



## PR4 Report – Testing and updating of learning material

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### Short Description:

Deliverable PR4 is a report on the testing actions carried out to assess and update the learning materials produced as PR3. PR4 contains two tasks: T4.1: Design, planning and implementation of testing, and T4.2: Tuning of learning materials.

### Keywords:

BIRGIT Project, BIM and GIS integration, vocational training,

### Dissemination Level

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## 1 Introduction

The objective of this report is to describe the results of BIRGIT Project Results 4 (PR4) activities about the testing and updating of learning materials developed in PR3.

PR4 is divided into two tasks, namely *T4.1: Design, planning and implementation of testing of training materials*, and *T4.2: Tuning of training materials*.

### 1.1 The BIRGIT project

Both in the public and private sectors, the construction and geospatial (mapping) industries are demanding new approaches for urban planning, asset design and management. Digitization is one of the key developments to reduce costs, environmental impact and carbon footprints. One of the fundamental approaches in this development is bringing together Building Information Modelling (BIM) and Geographic Information Systems (GIS) technologies. By connecting the construction and geospatial information management, an increased improvement of the construction processes, asset management, including buildings, roads, and other essential public facilities, will be provided.

There is a lack of skilled personnel, especially in VET courses, addressing the competencies required to achieve BIM-GIS integration. The study “*Challenges and Opportunities for BIM-GIS Integration*”<sup>1</sup> published by members of the consortium and based on insights gathered during the first phase of the project, emphasizes the need for educational solutions that train specialists with expertise in both areas to facilitate successful BIM-GIS integration.

Existing VET programs across Europe for civil engineers, architects, land surveyors, geographers and other professionals working in the built environment and urban management, usually include separate courses in BIM or GIS, but not their integration. As a consequence, professionals in these domains rarely know how to solve problems where a unified approach to BIM and GIS data management is needed.

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<sup>1</sup> <https://hrcak.srce.hr/file/466472>



The industry, however, is moving fast and new technologies are now being implemented within private companies and public authorities. This development clearly characterises one structural problem in the current education system, namely that new technologies and collaboration patterns put new requirements on education providers, who often have difficulties in coping with these requirements and a fast-changing society.

The main objective of this project is to bridge the gap between supply and demand of these skills by improving the quality of the existing VET offers by providing new courses. New learning materials aiming at developing the necessary skills to integrate BIM and GIS will be developed. These materials will specify learning outcomes addressing the achievement of knowledge on methods and mechanisms (mostly software tools and data modelling) but also on practical application cases. The expected general impact will be the improvement of quality of the VET programmes within the partnership and the possibility of using these courses by other training providers as well.

The Project results (PRs) are:

- PR1 Industry requirements on BIM-GIS training programs and courses
- PR2 Localization of existing courses
- PR3 Development of new courses
- PR4 Testing and updating of learning material

## **1.2 PR4 Testing and updating of learning material**

The goal of PR4 is to evaluate the quality of the BIM-GIS training offers developed in PR3 and the related learning materials, to collect suggestions for improvements and to implement a selected set of improvements. The Project Result leading organisation is FORMA.Azione srl.

The main element for the testing is the feedback coming from the different training actions organized in each participating country (Croatia, Italy, Spain and Sweden) that made use of the developed training materials. Such testing actions were carried out both in classroom settings and in online form.



The following tasks were implemented: T4.1: Design, planning of testing of training offer and learning material, and Task 4.2. Tuning of the training materials.

Task 4.1 involved both the planning and organisational aspects of these training actions and the methods for collecting and processing the feedback on the quality and usability of the learning materials. All feedback received from the users participating in those actions were thus collected.

Task 4.2 involved the analysis and selected implementation of feedback and suggestions for improvement collected, used to tune and adjust the materials and platforms/means for the provision of these materials before the end of the project.

The main target group of this project result was mainly the developers of the learning material. The impact of this activity is primarily that the produced learning material has been improved, validated, and updated, making it ready for download on the BIRGIT website for a wide EU audience. Additionally, the improved and assessed training materials can be utilized by training providers in future training sessions to be organized.

### **1.3 Structure of the document**

The document is organised as follows. Chapter 2 describes the actions carried out in *T.4.1 Testing of training offer and learning materials*, namely the design of the methods for collecting and processing feedback and the description of the 4 tests conducted.

Chapter 3 presents the methodology and results related to *Task 4.2. Tuning and improvement of the Training Materials*, with a description of the methodologies applied, as well as their results and analysis of feedback, and finally the tuning actions implemented.

Chapter 4 is dedicated to the future sustainability and exploitation strategies of training materials, with a section on each of the training providers involved in the project (University North, AIN, FORMA.Azione and Ocellus).

Finally, in Chapter 5, the PR4 results are summarised and discussed together with main conclusions.



The annexes of this report provide valuable supplementary information that complements the main content and offers additional insights into the methodologies, tools, and feedback utilized throughout the project. Below is an overview of the annexes included in the report:

Annex I includes the templates for the satisfaction questionnaires used to gather feedback from both students and trainers. Annex II presents the questionnaire designed to evaluate participants' knowledge before and after the training sessions. Annex III provides the standardized template used for submitting and documenting change requests. Finally, Annex IV details the specific change requests received during the project. It includes a comprehensive list of feedback from various stakeholders, outlining the nature of each request, the proposed solutions, and their status in the revision process.

## **2 Testing of training offer and learning materials**

A series of four tests (training actions) were arranged, one in each of the participating countries (Croatia, Italy, Spain and Sweden), where the developed training modules or selected parts of them were tested by the target groups.

Each test shared several common organisational and content elements, but the final design and implementation was the responsibility of the involved training providers. This task also specified the methods for collecting and processing the feedback on the materials and the user experience during the organized training actions. Satisfaction questionnaires were used both for learners and for trainers, and learners were asked to complete a preliminary self-assessment questionnaire on existing knowledge and competences and an ex-post self-assessment questionnaire on the same topic.

The questionnaires complied with the EQAVET (European Quality Assurance in Vocational Education and Training) standard quality assurance and included relevant indicators and descriptors.

The leader of this task was AIN, with contributions by Forma.Azione, Ocellus, UniNorth, GISIG, and Novogit.



## 2.1 Methodology for collecting feedback

To evaluate the effectiveness and quality of the content developed within the framework of the project, an approach was designed based on the use of questionnaires aimed at both students and trainers. This method was applied in all countries conducting BIRGIT training actions with some variations since the questionnaires were translated to the local language.

The collection of feedback was conducted using two questionnaires, administered for each of the four training actions developed. These tools were designed to assess participant satisfaction and measure learning impact effectively.

This structured approach to feedback collection ensured a common and comprehensive understanding of both participant satisfaction and learning progression across the training activities.

The design of these questionnaires was based on the experience of project partners in quality assurance measurement, evaluation procedures gained also through previous European training projects. The questionnaire templates are provided in the Annex of this report.

### **The BIRGIT Self-Assessment questionnaires**

This questionnaire was designed to be used in two phases: the Previous Knowledge Self-Assessment phase and the Ex-Post Self-Assessment phase.

The questionnaire was intended to assess participants' baseline knowledge and competencies before starting the training course, and to evaluate their perceived progress and learning outcomes after completing the course.

Both questionnaires were anonymous and featured identical questions to allow for a direct comparison of responses before and after the course, thereby effectively measuring learning impact. Therefore, the only difference between the two questionnaires was the timing of administration: the Previous Knowledge Questionnaire was administered before the training, while the Ex-Post Self-Assessment was completed after the training concluded.

### **The BIRGIT Satisfaction questionnaires**

The BIRGIT Satisfaction Questionnaires were developed to gather feedback on the overall satisfaction of both course participants and teachers involved in tutoring or delivering the classes.





Therefore, this tool aimed to evaluate the experiences and perspectives of both learners and teachers regarding the training provided.

For teachers, the questionnaire was designed to assess the relevance of the course content, the overall quality of the presentations and accompanying materials, as well as the effectiveness of the methodology and didactic strategies employed.

For learners, the questionnaire enabled participants to evaluate the course content while also providing space for specific comments and suggestions, allowing them to share additional insights and recommendations.

The estimated completion time for the questionnaire, both for teachers and learners, was approximately 5-10 minutes and it was intended to be completed after the conclusion of the course.

Regarding the format of the questions, the main method used was the satisfaction scale, which ranged from “not at all satisfied” to “very satisfied”. This type of question had several advantages:

- Ease of response: Participants could quickly complete surveys, ensuring a high response rate.
- Simple quantitative analysis: The scales provided easily comparable data, which allowed the identification of general trends in the quality and effectiveness of the content.
- Impact measurement: For students, the same scales were used before and after the training to assess progress in their knowledge.

Strategic open-ended questions were also included in each questionnaire to obtain more detailed and specific feedback. These questions allowed participants to freely express their opinions, identify areas for improvement, and highlight positive aspects that had not been considered in the closed-ended questions. In the case of students, these questions addressed suggestions to improve the content or comments on their experience with the classes. For the trainers, the open-ended questions focused on the use of the teaching materials and the difficulties encountered during their implementation.



## 2.2 Planning and implementation of training actions

This section aims to describe the training tests carried out within the framework of the project, carried out by the four training providers involved: University North (Croatia), FORMA.Azione (Italy), AIN (Spain), and Ocellus (Sweden).

These tests were designed to evaluate the effectiveness of the modules developed, the quality of the teaching materials and the satisfaction of the participants, both students and trainers.

Each provider implemented the training modules in specific contexts, adapting the training methodologies to face-to-face or online modalities, according to the needs and characteristics of their target audience.

The following subsections provide an overview of the training actions conducted in each country, addressing key aspects such as the modules tested, the profiles of the trainers involved, the recognition given to the students and the training modalities used.

Provider	Place	Dates	Num. of Learners	Teaching method
University North (Croatia)	Varaždin	24 October 2024.	35	Presential (in-class lectures).
FORMA.Azione (Italy)	Perugia	From November 13 and to December 13, 2024.	38	Online synchronous (scheduled classes).
AIN (Spain)	Online	From September 15 to February 2, 2024.	32	Online asynchronous (using e-learning platform).
OCELLUS (Sweden)	Online	Between 30 September and 13 October 2024.	52	Online asynchronous (using e-learning platform).

*Summary of the testing actions conducted*



## 2.2.1 Croatia

### **Modules tested**

The testing of learning materials at University North was done on 24 October 2024.

The testing was organised as a part of regular teaching activities with the students (learners) of 2nd year of Geodesy and Geomatics on Bachelor study programme. The testing was organised as a whole day (8 hours) exercise with 35 learners (students) and 1 lecturer.

The testing was done with localised materials (in Croatian language).

