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VI-TRAIN
VIrtual TRAINing for traditional crafts

IO 4: Virtual Building Damage Identification Training

VI-TRAIN-Crafts - Virtuálny tréning pre tradičné remeslá

Referenčné číslo: 2020-1-AT01-KA226-VET-092635

Konečné výsledky

Pripravili:

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UBW GmbH
Viedeň, Novembra 2023

Spolufinancované z
programu Európskej únie
Erasmus+

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Es konnten keine Einträge für ein Abbildungsverzeichnis gefunden werden.

1. O Čom Je Projekt VI-Train-Crafts?

Kultúrne dedičstvo (KD) je v centre pozornosti Európskej únie ako hnacia sila zamestnanosti, ekonomickej sily a rozvoja. Aby sa zaručila dlhá životnosť a využiteľnosť európskeho kultúrneho dedičstva, je nevyhnutné držať krok s požiadavkami spoločnosti, ako sú nové technológie a digitalizácia.

Kríza Covid19 dodala tejto otázke na naliehavosti, keďže vzdelávacie organizácie silne trpeli obmedzeniami a novými pravidlami, ktoré ohrozovali tradičné vzdelávacie a školiace aktivity. Najmä pokiaľ ide o praktické školenia, kde sa inštruktori musia dostať naozaj blízko k učiacim sa, aby mohli vyučovať praktické zručnosti.

Konzorcium VI-TRAIN Crafts prijalo výzvu vytvoriť inovatívne školenia pre tradičné/ohrozené remeslá a nakladanie so stavebnými škodami, ktoré podporia digitalizáciu školení v oblasti (stavebného) kultúrneho dedičstva. Veľký dôraz sa kladie na remeslá, ktoré sa už takmer nikde nevyučujú. Mnohé z týchto remesiel však potrebujú veľa skúseností a vedenie skúsenými remeselníkmi. Najmä toto vzdelávanie sa podporí rôznou podporou digitalizácie.

Predpokladané ciele projektu VI-TRAIN Crafts boli:

- identifikovať vhodné prostriedky dištančného vzdelávania pre odbornú prípravu remeselníkov (manuálna práca),
- identifikovať vhodné prostriedky online spolupráce v oblasti odbornej prípravy, pokiaľ ide o funkčnosť, GDPR a bezpečnosť údajov
- odvodiť kritériá úspešnosti pre vysoko akceptované digitálne riešenia
- vyvinúť a otestovať systém virtuálneho/3D vzdelávania remeselníkov pomocou senzorov a VR/AR
- vyvinúť a otestovať virtuálny/3D-výcvikový systém na identifikáciu poškodení budov
- preskúmať a otestovať možnosti prekonania obmedzení, napr. choroby z pohybu,
- vyvinúť systém výcviku trénerov na aplikáciu vybraných nástrojov pri výcviku tradičných remesiel

Účastníci kurzov vytvorených v rámci projektu VI-TRAIN Crafts môžu získať európsky certifikát, a to absolvovaním certifikačného procesu, ktorý zabezpečuje ECQA, medzinárodne pôsobiaca organizácia špecializujúca sa na certifikáciu zručností a kompetencií.
Projekt VI-TRAIN Crafts obohacuje ponuku Európskej akadémie kultúrneho dedičstva (EHA), ktorá bude po skončení projektu zodpovedná za poskytovanie vzdelávacích kurzov VI-TRAIN Crafts. EHA sídli v Charterhouse Mauerbach, budúcom kompetenčnom a komunitnom centre EÚ pre ochranu architektúry, ktoré sa zriaďuje počas pilotného projektu INCREAS pre kultúrne a kreatívne odvetvia, financovanie, vzdelávanie, inovácie a patentovanie pre kultúrne a kreatívne odvetvia (FLIP pre KKP-2).

2. POPIS VYBRANÉHO PRÍSTUPU

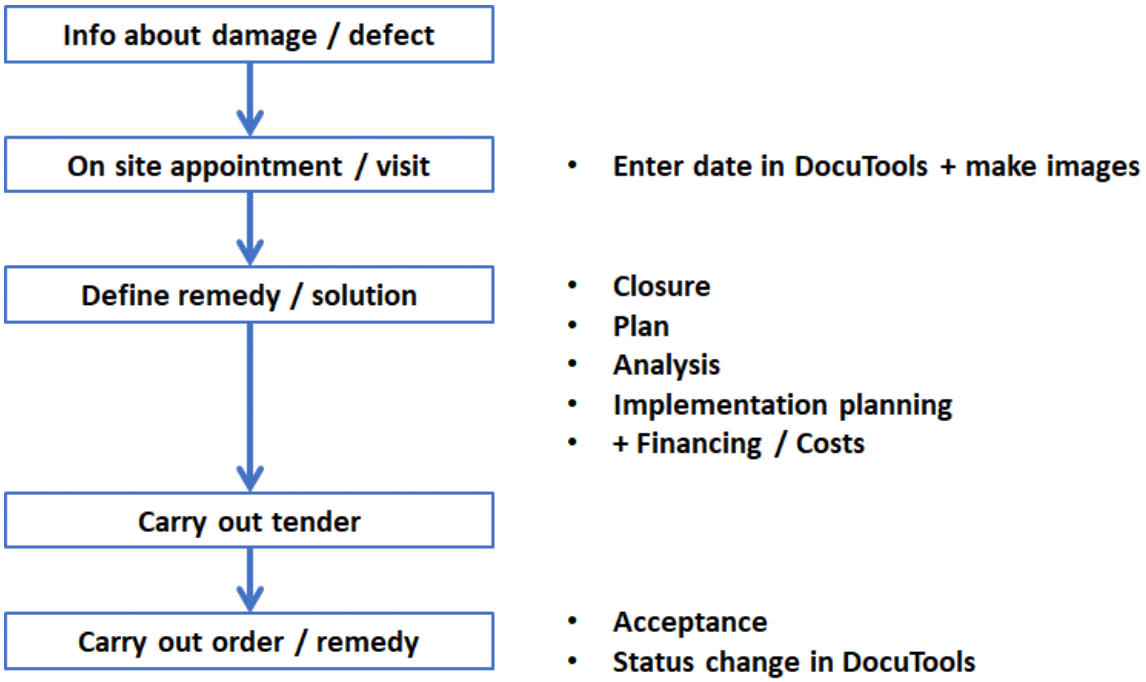
Na základe štúdií (O1 a O2) a definovaných požiadaviek partnerskej organizácie a jej zamestnancov bude vytvorená obsahová štruktúra e-learningovej platformy, ako aj obsah virtuálneho školiaceho kurzu pre remeselníkov pre historické objekty a lokality CH. vyvinuté. Konečným výstupom bude osnova školenia vrátane koncepcie školiteľa a podrobného popisu štruktúry, harmonogramu a aktivít tohto virtuálneho školenia. Vyvinie sa a otestuje školiaci materiál pre „VI-TRAIN-Crafts – virtuálny tréning identifikácie poškodenia budovy“:

1. Rozvíjajte výsledky vzdelávania podľa jednotlivých prvkov vzdelávania
2. Vytvorte školiaci materiál pomocou navigátora design.train.mastery
3. Preložte z EN do partnerských jazykov
4. Podporovať všetkých partnerov pri využívaní platformy ECQA a online spoločných tried na vyučovanie
5. Testovací školiaci materiál “VI-TRAIN-Crafts – Virtual Building Damage Identification Training” (virtuálny)

Analýza potrieb: prehĺbenie skúseností a znalostí o dostupnom virtuálnom vzdelávaní (prípady osvedčených postupov)

Základným základom na dosiahnutie cieľov projektu je rozvoj súboru zručností nového „VI-TRAIN-Crafts – Virtual Building Damage Identification Training.“ Súbor zručností popisuje kompetencie cieľového profilu v zmysle učebných jednotiek, ktoré sú samy definované prostredníctvom prvkov učenia. Všetci partneri sa musia dohodnúť na súbore zručností a mali by zapojiť čo najviac kompetentných partnerov, aby sa overil jeho široký význam. Na základe tohto súboru zručností budú prvky vzdelávania pridelené partnerom konzorcia na ďalší rozvoj, najmä pokiaľ ide o školiaci materiál a testové otázky. Súčasťou súboru zručností sú vysvetlenia (podtexty) vzdelávacích prvkov a kognitívnych úrovní pre každú tému alebo podtému v teste. Tieto podrobnosti Tento súbor zručností je súčasťou rozšírenej pracovnej pozície „Manažment budovaného kultúrneho dedičstva“ (bývalá "Správa aktív dedičstva").

Na niekoľkých stretnutiach konzorcium definovalo štandardný proces, ktorý sa používa ako základ pre tréningový kurz. Tento proces je znázornený na nasledujúcom obrázku:

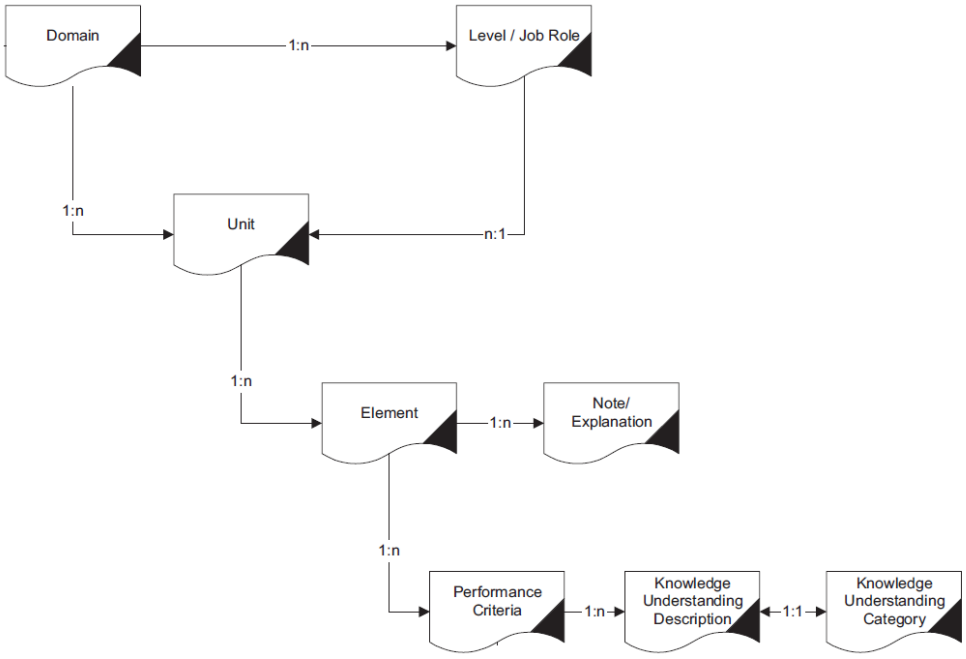


Konzorcium označilo za dôležité pre ďalšiu prácu na projekte a následnú integráciu a do existujúcich nástrojov pre dokumentáciu a účtovníctvo. Táto integrácia je hlavnou príčinou akceptácie zainteresovanými stranami. Na účely školenia však nie je možné pokryť všetky relevantné systémy.

