

D.3.1.3 PACKAGE OF GUIDELINES AND TUTORIALS for circular and digital construction



VVÖH

POR

and the ReBuilt project partners

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Introduction

Demand-side measures are one of the most important tools for the transition to circular economy. They focus on influencing the behaviour and decisions of consumers, businesses, and governments to prioritise sustainable practices, reduce waste, and promote the reuse, recycling and recovery of materials. In the context of the construction industry, which is one of the world's largest consumers of raw materials and generators of waste, demand-side measures can play a transformative role in driving the shift towards circularity.

Within the EU, **circularity** in construction is regulated by several directives and frameworks, such as the Circular Economy Action Plan or the New Construction Products Regulation, and there are also various financial instruments and initiatives that support Member States in implementing circular economy and circular construction principles.

Digitalisation in construction allows for more accurate project planning, monitoring and control of construction processes, and real-time sharing of necessary data between project stakeholders. Digitisation also facilitates the integration of environmental and energy saving solutions and initiatives to improve sustainability of the construction industry into construction processes.¹

This document brings together guidelines and tutorials in connection with digital and circular construction on the following topics:

- Digital tools for circular construction, collected by desktop research and from the project partners;
- Environmental and construction legislation, collected from reports on Activity 1.1 - Initial mapping of stakeholders and the State-of-the- Art in central European construction and spill-off sectors, Activity 1.2 - Development of educational/training programme for circular and digital construction in Central Europe, and reports on Activity 1.3 - Testing of circular and digital construction training programme;
- LCA/EPD/PEF Level(s), collected from the project partners;
- Circular Business Creation, collected from the project partners;
- Eco-design, new materials and technologies, collected from the project partners.

The content of the document is based on research, input from the project partners, and previously completed deliverables such as **D.1.1.4** - Report on initial assessment of construction and spill-off sectors in the urban and rural areas; **D.1.2.6** - ReBuilt education and training programme for circular and digital construction; **D.1.3.1** - **D.1.3.5** - Reports on educational and training events for various stakeholder groups.

Each chapter ends with a “Practical guidance / tutorials” part that complements the description of existing European and national guidelines. While the main text provides an overview of relevant strategies, standards, and tools already in place, the practical sections aim to translate these into concrete steps for everyday use. They highlight how digital tools can be applied in practice, provide links to tutorials and handbooks, and offer tips tailored especially for SMEs and local stakeholders. In this way, the guidelines go beyond a simple collection of regulatory documents and serve as an accessible manual that supports real-life implementation of circular construction principles.

¹ <https://www.doka.com/hu/news/digitalizacio-es-az-epitoipar>



1. Digital tools for circular construction

Digital technologies are being explored as promising solutions to support decision-making and enable circular solutions in the architecture, engineering, and construction sector. These are a prerequisite for a paradigm shift towards a circular construction economy, and could also facilitate collaboration and improve communication, bringing stakeholders closer together to tackle climate change together.

a. Building Information Modeling (BIM)

Building Information Modelling (BIM), is a digital tool disrupting the construction industry as a platform for central integrated design, modelling, asset planning running and cooperation. It provides all stakeholders with a digital representation of a building's characteristics in its whole life-cycle and thereby holds out the promise of large efficiency gains.²

Guidelines and standards for BIM

- **Directive 2014/24/EU** of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC

The European Public Procurement Directive defines the basic principles, thresholds, decision-making criteria, guarantees and exemptions applicable to public procurement procedures. It includes encouragement for BIM in the procurement of public works to support the modernisation of procurement processes, improvements to cost efficiency of public funding and to increase consideration for whole-life costing in public works. The Directive establishes the need to use software (media data and tools to model the building) in processes for contracting construction work, services and supplies.

<https://eur-lex.europa.eu/eli/dir/2014/24/oj/eng>

- **ISO 19650** - Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) – Information management using building information modelling

https://www.iso.org/search.html?PROD_isoorg_en%5Bquery%5D=19650&PROD_isoorg_en%5Bmenu%5D%5Bfacet%5D=standard

Hungary

- **Lechner Tudásközpont: BIM kézikönyv** (BIM-manual by Lechner Knowledge Center)

In order to facilitate and support the spread of BIM in Hungary, these recommendations and methods, based on the guidelines of the International Organisation for Standardisation and extensive professional feedback, ensure its implementation.

<http://bim.lechnerkozpont.hu/hu/letoltesek>

- **ÉMI BIM Pilot Program**

Author: ÉMI Nonprofit Kft. (Építésügyi Minőségellenőrző Innovációs Nonprofit Kft.)

Description: As Hungary's national building quality control institute, ÉMI ran a BIM pilot program to test practical implementation, data management, and regulatory integration of BIM in construction workflows. It aims to provide benchmarks and lessons learned for broader adoption.

<https://emi.hu/EMI/web.nsf/Pub/kutatasok-nemzetkozi-newcom.html>

- **BIM Hungary - Munkacsoport Jelentések** (Working Group Reports)

² <https://publications.jrc.ec.europa.eu/repository/handle/JRC109656>



Author: Hungarian BIM Association (Magyar BIM Szövetség)

Description: A series of position papers, use-case studies, and working group reports on BIM implementation and digital transformation in the Hungarian construction sector. The association advocates policy integration, education, and public sector BIM mandates.

Link: NA. Hungarian BIM Association

- **BIM Alkalmazási Útmutató a Közbeszerzésekhez "BIM Implementation Guide for Public Procurements"**

Author: Ministry for Innovation and Technology (Hungary)

Description: A practical government-issued guide for integrating BIM requirements into public tenders and procurement processes in compliance with Directive 2014/24/EU. It emphasizes standardisation, digital workflows, and whole-life cost analysis.

Availability: Limited online; internal distribution, may be requested through professional associations.

- **MÉK - BIM a tervezésben (BIM in Architecture)**

Author: Magyar Építész Kamara (Hungarian Chamber of Architects)

Description: Educational materials and presentations that outline the use of BIM in architectural design workflows, specifically aimed at Hungarian architects. It covers legal, technical, and workflow considerations for BIM adoption.

<https://mek.hu> (Search for "BIM")

Czech Republic

- **BIM Implementation Strategy in the Czech Republic**

Author: Ministry of Industry and Trade (2017)

On September 25, 2017, the Czech government approved the BIM Implementation Concept to reduce costs and boost productivity throughout the construction lifecycle.

The plan, developed by the Ministry of Industry and Trade with support from the BIM Expert Board and State Transport Infrastructure Fund, covers a plan for 2018-2027, aiming to make BIM mandatory for large public projects above the EU threshold by 2023.

https://mpo.gov.cz/assets/cz/stavebnictvi-a-suroviny/bim/2019/3/Koncepcie-zavadeni-metody-BIM-v-CR_EN.pdf

- **Concept of implementing the BIM method in the Czech Republic**

Author: Ministry of Industry and Trade (2017)

Implementation: Government Decree No. 682/2017 Coll.

This decree, issued on September 25, 2017, approved the Concept of Implementation of the BIM Method in the Czech Republic. (outlines the strategic approach of the Czech Republic)

<https://konceptebim.gov.cz/koncepcie-bim/koncepcie-zavadeni-metody-bim-v-cr/>

- **Digital Czech Republic is our common future**

Digital Czechia Program: This program represents the Czech Republic's strive to make the adminstry, country, and sectors more digitised and advance in technology.

BIM is a direct link from this as it increases the use of technology in the construction sector which ultimately improves the industry both economically and sustainably.

<https://digitalnicesko.gov.cz/>

- **BIM Implementation Strategy in the Czech Republic**



Author: Ministry of Industry and Trade (2017)

https://mpo.gov.cz/assets/cz/stavebnictvi-a-suroviny/bim/2019/3/Koncepcie-zavadeni-metody-BIM-v-CR_EN.pdf

▪ ČSN EN ISO 19650 Series

The Czech Republic has adopted the international ISO 19650 standard to guide construction projects in improving collaboration and promoting sustainable practices through efficient use of BIM. The set of standards consists of the following parts: 1 - Concepts and principles, 2 - Delivery phase of assets, 3 - Operational phase of assets, 4 - Information exchange, 5 - Security-oriented approach to information management.

Some key guidelines of the standard include:

Common Data Environment (CDE): All project information is stored in a shared digital platform to ensure everyone accesses the most up-to-date and accurate files.

Defined Roles and Responsibilities: Each participant (designers, builders, owners) clearly understands their duties regarding the creation and sharing of information.

Shared Process: Projects follow agreed-upon steps for creating, reviewing, and approving BIM data to minimize errors and conflicts.

Standards adopted from international systems are not specific guidelines, but rather a list of basic principles and rules. Specific implementation and application, setting up of own processes, documents and forms is up to the user or is subject to further clarification at national level.

▪ Příručka pro aplikaci ČSN EN ISO 19650

Author: The Czech Agency for Standardisation

The Czech Agency for Standardisation also provides a guidebook that supplements the text of the standards and explains what the implementation of procedures in accordance with these standards actually means. The guidebook is available here:

https://mpo.gov.cz/assets/cz/stavebnictvi-a-suroviny/bim/2021/4/Prirucka-pro-aplikaci-CSN-EN-ISO-19650_Agentura-CAS.pdf

▪ Czech BIM Execution Plan - CzBEP - 2025

The Czech Agency for Standardisation further developed the CzBEP as a practical template and checklist to help project teams plan the use of BIM during construction projects. The CzBEP is based on the BIM protocol, the purpose of which is to specify how the BIM method will be applied to a given project.

Some key features of the CzBEP include:

- **Digital Models:** Specifies how the 3D BIM files and digital building models will be created and managed
- **Owner's Information Requirements:** Details what information the building owner needs to receive throughout the project
- **Data Management Rules:** Defines how all project data will be shared, stored, and organized among participants

The CzBEP provides a clear, step-by-step framework so that architects, engineers, builders, and owners all understand their roles and responsibilities. This reduces confusion, promotes smooth collaboration, and helps the project run efficiently by setting clear expectations for everyone involved.

▪ BIM BEP implementation plan (Plán realizace BIM BEP)



Author: Czech Agency for Standardization

https://konceptcebim.gov.cz/wp-content/uploads/2025/05/20250331_bep_finalni-verze-cas_kor_pri.pdf

▪ BIM-protokol

Author: Česká Agentura Pro Standardizaci

https://konceptcebim.gov.cz/wp-content/uploads/2025/05/20250331_bim-protokol-formatovana-verze_final_kor_pri.pdf

▪ BIM Guide for Investors - 2018

Published by the Czech BIM Council, this guide helps investors understand BIM and its benefits for building projects.

Some key points covered in the guide include:

- Cost and Time Savings: Explains how using BIM can reduce expenses and shorten project timelines
- Improved Collaboration: Shows how BIM helps different teams work together more effectively
- Better Decision-Making: Describes how BIM provides clearer information to support smarter choices during the project.
- Collaboration Models: Outlines different ways stakeholders can cooperate using BIM.

This guide highlights the need for investors to understand and integrate BIM into their projects, helping them decide whether to use BIM. It gives them the confidence to support BIM and understand what to expect from the process.

▪ BIM Guide for Investors

Author: Czech BIM Council

<https://issuu.com/czbim/docs/bim-prirucka-pro-investory>

▪ Institutional Support and Resources

- *Czech Standardization Agency (ČAS)*: ČAS plays a key role in the development and spreading of national standards, including those related to BIM. It collaborates with various stakeholders to ensure that standards meet the needs of the construction sector.

<https://agenturacas.gov.cz/>

- *Czech BIM Council*: czBIM is an independent Czech association and member of buildingSMART, promoting digitalization and openBIM in construction. Since 2011, it has supported BIM adoption across the public and private sectors, developed practical standards, educated professionals, and advocated for transparent, practice-based implementation. It also fosters sustainability, SME support, and international cooperation in the digital built environment.

<https://www.czbim.org/>

Austria

▪ ÖNORM A 6241-1:2015 Digitale Bauwerksdokumentation

Teil 1: CAD-Datenstrukturen und Building, Information Modeling (BIM) - Level 2

<https://www.austrian-standards.at/de/shop/onorm-a-6241-1-2015-07-01-p2142320>

▪ ÖNORM A 6241-2:2015 Digitale Bauwerksdokumentation

Teil 2: Building Information Modeling, (BIM) - Level 3-iBIM



<https://www.austrian-standards.at/de/shop/onorm-a-6241-2-2015-07-01-p2429816>

Poland

▪ Roadmap for BIM Implementation in Public Procurement (Mapa drogowa BIM)

Author: Ministry of Development (Ministerstwo Rozwoju), 2020.

A government-commissioned roadmap outlining steps and timelines to adopt BIM in Poland's public sector construction projects. Developed with PwC Poland and EU support, it analyzes international BIM adoption, legal conditions, and proposes a staged plan (push-pull strategy) to mandate BIM for large public investments by 2025 and all by 2030. It serves as a basis for a future national BIM implementation strategy

<https://www.gov.pl/attachment/f3be402f-b236-43bb-81f3-24ab7174d8d0> (Polish pdf, no official English version)

▪ BIM Standard PL

Author: Polish Association of Construction Employers (PZPB) with PZiTb, SARP, etc., first edition 2020.

A comprehensive 322-page industry BIM manual (with templates) intended to standardize BIM processes in public construction projects in Poland. It was developed collaboratively by major construction and design organizations and experts (under PZPB/PZiTb/SARP patronage) to support public clients and contractors in effective BIM implementation. This is a proposal (not an official law) made available for market consultation, envisioned as a national BIM guide for public investments

<https://www.gov.pl/attachment/ad97ac6d-9ed6-4f0f-b684-6becf4982e85> (Polish pdf, no official English version)

▪ BIM-D Guidelines for Roads (Wzorce i Standardy BIM-D)

Author: Ministry of Infrastructure, latest version 7.0 (2022).

Official guidance for road infrastructure projects, titled "BIM-D-01 Wprowadzenie do stosowania technologii BIM w budownictwie drogowym" (Introduction to BIM in Road Construction). This document (first issued 2020, updated through 2022) provides informational standards and best-practice pointers for procuring and delivering road projects with BIM. It is not a mandatory regulation but a recommended framework to unify BIM approach in the road sector, endorsed by the Minister of Transport.

<https://www.gov.pl/attachment/98164b3b-53be-4e2b-91f2-6f6983ebe443> (Polish pdf, no English version)

▪ BIM-M Guidelines for Bridges/Engineering Structures (Wzorce i Standardy BIM-M)

Author: Ministry of Infrastructure, latest version 7.0 (2022).

Similar to BIM-D, this is an official guidance for road engineering structures (bridges, overpasses, tunnels). The key document is "BIM-M-01 Powiązanie wymagań technicznych dotyczących drogowych obiektów inżynierskich z technologią BIM" (Linking Technical Requirements of Road Engineering Structures with BIM), released 2021 and updated through 2022. It provides a unified approach to applying BIM in the design and construction of infrastructure structures, and is recommended (non-mandatory) by the transport ministry.

<https://www.gov.pl/attachment/3ce9ead6-08d8-4e11-80a8-5d22124eddf> (Polish pdf, no English version)

▪ PN-EN ISO 19650 Standards (Parts 1-2)

Author: Polish Committee for Standardization (PKN), adopted 2019.

The Polish adoption of the international ISO 19650 series on BIM information management. Part 1 (Concepts and Principles) and Part 2 (Project Delivery Phase) were published as Polish Standards PN-



EN ISO 19650-1:2019 and PN-EN ISO 19650-2:2019. These standards mirror the ISO/British BIM Level 2 framework, providing unified high-level requirements for organizing and digitizing building and infrastructure information using BIM. (They form the basis for BIM processes in Poland's industry, aligning with global best practices).

Polish BIM Implementation Strategy (Draft) - BIM Working Group, Ministry of Development/Technology, ongoing (2022-). A draft national BIM strategy being developed by an inter-ministerial BIM working group launched in 20223. (As of 2025, the strategy is under development and not yet published as a formal document, but it represents the government's plan to push BIM in construction.)

<https://www.gov.pl/web/rozwoj-technologia/grupa-robocza-do-spraw-bim>

Italy

The adoption of the BIM methodology in Italy has reached a turning point thanks to the introduction of new legislation (DM 560/2017, known as the "Baratono Decree," which since 2019 has provided for the gradual introduction of mandatory BIM for contracting authorities) and the technical standard UNI 11337, one of the most influential in Europe.

The standard introduced general concepts related to the nature and origin of information, starting from the definition of data and progressing to the definition of more complex structures. In particular, it defined all aspects related to the quantity and quality of informational content, setting objectives to be achieved at each stage of the process and establishing an Italian LOD (Level of Development) scale. It also defined the roles, rules, and coordination and approval workflows necessary to activate and ensure the digitalized construction process.

The publication of the standard, in particular, opened new opportunities for the recognition of BIM-related professional skills through specific certifications issued in accordance with a national standard. UNI 11337 is the only national annex to ISO 19650-1-2:2019.

<https://www.01building.it/bim-e-normativa-le-norme-iso-e-uni-di-riferimento/>

▪ BIM mandatory from 2025 for Public Contracts

The Public Works Decree (Legislative Decree 36/2023) mandates, from January 1, 2025, the compulsory use of BIM (Building Information Modeling) for contracts over 1 million euros, with obligations for digital information management and the use of interoperable tools in compliance with UNI 11337 and ISO IFC standards.

<https://www.youbuildweb.it/le-nuove-tecnologie-in-edilizia-sono-via-per-ottenere-qualita-e-sicurezza>

Germany

• VDI 2552: Building Information Modeling

Author: Association of German Engineers (VDI)

Description: The VDI 2552 series is the most widely recognized set of BIM guidelines in Germany, providing comprehensive instructions for the implementation of BIM across the construction and building lifecycle. It consists of multiple parts covering general principles, terms, processes, roles, data exchange formats, legal aspects, and collaboration. It is designed to complement international standards like ISO 19650 and to adapt them to German practice.