The following learning materials were tested:

*Module: Introduction to BIM*

- Lecture: Fundamentals of BIM

*Module: 3D GIS, City Models and Digital Twins*

- Lecture: Introduction to Digital Urban Twins

*Module: BIM-GIS integration*

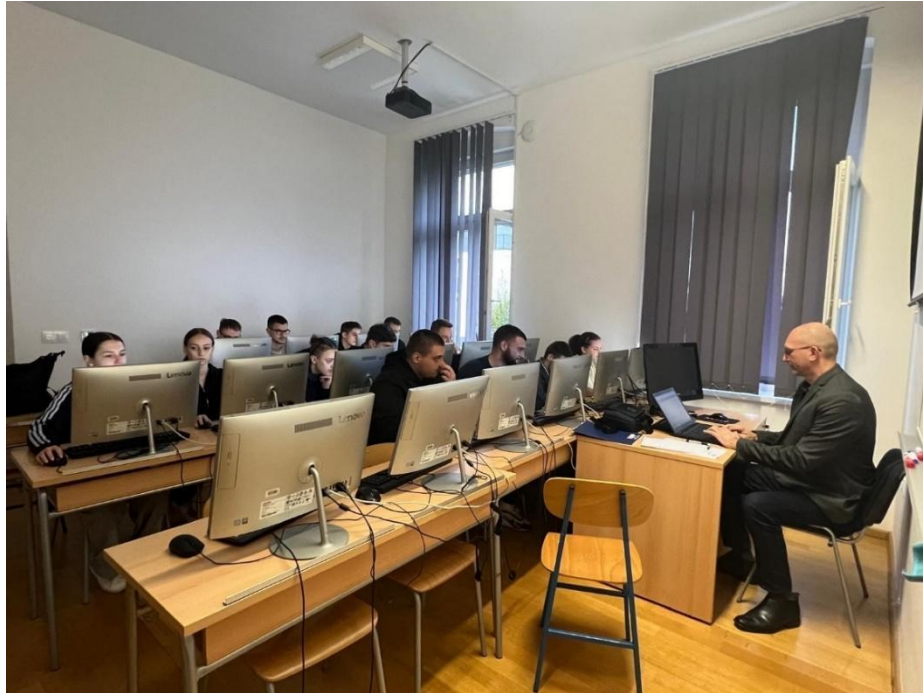
- Lecture: BIM-GIS Data Conversion

Learners were divided in 3 groups (Group 1 – 12 learners, Group 2 – 13 learners and Group 3 – 10 learners) and each group took part in one module (i.e. Group 1 in Fundamentals of BIM, Group 2 in Introduction to Digital Urban Twins and Group 3 in BIM-GIS Data Conversion).

The preparation took 2 hours and for each module 2 hours were used for testing.

### **Trainers involved**

One trainer (lecturer) was involved in the testing. He is working at the State Geodetic Administration in Croatia and is also engaged as an external teacher at the University North. University North staff involved as project partners were helping external lecturer in the preparation of testing.



*The testing was organised at the University North on 24 October 2024 in the Computer lab.*

### **Training methods**

The testing was organised synchronously in person.

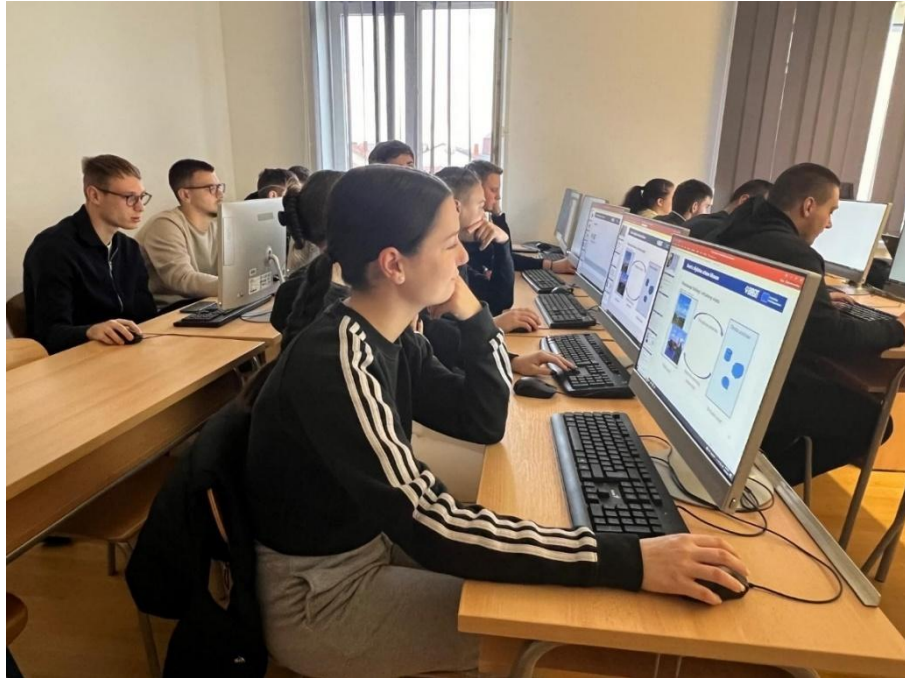
At the beginning of testing for each module, the trainer provided introduction and clear instruction to students about their tasks.

The testing for students for each module included 4 steps (in 2 hours' time):

- Self-Assessment of previous knowledge
- Testing of lecture (learning materials)
- Satisfaction Survey
- Ex-post Self-Assessment

### **Recognition**

The testing was organised during the schedule for regular exercise on the subject: Geoinformation Systems. All students participated voluntarily in the testing process. Nevertheless, their contribution will be awarded as an extra contribution in the subject Geoinformation Systems.



*Testing at the University North.*

### *2.2.2 Italy*

Between November 13 and December 4, 2024, a Pilot testing course was organized to participants with in-depth insights into testing methodologies and practices.

The pilot course was promoted through FORMA.Azione's communication channels and contact lists, ensuring broad outreach to local professionals. Aimed primarily at professionals and technical staff from public administrations, the course addressed the integration of Building Information Models (BIM) and Geographic Information Systems (GIS), particularly considering upcoming legislative requirements for BIM adoption in public procurement.

The course, conducted entirely online via the ZOOM platform, attracted a total of 46 registrants, out of which 38 professionals attended at least one full lecture. By the end of the program, 29 participants met the eligibility criteria to receive a certificate of attendance.

The course comprised five lectures, each lasting three hours, delivered by four highly experienced trainers who were invited to test and refine the materials. Trainers adhered to the original lecture



materials (slides and lecture notes) but, depending on their individual teaching styles and areas of expertise, some trainers also integrated the content for consistency, by adding practical examples and own materials. These integrations were explicitly communicated to the participants, and are not included in the list of change requests, since are to be considered adaptation to the trainers' teaching methods.

Participants were provided with an email containing a detailed description of the lecture content alongside the original program they subscribed to. This approach ensured clarity and allowed attendees to prepare effectively for each session. Moreover, to accommodate professionals unable to attend the sessions synchronously due to work commitments, all lectures were recorded. The recordings were made accessible to all participants until December 13.

### **Modules tested**

#### *Module: Introduction to BIM*

- Lecture: BIM for infrastructures and facility management
- Lecture: BIM for historical existing buildings

#### *Module: 3D GIS, City Models and Digital Twins*

- Lecture: Introduction to Digital Urban Twins
- Lecture: Concepts of 3D modelling of the built environment
- Lecture: Semantic 3D city models
- Lecture: 3D GIS data standards
- Lecture: 3D Data acquisition technologies
- Lecture: 3D Data Sources

#### *Module: BIM-GIS integration*

- Lecture: Introduction to BIM-GIS integration
- Lecture: BIM-GIS integration workflow
- Lecture: BIM-GIS Data Conversion
- Lecture: BIM-GIS integration in project life cycle
- Lecture: BIM-GIS integration use cases

### **Trainers involved**

The course was led by four trainers selected for their expertise, affiliation with key local organizations, and practical involvement in relevant fields. Each trainer was tasked with designing



their lectures based on the BIRGIT course materials, evaluating and selecting the most suitable content to align with their knowledge and teaching approach:

1. Giulia Calamita – architect specializing in participatory policy design and smart city solutions; manager of WiseTown, a brand of the software company TeamDev. She led projects like the digital twin of Perugia and worked on City of Parma’s Digital Twin, integrating urban management with public service optimization.
2. Chiara Montagnini – Civil Engineer specialized in Construction Engineering and BIM Coordination, with expertise as a BIM Specialist and Manager. Experienced in BIM modelling and design for public procurement projects. Trainer and Project Manager with a strong background in publicly funded initiatives focused on conservation.
3. Fabiana Ilari – structural engineer and certified Autodesk Revit professional; specialized in BIM processes, Revit workflows, and Scan-to-BIM for historical and contemporary structures. Experienced BIM trainer, integrating theoretical lectures with concrete examples on how to create detailed Revit parametric families and modelled buildings with precision using point cloud data.
4. Alessandro Santucci – GIS specialist and senior official in Tuscany’s regional government, working on georeferenced information systems, spatial databases, and environmental management. Lecturer on GIS at the University of Pisa’s Department of Engineering.

### **Training methods**

The training combined theory with practical applications, ensuring a balanced learning experience. Trainers tailored their sessions using BIRGIT course materials, selecting and adapting content based on their expertise. Lectures were delivered online via ZOOM and often supplemented with examples and additional resources. Recordings of all sessions were provided to ensure flexibility for participants unable to attend live, remaining accessible until December 13.

### **Recognition**

29 of the course participants received a certificate of attendance at the end of the testing course. The eligibility threshold was the attendance to at least 3 of the scheduled lectures, with the possibility to attend asynchronously through the recording.



### 2.2.3 Spain

#### **Modules tested**

The following learning materials were tested:

*Module: Introduction to BIM*

- Lecture: Fundamentals of BIM

*Module: 3D GIS, City Models and Digital Twins*

- Lecture: Introduction to Digital Urban Twins

*Module: BIM-GIS integration*

- Lecture: BIM-GIS Data Conversion

32 professionals from different sectors followed the online courses.

AIN is an expert in training employed people. The trainees were mostly professionals such as the COAVNA (Official College of Basque-Navarrese Architects), professionals working for the government of the Basque Country in the department of transport and workers of the Spanish UNED (National University of Distance Education).

The diversity of student profiles contributed significantly to the enrichment of the training process, since each participant contributed with different experiences and perspectives, promoting collaborative and multidisciplinary learning.

#### **Trainers involved**

1. Esther Bautista, PhD in industrial engineering, bachelor's and master's degree in education, GIS training manager at AIN; work experience in GIS and surveying. Esther's role during the course was to answer the students' questions about BIM and GIS.
2. Carlos Clemente, Telecommunications Engineer, Project Manager at AIN. Carlos' role during the course was to answer the most basic questions about the contents of the courses, management of the application that hosts the courses and collection of all the information generated by the students.





## **Training methods**

The training was carried out online, using the AIN training portal as the main platform. AIN's approach to managing the course involves publishing it and scheduling enrolment periods every 15 days. This system allowed the 32 participants in the pilot program to enrol in small groups, facilitating better tracking of student progress and more efficient organizational management.

The pilot program ran from September, when the first students enrolled, until December, at which point the active promotion of the courses was reduced. Although the courses remain published and open for anyone interested in expanding their knowledge of BIM and GIS, no additional enrolments have been recorded since the end of the dissemination period.

The course was designed in a sequential format, ensuring that students complete each unit before progressing to the next. This approach ensures that participants acquire the knowledge and skills progressively and comprehensively, which is essential for obtaining the certificate of achievement.

## **Teaching materials:**

- The units were presented in SCORM format, as dynamic presentations that facilitate the understanding of key concepts.
- Each unit includes supplementary material in PDF format, which students can download to deepen the topics covered in the presentations.
- Practical exercises: Exercises were designed to reinforce learning and allow participants to apply the knowledge acquired to real situations.

## **Recognition**

At the end of the course, students who completed the training activities and answered the assessment questionnaires received an official attendance certificate issued by AIN.

