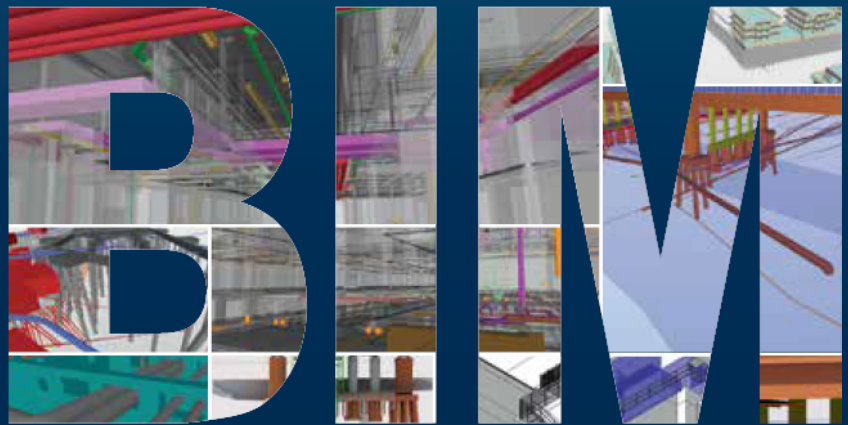




Special



IN EVERYDAY PROJECT LIFE

INROS LACKNER.



Dear readers,

BIM offers great potential for optimising planning, design and construction processes, but implementing it presents challenges for us as a company – for example, in developing the necessary IT skills and adapting personnel and responsibility structures. To ensure sustainable future-readiness, we have placed a strong focus in recent years on digitising our work processes. In the past year, for instance, we successfully developed a program tool that transforms CPIXML road design data into IFC-compatible data. But despite all the euphoria about BIM, it is our technical experience and knowledge that are most important in enabling us to achieve project goals – specialist know-how that thanks to BIM can be applied more efficiently in the future. In this edition of our customer magazine, we take a look at the status quo, presenting BIM design work and current international projects. This year, we successfully completed an important port construction project with the opening of Turkmenbashi's International Seaport. In Africa we are playing an important role on a wide variety of projects, and report on current port developments in East Africa and river development projects in Senegal and the Congo. In Germany, our specialist engineers faced particular challenges in the construction, in Berlin's Europacity district, of the new 50Hertz head office – a building that exemplifies today's building culture in Germany. The overall project was awarded Gold certifications by both DGNB and LEED, the leading sustainability certification systems, and the building became the first in the world to be awarded DGNB Diamond certification.

We hope you enjoy your read, and would like to wish you already a happy and successful New Year!

Klaus Richter

Dr. Klaus Richter
Executive Director

Gregor Gebert
Executive Director



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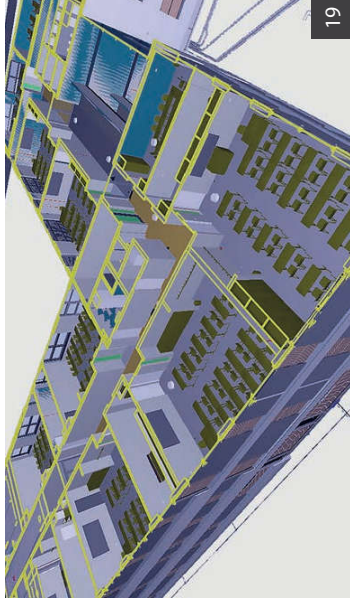
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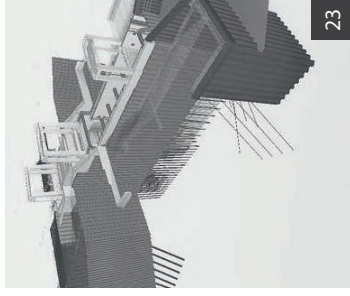
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New building for Ørsted

A modern Operations and Maintenance Centre has been built for the energy supplier Ørsted on its property of total area approx. 30,000 m², in the town of Norddeich on Germany's North-Sea coast. The building offers new storage and office space, which is needed for current projects such as the Borkum Riffgrund 2 offshore wind farm. It also has a truck terminal, which facilitates the supply and removal of components and equipment for this and other wind farms. As General Planner, working in collaboration with Danish architects, Inros Lackner successfully planned and implemented the construction project. The company's interdisciplinary team was responsible for design and approvals planning, functional tendering, site supervision and providing technical support.

Topping-out ceremony for Bauhaus Museum

The building shell of the new Bauhaus Museum in Dessau has been erected. To mark this milestone in August this year, the building's owners, designers and construction workers celebrated with a traditional topping-out ceremony. The work on the ground and upper floors is almost complete, and the first windows and building services are being installed. The internationally acclaimed museum will open next year. Inros Lackner is responsible for the planning and design of the technical building systems. The respective trades have begun their work. The project is a particular success for the technical building systems team. The Weimar.



River transport in north-eastern India

Following an international tender process, Inros Lackner was commissioned by the Indian Water Transport and Shipping Authority of Assam to draw up a development plan for river transport, connecting with the region's roads and railways. In particular, this includes the goal of optimising ferry traffic from the city of Cawwathi in the northeast, on the south bank of the Brahmaputra river, to the border with Bangladesh in the west of the country, over a length of about 890 km. At eleven locations in the Barak and Brahmaputra valleys, possibilities are being evaluated for developing sustainable and efficient solutions for the transport of people and goods on the water, and a variety of influencing factors and limiting conditions are being examined. Over a period of seven months, the Inros Lackner team will develop a complex and future-oriented transportation solution, on the basis of which the World Bank will provide financial support.



IL Special 2018

Roofing ceremony for new shipbuilding hall

Less than five months after ground was broken for the construction of MV Werften's new hall complex in the German port of Warnemünde, just north of Rostock – for which Inros Lackner is providing General Planner services – a key milestone was reached with the topping out ceremony in March 2018. Those present included Mecklenburg-Vorpommern's finance minister, Harry Glawe, and representatives of Genting Hong Kong, MV Werften, Inros Lackner, Züblin and other project partners, in January.



© MV WERFTEN

City development project in Togo

A large part of the population in the north-east of Lomé, the capital of Togo, is affected by flooding due to a lack of effective rainwater drainage. This has an impact on their health, their living conditions and their life situation. As part of the PAUT II urban development project, the area's urban infrastructure is being renovated and measures to improve rainwater drainage are being implemented. At the end of May 2018, creation of a fourth lake in the area was completed, to serve as a water retention basin during heavy rainfall periods, thus achieving an important milestone in the infrastructure and rainwater management development works. President Faure Gnassingbé, the EU Commissioner for International Cooperation and Development and the French Ambassador were present at the inauguration ceremony. Inros Lackner's Bremen and Togo offices, working with other partners in a joint venture, provided the required planning/design and construction supervision services. This urban development project is of great national importance and is expected to significantly improve the socio-economic and health conditions of the population of the affected urban areas.

"Moving Rwanda"

© Inga Klier / Photothek



At the end of February 2018, the German federal development ministry, together with Volkswagen, Siemens, SAP, GIZ and Inros Lackner, launched the mobility partnership "Moving Rwanda" for the Rwandan capital, Kigali, and surrounding region. Inros Lackner SE will contribute expertise in the development of infrastructure and in logistics, being well placed to do this thanks to the company's many years of project experience in Africa. The project "Moving Rwanda" was initiated as part of the "Strategic Partnership Digital Africa" programme of the German Federal Ministry for

Economic Cooperation and Development (BMZ). With "Moving Rwanda", Volkswagen's soon-to-commence car production in Kigali will be supplemented by modern integrated mobility services such as environmentally-friendly app-based car sharing models. Rwanda is one of Africa's leaders in terms of economic growth, digitalisation and urban development, and ambitious plans for smart mobility are being developed. In 2016, for instance, a bus system with on-board Wi-Fi was introduced, cycling was actively promoted and a focus was placed on footpath construction.



OPENING OF TURKMENBASHI'S NEW PORT

The largest port construction project in Central Asia has been successfully completed.

On 2nd May 2018, after a lengthy construction period, Turkmenbashi's International Port on Turkmenistan's Caspian Sea coast, at the heart of the historic Silk Road, was opened to shipping traffic with a celebratory ceremony. This completed a major Turkmenistani project which is contributing to reviving the historic Silk Road from Asia to Europe. As General Planner, Inros Lackner was responsible for planning and design, tendering, construction supervision and technical consultancy on behalf of Turkmenistan's Ministry of Marine and Inland Transport. With a total investment of approximately USD 1.5 billion, it is the largest port construction project in Central Asia – this new transport hub between Asia and Europe.

This major contract for Inros Lackner is a significant success and proof of the company's international reputation as a provider of planning and design services for complex port construction projects. The port was designed in accordance with "Green Port" standards, in order to appropriately consider the fragile ecosystem of the world's largest inland sea. On a total area of over 130 hectares, five new terminals were built – for ferries, passengers, general cargo, bulk goods and containers. An existing railway ferry port was

also modernised, and a whole new shipyard including a ship lift was built. In addition, complete new transport connections to the port were created, with railway track and shunting facilities as well as motorway connections. Port-related service buildings such as a hospital and a fire brigade building were also constructed. The expected annual goods handling capacity of the port is approximately 17 million tonnes.