3. VYPRACOVANIE KARTY ZRUČNOSTÍ ECQA

3.1. Všeobecná štruktúra kariet zručností

Súbory zručností ECQA vychádzajú z definície zručností, ktorú navrhlo Ministerstvo obchodu a priemyslu Spojeného kráľovstva pre normy národnej odbornej kvalifikácie. Definícia zručností obsahuje nasledujúce položky (pozri nasledujúci obrázok):



Obrázok 1: Štruktúra karty zručností ECQA

Skladá sa z týchto prvkov:

- Učebná jednotka (identifikátor, názov a opis)
- Vzdelávací prvok (identifikátor, názov a opis)
- Kritérium výkonu (identifikátor, názov a opis)
- Kritérium výkonu Znalosť porozumenia (opis)

Opis výkonového kritéria obsahuje výsledky vzdelávania.

3.2. Štruktúra kariet VI-TRAIN-Crafts Virtual Crafts Training Expert Skills

VI-TRAIN-Crafts Virtuálny odborník na vzdelávanie remeselníkov pre (stavebné) kultúrne dedičstvo sa riadi základnou štruktúrou ECQA, ale je zostavený vzdelávacie jednotky a vzdelávacie prvky do jednej časti, ktorú konzorcium nazýva Curriculum. V rámci tohto učebného plánu konzorcium doplnilo tieto prvky:

- Učebné osnovy
- Výsledky vzdelávania
- Školiace materiály

3.2.1. Kurikulum

Súčasné učebné osnovy obsahujú prvky, ktoré zahŕňajú:

- Úvod do manažmentu kultúrneho dedičstva
- Nástroje pre virtuálnu odbornú prípravu ručných remeselných prác
- Typy virtualizácie odbornej prípravy
- Virtuálne vzdelávanie v oblasti ručných remesiel
- Ekologická stopa virtuálneho vzdelávania v oblasti ručných prác
- Implementácia virtuálnej odbornej prípravy pre ručné remeselné práce

V učebnom pláne je uvedené aj prepojenie zvolenej úrovne EQF.

Curricula	Unit	Learning element	Online/f2f	EQF Level
Virtual Building Damage Inspector for Cultural Heritage				**EQF**
	U1	**Introduction**		
VBI	U1.E1	Cultural Heritage Management - Overview	online	4
	U2	**Scanning theory**		
VBI	U2.E1	Laser scanning	face-to-face	4
VBI	U2.E2	Photogrammetry	face-to-face	4
VBI	U2.E3	Drones	face-to-face	4
VBI	U2.E4	Building Information Modelling	face-to-face	4
VBI	U2.E5	Modelling of traditional Buildings	face-to-face	4
	U3	**Scanning practice**		
VBI	U3.E1	Use of Laserscans	face-to-face	4
VBI	U3.E2	Use of Drones	face-to-face	4
VBI	U3.E5	Use of Photogrammetry	face-to-face	4
	U4	**Building Damage Identification**		
VBI	U4.E1	Process of Building damage Inspection	face-to-face	4
VBI	U4.E2	Virtual Building Damage Inspection	face-to-face	4
VBI	U4.E2	Assessment of Building Damage Inspection	face-to-face	4
VBI	U4.E3	Feasibility and Business Concept of Virtual Building Damage Inspection	face-to-face	4
	U5	**Application of scanning in the Cultural Heritage Sector**		
VBI	U5.E1	Application of scanning in the Cultural Heritage Sector	face-to-face	4

Table 1: Curriculum “Virtual Building Damage Inspection for (Built) Cultural Heritage”

3.2.2. Výsledky vzdelávania

VI-TRAIN-Crafts využíva výsledky vzdelávania na štruktúrovanie školiacich materiálov pre energetických expertov. Definovať výsledky vzdelávania (LO) znamená:

"... zamyslieť sa najprv nad tým, čo je nevyhnutné, aby študenti vedeli alebo dokázali urobiť po ukončení kurzu alebo programu - čo študenti potrebujú vedieť a čo by mohli výrazne využiť na skvalitnenie svojho života a efektívnejší prínos pre spoločnosť. Veríme, že takéto uvažovanie povedie vyučujúcich k tomu, aby sa zamerali na širokú syntézu schopností, ktoré spájajú vedomosti, zručnosti a hodnoty do celku, ktorý odráža, ako ľudia skutočne využívajú vedomosti."[1]

[1] Battersby, Mark: "So, What's a Learning Outcome Anyway?", p.1

Competence Card	ECQA Certified Virtual Building Damage Inspector for Cultural Heritage (VBI)				
Unit Identifier	Unit Name	Element Identifier	Element Name	Performance Criterion Identifier	PC Comment
(starts with 1)	(should not be empty)	(starts with 1)	(should not be empty)	(starts with 1)	(may be empty)
VBI-U1	**Introducing to Cultural Heritage Management**	VBI-U1.E1	Cultural Heritage Management-Energy Expert / Overview	ECH-U1.E1.LO1	The learner is able to explain measures for improving energy efficiency of traditional buildings properly
				ECH-U1.E1.LO2	The learner is able to apply appropriate energy efficiency measures in the repair / refurbishment of historic buildings, both in projects and their day-to-day role
VBI-U2	**Scanning theory**	VBI-U2.E1	Laser Scanning	ECH-U2.E1.LO1	The learner is able to explain the basics and the use of Laser Scanning
		VBI-U2.E2	Photogrammetry	ECH-U2.E4.LO1	The learner is able to explain the basics and the use of Photogrammetry
		VBI-U2.E3	Drones	ECH-U2.E5.LO1	The learner is able to explain the basics and the use of Drones
		VBI-U2.E4	Building Information Modelling	ECH-U2.E7.LO1	The learner is able to explain the basics and the use of Building Information Modelling
		VBI-U2.E5	Modelling of traditional Buildings	ECH-U2.E7.LO1	The learner is able to describe the appropriate modelling of traditional buildings
VBI-U3	**Scanning practice**	VBI-U3.E1	Use of Laserscans	ECH-U3.E1.LO1	The learner is able to use Laserscans
		VBI-U3.E2	Use of Drones	ECH-U3.E2.LO1	The learner is able to use Drones
		VBI-U3.E3	Use of Photogrammetry	ECH-U3.E3.LO1	The learner is able to use Photogrammetry
VBI-U4	**Building Damage Identification**	VBI-U4.E1	Process of Building Damage Inspection	ECH-U4.E1.LO1	The learner is able to explain the optimal process of Building Damage Inspection
		VBI-U4.E2	Virtual Building Damage Inspection	ECH-U4.E2.LO1	The learner is able to explain how virtual building damage inspection is working
		VBI-U4.E3	Assessment of Building Damage Inspection	ECH-U4.E3.LO1	The learner is able to explain how the assessment of virtual building damage inspection is working
		VBI-U4.E4	Feasibility and Business Concept of Virtual Building Damage Inspection	ECH-U4.E4.LO1	The learner is able to explain the feasibility and business concept for virtual building damage inspection
VBI-U5	**Application of scanning in the Cultural Heritage Sector**	VBI-U5.E1	Working Practices Virtual Building Damage Inspection	ECH-U4.E5.LO1	The learner is able to apply the learnings related to virtual building damage inspection
				ECH-U4.E5.LO2	The learner is being able to actively convince others from the advantages of virtual building damage inspection

Table 2: Learning Outcomes “Virtual Building Damage Inspection”

4. *PRÍPRAVNÉ PODUJATIE PRE ŠTUDENTOV*

4.1. Tréningová logistika

Logistika školenia zahŕňa každú organizačnú úlohu okolo prípravy, vedenia a následného spracovania školenia. To znamená:

- Získanie miesta školenia
  - Použite kontrolný zoznam „Výber miesta konania“
  - Rozhodnúť/vyjednať miesto školenia
- Pripravte školenie
  - Definujte plán tréningu
  - Oznámiť/pozvať účastníkov
  - Informujte účastníkov o možnostiach cestovania a dopravy
  - Organizovanie zariadení pre prácu v teréne (ak nie sú k dispozícii na mieste školenia)
  - Skontrolujte si svoju prípravu (napr. dostupnosť školiaceho materiálu, letákov, testovacích materiálov pre haptické cvičenia)
- Pripravte miesto tréningu 1-2 hodiny pred začiatkom tréningu
  - Skontrolujte si svoju prípravu (napr. dostupnosť školiaceho materiálu, flipchartu, flipchartových pier, nástenných tabúľ alebo ekvivalentov)
  - Zorganizujte prostredie v školiacich miestnostiach
  - Skontrolujte infraštruktúru (napr. projektor/TV, svetlá, tienenie, catering, miestnosti na osvieženie)
  - Uistite sa, že sú k dispozícii kontaktné osoby

Kontrolný zoznam „Výber miesta konania“

Čo je potrebné na školenie (napr. terénne pracovné priestory, oddychové miestnosti pre skupinovú prácu, požadované vybavenie, požadované stravovanie a hlavne nápoje, kontaktná osoba)?

Kontrolný zoznam „Pripravte si nadchádzajúci tréning“

Čo si musí organizátor pripraviť pred tréningom (napr. zorganizovať nápoje, vybavenie ako flipchart, lúč a flipchart perá)?

Kontrolný zoznam „Pripravte školiacu miestnosť na školenie“

Čo musí tréner urobiť pred začiatkom tréningu v prvý tréningový deň? Čo je potrebné urobiť v nasledujúcich dňoch (napr. kontrola a vo väčšine prípadov prispôsobenie nastavenia miestnosti, kontrola zariadení, príprava agendy, príprava zariadení pre skupinovú prácu a skupinovú prácu, kontrola workshopov, kontrola školiacich materiálov, kontrola internetového pripojenia pre vzdelávací portál)?

4.2. Tréningové miesta a príprava

Konzorcium sa rozhodlo uskutočniť tento kurz v Charterhouse Mauerbach kvôli logistickým výhodám (preprava potrebného vybavenia, ako sú drony, je jednoduchá a krátka.

