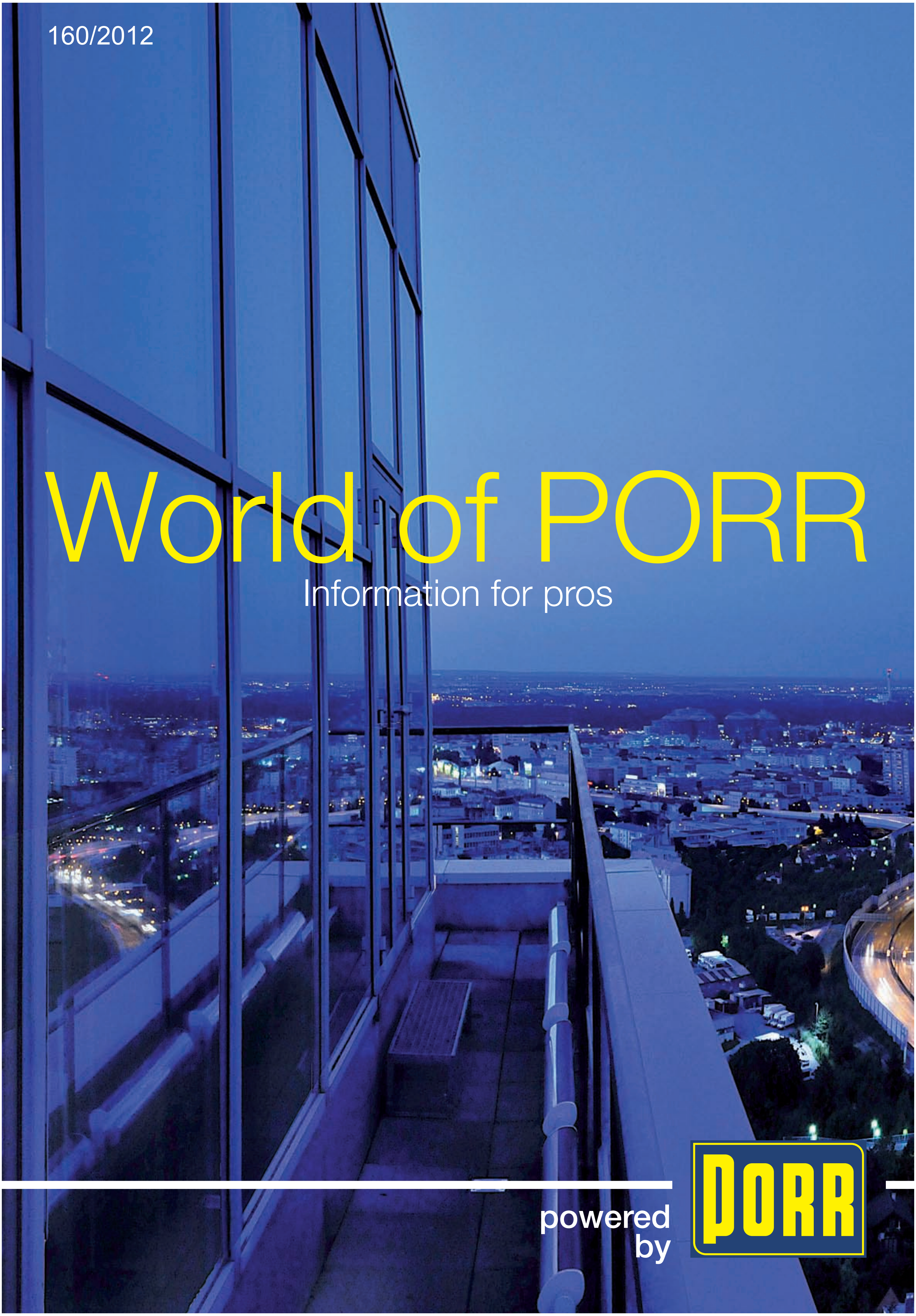
160/2012

World of PORR

Information for pros



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PORR Updates

CEO Karl-Heinz Strauss

CEO Karl-Heinz Strauss
Image: PORR

Ladies and gentlemen,
Dear business partners,

Welcome to the second edition of “World of PORR” in its new format. I am glad to report that the digital version of our traditional company journal, which we launched with the edition before this one, has been a success. We received a lot of positive feedback, for which I would like to thank you on behalf of the PORR Group. It goes without saying that we will be happy to answer any queries and take up your suggestions – for contact details, see the last page.

The focus of this issue of “World of PORR” is on healthcare, a sector that has risen to prominence against the background of tight government budgets. The heated, often highly emotional debates about the capacity and cost of our public healthcare systems are evidence of the importance that we as a society attach to these questions. At the same time, a field as sensitive as this does not lend itself to quick fixes; decisions must only be taken after careful consideration.

Health is indeed the most precious good we have, and I am proud of the PORR Group’s excellent know-how in hospital and rehabilitation centre design and construction, which we have been able to deploy in many projects, some of them far beyond the borders of Austria, in recent years. Specifically, let me draw your attention to the feature article about Surgical Ward West II in Salzburg. Health and nursing care are also major topics of the article, which discusses the Simmering Residential Care Facility in Vienna.

Within the field of building construction, this edition of “World of PORR” also dedicates space to housing and hotel development projects. We present a combined housing and students’ residence complex and another residential complex in Vienna (projects Gasgasse and Donaufelderstraße). With respect to tourism developments, you will find an update on the Tivoli hotel project in Innsbruck and an article about a castle (Schloss Untermerzbach) that was converted into a seminar hotel.

Moving on to civil engineering and infrastructure, this issue presents a wide range of projects which the PORR Group has been implementing. In addition to road and bridge construction, the energy sector features prominently with reports on two hydropower plants: one in Ashta, Albania, and the other in Salzburg, Austria. Just like healthcare, energy supply is a critical field for the future, and the PORR Group will continue its activities in both fields in the years to come.

I hope that we have picked subjects you will find interesting, and that "World of PORR" will make exciting reading for you.

Karl-Heinz Strauss
CEO and Chairman of the Board

Renovation and widening of the Aabachtal Viaduct at Lenzburg, Switzerland

A challenge in terms of technology and traffic

Patrick Peter

Just 23.2 m wide and 366 m long, the Aabachtal viaduct spans the gorge of the Aabach stream at Lenzburg, Switzerland. It is one of the narrowest sections of the 9.5 km motorway connection between Lenzburg and Birrfeld. As part of the A1 motorway improvement programme, the viaduct is being widened to bring it up to modern standards and ensure traffic safety.

The project

It became necessary to widen the carriageway to bring it up to the standard required for class 1 national motorways, which means adding about 5 m of width to the existing viaduct deck. To cope with the added load, some of the support foundations have to be strengthened. In addition, new in-situ concrete transversal beams are required.

In the process, preparations are being made for a potential conversion to six-lane traffic in the future. Should it become desirable to have six lanes 20 or 30 years from now, there will be no need for another widening project, hence no massive incremental investment expenditure.

Preliminary investigations showed that the substance of the bridge structure is still sound enough for the renovation and widening works to be carried out. Considering that the viaduct was opened for traffic in 1966, i.e. that it has been in place for nearly 50 years, and that it is one of the most heavily frequented motorway structures in Switzerland, its current condition is in fact remarkably good. An average of 80,000 vehicles travel the Lenzburg-Birrfeld route in both directions every day.

Construction of the Aabachtal viaduct, 1963
Image: ETH Zurich

Project description

Structural design for widening

Out of three possible designs, the client selected the option that would allow traffic on the viaduct to continue during the works and would have the least impact on the viaduct's architectural design. With additional longitudinal webs, the existing hollow boxes are converted into two-cell box girders, and transversal beams are added to the existing superstructure to transfer the loads from the new longitudinal webs to the supports.

Prestressing

Strand cables are used for prestressing, with four cables (P0=4090 kN) per standard panel and six cables above the supports. The prestress achieves a mean compensation of 102% of dead loads, resulting in a mean concrete compression of 6-7 N/mm². Prestressing is carried out in three stages for each side of the bridge.

Close to the supports, the construction calls for cross-pretensioning of the lower box plates through the existing hollow box, ensuring the shear connection of the new lower box plate. Four to six strand cables (P0=1300 kN) are used per panel.

Pulling heads
Image: PORR

Hollow box girder
Image: PORR

Longitudinal joints

The biggest challenge was to make sure that the new 2.5 m addition to either side of the deck would not tilt. The solution to this problem was to place steel girders adjacent to the transversal beams to protect against tilting. A longitudinal, 55 cm gap is provisionally left open between the old and the newly added bridge deck segments. This ensures that the normal force from the prestressing acts on the new cross-section and does not migrate into the existing bridge structure. Only when all cables are fully pre-tensioned is the centring lowered and the joint subsequently closed.

Anti-tilting structure on the transversal beam
Image: PORR

Lower joint gap
Image: PORR

Upper joint gap
Image: PORR

Renovation of the load-bearing concrete structures

The side walls (south and north side) are being demolished, so that renovation works are limited to the drilling out and derusting of steel reinforcements and subsequent reprofiling.

Major repair works are required on the abutments. In the hollows underneath the carriageway transition areas, the concrete cover has to be largely broken away from the reinforcement and reprofiled, especially on the walls.

The contract also includes replacement of the mastic asphalt cover and of the existing drainage system. Additionally, plexiglass noise barriers have to be mounted on the new side walls.


New side wall
Image: PORR


Widened south side with plexiglass noise barrier
Image: PORR


New side wall
Image: PORR

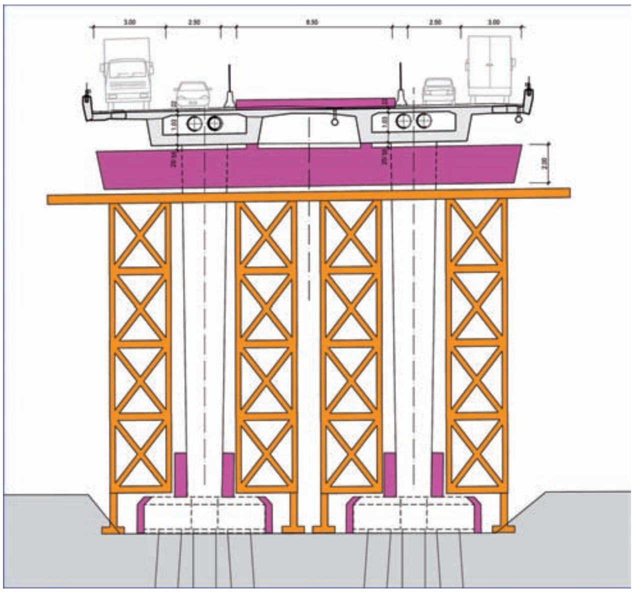

Full view of the south and north sides of the construction site
Image: PORR

The construction stages

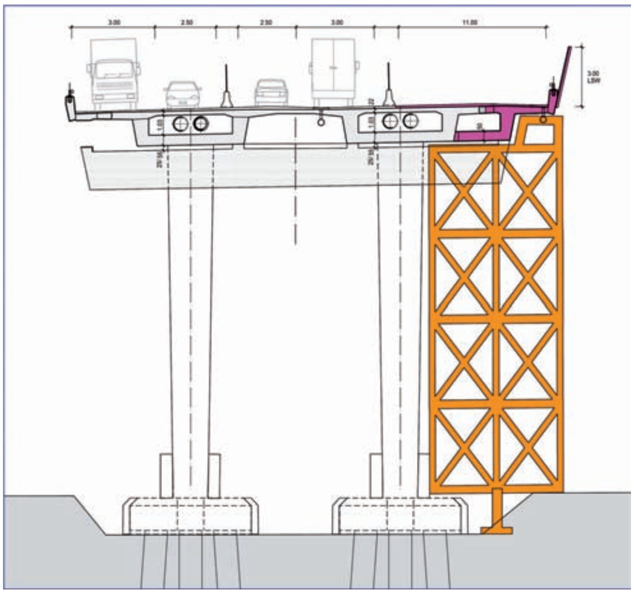
The construction process is divided into three stages, each with a defined deadline. The uninterrupted traffic flow across the bridge during the works makes the widening project a challenging task that requires precise coordination of all work processes. Temporary barriers help to ensure the safety of workers along the busy lanes and on the central reserve.

Stage 1: Strengthening of foundations / transversal beams

- Strengthening of foundations and connection to the supports
- Concreting of new transversal beams adjacent to the supports
- Restoration of the central part of the bridge deck
- Widening of the abutments and installation of new drainage pipes in the centre of the carriageway



Strengthening of foundation / transversal beams April to November 2010
Image: PORR



Widening December 2010 to November 2011
Image: PORR

Transversal beams
Image: PORR

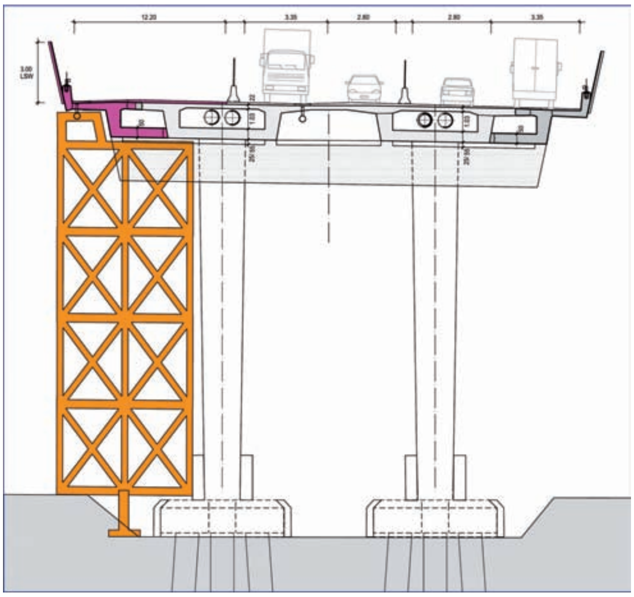
Stage 2: Widening on the south side

- Widening of the south side by approx. 2.50 m
- Widening of the southern abutments
- Complex centring for the widening construction
- 3 main phases in longitudinal direction
- Transversally, the trough and deck are separately shuttered and concreted

Centring for the box girder, north side
Image: PORR

Stage 3: Widening on the north side

- Widening of the north side by approx. 2.50 m
- Widening of the northern abutments
- Sophisticated centring for the widening construction
- 3 main phases in longitudinal direction
- Transversally, the trough and deck are separately shuttered and concreted



Widening December 2011 to November 2012
Image: PORR

Box girder shuttering on the north side
Image: PORR

The project is currently in its completion stage and will be handed over to the client according to schedule in November 2012. Excellent cooperation between all parties involved has made it possible to rise to the challenges and make a success of this demanding project.

Project data

Client	Bundesamt für Strassen ASTRA (Federal Road Authority)
Project design	Rothpletz, Lienhard + Cie AG
Contractor	PORR SUISSE AG Tiefbau
Construction period	April 2010 – November 2012
New bridge width	26.5 m
Length of bridge	366 m
Shuttering	13,000 m²
Reinforcing steel	600 t
Concrete	4,750 m³
Prestressing system	approx. 5,450 m of stretching cable approx. 400 anchors

Gasgasse housing complex and students' residence

The PORR Group built a cooperative housing complex with 265 government-subsidised apartments and a students' residence in Vienna's 15th district.

Horst Schwarzinger

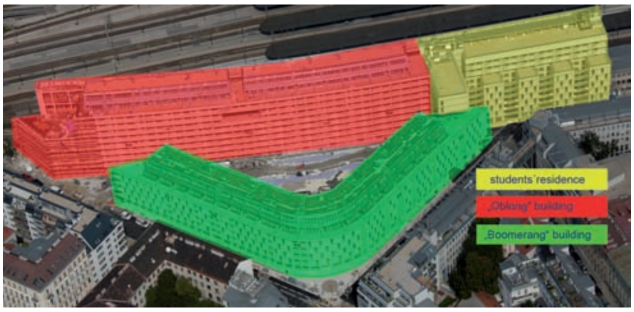
On 1st September 2009, PORR was appointed by Heimbau Gemeinnützige Bau-, Wohnungs- und Siedlungsgenossenschaft (a cooperative building association) as general contractor for the construction of a housing complex and a students' residence at Gasgasse 2-6 in Vienna's 15th district. The architecture firm Kohlbauer developed the permit application design, and the architecture firm Maurer prepared the construction documents for execution of the project.

View from the south
Image: Luftbildservice Redl

Project description

The general contractor was commissioned to construct 265 apartments, ready for occupancy, in the housing complex and 194 rooms for students in the students' residence wing. The latter is designed to meet the Passive House Standard for energy efficiency. The contract further included the provision of 295 car parking spaces, two bin rooms, pram and bicycle storage rooms as well as laundry rooms.

The project was subdivided into an oblong and a boomerang-shaped building. 34 maisonette apartments were constructed on the topmost floors, and the complex has ten staircases equipped with lift systems.



Building section
Image: PORR

Execution of the construction works

In September 2009, the construction works were started.

Excavation support system

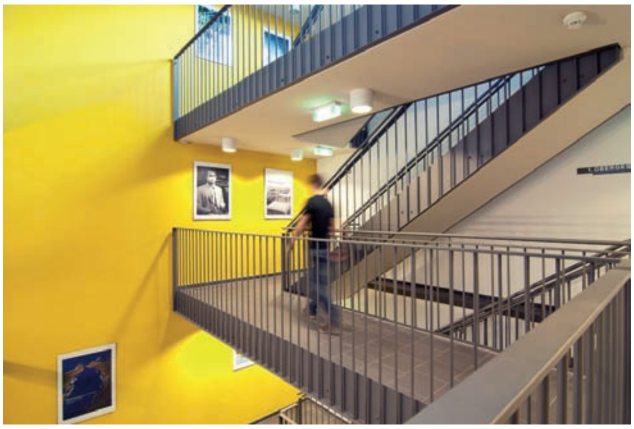
In the area of the Westbahnhof railway station, the excavation was secured by a bored pile wall with removable anti-shock anchor bolts.
Along Gasgasse, GRP bolts were installed in the existing light wells of the former mail distribution centre in order to secure the excavation.

The buildings are founded on bottom slabs of waterproof concrete in combination with bored piles. In the area of the Boomerang building, the bottom slab is 100 cm thick; in the area of the Oblong it is 50 cm. The outer basement walls are 30-cm reinforced concrete walls which are also waterproof. The basement ceiling consists largely of in situ concrete, whereas precast floor slabs were used for the upper floors.

Students' residence – building to the Passive House Energy Standard

Building the students' residence wing to the Passive House Standard was a special challenge. A 36-cm external thermal insulation composite system was used for the façade, and the site team conducted blower door tests in each room unit during construction. Additional random sample measurements were taken by an external civil engineering firm to verify the test results. An air exchange rate of n50<=0.3/h was achieved, as had been stipulated by the owner.


Outside view of the students' residence
Image: OeAD-GmbH


Staircase, students' residence
Image: OeAD-GmbH


Room interior, students' residence
Image: OeAD-GmbH

The "Cloud Link"
Projecting from the students' residence wing at a height of 19 m, the Cloud Link establishes a connection with the housing complex. The Cloud Link was constructed using concrete beams which were cast at the construction site and self-supporting floor slabs, so that no complex and costly additional support structures were required.


“Cloud Link”
Image: PORR

Residential complex
The apartments in the Oblong building are accessed via a closed walkway facing the adjacent premises of the Austrian Federal Railways.

The maisonette apartments on the topmost floors are topped by concrete roof constructions with isosceles trapezoid cross-sections (“coffin-lid construction”). In the Oblong building, trapezoidal metal profiles were used for the roof structure to comply with the requirements for high-rise buildings; in the Boomerang building, a standard timber construction was used.