KEY FACTS

Client

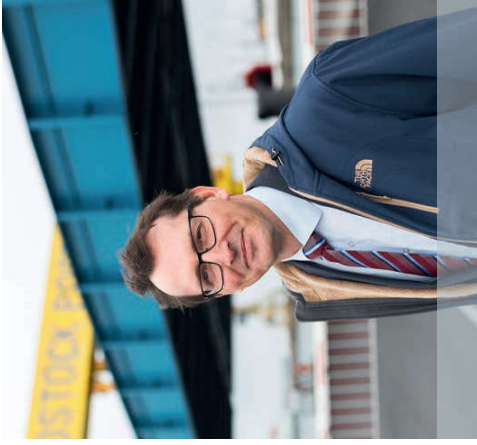
The State Service of Maritime and River Transportation of Turkmenistan

Project Period

2012–2018

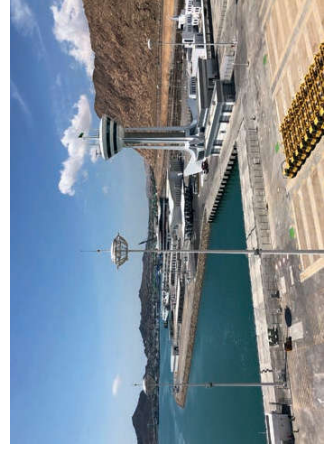
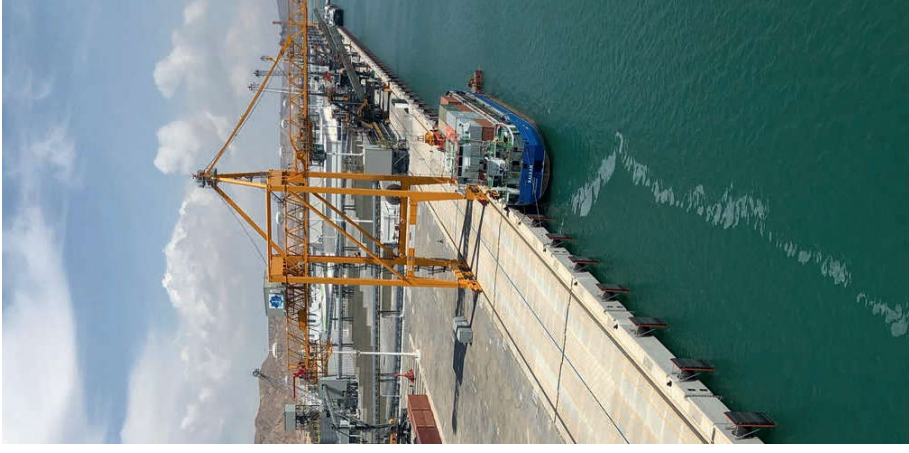
Services provided

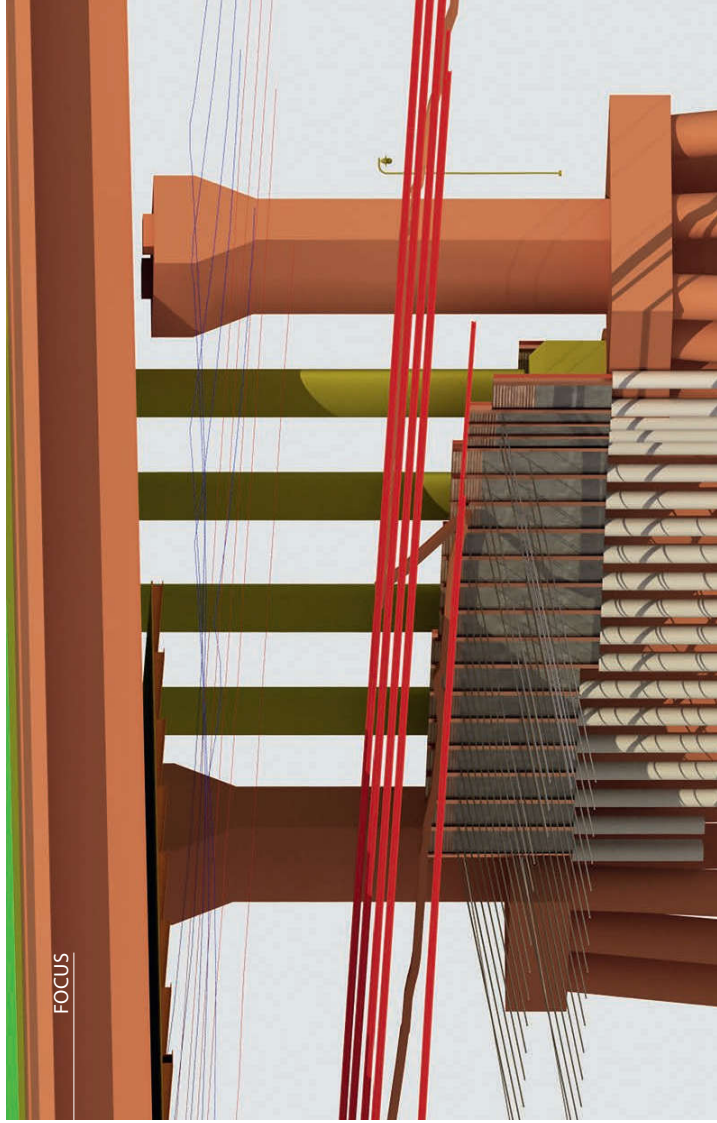
General Planner services incl. master and operational designs, tendering, construction supervision



Tobias Günzl
Project Manager

"Being the Project Manager for one of the world's largest port development projects I feel honoured by our Client's exceptional statement of faith and believe in our capabilities. Our team started the project with a preliminary design in 2012, and now we have designed the seaport in detail and supervised its construction. Of course, critical challenges have been resolved in close cooperation with the Ministry; in addition to undertaking the technical design and contract negotiations, we also guided the Client through such situations – an important management task. I am personally very proud of this outstanding project, which we have managed to bring to a successful completion, with operations having already commenced."





Temporary support construction in area of railway crossing, Schwelmetal Bridge on the A1 autobahn

TAKING STOCK: BIM IN EVERYDAY PROJECT LIFE

With various BIM pilot projects being successfully implemented, the advantages for the planning and construction processes are clearly visible. In Germany, DEGES is one of the pioneers in the infrastructure sector. On the "Schwelmetal Bridge" pilot project, the comprehensive, coordinated 3D model will remain in use for the checking of construction work and for project invoicing.

Mr. Gebert, how advanced is the application of BIM in the "Schwelmetal Bridge" project?

The Schwelmetal Bridge project was launched in 2015 as North Rhein-Westphalia's "BIM pilot project", with the aim of gaining experience for future applications. In this pilot project, all structural design work was done using the BIM method. The existing situation (terrain, traffic facilities, existing bridge, nearby structures) and the new structure were modelled in 3D. Drawings and quantities were also largely derived from the model, but the 4D/5D design was not the focus in this project phase. Meanwhile, the construction contract has been tendered and is expected to be awarded very soon. The project BIM model was provided to tenderers for

What especially characterises the project and the associated collaboration on the project with the Inros Lackner team?

The Schwelmetal Bridge is one of DEGES's first BIM projects. Due to the complex, inner-city conditions on the one hand, and the limited space available, the structure was particularly suitable for the

information and for use as a calculation aid. It can also be used by the contractor for further planning work. The comprehensive, coordinated 3D model will be updated by Inros Lackner throughout the construction phase, creating a detailed as-built record and assisting in the calculation of amounts due for payment. 4D and 5D planning are used for this.

IN CONVERSATION WITH:



Dipl.-Ing. Gregor Gebert
Head of Structural Engineering, DEGES (Deutsche Einheit Fernstrassenplanungs- und -bau GmbH)

After studying structural engineering at the Technical University of Dresden, Gregor Gebert worked for Verkehrs- und Ingenieurbau Consult (VIC) and was a department manager and authorised representative of Schlüssel-Plan Engineering until 2013. He has played a significant role in numerous major projects, such as the Rügen Bridge, the Wesel Lower Rhine Bridge, the Duisburg-Neuenkamp Rhine Bridge and several bridges over the Nile in Khartoum, Sudan.

application of the BIM method. DEGES was able to benefit from the previous experience of the Inros Lackner team in this area. Our common goal was to engage and exchange, to learn and to gain more experience from the BIM pilot project – and we succeeded. The collaboration was still largely on an analogue basis, but the models are currently being provided by Inros Lackner to DEGES for viewing using the Solibri Model Viewer.

What are the benefits of BIM for you as the client? How has it affected collaboration with the contractors?

The current results from our pilot projects clearly show that application of the BIM method improves the planning process. The advantages lie especially in the 3D representation of the individual specialisations, which are brought together in a coordinated overall model. Conflicts, especially arising from interdisciplinary cooperation, can be reduced. BIM offers better verifiability – designs and communications with stakeholders (companies, authorities, railways, etc.) are made more easily understandable through visualisation. In short, the quality of the design work and of the communication with stakeholders is improved.

How can efficiencies from digital planning be used even better in the future?

The continuous development of BIM methodology and the definition of uniform interfaces and processes is a key requirement for the efficient cooperation of the various participants in the planning and design work. We are working hard to further develop and improve the client information requirements – to make the documents and tools as uniform as possible for the various designers, client representatives and construction companies. We can only do this in collaboration with the involved partners, especially the engineering firms.

A common learning curve is clearly visible in the "Schwelmetal Bridge" project. It is planned to continue using and updating the BIM model throughout the construction phase. The aim is to gain experience in BIM-based construction billing and to use the BIM model e.g. for checking construction processes, enabling these to be better evaluated. Upon completion of the construction project, an as-built model will be available, which can be handed over to the future operator.

The BIM method shows that we are moving into a different culture of collaboration, which is characterised by increased transparency in the planning and design process for all project participants. An important aspect, in my view, is the continued use of the created BIM model during the structure's service life. This requires clear specifications in relation to the model structure and the relevant data.