Vývoj požadovaných školiacich materiálov sa začal a bude ukončený pred začiatkom kurzu. Pozvánka sa posiela všetkým partnerom.

4.3. Použité produkty/materiály pre Learner Event

Konzorcium vygenerovalo detailný 3D model Charterhouse Mauerbach a steny pre Inšpekciu škôd na budovách resp. model z mníšskej cely. Tieto sú k dispozícii tu:

Monkova cela: https://p3d.in/TlP6E
Prieskum steny: https://p3d.in/AELBi

4.4. Training materials

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1. **Definition**
2. **Objective(s)**
3. **Available Certifications**
4. **Training Offers**
5. **Certification and Recognition**

ECQA Certified Training Programme
U1.E1 Cultural Heritage Management

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U1.E1
Cultural Heritage Management

1. Definition

ECQA
European Certification & Qualification Association

ECQA Certified Training Material
Authors: VI-TRAIN Project team
www.ecqa.org
Version: 2023

Cultural Heritage (Asset) Management

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- A (cultural) heritage asset is an item that has value because of its contribution to a nation's society, knowledge and/or culture
- They are usually physical assets, but some countries also use the term in relation to intangible social and spiritual inheritance
- It contains:
  - Historic buildings; war and other memorials; historic parks and gardens; conservation areas; archaeological sites etc.
  - Listed / not listed buildings
  - Designated / not designated
  - Independent of current use

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2. Objective(s)

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Project objective(s) VI-TRAIN

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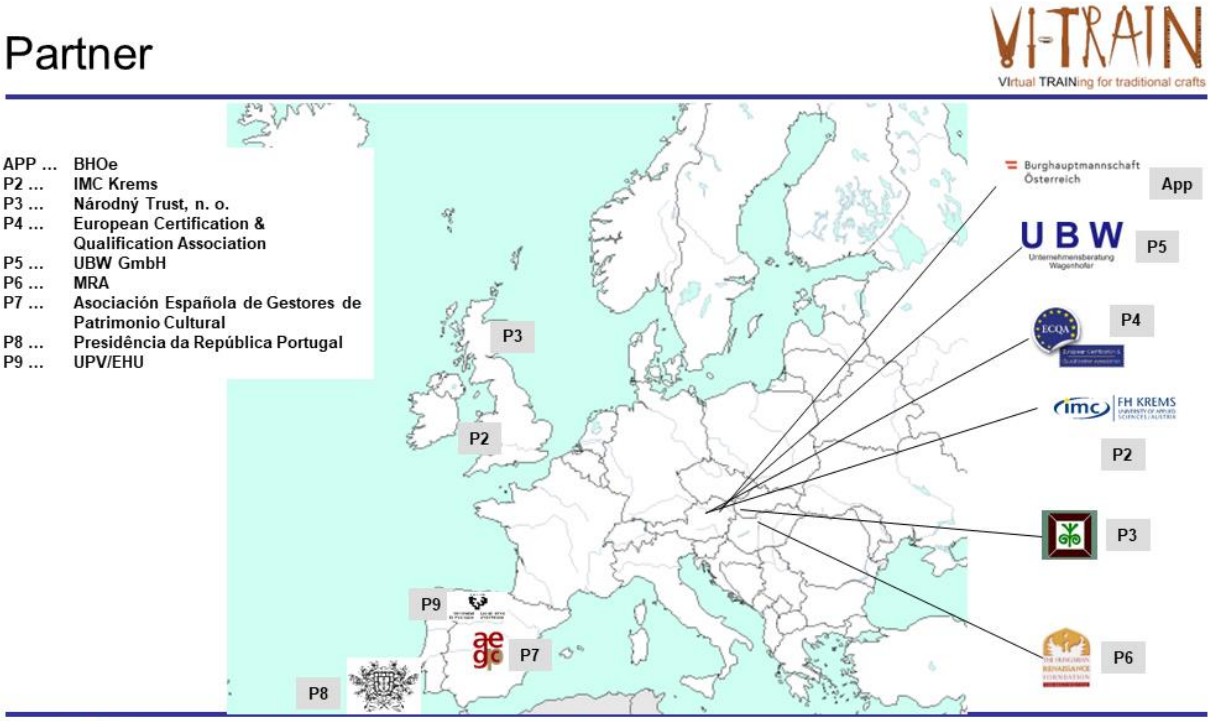
The anticipated objectives of VI-TRAIN are:

- to analyse and identify appropriate means of distance learning for the purpose of training craftspeople (manual work), specifically for traditional crafts
- to analyse and identify appropriate means of online cooperation in trainings regarding functionality, GDPR and data security
- to derive success criteria for highly accepted digital solutions
- to develop and test a virtual/3D-crafts training system by using sensors and VR/AR
- to develop and test a virtual/3D-buidling damage identification training system
- to investigate and test options overcoming restrictions, like move sickness, hesitation to use digital means, in VR/AR for craftspeople and building damage inspectors
- to develop a train-the-trainer system for application of selected tools in training of traditional crafts

Partner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APP ... BHOe
P2 ... IMC Krems
P3 ... Národný Trust, n. o.
P4 ... European Certification & Qualification Association
P5 ... UBW GmbH
P6 ... MRA
P7 ... Asociación Española de Gestores de Patrimonio Cultural
P8 ... Presidência da República Portugal
P9 ... UPV/EHU
Burghauptmannschaft Österreich
App
UBW
P5
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imc FH KREMS
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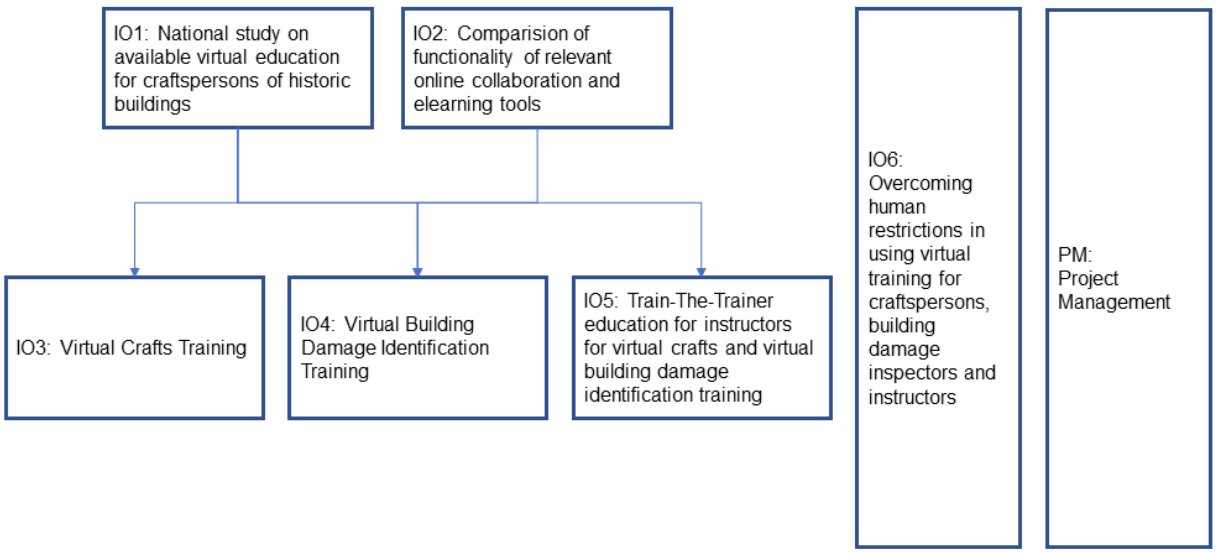
General approach



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3. Available Certifications

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Available Certifications

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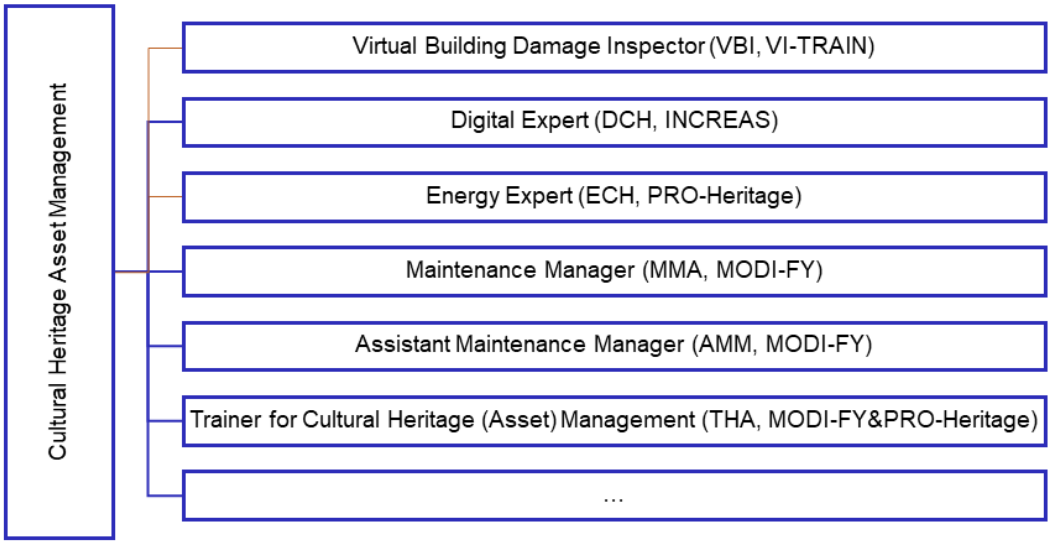
For Built Cultural Heritage:

- Certified Virtual Building Damage Inspector
- Certified Digital Expert
- Certified Energy Expert
- Certified Trainer for Cultural Heritage (Asset) Management
- Certified Maintenance Manager
- Certified Assistant Maintenance Manager
- Certified Construction Site Worker in Built Heritage

Structure and development



Target groups

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Persons:
- Tradespersons
- Manager of (mainly built) heritage assets, like historic buildings
- Manager of adaptive (re-)use projects in heritage assets
- Ascended staff member of responsible organisation
- Volunteers within targeted/responsible organisations
- New staff member of responsible organisation

Professions:
- Architects and structural engineers
- Civil engineers and planners
- Restorers
- Art historians
- and many more …

