



## D5.1: CBIM Training Curriculum and Assessment Strategies

### Work Package 5: Training

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24/06/2020	0.6	D. Rovas (UCL)	Prepared the Training Event template
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## Abbreviations and Acronyms

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Acronym	Description
CBIM	Cloud-Based Building Information Modelling
CEN	European Committee for Standardisation
CIB	Council for Research and Innovation in Building and Construction
EC3	European Conference on Computing in Construction
ESR	Early Stage Researchers
MOOC	Massive Open Online Course
ISO	International Organization for Standardisation



## Executive Summary

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The primary aim of the Cloud-based Building Information Modelling (CBIM) network is to deliver training to 14 Early Stage Researchers (ESRs) in the multidisciplinary aspects of CBIM.

The training of each ESR consists mainly of training by curiosity-driven research which is supervised by a supervisory board of academics and industry practitioners. Also, the CBIM network will develop a set of taught components, called “PhD Schools” or “Training Events” and are to be delivered primarily by the network of beneficiaries and partners but also, where relevant, by invited external participants.

This Deliverable provides a detailed plan of the events scheduled to take place. It provides a framework for planning these events to account for transparency, quality and take into consideration ethical, data protection and copyright issues. A significant part of the network is the bespoke CBIM-specific “structured training” events. The practical aspects of developing content and delivering these events in the context of CBIM are also touched upon within this Deliverable. In developing this framework, a top-down approach is taken, guided by a set of principles that can support the development, planning and delivery of the CBIM PhD school activities. The framework can then be used in a bottom-up manner towards development and delivery of the training events that: (1) meet the CBIM network objectives, and; (2) considers pedagogical and organisational aspects.

The bottom-up development uses a set of templates that capture all relevant information for each training event. We tried to provide enough information in this first instance, but we intend to continue to detail each of the events in the following periods. This should ensure coherence and alignment between the various activities, leading ultimately to the “Integrated CBIM Training Curriculum.” A quality control mechanism is stipulated to ensure that the event developed meet the needs of the Early Stage Researchers, but also additional external participants to be invited to join and contribute to the structured training events.

The second area of concern in this Deliverable is the Personal Career Development Plan, and the template to be used is being prepared.



## 1 Training Principles

The training events foreseen are listed below. In the proposal (now Description of Action, DoA) we have detailed each of the events in terms of content and the dates these are to take place<sup>1</sup>:

	Main Training Events & Conferences	ECTS <sup>2</sup> (if any)	Lead Institution	Action Month <sup>3</sup>
TE1	PhD School: BIM fundamentals and BIM Research Methods (Cambridge, UK)	4	UCAM	Dec 2020
Mod1	Module on Product Modelling and Management (Distance Learning)	4	TUB	Jan-Mar 2021
TE2	PhD School: Sensing and Data Collection (Valladolid, ES)	4	CARTIF	May 2021
TE3	PhD School: Linked Data, Data Integration and Collaborative Working, leveraging LDAC workshops (Espoo, FI)	4	TRMB	Sept 2021
TE4	PhD School on BIM Applications (Haifa, IL)	4	TECH	Dec 2021
C1	Workshop on CBIM Data Models and Semantic Enrichment (London, UK)	-	UCL	July 2022
Mod2	Module on Entrepreneurship Management (Distance Learning)	4	LOLA	Oct-Dec 2022
HT	CBIM App Development Hackathon (Berlin, DE)	1	CON, UCD (lead)	Dec 2022
C2	Conference on advances in BIM and its applications through CBIM (Location: Dublin, IE)	-	UCD	Aug 2022

TE = Training event; Mod = Module; C = Conference; HT = Hackathon

This section discusses several aspects to support the planning of these events, considering the requirements set forth in the Description of Action and the Consortium Agreement. The following should be noted:

- Each beneficiary is responsible for organising one such event.
- There might be some flexibility on the event dates, but these are timed to align with core project activities.
- Risk assessment is necessary for all events. This should consider Health and Safety issues, pedagogical risks, CV-19 planning, and reputational risks (especially for shared events).
- In the proposal we provided a sketch of a programme, but this was developed initially some time ago. We need to use this as the baseline and update to ensure a forward-looking set of learning activities that align with the current state-of-the-art.

The following sections consider overarching aspects in several categories that include costs, impact, audience and overheads. These principles should help guide development of training programmes.

### 1.1 Costs

- The network funding covers research, training and networking (RTN) costs which are calculated as Unit Costs for each ESR. While a country correction coefficient has been applied for the living and mobility allowance<sup>4</sup>, no such coefficient is applied for research, training and networking costs.
- The RTN costs are Institutional Costs and can be used to cover: costs for training and networking activities that contribute directly to the researchers' career development (e.g. participation in conferences, trips related to work on the action, training, language courses, seminars, lab material, books, library records, publication costs). In addition, costs for visa-fees

<sup>1</sup> Note: The CV-19 situation might force changes to events that should be considered. For example, certain events may be delayed and/or converted to online events.

<sup>2</sup> ECTS: European Credit Transfer and Accumulation System. [http://ec.europa.eu/education/ects/users-guide/docs/ects-users-guide\\_en.pdf](http://ec.europa.eu/education/ects/users-guide/docs/ects-users-guide_en.pdf). The number of ECTS is indicative of the amount of time and effort expected by each student participating in each of the training events. Note that 1 ECTS ≈ 20 Learning/Research Hours, which includes independent study.

<sup>3</sup> The actual dates will be set by the event organisers in consultation with the beneficiaries.

<sup>4</sup> This researcher unit cost can be used to cover costs related to the ESR's mobility to be with the beneficiary. This can be used to cover accommodation (e.g. rent) at the beneficiary location or to pay for private travel back to the home country. Most organisations will include this in the salary, but some might opt to cover some of these costs directly. These costs cannot be used to cover professional travel and/or training costs.



and PhD study fees can be charged to these costs. The allowable expenses per ESR are €64,800 for the duration of the training. While this seems significant, it is expected that these fees will also be used to cover secondment costs (of up to 10 months) and travel of supervisors to attend training events and network meetings.

- The remaining amount can be used to cover conference travel, Article Processing Charges (APC) for open access funding and help maximise impact. All spending should be compliant with the Grant Agreement requirements and institutional policies.
- Although the process of determining cost eligibility is simple (unit costs), all costs must be auditable by the European Commission.
- The grant does not include personnel costs for development of training material. These can only be covered by the RTN costs (which include all other activities), but these funds are quite limited. All participants have contributed (50%) of the to the management costs to a shared pot for the management of the network. These resources should be exploited as much as possible to reduce overheads (e.g. handling of finances, updating the website, monitoring and maintaining training materials on the project website).

**Principle 1:** We need to carefully plan the events to maximise value whilst keeping costs manageable.

**Principle 2:** All costs should be transparent and auditable (by the EC).

**Disclaimer:** This guidance draws information from several sources (DoA, CA, AMGA, Institutional Guidance, etc.) and aspires to consolidate information and facilitate planning compliant with the contract signed with the EU and prevailing national laws.

## 1.2 Intended audience

In addition to the CBIM ESRs, structured training activities should be open to external participants.

### Training Events:

**TE1 – TE4:** “The PhD schools (TE1 to TE4) will be opened to 25-30 European PhD non-CBIM students and engineers outside CBIM (the numbers are limited only by the resources available to the organizers) already working in the AEC/FM sector to give the opportunity to PhDs outside the CBIM network to benefit from broad, in-depth education and training in BIM.”<sup>5</sup>

**C1-C2:** This also applies to the workshops. C1 is planned as a two-day event with one day open to the public. C2 is an open conference, possibly collocated or organised under the auspices of a major conference.

**Mod1 and Mod2:** The two remote Modules (Mod1 and Mod2) can be confined to consortium members or be made more broadly accessible to audiences – this is at the discretion of the organisers.

**HT1:** Linked to Mod2 and possibly closed to externals.

**Principle 3:** Events should be open and accessible to as wide a public as possible and practical.

### Widening participation:

“We plan to enlarge the ETN with additional members and institutions that show their support by agreeing to give lectures or participate in training events organised by the project; in return, they can benefit from access to the extensive training network and its results.”

**Principle 4:** Local events should seek to engage local (e.g. at a national level) participants and engage them in network activities, including training events.

<sup>5</sup> Unless otherwise mentioned these costs are from Part B of the Description of Action.

### 1.3 Pedagogical

Each training event should place special emphasis on pedagogical matters. For this reason, a varied set of approaches to training will be followed, combining:

- Traditional lectures
- Active and visible learning methods (e.g. group discussions, student presentations, problem-solving, hackathons)
- Use of blended and flipped learning approaches, to ensure effective utilisation of time, especially for skills sessions.
- Peer-learning by encouraging students to work together.

All these are already encapsulated in the training programme outlined in the DoA. A balanced approach to activities and active learning approaches is to be sought. This should ensure maximisation of efficacy, as well as, be accommodating to different methods of learning.

**Principle 5:** Pedagogy should be at the core of all activities driving the design and delivery of CBIM learning.

We need to recognise learning and provide evidence for attainment of specific learning outcomes. This can help recognise achievement of each ESR but also encourage participation. To achieve this:

1. A list of expected learning outcomes should be drawn up for each event.
2. An assessment methodology should be applied to gauge the level of attainment of the desired learning outcomes.
3. Once these have been attained, certificates must be issued.

These learning outcomes should be clearly articulated and be made available on the web site. A diversity of assessment methods should be identified.

**Principle 6:** Each of the Training Events and online Modules should draw up a list of learning outcomes and devise assessment methods to ensure that these are met.

**Principle 7:** Learning attainment should be documented and rewarded.

### 1.4 Maximizing impact

From the DoA: **“CBIM lectures, Massive Open Online Course (MOOCs) & online wikis (M12-M48):** *Videos of selected public lectures, lab demonstrations and interviews with ESRs and PIs will be published on the project website. Selected courses in Training Events will be assembled in one or several MOOCs (Deliverable 6.6). A periodic survey of wiki’s (e.g. Wikipedia) will be carried out to update articles covering the CBIM domain.”*

*“The tenets of Open Science, and in particular Open Access of Publications, Open Access of Data, Open Access of Source Code and Open Access to Education Resources will be part of the training and will be effectively used to maximise impact.”*

Dissemination material	Access	Description
Articles and conference materials	“Gold” open access	The final typeset paper is made publicly available for an open access charge paid by CBIM on publishers’ websites and institutional repositories.
	“Green” open access	Final text is made publicly available as an “author version” on an electronic repository for quicker dissemination of information
Presentations, lecture notes and training materials (from Training Events)	Free Access	Free access to CBIM website for maximum dissemination to students and other stakeholders (using a Creative Commons License)
Patents		The text will be made publicly available. For innovations that will not be patented, an 18-month blackout period will apply before they are published.

*“A membership zone with compulsory registration (free of charge) will be set up to give access to the research outcomes and training curriculum material.”*

**Principle 8:** TE material (recordings, lecture material) should be captured and made openly available on the web.

## 1.5 Compliance

We must ensure compliance with data protection laws (e.g. GDPR and its local implementation) and institutional policies.

**Principle 9:** Ensure compliance with local and institutional policies and data protection laws

## 2 Summary of guiding principles

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The 9 guiding principles that should drive the specification of the training events is provided below.

### Principle 1

We need to carefully plan the events to maximise value whilst keeping costs manageable.

### Principle 2

All costs should be transparent and auditable (by the EC)

### Principle 3

Events should be open and accessible to as wide a public as possible.

### Principle 4

Local events should seek to engage local (e.g. at a national level) participants and engage them to network activities, including training events

### Principle 5

Pedagogy should be at the core of all activities driving the design and delivery of CBIM learning.

### Principle 6

Each of the Training Events and online Modules should draw a list of outcomes and devise assessment methods to ensure that these are met.

### Principle 7

Learning attainment should be documented and rewarded.

### Principle 8

Training event material (recordings, lecture material) should be captured and made available openly available on the web.

### Principle 9

Ensure compliance with institutional policies and data protection laws

### 3 Guidelines and recommendation for developing Training Events

Each beneficiary is responsible for organisation of the following events (shown in the table):

Table 1: Training Events

	Training Events & Conferences	Organiser	Action Month <sup>6</sup>
TE1	PhD School: BIM fundamentals and BIM Research Methods (Cambridge, UK)	UCAM	Dec 2020
Mod1	Module on Product Modelling and Management (Distance Learning)	TUB	Jan-Mar 2021
TE2	PhD School: Sensing and Data Collection (Valladolid, ES)	CARTIF	May 2021
TE3	PhD School: Linked Data, Data Integration and Collaborative Working, leveraging LDAC workshops (Espoo, FI)	TRMB	Sept 2021
TE4	PhD School on BIM Applications (Haifa, IL)	TECH	Dec 2021
C1	Workshop on CBIM Data Models and Semantic Enrichment (London, UK)	UCL	July 2022
Mod2	Module on Entrepreneurship Management (Distance Learning)	LOLA	Oct-Dec 2022
HT	CBIM App Development Hackathon (Berlin, DE)	CON, UCD (lead)	Dec 2022
C2	Conference on advances in BIM and its applications through CBIM (Location: Dublin, IE)	UCD	Aug 2023

TE = Training event; Mod = Module; C = Conference; HT = Hackathon

There are a variety of aspects that should be considered when developing such training events. These events serve a dual purpose:

1. To provide knowledge and skills training to ESRs but open these events to the benefit of external students as well.
2. To enhance visibility of the network activities and provide material in support of the project communication activities.

The organisers of each Training Event should prepare a detailed plan using the [CBIM training Event Template provided](#). (Annex 6 to this guidance). Where relevant, the organiser should oversee the logistics and the communication with the supervisors. Guidance on aspects that should be considered is given below. The planning exercise should not be laborious but should ensure we consider and capture all information about the programme and organisational aspects – this is required for the reporting to the EC.

#### 3.1 Organisational considerations

Each event can be organised following one of three approaches:

1. Independent Event provided by a CBIM Beneficiary.
2. Virtual learning event (e.g. online Modules 1 and 2).
3. Event provided by an external organisation (outsourced provision, e.g. EC<sup>3</sup> summer school).

In all cases, ESRs pay attendance fees from their RTN budgets. The supervisory board will review the event and decide suitability. The organiser of each event has the freedom to make organisational decisions but should adhere to the principles set forth above. The event organiser should prepare a plan for the event and submit it for review by CBIM. The training committee will review the pedagogic aspects of all training event proposals and provide feedback on quality control. The Supervisory Board will evaluate the scientific activity implementation, intellectual property protection and exploitation of the

<sup>6</sup> The actual dates will be set by the event organisers in consultation with the beneficiaries.

results, any other decision related to financial issues. This can be an iterative process, requiring clarifications and amends where these might be required.

An initial proposal for each TE was submitted in the context of the preparation of this Deliverable. These proposals will be reviewed in terms of compliance with the CBIM Training Principles and the guidelines provided below. Where changes are sought to the programme (e.g. confirming the schedule of events closer to the time they occur) a revised proposal must be submitted to the training coordinator and approved by the training committee.

### 3.1.1 Event provided by a CBIM Beneficiary

This is a transparent and recommended option. It has characteristics of a “traditional” research project meeting, with the only difference that externals (students or professionals) might be able to join the public parts of the event (subject to capacity constraints). It provides a low-risk approach to the consortium – much of the risk is borne by the organiser (and the risk level taken can be reflected in organisational decisions). Cost accounting at the network level is simple, devolving this responsibility to the event organisers. An important concern is that this option may lead to a lack of transparency if costs and financial decisions are not traceable or if there is any conflict of interest. The training event plan will be approved by the Training Committee in advance, and financial issues will be handled by the Supervisory Board and the Coordinator. Auditable documents must be maintained for all expenses. A risk assessment will be required as part of the training event plan.

Guidelines (these are indicative, alternative modalities will be reviewed following the project internal decision-making procedures as stipulated in the Consortium Agreement):

- Providing beneficiary will set the costs to cover the full event cost.
- Payment and registration systems must be set up for charging ESRs and external participants. Invoices will be required.
- Host beneficiary can make in kind contributions (e.g. use of meeting spaces).
- A transparent and auditable process is required with suitable documents.
- Limited or no liability on the side of the consortium, but some risks if the event is cancelled or scope reduced due to budgetary or other restrictions. Financial risk is borne by beneficiary, which implies additional approvals might be sought internally.
- The organiser is encouraged to make block reservations for accommodation with preferential rates where possible, but travel and accommodation will be paid directly by the participants. ESRs and supervisors will be reimbursed by claiming directly on their beneficiary’s RTN budget. Travel and accommodation will not be included in the fees.
- After the event, a brief pedagogic report should be submitted to the coordinator. This report will be used in preparing reports to the European Commission.

#### Recommended best practice

- Wherever possible, network-level resources from the network (central management, administrative support) should be used.
- Where possible, lectures should be streamed rather than incur travel expenses for external lecturers.
- The announcement of the school should be hosted as part of the CBIM web site. A separate beneficiary website can be developed but due consideration to costs should be given.
- The event should be marketed at the consortium level, but additional marketing of the event can be done by the partners and beneficiaries. In addition to network-level dissemination activities, it is recommended that the TE organiser actively markets the event.



- Where possible, a room (classroom, lecture theatre, meeting room) should be reserved at the beneficiary premises at no cost. Confirm that the room has necessary A/V equipment for recording lectures.
- Ideally, a no-profit rule should apply. Where relevant, sponsorships or third-party support may be sought to cover part of the costs. These can be used to increase value of the event (either by scheduling additional activities or by reducing the ESR participation fees).
- Where possible, pro bono local support should be sought using existing administrative structures (e.g. teaching/events support team).
- It is the responsibility of the TE chair to provide for updating and uploading of the VLE environment. All participants should have access to the training material and recorded lectures, even after the event.
- An evaluation questionnaire should be prepared and distributed. Things that students liked, lessons learnt and suggestions for improvement should be captured in this report. This could be useful if the course becomes a MOOC (when updating the material for final upload there).

#### Adherence to principles:

**Principle 1:** We need to carefully plan the events to maximise value whilst keeping costs manageable.

Achieved by:

- Using beneficiary resources for room bookings, administrative support and secretariat
- Using CBIM management and administrative support for:
  - Communicating to potentially interested parties
  - Hosting training material in a VLE
- Beneficiaries should deliver significant portion of teaching; part of the teaching can be delivered remotely

**Principle 2:** All costs should be transparent and auditable (by the EC and beneficiaries)

- Financials implications of events to be reviewed by the supervisory board.
- A pedagogic report should be provided at the end of the event to the coordinator, to support reporting to the EC.
- Ideally for the whole event, a no-profit rule should apply.

**Principle 3:** Events should be open and accessible to as wide a public as possible.

- Students and young industry professionals might have limited funds to pay for such events. Keeping their participation costs low is important to ensure attendance is maximised (within capacity limits).
- Any CBIM network-specific activities should be separated from the training activities open to the public.

**Principle 4:** Local events should seek to engage local (e.g. at a national level) participants and engage them in network activities, including training events

- To expand the network local and national resources should be used, where possible, to deliver the training.
- Where international instructors are required, they should provide their training using teleconferencing.
- Where possible, co-locate with other events (e.g. training events, conferences) to benefit from synergies.

**Principle 9:** Ensure compliance with institutional policies and data protection laws

- Ensure that all costs are traceable.

- Privacy and data protection issues should be handled in compliance with GDPR requirements. Where a beneficiary processes personal data (data controller) and some of these data must be transferred to the coordinator e.g. for reporting, the data processors are the controller and the coordinator (Technion).
- Disclaimers about GDPR and consents should be taken for all events.
- Ideally the TE should be managed administratively and financially through the beneficiary (e.g. using a separate account) following the beneficiary's accepted principles. Organising through a third-party entity should be avoided, if possible, as it will require a number of additional considerations (e.g. GDPR compliance) and does not benefit from the protection of the Consortium Agreement.
- Privacy and data protection issues should be handled in a GDPR-compliant way.