To receive the certificate, participants should meet the following requirements:

- Students must complete the training program, demonstrating an adequate level of understanding and dedication to the topics covered.
- Participate in the evaluation of the course.



- Provide constructive feedback: In addition to completing the satisfaction scales, students are encouraged to include observations and suggestions that can be used to improve future training programs.

## 2.2.4 Sweden

### Modules tested

In Sweden, the original learning materials were adapted from all three modules. A selection of the materials from the different modules was made to best match the general knowledge level of other courses provided by OCELLUS. The selection also served to avoid the inclusion of much too detailed technical information such as the specifics of the structure of IFC-files and the like when there were no practical assignments included to take advantage of this knowledge.

The selected materials were then rewritten in its entirety to better align with a video-based format and the general presentation of other OCELLUS course materials. The preparation of the video material was not financed by the project but carried out using external resources. As a result, the video material is not considered as project results and is not considered as open material. However, the lecture notes and assignments in English and Swedish underpinning the videos, are classified as project results and consequently provided under open licenses.

The learning materials that were adapted in the creation of this OCELLUS pilot course were as follows:

#### *Module: Introduction to BIM*

- Lecture: Benefits and challenges using BIM
- Lecture: Level of development and 3D-10D BIM
- Lecture: BIM process workflow
- Lecture: BIM coordination

#### *Module: 3D GIS, City Models and Digital Twins*

- Lecture: Concepts of 3D modelling
- Lecture: Semantic city models
- Lecture: 3D data standards
- Lecture: Introduction to Digital Urban Twins



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### *Module: BIM-GIS integration*

- Lecture: Introduction to BIM-GIS integration
- Lecture: BIM-GIS Integration Workflow
- Lecture: BIM-GIS data conversion

### **Trainers involved**

The testing involved no active participation from trainers as it was conducted as a self-paced course.

### **Training methods**

The testing of the material was done through a self-paced video-based pilot course that was available for a duration of two weeks between 30/9 - 13/10, 2024. The course was hosted on the online platform *Kajabi* and consisted of recorded lectures followed by quizzes that tested the gained knowledge.

Participation of the pilot course was on a voluntary basis and all participants were current students of one of the VET programmes conducted by OCELLUS. The self-paced structure of the pilot course allowed students to take the course alongside their regularly scheduled studies. Estimated maximum time for completion of the full course was 30 hours. A total number of 52 students participated in the course.



*An example showing the module “Introduction to BIM” from the OCELLUS course on the Kajabi platform*



## Recognition

The students participating in the course received a certificate of completion at the end of the course. To be eligible to receive this certificate, the participants had to fully complete the course by going through all the course material and answering a course evaluation.

## 3 Tuning of the training materials

The objective of Task 4.2 “*Tuning and Improvement of the Training Materials*” is to refine and enhance the training materials and deliver new and improved versions of training components based on the feedback and results gathered from the testing activities carried out. This task ensures that the final versions of the materials are effective and tailored to the needs of the specific target groups, addressing any identified shortcomings and improving the overall quality of the learning experience.

The process begins with the systematic collection and analysis of feedback obtained during the testing phase (Task 4.1). Feedback is gathered from multiple stakeholders, including learners, trainers, and other relevant participants, using standardized tools such as self-assessments, satisfaction questionnaires, and structured evaluations. The feedback covers key aspects of the training modules, including content relevance, clarity, instructional methods, technical delivery, and learner engagement.

Based on this comprehensive evaluation, a detailed list of proposed modifications and improvements is created. These proposed changes, also called “Change Requests” address issues such as content gaps, instructional clarity, technical errors, user experience enhancements, and alignment with the target audience's learning needs. Each proposed change is analysed and prioritized in collaboration with the project partners and the relevant authors.

This PR4 report serves as both a record of the refinement process and a tool for ensuring the sustainability and future applicability of the training materials. By incorporating stakeholder feedback and continuously improving the resources, this task guarantees that the final training



materials are of high quality, adaptable to various learning environments, and aligned with the expectations of the target groups at both local and European levels.

### 3.1 Methodology

We adopted a structured methodology for refining and updating training materials based on feedback from real training actions.

To facilitate the update process, a Change Request (CR) procedure is used. Each CR is documented with a clear description of the requested modification, a rationale for the proposed change, and the suggested implementation solution. The responsible authors and content developers then implement the approved changes, ensuring consistency across all modules and training materials. The updated materials undergo a final quality review to confirm that the improvements have been effectively integrated.

This approach relies on the systematic use of Change Request (CR) sheets, which serve as standardized documents for requesting updates, improvements, or enhancements to specific lectures or assignments.

Each Change Request sheet is associated with a single training component (e.g., lecture or assignment). These CR sheets capture feedback from various sources, including instructors, reviewers, and students, during or after the training sessions.

The Change Request template, provided in Annex III of this report, includes several key fields to ensure clarity and precision. It begins with the “*Component Name and Version*”, which clearly identifies the specific training material or learning component to which the request applies. Then, for each component a list of change requests is defined. To each change request is assigned a unique identifier, along with the date it was submitted and the requester’s information (whether a partner, teacher, or student). For each request, the “*Description of the Request*” provides detailed information about the proposed modification or enhancement. Additionally, this field is used also for a justification or rationale explaining the reason for the change and its expected benefits. Finally, a “*Proposed Solution*” section suggests the changes or approaches for addressing the requested change. This structured format ensures that all requests are clear, actionable, and effectively address the feedback received.



Change Requests are categorized into three distinct groups to streamline the revision process. The first category, “*To be included in next version*”, includes requests that have been approved and are scheduled for inclusion in the next version of the training materials. The second category, “*Not yet processed*”, consists of requests that are still under review or awaiting prioritization for future updates. Finally, the “*Closed*” category comprises requests that have been successfully implemented and verified or considered to be out of scope.

Regarding monitoring and traceability, all Change Requests are tracked and stored in the project’s repository. Each CR is uniquely named and described to enable clear traceability of its status and fulfilment history. All current CRs are also available in Annex VI of this report.

This methodology allows for iterative improvement of the training materials based on actual usage and stakeholder input. By systematically processing CRs, the project ensures that training content remains relevant, accurate, and aligned with the needs of learners. Furthermore, this approach fosters a collaborative environment among teachers, authors, and reviewers, supporting the continuous enhancement of the training materials, referring to appropriate Quality Assurance principles and methods.

## **3.2 Feedback analysis**

This section of the report explores and analyses the feedback received from both students and teachers involved in the training activities conducted during the project, based on the developed training materials. Main source of feedback are the questionnaires described in section 2.1 of this report.

For each country, the feedback collected through the questionnaires is examined and analysed in detail to assess the effectiveness and impact of the training activities.

### **3.2.1 Croatia**

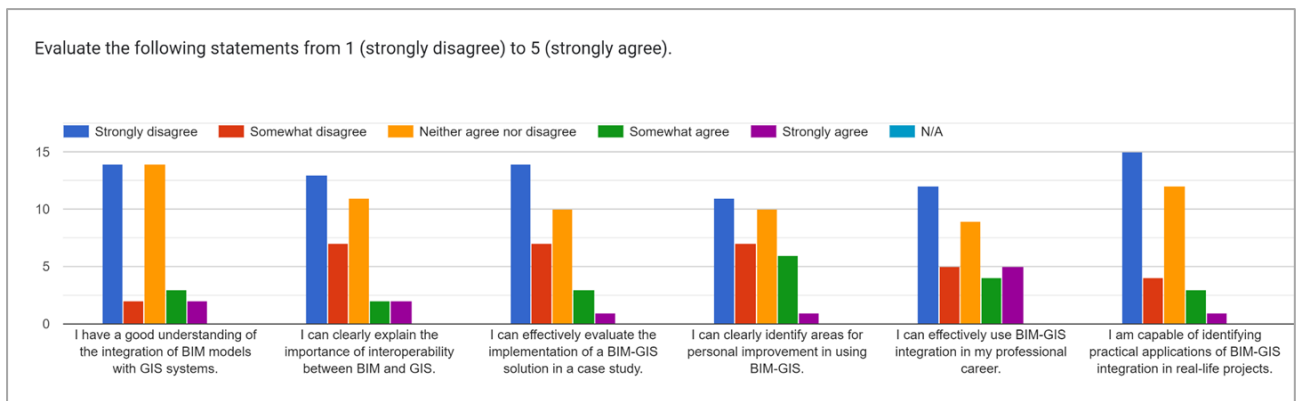
#### **Feedback from students**

Students responded to 3 questionnaires for each module (lecture) tested. It includes:

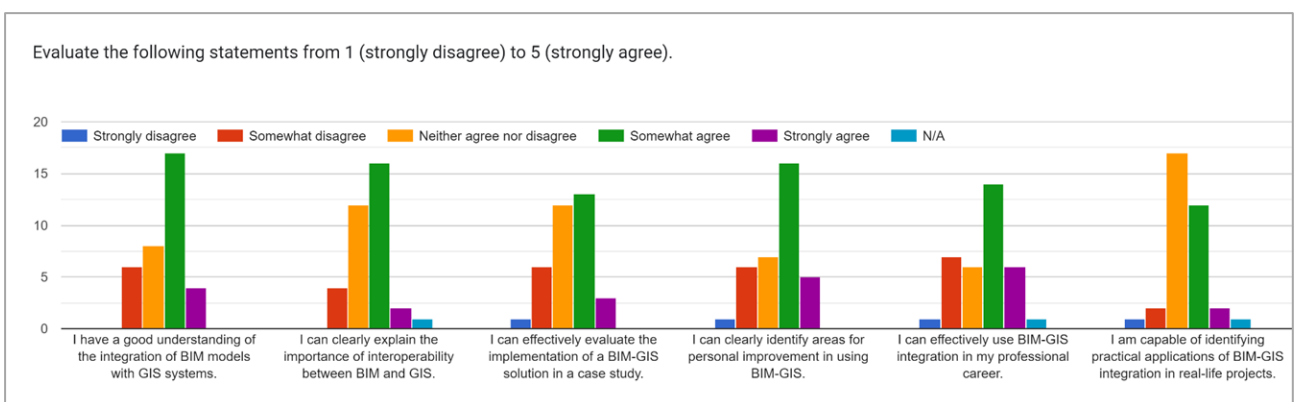


- Self-Assessment of previous knowledge
- Ex-post Self-Assessment
- Satisfaction survey

The students' self-assessment of their prior knowledge, along with the ex-post self-assessment, clearly demonstrates an improvement. Most learners reported having limited knowledge and understanding of the general topic of BIM-GIS integration before the training. However, by the end of the 8-hour session, which was the duration of the training action, they acknowledged a significant improvement in their knowledge.



*University North students Self-Assessment of previous knowledge*



*University North students Ex-post Self-Assessment*

Regarding the satisfaction questionnaire on the learning materials tested, there was a noticeable disparity in the feedback received. Opinions ranged from positive to mixed, both about the



organization and content of the training action, highlighting several areas for potential improvement in future iterations.

A total of 35 questionnaires were collected, providing a robust number of replies for the analysis. Some criticism emerged regarding the ease of following the lectures and the perceived difficulty of the content, most likely due to a lack of prior knowledge among the students. Similar concerns were raised about the clarity of the lectures, suggesting room for improvement in the presentation of the more complex topics.