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4. Training Offers

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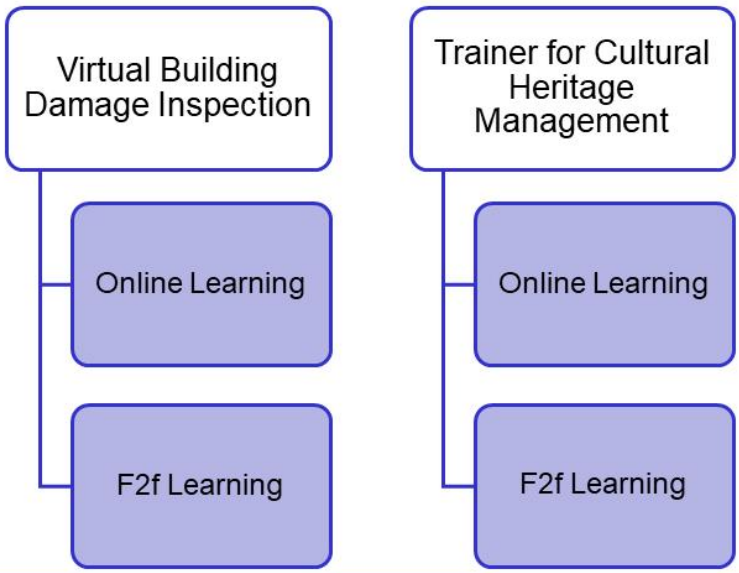
Training offers



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5. Certification and Recognition

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Certification and Recognition

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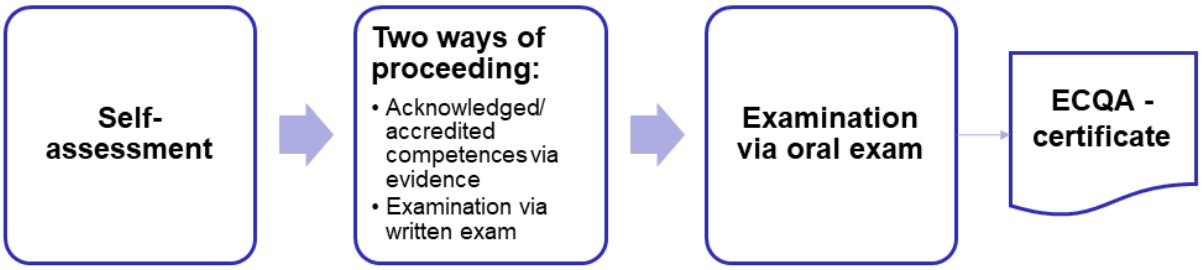

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- Gerald Wagenhofer: UBW Unternehmensberatung Wagenhofer GmbH
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U2.E4 Building Information Modelling

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Building Information Modelling

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Programme

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1. **Terminology**
2. **Modelling**
3. **Use of BIM for Cultural Heritage**
4. **References**

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1. Terminology

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Terminology

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Model:

- In science, a model is a more or less comprehensive representation of reality
- Human creative activity: unthinkable without models
- The real world is full of complex interrelationships.
- A model allows us to create a simplifying, reducing view of a part of it (the "original") and to orientate ourselves on it

Terminology

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Business Information Model:

- is a process involving the generation and management of digital representations of physical and functional characteristics of places
- integrates structured, multi-disciplinary data to produce a digital representation of an asset across its lifecycle, from planning and design to construction and operations
- Managed in an open cloud platform for real-time collaboration
- is more than visual 3D
- it allows to connect digitally building characteristics with sketches & plans

Terminology

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Digital Twin:

- is a virtual representation of an object or system that spans its lifecycle
- is updated from real-time data, and
- uses simulation, machine learning and reasoning to help decision making
- is a virtual model designed to accurately reflect a physical object
- The object being studied is outfitted with various sensors related to vital areas of functionality
- These sensors produce data about different aspects of the physical object's performance, such as energy output, temperature, weather conditions and more
- This data is then relayed to a processing system and applied to the digital copy

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2. Modelling

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Modeling 1

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Set level of detail:

- Rough/low
  consists of very few, to be precise only the most necessary polygons, to represent the shape of the modelled object. Small details are details are often simply left out and the outer form only roughly corresponds to reality
- Medium/standard
  has accordingly many more polygons in order toto reproduce even the small details of the modelled object realistically
- Fine/high
  lies between the two levels of detail

Modeling 2

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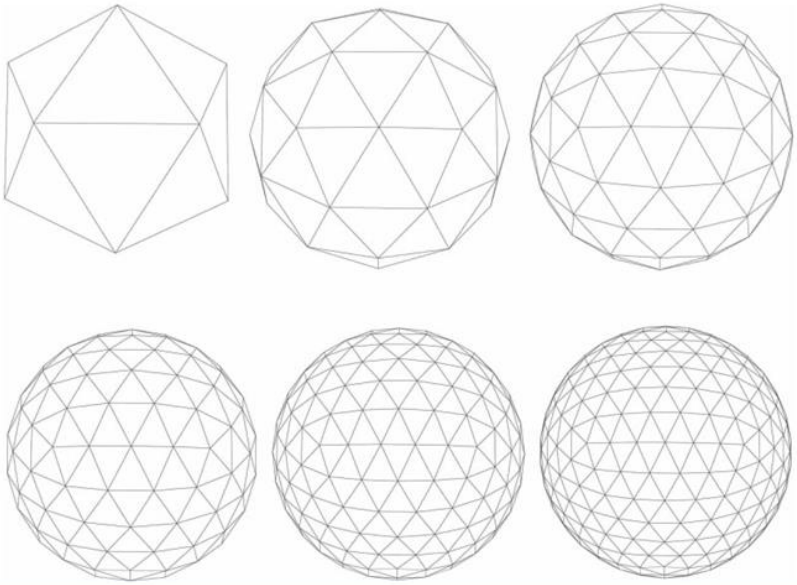
Polygons:



Modeling 3

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Set level of detail:

Modelling details	simple	medium	high
Rough (examples): - Window/door openings - Planar stair railings - Rough roof shape	X	X	X
Medium (examples): - Window/door frames - Simple stair railings - Differentiated roof form		X	X
Fine (example): - Door handles, window handles - Baseboards - Moulded stair railings - Roof gutters, parapet plates			X

Modeling 4

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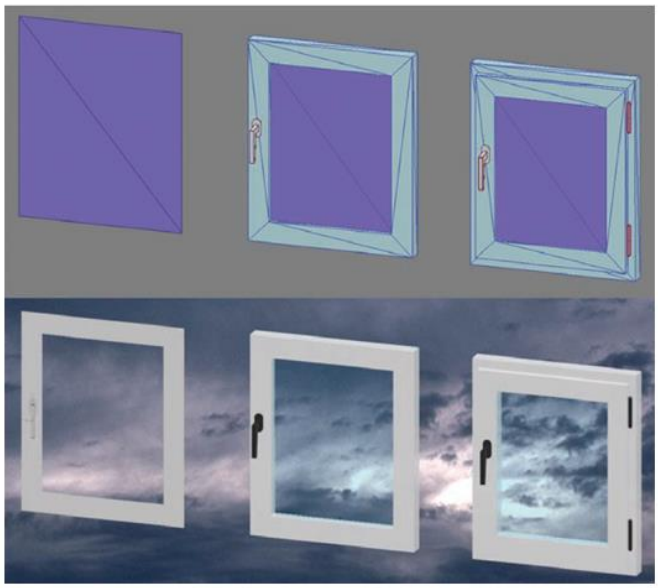

Level of detail using the example of a window:

- On the left, the window is modelled as a singe layer consisting of only two polygons (low-poly)
- in the middle the window has a frame and already a window handle
- On the right, the window is modelled in great detail (high poly), with frame and sash, handle and hinge
- Below the rendering of the models; the left window does not have the handle via the modelling, but via the texture

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3. Use of BIM for Cultural Heritage

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Specific Challenges in Traditional Buildings 1

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IFC:

- Developed by buildingSMART International (bSI)
- In the IFC data structure the different elements such as wall, column, etc. are contained
- At each alphanumeric and quantitative information is attached to each element
- Which information an element carries is defined in the property sets = Pset
- For quantities/masses there are the Quantity Sets = Qto
- The advantage is that everyone can access stored information at the specific/identical point

→ The required information are not included in the IFC

Specific Challenges in Traditional Buildings 2

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LOI (Level of Information):

- defines what information must be available
  - at what time
  - from whom
  - coming from whom

LOG (Level of Geometry):

- basically describes which geometrical information needs to be present in the system and when it needed

→ Built Cultural Heritage is always containing the highest level of information and geometry because it is already built

LOI (Level of Information)

LOG (Level of Geometry)

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REQUIRED HBIM LEVEL OF GEOMETRY					
LOG 100 CONCEPTUAL MODEL, HISTORICAL REPORTS, ARCHIVES	**LOG 200** APPROPRIATE GEOMETRY, 3D SURVEY, DATA ACQUISITION	**LOG 300** PRECISE GEOMETRY, SCAN-to-BIM MODEL OBJECT	**LOG 400** BIM USES CONSERVATION PLAN	**LOG 500** CONSERVATION SITE	**LOG 600** AS-BUILT, LLCM, CDE, HUBs
historical building contracts, historical drawings, historical documentation (pictures, photos and documents)	*on-site data acquisition, 3D surveying, 2D/3D restitutions (plans and sections, 3D meshes)*	*object modeling, precise drawing extraction*	*material/decay mapping, diagnostics IRT, NTD,BIM-to-FEA, energy analysis, BIM implants, on-site construction management, WBS and computation*	*on-site construction interventions of conservation*	*Life Cycle Cost Management and Monitoring, VR and sensor-based communication purposes*