### 3.1.2 Virtual Learning Events

When a virtual learning event is proposed, general items from 3.1.1 apply here as well (e.g. in relation to the reporting to the coordinator and the EC). In addition:

#### Aspects to consider:

- Virtual learning events are a cost-effective way to deliver training to ESRs
- Reserve the time slots early in advance and notify students so that they can block their calendars.
- Consider synchronous learning approaches for delivery of teaching. The use of flipped teaching approaches can be quite effective. Guest lecturers (especially from the industry) can help provide practical insights.
- Consider opening this up to external students. Given that capacity constraints do not exist, consider how many students should this be delivered to?
- Use the Virtual Learning Environment to share all material, communications and, if possible, the synchronous teaching approach.
- Decide if the virtual event should be part of the CBIM training material (and publicly available) or only for the consortium (although we are required to publish all material openly).

#### Recommended best practice:

- The guidance for Option 1 applies here.
- There are minor cost implications and a budget might not be required.
- The event should be published (even if closed to externals) and a report will be required at the end.
- A registration system should be put in place for externals only. This can be something as simple as a Google or MS Form. Their information can be used to provide access information to the course.
- For each lecture attendance should be captured.
- Small costs for consumables can be charged. Local support should be sought using existing administrative structures (e.g. teaching/events support team) and where possible at no cost. If additional support is required, then this should be costed, and approval sought by the network.
- A short report of activities after each training event will be expected. This will be used for reporting purposes and a condensed version will be uploaded for public view on the web site. All participants should have access to the training material and recorded lectures, even after the event. The report should include the communication activities undertaken to promote the school and the level of attendance.



- A questionnaire should be prepared, and evaluation forms should be distributed. These forms should capture aspects like the overall quality, things that students liked, lessons learnt and suggestions for improvement should be captured in this report. This could be useful if the course becomes a MOOC (when updating the material for final upload there).

Adherence to principles:

**Principle 1:** We need to carefully plan the events to maximise value whilst keeping costs manageable.

- A virtual event is by default cost effective. Consider how to maximise value for the participants.

**Principle 2:** All costs should be transparent and auditable (by the EC)

- Financial aspects to be reviewed by the supervisory board.
- The network to provide infrastructure and administrative support, although for local matters such support might be limited.

**Principle 3:** Events should be open and accessible to as wide a public as possible.

- In the DoA it is made clear that all material should be made open.
- It is at the discretion of the organisers whether they would like to make this available to external students.

**Principle 9:** Ensure compliance with institutional policies and data protection laws

- GDPR concerns need to be addressed. Students should accept a statement regarding GDPR and data use.

### 3.1.3 Event provided by an external organisation (outsourced)

In certain cases, there is benefit in outsourcing the provision to a third-party. There are several high-quality events already taking place (e.g. EC<sup>3</sup>, LDAC and associated summer schools). Selecting such events for ESRs should seek to maximise value and in addition to providing learning opportunities, further support widening the ESR's network. many of these events happen in association with academic conferences and workshops, so a side benefit is that ESRs could attend these activities.

Aspects to consider: (indicative list, some might not be apply):

- The content of the summer school should align with the network learning objectives (e.g. there should not be significant duplication with other activities) and help achieve the overall expected learning outcomes.
- A third party might be organising the event. The prices should be clearly advertised on a web site. Evidence of prior events (unrelated to CBIM) should be provided to ensure credibility of the training event.
- Once such an event has been identified, the CBIM training committee will consider suitability of the event and approve participation (and contribution).
- ESRs will register directly with the school and claim on their RTN budget.
- There must be a quality assessment of the outsourced provision to ensure that the event meets the quality criteria expected by the network.
- If possible, enquire with organisers if materials used can be shared and made available on the network platform.
- As the group will comprise of 14 ESRs a group discount should be negotiated with the organisers.
- The costs of participation with the discount should be on par with the costs of the event being independently organised by the network. This should consider potential additional benefits (e.g. collocation with an event).

- We need to confirm that the material to be made available by the organisers (and allowed to be published on the web site) complement existing material so that the “Integrated CBIM curriculum” will be complete after the end of the project.

## 3.2 Pedagogical

Pedagogy should be at the core of the structured training activities. The CBIM network has extensive experience in the development and delivery of such activities and will utilise these experiences to maximise the benefit of the students.

### 3.2.1 Innovative Doctoral Training

An advice paper published by a League of European Research Universities<sup>7</sup> states that:

*“Doctoral training has changed significantly in recent years. It is now widely recognised that doctoral graduates make significant contributions to innovation and that they need both a thorough and broad skill set to do so. With many graduates gaining employment outside of academia, the tradition of doctoral training only for replenishment of academia belongs to the past. This recognition has resulted in the growth of structured doctorates and institutional structures to ensure breadth and consistency of training at universities.”*

CBIM as a training network seeks to create entrepreneurial candidates with the knowledge and skills to make contributions in the area of Cloud-based BIM. “Formal research training” forms an integral part of the training, and this in CBIM is accomplished through the envisaged training events.

Research on digital twins and their use for delivery of services in facility management, operational optimisation, energy modelling, gamification (some of the areas covered in CBIM) will have a transformative impact in the respective application domains and strategically position the ESRs to lead this transformation.

By the end of the training programme, ESRs will have the knowledge and skills to be employable in roles such as: a) professors/researchers; b) digital engineers/managers with national/local government agencies, technology providers, major design firms, or major construction contractors; or c) CTOs of CBIM technology start-ups.

One of CBIM's main objectives is to stimulate and enhance career perspectives of early stage researchers through their involvement in transformative technological innovations. To develop this technological and scientific potential, CBIM will offer an integrated interdisciplinary training and educational programme for early career researchers spanning from training in various research topics related to BIM (generation of BIM geometry, semantic enrichment, life-cycle data management), to understanding of standardisation, which is particularly important in the field (ESR 14), to business concepts and technology transfer (ESR11). This will be complemented by secondments in other academic and industrial institutions to give the fellows additional hands-on experience and skills training. Also, as part of the TEs, all ESRs will acquire a core set of transferable skills. The development of the CBIM training programme and ESR supervision principles are underpinned by the guidelines proposed in the *connected curriculum* approach<sup>8</sup>:

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<sup>7</sup> “Good practice elements of doctoral training”, Advice paper, No.15 – January 2014

<sup>8</sup> Fung, D. (2016). Strength-based scholarship and good education: The scholarship circle, Innovations in Education and Teaching International, pp. 1-10, Available online: <http://dx.doi.org/10.1080/14703297.2016.1257951>

Table 1: Enhancing career perspectives and employability of CBIM researchers

Dimensions	Addressed in CBIM
Students connect with researchers and with the CBIM participating institutions' research	<ul style="list-style-type: none"> <li>- Students become integral and active contributors to the beneficiaries' research groups, and through secondments, gain training and exposure to world-leading academic and industry groups. This gives each ESR the unrivalled opportunity to interact and learn from experienced researchers in areas that transcend disciplinary and sectoral boundaries.</li> <li>- Active dialogue is maintained throughout the project through the TEs and conferences, peer-learning and the individual projects.</li> <li>- The interdisciplinary training program of CBIM engages ESRs with an enquiry into their professional practice.</li> </ul>
Research-based learning activities are built into each ESR's training activities	<ul style="list-style-type: none"> <li>- Individual research programmes are the core research activities of each ESR supported by experienced academic and industrial supervisors.</li> <li>- Assessment and feedback are provided in a timely fashion so that researchers develop within their involvement in CBIM. Students are given opportunities and flexibility (through the personalized PCDPs) to develop their own learning narrative.</li> </ul>
Students make connections across subjects and out to the world	<ul style="list-style-type: none"> <li>- ESRs benefit by being members of the training network with multi-disciplinary interactions. They are exposed to and develop through common network activities an understanding and appreciation of work beyond the remit of their projects.</li> <li>- ESRs become members of active world-class research institutions and adapt core values on Responsible Research and Innovation.</li> <li>- All ESRs will be encouraged to participate in other workshops and research networks. Examples include Product and Asset Lifecycle Management (PALM) doctoral workshop, Linked Building Data W3C working group, etc.</li> <li>- CBIM is a European citizenship program, and ESRs become active members of it.</li> </ul>
Students connect academic learning and workplace learning	<ul style="list-style-type: none"> <li>- Each ESR hosted in an academic beneficiary will spend time (as part of his core activities or through secondment) at one or more industry partners developing an appreciation for workplace practices beyond their academic training environment.</li> <li>- All ESRs projects have a strong focus towards research with real-world impact. Students within the network will benefit from group work and training on project management, enterprise and leadership.</li> </ul>
Students learn to produce outputs – assessments directed at an audience	<ul style="list-style-type: none"> <li>- Students acquire skills (through TEs) to articulate and communicate the depth and breadth of their knowledge to different audiences, including future employees.</li> <li>- All ESRs will take part in skills training (see TEs above): this will impart them with basic techniques of critical analysis of literature, research methodologies, and evidence-based research in addition to presentation and scientific writing skills tailored at different audiences (e.g., researchers, industrialists, students), thus impart them with the experience and confidence to address a disparate audience.</li> <li>- Peer assessment and feedback is adopted as a training methodology, contributing to the learning process.</li> </ul>
Students connect with each other across phases,	<ul style="list-style-type: none"> <li>- The CBIM ETN will have an impact beyond the life of the training network. CBIM participants (ESRs, supervisors, associates) form a community of like-minded individuals, sharing a common group of values, which enables them to develop</li> </ul>

<b>with alumni, and establish professional networks</b>	<p>professionally and work in advancing the state-of-practice in BIM and its applications.</p> <ul style="list-style-type: none"> <li>- Individual Research Projects have been designed to foster collaborations between ESRs (e.g. clusters on information management, facility management and operational optimisation). This will enable individuals to work in groups and, also, organic interactions are expected to develop through the common events in the duration of the project.</li> <li>- ESRs will be given (through the two CBIM conferences) with the opportunity to develop their professional networks.</li> <li>- ESR will join world-leading PhD programmes and connect with fellow PhD students, expanding their peer network.</li> </ul>
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At the core of each of these dimensions of the connected curriculum lies pedagogy, and Principle 5.

**Principle 5:** Pedagogy should be at the core of all activities driving the design and delivery of CBIM learning.

It is important that activities are planned in line with the dimensions above. Already during the proposal stage, these dimensions were considered in the high-level specification of these events. This forms a solid starting point for the detailed specification of the CBIM structured training curriculum.

### 3.2.2 Envisaged Training Events and Related Activities

The Table below indicates the starting point which provides, for each event, an outline, a list of learning outcomes, and an outline schedule. Given the budget and presenter availability constraints the plan will be revisited and detailed for each of the events. The current version is described on the forms developed using the guidance of this document, which are attached at the end of the document.

Due to the global health crisis situation certain events might have to be re-structured for blended or fully online delivery.

**Table 2: TE1: PhD School on BIM fundamentals & BIM Research Methods**

Open to qualifying European PhD students outside CBIM)			
<p><b>Outline:</b> This TE serves a dual purpose: a broad introduction to BIM fundamentals and research methods, but also a bonding opportunity/community-development exercise for ESRs. The first part of TE1 will familiarise students with BIM as a product and as a process, BIM tools, data models (e.g. the Industry Foundation Classes), BIM data exchange and cross-sector interoperability. The second part of TE1 focuses on research methods training, ESR project management, and ethics contextualised to the BIM area. Tutorials will require students to get hands-on experience in collecting data and working with BIM models. The organisers have sought a balance between lectures given by consortium members and invited lectures from industry. Considering its introductory nature, TE1 is scheduled early in the CBIM program and serves as an introduction to Mod1. Social events and short excursions after the daily activities will be scheduled to facilitate ESR community development.</p> <p><b>Learning outcomes:</b> The student must be able to:</p> <ul style="list-style-type: none"> <li>(i) understand how conventional research methods can be employed in the BIM area to solve research problems;</li> <li>(ii) understand what BIM is and its value;</li> <li>(iii) gain familiarity with coding and working with BIM data, and;</li> <li>(iv) understand how to develop and manage his research programme..</li> </ul>			
<b>Organiser: Ioannis Brilakis</b>		<b>Action Month: M10</b>	
<b>Location: Cambridge, UK</b>		<b>Contributing Organization</b>	
		<b>Beneficiary</b>	<b>Partner</b>
<b>Day 1 Welcome/ Overview</b>	Network overview, partner capacities, training plan (1h30) ESR short introductions (5 min each ESR) Building Information Modelling: A concise introduction (1h30) How does Building Information Modelling create value? (1h30)	R. Sacks (TECH) All ESRs R. Sacks (TECH)	M. Bew (PCSG)
<b>Day 2 BIM Basics I</b>	Introduction to STEP and EXPRESS (1h30) Current and upcoming openBIM standards: IFC4 ifcOWL, IFC5 (1h30) Working with BIM data: Tools & concepts (1h30) Data quality and related Issues: Model-checking, BCF Tutorial (1h30)	I. May (LOLA) R. Sacks (TECH) K. Nyberg (TRMB)	M. Bew (PCSG)
<b>Day 3 BIM Basics II</b>	Developing a BIM model and performing basic queries (1h30) BIM tools and parametric modelling (1h30) Interoperability (1h30) Mixed Reality for BIM and demonstration (1h30)	K. Nyberg (TRMB)  R. Sacks (TECH) I. Brilakis (UCAM)	D. Robertson (BNTY)
<b>Day 4</b>	BIM research challenges roadmap (1h30) Introduction to research methods using examples from the BIM area (1h30)	R. Sacks (TECH) I. Brilakis (UCAM)	

<b>BIM Research Methods I</b>	Defining research questions, objectives and hypotheses (1h) Qualitative, quantitative and mixed research strategies in BIM research (2h)	D. Rovas (UCL) T. Hartmann (TUB)	
<b>Day 5 BIM Research Methods II</b>	Methods for collecting, preparing & archiving BIM research data (1h) Selecting validation metrics / conducting experiments for novel BIM tools testing (1h) Managing your project (1h) Responsible research & innovation / gender aspects (2h) Tutorial: Research/create Pecha-Kucha-style presentation on pre-assigned BIM topic (1h) Presentations and feedback (1h30)	I. Brilakis (UCAM) T. Hartmann (TUB)	L. Guibas (STFD)  A. Locke (LOR) G. Herries (LOR)

Table 3: TE2: PhD School on Sensing and Data Collection

(Days 1-3 open to qualifying European PhD students outside CBIM)			
<b>Outline:</b> This TE will offer ESR fellows the opportunity to attend a series of key lectures given by experts in the field of sensing and data collection. The course will offer a general introduction to theoretical concepts relevant to sensing, data acquisition and storage. This includes sensor hardware fundamentals, data types (point-clouds, building sensor data, RGB/D and thermographic imagery, etc.), and quality evaluation metrics. Students will visit two CARTIF Buildings that are living labs (fully equipped and monitored research facilities) and experience the configuration, data collection and quality management mechanisms through a hands-on exercise; they will collect and fuse structured data with the BIM of the CARTIF building. This event will be scheduled to coincide with the mid-term check event. <b>Learning Outcomes:</b> The student should be able to: (i) understand data collection processes for both structured and unstructured built environment data; (ii) understand the different sensors, Building Management Systems, and basic IoT technologies and protocols; (iii) fuse BIM and measured data; (iv) develop appreciation on the value of analytics for facility management and operational optimisation.			
<b>Organiser: Cesar Valmaseda (CARTIF)</b>		<b>Contributing Organization</b>	
<b>Location: Valladolid, Spain</b>		<b>Action Month: M15</b>	
		<b>Beneficiary</b>	<b>Partner</b>
<b>Day 1 Collecting Geometry Data</b>	Workshop objectives (1h) Geometric BIM Model Generation (2h) Data transfer and export (MVDs, Visualisation) (1h) Tutorial (Data capture session: Imaging data) (1h) Videogrammetry (or laser scanning) data collection and storage (1h)	C. Valmaseda(CARTIF )  K. Nyberg (TRMB)	L. Guibas (STFD) M. Weise (AEC3) F. Lehmann (DLR) F. Lehmann (DLR)
<b>Day 2 Collecting Operational Data</b>	Collection of operational data (1h) Temperature and humidity measurements (1h) Building Management Systems lecture and visit at CARTIF's building living lab (2h) Collecting thermographic images (Hands-on session – UCL to provide sensors) (1h) Temperature and Humidity Data Loggers (1h) BMS and IoT protocols (1h)	M. Andrés (CARTIF) D. Rovas (UCL) J. O'Donnell (UCD) D. Rovas (UCL)	P. Brennan (BAM)  P. Devitt (LOR) M. Bew (PCSG)
<b>Day 3 Data Preparation</b>	Data Quality (1h) Problems with geometric data (quality control mechanisms) (1h) Missing data and data imputation (1h) <i>Workshop:</i> Developing a software architecture for storing and linking data (2h) Students in teams to collect, enrich and store data obtained from the CARTIF building (2h)	I. Brilakis (UCAM)  K. Jung (LOLA) M. Andrés (CARTIF)	S. McGovern (LOR) L. Guibas (STFD)
<b>Days 4 &amp; 5</b>	Mid-term Check. ESRs present their research projects, questions and preliminary findings from their literature review. Discussion and formative feedback from participants.	All CBIM Consortium	

Table 4: TE3: PhD School on Linked Data, Data Integration and Collaborative Working

(Open to qualifying European PhD students outside CBIM)			
<b>Outline:</b> This TE will offer ESR fellows the opportunity to attend a series of key lectures given by experts in the fields of linked data and data integration, BIM data standards including geospatial data, as well as, data management concepts. The course will offer a general introduction to concepts relevant to open standards and data definitions, process definitions, dictionaries and ontologies, data and transaction provenance as well as applications, tools and practical solutions. Lectures will include data handling techniques and concepts from other industries such as gaming, manufacturing and plant engineering. A peer-to-peer assessment exercise will be utilised so that students develop an appreciation on ways to assess and provide feedback of peers' work. <b>Learning Outcomes:</b> The student should be able to: (i) understand different data and database structures and standards; (ii) understand the relevant processes and concepts for linked integrated data from various data sources; (iii) develop appreciation on the value of non-proprietary data management solutions.			
<b>Organiser: Kim Nyberg (TRMB) and Ilka May (LOLA)</b>		<b>Contributing Organization</b>	
<b>Location: Espoo, Finland</b>		<b>Action Month: M19</b>	
		<b>Beneficiary</b>	<b>Partner</b>
<b>Day 1 Data Types &amp; Architectures</b>	Data and systems architecture (1h) Relational Database Technology (1h) STEP / EXPRESS Technology (1h) Semantic Web (Triple Store) Technology (1h) Graph Tech & Games techniques (LOD, instancing, loading-unloading, semantisation) (1h)	K. Nyberg (TRMB) R. Sacks (TECH)  K. Jung (LOLA)	D. Frommholtz (DLR) D. Frommholtz (DLR) M. Weise (AEC3) M. Weise (AEC3) M. Bew (PCSG)

	Open Standards vs Open Source (1h)		
<b>Day 2 Data Standards – Part I</b>	BuildingSMART solutions; IFD, IDM/bsDD, MVD Architecture (1h) ifcXML / ifcOWL, W3C serializations and use-cases (1h) IFC4, IFC4x1/IFC5 (alignment extensions for road, bridge, tunnel) (1h) bsDD / BSi links towards Semantic Web (1h) COBie (1h)	R. Wessman (TRMB) K. Jung (LOLA)	T. Liebich (AEC3) T. Liebich (AEC3) T. Liebich (AEC3)
<b>Day 3 Data Standards – Part II</b>	Ontology Alignment and Data Linking (1h) Games Techniques (1h30) LOD applied, instancing, loading-unloading, semantisation (1h30) CityGML, InfraGML, extensions, KML (1h30) Others: CIS/2, GDL, etc. (1h)	I. May (LOLA) K. Jung (LOLA)	L. Ungureanu (CON) D. Harasymczuk (CON)
<b>Day 4 Coding BIM</b>	Practical Software Implementation Toolkits / Solutions (1h) Coding BIM applications with C# (2h) Open Source BIM server, xBIM Toolkit (1h) IFC Engine (1h) JENA, Sesame (RDF4J), Fuseki 2 (1h) Coding smart contracts in Solidity (1h30)	K. Nyberg (TRMB) K. Jung (LOLA)  K. Jung (LOLA) E Papadonikolaki (UCL)	M Weise (AEC3) D. Robertson (BNTY)
<b>Day 5 P2P learning</b>	Students make short presentations on their ESR projects. Peer-to-peer assessment and feedback are to be utilised based on pre-determined criteria.	All supervisors	

Table 5: TE4: PhD School on Advanced BIM Applications and Digital Twin Technology

