported by Valais and Vaud Cantons. BG’s tasks: Overall conceptual design, hydraulics and cartography as part of the GR3 consortium. Duration of Project: 1993 to 2040. Project Status: The general project is awaiting approval by the cantons. Immediate flood-protection measures are already being implemented.

MORE INFORMATION www.vs.ch/rhone

OVERVIEW AND DETAILS Marion Bourgeois and Khalid Essyad bring large-project experience to this project.

PROJECT SKETCHES AS A BASIS FOR DISCUSSION Doing things right is critical.
The wastewater treatment plant (WTP) of the Interlaken Region employs highly qualified micro-specialists, i.e. myriads of bacteria tasked with restoring water to its natural purity. Thanks to BG, these labourers — invisible to the naked eye — enjoy ideal working conditions.
Toilet tissue, spaghetti, faeces, plastic bags, sand and oil float in the sludge that flows like a capillary stream into the WTP of the Interlaken Region. Wastewater from the entire area converges here. Large pieces of waste pose few problems for the plant, as they are removed with rakes, settling tanks and suction pipes. The dissolved substances are much more difficult to eliminate: proteins, fats, pharmaceuticals, cleaning agents, ammonium and the like. Separating them from the water requires painstaking and accurate work, carried out by the WTP’s tiniest employees: bacteria.

“Without bacteria it would not work. They do the biggest share of the work in the WTP,” says Dr. Thomas Haltmeier, the person responsible at BG for determining the facility’s layout. The wastewater contains more than enough food for these tiny employees. The bacteria thrive and multiply, but they quickly become lazy. “Take *Sphaerotilus natans*, for example, whose favourite food is sugar. Only when no sugar remains will it begin to eat other things.” *Escherichia coli* and *streptococci* are omnivorous – but even they get lazy when there is a large food supply. “We have to motivate the bacteria to eat other things too. We do that by limiting their food in certain parts of the tank,” Haltmeier explains. If the supply is low, the bacteria turn to less accessible nourishment and absorb other substances that must be eliminated.

Ammonium presents a big challenge for every WTP. This substance, excreted by humans and animals in the urine, is toxic to fish. If water containing ammonium is released into a stream, there are deadly consequences. Ammonium is not broken down by the usual bacteria. However, there are some that specialise in it: *Nitrosomonas* and *Nitrobacter*.

*Nitrosomonas* feeds exclusively on ammonium and converts it to nitrite. Then its co-worker, *Nitrobacter*, transforms the nitrite into nitrate. These specialists are rather rare and demanding. They love heat, need oxygen, and enjoy living on surfaces. That is why, in future, the WTP of the Interlaken Region will offer these specialists a home made just for them, on thousands upon thousands of small plastic plates in the water.

Once the two specialists have taken care of the hardest part of the job by breaking down ammonium, the all-rounders come into play: they change the nitrate made from the ammonium into nitorgen, a harmless substance. But they do not engage in this activity spontaneously. Only when no oxygen remains available in the water do they go after the oxygen molecules they need, which are contained in the nitrate, dissolving the compound as expected. “That is why it is important not to aerate some parts of the tank,” explains Thomas Haltmeier. If the system is properly designed and functional, even a difficult substance such as ammonium can be eliminated almost completely from the water. “The bacteria do an unbelievable job: the water that we get at the end of the biological cleaning process can be discharged into a stream without any difficulty whatsoever,” says a convinced Thomas Haltmeier.

**Refurbishment of the Interlaken Region WTP**

The Interlaken Region WTP treats an average of 10,000 cubic metres of wastewater each day. To date, thirteen municipalities have been connected to it. The treated wastewater flows into Lake Thun. Since the plant — the size of which is relatively modest — can no longer fully meet the conditions for discharging water into the lake, it is now being completely refurbished. In particular, the biological phase is being updated and the ammonium decomposition process improved. One new feature is the small square plastic plates with a textile-like surface that serve as supports for the nitrifying bacteria in the water. The plates occupy parts of the tank that are separated off by gratings.
In the La Défense district of Paris, office buildings are cooled with water from the Seine. To avoid any overheating, BG helped build a new flood-safe pumping station. The limited space available meant that right from the design phase, the engineers responsible for the project had to keep cool heads.

