

## Agenda

- 16.00 - 16.25 - Case Study
- Current projects

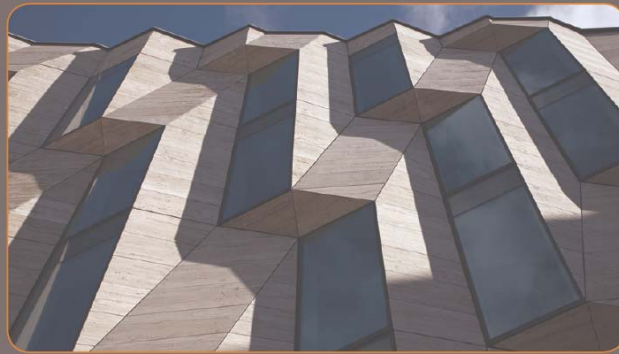
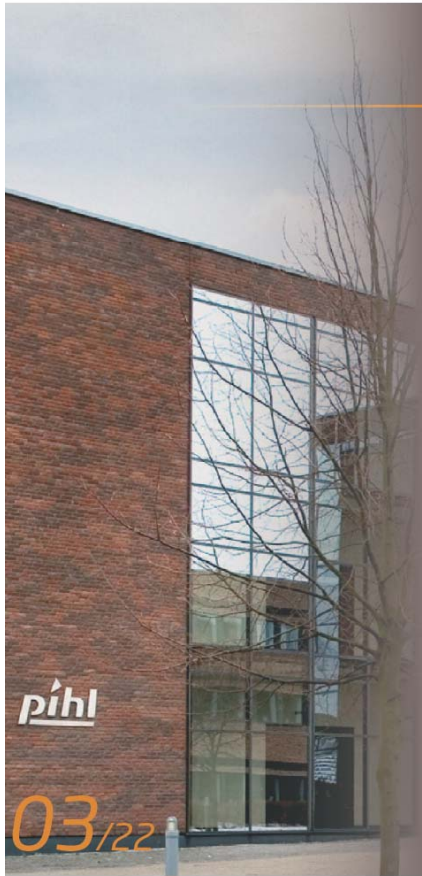
## E. Pihl & Søn A.S.

- Stefan Brandt Johansen
- BIM Manager
- sbj@pihl-as.dk



## E. Pihl & Søn A.S.

- The Company
- Key Figures
  
- Infrastructure
- Building

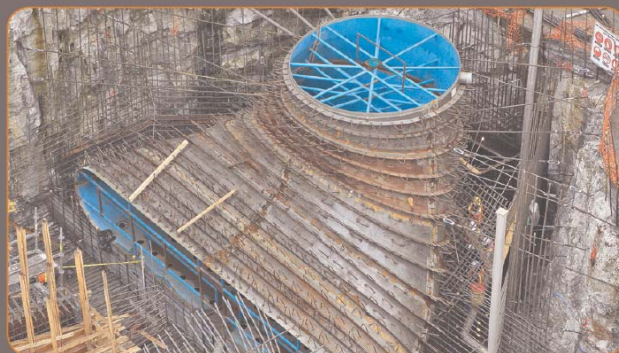
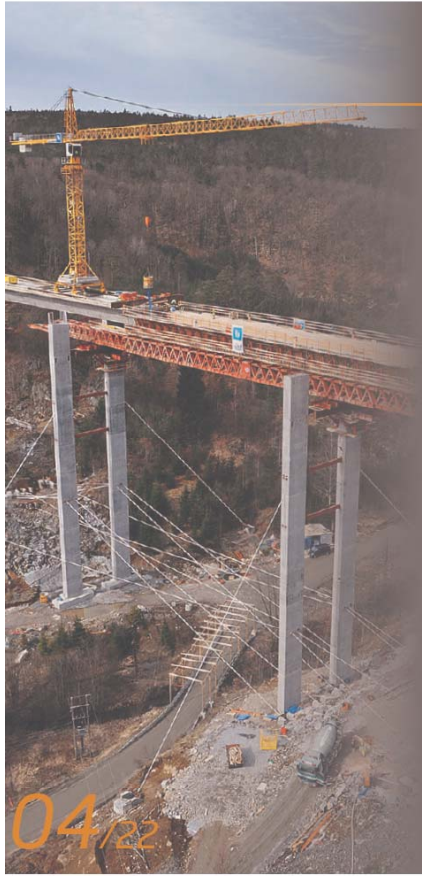