Level of Development (LOD) = LOG + LOI

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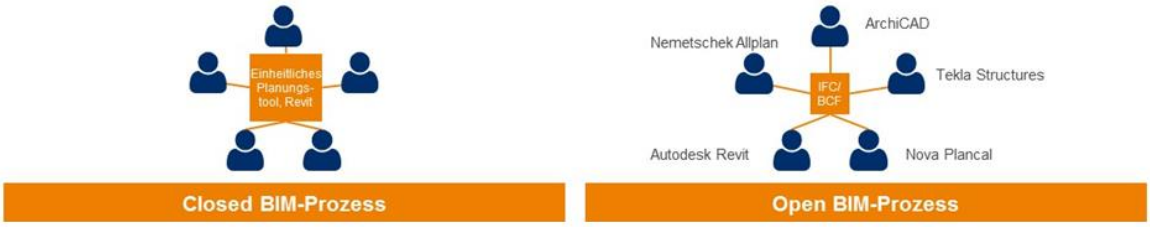
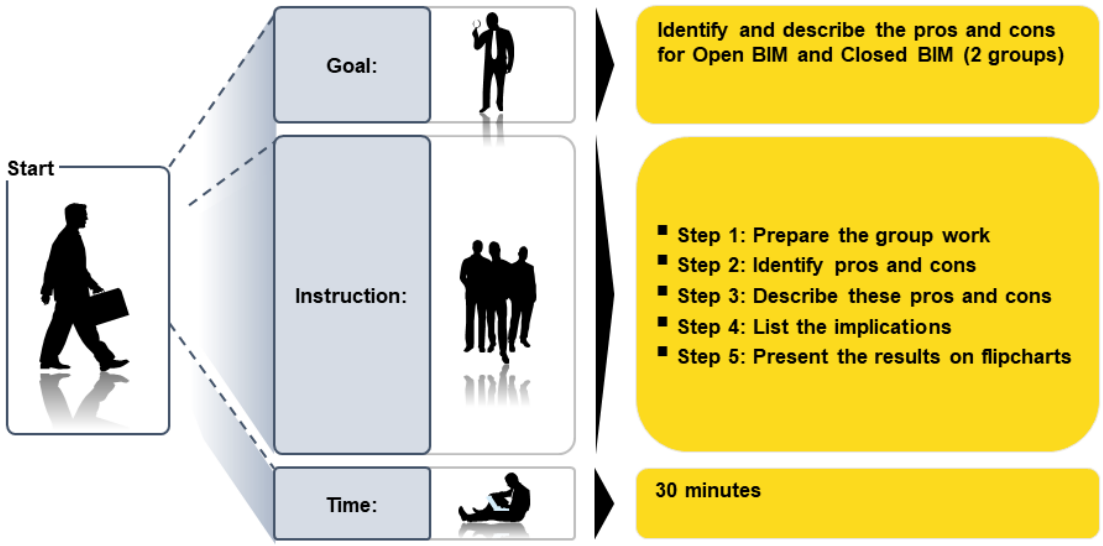
Project type	LOI	LOG
Maintenance/Service	LOI 500	LOG 500
Repair/Restoration	LOI 500	LOG 500
Refurbishment	LOI 300 LOI 400 LOI 500	LOG 300 LOG 400 LOG 500

BIM Philosophy



Exercise: OpenBIM vs. ClosedBIM



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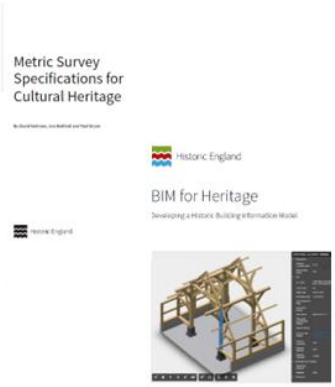

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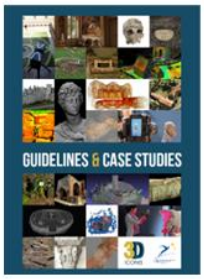

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U2.E5
Modelling of traditional buildings

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1. **Terminology**
2. **Challenges in Modelling Traditional Buildings**
3. **Benefits of BIM use**
4. **References**

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U2.E5 Modelling of Traditional Buildings

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Modelling of traditional buildings

1. Terminology

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Traditional Buildings – Definition

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- These are understood to be buildings constructed before 1919. Modern materials and techniques were used widely in the construction industry from around this time onwards.
- Traditional buildings are often referred to as being of 'breathable construction'. This means that the construction materials used can absorb and release moisture.

Building Damage

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- A distinction is made between structural damage and structural defect
- Structural damage is usually the cause of a construction defect
- A building defect is a deterioration in the condition of a property
- The warranty for immovable property such as buildings is 3 years in Austria
- Building damage can be caused by incorrect construction methods or low-quality building materials
- The most common types of structural damage are mold, cracks, peeling, roof damage, basement moisture and floor and terrace damage
- The causes of structural damage can be many and varied and should be noted by an expert

Structural damage vs. defect

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Wrong material used

Crack in a old wall

Wood destroying fungi

Crack in newly built brick wall

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2. Challenges in Modelling Traditional Buildings

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Special Requirements Traditional Buildings I

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- Old, partly heterogeneous and unknown building fabric with special maintenance requirements
- Special interaction between use, operation and value preservation
- often complex ownership structures and very different groups of user groups
- Historical documentation as a special requirement for IT-knowledge management
- Diverse research needs, for which information has to be provided
- Sometimes very large amounts of data that are difficult to handle
- Sometimes surprising findings and the need to adapt data
- Dealing with unknown and unplannable factors during construction & refurbishment & expansion

Special Requirements Traditional Buildings II

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- Need to integrate data from different sources and keep it up-to-date- correspondingly many interfaces with different IT systems
- Very special, different kind of value chains in historic preservation and restoration
- Use of rare and increasingly sought-after occupational groups in crafts and restoration
- Consideration of SMEs and micro-enterprises as well as individual experts and their skills and knowledge gaps

Complete Models

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When introducing BIM, it must be noted that all trades must be represented in specialist models, coordination models and finally in an overall model, such as:

- Historical inventory and current condition (incl. listed building status).
- Architecture
- Statics and construction
- Technical building equipment, building control systems
- Interior design, flexible equipment and furnishings

System architecture

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Beside of BIM there are other systems in place:

- Commercial systems (enterprise resource planning, SAP, etc.)
- Operational applications (asset management, CAFM, exhibition and congress management, etc.)
- Special solutions, such as real estate databases, documentation tools
- Workflow tools such as electronic governmental file systems

Typical Demand Cases

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- Identify historical documents and make them digitally analysable, available, the contents understandable
- Produce a model series on historic building conditions, also available for Augmented Reality/Virtual Reality/Mixed Reality (AR/VR/MR) applications on the part of the cultural users
- Plan, simulate, and evaluate necessary maintenance and preservation measures in relation to evaluate the associated risk
- Plan, simulate and optimize future construction measures
- Plan, visualize and optimize future uses
- Plan and visualize future operational concepts
- Etc.

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3. Benefits of BIM use

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Benefits for New Buildings

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Main BIM drivers in new construction are efficiency gains in planning, construction and building operation. These advantages depend on:

- Achieving a high degree of standardisation
- Making processes as efficient as possible thanks to the highest possible degree of repeatability
- Ensuring consistent processes via standardised data structures
- To use the data from planning in official procedures and tenders as consistently as possible
- To use the planning data in construction preparation, construction logistics and on the construction site
- To use the construction documentation as an optimal basis for operation

Modelling Traditional Building

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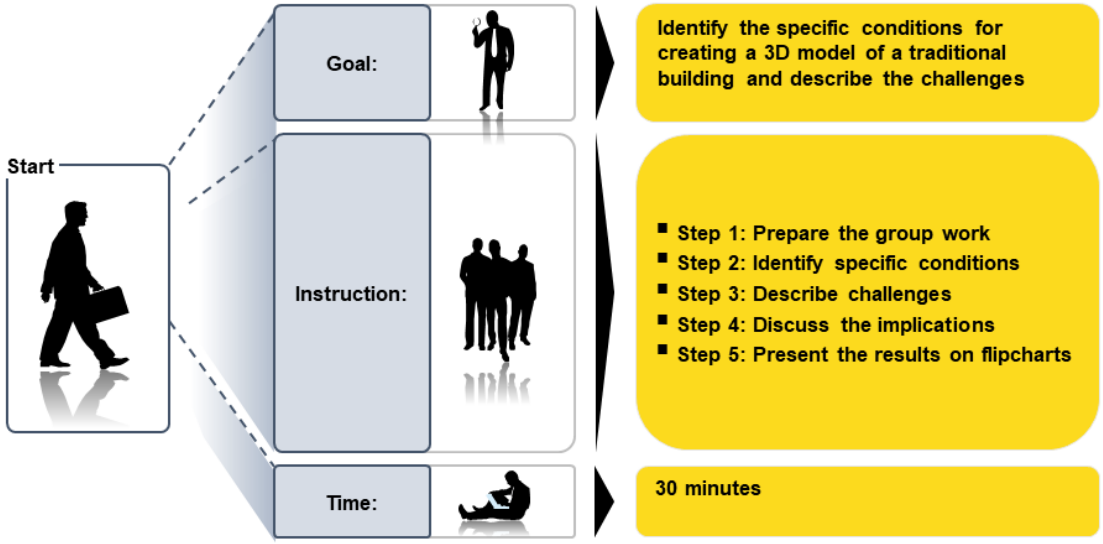

Specific conditions

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For modelling traditional buildings:

- Geometry
- Thick walls
- Heterogeneous wall structure and materials
- Small-scale nature
- Level of Development = Level of Geometry + Level of Information
- Plans showing construction periods resp. historic plans
- Change Management / Mobilising Stakeholder

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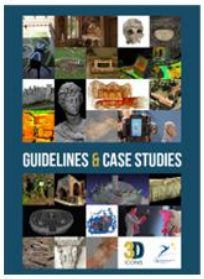

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U3.E2 Drone Exercise

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U3.E2
Use of Drones

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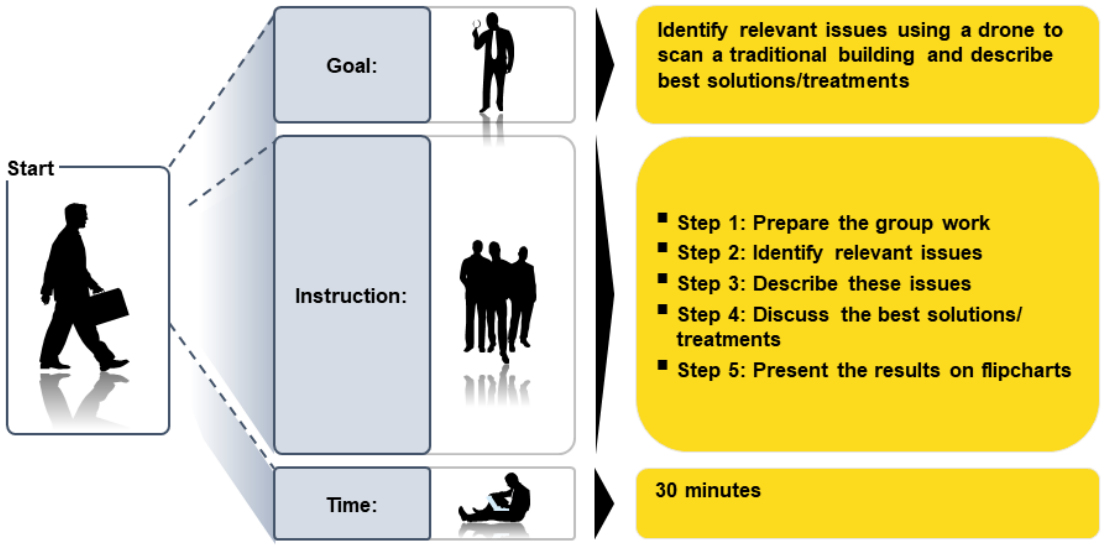
Exercise: Use of Drones