AIR CONDITIONING WITH WATER FROM THE SEINE The office buildings of the La Défense district in Paris can be efficiently cooled through thermal exchange in an environmentally friendly way.
The La Défense area in western Paris is known as Europe’s largest office district. Its 160 hectares contain three million square metres of office space. Fourteen of the twenty largest French companies have their headquarters in La Défense. Characteristic of this district located along the extension of the Champs-Élysées are its many high-rises, in which the vast majority of the 170,000 people employed there work.

Air-conditioning the office buildings requires a great deal of energy. Société Urbaine de Climatisation, a subsidiary of Dalkia, specialises in environmentally friendly cooling. It uses the nearby Seine to cool the units that supply the chilled water networks. A study showed that the pumping station currently used for this purpose, which was put in service in 1992, would be completely inundated by an average flood. The pumps would fail, with all the consequences one can imagine on the air conditioning facilities in the neighbouring offices.

A new solution was sought so that employees in the affected offices could continue to work at comfortable temperatures even if the Seine were to overflow its banks.

After the feasibility studies, BG also did the design engineering and oversaw the project as it was carried out. For instance, the group directed the implementation work and was heavily involved in creating the detailed design. When the pumping station was built, the very limited amount of space available was a real puzzle. Daily, thousands of vehicles pass between the pumping station and the river via Paul Doumer Wharf. Général Audran Street and National Highway 187 also pass directly by the construction site. The high-rises of La Défense tower only a few metres away.

Limited site access meant that a cool head was needed to plan each step of the work. Before excavation could begin, some of the pumping station’s existing water lines had to be moved. Once the new station’s side walls and floor had been built, the water intake from the Seine could be constructed. Due to the presence of Paul Doumer Wharf along the bank, the intake on the river could not be built from the land side. All necessary construction materials and machinery were loaded onto a freight barge and the construction site for the intake (which has a screen to filter out the largest floating rubbish) was isolated. The water from the Seine reaches the pumping station through a 60-metre-long supply pipe with an inside diameter of 1.60 metres, made using a micro-tunnel boring machine. Periodically, residues from successive automatic filtrations of the water are moved to the surface by a platform lift. A total of five pumps with a maximum capacity of 12,000 m³/h circulate the water through the heat exchangers located approximately 600 metres further on. The electrical installations were housed in a nearby above-ground building that is higher than the hundred-year flood level. So the pumps will operate perfectly even if the Seine overflows its banks.

Since the keys were handed over, the client has had the use of a highly effective backup facility.

Reliability Assured Even in Times of Flood

Société Urbaine de Climatisation commissioned the canalE company, which has been part of the BG group since 2007, to carry out the preliminary studies for the project. A dual technical approach was chosen to ensure that the new pumping station would operate in the event of a flood: positioning the electrical installation above the hundred-year-flood level, and using submersible pump technology.

In addition to designing and planning the construction work to take the space constraints into account, BG ordered the station’s most important elements (pumps, screens and platform lift), oversaw their installation and tested their operation.
STRUCTURE SPECIALISTS Michel Capron explains the importance of quality teamwork for a project’s success. Here, together with Nicolas Robadey, Delphine Chou and Benjamin Bastard.
A Unique Challenge, Calculable Risks

This structure is unbuildable, experts said. But there it is — the Rolex Learning Center is indeed standing on the campus of the Swiss Federal Institute of Technology in Lausanne. Michel Capron and his team supervised the structural calculations, among other things.
BG: Mr. Capron, as an avid mountain climber, you know how to handle risks. What risk factors do you consider before and during a climb? Michel Capron: Anyone who plans a mountaineering trip should make serious preparations: study the route, inspect the equipment, check weather reports and avalanche bulletins, and so on. On site, I also pay attention to the local weather conditions, the lie of the land and the physical condition of my companions.

BG: As an engineer, you also calculate risks. Can the engineer learn from the mountain climber?

