Learning scenarios for construction processes following the action scenarios

DigiCon

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1. INTRODUCTION

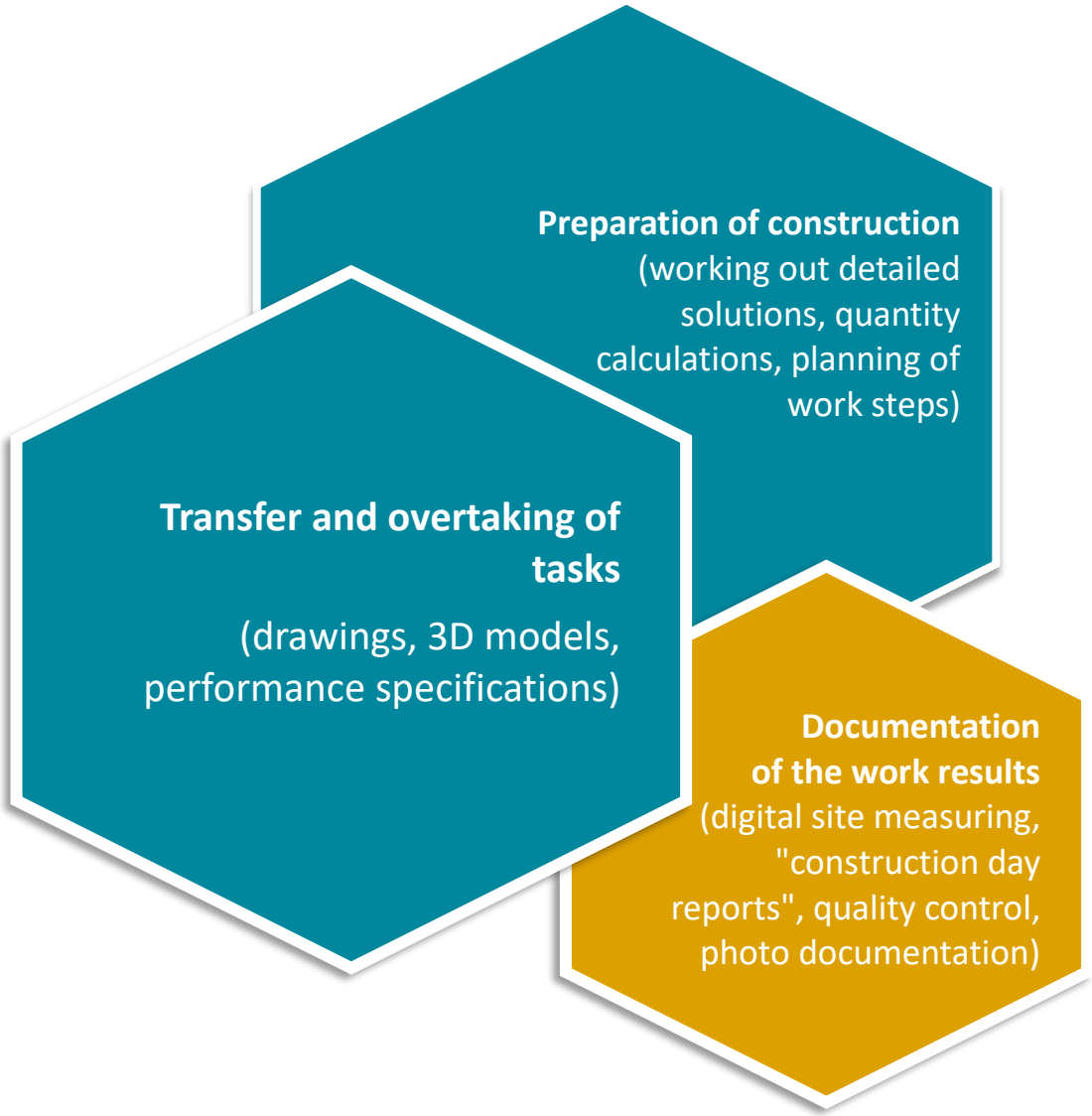
Along the action scenarios, learning scenarios on digital processes in construction were developed, which are oriented towards typical work processes. At the same time, the trainees practiced the handling of digital applications and devices.

The learning scenarios

can be integrated into learning fields or learning units. They include:

1. A detailed description of the activities to be practised and the envisaged acquisition of competencies
2. Information on the docking of the digital applications/tools for carrying out the activities
3. Concrete learning tasks along these typical work situations (combining text, audio, image and video elements)
4. Information on learning progress monitoring (e.g. interactive questions, multiple choice, sorting, etc.)
5. Required learning materials, applications and equipment
6. The learning scenarios cover various topics related to digital building - from the contract acquisition to the documentation of results - and are relevant for different building professions (reinforced concrete workers, electricians and ventilation technicians, drywall builder, masons and carpenters)
7. Typical subject areas are: Construction surveying (e.g. laser scanning); handling of digital models; systematic transmission of digital partial model data (roof truss, staircase etc.); creation of digital AS-BUILT situations (sewer works, electrical plans, ventilation etc.); digital communication (synchronous and asynchronous).

Learning tasks are embedded in the action scenarios, which reproduce the complexity of the work processes. The focus was on the handling of digital data, digital tools and communication with digital media and applications, in particular:



The learning scenarios were used within the framework of regular training and complement it and were flexibly adapted to the requirements of specialist teaching. The scenarios are suitable for individual or group learning and can be used in specialist teaching and independent learning. They contain participative and interactive elements.

2. LEARNING SCENARIO

2.1 Learning scenario 1: Construction of a Wall

LS 1.1
Transfer of the data from the 3D-model

Time benchmark:
2 hours (a 60min)

Description of the situation:

Producing a partition wall made of masonry on the ground floor of a single-family house. All relevant technical information for this assignment can be found in the documents for the exercise and the digital model provided.

Work task:

- Read the 3D-model into your viewer
- Determine the size of the wall to be erected in the digital model (length, height, area, volume)
- Edit the planning tasks in the task definition

General implementation instructions and explanations

Licensed programmes and free manufacturer software "freeware" are used for the implementation.

Implementation of the learning unit as group work for:

- reading in the 3D model

Implementation of the learning unit as individual work for:

- working on the planning tasks

Training materials

- digital terminals (tablet computers, laser measuring devices for controls)
- viewer software for the tablet computers
- storage medium (cloud, USB)
- 3D model
- task definition

<table>
<tr><th colspan="2">Professional skills</th><th>Linguistic and communicative competence</th></tr>
<tr><td colspan="3">The apprentices can:</td></tr>
<tr><td colspan="2">▪ operate the specified software for reading in the data models
▪ read in the 3D digital models from the specified storage locations
▪ navigate in the 3D model
▪ read out the data required by the task</td><td>▪ communicate with stakeholders within the training group
▪ document the relevant information
▪ use technical terms correctly and understandably</td></tr>
<tr><th>Pre-knowledge</th><th>Assessment</th><th>Interdisciplinary notes</th></tr>
<tr><td>▪ basic knowledge in the use of digital end devices
▪ basic knowledge of data storage and transmission
▪ previous knowledge of construction, e.g. reading building drawings, types and technical construction of masonry walls
▪ written language skills</td><td>▪ handling the digital devices
▪ application of the viewer software
▪ results of the planning tasks</td><td>▪ usable for all subject areas</td></tr>
<tr><td colspan="3">Evaluation

▪ The apprentices are able to read in the models independently and to orientate themselves in them three-dimensionally.
▪ They can process the extracted data according to the task.</td></tr>
</table>

LS 1.2
Quantity determination from the data of the 3D model

Time benchmark:
2 hours (a 60min)

Description of the situation:

Produce a partition wall made of masonry on the ground floor of a single-family house. All relevant technical information for this assignment can be found in the documents for the exercise and the digital model provided.