Open to qualifying European PhD students outside CBIM			
<b>Outline:</b> Design and construction of modern buildings require not only professional skills but also the ability to collaborate in multi-disciplinary teams and knowledge of and proficiency in the use of sophisticated information technologies. In this TE, students will learn advanced concepts of Building Information Modelling through formal lectures, but they will also have the opportunity, through hands-on group projects, to apply the theoretical knowledge to development of a building project from conceptual design, through engineering and cost analyses, to detailed design and fabrication of models using rapid prototyping technology. <b>Learning Outcomes:</b> On completion, students will have a good understanding of the capabilities and limitations of BIM technology. Students will also have the first-hand experience of how BIM can be used to support professional and multi-disciplinary teamwork, compilation of digital twins for new buildings, and will be competent in a broad set of tools appropriate for their profession.			
<b>Organiser: Rafael Sacks (TECH)</b>		<b>Contributing Organization</b>	
<b>Location: Haifa, IL</b>		<b>Action Month: M22</b>	
		<b>Beneficiary</b>	<b>Partner</b>
<b>Day 1 BIM Tech</b>	Concepts (Object-oriented modelling, solid modelling and CSG, parametric modelling (2h) The future of BIM in architectural design and structural engineering (1h) BIM systems, content libraries, creating new object classes, design intent (1h) Different representations in BIM software (1h) Interoperability problem, IFC Schema and exchanges (1h) Collaboration tools and IFC Viewers (1h)	R. Sacks (TECH)  K. Nyberg (TRMB) A. Parlikad (UCAM)	D. Robertson (BNTY) T. Liebich (AEC3)  T. Liebich (AEC3)
<b>Day 2 BIM for Architects &amp; Engineers</b>	Conceptual design in Revit/Rhino/Dynamo –advantages/limitations of existing tools. (1h) Structural analysis of BIM models (1h) Structural detailing (steel, precast concrete, cast-in-place concrete) (1h) Quantity take-off and Cost Analysis (1h) 4D CAD concepts (1h) Target Value Design (1h)	R. Sacks (TECH) K. Nyberg (TRMB)	P. Brennan (BAM) G. Harrington (BAM) G. Herries (LOR) M. Keohane (BAM)
<b>Day 3 BIM for Contractors</b>	Target Value and Target Costing (1h30) QTO and Estimating (1h) Construction Planning (1h) Production management (1h30)	K. Nyberg (TRMB)	L. Ungureanu (CON) G. Brierley (LOR) A. Locke (LOR)
<b>Day 4 BIM for Subcontractors &amp; Fabricators</b>	Introduction – BIM and computer-based manufacturing in architecture (1h30) CNC, rapid prototyping, contour-crafting, Loughborough IMRC research (1h30) Steelbuildings.com (1h30) Precast detailing (1h30)	R. Sacks (TECH) K. Nyberg (TRMB)	G. Harrington (BAM) P. Brennan (BAM)
<b>Day 5 BIM and Management for Sustainability</b>	BIM throughout the building life-cycle (1h30)  BIM and BPA (Building Performance Analysis) tools (1h30) Integrating BIM with blockchain technology for data provenance (1h30)  BIM and Asset Management tools (1h30)	E. Papadonikolaki (UCL) J. O'Donnell (UCD) E. Papadonikolaki (UCL) A. Parlikad (UCAM)	

Table 6: Module 1: Product Modelling and Management

<b>Mod1: Product Modelling and Management</b>	
<p><b>Outline:</b> In this module, students will learn, in a series of weekly lectures, product modelling theory, which not only forms the basis of state-of-the-art Building Information Systems but is also required to organise and structure any complex engineering effort within the realm of infrastructure engineering. This module will be broadcasted so that all consortium researchers can participate in the class. Following the introductory lectures in TE1, this module goes in more depth on topics related to product modelling</p> <p><b>Learning Objectives:</b> Students will gain the required skills to represent and describe all type of built environment engineering objects with their components, functions, and properties ranging from buildings to infrastructure. To ground the theoretical part of the module, students will also gain practical hands-on experiences modelling complex infrastructure and building systems using state of the art ontology modelling software.</p>	
<p><b>Organiser:</b> Timo Hartmann (TUB), Rafael Sacks (TECH)</p> <p><b>Location:</b> Distance Learning <span style="float: right;"><b>Action Month: M11-M13</b></span></p>	
<p>The module will shed light on ontologies and information models based on the viewpoint of semiotic theory and logic. Related concepts such as level of detail, abstraction, and interpretation are introduced to provide insights into how to best computationally model engineered systems to support knowledge-intensive engineering work. Additionally, rich practical case studies and advanced topics from the field of systems engineering will be introduced to show the need for adequate models to support the engineering of complex civil infrastructure and building systems. Topics to be covered include ontological reasoning, parametric modelling, requirements management, configuration management, information management, cost and risk engineering.</p>	

<b>Mod2: Entrepreneurship Management</b>		
<p><b>Outline and Learning Objectives:</b> This module will introduce ESRs to business modelling and entrepreneurial financing with a focus on the establishment of innovative start-ups around novel CBIM solutions. This will be structured training towards the development of skills and approaches necessary to becoming effective entrepreneurial leaders and managers. These skills comprise assessing risk, understanding business models, developing go-to-market concepts, analysing key operational metrics, modelling cash flow and capital requirements, evaluating sources of financing, structuring and negotiating investments, managing organisational culture and incentives, managing the interplay between ownership and growth, and handling adversity and failure. The module will be specifically targeted at innovation management within the wider construction industry. To gain hands-on experiences all students need to develop a business plan that will be evaluated regarding feasibility by the consortium's industrial partners. This module is scheduled in Year 3 of the ESRs training to coincide with the period where ESRs have prototypes and are thinking of commercialization pathways for their work.</p>		
<p><b>Organiser:</b> Ilka May (LOLA), Timo Hartmann (TUB)</p> <p><b>Location:</b> Distance Learning <span style="float: right;"><b>Action Month: M32-M34</b></span></p>		
<p><b>Topics Covered:</b></p> <ul style="list-style-type: none"> <li>• Introduction and Business Ecosystems</li> <li>• Innovation and Industry Life Cycles</li> <li>• Strategy and Management</li> <li>• Intellectual Property Rights</li> </ul>	<ul style="list-style-type: none"> <li>• Funding Start-Ups</li> <li>• Accounting</li> <li>• Financial Analysis</li> <li>• HR and Team Aspects BIM Industry in Europe</li> <li>• Case Study I: Construction Industry</li> </ul>	<ul style="list-style-type: none"> <li>• Case Study II: Facility Management Entrepreneurship Management</li> <li>• Defining your academic venture Financial Planning</li> <li>• Business Plans</li> <li>• Business Model Canvas</li> </ul> <p>Assessment: Developing a Business plan for CBIM innovations</p>

<b>HT: CBIM App Development Hackathon</b>		
<b>Organisers:</b> James O'Donnell (UCD), Contecht (CON)	<b>Action Month:</b> M34	<b>Contributing Organization:</b> DEB, ARC, TRMB
<b>Location:</b> Berlin, Germany		
<p>In M34, following Mod2, all ESRs of the consortium will participate in a 5-day hackathon. The goal of the hackathon will be to jointly develop innovative apps that make use of distributed data repositories. Two cases and rich data repositories will be made available to the hackathon participants: the TUB bridge case, and the TUB train station renovation case. In addition to immediate learning effects for the consortium's researchers, the results of the hackathon will be made publicly available on the web and will serve as a great showcase for the future innovation potential of CBIM solutions. In addition to the technical aspects, students will develop a business plan and ways to promote and market their product/app; this will draw upon knowledge acquired in Mod2.</p>		

<b>C1: Workshop on CBIM Data Models and Semantic Enrichment (Day 1 open to the public)</b>		
<b>Organisers:</b> Dimitrios Rovas, Eleni Papadonikolaki (UCL)	<b>Action Month:</b> M29	<b>Contributing Organization:</b> All CBIM Participants
<b>Location:</b> London, UK		
<p><b>Outline:</b> A two-day workshop at UCL on M29 of the project. The first day of the event will involve three sessions: one with invited speakers outside the network (from academia and industry) that are performing world-class work in topics of interest/relevance to the ESRs. The speakers will deliver keynote lectures on a number of topics, followed by a discussion session. In the second part of the event, a project overview presentation will be given by the coordinator followed by short presentations of the ESRs describing their research work. This will be followed by a poster session where students discuss in more details their results and the problems they have faced. The third part will be an interactive panel session on the future of BIM in Europe where the keynote speakers will be discussing with the audience. This event will be open to the public and will be widely advertised in existing networks to attract an audience of 40-50 people from the industry or the academia. The second day of the event will be only for the consortium and ESRs will present their research projects and problems they are facing so that they can obtain constructive feedback from the consortium and the supervisory board. This feedback is timely (on M29 which is before the end of the second year) so that they can incorporate any suggestions in the last phase of their work.</p>		

<b>C2: Conference on advances in BIM and its applications through CBIM (open to the public)</b>		
<b>Organisers:</b> James O'Donnell (UCD), Kim Nyberg (TRMB), Dimitrios Rovas (UCL), Ioannis Brilakis (UCAM)	<b>Action Month:</b> M42	<b>Contributing Organization:</b> All CBIM Participants
<b>Location:</b> Dublin, Ireland		
<p><b>Outline:</b> The final event of CBIM will be dedicated to the presentation of the results of the network. This will be a standalone event with a focus on showcasing the CBIM network and the work performed by the ESRs. During this final event each ESR fellow will give at least one oral presentation to: (a) present the research work he/she has accomplished; (b) explain how the different collaborations and secondments created by the CBIM network has allowed the fellow to achieve the targeted research objectives; (c) give an insight on the benefits CBIM has brought to him/her; (d) expose his/her career plan and his/her vision about the future of his/her research. A panel discussion will take place after each group of presentations. These presentations and feedback received will form the basis for the assessment of the final project accomplishments. The event organisers will make effort to schedule this event to coincide with a major conference (e.g. CIB W078, EC3, or ECPPM) so that leverage can be obtained. ESRs will be asked to submit papers of their work in the conference for peer review. The event organisers will also submit a proposal for a special session that focuses on disseminating the project results. The session will cover the following structure: Advances in the state-of-the-art in automated as-built BIM generation; semantic enrichment for geometric relationship inference; advanced CBIM applications; CBIM contributions to standardisation.</p>		

### 3.2.3 Planning of the training events

#### 3.2.3.1 Training Event design concepts

According to:

**Principle 6:** Each of the Training Events and online Modules should draw a list of outcomes and devise assessment methods to ensure that these are met.

A conceptual high-level schematic lucidly illustrates the concept of Principle 6.



Figure 1: Learning Outcomes and their attainment

For each of the training activities, specific event-level learning outcomes have been identified. These delineate the expected graduate profile in terms of the knowledge, understanding and skills required. These learning outcomes serve as the starting point to the detailed design and specification of the activities that comprise each event. A first version of this description has already been undertaken in the proposal stage, but these activities (including possibly the learning outcomes) have been reviewed as part of the ESR training setup phase (M1-M4 of the CBIM project).

See **Annex 1** of the present document for a template that can be used in setting Learning Outcomes at the Training Event level.

#### 3.2.3.2 Learning Activities

For each event learning activities should be chosen as fundamental learning-delivery blocks that supports attainment of the programme level outcomes. Beetham<sup>9</sup> notes that students learn more effectively when they:

- are active;
- are motivated and engaged;
- can bring their existing capabilities into play;
- are appropriately challenged;
- have opportunities for dialogue;
- receive feedback;
- have opportunities for consolidation and integration.

For these reasons, learning activities should include:

1. Traditional style lectures delivered by CBIM supervisors, partners and external speakers, **but also and where possible**
2. Active learning activities, that involve active student learning methods include:

<sup>9</sup> Beetham, H. (2007) 'An approach to learning activity design', In: Beetham, H. and Sharpe, R., Eds. *Rethinking pedagogy for a digital age: designing and delivering e-learning*, Abingdon: Routledge. (pp 26-40.)

- Group discussions
- Brainstorming
- Student presentations
- Problem-solving
- Hackathons

To maximise effectiveness of teaching, especially for skills-related aspects of the training (e.g. learning a new software) instructors may be able to beneficially use flipped teaching. This includes preparation of students before the training event (e.g. by doing exercises, online tutorials, reading preparatory material) and with the actual session focusing more on group discussions, problem-solving, and discussing salient points. In that regard the use and access to a VLE (Virtual Learning Environment) is very important. A hackathon is already envisaged. Other similar activities can be integrated both for the Face-to-face training events but also for the distance-learning modules.

For each learning activities it is good practice (in terms of lecturer coordination and TE design) to include expected outcomes:

*“By the end of this lecture, students should be able to:*

- Outcome 1
- Outcome 2
- Outcome 3
- Outcome 4”

This can help ensure a coherent and coordinated set of activities. The training event lead will oversee the process with support from the training coordinator. The training committee will review all material and provide feedback in support of the quality assurance processes of the project.

Reading material and other expectations before an activity should be made accessible to students, along with a clear description of expectations. The VLE is the proper medium to communicate such expectations and make material available to students.

In planning the learning activities, a team building/ice-breaker activity (or set of activities) should be set for all the events. While ESRs will know each other after the first event, externals need to feel integrated into the training. For this reason, one such activity should be included in each event.

For virtual learning events, enhancing interactivity is key. This can be achieved:

1. By using the breakout group functionality in Blackboard Collaborate, and
2. Using digital whiteboarding tools (e.g. Miro) to facilitate digital real-time collaboration. Also, audience engagement can be increased with digital interaction tools like Sli.do or Mentimeter (these are useful tools for both virtual and face-to-face delivery). Note that there are small costs associated with the use of these which can be accounted in the event budget.

### 3.2.3.3 Assessment and Feedback

Assessment an integral part of the training process. Well-designed assessments help gauge attainment of the expected learning outcomes and supports student progress. Assessment helps measure progress, as well as, helps identify areas that still need further work. It helps learning, by focusing the student’s attention on tasks and content that reflect the learning outcomes of the programme. It may also help<sup>10</sup>:

- Educating through dialogue and active, critical enquiry
- Creating an inclusive research and learning community

<sup>10</sup> List adapted from the UCL academic manual, guidance on [assessment and feedback](#).

- Making connections across components, programmes and beyond the classroom
- Creating assessments that mirror 'public engagement' in research
- Equipping students to address interdisciplinary challenges
- Exploring critically the values and practices of global citizenship
- Engaging students as partners in their education, and as co-producers of knowledge
- Improving the experiences of both students and staff.

An understanding of the process of assessment and providing feedback is also important as a personal and professional skill. This can be developed using peer-assessment approaches, or guided marking. In that sense (and to communicate expectations), a rubric like the one shown in Annex 2 can be presented. Feedback is an important part of the process. The students should be presenting outputs linked to their learning and receive feedback from one (or more) of the supervisors. Such feedback should focus on positive aspects (i.e. attainment of learning) but also identify areas of further improvement. In the latter case, actionable feedback can be more useful to students. Supervisors should engage with the students in the process and establish an active dialogue.

**Principle 6:** Each of the Training Events and online Modules should draw a list of outcomes and devise assessment methods to ensure that these are met.

To ensure a coherent training programme, the training leads should devise an assessment strategy. This can include more than one types of assessment. The training committee will ensure a balanced diet of assessments is applied throughout the programme to ensure exposure of ESRs to as wide a range of learning and assessment opportunities as possible.

**Principle 7:** Learning attainment should be rewarded and documented.

A properly designed assessment provides the opportunity to measure the level of attainment of learning (in relation to the stated expected learning outcomes). Once this is measured, the attainment of threshold knowledge should be rewarded with a certificate of learning (or attendance).

In addition, student competitions are also a good way of forcing healthy competition. Providing awards to best performing students should be considered for each activity.

#### 3.2.3.4 External students

Each event will be attended by external students. It is important to consider not only the ESRs but also these students when designing the training activities. In particular:

1. An ice-breaker session should be integrated to each programme, and possibly a social event early on in the programme.
2. Preparatory readings and supplementary material (as well as expectations in terms of threshold knowledge and skills, e.g. programming) should be clearly communicated in the registration page.
3. CBIM specific events should be clearly separated. Organisers must keep in mind that the CBIM schools are open to the public and not CBIM-specific. Where CBIM specific activities are envisaged (e.g. review, etc) these activities should be on a separate slot (before or after the school). Budgetary considerations should treat these activities separately.
4. All participants should receive a certificate of attendance.
5. Where a registration fee is to be paid, the easiest approach is to use a site like Eventbrite. Various institutions (e.g. UCL) have their own online ticketing systems – where available these can be used as well. Participants may need to claim back the costs, so invoices (and proofs of attendance) should be created. Once the list of participants is known, this should be used to provide access to the VLE.

### 3.2.3.5 Virtual Learning Environment

<b>Principle 8:</b> TE material (recordings, lecture material) should be captured and made available for free on web.
This sharing aspect can be served using a Virtual Learning Environment (VLE) platform. Such platforms provide for controlled (but still free) access to material and activity tracking.
Consent to record and publish lectures, should be obtained from everyone involved.

The selection of such a platform for hosting is important to support the delivery of the training events.

The following options were considered:

<b>Moodle</b>	Moodle is a free open-source learning platform. It is one of the most widely deployed platforms and used by many Universities around the world. The extensible nature (using a plug-in approach) allows third party developers to integrate their solutions with the core Moodle installation. This allows integration of plagiarism tools (e.g. Turitin) as well as third party collaboration utilities (e.g. Blackboard collaborate). Many universities have developed additional plugins and extensive guidance on how to use Moodle. Many academics use the Moodle VLE
<b>edX</b>	The open edX platform is made available as open source ( <a href="https://github.com/edx/edx-platform">https://github.com/edx/edx-platform</a> ). It can be deployed on a self-managed configuration (various distributions exist), or a SaaS-type fully managed subscription. This is a standard MOOC platform of choice. All these options are suitable but require significant overhead for the setup and management (as well as costs) and therefore it was deemed a good solution for MooC publishing of the entire training material in the future.
<b>Coursera</b>	Coursera is similar in scope and use cases to edX. With Techion being a partner it is a possibility to create and publish the course. In terms of Course management tools it seems similar to edX.
<b>Future Learn</b>	Future learn is a similar platform supported by UK universities (including UCL).

All MooC platforms offer similar capabilities with a focus on asynchronous learning on a geographically distributed region. As described above, setting up a course requires an agreement with the platform provider and can involve access, use and maintenance costs. Given that a “blended” style of teaching is envisaged for the online events video capture and recording of the lecture is preferred. This can be accomplished either synchronously or asynchronously. For flexibility and pedagogy, synchronous online delivery is preferred. Such capabilities are offered in all platforms (e.g. in Moodle through integration with plugins like Blackboard Collaborate). Moodle is usually managed centrally, and this can be an issue regarding user account management. UCL offers two instances of Moodle: one for internal purposes and another public facing used for short course and executive education offerings. The public-facing version allows for flexibility in user management and provides a basic level of user-level access control. Given that the CBIM training events will be developed (and delivered) for the first time, having flexibility is perhaps more important than scalability. It is therefore suggested that Moodle is used – this can be UCLeXtend (<https://extend.ucl.ac.uk/>) or another instance installed by one of our network partners.

It is expected that the Training Event lead (possibly with support from students) will oversee the populating of all information required. There exists extensive guidance and support will be provided by the network where this is required.

### 3.2.3.6 Academic Integrity

When *working collaboratively*, it is important to understand the differences that exist across disciplines, institutions, countries and cultures.

For instance, the differences that exist between:

- institutional policies and guidelines
- legislation and culture
- authorship norms
- ethical codes of conduct
- common practice and terminology.

With a data-intensive project like CBIM understanding the GDPR and relevant data protection laws is of importance. In addition to legal requirements, and to maximise the impact of research it is important that students understand and appreciate ethics and undertake an ethical approach to research. Acknowledging and discussing cultural or other differences **before** research commences can help avoid future disagreements or misunderstandings. It is therefore important that ethics and data protection implications are considered in all Training Events.

## 3.3 Compliance

<b>Principle 9:</b> Ensure compliance with institutional policies and data protection laws
We need to ensure that events meet compliance with the policies and operational procedures of each beneficiary.