M.C.: Whether on the mountain or at work, you have to know your limits and not exceed them. Anyone who loves adventure and looks for challenges must have gotten rid of any suicidal streak a long time ago.

BG: In February 2010 the Rolex Learning Center opened. Apart from the architecture, its construction ensured a worldwide sensation. Why?

M.C.: This is a pioneering project. Many techniques had to be developed first. For example, the vaulted concrete shells are unique. They serve as the floor and have to support far heavier loads than the thin shells usually used as the roof only. Moreover, these streamlined shells combine a height of less than 5 metres with span widths of up to 80 metres. That is huge.

The shells rest on arches that are held by underground pre-stressed cables. Construction of the roof from metal and wood was also a big challenge. Because the concrete shells consist of a single casting, roof and façade elements had to be flexible enough to adapt to concrete deformation.

BG: BG assisted with the technical execution of the structure on behalf of the full-service general contractor. In concrete terms, what tasks were included in this assignment?

M.C.: Our primary task was to check the calculations for everything from the pillars through the concrete shells to the roof. We examined the static behaviour by combining all of the structures into a single three-dimensional calculation model. In addition, we created various specific calculation models.

BG: Every climb has critical moments. What were the critical moments with the Rolex Learning Center?

M.C.: Many experts were of the opinion that this project was simply unbuildable. That made us more aware of not underestimating the risks. The most delicate moment was the removal of the formwork for the large concrete shells, which we had to raise and then lower again using fifty hydraulic jacks. The entire process involved risks and required quick decisions.

BG: On the mountain you have to be able to rely on your roped party. How important was the team in the Rolex Learning Center’s case?

M.C.: It was the critical factor in our success. My colleagues developed the models we used to check and optimise the calculations. The relevance of our proposals depended on the quality of their work.

BG: What is it about projects such as the Rolex Learning Center that appeals to Michel Capron? Is it the allure of pushing the limits of what is possible?

“As a mountain climber, I can risk my life; as an engineer I have no right to gamble with the lives of others”
Rolex Learning Center

The Rolex Learning Center of the Swiss Federal Institute of Technology in Lausanne is first and foremost a library. It holds over 500,000 volumes in one of Europe’s most comprehensive collections of scientific literature. The building also contains work areas for students, offices, restaurants, a bookstore and a bank. Led by Kazuyo Sejima and Ryue Nishizawa — winners of the 2010 Pritzker Prize among others for their work on the Rolex Learning Center —, Japanese architecture firm SANAA created an experimental work. Inspired by the Vaud Canton’s topography, the building resembles a landscape with gentle hills and broad valleys. Covering an area of 20,000 square metres, the effect is light and vibrant thanks to the way the vaulted roof parallels the floor. Building the enormous concrete shells and the flexible roof and façade systems were huge challenges for the participating engineering firms — including BG — and the general contractor (Losinger Construction SA). The greatest possible precision was required during construction. For example, the wooden formworks were cut with lasers and positioned using GPS technology. The Rolex Learning Center opened on February 17, 2010 and cost CHF 110 million (more than € 70 million).

M.C.: Only people who take big risks reach the limits of what is possible. As a mountain climber, I can risk my life; as an engineer I have no right to gamble with the lives of others. What appeals to me? I enjoy travelling new roads. And I like to challenge myself with increasingly complex tasks. That is why I rarely climb the same peak twice.

BG: How do you feel when you walk through the Rolex Learning Center now? Is it like standing on the summit after a difficult climb?
M.C.: When I stand on the summit I enjoy the feeling of having reached a beautiful goal via a demanding route. The Rolex Learning Center also combines complexity and aesthetics. So the feeling is comparable.

MORE INFORMATION www.rolexlearningcenter.ch
A Solid Framework for Those Who Aim High

When building owners and architects set their sights high, they must be able to rely on solid foundations. That is why renovating the tower that houses Television Suisse Romande (TSR) in Geneva required creative, flexible civil engineers.
Before the TSR tower could be renovated, the hazardous substances used when it was built had to be removed: asbestos, employed as a fire-resistant insulator on the steel beams and in the floors; and PCBs, used as plasticizers in joints. BG developed the corresponding study and the specifications for the decontamination, which lasted from spring 2007 until spring 2008. Eighty specialists removed the highly carcino- genic substances in a complex manual process, following the most stringent safety measures. About 400 metric tons of hazardous waste were removed.