Work task:

Determine the demand for KS masonry units in pieces, the demand for mortar in litres and the other materials.
(KS…sand - lime brick)

General implementation instructions and explanations

Create a spreadsheet on your digital device for the calculation.

Training materials

1. Digital terminals (tablet computers
2. Viewer software for the tablet computers
3. Spreadsheet software
4. Storage medium (cloud, USB)
5. 3D model
6. Task definition

Professional skills	Linguistic and communicative competence
The apprentices can:	
▪ navigate in the 3D model ▪ read out the data required in the task ▪ create a simple spreadsheet in the spreadsheet application ▪ check the results of the calculation for plausibility	▪ communicate with stakeholders within the training group ▪ document the relevant information ▪ use technical terms correctly and understandably

Pre-knowledge	Assessment	Interdisciplinary notes
▪ basic knowledge in the use of digital end devices, ▪ basic knowledge of data storage and transmission, ▪ previous knowledge of construction, e.g. reading construction drawings, types and technical construction of masonry walls ▪ basic knowledge in the use of spreadsheets ▪ written language skills	▪ handling of the digital devices ▪ application of the viewer software ▪ results of the quantity take off	▪ use subject related data models

Evaluation

- The apprentices are able to orient themselves independently three dimensionally in models.
- They can further process the extracted data in a spreadsheet according to the task.
- They can check the results of the calculations for plausibility.

LS 1.3
Build a masonry wall

Time benchmark:
8 hours (a 60min)

Description of the situation:

Produce a partition wall made of masonry on the ground floor of a single-family house. All relevant technical information for this assignment can be found in the documents for the exercise and the digital model provided.

Work task:

Build the masonry wall according to the task. (interactive task)

General implementation instructions and explanations:

Construct the masonry wall as given in the task sheet.

Training materials

- Digital terminals (tablet computers
- Viewer software for the tablet computers
- Spreadsheet software
- Storage medium (cloud, USB)
- 3D model
- Task sheet
- Material and tools according to the task

Professional skills	Linguistic and communicative competence
The apprentices can:	
▪ navigate in the 3D model ▪ read out the data required in the task ▪ build the masonry wall professionally and on time ▪ apply the rules of occupational health and safety	▪ communicate with stakeholders within the training group ▪ document the relevant information ▪ use technical terms correctly and understandably

Pre-knowledge	Assessment	Interdisciplinary notes
▪ basic knowledge in the use of digital end devices ▪ previous knowledge of construction, e.g. reading construction drawings, types and technical construction of masonry walls ▪ knowledge of masonry construction ▪ written language skills	▪ handling of the digital devices ▪ professional evaluation of the exercise piece ▪ compliance with the time requirements	▪ interfaces with other trades such as plasterers and screed layers

Evaluation

- The apprentices are able to orient themselves independently three dimensionally in models.
- They are able to produce the masonry according to the specifications of the task in a professional and timely manner.

LS 1.4
Create a measurement and a performance documentation

Time benchmark:
4 hours (a 60min)

Description of the situation:

Produce a partition wall made of masonry on the ground floor of a single-family house.
All relevant technical information for this assignment can be found in the documents for the exercise and the digital model provided.

Work task:

Create a measurement and a performance documentation for the masonry wall you have built.

General implementation instructions and explanations

Create a (photo) measurements of your masonry wall with the help of a distance laser measuring device.
Calculate the deviation of your work performance (time) from the target.

Training materials

- Digital terminals (tablet computers
- Viewer software for the tablet computers
- Spreadsheet software
- Storage medium (cloud, USB)
- 3D model
- Task definition
- Laser measuring device (Bluetooth)

Professional skills	Linguistic and communicative competence
The apprentices can:	
▪ navigate in the 3D model ▪ read out the data required in the task ▪ measure the masonry wall you have erected ▪ calculate the deviation of your performance time from the target time	▪ communicate with stakeholders within the training group ▪ document the relevant information ▪ use technical terms correctly and understandably

Pre-knowledge	Assessment	Interdisciplinary notes
▪ basic knowledge in the use of digital end devices, ▪ previous knowledge of construction, e.g. reading building drawings, types and technical construction of masonry walls ▪ written language skills	▪ handling of the digital terminals, ▪ application of the viewer software ▪ result of the measurement ▪ result of the performance calculation	▪ observe VOB measurement rules

Evaluation

- The apprentices are able to orient themselves independently three dimensionally in models.
- They can extract the extracted data according to the task.
- They can measure the erected masonry with a laser measuring device.

2.2 Learning scenario 2: Build beam on site

The use of digital methods in the production process of reinforced concrete beam.

LS 2.1
Preparation and assembly of formwork (mold, formwork) of reinforced concrete beam using digital methods.

Time benchmark:
5 hours (a 45 min)

Description of the situation:

Before the implementation of construction works consisting in the preparation and assembly of formwork (mold, formwork), you receive from the designer / construction manager (teacher) construction documentation in a digital version (drawings of formwork in *dwg* format and a digital model of the object *IFC* format – beam element). For the preparation and execution of formwork you need the dimensions of the beam and notes on how to formwork.

Working task:

Make the formwork of the reinforced concrete beam in accordance with the dimensions that you will read from the construction documentation received in a digital version (available on the platform) from the designer / construction manager (teacher). To read dimensions using a tablet, use *AutoCad* and the *Trimble Connect web model viewer*. After reading the dimensions, make the formwork of the beam by systematically checking the dimensions with a laser rangefinder and leveling with a laser level. The working task is carried out during practical classes.

General implementation guidelines and clarifications:

The Google Classroom learning platform can be used for implementation. It is used to place materials in a digital version on the basis of which students will carry out a working task (drawings in a digital version in dwg format, an object model in IFC format – a beam element, instructions for assembling formwork, instructional videos, etc.), but also to secure (save) the results of work (photos, videos, results of receipts - forms). When performing a working task, it is envisaged to work in teams of 2 people.