With a 12-cm ETICS façade and wood-aluminium windows, the apartments meet the requirements of the Low-Energy Building Standard.


Closed walkway in the Oblong building
Image: PORR

Solar protection
In the area of the maisonette apartments, rigid aluminium louvred sunscreens with a width of 30 cm were installed in addition to 400 external sun shades.

In the apartments on the lower floors, internal Venetian blinds were used, and the balconies were provided with electrically operated external roller blinds.

Ledges, pigeon control
The ledge construction, being 1,400 m long and 36 cm wide, constituted a real challenge. The prefabricated ledges had to be fixed to the 36-cm ETICS façade of the students' residence wing and to the 12-cm ETICS façade of the residential building. The surface was covered with sheet metal. Due to the proximity of the Westbahnhof railway station, all the ledges were fitted with a pigeon proofing system (electric wires). In addition, acoustic pigeon deterrent systems were installed in the area of the communal terraces.

Lifts
Ten lift systems were constructed, five of them being "fire brigade lifts". Stainless steel wall panels and tile floors were used for the lift interiors.

Building maintenance system
A building maintenance system was installed for cleaning the aluminium-glass façades of the Oblong building building, which faces the railway station.

It consists of a work platform which can be moved via a rail system along the topmost storey.

View from the north
Image: Luftbildservice Redl

Flat roofs
The roofs of the Oblong building are covered with gravel, while the Boomerang building has a planted green roof.

On the roof of the students' residence section, the owner additionally constructed a photovoltaic installation, which was integrated into the warm roof construction provided by PORR.

Pressurised ventilation system for staircases
Due to the different geometries of the building parts, different pressurised ventilation systems had to be installed for the staircases.

Garage door system
To ensure a smooth traffic flow for those parking their vehicles in the garage, a high-speed door with an opening rate of 3 m/s was installed.

Concluding remarks
The students' residence wing was handed over to the owner in June 2011, the housing complex in December 2011, both on schedule. Thanks to excellent cooperation with the owner, the construction works proceeded smoothly and without any hitches.

Project data

Client	"Heimbau" Gemeinnützige Bau-, Wohnungs- und Siedlungsgenossenschaft reg.Gen.m.b.H.
Start of construction works	September 2009
Completion students' residence	June 2011
Completion apartment complex	December 2011
Gross floor space	38,175 m²
Usable floor space	28,145 m²
Number of rooms for students	194
Number of apartments	265
Number of parking spaces	295

Resurfacing and repair of A2 motorway (Südautobahn), section Ilz–Sinabelkirchen

Replacement of asphalt pavement and bridge repair on an 8-km stretch of motorway

Peter Buchner, René Jagerhofer

In August 2011, the local branch of TEERAG-ASDAG AG in the province of Styria was commissioned by Austria’s government-owned motorway management company ASFINAG to renew the asphalt concrete on the Vienna-bound carriageway of the A2 motorway section between the towns of Ilz and Sinabelkirchen and repair seven bridge structures en route.

Challenges

The main challenges were the short time allowed for the works (95 calendar days) and the number of bridge structures that required repair works which had to be coordinated with the road construction works. Cramped space was an additional issue as the repair works had to be carried out on one half of the carriageway at a time.

Grinding off of asphalt paving
Image: PORR

Asphalting in a cramped space
Image: PORR

Renewal of asphalt paving
Image: PORR

Recycled material used in asphalt mix

To economise on construction material and help protect the environment, ASFINAG is promoting the use of recycled materials. In this case, the specified asphalt mix type “AC32binder, PmB 45/80-65, H1, G4, RA20” contains 20 mass percent reclaimed asphalt pavement.

Road engineering works

The engineering works were conducted on the Vienna-bound carriageway of the A2 motorway section between km 142,500 and km 150,900, including motorway bridges A1, A2, H44a, H45a, H46, H46a and H47. The works comprised renewal of the carriageway pavement and increasing the gradients of bridge H46, including all required clearance and demolition works, groundworks, and road construction works.

The asphalt cover was ground off to an average depth of 15.5 cm on the first and second lanes and to an average depth of 3.5 cm on the hard shoulder, exit and entrance ramps. The carriageway was then repaved with a 12-cm subsurface course and a 3.5-cm SMA surface course (load class S).

Project data – road engineering

Ground-off asphalt	12,454 m³
Hydrocleaning	108,000 m²
PmB tack coat	178,000 m²
Asphalt mix	32,000 t
Temporary concrete crash barriers	10,500 m

Precast concrete restraint system	560 m

Bridge repairs

Seven bridges were repaired on the Ilz–Sinabelkirchen motorway section. This involved conversion of the rubble walls, complete replacement of all sliding plates and partial renewal of edge beams, sealing and other components. The load-bearing substructure of bridge A2 (at Sinabelkirchen) was completely rebuilt. The works were carried out in two phases while traffic continued to flow on the provincial road underneath, except for a brief interruption during the demolition phase. Another bridge received an additional layer of concrete for added strength, and a massive rubble wall conversion was carried out so as to enable the structure to withstand the loads generated by traffic today.

Bridge repairs
Image: PORR

New crash barriers
Image: PORR

Project data – bridge repairs

Underground treatment	1,250 m²
Repairs to improve load-bearing capacity	600 m³
Repairs without effect on load-bearing capacity	450 m²
Surface treatments, painting, coating	1,150 m²

Completion

The contract specified completion within 95 calendar days of the start date, with penalties due in case of overruns. The works started on 15th August 2011 and ended on 25th November 2011, i.e. all works were successfully completed three days before the contractual completion date.

Project data

Client	ASFINAG Baumanagement GmbH 1030 Vienna Modecenterstr. 16
Contractor	TEERAG-ASDAG AG Styria branch
Start date	15th August 2011
Completion date	25th November 2011

Seminar hotel Schloss Untermerzbach

Construction of a new hotel building and extensive renovation of the existing historic building

Anke Dimmer

Schloss Untermerzbach is a castle located in the Lower Franconian town of the same name. The first construction at the site dates back to the 16th century, and from 1922, the existing castle building was used by the Apostolic Society of the Pallottines as a novices' residence and philosophical academy. After the Pallottines moved out in 2009, PORR-Deutschland GmbH (Thuringia-Saxony branch) was commissioned in summer 2010 by Amicitia Untermerzbach GmbH & Co.KG to carry out a conversion and extension project to turn the castle into a modern, 100-room seminar hotel, to be used by the insurance cooperative Verwaltungsberufsgenossenschaft (VBG).

The castle building

The castle building is rectangular in shape and has six windows per storey on the longer sides. The front is flanked by two four-storey corner towers standing at an angle to the main body of the building. The plain facade is interrupted only by a simple string course below the top tower storeys.

The main building and the two towers are topped by slate mansard roofs with numerous dormers.

The castle owes some of its imposing effect to its elevated site above the town. A splendid early classicist ensemble of steps and terraces provides a visual connection to the town centre.

The castle is surrounded by a large, walled park, with access via two decorative wrought-iron gates.

Renovated castle building and new wing, view from the town
Image: PORR

The project in brief

During the construction period of only ten months, an existing accommodation building was demolished and replaced by a new hotel building with a gross floor space of 3,500 m² which houses 75 hotel rooms, several modern seminar and meeting rooms, offices, areas for coffee breaks, as well as a sauna and fitness studio.

Another 25 hotel rooms were created in the historic castle building where extensive renovation and conversion works were carried out to bring the building up to modern standards, in particular as regards building services. A glass lift was added on the outside of the building, and a modern kitchen, buffet and dining rooms, conference room, lobby and bar were created inside. More seminar and meeting rooms take up the space inside a former church. All in all, 2,800 m² of existing gross floor space were completely renovated and refurbished.

Project data

Gross floor space new building	3,500 m²
Usable floor space new building	3,100 m²
Gross floor space existing building	2,800 m²
Usable floor space existing building	1,800 m²
Prefab elements – walls and ceilings	5,900 m²
Concrete	1,800 m³
Reinforcement steel	80 t

Structural works

After demolition of the 1960s residential building, construction work started on the new hotel wing in October 2011. The building was erected using reinforced precast concrete elements (hollow walls and filigree floors), as well as precast bathroom units. It was thus possible to complete the shell of this five-storey building with 3,500 m² of gross floor space in only four months. The building has a flat inverted roof with planting on top.

At the same time, extensive demolition and bricklaying works were carried out in the main building, as the existing en-suite bathrooms were completely refurbished, including some floor plan modifications. Major conversion works were also carried out on the ground floor, where staff rooms and toilets had to be added.

Interior finishing

This was soon followed by the interior finishing works, after extensive examination of sample materials with representatives of the building owner and the tenant. A specific condition of the project was that colours and materials had to fit in with the existing design of the building, so that the visual requirements were completely different from those in the newly constructed wing.

The upper floors of the castle building now accommodate 14 single and nine double rooms, as well as two suites. A modern lobby connects the historic building and the new wing, and restored parquet floors and stucco decorations give renewed splendour to the ground-floor dining room and the meeting rooms and offices on the upper floors.

After successful negotiations with the authorities in charge of historic monument conservation, permission was obtained to build a glass lift and a steel spiral fire escape on the outside of the building. All of the castle's 120 multi-light, wooden casement windows were repaired, made openable and received fresh coats of paint.

The interior finishing works were already well under way when the tenant decided to have the kitchen completely overhauled. The plans were adjusted accordingly, and a new restaurant kitchen to cater for about 150 guests was installed, complete with buffet area and hotel bar.

Raised access floors were installed on the ground and basement floors of the new wing, and the sizeable seminar, meeting and office spaces furbished to a high standard. The new wing also houses a health suite with separate saunas for ladies and men, as well as a fitness studio. 48 single rooms, 24 double rooms and three barrier-free rooms are distributed over the three upper floors.

Renovated staircase
Image: PORR

Restaurant
Image: PORR

Building services

The heating system is based on a gas-fired condensing boiler, with conventional flat radiators in the rooms and bathroom radiators in the bathrooms. As precast bathroom modules were installed in the new wing, new sanitary installations and plumbing were required only in the 25 en-suite bathrooms in the old castle building, as well as toilets in the public areas and staff rooms.

Air conditioning is provided by split air-conditioning units on the basement and ground floors. Ventilation units were installed in all bathrooms and other rooms in the building interior, with ventilation exhaust pipes ending on the planted roof of the new wing. The basement sauna is ventilated by a separate system which has been placed outdoors, near the sauna.

Most of the existing electric installations in the old castle building were replaced and the system extended. The whole building was fitted with a fire and burglar alarm system with CCTV monitors. The tenant specified extraordinarily high requirements with respect to the lighting of the seminar, meeting and office rooms. These areas were fitted with digitally controlled microprism lighting, and a backlit pane was hung in the seminar area in the former church.

Outdoor facilities

A parcel of land outside the town and adjacent to the castle ensemble has been landscaped to provide an outdoor park, including walkways, handrails and lighting. A ramp was built to allow barrier-free access to the hotel lobby.

Conclusion

This project was carried out under a Guaranteed Maximum Price Contract model, which required close cooperation with the project owner in a spirit of mutual trust. Problems that occurred in the course of the works were successfully resolved by all parties involved so that the seminar hotel was completed to the full satisfaction of the owner and handed over on time on 30th August 2011.

Surgical Ward West II, Salzburg

Alterations and additions to the existing buildings to create one of the most modern hospitals in Central Europe

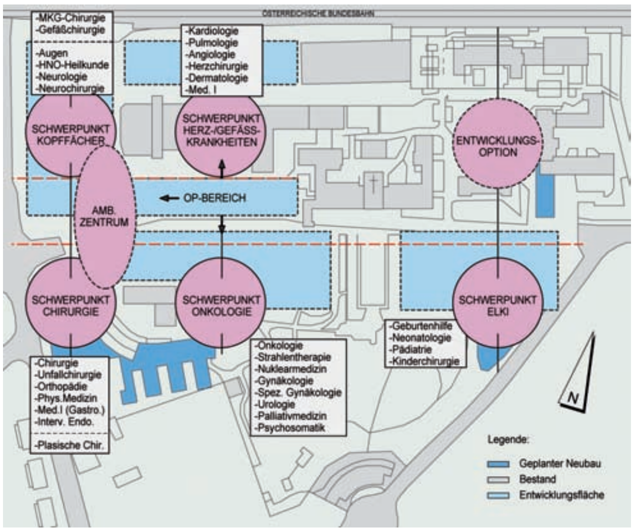
Wolfram Heigl, Karl Naumann, Christian Salesny

Rendering Surgical Ward West II
Image: ARGE Pernthaler-Tichon ZT GmbH

Project description

The master plan | SALK 2020 charted the course for hospital development in the federal province of Salzburg, including one of the most modern central hospitals in Central Europe. The construction of this central hospital, which is carried out in several stages, is currently under way.

One of the aims of the structural measures is to improve links between different medical wards to ensure optimal patient care and more efficient use of the institution's capacity.



Master plan SALK 2020
Image: PORR

The client, the Salzburger Landeskliniken (SALK, Salzburg Provincial Hospitals), is an association of four hospitals which are run by the federal province of Salzburg. With an overall capacity of approx. 1,900 beds, they rank among Austria's largest and most important medical institutions.

The enlargement of the Surgical Ward West in the second construction phase is provided for by the SALK master plan, which foresees construction works to be carried out on the hospital premises until 2020.

Since the completion of the construction works in April 2012, 260 beds have been available in the Surgical Ward West. About 600 people are employed here.
The intended integration of the orthopaedic ward, the physical medicine department and the trauma surgery ward played an important role in the underlying considerations regarding the plans for the annexe.

In November 2009, PORR emerged as the winner of the public tender process and was commissioned to implement the alterations and additions to the Surgical Ward West II. The contract included construction works as well as all building services engineering, including medical gas installations.

Construction site: original situation in 2009
Image: PORR

The project was carried out by an "in-house consortium" of Porr's Building Construction–Major Projects department and the Group's local branch, Porr GmbH NL Salzburg.

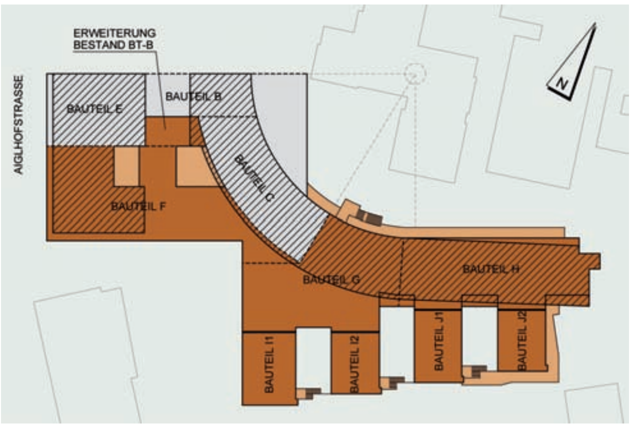
Before starting the construction works, several temporary arrangements had to be made to prevent any disruption to the hospital operations.

The temporary arrangements were required and specifically designed to provide escape and rescue routes and ensure that clinical work could continue uninterrupted at the Surgical Ward West.

The construction site is located within the approach area to the helipad on the roof of the Surgical Ward West I.

For this reason, the heights and slewing ranges of cranes and other lifting equipment were subject to certain limitations, which had to be taken into account during both regular working hours and downtimes.

Moreover, parts of the construction site and storage areas were located close to the landing pad and were thus repeatedly affected by strong downdraughts caused by the air traffic. For this reason, special measures had to be taken, for example for safe storage of materials (insulating materials, tarpaulins, plastic sheets) and during excavation works. Excavated material or other bulk materials which were temporarily stored at the construction site had to be covered up.



Project overview
Image: PORR

Hydrology / Foundation

The excavation was secured by means of a tied-back sheet-pile wall. Construction of the excavation support system, digging and specialised foundation works started in February 2010. The existing buildings were underpinned by jet-grouted columns, which had been prescribed by the site geologist to ensure the smooth functioning of the dewatering system.

The need to secure a historic wall and listed buildings immediately adjacent to the construction site, including the mill of St. Peter's Abbey, was an important factor in the construction works from the very beginning, necessitating additional securing measures and some adjustment of the originally planned construction schedule.

The high-pressure grouting works, the sheet piling and anchoring works as well as the external works, drainage and sewer construction works were all carried out by companies of the PORR group, including the tunnelling and foundation engineering divisions PORR TUNNELBAU and PORR GRUNDBAU, as well as the subsidiary TEERAG-ASDAG AG.

Construction works

The construction phase started with substantial demolition works, which included pulling down the entire building section formerly housing the day unit and the emergency ambulance base, including lifts, staircases and adjacent rooms.

The foundation consists of reinforced concrete slabs 30 to 100 cm thick (in some places, they are even up to 140 cm thick).

The excavation was sealed against pressing water by means of bentonite slurry walls.

Construction work in progress, July 2010
Image: PORR

Except for the basements, the carcass consists of a reinforced concrete shell whose ceilings are not joisted; for fire protection reasons, the parapets are also made largely of reinforced concrete.

The 30-cm outer walls of the basements are made of waterproof concrete (in areas of pressing water, additional bentonite slurry walls were installed).

After completion in November 2011
Image: PORR

As of 5th September 2011, the offices were ready to be occupied and the endoscopy unit was fully operational.

The topping-out ceremony to celebrate the punctual completion of the carcass took place on 14th December 2011.

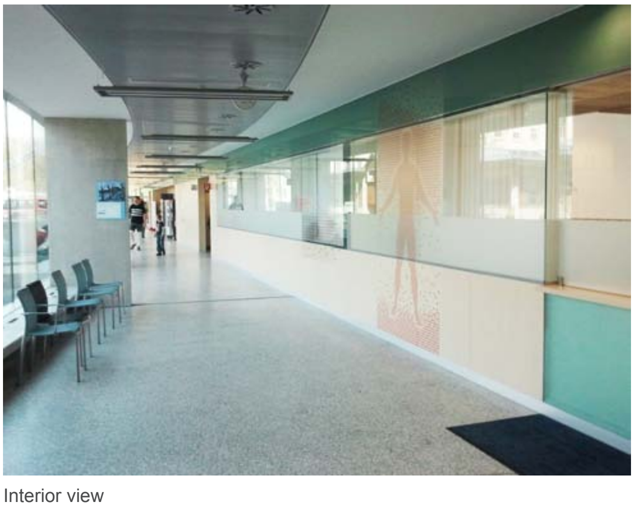
Building services technology

The state-of-the-art building services technology is operated by a central control system.

It comprises the following electrical installations:

- lighting system, emergency lighting system
- medium voltage switchgear
- emergency standby power system powered by a diesel generator
- low voltage switchgear, including emergency power supply
- lightning protection system
- IT and telecommunication network, TV system for the patients
- comprehensive fire detection system for the entire building
- nurse call system
- door entry intercom system
- clock system
- public address system
- intercom system
- video surveillance system (operating theatres)

SALK's own high in-house quality standards for electrical installations constitute a special feature of this project. In order to minimise the risk of failures, all terminals and connectors were arranged in patch panels.