Despite these criticisms, most students agreed that the materials were of high quality and well-supported by the teacher.

Here are just some examples of general comments on learning materials received:

- *“The materials were interesting, innovative, educational and easy to read”*
- *“Everything was great”*
- *“A very interesting and educational course”*
- *“It would be convenient if the course included more examples that we see in our areas (local)”*
- *“I liked it, it encouraged me to further research and education”*
- *“I think this is not that important for my current academic education now, that is, I am not sure what I can do with this information now. In later years, it would be much better, I suppose”*

### **Feedback from trainers**

The teacher (and external lecturer at University North) who supervised the training action completed the satisfaction questionnaire. Overall, he was satisfied with the content but suggested that more local examples (from Croatia) should be incorporated into the learning materials.

As we will see, the need for more localised practical content emerged as recurring feedback from all participants who were asked to provide input on the training actions.

### **Change requests and proposals for improvement**

The feedback received from the students and the trainer was general in nature and did not result in the definition of any specific change request or interventions for the training materials.



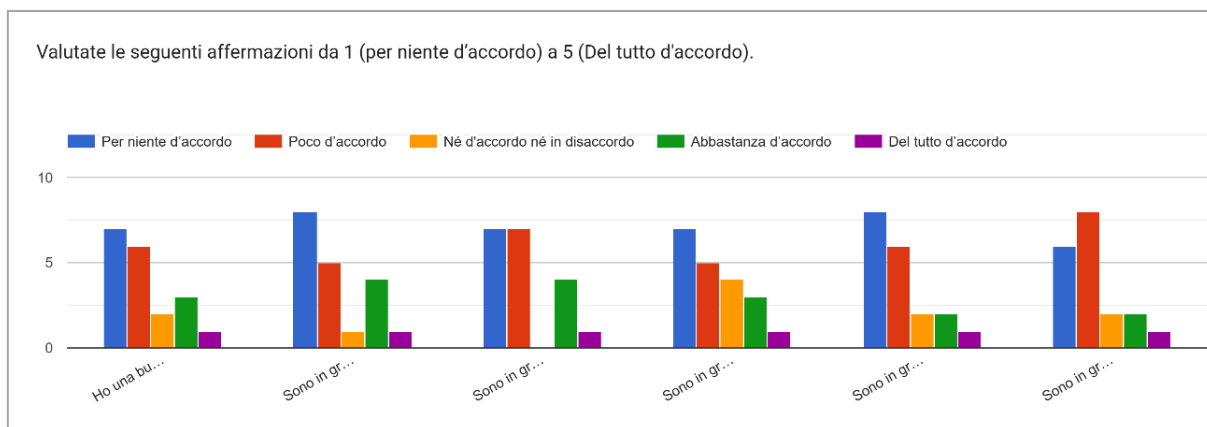


### 3.2.2 *Italy*

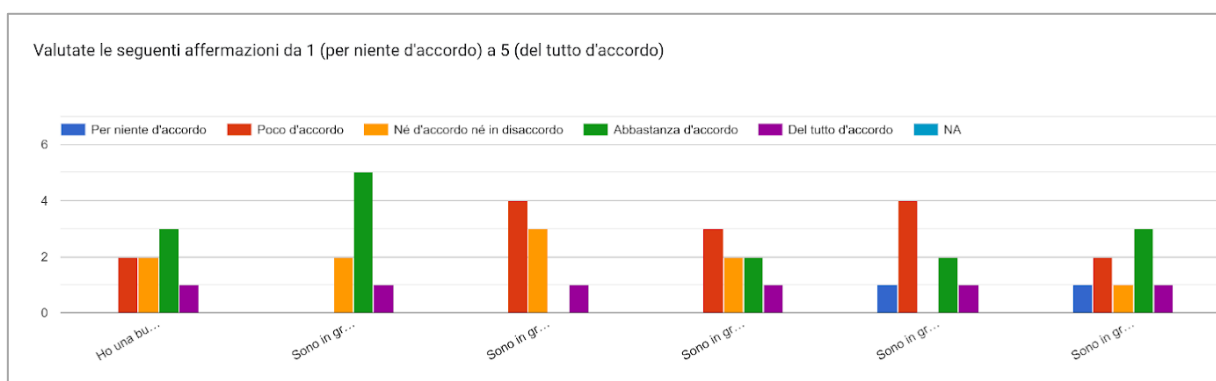
#### **Feedback from participants**

FORMA.Azione asked participants to complete three different questionnaires as part of the project, using Google Forms to facilitate completion: two self-assessment questionnaires (to be completed before and after the training, respectively) and an overall satisfaction questionnaire regarding the training experience. The questionnaires, slightly adapted from the project's template, were enriched with specific questions to gather feedback relevant to the type of training provided in Italy. In particular, a question was added to collect the participation rate across the five lessons, while ensuring anonymity. Additionally, considering the diverse professional backgrounds of the participants, information about their professions was also requested. From the 46 people who registered to participate, 19 responses to the preliminary self-assessment questionnaire were collected. At the end of the course, participants were asked to complete an ex-post self-assessment to evaluate the training's impact, resulting in 8 submissions. Additionally, 12 participants completed a satisfaction questionnaire to evaluate the overall quality of the training. The next section details these results.

In the preliminary questionnaire, 8 respondents indicated they were from public administrations (local councils, technical areas), while 11 were from the private sector, including 5 professionals working with both BIM and GIS. In the ex-post questionnaire, 7 respondents identified as being from the private sector, and only one was from the public administration sector. All respondents reported attending at least 4 of the five lectures, with 6 participants attending all sessions.



*Preliminary responses self-assessment questionnaire (in Italian)*



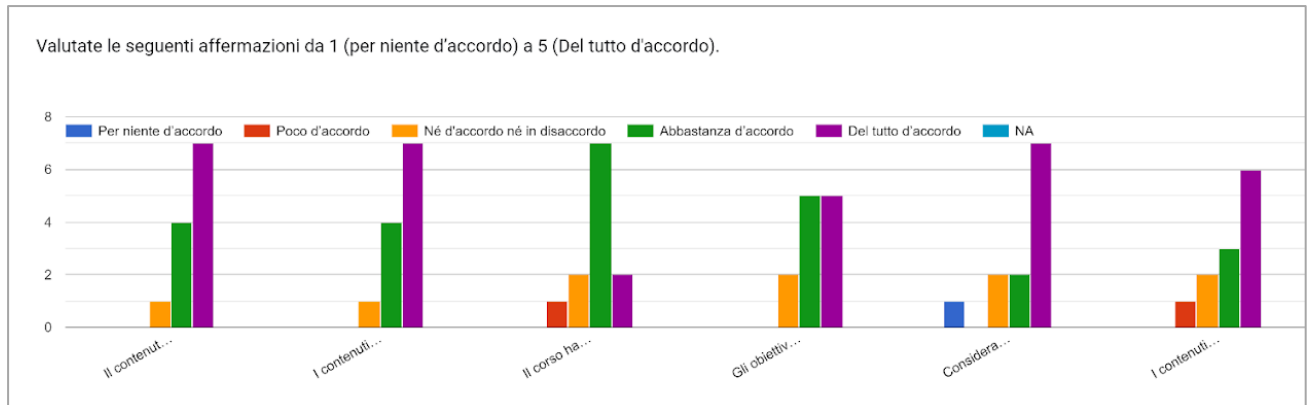
*Ex-post self-assessment questionnaire (in Italian)*

Overall, the ex-post self-assessment questionnaire revealed a significant reduction in the lowest scores (indicating no prior knowledge of the topic), demonstrating a clear improvement in participants' understanding. The perception of change was less pronounced when it came to practical ability in applying the topics covered. Despite the theoretical nature of the training and the absence of practical exercises or formal evaluations, the results highlight a meaningful increase in knowledge across the course topics, reflecting a positive impact of the training.

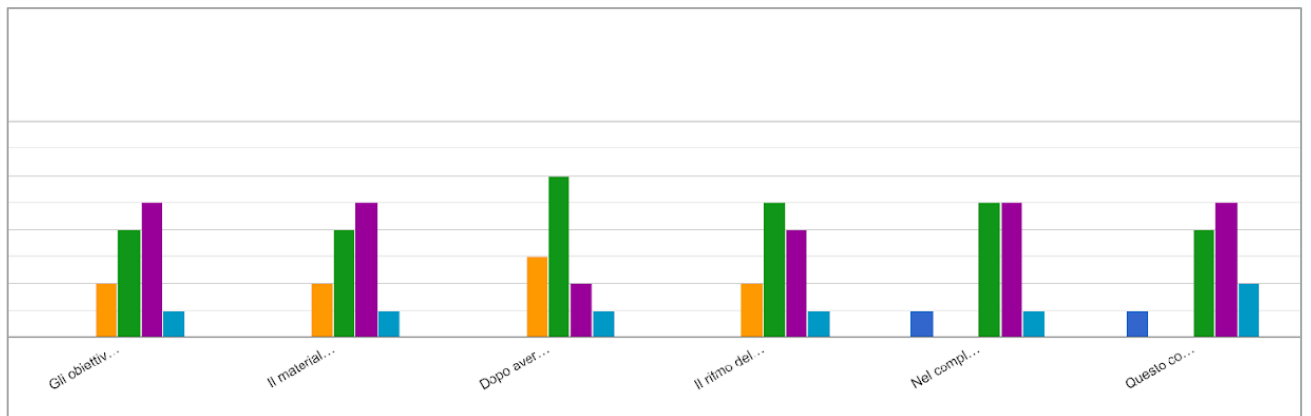
The following graphs show the satisfaction questionnaire results. Statements from the original template (see Annex) had been translated into Italian. The following colours indicate



the degree of agreement: (blue = completely disagree; red = somewhat disagree; yellow = neither agree nor disagree; green = somewhat agree; purple = totally agree; light blue = N.A.)



overall course evaluation (in Italian) pt1



overall course evaluation (in Italian) pt2

Overall, answers have been mostly positive, with one dissatisfied participant regarding the course length and structure, but further an overwhelming majority of either “agree” or “completely agree”, especially regarding course content and course materials.

Among the most appreciated aspects of the course, the following were mentioned:

- Concrete examples and technical aspects from lectures;
- Timeliness;
- The integration of (previous) BIM knowledge with the GIS technology;



- The modularity of the training offer;
- Supporting materials (slides, recorded lectures);
- Digital twin;

Among the suggestions to improve the training offer, the following was mentioned:

- More time dedicated to the overarching introduction of the course;
- Some lectures went too deeply into technical aspects, with not enough time to deepen the topics;
- More practical examples and more time dedicated to practical exercises;
- The use of specific software;
- Lectures in presence;
- Introductory lectures regarding GIS technology due to lack of technical background;
- Consider longer training courses as the material was too much to be presented in such a short amount of time.

### **Feedback from trainers**

The four trainers involved in the pilot course were asked to complete a satisfaction questionnaire.

Regarding the structure of the lectures and the content of the training materials, the materials were evaluated of good quality, proportionate to the trainees' needs, and aligned with the course objectives. However, not all trainers found the materials innovative in their approach, and some considered them insufficient to fully meet their students' needs. In particular, practical examples were lacking and had to be supplemented by the trainer.

Regarding the didactic strategy and methodology, they were generally considered sufficient and effective, with the notable exception of a lack of sufficient examples provided.