Teaching materials		
▪ *AutoCad* ▪ Viewer of digital models saved in *IFC Trimble Connect* format ▪ Laser spirit level ▪ Laser rangefinder ▪ Digital devices (smartphone or tablet) ▪ Internet access ▪ Information materials – Google Classroom platform (e.g. instructional videos, photos)		
Professional competence	Personal and social competence	Language and communication competences
Students should:		
▪ be able to choose the right device and digital programs to read dimensions from digital documentation ▪ be able to export data in the right form for further use ▪ be able to use digital devices and programs to read dimensions from digital documentation ▪ be able to use digital tools in control and measurement activities ▪ be able to choose the right digital device and programs for saving and transferring digital data	▪ observe the principles of personal culture and professional ethics ▪ plan the execution of the task ▪ be responsible for the actions taken ▪ be creative and open to change ▪ use stress management techniques ▪ improve professional skills ▪ apply the principles of interpersonal communication ▪ use methods and techniques of problem solving ▪ collaborate in a team	▪ use the basic resource of language means in a foreign language, enabling the implementation of professional activities ▪ understand oral statements, as well as simple written statements in a foreign language, to the extent enabling the implementation of professional tasks ▪ independently create short, simple, consistent and logical oral and written statements in a foreign language, to the extent enabling the implementation of professional tasks ▪ participate in the conversation in typical situations related to the implementation of professional tasks – ▪ react in a foreign language in an understandable way adequately to the communicative situation, orally or in the form of a simple text

		▪ change the form of oral or written transmission in a foreign language in typical situations related to the performance of professional activities ▪ use strategies to improve their own language skills and raise language awareness
Prior knowledge ▪ general knowledge in the field of construction ▪ knowledge of issues related to the technology of reinforcement and concrete works ▪ ability to use drawing documentation (reading a technical construction drawing, knowledge of construction standards for drawing) ▪ basic knowledge of the use of digital devices (smartphone, tablet) ▪ basic knowledge of the digital environment applicable in construction (computer programs used in construction) ▪ ability to use digital control and measurement tools	**Assessment** ▪ JPG files constituting photographic documentation of a correctly assembled formwork (form, formwork) of the beam ▪ MP4 files constituting film documentation of correctly edited formwork (mold, formwork) of the beam ▪ text files - collection results (forms), the result or checking the dimensions of formwork ▪ workflow (using digital devices, e.g. tablet, digital programs e.g. Trimble Connect browser, digital tools, e.g. laser rangefinder) ▪ team work ▪ work cycle (compliance with health and safety regulations)	**Interdisciplinary references** ▪ knowledge of digital teaching methods in various vocational education subjects (theoretical and practical) ▪ knowledge of a professional foreign language (e.g. English) as a universal language for navigating through the digital environment used in construction

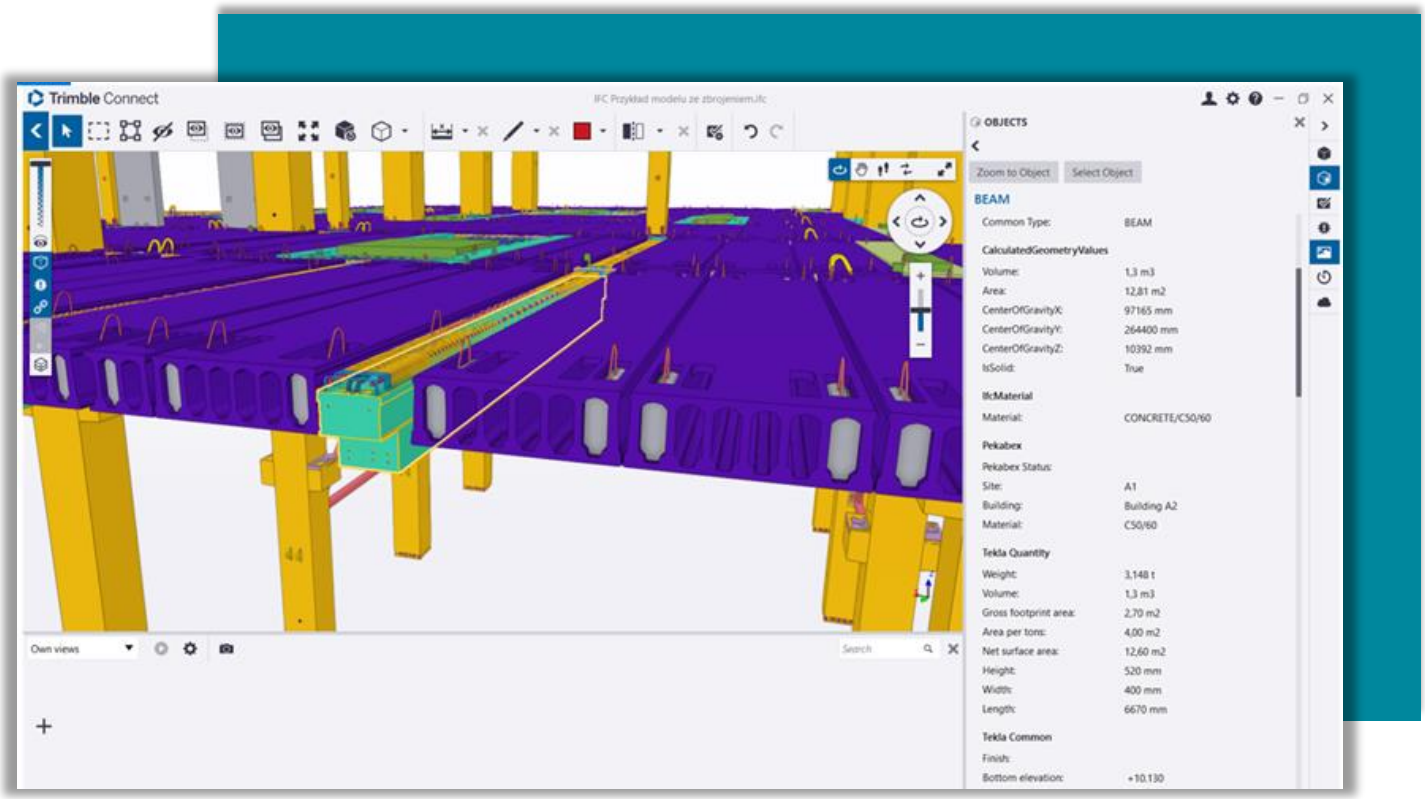
Application in the following professions:	Levels:
▪ construction technician on the basis of qualification: BUD.01. performing reinforcement and concrete works	▪ PQF level 4 (NQF) equivalent to EQF level 4 - diploma confirming full qualification (BUD.01. and BUD.14.) after graduating from technical secondary school