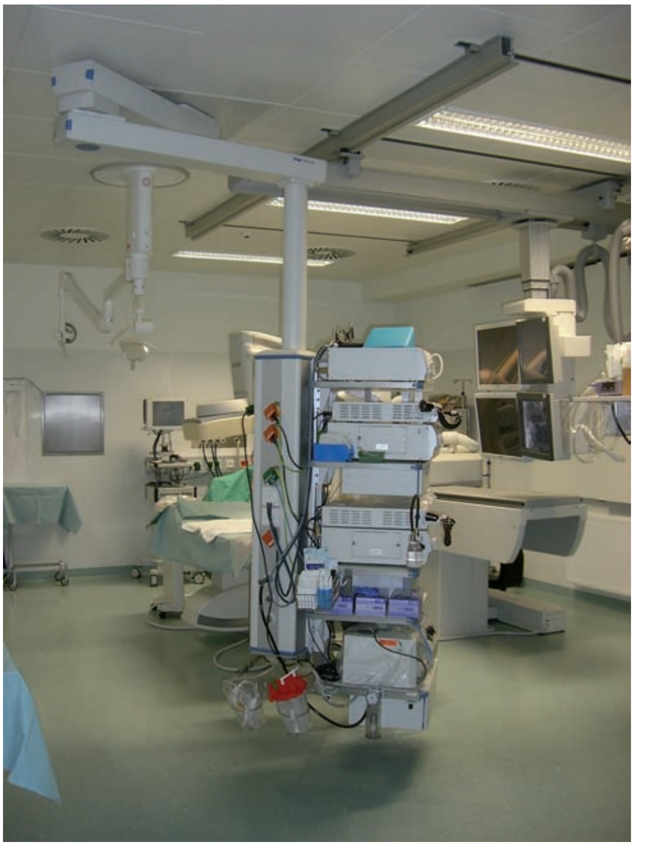


Interior view
Image: PORR

The construction of a ventilation system according to the Austrian standard ÖNORM H6020, consisting of four central ventilation plants with an overall ventilation capacity of 200,000 m³/h, constituted a further challenge.

The building's ventilation is largely mechanical. A special feature of the system is the sterile air ventilation system for the operating theatres with sterile air filters with diameters of 3 m.

Moreover, the section in which the operating theatres are located is fully air-conditioned. The ventilation of the ward wings is partially mechanical, fresh air being drawn in from the outside via fresh air ducts which were specially constructed using panels.



Endoscopy
Image: PORR

A compact pure-steam system with a capacity of 600 kg steam per hour was provided for sterilising medical instruments and additionally humidifying the air within the building.

The building is heated by remote heating, supplied via the public remote heating network.

The overall heating capacity of 1,750 KW is distributed over the entire building via several heat exchangers, using radiators or under-floor heating.

To ensure an optimal indoor climate, a cooling system with a capacity of 1,500 KW was installed.

The rooms are cooled via the ventilation system and by means of cooling ceilings.

Almost all the rooms are equipped with outlets for medical gases, including oxygen and nitrous oxide, as well as vacuum and compressed air systems.

A new facility now in use at Salzburger Landeskliniken is the therapy pool. This is a stainless-steel basin fitted with a water treatment system, as required by Austrian hygiene law.

Copper pipes, medical gas supply
Image: PORR

Four lift systems were installed to ensure sufficient capacity for the number of patients.

The successful completion of this project once again evidenced PORR's outstanding expertise in the field of health care construction projects.

Project data

Client	SALK
Start of construction works	Dec. 2009
Completion of construction works	April 2012
Gross floor space	19,000 m²
Useable floor space	16,000 m²
Cubic content	110,000 m³
Excavated material	25,000 m³
Concrete	12,000 m³
Reinforcements	1,100 t
Formwork	34,000 m²
Dewatering/pumping capacity	150,000 m³
Piping (HVAC, sanitation, medical gas)	130,000 m
Ceramic sanitary fittings, valves, etc.	8,000 pcs.
Cooling ceilings	1,000 m²

The Simmering Residential Care Facility

A home for 348 residents with special nursing care needs

Stefan Posch

On a park-like site at Dittmanngasse 3A-5, near Enkplatz, in the 11th district of Vienna, the Simmering Residential Care Facility was developed by "Senuin Beteiligungsverwaltung GmbH", a subsidiary of Strauss & Partner Development GmbH. Upon its completion, it was let to the Vienna Hospitals Association (KAV) which now runs the facility.

View of the facility from Dittmanngasse
Image: PORR

The oblong main body of the residential care facility was constructed by PORR in its capacity of general contractor (consortium of the two Vienna-based departments building construction 1 and large-scale projects 2) within a 25-month construction period. The building has two basement levels, the ground floor and three upper floors (four in one wing). On the north side, cantilevering of the top floor has saved a mature stand of trees and provides shade for newly laid out paths and gardens.

Top Floor Cantilever
Image: PORR

The twelve nursing wards and two dementia wards on the upper floors can be accessed via six lifts and five staircases. In all, the building houses 280 patient rooms with 348 beds.

The design provided for a division of the building complex into two main sections, each comprising two wards per floor. Central supply zones permit and facilitate communication and optimum operational management between pairs of adjacent wards.

Resident interaction on the wards is encouraged by themed spaces, communal loggias, dayroom areas and aquariums. The individual rooms have glass partitions on the corridor side, which enable residents to "be part of life" on the wards. The bathrooms are all situated along the outer walls of the building to admit daylight and ensure natural ventilation.

The administrative department with the cloakrooms, examining rooms and treatment rooms, the multi-purpose hall, the meditation room, the prayer room as well as a café and the staff restaurant are situated on the ground floor. The two basement floors house a day-care centre on space rented by the "Vienna Social Fund", the underground car park, the "cook & chill" kitchen as well as all the control rooms. A loading ramp has been installed for deliveries and transport purposes.

Delivery
Image: PORR

Two property developers, one above the other

Eight months after the start of construction work on the residential care facility, the PORR consortium which was already active on the site received a second general contractor assignment from the "Neue Heimat Gemeinnützige Wohnungs- u SiedlungsgesmbH" for the construction of 56 flats on top of the Simmering residential care facility. This second commission meant that two different property developers were having two actually separate construction projects implemented – one above the other. The idea was to keep points of contact or intersection to a minimum, in order to prevent future conflict. Nevertheless, the architect and the building services engineer were the same for both commissions.

Foundation of 750 CFA piles

The building is supported by approximately 750 cast-in-situ rotary bored piles with an average length of 12 m. Complex pile structures with diverse ground-plan shapes and diameters were produced to transfer the load to the base plate. Once the base plate was in place, the four rotary tower cranes could be used to capacity. Because of the slim design with massive reinforced concrete cores, which are essential in ensuring seismic safety, 85% of the building shell could be built with in-situ concrete. The only exception were the precast shafts in the patient bathrooms. All the ascending ventilation, water mains and wastewater pipes for the patient rooms as well as the substructures for WCs and washstands in the bathrooms were housed in these units. Precast loggias with built-in modular baskets as well as precast staircases were simply slotted in on site. In the course of the structural work 39,000 m³ of excavated earth were removed, 3,500 tonnes of steel were installed and 24,000 m³ of concrete placed. Structural work was completed 13 months after the contract had been awarded.

Meandered clay-tile façade

The external eye-catcher of the entire construction project is the clay-tile curtain wall, which is interveined with 30-cm-thick full thermal insulation meanders. This combination called for detailed façade planning by the contractors concerned, as it was necessary to define axis spacing which also made allowance for the installation of the windows. After imprinting of the façade pattern on the outer reinforced concrete walls, work was started on the substructure and the thermal insulation meanders. After that the rock wool insulation and the carrier rail for the suspended tiles were mounted. In order to achieve the finished visual effect on the façade, 28 tile formats, cut to hundreds of sizes, had to be precisely placed; the façade had to be cleaned and parapet plates and terminal panels mounted. Eventually the picture shown on the 3D design sketch was realised in practice.

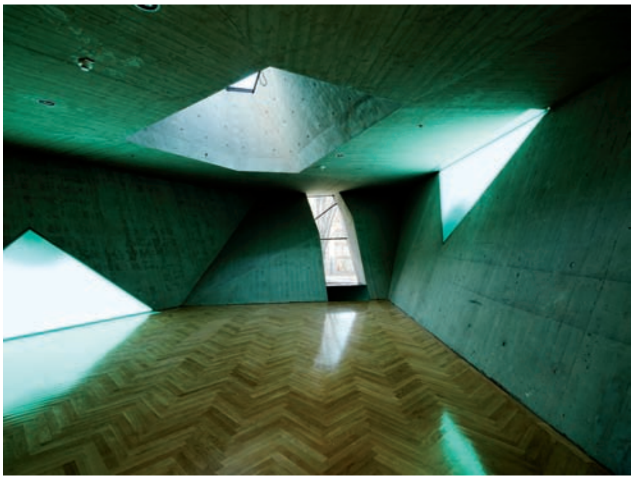
Façade
Image: PORR

Façade
Image: PORR

The meditation room

The architect's design was for a room with inclined walls, angled in places. The main technical challenge, however, was the fabrication of insulated wall elements with the quality of fairfaced concrete on both exterior and interior. After several months of detailed planning together with a whole range of specialised companies, a solution was developed which is now in place – full-depth precast elements which form the outer shell, supported by custom-made scaffolding. The insulation of extruded polystyrene with attached reinforcement was affixed to it on the interior side. Once the interior fairfaced concrete formwork was ready, the interspace could finally be concreted. The meditation room is topped by a ceiling with an inclined skylight dome, and the space is rounded off by customised glazing elements in the skylight dome, angled windows and LED lighting designed by a lighting artist, as well as a wall of fitted cupboards and a solid parquet floor.

Meditation room outside
Image: see below



Meditation room inside
Image: see below

Tests and trials

In order to meet the requirements of the client and of KAV, the user, a number of tests and trials had to be performed while the building was still under construction. In the laboratory of Municipal Department 39, the glass partitions between patient rooms and corridors were subjected to a test, including the use of a sprinkler, for a fire resistance of 30 minutes. Finding a solution for this architectural detail was rendered particularly difficult by the requirement that, for optical reasons, the VSG glass partitions be fixed with adhesive only and mounted flush with the wall.

A detail of major importance for both patients and nursing staff was that the loggia doors were to have the lowest possible thresholds in order to permit trip- and rumble-free crossing with walkers, rollators or beds.

Patient room with loggia
Image: see below

To meet this requirement, a special mock-up for a 'bed rolling trial' was developed together with the user KAV, in order to obtain the all-clear for the production of the thresholds.

Once the mock-up room was ready, airborne noise and footfall sound readings were performed. The specially selected plasterboard wall construction with more solid panels had to meet the noise protection requirements.

Drain installation in the shower areas of the patient bathrooms was a high-precision job. Puddling caused by imprecise tiling or too little gradient was unacceptable, as it would have meant a high risk of dust and dirt build-up and of bacterial growth.

Patient bathroom
Image: see below

An air-leak test was also performed, since draughts in the patient rooms were considered harmful to the patients and therefore had to be prevented through precise adjustment of the ventilation.

500 lux mean illuminance was required in the patients' bed areas to permit medical examination. A combination of different light fixtures as well as calculations and measurements confirmed that this requirement was met.

Before the finishing work was completed, numerous tests were performed with wheelchairs, patient beds and other means of person transport. The objective was to guarantee the unimpeded and unobstructed use of the entire building in every possible way.

Life on a nursing ward

Each ward is surrounded by twenty rooms (single and double rooms). The bed space of each individual resident is fitted out with a so-called “suspended headboard” equipped with diverse light fixtures, power outlets and data sockets, and an oxygen connector. A bench seat in a niche, a fitted wardrobe with a TV set and a table and chair are designed to create a feeling of homeliness. Moreover, each room gives on to a loggia roomy enough to accommodate the bed. Solar protection is provided by external blinds fitted to the façade area. The bathrooms are spacious and adapted to the needs of the disabled, each having a window, shower, WC and washstand as well as the required handholds.

Lounge areas for smokers and non-smokers, communal loggias and theme spaces and aquariums are designed to facilitate interaction and create a sense of togetherness on the wards.

Patient room with glazed corridor partition
Image: see below

Ward lounge area with nurses’ station
Image: see below

Challanges posed by hygiene requirements

The hygiene regulation specified in the contract (Austrian standard ÖNORM H6020) was an ever-present challenge throughout the construction period. Every single product installed was not only subject to visual and technical sampling inspections but had to be approved by the hygiene officers of the Vienna Hospitals Association. Samples were treated with various cleaning agents and strained to test their resistance. Corners and surfaces have to be easy to clean. Moreover, the hygiene officers ruled that in sanitary installations, the plughole must never be directly hit by a water jet, since floating germs would expose residents to unacceptable risks.

In order to obtain the required approvals or in preparation for trials, products and samples had to be provided in good time so that alternatives could be submitted if necessary.

These highly demanding tasks were successfully concluded in October 2011 with the "official sanitary inspection" under the supervision and guidance of Municipal Department 40. The inspection of the residential care facility by hygienists, occupational physicians and the health and safety inspectorate as well as by many other representatives of public authorities confirmed that the Simmering Residential Care Facility met all the requirements for unrestricted use.

Ward lounge area
Image: see below

Two-storey themed space
Image: see below

Management and supplies

The ground floor and the two basement floors are the administrative and service zones.

The porter's desk with the building services control panels occupies the core area at the main entrance.

Porter's desk
Image: see below

The café and the staff restaurant are situated behind it.

Staff restaurant
Image: see below

Right next to the main entrance is the entrance to the examination and treatment area, where residents receive medical care and treatment.

Registration-cum-waiting area & examination & treatment rooms
Image: see below

Ergotherapy
Image: see below

A hairdresser and a florist moved into the two business premises. The multi-purpose hall with mobile partition walls, the meditation room and the prayer room round off the residents' area on the ground floor. Building sections C and D house the entire administration, the technical support, the night-duty rooms and the main cloakroom for the nursing and cleaning staff. The farewell room and the mortuary refrigeration unit occupy an area set apart from day-to-day activities.

The west-facing part of the first basement level houses the underground car park with 60 parking spaces, the central ventilation and electricity generating plant as well as storage rooms for beds and equipment. Owing to the sloping terrain, with an elevation drop of 4 m on the eastern side, the basement floor rises from the ground to its full height on this side and the resulting ground level is used by the Vienna Social -Fund as a day care centre for care recipients.

The second basement level accommodates a 70-m collector with supply mains as well as the central ventilation plant, the central cooling plant, the liquid refuse disposal system, the remote heating plant room and the sprinkler station with the sprinkler tank.

Building services technology

Utmost care had to be taken to keep ventilation ducts and domestic water pipes free of dirt and dust during installation. To prevent future nucleation, the ventilation ducts had to be sealed with foil and there was a ban on dead-end conduits in the domestic water pipe system. Once the water pipes had been filled, all the fittings had to be regularly flushed. Before completion, measurements were made and samples taken to confirm sterility.

The air-conditioning systems in the examination and treatment areas and in the patient rooms were installed in compliance with Austrian standard ÖNORM H 6020 [air-conditioning systems in hospital facilities]. The ventilation system was inspected by a hygienist who confirmed that it conformed to standards.

Two of the five staircases are equipped with pressure ventilation systems. The fire brigade lifts situated directly in the staircase area are also pressure-ventilated to ensure that bedridden persons can be safely evacuated in case of fire.

With the exception of the apartments, the entire building is equipped with a “fully protected” fire detection system with alarm transmission to the Vienna city fire brigade. The installation of a sprinkler system throughout the entire residential care facility was part of the fire protection plan and involved the mounting of approximately 2,800 sprinkler heads.

The electrical engineering jobs in the medical treatment rooms, and to a lesser extent in the patient rooms, were performed in accordance with ÖVE/ÖNORM E 8007 [electrical installations in hospitals and locations for medical use outside hospitals], application group 1. Among other things the standard provides for equipotential bonding of radiators and door frames. The laying of conductive rubber floor covering is another precondition for meeting the standard, and this was consequently installed in all the examination rooms.

A major challenge was posed by the task of putting in place a control and adjustment system for the entire complex via the building control system which is in part linked up to the emergency generator on the roof. The installed bus system which controls the external blinds and the lighting system had to be programmed in compliance with the requirements.

To comply with the rule that during normal operations the wards can only be accessed by lift, the staircase doors were fitted with access control systems and card readers. In addition, disorientation systems were installed on the two dementia wards. Dementia patients are equipped with bracelets that emit sensor-controlled signals to the nurses’ station, thus preventing patients from “slipping out” unnoticed.

As planned, the first residents moved into the Simmering Residential Care Facility in February 2012.

Project data

Project	Simmering Residential Care Facility
Project owner residential care facility	Seniun Beteiligungsverwaltung GmbH
Project owner apartments	"Neue Heimat" Gemeinnützige Wohnungs- und Siedlungsgesellschaft Ges.m.b.H
Architect	Josef Weichenberger architects + Partner
Project management, coordination and structural engineering	FCP – Fritsch, Chiari & Partner ZT GmbH
Landscaping	3:0 Landschaftsarchitektur

Contractor	PORR Group, project partners: departments building construction 1 + major projects 2
Contract type	General contractor order
Gross floor space	38,215 m²
Start of construction works	1st September 2009
Project completion	7th November 2011
Handover of apartments to tenants	8th December 2011
Opening of Simmering residential care facility	February 2012
Dimensions	approx. 201 m x 19 m x 24 m

The Simmering Residential Care Facility was handed over to our client Senuin Beteiligungsverwaltungs GmbH (a subsidiary of Strauss & Partner) on 7th November 2011, and subsequently started operations as part of the hospital and nursing care network of the Vienna Hospitals Association (KAV).

As planned, the first residents moved into the Simmering Residential Care Facility in February 2012.

Images: Paul Ott, Josef Weichenberger architects + Partner

Flood control at Rossatz/Wachau

Extensive engineering works to protect local inhabitants against the constant threat of flooding

Christina Stöger

Project description

A contract for the construction of flood defences for the towns of Rührsdorf and Oberarnsdorf, which belong to the local community of Rossatz-Arnsdorf, was awarded to a consortium consisting of PORR TECHNOBAU UND UMWELT AG, TEERAG-ASDAG AG and PORR GMBH in September 2010. The site is located in the Wachau region, on the right bank of the river Danube.

A construction period of 20 months, ending in summer 2012, has been scheduled for the project, which comprises effective underground sealing and the erection of a reinforced concrete wall above the sealed base. The wall is designed so that mobile flood protection elements can additionally be mounted on top of it in emergency situations. With these measures, the local communities will be protected against a 100-year flood. The project works also include the building of flood embankments and a drainage system on the landward side of the wall base.

The consortium is providing all earthwork, construction, laying of pipes and underground sealing.

Wall with bush-hammered surface
Image: PORR

A wide range of services

The total length of the flood control structures is 1,350 m in the town of Rührsdorf and 890 m in Oberarnsdorf.

Depending on subsoil conditions, underground sealing is effected by means of bored concrete piles with fins in between, jet-grouted columns, a vib wall cut-off or sealing injections. With these sealing methods, depths of some 17 m are reached.

The flood protection wall is a reinforced in-situ concrete wall which is erected above the bored piles. Water barriers are installed at the anchor points to ensure the impermeability of the structure. The metal plates on top which serve as the base for the screw-on mobile protection elements have to be installed with utmost precision. The margin of accuracy is just 0.2 mm so as to make sure that the mobile elements will form a smooth, unbroken wall when screwed in place.

Seepage and drainage ducts (DN 300-800), containment and overflow structures in the sewer system (mixed sanitary and stormwater runoff system) and two pumping stations, plus the cable connections needed for these structures, are installed to provide hinterland drainage. Jet-grouted columns and a shotcrete wall, as well as sheet piling with sufficient reinforcements, were used to stabilise the pumping station construction pits.

Care is being taken over the visual appearance of the flood defences so that they blend in smoothly with the surrounding built environment. Exposed concrete surfaces are being texturised by sandblasting, stabbing and bush-hammering, and additional streetscape and urban design measures are also being taken.