The slides and lecture notes were evaluated positively or very positively, except for their design, which was not always considered effective. There was some room for improvement, particularly in terms of clarity.



In addition, the trainers were asked to leave qualitative feedback with two open questions.

Regarding the most appreciated and valued aspects on the materials given:

- The punctual descriptions and lecture notes attached to each of the slides;
- The quality of the research beyond each lecture, and the availability of concrete examples, with links, especially regarding 3D models and digital twins of (different) cities.
- The quality of examples given;
- Lecture on Semantic models was very clear and well organized and full of useful examples;

General suggestions for improvement:

- Enhancement of graphic quality of the material, to give a clearer hierarchy of topics (referred to Digital Twins lecture);
- Lack of practical examples that were asked by participants during the lecture but that I was unable to give at the time;
- *“It was a lesson with high-quality materials and advanced topics. I hope all the participants were able to understand because I’m not sure if everyone had the necessary knowledge in BIM and GIS. Perhaps an initial test to assess the participants’ level could help the instructor to tailor the lessons more effectively.”*

To conclude, all trainers involved think that they will adapt their own training materials with the BIRGIT materials to enhance results.

### **Change requests and proposals for improvement**

The feedback received was based on the Italian versions of the materials. A good number of Change Requests for the localized materials were received, particularly concerning the notes accompanying the materials. Most of the requests related to typos or suggestions for improving the translated text.

Since the materials were translated by FORMA.Azione, they will handle the improvements to the Italian translation directly.



However, some requests (detailed in the annex of this report) referred to the original English version and were evaluated by the authors of the training materials.

### 3.2.3 Spain

#### Feedback from students

AIN gathered information from the questionnaires designed to assess students' competencies both before and after the course, as well as their opinions and feedback regarding the training materials. It is also worth noting that AIN collected valuable additional information through its website, which will be detailed in the subsection “*Additional Information collected*”

Regarding pre-knowledge, 14 questionnaires were collected, and for post-knowledge, 7 questionnaires were gathered. The analysis of the questionnaires indicates positive feedback in terms of improvements in knowledge related to BIM-GIS integration before and after the training. Most users reported having little to no knowledge on the topic before the course.

The self-assessment of knowledge gained after the training demonstrated a clear improvement, although most students expressed that the knowledge gained, while valuable, was not sufficient in many cases. Nevertheless, they considered it to be a very good introduction to the topic.

Concerning the general satisfaction questionnaires completed by AIN students, 11 questionnaires were collected, and the feedback was mostly positive across all areas of the questionnaire.

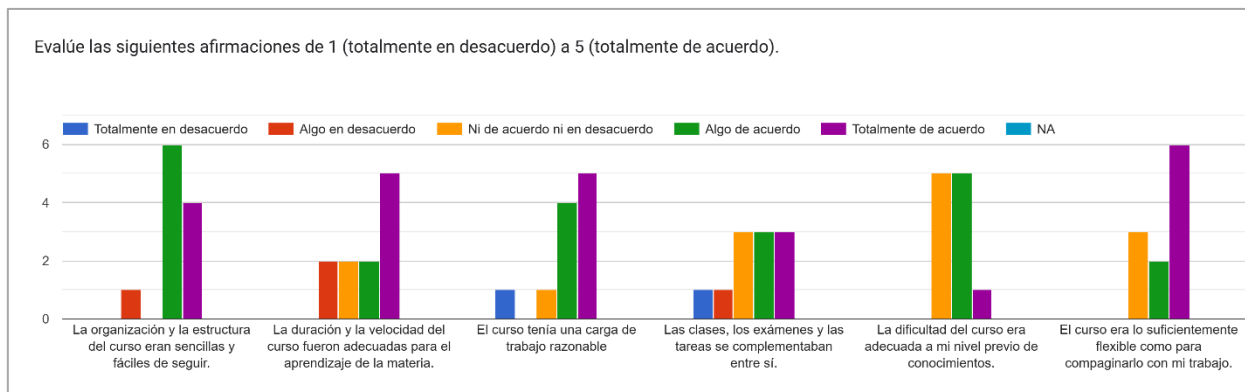
We can highlight a few key points from the feedback:

- Regarding the ease of following the materials, some less favourable evaluations were expressed due to the fact that the entire course was conducted online with limited tutoring. It was also noted that the courses were not very well structured, and the



three modules felt somewhat isolated, with little relation among them and few cross-cutting topics. Overall, the level of the course was perceived as a bit low.

- On a positive note, the availability of the courses on the online AIN platform was highly appreciated, as it allowed students to follow the lectures at their own pace. The platform itself was easy to use.
- There were some criticisms regarding the clarity of the materials, particularly related to the quality of some Spanish translations, which in some cases caused confusion with specific terms.
- Some responses also indicated that the exercises and practical components were insufficient for evaluating the acquisition of new knowledge. There was generally little positive feedback on the evaluation of knowledge through the exercises.
- Overall, the materials were seen as a good opportunity for an initial introduction to the topic and a first step toward further developing knowledge in this area.
- As expected, some students gave poor evaluations, while others provided very positive feedback, so we focused on the overall satisfaction grade rather than the more extreme opinions.



*AIN assessment of the module 'Introduction to BIM' using their BIRGIT satisfaction questionnaire translated in Spanish language.*

The interaction with students during the course was positively valued.

Despite the training being conducted online, a satisfactory level of participation was evident, as reflected in the completion of proposed exercises, student consultations, and the



assessments submitted at the end of the course. The sequential structure of the course fostered active engagement, ensuring consistent progression through the modules.

### **Feedback from trainers**

The satisfaction survey was completed by both teachers responsible for monitoring and tutoring the training action conducted in Spain.

The feedback from the teachers regarding the materials was generally positive, with agreement on the achievement of the learning objectives for the modules. No significant issues were identified in the materials' content. In terms of material quality, the feedback was also largely positive or very positive, with no low evaluations recorded in their surveys.

Trainers emphasized that the developed material is highly valuable for professionals seeking to expand their knowledge in GIS and Digital Twin technologies. It also provides a solid and accessible foundation for those new to the field of BIM, making it ideal for beginners.

However, one aspect that was highlighted was the difficulty in adapting some of the materials to AIN's specific learning environment and meeting the real needs of its students. This is understandable, as the original materials were created without targeting particular training needs or a specific geographical context.

There was also a general observation about the need for a more practical approach in the creation of training materials. This issue was acknowledged in other countries as well, and it is evident that the lack of exercises in certain cases was a weakness of the overall training offer. The inclusion of more practical examples would clearly enhance the materials' effectiveness.

Another concern raised was the quality of the Spanish translations. It was noted that some aspects of the translations could be improved, as automation methods were used for translation in certain instances. However, since this issue regards the localized Spanish versions of the materials, it was not translated into an official change request to the authors of the original English materials.



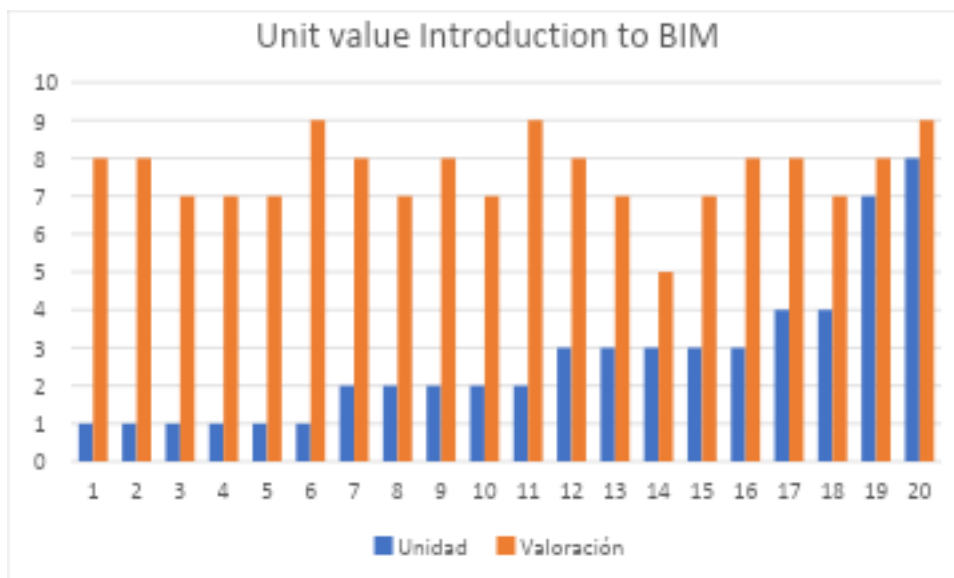


### Additional information collected

Additional information was collected through AIN's own feedback system, which provided valuable insights for potential improvements to the courses. This system allowed students to submit concrete comments on the materials using the e-learning environment provided by AIN for course participation.

Most comments focused on the overall view of the modules, as feedback was requested at the module level. Several interesting suggestions emerged, particularly one that called for more practical content involving BIM files. Some recurring feedback also noted that the course was considered "intense," especially for those without prior knowledge, and in some instances, students found it difficult to follow.

The 3D GIS and Digital Twins course received the highest ratings and was the most requested.



*AIN internal assessment of the module 'Introduction to BIM' using their own evaluation system*

### Change requests and proposals for improvement

During the evaluation, several areas for improvement were identified to optimize future training actions.



- There was a general request for more practical exercises, such as those focusing on interoperability between BIM and GIS.
- One key suggestion is to incorporate local data, such as that from the Spanish Cartography Agency or other relevant sources, to contextualize the exercises and make them more relatable to the participants' reality. For example, including references to BIM models of the Barcelona Metropolitan Area, available as downloadable IFC files on [geoportalcartografia.amb.cat](http://geoportalcartografia.amb.cat), was suggested to enhance the course's practical relevance.
- Another recommendation is to expand the practical examples by including additional case studies that demonstrate BIM-GIS integration in real projects, helping bridge the gap between theoretical learning and practical application.
- Several comments pointed out the need to improve the quality of the translations into Spanish, as well as fixing broken links.
- Some students criticized the course for being too theoretical, expecting it to be more practical and visually engaging rather than just using slide images.

### 3.2.4 Sweden

#### Feedback from students

Students answered three questionnaires during the course. A self-assessment of previous knowledge prior to starting the course, an ex-post self-assessment to see areas of improvement after completing the course and finally a more general course satisfaction survey. Out of 52 total participants, 39 completed the course and sent in all three questionnaires.

The combined average of all questions from the self-assessment of previous knowledge was 1.99 out of 5 and the average of the ex-post self-assessment was 3.45 out of 5. This result shows a clear improvement in the knowledge of BIM-GIS integration after completion of the course. Since OCELLUS students are very familiar with GIS as it is the main subject of the current VET programmes, the improvement in this area was less apparent.



Feedback from the course satisfaction survey was generally positive with a score of 4.26 out of 5 on the overall satisfaction with the course. The average of all questions combined amounted to 4.22 out of 5.

Below is an example of comments received.