The renovated TSR tower communicates with the city

The asymmetrically structured steel and glass façade now noticeably “communicates” with the city that surrounds it. The building has been given a “face” that allows one to look in from the outside and see out from the inside. This was made possible by the ambitious project of Geneva architects Devanthéry & Lamunière, the winners of a 2005 architectural competition.

Implementation of the project required, first, that the tower be dismantled down to its concrete core and steel skeleton, the bearing elements. Because the renovation project strove to incorporate space requirements and architectural ideas that were not directly related to the existing statics, one central task fell to the engineers: they had to ensure that the old framework would solidly support the new construction. BG was entrusted with this mission on behalf of full-service general contractor Implenia.

BG project manager Guido Roelfstra notes the three main elements of new construction that affect the statics. The most obvious is the cantilever that extends as an undivided spatial body over both of the two top storeys and protrudes from the façade like a balcony. A weight of 300 metric tonnes hangs over the edge. Guido Roelfstra says, “We used prestressed cables to transfer these forces to the concrete core, which had to be strengthened.” Another modification to the weight-bearing structure was the construction of three lounges (atriums) that extend over two or three storeys. In this case, as well, intermediate floors and part of the metal framing were removed. As a result, the remaining bearing structure had in turn to be reinforced and adapted. Then there is the new façade, thanks to which the building now meets the Minergie standard, which aims to rationalise energy consumption. It was built around the building, such that the storey floors were extended outward by 60 centimetres. The weight of the attached plates and steel elements likewise required adjustments to the steel skeleton.

Yet, according to Guido Roelfstra, structural analysis was not the biggest challenge. “What was difficult was that the building’s tenant, TSR, had to have access to the transmitters on the roof at all times, since they were still in use.” In addition, the engineers had to continually adapt the underlying weight-bearing structure, because when the conduits for power, water, ventilation, etc. were being installed, interventions that were not originally planned became necessary as the works progressed. So Guido Roelfstra and his team had to be creative and flexible.

Dangerous Substances Removed

Monolithic, closed, silent — such adjectives were often used when Geneva residents described “their” television station. This 60-metre tower, with its 17 storeys above ground that reached for the sky, was a child of its time. Finished in 1972, its central concrete core and skeleton of steel beams were reminiscent of the former World Trade Center in New York. More than 500 employees worked there, mostly in small rooms connected by narrow hallways and corridors. The inside and the outside somehow had nothing to do with each other.

All that is history. In 2010, TSR employees will return from their temporary location to the bank of the Arve. They will discover a distinctly improved working environment with spacious offices and large windows. And from the outside,
Towards the City of the Future

Traditional cities can function only by importing large amounts of fossil fuels. In the context of the Coordinated Metropolitan Planning Area for St. Julien – Plaine de l’Aire, BG is evaluating local potentials for renewable energy using the “regional energy planning” method.
The future is being built in the desert. Take Masdar City, which is under construction 30 kilometres from Abu Dhabi in the United Arab Emirates. The plan is that soon this city will accommodate 50,000 residents and provide 90,000 jobs, using no fossil fuels whatsoever. All needs of this city of the future are to be covered by local renewable energy sources. Eighty percent will come from solar power, the rest from wind energy or waste recycling. There will be no cars in Masdar City; residents will park them on the outskirts, where underground cable cars will be waiting for them. Passengers will be able to travel to 85 destinations using these vehicles, which will run on solar energy and be remotely guided. For longer distances, the transportation network will be supplemented by an open-air maglev railway. But daily travel will be mainly by bicycle and on foot. Thanks to the absence of cars on the roads, people will be able to move about freely and breathe clean air.

The scene changes to the France/Vaud/Geneva conurbation on the French-Swiss border, more specifically, the 8-km stretch between Geneva and Saint-Julien-en-Genevois, on the other side of the frontier with France. By 2030 this area will be one of the most important development corridors for this metropolitan area along the Rhone, with 14,000 new jobs and 32,000 additional residents.