Shuttering at Oberarnsdorf
Image: PORR

Embankment stabilisation works
Image: PORR

Special challenges

The flood protection wall is built of coloured concrete, with curvature radii of up to 3 m and heights of up to 4 m. The wall also requires particular attention as it is being erected without anchors for architectural design reasons. As the construction site is located in the built-up area of historic towns, cramped space poses particular challenges for site organisation and the use of heavy equipment.

This project is yet another example of the PORR Group's competence in flood control works.

Team: foreman Gerhard Köck, engineer Christina Stöger and construction site manager Gerald Bieder
Image: PORR

Project data

Client	Community of Rossatz-Arnsdorf
Start of construction	December 2010
Scheduled completion date	July 2012
Length of projected structures	2,300 m
Concrete	6,500 m³
Steel	700 t
Drainage	3,440 m
Flood embankment earthwork	24,000 m³
Bored piles	414
Jet-grouted cut-off wall	9,700 m²
Vib wall cut-off	3,900 m²
Grout injections	400 m³

HPP Ashta

Hydropower plants in Albania

Karlheinz Strutzmann

Image: PORR

Introduction

In the autumn of 2008, the Albanian Ministry of Energy (METE) awarded a concession for the construction and operation of a hydropower plant in northern Albania near Shkodra, the country's fourth-largest city, to Austrian energy utility Verbund. Together with a second Austrian utility company, EVN, Verbund founded the joint venture Energji Ashta Shpk to carry out the project, which is based on a BOOT (Build-Own-Operate-Transfer) contract with a contract period of 35 years.

The Ashta project completes a chain of existing hydropower plants, using the difference in level between the Spathara reservoir, which is fed by the river Drin, and the confluence of the rivers Drin and Buna. The Drin has a catchment area of 11,500 km² and a mean discharge rate of about 310 m³/s. The project is for a two-stage diversion power plant which incorporates some pre-existing structures.

Geographic location
Image: PORR

A special feature of the project is that 2 x 45 hydro matrix turbines will be installed, making this the biggest installation of its kind worldwide.

Historical background

Back in the 1970s, a predecessor project ("Bushat") to the current one was launched. It, too, foresaw a diversion HPP, but with a much longer canal and a longer tailrace. A weir with solid footing was completed in 1973, the intake structure plus road and rail bridge in 1975. However, works were stopped that year due to funding problems. An attempt to continue with the project was made in 2001, but failed for economic and also ecological reasons, as it was suspected that the power plant might have an impact on Lake Skadar whose Montenegrin part had been declared a National Park in 1996. The Albanian authorities subsequently redrafted the project so that the tailrace flows into the bed of the river Drin before its confluence with the Buna, ruling out any potentially negative impacts on the ecosystems of the Buna and Lake Skadar. Based on this design, an international tender for a concession project was then issued with the help of the IFC (International Finance Corporation).

Visual impression of the project
Image: PORR

After the concession had been awarded and all necessary approvals and permits obtained by 2009, Energji Ashta Shpk, a joint venture by Verbund Hydro Power AG and EVN, started the works in early 2010.

Project description

A 240 m long inflatable weir is placed in front of the existing weir and solid footing to achieve the desired dammed-up water level of 23 m above Adriatic sea level and to ensure the safe discharge of water in the event of floods. An intake canal is connected to the existing intake structure. It is 200 m long and widens from 104 m to 126 m (width of the power plant). The exit structure for a fish pass is located near the right river bank upstream of the power plant.

The Ashta 1 powerhouse consists of nine separate sections, each of which houses five turbine-generator units (TGUs). Its foundation consists of rows of bored piles and reinforced diaphragm walls which serve as sealing walls for the construction pit during construction. A hydraulic trashrack cleaning rig keeps floating debris and bedload away from the turbines. Stop-planks can be used to dam off individual sections for inspection purposes. The electrical equipment, hydraulic aggregates and nine block transformers (20/3.3 kV) are housed in the gallery (machine hall). Electrical energy is carried via the transformers to the 20 kV substation in the station building, and from there to a 110 kV outdoor substation, to be fed into the Albanian grid. The power station building houses offices and a ground-floor workshop as well as the power generation rooms.

Overview of Ashta 1 construction site
Image: PORR

Following a tailrace section of about 300 m, the actual diversion canal is 85 m wide at the bottom and about 5 km long. Residual water is discharged at a rate of 30 m³/s (i.e. about 10% of the average river discharge) into the original riverbed below the first weir; in combination with a state-of-the-art fish pass (the first one built in Albania), this preserves the ecological function of the old riverbed.

The embankments along the diversion canal are made of locally available sandy gravel. The embankment slope has a 1:2 incline, and its 4-m wide top serves as a connecting road between the two power stations. Embankment height varies between 4 and 8 m. To prevent any impact on groundwater regime in the area immediately south of the plant, the canal bed is only partially sealed off with liner. The embankment slopes and an adjacent stretch of about 20 m on either side of the canal bed are lined with bentonite matting, but the central part of the canal bed remains unsealed. The lower (widened) section of the diversion canal then feeds into the 126-m wide Ashta 2 power station. While Ashta 2 has no trashrack cleaner and headrace stop-plank, the powerhouse construction and equipment is the same as that of the first stage.

The Ashta 2 powerhouse is followed by an 800-m tailrace. This connects to a 2.3-km canal which is built by excavating the natural terrain to a depth of about 5 m. The bed width is 85 m for both the tailrace and the canal. The banks are protected against erosion by heavy riprap (single rock weight 300-800 kg).

Technical data

Ashta 1	
Flow rate QA	560 m³/s
Head at QA	4.98 m
Residual water discharge	30 m³/s
Number of TGUs	45
Power per TGU	524 kVA
Total apparent power	21 MVA
Annual power generation	97 GWh

Ashta 2	
Flow rate QA	530 m³/s
Head at QA	7.53 m
Residual water discharge	-
Number of TGUs	45
Power per TGU	995 kVA
Total apparent power	32 MVA
Annual power generation	144GWh

Main structure

Concrete structure

Each of the two power stations Ashta 1 and Ashta 2 is made up of five sections which have been designed for optimum load-bearing capacity and distribution of expansion joints. Each section consists of 20 concrete blocks, with block sizes varying between 100 m³ and 400 m³. The blocks are erected like a stair, rising from left to right, and reach a full height of about 20 m. A submerged wall with trashrack cleaner is additionally installed at the Ashta 1 stage.

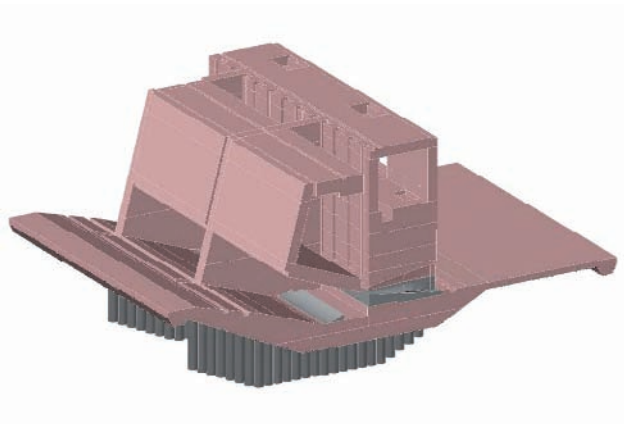


Diagram of concrete structure
Image: PÖYRY Energy 2010

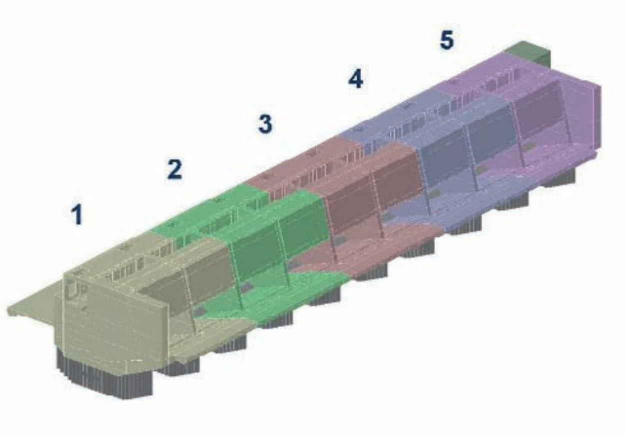
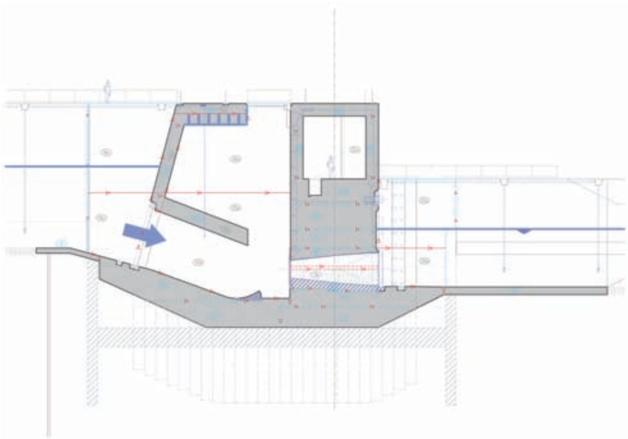
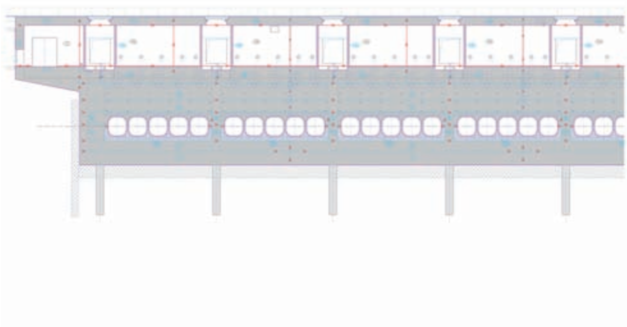


Diagram of concrete structure
Image: PÖYRY Energy 2010

In all, it took 90,000 m³ of concrete to erect the two power stations. A specifically adjusted concrete mix recipe was used to meet the demands placed on bulk concrete. The biggest problem in this context was to supply the construction site with the right kind of cement, as CEM III cement was not available locally. Because of the high temperatures in southern Europe most concreting took place at night, allowing temperature differentials between concrete surfaces and cores to be kept below the required maximum limit.



Cross-section
Image: PORR



Longitudinal section
Image: PORR

45 matrix turbines with steel draft tubes were placed side by side on a rectangle of 126 m by 24 m. Guide rails were installed to enable each turbine to be lifted out at any time for maintenance work. The draft tubes for the matrix turbines are integrated in the powerhouse block and were installed by concreting with self-compacting concrete. During casting, threaded rods were used to keep down the draft tubes, thus counteracting uplift.

Installation of draft tubes
Image: PORR

However, where the two power stations differ most is in their subsoil conditions.

The Ashta 2 station was completely founded on hard rock. As the construction pit was sealed off by an all-round diaphragm wall that bonded directly to the rock underneath, de-watering was a minor issue, involving only the management of residual quantities of water.

Conditions were much more difficult at Ashta 1, where extremely high permeability of the subsoil at the foundation site required a more sophisticated engineering approach.

Foundation

The native soil at Ashta 1 consists of sandy gravel in loose sediment layers; where the subsoil contains plate-like gravels, it is capable of massive compaction, however. The composition of the subsoil is typical for recent-era river sediments, with a small portion of fine-grained material. The stated permeability coefficient was 1.2 x 10-3 m/s. The groundwater table is only a short distance below the terrain surface; owing to the high permeability of the ground, the groundwater level varies widely and very quickly in response to the water level fluctuations of the river Drin; these in turn are big as a result of the hydropower generation along the upper reaches of the river.

Construction pit before underwater concrete base casting
Image: PORR

The bottom side of the Ashta 1 power station reaches down to a depth of 6 m. Unlike Ashta 2, the ground under the station consists exclusively of sandy gravel; neither is there an impermeable layer that might have been used as an embedment for a containment wall around the construction pit. When trial piles were driven into the ground, another phenomenon was observed: self-compacting of the soil during each drive or vibration. This occurred in layers up to 4 m thick at depths of about 7 m below the ground surface, and the compaction was so massive that any further pile drives or vibrations nearby became impossible.

Crater after trial pile drive
Image: PORR

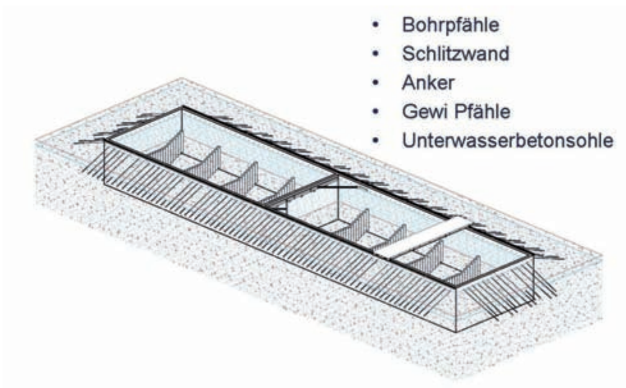
Crater after trial pile drive
Image: PORR

Large-calibre exploration drilling revealed major amounts of platy gravel that tended to align like rooftiles during the pile driving, which made driving through these layers very difficult and apparently also resulted in compaction of the surrounding subsoil. Sheetpiling or a vib wall cut-off were therefore not an option.

Pumping trials showed permeability coefficients between 5 und 9 x 10-3 m/s in some areas. This meant that realisation of the original design – a 20-m deep submerged wall and de-watering pumps – would have resulted in uncontrolled water ingress into the construction pit, with flow rates of some 3-4 m³/s. An additional concern was the risk of power outages, which have to be expected in Albania, during operation of the pumps. It was therefore decided that the only feasible alternative was to build a sealed tank with anchored diaphragm walls and a tied-back underwater concrete base.

Construction pit

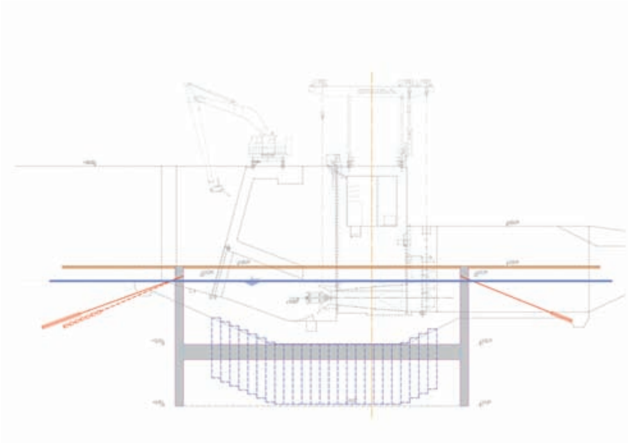
The technological challenges posed by the Ashta 1 construction pit were major by any standard. Different international-standard underground engineering methods had to be applied to successfully control groundwater ingress from the river Drin.



Construction pit: bored piles, diaphragm wall, anchors, Gewi piles, underwater concrete base
Image: PORR

First, eight rows of piles with a diameter of 90 cm were bored from the surface level to serve as the foundation for the actual power station. A transversal diaphragm wall which served as a bulkhead later doubled as the ninth row. The borings were executed to a depth of 12 m against pressing water. The piles were later cut down flush with the upper edge of the underwater concrete base.

A 15-m deep and 80-cm wide reinforced diaphragm wall was erected to seal off the construction pit and provide lateral support. To ensure load-bearing stability, the diaphragm wall was tied back with ground anchors above groundwater level. A transversal diaphragm wall was installed as a bulkhead, dividing the pit into two parts. This greatly reduced the area in which the difficult process of underwater casting of the concrete base had to be performed, and made it possible to start concreting the first part of the pit at an earlier point. Because of the different construction stages on either side, 3 HEM 300 profiles were used as stiffeners for the bulkhead.



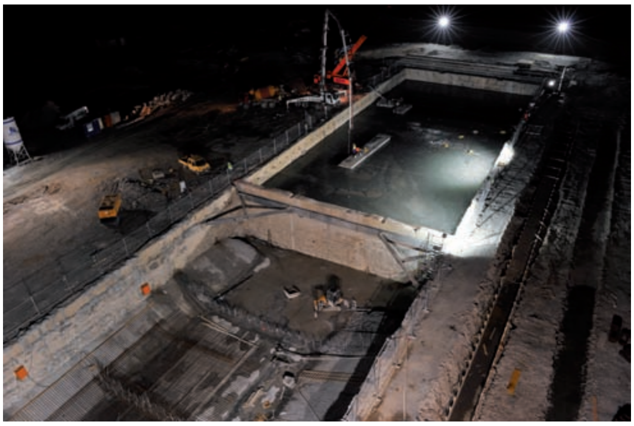
Cross-section of the construction pit
Image: PORR

The total surface of the construction pit was 128 m by 28 m. After the bored piles, the diaphragm wall and the ground anchors had been put in place, the pit was excavated, using a long-reach excavator, to the planned depth of the underwater concrete base bottom. The groundwater level in the pit remained unchanged, ensuring the necessary hydraulic and static balance.

Bridge construction for Gewi piles
Image: PORR

To prevent the underwater concrete base from being lifted by the water pressure after the complete draining of the pit, an additional 216 Gewi piles were used to hold it down, counteracting the uplift. The 8-m deep Gewi piles were sunk from a movable bridge in a 3 m by 3 m grid. The bridge had a span of 30 m and consisted of four HEB 800 profiles with a square-edged timber superstructure. The bridge was set on rails and armoured bearings and was moved by two backhoe excavators.

After the Gewi piles had been put into place, the fines and sludge that had settled on the pit bottom were suctioned off. The connections between the concrete base and the diaphragm wall and piles were cleaned, and grouting hoses were additionally put in place. Anchor plates were used to bond the Gewi piles to the underwater concrete base.



Underwater concrete casting
Image: PORR

The next step was the casting of the underwater concrete base, for which professional divers were flown in from Austria. They produced the 1.5-m concrete base in one piece, placing the concrete at a depth of 8 m below water level at a rate of 60 m³/h. The main challenge was to cast the underwater concrete continuously, preventing any sludge bubbles from becoming trapped in the concrete. The required volume of 3,000 m³ of concrete was placed within 50 hours.

The groundwater could now be safely pumped out from the first part of the pit, and everyone was happy that the installed grouting hoses were no longer needed.

Good cooperation between project owner, designers and the construction company made it possible to successfully implement the complex works, which comprised a series of sophisticated engineering tasks, within a short period of time and to a high quality standard. The heavy engineering machinery needed was shipped to the site via Trieste.

Concreting starts in the dry pit
Image: PORR

In addition to the two run-of-the-river power stations Ashta 1 and Ashta 2, the project also includes another significant structure.

This is the 5-km long diversion canal between the two power stations – a good example of a major effect being achieved on the basis of a simple technical idea.

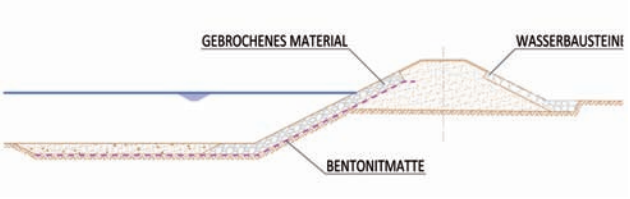
Diversion canal

Tender

The diversion canal between Ashta 1 and Ashta 2 is about 5 km long and 85 m wide. Construction of the embankments poses major logistic challenges, given the amount of excavated material to be managed: more than 3 million m³ of material have to be moved in less than two years.

Location of diversion canal
Image: PORR

Through the unsealed bottom part in the centre of its cross-section, the diversion canal communicates with the aquifer and the nearby river Drin so that a sufficient groundwater table is maintained. The embankments are lined with 300,000 m² of bentonite matting on the water side to seal off the inner slopes against the canal. On the land side, 400,000 tonnes of riprap are used to protect the canal against flooding.