### Aspects to be considered:

1. It is important that both the web site (where this event is hosted) properly addresses issues related to GDPR and personal data processing. For externals this will depend upon how the payment processing is to happen. A template that can be adapted is provided in Annex 3.
2. In addition to publishing the materials, a consent should be obtained for the video recording of lectures, but also for the use of pictures in our web site, social media, etc. It is very important that everyone registering has to accept a consent clause but is also given the option to rescind that consent if so required. Templates on this are provided in Annex 4.
3. Due consideration on copyright (for material generated by the instructors). Our DoA states *our intention* to publish all material under a CC license – more details on how CC works is attached below. Please make sure this is discussed with everyone that will be preparing teaching material for the TEs and consent has been agreed. It is suggested that in CBIM, as a minimum, “Attribution-NonCommercial-NoDerivatives 4.0 International” (CC BY-NC-ND 4.0) is used. Of course, where commercially sensitive information is presented a redacted version should be made available. More information about Creative Commons can be found in Annex 5 and the links contained therein.
4. It is envisaged that we will use LinkedIn, Twitter for marketing and communicating the project results and TEs. The privacy statement should include explicit reference on the policies of all these organisations that are acting as data controllers (and processors) or personal data related to the project. (**Note:** These data are linked to the implementation of the action and are not linked to the actual technical content).
5. Where technical data contain personal or protected information, they will be de-anonymised to the extent that this does not jeopardise the research or training objectives.

**Note:** The ethics review of the proposal raised ethical issues regarding dual use (minor), the protection of personal data and third countries.

- Items 2, 4 and 5 should help partly address the concern of GDPR. Note there are also the issues with Israel (and now UK) being third countries.

In this case the EU Ethics and Data Protection Guidance states:

**Transferring personal data out of the EU:**

- Ensure that any international data transfers fulfil at least one of the relevant conditions in Chapter V GDPR;
- Check that any third-party services you intend to use (e.g. survey tools, data analytics, cloud storage, etc.) are incorporated in an EU Member State or legally represented in the EU in accordance with the GDPR;
- adopt legally binding and enforceable agreements with partners or service providers prior to data transfers;
- prohibit the onward transfer of personal data by members of your consortium and any other recipients outside the framework of such agreements; and
- implement appropriate organisational and technical measures to ensure that personal data are transferred securely.

**Collecting personal data in non-EU countries:**

- Ensure that processing, notification, consent and accountability provisions meet GDPR standards;
- Identify any further data protection requirements in applicable laws in the country in which data are

to be collected and explain in your proposal how you will comply with them;

- If applicable, ensure that research participants understand and consent to the export of the personal

data they provide to an EU Member State or an non-EU country;

- Use pseudonymisation or anonymisation techniques to minimise the risk to data subjects;
- Implement appropriate organisational and technical measures to ensure that personal data are

transferred securely.

These aspects should be considered. Regarding Israel the EU has made an adequacy decision<sup>11</sup> in relation to the compliance of Israel's privacy protection regulations with EU laws. At present, no such decision has been made for the UK, although regulatory alignment is still in place. This might change though in the duration of the project and must be monitored. For UK-based events this should be considered, but the Data Protection Act should be GDPR compliant.

<sup>11</sup> [https://ec.europa.eu/info/law/law-topic/data-protection/international-dimension-data-protection/adequacy-decisions\\_en](https://ec.europa.eu/info/law/law-topic/data-protection/international-dimension-data-protection/adequacy-decisions_en)

## 4 Process for collecting inputs

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### 4.1 Initial version

**Step 1:** Send out forms to TE leads

**Step 2:** Training event leads responsible for completing forms with as much detail as possible (these forms will be a living document)

**Step 3:** Training committee to review forms and provide feedback

**Step 4:** Supervisory board to review financial implications.

**Step 5:** Seek revised forms – and review until all points have been met.

Ensure that the training plan envisaged meets CBIM training goals and expected deliverables, as well as, that it adheres to principles articulated in this document.

**Step 6:** Collate this along with an expanded version of this guidance document to create the deliverable.

**In the first instance it is important to have:**

- TE-level learning outcomes.
- Detailed programme and requirements of each speaker
- The form as complete as possible (organisational aspects)
- The expected organisation cost for the event (this information will be used to develop the ESR-specific budgets for the RTN events).

### 4.2 Modifications

Where modifications are sought (e.g. closer to the time), a resubmission of these forms will be required highlighting the changes. These will be reviewed by the training committee and changes approved. This should allow progress tracking. The goal is to have a complete information pack at least 3 months before each event (to facilitate planning and advertising). The corresponding page and all supporting registration infrastructure should be ready by this time.

## Annex 1: Example for Learning Outcomes Statement (at the Training Event Level)

<b>List of learning outcomes:</b> (Example drawn from the BuildingSmart Professional Certification programme) – see <a href="http://education.buildingsmart.org">education.buildingsmart.org</a>	
<p>1 Understand what BIM is, why it is needed, and recognise its specific terminology.</p> <p>1.1 Define the drivers that have led to BIM;</p> <p>1.2 Define BIM;</p> <p>1.3 Identify &amp; define key BIM terminology;</p> <p>1.4 Define BIM maturity levels;</p> <p>1.5 Define what constitutes an Information Model.</p> <p>2 Recognise the advantages of BIM compared to traditional project delivery.</p> <p>2.1 Know why collaborative and new ways of working are required;</p> <p>2.2 Identify the effects of poor information management on projects;</p> <p>2.3 Identify the standards developed to mitigate poor information;</p> <p>2.4 Identify the benefits of BIM to construction professionals;</p> <p>2.5 Identify the benefits of BIM adoption to clients and facility management.</p> <p>3 Understand the project information development cycle (and its key terms); specifically, how project information is specified, produced, exchanged, and maintained.</p> <p>3.1 Know why employers need to clearly define their requirements (EIR);</p> <p>3.2 Know why the supply chain needs to agree a plan to execute BIM on the project (BEP);</p> <p>3.3 Know why consistent exchanges of information are required;</p> <p>3.4 Identify the key elements and benefits of using a collaborative exchange platform (COE);</p> <p>3.5 Know why clearly defined information management responsibilities are required;</p> <p>3.6 Know why assessing potential supply chain members before appointment is required.</p>	<p>4 Recognise the need for open and interoperable solutions.</p> <p>4.1 Define the buildingSMART community;</p> <p>4.2 Define openBIM and its benefits compared to using proprietary products and systems;</p> <p>4.3 Know what IFC is and its benefits;</p> <p>4.4 Know what MVDs are and their benefits;</p> <p>4.5 Know what IDMs are and their benefits;</p> <p>4.6 Know what the bSDD is and its benefits;</p> <p>4.7 Know what BCF is and its benefits.</p> <p>5 Identify an organisation's capability in working with BIM.</p> <p>5.1 Understand the potential benefits for a company in adopting BIM;</p> <p>5.2 Understand the factors that define an organisation's level of BIM Maturity;</p> <p>5.3 Know why BIM adoption needs to align to organisational goals;</p> <p>5.4 Identify the benefits and challenges to BIM adoption;</p> <p>5.5 Know what the data security implications are for adopting BIM.</p>

## Annex 2: Measuring attainment of Learning Outcomes and communicating expectations: Marking scheme using a rubric

The level of attainment of learning outcomes must be consistent. A way of ensuring this is using a marking rubric. The rubric below sets general criteria (see below adapted from UCL Arena). The teaching school leads are encouraged to use this as a basis for developing a marking scheme for each Training Event. In addition, bespoke oral or written feedback should be provided.

Marks	0-39	40-49	50-59	60-69	70-85	86-100
	Fail	Fail	Pass	Merit	Distinction	Distinction
<b>Knowledge and understanding of field, and intellectual skills</b> e.g. analysis and synthesis; deploying logical argument supported by evidence; focus on topic; drawing conclusions	Demonstrates little knowledge of the field. Demonstrates significant weaknesses in the knowledge base, and/or simply reproduces knowledge without evidence of understanding. Shows little or no critical ability. Poor, inconsistent analysis.	Demonstrates knowledge of the field and awareness of current evidence and issues, but with some notable weaknesses. Lacks knowledge and understanding of some key areas. Offers some appropriate analysis, but with some significant inconsistencies which affect the soundness of argument and/or conclusions. Demonstrates very limited critical ability.	Demonstrates a sound knowledge and understanding of material within a specialized field. Demonstrates an understanding of current theoretical and methodological approaches and how these affect the way the knowledge base is interpreted. Provides evidence of relevant and sound analysis within the specialized area, with some critical evaluation. Can analyze complex issues and make appropriate judgements.	Produces work with a well-defined focus. Demonstrates a systematic knowledge, understanding and critical awareness of current problems and/or new insights, much of which is at, or informed by, the forefront of the academic discipline, field of study or area of professional practice. Can evaluate methodologies critically and, where appropriate, to propose new hypotheses. Can deal with complex issues both systematically and creatively, making sound judgements in the absence of complete data.	Produces work of exceptional standard, reflecting excellent understanding. Displays mastery of a complex and specialized area of knowledge and skills, with notable critical awareness of current problems and/or new insights at forefront of field. Shows excellent ability to evaluate methodologies critically and, where appropriate, to propose new hypotheses. Deals with complex issues systematically and creatively, making excellent judgements.	This work meets and often exceeds the standard for distinction, as described in the 70-85 band, across all sub-categories of criteria: knowledge and understanding of subject; intellectual skills; research skills; use of research-informed literature and other scholarly practices; and skills for life and professional employment.  This work is of publishable quality, with only very minor amendments, and would be likely to receive that judgement if submitted to a peer-reviewed journal.
<b>Research and enquiry</b> e.g. framing and creating questions; using appropriate methods for gathering evidence; awareness of methodological benefits/limitations; ethics and integrity; analysis of evidence; communicating findings for a given context and audience	Little or no skill demonstrated in selected techniques applicable to own research or advanced scholarship. Lacks any understanding of how established techniques of research and enquiry are used to create and interpret knowledge.	Demonstrates some skill in selected techniques and/or approaches applicable to own research or advanced scholarship, but with significant areas of weakness. Lacks sufficient understanding of how established techniques of research and enquiry are used to create and	Demonstrates understanding of and skills in selected techniques/ approaches applicable to own research or advanced scholarship. Shows some originality in the application of knowledge, and some understanding of how established techniques of research and enquiry are used to create and interpret knowledge in the discipline. Able to communicate	Displays a comprehensive understanding of and skills in techniques/approaches applicable to own research or advanced scholarship. Shows originality in the application of knowledge, and a good understanding of how established techniques of research and enquiry are used to create and interpret knowledge in the discipline. Able to communicate very	Conducts research highly effectively, using technical and/or professional skills as appropriate. Displays exceptional grasp of a range of techniques applicable to own research or advanced scholarship. Shows originality in application of knowledge, and excellent grasp of how knowledge is created and interpreted in the discipline. Able to communicate at a very	Work is of such a quality that the student is clearly highly capable of doctoral research in the discipline.

Marks	0-39	40-49	50-59	60-69	70-85	86-100
	Fail	Fail	Pass	Merit	Distinction	Distinction
		interpret knowledge.	effectively with a given audience.	effectively arguments, evidence and conclusions to specialist and non-specialist audiences.	high level, with arguments, evidence and conclusions to diverse audiences	
<b>Scholarly practices</b> e.g. use of relevant literature; academic writing; academic honesty, referencing and citation	Fails to evidence or discuss/apply appropriate examples of literature relating to current research and advanced scholarship in the field. References to literature/ evidence and use of academic conventions are flawed/irrelevant.	Can evidence and discuss/apply examples of literature relating to current research but lacks critical engagement. References to appropriate literature/ evidence and use of academic conventions are insufficient and/or inconsistent.	Can evaluate critically examples of literature relating to current research and advanced scholarship in the field. Makes consistently sound use of appropriate academic conventions and academic honesty.	Is able to evaluate critically a range of literature relating to current research and advanced scholarship in the discipline. Makes consistently good use of appropriate academic conventions and academic honesty.	Is able to evaluate critically, with notable insight, a range of literature relating to current research and advanced scholarship in the discipline. Makes consistently excellent use of appropriate academic conventions and academic honesty	
<b>Professional skills and Attributes</b> e.g. creativity; digital literacies and practices; presentation skills; ethical awareness and integrity; collaboration and team-working; self-management; project and time management; leadership; innovation; ability to recognize own strengths and weaknesses, and to take steps to improve, by identifying and choosing appropriate methods (online resources, courses, peer learning etc.).	Significant weaknesses evident in key areas such as digital literacy, communication, problem-solving and project management. Inability to adapt. Inability to work flexibly, independently and/or as part of a team.	Demonstrates generally effective employability skills, including communication and problem-solving, but with some problematic areas of weakness. Limited ability to adapt. Ability to work flexibly, independently and/or as part of a team, but with areas of weakness.	Shows a consistently good level of employability skills, including team working, project management, IT/computer literacy, creativity and flexibility. Demonstrates capabilities to support effective communication in a range of complex and specialised contexts. Shows consistent ability in tackling and solving demanding problems. Can plan and direct own learning. Demonstrates ability to advance own knowledge and skills. Demonstrates the independent learning ability required for continuing professional development.	Shows a high level of employability skills, including team working, project management, digital literacy, creativity and flexibility. Demonstrates very effective communication in a range of complex and specialised contexts. Demonstrates self-reliance in tackling and solving demanding problems. Can act autonomously in planning and implementing tasks at a professional or equivalent level. Demonstrates attitudes needed to advance own knowledge, understanding, and skills. Demonstrates the independent learning ability required for continuing professional development.	Shows a very high level of employability skills, including team working/leadership, project management, digital literacies and practices, creativity and flexibility. Demonstrates at high level communication skills in a range of complex contexts, and ability to write at publishable standard. Demonstrates autonomy and notable originality in tackling and solving demanding problems. Shows a high level of consistency and autonomy in planning and implementing tasks at a professional or equivalent level. Demonstrates the skills and attitudes needed to advance own knowledge and understanding, and to develop new skills to a high level. Demonstrates the independent learning ability required for continuing professional development.	
Marks	0-39	40-49	50-59	60-69	70-85	86-100



## Annex 3: Privacy notice for training event

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This is a template for each organiser to adapt accordingly. Include relevant institutional and other legal information. **Note: This is just a template. It should give you a solid starting point but should be adapted for the requirements of each training event.**

### Who are we?

CBIM is a European Training Network in the area of Cloud-based Building Information Modelling. CBIM brings together five leading universities, two software companies and a research institute from six countries, to provide PhD training through state-of-the-art research. This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 860555. You can find more information on the [project web-site](#).

This training event is hosted by [Legal Entity], who for the purposes of this is the data controller.

[Include institutional information for questions, and subject data requests. Who are additional data processors?] [Option 1: Your information will be shared with Technion University (data processor) who will use this information you provide regarding delivery of the event and to meet contractual and reporting requirements to the CBIM project funder (European Commission) who is partly supporting these activities. Or Option 2: Participants may opt to receive information from the CBIM network by subscribing to a mailing list.] The data will also be used (in anonymised) form to support impact assessment of the action.

For the purposes of the training we will be using UCL eXtend as the Virtual Learning Environment (VLE). UCL eXtend is UCL's public-facing learning environment for delivery of non-credit bearing short courses for CPD, executive education, and outreach purposes. The service is provided by the [UCL Digital Education team](#) in collaboration with [UCL Life Learning](#) and other teams across the university. The platform is open to all UCL staff and students in addition to members of the public.

### What information is being collected from you?

Upon registration to one of the training events we will collect:

- Your name and affiliation
- Your address, e-mail and other contact information you might want to provide.
- Dietary preferences and any allergies and intolerances you might have.

In addition, upon account creation and acceptance of the [Terms of Website Use and Acceptable Use Policy](#),

UCLeXtend will collect:

- Background information. Upon registration this includes your name and email address, but may also span other information as volunteered by you, e.g. country or city
- Any further detail you choose to add to your user profile, e.g. user preferences, a profile image, interests, or social media account names
- Details about the courses you are enrolled on
- Details of your activity within courses including dates and times, e.g. logins, resources viewed, and use of specific learning activities.

[Payment processor information – if using something like Eventbrite or Stripe. Usually a link to their privacy policy will suffice]

### How will the information be used?



We will use your personal information to organise the event:

- Printing badges and include in distribution contact lists
- Use your dietary preferences to order lunches and coffee breaks.
- Report on the impact of the action to the European Commission.
- We may use information you prepare as part of the training activities to assess your level of attainment of the learning outcomes and can be used on the issuing of attendance certificates.

UCLeXtend may use your information to:

- Create your unique user account and process enrolment(s) on your requested course(s)
- Enable tutors to make contact with you as part of a course learning experience
- Enable tutors to access learner engagement information at both course and individual student levels
- Deliver improvements to the UCLeXtend service
- Notify you of changes to the UCLeXtend service.

#### **Who has access to your information?**

Your information will not be sold or rented to any third parties or shared with third parties for marketing purposes. We will not make any further contact with you for marketing or research purposes unless you separately and explicitly offer your consent for us to do so.

Only those members of staff who are designated as tutors within a UCLeXtend course can access information relating to your use of or engagement with materials.

We work with third party service providers to inform improvements to the platform or provide access to additional learning-focused tools that may form part of a course learning experience. These include Google Analytics, Blackboard Collaborate, Echo360 Lecturecast, and H5P. Such services may record additional information, such as your IP address and location. In most cases these services will act as the controller of your data and it is therefore advised that you consult their privacy policy for further information.

#### **How is the information kept secure?**

During your visit to the training website and to be able to register for the conference, we may ask you to fill in your personal information (name, surname, email address, mailing address, credit card details, etc.). These data will be stored and processed per the General Data Protection Law (GDPR) that went into effect on May 25<sup>th</sup>, 2018. The sole purpose for the use of the data is to complete the order placed by our conference registrants and shall in no way disclose, publish or sell these data to any third parties, except in case a legal procedure regarding the withdrawal of confidentiality is initiated or according to other obligations arising from the national implementation of Directive 24/2006. The training website operates according to the EU legislation.

The UCLeXtend service is provided to UCL via an external hosting company, [LEO Learning](#). LEO Learning acts in a 'data processor' capacity for UCL, and any personal information held by their database servers is in accordance with Article 28 of the General Data Protection Regulation (EU Regulation 2016/679; the 'GDPR'). This information will be not be accessed or used unnecessarily, and appropriate security precautions are employed to ensure that the information is not available to any unauthorised person or organisation. No personal data will be transferred outside of the European Economic Area without the written consent of UCL. UCL acts in a 'data controller' capacity for the platform and is responsible for informing users of how information is stored and used in addition to reporting any data storage and reporting issues. Any queries relating to data protection can be directed to [data-protection@ucl.ac.uk](mailto:data-protection@ucl.ac.uk).



**How you can access and change your information**

You have the right to request access or changes to the information held about you at any time. To submit a request for your information to be changed or removed, please contact the school administrator in the first instance at [joedoe@organisation.org](mailto:joedoe@organisation.org) . In addition, and regarding your data held by UCL for the eXtend platform you may contact the platform administrator at: [extend@ucl.ac.uk](mailto:extend@ucl.ac.uk).

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#### Annex 4: Consent form

The following consent statement should be accepted as part of the registration process. Note: all participants should accept one of the following statements depending on whether they are an attendee or presenter.

### 1. Video Recording and Photography Consent Form - Attendee

Attendees grant the organisers and anyone working on their behalf permission to video record and/or photograph the attendee and, if a presenter, his/her presentation or poster at the training event, and to publish the photos or videos on the Virtual Learning Environment and/or on the CBIM network website and social media pages, during and after the training event. Attendees who wish to withdraw consent in this regard can do so by signing the permission rescind form for video/photo publication permission at the time of collecting the registration material at the registration desk of the conference.

### 2. Video Recording and Photography Consent Form - Presenter

The presenter grants the organisers and anyone working on their behalf permission to video record and/or photograph the attendee and, if a presenter, his/her presentation or poster at the training event, and to publish the photos or videos on the Virtual Learning Environment and/or on the CBIM network website and social media pages, during and after the training event. In addition, they agree to public sharing of their presentation (or a redacted version in it contains sensitive information). These materials will be made available on UCL eXtend and access will be provided without restrictions to interested parties that would like to follow the material.