- *“Good information with just the right amount of depth for the subject, a good level for a beginner, especially when it comes to BIM-GIS integration. It sparked my interest in learning more about AEC, BIM, and 3D GIS”.*
- *“I think several difficult concepts are used, which can be overwhelming, especially when learning about a new subject area. It would be great to see the actual BIM software in use with a video showing how GIS and BIM are integrated. I really appreciated the presentations—they were well-made.”*
- *“The teaching—regarding the subject, structure, order, etc.—was very effective. The course could be improved significantly by adding resources to read more about the subject and maybe even access to a platform with practical examples. “*
- *“The course pace was great. It was convenient to access the content whenever and pause when needed to study at my own pace. The course deadline motivated me to complete it when I had time. The content length was just right. Some longer videos had a lot of info, making it a bit overwhelming during self-study. But the chance to retry the questions helped.”*
- *“Good to have self-assessment questions after each section; they made it easier to follow along and check if I was keeping up with the information! Some videos were a bit long for me to listen to in one go, but since you can pause and watch again, it wasn’t a major issue.”*

### **Feedback from trainers**

An experienced VET teacher at OCELLUS, Tim Näslund, with an educational background in geoscience, computer science and GIS was responsible for the adaptation of the materials into the pilot course. He answered a questionnaire on the BIRGIT learning materials and how the process of adapting the materials worked. See the annex for the questionnaire.

The feedback he provided was that the learning materials effectively covered the fundamental concepts of BIM and GIS, along with the value of integrating these technologies. They provided a comprehensive general overview, making them particularly useful for individuals with limited prior knowledge of the topics. However, the materials lacked more in-depth practical BIM and integration



exercises for Introduction to BIM and BIM-GIS integration. This was understandably largely due to the limited availability of suitable free and open-source software for such work.

There were also several spelling errors and the occasional convoluted explanation of concepts that impacted the readability of the lecture notes. The writing could often come across as a bit too casual in the way the sentences were constructed. Additionally, the flow of the material was often disrupted by references to other lectures for more detailed discussions on certain topics. These references might be better presented as footnotes to maintain the narrative continuity.

Despite the required adjustments made for the OCELLUS pilot course, the well-documented source material and structured approach of the original BIRGIT learning materials which addressed the essential BIM-GIS topics, greatly facilitated the adaptation process. As a result, there was minimal need to seek additional sources beyond those provided by BIRGIT.

### **Change requests and proposals for improvement.**

A significant number of change requests came from the training action in Sweden. These requests were addressed by a VET teacher at OCELLUS and are included in the Annex IV of this report.

### **3.3 Modifications and improvements**

Change requests for training materials (CRs) allow stakeholders to propose modifications to enhance our project outcomes. The approval process begins with the submission of a CR to the leader of task 4.2, which can be initiated by the organizer of a training action, the author of the training materials, or the reviewers of the training materials.

Each change request is then reviewed by the leader of Task 4.2 and the author of the training materials in question. This initial review assesses the request's relevance, potential impact, and feasibility based on predefined criteria, including alignment with project goals and resource availability.



Decisions on change requests can result in approval, denial, or requests for revision. Some CRs may be deemed irrelevant if they do not align with the project's objectives, or not important, leaving it to the author's discretion to decide if implement the request or not.

Once the change request is approved, it is the responsibility of each author of the training materials to manage the revision and send the updated version of training materials to replace the existing ones in the project website in the section <https://birgitproject.eu/learning-materials/>.

It is important to highlight that change requests and modifications can be based on feedback received for all types of training materials produced in the project, both original English versions and localized versions (in the national languages of the training actions). Nevertheless, it has been decided that the focus of the materials update should be on the original training materials in English, leaving it to the discretion of the authors of the localized and translated versions to decide whether to update their materials or not.

In the following subsections, we will include details on the most relevant change requests implemented and the improvements made to the materials.

### **Change of license for some selected materials**

One important request from the Swedish partner, Ocellus, concerned changing the license for a subset of materials from the Creative Commons BY-SA 4.0 license to CC BY 4.0. This change was discussed and approved by the project's Steering Committee and is justified by the partner's strategy for future reuse and exploitation of the training materials.

### **New Assignment in the BIM-GIS Integration Module**

A new assignment, titled *Noise Modelling*, has been added to the BIM-GIS Integration module and is now available on the project website alongside the rest of the training materials. This assignment offers a practical application of BIM-GIS integration, enriching the already available theoretical materials and showcasing its relevance and importance in urban planning and design processes.

The *Noise Modelling* assignment focuses on performing noise simulations within a combined BIM and GIS data environment. Noise modelling is a critical task in urban planning as it directly impacts the quality of life for people living or working in affected areas. Buildings serve as both



obstacles to noise propagation and the spaces where noise disturbances are experienced. GIS tools are often employed to prepare input data for noise modelling software. However, when large reconstruction projects are planned, proposed changes in the physical environment may only be available in BIM models. To evaluate the noise impact of new constructions, BIM data must be integrated with GIS data to support noise modelling. The results of such simulations may reveal the need to redesign planned constructions to minimize noise disturbances.

For this assignment, the study area is a small part of the city of Zagreb. A new building is proposed to be constructed in this area, and the task is to evaluate the effect the new building will have on the noise levels in its surroundings.

Participants will:

- Merge BIM data for the new building with GIS data for the existing urban environment.
- Conduct noise simulations to assess the impact of the new construction on the noise levels in its neighbourhood.
- Use the results to determine if design modifications are necessary to reduce potential noise disturbances.



*Noise maps, before and after inserting a new office building.*



## **Enhancing practical training, addressing the need for local data and open-source resources**

One recurring aspect from the training actions was the request for more practical exercises, particularly those utilizing local data. This feedback, combined with the need for greater emphasis on raising awareness among students about available sources or open-source repositories of 3D GIS data and BIM files for training purposes, highlights areas for improvement in future training materials.

Training providers interested in replicating these actions acknowledged the necessity to address these issues moving forward. Ensuring that training materials are more focused on practical application and local data sources will not only enhance the relevance of the content but also better prepare students for real-world challenges in the field.

The lack of open-source software significantly limits the ability to offer effective training initiatives in the field of BIM-GIS integration. Without access to appropriate tools, participants are restricted in their ability to develop practical skills. Many open-source software options could provide invaluable hands-on experience for students, but without proper licenses or access to these resources, the training experience is incomplete. Therefore, organizers of future training actions must consider providing the necessary software or licenses to ensure that participants can actively apply their learning and gain the real-world skills needed in this rapidly evolving field. Providing access to the right tools not only enhances the quality of training but also empowers participants to explore and implement BIM-GIS integration in future projects.



## 4 Future sustainability and development

The BIRGIT courses have been tested in real training contexts by the project's training provider partners. These training actions can, of course, be replicated in the future, as the materials will remain available to all partners.

The training providers have integrated the materials into their portfolio of educational resources for future use, becoming part of their official training offer and enhancing their capacity, an important objective of the project.

Thanks to the testing phase, a thorough review and update of the modules was conducted, ensuring they are now assessed and ready for future rounds of training actions.

Additionally, the training materials have been uploaded and made available to the public on the project website at: <https://birgitproject.eu/learning-materials/>. They can be downloaded for free in both the original and translated versions. These materials will remain accessible for at least five years beyond the project's duration, in accordance with the contractual rules of the program. The website and its content will be maintained by the project coordinator, Ocellus.





The screenshot shows the BIRGIT project website. At the top left is the BIRGIT logo with the tagline "Filling skill gaps in BIM-GIS integration". To the right is a navigation menu with "THE PROJECT", "LEARNING MATERIALS", "NEWS", and "CONTACT". The main content area is titled "The BIRGIT learning materials" and contains a paragraph: "Our training offer features three training modules. The content is tailored for professionals, students, and educators looking for updated teaching resources related to the integration of BIM and GIS." Below this are three module cards:

- Introduction to BIM**: This module offers an introduction to Building Information Modeling (BIM), covering its fundamentals, benefits, and challenges in construction. It explores BIM data management, workflow optimization, and its applications in infrastructure and facility management. [Access the module](#)
- 3D GIS, City Models and Digital Twins**: An increasing number of urban development activities require 3D geospatial data. This module deals with the creation and management of 3D city models as well as digital urban twins. The learning material is mainly aimed at learners having a GIS background. [Access the module](#)
- BIM-GIS integration**: These materials introduce BIM-GIS integration, explaining the benefits, differences, and challenges of combining these models. They cover integration approaches, workflows, data quality issues, and data conversion between BIM and GIS. Practical use cases are also discussed. [Access the module](#)

*The BIRGIT learning materials, available in the project website*

In the following subsections, we provide details on how the different training providers involved in the project plan to further exploit the BIRGIT training materials in the future.

#### 4.1 University North

BIRGIT learning materials that were localised into the Croatian language will be utilised after the project ends in two ways. The materials will be used to update existing courses for undergraduate and graduate students at the University North at the Department of Geodesy and Geomatics and at the Department of Civil engineering.



The materials will also be used in the lifelong learning activities for The Chartered geodetic engineers and The Croatian Chamber of Civil Engineers. The content of the materials will be regularly updated based on users' feedback but also with new technological developments.

## 4.2 FORMA.Azione srl

Through the pilot course of the BIRGIT project, FORMA.Azione has gathered valuable feedback from both the local private and public sectors regarding training needs, with a particular focus on BIM and the integration of BIM and GIS. Based on this feedback, a new course is scheduled to be launched in spring 2025, already generating significant interest.

Notably, the private sector, including private studios, has approached FORMA.Azione to inquire about the possibility of tailored training programs on the subject. Similarly, the public administration has shown interest, especially in relation to the progressive introduction of BIM in public procurement.

A clear indication of this growing engagement is the recognition of the "*Patrocinio*" (free sponsorship) granted by the Municipality of Perugia, aimed at attracting more public sector participants and promoting professional development on the topic. Moving forward, FORMA.Azione will continue to focus on these two directions—organizing and delivering courses while utilizing the developed training materials to meet the growing demand.

## 4.3 AIN

Once the project is completed, AIN plans to incorporate the courses developed into its training catalogue as a complement to other courses related to BIM, GIS and Digital Twins. This will allow better support to all professionals and companies wishing to expand their knowledge.

After analysing the errors and changes suggested by the students during the piloting, AIN will proceed to make the necessary corrections and update the contents in its current courses.

As an association dedicated to continuous training for companies, AIN has identified that the demand for professionals specialized in BIM is constantly growing. For this reason, it considers the



BIM introductory course as a key tool to support those who wish to get started in this field and start acquiring the necessary skills in this technology.

#### **4.4 Ocellus**

OCELLUS will continue to build upon and update the video-based pilot course, which was developed using content from all three modules of the BIRGIT learning materials. There are current plans to introduce a new VET programme focused on BIM and GIS integration, which will incorporate some courses into its curriculum.

Additionally, it is possible that other BIRGIT learning materials will be utilized in the creation of new courses designed for this VET programme.

The video-based course may also be offered as a standalone course package to interested parties, such as industry professionals seeking to deepen their understanding of BIM-GIS integration. Feedback from course participants will be continuously collected and used to guide quality improvement efforts.

## **5 Conclusions**

The BIRGIT Project Result 4 (PR4) focused on testing and updating learning materials for BIM-GIS integration, developed in PR3. Its aim was to evaluate the materials' quality, gather feedback, and implement improvements to ensure the materials meet the needs of learners and training providers.

Four tests were performed in Croatia, Italy, Spain, and Sweden, involving a mix of in-class and online modalities. The feedback collected from students and trainers highlighted both achievements and areas for improvement.