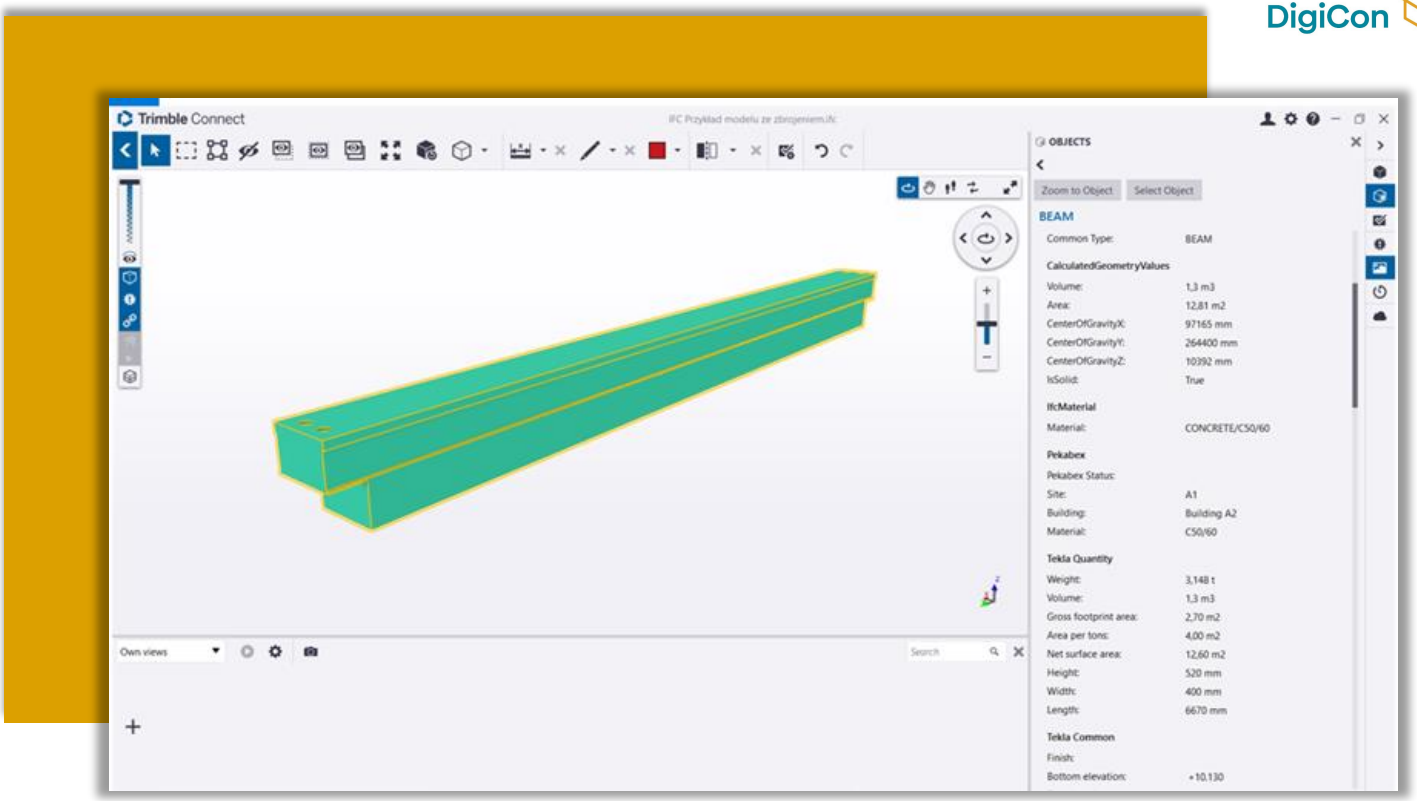
TOPIC OVERVIEW

The use of digital methods in the preparation and assembly of formwork (mold, formwork) of reinforced concrete beam

1. Cutting of formwork elements (form, formwork) in accordance with the design assumptions – appropriate shape and dimensions (formwork drawings)

→ The use of documentation in a digital version – drawings of formwork (form, formwork) of the beam (AutoCad); digital object model IFC format – beam element (Trimble Connect browser).





➔ The use of an automated CNC machine for trimming formwork elements (molds, formwork).

2. Installation of formwork (mold, formwork) in a tight way while maintaining appropriate risers and levels

→ The use of documentation in a digital version – drawings of formwork (form, formwork) of the beam (AutoCad); digital object model IFC format – beam element (Trimble Connect browser).

→ The use of a laser level.

3. Acceptance of fading works – beam reinforcement

→ Checking the quality of the wood-based formwork material used (mold, formwork).

→ Checking the correctness of assembly, tightness and strength of the joints of formwork elements (mold, formwork).

→ Checking the levels and risers of formwork (mold, formwork) – the use of a laser level.

→ Checking the dimensions of formwork (mold, formwork) – the use of a laser rangefinder; documentation in a digital version – drawings of formwork (mold, formwork) of the beam (AutoCad); digital object model IFC format – beam element (Trimble Connect viewer).

→ Preparation of a protocol of acceptance of works – document.

LS 2.2
Preparation and montage of reinforced concrete beam reinforcement using digital methods.

Reference value time:
5 hours (a 45 min)

Description of the situation:

Before the implementation of construction works consisting in the preparation and assembly of reinforcement, you receive from the designer / construction manager (teacher) construction documentation in digital version (reinforcement drawings in *dwg* format, digital model of the object *IFC* format – beam element, reinforcement steel statement). For the preparation and assembly of reinforcement you need the dimensions of the reinforcement (length, diameter, shape) and notes on how to connect the rebars.

Working task:

Make a reinforced concrete beam reinforcement skeleton in accordance with the dimensions that you will read from the construction documentation received in a digital version (available on the platform) from the designer / construction manager (teacher). To read dimensions using a tablet, use *AutoCad* and the *Trimble Connect web model viewer*. After dewatering the dimensions, make a skeleton of the beam reinforcement by systematically checking the dimensions with a laser rangefinder and a measure. The working task is carried out during practical classes.

General implementation guidelines and clarifications

The Google Classroom learning platform can be used for implementation. It is used to place materials in a digital version on the basis of which students will carry out a working task (drawings in a digital version in dwg format, an object model in IFC format – a beam element, instructions on reinforcement assembly, instructional videos, etc.), but also to secure (save) the results of work (photos, videos, results of acceptance - forms). When performing a working task, it is envisaged to work in teams of 2 people.

Teaching materials

- *AutoCad*
- viewer of digital models saved in *IFC Trimble Connect* format
- Laser spirit level
- Laser rangefinder
- Digital devices (smartphone or tablet)
- Internet access
- information materials – Google Classroom platform (e.g. instructional videos, photos)

Professional competence	Personal and social competence	Language and communication competences
Students should:		
▪ be able to choose the right device and digital programs to read dimensions from digital documentation ▪ be able to export data in the right form for further use ▪ be able to use digital devices and programs to read dimensions from digital documentation ▪ be able to use digital tools in control and measurement activities ▪ be able to choose the right digital device and programs for saving and transferring digital data	▪ observe the principles of personal culture and professional ethics ▪ plan the execution of the task ▪ be responsible for the actions taken ▪ be creative and open to change ▪ use stress management techniques ▪ improve professional skills ▪ apply the principles of interpersonal communication ▪ use methods and techniques of problem solving ▪ collaborate in a team	▪ use the basic resource of language means in a foreign language, enabling the implementation of professional activities ▪ understand oral statements, as well as simple written statements in a foreign language, to the extent enabling the implementation of professional tasks ▪ independently create short, simple, consistent and logical oral and written statements in a foreign language, to the extent enabling the implementation of professional tasks ▪ participate in the conversation in typical situations related to the implementation of professional tasks – ▪ react in a foreign language in an understandable way adequately to the communicative situation, orally or in the form of a simple text ▪ change the form of oral or written transmission in a foreign language in typical situations related to the performance of professional activities ▪ use strategies to improve their own language skills and raise language awareness