### 3. Rescind Consent (Form)

**Adapt to the event needs. Some text can be shown below.**

As part of the registration to the training event, the following clause was provided:

"Attendees grant the organisers and anyone working on their behalf permission to video record and/or photograph the attendee and, if a presenter, his/her presentation or poster at the training event, and to publish the photos or videos on the Virtual Learning Environment and/or on the CBIM network website and social media pages, during and after the training event. Attendees who wish to withdraw consent in this regard can do so by signing the permission rescind form for video/photo publication permission at the time of collecting the registration material at the registration desk of the conference."

This is used to document activities of the conference in social networks and create the video proceedings that will be published along with your paper in the EC<sup>3</sup> web-site.

If you would like to withdraw consent, please complete and sign the following form:

Name(s):

Affiliation:

I would like to rescind the consent I have given to video recording of the presentation, as part of the registration clause above.

Signature:

Date:



## Annex 5: Creative commons<sup>12</sup>

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Creative Commons is a set of copyright licences under which copyrightable work can be distributed. Copyrightable works include books, websites, blogs, photographs, films, videos, songs and other audio & visual recordings, etc. It offers an alternative to the blanket 'all rights reserved' licence that any such work automatically gets. It allows people or organisations who want to share their work with others to make explicit the terms under which this sharing can occur.

### Why we need it?

Traditional copyright is too inflexible in the Internet age, where works can be copied and redistributed at next to no cost, and stifles creative use of digital works. Standard copyright puts a blanket 'all rights reserved' on any work, and this is the only licence that 'travels' with the work, making it difficult, and often impossible for users to identify the owner and find out what they can and can't do with it.

Creative Commons has been set up to provide flexibility and transparency.

*For instructors:* it allows them to retain your copyright in a work, while allowing certain uses of their work that they specify. They offer their work as having 'some rights reserved'.

*For students that are consuming copyrighted works:* by using works released under Creative Commons they can see exactly what they can and can't do with it. They do not need to identify and find the copyright owner and seek permission from them.

### How it works:

A producer of a work decides what s/he wants others to be able to do with their work. There are four attributes that the producer can specify:

*Attribution:* the producer decides if s/he wants to be recognised as the creator of the work. If they do, then anyone using or redistributing the work must give the original creator credit and provide a link to their original licence.

*Commercial use:* the producer of the work decides whether people can make money from its use. If they decide that they are, then anyone can do so, without having to get permission. If they decide that they are not allowed to do so, then users know exactly where they stand. Of course, if they really want to use the work, there is nothing to stop them approaching the creator and seeking permission (probably for a fee).

*Derivative works:* the producer decides if they will allow others to alter or transform the work. If they do allow this, users can take the work and change it (e.g. resize a photograph, or write a play using the plotline from the work). If this is not allowed, then the user must seek permission before doing this.

*Share alike:* the producer of the work decides to make it a condition of use that any new work that contains it must be made available under the same conditions on which it was offered. For example, if I produce a photograph and someone uses it in a book, then that book must be released to the world under the same conditions as my photograph, which may have stipulated no commercial use, or no derivative works.

These four attributes can be combined in a total of eleven ways, providing a wide range of flexibility. A twelfth option is to make the work available with no restrictions at all (no rights reserved) - in this case it becomes 'public domain'.

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<sup>12</sup> This section is based on [UCL-guidance](#) on copyright. Small adjustments have been made to contextualise this information.

**Specifics for CBIM:**

Content creators need to get credit for their efforts, whilst allowing the CBIM network to openly share and publish material in line with the stated objectives. This must be discussed and agreed with content creators.

For online works you choose the appropriate Creative Commons licence by completing the questionnaire here: <https://creativecommons.org/choose/>

This tool allows to answer a few questions and determine the type of licensing. It is suggested that as a minimum Attribution-NonCommercial-NoDerivatives 4.0 International is used.<sup>13</sup>

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<sup>13</sup> <https://creativecommons.org/licenses/by-nc-nd/4.0/>



## Annex 6: Personal Career Development Plan

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### Career Development Plan-Year 1 (Template)

Name of fellow:

Department:

Name of Supervisor:

Date:

**BRIEF OVERVIEW OF RESEARCH PROJECT AND MAJOR ACCOMPLISHMENTS EXPECTED (half page should be sufficient):**

**LONG-TERM CAREER OBJECTIVES (over 5 years):**

1. Goals:
2. What further research activity or other training is needed to attain these goals?

**SHORT-TERM OBJECTIVES (1-2 years):**

1. Research results
  - Anticipated publications:
  - Anticipated conference, workshop attendance, courses, and /or seminar presentations:
2. Research Skills and techniques:
  - Training in specific new areas, or technical expertise etc:



3. Research management:
  - Fellowship or other funding applications planned (indicate name of award if known; include fellowships with entire funding periods, grants written/applied for/received, professional society presentation awards or travel awards, etc.)
  
4. Communication skills:
  
5. Other professional training (course work, teaching activity):
  
6. Anticipated networking opportunities
  
7. Other activities (community, etc) with professional relevance:

Date & Signature of fellow:

Date & Signature of supervisor



**Career Development Plan-Final year**  
*(Draft)*

**BRIEF OVERVIEW OF PROGRESS, ACHIEVEMENT AND PERFORMANCE (half page should be sufficient):**

**LONG-TERM CAREER OBJECTIVES (over 5 years):**

If relevant, mention any adjustments to your long-term career objectives as a result of the training received.

**SHORT-TERM OBJECTIVES ACHIEVED DURING THE TRAINING PERIOD:**

1. Research results
  - Publications (incl. in press):
  
  - Conference, workshop attendance, courses, and /or seminar presentations:
  
2. Research Skills and techniques acquired:
  - Training in specific new areas, or technical expertise etc:
  
3. Research management:
  - Fellowship or other funding applications achieved (indicate name of award if known; include fellowships with entire funding periods, grants written/applied for/received, professional society presentation awards or travel awards, etc.)
  
4. Communication skills:
  
5. Other professional training (course work, teaching activity):



6. Anticipated networking opportunities

7. Other activities (community, etc) with professional relevance:

Date & Signature of fellow:

Date & Signature of supervisor



## Career Development Plan

### Guidance on some of the competencies expected

The following points are a non-exhaustive series of aspects that could be covered by the career development plan, and it is relevant to the short-term objectives that will be set by the researcher and the reviewer at the beginning of the fellowship period. The objectives should be set with respect to the skills and experience that each researcher should acquire at a given time of his/her career. A postgraduate researcher at PhD level will have very different needs compared to a post-doctoral researcher at an advanced stage of his/her professional development. These objectives should be revised at the end of the fellowship and should be used as a pro-active monitoring of progress in the researcher's career.

#### 1. Research results.

These should give an overview of the main direct results obtained as a consequence of the research carried out during the training period. It may include publications, conference, workshop attendance, courses, and /or seminar presentations, patents etc. This will vary according to the area of research and the type of results most common to each field. The information at this level should be relatively general since the career development plan does not strictly constitute a report on the scientific results achieved.

#### 2. Research Skills and techniques acquired.

Competence in experimental design, quantitative and qualitative methods, relevant research methodologies, data capture, statistics, analytical skills.

Original, independent and critical thinking.

Critical analysis and evaluation of one's findings and those of others

Acquisition of new expertise in areas and techniques related to the researcher's field and adequate understanding their appropriate application

Foresight and technology transfer, grasp of ethics and appreciation of IPPR.

#### 3. Research management.

Ability to successfully identify and secure possible sources of funding for personal and team research as appropriate.

Project management skills relating to proposals and tenders work programming, supervision, deadlines and delivery, negotiation with funders, financial planning, and resource management.

Skills appropriate to working with others and in teams and in teambuilding.



#### **4. Communication skills.**

Personal presentation skills, poster presentations, skills in report writing and preparing academic papers and books.

To be able to defend research outcomes at seminars, conferences, etc.

Contribute to promote public understanding of one's own field

#### **5. Other professional training (course work, teaching activity):**

Involvement in teaching, supervision or mentoring

#### **6. Anticipated networking opportunities.**

Develop/maintain co-operative networks and working relationships as appropriate with supervisor/peers/colleagues within the institution and the wider research community

#### **7. Other activities (community, etc) with professional relevance.**

Issues related with career management, including transferable skills, management of own career progression, ways to develop employability, awareness of what potential employers are looking for when considering CV applications etc.

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## Annex 7: Training Event Planning Template

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This is the template to be completed by the supervisors in consultation with the ESRs



# Template for Training Event CBIM

## 1. Training Event (Basic information)

### 1.1 General Information

Event Name:

Type of event: [Independent/Virtual Learning/Outsourced]

Dates:

Location:

Organiser(s): [Name, Affiliation]

### 1.2 Outline of the programme (up to 300 words)

[Describe what the training event is about]

### 1.3 Expected Learning Outcomes

[List 4-5 programme-level learning outcomes. These should be Specific, Measurable, Attainable, Realistic]

### 1.4 Links for the overall CBIM structured training programme (up to 100 words)

Explain how this TE fits within the broader envisaged structured training.

### 1.5 Audience

In addition to the ESRs (for which this is tailored to), who else could potentially benefit? What is the target audience?

### 1.5 Attendance Numbers

Estimate student numbers (for capacity and budget planning)

ESRs/CBIM Instructors (e.g. from partners and beneficiaries)/External Trainees

If numbers vary by day, can be broken down by days (useful for budgeting requirements).

## 2. Structure

### 2.1 Plan of activities

On the table below please include all module activities such as lectures, tutorials, independent study (e.g. before or after the event), field work, social activities, etc.

Activity ID	Date	Time	Event
e.g. TE1.1	e.g. Tuesday 3 October 2017 or Day 1	e.g. 10:00-13:00	e.g. Lecture 1: Introduction and overview of CBIM

### 2.2 Activity Details

For each of the activities above provide details (these should be solicited from the instructors)

#### [Activity ID]: Name

**Activity Lead:** Name and Affiliation

**Activity Type:** Lecture/Social/Independent Study/Visit/Presentation/etc..

**Topic:**

**Activity Outline:** (short description up to 1 paragraph)

**Expected outcomes of the activity e.g.:** By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

. [Repeat table above as many times as possible]

. [Where relevant separate

#### [Activity ID]: Name

**Activity Lead:** Name and Affiliation

**Activity Type:** Lecture/Social/Independent Study/Visit/Presentation/etc..

**Topic:**

**Activity Outline:** (short description up to 1 paragraph)

**Expected outcomes of the activity e.g.:** By the end of the lecture students will have learnt:

Event: [Name]

Date: [], Version:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – If yes, attach consent form]

**Uploads** (please link/attach if any): Material to be uploaded on Moodle. Each Activity will have a separate session on Moodle.

### 2.3 Pedagogy (approx. 200-300 words)

Describe the concept of the event and the training activities envisaged (lectures/ice-breaker events/social activities/active learning/etc). Teaching and learning methods and strategies. How do these contribute to meeting the programme-level learning objectives?

See Section 3.2 of the guidance document on what should be covered.

### 2.4 Assessment

Detail the type of assessment activities that will be undertaken. Where relevant upload the assessment brief(s) to be circulated to the students. In addition, a rubric should be attached for each assessment. For a template see Annex 2 of the master document.

Where relevant, students can submit essays, posters, etc using the Turnitin activity on Moodle, which will be set up by the Moodle administrator. If other Moodle activities should be setup (e.g. polling, attendance, quizzes) please describe the requirements here.

### 2.5 Awards

Discuss how learning is to be awarded (e.g. competitions, certificates of completion, etc).

### 2.6 Reading List

Include a reading list of material that students should have access to and possibly review.

All modules will have a reading list on which will be linked to Moodle. The administrator can prepare the reading list for your module (if he is provided with the references/files/links). Reading lists can include any type of resource including websites, videos etc.

Please provide the following information:

Reference

Which lecture the text relates to (or note if not linked to a specific teaching week)

Whether the text is essential, recommended or optional

### 2.6 Attendance pre-requisites

Pre-requisites for ESRs and external students

Reading material

Skill preparation (e.g. knowledge of programming languages)

Software available.

### 3. Organisational

#### 3.1 Organisational aspects

Review section 3.1 of the guidance. Describe the organisational aspects of the event (registration system, accomodation, developing a public presence). It would be useful to have a timeline (e.g in the form of a simple Gantt chart) of the type of activities required. Registration systems to be used, invoicing requirements, etc.

#### 3.2 Communication Plan

##### Before the event:

Describe the plan to communicate this to relevant communities at local and national level.

How will equality and diversity be achieved?

##### During the event:

Consider using Moodle. Two forums can be setup:

Announcements Forum – this is for staff to post updates and news items about the module. Students can't post or reply to messages in here.

Question and Answer forum – this is for students to post questions for the tutor. Tutors are expected to answer questions on the Q&A forum at least once per week during term time. Students are also encouraged to answer each other's questions.

#### 3.3 Risk assessment

Perform a mini risk assessment that covers:

- Risks to attendees (e.g. during site visits)
- Financial risks (and possible mitigation plan)
- Resourcing risks (e.g. one or more instructors are unavailable)
- Contextual risks (e.g. CV-19 )

#### 3.4 Staffing and support requirements.

Describe the support required to setup and run the event. Include:

- Staffing;
- Teaching assistant(s): (Oversight of students);
- Administrative Support: (populating the website, printing badges, organising transport);
- Local support.

And describe how these needs are to be covered.

## 4. Compliance

Prepare and attach the following:

1. Privacy notice – see Annex 3 of the guidance document
2. Registration form for instructors (including handling required consents) – see Annex 4 of the guidance document
3. Forms to rescind consent (for students)

### 3.4 Ethics and GDPR considerations (up to 100 words)

Describe how handling of personal information is to be secured (include data retention policies).

## 5. Attachments

- Assessment brief (Section 2.4)
- Training Event Budget (Make super to separate costs for CBIM and externals). Where known include additional information like quotes, et.
- Certificate of completion/awards (for students) – Attach pro forma to be used.
- Event and Reading List materials: (If you have any course materials/links to be uploaded to Moodle please attach them).
- Compliance (privacy and permission forms)
- Website structure document
- Images (If you have a relevant image that can be uploaded to the top of your Moodle page please attach them. Ensure you have proper rights to use these images).

# Template for Training Event

## CBIM

### 1. Training Event (Basic information)

#### 1.1 General Information

Event Name: Building Information Modelling School  
Type of event: Virtual Learning  
Dates: 7-11 December 2020  
Location: Online  
Organiser(s): Ioannis Brilakis, University of Cambridge

#### 1.2 Outline of the programme (up to 300 words)

This winter school is the first in a series of training events sponsored by the Cloud BIM European Training Network (CBIM ETN). It serves a dual purpose: (i) a broad introduction to BIM fundamentals and research methods; (ii) a bonding opportunity/community-development exercise for early stage researchers and practitioners. The first part of this training event will familiarise students with BIM as a product and as a process, BIM tools, data models (e.g. the Industry Foundation Classes), BIM data exchange and cross-sector interoperability. The second part of this training event focuses on research methods training, PhD project management, and ethics contextualised to the BIM area. Tutorials will require students to get hands-on experience in collecting data and working with BIM models. The organisers have sought a balance between lectures given by CBIM ETN consortium members and invited lectures from industry. Considering its introductory nature, this training event is scheduled early in the CBIM training programme and serves as an introduction to future training events. Social events and short excursions mixed into the daily activities will be scheduled to facilitate networking and community development.

#### 1.3 Expected Learning Outcomes

The student must be able to (i) understand how conventional research methods can be employed in the BIM area to solve research problems; (ii) understand what BIM is and its value; (iii) gain familiarity with coding and working with BIM data, and; (iv) understand how to develop and manage his/her research programme.

#### 1.4 Links for the overall CBIM structured training programme (up to 100 words)

This is the first training event for the CBIM ESRs, who will all be in their first few months from their starting date. Therefore, all subjects are introductory with an aim to familiarise the students with the basics and allow them to attain a similar level of skills in Building Information Modelling.

#### 1.5 Audience

Master and PhD students, post-doctoral research associates, and early career industry practitioners.

#### 1.5 Attendance Numbers

14 Early Stage Researchers  
11 Instructors

## 2. Structure

### 2.1 Plan of activities

On the table below please include all module activities such as lectures, tutorials, independent study (e.g. before or after the event), field work, social activities, etc.

Day 1 – Monday 7 December: Overview

09:00-10:30 Welcome and introductions – R. Sacks, D. Rovas, I. Brilakis

10:30-10:50 Break

10:50-12:00 Participant short introductions

12:00-13:00 Lunch break and project session 1 – Y. Hong (UCAM)

13:00-14:30 Building Information Modelling: A concise introduction - R. Sacks (TECH)

14:30-14:50 Break

14:50-16:20 Developing a BIM model and performing basic queries – E. Papadonikolaki (UCL)

Day 2 – Tuesday 8 December: BIM Basics I

09:00-10:30 Introduction to STEP and EXPRESS - I. May (LOLA)

10:30-10:50 Break

10:50-12:00 Current and upcoming openBIM standards: IFC4 ifcOWL, IFC5 – T. Liebich (AEC3)

12:00-13:00 Lunch break and project session 2 – Y. Hong (UCAM)

13:00-14:30 Working with BIM data: Tools & concepts - M. Bew (PCSG)

14:30-14:50 Break

14:50-16:20 Data quality and related Issues: Model-checking, BCF Tutorial - K. Nyberg (TRMB)

Day 3 – Wednesday 9 December: BIM Basics II

09:00-10:30 How does Building Information Modelling create value? - M. Bew (PCSG)

10:30-10:50 Break

10:50-12:00 BIM tools and parametric modelling - N. Abou-Rahme (BNTY)

12:00-13:00 Lunch break and project session 3 – Y. Hong (UCAM)

13:00-14:30 Interoperability - R. Sacks (TECH)

14:30-14:50 Break

14:50-16:20 Mixed Reality for BIM and demonstration - K. Nyberg (TRMB)

Day 4 – Thursday 10 December: Research Methods I

09:00-10:30 BIM research challenges roadmap - R. Sacks (TECH)

10:30-10:50 Break

10:50-12:00 Structuring your research - I. Brilakis (UCAM)

12:00-13:00 Lunch and project session 4 – Y. Hong (UCAM)

13:00-14:30 Defining research questions, objectives and hypotheses - D. Rovas (UCL)

14:30-14:50 Break

14:50-16:20 Qualitative, quantitative and mixed research strategies in BIM research - T. Hartmann (TUB)

Day 5 – Friday 11 December: Research Methods II

09:00-10:30 Collecting, preparing & archiving research data – Library?

10:30-10:50 Break

10:50-12:00 Managing and writing your project - I. Brilakis (UCAM)

12:00-13:00 Lunch and project session 5 – Y. Hong (UCAM)

13:00-14:30 Responsible Research & Innovation; Equality, Diversity & Inclusion – I. May (LOLA)

14:30-14:50 Break

14:50-16:20 BIM project presentations and feedback - A. Locke (LOR)

\*All listed times are in the GMT time zone. Participants in GMT+2 are encouraged to continue work on their projects before school starts each day. Participants in GMT are encouraged to do the same after school ends each day.

## 2.2 Activity Details

For each of the activities above provide details (these should be solicited from the instructors)

### [Activity ID]: Name

**Activity Lead:** Name and Affiliation

**Activity Type:** Lecture/Social/Independent Study/Visit/Presentation/etc..

**Topic:**

**Activity Outline:** (short description up to 1 paragraph)

**Expected outcomes of the activity e.g.:** By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

. [Repeat table above as many times as possible]

. [Where relevant separate

### [Activity ID]: Name

**Activity Lead:** Name and Affiliation

**Activity Type:** Lecture/Social/Independent Study/Visit/Presentation/etc..

**Topic:**

**Activity Outline:** (short description up to 1 paragraph)

**Expected outcomes of the activity e.g.:** By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – If yes, attach consent form]

**Uploads** (please link/attach if any): Material to be uploaded on Moodle. Each Activity will have a separate session on Moodle.

## 2.3 Pedagogy (approx. 200-300 words)

Describe the concept of the event and the training activities envisaged (lectures/ice-breaker events/social activities/active learning/etc). Teaching and learning methods and strategies. How do these contribute to meeting the programme-level learning objectives?

See Section 3.2 of the guidance document on what should be covered.

## 2.4 Assessment

Detail the type of assessment activities that will be undertaken. Where relevant upload the assessment brief(s) to be circulated to the students. In addition, a rubric should be attached for each assessment. For a template see Annex 2 of the master document.