Key findings on the feedback collected from these training actions is summarised below:



- Knowledge Improvement: Self-assessment surveys revealed a clear improvement in participants' knowledge of BIM-GIS integration after completing the training. Most students began with limited knowledge and reported significant progress.
- Quality of Materials: The materials were generally praised for their quality and accessibility. However, issues such as the lack of practical exercises, local examples and data, and clarity in some translations were noted.
- Practical Relevance: A recurring request across all countries was the inclusion of more hands-on exercises, particularly using local data and real-world examples. This feedback emphasized the need to bridge theoretical content with practical application.
- Translation and Accessibility: Some feedback highlighted challenges with translation quality, especially in the Spanish versions, as well as minor technical issues such as broken links.
- Open-Source Tools: The limited use of open-source software was identified as a barrier to effective training. Participants and trainers recommended providing access to tools and licenses to enhance practical learning.
- Training Modalities: Online training was appreciated for its flexibility, but some participants found it challenging due to limited interaction with trainers and the complexity of the content.

Regarding the future, the revised training materials have been made publicly available on the project website, ensuring accessibility for a wide audience. Training providers plan to integrate these materials into their educational offerings, guaranteeing their continued use and development.

The PR4 activities successfully validated and enhanced the BIRGIT training materials, addressing key gaps and preparing them for broader implementation across Europe. While significant progress has been made, areas for improvement remain, such as incorporating more practical exercises, refining translations, and including local data to increase relevance.

BIRGIT has established a solid foundation for future training initiatives, ensuring the materials remain impactful and effective in meeting industry needs.



## Annex 1: Satisfaction Questionnaire templates

### BIRGIT Satisfaction Questionnaire for Learners

The BIRGIT satisfaction questionnaire for learners was designed to gather feedback on the level of satisfaction from participants who attended the courses. This tool aimed to assess learners' overall experience and perspectives regarding the training provided.

<p><b><u>Course title:</u></b></p> <p><b><u>Instructor(s) (if applicable):</u></b> _____</p> <p><b><u>Date:</u></b> _____</p> <p>Instructions: Please take a few minutes to provide your feedback on the course. Your responses will remain anonymous and will help improve future courses.</p>						
<b>Professional profile</b>						
<ul style="list-style-type: none"> <li>● GIS Professional</li> <li>● BIM Professional</li> <li>● Student</li> <li>● Other: _____</li> </ul>						
<p>A. <b><u>Course Structure</u></b></p>						
Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	N.A.
The organization and structure of the course were simple and easy to follow.						



The duration and speed of the course were adequate for learning the subject.						
The course had a reasonable workload.						
Classes, tests and assignments complemented each other.						
The difficulty of the course was appropriate to my previous level of knowledge.						
The course was flexible enough to combine with my work.						

**B. Course materials and methodology**

Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	1	2	3	4	5	6
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	NA
The material provided was sufficient and useful for learning the subject.						
The course material was clear and understandable.						
The materials provided						



increased my knowledge and skills in the field.						
The digital media and platform used were intuitive and easy to use.						
The teaching methods used were innovative and effective for learning the subject.						

**C. Course Content**

Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	1	2	3	4	5	6
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	NA
The content of the materials was innovative and offered new perspectives.						
The materials were relevant to my work.						
The materials were of high quality and well-supported.						

**D. Course evaluation methods**

Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	1	2	3	4	5	6
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	NA



The tasks set during the course were useful to better understand the contents.						
The assessment methods correctly measured my level of subject knowledge.						
The frequency of the evaluations was adequate for the learning of the subject						

**E. Overall Course Evaluation**

Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	1	2	3	4	5	6
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	NA
The course content was up-to-date and based on current information.						
The content I have learned in the course is beneficial for the growth and development of my professional career.						
The course has covered all the						





areas I expected.						
The learning objectives set at the beginning of the course have been met.						
Considering my complete experience with the course, I would recommend it to my peers.						
The course content was relevant to my interests and needs.						
The course objectives were clearly explained at the beginning.						
The materials provided (readings, videos, etc.) were useful for my understanding of the topics.						
I can clearly identify areas for personal improvement in using BIM-GIS after completing the course.						
The pace of the course was appropriate for my learning level.						
Overall, I am satisfied with the course.						



This course has increased my interest in the subject area.						
<b>COMMENTS AND SUGGESTIONS</b> <b>Any feedback will be highly appreciated</b>						
<i>Highlights</i> <i>Points you would change</i>						

### BIRGIT Satisfaction Questionnaire for Teachers/Trainers

The BIRGIT satisfaction questionnaire for teachers and trainers was developed to evaluate the perspectives and overall satisfaction of instructors involved in delivering the courses. This tool aimed to gather insights into the effectiveness of the training methods, materials, and overall organization, as well as to identify areas for improvement from the trainers' point of view.

**Course title:**

**Name and Surname Trainer:** \_\_\_\_\_

**Date:** \_\_\_\_\_

Instructions: Please take a few minutes to provide your feedback on the course.  
Your responses will help improve future courses.

<b>Professional specialty</b>
<ul style="list-style-type: none"> <li>● Architecture</li> <li>● Civil, Electrical, Mechanical Engineering...</li> <li>● Construction Management</li> <li>● BIM Expert (Analyst, Researcher, Educator)</li> <li>● Information Technology and Software</li> <li>● Geography</li> <li>● Geomatics Engineering</li> <li>● Urban and Regional Planning</li> <li>● Environmental Sciences</li> <li>● Spatial Data Management:</li> <li>● Industry Applications of GIS</li> <li>● Other: _____</li> </ul>



**A. Structure and Content of Learning Materials**

Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	1	2	3	4	5	6
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	N.A.
The learning objectives were clearly defined.						
The content taught was relevant to the objectives of the course.						
The amount of content was adequate for the time available.						
The materials and resources provided (books, articles, presentations, etc.) were adequate and sufficient in supporting my teaching objectives.						
The content was easy to adapt to different learning styles and student needs.						
The quality of the content was adequate for the needs of the learners.						



The content provided had an innovative approach.						
<b><u>B. Methodology and Didactic Strategies</u></b>						
Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	N.A.
The didactic strategies used were effective for understanding the content.						
Learners' participation was encouraged by the learning materials.						
The activities and practical exercises were useful for the learners.						
Sufficient content was provided for learners to apply the concepts learned.						
The learning materials included enough practical examples and relevant case studies.						
The teaching strategies						



<p>were adapted to different learning styles (visual, auditory, kinesthetic).</p>						
-----------------------------------------------------------------------------------	--	--	--	--	--	--

**C. Quality of Materials: Presentations**

Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	1	2	3	4	5	6
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	N.A.
The overall structure of the presentation was clear.						
The contents of the presentation were relevant to the objectives of the course.						
The number of slides was adequate for the time available.						
The design of the slides (use of graphics, images, text) facilitated the understanding of the contents.						
The examples provided in the presentation were helpful and clear.						



<b><u>D. Quality of Materials: Lecture Notes</u></b>						
Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	1	2	3	4	5	6
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	N.A.
The supplemental reading was clear and easy to understand.						
The complementary reading adequately developed the contents presented in the PPTX.						
The examples and explanations in the reading were helpful and clear.						
The supplementary material was sufficient to cover the topics addressed in the presentation.						
<b><u>E. Sustainability and Relevance of course content</u></b>						
Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	1	2	3	4	5	6
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	N.A.
I would recommend						



the learning materials to other colleagues or learners for future use.						
I plan to use these learning materials in my future teaching or training sessions.						
I will adapt my future courses with the support of these learning materials to enhance learning outcomes.						

<b>Do you have any additional suggestions or comments?</b>



## Annex II: Preliminary and ex-post self-assessment questionnaires

### BIRGIT Self-Assessment questionnaires

The BIRGIT Previous Knowledge and Ex-Post Self-Assessment questionnaires were developed to:

- Assess participants' baseline knowledge and competencies prior to starting a training course.
- Evaluate learners' perceived progress and outcomes after completing the training course.

Both questionnaires were anonymous and featured identical questions, allowing for a direct comparison of responses before and after the course to measure learning impact.

<b><u>Course title:</u></b>						
<b><u>Instructor(s):</u></b> _____						
<b><u>Date:</u></b> _____						
<b>Professional profile</b>						
<ul style="list-style-type: none"> <li>• GIS Professional</li> <li>• BIM Professional</li> <li>• Student</li> <li>• Other: _____</li> </ul>						
<b><u>Knowledge about the course contents</u></b>						
Evaluate the following statements from 1 (strongly disagree) to 5 (strongly agree).	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>
	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	NA
I have a good understanding of the integration of BIM models						





with GIS systems.						
I can clearly explain the importance of interoperability between BIM and GIS.						
I can effectively evaluate the implementation of a BIM-GIS solution in a case study.						
I can clearly identify areas for personal improvement in using BIM-GIS.						
I can effectively use BIM-GIS integration in my professional career.						
I am capable of identifying practical applications of BIM-GIS integration in real-life projects.						
I have considerable knowledge about BIM-GIS integration.						
I consider myself competent in solving problems related to BIM and GIS.						
I am familiar with the software used for BIM (e.g., Revit, ArchiCAD).						



I am familiar with the software used for GIS (e.g., ArcGIS, QGIS).						
I am clear on which specific areas I need to improve regarding BIM-GIS integration.						



## Annex III: Change requests template

Learning material: Name and version
CR's to be included in next version
<b>CR#1/date/source</b> Description of the request. Proposed solution:
Change Requests not yet processed
<b>CR#1/date/source</b> Description of the request.  <b>Example</b> <b>CR#5/2018-10-30/PLUS student</b> The assignment (questions 2-5, research of market and legal situation of district heating) has a weak link to the topic "GIS-management of underground infrastructure".
Closed change requests
<b>CR#2/date/source</b> Description of the request Proposed solution: Action taken or motivation for no action.



## Annex IV: Requests for changes

The following section compiles all the submitted change requests based on the provided template. The content is organized according to the BIRGIT learning materials modules. For each module, you will find the corresponding change requests for the associated lectures and assignments.

Additionally, an initial generic change request sheet is provided. This sheet applies to all the training materials and should be considered in relation to the entire training offer developed.

### Change requests for all materials

#### Learning material: ALL

CR's to be included in next version

Change Requests not yet processed

#### **CR#1/2024-11-13/OCELLUS pilot course students**

There is an interest in implementing more practical work to complement the learning materials, such as testing the integration between BIM-GIS and show more in-depth how the process is like with applicable integration software. This can help illustrate the more abstract theory.

#### **CR#2/2024-11-13/OCELLUS pilot course students**

Some students expressed interest in the inclusion of a glossary for clarifying industry terminology.

#### **CR#3/2024-12-10/Teacher (TN)**

In the OCELLUS pilot course, the students appreciated the use of self-assessment tests throughout every module as it helped them retain knowledge and increased interactivity with the content.

Consider including questions or prompts at the end of some sections of the BIRGIT learning materials to encourage reflection or discussion.

#### **CR#4/2024-12-10/Teacher (TN)**

Consider ensuring that each slide with accompanying text is standardized (e.g., consistent use of headings, bullet points or captions) among all authors to improve readability and navigation.



**CR#5/2024-12-10/Teacher (TN)**

The flow of the material was often disrupted by references to other lectures for more detailed discussions on certain topics. These references might be better presented as footnotes to maintain the narrative continuity.

**CR#6/2024-12-10/Teacher (TN)**

Information on certain topics is sometimes repeated in different lectures by different authors. Some repetition is good for better retention of knowledge but consider limiting the scope of this repetition.