Prior knowledge	Assessment	Interdisciplinary references
▪ general knowledge in the field of construction ▪ knowledge of issues related to the technology of reinforcement and concrete works ▪ ability to use drawing documentation (reading a technical construction drawing, knowledge of construction standards for drawing) ▪ basic knowledge of the use of digital devices (smartphone, tablet) ▪ basic knowledge of the digital environment applicable in construction (computer programs used in construction) ▪ ability to use digital control and measurement tools	▪ JPG files constituting photographic documentation of a correctly assembled beam reinforcement ▪ MP4 files constituting film documentation of a correctly assembled beam reinforcement ▪ text files - results of receipt (forms), the result, i.e. checking the dimensions (spacing, lengths, bar cover) ▪ workflow (using digital devices, e.g. tablet, digital programs e.g. Trimble Connect browser, digital tools, e.g. laser rangefinder) ▪ team work ▪ work cycle (compliance with health and safety regulations)	▪ knowledge of digital teaching methods in various vocational education subjects (theoretical and practical) ▪ knowledge of a professional foreign language (e.g. English) as a universal language for navigating through the digital environment used in construction

Application in the following professions:	Levels:
· construction technician on the basis of qualification: BUD.01. performing reinforcement and concrete works	▪ **PQF** level 4 (**NQF**) equivalent to **EQF** level 4 - diploma confirming full qualifications (BUD.01. and BUD.14.) after graduating from technical secondary school

TOPIC OVERVIEW

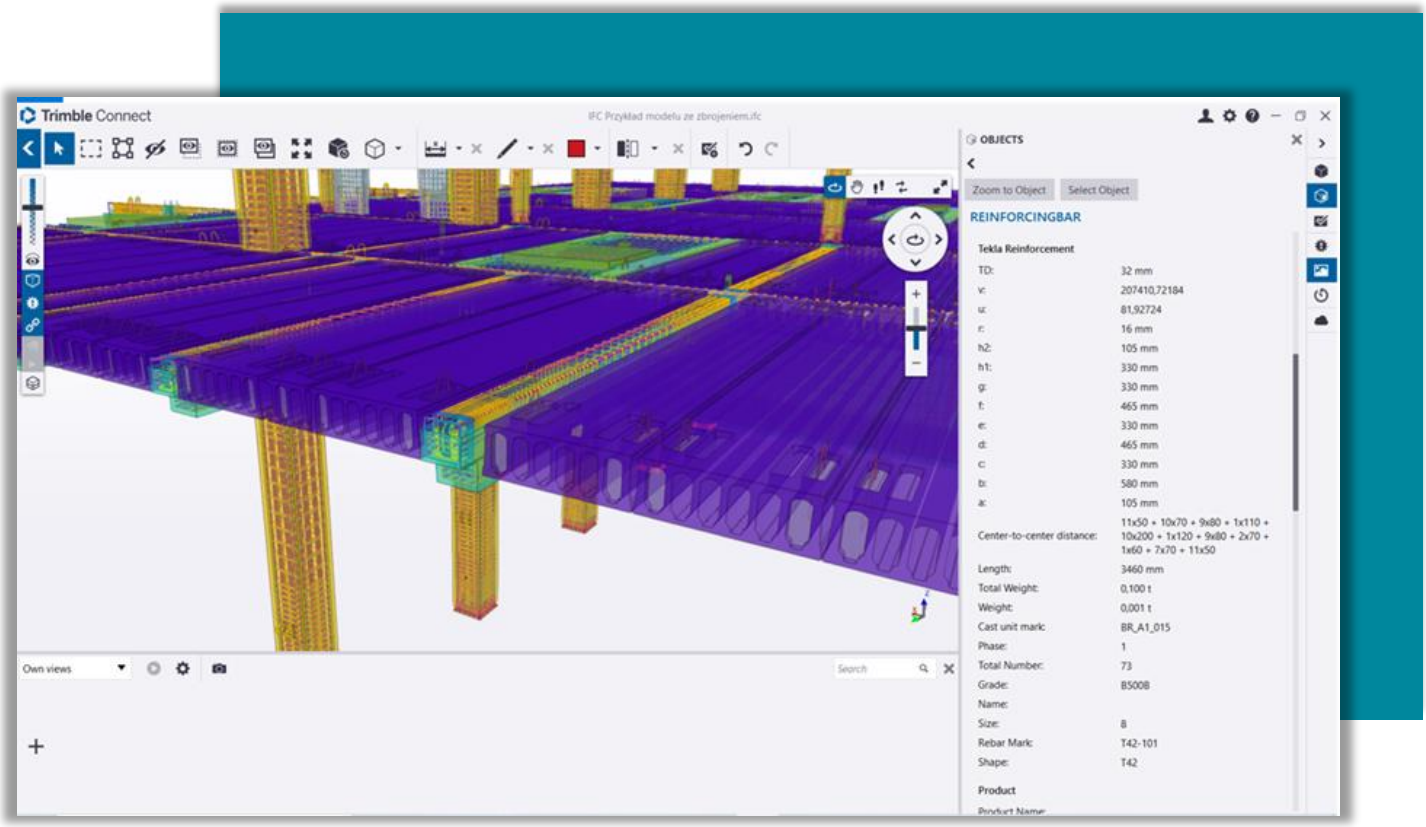
The use of digital methods in the preparation and installation of beam reinforcement.

