Interreg Co-funded by the European Union

Alpine Space

BAUHALPS

D.1.4.2 – Conceptualisation BAUHALPS Toolkit V.1.2

Lead Beneficiary: Ca' Foscari University Foundation Venice

Main Authors: Silvia Maria Carolo, Antonio Sellitri, Hans Jahn, Julia Wirnshofer, Veronika Fischer and Henning Berthold

Delivery Date: 06.03. 2025

This project is co-funded by the European Union through the Interreg Alpine Space programme.

DISCLAIMER

DOCUMENT SHEET

Project acronyms	BAUHALPS
Full title	Building Circular in the Alpine Space
Grant Agreement number	ASP0500382
Coordinator	Ca' Foscari University Foundation Venice
Website	BAUHALPS - Alpine Space Programme

Deliverable number	D.1.4.2
Deliverable name	Conceptualisation BAUHALPS Toolkit
Lead beneficiary	Ca' Foscari University Foundation Venice
WP	Work package 1
Related activity	Activity 1.4
Type	Report
Dissemination level	Public
Delivery date	06.03.2025
Main author	Silvia Maria Carolo, Antonio Sellitri, Hans Jahn, Julia Wirnshofer, Veronika Fischer and Henning Berthold

This project is co-funded by the European Union
through the Interreg Alpine Space programme

TABLE OF CONTENTS

Contents

This project is co-funded by the European Union
through the Interreg Alpine Space programme

LIST OF FIGURES

LIST OF TABLES

This project is co-funded by the European Union
through the Interreg Alpine Space programme

EXECUTIVE SUMMARY

The conceptualisation of the BAUHALPS Toolkit (D.1.4.2), developed under the Interreg Alpine Space programme, provides a practical framework to accelerate circular transformation in Alpine building systems. Anchored in the New European Bauhaus (NEB) values – sustainability, inclusiveness, and aesthetics – the toolkit operationalises the BAUHALPS Model (D.1.4.1) by translating its conceptual layers into actionable tools. It comprises three core components: a roadmap for engaging local communities, a Genius Loci repository to capture site-specific resources, and a Circularity Maturity Assessment Tool (D.1.3.2) to evaluate progress across qualitative, semi-quantitative, and quantitative indicators.

The community engagement roadmap structures participation into four phases: awareness and education, participatory planning and co-design, implementation and capacity building, and monitoring, evaluation, and scaling. Each phase includes practical steps, low-entry tools, and precedents to foster collaborative inquiry and the development of novel solutions. The Genius Loci approach ensures that interventions resonate with local identity, integrating traditional practices and resources to enhance acceptance and aesthetic appeal. Finally, the Circularity Maturity Assessment Tool provides a structured method for assessing circular performance, supporting data-driven decision-making and replication across Alpine networks.

This conceptualisation sets the foundation for pilot testing and refinement in subsequent work packages, paving the way for a scalable, culturally embedded circular building strategy.

This project is co-funded by the European Union
through the Interreg Alpine Space programme

1. INTRODUCTION AND OBJECTIVES

1.1 Introduction to BAUHALPS

BAUHALPS is a project within the framework of the **European Interreg Alpine Space programme**[1] and aspires to **catalyse the circular transformation of the built environment in the Alps**. It does so by conceiving the region as a real-life-laboratory that invites to study in situ the development of circular building systems, emphasising the role of local communities and resources as well as new forms of collaboration and intervention across the construction value chain. The project ties in with the **New European Bauhaus (NEB) initiative** in that it pursues the establishment of circularity and transitioning towards a sustainable future as an immanently cultural rather than exclusively technological project. In doing so, it draws on the NEB values – sustainability, togetherness (inclusiveness) and beauty (aesthetics) – and pursues the NEB working principles of participation, transdisciplinarity, and multi-level engagement (for further information see BAUHALPS Model).

1.2 What is the BAUHALPS Toolkit and how does it work?

The **BAUHALPS toolkit** serves to support the development of circular thinking and practice in the Alpine building ecosystem(s). It is composed of three elements as depicted in Fig. 1, bringing together

- a **roadmap** for engaging local communities[2] (-> methodology)