<https://www.vdi.de/richtlinien/unsere-richtlinien-highlights/vdi-2552>

• Stufenplan Digitales Planen und Bauen (Step-by-step plan for Digital Planning and Construction)

³ <https://www.gov.pl/web/rozwoj-technologia/grupa-robocza-do-spraw-bim>



Author: Federal Ministry of Transport and Digital Infrastructure (BMVI)

Description: This roadmap outlines the German government's phased approach to implementing BIM in infrastructure projects. It defines mandatory BIM usage in federal infrastructure projects from 2020 onward and sets out objectives, milestones, and supporting measures.

https://www.bmv.de/SharedDocs/DE/Publikationen/DG/stufenplan-digitales-bauen.pdf?__blob=publicationFile

https://www.bmi.bund.de/SharedDocs/downloads/DE/veroeffentlichungen/2021/10/masterplan-bim.pdf?__blob=publicationFile

<https://www.bim-bundesfernstrassen.de/masterplan>

- **HOAI and BIM (Fee Structure for Architects and Engineers with BIM)**

Author: Bundesarchitektenkammer & Bundesingenieurkammer

Description: Although not a separate standard, the German fee regulations (HOAI) have been supplemented with recommendations on how to integrate BIM processes into traditional service phases and fee structures, helping to clarify contractual and fee-related aspects when using BIM.

Link (guidance on BIM and HOAI, German with some English resources available through chambers of architects and engineers):

<https://bak.de/presse/pressemitteilungen/bim-neuer-leitfaden-bietet-orientierung/>

Croatia

- **EU BIM Taskgroup: Handbook for the Implementation of Building Information Modeling (BIM) by the European Public Sector**

The Handbook for the Implementation of Building Information Modeling (BIM) by the European Public Sector addresses the growing need for governments and public clients to promote economic growth, competitiveness, and efficiency through the adoption of BIM. It serves as a central reference to guide public sector organizations in introducing BIM, offering leadership to the construction industry—especially SMEs—while promoting a unified European approach to reduce fragmentation and inefficiencies.

The handbook outlines:

- Why governments are supporting BIM,
- The benefits of BIM implementation,
- How public authorities can lead and collaborate with industry,
- The importance of public leadership and EU-wide alignment,
- A shared European definition of BIM.

It is divided into two parts:

- General Guidance - covering the value proposition of BIM, the need for a common strategy, a European BIM framework, and performance benchmarks.
- Action Recommendations - offering strategic guidance on policy, technology, processes, and skills needed for BIM adoption.

<https://eubim.eu/handbook-selection/>

<https://mpgi.gov.hr/o-ministarstvu/djelokrug/graditeljstvo-98/bim-digitalna-revolucija-gradjevinskog-sektora/9203>

- **Croatian Chamber of Civil Engineers: General Guidelines for BIM Approach in Construction (2017)**



Introduces BIM methodology for all types of construction projects in Croatia, explaining information management, data exchange, and practical use of models. Serves as a foundational guide for companies beginning with BIM. While the guidelines do not cover every aspect of the BIM approach in detail, they focus on the design and construction phases, as well as on asset and facility management. It should also be noted that the provisions in these Guidelines are recommendations, not obligations. By developing these Guidelines, a clear and unequivocal message is being sent: "In order to increase competitiveness in both domestic and international markets, Croatian companies must adopt the BIM approach as soon as possible. This will enhance the quality of design and construction, and ultimately reduce construction and maintenance costs.

<https://www.hkig.hr/Strucno-usavrsavanje/Strucna-izdanja-Komore/Izdanja/Opc%CC%81e-smjernice-za-BIM-pristup-u-graditeljstvu/16>

- **Croatian Chamber of Civil Engineers: Guidelines for BIM Approach in Infrastructure Projects (2021)**

A specialized guide from the Croatian Chamber of Civil Engineers, tailored for infrastructure works. Covers BIM at all stages—from design coordination to construction and maintenance—and highlights competitiveness gains for Croatian firms.

They provide an overview of the most widely used BIM tools in infrastructure projects, including the basic settings for project collaboration, the use of a common data environment, and interoperability.

Digital collaboration modes, types of models, levels of detail (LOD), and model management are covered in the first part of the document. The second part focuses on key processes involved in BIM implementation at both the company and project level. This section outlines how BIM impacts current workflows and what steps are necessary to transition to a fully collaborative, model-based infrastructure project development process. The Guidelines are supported by LOD tables tailored to the most common types of infrastructure-related buildings.

<https://www.hkig.hr/Strucno-usavrsavanje/Strucna-izdanja-Komore/Izdanja/Smjernice-za-BIM-pristup-u-infrastrukturnim-projektima/22>

- **Centre for Digital Built Croatia**

The Centre for Digital Built Croatia was established in 2022 by construction enthusiasts with the aim of promoting digital solutions across all processes and projects within the construction industry. The Centre brings together representatives from the public sector, industry leaders, universities, individual enthusiasts, and all those who wish to make their daily work more efficient and of higher quality. The website features a wide range of video materials that may be used as guidelines on topics such as Digitalisation of Croatian Construction, Application of Digital Technologies in Infrastructure Projects, How to Approach a BIM Project, and others.

<https://cdih.hr/en/video/>



b. Spatial Data Acquisition

Spatial data can be obtained either directly, through methods like field surveys and remote sensing, or indirectly, from existing sources such as printed maps or digital datasets. Primary data come from direct observation and require understanding of how they were collected, including instrument settings and quality control. Due to time and cost constraints, indirect or secondary data—collected for other purposes—are often used. These include scanned maps or purchased datasets. In recent years, the digital collection and sharing of spatial data have grown significantly, driven by new technologies and broader applications, as data spaces. As availability increases, ensuring data quality for analysis and decision-making becomes increasingly important.

Methods of spatial data acquisition:

- **Field Surveys (Ground-Based Observation)**

Manual collection using GPS devices, total stations, or mobile apps for capturing high-accuracy point, line, or polygon data on-site.

- **Remote Sensing**

Use of satellite or aerial imagery to gather data without physical contact for large-area coverage, such as land use, vegetation, or urban expansion.

- **Scanning and Digitizing Paper Maps**

Converting printed maps to digital raster or vector formats for historical data integration or areas with limited digital resources.

- **Web-Based Data Portals**

Downloading existing datasets from online sources (government, open data) for cost-effectively access large-scale spatial data.

- **Crowdsourced Data (e.g., OpenStreetMap)**

Community-driven mapping platforms with global coverage, which is useful for dynamic or under-mapped areas.

- **Purchasing from Commercial Providers**

High-resolution or specialized spatial datasets (e.g., LiDAR, satellite imagery) for urban planning, infrastructure monitoring, environmental analysis.

- **UAVs / Drones**

Capturing aerial imagery using unmanned aerial vehicles, used for agriculture, construction, disaster response.

Guidelines and tutorials for spatial data acquisition

- **INSPIRE Data Specification on Buildings - Technical Guidelines**

Technical guidance document produced under the INSPIRE Directive, containing specifications for spatial data related to buildings.

https://knowledge-base.inspire.ec.europa.eu/publications/inspire-data-specification-buildings-technical-guidelines_en

- **UN-GGIM Europe - Core Spatial Data Theme 'Buildings'**

Recommendations on the content of building-related spatial data, with particular reference to the recording of energy efficiency data.



https://un-ggim-europe.org/wp-content/uploads/2023/03/UN-GGIM-Europe_WGA_Recommendation_Content_theme-BU-v1.1.pdf

Hungary

- **Nemzeti Térinformatikai Adatinfrastruktúra (NTAI) - National Spatial Data Infrastructure**

Author: Lechner Tudásközpont / Government of Hungary

Description: The NTAI framework serves as Hungary's implementation of the EU INSPIRE directive. It ensures the interoperability and accessibility of spatial datasets across government institutions. It includes metadata standards, data access protocols, and coordination guidelines for spatial data acquisition and management.

[NTAI Portal](#) (Hungarian only)

- **Digitális Állami Térképi Adatbázis (DÁTA) - Digital State Map Database**

Author: Lechner Tudásközpont

Description: DÁTA is the official base map database of Hungary, compiling spatial data from various sources including field surveys, remote sensing, and cadastral data. It defines standards for data capture, classification, resolution, and periodic updates.

<https://www.lechnerkozpont.hu/szolgaltatasok/digitalis-allami-terkepek>

- **FÖMI / LTK - Aerial Surveying and Remote Sensing Guidelines**

Author: FÖMI (Földmérési és Távérzékelési Intézet) - now integrated into Lechner Tudásközpont

Description: Guidelines and specifications for aerial photography, satellite imagery, orthophoto production, and LiDAR surveys in Hungary. Includes flight planning, resolution requirements, and georeferencing standards.

<https://www.lechnerkozpont.hu/szolgaltatasok/ortofotok>

- **EOV - Egységes Országos Vetületi Rendszer (Unified National Projection System)**

Author: Government of Hungary

Description: The standard coordinate reference system used in Hungary for spatial data acquisition and mapping. All public spatial datasets must be referenced in EOV (a transverse Mercator projection tailored for Hungary). Essential for aligning data from different acquisition methods.

https://www.icc.cat/content/download/58230/499848/version/1/file/Session2_Hungary_GeodeticSystems.pdf

- **Geoportál - Hungarian Spatial Data Access Portal**

Author: Lechner Tudásközpont

Description: This portal provides downloadable spatial datasets from Hungarian government sources, including cadastral data, topographic maps, orthophotos, and planning zones. The portal supports INSPIRE-compliant metadata and services (WMS/WFS).

<https://geoportal.hu> (Main portal - Hungarian interface)

- **Open Data Portal Hungary - Spatial Dataset Catalog**

Author: Kormányzati Adatnyilvántartás / Hungarian Government

Description: The national open data portal hosts geospatial datasets that can be used for analysis, planning, and academic research. Datasets include transportation networks, hydrography, environmental monitoring zones, etc.



<https://data.gov.hu> (Filter by “Térinformatika” or “geoadatok”)

- **Drone Mapping Regulation (Hungarian UAV Law - 2021 onwards)**

Author: Hungarian Civil Aviation Authority / Ministry of Technology and Industry

Description: Legal framework regulating drone use for spatial data acquisition in Hungary. It includes licensing, flight zone classification, and privacy/GDPR-related restrictions for aerial imaging.

[Hungarian UAV Regulations - Summary](#) (Site may require specific search: “drón szabályozás”)

Czech Republic

- **Spatial Development Policy - in effect from 1 March 2025**

A national strategy covering the whole country. It sets priorities for spatial planning, settlement structures, transport, and infrastructure. It is binding for other spatial plans and decisions

Title of publication: TERRITORIAL DEVELOPMENT POLICY OF THE CZECH REPUBLIC

Author: Ministry for the Development of the Czech Republic

https://www.uur.cz/media/prspmmxz/uplne_zneni_pur_cr_zavazne_od_01-03-2025-final.pdf

- **Decree No. 157/2024 Coll., on the ÚAP, ÚPD and the uniform standard**

Author: Ministry of Regional Development

The Decree came into place on July 1, 2024.

It sets the rules regarding what must be included in different types of spatial planning documents.

<https://mmr.gov.cz/cs/ministerstvo/stavebni-pravo/pravo-a-legislativa/novy-stavebni-zakon/vyhlaskey/vyhlasaka-o-uap,-upd-a-jednotnem-standardu>

- **Spatial Analytical Documents (ÚAP)**

These must include data and analysis about the territory, such as land use, environmental values, infrastructure, and social and economic factors. ÚAP documents are the basis for all further planning and must be updated regularly.

Example of ÚAP for Prague: <https://geoportalpraha.cz/>

Example for Brno: <https://kambrno.cz/uzemne-analyticke-podklady/>

- **Spatial Planning Documentation (ÚPD):**

Spatial Development Plan (national level): must clearly outline strategic projects, development areas, and infrastructure priorities in line with national interests and international commitments.

Spatial Development Principles (regional level): specify the development concept for the region, highlighting important areas and corridors and coordinating municipal activities.

Spatial Plan (municipal level): describes land use, built-up areas, protected zones, and development conditions across the entire municipality.

Regulatory Plan (detailed local level): provides precise land-use conditions, building locations, and protection measures for selected parts of municipalities.

- **Spatial planning in the Czech Republic**

Author: Ministry of Regional Development

The main law governing spatial planning is the Building Act (No. 283/2021 Coll.), which came into effect from July 1, 2024. Detailed rules are in Decree No. 157/2024.



Spatial planning is used to meet the environmental, economic, and social priorities of people and nature.

Spatial planning evaluates the current state and value of its land and sets urban and architectural standards, especially for building permits.

Spatial planning instruments:

tools used at national, regional, and local levels to guide how land and territory are used and developed.

https://mmr.gov.cz/getmedia/e3da04bf-74e2-469a-b0b3-387d32cfb37b/Leaflet-Spatial-Planning-CZ-2025-04.pdf.aspx?ext=.pdf&utm_source=chatgpt.com

- **National geoportal of spatial planning**

The Ministry of Regional Development has made available the National Geoportal of Spatial Planning (NGÚP). It is a web application that is a central tool for digitalization of spatial planning and spatial development. It will serve the public and authorities involved in spatial planning. The National Geoportal for Spatial Planning is the central place where spatial planning documents and their amendments are published.

<https://uzemniplanovani.gov.cz/>

- **The Register of Census Districts and Buildings**

The Register of Census Districts and Buildings is a public list maintained pursuant to Section 20a) of Act No. 89/1995 Coll., on the State Statistical Service, as amended (Act No. 81/2004 Coll., Act No. 230/2006 Coll.).

The register records descriptive and locational data for statistical purposes on:

- territorial and territorial registration elements;
- statistical territorial units;
- buildings with assigned house numbers (including entrances to dwellings) and their addresses;
- dwellings (non-public data).

https://csu.gov.cz/rso/registr_scitacich_obvodu

- **The structure of unoccupied apartments in the Czech Republic and the tools for their activation used in OECD countries**

Author: Ministry for Regional Development

The publication provides an in-depth look at the problem of housing unaffordability, which in recent decades has affected not only the Czech Republic but also many countries in Europe and North America.

<https://mmr.gov.cz/getattachment/b515c571-1a07-460e-8aeb-f540825ea638/Studie-neobydlene-byty.pdf.aspx?lang=cs-CZ&ext=.pdf>

- **A unique platform, the National Centre for Construction 4.0, has been created at the CTU in Prague**

Author: Czech Technical University in Prague

Construction 4.0 in the Czech Republic focuses on combining digital technology, automation, and sustainable practices into every stage of building to reduce environmental impact.

There are two main aspects of the system:

- GREEN: Focuses on sustainable practices such as reducing waste, recycling materials, managing water, improving air quality, and lowering energy use in buildings.
- SMART: This element focuses on digitising construction processes with tools like BIM, AI, IoT, robotics, and improved management techniques to optimize work and reduce resource use.



The SMART aspect promotes the integration of AI and Big Data to modernize the entire lifecycle of buildings. These technologies enable process automation, predictive maintenance, smart decision-making, and more efficient resource use.

Through AI, the construction industry can optimize workflows, improve safety, and reduce environmental impact. Big Data analytics supports better project planning, energy efficiency, and lifecycle monitoring of buildings.

The National Centre for Construction 4.0 (NCS 4.0), located at the Czech Technical University (CTU) in Prague, plays a key role in driving this transformation. It connects academia, industry, and government to support innovation projects involving AI and Big Data. The Centre provides a platform for companies to collaborate on advanced technologies and participate in national and EU-funded initiatives aimed at digital transformation and sustainability in construction.

<https://aktualne.cvut.cz/en/reports/20220118-a-unique-platform-the-national-centre-for-construction-40-has-been-created-at-the>

- **Proof of Concept: 3D geotechnic monitoring SIISEL**

The SIISEL information system has demonstrated its applicability in modern geotechnical monitoring by integrating 3D models, digital twins, and real-time sensor data. In cooperation with LinkSoft, SUDOP CIT, GeoTec-GS, and PUDIS, a Proof of Concept was carried out using a section of the Prague Metro, employing the Bentley iTwin platform. This enabled the visualization of deformations, vibrations, and other critical indicators directly within a 3D construction model. The system allows for more intuitive interpretation of measurement data, facilitates faster identification of risks, and supports proactive infrastructure management. Integration with IoT sensors enables real-time data acquisition and the potential for automated responses based on pre-defined thresholds. The pilot confirmed that such a solution can be deployed within a few days and holds potential for broader use in transport and infrastructure projects.

<https://www.linksoft.eu/cs/poc-3d-geotechnicky-monitoring-siisel>

<https://siisel.cz/>

- **Statistical Surveys:**

- ***Monthly Report on Building Notifications and Permits, Buildings and Dwellings (Form Stav 2-12)***

This monthly statistical survey collects data on:

- the number of issued building notifications and permits (SOP), broken down by residential buildings, non-residential buildings, environmental protection structures, and other constructions
- the number of completed buildings and newly constructed dwellings
- the number of demolished buildings and cancelled dwellings
- accommodation capacities (reported once a year)

The survey is submitted by general construction offices, specialized construction offices (e.g., for air, rail, water, or highway structures), and military construction authorities. The report has 100% return rate and no data imputation is applied.

- ***Notification on Completion of a Building or Dwelling (Form Stav 7-99)***

This survey covers all new buildings (residential and non-residential) that have been assigned a descriptive or evidential number, as well as new buildings within existing premises valued at CZK 50 million or more without a new address number. It also includes newly completed dwellings within existing buildings.

Collected data includes:



- territorial identification for the Statistical Register of Territorial Units (RSÚJ)
- technical parameters of the buildings
- number and types of dwellings, including floor area (e.g., studios to 5+ room apartments)

Data are provided monthly by local construction authorities, selected special construction offices, and military construction bodies. The report is formatted for optical character recognition and used for processing by the CZSO and other government bodies.

▪ ***Notification on Demolition of a Building or Cancellation of a Dwelling (Form Stav 4-99)***

This statistical report captures data on all demolished buildings (both residential and non-residential) and cancelled dwellings.