What is the connection between Geneva/Saint-Julien-en-Genevois and Masdar City? Like the United Arab Emirates, Geneva and its suburbs are working on their energy future and pursuing ambitious goals. The key words are “Factor 4” for France and “2,000-watt society” for Switzerland. What these two concepts have in common is that they aim for a spectacular reduction in greenhouse gas emissions (see box). This is to be achieved by improving energy efficiency and promoting renewable energy sources.

In the context of coordinated, cross-border regional planning, BG has been given responsibility for the energy component by the seven participating municipalities. The goal is that one day, as at Masdar City, the largest possible fraction of energy needs will be met by local renewable energy resources. In this respect, the basic idea is “regional energy planning.”

BG’s engineers are taking stock of the current situation and the development potential by 2030 for all forms of renewable energy. Astonishingly, the range of available sources is already very broad: photovoltaic and thermal solar panels on roofs, household waste, wood, agricultural biomass, geothermal, small hydropower plants, etc. At the same time, demographic models allow future energy needs to be estimated for the area under study. Comparing the expected needs and the developable potential for renewable energies helps identify steps that should be taken to achieve the desired objectives. For this purpose, energy resources are allocated to various categories depending on where they are available, how they can be transported and the extent of necessary infrastructures. This also brings out areas where synergies exist among the various resources as well as obstacles to their optimal development. All of these studies yield results that provide the concerned authorities with reliable information based upon which, beginning now, they can actively take control of their energy future.
Many plants and animals worth protecting live either in or near running water. But running water can also be used as a source of renewable energy that can be tapped by small hydroelectric power plants. A methodology developed by BG helps find the best possible solution for the conflicting goals of these two environmental concerns.
Climate change, rising petroleum prices and foreign dependence are among the many compelling reasons to encourage the use of renewable energies. For example, among other projects, Switzerland is offering financial incentives for electricity production by small hydropower plants. Interest in the federal subsidies is high. In the first three months of the subsidy programme alone, 347 applications for small hydropower plants were submitted. The new federal funds have triggered a real boom in small power-plant construction projects.

This development, which at first sight looks positive, is however not without risk. Along with opportunities for producing renewable energy, running water also provides habitat for many threatened plant and animal species. New power plants are always associated with impairments of the natural environment. Power plants that make sense in terms of protecting the climate also threaten ecologically valuable habitats.

Besides having to balance these conflicting goals, the responsible authorities are concerned by the magnitude of new applications. While in the past every application for a new power plant could be checked in a timely manner, the capacity to do so today is insufficient owing to the above mentioned boom. Furthermore, the applications must be evaluated fairly, i.e., using transparent and uniform criteria.

Given the issues of environmental protection, insufficient capacity and the fairness imperative, it quickly became clear that novel approaches were needed so that new power plant applications would not turn into an uncontrollable flood.

Water Agenda 21 – a grouping of the main public and private stakeholders in the Swiss water sector – commissioned BG to develop an appropriate methodology that would take both the water use and protection aspects into account.

The methodology, developed in workshops with the concerned stakeholders, is based on a two-dimensional assessment of individual segments of watercourses. One area of focus, the water use aspect, is examined in light of the principle that the more economically advantageous a watercourse segment is, the more “worth using” it is. In opposition to this classification is the protection aspect: the more valuable a watercourse segment is, the more “worth protecting” it is. Several individual criteria are assessed and weighted to determine how economically advantageous or valuable a watercourse segment really is.

Then the resulting water use and protection interests are set against each other. The combination yields the result for the relevant watercourse. Segments with great economic potential and few protection interests are appropriate for use in generating hydropower. On the other hand, valuable watercourses with low potential should be protected and new projects avoided. And finally, there are segments that have potential for utilisation but at the same time are classified as deserving of environmental protection. In these cases, the water use and protection interests are clearly in conflict. More stringent requirements for new plants ensure that even in these areas, the protection aspect is appropriately taken into account.

Within a short period of time, a balanced methodology was developed that enables the authorities to efficiently evaluate the applications using uniform criteria.