»The BIM method shows that we are moving into a different culture of collaboration, which is characterised by increased transparency for all project participants. An important aspect, in my view, is the continued use of the created BIM model during the structure's service life.«

IN CONVERSATION WITH:

Frank Bernhardt
Company Director, INROS LACKNER SE

Bridges have always fascinated Frank Bernhardt. They accompany him throughout his professional life. After completing his civil engineering studies, he worked, among other places, at the Krebs & Kiefer engineering consultancy and at INROS Planungsgesellschaft. From 1994 to 2003 he was managing director of the engineering firm Koldrack, Bernhardt & Partner, and has been a member of the management of INROS LACKNER since 2004.



Mr Bernhardt, you have overseen the introduction of BIM at Inros Lackner in recent years. What key milestones have been achieved in the last three years?

The main milestones of our BIM implementation can be seen in our annual objectives in relation to BIM action planning, department-specific development goals and optimisation of our planning and design processes. Until the end of 2014, the partial creation of 3D models was typically the primary BIM requirement. Since 2015, the targeted introduction of the BIM method has occurred. Key prerequisites for this were the management's unequivocal prioritisation of BIM and the establishment of the BIM working group in 2014. The next step was the acquisition and testing of trial applications for 3D CAD constructions (Siemens NX), transport infrastructure CAD (ProVI) and tendering software (ITWO / AWARO), and detailed discussions with our existing software suppliers about improving BIM com-

patibility. We also started implementing BIM sub-processes, such as the linking of different 3D models and model handovers and created a teaching video on modelling 3D structures.

In 2016, we introduced the AVA software (ITWO), converted to 3D design and implemented our first fully integrated BIM projects (3D/4D/5D). To ensure BIM integration, a knowledge management system was initiated to ensure the development of the required BIM competencies within the company. Since then, BIM has been continuously integrated into the various departments at different locations, and we have continued to build up our information and component databases. It is particularly worth noting that, this year, we have succeeded in developing a program tool that converts CPiXML road design data into IFC-interface-enabled data with attribute handover.

Where is there still work to be done and what goals has Inros Lackner set for the development of BIM competencies in the coming years?

Our knowledge and goals have been anchored in our BIM manual. The challenge lies in the company-wide, practical implementation and is therefore one of our main goals in connection with the ongoing optimisation of our planning, design and construction management processes. In the future, the use of a common data environment and a central data management system, in preparing models showing existing details and proposed designs, will play an ever greater role.

The use of company-internal servers for geographical information systems (GIS) in making available various types of planning data increases information density. Likewise, clear and consistent allocation of roles and responsibilities among a project's

individual participants, and definition of associated limitations, is essential.

What general developments are necessary for increased digital collaboration in the industry?

A first point concerns the relationships that arise in collaborative work. The BIM process promotes an open and cooperative way of working, and requires people to work together in a spirit of partnership. Second, interchangeability of different software systems among various disciplines is crucial. This calls for the use of the IFC-5 interface, which is planned for about 2020.

»We have succeeded in developing a program tool that converts CPiXML road design data into IFC-interface-enabled data.«

ON BEHALF OF DEGES:

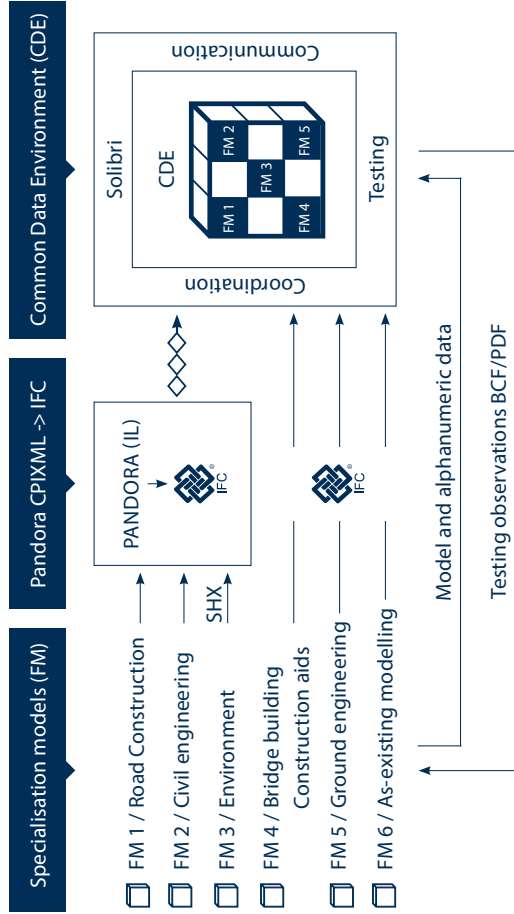


Schweimetal Bridge on the A1 autobahn

This replacement structure is being planned and designed for DEGES as a BIM pilot project for the German state of North Rhine-Westphalia. The complex bridge structure was built in 1960, and in some respects no longer meets current structural design requirements.

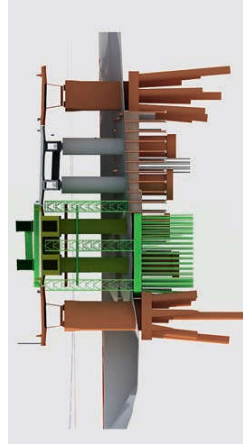
The approximately 200m-long steel composite bridge is located near Wuppertal on the German A1 autobahn, one of the country's most important north-south connections. In the area of the structure, the autobahn was widened to six lanes in 2006. A structural inspection of the bridge has identified substantial shortcomings in relation to the load-bearing capacity and serviceability of the bridge's inner prestressed concrete elements, with distinct evidence of cracking. The planned construction project involves these two inner structures, each dating back to the 1960s, which are being removed and reconstructed. The bridge's two outer structures, which were built only at the beginning of the new century and are currently used by truck traffic in both directions, can be retained.

DATA MANAGEMENT AND COLLABORATION



The special challenges of this project include:

- Keeping six lanes in operation at all times to meet the needs of traffic on this stretch of the A1 autobahn, which carries approx. 100,000 trucks per day
- Maintaining the six-track intersection of the inter-city railway (160 km/h), with a detailed track closure plan (short night-time closures only)
- Consideration of a crossing four-lane highway with management of diversions and traffic restrictions
- Numerous above-ground and underground structures in the construction area, such as shaft access and flood relief tunnels, retaining walls, railway facilities and gas cylinder stores, and numerous pipes and cables
- 3D modelling showing existing condition, new construction and demolition, and soil and ground management
- Development of a detailed plan for construction site management, production and removal (model-based virtual construction process simulation)
- Reduction of emissions such as noise, dust and nitrogen oxide from construction work, calculating estimates depending on construction activities and planning elimination and reduction measures
- Dismantling and removal of the 207m-long existing structure in numerous phases, with varying structural limitations applying
- Continued use of the substructures with upgrading of the shaft foundations and complex design verifications required



Cross-section of 3D model of the replacement structure, 2nd phase

Results of the pilot BIM process

At the beginning of the planning phase, as-existing data was generated in the form of models of the existing structures, road constructions, pipes, terrain and construction ground, in various specialist models. The planning/design work was carried out in the relevant specialist disciplines, including models for construction aids and temporary clearance profiles as well as road construction

Dirk Trantow
BIM Manager (Infrastructure),
Project Manager

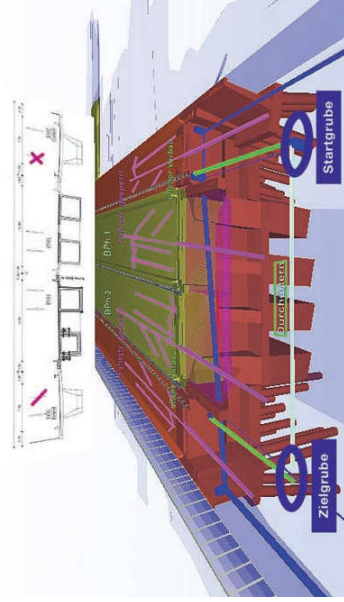
"Due to the high density of buildings and the relatively intensive use of land in Germany, construction projects in public spaces give rise to many concerns that must be taken into account. The answer lies in the active control of the planning, design, approval and construction processes as an integrated management task. Despite all the euphoria regarding newly available technologies, engineering-oriented thinking and acting cannot be replaced by automatism and form the basis for high-quality planning and design work. BIM is not the creation of 3D models, but the methodical handling of this data."



and civil engineering. The linking and combination of the individual specialist models in a single collaboration model was realised via the IFC interface's standardised link. For the linking of the road and civil engineering models, the program tool "Pandora" was developed in-house. This enables all infrastructure design data to be linked together, facilitating a geometric and temporal simulation of construction processes for the optimisation of planned construction work. Furthermore, RIB-TWO was used to link the model data with scheduling