Embankment cross-section
Image: PORR

The appropriateness of the design was proven even as the structures were being erected when heavy rainfalls hit the area for several weeks in December 2010. As the hydropower stations on the upper reaches of the Drin were forced to take emergency action to lower their water levels, the river's discharge rate jumped to levels of up to 3,000m³/s, ten times the mean discharge rate.

With respect to the laying of the bentonite liner, the original plan was to use the standard process, i.e. to roll out the mats on dry ground. However, this would have entailed the installation of bulkheads to lower the groundwater table, in some sections by up to 2 m.

Proposal for an alternative solution

As the groundwater lowering would have been very expensive, a proposal was made for an alternative approach whereby the bentonite matting is laid out directly under the surfaced groundwater in as simple and economical a manner as possible.

The idea was to use a structure very similar to a gantry crane to roll out the bentonite liner, much like a carpet, on the embankment slopes and on a 20-m wide stretch on each side of the canal bed, positioning the matting with maximum precision.

Structure for the bentonite matting "rollout"
Image: PORR

The biggest obstacle for this solution was that in most types of bentonite mats, the bentonite is added to the geotextile in powder form: the bentonite powder is embedded in the geotextile and bonded by needlepunching. When rolled out in water, this "quilt" would have a tendency to float up to the surface like an air-filled carpet. It was therefore necessary to find a supplier that uses granulated bentonite to make the liner. The larger grain size of the granules means that the interstices between them are also bigger, and air flows out much faster from the bigger hollows. As a result, the bentonite mat does not float on the surface, but quickly sinks to the ground under its own weight.

To make sure that this solution would work well, several trials were carried out with granulate-based bentonite mats which were laid out in quarry ponds in Austria.

Execution

The rollout assembly can place up to 15 bentonite mats per day. Given a length of 30 m and width of 4.5 m per mat, this equals a capacity of nearly 2,000 m² of liner per day. The rollout assembly basically consists of a truss girder that is moved by two backhoes at 4.5 m intervals. The rolls of bentonite matting are simply suspended from a movable hydraulic arrangement that is mounted on the truss, and are rolled out from there.

The rollout assembly in action
Image: PORR

The rollout assembly in action
Image: PORR

The rollout assembly in action
Image: PORR

The rollout assembly in action
Image: PORR

This simple technical adjustment resulted in significant advantages for both client and contractor. For the latter, the alternative proposal was an important factor in winning the contract, and for the former, overall project cost was significantly reduced because there was no need for temporary de-watering.

Conclusion

Carrying out exacting engineering works in a foreign country, in unknown terrain, and completing the job successfully and in a timely manner, of course involves major challenges. Albania, hitherto a white spot on the map for all those involved, turned out to be a welcoming country with hospitable people.

The project has been a positive experience, both for the client and for PORR, and we are looking forward with some excitement to its completion in late 2012.

Sunset at the construction site
Image: PORR

Revitalising the main building of BBRZ Reha GmbH in Linz

New visual identity for the vocational training and rehabilitation centre

Richard Weissenböck

BBRZ Reha GmbH, which was founded in 2003, is restructuring its main building at Grillparzerstraße 50 in the city of Linz. The company forms part of the strategic business unit for vocational rehabilitation within the BBRZ group.

Its business model comprises comprehensive measures for the integration of people with disabilities into the labour market and for professional, medical and social rehabilitation.

History

The 12-storey main building (construction unit L01), which was erected in the '70s, covers a net surface area of about 14,000 m² (12,250 m² of which are above ground and about 1,750 m² subterranean). In spatial and technical terms it is closely interrelated with the surrounding construction units, which form part of a vocational rehabilitation centre. In addition to the main building (L01), two three-storey annexes, L04 und L05, will be completely renovated and adapted.

Prior to its revitalisation the main building provided space for both office premises and training rooms. In future it will be mainly used for vocational rehabilitation purposes, including a medical centre. Office premises will occupy much less space.

During revitalisation, the former functional units in the main building will be evacuated so that the building can be reduced to its carcass and gutted, the façade renewed and building services as well as interior finishing work upgraded.

View of the original building – Grillparzerstrasse entrance, 2010
Image: PORR

Orientation map for the main building in Linz
Image: PORR

Award of works contract

Subsequent to an EU-wide call for tenders under the heading "Revitalisation of main building in Linz – full service general contractor", BBRZ Reha GmbH awarded the contract in October 2010 to the bidding consortium in which Porr Bau GmbH was one of the main partners. In the course of a multi-step negotiating procedure, the client had been won over with a detailed and well-presented architectural concept. The professional response to the functional requirements underlying the tender was another point in favour of the consortium.

Within the consortium, Porr Bau GmbH is responsible for the technical management as well as for the project and construction management.

The subject of the commission is the turnkey planning and execution of the complete revitalisation of the main building (including building supervision) by the full service general contractor. Construction work started in February 2011; the building will be handed over, ready for occupation, in December 2012.

The work and services provided by the contractor also and in particular include the complete planning and construction of the building services technology and the handling or co-handling of all necessary authority procedures. Moreover, the commission covers all permanently installed equipment and fixtures.

Gutting of the high-rise building

Keeping the adjacent building units operational while the building was gutted was one of the principal requirements. This pertained first and foremost to the building services technology and the electrical installations, many of which were shared by the various buildings.

The first step during the construction stage was the complete gutting of the building down to its reinforced concrete shell. Dismantling the washed concrete panel façade posed a special challenge for the site team.

The façade panels were fixed to the rising, reinforced concrete outer walls and had to be carefully sawed and drilled off piece by piece, while observing each and every demolition rule laid down by the structural engineer. The façade panels, each of them weighing up to 3.5 t, were dismantled with the help of the construction crane.

The panels were crushed on the building site and transported by dumpers to the concrete recycling plant.

Demolition waste

Façade panels	5,000 m²
Windows	2,000 m²
Untreated timber	266 t
Mixed municipal waste	362 t
Construction rubble and excavation waste	1,034 t
Concrete	3,463 t
Iron and steel	1,475 t

Dismantling of façade panels
Image: PORR

Dismantling of façade panels
Image: PORR

Conversion of the existing building

An internal reinforced-steel escape staircase was removed along the full height of the building, from the first basement level up to the 12th floor. The resulting holes in the ceilings were closed with new cast-in-situ concrete. The additional kitchenettes required on each floor were fitted into the newly won space.

Additional surface gains were achieved on all the floors, where ceilings were extended across façade set-backs (four per storey). Apart from the space gained on every floor, this gave the façade a new, more compact look.

The removed escape staircase was replaced by an exterior structural steel fire escape conforming to the walking width of 200 cm prescribed by the fire service regulations.

Dismantling of the interior escape staircase
Image: PORR

New structural steel fire escape
Image: PORR

Functional specifications laid down in the tendering documents

The storey-by-storey designation of space for different types of use was stipulated by the client. We had to come up with proposals for solutions corresponding to these functional specifications.

Overview of different types of use

- 12th floor: meeting areas and building services technology
- 10th-11th floor: administration
- 4th-9th floor: training area
- 2nd-3rd floor: training and office area (mixed-purpose area)
- 1st floor: medical services
- ground floor: entrance floor (services, distribution, etc.)
- basement floor: technical services, ancillary spaces

Finishing work

All the administrative areas had to be designed and built in such a way that the spatial arrangements are reversible. Unit spacing was fixed at 1.40 m by the client. Since inflexible space design is bound to impede possible changes, provision had to be made during revitalisation for subsequent conversion jobs to be performed without major structural work.

Thanks to a clearly structured testing and inspection process, the interior works currently under way are running right on schedule. To give an impression of the main areas, a 1:1 model of an office and adjacent corridor was set up in a hall forming part of the BBRZ complex.

On the same scale the façade with windows and solar protection was tested and inspected on a vacant space; this helped to expedite decision-making by the client and the planning commission of the City of Linz.

In compliance with the client's request for both individual and open-plan offices, dividing drywalls were mounted as required on the raised access floors. These access floors are extremely useful when retrofitting is called for during any later conversion work. All the offices will be equipped with suspended metal cassette ceilings.

A modular grid system of office partition walls, with corridor walls of calendered glass and wooden door elements, guarantees both high surface quality and maximum flexibility in case of subsequent reutilisation of the office rooms.

Along with the finishing work, sound insulation measurements are made to avoid deviations from the required insulation values caused by possible sources of error.

Newly designed entrance area
Image: Arch. Holzbauer und Partner

Office with corridor
Image: Arch. Holzbauer und Partner

Façade
The existing façade is structured by strip windows. The first design submitted by the Holzbauer & Partner firm of architects was rejected by the planning commission of the City of Linz; agreement was then reached on a structure with horizontal pilaster strips in the parapet and lintel area. The rear-ventilated façade of Colofer sheet metal was made to measure at the factory, then transported to the construction site for mounting. Using a patented process, Voest Alpine manufactures the Colofer sheet metal façade elements nearby in Linz. The Energy Performance Certificate provides for an insulation thickness of 18 cm.

The aluminium window construction is also being adjusted to the specified interior works grid of 1.40 m. Blinds with Z-shaped louvre blades were mounted for exterior shading; indoor areas were fitted with textile glare protection. All the façade components are made of non-combustible materials. Work on the windows and the façade is currently being carried out by the ALU SOMMER subsidiary to the full satisfaction of the site engineers.

Façade with new main entrance
Image: Arch. Holzbauer und Partner

Technical building equipment
The building is supplied with remote heating via Fernwärme Linz heat exchange stations.

The office and training areas are heated mainly by radiators. Rooms with mullion/transom façades of full room height are supplied with extra heat via under-floor convectors. Under-floor heating will be installed in the entrance area.

The offices, the training rooms, the treatment area and the storerooms will be equipped with mechanical air supply and exhaust systems. The ventilation equipment will be set up in the central ventilation plants on the 12th floor. The building will be additionally equipped with a cooling system. The required cooling capacity is generated by two refrigeration units, which will be placed on the 1st basement floor. The groundwater supply will also be used to cool the building. The dry coolers of the cooling machines will be installed on the roof above the 12th floor. Whenever outdoor temperatures permit, these dry coolers will be used for free cooling by means of a heat exchanger. The offices and training rooms will be cooled by ceiling induction diffusers.

In case of fire, pressure aeration of the internal staircase will guarantee smoke-free escape routes. Passenger lifts give vertical access to the individual floors. An extra safety lift will be installed and equipped with 'fire brigade control'. On each floor the waiting areas at the access points to the safety lifts will be designed as separate fire sub-sections in the form of safety air locks. These air locks will be equipped with extra intercom terminals. A special fire meeting point for persons with mobility difficulties who are using the building is also to be found in this area.

In the event of power failure, the power supply for the safety-related systems will be guaranteed by an emergency power generator.

Sustainable building construction
Constructing a sustainable building that will be certified by the "Austrian Society for Sustainable Real Estate" (ÖGNI) is one of the client’s special concerns. In this context it is of prime importance to have the building materials inspected in advance by technical experts for compliance with the certification rules. The same goes for the subsequent building operation. Particular attention is also called for when inviting tenders from third-party suppliers. In the interest of ecological sustainability, specific materials and working procedures are of the essence when it comes to meeting requirements.

Considering the measures listed above, the team in charge is confident that the certification procedures will be successfully concluded.

Closing remarks
Considering that finishing work is currently under way and that all those involved in constructing the building are acting with a high degree of professionalism, it can be safely expected that handover will be effected as scheduled at the end of the year.

Project data

Client	BBRZ Reha GmbH, Linz
Contractor	ARGE BBRZ Linz Porr GmbH - Alpine Bau
Architect	Holzbauer und Partner ZT GesmbH, Vienna
Commencement of construction	1st February 2011
Completion	30th November 2012
Net floor space	14,000 m²
Steel construction	140 t
Façade	7,900 m²

Address	BBRZ Reha GmbH Zentralgebäude/Main Building Grillparzerstrasse 50 4020 Linz

Façade illumination
Image: Arch. Holzbauer und Partner

Rehabilitation works on A1 motorway (Westautobahn)

Extensive repairs on Auhof access/exit section

Constanze Mitterer

Introduction
Construction of Austria's A1 motorway (Westautobahn, Vienna–Salzburg) was completed in 1966 when the last section, which connects Vienna's western suburb Auhof to the town of Pressbaum, cutting through the Vienna Woods, was opened to traffic.

Some 45 years later repair and renewal works became necessary, and Austria's government-owned motorway management company ASFiNAG tendered the required rehabilitation works in several lots corresponding to sections of the A1 motorway.

In July 2011, TEERAG-ASDAG AG was awarded the contract for repair and renewal works on the A1 access/exit section at Auhof. The works were carried out in a collaborative project by the company's Krems and Gänserndorf branches.

The project comprised renewal of the pavement construction, the drainage system, traffic guidance systems and lighting. In addition, the contract foresaw construction of a new protection system for nearby bodies of water and major repair works on three bridges.

The length of the contract section was about 1,000 m (from km 8.6 to km 9.5), including two ramps.

Traffic management
The transport authority had specified that two lanes on each carriageway had to be kept open for traffic at any time, which meant that the works had to be scheduled in three phases. Night-time and weekend works were necessary on two-lane sections without a hard shoulder.

The contractual construction time was only 13 weeks, which posed a major organisational challenge, especially considering the critical bridge repair works that had to be scheduled within the three phases.

Traffic management in phase 2 – "island" construction site on the Vienna-bound carriageway
Image: see below

Project data

Construction period	July 2011 – November 2011
Groundworks	10,000 m³
Soil stabilisation	5,700 m²
Elastic control joint 50/12	60 m
Bridge sealing system SysI+BEKVg+BPKVf	1,400 m²
AC32 bind, PmB45/80-65,H1,G4	26,200 m²
SMA11, PmB45/80-65,S2,GS, 3.5cm	23,300 m²
In-situ concrete retaining wall h=1.0 m	650 m
Steel crash barriers H2, B, W5	2,100 m
Lighting masts 9.0 m and 12.0 m incl. foundation	58 units
Lighting cables Cu 4x10, 4x16	5,500 m

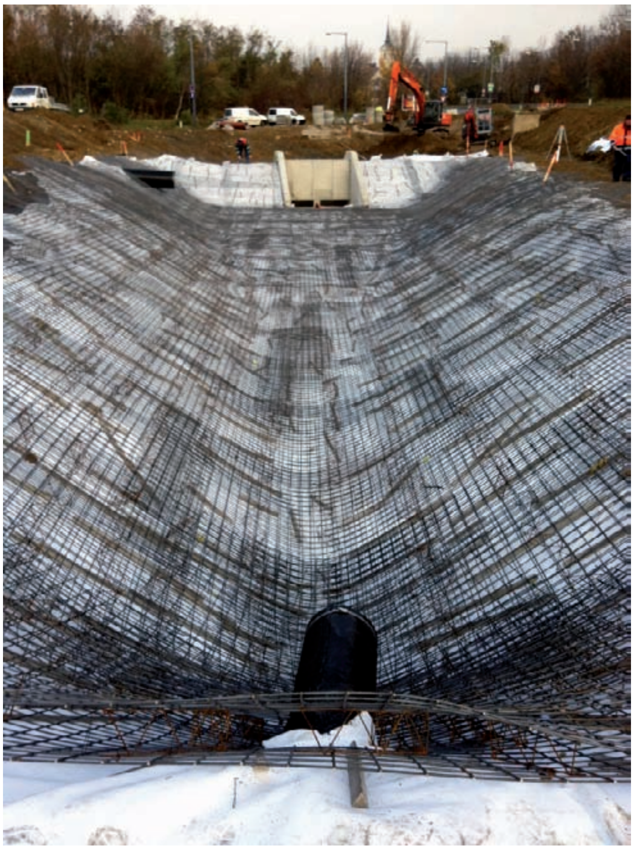
Pavment construction renewal
Parts of the existing asphalt construction were ground off to a depth of 15 cm and replaced by a 12-cm subsurface course (AC32) and a 3.5-cm surface course (SMA 11). Existing concrete surfaces were also replaced by asphalt constructions (19.5 cm AC32 and 3.5 cm SMA 11).

When the concrete surface was broken off, it became clear that the compaction of the lower base course did not conform to road-building regulations. Given the time constraints on the project, the roadbase was not removed and replaced, but stabilised in situ using Cinerit (25 kg/m²).

Traffic guidance systems and drainage

The steel crash barriers were removed and replaced by a higher-quality system. In-situ concrete guide walls were erected along the central reserve.

The project plans called for installation of a new protection system for nearby natural bodies of water. The facility is located at the start of the rehabilitated section. A pipe that connects to the central reserve drainage system was installed by pipe jacking; this carries the runoff to a sewer pipe fixed to the bridge. The central reserve drainage system is located at depths of up to 4 m.



Water protection facility – reinforcement of settling basin
Image: see below

Water protection facility – concreting of settling basin, installation of filter bed
Image: see below

Water protection facility
Image: see below

Bridge repairs

Concrete repair works were required on all three bridges on the contract section, with additional works required on the A1.00C bridge (an overpass where the A1 motorway crosses the B1 federal road). The latter included strengthening of the load-bearing structure by adding concrete layers, replacement of edge beams, renewal of bridge drainage and sealing systems, railing, crash barriers, and renewing the pavement construction of the carriageway. The existing transition structures were replaced by elastic control joints.

Bridge A1.00C – reinforcing grid for an additional concrete top course
Image: see below

Bridge A1.00C – rehabilitation of the overpass crossing the B1 federal road
Image: see below

Bridge A1.00C – concrete repairs on the bottom side of the load-bearing structure
Image: see below

Installation of new lightning system

The existing lighting system was completely removed and replaced by 12-m lighting pylons along the main carriageways and 9-m high pylons along the ramps.

During the replacement work, which proceeded in keeping with the three scheduled construction stages, only 50% of the existing lights could be switched off.

The full commitment and energetic efforts of all the project partners allowed the works to be completed within the tight schedule to the full satisfaction of the project owner.

New lighting system
Image: see below

Images: PORR

New construction replaces Achbrücke railway bridge, Tyrol

Elegant bridge design benefits rail passengers too

Stefan Plankensteiner

Introduction

The “Ötztaler Achbrücke” is a single-track railway bridge in the Austrian province of Tyrol. Owned by ÖBB, the Austrian Federal Rail System, it forms part of the rail connection between the stations Ötztal and Imst, crossing the stream that runs along the Ötz valley (Ötztaler Ache) close to where the Ache flows into the river Inn. The first, 121 m-long bridge at this site was built in 1883; in 1968, the original truss construction was replaced by a 280-t steel hollow box girder. The level three-span bridge crosses the valley floor at a height of approx. 23 m. The first of the three spans is designed as a single-span girder. The other two spans are bridged by a through girder. The two piers are founded on either side of the stream, outside its normal flow cross-section.

The steel structure of the bridge required a great deal of maintenance and, due to insufficient durability of the joints and fastenings, major repair works were necessary on an ongoing basis. Because of this situation, trains could only pass the bridge at speeds of around 40 km/h, which in effect meant that express trains regularly lost two minutes of travel time on this part of the line. Moreover, the noise levels were no longer acceptable.

Old “Ötztaler Achbrücke” bridge (2010)
Image: PORR

ÖBB Infrastruktur AG, the rail infrastructure subsidiary of ÖBB, finally decided to hold a competition, inviting bidders to submit variant analyses with regard to different structural system and architectural design options. As a result of the competition, ÖBB eventually decided not to rehabilitate the existing structure, but to have a new bridge built, as this was the most economical solution for the single-track line. The new bridge, which boasts extraordinary design features, is sited parallel to and 10 to 14 m away from the old one.