### The Company

- Contractor
- Headquarters in Lyngby, Denmark
- Established in 1887
- Pihl has operated in 51 countries over the years
- Pihl is currently operating in 17 countries
- Istak is a subsidiary of Pihl

### Key Figures

- Pihl employed approx. 3,000 persons in 2010
- Annual turnover in 2010 amounted to EUR 650 million
- 55 % of the annual turnover in 2010 derived from work carried out abroad
- Pihl is ranked No. 116 on the 2010 ENR List



### Infrastructure projects

- Transport sector projects such as:
  - Harbours
  - Bridges
  - Tunnels
  - Roads
  - Airports

### Infrastructure projects

- Energy and environmental projects such as:
  - Power stations
  - Off-shore wind farms (foundations)
  - Hydropower plants
  - Wastewater treatment plants



### Building industry

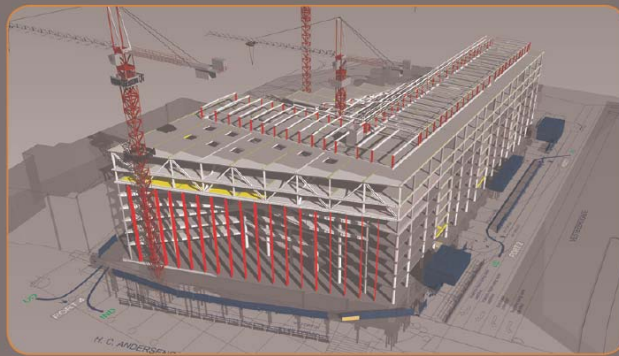
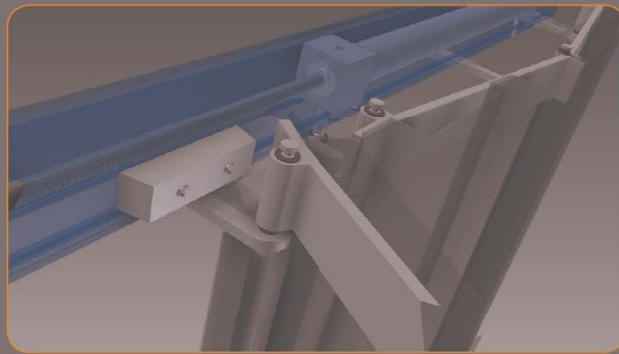
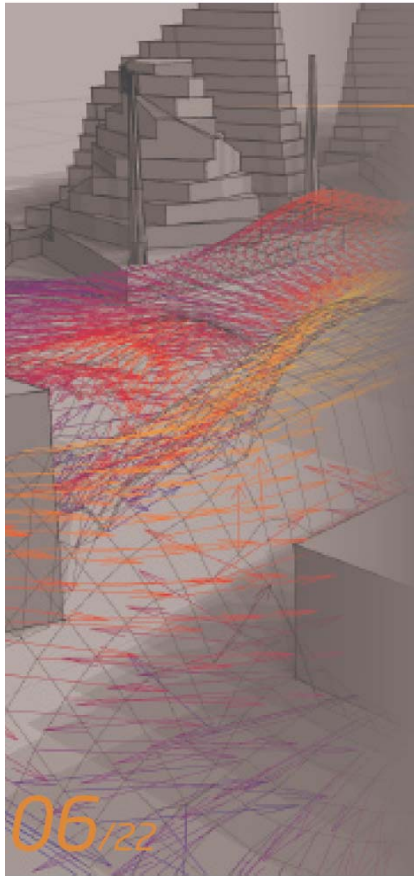
- Construction work in the following sectors:
- Commercial
- Industrial
- Public
- Residential
- Retail
- Arts and culture



05/22

## Implementation

- BIM in Pihl
- Software



### BIM in Pihl

- Pihl has been working with BIM for 10 years
- Own design department
- Detailed design
- Value engineering
- Digital integration to suppliers
- Close collaboration with clients and consultants
- BIM is a key figure to find the right solutions