Green, Yellow or Red? Water Use Versus Protection in Berne Canton

BG developed the methodology in cooperation with Berne Canton and immediately applied it. All of the canton’s watercourses were evaluated for their use potential and protection interest. Overlaying the two aspects resulted in a cantonal map with green, yellow and red watercourse segments, depending on whether priority is given to water use or protection. The responsible authorities can use this information in their initial evaluation of applications for hydropower development. The map is an important basis for the canton’s water management strategy, which was released for comment in early 2010. This strategy should make it possible to achieve the best possible results for both renewable energy production and environmental protection.

More information: www.bve.be.ch/site/index/awa/-14.content.awa-newpage
Renewable Energy

Thermal Tunnels

Sustainable development combines innovative ideas and creativity with the discovery of new solutions. BG actively participates in the effort through several research projects. For example, in a programme sponsored by the Federal Office for Roadways (OFROU), the energy generated in the Galgenbuck Tunnel will be used to heat a nearby bridge and roundabout and prevent black ice formation. “We’re looking at transferring the thermal energy generated in the tunnel to an adjacent bridge by using a heat transfer fluid in the heating coils on the bridge,” explains Frank Doppenberg, head of BG’s Energy competence centre. “So we can make use of energy that is currently wasted. This also reduces excessive use of polluting and corrosive rock salt on the roads.”

Structural Engineering

Just the Right Size

“The foundations of Berne’s Stade de Suisse were built using highly innovative methods,” states Kai-Uwe Schweizer, Director of Beyeler Ingenieure AG in Berne, a BG subsidiary.

Beyeler Ingenieure AG and EPFL Professor Brühwiler worked on a series of calculations and tests to optimise the size and design of the reinforced concrete slab foundations. The data gathered provided valuable information about the concrete-pouring phases and the best way to reinforce the slab during construction. To control cracking and deformation, sensors were embedded in the foundation.

Despite the significant cost of the research, the engineers’ efforts reduced construction costs by over CHF 1 million (over € 660,000), which would otherwise have been spent on steel and chemical additives.”
Although tunnel building may be considered the height of Swiss construction ingenuity, tunnels are nonetheless difficult structures to design and build. “The geological variations inherent to underground projects, particularly those that go very deep, can cause serious disruptions to the construction site. In the extreme situation in which a tunnel boring machine — also known as TBM — becomes blocked by excessive loading pressures or significant groundwater inflow, the project may have to be completely redesigned, if not abandoned altogether, resulting in enormous financial loss,” explains Daniel Collomb, project manager for underground works at BG. To reduce the effects of these geological risks on TBM works, in 2009 BG joined a project led by EPFL Professor Zhao and co-financed by the Swiss Innovation Promotion Agency (CTI). The study will take several years and will be done in partnership with world-leading TBM manufacturer Herrenknecht, Spain’s Acciona company and the Amberg and Lombardi engineering firms. “BG brings to the collaboration the expertise it has gained from numerous research and construction projects, along with significant on-site experience, particularly from the Lötschberg tunnel,” adds Collomb. 

At one of Geneva’s major industrial sites, recycling heat from wastewater could save 4.5 GWh of natural gas every year, or 900 metric tons of CO₂. Therefore the Geneva Public Works (SIG) has commissioned BG to implement this “Negawatts” project (the opposite of “Megawatts”). As a third-party investor, SIG finances the construction and then reimburses itself from the savings the project generates. This allows the industrial partner to reduce operating costs and benefit from energy savings after amortization, without having to invest its own funds. SIG also shoulders any technical or financial risks.