The project

The new three-span bridge with span lengths of 42 m, 60.6 m and another 42 m has a composite structure with a steel hollow box girder and in-situ concrete deck. A special feature is that the steel box girder is rigid-jointed to the piers, so that no bearings (which are high-maintenance, with frequent need for inspections) were required on the pier heads. A continuous ballast bed was placed on top of the new load-bearing structure. This homogenous superstructure improves the track quality for driving, while at the same time reducing noise emissions.

The variant analyses had shown that building a new bridge alongside the old one was a better solution, both technically and economically, than replacing the load-bearing structure of the existing one. Moving the track’s axis to the north had the added advantage of widening the curve on the connecting line towards the city of Innsbruck, adding about 10 km/h to permissible train travel speed on this section of the line. The layout of the rail route was modified over a length of 700 m and sited so that it will be possible to build a second single-track bridge structure south of the existing one, should the rail line be upgraded to twin-track operation at some point in the future.

The contract

In November 2010, the relevant ÖBB branch (ÖBB-Infrastruktur Aktiengesellschaft – GB Strecken- und Bahnhofsmanagement Region West) awarded the contract for the demolition of the “venerable” Ötztaler Achbrücke railway bridge and construction of a 145 m-long and 16 m-wide steel bridge, plus all required groundwork, drainage and foundation works, to the Tyrol branch of TEERAG-ASDAG AG. After a thorough examination of the site and probing for potentially dangerous war relics in the autumn of 2010, the demanding work on this impressive project began in January 2011. The new bridge was opened for rail operation on time, on 21st August 2011. Over the following months, the old bridge was demolished, and the temporary bridge that had been used during construction was removed, as was the now redundant railway embankment. After the necessary road construction, landscaping and other finishing works had been completed, the project was concluded in the spring of 2012.

Foundation and substructure

At the start of the works, a temporary bridge structure had to be erected to provide access to all parts of the site, including the eastern abutment on the Innsbruck side, across the Ötztaler Ache. As soon as this and the necessary site access roads were in place, groundwork started on the Innsbruck abutment to prepare the construction and assembly site. The site around the other abutment on the Bludenz side was prepared at the same time, independently of the erection of the temporary bridge.

The foundation of the bridge consists of 24 large-diameter bored piles (diameter 120 cm), arranged in two rows. The piles are up to 20 m long and were placed at an angle, with the pile heads bonded to massive reinforced concrete slabs which are up to 2.5 m thick. To allow access for inspection of the hollow box girder in the course of future maintenance works, the abutment on the Innsbruck side was built with an interior staircase. Both the Innsbruck and Bludenz abutments are founded on four slanted large-diameter piles. The two piers are approximately 16 m high and located close to the river banks. They are designed with hexagonal cross-sections above the pile head slabs and rectangular cross-sections at the lower end of the superstructure. Rising from the slabs in conical shape, the piers taper to an inflection point about 4.3 m below the bottom of the superstructure. The architectural design of the massive piers involved complex shuttering and reinforcement work, which together with sometimes freezing temperatures posed a major challenge to the workers.

Driving of piles and formwork for pier concreting
Image: PORR

Reinforcement and formwork for pier on Bludenz side
Image: PORR

Reinforcement and formwork for pier on Bludenz side
Image: PORR

Structural design – steel frame – steel-concrete composite structure

The 145.6 m-long superstructure of the bridge was designed as a three-span steel and concrete composite structure based on a torsion-proof hollow box. The finished height of the structure is 1.9 m at the abutments and about 3.1 m at the pier heads, plus up to 100 mm-thick metal plates (web and chord plates). The arched beams and narrow steel structure (lower chord: 2.6 m, upper chord: 3.8 m) lend the bridge an elegant, light-weight appearance. The steel structure is rigid-jointed to the pier heads by means of a “capping construction”. This consists of two 40-mm vertical metal plates on the sides, which were welded onto the massive, 100 mm-thick lower chord plate of the steel structure on the one side; on the other side, they are fixed to the pier head using some 2,400 shear connectors. These steel elements were embedded in the concrete when the piers were cast.

The hollow steel girder has a total weight of 510 tonnes. It was produced at the steel workshop in nine individual segments which were delivered by heavy transport vehicles. An added difficulty was that access to the site was partly over unpaved roads. Having arrived at the prepared on-site assembly areas, the segments were pre-assembled and welded together to form six bridge sections, each of which was up to 34 m long and weighed up to 100 tonnes. The steel structure sections were then lifted one by one onto the pier heads, abutments and temporary frames by one of the biggest caterpillar cranes in Austria. With a maximum height of 140 m and a weight of 960 tonnes, the lattice boom crane (Liebherr model LR 1600) can lift loads of up to 600 tonnes. Its imposing shape was visible from a considerable distance around the construction site. The steelwork was completed with the welding together of the girder sections. The entire steel structure was put in place within an ambitiously scheduled period of only about three weeks.

Aerial view of the steel structure in April 2011
Image: PORR

Positioning of the central section of the hollow steel box
Image: PORR

Meanwhile, erection of the complex falsework and formwork (travelling formwork) for the 6.5 m-wide reinforced in-situ concrete deck slab had already begun. Reinforcing and concreting were carried out in five sections (26.5 – 31.2 m), applying a “step-and-backstep” process.

Preparing the steel-concrete composite structure
Image: PORR

Travelling formwork for the composite structure, central section of the bridge
Image: PORR

Finishing works

This was followed by the finishing works, including installation of the track transition sections and drainage outlets, sealing of the load-bearing structure and application of the protective asphalt cover, placement of the precast side beams with integrated cable troughs, installation of the bridge railings, etc. During an operational shutdown from 5th to 21st August 2011, which had been scheduled well ahead, groundwork and superstructure completion works (which lasted only 48 hours) were carried out in the transition zones; the continuous ballast bed and tracks were put in place, including additional finishing works (overhead contact line, etc.). After the works had been duly completed as scheduled, the bridge was load-tested on 21st August 2011. Three ÖBB locomotives of the 1044 series with a total weight of about 260 tonnes were used in the trial. Immediately after the strain measurements, the first regular ÖBB Railjet train crossed the new bridge at a speed of 80 km/h.

Completion of the new Ötztaler Achbrücke bridge in August 2011
Image: PORR

Load-bearing structure and track deck, view towards west
Image: PORR

Demolition of old bridge – final work stages

The steel structure of the old bridge was removed on 8th November 2011. The method used was simple: on the pier heads and abutments, the 230-t steel structure was slowly pushed sideways in a controlled movement until it toppled over the edge and fell down in one piece, hitting the ground below after a 120-m fall.

The steel structure was then dismantled in an orderly process and the scrap reclaimed for reuse. The piers and abutments were demolished by blasting as well as conventional cutting. In the autumn of 2011, the revetment of the banks was reconstituted, the temporary bridge was dismantled, and the old railway embankments, which were no longer needed, were removed. Landscaping and replanting, road construction and finishing works concluded the project in spring 2012.

Conclusion

The project posed major challenges for the construction company TEERAG-ASDAG AG (Tyrol branch), the sub-contractor responsible for the steel structure, the designing engineers and the local construction supervisors. These were due to the technical complexity of the construction and erection of the bridge, the short construction period of only eight months and the fact that rail traffic on the line had to continue nearly uninterrupted throughout the whole construction period. Moreover, the local site conditions (access roads) were difficult, and special consideration had to be given to the fact that the site is located in a nature conservation area ("Bergsturz Tschirgant" area). With this project, TEERAG-ASDAG AG, an important division of the PORR group, furnished ample proof of its ability to successfully carry out complex infrastructure projects to short deadlines.

The hollow box girder and one pier seen from below
Image: PORR

With the new "Ötztaler Achbrücke" in place, the speed restriction (40 km/h) has become a thing of the past. The new structure has brought significant improvements for rail passengers. For them, it means less noise, punctual train services, a stable timetable and greater overall reliability of the local transport infrastructure. With its aesthetically pleasing, elegant design, the bridge is a railway engineering landmark. Positioned at the entry to the Ötztal valley, it is set in an impressive landscape and blends harmoniously into the surrounding nature conservation zone.

Project data

Client	ÖBB Infrastruktur AG, Innsbruck
Contractor	TEERAG-ASDAG AG Tyrol branch
Length of contract section	800 m
Bridge length	145 m
Bridge width	7.06 m
Bridge surface	950 m²
Span widths	42 m – 60.6 m – 42 m
Pier height	16 m
Steel structure	510 t

Concrete	1,500 m³
Reinforcing steel	390 t
Bored piles	450 m
Embankment filling	12,000 m³
Start of construction	January 2011
Start of rail operation	21st August 2011
Demolition of old bridge	November 2011
Completion of project	Spring 2012

Underground car park at Rossauer Kaserne barracks

Construction within a confined space

Gerhard Gail

Project description

In October 2010 Porr Technobau und Umwelt AG and Porr Projekt und Hochbau AG (revitalisation department) were jointly commissioned to build an underground car park underneath the central courtyard of Rossauer Kaserne, a historic army barracks building. The contract for the turnkey project was awarded by Rossauer Garagen GmbH.

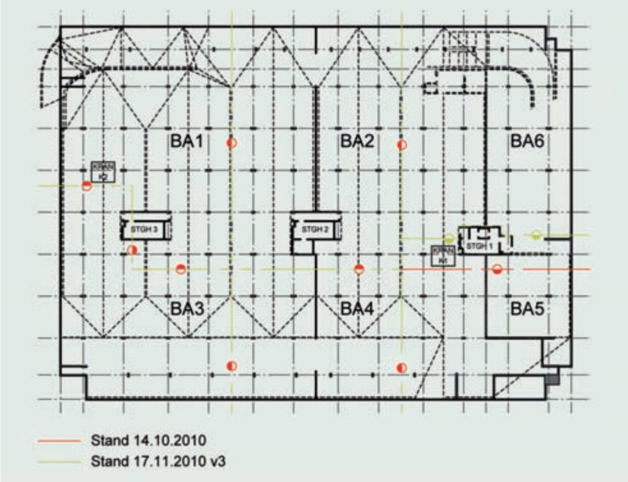
The two-storey car park offers short- and long-term parking for 479 cars, including, but not limited to, army personnel cars. It is divided into four fire compartments.

The contract was for a turnkey project. In addition to the construction works – excavation and spoil removal and concrete construction – it included all electrical installations and building services engineering, coating and painting works, installation of doors, gates and windows, and a steel-glass construction for the staircases leading to the courtyard above ground. Installation of a lift and reconstruction of the courtyard surface with paving stones, as well as asphalting of the access and entry ramps, were also part of the project. A special requirement was that the paving had to blend in with the surrounding structures, as the building complex is a protected historic monument.

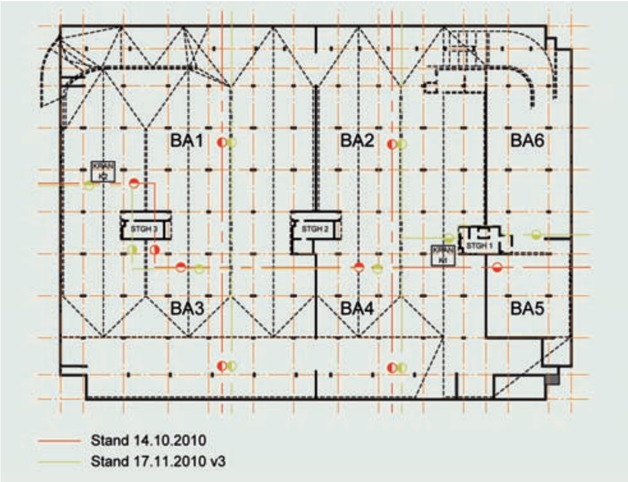
The works were executed to a high quality standard and commended by the client as an example of best practice in underground car park construction. All work phases were completed as scheduled, and the project was concluded successfully and on time for the scheduled opening on 1st December 2011.

Project data

Project type	GENERAL CONTRACTOR ORDER
Start of construction	19th Oct. 2010
Completion date	22nd Nov. 2011
Key data	2-storey UNDERGROUND CAR PARK for 479 cars
Concrete	approx.13,000 m³
Reinforcing steel	approx. 1,300 t
Excavated material	approx. 50,000 m³
Reconstructed surface area (stone pavement)	approx. 7000 m²



Construction sections on underground level 1
Image: PORR



Construction sections (concreting sequence)
Image: PORR

Project execution within the Rossauer Kaserne building

Main works

The spatial constraints of a courtyard enclosed by a building and with only two narrow gateways – one for access, one for egress – constituted a special challenge in this project. The management and logistics of the construction site had to be adjusted to cope with these difficult conditions on a daily basis.

The construction site for the underground car park was divided into six sections. Bottom slabs, walls, columns and ceilings were cast section by section and floor by floor in a complex “nested” construction process.

Site overview – “nesting” of construction stages
Image: PORR

After casting of the bottom slab, two-storey outer walls were erected, using single-sided formwork and a support frame system. The load-bearing interior walls and columns came next, with section-by-section forming, reinforcing and placing of concrete on each level. Then the ceilings above underground level 2, which are structurally connected to the walls by inserted joints, were concreted. This process was repeated for underground level 1, providing the substructure for the surface pavement to be laid in the courtyard.

As can be seen in the photo, excavation work was still under way in section 6 while in section 1 the formwork was already being erected for the ceiling joists above level 1. At the same time, the reinforcing steel for the ceiling above level 2 was being installed in section three, while work on the bottom slab was proceeding in sections 4 and 5.

Given the space constraints of the construction site, this intricate “nesting” of work sequences was the only possible way to carry out the project.

The site was serviced by two revolving tower cranes that were positioned within the future car park. This required ceiling openings which were concreted after the cranes had been dismantled.

Finishing works

After the structural works had been completed in July 2011, the finishing works started with electrical installations and building services engineering. For most of September 2011 the car park was closed for coating and painting works.

The coating system consists of three coats: a base coat, a crack-covering interim coat and a coloured surface coat which has been specially developed for underground car parks. Underground level 1 received a blue surface coat, level 2 a green one.

Finished UG level 2 with green surface coating
Image: PORR

Finished UG level 1 with blue surface coating
Image: PORR

Pavement design

While the finishing works were carried out underground, the courtyard surface was repaved. In consultations with the client and the barracks management, it was decided to use “double interlocking pavers” for the pavement surface. Given that the cover above the underground car park is rather thin and that proper surface drainage must be ensured, a bridge sealing system was laid out on the surface, rising at the sides.

Structure of the pavement with sealing system:

- Sloping asphalt
- Two sealing layers, suitable for hot-mix asphalt
- Sloping layer of protective asphalt
- Levelling layer of sand
- 8-cm double interlocking pavers

These works were subcontracted to the PORR subsidiaries TEERAG-ASDAG and Allbau and carried out to the full satisfaction of the construction supervisor.

In parallel with the surface paving, the high-speed doors and barrier systems were installed, and the steel-glass staircase structures were finished with artificial stone cladding.

A wide range of works

The challenge in the construction of this underground car park was to combine the construction of high-quality exposed concrete structures and all the finishing works to complete the project, ready for operation, in time for the scheduled opening.

This also included technical inspection and approval procedures for the lifts, fire protection installations, the high-speed doors and other elements required to ensure the safety of the car park users.

Conclusion

Despite the confined working space and the harsh weather conditions prevailing in the winter of 2010/2011, this technically challenging project was carried out by PORR to the full satisfaction of the operator, the investor and the Austrian army, and was handed over as scheduled on 22nd December 2011.

Hydropower station at the riverbed sill in Lehen

Environmentally friendly generation of electricity and improved flood protection

Wolfgang Poschacher

Visualisation: downstream view of the power station
Image: Salzburg AG

Weir section
Image: PORR

The project

Faced with steadily increasing energy demand, particularly in conurbations, Salzburg AG has devised a unique project at the heart of the city of Salzburg.

A hydropower station with a capacity of 13.7 MW is currently being constructed in a residential quarter of the city.

The riverbed sill was constructed in 1968 and has seriously interfered with the flow of the river Salzach ever since. The construction of the power station at the Lehen riverbed sill, in connection with the construction of a fish pass, will significantly improve the situation. Cut-off walls on both riverbanks and a drainage system on the right bank of the Salzach in the dam area will slow down the rise of groundwater levels in the event of floods. In addition, a recreational area will be created at the centre of the city in the course of the construction of the power plant. It will be mainly the residents of the adjacent, densely built-up districts of Lehen, Liefering and Itzling who will benefit from this newly created area.

The power station, consisting of a powerhouse with two power generating units and a weir with four gates, is situated approximately 170 m downstream of the existing riverbed sill.

In spring 2010, the ARGE KW Sohlstufe Lehen, a consortium involving Porr Bau GmbH and TEERAG ASDAG AG, was commissioned with the construction works for the power station at the riverbed sill in Lehen.

The construction works

Due to space limitations, it was not possible to construct the entire power station while diverting the Salzach, so construction was divided into two phases.

After completion of the preparatory works in summer 2010, the first construction phase was initiated in September 2010.

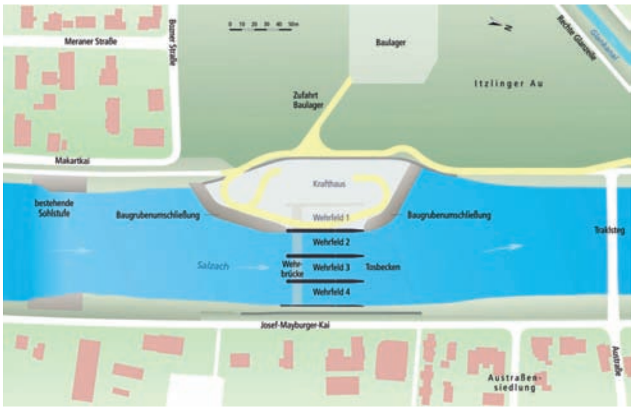
Schematic overview of the first construction phase
Image: Salzburg AG

In the first construction phase, three of the four weir gates were constructed on the right side of the Salzach, and a cut-off wall was jet-grouted in the dam area on the left bank.

Construction phase 1
Image: PORR

The first construction phase was completed according to schedule in December 2011. The second phase was then initiated in January 2012.

Diversion of the Salzach for the second construction phase
Image: PORR



Schematic overview of the second construction phase
Image: Salzburg AG

The Salzach now already flows through the completed weir, while the fourth, and last, weir gate, the powerhouse and the generators are being installed on the left side of the river. In addition, the second construction phase also includes the construction of a cut-off wall and a drainage system behind it in the dam area on the right bank.

Diversion of the Salzach during construction phase 2
Image: PORR

Diversion of the Salzach during construction phase 2
Image: PORR

Securing the excavation

Highly complex specialised civil engineering works were required to make the excavation work for the weir gates and the powerhouse possible. The excavations on the left and right sides of the Salzach were secured by means of contiguous cast-in-situ pile walls with jet-grouted spandrel sealings, while a secant pile wall was erected in the middle of the river. Cofferdams of up to 19 m long sheet piling were erected as needed in the course of the works to serve as excavation supports between the pile walls.

The bored pile walls, reaching depths of up to 25 m, were tied back into the flysch with up to 40 m-long anchors distributed over four anchor horizons.

In order to provide adequate flood protection, the cofferdams also had to be secured by up to three anchor layers.

The specialised civil engineering works were directed by Porr Bau GmbH.

As of mid-2013, the power station at the Lehen riverbed sill will have a capacity of 13.7 MW, generating approximately 81 million KWh of clean hydropower every year. This will be sufficient to secure the electricity supply of about 23,000 households in Salzburg's Lehen, Liefering and

Itzling districts.