### Software

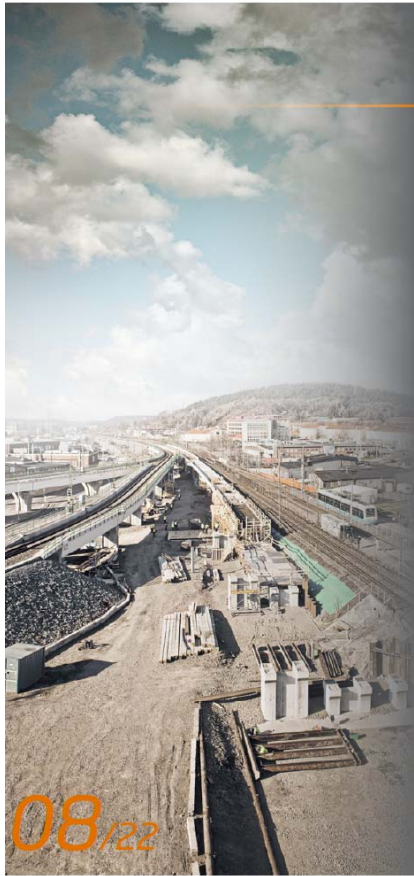
- Revit Architecture
- Tekla Structures
- Inventor and Civil 3D
- AutoCAD Architecture and LT
- Navisworks Simulate and Solibri
- Rhino, Sketch Up Pro and 3DS Max Design
- Vico and Tilos
- MathCAD, Robot, Etabs and Strudl



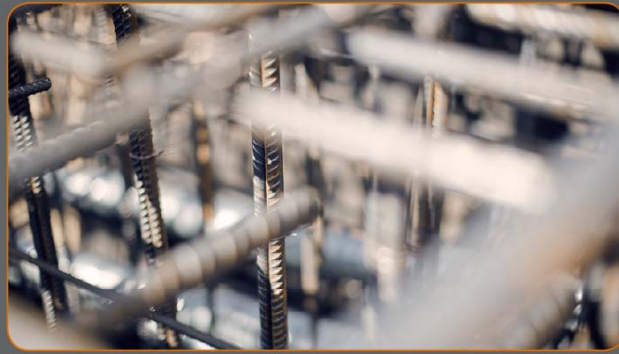
## Case study

- Marieholm-Olskroen
- Project Figures
  
- Reinforcement of Bridge
- Development of Link
- Execution Phase
- Conclusion





08/22



### Case: Marieholm-Olskroken

- Gothenburg, Sweden
- Expected; 2012-08
- Client; Trafikverket
- Engineer; Centerlöff & Holmberg
- Turnkey contractor; E. Pihl & Søn A.S.
- Double track railway bridge
- Carried out in two phases of 400 m and 500 m
- Cast in place concrete (cast in situ)

### Reinforcement in Tekla

- Process optimization
- Business development and competitiveness
- Increased constructability and productivity
- Automation of manual repetitive processes
- Reduced number of errors



09/22

```

attribute("LABEL1", "Angiv information
vedrørende lejeplader PS", label, "%s", no,
none, "0.0", "0.0", 30, 30)
attribute("P42", "Generering af lejeplader.",
option, %s, no, none, "0", "0", 385, 60,
180)
    {
    value("Nej",1)
    value("Ja",0)
    }
attribute("P43", "Generering af udsparringer.",
option, %s, no, none, "0", "0", 385, 90,
180, "toggle_field:P27=0;P28=0")
    {
    value("Nej",1)
    value("Ja",0)
    }
picture("jbp_bs_hor_line_1", 160, 2, 30)
    
```



### Parametric modeling

- Custom component for generation of columns
- Requires simple coding in Tekla
- Ensures consistency in the modelled construction
- Reduced modelling duration
- Large benefits in case of changes to the design