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U3.E3
Use of Photogrammetry

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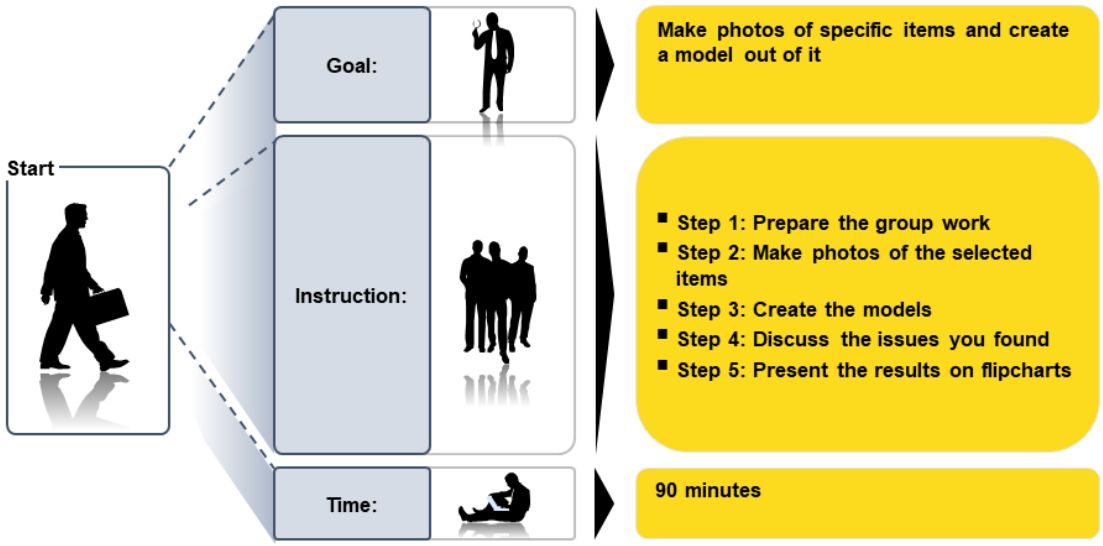
Exercise: Use of Photogrammetry



Objects for Exercise

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Examples in the Charterhouse Mauerbach:

- Tree next to chapel
- Column next to Church
- Trash box next to side entrance and
- Wall in Charterhouse

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1. **Terminology**
2. **Process**
3. **References**

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Process of Building Damage Inspection

1. Definition

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Terminology

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- A (cultural) heritage asset is an item that has value because of its contribution to a nation's society, knowledge and/or culture
- They are usually physical assets, but some countries also use the term in relation to intangible social and spiritual inheritance
- It contains:
  - Historic buildings; war and other memorials; historic parks and gardens; conservation areas; archaeological sites etc.
  - Listed / not listed buildings
  - Designated / not designated
  - Independent of current use

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2. Process

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Introduction

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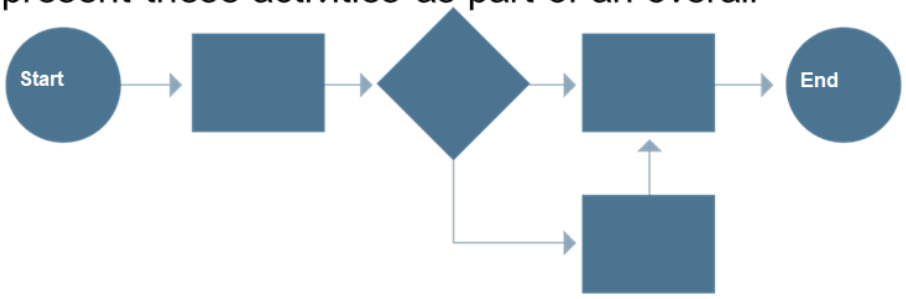
- Just about everything we do is in the form of processes
- A process is a set of activities that transforms one or more inputs into outputs that are of value to the customer
- To gain a basic understanding of how activities occur, it is important to represent these activities as part of an overall process e.g.:



Definition of a Process

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A process is a series of activities that transform one or more inputs into outputs that are of value to the customer.

Process Presentation

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- Provides a visibly simplified structure for thinking through a complex process
- Gives the team an opportunity to look at the whole process
- Is a way of seeing that changes affect the whole process
- Identifies initial areas or steps that do not deliver value

Process Boundaries

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- Identifying the starting and ending points of the process is the first important step in process mapping. After the boundaries are established, the team can define all the necessary steps, events and activities that make up the process.
- Usually, the starting point of a process is the first step where the input comes from the supplier. The end point is usually given with the delivery of the product to the customer or the service.

Standard Symbols for Process Representation

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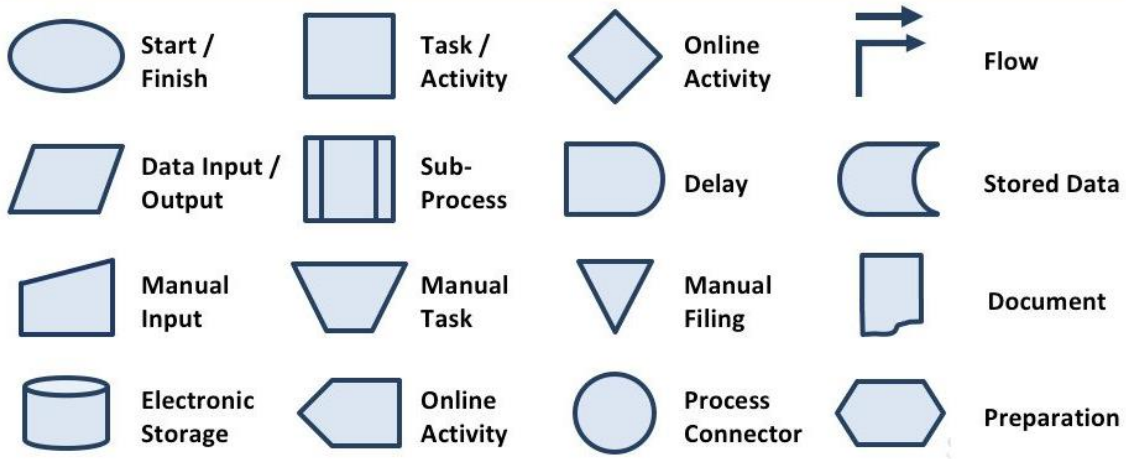
Process Mapping Symbols



Process Flowchart

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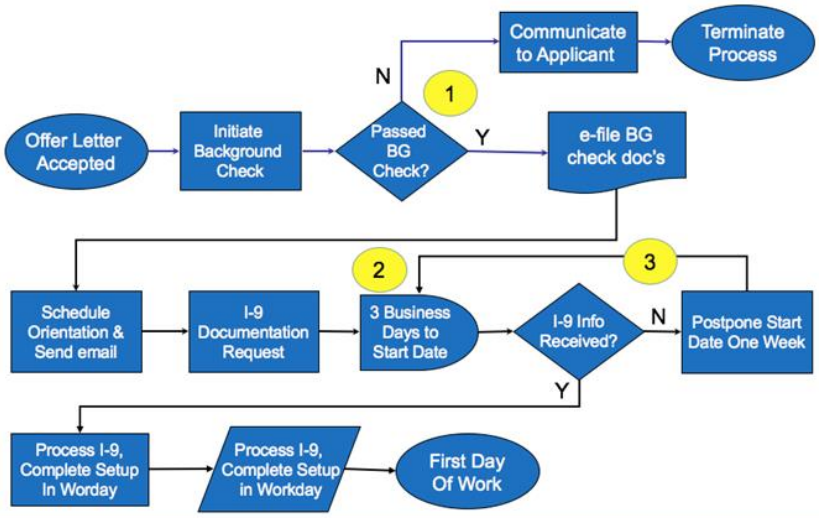
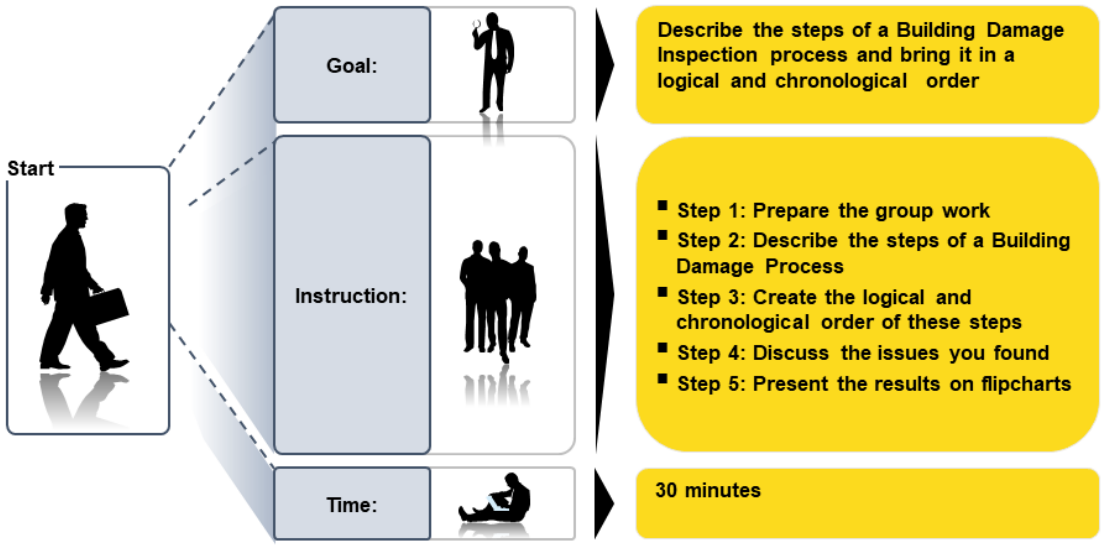
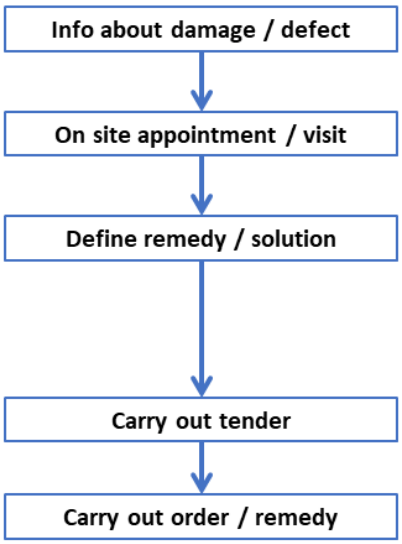
Process Flowchart – Employee Onboarding Process