Collected data includes:

- territorial identification for RSÚJ (same structure as Stav 7-99)
- technical parameters of demolished buildings
- number and types of cancelled dwellings, including living area and structure

The report is submitted monthly by local, special, and military construction authorities. Like Stav 7-99, it is formatted for optical scanning and serves as input for national statistical databases and planning tools.

▪ **Standards:**

▪ ***Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries – Part 1: Data schema***

Produced by: ISO Technical Committee ISO/TC 59/SC 13 “Organization of information about buildings and civil engineering works”

(ČSN EN ISO 16739-1 (730100) Datový formát Industry Foundation Classes (IFC) pro sdílení dat ve stavebnictví a ve facility managementu - Část 1: Datové schéma)

[ČSN EN ISO 16739-1](#) | [ČSN online](#)

▪ ***Buildings and civil engineering structures - Organization of information on buildings - Part 2: Framework for classification***

Produced by: ISO/TC 59/SC 13 - Organization of information about construction works

(ČSN EN ISO 12006-2 (730101) Budovy a inženýrské stavby - Organizace informací o stavbách - Část 2: Rámec pro klasifikaci)

[ČSN EN ISO 12006-2](#) | [ČSN online](#)

▪ ***Buildings and civil engineering structures - Organization of building information - Part 3: Framework for object-oriented information***

Produced by: ISO/TC 59/SC 13 in collaboration with CEN/TC 442 (BIM)

(ČSN EN ISO 12006-3 (730101) Budovy a inženýrské stavby - Organizace informací o stavbách - Část 3: Rámec pro objektově orientované informace)

[ČSN EN ISO 12006-3](#) | [ČSN online](#)

▪ ***Data structures for electronic product catalogues for building services - Part 1***

Produced by: ISO/TC 59/SC 13

(ČSN EN ISO 16757-1 (730112) Datové struktury pro elektronické katalogy výrobků pro technická zařízení budov)



[ČSN EN ISO 16757-1 | ČSN online](#)

- ***Building information modelling and other digital processes used in construction - Methodology to describe, author and maintain properties in interconnected data dictionaries***

Produced by: ISO/TC 59/SC 13 in collaboration with CEN/TC 442 (BIM)

(ČSN EN ISO 23386 (730113) Informační modelování staveb a další digitální procesy používané ve stavebnictví - Metodika pro popisování, vytváření a udržování vlastností v propojených datových slovnících)

[ČSN EN ISO 23386 | ČSN online](#)

- ***Building information modelling (BIM) - Data templates for construction objects used during the life cycle of built assets***

Produced by: ISO/TC 59/SC 13 in collaboration with CEN/TC 442 (BIM)

(ČSN EN ISO 23387 (730114) Informační modelování staveb (BIM) - Datové šablony pro stavební objekty používané v životním cyklu staveb)

[ČSN EN ISO 23387 | ČSN online](#)

- ***Building information modelling - Information structure based on EN ISO 16739-1 for data templates and data sheets exchange for construction objects - Part 2: Configurable construction objects and requirements***

Produced by: CEN/TC 442 (BIM)

(ČSN EN 17549-2 (730115) Informační modelování staveb - Struktura informací založená na EN ISO 16739-1 pro výměnu datových šablon a datových listů pro stavební předměty - Část 2: Konfigurovatelné stavební předměty a požadavky)

[ČSN EN 17549-2 | ČSN online](#)

- ***Library objects for architecture, engineering, construction and operation***

Produced by: ISO/TC 59/SC 13

(ČSN EN ISO 22014 (730116) Knihovní předměty pro architekturu, stavební obory, výstavbu a užívání staveb)

[ČSN EN ISO 22014 | ČSN online](#)

- ***Framework for building information modelling (BIM) guidance***

Produced by: [ISO/TC 59/SC 13](#)

(ČSN P ISO/TS 12911 (730121) Rámec pro návody na informační modelování staveb (BIM))

[ČSN P ISO/TS 12911 | ČSN online](#)

- ***Building information models - Information delivery manual - Part 1: Methodology and format***

Produced by: [ISO/TC 59/SC 13](#)

(ČSN EN ISO 29481-1 (730122) Informační modely staveb)

[ČSN EN ISO 29481-1 | ČSN online](#)

- ***Information container for linked document delivery - Part 1: Exchange specification***

Produced by: [ISO/TC 59/SC 13](#)

(ČSN EN ISO 21597-1 (730123) Informační kontejner pro předávání propojených dokumentů - Specifikace výměny)



[ČSN EN ISO 21597-1 | ČSN online](#)

▪ ***Building information modelling (BIM) - Semantic modelling and linking (SML)***

Produced by: [CEN/TC 442 \(BIM\)](#)

(ČSN EN 17632-1 (730124) Informační modelování staveb (BIM) - Sémantické modelování a propojování (SML))

[ČSN EN 17632-1 | ČSN online](#)

▪ ***Building information modelling - Level of information need***

Produced by: [ISO/TC 59/SC 13](#)

(ČSN EN ISO 7817-1 (730141) Informační modelování staveb - Úroveň informačních potřeb)

[ČSN EN ISO 7817-1 | ČSN online](#)

▪ ***Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM) - Information management using building information modelling - Part 1: Concepts and principles***

Produced by: [ISO/TC 59/SC 13](#)

(ČSN EN ISO 19650-1 (730150) Organizace a digitalizace informací o budovách a inženýrských stavbách včetně informačního modelování staveb (BIM) - Management informací s využitím informačního modelování staveb)

[ČSN EN ISO 19650-1 | ČSN online](#)

▪ **Publications:**

▪ ***Zero Carbon Roadmap - CZGBC - Overview of the Building Decarbonisation Strategy***

This publication outlines a comprehensive set of measures required to decarbonise the Czech building stock by 2050. It serves as a strategic framework for aligning energy, climate, and construction policies, aiming to ensure that buildings have a climate-neutral impact throughout their lifecycle – from construction and use to renovation and demolition. A key emphasis is placed on the need for reliable data collection and monitoring to support evidence-based policymaking. The document highlights strategic, legislative, and implementation steps including data-driven renovation planning, integration of low-carbon materials, renewable energy deployment, and public sector leadership. It stresses the importance of harmonising planning tools, supporting innovation and research, and increasing awareness and education across the building sector

▪ **EPD database:**

▪ ***Environmental database SBToolCZ***

Since 2022, the SBToolCZ assessment methodology requires the use of data primarily from environmental product declarations (EPDs), supplemented by generic data from the ecoinvent version 3.8 database. The use of the previously recommended envimat.cz tool is no longer permitted for assessment under the current methodology. Generic data can be obtained by direct access to the Ecoinvent database (for a fee) or indirectly through one of the specialised software programs that use this data. For others, the Czech Technical University in Prague offers the SBToolCZ Environmental Database to authorised SBToolCZ persons.

The SBToolCZ Environmental Database contains so-called unit data used for the assessment of criteria:

- Primary energy from non-renewable sources (E.PEE)
- Global warming potential (E.GWP)
- Acidification potential (E.ACP)



- Eutrophication potential (E.EUP)
- Ozone depletion potential (E.ODP)
- Ground-level ozone creation potential (E.POC)

<https://www.sbtool.cz/ometodice/environmentalni-database/>

▪ *EPD database in the Czech Republic*

The database contains Environmental Product Declarations (EPDs) developed in accordance with clearly defined Product Category Rules (PCRs) and duly verified under the Rules of the National Programme for Environmental Labelling (NPEZ). It provides transparent, credible data on the environmental performance of products across their life cycle.

<https://cenia.gov.cz/spolecenska-odpovednost/epd/database-epd/>

<https://www.ekoznacka.cz/database-epd-v-cr/>

▪ *Title of publication: Existing database of environmental parameters*

The list of existing databases for life cycle assessment results—particularly for construction materials with varying system boundaries—is provided below:

<http://www.envimat.cz/metodika/database/>

Poland

▪ **Regulation on Spatial Data Sets and Metadata in Spatial Development**

This regulation of the Ministry of Economic Development, Labour and Technology standardizes the creation and maintenance of spatial data and metadata related to spatial development. It defines classifications, attributes, relationships, coordinate systems, data formats and metadata structures to ensure the consistency and interoperability of spatial planning documents. An English summary is available:

<https://www.gov.pl/web/development-technology/new-spatial-data-creation-standards--spatial-planning-regulations-enter-into-force>

▪ **Geoportal.gov.pl - National Geoportal**

The Geoportal.gov.pl service of the Head Office of Geodesy and Cartography (GUGiK) serves as a central access point to Poland's spatial data infrastructure. It provides users with access to various spatial data sets, including cadastral maps, orthophotomaps, elevation models and administrative boundaries, supporting the needs of both public administration and the private sector.

<https://www.geoportal.gov.pl/en/data/>

▪ **Technical Instructions for Geodetic and Cartographic Works**

These technical instructions Head Office of Geodesy and Cartography (GUGiK) provide detailed guidelines for conducting geodetic and cartographic works in Poland. They cover aspects such as establishing geodetic control networks, developing base maps, maintaining the geodetic register of utilities, and preparing geodetic documentation for legal and design purposes. Available in Polish version.

<https://www.gov.pl/web/gugik/wytyczne-techniczne>

▪ **Act on Spatial Information Infrastructure (INSPIRE Implementation)**

This governments act implements the European INSPIRE Directive into Polish law, establishing the framework for creating and maintaining spatial information infrastructure. It mandates the sharing and interoperability of spatial data across various administrative levels and sectors.



▪ x0Digitisation of Spatial Planning

This initiative of Ministry of Economic Development and Technology focuses on improving access to spatial planning information through digitisation. It aims to accelerate investment and construction processes by making datasets on spatial planning documents available to the public via the internet. An English summary is available.

<https://www.gov.pl/web/development-technology/the-digitisation-of-spatial-planning---the-planning-data-available-to-the-public>

▪ LandCover.ai Dataset

LandCover.ai is a dataset designed for automatic mapping of buildings, woodlands, water, and roads from aerial imagery. It supports the development of machine learning models for land cover classification, aiding in environmental monitoring and urban planning.

<https://landcover.ai.linuxpolska.com>

▪ Spatial Data Infrastructure in Poland - Lessons Learnt

This paper discusses the development and implementation of spatial data infrastructure (SDI) in Poland, highlighting the challenges and achievements in standardizing spatial data across various sectors and administrative levels.

<https://journals.pan.pl/Content/103270/PDF/art01.pdf>

Italy

AgID (Agency for Digital Italy) has published the National Strategy for Artificial Intelligence 2024-2026, with guidelines open for public consultation until March 2025, aimed at ensuring the ethical, compliant, and controllable adoption of AI in public administration.

Although not specific to the construction sector, these guidelines represent a standard that can also be applied to the digital administrative management of the industry.

<https://www.agid.gov.it/it/ambiti-intervento/intelligenza-artificiale>

Germany

• ISO 19100 Series – Geographic Information Standards

Author: International Organization for Standardization (ISO/TC 211)

Description: The ISO 19100 family of standards defines the principles, methods, and best practices for geographic information, covering data acquisition, quality, metadata, and data exchange. Particularly relevant are:

ISO 19101 (Reference model)

ISO 19113 (Quality principles)

ISO 19115 (Metadata)

ISO 19133 (Tracking and navigation)

These ensure that spatial data collected—whether primary or secondary—meet defined levels of accuracy, completeness, and usability.

<https://www.iso.org/obp/ui/#iso:std:iso:tr:19120:ed-1:v1:en>

• AdV – AFIS-ALKIS-ATKIS Documentation (AAA model)



Author: Arbeitsgemeinschaft der Vermessungsverwaltungen der Länder der Bundesrepublik Deutschland (AdV) – Working Committee of the Surveying Authorities of the States of the Federal Republic of Germany

Description: The AAA model defines the standardised structure and content for Germany's official geospatial reference data:

AFIS: Official geodetic control points (surveying reference)

ALKIS: Official cadastral information (land parcels and buildings)

ATKIS: Topographic-cartographic information

It includes detailed documentation of data models, collection procedures, and quality assurance for field-surveyed and remotely sensed data.

<https://www.adv-online.de/Publications/>

- **AdV – GeoInfoDok** (Official Geoinformation Documentation)

Author: AdV

Description: GeoInfoDok describes the data models and documentation rules for the acquisition, management, and provision of official German spatial data. It defines the technical specifications and standards that surveying authorities use when collecting and providing data for ALKIS, ATKIS, and AFIS.

<https://www.adv-online.de/Publications/AFIS-ALKIS-ATKIS-Project/>

- **BKG – Guidelines on Geospatial Data Quality**

Author: Bundesamt für Kartographie und Geodäsie (BKG) – Federal Agency for Cartography and Geodesy

Description: The BKG provides national guidance for the acquisition, quality assurance, and use of geospatial data in Germany. This includes metadata standards, recommended coordinate reference systems, and accuracy specifications in line with INSPIRE and ISO standards.

<https://www.bkg.bund.de/EN/Home/home.html>

- **DIN 18710: Surveying – Field Procedures**

Author: German Institute for Standardization (DIN)

Description: DIN 18710 is a German standard that provides a framework for engineering surveys, focusing on establishing general principles, describing survey requirements, and promoting better communication between involved parties.

- **GDI-DE – Geodateninfrastruktur Deutschland** (Technical guidelines and standards)

Author: Koordinierungsstelle GDI-DE (hosted by BKG)

Description: Framework and technical rules for spatial data interoperability across German federal, state, and municipal levels. Closely aligned with INSPIRE requirements.

German portal: GDI-DE Portal (DE)

English overview: GDI-DE in English

<https://www.gdi-de.org/en/SDI/components/Geoportal.de>

Croatia

- **State Geodetic Administration of Croatia / UN-GGIM: Geospatial Information Management in Croatia (UN-GGIM Country Report) (2019)**

A comprehensive **overview** of Croatia's National Spatial Data Infrastructure (NSDI), detailing its legal basis (INSPIRE Directive compliance), institutional framework, geoportal services, and interoperability



standards. Essential for understanding how standardized spatial data supports digital construction workflows and asset management.

https://ggim.un.org/country-reports/documents/UN-GGIM_Report_Croatia.pdf

- **S Šamanović et al. (2024): Challenges and Opportunities for BIM-GIS Integration - BIRGIT Case Study**

A recent academic **case study** exploring the integration of BIM (Building Information Modelling) and GIS within Croatian infrastructure projects. It describes how detailed geometric and attribute data from BIM models can enrich spatial environmental analysis—critical for site surveys, circular reuse planning, and digital construction coordination.

The integration of **BIM and GIS** is increasingly crucial for **smart cities** and **digital twins**, but the industry still faces a significant **skills gap**. Research from the **BIRGIT project**, involving partners from **Sweden, Italy, Spain, Belgium, and Croatia**, reveals that many professionals lack the knowledge to combine these technologies effectively. Although integration efforts are progressing, they remain at an **early stage**. To address this, BIRGIT is developing **new educational programs** aligned with market needs. Such initiatives are essential to enhance professional capabilities, improve project management, and support better decision-making in construction and urban planning.

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

c. AI and Big Data

Artificial intelligence (AI) and big data are transforming the construction industry by enhancing project planning, resource management, and decision-making. AI technologies support automation, improve safety, and contribute to smarter, more sustainable building practices—especially in the context of smart cities and environmental goals. Meanwhile, big data analytics enables the analysis of vast information streams from sensors, software, and GPS tools, offering deep insights into project performance. Together, AI and big data empower construction professionals to optimise processes, reduce waste, and manage risks more effectively throughout a project's lifecycle. To use AI in the effective way, the real data from the stakeholders in construction sector extremely important. This is the reason why it is important to implement the technologies, that we can trust, as data spaces.

This approach, we can consider in holistic way across all sectors.

Guidelines and tutorials for AI and Big Data

- **European Approach to Artificial Intelligence**

The EU's AI strategy, based on the principles of excellence and trust, aims to boost research and industrial capacity while ensuring safety and fundamental rights.

<https://digital-strategy.ec.europa.eu/en/policies/european-approach-artificial-intelligence>

- **Digitalisation and AI Reshaping Competitiveness in the Construction Sector**

Analysis of how digitalisation and artificial intelligence are changing the competitiveness of the construction industry in Europe.

<https://build-up.ec.europa.eu/en/resources-and-tools/articles/digitalisation-and-AI-reshaping-competitiveness-construction-sector>

Hungary

- **Hungarian Artificial Intelligence Strategy (2020-2030)**

Author: Ministry for Innovation and Technology (ITM) & Neumann Nonprofit Ltd.



Description: This national AI strategy outlines Hungary's goals in research, industry development, education, and public sector AI adoption. It includes domain-specific focus areas, such as construction, smart cities, and digital infrastructure. Emphasizes the development of an AI ecosystem and data governance.

Link (English summary): <https://aihungary.com/en/ai-strategy>

- **Artificial Intelligence Coalition Hungary (MI Koalíció)**

Author: Digitális Jólét Program (Digital Success Program)

Description: A government-supported public-private coalition bringing together stakeholders from academia, industry, and public administration to promote responsible AI adoption. It includes working groups focusing on AI in construction, logistics, and urban development.

<https://aihungary.com/en/>

- **National Data Economy Strategy (2021-2030)**

Author: Ministry for Innovation and Technology (ITM)

Description: This strategy defines Hungary's roadmap to building a competitive data economy. It focuses on the interoperability of public and private data platforms, encourages open data, and promotes big data technologies in sectors including construction and infrastructure.

Link (PDF in Hungarian): <https://digitalisjoletprogram.hu/hu/tartalom/adatgazdasag-strategia>

- **Lechner Tudásközpont - Smart City Technologies and AI in Urban Development**

Author: Lechner Knowledge Center

Description: Ongoing projects and research into how AI and data analytics can support urban development, including traffic modeling, energy optimization, and predictive maintenance of public infrastructure. Supports smart city initiatives at the national and municipal levels.