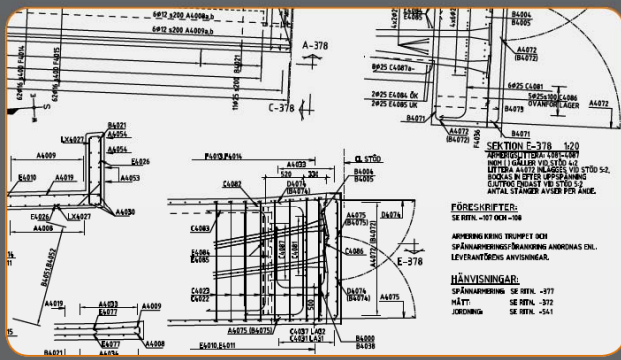
### Example

- Generation of sheetpiles, foundations and columns
- A few keystrokes result in generation of geometry
- The custom component has 36 variables





10/22



## Building Information Modelling in Pihl

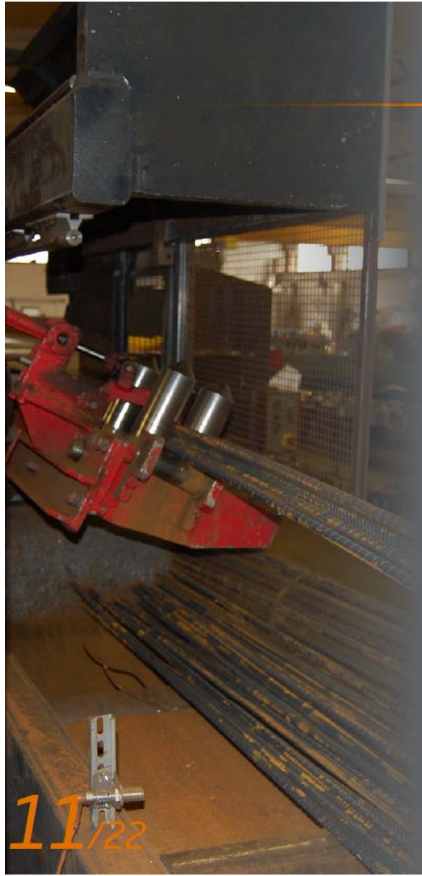
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### Reinforcement of bridge decks

- First bridge deck reinforced using traditional methods
- Succeeding bridge decks modelled and reinforced in Tekla Structures
- Bridge deck more complex than column structures
- Improved dialogue with consultant and client
- Four different types of bridgedecks

### Example

- Bridge deck 4:2 - 5:2 with a span of 25 m
- Variable cross section
- 12.9 tonnes reinforcement and 8 stressed cables
- Primarily D12, D16, D20 and D25



11/22

Type	Pos	Antal	Ø	Længde	a	b
AB	AB1591	12	25	3697	800	263
AB	AB1591	4	25	3627	800	225
C	C1551	45	25	6669	800	5280
C	C1552	23	16	6745	800	5280
C	C1553	27	20	5914	800	4480
C	C1554	27	16	5945	800	4480
C	C1555	120	16	1816	800	320
B	B1556	10	16	5132	4400	800



## Building Information Modelling in Pihl

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### Development of link

- A wish to establish a digital workflow
- Automation of manual input
- Dialogue with Celsa about production format
- Involvement of Tekla in integration with Qrebar
- Development by Tekla and Pihl
- Link establishes export from Tekla to Qrebar
- Celsa uses the exported file directly in production

### Example

- Bridge deck from 9:2 to 10:2
- 11 different bending shapes
- 68 different rebar groups
- 2412 pieces of reinforcement
- 12.3 tonnes rebar





### Usage in construction phase

- Improved and simplified communication
- Used at production meetings
- Viewer used in site office
- Screenshots support 2D drawings
- Involvement of site engineers
- Model located on server
- Training of site engineers
- Involvement of Celsa Steel Service

### Example

- Primarily used to communicate the design
- Highly complex and unique solutions
- Variations in reinforcement work
- Four types of bridge decks
- Extraction of specific concrete quantities
- Visualization of reinforcement on laptop
- Extraction of formwork area