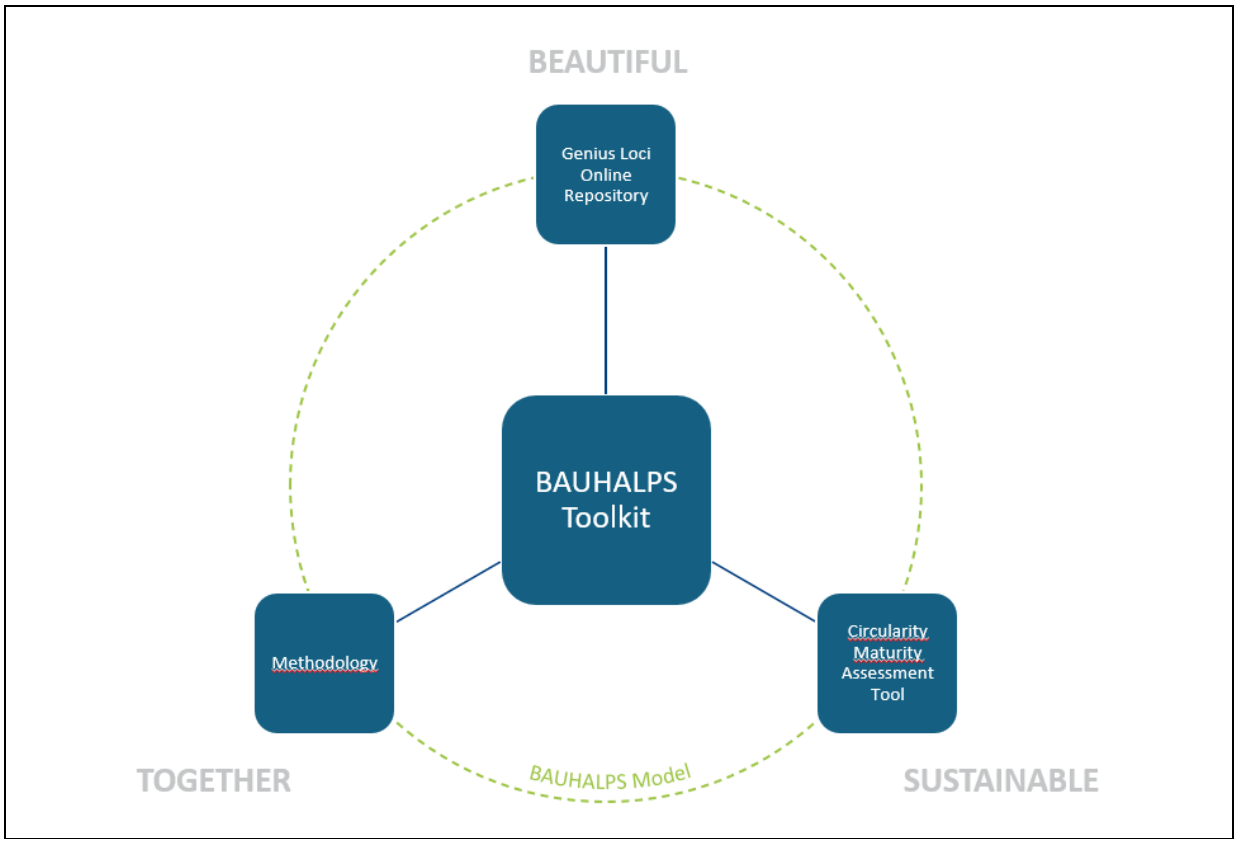
[1] **Interreg** is the EU's programme for strengthening cohesion between regions through European Territorial Cooperation. It operates through four action areas: cross-border cooperation (A) for neighbouring regions, transnational cooperation (B) in larger areas like the Alpine Space, interregional cooperation (C) for knowledge exchange, and outermost regions (D). Since 2000, the Interreg Alpine Space Programme has united seven countries to tackle shared challenges and improve life for 80 million people. In 2021–2027, with €1.466 billion EU funding, Interreg drives the transition toward a carbon-neutral, climate-resilient Alpine region.

[2] **Local Communities** are defined within the remit of the BAUHALPS project as "composition of people and things, (temporarily) tied together by the very process/activity of probing into and

This project is co-funded by the European Union
through the Interreg Alpine Space programme

- a **collection** of local building resources (-> genius loci repository), and
- a **tool** for assessing the degree of circular building practices (-> circularity maturity assessment tool).

Figure 1: Components of BAUHALPS Toolkit



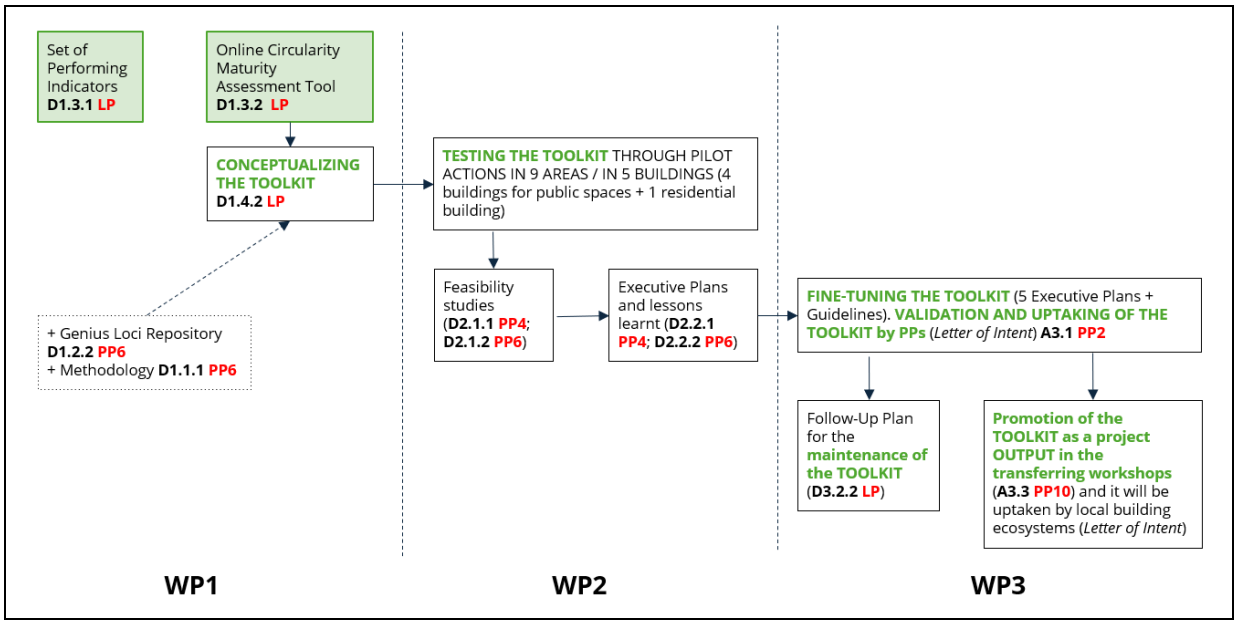
The toolkit is bound together by the **BAUHALPS Model** (s. Fig. 3; see also D.1.4.1 BAUHALPS Model). The model provides a conceptual framework for the BAUHALPS project and informs its activities and outcomes. It defines the scope of the project and clarifies the areas of intervention.