<https://lechnerkozpont.hu> (Hungarian only - Search for "MI" or "okos város")

- **ÉMI Digital Construction Competence Center - AI for Construction Quality and Safety**

Author: ÉMI Nonprofit Kft.

Description: A national competence center exploring how AI and big data tools can improve quality control, safety monitoring, and predictive analytics in construction projects. Supports the testing and implementation of digital twins, sensor networks, and anomaly detection using AI.

<https://emi.hu> (Search for "digitális kompetencia központ" or "AI")

- **SZTAKI - AI and Machine Learning in Construction Research**

Author: Institute for Computer Science and Control (SZTAKI), Hungarian Academy of Sciences

Description: Academic research projects applying AI and big data analytics to smart buildings, real-time sensor networks, and predictive facility management. SZTAKI collaborates with industry partners to develop machine learning tools for the built environment.

<https://sztaki.hu/en>

- **Digitális Építőipar Platform (Digital Construction Platform)**

Author: Hungarian Chamber of Engineers (MMK) & Industry partners

Description: This platform promotes innovation and the digital transformation of the construction sector in Hungary. It provides guidance on integrating AI, BIM, IoT, and data analytics into planning and project execution phases.

<https://digitalisepitoipar.hu> (Hungarian only)



Czech Republic

- **National Artificial Intelligence Strategy of the Czech Republic Published By: Ministry of Industry and Trade of the Czech Republic**

The Czech National AI Strategy, approved in May 2019 (updated in 2024) with a plan until 2030, outlines the country's plan to become a global AI leader by integrating research, business, education, law, and international cooperation. Aligned with EU initiatives, it brings together government, organizations, and society to promote AI for economic growth while ensuring societal and business protection.

At the national level, this strategy builds on key government digitization efforts, especially the Digital Economy and Society (DES) plan, part of the broader Digital Czech Republic program. DES sets specific goals for AI, including the Czech Republic's active involvement in the EU, AI initiatives, support for AI development, consistent application of AI laws, and coordination of national and European digital programs.

Key goals include:

- Creating AI research centers and innovation hubs
- Supporting startups, small and medium-sized enterprises (SMEs), and domestic brands to thrive in AI-driven markets
- Expanding digital infrastructure and making more high-quality data available
- Developing AI skills through education programs to prepare the workforce for the future
- Establishing clear laws to protect fundamental rights, ensure security, and provide legal certainty for investors
- Promoting international collaboration, especially within the EU, to benefit from global AI advances.

Main coordinators and some goals allocated to each:

- National AI strategy
- Czech government: sets national laws and regulations regarding the use and implications of AI in the country. They want to foster AI growth while protecting society and business.

Goals:

- Remove legal barriers for AI startups
- Set legal frameworks for AI systems that protect personality and privacy, especially digital replicas of people
- Establish AI competence centers, certification labs, and cybersecurity excellence hubs.
- Pass laws supporting new AI-driven business models in the digital economy.
- Ministry of industry and trade
 - Setting up a special research center to explore how AI can be used in space research, either at a top European center or a technical university
 - Substantially increasing the current amount of research papers published in top scientific journals
 - Greater involvement in EU efforts to create top AI research hubs, testing facilities, and Digital Innovation
 - Working with public and private sectors to find and share data needed to train AI systems, and making it easier for researchers to access this data.

https://mpo.gov.cz/assets/cz/rozcestnik/pro-media/tiskove-zpravy/2019/6/NAIS_eng_korektura_06-19_web.pdf



Poland

- **National AI and Big Data Strategies Relevant to Construction**

- *Policy for the Development of Artificial Intelligence in Poland from 2020*

Published by Polish Ministry of Digital Affairs. This foundational strategy outlines Poland's vision for AI development across six pillars, including the economy, science, education, and public administration. It emphasizes the creation of a trustworthy data ecosystem and the integration of AI into sectors like construction and logistics.

<https://www.cliffordchance.com/content/dam/cliffordchance/briefings/2024/11/cb%20-%20projekt%20AI%20eng.pdf>

- *Poland AI Strategy Report for European Commission.*

This report provides an overview of Poland's AI policy initiatives, focusing on education reforms, support for AI companies, and the development of a high-quality data ecosystem. It also details the governance structures established to oversee AI policy enforcement.

https://ai-watch.ec.europa.eu/countries/poland/poland-ai-strategy-report_en

- *AI, Machine Learning & Big Data Laws and Regulations 2025 - Poland*

Published on Global Legal Insights

This legal guide covers Poland's regulatory landscape for AI and Big Data, including ownership rights, antitrust laws, and the implementation of the EU AI Act. It discusses the application of AI in various sectors, such as construction, and addresses issues like data protection and algorithmic transparency.

<https://www.globallegalinsights.com/practice-areas/ai-machine-learning-and-big-data-laws-and-regulations/poland/>

- *Construction-Specific Standards and Guidelines*

Construction-Specific Standards and Guidelines, like Building Information Modelling (BIM), Environmental Product Declarations (EPD) and EN 15804 Standard are described in the following chapters.

- **Local Government Initiatives**

- *Warsaw AI Guidelines*

City of Warsaw has developed AI guidelines focusing on ethical considerations, transparency, and public trust. These guidelines are part of the city's efforts to integrate AI responsibly into urban management, which can influence construction and infrastructure projects.

- **Additional Resources**

- *OECD AI Policy Dashboard - Poland*

An interactive platform providing updates on Poland's AI policies, strategies, and related news.

<https://oecd.ai/en/dashboards/countries/Poland>

- *AI Act Overview by Bird & Bird*

An analysis of the EU AI Act's implications, particularly concerning high-risk AI systems relevant to sectors like construction.



<https://www.twobirds.com/en/insights/2025/poland/the-ai-act-primarily-regulates-high-risk-ai-systems>

Italy

AgID (Agency for Digital Italy) has published the **National Strategy for Artificial Intelligence 2024-2026**, with guidelines open for public consultation until March 2025, aimed at ensuring the ethical, compliant, and controllable adoption of AI in public administration.

Although not specific to the construction sector, these guidelines represent a standard that can also be applied to the digital administrative management of the industry.

<https://www.agid.gov.it/it/ambiti-intervento/intelligenza-artificiale>

Germany

- **Gaia-X — European Data Infrastructure Initiative**

Author: BMWK (German Federal Ministry for Economic Affairs and Climate Action) & Gaia-X Association

Description: A project to develop a trusted and sovereign European data infrastructure. Gaia-X standards promote secure data sharing across sectors, including construction and smart cities.

<https://gaia-x.eu/>

- **Studie KI in der Bauwirtschaft** (AI in the construction industry)

Author: Fraunhofer IAO & Mittelstand-Digital Zentrum Bau

Description: A practical German-language guide that explains use cases, technologies, and implementation strategies for AI in the construction industry.

https://www.iuk.fraunhofer.de/content/dam/iuk/whitepapers/de/iao/2021_IAO_ST_KI%20in%20der%20Bauwirtschaft_DE.pdf (only German, English version not yet available)

- **AI Guidelines on the Use of Generative AI in Higher Education** (based on Hochschule Bayern's guideline)

Published by: Hochschule Bayern e. V. (in cooperation with Bavarian universities, including Hochschule München)

Date: February 2024

<https://www.dinmedia.de/de/technische-regel/din-spec-92001-1/303650673>

Croatia

- **Digital Croatia Strategy for the period until 2032**

Although not specific to construction, this strategic roadmap defines priorities for **digital transformation**, including digital skills, big data infrastructure, and data-driven innovation, which directly enable AI and smart data integration in the construction sector.

The Digital Croatia Strategy 2032, adopted by the Croatian Parliament in December 2022, outlines the country's long-term vision for digital transformation. Aligned with the EU's Digital Decade objectives, the strategy provides a framework for national, EU, and private investments in the digitalisation of society, the economy, and public administration. It sets strategic goals across four priority areas: developing an innovative digital economy, digitalising public administration, ensuring the availability and uptake of Very High Capacity Networks (VHCN), and enhancing digital competences for work and daily life. A major challenge identified is the gap between workforce skills and labour market needs, particularly the shortage of ICT professionals and the lack of STEM teachers in the primary and secondary education system. Additionally, the low participation of citizens in lifelong learning hinders



the widespread acquisition of digital skills. To address these issues, the strategy focuses on increasing the number of ICT specialists, improving digital literacy among citizens, and supporting digital transformation in education and research. Ultimately, Croatia aims to become a digitally advanced and economically competitive country by fostering a supportive regulatory and investment environment, enhancing public and private sector innovation, and investing in human capital.

https://mpudt.gov.hr/UserDocsImages/RDD/SDURDD-dokumenti/Strategija_Digitalne_Hrvatske_final_v1_EN.pdf?lang=de

d. Blockchain technology and IoT

Since the construction industry's supply chain has complex subcontracting and liabilities, it is necessary to offer transparent value transactions. Blockchain technology serves as a secure way to trace materials. Additionally, tagging technologies such as quick response (QR) codes and radio frequency identification system (RFID) chips are also interesting for material tracking. In the "ETH Reuse Dome" built with my research group, we engraved QR codes onto every building component leading directly to the material passport. Tagging methods also enable us to use the Internet of Things (IoT) to gather, store, and transmit data on the condition and availability of material using cloud computing and wireless sensor networks.

Guidelines and tutorials for blockchain technology and IoT

- **Simplilearn**

A Blackstone company, Simplilearn is the world's leading digital skills training provider, enabling learners across the globe with new-age digital skills.

<https://www.simplilearn.com/tutorials/blockchain-tutorial/blockchain-technology>

- **IEEE blockchain**

IEEE recognizes the vital role standards will play in the development and adoption of blockchain technologies. IEEE Standards Association (IEEE SA), a globally recognized standards-setting body within IEEE, has been actively pursuing blockchain standardization efforts through various activities in multiple industry sectors. The IEEE Blockchain Technical Community will collaborate with IEEE SA to further develop and progress blockchain related standards.

<https://blockchain.ieee.org/>

Hungary

- **Blockchain Hungary - National Blockchain Strategy (2022-2030)**

Author: Ministry for Innovation and Technology (ITM), Neumann Nonprofit Kft.

Description: Hungary's official Blockchain Strategy aims to introduce and regulate blockchain applications across public services and industries, including construction, logistics, and energy. It promotes traceability of materials, smart contracts, and decentralized data sharing in supply chains.

English summary: <https://blockchainhungary.hu/en>

- **Blockchain Coalition Hungary (Blockchain Koalíció)**

Author: Digitális Jólét Program (Digital Success Program)

Description: A government-supported ecosystem for developing blockchain-based solutions in Hungary. It includes working groups for digital identity, traceability, smart contracts, and materials passporting – relevant for construction sector innovations.

<https://blockchainhungary.hu>



- **IoT Hungary - Internet of Things Application Network**

Author: Hungarian IoT Association (IoT Szövetség)

Description: A professional body promoting the adoption of IoT technologies across various sectors, including construction, utilities, and smart cities. It supports guidelines, training, and project matchmaking for deploying sensor networks, RFID tracking, and cloud-based monitoring systems.

<https://iotszovetseg.hu> (Hungarian only)

- **Lechner Tudásközpont - Smart Infrastructure and Material Tracking Pilots**

Author: Lechner Knowledge Center

Description: Research and pilot projects using RFID/QR-tagged construction elements combined with BIM databases and IoT sensor systems. Lechner's work includes material passporting for sustainability tracking and smart building infrastructure monitoring.

<https://lechnerkozpont.hu> (Search for “IoT”, “anyagkövetés”, or “okos infrastruktúra”)

- **Budapest Smart City Strategy - IoT for Infrastructure and Maintenance**

Author: Municipality of Budapest

Description: The smart city strategy for Budapest includes extensive IoT deployment for infrastructure monitoring, traffic, environmental sensors, and waste management. It encourages open APIs and digital interfaces to integrate urban data streams into decision-making platforms.

<https://smartcitybudapest.hu/en> - overview in English

- **Budapest University of Technology and Economics (BME) - Blockchain & IoT Research in Construction**

Author: Department of Construction Technology and Management (Építéstechnológia és Szervezés Tanszék)

Description: Ongoing academic research into how blockchain and IoT can improve construction logistics, prevent material fraud, and enable circularity through traceable building components. Projects explore use of QR tagging and distributed ledgers for sustainable construction.

<https://epito.bme.hu> (Search for “blockchain”, “IoT”)

- **Neumann Nonprofit Ltd. - Blockchain for Digital Public Infrastructure**

Author: Neumann Nonprofit Ltd. (Digital Government Agency)

Description: As a national digital transformation body, Neumann works on integrating blockchain technologies into digital public infrastructure. Although sector-agnostic, its strategies impact permitting, material certification, and document authentication relevant to construction.

<https://neumannproject.hu>

Czech Republic

- **The Strategic Plan for the Digitalization of Czechia by 2030**

Author: Digitální Česko

This plan is aligned with the EU's Digital Decade Policy Programme 2030, it outlines the country's path toward digital transformation. It focuses on enhancing digital infrastructure, skills, business digitalization, and public services. While it does not explicitly detail guidelines for blockchain and IoT technologies, it emphasizes the importance of adopting advanced digital tools across sectors. This includes leveraging technologies like blockchain for secure data management and IoT for real-time



monitoring and automation, particularly in industries such as construction, manufacturing, and public services.

https://digitalnicesko.gov.cz/media/files/The_Path_to_Europes_Digital_Decade_The_Strategic_Plan_for_the_Digitalization_of_Czechia_by_2030_oOROu6l.pdf

- **The Potential of Decentralized Technologies for the Development of the Czech Economy**

Published By: Ministry of Industry and Trade

The publication "The Potential of Decentralized Technologies for the Development of the Czech Economy" explores how blockchain and other decentralized technologies (BDLT) can address key limitations of the current internet architecture, such as the lack of native identity verification, trust mechanisms, and secure value transfer. It highlights how these technologies could reduce costs in the digital economy, combat disinformation, and enhance data control and auditability. BDLT promises to increase liquidity of digital assets, support tokenized economies, and improve sectors like finance, logistics, public administration, and national security. The study emphasizes the need for legal and regulatory reforms in the Czech Republic—particularly in securities law—to enable broader deployment of digital assets. It also outlines strategic recommendations for the Czech government, including adopting international legal standards (e.g., MLETR), fostering innovation, and supporting research on the social and economic impacts of decentralization.

https://mpo.gov.cz/assets/cz/podnikani/digitalni-spolecnost/2020/1/Potencial_decentralizovanych_tehnologii_pro_rozvoj_ceske_ekonomiky.pdf

- **Existing solution/initiatives:**

- *National Blockchain Registry (NABRE)*

National Blockchain Registry (NABRE) is an innovative ecosystem based on blockchain technology, currently uniting 36 companies and institutions. It leverages cutting-edge technologies such as blockchain, 5G mobile networks, and future integration of artificial intelligence to ensure the integrity and authenticity of digital data across various industries, commerce, and services. NABRE enables users to verify in real time the authenticity of information, event progress, and process status, providing robust protection against unauthorized data manipulation. A key feature is the concept of a "digital trustee," which can authenticate video recordings (e.g., shipment packaging, skill certification tests, or important statements), effectively preventing tampering or deepfake manipulation. NABRE also includes a secure online voting application ("per rollam") that offers blockchain-backed auditability of voting results, adaptable to clients' branding and ideal for virtual meetings or board sessions.

Poland

- **BAIOT Project: Blockchain and IoT for Environmental Education**

BAIOT startup, in collaboration with the Polish Blockchain Association and the city of Mińsk Mazowiecki. An initiative where students collected plastic caps, which were tracked using IoT devices. The collected data was recorded on the BSV blockchain, and students received Non-Fungible Tokens (NFTs) in exchange, promoting environmental awareness through technology.

<https://bsvblockchain.org/news/baiot-project-showcasing-how-blockchain-can-help-tackle-environmental-challenges/>

- **Poland's Draft Cryptoassets Market Act (2024)**

Polish Ministry of Finance prepared a legislative proposal aligning with the EU's Markets in Crypto-Assets Regulation (MiCA), introducing licensing requirements for Virtual Asset Service Providers (VASPs) and setting compliance deadlines.

<https://www.dudkowiak.com/blog/new-draft-of-polish-act-on-cryptoassets-market/>



- **Blockchain Unchained Report**

Instytut Kościuszki (Kościuszko Institute) published a comprehensive report discussing the potential of blockchain technology in Poland, including its applications in various sectors and the need for regulatory frameworks.

https://ik.org.pl/wp-content/uploads/2023/11/blockchain_unchained_report_online.pdf

- **Integration of IoT, BIM, and Blockchain for Construction**

Researchers in the field of construction technology published a study proposing a framework that combines IoT, Building Information Modeling (BIM), and blockchain to enhance data traceability and transparency in construction projects.

<https://www.sciencedirect.com/science/article/pii/S0926580524000025>

- **European Standards and Guidelines**

- *EN 17927:2023 - Security Evaluation Standard for IoT Platforms (SESIP)*

European Committee for Standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC) prepared a standard providing a methodology for evaluating the security of IoT platforms, supporting compliance with EU regulations like the Cyber Resilience Act.

- *IEEE 2144.1-2020 - Framework for Blockchain-based IoT Data Management*

IEEE Standards Association published standard outlines a framework for managing IoT data using blockchain technology, focusing on data integrity and security.

<https://blockchain.ieee.org/standards>

- *Draft Standard for Blockchain-based Zero-Trust Framework for IoT*

At StandICT.eu portal was published a draft standard proposing a zero-trust access control framework for IoT applications, leveraging blockchain for enhanced security.

<https://standards.ieee.org/ieee/3219/11163/>

- *ISO/IEC 27400 Series - IoT Security and Privacy Guidelines*

International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) prepared a series of standards providing guidelines for securing IoT devices and ensuring privacy, relevant for integrating IoT in construction projects.