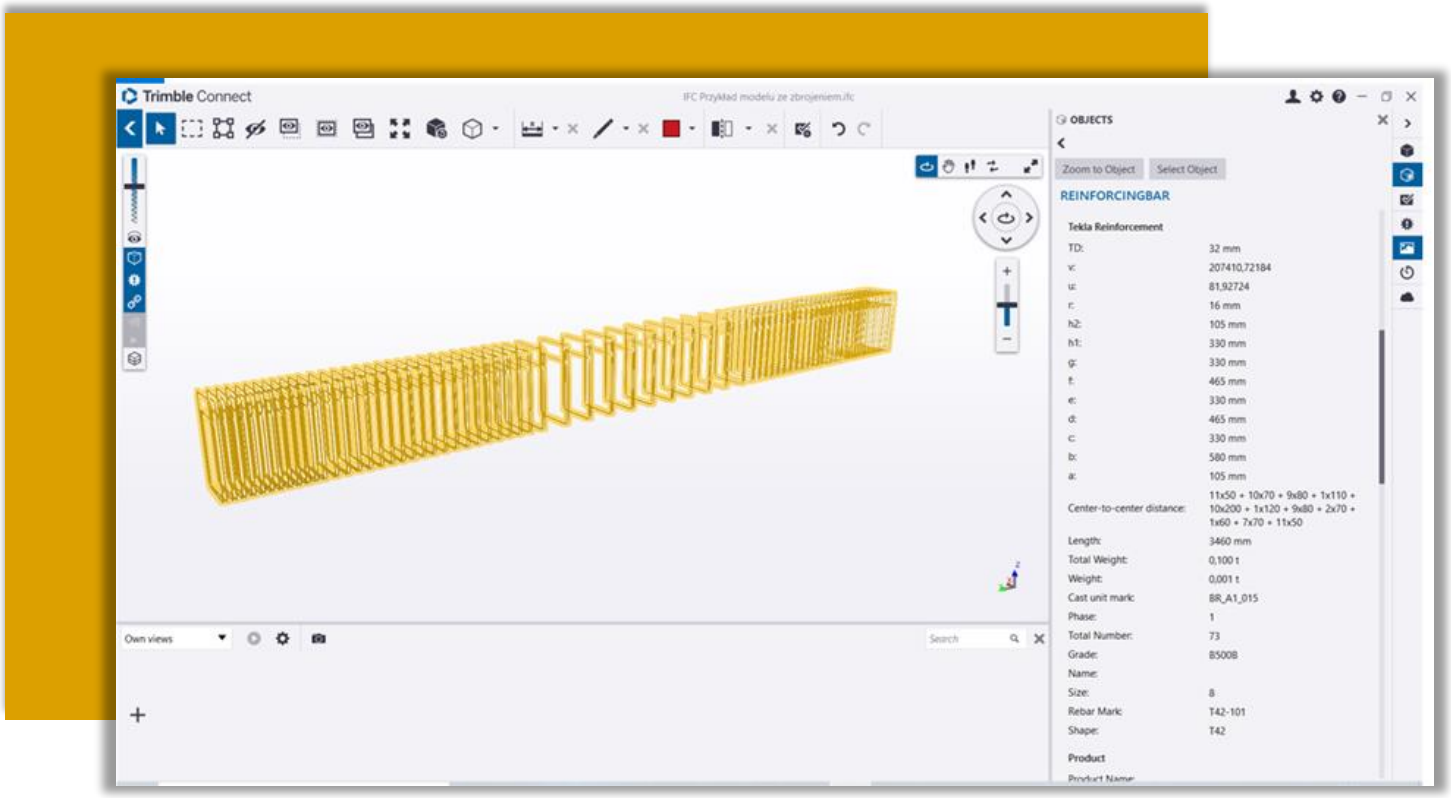
1. Preparation of beam reinforcement

→ Cleaning of rebar with wire brushes.

→ Cutting and bending rebar in accordance with the design assumptions – appropriate shape and dimensions (reinforcement drawings).

→ The use of documentation in a digital version – drawings of beam reinforcement (AutoCad); digital object model IFC format – beam reinforcement element (Trimble Connect browser).





→ Checking the diameters of the bars, their arrangement (spacing) in the formwork and whether the concrete cover has been preserved – the use of a laser rangefinder; documentation in a digital version – drawings of beam reinforcement (AutoCad); digital object model IFC format – beam reinforcement element (Trimble Connect browser).

→ Checking the durability (strength) of the joints of the rods.

→ Preparation of a protocol of acceptance of works – document.

LS 2.3
Laying and compacting of concrete mix using digital methods.

Time benchmark:
2 hours (a 45 min)

Description of the situation:

Before carrying out construction works involving the laying and compaction of the concrete mix, you receive instructions from the construction manager (teacher) on how (manual/mechanical methods) to lay and compact the concrete mix in the digital version (instructions, guidelines, instructional videos). For laying and compacting the concrete mix, depending on the method adopted, you need the right tool/machine.

Working task:

Arrange the concrete mix in a mold and then compact it according to the documentation received in a digital version (available on the platform) from the construction manager (teacher). Use a web browser to read documentation using your tablet. The working task is carried out during practical classes.

General implementation guidelines and clarifications

The Google Classroom learning platform can be used for implementation. It is used to place materials in a digital version on the basis of which students will carry out a working task (drawings in a digital version in dwg format, an object model in *IFC* format – a beam element, instructions on laying and compacting a concrete mix, instructional videos, etc.), but also to secure (save) the results of work (photos, videos, acceptance results - forms). When performing a working task, it is envisaged to work in teams of 2 people.

Teaching materials

- *AutoCad*
- Viewer of digital models saved in *IFC Trimble Connect* format
- Digital devices (smartphone or tablet)
- Internet access
- information materials – Google Classroom platform (e.g. instructional videos, photos)

Professional competence	Personal and social competence	Language and communication competences
Students should:		
▪ be able to choose the right device and digital thresholds to read the necessary information from digital documentation ▪ be able to export data in the right form for further use ▪ be able to use digital devices and programs to read the necessary information from digital documentation ▪ be able to choose the right digital device and programs for saving and transferring digital data	▪ observe the principles of personal culture and professional ethics ▪ plan the execution of the task ▪ be responsible for the actions taken ▪ be creative and open to change ▪ use stress management techniques ▪ improve professional skills ▪ apply the principles of interpersonal communication ▪ use methods and techniques of problem solving ▪ collaborate in a team	▪ use the basic resource of language means in a foreign language, enabling the implementation of professional activities ▪ understand oral statements, as well as simple written statements in a foreign language, to the extent enabling the implementation of professional tasks ▪ independently create short, simple, consistent and logical oral and written statements in a foreign language, to the extent enabling the implementation of professional tasks ▪ participate in the conversation in typical situations related to the implementation of professional tasks – ▪ react in a foreign language in an understandable way adequately to the communicative situation, orally or in the form of a simple text ▪ change the form of oral or written transmission in a foreign language in typical situations related to the performance of professional activities ▪ use strategies to improve their own language skills and raise language awareness

Prior knowledge	Assessment	Interdisciplinary references
▪ general knowledge in the field of construction ▪ knowledge of issues related to the technology of reinforcement and concrete works ▪ ability to use drawing documentation (reading a technical construction drawing, knowledge of construction standards for drawing) ▪ basic knowledge of the use of digital devices (smartphone, tablet) ▪ basic knowledge of the digital environment applicable in construction (computer programs used in construction)	▪ JPG files constituting photographic documentation of the laid concrete mix in the form of ▪ MP4 files constituting film documentation showing the method of laying and compacting the concrete mix in the form of ▪ workflow (using digital devices, e.g. tablet, digital programs, e.g. Trimble Connect browser – control of the amount / volume of concrete mix used) ▪ team work ▪ workflow (compliance with health and safety regulations)	▪ knowledge of digital teaching methods in various vocational education subjects (theoretical and practical) ▪ knowledge of a professional foreign language (e.g. English) as a universal language for navigating through the digital environment used in construction

Application in the following professions:	Levels:
▪ construction technician on the basis of qualification: BUD.01. performing reinforcement and concrete works	▪ **PQF** level 4 (**NQF**) equivalent to **EQF** level 4 - diploma confirming full qualifications (BUD.01. and BUD.14.) after graduating from technical secondary school

TOPIC OVERVIEW

The use of digital methods in the laying and compaction of concrete mix.

1. Manual/mechanical laying of concrete mix using a hydraulic concrete pump
2. Care of fresh concret

LS 2.4
Dismantling of the formwork (form, formwork) of the beam using digital methods.