driving circular building practices within the alpine space. [...] These communities may include a range of actors from local residents and craftsmen to artists and cultural mediators to educators and researchers to SMEs and key actors from the construction value chain to communal authorities and policy-makers to other decision-makers" (D.1.1.1 Methodology).

This project is co-funded by the European Union
through the Interreg Alpine Space programme

How to intervene is the concern of the BAUHALPS toolkit. The toolkit is designed as a collection of tools, practices, glossaries, and methodologies that can be adopted by the partners during the pilot phase. Each section contains guidelines on how the different items might be applied, offering an intuitive and adaptable approach. Provided is a guide that partners both within the immediate context of BAUHALPS and beyond can consult when embarking on their respective pilot/building project.

Figure 2: BAUHALPS Project Stages



It is worth noting that the present document constitutes the **conceptualisation of the BAUHALPS Toolkit** (s. Application Act. 1.4/D1.4.2). This will be reviewed, fine-tuned and settled in the course of Work Package 3 (s. Fig. 2. A.3.1.), taking into consideration the executive plans developed in Work Package 2 (Act 2.2). The final version of the toolkit might then take a different form (such as a website rather than a PDF document) to be more accessible and interactive and publicised in conjunction with other outputs of the project (i.e. the Genius Loci Repository, etc.). Such website-based format would also lend itself to be translated into different languages in order to facilitate to the integration of the toolkit into the project's maintenance and dissemination plans (D.3.2.2) and lower the barriers for the toolkit and other resources to be used.

This project is co-funded by the European Union
through the Interreg Alpine Space programme

2. FROM BAUHALPS MODEL TO BAUHALPS TOOLKIT

The BAUHALPS Model, as indicated above, defines the conceptual space within which the BAUHALPS project operates (see Fig. 3). Its different conceptual layers are to be understood as lenses through which the individual pilot/building project is viewed and engaged with. They are interlinked yet do not build upon each other. Each lens adds focus, clarifies the entry points of the project and directs action.

Table 1: Conceptual composition of BAUHALPS Model

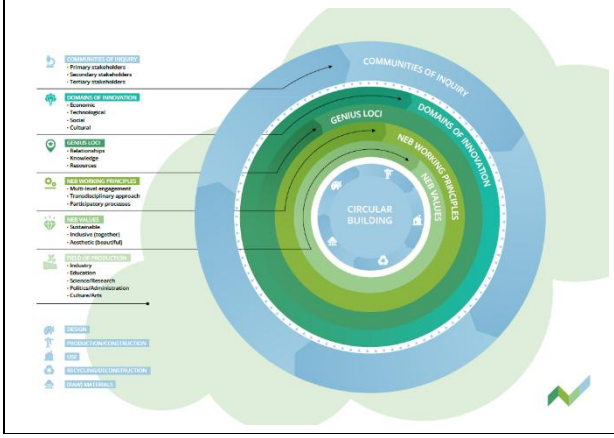
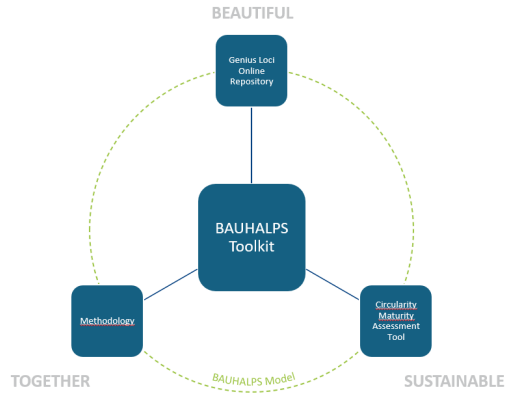
Conceptual Layer	Title	Description	Purpose	NEB Value Import
Layer 1	Circular building	Central theme	Demands holistic view and systemic thinking and action	Sustainability
Layer 2	NEB Values	Fundamental assumptions and/or beliefs	Points to and calibrates areas of critical importance	n/a
Layer 3	NEB Working principles	Operational approach(es)	Clarifies mode of operation and levels of engagement	n/a
Layer 4	Genius Loci	Distinguishing local factors	Places individual building project within specific local context	Beauty (Aesthetics)
Layer 5	Domains of Innovation	Areas of intervention	Enriches concept of innovation and guides action	All
Layer 6	Communities of inquiry	Epistemic approach	Structures shared practice of exploration and knowledge-building	Togetherness (Inclusiveness)
Layer 7	Field of production	Environing conditions	Alerts to external factors shaping the course of events	All

This project is co-funded by the European Union
through the Interreg Alpine Space programme

Central to the model are the guiding values of the NEB initiative: sustainable, beautiful (aesthetic) and together (inclusive). They reflect a new understanding of the challenges associated with the green transformation and point to the critical aspects of agency and human-centeredness. That is, granting ownership over the process(es) of transformation and identifying and effectively addressing people's needs. The realisation of the green transformation therefore is tied up with the concepts of inclusiveness and aesthetics.