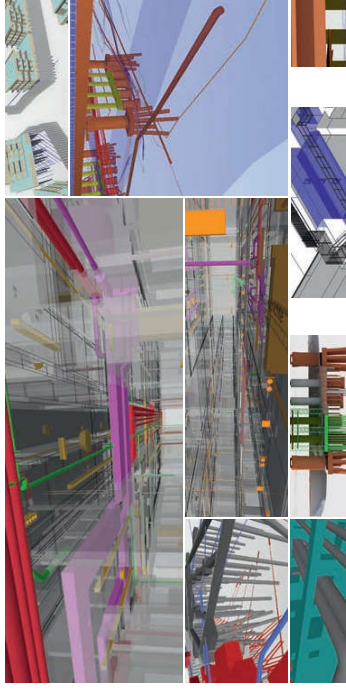
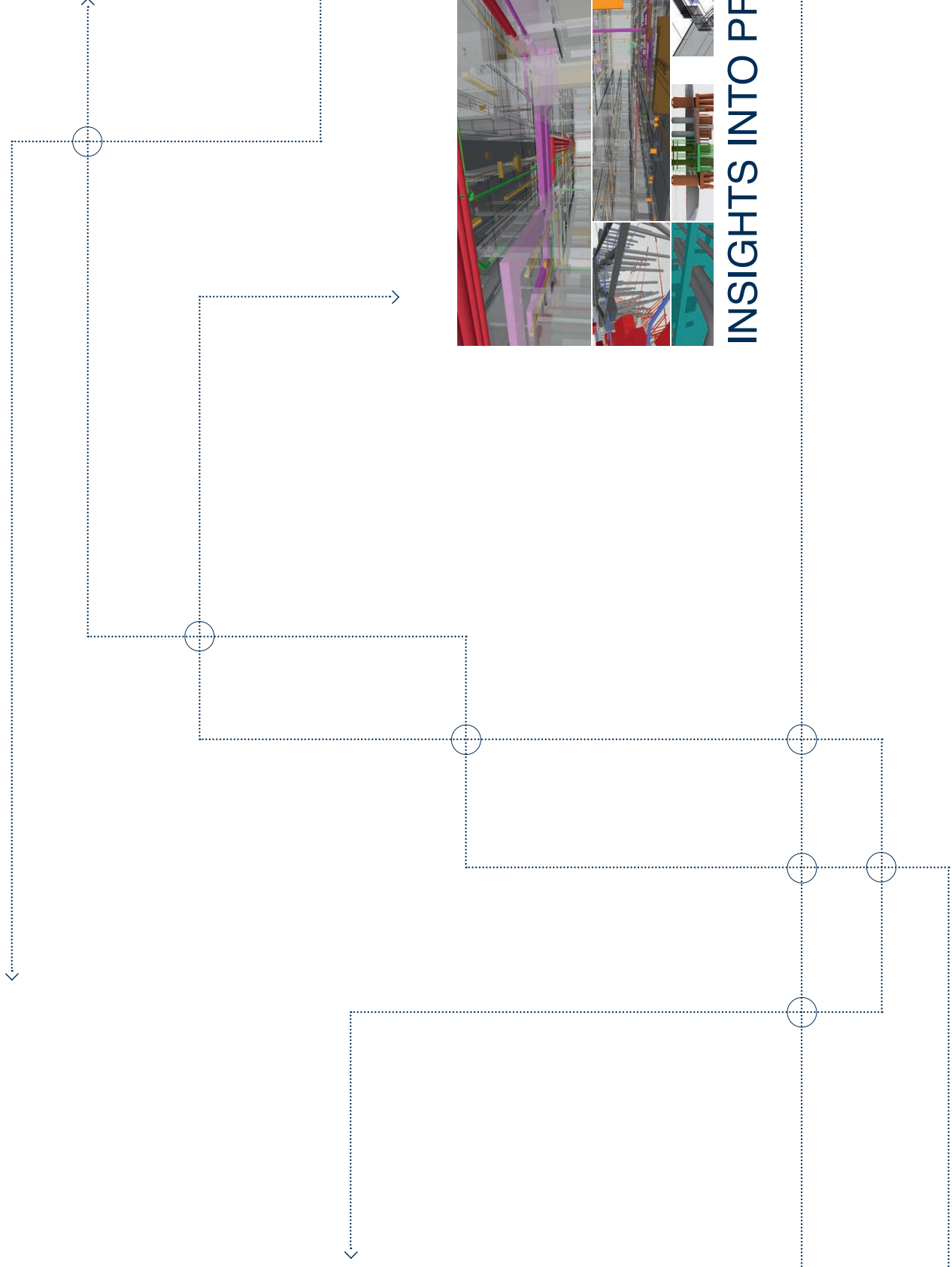
achieved with respect to communication in the planning, design and approval process. Costs are reduced, in particular, by a better 3D representation of conflict points and simultaneous presentation of possible solutions. The planning/design meetings were carried out and recorded digitally and model-based, and deadlines, responsibilities and special requirements were defined interactively. The Schwellmetal Bridge BIM pilot project has been concluded for the time being with the preparation of tender documents. Further development opportunities for a continuous BIM process, up to and including the construction phase with digital invoicing aids and construction monitoring options, are being discussed with DEGES.

The experience gained in this pilot project demonstrated the special added value



Problem presentation in the collaboration model for coordination, testing and communication

»Engineering-oriented thinking and acting cannot be replaced by automatism.«



INSIGHTS INTO PROJECTS



Bird's eye view © archlab.de

HARBOUR DISTRICT AT THE BALTIC SEA

In the role of General Planner on this project, IL's Complex Building Design team combined 3D models from Allplan, Revit, Plancai Nova and DDS-Cad in a single overall design. The Solibri Model Checker program was used for this "Open BIM" process.

Mecklenburg-Vorpommern is one of Germany's most important tourist regions. Its stretch of Baltic Sea coast, with its long sandy beaches, resorts and harbour districts, is a special attraction. On behalf of the company Barther Hafen Invest GmbH, Inros Lackner is designing the buildings for a harbour district in the Barth "Vinetastadt" – a landmark project in the area. A new harbour is to be built, and an adjoining urban quarter consisting of 11 buildings with about 250 holiday apartments. In addition to the apartments, the buildings will also have space for restaurants, a wellness area and a swimming pool. Inros Lackner has taken on the role of General Planner for the project to construct the buildings around the harbour, based on the design of the EWP architecture and engineering firm. The scope of services includes overall property design work, technical systems, and electrical and structural design from the preliminary design stage through to monitoring of construction. The buildings' location right at the harbour presents a number of particular design and coordination challenges. For instance, the harbour walls and the buildings must be independent of each other, and not influence each other in any way. Since the buildings

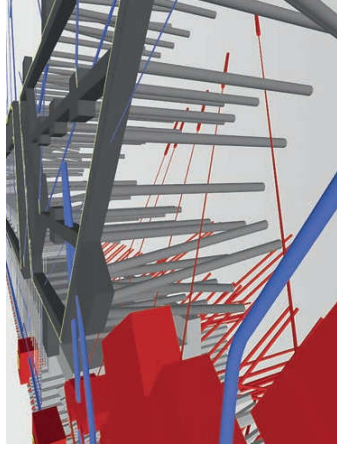
slabs' downstand beams as strongly reinforced as they are, it will be very difficult at a later date to introduce new holes for services to pass through. Coordination of all requirements on the overall model was therefore necessary in order to meet all needs and avoid clashes. The individual designers created their discipline-specific 3D models as usual, for overall property design, structural design, heating, ventilation, plumbing, electricity and gas. These individual models were then combined by means of separate IFC files to create a common central model. With sub-models from Allplan, Revit, Plancai Nova and DDS-Cad brought together in a single model, this might be thought of as "Open BIM". An advantage of this method is that the various discipline designers can continue to work with their own specific software.

Central model with Solibri Model Checker

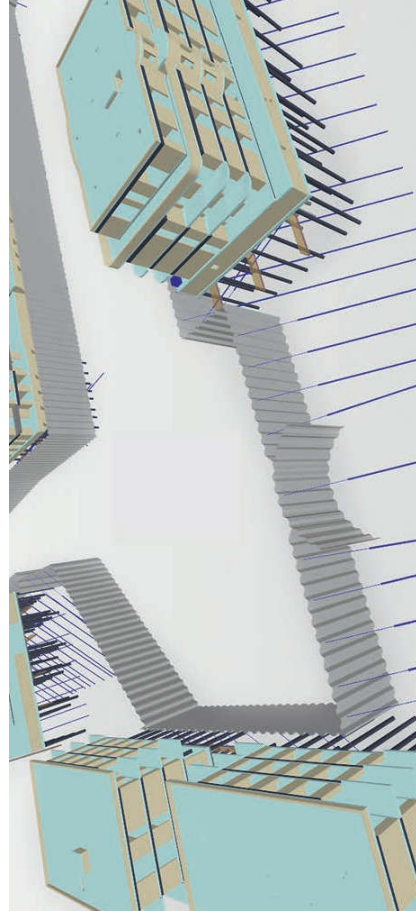
In this approach, a central model is created for the overall communication in the project team. The Solibri Model Checker program is used to bring the discipline models together and to analyse and maintain the central model. The individual IFC models of the discipline designers cannot be changed or manipulated in the Solibri Model Checker file. The responsibility for creating and correcting each individual discipline model remains solely with the respective discipline designer. Work on the Solibri Model Checker is done by the BIM coordinator. On behalf of the project managers, the coordinator combines the individual models together, carries out checks, and creates filter routines and evaluation functions, e.g. for concrete quantities, masonry surfaces or exposed concrete surfaces. The key here is that the data generated by the BIM coordinator is accessible to each member of the project team. For this purpose, Solibri's free model viewer is installed on all computers. This makes it possible to open all IFC models as well as the overall model. The communication structures within the project team have also changed significantly. Rather than being based on e-mails and PDF files, coordination between staff members of different disciplines and responsibilities takes place directly on the model.



Visualisation of House 11 @ archlab.de



Coordination view of piles and anchorages



Coordination model of the structure and the harbour wall

»The individual 3D models from Allplan, Revit, Plancal Nova and DDS-Cad were brought together in a single central model using separate IFC files, in what might be thought of as an "Open BIM" process.«

Conflict Management

The program's check routines facilitate the targeted identification of conflict points. The clash check is the simplest type, and many other checks can be performed using the Solibri Model Checker, e.g. in relation to the necessary compatibility of property design and structural design models. Prescribed clearances, escape route widths and lengths, accessibility requirements and required window area per room can also be determined, and formal criteria checked, such as the designation of floors according to the prescribed principles. The evaluation of check results is the responsibility of the BIM coordinator and the project manager. With the help of the central model and the applicable software, these are now better able to identify any relevant, significant conflicts and to communicate them to the project team. After addressing the conflict points and updating the models, a check is made as to whether the conflict remains or has been resolved.