BG is participating in a CHF 12 million (around € 8 million) research project in partnership with EAWAG, ETH Zurich, Ecoplan and the EBP engineering firm. Funded by the Swiss National Science Foundation (PNR 61), this research programme will analyse water resources management methods by watershed. About 30 cases in Switzerland will be studied. “Those at near optimal performance will serve as models to help us come up with recommendations on how to manage water resources sustainably,” explains Olivier Chaix, BG Executive Director and Water and Environment Director for Switzerland.
Committed Company Directors

Promoting the Engineering Profession

BG is committed to serving society in contexts outside its commissioned work. Several BG executives are involved in developing the engineering profession by participating in various professional associations. CEO Laurent Vulliet was appointed Vice-President of the Swiss Association for Engineers and Architects (SIA). In his capacity as a professor at the EPFL, he also maintains ties with students. Executive Directors Pierre Kohler and Olivier Chaix are respectively an expert for the French National Commission on Evaluating Road Construction Safety (CNESOR) and the Vice-President of the Swiss Water Association (VSA). Vice-President Joseph von Aarburg was re-elected to another four-year term with the Swiss Association of Consulting Engineers (USIC).

“Dare to Try Any Profession”

Honouring the Children

Breaking down the barriers between professions which are typically considered to be either “masculine” or “feminine” was the focus of French-speaking Switzerland’s “Dare to Try Any Profession” day on November 12, 2009. Children aged 10 to 13 were invited to come to work with their parents, in an effort to encourage them to consider career options outside the traditional gender norms. “Parents and children spent the day with us and we all ate crêpes together at lunch,” describes BG’s HR Director Béatrice Saxer Brown. “The parents enjoyed themselves and laughed as much as the children.” The visitors participated in two activities: a visit to Lausanne’s m2 subway to learn about careers in electromechanical engineering, and a look at computer-aided design as an introduction to civil engineering design. A dozen children took part in the enriching, fun-filled experience. “We plan to continue the practice every year and offer additional activities whenever possible,” says Saxer Brown.

Sustainable Development

BG Rewards Two Students

BG’s Prizes for Sustainable Development are awarded to Master’s level projects at the EPFL that take an approach integrating economic, social and environmental issues. The winners of the 2009 prizes were Magalie Bassan, an Environmental Sciences and Engineering student, and Architecture student Isabelle Dorsaz.

Magalie Bassan’s thesis outlined specific proposals that could lead to tangible, sustainable improvements for managing sewage treatment systems in developing countries.

Isabelle Dorsaz was rewarded for an architectural project that rethinks the planning of Onex-Lancy (Geneva Canton) by optimising the use of existing built space.
Why did you decide to launch BG Academy?

Laurent Vulliet: BG Academy is our in-house training project and responds to an obvious need for what English-speakers refer to as “lifelong learning.” In BG’s case the concept of continuing education is particularly important, as the company’s products are intellectual services provided by highly qualified experts (editor’s note: two-thirds of BG’s employees are university graduates). In a world of constantly evolving technologies, changing legal and economic conditions and continual modifications to our work space, staying at the forefront of knowledge is a competitive advantage and arguably a condition for both the company and individual survival in the business.

Béatrice Saxer Brown: BG has always been committed to its employees. BG Academy will serve as another tool to attract new talent and further develop our staff’s skills. Functioning on both the virtual and physical levels, BG Academy will also serve to develop and maintain the corporate culture. It will help new employees coming from both organic and external growth to fit in. Finally, it is a personal career management tool.

In concrete terms, how will BG Academy be implemented?

B.S.B.: Many opportunities for continuing education are already available inside the Group. BG Academy will consolidate these initiatives and develop aspects previously managed differently within the company. It will cement these activities together. In addition, it will bring innovative solutions in several areas such as project management, risk analysis, interpersonal relationships (soft skills) and technology monitoring.

L.V.: We set short-, medium-, and long-term goals. We’ll be working in partnership with universities, professional associations and selected training companies. Part of the training on offer will be in-house and we will be calling on recently retired staff to share their knowledge and experience.

How will this corporate university be structured?

B.S.B.: BG Academy’s structure will include several types of training (technical, managerial, office automation, foreign language training and personal development skills). Various teaching methods will be used, from traditional face-to-face learning to e-learning (via our “2.0” web platform).

How will staff benefit from BG Academy?

B.S.B.: Every staff member will be able to create a training portfolio that will be useful for his or her progress within the company and also, we hope, for individual development and achievement of personal goals.
A single figure sums up 2009 for BG: the 34% rise in turnover. This increase validates the Group’s strategy, confirms the value of its employees and, above all, expresses the continuing confidence of its clients.