Time benchmark:
2 hours (a 45 min)

Description of the situation:

Before the implementation of construction works involving the dismantling of the formwork (mold, formwork) of the beam, you receive instructions from the construction manager (teacher) on how to dismantle the formwork (mold, formwork) in the digital version (instructions, guidelines, instructional videos). For disassembling formwork (mold, formwork) depending on the method adopted, you need the right tools.

Working task:

Perform the disassembly of the formwork (mold, formwork) of the beam according to the documentation received in the digital version (available on the platform) from the construction manager (teacher). Use a web browser to read documentation using your tablet. The working task is carried out during practical classes.

General implementation guidelines and clarifications

The Google Classroom learning platform can be used for implementation. It is used to place materials in a digital version on the basis of which students will carry out a working task (drawings in a digital version in dwg format, an object model in IFC format – a beam element, instructions on dismantling formwork (mold, formwork), instructional videos, etc.), but also to secure (save) the results of work (photos, videos, acceptance results - forms). When performing a working task, it is envisaged to work in teams of 2 people.

Teaching materials

- *AutoCad*
- Viewer of digital models saved in IFC Trimble Connect format
- Digital devices (smartphone or tablet)
- Internet access
- Information materials – Google Classroom platform (e.g. instructional videos, photos)

Professional competence	Personal and social competence	Language and communication competences
Students should:		
▪ be able to choose the right device and digital thresholds to read the necessary information from digital documentation ▪ be able to export data in the right form for further use ▪ be able to use digital devices and programs to read the necessary information from digital documentation ▪ be able to choose the right digital device and programs for saving and transferring digital data	▪ observe the principles of personal culture and professional ethics ▪ plan the execution of the task ▪ be responsible for the actions taken ▪ be creative and open to change ▪ use stress management techniques ▪ improve professional skills ▪ apply the principles of interpersonal communication ▪ use methods and techniques of problem solving ▪ collaborate in a team	▪ use the basic resource of language means in a foreign language, enabling the implementation of professional activities ▪ understand oral statements, as well as simple written statements in a foreign language, to the extent enabling the implementation of professional tasks ▪ independently create short, simple, consistent and logical oral and written statements in a foreign language, to the extent enabling the implementation of professional tasks ▪ participate in the conversation in typical situations related to the implementation of professional tasks – ▪ react in a foreign language in an understandable way adequately to the communicative situation, orally or in the form of a simple text ▪ change the form of oral or written transmission in a foreign language in typical situations related to the performance of professional activities ▪ use strategies to improve their own language skills and raise language awareness

Prior knowledge	Assessment	Interdisciplinary references
▪ general knowledge in the field of construction ▪ knowledge of issues related to the technology of reinforcement and concrete works ▪ ability to use drawing documentation (reading a technical construction drawing, knowledge of construction standards for drawing) ▪ basic knowledge of the use of digital devices (smartphone, tablet) ▪ basic knowledge of the digital environment applicable in construction (computer programs used in construction)	▪ JPG files constituting photographic documentation of dismantled formwork (form, formwork) of the beam ▪ MP4 files constituting film documentation showing how to dismantle the formwork (formwork, formwork) of the beam ▪ workflow (using digital devices, e.g. tablet, digital programs e.g. Trimble Connect browser – control of the order of disassembled formwork elements) ▪ team work ▪ workflow (compliance with health and safety regulations)	▪ knowledge of digital teaching methods in various vocational education subjects (theoretical and practical) ▪ knowledge of a professional foreign language (e.g. English) as a universal language for navigating through the digital environment used in construction

Application in the following professions:	Levels:
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TOPIC OVERVIEW

The use of digital methods in the disassembly of formwork (mold, formwork) of the beam:

1. Disassembly of formwork (mold, formwork) after (x days) from laying the concrete mix in formwork (form, formwork)
2. Disassembly of individual formwork elements (mold, formwork)

LS 2.5
Final acceptance of the beam using digital methods

Time benchmark:
2 hours (a 45 min)

Description of the situation:

Before the final technical acceptance of the made beam, you receive from the construction manager (teacher) construction documentation in digital version (drawings of the beam in dwg format and a digital model of the object in *IFC* format – beam element). To perform the final technical acceptance of the beam, you need the information contained in the construction documentation received in a digital version and appropriate tools for acceptance and control activities.

Working task:

Make the final technical acceptance of the made beam and check the correctness of its execution with the construction documentation received in a digital version (available on the platform) from the construction manager (teacher). To perform receiving and controlling activities, use a tablet equipped with *AutoCad* and an online view of *Trimble Connect* models. Carry out control activities using digital tools, e.g. laser rangefinder, laser spirit level. The working task is carried out during practical classes.

General implementation guidelines and clarifications

The Google Classroom learning platform can be used for implementation. It is used to place materials in a digital version on the basis of which students will carry out a working task (drawings in a digital version in dwg format, an object model in *IFC* format – a beam element, etc.), but also to secure (save) the results of work (photos, videos, results of receipts - forms). When performing a working task, it is envisaged to work in teams of 2 people.

Teaching materials

- *AutoCad*
- Viewer of digital models saved in IFC Trimble Connect format
- Laser spirit level
- Laser rangefinder
- Digital devices (smartphone or tablet)
- Internet access
- Information materials – Google Classroom platform (e.g. instructional videos, photos)

Professional competence	Personal and social competence	Language and communication competences
Students should:		
▪ be able to choose the right device and digital programs to read dimensions from digital documentation ▪ be able to export data in the right form for further use ▪ be able to use digital devices and programs to read dimensions from digital documentation ▪ be able to use digital tools in control and measurement activities ▪ be able to choose the right digital device and programs for saving and transferring digital data	▪ observe the principles of personal culture and professional ethics ▪ plan the execution of the task ▪ be responsible for the actions taken ▪ be creative and open to change ▪ use stress management techniques ▪ improve professional skills ▪ apply the principles of interpersonal communication ▪ use methods and techniques of problem solving ▪ collaborate in a team	▪ use the basic resource of language means in a foreign language, enabling the implementation of professional activities ▪ understand oral statements, as well as simple written statements in a foreign language, to the extent enabling the implementation of professional tasks ▪ independently create short, simple, consistent and logical oral and written statements in a foreign language, to the extent enabling the implementation of professional tasks ▪ participate in the conversation in typical situations related to the implementation of professional tasks – ▪ react in a foreign language in an understandable way adequately to the communicative situation, orally or in the form of a simple text ▪ change the form of oral or written transmission in a foreign language in typical situations related to the performance of professional activities ▪ use strategies to improve their own language skills and raise language awareness

Prior knowledge	Assessment	Interdisciplinary references
▪ general knowledge in the field of construction ▪ knowledge of issues related to the technology of reinforcement and concrete works ▪ ability to use drawing documentation (reading a technical construction drawing, knowledge of construction standards for drawing) ▪ basic knowledge of the use of digital devices (smartphone, tablet) ▪ basic knowledge of the digital environment applicable in construction (computer programs used in construction) ▪ ability to use digital control and measurement tools	▪ JPG files constituting photographic documentation of a correctly made beam ▪ text files - collection results (forms) ▪ workflow (use of digital devices, e.g. tablet, digital programs e.g. Trimble Connect browser, digital tools e.g. laser rangefinder, laser spirit level) ▪ team work ▪ workflow (compliance with health and safety regulations)	▪ knowledge of digital teaching methods in various vocational education subjects (theoretical and practical) ▪ knowledge of a professional foreign language (e.g. English) as a universal language for navigating through the digital environment used in construction

Application in the following professions:	Levels:
▪ construction technician on the basis of qualification: BUD.01. performing reinforcement and concrete works	▪ **PQF** level 4 (**NQF**) equivalent to **EQF** level 4 - diploma confirming full qualifications (BUD.01. and BUD.14.) after graduating from technical secondary school

TOPIC OVERVIEW

The use of digital methods in the final technical acceptance of the made beam.