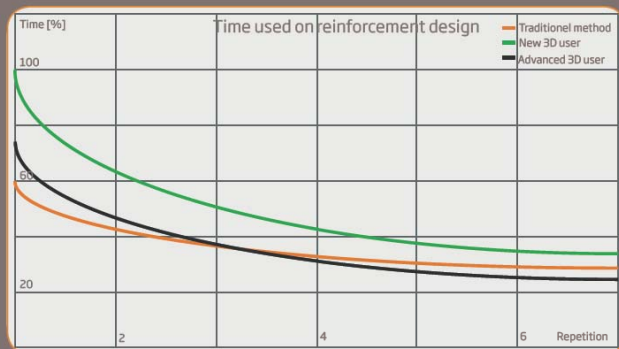


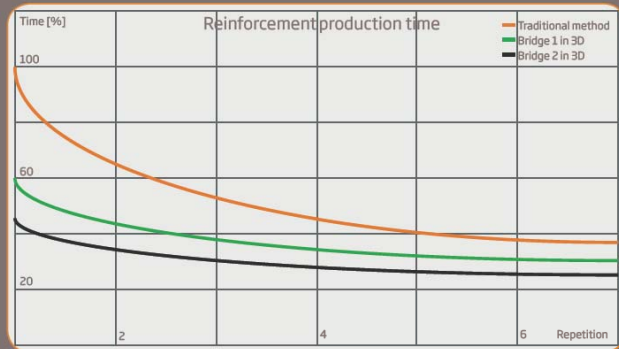
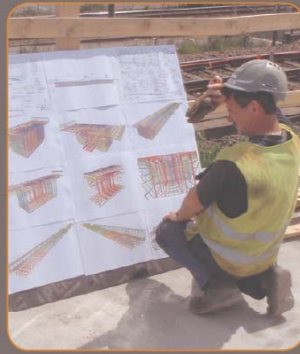
### Design phase

- Learning curve
- Technology requires dedication
- High development potential
- The working method generates new ideas

### Summary

- A digital workflow has been established with Tekla
- High-quality cut and bending list
- Perfect reinforcement design
- The technology is competitive
- Increased and improved dialogue with consultant





### Construction phase

- Better dialogue with workers on site
- 3D specialist should be on site
- Low-tech solutions are also necessary

### Summary

- Production time is reduced
- Better communication regarding new rebar design
- Less wasted material - now 1-2%
- Optimal productivity rates are achieved faster
- Value creation is higher than implementation costs



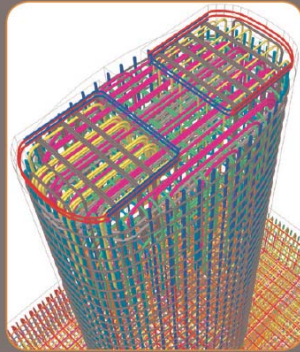
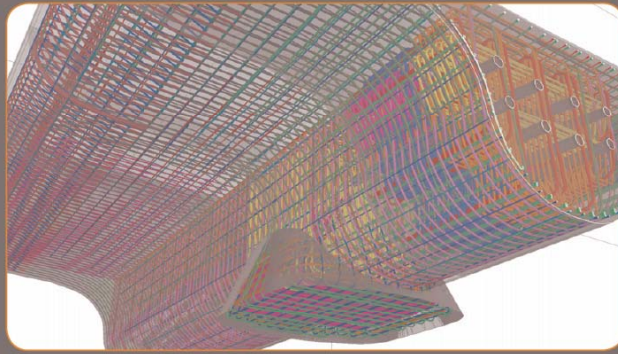
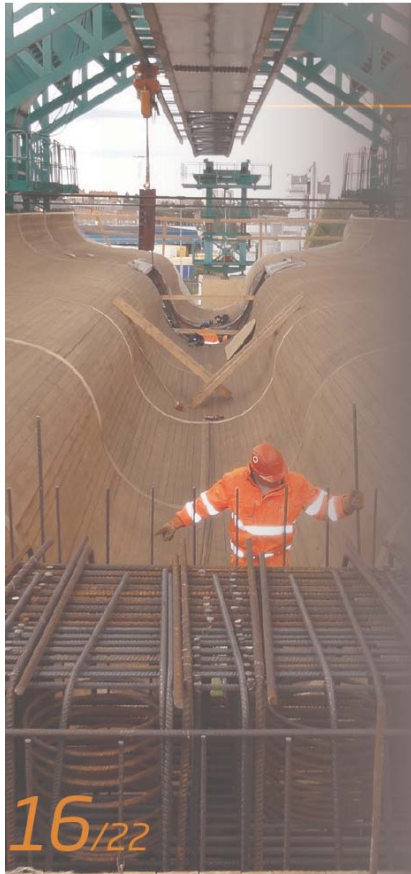
### Current projects