In a world economic situation that remains troubled – conditions are still sluggish in some sectors – the BG group continues to enjoy encouragingly robust health. Two elements supported this momentum in 2009.

First, construction and civil engineering were relatively unaffected on BG’s traditional markets. Business expanded in Switzerland, France and Algeria, supported in part by the public sector’s needs. Second, the BG group patiently continued to pursue a development strategy that allowed it to conquer new markets, innovate by offering new services, recruit high-quality employees, and strengthen its special relationship with its clients.

Sustained Growth

In 2009 the Group’s turnover rose by 34%, a record for the company which today boasts a staff of over 500. One quarter of the increase was due to organic growth as several units expanded. Despite a persistent shortage of talent, BG succeeded in recruiting 80 new employees in 2009.

As for the rest, external growth was remarkable. The companies that joined the Group in 2009, namely FMNi in Corcelles, Beyeler Ingenieure in Berne and ARP in Zug, Zurich and Schwyz, contributed CHF 16 million (around €11 million) to the Group’s consolidated turnover for the year. Gradual inclusion of the subsidiaries is proceeding in perfect symbiosis with management retention, recruitment, improvement of the production tool and the creation of added value through synergistic effects.

Market Consolidation

In Switzerland, BG has achieved national stature. The Group’s recent development has been especially striking in German-speaking Switzerland, with a local presence ensuring even closer contact with the clientele. This geographic coverage extends to the urban areas of Switzerland that offer the greatest development potential.

In the French-speaking part of the country, the wide range of services provided by BG reinforces its leading position. The energy sector – both at the scale of individual buildings and at the regional or network scale – stands out for its remarkable advance.

In France, the Paris-Lyons-Marseille corridor showed encouraging vitality in 2009. In the Paris region, BG’s historic activities in water and the environment continued. New business is being developed in transport infrastructure and building energy. Larger offices will be taken up in Ivry in July 2010.

The Lyons region, which is also showing strong growth, is at the core of BG’s transport infrastructure development. BG’s Aix-les-Bains subsidiary Tonello, which has expertise in engineering structures, has been in new offices since March 2010. In Marseilles, several significant projects were awarded in 2009 in the transport infrastructures and regional energy management
sectors. Efforts focused on building maritime and river hydraulics activities.

For Algeria, in 2009 BG's Board of Directors approved a strategy for developing business in the water and environment sector. BG now has a presence at four locations: Algiers, Annaba, El Oued and Ghardaïa.

New Cross-Disciplinary Services

The creation of four centres of competence in Energy, Structural Engineering, Integrated Risk Management and Transport Systems strengthens the Group’s cross-disciplinary service offering. By consolidating its resources in areas that provide productive synergies, BG is preparing to serve its clients’ interests in the future.

Innovation Through Continuing Education

In 2009 personnel management paralleled the Group’s development as it continued to move toward favouring the international and multilingual dimension. An important project, “BG Academy,” came into being. It includes all continuing education initiatives, one of BG’s key development strategies.

Moving Toward Participatory Communication

BG’s new web site is already a year old! Based on a “2.0” approach, it incorporates dynamic content management based on the principles of collective creation and user interaction. Alongside electronic document management and videoconference systems, the intranet was developed as a support for collective intelligence.

Strengthening the Internal Partnership

While continuing to maintain all of its capital in the hands of its employees, the BG group completely revised its internal partnership principle in 2009. The nearly thirty partners are company managers and experts of international repute. They are helping define the strategy and are committed to holding together two-thirds of the company’s capital for the long term. This is how BG is increasing its overall financial independence.

An Untroubled Future

The year 2010 began with the fullest order book in history, with encouraging business prospects despite very strong price pressures on all markets.

BG intends to continue its development by paying special attention to consolidating recent growth operations and freeing up resources for innovation, training and continual improvement of working conditions. In 2010 the Group will focus more than ever on its clients through a new customer satisfaction survey. BG will direct all its energies to living up to its business partners’ trust and meeting their expectations.

Innovation, multidisciplinarity and management of complexity remain the Group’s watchwords, which are translated into international and multicultural dimensions.
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