In conclusion, it can be said that working together on a single overall model has significantly improved cooperation within the project team and understanding of the project. Not only are clashes identified sooner, they can also be solved efficiently thanks to the detailed presentation provided by the model. The application of BIM to project work thus facilitates more harmonious work, with higher staff and client satisfaction and a reduction in time-consuming and costly effort peaks.



Project Manager Marcus Fourmont
Head of Structural Design

"One advantage of the BIM method as presented here, using an overall model in complex building design, is that each discipline designer can work with his/her own specific software. There are also fewer hurdles across the company to deal with in changing, in certain areas where required, the software used. Therefore, I can say that this method results in more harmonious collaboration within the team and higher staff and client satisfaction, and a reduction in time-consuming and costly effort peaks. Not only are clashes detected sooner, they are also resolved more quickly thanks to their detailed presentation on the model."



Visualisation of Houses 6 – 8 as viewed from the harbour ©archlab.de

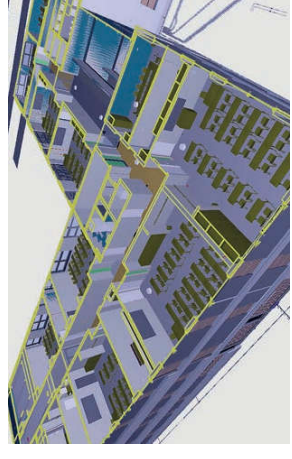


CONSTRUCTION OF NEW SPREE SECONDARY SCHOOL

In addition to a new school building, complete with sport and recreation areas for about 500 pupils, a two-field sports hall is being built. Two central models were developed on the basis of multi-office collaboration.

Inros Lackner has designed a new secondary school for the district of Oder-Spree in Brandenburg, Germany. The architectural concept addresses the special requirements stipulated relating to inclusion, integration and practice-oriented teaching. The subject of sustainable energy generation is also integrated in the design. Inros Lackner was appointed in the role of General Planner for all phases, covering overall property design, structural design, heating, ventilation, plumbing, electrical engineering, engineering structures and civil engineering. Reports were also produced relating to fire protection, building physics and pollutant mapping during demolition of the existing building. The three-storey building has an S-shaped layout, and a centrally located foyer with generous glass surfaces. The central area also has areas for vertical circulation in the form of staircases and an elevator, and for the cafeteria, the kitchen and ancillary rooms. The school building has no basement; the foundation takes the form of a load-distributing floor slab. The floor plans each provide for a central corridor with classrooms, cabinets and teacher and administration offices on both sides. This results in two longitudinal load-bearing walls along the middle of the building wing. The reinforced concrete slab thus stretches from one load-bearing perforated-façade outer wall to the other, with approximately equal spans across the middle support, which actually consists of a very

short span between the corridor walls. In general, the reinforced concrete walls carry the loads directly into the subsoil. At the cafeteria on the ground floor, longer spans and larger rooms are required. The upper floors are supported by storey-high wall-like beams at the first-floor level. The floor/ceiling slabs are designed without downstand beams. Lintels and breastwork are provided only at doors and window openings.



Horizontal section of school building



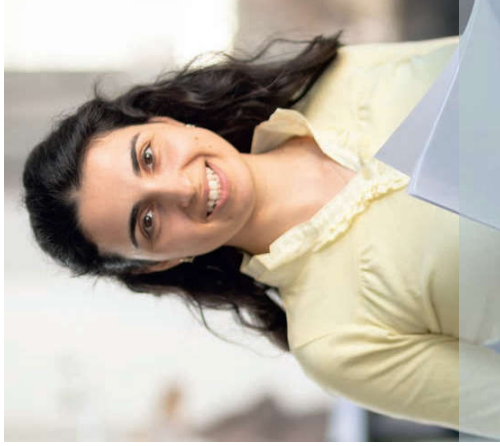
Clash check, HVAC and MEP pipes and cables

Communication in the project team

The project was carried out according to the standards of IFL's Complex Building Design team on a central model. In this case, two separate models for the school and the sports hall had to be coordinated. After agreeing on key modelling principles, it was possible to use the overall property design model to create the required structural design and electrical engineering models. This enabled the modelling effort and the risk of errors in the transfer of information between the various discipline designers to be reduced.

A special feature of this project was the multi-office nature of the design work. The benefits of communicating using the model were very much taken advantage of in regular video conferencing. Telephone discussions and the sending of drawings by e-mail were replaced by direct on-screen discussion and agreement, with all participants in the discussion having access to the same model to explain their concerns. The school design process was also characterised by very close cooperation with the client, with whom issues were regularly discussed and agreed direct on the model.

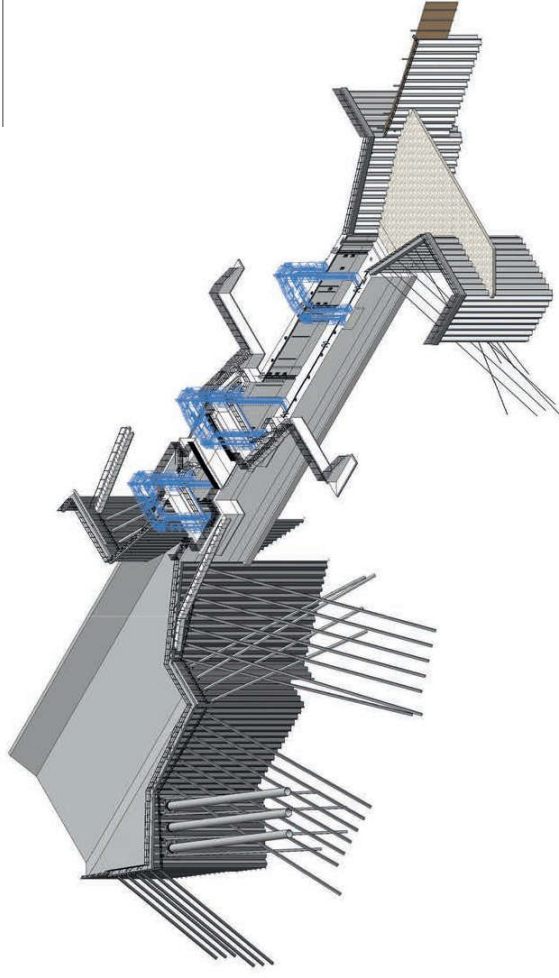
Furthermore, the client also worked with Solibri Model Viewer and was thus able to quickly develop a very good understanding of the project. This facilitated a high degree of transparency in the design process, and more reliability with respect to matters that had been agreed with the client. As a result, communication was more open, satisfaction was increased due to the reduction in conflict points, and cost estimates were more reliable thanks to the generated quantity calculations.



Anna Babayan
Project Engineer, Architecture

“The project consists of two complex buildings, with special requirements relating to the internal and external spaces’ design concepts, structural design calculations and innovative building technology. A key aspect of the architectural concept is exposed concrete surfaces that are free of ‘disturbances’. 3D models enable all elements to be displayed in their complexity and configuration in space and thus identify potential problems in good time. Solibri Model Viewer’s clash check, e.g. in the case of densely arranged pipes, plays a crucial role. The program shows how pipes can be routed sensibly and how clashes can be resolved. From us engineers, this requires very detail-oriented work in the creation of our discipline-specific 3D models, and close cooperation and significant time investments already in the initial design phase. A unified system of designations, names, insertion points and parameters for individual discipline models is important so that the Solibri Model Viewer can detect potential conflict points.”

»With BIM, design work becomes more complex, but also more accurate. We invest more time in the initial design phase, but we save time and money during the execution phase.«



HADELN CANAL LOCK ON THE ELBE-WESER-WATERWAY

BIM also offers interesting possibilities and prospects in hydraulic construction engineering. For the project to replace this canal lock, the overall model of the lock was integrated into a digital terrain model.

In the course of the ongoing major project to increase the height and strengthen the River Elbe’s embankments, the Hadeln Canal Lock in Cuxhaven, a lock of the guillotine type with sluice gates, is being replaced in order to meet current coastal protection requirements. The Hadeln Canal Lock was built in 1854 to drain the Hadeln Canal while meeting the needs of inland shipping between the Elbe and Weser rivers.

using BIM-capable software from a very early stage. The client is Lower Saxony’s water management, coastal protection and nature conservation agency in the city of Stade.

BIM sub-models

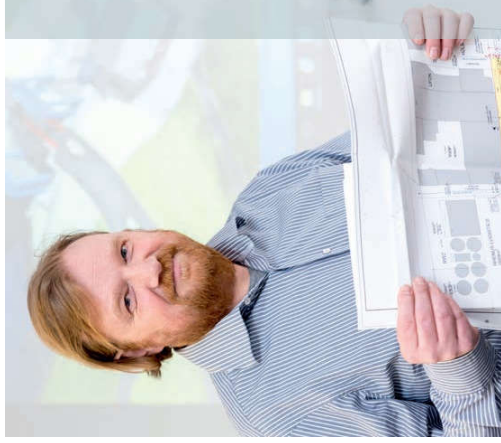
In creating the overall model, different sub-models were created. Data for the surrounding terrain was imported from a digital terrain model (DTM) by reading a .dwg file and used as the basis for further work.