Italy

- **BuildingSMART Italia (the Italian chapter of IBIMI)** has developed specific operational guidelines (between 2021 and 2023) dedicated to the use of blockchain in construction, including:

- Application of blockchain in a CDE (Common Data Environment) to record data exchange, including smart contracts and an immutable register of information flows.
- Dematerialisation of construction site documents, with long-term digital certification.
- Integration of blockchain into the BIM process for existing buildings, to certify diagnostic data, materials, DoPs, as-built status and planned interventions.

These guidelines are not mandatory, but they constitute a recognised reference for the design and validation of DLT- and smart contract-based platforms in the construction sector.

<https://www.buildingsmartitalia.org/utenti/publicazioni/linee-guida-blockchain/>

- **Project work and regional case studies** (Emilia Romagna, BLOCH4MAT)



As part of the Smart Specialisation Strategy S3 (FESR 2021 27), the Emilia Romagna Region co-financed the BLOCH4MAT project, which focuses on the traceability of construction materials (ceramics, bricks, etc.) using blockchain integrated with BIM and smartCE. The aim is to ensure transparency throughout the production chain, validity and interoperability between different actors.

<https://www.bloch4mat.it/progetto/>

Germany

- **DIN SPEC 16597:2018 – Terminology for Blockchains**

Author: German Institute for Standardization (DIN)

Description: Defines standard terminology for blockchain and distributed ledger technologies applicable across industries, facilitating clarity and interoperability. Often referenced as a foundation for other DIN blockchain specs.

<https://www.dinmedia.de/de/technische-regel/din-spec-16597/281677808>

- **DIN SPEC 3103:2019 – Blockchain & Distributed Ledger Technologies in Industry 4.0 Scenarios**

Author: German Institute for Standardization (DIN)

Description: Illustrates application scenarios for blockchain and DLT within Industry 4.0. Includes use cases, sequence diagrams, and decision support guidance—suitable for construction material tracking and supply chain integration.

<https://www.dinmedia.de/de/technische-regel/din-spec-3103/306199037>

- **ISO/TS 23635:2022 – Blockchain & DLT: Guidelines for Governance**

Author: International Organization for Standardization (ISO/TC 307)

Description: Governance framework for DLT systems, vital for trust and compliance in material tracking systems. It covers accountability, transparency, risk management, interoperability, and life cycle stages.

<https://www.iso.org/standard/76480.html>

- **EN 17927:2023 – Security Evaluation Standard for IoT Platforms (SESIP)**

Author: CEN / CENELEC, referenced by ENISA

Description: European standard for cybersecurity evaluation of IoT platforms (e.g. RFID, sensors), defining five assurance levels. Critical for secure tracking of materials in construction via IoT-enabled tags.

English version: Full standard published in English (EN) Wikipedia+1SpringerLink+1.

Croatia

- **CROBOHUB++ - EDIH for Blockchain, IoT & Smart Sensors (Croatia)**

CROBOHUB++ is a national Digital Innovation Hub supporting SMEs and public agencies in deploying Blockchain, IoT, robotics, and smart sensors. Offers services such as technology transfer, pilot testing, training, and digital prototyping—ideal for construction sector experimentation and circular practices.

<https://crobohub.fer.hr/>

- **Blockchain Technology in the Process of Financing the Construction and Purchase of Commercial Vessels (Case Study), Authors: Zoran Kunkera, Dragutin Lisjak, Nataša Tošanović et al.**



Although focused on the maritime sector, this 2025 case study demonstrates how **Blockchain-based smart contracts** can streamline financing processes, enhance transparency, and reduce legal and operational costs. The concepts and mechanisms are transferable to construction contract workflows and resource management in building projects.

<https://www.mdpi.com/1911-8074/18/4/169>

e. Digital Twin

A digital twin, also called data twin, is a digital representation of a real-world object. Digital twins have many applications outside the built environment, and are used in the automotive, healthcare, systems engineering, and aerospace industries. In construction, a digital twin is an exact digital replica of a construction project or asset: A building or group of buildings, a bridge, a highway, a city block, or even an entire city. Digital twins in construction can also be called data twins, virtual models or even next-generation as-built drawings.

The importance of the creation of Digital Twin is that they are constructed on federative principles. The added value of this approach is flexibility and unstopped development.

Guidelines and tutorials for digital twin

- **StandICT.eu - Standards Supporting Digital Transformation**

Standards to support the digital transformation of the construction industry, with particular reference to the use of digital twins.

<https://www.standict.eu/news/standards-supporting-digital-transformation-construction-industry>

- **Webinar - Practical Tools for the Construction Sector in Digital Twin**

Webinar presenting practical tools for using digital twins in the construction industry.

<https://build-up.ec.europa.eu/en/resources-and-tools/audio-visual-resources/webinar-practical-tools-construction-sector-digital-twin>

Hungary

- **Lechner Tudásközpont - Digital Twin for Urban Management and Planning**

Author: Lechner Knowledge Center

Description: Lechner is leading national efforts to apply digital twin technology for urban and regional development. Projects include integrating BIM, GIS, IoT, and public data into spatially anchored digital twins for municipalities. Emphasis on energy efficiency, infrastructure lifecycle management, and spatial planning tools.

<https://lechnerkozpont.hu> (Search for: “digitális iker”, “városmodellezés”)

- **Budapest Digital Twin Pilot - Smart City Data Integration**

Author: Municipality of Budapest, BKK, BME, Lechner

Description: A pilot project to create a digital twin of Budapest using real-time traffic data, sensor networks, and urban infrastructure models. Aims to support decision-making in transportation, zoning, and climate adaptation.

<https://smartcitybudapest.hu/en> (Digital Twin featured in Smart Mobility and Smart Governance sections)



- **ÉMI Nonprofit Kft. - Digital Twin for Infrastructure Lifecycle Monitoring**

Author: ÉMI Nonprofit Ltd.

Description: National construction research institute applying digital twin principles to monitor buildings and infrastructure. Projects involve integrating sensor data (IoT) with BIM to simulate structural conditions, maintenance needs, and energy use in real time.

<https://emi.hu> (Hungarian - search: “digitális iker”, “épületmonitorozás”)

- **BME (Budapest University of Technology and Economics) - Digital Twin Research Group**

Author: Department of Construction Management and Department of Urban Planning

Description: Interdisciplinary research into the use of digital twins in urban planning, facility management, and construction logistics. Focus on developing interoperable platforms linking BIM, GIS, and simulation data for real-time project tracking and prediction.

<https://epito.bme.hu> (Hungarian)

- **Hungarian Smart City Platform - Digital Twin Framework**

Author: Digitális Jólét Program (Smart City division)

Description: The national smart city platform encourages municipalities to adopt digital twin frameworks for city planning, infrastructure resilience, and digital public services. Offers templates and use cases for Hungarian cities to implement their own digital twins.

<https://okosvaros.lechnerkozpont.hu> (Hungarian - search: “digitális iker”, “városmodell”)

- **Neumann Nonprofit Kft. - Digital Twin and Public Asset Management**

Author: Neumann Nonprofit Ltd.

Description: National body for digital government promoting digital twin use in asset management, public works supervision, and digital permitting. Supports integration of twins into Hungary’s “e-közmű” (utility mapping) and “e-építési napló” (construction logbook) systems.

<https://neumannproject.hu> (Hungarian)

- **Pécs Digital Twin Concept - University and City Collaboration**

Author: University of Pécs & City of Pécs

Description: Collaboration on developing a digital twin of the historical city for smart tourism, traffic control, and heritage building management. Combines 3D scans, IoT, and public GIS data.

Project info available via University of Pécs Faculty of Engineering and Information Technology

<https://mik.pte.hu/en>

Czech Republic

- **Digital twins for transportation in smart cities**

Published by: Faculty of Transportation Sciences CTU In Prague

In Prague, the TAČR D3E project is developing a living laboratory to test smart city transport technologies. Central to the project is a Transport Digital Twin that mirrors real-time traffic to evaluate and improve smart solutions. It explores adaptive algorithms, autonomous systems, and intelligent infrastructure, focusing on traffic management.

While the initiative primarily focuses on smart city transport, it has direct implications for the construction sector, especially in urban planning and infrastructure development. Additionally the Digital Twin can be mirrored into construction development.



<https://intranet.fd.cvut.cz/en/students/project-detail.html?kod=441>

- **BIM Dictionary**

The BIM Dictionary is a collaborative project under the BIME Initiative aimed at providing a reliable, peer-reviewed reference for commonly used terms in the built environment. It links hundreds of terms to verified definitions and translations, supporting shared understanding and connecting to related guides and tools.

<https://bimdictionary.com/>

- **Projects:**

- *RECONMATIC - Automated Solutions for Sustainable and Circular Construction and Demolition Waste Management*

The Horizon Europe project RECONMATIC aims to revolutionize the management of construction and demolition waste (CDW), which accounted for nearly 36% of total EU waste in 2018. Recognizing the low-value reuse of CDW and the industry's preference for certified primary materials, the project will develop digital and automated solutions to enhance waste handling across the entire building lifecycle. It will focus on material sorting, pre-demolition audits, selective deconstruction, and real-time monitoring, while also addressing broader issues like business models, sustainability, and market readiness. RECONMATIC seeks to drive a shift towards a zero-waste, circular construction economy.

<https://www.reconmatic.eu/>

Poland

- **Polish Context and Legal Framework**

- *Amendment to the Polish Construction Law (2023)*

Polish Parliament in January 2023, amended Polish its Construction Law to facilitate digital processes in construction. This change simplifies the maintenance of documentation related to the development process and building facilities, paving the way for digital twin adoption by streamlining digital documentation and compliance procedures.

<https://dwfgroup.com/en/news-and-insights/insights/2023/2/digital-changes-to-construction-law-regulations>

- **European Standards and Initiatives**

- *CEN/TR 18077:2024 - Digital Twins Applied to the Built Environment*

European Committee for Standardization (CEN), Technical Committee 442 provided technical report about concepts and principles to establish a methodology for specifying the level of information need and information deliveries in a consistent way when using Building Information Modelling (BIM). It covers the entire lifecycle of built assets, from strategic planning to end-of-life.

<https://standards.iteh.ai/catalog/standards/cen/0773163a-2eb7-4a70-a6ee-4914d1049917/cen-tr-18077-2024>

- *ASHVIN Project - Digital Twins for a More Efficient, Reliable, and Safe Construction Industry*

European Union Horizon 2020 Programme ASHVIN project aims to improve productivity, reduce costs, and ensure safe working conditions in the European construction industry by using digital twins. It focuses on creating a European digital twin standard and an open-source platform integrating IoT and image processing technologies.

<https://www.upc.edu/en/press-room/news/digital-twins-for-a-more-efficient-reliable-and-safe-construction-industry>



- **International Standards and Frameworks**

- *IEC 81346 Series - Reference Designation System for Power Plants, Industrial Systems, and Equipment*

International Electrotechnical Commission (IEC) provides series of rules for structuring and reference designation in industrial systems, which is essential for the consistent organization of information in digital twins.

<https://webstore.iec.ch/en/publication/6028>

- **Educational Resources and Tutorials**

- *Digital Twin Conceptual Framework for the Operation and Maintenance Process of Cubature Building Objects*

Andrzej Szymon Borkowski published an academic paper that presents a conceptual framework for the operation and maintenance phase of building objects using digital twins. It considers the integration of IoT and AI technologies and can be adapted to infrastructure facilities or city fragments.

<https://arxiv.org/pdf/2308.13873>

- *Digital Twins in Construction: Your Complete Guide 2024*

Development company Program-Ace shares publicly available comprehensive guide that explores the main points about digital twin usage in construction and the value it brings to optimize processes. It covers benefits, challenges, implementation steps, and real-world applications.

<https://program-ace.com/blog/digital-twins-in-construction/>

Italy

According to industry experts, there is still a lack of widespread data culture and advanced digital skills in the Italian construction sector: the digital twin is still more of a vision than an established practice, often limited to large clients or complex infrastructures.

<https://www.ingegno-web.it/articoli/i-limiti-della-digitalizzazione-nelle-costruzioni-e-la-fine-della-grande-narrazione-sulla-transizione-gemella>

Germany

- **Digitaler Zwilling Bundesfernstrassen (Digital twins Federal Highways)**

Author: Federal Highway and Transport Research Institute (BaSt)

Description: Introduction and application of the BIM method for planning, construction and management of federal highways in Germany, with the aim of enabling efficient, transparent and sustainable infrastructure development through the digital twin used as a comprehensive, dynamic model to integrate and analyze the entire life cycle information of the roads in real time.

https://www.bim-bundesfernstrassen.de/fileadmin/user_upload/Rahmendokumente/bim-rd-digitaler-zwilling-definition.pdf

- **ASHVIN Project Deliverables - Digital Twin Interoperability in Construction**

Author: EU-funded ASHVIN Consortium (various universities including Technical University of Berlin)

Description: A set of technical deliverables and guidelines covering digital twin interoperability, privacy/safety, IoT data pipelines, KPIs for monitoring, and simulation models aimed at construction scenarios.



<https://www.ashvin.eu/>

- **Standardization Plan for Digital Twin (StandICT.eu / ASHVIN)**

Author: StandICT.eu 2023 community, under EU digital standardization initiatives

Description: A roadmap and standardization effort to define reference architectures and consensus standards for digital twins in the European construction industry.

<https://standict.eu/>

- **Plattform Industrie 4.0 / RAMI 4.0 - Asset Administration Shell**

Author: Plattform Industrie 4.0 & ZVEI, under support of German Federal Ministry for Economic Affairs

Description: The Industry 4.0 reference architecture model (RAMI 4.0) and Asset Administration Shell concept provide standardized patterns for representing digital twins of physical assets—fully relevant to construction infrastructure components.

https://www.plattform-i40.de/IP/Redaktion/DE/Downloads/Publikation/AAS-ReadingGuide_202201.pdf?__blob=publicationFile&v=1

Croatia

- **Video material: Mateo Viškanić: Digital Twins of Underwater Infrastructure and Analysis of Changes Over Time**

The Centre for Digital Built Croatia was established in 2022 by construction enthusiasts with the aim of promoting digital solutions across all processes and projects within the construction industry. The Centre brings together representatives from the public sector, industry leaders, universities, individual enthusiasts, and all those who wish to make their daily work more efficient and of higher quality. The website features a wide range of video materials that may be used as guidelines - also on the topic of **Digital Twins of the Seabed - Technology in the Service of Coastal Infrastructure** - How can we monitor changes in underwater structures over time? The video material offers fascinating insight into the application of digital twins in underwater environments. The lecture offers to discover the process of digitalizing underwater infrastructure - from data collection using advanced technologies, through the creation of precise 3D models, to comparing conditions across time intervals. Digital twins enable more efficient inspection, maintenance, and long-term management of coastal systems.

<https://cdih.hr/en/youtube/digitalizacija-hrvatskog-graditeljstva-rijeka/>

- **Developing of a Digital Twin for Urban Planning in an International Context**

Authors: Darko Šiško, Vlado Cetl, Hrvoje Matijević (University North & University of Zagreb)

The digital twin, tailored for urban planning and monitoring, is currently being explored and developed across academic, commercial, and public sectors. This article, that may be used as a tutorial, places the concept in an international context, examining both theory and real-world application in terms of maturity, scope, purpose, structure, data input, processing capabilities, and output. As a case study, the City of Zagreb is highlighted for its use of GIS and 3D city models in urban planning and its ongoing efforts toward becoming a digital twin city. Drawing from research and local conditions, a digital twin model was proposed to support urban planning needs, along with identifying key future challenges.

https://www.researchgate.net/publication/386151243_Developing_of_a_Digital_Twin_for_Urban_Planning_in_an_International_Context

f. Augmented Reality and Virtual Reality

Augmented Reality is successfully used in construction project scheduling, progress tracking, worker training, safety issue, time and cost management, quality and defects management. Virtual Reality is



effectively used as visualization tools, worker training technologies, safety management tools, and quality and defects management tools. AR and VR are also used for developing a network that allows the possibility of having conferences with those who are geographically far off from each other.

Guidelines and tutorials for AR and VR

- **Virtual and Augmented Reality Industrial Coalition**

A platform created by the EU to provide a structured dialog between the VR/AR ecosystem and decision makers.

<https://digital-strategy.ec.europa.eu/en/policies/virtual-and-augmented-reality-coalition>

- **Construction with Augmented Reality (AR) and BIM - IMMERSIA**

Shows how AR and BIM integration improves visualization and collaboration on construction projects.

<https://immersia.eu/en/construction-with-augmented-reality-ar-and-bim-enhancing-visualization-and-collaboration-in-innovative-projects/>

Hungary

- **BME - Virtual Construction Training Platform**

Author: Budapest University of Technology and Economics (BME), Department of Construction Technology and Management

Description: Development of an immersive VR training platform to simulate construction site scenarios for engineering students and professionals. It includes safety training modules, construction sequencing, and equipment handling.

<https://epito.bme.hu> (Hungarian - search: “virtuális valóság”, “VR oktatás”, “építési szimuláció”)

- **SZTAKI AR/VR Laboratory - Industrial AR/VR for Design and Manufacturing**

Author: Institute for Computer Science and Control (SZTAKI), Hungarian Academy of Sciences

Description: SZTAKI develops AR/VR tools for design visualization, product lifecycle management, and smart manufacturing, with applications extending to construction technology and prefabrication.

<https://www.sztaki.hu/en> (See Research > Virtual and Augmented Reality)

- **Lechner Tudásközpont - AR Visualization in Urban Planning and Heritage Protection**

Author: Lechner Knowledge Center

Description: AR-supported tools developed for visualizing urban development projects, heritage site reconstructions, and zoning impacts. Enables planners and citizens to engage with 3D visual content on-site via mobile apps.

<https://lechnerkozpont.hu> (Hungarian - search: “kiterjesztett valóság”, “örökségvédelem AR”)

- **VR Learning for Skilled Construction Workers (GINOP Project)**

Author: Ministry for Innovation and Technology (GINOP), various technical schools

Description: EU-funded vocational training project using VR to simulate worksite scenarios such as scaffolding, welding, and concrete work. Designed for early-stage apprentices to reduce on-site risks during training.