Exercise: Process Building Damage Inspection



Basic Process



- Enter date in DocuTools + make images
- Closure
- Plan
- Analysis
- Implementation planning
- + Financing / Costs
- Approval
- Status change in DocuTools

U4.E1
Process of Building Damage Inspection

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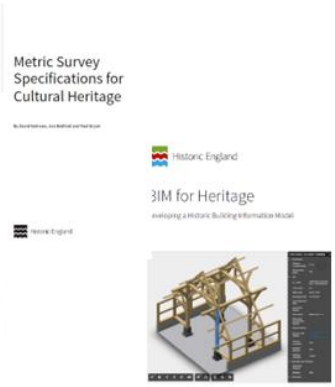

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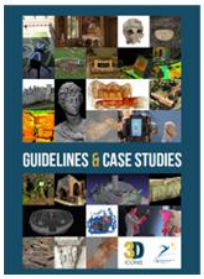

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1. **Terminology**
2. **Inspection Procedure and Rules**
3. **References**

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1. Terminology

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Terminology

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Virtual means:

- created by computer technology and appearing to exist but not existing in the physical world
- done using computer technology over the internet, and not involving people physically going somewhere

→ For building damage inspection this means:

- Using digital means for the inspection
- Could happen at the same time
- Changes in processes and organisational roles

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2. Inspection Procedure and Rules

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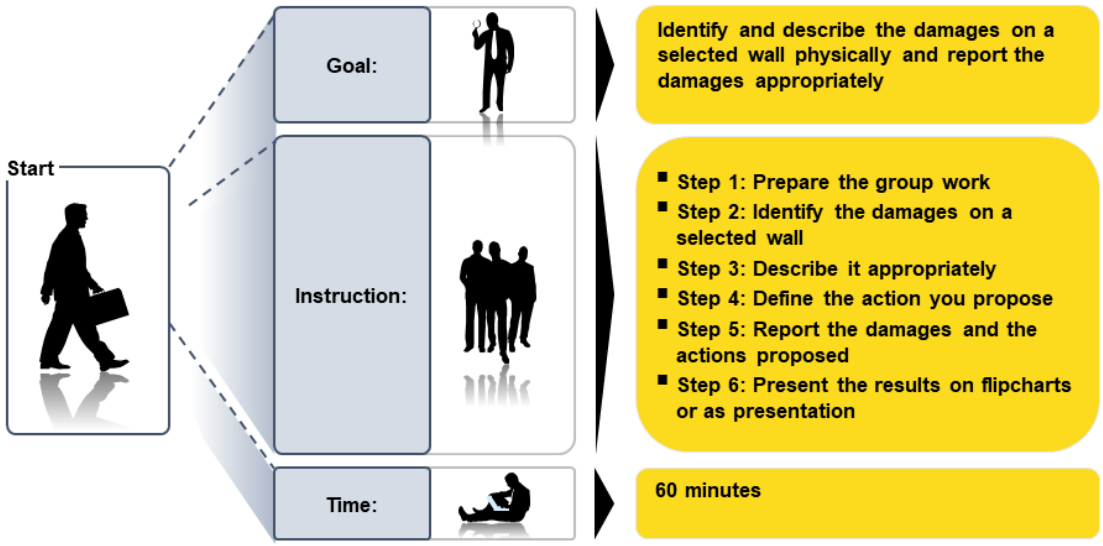
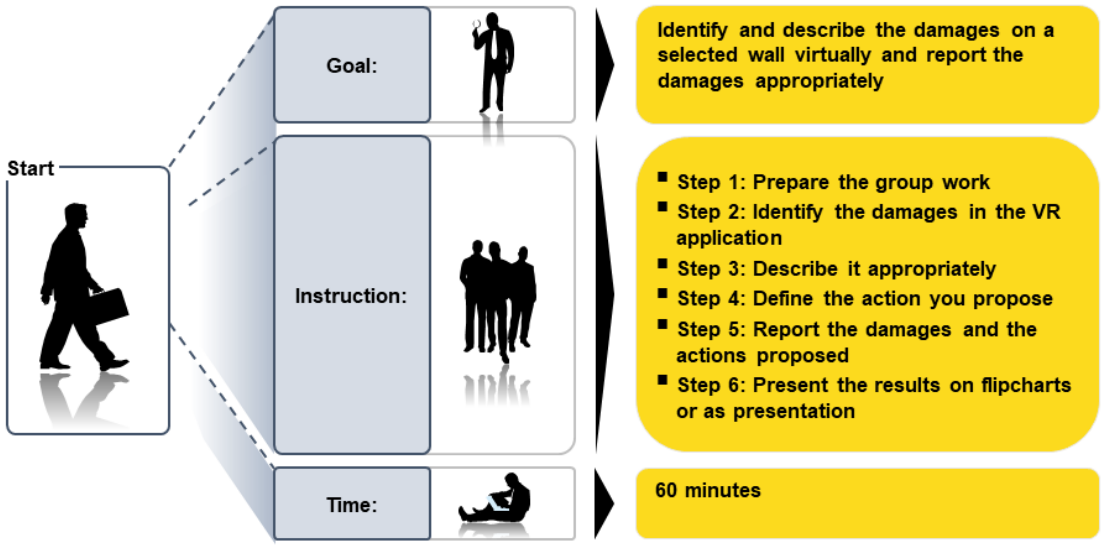
Exercise: Building Damage Inspection



Exercise: Virtual Building Damage Inspection



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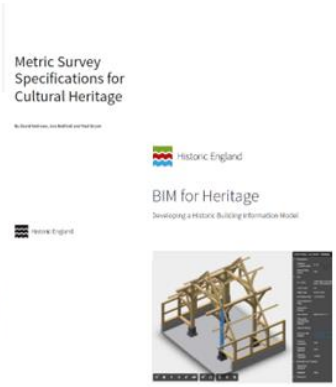

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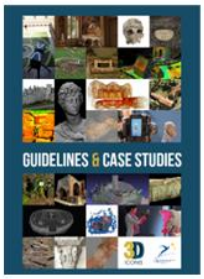

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U4.E3
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2. **Assessment Approach**
3. **References**

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U4.E3
Assessment of Virtual Building Inspection Results

1. Terminology

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Terminology

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Assessment:

- the act of judging or deciding the amount, value, quality, or importance of something, or the judgment or decision that is made

Evaluation:

- the process of judging or calculating the quality, importance, amount, or value of something

Inspection:

- the act of looking at something carefully, or an official visit to a building or organization to check that everything is correct and legal

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2. Assessment Approach

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General approach I

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- Scanning site
- Creating 3D point cloud
- Creating 3D Model
- Checking delta to reality
- Releasing 3D model

Laserscanner

General approach II

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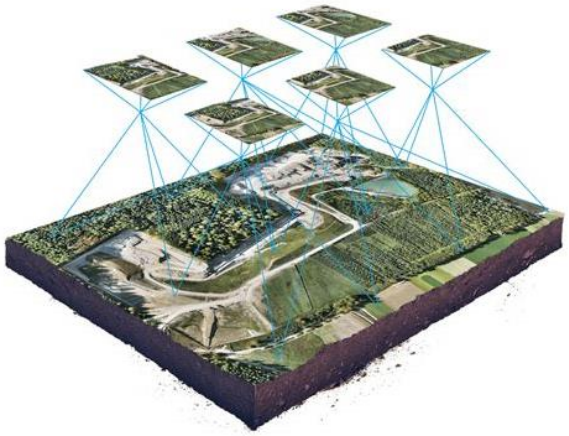
- Scanning site
- Creating 3D point cloud
- Creating 3D Model
- Checking delta to reality
- Releasing 3D model

Photogrammetry



General approach III

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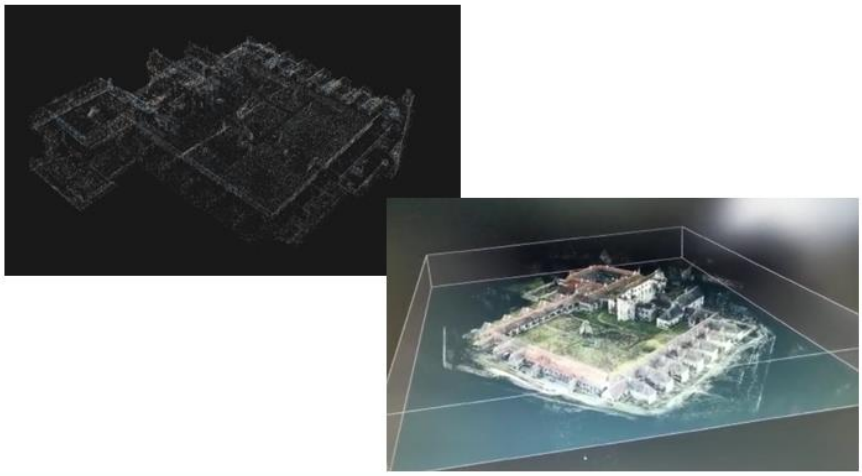
- Scanning site
- Creating 3D point cloud
- Creating 3D Model
- Checking delta to reality
- Releasing 3D model

3D point cloud



General approach IV

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- Scanning site
- Creating 3D point cloud
- Creating 3D BIM Model
- Checking delta to reality
- Releasing 3D model