Key structural data

The new lock in the same location as the old one it replaces, is designed as a monolithic reinforced concrete structure. In the final state, loads from the lock will be resisted by its underwater concrete base slab and uplift-resisting piles in the load-bearing ground. The outer part has two sluice gates to meet coastal protection needs, and the inner part has a further sluice gate. A road crosses the lock between the two sluice gates of the outer part, via a reinforced concrete bridge that is integrated in the lock construction. The existing adjoining soil embankments on both sides are being heightened to the required level and extended to the structure. Design work on the project, on which Irros Lackner collaborated with the Lahmeyer Hydroprojekt engineering firm, was already done



Digital terrain model / "Terrain" sub-model



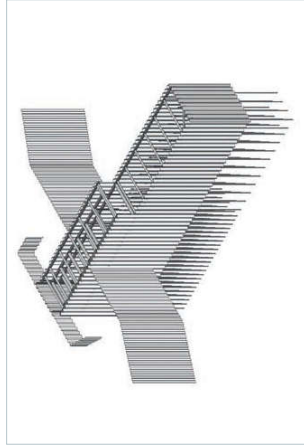
Ingo Wellbrock
Project Manager

"A particular challenge for the project team was the deeper application of the new programs, abandoning previously known ways of handling projects. Due to the structure's complexity, very different elements had to be brought together in one model without the aid of existing element detail libraries."

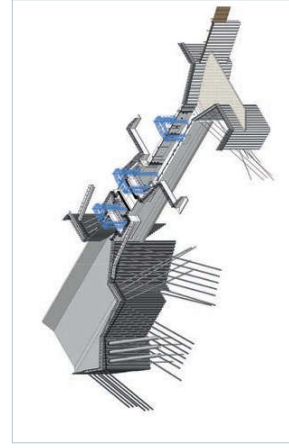
The new lock system is being built along the axis of the existing structure. The existing situation is detailed in a separate sub-model. Work on other civil engineering projects has shown that modelling of existing structures offers a very good opportunity to "practice" using the BIM-capable programs. These can be modelled quickly and easily on the basis of as-built drawings etc., at a low LOD (Level of Detail) or to MDG 100 (model detailing degree 100 per German HOAI Service Phase 2 specifications). The models provide important information regarding possible clashes with other elements and the general integration of existing details in the overall construction project. In another sub-model, the excavation in which the new lock structure is to be constructed was modelled with geometric and non-geometric information. Further sub-models show the main structure of monolithic joint-



Overlay of the sub-models "Terrain" and "Existing structure"



Sub-model "Excavation pit"



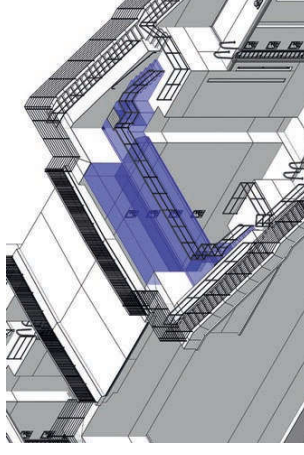
Sub-model "Main concrete structure with steel hydraulic engineering constructions"

less reinforced concrete with a trough cross section, and the steel hydraulic engineering constructions consisting of the three lifting sluice gates with their portals and the required drive and machine technology.

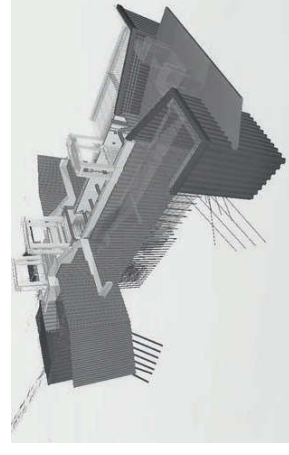
Checking and determination of quantities and costs

In a further design phase, the so-called 5th dimension, details of quantities and costs were generated via the interface with other BIM-compatible programs. This required the components used to have certain attribute values. Drawings required for the design approval and execution of construction work on site could be derived from the respective 3D sub-model in the form of 2D drawings, and quantity and dimension details could similarly be derived from the 3D sub-model, complete with the required documentation. Models are checked using the BIM Model Checker program, which can be used to perform intelligent, documentation-ready checks, ensuring model quality.

»The quantity and dimension details needed and the required documentation were also extracted from the 3D model.«



Detail excerpt showing lock chamber in the area of the road crossing



Overall model of the individual sub-models

Pablo González Martínez
Project Engineer

"For me, working on this project was an exciting start with the BIM method and, in this sense, a milestone in my professional career. Collaboration in the team was smooth and productive, and always characterised by a shared enthusiasm to enter the BIM world. As far as the creation of the model was concerned, there were some elements that were particularly challenging to model, e.g. the fenders. In the course of the modelling process and while addressing the associated hurdles, we managed to optimise performance in general and the modelling principles in particular. At the same time, our computer hardware was improved to enhance program performance."

CONTAINER TERMINALS IN WEST AFRICA

Evaluation of options for the extension of the
Port of Luanda in Angola

The possibilities for the expansion of this port are limited, since new quay walls cannot be built parallel to the waterfront. For this reason, alternative options were examined for extending the port with structures oriented perpendicular to the waterfront. These included structures built by various construction methods, including cofferdams, column-supported pier slabs, caissons and floating structures.

Preferred option

Considering the facility's planned temporary nature and the associated concession period, the floating option was concluded to present the best solution. This comprises a semi-submersible steel floating platform with a total length of 400 m, a width of 60 m and a height of 10.55 m. The platform was designed to accommodate four large container cranes and for the docking of container ships of capacity up to 130,000 DWT.

The structure consists of a lower buoyancy part with a height of 4.3 m, in which the machinery and pump rooms for ballasting are housed, and the 1m-high upper part with an orthotropic deck slab. These parts are connected together by columns of height 4.6 m. The structure is anchored to

the ground by means of tension elements which allow vertical movements due to tidal effects. These tension elements are also designed to withstand horizontal loads.

BIM modelling

The project's 3D modelling was done in 2015 using Autodesk Revit software. Although Revit is a powerful program that can be used in all areas of construction, the internal BIM structure library was highly buildings-oriented at the time. This fact, together with the proposed structure's unique design, meant that almost all the individual parts that made up the project's 3D model had to be specially designed. The valuable experience gained from using Revit on this project served as the basis for the ongoing development and use of BIM in our work in the field of hydraulic construction engineering.



A NEW LIFE FOR A SHIPYARD HARBOUR

The property of the former shipyard docks in Rostock-Warmemünde is to be redeveloped and revitalised. The result will be a multi-purpose port offering public use of its berths and serving the cruise ship and maritime industries.

As part of the development project, existing infrastructure will be renewed or replaced and all contamination will be removed. The harbour will be partially filled in, with access for ships provided at the sea side.

- Provision of services for the commercial area

The necessary works to redesign the harbour area cover all major fields of civil engineering, including infrastructure design, hydraulic engineering, environmental and landscape design, building design and structural design. And the necessary design investigations and the required programming systems are correspondingly extensive. However, the overall project has like specific individual projects, a coherent timeline and a maximum cost budget, which should, if possible, be determined in the initial planning phases and adhered to until completion. Planning and design services and equipment for the berths

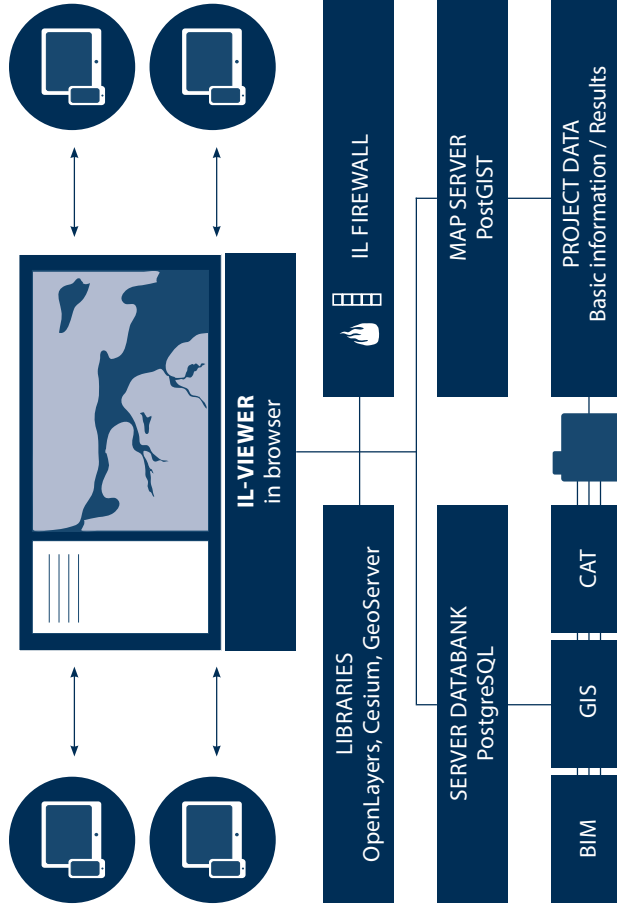
The required construction work primarily includes:

- Site clearance, demolition / dismantling work including excavation for soil replacement
- Construction of the new quaysides and embankments
- Dredging work, moving and containment of dredged material
- Soil exchange, landfill, provision of services and equipment for the berths

work began in 2017 with the aim of obtaining the necessary permissions in 2019. The construction period is estimated at about three years.