Where relevant, students can submit essays, posters, etc using the Turnitin activity on Moodle, which will be set up by the Moodle administrator. If other Moodle activities should be setup (e.g. polling, attendance, quizzes) please describe the requirements here.

## 2.5 Awards

Discuss how learning is to be awarded (e.g. competitions, certificates of completion, etc).

## 2.6 Reading List

Include a reading list of material that students should have access to and possibly review.

All modules will have a reading list on which will be linked to Moodle. The administrator can prepare the reading list for your module (if he is provided with the references/files/links). Reading lists can include any type of resource including websites, videos etc.

Please provide the following information:

Reference

Which lecture the text relates to (or note if not linked to a specific teaching week)

Whether the text is essential, recommended or optional

## 2.6 Attendance pre-requisites

Pre-requisites for ESRs and external students

Reading material

Skill preparation (e.g. knowledge of programming languages)

Software available.

### 3. Organisational

#### 3.1 Organisational aspects

Review section 3.1 of the guidance. Describe the organisational aspects of the event (registration system, accomodation, developing a public presence). It would be useful to have a timeline (e.g in the form of a simple Gantt chart) of the type of activities required. Registration systems to be used, invoicing requirements, etc.

#### 3.2 Communication Plan

##### Before the event:

Describe the plan to communicate this to relevant communities at local and national level.

How will equality and diversity be achieved?

##### During the event:

Consider using Moodle. Two forums can be setup:

Announcements Forum – this is for staff to post updates and news items about the module. Students can't post or reply to messages in here.

Question and Answer forum – this is for students to post questions for the tutor. Tutors are expected to answer questions on the Q&A forum at least once per week during term time. Students are also encouraged to answer each other's questions.

#### 3.3 Risk assessment

Perform a mini risk assessment that covers:

- Risks to attendees (e.g. during site visits)
- Financial risks (and possible mitigation plan)
- Resourcing risks (e.g. one or more instructors are unavailable)
- Contextual risks (e.g. CV-19 )

#### 3.4 Staffing and support requirements.

Describe the support required to setup and run the event. Include:

- Staffing;
- Teaching assistant(s): (Oversight of students);
- Administrative Support: (populating the website, printing badges, organising transport);
- Local support.

And describe how these needs are to be covered.

## 4. Compliance

Prepare and attach the following:

1. Privacy notice – see Annex 3 of the guidance document
2. Registration form for instructors (including handling required consents) – see Annex 4 of the guidance document
3. Forms to rescind consent (for students)

### 3.4 Ethics and GDPR considerations (up to 100 words)

Describe how handling of personal information is to be secured (include data retention policies).

## 5. Attachments

- Assessment brief (Section 2.4)
- Training Event Budget (Make super to separate costs for CBIM and externals). Where known include additional information like quotes, et.
- Certificate of completion/awards (for students) – Attach pro forma to be used.
- Event and Reading List materials: (If you have any course materials/links to be uploaded to Moodle please attach them).
- Compliance (privacy and permission forms)
- Website structure document
- Images (If you have a relevant image that can be uploaded to the top of your Moodle page please attach them. Ensure you have proper rights to use these images).

# Template for Training Event

## CBIM

### 1. Training Event (Basic information)

#### 1.1 General Information

Event Name: CBIM School on Sensing and Data Collection

Type of event: Independent

Dates: May 2021

Location: Spain

Organiser(s): Susana Martín (CARTIF)

#### 1.2 Outline of the programme (up to 300 words)

This school is the second training event of the CBIM training Network. The school will offer ESR fellows and other European PhD students outside CMIN the opportunity to attend a series of key lectures given by experts in the field of sensing and data collection. The course will offer a general introduction to theoretical concepts relevant to sensing, data acquisition and storage. This includes sensor hardware fundamentals, data types (point-clouds, building sensor data, RGB/D and thermographic imagery, etc.), and quality evaluation metrics. Students will visit two CARTIF Buildings that are living labs (fully equipped and monitored research facilities) and experience the configuration, data collection and quality management mechanisms through a hands-on exercise; they will collect and fuse structured data with the BIM of the CARTIF building. This event will be scheduled to coincide with the mid-term check event, in this case not opened to students outside CBIM.

#### 1.3 Expected Learning Outcomes

The student should be able to:

1. Understand data collection processes for both structured and unstructured built environment data.
2. Understand the different sensors, Building Management Systems, and basic IoT technologies and protocols
3. Fuse BIM and measured (real time or dynamic) data.
4. Develop appreciation on the value of analytics for facility management and operational optimisation.

#### 1.4 Links for the overall CBIM structured training programme (up to 100 words)

This training event is the second of a series of training activities in the context of the Cloud BIM European Training Network (CBIM ETN). It gives continuity to the first school focused on BIM introduction, fundamental and research methods, highlighting BIM capabilities, BIM tools, openBIM standards for data representation and interoperability. This second training event provides the link towards the semantic enrichment of BIM by means of static and dynamic data acquisition. Real premises in CARTIF, in the form of living labs, will be used to analyse the different alternatives of data monitoring and control through the configuration and management of sensors, actuators and controllers of the HVAC systems. These field level devices, connected to a BACN and accessed through BEMS systems are mapped to enrich the BIM representation with static and dynamic information useful to develop Facility Management (FM) and Building Energy Performance (BEP) analytics.

#### 1.5 Audience

In addition to the ESRs (for which this is tailored to), this event is opened to other qualified Master and PhD students, post-doctoral research associates and early career industry practitioners.

#### 1.5 Attendance Numbers

Days 1-3: All ESRs and CBIM Instructors (25 people) + External Trainees (25 people)

Days 4-5: All CBIM consortium including ESRs and CBIM instructors (25 people)

## 2. Structure

### 2.1 Plan of activities

On the table below please include all module activities such as lectures, tutorials, independent study (e.g. before or after the event), field work, social activities, etc.

Activity ID	Date	Time	Event
<b>Day 1: Collecting Geometry Data</b>			
	Day 1	8h30-9h00	Welcome coffee
TE0.1	Day 1	9h00-9h30	Welcome from the organizer and CBIM coordinator
TE1.0	Day 1	9h30-10h30	Objectives of the workshop
	Day 1	10h30-11h00	Break
TE1.1	Day 1	11h00-13h00	Lecture 1: Geometric BIM Model Generation
	Day 1	13h00-14h00	Lunch (CARTIF premises)
TE1.2	Day 1	14h00-15h00	Lecture 2: Data transfer and export (MVDs, Visualization)
TE1.3	Day 1	15h00-16h30	Lecture 3: Tutorial (Data capture session: Imaging data)
	Day 1	16h30-17h00	Break
TE1.4	Day 1	17h00-18h00	Lecture 4: Videogrammetry (or laser scanning ) data collection and storage
	Day 1	20h30-22h30	Dinner (Rte. Patio Herreriano)

Activity ID	Date	Time	Event
<b>Day 2: Collecting Operational Data</b>			
	Day 2	8h30-9h00	Welcome coffee
TE2.1	Day 2	9h00-10h00	Lecture 5: Collection of operational data
TE2.2	Day 2	10h00-11h00	Lecture 6: Temperature and humidity measurements
	Day 2	11h00-11h30	Break
TE2.3	Day 2	11h30-13h30	Building Management Systems lecture and visit at CARTIF's building living lab
	Day 2	13h30-14h30	Lunch (CARTIF premises)
TE2.4	Day 2	14h30-15h30	Collecting thermographic images (Hands-on session – UCL to provide session)
TE2.5	Day 2	15h30-16h30	Lecture 7: Temperature and Humidity Data Loggers
	Day 2	16h30-17h00	Break
TE2.6	Day 2	17h00-18h00	Lecture 8: BMS and IoT protocols
	Day 2	20h30-22h30	Dinner (Rte. La Parrilla de San Lorenzo)

Activity ID	Date	Time	Event
<b>Day 3: Data Preparation</b>			
	Day 3	8h30-9h00	Welcome coffee
TE3.1	Day 3	9h00-10h00	Lecture 9: Data Quality

TE3.2	Day 3	10h00-11h00	Lecture 10: Problems with geometric data (quality control mechanisms)
	Day 3	11h00-11h30	Break
TE3.3	Day 3	11h30-12h30	Lecture 11: Missing data and data imputation
	Day 3	12h30-13h30	Lunch (CARTIF premises)
TE3.4	Day 3	13h30-15h30	Workshop: Developing a software architecture for storing and linking data
	Day 3	15h30-16h00	Break
TE3.5	Day 3	16h00-18h00	Students in teams to collect, enrich and store data obtained from CARTIF buildings
	Day 3	20h30-22h30	Dinner (Rte. Aquarium)

Activity ID	Date	Time	Event
<b>Day 4 &amp; 5: Mid-term check of project achievements</b>			
TE4.0	Day 4 & 5		Agenda to be defined with collaboration of all CBIM consortium

## 2.2 Activity Details

For each of the activities above provide details (these should be solicited from the instructors)

### [TE0.1]: Welcome from the organizer and CBIM coordinator

Activity Lead: A. Vasallo (CAR), R. Sacks (TECH)

Activity Type: Presentation

Topic: CARTIF presentation and welcome from the CBIM project coordinator

Activity Outline: Present to the audience the nature of CARTIF and the activity we develop, mainly related to the topics of the CBIM training network. Welcome from the CBIM project coordinator.

**Instructor Special Requirements:** e.g. Projector

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

### [TE1.0]: Objectives of the workshop

Activity Lead: S. Martín (CAR)

Activity Type: Presentation

Topic: Objectives of the workshop

Activity Outline: Presentation of the objectives of the workshop, both, from an academic and social point of view. Presentation of the expected outcomes at the end of the training event. Presentation of the agenda, typology and organization of every session.

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

### [TE1.1]: Geometric BIM Model Generation

Activity Lead: L. Guibas (STFD)

Activity Support: S. Álvarez (CARTIF) – Link between theory and reality in CARTIF premises.

Activity Type: Lecture

Topic: Geometric BIM Model Generation

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

### [TE1.2]: Data transfer and export (MVDs, Visualization)

Activity Lead: M. Weise (AEC3)

Activity Support: XXXX (CARTIF)

Activity Type: Lecture

Topic: Data transfer and export (MVDs, Visualization)

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

### [TE1.3]: Tutorial (Data capture session: Imaging data)

Activity Lead: K. Nyberg (TRMB), F. Lehmann (DLR)

Activity Support: S. Álvarez and P. Martín L. (CARTIF) – Link between theory and reality in CARTIF premises.

Activity Type: Lecture/Tutorial

Topic: Tutorial (Data capture session: Imaging data)

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1

- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

#### [TE1.4]: Videogrammetry (or laser scanning ) data collection and storage

Activity Lead: F. Lehmann (DLR)

**Activity Support:** S. Álvarez and P. Martín L. (CARTIF) – Link between theory and reality in CARTIF premises.

Activity Type: Lecture

Topic: Videogrammetry (or laser scanning ) data collection and storage

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

#### [TE2.1]: Collection of operational data

Activity Lead: P. Brennan (BAM)

**Activity Support:** R. Sanz (CARTIF) - Link between theory and reality in CARTIF premises.

Activity Type: Lecture

Topic: Collection of operational data

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

#### [TE2.2]: Temperature and humidity measurements

Activity Lead: M. Andrés (CARTIF)

**Activity Support:** R. Sanz (CARTIF) - Link between theory and reality in CARTIF premises.

Activity Type: Lecture

Topic: Temperature and humidity measurements

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

**[TE2.3]:** Building Management Systems lecture and visit at CARTIF's building living lab

Activity Lead: D. Rovas (UCL)

**Activity Support:** R. Sanz (CARTIF) – visit at CARTIF's building living lab

Activity Type: Lecture/physical visit

Topic: Building Management Systems lecture and visit at CARTIF's building living lab

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

**[TE2.4]:** Collecting thermographic images (Hands-on session – UCL to provide session)

Activity Lead: J. O'Donnell (UDC)

**Activity Support:** M. Andrés (CARTIF) - Link between theory and reality in CARTIF premises.

Activity Type: Hands-on session

Topic: Collecting thermographic images (Hands-on session – UCL to provide session)

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

### [TE2.5]: Temperature and Humidity Data Loggers

Activity Lead: D. Rovas (UCL), P. Devitt (LOR)

**Activity Support:** M. Andrés, R. Sanz (CARTIF) - Link between theory and reality in CARTIF premises.

Activity Type: Lecture

Topic: Temperature and Humidity Data Loggers

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

### [TE2.6]: BMS and IoT protocols

Activity Lead: M. Bew (PCSG)

**Activity Support:** R. Sanz, S. Martín (CARTIF) - Link between theory and reality in CARTIF premises.

Activity Type: Lecture

Topic: BMS and IoT protocols

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

### [TE3.1]: Data Quality

Activity Lead: S. McGovern (LOR)

**Activity Support:** XXX (CARTIF)

Activity Type: Lecture

Topic: Data Quality

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

[TE3.2]: Problems with geometric data (quality control mechanisms)

Activity Lead: I. Brilakis (UCAM)

**Activity Support:** S. Álvarez (CARTIF) - Link between theory and reality in CARTIF premises.

Activity Type: Lecture

Topic: Problems with geometric data (quality control mechanisms)

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

[TE3.3]: Missing data and data imputation

Activity Lead: L. Guibas (STFD)

**Activity Support:** S. Martín (CARTIF) - Link between theory and reality in CARTIF premises.

Activity Type: Lecture

Topic: Missing data and data imputation

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

**[TE3.4]:** Developing a software architecture for storing and linking data

Activity Lead: M. Bew (PCSG)

Activity Support: S. Martín, R. Sanz (CARTIF)

Activity Type: Workshop

Topic: Developing a software architecture for storing and linking data

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

**[TE3.5]:** Students in teams to collect, enrich and store data obtained from CARTIF buildings

Activity Lead: M. Andrés (CARTIF)

Activity Support: R. Sanz, S. Álvarez, S. Martín, M. Regidor (CARTIF)

Activity Type: Workshop/hands-on session (practical exercise)

Topic: Students in teams to collect, enrich and store data obtained from CARTIF buildings

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

**2.3 Pedagogy (approx. 200-300 words)**

*Describe the concept of the event and the training activities envisaged (lectures/ice-breaker events/social activities/active learning/etc). Teaching and learning methods and strategies. How do these contribute to meeting the programme-level learning objectives?*

*See Section 3.2 of the guidance document on what should be covered.*

**Concept description:** Sensing and data collection, and its relation with the Internet of Things, is one of the main research topics supporting the digitalization of the industry towards the Industry 4.0 in its different domains (construction, energy, automation, etc.). The diversity of sensors and connectivity means that it is necessary to establish common and standardized procedures for data retrieval, representation, imputation and persistency. In the context of the built environment sector, the combination of the static and dynamic data collection with the

Building Information Modelling is allowing the generation of digital versions, or digital twins, of the real infrastructure enhancing the application of big data, data analytics or other AI techniques to extract value from this big amount of nowadays accessible data.

The course will offer a general introduction to theoretical concepts relevant to sensing, data acquisition and storage. This includes sensor hardware fundamentals, data types (pointclouds, building sensor data, RGB/D and thermographic imagery, etc.), and quality evaluation metrics. Students will visit two CARTIF Buildings that are living labs (fully equipped and monitored research facilities) and experience the configuration, data collection and quality management mechanisms through a hands-on exercise; they will collect and fuse structured data with the BIM of the CARTIF building.

**Training activities envisaged:** lectures, tutorials, workshops, hands-on sessions, physical visits to real facilities and social events are envisaged.

**Teaching and learning methods and strategies:** TBD with every activity leader.

## 2.4 Assessment

*Detail the type of assessment activities that will be undertaken. Where relevant upload the assessment brief(s) to be circulated to the students. In addition, a rubric should be attached for each assessment. For a template see Annex 2 of the master document.*

TBD

*Where relevant, students can submit essays, posters, etc using the Turnitin activity on Moodle, which will be set up by the Moodle administrator. If other Moodle activities should be setup (e.g. polling, attendance, quizzes) please describe the requirements here.*

## 2.5 Awards

Learning will be awarded through certificates of completion.

## 2.6 Reading List

*Include a reading list of material that students should have access to and possibly review.*

*All modules will have a reading list on which will be linked to Moodle. The administrator can prepare the reading list for your module (if he is provided with the references/files/links). Reading lists can include any type of resource including websites, videos etc.*

*Please provide the following information:*

*Reference*

*Which lecture the text relates to (or note if not linked to a specific teaching week)*

*Whether the text is essential, recommended or optional*

TBD

## 2.6 Attendance pre-requisites

*Pre-requisites for ESRs and external students*

*Reading material*

*Skill preparation (e.g. knowledge of programming languages)*

*Software available.*

TBD

### 3. Organisational

#### 3.1 Organisational aspects

*Review section 3.1 of the guidance. Describe the organisational aspects of the event (registration system, accommodation, developing a public presence). It would be useful to have a timeline (e.g in the form of a simple Gantt chart) of the type of activities required. Registration systems to be used, invoicing requirements, etc.*

TBD

#### 3.2 Communication Plan

##### Before the event:

Describe the plan to communicate this to relevant communities at local and national level.

How will equality and diversity be achieved?

##### During the event:

Consider using Moodle. Two forums can be setup:

Announcements Forum – this is for staff to post updates and news items about the module. Students can't post or reply to messages in here.

Question and Answer forum – this is for students to post questions for the tutor. Tutors are expected to answer questions on the Q&A forum at least once per week during term time. Students are also encouraged to answer each other's questions.

#### 3.3 Risk assessment

Perform a mini risk assessment that covers:

- Risks to attendees (e.g. during site visits)
- Financial risks (and possible mitigation plan)
- Resourcing risks (e.g. one or more instructors are unavailable)
- Contextual risks (e.g. CV-19 )

#### 3.4 Staffing and support requirements.

Describe the support required to setup and run the event. Include:

- Staffing;
- Teaching assistant(s): (Oversight of students);
- Administrative Support: (populating the website, printing badges, organising transport);
- Local support.

And describe how these needs are to be covered.

## 4. Compliance

Prepare and attach the following:

1. Privacy notice – see Annex 3 of the guidance document
2. Registration form for instructors (including handling required consents) – see Annex 4 of the guidance document
3. Forms to rescind consent (for students)

### 3.4 Ethics and GDPR considerations (up to 100 words)

Describe how handling of personal information is to be secured (include data retention policies).

## 5. Attachments

- Assessment brief (Section 2.4)
- Training Event Budget (Make super to separate costs for CBIM and externals). Where known include additional information like quotes, et.
- Certificate of completion/awards (for students) – Attach pro forma to be used.
- Event and Reading List materials: (If you have any course materials/links to be uploaded to Moodle please attach them).
- Compliance (privacy and permission forms)
- Website structure document
- Images (If you have a relevant image that can be uploaded to the top of your Moodle page please attach them. Ensure you have proper rights to use these images).

# Template for Training Event CBIM

## 1. Training Event (Basic information)

### 1.1 General Information

Event Name: PhD School on Linked Data, Data Integration and Collaborative Working  
Type of event: Outsourced  
Dates: October 2021  
Location: Luxemburg  
Organiser(s): Linked Data in Architecture and Construction working group

### 1.2 Outline of the programme (up to 300 words)

This TE will offer ESR fellows the opportunity to attend a series of key lectures given by experts in the fields of linked data and data integration, BIM data standards including geospatial data, as well as, data management concepts. The course will offer a general introduction to concepts relevant to open standards and data definitions, process definitions, dictionaries and ontologies, data and transaction provenance as well as applications, tools and practical solutions. Lectures will include data handling techniques and concepts from other industries such as gaming, manufacturing and plant engineering. A peer-to-peer assessment exercise will be utilised so that students develop an appreciation on ways to assess and provide feedback of peers' work.

### 1.3 Expected Learning Outcomes

The student should be able to: (i) understand different data and database structures and standards; (ii) understand the relevant processes and concepts for linked integrated data from various data sources; (iii) develop appreciation on the value of non-proprietary data management solutions.

### 1.4 Links for the overall CBIM structured training programme (up to 100 words)

Explain how this TE fits within the broader envisaged structured training.

### 1.5 Audience

N/A (Third party will handle registration).