The BAUHALPS Toolkit delineates the practical scope of the project. It instructs how to go about driving circular thinking and practice in the alpine space building context by mobilising and/or growing the local building ecosystem and harnessing local resources. More specifically, the toolkit instructs how to engage with local communities, determine the genius loci (distinct local qualities) and assess the circularity maturity performance of a particular pilot/building project.

Figure 3: Relationship between BAUHALPS Model and BAUHALPS Toolkit

BAUHALPS Model	BAUHALPS Toolkit
Conceptual scope: What to do?	**Practical scope: How** to do it?
	

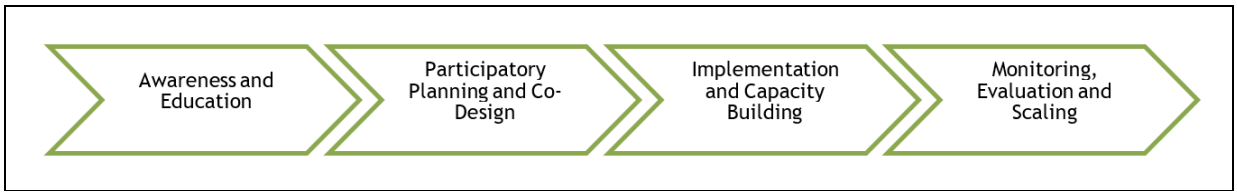
2.1 Engaging Local Communities

Building projects are a collective effort and the construction value chain is composed of a vast (and often dispersed) network of individual and institutional actors. BAUHALPS aspires to systematise the explorative approach to driving circular thinking and practice in Alpine building system. Drawing on the concept of Communities of Inquiry (CoI), communities are

This project is co-funded by the European Union
through the Interreg Alpine Space programme

understood here as the vast network of local actors that (might) have a stake in the respective pilot/building project and that come together in a process of shared inquiry, collective sensemaking, knowledge-building and action. As a group they embark on the complex task of developing circular building practices by problematising the status quo, gathering insight, embracing the genius loci and burrowing into new solutions.

Figure 4: Community Engagement Roadmap



The BAUHALPS Methodology (D.1.1.1) offers an encompassing view of how to engage these local communities to the end of driving circular building practices in the Alpine Space. Rooted in the guiding values and working principles of the NEB, a four-phase roadmap was proposed (s. Fig. 5). The following section carries this forward and provides practical guidance as to how this roadmap might be implemented. It clarifies the primary objective of each phase, practical steps, advisable tools and insightful examples/actionable precedents.

Phase 1: Awareness and Education

Primary objective(s):

Create local buy-in and a shared understanding of circularity, the NEB initiaitve, and each pilot's purpose, using accessible formats and Alpine-specific narratives.

Practical steps:

1. **Identify local "story anchors"** (heritage, crafts, ecology) for each site and prepare 3–5 short stories (text/photo/audio) that connect circularity to place and embrace the Genius Loci. Such stories could revolve around the following themes:
    - Lucerne: student–craftsman collaboration stories around temporary timber pavilions.

This project is co-funded by the European Union
through the Interreg Alpine Space programme

- Saint-Romain-le-Puy: narratives on reconnecting the old town core and reusing materials
- Ljubljana (Fužine Castle): "attic to living lab" story focusing on heritage & energy loss.
- Rovereto: "factory to community innovation" story for the tobacco complex.
- Salzburg: "from vacant school to makerspace" story of Pioniergarage 2.0.
- Padua: "Cittadella's civic hub" story on accessible events & smarter systems.

2. **Run micro-events (90–120 min) in low-barrier venues**: school halls, municipal rooms, museum foyer; include a 10-minute intro to NEB, a 20-minute local story, and a 30-minute show-and-tell with reclaimed materials.
3. **Launch a "pop-up" mobile engagement unit** for dispersed Alpine communities—one foldable stand + material samples + feedback cards; schedule market-day appearances.
4. **Embed art & culture**: commission 1–2 mini-residencies (2–4 weeks) per pilot for site-specific installations from reclaimed materials; culminating with an open walk-through and Q&A.

Advisable tools (low-entry):

- Printed A3 infographics; multilingual leaflets; poster series.
- Simple social posts; short smartphone videos; QR-linked feedback forms (Google Forms).
- "Material touch table": labelled samples and a one-page reuse fact sheet.
- Artist micro-grants (€1–3k) and local maker stipends.

Insightful example(s):

- Belluno (IT): School-based climate workshops → low-threshold entry point, engages families, sparks interest in building topics.
  Reference: Climate Action in Alpine Towns – Belluno case: https://alpinetowns.alpconv.org/pilot-action/

Phase 2: Participatory Planning and Co-Design

Primary objective(s):

This project is co-funded by the European Union
through the Interreg Alpine Space programme

Co-define priorities and solutions with residents, users, and SMEs, aligning feasibility with NEB aesthetics and inclusion.