Construction phase 1 – weir gates 2 to 4, April 2012
Image: PORR


Construction phase 2 – powerhouse
Image: PORR


Construction phase 2 – weir gate 1, April 2012
Image: PORR

Project data

Excavated gravel	30,000 m³
Excavated rock	4,000 m³
Excavated lacustrine clay	100,000 m³
Armour stones	40,000 t
Concrete	40,000 m³
Reinforcing material	3,600 t
Sheet pile walls	1,000 t

Key data – Lehen riverbed still power station

Technical Data

Maximum capacity	13.7 MW
Annual production p.a.	81.0m kWh
Catchment area	4,426 km²
River	Salzach
Maximum flow rate	250 m³/s

Dam area, weir

Top water level	413.50 m above Adriatic sea level
Head	6.60 m
Weir	4 weir gates, width = 16.00 m

Weir gates	4 pressure segments with fitted shutters

Machines and electrical installations

Turbines	2 Kaplan turbines with cylindrical gearing turbine wheel diameter of 4,000 mm

TEMPJET: Continuous Quality Control and Quality Assurance

Thermal modelling software to determine the diameter of jet-grouted columns

Klaus Meinhard

The Foundation Engineering Division of PORR Bau GmbH Infrastruktur has held an Austrian patent for Tempjet since 2009. The European patent will be granted in 2012. The innovative Tempjet method allows fast and efficient determination of the diameter and cement content of jet-grouted columns – even at great depths. It is no longer necessary to excavate test columns and conduct time-consuming examinations. PORR has also been selling licences for the application of the Tempjet method for about one year now, and some renowned international companies have already purchased such a licence. The Tempjet method has already been successfully used for quality control in jet-grouting works in Austria, Germany, Hungary, Poland, the UK, Greece, Denmark and Switzerland – either as a service provided by PORR or by licence holders themselves. A company based in Cleveland, Ohio which offers quality assurance services on the global market has also expressed its interest in PORR's Tempjet method.

General information

The thermal simulation model described in this article provides a new method for determining the diameter of columns which are produced by jet grouting, a method frequently used in specialised civil engineering. The model is based on a numerical simulation of temperature changes in hydrating jet-grouted columns and of heat transfer to the surrounding soil. The properties of the grout used in the method, the thermal characteristics of the jet-grouting suspension and the physical and thermal characteristics of the native soil constitute the input parameters. A comparison of the temperature changes at the centre of the column as measured at the construction site and of the temperature curve that results from the numerical modelling process provides an indication of the diameter and cement content of the column. The key economic advantage of this solution is that it is no longer necessary to drill additional holes or to excavate test columns to measure their diameters. Regardless of the method used for producing the columns (single, double or triple fluid jet grouting), excellent results can be achieved with various grouts and in a wide range of different soils. The aim of the method is to allow continuous quality assurance on site throughout the entire course of the jet-grouting works.

State of the art

The most reliable way of determining the properties of a jet-grouted column until now has been to produce test columns, which are left to set for at least two days and are then excavated (see fig. 1). The European Standard EN 12716, which applies to jet-grouting procedures, also provides for using this method. A major drawback of these quality control measurements is that, apart from being rather time-consuming, they only provide very selective information about the properties of the jet-grouted elements as obtained from the measurement points. If jet-grouting works are carried out at greater depths, an excavation of test columns is often neither technically feasible nor economically defensible.

Examples of measuring methods which are currently used by specialised civil engineering companies for determining the diameter of jet-grouted columns include the use of a probe or a mechanical measuring device which folds like an umbrella, erosion measurements at pre-installed level indicators, examinations of the slurry flowing back out at the surface, sound level measurements using hydrophones and ultrasound measurements. The main constraints that limit the applicability of these methods are the characteristics of the native soil, the geometrical properties of the elements and economic considerations.

Fig. 1: Excavated test columns
Image: PORR

Theoretical background

A method for determining the diameter of jet-grouted columns and the material properties of the grout used for jet grouting was developed in a research project which was carried out by PORR Technobau und Umwelt AG in cooperation with the Institute for Mechanics of Materials and Structures at Vienna University of Technology and completed in 2007. This method combines in situ temperature measurements with a simulation model that describes the exothermic setting reactions of cement-bound materials.

The temperature changes measured at the construction site generally show an initial increase of the column's temperature due to the exothermic setting reaction taking place during the hydration of the cement. After 10 to 60 hours, a peak temperature is reached. The progress of the subsequent temperature decrease is mainly influenced by the properties of the native soil and the dimensions of the column.

Numerical parameter studies have shown that the cement content of a column mainly influences the temperature rise at the start of the setting process (see fig. 2a: Parameter study – temperature changes at the centre of jet-grouted columns having a constant diameter of 150 cm, their cement content varying from 100 to 500 kg/m3) and that an increased diameter results in a later peaking and a slower decrease of the temperature (see fig. 2b: Parameter study – temperature changes at the centre of jet-grouted columns having a constant cement content of 300 kg/m3, their diameters varying from 80 to 240 cm). These effects can also be observed in in situ temperature measurements.

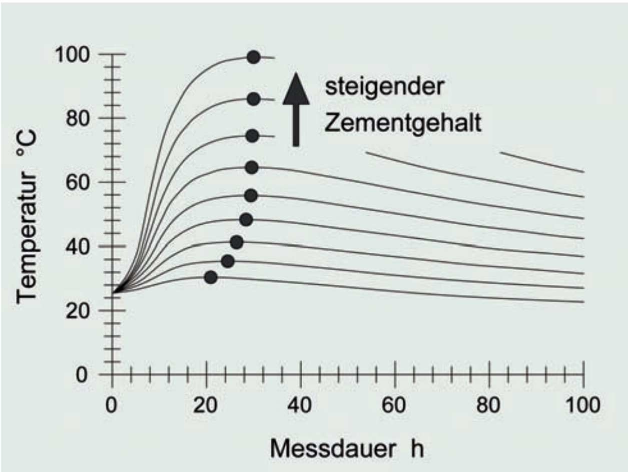


Fig. 2a
Image: PORR

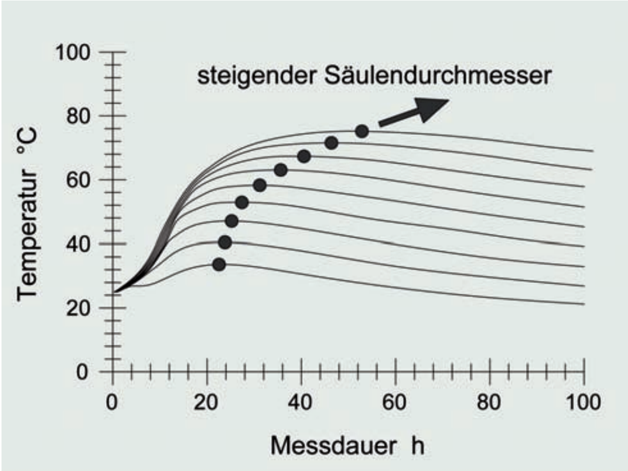


Fig. 2b
Image: PORR

Due to these significant differences, a comparison of temperature changes as measured at the construction site and the results of numerical calculations provides an indication of the cement content and the diameter of the columns.

The quality of the results, i.e. the properties of the jet-grouted element that are identified by the comparison, very much depends on the description of the cement hydration process and of the thermal properties of the soil and the grout suspension on which the model is based.

Measuring method

The temperature changes in the columns are determined by a measuring system consisting of a data logger and a temperature probe.

Commercially available temperature measuring systems which allow simultaneous measurements to be taken at several temperature measuring cables and automatically record the results are used as data loggers. PORR has developed and produced GSM measuring devices for online monitoring to enable automatic recording of measurement results at construction sites (see fig. 3: Measuring system, consisting of a data logger including a GSM module for remote monitoring, a spare battery and connected thermo sensors).

Fig. 3
Image: PORR

The temperature probe consists of a PVC sleeve of the type that is commonly used for electric installations in building construction. The sleeve has a diameter of approximately 14 mm, and up to six measurement cables can be inserted into it. Temperature probes are assembled as needed, depending on the conditions at the construction site, including the depth of the soil layers to be examined and the total length of the column (see fig. 4: Temperature probe with internal temperature measuring cables).

Fig. 4
Image: PORR

In the future, use might be made of a measuring cable protected by worldwide patent which allows digital measurement of temperatures throughout the jet-grouted column, e.g. at distances of approx. 30 cm. This cable was first tested in March 2012.

Use at construction sites

With the thermal modelling solution, it is no longer necessary to produce special test columns to determine the column diameter. The temperature can be measured in any column of the building structure. It is, however, important to adjust the length of the respective column if necessary, as it should extend above and below each temperature sensor by a length corresponding to the obtained diameter, in order to prevent the temperature changes from being influenced from the upper or lower edge of the column.

It is important to make sure that the sensors are positioned at the exact centre of the column and at the desired depth immediately after grouting. They are usually inserted via the drill rod of the drilling tool, allowing for the simultaneous positioning of several sensors at different depths.

The positioning of the temperature probe is illustrated in detail in the following figures.

Fig. 5a: The drill rod is drilled into the soil until it reaches the lower edge of the jet-grouted column.
Fig. 5b: The rod is broken open, and the temperature probe is inserted.
Fig. 5c: The temperature probe is inserted into the jet-grouted column until it reaches its lower edge.
Fig. 5d: The drill rod is re-assembled in order to be pulled out; the probe remains in the drilled hole.
Fig. 5e: The drill rod has been completely pulled out; the probe remains in the soil.
Fig. 5f: Data logger connected to the probe for conducting temperature measurements (this photo shows the testing of newly developed measuring devices from the Cleveland-based company PDI, conducted at the construction site of the Palais Fürth building project in Vienna.)

Fig. 5a
Image: PORR

Fig. 5b
Image: PORR

Fig. 5d
Image: PORR

Fig. 5c
Image: PORR

Fig. 5e
Image: PORR

Fig. 5f
Image: PORR

After the drill rod has been pulled out, the data logger is connected to the temperature sensors, and data recording starts. Although the recorded data can be checked at any time, the presented method can only be applied after the hydration temperature has peaked (approximately after 15 hours for columns with a diameter of about 1.0 m, after 60 hours for columns with a diameter of about 2.5 m).

Once the data have been read from the data logger, each individual curve derived from the recorded measurements (see fig. 6: Read-out temperature file) is assigned to the depth at which the corresponding temperature sensor was installed. Temperature changes in the column are then numerically simulated for each depth. In addition to the input parameters, including a specification of the grout, soil parameters (raw unit weight, thermal parameters), etc., a search range is defined for the simulation by setting minimum and maximum values for the possible column diameter and cement content. The numerically calculated temperature curves for a large number of pairs of values (diameter and cement content) within this range are then compared to the actual temperature curve measured at the construction site. The pair of values that gives the best match between the calculated curve and the curve measured in situ describes the predicted properties of the jet-grouted column at the respective depth (see fig. 7: Simulation result showing matching temperature curves – blue: curve measured in situ; red: numerical simulation).

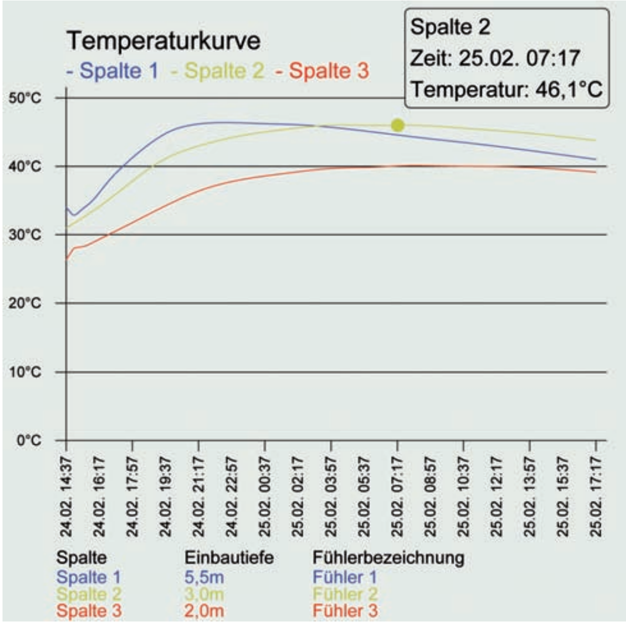


Fig. 6
Image: PORR

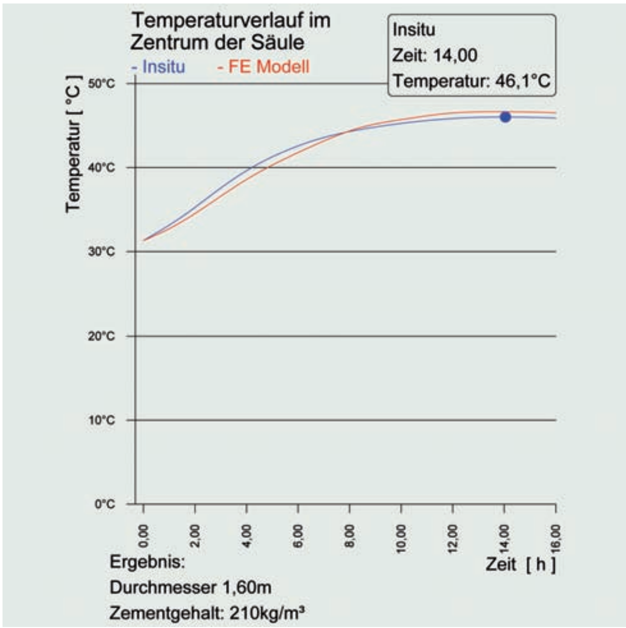


Fig. 7
Image: PORR

Limitations of use

The presented method is based on the correct recording of temperature changes in the course of hydration and of the heat transfer to the surrounding soil. If the hydration heat of the applied grout is low (e.g. grouts with a blast-furnace slag or rock flour content of > 80%), the distinct temperature rise at the centre of the jet-grouted column that is required for the simulation will not occur. In this case, the process cannot be modelled. Groundwater streams and neighbouring columns that are hydrating at the same time also adversely affect the precise determination of column diameters by means of thermal modelling, as they may prevent a steady, rotationally symmetrical dissipation of heat from the jet-grouted column.

Summary

In recent years, thermal modelling to determine the diameter of jet-grouted columns has been applied at numerous construction sites, yielding a high correspondence between numerically predicted diameters and the actual diameters of excavated test columns. This method also allows determination of the cement content of a jet-grouted column. Due to the low additional costs, its application has proved very efficient for quality assurance during jet-grouting works, always bearing in mind the limitations described above.

PORR celebrates drivage start-up for Ampass tunnel

The drivage start-up for the 1,400-m Ampass side drift near Innsbruck was celebrated under cloudless skies on 2nd May 2012.

Start-up festivities in Tyrol
Image: PORR

The contract for the tunnel was awarded in mid-2011 by Brenner Basistunnel BBT SE to a consortium of Strabag and Porr Tunnelbau. Preparatory works – diversion of a local road and motorway slip roads, construction of supporting walls and preparation of the spoil area – began in the autumn of 2011. The Ampass tunnel is a side drift for the Brenner base tunnel project and will be used as an access route during construction of the rescue and escape tunnel. The first 300 m of the tunnel, where loose rock is expected, will be mechanically driven; after this stage, tunnelling will progress by drill-and-blast excavation. In his celebratory address, BBT SE CEO Konrad Bergmeister expressed his appreciation for the excellent work done by former BEG managing director Hans Lindenberger on the whole Brenner base tunnel project. The honour of placing a statue of St. Barbara in its specially prepared niche near the tunnel portal fell to tunnel patroness Christine Lindenberger, who wished all those involved in the project accident-free works and concluded her remarks with the traditional miners' greeting "Glück auf!"

Topping-out at the Andersia Business Centre in Poznań, Poland

The topping-out ceremony at the Andersia Business Centre in Poznań was held on 23rd November

Words of welcome at the topping-out ceremony
Image: PORR

The Andersia Business Centre in Poznań, Poland is being developed as a joint project by the City of Poznań and the Von der Heyden Group. The works are being executed in two construction stages, with PORR (POLSKA) S.A. as contractor for both. The first stage ("ABC-Status 0") comprised construction of a two-storey underground car park and was already concluded in November 2010.

Stage II started on 13th July 2011 and is dedicated to the construction of a five-storey building with approximately 14,000 m² of usable floor space and a cubic content of about 100,000 m³. Completion is scheduled for September 2012.

PORR was able to complete the above-ground building structure in only four months. The project developers were pleased with the speed and excellent quality of the works.

The class A building being developed will serve as an office and commercial building, with about 2,300 m² of modern retail space on the ground floor and high-quality office space on the upper floors. The building is located on Królowej Jadwigi Street, with a 126-m street frontage.

The Mayor of the City of Poznań, Ryszard Grobelny, attended the ceremony, as did representatives of all the parties involved in the project: project developers Andersia Business Centre Sp. z o.o. and Von der Heyden Group, general contractor PORR (POLSKA) S.A., architects Ewa und Stanisław Sipiński, the subcontractor in charge of the shell construction – Technobud Nowy Sącz – as well as other guests of honour and members of the press. The developers' and general contractor's representatives reported on the progress of the project at a press conference that preceded the celebration. The participants in the ceremony then watched as the decorative wreath that symbolises the achievement at this stage of a project was put in place atop the building structure.

PORR wins EU award for Campina–Predeal rail project (Romania)

Rail upgrade designated best EU co-financed project

Image: PORR

After a selection process in which all citizens of the European Union were able to participate, the European Commission designated the rehabilitation and improvement works on the Campina-Predeal rail route in Romania as the best of all infrastructure projects that had received EU co-financing, confirming the excellent performance of PORR during the works on this important part of the trans-European rail corridor.

Besting 26 other projects from across the EU, the twin-track, 48-km rail project brought victory in the competition to Romania. Runners-up were a Spanish project to reduce youth unemployment and the Austrian Brenner base tunnel project. The European Commission cited the cost-cutting potential for transport in Romania and the complex challenges involved in the works execution as the key factors in its decision.

In addition to the complete overhaul of the 48-km rail line, the contract also comprises rehabilitation or reconstruction of nearly 120 bridges, six rail stations and six stops with a combined platform length of 7 km.

With this project, PORR has once more been able to demonstrate its great technical know-how and its excellence in infrastructure engineering, a core competence area of the Group.

Energy contracting saves CO2 – and taxpayer's money

Mark Wittrich, Udo Magyar

In the context of the Austrian government's Energy Performance Contracting Policy, the Federal Ministry of Justice awarded a contract for the optimisation of energy efficiency at the penal institutions Krems-Stein (Lower Austria) and Garsten (Upper Austria) to FMA Gebäudemanagement GmbH in March 2011.

FMA Gebäudemanagement GmbH, a 100% subsidiary of PORREAL Immobilien GmbH, is active in innovative and renewable energy projects and has also established a reputation for itself as an energy performance contractor. A combination of technical solutions is being applied at the two prisons to achieve a significant reduction in energy consumption.

The contract period is 11 years for both institutions, with installation and optimisation of new technical installations and equipment to be completed by year-end 2012.

The main purpose of the project is to reduce the energy required for heating of the buildings by nearly one third over the whole contract period. The Contracting Department of FMA Gebäudemanagement GmbH is responsible for all design, engineering and installation works.

At the heart of the project is the construction of three combined heat-and-power (CHP) cogeneration plants that generate both heat and electricity. Each CHP unit can produce 750 kW of heat and 360 kW of power.