### 1.5 Attendance Numbers

Past events where attended by 30-40 students

## 2. Structure

The structure to follow the previous LDAC schools: <http://linkedbuildingdata.net/ldac2019/summerschool/>

The attendees will also have the opportunity to register to the LDAC workshop and/or CIB W78 school.

### 2.1 Plan of activities

On the table below please include all module activities such as lectures, tutorials, independent study (e.g. before or after the event), field work, social activities, etc.

Table is indicative (from 2019 event)

#### Day 1

##### Opening ([presentation](#))

09:00 - 09:30: José Beirao, Rui de Klerk, Pieter Pauwels, Anna Wagner, Georg Schneider

##### Linked Data and the Semantic Web: The Basics ([exercises](#) - [presentation](#))

09:30 - 11:30: Pieter Pauwels

11:30 - 12:00: Coffee break / open space

##### Ontology Development ([presentation](#))

12:00 - 13:00: María Poveda Villalón

13:00 - 14:00: Lunch with informal Q&A

##### Introduction to querying Linked Data ([exercises](#) - [presentation](#))

14:00 - 15:30: Mads Holten Rasmussen

15:30 - 16:00: Coffee break / open space

##### Linked Building Data: Examples & Tools ([exercises](#) - [presentation](#))

16:00 - 17:30: Mads Holten Rasmussen

17:30 - 18:00: Coffee break / open space

##### Kickoff coding challenge ([presentation](#))

18:00 - 18:30: Anna Wagner, Georg Schneider

from 18:30: Hackathon

#### Day 2

##### Recap of the previous day

09:00 - 09:30: Anna Wagner

##### Triple Stores: Introduction ([presentation](#))

09:30 - 10:30: Mathias Bonduel

10:30 - 11:00: Coffee break / open space

##### Coding with Linked Data

- . Geometry ([presentation](#)) - Anna Wagner

11:00 - 12:00: • . Coding with Linked Data: RDFLib ([exercise](#) - [exercise](#)) - Georg Schneider

##### Coding with Linked Data

- . Coding with Linked Data: NodeRED ([exercise](#) - [presentation](#)) - Walter Terkaj

12:00 - 13:00: • . Coding with Linked Data: Jena ([presentation](#)) - Jakob Beetz

13:00 - 14:00: Lunch

##### Coding with Linked Data

- . Coding with Linked Data: Geospatial data ([exercise](#)) - Kris McGlenn

14:00 - 15:00: • . Linked Building Product Data - Anna Wagner

from 15:00: Hackathon

### 2.3 Pedagogy (approx. 200-300 words)

Describe the concept of the event and the training activities envisaged (lectures/ice-breaker events/social activities/active learning/etc). Teaching and learning methods and strategies. How do these contribute to meeting the programme-level learning objectives?

See Section 3.2 of the guidance document on what should be covered.

### 2.4 Assessment

#### **CODING CHALLENGE**

An integral part of the summer school is the application and strengthening of newly learned knowledge from lectures in practical research work: **The coding challenge.**

The goal of the challenge is for participants, grouped in interdisciplinary teams, to address and define real world problems. The teams build lightweight applications enabling enrichment, querying and browsing of Linked Building Data sets, cross-domain data exploration and reasoning, generate own small test data sets and formalize existing data sets using adapters.

As a field of study, open data sets are provided as a playground for participants and can be augmented by own data sets. A suite of open-source tools are introduced to perform related tasks and form in combination with the support of the tutors the initial spark create something new.

Coding challenges

The following coding challenges are set up for all participants (groups of 4/5):

- [02-00 Publish Smart Home Sensor Data using SWT](#)
- [02-01 Integrate heterogeneous building product data](#)
- [02-02 Automated Ontology Matching in the Built Environment](#)
- [02-03 Extraction and Semantic Annotation of Geometry Data from IFC](#)
- [02-04 Generation of 3D Virtual Reality Scene from Linked Building Data](#)
- [02-05 Open Data Model for AEC Industry](#)

### 2.5 Awards

Prizes were offered to winners of

### 2.6 Reading List

Providers give preparatory presentations

### 2.6 Attendance pre-requisites

Basic coding skills, Attendance to TE1

### 3. Organisational

#### 3.1 Organisational aspects

Review section 3.1 of the guidance. Describe the organisational aspects of the event (registration system, accomodation, developing a public presence). It would be useful to have a timeline (e.g in the form of a simple Gantt chart) of the type of activities required. Registration systems to be used, invoicing requirements, etc.

#### 3.2 Communication Plan

##### Before the event:

Describe the plan to communicate this to relevant communities at local and national level.

How will equality and diversity be achieved?

##### During the event:

Consider using Moodle. Two forums can be setup:

Announcements Forum – this is for staff to post updates and news items about the module. Students can't post or reply to messages in here.

Question and Answer forum – this is for students to post questions for the tutor. Tutors are expected to answer questions on the Q&A forum at least once per week during term time. Students are also encouraged to answer each other's questions.

#### 3.3 Risk assessment

Perform a mini risk assessment that covers:

- Risks to attendees (e.g. during site visits)
- Financial risks (and possible mitigation plan)
- Resourcing risks (e.g. one or more instructors are unavailable)
- Contextual risks (e.g. CV-19 )

#### 3.4 Staffing and support requirements.

Describe the support required to setup and run the event. Include:

- Staffing;
- Teaching assistant(s): (Oversight of students);
- Administrative Support: (populating the website, printing badges, organising transport);
- Local support.

And describe how these needs are to be covered.

## 4. Compliance

Prepare and attach the following:

1. Privacy notice – see Annex 3 of the guidance document
2. Registration form for instructors (including handling required consents) – see Annex 4 of the guidance document
3. Forms to rescind consent (for students)

### 3.4 Ethics and GDPR considerations (up to 100 words)

Describe how handling of personal information is to be secured (include data retention policies).

## 5. Attachments

- Assessment brief (Section 2.4)
- Training Event Budget (Make super to separate costs for CBIM and externals). Where known include additional information like quotes, et.
- Certificate of completion/awards (for students) – Attach pro forma to be used.
- Event and Reading List materials: (If you have any course materials/links to be uploaded to Moodle please attach them).
- Compliance (privacy and permission forms)
- Website structure document
- Images (If you have a relevant image that can be uploaded to the top of your Moodle page please attach them. Ensure you have proper rights to use these images).

# Template for Training Event CBIM

## 1. Training Event (Basic information) TE4

### 1.1 General Information

Event Name: **PhD School on Advanced BIM Applications and Digital Twin Technology**

Type of event: Independent

Dates: December 2021

Location: Haifa, Israel

Organiser(s): Prof. Rafael Sacks, Dr. Silvana Bruno (TECH)

### 1.2 Outline of the programme (up to 300 words)

Design and construction of modern buildings require not only professional skills but also the ability to collaborate in multi-disciplinary teams and knowledge of and proficiency in the use of sophisticated information technologies. In this TE, students will learn advanced concepts of Building Information Modelling through formal lectures, but they will also have the opportunity, through hands-on group projects, to apply the theoretical knowledge to development of a building project from conceptual design, through engineering and cost analyses, to detailed design and fabrication of models using rapid prototyping technology.

### 1.3 Expected Learning Outcomes

On completion, students will have a good understanding of the capabilities and limitations of BIM technology. Students will also have the first-hand experience of how BIM can be used to support professional and multi-disciplinary teamwork with concurrent engineering, compilation of digital twins for new buildings, and will be competent in a broad set of tools appropriate for their profession.

On completion, the student should be able to:

1. Effectively collaborate as a member of a multi-disciplinary design team.
2. Design, set up and manage a project Common Data Repository (CDE),
3. Design, set up and manage a cloud collaboration network for a construction project team.
4. Operate a set of building simulation and analysis software tools and effectively share the results with team members.
5. Present their design and construction projects to an audience as a member of a collaborative team, making extensive use of BIM visualisation tools.

### 1.4 Links for the overall CBIM structured training programme (up to 100 words)

This training event is the fourth of a series of training activities in the context of the Cloud BIM European Training Network (CBIM ETN). It provides the capstone training experience, bringing together and integrating the basic knowledge that has been gained in the previous training events and the online modules. The focus is on teamwork, collaboration and concurrent engineering, using all of the skills and the tools acquired earlier.

### 1.5 Audience

In addition to the ESRs (for which this is tailored to), this event is opened to other qualified Master and PhD students, post-doctoral research associates and early career industry practitioners.

### 1.5 Attendance Numbers

All ESRs and CBIM Instructors (25 people) + External Trainees (15 people)

## 2. Structure

### 2.1 Plan of activities

#### Day 1: BIM Collaboration Processes and Technology for Teamwork

Activity ID	Time	Event	Lecturer
	8h30-9h00	Welcome coffee	
TE0.1	9h00-9h30	Welcome from the organizer and CBIM coordinator	R. Sacks (TECH)
TE1.0	9h30-10h30	Objectives of the workshop Team project definition and assignment of teams	R. Sacks (TECH) S. Bruno (TECH)
	10h30-11h00	Break	
TE1.1	11h00-13h00	BIM Concepts for collaboration: Object-oriented modelling, solid modelling and CSG, parametric modelling, cloud-based BIM systems, ISO 19650 (2h)	R. Sacks (TECH)
	13h00-14h00	Lunch (Faculty cafeteria)	
TE1.2	14h00-15h00	First team meeting to coordinate project work (1h)	All faculty supervise, one per team
TE1.3	15h00-16h00	BIM collaboration systems, content libraries, creating new projects, sharing design intent, CDE and cloud work spaces (1h)	K. Nyberg (TRMB)
	16h00-16h30	Break	
TE1.4	16h30-17h30	Update on interoperability: different representations in BIM software, update on IFC 5.0 (1h)	T. Liebich (AEC3)
TE1.5	19h00-21h30	Team collaboration working dinner	Borowitz building ground floor seminar rooms

#### Day 2: BIM for Architects & Engineers

Activity ID	Time	Event	Lecturer
	8h30-9h00	Coffee & sandwiches	
TE2.1	9h00-10h00	Conceptual design in Revit/Rhino/Dynamo – advantages/limitations of existing tools. (1h)	Avishag Shemesh (TECH)
TE2.2	10h00-11h00	Structural analysis of BIM models (1h)	D. Robertson (BNTY)
	11h00-11h30	Break	
TE2.3	11h30-13h00	Quantity take-off and Cost Analysis (1h)	P. Brennan (BAM) G. Harrington (BAM)
	13h00-14h00	Lunch (Faculty cafeteria)	
TE2.4	14h00-15h00	Supervised team meeting for project work (1h)	All faculty supervise, one per team
TE2.5	15h00-16h00	4D CAD concepts (1h)	G. Herries (LOR)
	16h00-16h30	Break	
TE2.6	16h30-17h30	Target Value Design (1h)	M. Keohane (BAM)

TE2.7	19h00-21h30	Team collaboration working dinner	Borowitz building ground floor seminar rooms
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### Day 3: BIM for Contractors

Activity ID	Time	Event	Lecturer
	8h30-9h00	Coffee & sandwiches	
TE3.1	9h00-10h30	Construction planning and production management	G. Brierley (LOR) A. Locke (LOR)
	10h30-11h00	Break	
TE3.2	11h00-13h00	Team project work	Borowitz building ground floor seminar rooms
	13h00-14h00	Lunch (Faculty cafeteria)	
TE3.4	14h00-15h00	Supervised team meeting for project work (1h)	All faculty supervise, one per team
TE3.5	15h00-16h00	BIM and BPA (Building Performance Analysis) tools (1h00)	J. O'Donnell (UCD)
	16h00-16h30	Break	
TE3.6	16h30-17h30	BIM and Asset Management tools (1h00)	A. Parlikad (UCAM)
	19h00-21h30	Training Event Dinner – German Colony Haifa	

### Day 4: BIM for Subcontractors & Fabricators

Activity ID	Time	Event	Lecturer
	8h30-9h00	Coffee & sandwiches	
TE4.1	9h00-10h30	Introduction – BIM and computer-based manufacturing in architecture (1h30)	Y. Grobman (TECH)
	10h30-11h00	Break	
TE4.2	11h00-13h00	CNC, rapid prototyping, contour-crafting, 3D printing, including lab visit and demonstrations (2h00)	A. Sprecher (TECH)
	13h00-14h00	Lunch (Faculty cafeteria)	
TE4.4	14h00-15h00	Supervised team meeting for project work (1h)	All faculty supervise, one per team
TE4.5	15h00-16h00	Team project work	Borowitz building ground floor seminar rooms
	16h00-16h30	Break	
TE4.6	16h30-17h30	Team project work	Borowitz building ground floor seminar rooms
TE4.7	19h00-21h30	Team collaboration working dinner	Borowitz building ground floor seminar rooms

## Day 5: BIM and Management for Sustainability

Activity ID	Time	Event	Lecturer
	8h30-9h00	Coffee & sandwiches	
TE5.1	9h00-10h30	BIM <b>throughout</b> the building life-cycle (1h30)	E. Papadonikolaki (UCL)
	10h30-11h00	Break	
TE5.2	11h00-13h00	Integrating BIM with blockchain technology for data provenance (2h00)	E. Papadonikolaki (UCL)
	13h00-14h00	Lunch (Faculty cafeteria)	
TE5.4	14h00-17h00	Student team project presentations	R. Sacks (TECH) S. Bruno (TECH) VISLAB studio, Faculty of Architecture
	19h00-21h30	Dinner	

### 2.2 Activity Details

For each of the activities above provide details (these should be solicited from the instructors)

#### [TE0.1]: Welcome from the organizer and CBIM coordinator

Activity Lead: R. Sacks (TECH)

Activity Type: Presentation

Topic: Technion presentation and welcome from the CBIM project coordinator

Activity Outline: Present to the audience the nature of Technion, NBRI and the activity we develop, mainly related to the topics of the CBIM training network. Welcome from the CBIM project coordinator.

#### Instructor Special Requirements:

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

Remaining activity details TBD.

### 2.3 Pedagogy (approx. 200-300 words)

*Describe the concept of the event and the training activities envisaged (lectures/ice-breaker events/social activities/active learning/etc). Teaching and learning methods and strategies. How do these contribute to meeting the programme-level learning objectives?*

*See Section 3.2 of the guidance document on what should be covered.*

**Concept description:** The central theme of the TE is to learn the theory and practice of collaboration in multi-disciplinary teams in building design at the conceptual and system design stages. Lectures will cover a) team collaboration and concurrent engineering management, b) engineering analyses and simulations of various types for evaluating prototypical designs, and c) BIM technologies for collaboration. The cornerstone of this TE, however, will be a team project activity in which the students will play the roles of architect, structural engineer, MEP engineer, Information manager and project manager in project teams that are tasked with devising a coherent, competent design

solution for an outpatient medical clinic. Classroom learning will also be augmented with visits to construction research labs, such as the Technion 3D printing and prototyping lab.

**Training activities envisaged:** lectures, team workshops with hands-on sessions in team projects, physical visits to lab facilities and social events are envisaged.

**Teaching and learning methods and strategies:** For the lectures, TBD with every activity leader. For the team project – teams will be mentored by members of faculty, and they will be supported in designing, analysing, refining and modelling their team project.

## 2.4 Assessment

*Detail the type of assessment activities that will be undertaken. Where relevant upload the assessment brief(s) to be circulated to the students. In addition, a rubric should be attached for each assessment. For a template see Annex 2 of the master document.*

TBD

*Where relevant, students can submit essays, posters, etc using the Turnitin activity on Moodle, which will be set up by the Moodle administrator. If other Moodle activities should be setup (e.g. polling, attendance, quizzes) please describe the requirements here.*

Students will be assessed in their teamwork activities in three ways:

- a) Faculty supervisors will make individual assessments through observation of the engagement of each student within their teamwork.
- b) The faculty panel as a whole will judge the design presentations of the teams, awarding a team score
- c) Self-assessment by each student using a predefined form
- d) Peer-assessment by each student of the other students in their team.

## 2.5 Awards

Learning will be awarded through certificates of completion.

## 2.6 Reading List

*Include a reading list of material that students should have access to and possibly review.*

*All modules will have a reading list on which will be linked to Moodle. The administrator can prepare the reading list for your module (if he is provided with the references/files/links). Reading lists can include any type of resource including websites, videos etc.*

*Please provide the following information:*

*Reference*

*Which lecture the text relates to (or note if not linked to a specific teaching week)*

*Whether the text is essential, recommended or optional*

TBD

## 2.6 Attendance pre-requisites

*Pre-requisites for ESRs and external students*

*Reading material*

*Skill preparation (e.g. knowledge of programming languages)*

*Software available.*

TBD

### 3. Organisational

#### 3.1 Organisational aspects

*Review section 3.1 of the guidance. Describe the organisational aspects of the event (registration system, accommodation, developing a public presence). It would be useful to have a timeline (e.g in the form of a simple Gantt chart) of the type of activities required. Registration systems to be used, invoicing requirements, etc.*

TBD

#### 3.2 Communication Plan

Before the event:

*Describe the plan to communicate this to relevant communities at local and national level.*

*How will equality and diversity be achieved?*

During the event:

Moodle will be used. All course materials, questionnaires and assessments will be delivered via Moodle. Two forums can be setup:

Announcements Forum – this is for staff to post updates and news items about the module. Students can't post or reply to messages in here.

Question and Answer forum – this is for students to post questions for the tutor. Tutors are expected to answer questions on the Q&A forum at least once per week during term time. Students are also encouraged to answer each other's questions.

#### 3.3 Risk assessment

*Perform a mini risk assessment that covers:*

- *Risks to attendees (e.g. during site visits)*
- *Financial risks (and possible mitigation plan)*
- *Resourcing risks (e.g. one or more instructors are unavailable)*
- *Contextual risks (e.g. CV-19 )*

TBD

#### 3.4 Staffing and support requirements.

*Describe the support required to setup and run the event. Include:*

- *Staffing;*
- *Teaching assistant(s): (Oversight of students);*
- *Administrative Support: (populating the website, printing badges, organising transport);*
- *Local support.*

*And describe how these needs are to be covered.*

TBD

## 4. Compliance

Prepare and attach the following:

1. Privacy notice – see Annex 3 of the guidance document
2. Registration form for instructors (including handling required consents) – see Annex 4 of the guidance document
3. Forms to rescind consent (for students)

### 3.4 Ethics and GDPR considerations (up to 100 words)

Describe how handling of personal information is to be secured (include data retention policies).

## 5. Attachments

- Assessment brief (Section 2.4)
- Training Event Budget (Make super to separate costs for CBIM and externals). Where known include additional information like quotes, et.
- Certificate of completion/awards (for students) – Attach pro forma to be used.
- Event and Reading List materials: (If you have any course materials/links to be uploaded to Moodle please attach them).
- Compliance (privacy and permission forms)
- Website structure document
- Images (If you have a relevant image that can be uploaded to the top of your Moodle page please attach them. Ensure you have proper rights to use these images).

# Template for Training Event

## CBIM

### 1. Training Event (Basic information)

#### 1.1 General Information

Event Name: PhD School on Product Modelling and Management

Type of event: Virtual Learning

Dates: To be confirmed Nov 2020-Jan 2021

Location: Online

Organiser(s): Timo Hartmann, TU Berlin

#### 1.2 Outline of the programme (up to 300 words)

At the end of the module, students will understand the basics of product modelling theory, which not only forms the basis of state-of-the-art Building Information Systems, parametric modelling systems, and advanced integrated simulation platforms. With this knowledge about product modelling students will be able to organize and structure any complex engineering effort within the realm of civil engineering with or without the support of computers. Students will know the theoretical underpinnings of ontologies and information models from the viewpoint of semiotic theory and logic. Students will also understand related concepts such as level of detail, abstraction, and interpretation and can apply these concepts to computationally model engineered systems to support knowledge intensive engineering work. Students will gain the required skills to represent and describe all type of civil engineering objects with their components, functions, and properties ranging from buildings to infrastructure. Additionally, students will know advanced methods of parametric modelling to steer the geometric configuration of a system based on a few carefully selected input parameters.

To ground the theoretical part of the module, students will also gain practical hands on experiences modelling complex infrastructure and building systems using state of the art ontology modelling software. Additionally, students will get to know rich practical case studies and advanced topics from the field of systems engineering that will help them to deeply grasp the importance for adequate models to support the engineering of complex civil infrastructure and building systems. Among these concepts are for example ontological reasoning, parametric modelling, requirements management, configuration management, information management, cost and risk engineering, or control engineering.