Practical steps:

1. **Host a 1-day design charrette per pilot**:
   - Morning: site walk, constraints & possibilities;
   - Midday: creative breakout (sketching, quick mock-ups);
   - Afternoon: 3–5 concept boards + a "next-steps" list (materials to reuse, small wins).
2. **Community mapping – paper first**: print A0 maps; let participants mark resources, underused spaces, and logistics (e.g., access routes for deconstruction). Transfer results into a simple shared drive folder.
3. **Mini participatory budgeting (PB)**: set a **micro-budget (€5–20k)** for quick-impact circular actions voted by locals (e.g., a reused-timber bench series in Lucerne; courtyard shade structures in Saint-Romain-le-Puy; exhibition partitions from salvaged wood in Ljubljana; modular furniture in Salzburg; energy-saving fixtures in Padua).
4. **Small co-design sprints (2–3 weeks)** with cultural & creative practitioners: prototypes for signage, furniture, and wayfinding made from local salvage; test on site for user feedback.

Advisable tools (low-entry):

- Charrette kits: cardboard, markers, foamboard, tape;
- Printed maps + sticky dots;
- Simple polling (paper ballots + count);
- Shared folders for photos/drawings;
- Basic cost sheets (Excel/Google Sheets).

Insightful example(s):

- Vrin (CH): Farmers co-designed stables and zoning → walkshops + sketches ensure needs fit Alpine context.

This project is co-funded by the European Union
through the Interreg Alpine Space programme

Reference: Vrin village planning and Gion A. Caminada's participatory approach: https://52bestebauten.ch/30_caminada_vrin/

- Valendas (CH): Residents shaped square redesign and house reuse → charrettes and idea boards align heritage with modern use.
  Reference: Stiftung Zukunft Valendas revitalization process: https://www.verein.valendasimpuls.ch/

Phase 3: Implementation and Capacity Building

Primary objective(s):

Deliver visible pilot actions while upskilling local actors—craftspeople, SMEs, students—through hands-on circular methods.

Practical steps:

1. **Start with 1–2 "quick builds" per pilot (≤8 weeks)** using reclaimed materials:
   - Lucerne: seasonal pavilion rebuild using documented deconstruction steps.
   - Ljubljana: attic thermal improvements + modular exhibition units from salvage.
   - Salzburg: modular workbenches & partitions for the makerspace (reusable).
   - Rovereto: pilot office fit-out with high-efficiency lighting and reused furnishings.
   - Padua: upgrade AV/electrical with disassembly-ready cable trays and re-usable acoustic panels.
   - Saint-Romain-le-Puy: pilot street furniture and pocket-parks from reclaimed stone/timber.
2. **Run weekend "learn-by-doing" workshops**: deconstruction techniques, sorting & grading materials, safe modular assembly; pair apprentices with master craftsmen.
3. **Set up a micro material bank per pilot**: a corner storage with labeled racks; log items in a simple spreadsheet (ID, origin, quantity, condition, next use). Keep photos for each lot.

This project is co-funded by the European Union
through the Interreg Alpine Space programme

4. **Create a light governance loop**: a **community advisory circle** (6–10 people) meeting monthly to unblock issues and keep NEB values visible (sustainability/beauty/inclusion checklist).

Advisable tools (low-entry):

- Checklists for safety, deconstruction, and reuse grading;
- Spreadsheets for material inventory;
- Basic PPE kits; portable labelling printer;
- Simple build manuals (A4 with photos);
- A single shared calendar for volunteer shifts.

Insightful example(s):

- **Werkraum Bregenzerwald (AT):** Built by local firms; ongoing craft workshops → embeds know-how, fosters pride and maintenance skills.
  Reference: Werkraum Haus construction and programs: https://www.werkraum.at/das-haus/das-architekturerlebnis

Phase 4: Monitoring, Evaluation and Scaling

Primary objective(s):

- Measure outcomes (environmental, social, economic), share lessons, and replicate effective practices across Alpine networks.

Practical steps:

1. **Define 6–8 simple indicators per pilot** before implementation:
   - Environmental: kg materials reused; % energy reduction; waste avoided.
   - Social: # participants; diversity metrics; satisfaction (1–5 rating).
   - Economic: local spend with SMEs; volunteer hours; cost savings vs. linear options.
2. **Collect data with light methods**: end-of-event paper surveys; a feedback board on site; monthly volunteer logs; photo time-stamps of material flows; one story circle per quarter capturing lived experience.

This project is co-funded by the European Union
through the Interreg Alpine Space programme

3. **Publish a 4-page "pilot brief"** (what we tried, what worked, numbers, photos, next steps) and present it in a community assembly + upload to BAUHALPS channels for cross-learning.
4. **Scale via Alpine networks & events** (EUSALP/NEB/Interreg gatherings): package a **replication kit** (charrette guide, PB template, material bank spreadsheet, indicator sheet). Target **nearby municipalities** with similar assets (e.g., small heritage museums like Fužine; modest public buildings like Pioniergarage).