- Further development
- Current projects
- Conclusion

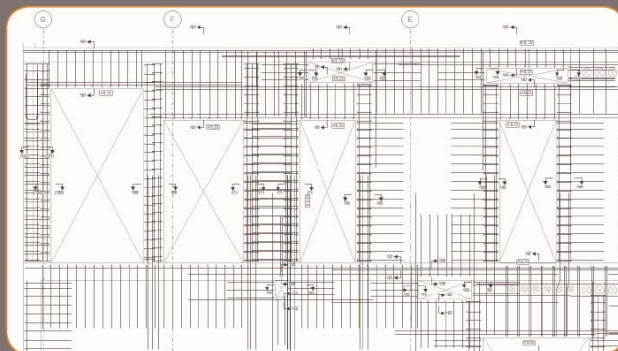
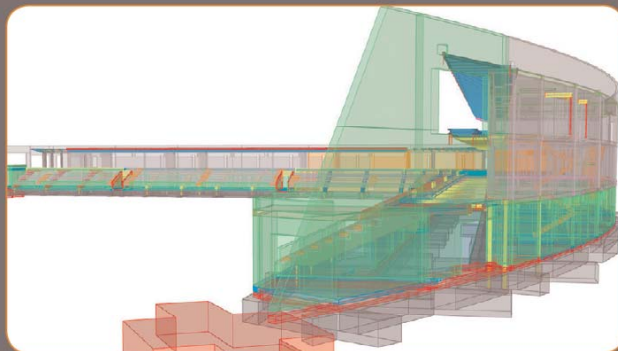
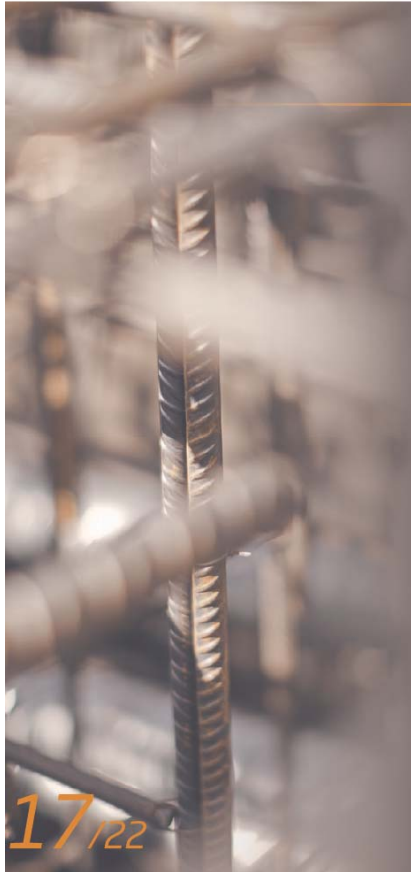




Case story - Bridge in Årsta



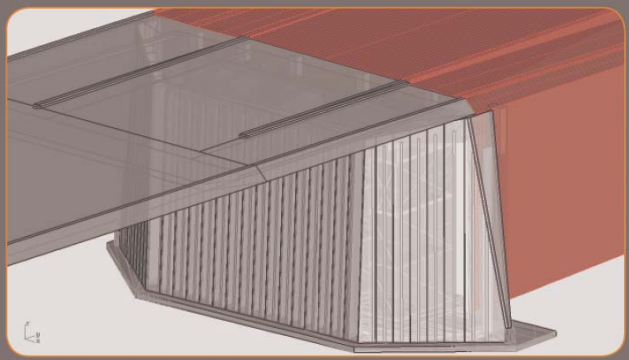
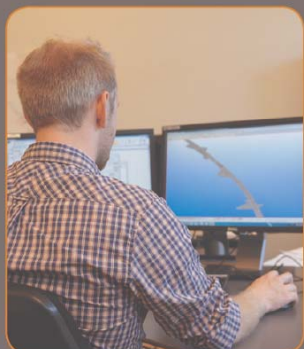
Case story: FC Gabala