BIM method via GIS integration with web-based information system

The technical implementation is supported by a BIM-GIS integration, which facilitates uniform storage of all key design data inputs and results in a 2D and 3D geodata infrastructure. On this basis, data can be used and evaluated via a user-defined access authorisation. The users of this database structure are the client, all participants in the planning and design process, the planning authorities, the construction companies and, in the future, the users of



the constructed facilities and properties. As software components of the WebGIS system, open-source solutions are used because they can be optimally coordinated with one another on a project-specific basis, and because import and export possibilities are loosely regulated. The WebGIS system consists of a server database with a map server and a viewer, which is fed from different libraries and runs as a web client without restrictions or additionally required plug-ins in common Internet browsers. The web client is a browser-independent 2D and 3D viewer that enables navigation, control and retrieval of hosted information. In addition to zoom and control functions, the viewer can map distances and spaces in 2D and 3D and independently edit vectors (point, line, polygon). Data can be loaded individually by users – including, for example, a user's own georeferenced as-existing and design documents, external geodata services (officially protected areas, terrain models, etc.),

and supporting CAD and GIS formats and image formats such as DWG, DXF, WMS, WFS, WMTS, KML, GML, Shapfile, WKT, GeoJSON, TIFF, PNG and JPG.

Design of the interface between design and construction work

In order to benefit from the full potential of the BIM method, especially during the construction phase, it is important that participating construction companies can already use the BIM model during the tender phase. This can help interfaces in the construction process to be better understood, enabling work to be properly planned and costs to be better calculated, resulting in a more efficient project execution following award of the contract. This requires the various design responsibilities in the overall BIM model to be defined to precisely correspond to responsibilities as defined in the construction contract. For example, a specific attribute may be used to indicate which compo-

nents may be changed in the construction company's further design work or as a result of product selection, and how they behave with the effects on neighbouring components. Also, the chosen level of detail and the information content of components in the BIM model should correspond to the level of detail of the design phase, enabling the design responsibility interface between the client and the construction company to be clearly defined. When the construction company is awarded the contract, following the approval phase, a BIM model can be handed over with summarised details of assemblies and specialist trades, and further detail specifications for the construction work can be provided by supplementary 2D designs. Furthermore, the detailing used for the calculation of payments for construction work should correspond to the detailing of the design on which the contract is based. Guiding principles are provided by the German procurement law VOB Part A,

in its "Specification of services with list of services" where the required execution-stage design work has already been done, or its "Specification of services with service programme" where extensive design work is still required from the construction company. The Anglo-Saxon construction contract documents by FIDIC (Red, Yellow or Silver Book) also offer well-proven specifications. This defines payments to construction companies depending on their



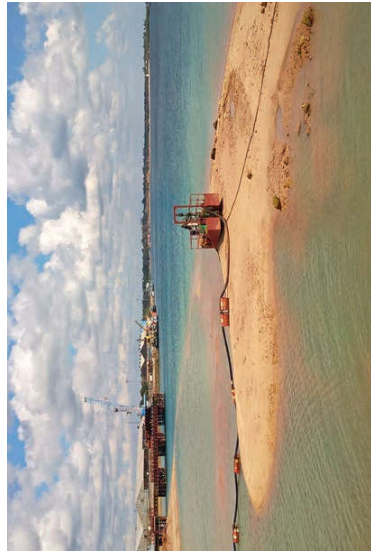
Torsten Retzlaff
Executive Director

"Due to the greatly varying requirements and the complexity of unique infrastructure and building construction projects, very different tools and programs are used in design and construction work. To implement the BIM approach, collaborative interfaces for the different planning tools and parameterised modelling should be further developed in all areas of design."

design responsibilities. In order to ensure consistent use of the BIM method in the planning, design and construction phases of a project and subsequently during the service life of the structure or facility, it is necessary to pay close attention to the clear definition of contractual interfaces and responsibilities of the parties involved in this overall process.

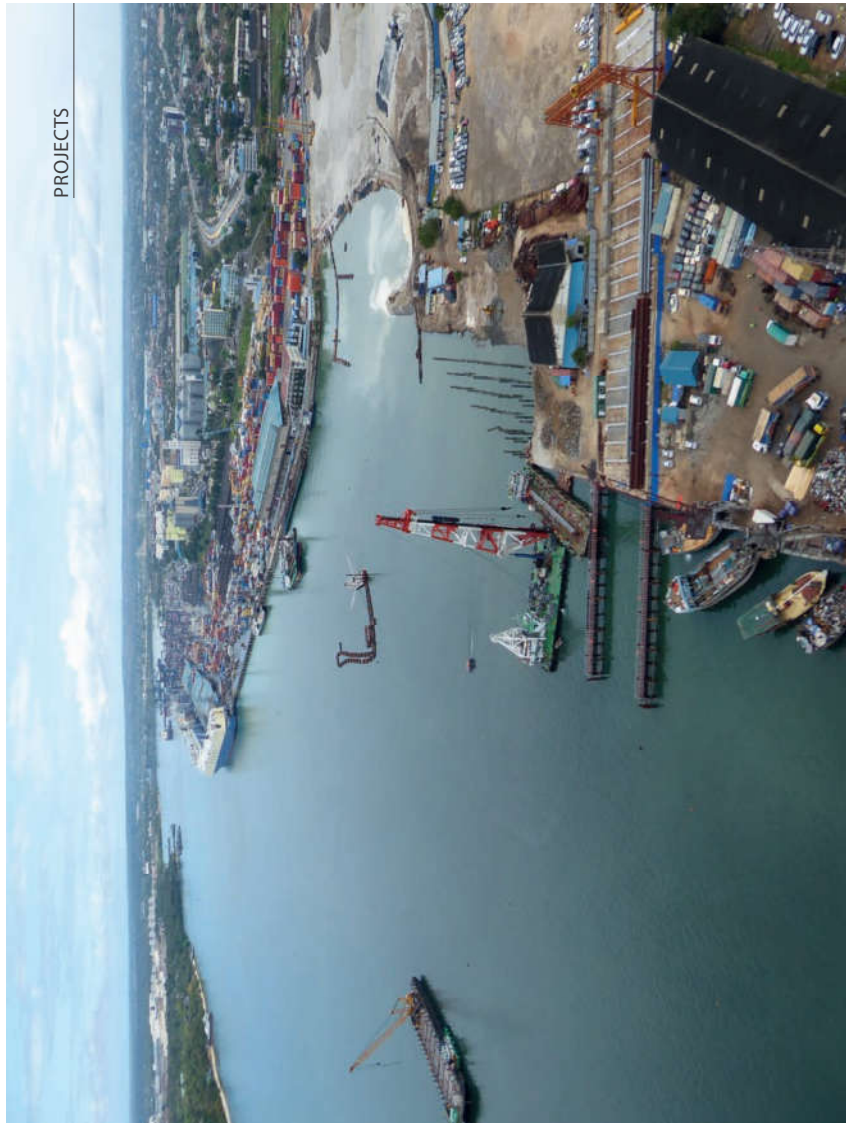
PORT DEVELOPMENT PROJECTS IN EAST AFRICA

With two major ongoing projects in Tanzania, Inros Lackner is continuing to build on its reputation as one of the region's most dependable suppliers of maritime engineering consultancy services.

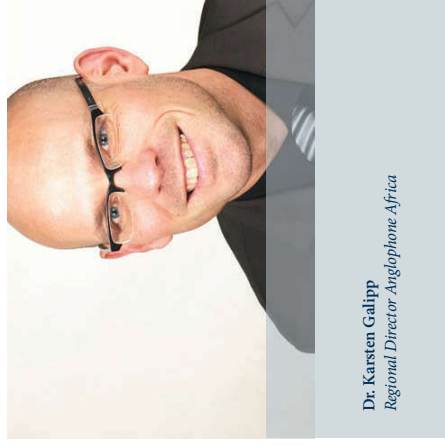


Reclamation works in Mtwara

Over the last five years, Inros Lackner has extended its market position in East Africa as a consulting firm for maritime infrastructure. Currently, having been appointed by the Tanzania Ports Authority, the company is supervising construction works at the ports of Dar es Salaam and Mtwara. The project in Dar es Salaam (value: USD 154 million), to build a new Ro-Ro terminal at the port and to deepen and strengthen seven of its existing berths, is one of Tanzania's major current infrastructure projects. The project in Mtwara consists of the construction of a new multi-purpose terminal and a berth to accommodate 65,000 dwt vessels. For both projects, Inros Lackner has overall responsibility for contract management and for monitoring and control of the works. Other recently completed or ongoing projects in East Africa include a feasibility study at Lake Tanganyika to develop dredging and soil disposal methods at eight ports in four different countries, and planning and design of a modern dry bulk cargo terminal in the Port of Mombasa.



Aerial view of construction sites in Dar es Salaam



Dr. Karsten Galipp
Regional Director Anglophone Africa

KEY FACTS

Dar es Salaam

- Deepening of Berths 1 to 7 from 10 m below Chart Datum (CD) to 14.90 m below CD
- Construction of a new RoRo terminal with a quay wall of length 230 m

Mtwara

- Construction of a new multipurpose terminal and a quay wall of length 300 m

»To combine German functionality with African nonchalance is the challenge and requires candidness on both sides to achieve optimal project results.«



River Senegal in Koudri in Mauritania

SHIPPING ROUTES IN WEST AFRICA

Inros Lackner has been active in West Africa for many years, and not only in port construction and port logistics. Engineering and consulting services are also provided for the development of shipping routes.

The Casamance River in Senegal is an important ferry and shipping route, connecting the Casamance region with the markets of the capital, Dakar. The 60-km stretch from the Dakar estuary to the seaport of Ziguinchor, the provincial capital of the Casamance region, has recently been optimised for navigability. Inros Lackner was responsible for the supervision of all construction work and oversaw the factory acceptance of the associated navigation aids.