Advisable tools (low-entry):

- Paper + digital survey templates; wall feedback boards;
- Photo diaries; shared drive folders;
- One-page indicator dashboard (Excel);
- Short "how-to" PDFs for charrettes, PB, material banks.

Insightful example(s):

- **Minergie (CH):** Municipal energy certification → clear KPIs, public dashboards motivate replication.
  Reference: Minergie standards and municipal benchmarking (e.g., Andermatt): https://www.minergie.ch/de/themen/angebote/gemeinden/
- **Alpine Town Network (EU):** Participatory budgets + annual climate reports → embeds citizen feedback, scales best practices across towns.
  Reference: Alpine Town of the Year network and Climate Action in Alpine Towns: https://territorialagenda.eu/news-articles/final-report-climate-action-in-alpine-towns/

2.2 Determining the Genius Loci

The following section will provide guidance as to how to determine the genius loci of the very context where the pilot/building project is situated. The concept of *genius loci* refers to the unique spirit or character of a place and corresponds with the concept of aesthetics as a function of identifying and (artistically) addressing people's needs. It is the central premise of the NEB initiative that aesthetics influences human orientation and acceptance. The

This project is co-funded by the European Union
through the Interreg Alpine Space programme

better a particular solution (be it building or otherwise) addresses people's needs (sensuously, emotionally, functionally, contextually, ...), the more likely they are to embrace it. Recognising and integrating local qualities (materials, skills/techniques, customs etc.) into a pilot or building project specifically within Alpine context is considered all the more important for that it

- preserves traditional building practices and materials,
- fosters sustainable development aligned with local heritage, and
- enhances cultural and environmental harmony in sensitive mountain regions.

Overall, this will help the project/development to resonate with local identity, create greater relevance, acceptance and aesthetic appeal.

Step 1: Explore Traditional Alpine Building Practices

- **Action:** Review the *Map of Traditional Alpine Building Skills, Techniques, and Materials*.
- **Goal:** Familiarise yourself with historical and regional building knowledge relevant to your pilot project.
- **Tool:** https://www.bayern-innovativ.de/en/article-preview/map-of-traditional-alpine-building-skills-techniques-and-materials/

Step 2: Analyse Site-Specific Qualities

- **Action:** Reassess the mapped data in the context of your pilot/building project.
- **Goal:** Identify distinct qualities of the location across three dimensions:
  - **Relationships:** Social and cultural connections.
  - **Knowledge:** Local craftsmanship and traditions.
  - **Resources:** Natural and material availability.
- **Tool:** List of Analytical Factors for Determining the Genius Loci (attached).

This project is co-funded by the European Union
through the Interreg Alpine Space programme

Step 3: Compile and Refine the Genius Loci Repertoire

- **Action:** Amend and finalise your findings to create a context-specific Genius Loci Repertoire.
- **Goal:** Ensure the repertoire reflects the authentic spirit of the location and informs decisions along the construction value chain.
- **Tool:** Template

Table 2: Genius Loci Repertoire for Pilot Project Location

Dimension of Genius Loci	Key Observations	Implications for Construction Value Chain
Relationships	e.g., local networks, community traditions, stories, …	How to integrate social patterns into composition of individual building phases?
Knowledge	e.g., traditional building techniques, historical references, environmental constraints, …	Which knowledge, skills and/or techniques to adopt or reinterpret?
Resources	e.g., local building materials, cultural artefacts, ancient customs, …	Which materials and immaterial resources to consider and apply?

2.3 Assessing the Circularity Maturity

This final section of the BAUHALPS Toolkit attends to the Circularity Maturity Assessment Tool and will provide guidance as to how to approach and use it. Specifically, it describes the structure and operation of the Excel file constituting the assessment tool. The file consists of four worksheets:

- pilot project details;

This project is co-funded by the European Union
through the Interreg Alpine Space programme

- tier 1,
- tier 2,
- tier 3.

As illustrated in Table 3, the *pilot project details* worksheet includes three tables requiring the input of general project information, location data, and details concerning the professionals involved in the assessed project.

Table 3: Informative tables from the pilot project details worksheet.

General project data	
Project name/title	
Building area	
Type of intervention	
Project phase	
Brief description of the intervention	
Project start year	
Year of project completion	
Location and site information	
Country	
Full address	
Coordinates or cartographic reference	
Current land-use zoning	
Existing constraints	
Property ownership	
Appointed professionals	
Planners/architects	
Developer/construction company	
Project manager	
Construction manager	
Certifier/auditor	

The information collection template described above has been developed in continuity with the requirements already defined within the framework of the *Genius Loci* (Act. 1.2). For certain fields, a completion note (Table 4) indicates the need to select one of several available options from a drop-down menu (Table 5).

Table 4: Detailed view of the data entry note

General project data	
Project name/title	
Building area	
Type of intervention	
Project phase	
Brief description of the intervention	
Project start year	
Year of project completion	

Please select one of the available options from the list

This project is co-funded by the European Union
through the Interreg Alpine Space programme

Table 5: Detailed view of the drop-down menu

General project data	
Project name/title	
Building area	
Type of intervention	Housing
Project phase	Tourism/Leisure
Brief description of the intervention	Office/Business
Project start year	Sport/Culture
	Education/Health

As shown in Table 6, the *tier 1* worksheet contains the set of qualitative indicators. Each indicator consists of a title and a short description formulated as a question. The indicators are complemented by additional notes that serve as guidance for the assessment.