1. Checking the compliance of the dimensions of the reinforced concrete beam with the model of the object (beam element) – using a measure, a laser rangefinder; documentation in digital version – beam drawings (*AutoCad*); digital object model IFC format – beam element (*Trimble Connect browser*)
2. Check that the surface of the beam does not crack and that adequate deviations have been maintained
3. Preparation of the final acceptance protocol of the executed element

2.3 Learning scenario 3: Roof Construction

LS 3.1
Be able to read in and process data models

Time benchmark:
24 hours (a 60 min)

Situation description:

Obtaining a digital building model.

Work task:

- What is a read-in format?
- Gain knowledge of the different read-in formats
- Determine read-in formats
- Prepare read-in format for the roof truss

General implementation instructions and explanations

Licensed programmes and free manufacturer software "freeware" are used for the implementation.

Implementation of the learning unit as group work for:

- Determine read-in formats in relation to my work

Carrying out the learning unit as individual work for:

- Act read-in format,
- Prepare read-in format for my roof truss

Teaching materials

- Digital terminals (laptop, PC, laser measuring devices for controls)
- School software for the creation of the roof truss *CADWork*
- Soft or "free" goods for the use of the read-in formats (*BimVision, Allplan BimPlus*, etc.)
- Storage medium (cloud, USB)
- Information materials (TEAMS platform, DALUX "free provision of the manufacturer for school use)

<table>
<tr><th colspan="2">Professional skills</th><th>Linguistic & communicative competence</th></tr>
<tr><td colspan="3">The pupils must:</td></tr>
<tr><td colspan="2">▪ handle the given software for reading in the data models
▪ be able to edit data models structurally
▪ prepare the data model for the creation of the future roof truss, CadWork</td><td>▪ communicate with the stakeholders within the group
▪ write the information on the structural features
▪ correct application of technical terms and software</td></tr>
<tr><th>Previous knowledge</th><th>Evaluation</th><th>Interdisciplinary references</th></tr>
<tr><td>▪ Basic knowledge in the use of laptop and PC as well as 3D software
▪ Basic knowledge of data storage and transmission,
▪ Prior technical knowledge of building situations,
▪ Written language competences</td><td>▪ Suitable file formats in 2 and 3D
▪ Text data
▪ Handling the equipment and teamwork,</td><td></td></tr>
<tr><td colspan="3">Evaluation

The students are able to read in the models independently, to orientate themselves three dimensionally, to complete the task three-dimensionally.</td></tr>
</table>

LS 3.2
Draw the roof truss in 3D based on a model

Time benchmark:
12 hours (a 60 min)

Situation description:

Obtaining a digital building model.

Work task:

- Laser measurement
- Check the given masonry contours, complete them and redraw them if necessary
- Real building contours
- Compare new building contours with the structural engineer, check adjustments, read- in of the new data
- Drawing the new roof truss
- Consideration of timber joints, roofing and insulation materials

General implementation instructions and explanations

- Use the manufacturer software for the implementation. Predominant use and further processing of IFC data models.
- Backup of data via CLOUD or hard disk
- Carry out the learning unit as individual or group work

Teaching materials

- Digital terminals (laptop, PC, laser measuring devices)
- Internet access,
- IFC data exchange formats (IFC)
- Storage medium (cloud, USB)
- Information materials (TEAMS platform)

<table>
<tr><td colspan="2">Professional competences</td><td>Linguistic & communicative competence</td></tr>
<tr><td colspan="3">The students should:</td></tr>
<tr><td colspan="2">▪ be able to create roof trusses three-dimensionally with the given software</td><td>▪ communicate with the stakeholders within the group
▪ write the information on the structural features, exchanging data and re-reading the data</td></tr>
<tr><td>Previous knowledge</td><td>Evaluation</td><td>Interdisciplinary references</td></tr>
<tr><td>▪ Basic knowledge of data storage and transmission, laser measurement
▪ Prior technical knowledge of building situations,
▪ Written language competences</td><td>▪ Suitable file formats in 3D,
▪ Text data,
▪ Handling the equipment and teamwork</td><td></td></tr>
<tr><td colspan="3">Evaluation
The students are able to create a roof truss 3 dimensional.</td></tr>
</table>

LS 3.3
Output the model in the exchange format for the purpose of follow-up check

Time benchmark:
16 hours (a 60 min)

Situation description:

Revise existing model according to specifications.

Work task:

- Output a given model,
- Incorporate requested adjustments into the model
- Produce the execution documents (2D and 3 D as well as data models)
- Issue models for follow-up inspection and approval

General implementation instructions and explanations

- Manufacturer software is used for the implementation. Predominant use and further processing of IFC data models,
- Backup of data via CLOUD or hard disk
- Carry out the learning unit as individual or group work

Teaching materials

- Digital terminals (laptop, PC, laser measuring devices)
- Internet access,
- IFC data exchange formats (IFC)
- Storage medium (cloud, USB)
- Information materials (TEAMS platform)

Professional competences	Linguistic & communicative competence
The students are able to...	
▪ Aligne and supplement data models ▪ Exchange, re-read and adapt data models ▪ Send the data in an adequate exchange format for storage and further use	▪ communicate with the stakeholders within the group, ▪ write the information on the structural features, exchanging data and re-reading the data

Previous knowledge	Evaluation	Interdisciplinary references
▪ Basic knowledge of data exchange and handling of IFC formats, ▪ Basic knowledge of data storage and transmission, ▪ be able to create roof trusses three-dimensionally, ▪ Written language competences	▪ Suitable file formats in 3D, ▪ IFC text data, ▪ Handling the equipment and teamwork	
Evaluation The students are able to transmit the data in the international standard and to read in their delivered corrections in your software, to handle them and to release them for the post-control.		

LS 3.4
Handing the collected information for the production

Time benchmark:
8 hours (a 60 min)

Situation description: Information evening theoretical and practical. **Work task:** ▪ None		
General implementation instructions and explanations		
Implementation as group work.		
Teaching materials		
▪ Digital terminals (laptop, PC) ▪ Internet access, ▪ DXF "IFC" data exchange formats ▪ Storage medium (cloud, USB)		
Professional skills		**Linguistic & communicative competence**
The students are able to...		
▪ read in data model and adapt to machine parameters and tools		▪ communicate with the stakeholders within the group
Previous knowledge	**Evaluation**	**Interdisciplinary references**
▪ Transfer file of the roof truss on machine		
Evaluation ▪ Students are able to submit the file		

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