BIM model

General approach V

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Scanning site

Creating 3D point cloud

Creating 3D Model

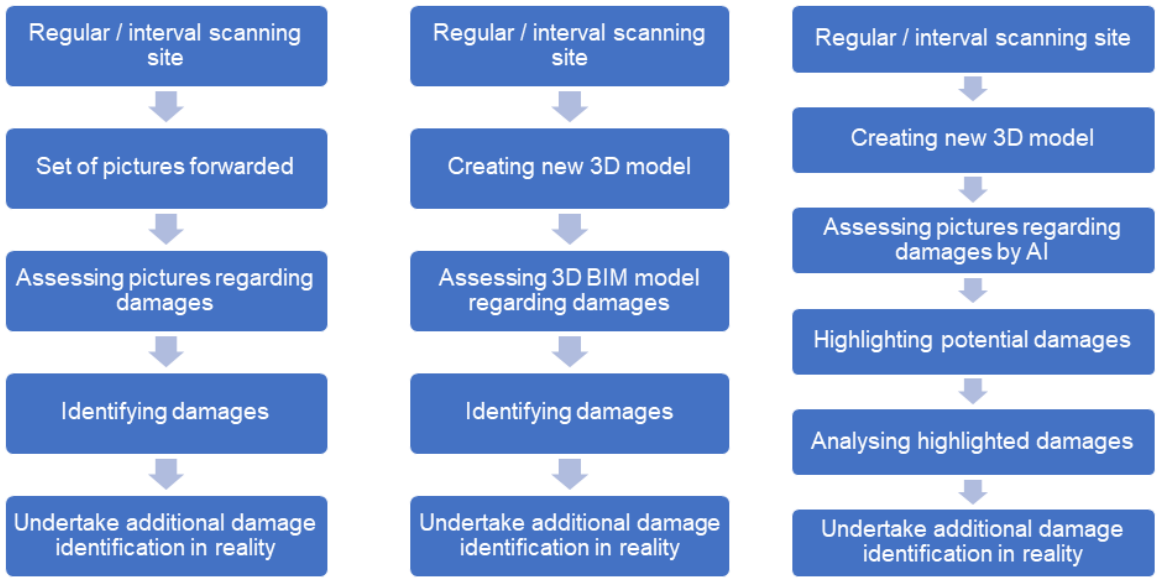
Checking delta to reality

Releasing 3D model

BIM model

Aerial photo

Three Ways of Assessment



Types of Damage Identification

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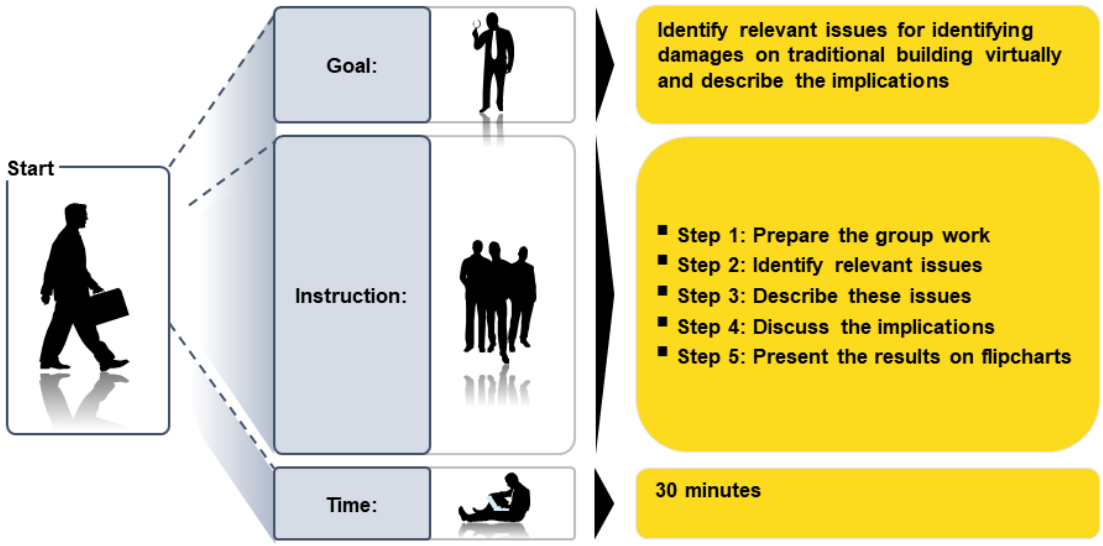
- Visual inspection – needed, but not sufficient 
- Haptic inspection 
- Olfactive inspection 
- Auditive inspection 
- Special inspection (reaction of watering) 

Exercise: Damage Identification



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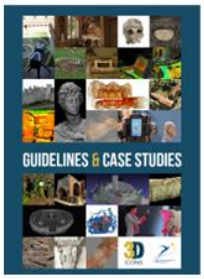

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U4.E4
Feasibility and Business Concept of Virtual Building Damage Inspection

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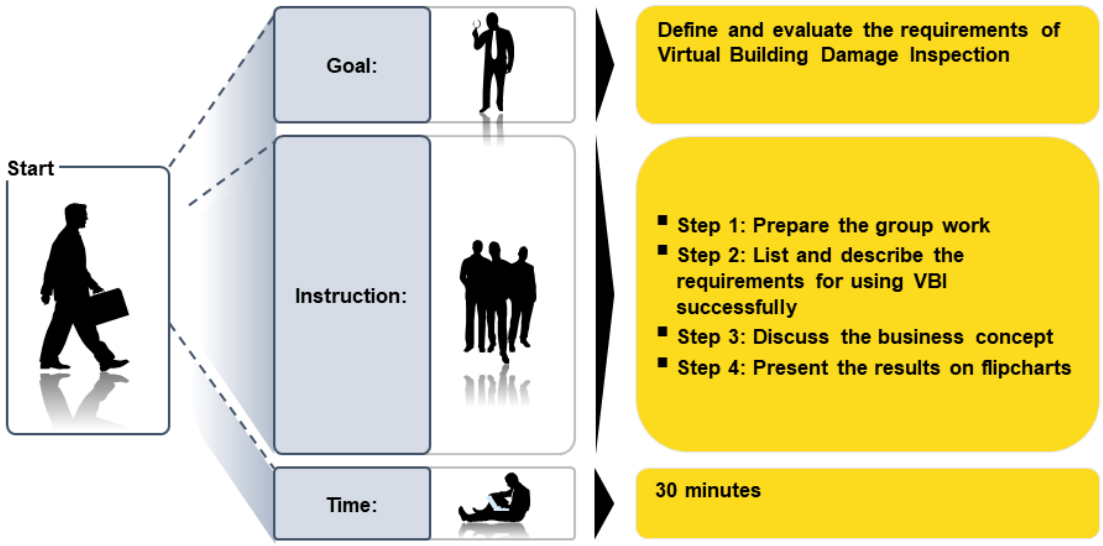
Exercise: Ecological Footprint



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5. POSÚDENIE VYBRANÉHO PRÍSTUPU

5.1. Štandardný proces

Definovaný proces bol aplikovaný v Learner Event. Partner uviedol ďalšie poznámky:

- Virtuálna obhliadka stavebných škôd na základe naskenovaného modelu steny v Charterhouse Mauerbach je všetkými partnermi a všetkými zainteresovanými odborníkmi považovaná za realizovateľnú. Presnosť modelu a funkcie priblíženia a oddialenia poskytujú vhodný základ pre kontrolu škôd na budovách
- Virtuálna kontrola poškodenia budovy nemôže nahradiť skutočnú/fyzickú kontrolu. Správna kontrola potrebuje haptické testy, ako je klopanie alebo pľuvanie.
- Zvyčajne sa kontrola vykonáva dvakrát. Prvá kontrola na identifikáciu škvŕn, ktoré si vyžadujú bližší pohľad. Druhá inšpekcia objasní požadované opatrenia na opravu/renováciu.

5.2. Lietanie s dronom

- Prvú kontrolu môže vykonať laik s dronmi. Jedinou podmienkou je, že osoba pozná budovu a jej skrytý roh/hrany.
- Existujú určité obmedzenia týkajúce sa letov s dronmi. Napríklad v Imperial Palace vo Viedni potrebujú lety dronov určitý čas na prípravu, povolenia a riešenie bezpečnostných rizík.
- Ďalšou výzvou je licencia na lietanie s dronmi. Pre lietajúce drony sú k dispozícii online vzdelávacie nástroje a skúška. Dokonca aj lietanie s dronmi počas výcvikového kurzu je problémom z dôvodu právnych a poistných záležitostí.

5.3. Vývoj 3D modelu

- Existuje niekoľko metód na vytvorenie 3D modelu. Prvým spôsobom je použitie 3D laserového skenera, ktorý poskytuje mrak 3D bodov. Z toho sa vytvorí model. Výhodou tejto metódy je, že model možno použiť na iné účely, ako je informačné modelovanie budovy, ktoré je založené na 3D mraku bodiek.
- Druhou metódou je použitie fotogrametrie, ktorá je založená na fotografiách zhotovených dronmi a inými prostriedkami. To si vyžaduje určitý počet fotografií, pretože pre model je potrebné prekrytie z dvoch tretín. Pre použitie tejto metódy musí vlastník/správca historických budov poskytnúť veľkú kapacitu na ukladanie dát.

5.4. Ďalší vývoj

- Aktuálne riešenie je založené na manuálnom spárovaní aktuálnej kontroly s predchádzajúcou. Tým je odborník schopný preskúmať miesta, ktoré si vyžadujú okamžité opatrenia, aby sa vyhli rizikám a/alebo identifikovať miesta, ktoré si vyžadujú podrobnú analýzu.
- V budúcnosti môže tento zápas vykonávať umelá inteligencia. To zahŕňa aj začatie nákupu požadovaných remeselných prác. AI bude zahŕňať aj odborníkov na podrobnú analýzu.

6. ZÁVERY

6.1. Súhrn úspechov

Übersetzung
Na základe definovaného procesu inšpekcie poškodenia budovy konzorcium identifikovalo realizovateľnosť. Rozšírením kontrolného procesu na dvojstupňovú kontrolu zaručujeme riadnu virtuálnu kontrolu. Príslušné školiace kurzy a karta zručností ECQA (učebný plán, výsledky vzdelávania a školiaci materiál) boli vyvinuté a otestované na podujatí Learner Event C2 v Mauerbachu.
Model, ktorý sa použije na účely školenia, je dostatočne podrobný a presný na vykonanie akejkoľvek kontroly. Na uplatnenie štandardného procesu v každodennej práci však existujú určité predpoklady. Prvým je, že je zavedený pravidelný interval kontroly. Toto je väčšinou dostupné, pretože je implementovaná európska norma pre inšpekcie nehnuteľností na hodnotenie rizík, ktorá definovala, že raz ročne bude každá lokalita kontrolovaná. Vlastník/správca historických pamiatok musí skontrolovať, či je tento interval dostatočný. Druhým je opäť snaha vyvinúť 3D model na základe skenu alebo fotografií zhotovených pri kontrole – zakaždým nový model. Je potrebné vziať do úvahy aj náklady na tieto nahrávky. Na druhej strane budú tieto 3D modely uložené a spolu s počiatočnými dátami aj obrovská kapacita dátového úložiska a interná prevádzková kapacita pre spustenie modelu na PC alebo notebookoch. Potom, po každej inšpekcii, musia byť 3D modely porovnané, analyzované a použité na odvodenie opatrení. Len ako budúci vývoj bude možné, že túto úlohu prevezme umelá inteligencia.

6.2. Kontakt na zodpovednú osobu koordinátora pre ochranu údajov

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