<https://ginop.ifka.hu> (Hungarian - search: “VR építőipar”, “virtuális oktatás”)

- **Pécs VR Campus - Architecture and Heritage Visualization**

Author: University of Pécs, Faculty of Engineering and IT (MIK)



Description: The university runs a VR lab for architectural visualization, urban design walkthroughs, and historical reconstruction of buildings. Projects have included VR-based public consultations and exhibitions.

<https://mik.pte.hu/en>

- **Hungarian VR/AR Association (Magyar VR/AR Szövetség)**

Author: Independent professional association

Description: A national platform supporting AR/VR adoption in education, architecture, health care, and industry. Provides networking, policy proposals, and guidelines for immersive technology deployment.

<https://vrarszovetseg.hu> (Hungarian)

- **MOME - Moholy-Nagy University of Art and Design - Immersive Technology Lab**

Author: MOME TechLab

Description: Research and prototyping in VR/AR for architecture, interior design, and interactive installations. Supports student projects and collaboration with public and private sector on virtual storytelling and spatial immersion.

<https://tech.mome.hu>

Czech Republic

- **Augmented Reality as a 3D Land Cover Visualisation Technique**

Published by: Czech Technical University in Prague

Institutions like the Czech Technical University in Prague explore AR as a 3D visualization method for land cover development.

Their work on Augmented Reality as a 3D Land Cover Visualization Technique explores how AR can be used to present detailed land cover data in three dimensions, providing a powerful tool for planning and environmental assessment in construction projects.

This research advances the understanding of how AR can integrate with geographic information systems (GIS) and cartography to enhance spatial awareness and project planning.

<https://ojs.cvut.cz/ojs/index.php/cej/article/view/9927>

- **Virtuplex company**

Virtuplex is a Czech-origin company developing VR and AR solutions for the built environment. It operates large-scale VR labs in Prague, Bratislava, and Dubai, offering spaces where users can explore full-scale virtual models of buildings. Their platform enables architects, designers, and clients to collaboratively test spatial layouts, validate design concepts, and make real-time decisions. Examples of their work include: railway station in Prague, shopping malls, residential and office buildings.

<https://www.virtuplex.com/>

- **Project DIGIS**

The DIGIS project (2021-2023, Erasmus+ funded) aimed to enhance digital programming skills in the rapidly growing fields of drone technology and virtual reality (VR) across five EU countries. It developed new VET (Vocational Education and Training) qualifications for drone programmers/operators and VR application developers by designing two-year curricula, creating online learning platforms, and testing the programs with students and teachers. The project also focused on gaining EU-wide recognition for these qualifications, improving employability, and aligning training with industry needs to support innovation, job creation, and sustainable growth in the digital economy.



<https://erasmusplus-digis.com/about-digis/>

- **The master's programme Digitalization in Construction**

The master's programme Digitalization in Construction (1.5 years, degree: Ing.) at Czech Technical University focuses on developing IT and digital skills for effective construction project management. It combines theoretical learning with hands-on experience, including a mandatory internship and interdisciplinary teaching from construction and IT faculties. Students gain expertise in BIM, VR/AR, programming, 3D scanning, and digital modeling using advanced tools and software. Graduates are prepared for roles such as digital construction engineers, project managers, BIM consultants, software developers, and sustainability specialists, strengthening their competitiveness in the modern construction sector.

<https://www.fsv.cvut.cz/uchazeci/magisterske-studium/digitalizace-ve-stavebnictvi/>

- **Virtual and augmented reality in practice on construction sites. See the future of construction - Interview**

The article on the ESTAV.cz portal presents the use of virtual reality (VR) and augmented reality (AR) in the construction industry, particularly in the design, construction, and operation of buildings. The main guest is Erik Štefanovič, CEO of DELTA Group Czech Republic, a company that is already applying these technologies in practice.

<https://www.estav.cz/cz/10150.virtualni-i-rozsirena-realita-v-praxi-na-stavbach-podivejte-se-na-budoucnost-stavebnictvi>

Poland

- **Polish Guidelines and Resources**

- *Readiness to Use Augmented Reality Solutions in SMEs in Poland*

ResearchGate Publication presents survey results assessing the readiness of Polish small and medium-sized enterprises (SMEs) to adopt AR technologies, highlighting opportunities and challenges in the Polish industrial sector⁴.

- *VR/AR Association - Poland Chapter*

VR/AR Association provides a platform fostering collaboration among VR/AR professionals, startups, and companies in Poland, promoting the adoption and development of immersive technologies in various sectors, including construction.

<https://www.thevrara.com/resources>

- *NobleProg AR/VR Training Programs in Poland*

NobleProg offers instructor-led training courses in Poland focusing on the application of AR/VR technologies across industries, including construction, enhancing skills in implementing immersive solutions.

<https://www.nobleprog.pl/en/cc/aiarvria>

- **European and International Guidelines**

- *Extended Reality in Construction: AR, VR, and MR*

Pinnacle Infotech explores the integration of extended reality technologies in construction, highlighting their impact on project planning, execution, and management to enhance collaboration and efficiency

⁴https://www.researchgate.net/publication/349049311_Readiness_to_Use_Augmented_Reality_Solutions_in_Small_and_Medium_Enterprises_in_Poland_A_Survey



<https://pinnacleinfotech.com/extended-reality-in-construction-guide-to-ar-vr-mr-xr/>

- *Case Studies and Benefits of Augmented Reality in Construction*

Nsflow presents real-world applications and advantages of AR in the construction industry, including improved design visualization, on-site guidance, and enhanced safety training.

<https://nsflow.com/blog/case-studies-and-benefits-of-augmented-reality-in-construction>

- *Transforming Construction: AI, BIM, VR, AR, Data Analytics, and IoT*

Royal Institution of Chartered Surveyors (RICS) discusses the convergence of emerging technologies in construction, emphasizing how AR/VR, alongside AI and BIM, are revolutionizing project delivery and stakeholder collaboration.

<https://www.rics.org/news-insights/transforming-construction-ai-bim-vr-ar-data-analytics-and-iot>

Italy

Standards such as **ISO 19650** and **UNI 11337 (Italian standards on BIM)** provide for multidimensional digital information management, opening up opportunities for integration with immersive technologies such as AR/VR. However, they do not define specific requirements for immersive technologies in construction.

The international standards IEEE 2888 and ISO IEC 23005 offer general standards for integration between the real and virtual worlds. They are not focused on the construction sector but can be useful as an advanced technological reference.

The Public Contracts Code (Legislative Decree 36/2023), in Annex I.9 and Article 43, recognises the use of digital devices and multidimensional models: this allows contracting authorities to request AR/VR in services, even without defining mandatory technical standards.

<https://www.ingenio-web.it/articoli/tecnologie-immersive-il-motore-silenzioso-della-rivoluzione-digitale>

- **Concrete cases and application examples in Italy**

- *University of Bergamo - AR project for training and sustainability (2024-2025)*

Researcher Vittorio Paris coordinates the international project “Technology Application of Augmented Reality for Renovation Work” (funded by NextGenerationEU) together with the universities of Bergamo, Ghent and Princeton. In collaboration with local companies (Taramelli, Edillio, Intellimech/Edinnova), they are studying how AR can accelerate training in complex construction techniques (e.g. thin vaults) directly on site, with visual instructions projected during operational work.

<https://blog.heidelbergmaterials.it/it/realta-aumentata-rivoluziona-edilizia-innovazione-progetto-ricerca-vittorio-paris>

Germany

- **Planning the Use of Augmented and Virtual Reality for Vocational Education and Training**

Author: Lutz Goertz, Thomas Hagenhofer, Christian Dominic Fehling (BIBB, mmb-Institut, Universität Wuppertal)

Description: Practical handbook for planning and designing AR/VR projects in the vocational training sector, including didactic concepts, technical requirements and use cases. Also relevant for training concepts in the construction context.

DOI: [10.18420/delfi2020-ws-102](https://doi.org/10.18420/delfi2020-ws-102)

- **Structural Inspections using 3D Building Models and Augmented/Virtual Reality**



Author: Fraunhofer FIT (on behalf of BASt, Federal Highway and Transport Research Institute)

Description: Pilotprojekt zur Unterstützung von Brückenprüfern mittels Mixed Reality: digitale Schadensdokumentation gekoppelt mit BIM-Modellen und mobiler AR-Anwendung vor Ort.

<https://www.fit.fraunhofer.de/en/business-areas/cooperation-systems/projects/structural-inspections-using-3d-building-models-and-augmented-virtual-reality.html>

- **Design Guidelines for AR/VR Training Systems (SKILLS project)**

Author: Sabine Webel et al. (Fraunhofer IGD in cooperation with TECHNION, PERCRO)

Description: DIN/CI-based design recommendations for AR and VR training systems for technical training - focus on process, cognitive and physical fidelity as well as guidance aids.

<https://publica.fraunhofer.de/entities/mainwork/07474bae-53a2-49ee-8475-ded01f0f1592>

Croatia

- **Extended Reality for Training Green Skills in the Construction Sector (XRGREEN.CON) (Erasmus+ project)**

University of Rijeka (Faculty of Civil Engineering), Croatia is partner in XRGREEN.CON project that aims to promote circular economy topics in construction, showing examples, best practices, and lessons to be learnt through educational AR/VR gamified simulations. Vocational trainers of the sector will be skilled with extended reality and Circular topics to develop experiences learner centered. It will allow employees, employers and stakeholders working in the industry to get experience and practice live situations in virtual simulation on how to make construction more sustainable. Within the project scope, the report "State of the art. Desk research in scientific databases." Has been prepared exploring way to use the XR in the construction industry and related educational fields (civil engineering, architectural engineering, construction management, etc.).

<https://xrgreencon.eu/>

https://xrgreencon.eu/wp-content/uploads/2024/07/XRGREEN.CON_State_of_the_art_report.pdf

g. Digital platforms - Marketplace, matchmaking sites

With the increase of digitalisation and the spread of digital tools and applications, the Construction sector faces a need for digital platforms and hubs that should allow the development and generalisation of common digital services and data for all stakeholders of the value chain, in all phases of Construction processes. These digital platforms should provide a fluent communication of semantic data models and instances between computer-based systems, a seamless integration of 3rd-party services and ensure a secured data management, based on agreed standards.

Guidelines and tutorials for digital platforms

- **Digitalisation in the Construction Sector - Analytical Report**

European Construction Monitor report on the state of digitization in the construction industry, including the role of digital platforms.

<https://ec.europa.eu/docsroom/documents/45547>

- **Digital Markets Act - Ensuring Fair and Open Digital Markets**

The EU's Digital Markets Act, which ensures fair and open digital markets, including online platforms.

https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/europe-fit-digital-age/digital-markets-act-ensuring-fair-and-open-digital-markets_en



Hungary

- **Építésügyi Digitális Szolgáltatási Platform (ÉTDR) - Digital Building Authority Platform**

Author: Lechner Tudásközpont / Ministry of Construction and Transport

Description: Hungary's official e-government platform for managing building permit procedures, digital document submissions, and communication between citizens, authorities, and professionals. Integrates structured data models and ensures standardized data management for the construction sector.

<https://www.etdr.gov.hu> (Hungarian)

(No full English version available, but key processes are described here: <https://lechnerkozpont.hu>)

- **Digital Construction Hub Hungary - Pilot Marketplace for Smart Building Services**

Author: National Research, Development and Innovation Office (NKFIH) - Innovation Ecosystem Projects

Description: A digital platform designed to connect startups, building tech developers, and construction companies. Facilitates matchmaking for digital services, smart materials, and technology providers through an online interface and open calls.

<https://nkfi.gov.hu> (Hungarian - search: "építőipari digitális piacter")

- **Magyar Multi Program - Industry 4.0 Construction Marketplace**

Author: Ministry of National Economy (formerly ITM), in cooperation with IFKA

Description: This program supports Hungarian SMEs with digital transformation, including sector-specific B2B platforms for construction and manufacturing. Encourages the adoption of interoperable tools and integrated services.

<https://ifka.hu/hu/page/view/magyar-multi-program> (Hungarian)

- **ÉMI Innovation Marketplace - Smart Construction Technology Exchange**

Author: ÉMI Nonprofit Kft. (Construction Quality Control and Innovation)

Description: A matchmaking initiative connecting Hungarian startups and tech companies offering BIM tools, energy modeling, sensor systems, and AR/VR solutions with construction stakeholders. Encourages cross-sectoral collaboration.

<https://emi.hu/hu/innovacios-piacter> (Hungarian)

- **Lechner Tudásközpont - BIM and Spatial Data Interoperability Services**

Author: Lechner Knowledge Center

Description: Platform under development offering interoperability tools, BIM object libraries, and common data environments (CDEs) to facilitate digital collaboration across disciplines. Designed to integrate semantic models (IFC, CityGML, etc.).

<http://bim.lechnerkozpont.hu> (Hungarian)

- **Digital Welfare Program (Digitális Jólét Program) - Construction Sector Digital Strategy**

Author: Government of Hungary - DJP2030

Description: The national framework for digitalization includes specific action plans for construction industry digital transformation, including open data platforms, cloud-based services, and smart city integration.

<https://digitalisjoletprogram.hu> (EN/HU)

Czech Republic



- **CYRKL Marketplace**

Cyrkl is an international technology and consulting company focused on circular waste management. It operates a digital marketplace for waste materials, recyclates, and by-products, helping companies turn waste into resources and costs into revenue through advanced technological solutions.

In its consulting services, Cyrkl offers Circular Waste Scans conducted by waste management experts to identify opportunities for cost savings and CO₂ emission reduction. The company also provides market analyses and supports the transfer of recycling technologies and legislation, driving innovation and circular economy principles in the waste management sector.

<https://www.cyrkl.com/cs/marketplace>

- **Startup Stavario**

Stavario offers a cloud application that connects workers, office staff, and investors, providing features like an electronic construction log, attendance tracking, tool monitoring, and more, saving both time and costs. The project was created in response to the administrative burden and manual work with spreadsheets that Beneš wanted to automate. The startup already has thousands of users, dozens of satisfied clients, and has secured investments and mentoring from CzechInvest, with plans to expand internationally, including to Asia, Germany, and the United Kingdom.

<https://stavario.com/en/>

- **Digital transformation of the Czech construction Industry**

The Czech Data Standard for Building Information Model—known as DSBIM or DSS—is a national initiative aimed at establishing a unified, semantic data dictionary and framework for the construction industry in the Czech Republic. This standard is being developed collaboratively by the Czech Standardisation Agency and Cobuilder, a leading provider of data management solutions for the built environment.

Industry stakeholders will be able to easily access the up-to-date DSBIM database, enabling faster, more consistent and unified data exchange.

This will lower costs, speed up the process, and help achieve sustainability goals, contributing to a greener Czech construction sector.

[https://www.pbctoday.co.uk/news/digital-construction-news/bim-news/digital-transformation-czech-construction-industry/110908/#:-:text=The%20goal%20is%20to%20facilitate,Czech%20Standardisation%20Agency%20\(CAS\)](https://www.pbctoday.co.uk/news/digital-construction-news/bim-news/digital-transformation-czech-construction-industry/110908/#:-:text=The%20goal%20is%20to%20facilitate,Czech%20Standardisation%20Agency%20(CAS))

Poland

- **Public/Nonprofit Initiatives and Platforms**

- *Polish Circular Hotspot*

Author: Institute of Innovation and Responsible Development (INNOWO), launched 2018.

A public-private collaboration platform uniting government, academia, NGOs, and businesses (across sectors including construction) to drive the transition to a circular economy in Poland. It develops strategies and roadmaps, shares best practices, and connects stakeholders (e.g. through Circular Week events and circular procurement workshops) to scale up circular solutions in construction and other industries.

<https://www.cp.org.pl/2019/01/przystapilismy-do-polish-circular.html> (Polish)

- *“Gospodarka Obiegu Zamkniętego w Praktyce”*

CSR Consulting (with BASF, Rekopol, Stena Recycling) in 2020 shared an online knowledge hub (“Circular Economy in Practice”) that provides resources on circular economy for businesses and



municipalities, including a library of regulations, case studies, tools, and model solutions. It covers multiple areas of CE with relevant content for construction (e.g. urban mining, material reuse, circular design). The platform's goal is to facilitate practical implementation of circular economy in Poland by sharing knowledge and best practices.

<https://gozwpraktyce.pl> (Polish)

- *CinderOSS (CINDERELA One-Stop-Shop)*

Author: H2020 CINDERELA Consortium (incl. IETU Poland), 2018-2022.

A digital “circular construction hub” developed under the EU CINDERELA project to match supply and demand for secondary raw materials in urban construction. It supports cities, contractors, and recyclers by providing a marketplace and ICT tools to implement circular business models. CinderOSS enables users to find construction materials derived from waste (e.g. recycled aggregates, excavated soil) and thus helps turn local waste streams into new building resources.

<https://circulareconomy.europa.eu/platform/en/news-and-events/all-events/h2020-cinderela-project-tool-building-circular-construction-hubs-cities>

- **Private and Commercial Platforms**

- *Madaster*

Author: Madaster Foundation (origin: NL), launched in PL ~2020.

A global digital platform for “material passports” that is now available in multiple countries (including Poland). Madaster serves as an online registry for materials in buildings and infrastructure, tracking all components used in a project. It generates material passports with data on reuse potential, residual value, embodied carbon, etc., thereby facilitating reuse and preventing construction waste. Polish real estate developers and asset owners can use Madaster to inventory their buildings’ materials and connect with reuse opportunities.

<https://circulareconomy.europa.eu/platform/en/dialogue/existing-eu-platforms/madaster>

- *UŻYJ.TO*

Author: UT Projekt sp. z o.o. (Polish startup), 2023.

A peer-to-peer marketplace for used and surplus building materials, described by its founders as a “Vinted for construction materials.” The online portal allows users to sell, donate, or buy leftover building products from renovations (tiles, paint, fixtures, etc.) instead of discarding them. The platform categorizes materials for easy searching and even offers support from architects (Użyj.to Studio) on how to incorporate second-hand materials. Użyj.to helps reduce renovation costs and waste, aligning with circular economy principles in the construction sector.