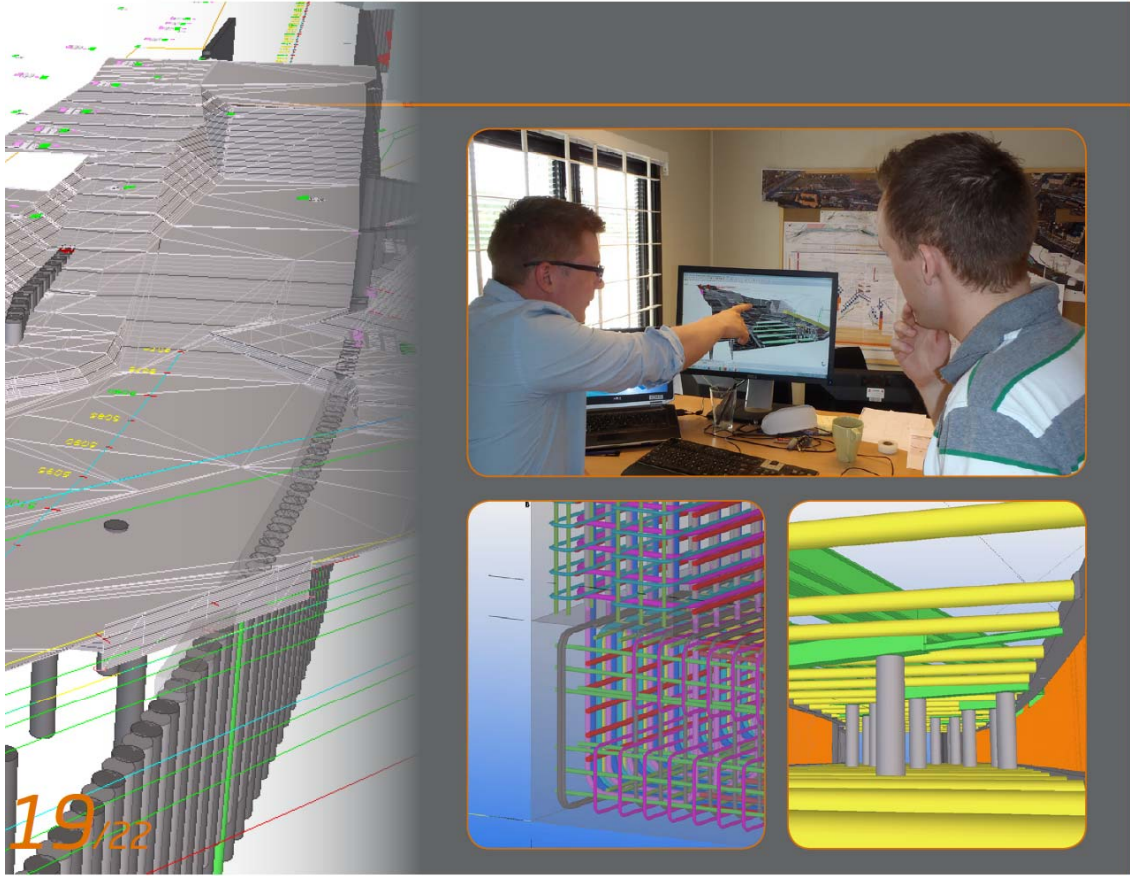
Case story - Bridge in Sundsvall



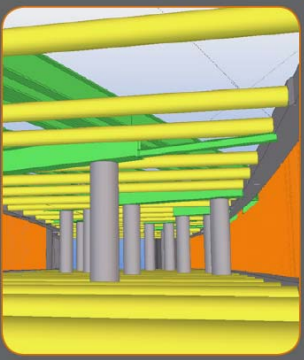
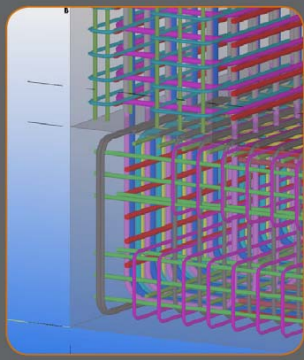
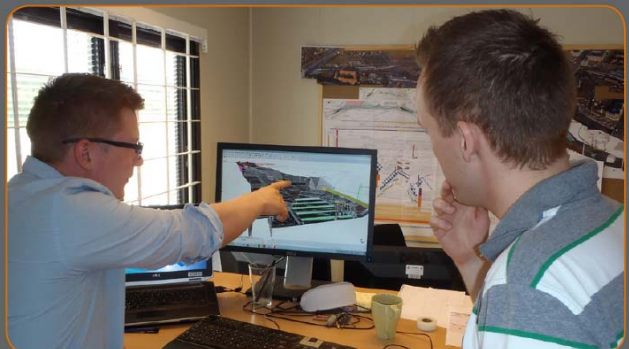
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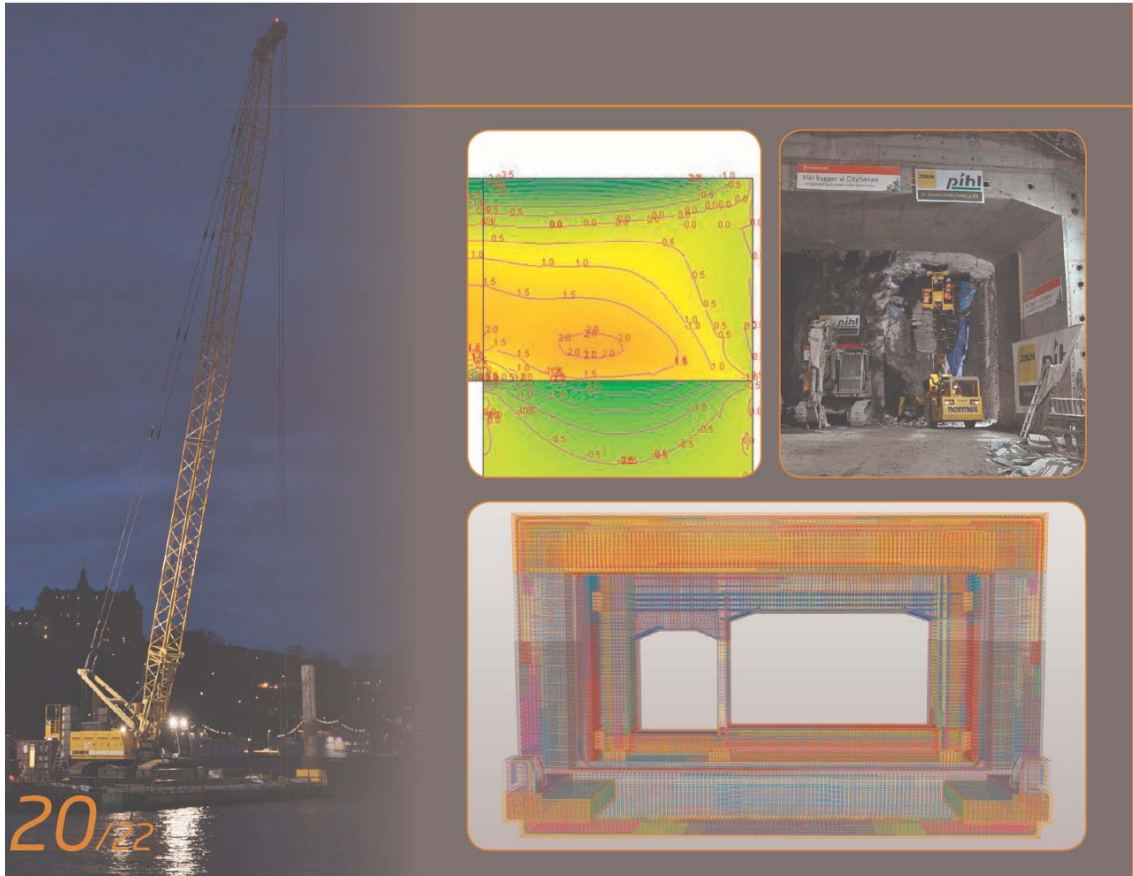
Case story: Nordhavnsvej



19/22



Case story - Söderström JH



Summary  
 - Questions  
 - Comments



## Summary

- Questions
- Comments

Thank you for your attention

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