**CR#7/2024-12-10/Teacher (TN)**

The writing could often come across as a bit too casual in the way the sentences were constructed. Consider rewrites to present a more factual/formal appearance of the text content.

Closed change requests

**Change requests for the module: Introduction to BIM**

**Lecture: Benefits and challenges using BIM v1.0**

CR's to be included in next version

Change Requests not yet processed

Closed change requests (included in V1.1 of the materials)

**CR#1/2024-11-13/Teacher (TN)**

- Page 7, unclear wording “New buildings are planned that they should be in use in 100 years at least.”
- Page 9, unclear wording “When merging the specific models together, there can appear to inaccuracies or errors.”
- Page 9, unclear wording “Though, it still helps to avoid many mistakes and therefore pays it off.”  
Proposed solution: Rewrite for better clarity

**CR#2/2024-11-13/Teacher (TN)**

Minor spelling errors throughout  
Proposed solution: Correct errors



**CR#3/2024-12-11/OCELLUS**

OCELLUS wants to be free to use another license for their adaptation of this learning material.  
Proposed solution: Change license of the material from CC BY-SA 4.0 to CC BY 4.0.

**Lecture: LOD and 3D to 10D BIM v1.0**

CR's to be included in next version

Change Requests not yet processed

Closed change requests (included in V1.1 of the materials)

**CR#1/2024-12-11/OCELLUS**

OCELLUS wants to be free to use another license for their adaptation of this learning material.  
Proposed solution: Change license of the material from CC BY-SA 4.0 to CC BY 4.0.

**CR#2/2024-12-11/Teacher (TN)**

Minor spelling errors throughout  
Proposed solution: Correct errors

**CR#3/2024-12-12/Teacher (TN)**

- Page 14, unclear wording "Of course that prices may change in future"
- Page 15, unclear wording "...in meaning of increased human well-being with proper society planning."

Proposed solution: Rewrite for better clarity

**Lecture: BIM process workflow v1.0**

CR's to be included in next version

Change Requests not yet processed



Closed change requests (included in V1.1 of the materials)

**CR#1/2024-12-11/OCELLUS**

OCELLUS wants to be free to use another license for their adaptation of this learning material.  
Proposed solution: Change license of the material from CC BY-SA 4.0 to CC BY 4.0.

**CR#2/2024-12-11/Teacher (TN)**

Minor spelling errors throughout  
Proposed solution: Correct errors

**Lecture: BIM coordination v1.0**

CR's to be included in next version

Change Requests not yet processed

Closed change requests (included in V1.1 of the materials)

**CR#1/2024-12-11/OCELLUS**

OCELLUS wants to be free to use another license for their adaptation of this learning material.  
Proposed solution: Change license of the material from CC BY-SA 4.0 to CC BY 4.0.

**CR#2/2024-12-11/Teacher (TN)**

Minor spelling errors throughout  
Proposed solution: Correct errors

**Lecture: IFC as a data exchange format - Lecture Notes version 1.0**

CR's to be included in next version

Change Requests not yet processed

**CR#2/2024-12-04/Author (A Östman)**

Procedures for importing / exporting IFC files to / from GIS environments may be added.



Closed change requests

**CR#2/2024-12-04/Author (A Östman)**

FreeCAD software may be used instead of or as a complement to usBIM viewer. FreeCAD is currently used in the assignment where BIM data is used in GIS environment in the BIM-GIS integration module. FreeCAD example included as an additional example in the lecture, version 1.1

**CR#3/2024-12-06/Ocellus**

Change license to CC-BY  
New license specified in document and on web site in version 1.1

**Assignment: Analyzing an IFC file v1.0**

CR's to be included in next version

Change Requests not yet processed

**CR#2/2024-12-04/Author (A Östman)**

Include a task where also a geometry element is analyzed.

Closed change requests

**CR#1/2024-12-04/Author (A Östman)**

Update solution in case FreeCAD is used instead.  
Task and solution based on FreeCAD included in version 1.1

**CR#3/2024-12-06/Ocellus**

Change license to CC-BY  
License change in document and on web site included in version 1.1

**Change requests for the module: 3D GIS, City Models and Digital Twins**

**Lecture: Concepts of 3D modeling of the built environment v1.0**

CR's to be included in next version





Change Requests not yet processed

Closed change requests (included in V1.1 of the materials)

**CR#1/2024-11-13/Teacher (TN)**

- Page 8, unclear wording “As first we can name visual 3D models.”
  - Page 13, unclear wording “For certain simulation is voxel model not optimal”
- Proposed solution: Rewrite for better clarity

**CR#2/2024-11-13/Teacher (TN)**

Minor spelling errors throughout  
Proposed solution: Correct errors

**CR#3/2024-12-11/OCELLUS**

OCELLUS wants to be free to use another license for their adaptation of this learning material.  
Proposed solution: Change license of the material from CC BY-SA 4.0 to CC BY 4.0.

**Lecture: Semantic 3D city models v1.0**

CR’s to be included in next version

Change Requests not yet processed

**CR#4/2025-01-20/Teacher (FORMA.Azione)**

To enhance understanding of the topic, it might be helpful to include some insights regarding the geographical data that can be collected in terms of surveying.

Proposed solution:

The following topics could be added to the slides:

- The technologies used for surveying, including drones, mobile mapping, and ground-penetrating radar (georadar)
- A detailed overview of photogrammetry and LiDAR technologies for drones

Examples of applications in cases of digital twins developed within the national territory

Closed change requests (included in V1.1 of the materials)

**CR#1/2024-11-13/Teacher (TN)**

- Page 14, unclear wording “...so it is just to connect it with the model.”



- Page 17, unclear wording “LOD1 can be open data, but LOD2 has one to pay for”
- Page 19, unclear wording “Or if the house can become Net-zero-energy building, without and with improvement of its thermal insulation parameters”
- Page 21, unclear wording “Of course that such analysis can be counted for any time of the year.”  
Proposed solution: Rewrite for better clarity

**CR#2/2024-11-13/Teacher (TN)**

Minor spelling errors throughout  
Proposed solution: Correct errors

**CR#3/2024-12-11/OCELLUS**

OCELLUS wants to be free to use another license for their adaptation of this learning material.  
Proposed solution: Change license of the material from CC BY-SA 4.0 to CC BY 4.0.

**Lecture: 3D GIS data standards v1.0**

CR's to be included in next version

Change Requests not yet processed

Closed change requests (included in V1.1 of the materials)

**CR#1/2024-12-11/OCELLUS**

OCELLUS wants to be free to use another license for their adaptation of this learning material.  
Proposed solution: Change license of the material from CC BY-SA 4.0 to CC BY 4.0.

**CR#2/2024-12-11/Teacher (TN)**

Minor spelling errors throughout  
Proposed solution: Correct errors

**Lecture: Introduction to Digital Urban Twins v1.0**

CR's to be included in next version



Change Requests not yet processed

**CR#1/2024-12-05/Author (A Östman)**

Add an example of digital twins, preferably outside Sweden and connected to BIM-GIS integration.

**CR#3/2025-01-20/Teacher (FORMA.Azione)**

The slides could include more information about the production and construction of an urban digital twin. It might help to understand the digital twin by clarifying what types of data can be integrated, which technologies are involved, and the kinds of analyses and monitoring that can be performed using this tool.

Proposed solution:

It is suggested to add some slides to the educational material that illustrate:

- Technology and data infrastructures used in the context of digital twins
- The types of data that can be integrated and collected within digital twins
- The types of data analysis and visualization that can be performed through digital twins
- The monitoring and predictions that can be implemented

Closed change requests

**CR#2/2024-12-06/Ocellus**

Change license to CC-BY

Linces updated in lecture notes as well as on web site, version 1.1

**Lecture: Sensor Data Standards v1.0**

CR's to be included in next version

Change Requests not yet processed

Closed change requests

**CR#1/2024-12-05/Author (A Östman)**

Include a section on the ZigBee standard, which is commonly used for IoT, smart home applications but increasingly now also in smart city applications as well as BIM.

Slides explaining ZigBee is included in lecture notes version v1.1

**CR#2/2024-12-06/Ocellus**



Change license to CC-BY  
License updated in lecture notes and on web site in version v1.1

### Lecture: Air Quality Programs v1.0

CR's to be included in next version

Change Requests not yet processed

Closed change requests

#### **CR#1/2024-12-05/Author (A Östman)**

Update content caused by the adoption of the new Air Quality Directive on October 14, 2024.  
New emission thresholds included in version v1.1

#### **CR#2/2024-12-06/Ocellus**

Change license to CC-BY  
New license included in lecture notes and on web site, version 1.1

### Assignment: Sensor alarms v1.0

CR's to be included in next version

Change Requests not yet processed

#### **CR#1/2024-12-05/Author (A Östman)**

Add an assignment where the OGC Sensor Thing API standard is used, for instance by using the services offered by the USAGE or AD4GD projects.

Closed change requests

#### **CR#2/2024-12-06/Ocellus**



Co-funded by the  
Erasmus+ Programme  
of the European Union



Change license to CC-BY  
License changed in document and on web site in version v1.1

### **Change requests for the module: BIM-GIS Integration**

#### **Lecture: Introduction to BIM-GIS integration v1.0**

CR's to be included in next version

Change Requests not yet processed

Closed change requests (included in V1.1 of the materials)

##### **CR#1/2024-12-11/OCELLUS**

OCELLUS wants to be free to use another license for their adaptation of this learning material.  
Proposed solution: Change license of the material from CC BY-SA 4.0 to CC BY 4.0.

##### **CR#2/2024-12-11/Teacher (TN)**

Minor spelling errors throughout  
Proposed solution: Correct errors

##### **CR#3/2024-12-11/Teacher (TN)**

Wrong placement of certain images.  
Proposed solution: Correct placement

##### **CR#3/2024-12-11/Teacher (TN)**

Page 4, clunky wording "And what the gains and losses are if one does so?"  
Proposed solution: Rewrite for better clarity

#### **Lecture: BIM-GIS Integration Workflow v1.0**

CR's to be included in next version



Change Requests not yet processed

**CR#4/2025-01-20/Teacher (FORMA.Azione)**

Indicate in brackets what the acronyms mean City JSON E City GML

Closed change requests (included in V1.1 of the materials)

**CR#1/2024-11-13/Teacher (TN)**

- Page 11, unclear wording, "Other becomes during the conversion"
- Page 13, unclear wording "...and stakeholders can answer questions otherwise impossible if the only system would be used."

Proposed solution: Rewrite for better clarity

**CR#2/2024-11-13/Teacher (TN)**

Minor spelling errors throughout

Proposed solution: Correct errors

**CR#3/2024-12-11/OCELLUS**

OCELLUS wants to be free to use another license for their adaptation of this learning material.

Proposed solution: Change license of the material from CC BY-SA 4.0 to CC BY 4.0.

## Lecture: BIM-GIS Data Conversionv1.0

CR's to be included in next version

Change Requests not yet processed

Closed change requests (included in V1.1 of the materials)

**CR#1/2024-12-11/OCELLUS**

OCELLUS wants to be free to use another license for their adaptation of this learning material.

Proposed solution: Change license of the material from CC BY-SA 4.0 to CC BY 4.0.

**CR#2/2024-12-11/Teacher (TN)**

Minor spelling errors throughout

Proposed solution: Correct errors