Table 6: Excerpt from the tier 1 worksheet, including the description of the indicators and guidance comments for their assessment

Indicator	Assessment guide comments
Demolition contractor involvement and definition of a construction strategy Provided there is local availability, has a demolition contractor been involved in the building project to conduct a deconstruction strategy (for new constructions) or a pre-demolition audit (for refurbishment projects)?	- A demolition contractor is a specialized professional responsible for planning and carrying out the safe, efficient, and compliant dismantling, removal, or clearance of buildings, structures, or other man-made facilities. - The pre-demolition audit is an activity resulting in the inventory of materials and components arising from the future demolition or renovation projects, and their management and recovery options (European Commission, 2017, EU Guidelines for the Waste Audits).
Design intent for modularity, disassembly and adptability Does the building project embed modular design and/or reconfigurable solutions that allow for disassembly and adaptability over time?	- Modular design (or modularity) refers to designing products by organizing sub-assemblies and components as distinct building blocks (i.e., modules) that can be integrated through configuration to fulfill customer and engineering requirements (Tseng M., Wang Y., Jiao R., 2018. Modular Design). - Reconfigurable solutions encompass three design principles for adaptability: - Versatility, defined as the ability to accommodate different functions with minor system changes; - Convertibility, defined as the ability to accommodate substantial changes in user needs by making modifications; - Expendability, defined as the characteristic of a system to accommodate a substantial change that supports or facilitates the addition of new space, features, capabilities and capacities. - The scope of application of modularity and design for disassembly principles (following a proper examination) spans across five levels: - Systems: adaptable construction works that can change to suit changing requirements. In some cases, entire modular buildings can undergo wholesale disassembly, movement, and re-use; - Elements: major structural part of a construction work (e.g. a roof, foundation, wall); - Component or assembly: combination of several subcomponents that are often non-structural (e.g., valves, solar panels); - Subcomponent: smaller pieces of the components (e.g., the duct system of a heating or cooling system; the glazing used for curtain walls; gaskets in piping systems, or controllers and software in a fire protection system); - Material: basic materials to which a product can be reduced, and that can be re-used or serve as a feedstock in the recycling process to produce other materials.
Digital project management and material documentation Does the building project implement digital tools and systems to support overall project management and the documentation of materials and components?	- e.g. BIM, COBie, digital twin. Some sustainability benefits resulting from the adoption of digital information models – such as BIM – can be referenced (da Cheng et al., 2024): increasing the decrease in material waste; encouraging green building; improving resource management effectiveness; increasing the effectiveness of the design; encouraging the execution of price and quantity and surveying procedures required for cost estimate; increasing the efficiency of building; supplying an all-inclusive database to facilitate the administration of the construction life cycle; assisting with the information entry, extraction, sharing, and transformation processes for projects; assisting in the seamless transfer of ideas from the design to the implementation, post-design, and maintenance stages. The Digital Product Passport (DPP) for construction products and materials will become mandatory starting in 2026. However, this requirement applies primarily to manufacturers of products and materials, while other economic operators – such as clients, de-installers, users, and national competent authorities – are granted access to the information contained in the DPP. - Required information should cover the origin of products and materials, their composition, and the strategies in place for their end-of-life management. Local sourcing of construction products and materials represents an added value for a building project in line with all NEB principles. It is therefore important to highlight their use, including through an "internal" tracking method capable of demonstrating selected sustainability aspects, as well as their cultural or social value.

To complete the qualitative assessment of the indicators, users are required to answer each question by selecting one of the available options from a drop-down menu (Table 7).

Table 7: Detailed view of the drop-down menu showing the options for scoring the qualitative indicators

Assessment guide comments	Indicator assessment	Notes
- A demolition contractor is a specialized professional responsible for planning and carrying out the safe, efficient, and compliant dismantling, removal, or clearance of buildings, structures, or other man-made facilities. - The pre-demolition audit is an activity resulting in the inventory of materials and components arising from the future demolition or renovation projects, and their management and recovery options (European Commission, 2017, EU Guidelines for the Waste Audits).		
- Modular design (or modularity) refers to designing products by organizing sub-assemblies and components as distinct building blocks (i.e., modules) that can be integrated through configuration to fulfill customer and engineering requirements (Tseng M., Wang Y., Jiao R., 2018. Modular Design). - Reconfigurable solutions encompass three design principles for adaptability: - Versatility, defined as the ability to accommodate different functions with minor system changes;	YES NO N.A.	t YES, f the s not been assessed

This project is co-funded by the European Union
through the Interreg Alpine Space programme

As shown in Table 8, the *tier 2* worksheet contains the set of indicators in a semi-quantitative form. In this configuration, indicators are assessed using an ordered value scale ranging from 0 to 3. As in *tier 1*, the indicator value can be selected via a dedicated drop-down menu.