<https://archisnob.com/architecture-pl/uzyj-to-czyli-vinted-dla-materialow-budowlanych/> (Polish)

- **Public Policies and Guidelines (Poland)**

- *Roadmap towards the Transition to a Circular Economy*

Author: Ministry of Development, Government of Poland (adopted Sept 2019).

This is Poland’s national circular economy roadmap, an official strategic document (Annex to Council of Ministers Resolution no. 136/2019) outlining the vision and measures for CE transition. While economy-wide, it highlights construction as a priority area for waste reduction and secondary material use. The roadmap identifies five focus areas (sustainable production, consumption, bioeconomy, new business models, and CE implementation/monitoring) and proposes cross-cutting tools (not only legislative) to support a new economic model.

<https://irculareconomy.europa.eu/platform/en/strategies/polands-circular-economy-roadmap>



<https://gozwpraktyce.pl/regulacja/mapa-drogowa/>

▪ *Guidelines for Contracting Authorities on Circular Economy in Public Procurement*

Author: Public Procurement Office (UZP), 2023.

A practical guidance document issued by UZP for public-sector buyers to incorporate circular economy principles in procurement processes. It explains how to extend product lifecycles (via reuse, repair requirements), reduce waste in public works, and includes model criteria for key product categories (including construction and demolition services). These guidelines (published 21 July 2023) help contracting authorities in Poland plan tenders that support material recovery and circular outcomes in construction projects. (Polish version only on UZP site).

<https://samorząd.pap.pl/kategoria/srodowisko/zasady-goz-w-przetargach-uzp-przygotowal-wytyczne-dla-zamawiajacych>

▪ *“Plan for Waste Management 2022” and C&D Waste Regulations*

Ministry of Climate and Environment In line with EU targets, Poland’s waste policies mandate at least 70% recovery of construction and demolition waste since 2020. New regulations (e.g. updated Waste Act 2021) enforce on-site segregation of building waste starting 2025, pushing the construction industry toward circular practices. Strategic documents like the National Waste Management Plan and National Raw Materials Policy emphasize circular use of construction materials (e.g. recycling concrete, reusing aggregates), complementing the above CE roadmap. The need for updates to these documents is outlined in Chapter 2.

• **Industry and Non-Governmental Publications**

▪ *“A Guide to Circularity in Construction” (Kompendium GOZ w budownictwie)*

Author: Polish Green Building Council (PLGBC) with GBC Iceland & Silesian University of Technology, 2023.

A comprehensive handbook developed under the CIRCON project (EEA Grants) to educate construction stakeholders on circular building design. This guide provides practical strategies for designing buildings for durability, adaptability, easy deconstruction, and reuse of components. It introduces circularity indicators tailored to the Polish (and Icelandic) context to measure a building’s circular performance. The publication includes case studies and recommendations on material reuse, modular design, and design for disassembly.

<https://www.gov.pl/web/climate/the-circular-economy-in-construction-eco-design-of-circular-buildings>

<https://plgbc.org.pl/wirtualna-biblioteka/guide-to-circularity-in-construction>

▪ *“Budownictwo w obiegu zamkniętym w praktyce”*

Author: INNOWO / Polish Circular Hotspot, 2019.

“Construction in the Circular Economy in Practice” is a report (in Polish) that resulted from a series of industry roundtables on sustainable building. Co-authored by Dr. Agnieszka Sznyk (INNOWO), it examines the state of Poland’s construction industry and identifies opportunities to apply circular economy principles. The report highlights business models and tools for keeping building materials in use, and it was one of the first in Poland to call for seeing construction waste as valuable resource rather than trash. (Polish PDF only via Polish Circular Hotspot).

<https://pccnl.nl/wp-content/uploads/2016/02/Raport-Budownictwo-2019.pdf>

▪ *“Odzysk Materiałów Budowlanych - możliwości i wyzwania”*

Author: Saint-Gobain Polska & INNOWO, 2024. This “Recovery of Building Materials - possibilities and challenges” report (Polish, April 2024)



The report is a practical guide for construction companies on how to reclaim materials from demolition or renovation projects. It outlines upcoming regulations (like mandatory construction waste sorting), details step-by-step procedures for material recovery on-site, and provides technical guidance for reusing specific materials (e.g. drywall, flooring, glass, insulation). The report includes case studies of successful material reuse and Saint-Gobain's own circular practices, aiming to encourage Polish builders and designers to view construction debris as a valuable secondary resource rather than waste.

<https://www.saint-gobain.pl/documents/nasze-raporty/raport-saint-gobain-innowo-odzysk-materialow-budowlanych.pdf>

- *Circularity Gap Report: Poland*

Author: Circle Economy + Partners, 2022.

A data-driven analysis of Poland's entire economy from a circularity perspective, which provides strategic insights for the construction sector. It found Poland to be only 10.2% circular, with housing and construction identified as a top opportunity to improve. The report quantifies material flows and suggests that building a more circular built environment (e.g. using more secondary materials, extending building lifespans, deep retrofitting) could cut Poland's material consumption by over 26% and significantly reduce emissions. This benchmarking study (though not a guideline per se) has informed both public and private stakeholders in setting targets and tracking progress for circular construction.

<https://www.circularity-gap.world/poland>

Italy

In Italy, there are no specific standards or laws dedicated to digital platforms, marketplaces or matchmaking sites for the construction sector. However, some general European and national regulations are also applicable to these platforms used in the construction sector.

- **E-procurement and public procurement**

The Public Contracts Code (Legislative Decree 36/2023) requires the mandatory use of certified e-procurement platforms (used by contracting authorities such as Consip or regional centres).

AgID coordinates the development of technical rules and certification requirements for these platforms, involving ANAC and industry stakeholders.

<https://www.agid.gov.it/it/piattaforme/procurement/regole-tecniche-procurement>

- **Real applications: platforms for construction in Italy**

At present, there are no B2B digital platforms for direct matchmaking in the construction sector managed by public bodies with specific regulations. However:

- *Consip / E-procurement purchasing centres*

Although not an "open marketplace" like a matching site between businesses and professionals, Consip platforms (and delegated regional platforms) fall under the definition of electronic procurement, with specific regulations in the Public Contracts Code.

They are used for public procurement (including construction works), are certified by AgID and subject to technical requirements of transparency, security and interoperability.

https://it.wikipedia.org/wiki/Appalti_telematici

Germany

- **VDI 2552 Blatt 11.1 - Common Data Environment (CDE)**



Author: Association of German Engineers (VDI)

Description: The standard defines the structure, technical and organizational requirements of a CDE, the central digital platform for the exchange of construction information models throughout the entire project cycle. Semantic modeling, versioning, security and user roles are covered.

https://www.vdi.de/fileadmin/pages/vdi_de/redakteure/richtlinien/inhaltsverzeichnisse/3000638.pdf (only German)

- **Plattformarchitektur für Datenpools im Bauwesen** (Platform architecture for data pools in the construction industry)

Author: Fraunhofer-Institute IFAM und IAIS

Description: Technical reports on the architecture of platforms with centralized data pools, including interoperability layers, semantic integration methods (e.g. RDF/OWL) and access control. Relevant for construction hubs, material databases and project portals.

<https://www.iais.fraunhofer.de/en/research/big-data-infrastructures.html>

- **Gaia-X – European Data Infrastructure Initiative**

Author: BMWK (German Federal Ministry for Economic Affairs and Climate Action) & Gaia-X Association

Description: A project to develop a trusted and sovereign European data infrastructure. Gaia-X standards promote secure data sharing across sectors, including construction and smart cities.

<https://gaia-x.eu/>

Croatia

- **Waste Exchange (Burza otpada)**

The **Waste Exchange** is an online platform under the Croatian Chamber of Economy designed to facilitate the trade of waste and secondary raw materials among businesses. It supports sustainable resource management and circular economy goals by helping companies connect easily to buy or sell recyclable materials. Established based on Croatia's Waste Management Plan, it also plays a key role in education and awareness. The platform promotes reducing raw material extraction, improving waste management, and increasing transparency in the secondary materials market. It covers various waste types like construction and wood waste. The website also highlights the benefits of using the Waste Exchange portal and provides clear guidelines on how to navigate and utilize the platform effectively.

<https://www.hgk.hr/hrvatska-gospodarska-komora/burza-otpada-1>

Practical guidance / tutorials

- **How to use BIM in practice**

Building Information Modelling (BIM) is one of the most important enablers of circular construction, because it provides a digital twin of the building. In practice, this means that every element of a construction project - from walls and windows to insulation materials - can be digitally recorded. The digital model allows tracking of material quantities, qualities, and potential for reuse. When combined with Life Cycle Assessment (LCA) software, BIM can also calculate the carbon footprint of design alternatives. For example, replacing a conventional material with a recycled one can be assessed immediately in terms of CO₂ reduction. BIM also facilitates selective demolition, because the digital twin contains detailed information about what materials will become available at the end of the building's life cycle.

- **Tutorials**



Several organisations offer step-by-step tutorials and guidelines for companies wishing to adopt BIM for circular purposes. The EU BIM Handbook explains how BIM supports sustainable procurement and public projects. In Hungary, ÉMI provides national BIM guidance that aligns with EU standards, while XRgreencon and other AR/VR projects offer video-based tutorials for immersive learning. These resources show practical examples of how digital modelling can save costs, reduce errors, and open opportunities for circular reuse.

- **Tips for SMEs**

Small and medium-sized enterprises (SMEs) often fear that BIM requires expensive software and specialised staff. However, there are affordable entry points: many providers offer free viewer versions of BIM software, trial access to Common Data Environments (CDEs), and lightweight modelling tools. SMEs can start small - for example, by documenting just a single type of building element - and scale up later. Platforms like Madaster allow firms to create material passports without owning a full BIM suite, while marketplaces like Cyrkl connect them to buyers and sellers of secondary raw materials. These low-barrier options help SMEs gain experience with digital tools at minimal cost.



2. Environmental and construction legislation

a. EU policies

European territorial cooperation (ETC) (EU)

European territorial cooperation (ETC) is the goal of cohesion policy that aims to solve problems across borders and to jointly develop the potential of diverse territories. Cooperation actions are supported by the European Regional Development Fund (ERDF) through three key components: cross-border cooperation, transnational cooperation and interregional cooperation. For the circular economy the CTE develops waste recovery and recycling protocols, as well as cross-border policies on the waste system and environmental protection, along with concrete management models for renewable energy, waste and its reuse, and material recovery. In addition, it contributes to the identification of good practices for the adoption of green procurement geared toward efficient use of resources.

A European Green Deal (EU)

The European Green Deal improves the well-being and health of citizens and future generations by providing fresh air, clean water, healthy soil and biodiversity, renovated, energy-efficient buildings, healthy and affordable food, more public transport, cleaner energy, and cutting-edge clean technological innovation, longer lasting products that can be repaired, recycled and re-used, future-proof jobs and skills training for the transition globally competitive and resilient industry.

A new Circular Economy Action Plan (EU)

This Plan provides a future-oriented agenda for achieving a cleaner and more competitive Europe in co-creation with economic actors, consumers, citizens, and civil society organisations. And, it provides a future-oriented agenda for achieving a cleaner and more competitive Europe in co-creation with economic actors, consumers, citizens, and civil society organisations. It aims at accelerating the transformational change required by the European Green Deal, while building on circular economy actions implemented since 2015. This plan will ensure that the regulatory framework is streamlined and made fit for a sustainable future, that the new opportunities from the transition are maximised, while minimising burdens on people and businesses. This plan presents a set of interrelated initiatives to establish a strong and coherent product policy framework that will make sustainable products, services, and business models the norm and transform consumption patterns so that no waste is produced in the first place. This product policy framework will be progressively rolled out, while key product value chains will be addressed as a matter of priority. Further measures will be put in place to reduce waste and ensure that the EU has a well-functioning internal market for high quality secondary raw materials. The capacity of the EU to take responsibility for its waste will be also strengthened.

New European Bauhaus (EU)

The New European Bauhaus is a creative and interdisciplinary initiative that connects the European Green Deal to our living spaces and experiences. The New European Bauhaus initiative calls on all of us to imagine and build together a sustainable and inclusive future that is beautiful for our eyes, minds, and souls, representing diverse stakeholders, from government to civil society, citizens' initiatives, and companies. The main is to embody the 'design for everyone' principle and ensure that the benefits of the digital and green transitions are shared broadly. The Neu Bauhaus core values: Sustainability (circular economy, energy efficiency, use the sustainable materials and construction techniques, re-use of materials and spaces, green mobility, restoring biodiversity); Aesthetics (places in harmony with nature, rediscovery of history and architectural heritage, work with people's creativity and imagination);



Inclusivity (attention to the need of marginalized groups, wider participation in design -making, expanding access).

EU Construction Products Regulation (EC/305/2011)

The Construction Products Regulation (CPR) lays down harmonised rules for the marketing of construction products in the EU. The Regulation provides a common technical language to assess the performance of construction products. It ensures that reliable information is available to professionals, public authorities, and consumers, so they can compare the performance of products from different manufacturers in different countries. On 30 March 2022, the Commission put forward a proposal to revise the CPR. The proposal is part of a package with several other sectoral proposals aimed at making sustainable products the norm in the EU and boosting circular business models. The stated aims of the proposal are to improve the functioning of the internal market for construction products, address the implementation challenges that still exist at national level (particularly regarding market surveillance), simplify the legal framework and support the green and digital transition in the sector.

Waste Framework Directive (EC/2008/98)

The Waste Framework Directive (WFD) sets the basic concepts and definitions related to waste management, including definitions of waste, recycling and recovery. It requires that waste be managed without endangering human health and harming the environment, without risk to water, air, soil, plants or animals, without causing a nuisance through noise or odours and without adversely affecting the countryside or places of special interest. The foundation of EU waste management is the five-step “waste hierarchy”, established in the Waste Framework Directive. It establishes an order of preference for managing and disposing of waste. In 2023 a proposal for amendment of Directive was given focusing additionally on two resource intensive sectors: textiles and food.

Strategy for the Digital Transformation of Enterprises

The digital transformation of the economy is supported by the adoption of the Strategy for the Digital Transformation of Enterprises, guidelines for innovative procurement, and the operationalisation of a single digital identity (e-identity) for companies. The Strategy provides for the transfer of different registers to one single business register. In accordance with the Strategy, at least 200 businesses shall acquire an e-identity.

b. National legislation and policies

HUNGARY

Nemzeti Fenntartható Építésgazdasági Stratégia 2021-2023 - National Sustainable Building Strategy 2021-2023

Reflecting the problems and needs of the building sector, the document formulates proposals to improve the quality and sustainability of the built environment and to improve the efficiency, productivity and stability of the sector - and thus the preservation of Hungarian jobs and the standard of living of Hungarian citizens.

Magyarország zöld közbeszerzési stratégiája 2022-2027 - Hungary's Green Public Procurement Strategy 2022-2027

Green public procurement is a procedure whereby public authorities give preference to the procurement of goods, services and works that have a lower environmental impact than other goods, services and works with the same purpose. The present strategy is also based on the above definition, with the



addition that a public procurement can only be green, where the contracting parties take environmental considerations into account in the procurement process, over and above the mandatory requirements generally applicable to the goods/services/works concerned.

Nemzeti Fenntartható Fejlődési Keretstratégia 2012-2024 - National Sustainable Development Framework Strategy 2012-2024

The document serves as a long-term concept in the public policy decision-making system. It provides a framework, targets and priorities for the preparation of other decisions, so that policy strategies or plans can establish a target-means-period-financing-resource system that can meaningfully serve the sustainability transition together with and in coherence with other policy strategies or plans.

5. Nemzeti Környezetvédelmi Program - 2026-ig szóló szakpolitikai stratégia - 5th National Environment Programme - Policy Strategy to 2026

The Programme defines the country's environmental objectives and the tasks and means necessary to achieve them, considering the country's environmental status, the development objectives of society and the obligations arising from international cooperation and EU membership. Emphasis is placed on the cross-cutting nature of environmental protection, i.e. its cross-sectoral nature, and it is important that environmental considerations are properly mainstreamed in all socio-economic processes.

Nemzeti Tiszta Fejlődési Stratégia 2020-2050 - National Clean Development Strategy 2020-2050

Hungary supports achieving full climate neutrality by 2050. The National Clean Development Strategy, which takes the form of a long-term concept, outlines a socio-economic and technological development pathway with a 30-year horizon that will enable us to achieve climate neutrality by 2050 while ensuring the protection of our natural assets and economic development, with the well-being of the Hungarian people at the centre.

Act about public construction investments - Az állami építési beruházások rendjéről szóló 2023. évi LXIX. törvény

Order on public construction based on local traditions, economically and environmentally sustainable. The purpose of this law is to (a) promote the efficiency of implementation and predictability for public works in the preparation and implementation of public works; (b) lay down the basic rules for public works preparation from preparation to design, construction work to the operation and maintenance, taking account of the requirements of cost-effectiveness and budgetary use of the public and Union funds, and the environmental sustainability, (c) to strengthen the transparency of public works, with particular respect to investment costs; d) determine the tasks and relations of the participants of public works.

Act about the Hungarian building industry - A magyar építészetéről szóló 2023. évi C. törvény

Act of law on Hungarian architecture which aims to promote civic sense, improve the quality of life and preserve our architectural heritage and green spaces. The new legislation affects all property investments due to aesthetic and townscape requirements for construction plans and the preference for underused areas that have lost their industrial and logistical role. It intends to define the architectural direction for the future by respecting the Hungarian architectural heritage and architectural identity, with a strong emphasis on the pursuit of greater aesthetic quality.