Hopper Dredger Waterway on River Casamance



New Buoys for Casamance River



Land Reclamation in Pointe Noire



Dredging of Pointe Noire Port

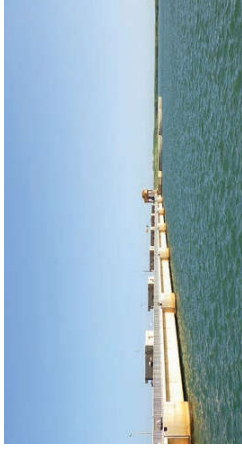
the sand from the river shallows could be used as fill at the river's banks. The larger quantities from the sandbank were disposed of in a dedicated dumping area.

Pointe-Noire Port

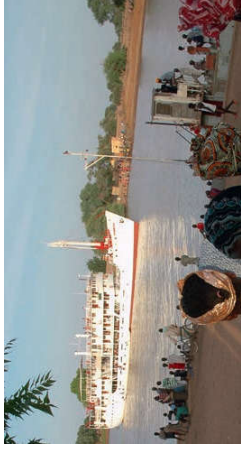
For over 10 years, Inros Lackner has been involved in the development of the port of Pointe-Noire in the Republic of the Congo. In recent years this has included, among other things, planning the new port entry and overseeing the associated dredging work. A particular challenge in Pointe-Noire was presented by the enormous oil-containing sand, from which oily, bituminous phases can separate during dredging, resulting in an oil slick on the water. Inros Lackner's staff used their expert knowledge in developing environmental studies for the dredging work at the port entrance and implemented measures for the environmentally friendly handling of the dredged material, and monitored the work on site.

Senegal River

Currently, Inros Lackner is preparing an environmental and social impact study for the development of the Senegal River. The international team is working on behalf of "OMVS - Organisation pour la mise en valeur du fleuve Sénégal", established by the states of Mali, Mauritania and Senegal. The aim of the organisation is to protect the interests of the Senegal River and its catchment area. The study will examine the impacts of dredging work for improved navigability and of the construction of eight regional ports and seven docking areas along a 905-km stretch of river from the mouth of the river in St. Louis, Senegal to the city of Ambedi in Mali. Plans are also being developed for the environmentally friendly and socially acceptable development of the river.



Dama Barrage, River Senegal



Historic Cruise Vessel Bou el Mogdad on River Senegal



Dr. Klaus Richter
Executive Director

"Connecting people and markets. The flow of trade and Infrastructure is one of the biggest demands in Africa. Our experts are delivering solutions in a future-oriented way. Digitalisation and next level ICT will not only enhance the efficient design of infrastructure but as well improve its operation and the transnational logistic chains."

INROS LACKNER SERVICES INCLUDE:

- Development of a space usage plan and a shipbuilding design concept
- Hydraulic modelling to establish sedimentation rates
- Proposal of measures to reduce the amount of dredging required for maintenance purposes
- Detailed feasibility study including cost estimates, construction schedule and preliminary design drawings
- Design calculations
- Preparation of tender documentation for the various trades
- Support during the tender phase
- Consultancy during contract negotiations
- Support of the client during construction work, installation of equipment, commissioning and entry into service

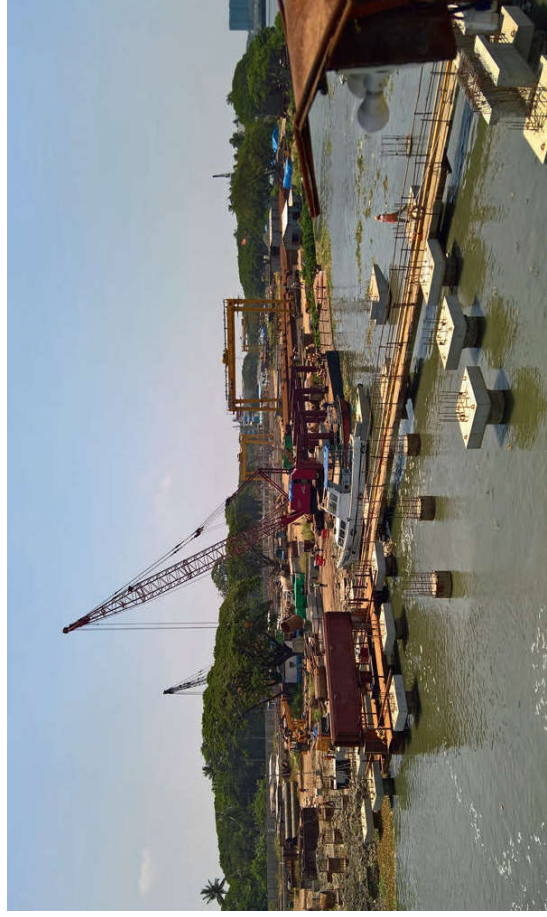


Oliver Schwarz
Regional Director Asia

"A lucky shot! While not fully focussing on the Indian market around late 2012, close business partners approached us for a joint submission of a bid. Our structured and well defined technical approach finally convinced the client to award this challenging project to Inros Lackner in March 2013."



Piling rig platforms I and II



Pile head preparations for placement of pre-cast reinforced concrete elements



Piling rig at work during construction of Cochin's new ship repair facility

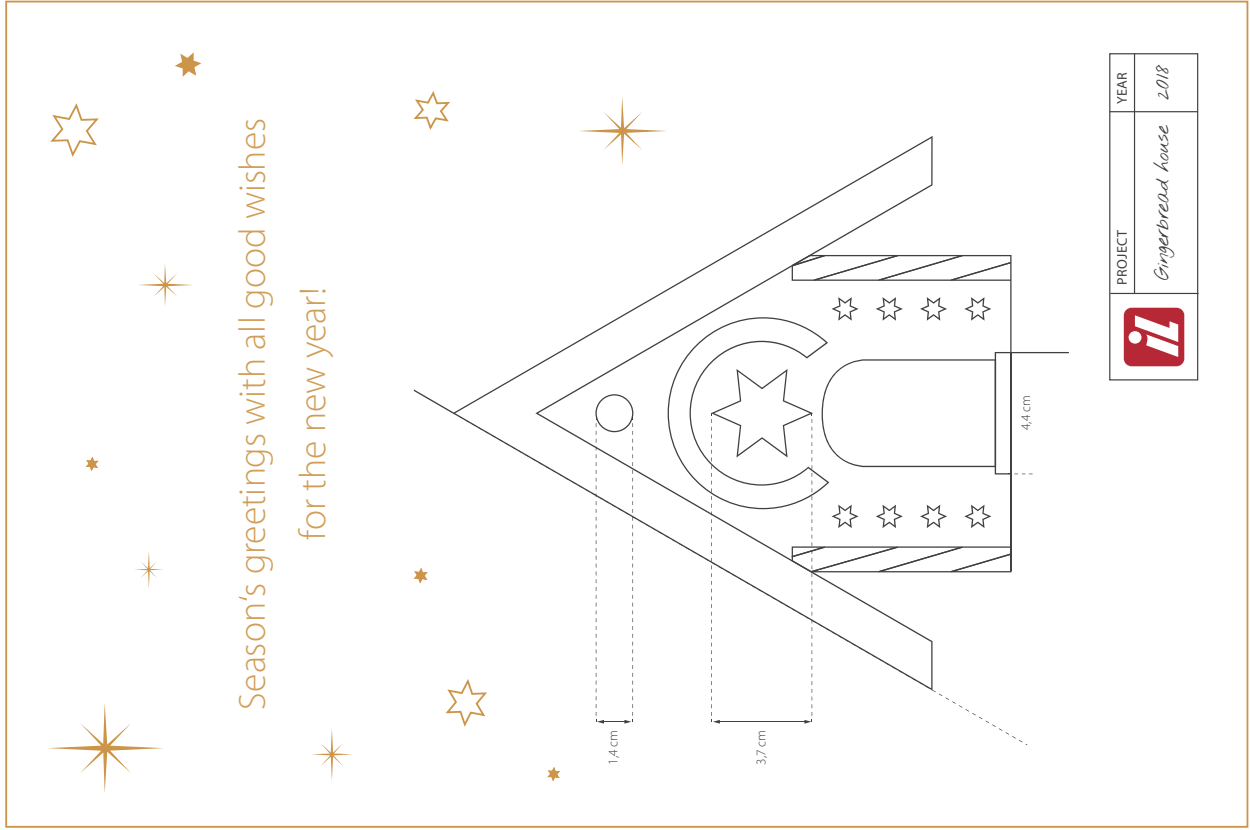
SHIP REPAIR FACILITY IN INDIA

Planning and design work is progressing well on the project to develop a new International Ship Repair Facility near the city of Cochin in southern India.

A major project to build a modern shipyard for ship repair work on India's west coast is now well underway, with construction having commenced following a lengthy tender process and preparation of detailed planning and design documentation. Inros Lackner is proud to have played a key role in the project thus far, and to continue making an important contribution to the project until its completion. Since being appointed in 2014 as Project Management Consultant for the project, the consortium of Inros Lackner - TATA Consulting Engineers, in association with M/s Danish Hydraulic Institute, has been providing the required design and consultancy services for this major project. The contract confers responsibility for the development of the project from the concep-

tual stage right through to commissioning and handing over upon completion - currently scheduled for 2021.

The property is located on Willingdon Island, India's largest artificial island, and has an area of 42 hectares and a waterfront of length 800 m. It already has a quay of length 86 m, a dry dock of dimensions 66 m x 12.5 m x 4 m, and repair workshops dating from 1938. These facilities are now being modernised and renovated, and supplemented by a new, modern ship lift (platform size 120 m x 25 m, lifting capacity 6,000 tonnes) with a transfer system, up to six shore-side repair spots and an outfitting pier of length approximately 535 m.



Season's greetings with all good wishes
for the new year!

	PROJECT	YEAR
	Gingerbread house	2018

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