To improve the efficient use of the power thus generated, heat pumps with a heating capacity of 1,500 kW are being installed. Porr Umwelttechnik was contracted to construct the required wells and seepage shafts to keep this part of the value chain within the Porr Group.

To ensure high efficiency standards in all building services plants, existing control systems have been removed and replaced by new "Greentelligence" control systems, a proprietary development of FMA Gebäudemanagement, throughout the premises of both institutions.

Daily energy consumption monitoring is performed by FMA's energy engineers so that all energy streams are observed and the plants' efficiency can be assured at any time. The monitoring data also serves as evidence of the energy savings achieved in any given observation period.

The new installations save 1,255 tonnes of CO2 p. a. – equivalent to the CO2 emissions released by 557 mid-size cars travelling 15,000 km per year! Temporary sequestration of this amount of CO2 would require the planting of 80,909 spruces.

With its innovative products and solutions, FMA Gebäudemanagement GmbH thus contributes to protecting the environment and the global climate.

Handover of Donaufelderstraße residential complex to housing cooperative ÖSW

Vienna City Councillor Michael Ludwig and board members of ÖSW thanked PORR for the outstanding quality of the construction work.

The Donaufelderstraße residential complex was officially handed over to the developer and owner, the housing cooperative ÖSW, on 18th January 2012. The event was attended by City Councillor Michael Ludwig, the ÖSW board members Michael Pech and Wolfgang Wahlmüller, architects Elsa Prochazka and Raab and a representative of the district of Donaustadt.

The head of the local branch of PORR, Alfred Vandrovec, received a personal thank-you for the exceptionally high quality of the works from the ÖSW board members and City Councillor Ludwig. With the successful completion of this project, the construction site team furnished proof of PORR's ability to perform to the highest standards.

Image: PORR

Image: PORR

Image: PORR

Breakthrough on the A5 eastern bypass at Biel, Switzerland

The last tunnel tube on the Biel motorway bypass has been holed through.

Work crews and PORR managers with tunnel boring machine
Image: PORR

On 18th February, the big day finally arrived: tunnel boring machine (TBM) "Belena" cut through the last tube of the Biel motorway bypass. 500 guests of honour attended the event, including representatives of PORR who underlined the impressive achievement of the work crews. Hans Köhler, managing director of Porr Tunnelbau GmbH, said: "A breakthrough is always special. It is first-hand evidence of the hard work the men have done." The 2,500-tonne TBM cut through 1.4 km of solid rock and 900 m of difficult loose rock mass.

The tunnelling got off to a difficult start, as rail tracks had to be undercrossed, making the very first section one of the most critical stages of the project. At later points, too, the tunnelling crews had to solve problems posed by tricky geological conditions. At the end of the Längholz tunnel, for example, loose masses of wet, loamy subsoil tended to jam the cutterhead. As the works progressed and the tunnelling crews gathered more and more experience with local conditions, they were able to fine-tune the tunnelling technique, stepping up the rate of progress. As a result, the second tubes of both the Büttenberg and Längholz tunnels were completed faster than the respective first tubes. The first tube of the Büttenberg tunnel in Orpund was holed through 159 days after tunnelling had started, but it took the work crews only 103 days to cut through 1.3 km of 28-million-year-old lower molasse deposits for the second, parallel tube. In the case of the 2.5-km Längholz tunnel, works on the second tube were completed two weeks faster than on the first one. In all, the tunnelling crews worked underground for 696 days.

Opening of railway underpass in Gramatneusiedl

The inhabitants of Gramatneusiedl had been waiting for it for years: on 11th May 2012, a railway underpass was opened that connects the two parts of the town, eliminating annoying waits at the former level crossing.

Photo 1
Image: PORR

Photo 1: The mayor of Gramatneusiedl, Erika Sikora, ÖBB engineer Werner Baltram, and local government officials Karl Wilfing and Peter Beiglböck symbolically removed the level crossing barrier that had divided the town.

The project for the construction of the 250-m watertight underpass ("White Tank" system) was managed by Porr Bau GmbH (rail construction department). About 7,500 m³ of concrete, 660,000 kg of structural steel and 6,200 m² of shuttering were used in the construction, which was completed with record speed in only 14 months. In addition to tight scheduling, the confined space on the site and unfavourable geological conditions posed major challenges for all project partners.

Close and fruitful cooperation with Heinz Höller, the responsible engineer of the Austrian Federal Rail System (ÖBB, ISM RL Ost 3), and his team enabled us to complete this project successfully.

Photo 2
Image: PORR

Photo 2: Director Johann Floh (Porr Rail Construction) and ÖBB (Federal Rail System) engineers Werner Baltram and Günter Novak were pleased with the successful completion of the project.

Festive hotel openings in Tyrol

Two extraordinary hotels were officially opened in the Austrian province of Tyrol in December: the Kempinski Group's Das Tirol in the town of Jochberg, and the three-star Ramada Innsbruck Tivoli in the provincial capital Innsbruck.

Kempinski Das Tirol

After about twelve months of conversion and improvement works, Das Tirol was officially opened on 7th December 2011 with a spectacular party. Some 500 guests from the fields of politics and business attended the festive event hosted by the Kempinski Group, the hotel's new owner.

The conversion and improvement works received much praise at the event. In his opening address, Das Tirol director Henning Reichel expressed his appreciation for the work of the project manager, Ms. Hofstetter, the technical manager, Mr. Pöll, and the PORR Solutions team, underlining that it was thanks to their committed efforts that the complex conversion works had been executed in such a short time.

The guests at the opening were introduced to the culinary excellence of the Kempinski Group, with delicious dishes being prepared by several of Kempinski's award-winning chefs.

Operations at Das Tirol got off to a successful start, with good initial bookings and high capacity utilisation as the winter season unfolded.

Kempinski Das Tirol
Image: PORR

Kempinski Das Tirol
Image: PORR

Ramada Innsbruck Tivoli

A festive celebration attended by many guests from the fields of business and politics marked the opening of the new three-star Ramada Innsbruck Tivoli hotel in mid-December.

The architecturally challenging project was completed as scheduled and within budget. "With the Ramada Innsbruck Tivoli project, we have landed right on target," said Johannes Karner, managing director of Strauss & Partner Development.

Mr. Schöffthaler and his team received a special thank-you for their excellent and committed work. Good cooperation between the developers, the authorities and the contractors resulted in successful completion of the project.

The hotel building was blessed by a priest, and after the formal handover of the keys, operations were officially launched.

Ramada Innsbruck Tivoli
Image: PORR

Flood defences in the Machland region are making record progress

Some 70,000 m³ of damming material were mixed on site and placed to produce a 2-km embankment dam within only six weeks.

The embankment construction project “Saxen” constitutes contract section 4 of a major flood control project along the Danube in the eastern Austrian region of Machland. It comes in the wake of contract sections 3 (“Baumgartenberg”), 6 (“Grein”) and 8 (“Dotationsbauwerk”, i.e. channelling structures).

After the submission of bids on 27th August 2011, the developer Machlanddamm GmbH awarded the contract to PORR on 21st September 2011, and the works duly commenced on 3rd October 2011. The lead partner in the project is the Upper Austrian branch of the PORR Group.

Following the extremely speedy tendering and contract awarding process, work on the embankment construction progressed at an extraordinary pace too, so that it took only until 30th November 2011 to complete the backfilling of the embankment. In addition to the extensive groundwork, 800 m of flood control walls are being built with sealing sheet-pile walls underneath, and 14 pumping stations are being installed.

In all, flood defences are being erected along a 20-km stretch of the Danube and will be completed as scheduled by August 2012.

Embankment construction proceeds at record pace
Image: PORR

Ground-breaking ceremony for apartment complex on Kaisermühlenstraße

PORR and prominent guests of honour celebrated Vienna’s newest residential project.

Guests of honour at the ground-breaking ceremony
Image: PORR

The official ground-breaking ceremony for a major project which PORR is carrying out for the building cooperative “bwsg – besser wohnen seit Generationen” was celebrated on 11th May.

The housing complex, which will conform to the highest standards of energy efficiency (Passive House Standard), will comprise 264 apartments on 24,580 m² of usable space, four offices and four retail units, plus a 259-space car park. Access to the apartments will be via 15 staircases.

The groundwork for the project was started in March, and has already been concluded. The building complex is scheduled for completion in mid-2014.

Among the prominent guests attending the ground-breaking ceremony were Wilhelm Haberzettl, CEO of the developer “bwsg”, architect Martin Trebersburg, district chairman Norbert Scheed and PORR manager Alfred Vandrovec. The event concluded with refreshments and interesting conversation on a bright and pleasant early summer's day.

Olympia Gate Munich GmbH launches major development project in the capital of Bavaria

Olympia Gate Munich GmbH is a joint venture of Münchener Grundbesitz Verwaltungs GmbH and PORR subsidiary Strauss & Partner Development.

The development project will be realised on about 15,000 m² of land in a popular residential area close to Munich's fashionable Schwabing neighbourhood. The area can be easily reached by high-capacity public transport lines (underground rail and tram), and with Munich's extensive Olympia Park directly north of the premises, the future inhabitants will have ample opportunity for outdoor recreation.

The project has been named Olympia Gate Munich to help create a corporate identity that stands for architectural excellence and smart land use design – qualities by which the development will be recognised and identified in the future.

Michael Wurzinger, managing director of Strauss & Partner Development, says: "This is an important project for Munich, and we are proud to develop it together with our joint venture partners. We are planning architectural highlights that will become landmarks of this great project in Munich, the capital of Bavaria."

TEERAG ASDAG (Tyrol branch) builds rockfall protection in record time to secure federal road

The rockfall protection embankment along the B186 federal road was commissioned by the government of the province of Tyrol and built in only seven weeks.

Following a massive rock fall on the B186 federal road (Ötztalbundesstraße) near Längenfeld in late August 2011, the route to the town of Sölden, a major tourist centre, had to be temporarily closed. As the existing protective structures were not capable of retaining the rock masses, the government of the province of Tyrol resolved in short order to issue a tender for a new protective embankment to be built, and the winning bidder TEERAG ASDAG (Tyrol branch) started on-site work on 11th October 2011. The existing earthen barrier, which had turned out to be too small, was removed and replaced by a new embankment structure along a road section about 400 m long. The new protective embankment is about 10 m high, with widths varying between 13 m and 5 m, and was built using a combination of engineering techniques. Its main body consists of reinforced soil, with dry stone pitching on the backslope side for impact protection and a 4-m catchment fence on top.

The earth masses and materials moved within just seven weeks were:

- Excavated material: approx. 15,500 m³
- Dry stone pitching: approx. 5,500 m³
- Embankment backfilling: approx. 33,000 m³
- Reinforced soil: approx. 3,840 m² surface area
- Geogrid reinforcements: approx. 41,200 m²
- Catchment fence, 4 m high: approx. 1,500 m²
- Road construction, incl. substructure: approx. 4,500 m²

The great efforts of all those involved in the project and the mild weather in November enabled the new rockfall protection to be completed ahead of schedule, so that the road was reopened to the public on 29th November 2011, one week earlier than expected.

Image: PORR

Image: PORR

Ground-breaking ceremony for clean-up of Brückl landfill

The Donau Chemie Group aims to implement a sustainable and eco-friendly solution for the Brückl industrial landfill. After a careful six-year planning process, PORR has started the clean-up works.

Invitations to a ground-breaking ceremony right on the landfill site had been issued by the board of the Donau Chemie Group. The event, which was attended by owner Alain de Krassny, provincial governor Gerhard Dörfler and other local government representatives, as well as the project partners, including PORR, marked the start of the final clean-up of one of the biggest contaminated sites in the province of Carinthia.

Catalogued as "Altlast (contaminated site) K20", the Brückl landfill is a brownfield site directly north of the premises of a former solvent production plant. It covers an area of about 20,000 m² and consists mostly of lime, which is partly contaminated with solvent residues.

Landfilling at the site stopped in 1981, and a ventilation system was installed in 2000 after consultations with the authorities to secure the site through continuous soil vapour extraction.

The two partners for the final clean-up were selected in a public tender which specified recycling of the lime and final disposal of non-recyclable material. The Wietersdorfer Group will be responsible for the recycling activities, while PORR and Strabag will jointly carry out the disposal of non-recyclable material, as well as the required engineering/construction works.

Numerous guests of honour attended the ground-breaking ceremony
Image: PORR

The infrastructure division of PORR (groundwork department) provides excavation support system STAR 22

A multi-functional neighbourhood centre with a students' residence, a nursing home, kindergarten, office and apartment buildings, as well as supermarkets and pubs, is being built in Vienna's 22nd district on the 11,500-m² premises formerly owned by the engineering group Waagner Biro.

The groundwork department of PORR's infrastructure division has been commissioned to erect the excavation support system for the construction site. This includes sheetpiling, vib-wall cut-offs and a diaphragm wall. The latter is not only part of the excavation support system in building section C, but will serve as the foundation for the future basement, which will contain storage areas and building services operation rooms. For this purpose, about 4,000 m² of diaphragm walls with a thickness of 80 cm were built, reaching down to a depth of about 20 m. Embedded in the local clay and silt aquiclude ("Viennese marl"), the excavation support system provides a watertight and safe working enclosure for all the subsequent on-site works. 2,000 Gewi bar anchors were used to minimise deformation of the diaphragm walls during excavation and under constantly changing loads. Steel stiffening was placed in the corners of the construction site and connected to the weld bases, which were embedded in the grid by concreting.

All the works required to produce the excavation support system – from the production of the diaphragm walls and anchoring to the steel stiffening – were carried out using resources of the PORR Group. The finished construction pit is yet another example of how resources across the Group are best employed for the smooth execution of works to a high quality standard to ensure customer satisfaction.

Image: PORR

Topping-out ceremony at the Storchengrund development project in Vienna

The topping-out was celebrated only eleven months after the start of construction.

The new hotel and Spar supermarket are centrally located.
Image: ZOOM

Image: ZOOM

All the project partners and invitees from politics and business attended the topping-out ceremony for a new hotel of the international Starr Inn Group on 10th May. In addition to the 3-star hotel building, the project also comprises construction of a Spar supermarket and an underground car park for more than 200 cars. Completion is scheduled for spring 2013.

Celebratory addresses were given by district chairman Gerhard Zatlokal, PORR CEO Karl-Heinz Strauss, the managing director of Rhomberg Bau GmbH, Peter Greußing, and Peter Kopezky, unit head at Porr Bau GmbH and technical managing director of the project consortium. All the speakers agreed that construction is progressing smoothly to high professional standards and expressed their thanks to the construction workers for their work.

The project is sited in a prime location in the centre of Vienna. Fronting Linke Wienzeile, a major inner-city traffic artery, it is easily accessible by car and by public transport. The westbound motorway out of Vienna is only a short ride away, and a nearby public transport hub (Längenfeldgasse, with underground lines U4 and U6 and bus lines 9A, 10A, 63A and 15A) provides additional easy options for arrival and departure.

The adjacent plot of land, which was sold to the building cooperative ÖSW, will be used for a Spar supermarket with about 1,000 m² of floor space and a residential building, rounding off the project. The hotel will have 283 rooms, a restaurant and seminar rooms for up to 70 persons on the ground floor. The underground car park will provide space for 204 cars.

Takeover of dolomite rock mining operation TKDZ in Wellen, Germany

PORR expands material production activities in Germany.

The TKDZ (Trierer Kalk-, Dolomit- und Zementwerke) GmbH in Wellen in the German state of Rhineland-Palatinate has been taken over by the PORR Group, ensuring the continued existence of the rock mining operations there. The dolomite rock supplied by TKDZ is used as an additive in the concrete industry and in road construction. PORR is keeping all TKDZ staff on the payroll and plans to create additional jobs in the future.

To ensure rock mass stability in the wake of mining operations, PORR plans to fill in the resulting cavities. The materials used for this purpose will be reclaimed waste materials that are environmentally harmless, so that the requirements of sustainability and efficient use of resources are met.

PORR regards the investment as part of its long-term strategy in Germany, which together with Austria, Switzerland, Poland and the Czech Republic constitutes the PORR Group's home market. The takeover and reorganisation of TKDZ GmbH will not only preserve locally important jobs, but will also help protect the environment. How serious the PORR Group is about this investment can be seen from its plans for capital investments at TKDZ: the works will receive a complete facelift, including step-by-step rehabilitation of access roads and infrastructure.

PORR has appointed Rainer Adami as the new managing director of TKDZ GmbH. Mr. Adami sees great opportunities ahead after the takeover and says: "The operations are an important complement to PORR's existing portfolio in input materials production. In addition to economic success, I personally also set great store by good cooperation with local policy-makers and the public. I am convinced that, working together, we will be able to come up with a viable future development model for the region."

Ground-breaking ceremony at Westside Wohnen project

New complex of resident-owned apartments to be built in the city of Klagenfurt

PORR CEO Karl-Heinz Strauss at the ground-breaking ceremony
Image: PORR

The ground-breaking ceremony for the Westside Wohnen apartment complex was celebrated at freezing temperatures on 9th February 2012. The project to build a complex of owner-occupied apartments (construction phase 2) at Anzengruberstraße in Klagenfurt on lake Wörthersee is being carried out jointly by developer KWG, a subsidiary of the Siedlungswerk Group, PORR and project partner MADILE. The complex of high-quality apartments ranging in size from 39 m² to 166 m² is scheduled for completion by spring 2013.

The guests of honour at the ground-breaking ceremony included PORR CEO Karl-Heinz Strauss, who expressed his enthusiasm for the project and commended the Carinthian branch of the PORR Group for their excellent work.

Tunnel breakthrough on Freistadt (Upper Austria) bypass road

A symbolic blast completed the breakthrough of the first tunnel section.

Image: PORR

Work on the bypass road at Freistadt, contract section 4.1 of the S10 road, started on 2nd November 2011 after Asfinag, Austria's government-owned motorway construction and management company, had awarded the contract to Porr Tunnelbau GmbH. The tunnelling division of the PORR Group is carrying out the project in an internal partnership with the Group's infrastructure division and the local Upper Austrian branch of the Group.

The contract for the 4.4 km-long bypass comprises 13 tunnelling and engineering structures, as well as general earthwork and road construction works, and is scheduled for completion in 2014 after a construction period of 32 months. The 13 individual structures are: two tunnels, six bridges, two underpasses, two galleries and one cut-and-cover tunnel.

Work on the first tunnel started on 14th March 2012 and made excellent progress, so that the breakthrough was achieved by 25th May 2012. Known by its toponymic name "Satzinger Siedlung", the tunnel is 260 m long and has two carriageways. Project owner Asfinag hosted the celebration, and the event was marked with a symbolic blast triggered by Asfinag supervisory board member and member of the Federal Constitutional Court Claudia Kahr, who presided as tunnel patroness. Co-celebrants at the festive event included Deputy Governor Franz Hiesl, Asfinag board members Alois Schedl and Klaus Schierhackl, as well as the managing director of Porr Bau GmbH, Alfred Sebl. By way of introduction, Mr. Sebl explained a tunnel patroness's duties to Ms. Kahr and thanked her for taking on this role. The tunnel was blessed by Father Eduard Röthlin, and prayers were offered for safe progress of the works. Glück Auf!

Image: At the breakthrough celebration: tunnel worker Ewald Grill, Porr Tunnelbau project manager Ernst Enengl, project supervisor Franz Sempelmann and managing director Gernot Brandter of Asfinag, tunnel patroness Claudia Kahr, Porr Bau GmbH managing director Alfred Sebl, Asfinag board members Klaus Schierhackl and Alois Schedl, Upper Austria's Councillor for Transport Policy Reinhold Entholzer and Deputy Governor Franz Hiesl, managing director Franz Weidinger and Asfinag managing director Alexander Walcher

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