Table 8: Extract of the *tier 2* worksheet, showing the indicators in semi-quantitative form and the corresponding assessment scale

Indicator	Indicator assessment	Scale interpretation
Demolition contractor involvement and definition of a construction strategy Level of integration of demolition or deconstruction expertise		0 - NO ADDRESSING No demolition contractors or deconstruction experts appointed; no audit conducted. 1 - PARTIAL ADDRESSING Experts appointed, but no deconstruction strategy defined or pre-refurbishment audit conducted. 2 - EXTENSIVE ADDRESSING Experts appointed and preliminary audit/strategy defined, but with limited coverage or scope. 3 - FULL ADDRESSING Experts appointed early in the design phase; comprehensive pre-demolition strategy defined or pre-refurbishment audit carried out, luding identification of reusable materials and selective dismantling opportunities.
Design intent for modularity, disassembly and adptability Degree of integration of modular and reconfigurable design solutions	0: No addressing 1: Partial addressing 2: Extensive addressing 3: Full addressing	or reconfigurable solutions are included in the design. ular or reconfigurable elements are present, but adaptability is minimal or not systematically planned. 2 - SUBSTANTIAL INTEGRATION Several modular or reconfigurable solutions are included, enabling partial adaptability to future changes in function, layout, or use. 3 - FULL INTEGRATION The building design is fully modular and reconfigurable, allowing for high adaptability and easy reconfiguration over time with minimal structural or functional constraints.

Table 9 presents the *tier 3* worksheet, which reports the quantitative assessment of the indicators. For this level, the calculation formulas of the indicators are embedded in the sheet, all expressed as ratios. The assessor can enter the numerator and denominator values in the designated cells, with the result automatically computed in the adjacent column. For some indicators, additional guidance comments are also provided to support the evaluation process.

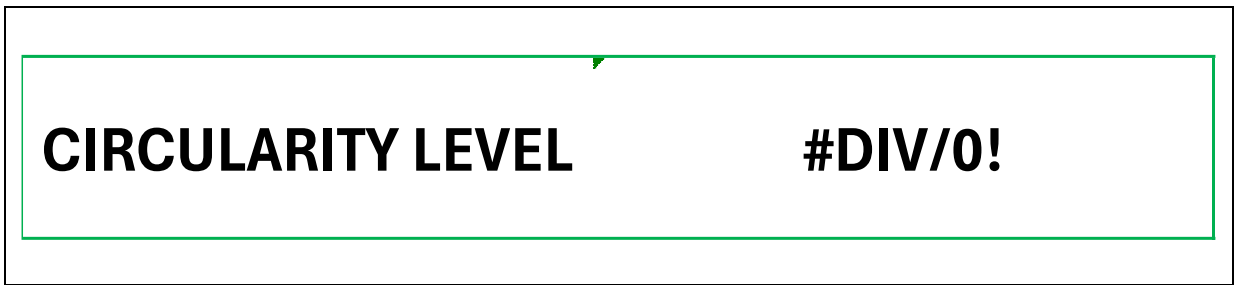
Table 9: Extract of the *tier 3* worksheet, presenting the indicators in quantitative form and the associated calculation formulas

Indicator formula	Indicator values		Indicator calculation
	Numerator	Denominator	
$\frac{B_r}{B_a}$ $B_r = number\ of\ building\ products\ for\ which\ high - quality\ reutilization\ has\ been\ dentified$ $B_a = total\ number\ of\ building\ products\ that\ were\ subjected\ to\ pre - demolition\ auditing$			#DIV/0!
$\frac{V_{mod} + V_{rec}}{V_{TOT}}$ $V_{mod} = volume\ of\ modular\ and - or\ prefabricated\ components$ $V_{rec} = usable\ volume\ in\ which\ walls, systems\ and\ finishes\ allow\ for\ non - structural\ reconfiguration$ $V_{TOT} = total\ internal\ volume$			#DIV/0!

This project is co-funded by the European Union
through the Interreg Alpine Space programme

At the end of the indicator list, the overall *circularity level* is displayed and automatically calculated as the average of the indicator values (Figure 5).

Figure 5: Circularity level index in the *tier 3* worksheet



2.4 Operationalisation of BAUHALPS Toolkit

Taking the conceptual elements of the BAUHALPS toolkit, presented in section 2.1 to 2.3, an initial online version (read: alpha version) was developed. The online tool offers practical way of navigating through the different sections of the toolkit elements and making preparations for integrating the BAUHALPS logic into the respective building project. The tool can be accessed by downloading the link below and using your browser (preferably Chrome or Safari) to open it:

https://drive.google.com/file/d/1NINrjSnyVQI7mDgOIiWumym78ILBhuNF/view?usp=drive_link

3. FINAL REMARKS: TOWARDS THE FEASIBILITY STUDY

The BAUHALPS Toolkit marks the completion of Work Package 1 and initiates the transition toward feasibility testing. By combining participatory methodologies, cultural contextualisation, and performance assessment, it equips stakeholders to advance circularity in the Alpine building sector. The next phase will validate these tools through pilot projects, ensuring alignment with both the NEB values and local needs. Ultimately, BAUHALPS aims to deliver a replicable model that strengthens community involvement, preserves heritage, and accelerates the green transformation of construction practices across the Alpine Space.

This project is co-funded by the European Union
through the Interreg Alpine Space programme

APPENDIX

1. Analytical Factors for Determining Genius Loci (GL)

Visit: https://docs.google.com/spreadsheets/d/11OvxxGTaGVXf2x5I3Ow-tU3P_TZLe_vr/edit?usp=drive_link&ouid=113574491500044311807&rtpof=true&sd=true

This project is co-funded by the European Union
through the Interreg Alpine Space programme