#### 1.3 Expected Learning Outcomes

[List 4-5 programme-level learning outcomes. These should be Specific, Measurable, Attainable, Realistic]

#### 1.4 Links for the overall CBIM structured training programme (up to 100 words)

Explain how this TE fits within the broader envisaged structured training.

#### 1.5 Audience

In addition to the ESRs (for which this is tailored to), who else could potentially benefit? What is the target audience?

#### 1.5 Attendance Numbers

Estimate student numbers (for capacity and budget planning)

ESRs/CBIM Instructors (e.g. from partners and beneficiaries)/External Trainees

If numbers vary by day, can be broken down by days (useful for budgeting requirements).

## 2. Structure

### 2.1 Plan of activities

On the table below please include all module activities such as lectures, tutorials, independent study (e.g. before or after the event), field work, social activities, etc.

Activity ID	Date	Time	Event
L1			Lecture: Introduction and Module Logistics
L2			Lecture: Ontological Modelling and Reasoning Primer: SE Tools - Product modelling formalisms
L3			Project week: Background Research into the components of an engineered system
L4			Lecture: Ontological reasoning
L5			Primer: Requirements management (Lecture)
L6			Geometry and Parametric Modelling Applications of parametric models in civil product engineering (Lecture)
L7			Primer: Configuration Management (Lecture)
L8			Primer: Information Management (Lecture)
PW1			Project Week
L9			Primer: Cost Management (Lecture)
L10			Primer: Risk Management (Lecture)
PW2			Project week - group project
PW3			Project week - group project
L11			Presentations: Integrated city models Outlook: Smart Infrastructure, Buildings, and Control Engineering Civil Systems Analysis (Lecture)

### 2.2 Activity Details

For each of the activities above provide details (these should be solicited from the instructors)

#### [Activity ID]: Name

Activity Lead: Name and Affiliation

Activity Type: Lecture/Social/Independent Study/Visit/Presentation/etc..

Topic:

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

. [Repeat table above as many times as possible]

. [Where relevant separate

### [Activity ID]: Name

**Activity Lead:** Name and Affiliation

**Activity Type:** Lecture/Social/Independent Study/Visit/Presentation/etc..

**Topic:**

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
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- Item 3
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**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – If yes, attach consent form]

**Uploads** (please link/attach if any): Material to be uploaded on Moodle. Each Activity will have a separate session on Moodle.

### 2.3 Pedagogy (approx. 200-300 words)

Describe the concept of the event and the training activities envisaged (lectures/ice-breaker events/social activities/active learning/etc). Teaching and learning methods and strategies. How do these contribute to meeting the programme-level learning objectives?

See Section 3.2 of the guidance document on what should be covered.

### 2.4 Assessment

Detail the type of assessment activities that will be undertaken. Where relevant upload the assessment brief(s) to be circulated to the students. In addition, a rubric should be attached for each assessment. For a template see Annex 2 of the master document.

Where relevant, students can submit essays, posters, etc using the Turnitin activity on Moodle, which will be set up by the Moodle administrator. If other Moodle activities should be setup (e.g. polling, attendance, quizzes) please describe the requirements here.

### 2.5 Awards

Discuss how learning is to be awarded (e.g. competitions, certificates of completion, etc).

### 2.6 Reading List

Include a reading list of material that students should have access to and possibly review.

All modules will have a reading list on which will be linked to Moodle. The administrator can prepare the reading list for your module (if he is provided with the references/files/links). Reading lists can include any type of resource including websites, videos etc.

Please provide the following information:

Reference

Which lecture the text relates to (or note if not linked to a specific teaching week)

Whether the text is essential, recommended or optional

## 2.6 Attendance pre-requisites

Pre-requisites for ESRs and external students

Reading material

Skill preparation (e.g. knowledge of programming languages)

Software available.

### 3. Organisational

#### 3.1 Organisational aspects

Review section 3.1 of the guidance. Describe the organisational aspects of the event (registration system, accomodation, developing a public presence). It would be useful to have a timeline (e.g in the form of a simple Gantt chart) of the type of activities required. Registration systems to be used, invoicing requirements, etc.

#### 3.2 Communication Plan

##### Before the event:

Describe the plan to communicate this to relevant communities at local and national level.

How will equality and diversity be achieved?

##### During the event:

Consider using Moodle. Two forums can be setup:

Announcements Forum – this is for staff to post updates and news items about the module. Students can't post or reply to messages in here.

Question and Answer forum – this is for students to post questions for the tutor. Tutors are expected to answer questions on the Q&A forum at least once per week during term time. Students are also encouraged to answer each other's questions.

#### 3.3 Risk assessment

Perform a mini risk assessment that covers:

- Risks to attendees (e.g. during site visits)
- Financial risks (and possible mitigation plan)
- Resourcing risks (e.g. one or more instructors are unavailable)
- Contextual risks (e.g. CV-19 )

#### 3.4 Staffing and support requirements.

Describe the support required to setup and run the event. Include:

- Staffing;
- Teaching assistant(s): (Oversight of students);
- Administrative Support: (populating the website, printing badges, organising transport);
- Local support.

And describe how these needs are to be covered.

## 4. Compliance

Prepare and attach the following:

1. Privacy notice – see Annex 3 of the guidance document
2. Registration form for instructors (including handling required consents) – see Annex 4 of the guidance document
3. Forms to rescind consent (for students)

### 3.4 Ethics and GDPR considerations (up to 100 words)

Describe how handling of personal information is to be secured (include data retention policies).

## 5. Attachments

- Assessment brief (Section 2.4)
- Training Event Budget (Make super to separate costs for CBIM and externals). Where known include additional information like quotes, et.
- Certificate of completion/awards (for students) – Attach pro forma to be used.
- Event and Reading List materials: (If you have any course materials/links to be uploaded to Moodle please attach them).
- Compliance (privacy and permission forms)
- Website structure document
- Images (If you have a relevant image that can be uploaded to the top of your Moodle page please attach them. Ensure you have proper rights to use these images).

# Template for Training Event

## CBIM

### 1. Training Event (Basic information)

#### 1.1 General Information

Event Name: PhD School on Entrepreneurship Management

Type of event: Virtual Learning

Dates: To be confirmed Oct 2022-Dec 2022

Location: Online

Organiser(s): Ilka May (LOLA), Timo Hartmann, TU Berlin

#### 1.2 Outline of the programme (up to 300 words)

This module will introduce ESRs to business modelling and entrepreneurial financing with a focus on the establishment of innovative start-ups around novel CBIM solutions. This will be structured training towards the development of skills and approaches necessary to becoming effective entrepreneurial leaders and managers. These skills comprise assessing risk, understanding business models, developing go-to-market concepts, analysing key operational metrics, modelling cash flow and capital requirements, evaluating sources of financing, structuring and negotiating investments, managing organisational culture and incentives, managing the interplay between ownership and growth, and handling adversity and failure.

The module will be specifically targeted at innovation management within the wider construction industry. To gain hands-on experiences all students need to develop a business plan that will be evaluated regarding feasibility by the consortium's industrial partners. This module is scheduled in Year 3 of the ESRs training to coincide with the period where ESRs have prototypes and are thinking of commercialization pathways for their work.

#### 1.3 Expected Learning Outcomes

[List 4-5 programme-level learning outcomes. These should be Specific, Measurable, Attainable, Realistic]

#### 1.4 Links for the overall CBIM structured training programme (up to 100 words)

Explain how this TE fits within the broader envisaged structured training.

#### 1.5 Audience

In addition to the ESRs (for which this is tailored to), who else could potentially benefit? What is the target audience?

#### 1.5 Attendance Numbers

Estimate student numbers (for capacity and budget planning)

ESRs/CBIM Instructors (e.g. from partners and beneficiaries)/External Trainees

If numbers vary by day, can be broken down by days (useful for budgeting requirements).

## 2. Structure

### 2.1 Plan of activities

On the table below please include all module activities such as lectures, tutorials, independent study (e.g. before or after the event), field work, social activities, etc.

#### Topics Covered:

- Introduction and Business Ecosystems
- Innovation and Industry Life Cycles
- Strategy and Management
- Intellectual Property Rights
- Funding Start-Ups
- Accounting
- Financial Analysis
- HR and Team Aspects BIM Industry in Europe
- Case Study I: Construction Industry
- Case Study II: Facility Management Entrepreneurship Management
- Defining your academic venture Financial Planning
- Business Plans
- Business Model Canvas
- Assessment: Developing a Business plan for CBIM innovations

### 2.2 Activity Details

For each of the activities above provide details (these should be solicited from the instructors)

#### [Activity ID]: Name

Activity Lead: Name and Affiliation

Activity Type: Lecture/Social/Independent Study/Visit/Presentation/etc..

Topic:

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – Attach form]

**Uploads** (please link/attach if any)

. [Repeat table above as many times as possible]

. [Where relevant separate

#### [Activity ID]: Name

Activity Lead: Name and Affiliation

Activity Type: Lecture/Social/Independent Study/Visit/Presentation/etc..

Topic:

Activity Outline: (short description up to 1 paragraph)

Expected outcomes of the activity e.g.: By the end of the lecture students will have learnt:

- Item 1
- Item 2
- Item 3
- Item 4

**Instructor Special Requirements:** e.g. A/V, equipment etc.

**Copyright:** [Discussed Y/N; Copyright using CC for sharing material] - See <https://creativecommons.org/choose/>

**Instructor GDPR Consent:** [Y/N – If yes, attach consent form]

**Uploads** (please link/attach if any): Material to be uploaded on Moodle. Each Activity will have a separate session on Moodle.

### 2.3 Pedagogy (approx. 200-300 words)

Describe the concept of the event and the training activities envisaged (lectures/ice-breaker events/social activities/active learning/etc). Teaching and learning methods and strategies. How do these contribute to meeting the programme-level learning objectives?

See Section 3.2 of the guidance document on what should be covered.

### 2.4 Assessment

Detail the type of assessment activities that will be undertaken. Where relevant upload the assessment brief(s) to be circulated to the students. In addition, a rubric should be attached for each assessment. For a template see Annex 2 of the master document.

Where relevant, students can submit essays, posters, etc using the Turnitin activity on Moodle, which will be set up by the Moodle administrator. If other Moodle activities should be setup (e.g. polling, attendance, quizzes) please describe the requirements here.

### 2.5 Awards

Discuss how learning is to be awarded (e.g. competitions, certificates of completion, etc).

### 2.6 Reading List

Include a reading list of material that students should have access to and possibly review.

All modules will have a reading list on which will be linked to Moodle. The administrator can prepare the reading list for your module (if he is provided with the references/files/links). Reading lists can include any type of resource including websites, videos etc.

Please provide the following information:

Reference

Which lecture the text relates to (or note if not linked to a specific teaching week)

Whether the text is essential, recommended or optional

### 2.6 Attendance pre-requisites

Pre-requisites for ESRs and external students

Reading material

Skill preparation (e.g. knowledge of programming languages)

Software available.



### 3. Organisational

#### 3.1 Organisational aspects

Review section 3.1 of the guidance. Describe the organisational aspects of the event (registration system, accomodation, developing a public presence). It would be useful to have a timeline (e.g in the form of a simple Gantt chart) of the type of activities required. Registration systems to be used, invoicing requirements, etc.

#### 3.2 Communication Plan

##### Before the event:

Describe the plan to communicate this to relevant communities at local and national level.

How will equality and diversity be achieved?

##### During the event:

Consider using Moodle. Two forums can be setup:

Announcements Forum – this is for staff to post updates and news items about the module. Students can't post or reply to messages in here.

Question and Answer forum – this is for students to post questions for the tutor. Tutors are expected to answer questions on the Q&A forum at least once per week during term time. Students are also encouraged to answer each other's questions.

#### 3.3 Risk assessment

Perform a mini risk assessment that covers:

- Risks to attendees (e.g. during site visits)
- Financial risks (and possible mitigation plan)
- Resourcing risks (e.g. one or more instructors are unavailable)
- Contextual risks (e.g. CV-19 )

#### 3.4 Staffing and support requirements.

Describe the support required to setup and run the event. Include:

- Staffing;
- Teaching assistant(s): (Oversight of students);
- Administrative Support: (populating the website, printing badges, organising transport);
- Local support.

And describe how these needs are to be covered.

## 4. Compliance

Prepare and attach the following:

1. Privacy notice – see Annex 3 of the guidance document
2. Registration form for instructors (including handling required consents) – see Annex 4 of the guidance document
3. Forms to rescind consent (for students)

### 3.4 Ethics and GDPR considerations (up to 100 words)

Describe how handling of personal information is to be secured (include data retention policies).

## 5. Attachments

- Assessment brief (Section 2.4)
- Training Event Budget (Make super to separate costs for CBIM and externals). Where known include additional information like quotes, et.
- Certificate of completion/awards (for students) – Attach pro forma to be used.
- Event and Reading List materials: (If you have any course materials/links to be uploaded to Moodle please attach them).
- Compliance (privacy and permission forms)
- Website structure document
- Images (If you have a relevant image that can be uploaded to the top of your Moodle page please attach them. Ensure you have proper rights to use these images).

# Hackathon Training Event CBIM

## 1. Training Event (Basic information)

### 1.1 General Information

Event Name: CBIM Hackathon  
Type of event: [Independent and Virtual Learning]  
Dates: CBIM M34  
Location: TUB Berlin, Germany.  
Organiser(s): James O'Donnell (UCD) and Lucian Urungeanu Contecht (CON)

### 1.2 Outline of the programme (up to 300 words)

All CBIM ESRs will participate in a 5-day hackathon. The goal of the hackathon will be to jointly develop innovative apps that make use of distributed data repositories. Two cases and rich data repositories will be made available to the hackathon participants:

1. the TUB bridge case, and
2. the TUB train station renovation case.

In addition to immediate learning effects for the consortium's researchers, the results of the hackathon will be made publicly available on the web and will serve as a great showcase for the future innovation potential of CBIM solutions. In addition to the technical aspects, students will develop a business plan and ways to promote and market their product/app; this will draw upon knowledge acquired in Mod2.

### 1.3 Expected Learning Outcomes

The event is a five-day design sprint-like competition where teams work together, on a specific idea, with the goal to create usable software or hardware as functioning prototype or product by the end of the event.

1. Develop teamwork or collaboration skills to deliver a working prototype using a preferred software framework,
2. Creativity or innovation skills as demonstrated by demarcated individual design components and contributions to the final prototype design.
3. Context specific skill (e.g. Java programming skills) for a BIM based application
4. Presentation (Dragon's Den Style) skill that clearly demonstration the value proposition for industry in the proposed prototype.

### 1.4 Links for the overall CBIM structured training programme (up to 100 words)

The CBIM Hackathon is scheduled for M34 and has teaching module 2 (Mod2) as a prerequisite. The intention is for this Hackathon to build on an almost complete CBIM training programme so as the ESRs approach the event with a comprehensive understanding of the domain and are informed with respect to areas for exploitation when developing and presenting their concepts and prototypes.

### 1.5 Audience

In addition to the ESRs (for which this is tailored to), other graduate research students working on a BIM related topic could potentially benefit. Coding skills would be beneficial but are not essential.

### 1.5 Attendance Numbers

#### Estimate student numbers (for capacity and budget planning)

Fixed number in Berlin with the opportunity for others to join in remotely?  
How many per team? Current thinking is 3-4.  
How many teams could be accommodated on site?

Maximum of 10 groups of 3-4 people.

**ESRs/CBIM Instructors (e.g. from partners and beneficiaries)/External Trainees**

Each team has a mentor (could be playing the role of a customer), could be a domain expert only.

Perhaps a talk each morning on each of the key components of the Hackathon. Idea is that the talks are very relevant to the exercise.

**If numbers vary by day, can be broken down by days (useful for budgeting requirements).**

Numbers should be consistent each day.

# Template for Training Event

## CBIM

### 1. Training Event (Basic information)

#### 1.1 General Information

Event Name: CBIM Conference C1  
Type of event: Workshop  
Dates: July 2022  
Location: London, UK  
Organiser(s): Dimitrios Rovas (UCL), Eleni Papadonikolaki (UCL)

#### 1.2 Outline of the programme (up to 300 words)

A two-day workshop at UCL on M29 of the project. The first day of the event will involve three sessions: one with invited speakers outside the network (from academia and industry) that are performing world-class work in topics of interest/relevance to the ESRs. The speakers will deliver keynote lectures on a number of topics, followed by a discussion session. In the second part of the event, a project overview presentation will be given by the coordinator followed by short presentations of the ESRs describing their research work. This will be followed by a poster session where students discuss in more details their results and the problems they have faced. The third part will be an interactive panel session on the future of BIM in Europe where the keynote speakers will be discussing with the audience. This event will be open to the public and will be widely advertised in existing networks to attract an audience of 40-50 people from the industry or the academia. The second day of the event will be only for the consortium and ESRs will present their research projects and problems they are facing so that they can obtain constructive feedback from the consortium and the supervisory board. This feedback is timely (on M29 which is before the end of the second year) so that they can incorporate any suggestions in the last phase of their work.

#### 1.3 Expected Learning Outcomes

Deliver a:

- (a) Present the research work he/she has accomplished;
- (b) Communicate to audiences of various background;
- (c) Develop personal and professional networks;
- (d) Receive timely feedback to inform the last stages of the ESR's research.

#### 1.4 Links for the overall CBIM structured training programme (up to 100 words)

This training event is a public workshop.

#### 1.5 Audience

The targeted audience are researchers and professional.

#### 1.5 Attendance Numbers

##### Estimate student numbers (for capacity and budget planning)

All ESRs and supervisors (25 people), industry partners will also be invited – max 50 people.

##### If numbers vary by day, can be broken down by days (useful for budgeting requirements).

The training event component is only 1 day for this event.

# Template for Training Event

## CBIM

### 1. Training Event (Basic information)

#### 1.1 General Information

Event Name: CBIM Conference C2

Type of event: Independent Track at the EC3 2023 Conference

Dates: July 2023

Location: Greece

Organiser(s): James O'Donnell (UCD), Kim Nyberg (TRMB), Dimitrios Rovas (UCL), Ioannis Brilakis (UCAM)

#### 1.2 Outline of the programme (up to 300 words)

The final event of CBIM will be dedicated to the presentation of the results of the network. This will be a standalone component of a highly reputable conference event with a focus on showcasing the CBIM network and the work performed by the ESRs. During this final event each ESR fellow will give at least one oral presentation to: (a) present the research work he/she has accomplished; (b) explain how the different collaborations and secondments created by the CBIM network has allowed the fellow to achieve the targeted research objectives; (c) give an insight on the benefits CBIM has brought to him/her; (d) expose his/her career plan and his/her vision about the future of his/her research.

A panel discussion will take place after each group of presentations. These presentations and feedback received will form the basis for the assessment of the final project accomplishments.

The event organisers will make effort to schedule this event to coincide with a major conference (e.g. CIB W078, EC3, or ECPPM) so that leverage can be obtained.

ESRs will be asked to submit papers of their work in the conference for peer review. The event organisers will also submit a proposal for a special session that focuses on disseminating the project results. The session will cover the following structure: Advances in the state-of-the-art in automated as-built BIM generation; semantic enrichment for geometric relationship inference; advanced CBIM applications; CBIM contributions to standardisation.

#### 1.3 Expected Learning Outcomes

[List 4-5 programme-level learning outcomes. These should be Specific, Measurable, Attainable, Realistic]

Deliver a

(a) Present the research work he/she has accomplished;

(b) Explain how the different collaborations and secondments created by the CBIM network has allowed the fellow to achieve the targeted research objectives;

(c) Provide an insight on the professional and personal benefits CBIM has brought to him/her;

(d) Expose his/her career plan and his/her vision about the future of his/her research.

#### 1.4 Links for the overall CBIM structured training programme (up to 100 words)

This training event will conclude the events section of the training programme and provides each ESR with the opportunity to present, discuss and answer questions about their research, network buildings, professional development and career plans.

#### 1.5 Audience

The targeted audience is the ESRs only for the CBIM training component and the conference audience (physical and virtual) for the presentation of the peer-reviewed conference paper.

#### 1.5 Attendance Numbers

**Estimate student numbers (for capacity and budget planning)**

All ESRs and supervisors (25 people), industry partners will also be invited.

**If numbers vary by day, can be broken down by days (useful for budgeting requirements).**

The training event component is only 1 day for this event.