CZECH REPUBLIC

Strategický rámec cirkulární ekonomiky České republiky 2040 - Strategic framework of the circular economy of the Czech Republic 2040

The purpose of the Strategic Framework of the Circular Economy of the Czech Republic 2040 is to formulate assumptions, goals and measures for the Czech Republic to be long-term resistant to future environmental threats, including climate change, and to develop an overall sustainable social system through the circular economy. The Czech Republic must be able to respond to future fundamental challenges also in connection with natural disasters or pandemics, etc.

Akční plán Cirkulární Česko - Action plan Circular Czech Republic

The Circular Czech Action Plan 2022-2027 is an implementation document of the Strategic framework of the circular economy of the Czech Republic 2040; for the period 2022-2027, The main function of the Action Plan is to set in more detail the method of fulfilling strategic goals, specific goals and typical measures of Circular Czech 2040 in the form of activities, thereby establishing a clear method of fulfilment, justifies the necessity, determines the main responsibilities for the activity (carriers, implementers), will estimate their financial demands and measurability. Circular Czech Action Plan 2022-2027 develops selected type measures in ten priority areas in the form of cards of activities, which is needed from the point of view of the development of the circular economy of the Czech Republic to be implemented in the next six years. One of the priority areas is also Circular cities and infrastructure.

Koncepce zavádění metody BIM v České republice - BIM Implementation Strategy in the Czech Republic

This strategy was elaborated based on Government Resolution No 958, on the importance of the Building Information Modelling (BIM) method for building practice in the Czech Republic and the proposal for further steps in its implementation, of 2 November 2016. In the Strategy, the Government expressed its support for the introduction of the BIM method in the Czech Republic in connection with its influence on the growth and competitiveness of the Czech economy and ordered the Ministry of Industry and Trade (MIT), with the support of other ministries, to elaborate the BIM Implementation Strategy in the Czech Republic.

ISO 19650

ISO 19650 is an international standard that provides a framework for managing BIM processes and information throughout the entire lifecycle of construction projects. In contrast, the Czech BIM Implementation Strategy is a national policy document initiated by the Czech government to promote and coordinate the adoption of BIM within the country, aiming to guide public authorities and industry stakeholders in applying BIM practices locally. While ISO 19650 sets the technical foundation for BIM on a global scale, the Czech strategy focuses on the practical steps and government support needed to implement BIM specifically in the Czech construction sector.

<https://globalbim.org/news/info-country/czech-republic/>

Plán odpadového hospodářství ČR - Waste management plan of the Czech Republic

The Waste Management Plan of the Czech Republic (Waste Management Plan of the Czech Republic) for the period 2015-2024 was approved by the government on 22 December 2014. The Waste Management Plan of the Czech Republic is a tool for managing the waste management of the Czech Republic and implementing a long-term waste management strategy. The obligation of the Czech Republic to prepare a waste management plan on its territory (Waste Management Plan of the Czech Republic) is stipulated



in Directive 2008/98/EC of the European Parliament and of the Council on waste. Pursuant to the Waste Act, the Ministry of the Environment prepared the POH of the CR in cooperation with the relevant public administration bodies and the public.

State Environmental Policy of the Czech Republic 2030 (SEP)

Published by: Ministry of the Environment of the Czech Republic

The SEP is the Czech Republic's main long-term strategic document for environmental protection, outlining goals through 2030 with a vision to 2050. It aligns with national, EU, and international strategies and reflects key factors such as demographic, economic, and environmental trends. It aims to ensure long-term legal protection of the environment and supports sustainable development.

The SEP identifies three main focus areas:

1. Environment and Health
2. Climate-Neutral and Circular Economy
3. Nature and Landscape

Each area contains specific objectives, ranked by priority based on international commitments, current trends, external pressures, and synergies. It prioritizes the climate and circular economy area.

The policy is guided by key principles such as prevention, polluter pays, cost-effectiveness, holistic approaches, public participation, and international responsibility.

https://mzp.gov.cz/system/files/2024-07/OPZPUR-SEP_2030_EN-20220525.pdf

ITALY

Decreto Legge 12 settembre 2014, n.133, "Decreto Sblocca Italia" - Decree-Law No. 133 of 12 September 2014

This decree law introduced urgent measures in Italy for the opening of construction sites, for the realisation of public works, for the digitisation of the country, and for bureaucratic simplification, with the objective of revitalising many productive activities in crisis, as well as ensuring sustainable development processes. In the building sector, the novelties have mainly concerned the single building regulation, a model scheme indicating the performance requirements for buildings, particularly about safety and energy saving.

Il D.lgs. 24 dicembre 2015 - Legislative Decree 24 dicembre 2015

This decree establishes the adoption of minimum environmental criteria for the procurement of design and construction services for new construction, renovation, and maintenance of buildings for public administration construction sites. It outlines criteria to be followed in the construction of buildings, also with a focus on sustainability.

Decreto Ministeriale 11 ottobre 2017 "Affidamento di servizi di progettazione e lavori per la nuova costruzione, ristrutturazione e manutenzione di edifici pubblici" - Ministerial Decree 11 October 2017 "Contracting of design and works services for new construction, renovation and maintenance of public buildings"

In this decree, we find for the first time the CAM (minimum environmental criteria - see row 7) for the construction sector. The document defines environmental criteria identified for various stages of the procurement procedure, aiming to enhance the service or work provided, striving for environmental performance above the sector's average. These criteria, where possible, correspond to characteristics



and environmental performance superior to those required by current national and regional laws. These criteria were subsequently reviewed and expanded in the Ministerial Decree of June 23, 2022, No. 256.

Criteri ambientali minimi (CAM) - Minimum environmental criteria

The acts constituting the regulatory framework often refer to minimum environmental criteria (CAM). CAM are the environmental requirements aimed at identifying the best design solution, the best product or service, in the green procurement phases of public administrations. Their application allows for the dissemination of technologies and products preferable from an environmental point of view. To date, CAM for the construction sector can be found in the Ministerial Decree of 11 October 2017 'Contracting of design services and works for the new construction, renovation and maintenance of public buildings' (see row 5). The document defines the environmental criteria, identified for the different stages of defining the tendering procedure that allow for the improvement of the service or the work provided, to ensure environmental performance above the sector average. These criteria, therefore, correspond where possible to characteristics and performance environmental characteristics and performance above those required by national and regional laws in force.

d.P.R. 13 giugno 2017, n. 120 - Legislative DECREE on excavated earth and rocks

Excavated earth and rocks finally make the quantum leap required by the circular economy. The difference between yesterday and today lies essentially in their classification, which has changed from 'waste' to 'by-product'.

DECRETO 27 settembre 2022, n. 152 - Regulation regulating the end-of-waste status of inert construction and demolition waste and other inert waste of mineral origin

Regulation regulating the end-of-waste status of inert construction and demolition waste and other inert waste of mineral origin.

Legge regionale 4 ottobre 2018 n. 16 (Misure per il riuso, la riqualificazione dell'edificato e la rigenerazione urbana) - Regional law 4 October 2018 no. 16 (Measures for reuse, redevelopment of the built environment and urban regeneration)

With this law, the Region of Piedmont intended to promote and incentivise the reuse and redevelopment of the existing building heritage and the regeneration of parts of the city, with the aim of regulating innovative and simplified building procedures that promote the recovery of the built heritage and of attics and rustic buildings. The aim of the law is to renovate parts of urbanised territory, generally made up of degraded and obsolete heritage, lacking functional, energy sustainability and seismic safety criteria, and at the same time promote the beauty, understood as urbanistic quality, of the landscape. With the implementation of these provisions, the Region also intends to achieve the objectives of sustainability in the building industry by assigning to urban requalification and regeneration projects requirements relating to the quality of materials, the saving of natural resources, the treatment of waste in the production cycle and the containment of energy consumption.

Legge regionale n. 14 del 04 aprile 2019 - Regional Law No. 14 of 4 April 2019

Veneto is one of the most advanced regions in the bio-building sector, so much so that with the regional law of 4 April 2019, no. 14 has set itself the objective of promoting policies for the densification of areas of consolidated urbanisation, through the demolition of incongruous artefacts and the environmental redevelopment, contemplating specific bonuses and volumetric increases connected to the use of



building credits from renaturalisation (Art.1, paragraph 2 Regional Law regional law no. 14 of 4 April 2019).

Programma Nazionale Prevenzione Rifiuti - National Waste Prevention Program

Achieve very high levels of preparedness for reuse, recycling and recovery of waste; adapt the network of plants necessary for integrated waste management; minimization, as a last and residual option, of final disposal; establishment of monitoring systems; avoid launching new infringement procedures against Italy address the low waste collection rate, discourage landfilling and ensure complementarity with regional waste programmes, allowing the objectives of EU legislation to be achieved and national waste management system and combating illegal waste dumping and open-air incineration.

Strategia nazionale per l'economia circolare - National strategy for the circular economy

For these reasons the "National strategy for the circular economy" is a programmatic document providing actions, objectives and measures that are intended to be pursued as institutional policies with the purpose to ensure an effective transition towards a circular economy.

GPP CAM - Criteri ambientali minimi / Green Public Procurement - minimum environmental criteria

The Minimum Environmental Criteria (CAM) are the environmental requirements defined for the various phases of the purchasing process, aimed at identifying the best design solution, product or service from the environmental point of view along the life cycle, considering market availability. CAMs are defined within the framework of the Plan for the Environmental Sustainability of Consumption in the Public Administration Sector and are adopted by Decree of the Minister.

POLAND

Roadmap for the Transformation towards a Circular Economy (Mapa drogowa transformacji w kierunku gospodarki o obiegu zamkniętym)

The Circular Economy Roadmap, adopted by the Council of Ministers of the Republic of Poland on October 10, 2019, is a strategic document outlining a set of tools—legislative, analytical, conceptual, informational, and promotional—aimed at creating the conditions for implementing a circular economy (CE) model in Poland.

The roadmap was developed by working groups under the Circular Economy Team and through extensive public consultations, involving over 100,000 participants and 200 socio-economic partners, including government and local administration representatives.

This roadmap is currently outdated and should be revised to align with new EU strategies such as the EU Circular Economy Action Plan (2020), the Construction Products Regulation (CPR), and PPWR (Proposal for Packaging and Packaging Waste Regulation).

https://circulareconomy.europa.eu/platform/sites/default/files/md_goz_final_en_r4_4.pdf

Act on Spatial Planning (Ustawa o planowaniu i zagospodarowaniu przestrzennym, 2023)

The Spatial Planning Act of September 24, 2023 regulates the spatial planning system in Poland. It governs the development of spatial policies and planning documents (strategies, general plans, local plans),



distributing planning powers among various levels of government. The Act introduces significant changes to construction project planning, such as the replacement of the "Study of conditions and directions of spatial development" with the General Plan (Plan ogólny), and strengthens the binding nature of local spatial development plans (MPZP).

Although the Act is not directly circular, local planning documents can integrate circularity principles such as sustainable material use, spatial circularity, and closed-loop infrastructure planning. Documents are not available in English.

National Waste Management Plan 2022 (KPGO 2022)

The National Waste Management Plan (KPGO 2022) defines Poland's national waste strategy, prioritizing waste prevention and improved recycling rates. It sets quantitative targets for recycling construction and demolition waste, aiming to increase reuse and material recovery.

Work is currently underway on the KPGO 2028 update, which is expected to align more closely with circular economy goals, including life-cycle approaches, digital tracking of materials, and better data integration. Document is not available in English.

Poland's Energy Policy until 2040 (PEP2040)

The PEP2040 strategy focuses on energy transition but also incorporates CE aspects by: supporting energy-efficient building design, promoting renewable energy use in construction, encouraging energy recovery from construction waste.

PEP2040 includes actions for integrating circularity in material use, particularly via energy performance in buildings and low-emission technologies.

<https://www.gov.pl/attachment/b1febd0c-e544-412d-a0d7-f6bff01707c1>

Act on Waste (Ustawa o odpadach, 2012; consolidated text)

The Act on Waste provides the legal foundation for waste management in Poland. It operationalizes circular economy principles by emphasizing: waste prevention, preparation for reuse, recycling and material recovery. It includes dedicated provisions for construction and demolition waste (CDW) and aligns with the EU Waste Framework Directive (2008/98/EC). Act is not available in English.

With growing emphasis on urban mining, material passports, and digital waste tracking, this act will likely require future updates to meet new EU obligations (e.g., under Digital Product Passport regulations and the Environmental Footprint framework).

Together, these documents and policies form the backbone of Poland's approach to circularity in the construction sector, though several of them are outdated and in need of alignment with EU 2020-2030 policies. Key challenges include: providing regional planning tools for the circular economy, updating KPGOs and spatial documents with circular economy criteria, integrating digital and life cycle tools (e.g. BIM, DPP), facilitating sectoral cooperation in the markets for reusing building materials.

SLOVENIA

Zakon o varstvu okolja ZVO-2 - Environmental Protection Act

This Act regulates the protection of the environment from pollution as a fundamental condition for sustainable development and, in this context, defines the basic principles of environmental protection, environmental protection measures, monitoring of the state of the environment and information on the environment, economic and financial instrumental protection, public services of environmental protection and others with protection environment related issues.



Uredba o odpadkih 2022 - Decree on waste

This Decree has a view to protect the environment and safeguard human health, lays down management rules and other conditions to prevent or reduce the adverse impacts of the generation and management of waste, reduce the overall effect of the use of natural resource, and improve the efficiency of the use of natural resources, following Directive 2008/89/EC.

Uredba o ravnanju z odpadki, ki nastanejo pri gradbenih delih - Decree on management of waste arising from construction work

This Decree stipulates the mandatory handling of waste generated during construction works due to the construction, reconstruction, adaptation, renovation, or removal of the building (after this: construction waste).

Uredba o odlagališčih odpadkov - Decree on waste landfill

The regulation aims to reduce waste disposal in landfills gradually, especially those suitable for recycling or other processing. The transition to a circular economy, conditions and measures related to the planning, construction, disposal, and closure of waste disposal sites, and reduction of environmental impacts. - reduction of greenhouse gas emissions and prevention of risks to human health.

Gradbeni zakon - Building Act

The purpose of the Act is to protect the public interest in the construction of buildings: respect for the principle of equal opportunities, environmental protection, nature conservation, water protection, protection of cultural heritage, promotion of sustainable construction, compliance with the placement of buildings in space, architecture, recording, usability, efficiency, quality of facilities and their compatibility with the environment throughout their life cycle.

Zakon o gradbenih proizvodih - Construction Products Act

The Act regulates the placing on the market of those products or sets of products intended for permanent installation in construction facilities and whose properties affect the properties of construction facilities. The Act first regulates the determination of requirements for construction products for which there are no harmonized European technical specifications. The Act represents an adaptation of Slovenian legislation in placing construction products on the market to the requirements of the European legal order, i.e., Regulation (EU) no. 305/2011.

Program ravnanja z odpadki in program preprečevanja odpadkov 2022 - A new Waste Management Programme and Waste Prevention Programme of the Republic of Slovenia

To achieve the goals of sustainable waste management per the Environmental Protection Act, Slovenia prepares an operational environmental protection program in waste every four years, consisting of a Waste Management Program and a Waste Prevention Program for the period up to 2035. In this way, it follows the implementation of European policies and obligations from EU environmental protection regulations. The emphasis is on preventing the generation of waste: i) preparation of waste for reuse and recycling before energy processing of waste, ii) processing of waste before its disposal, if this is the best option from the point of view of environmental protection, considering technical feasibility and economic sense.

Kažipot krožnega gospodarstva Slovenije - Roadmap towards the circular economy in Slovenia



The roadmap is based on the so-called “Circular Triangle”, the core of systemic change: Circular Economy (business models), Circular Change (government policies), and Circular Culture (citizens). We especially emphasize the importance of Circular Culture, since without reconsidering our values, creating new narratives, and changing our behavioural patterns, we cannot hope for a change in the economic models or corresponding shifts on a governmental level. Circular Culture is the aspect that seems to hide the greatest transformative capital for Slovenia.

Strategija Digitalna Slovenija 2030 - Digital Slovenia 2030 strategy

The strategy anticipates orientations and targets with indicators to address the biggest development gaps to accelerate the development of digital transformation in all areas, from gigabit infrastructure to the digital transformation of the economy, digital public services, the road to Smart Society 5.0, cybersecurity, digital competences and inclusion, and related content such as enabling supportive environments and the green transition. The strategy is a strategic document and contains specific measurable indicators in each of the thematic areas. The overarching objective of the strategy is to promote the digital transformation of Slovenia in all segments - society, government, local communities, and the economy. The ministry responsible for digital transformation will be responsible for managing the implementation of the strategy.

Občinski program varstva okolja Mestne občine Maribor za obdobje 2021-2030 - Municipality of Maribor: environmental protection program 2021-2030

The purpose of the municipal environmental protection program is to guide the implementation of environmental protection activities, establishing conditions for a quality and healthy living environment and enabling enforcement obligations from ratified international treaties of EU strategies, programs, and regulations related to various environmental areas. The program recognizes and it also raises awareness of, those challenges for which clear solutions are yet to be found are not known.

Strategija prehoda mesta Maribor v krožno gospodarstvo - Strategy for the transition to circular economy in the Municipality of Maribor

The Municipality of Maribor is currently the only municipality in Slovenia (member of the Partnership on Circular Economy) that redirects its activities, the operation of its companies and inhabitants into the model of circular management. This does not only include the concept of a circular economy in the field of municipal waste, but also the implementation of the concept in construction and industry, energy, water management, land use and mobility in the city. At the same time, MOM continues to implement the network of cooperative economy by promoting collaboration with NGOs, younger population, the elderly and minorities.

Trajnostna urbana strategija (TUS) - Sustainable Urban Strategy

The Sustainable Urban Strategy of the Municipality of Maribor (TUS-MOM) is a document that presents an outline of the situation and challenges, facing the city today. At the same time, it sets out the directions with which the city can and must move forward. Move forward, to lay the foundations for its sustainable development and to ensure an improved quality of life for its inhabitants. The strategy was developed by an expert working group in cooperation with the MOM and the public. The Sustainable Urban Strategy of the Municipality of Maribor (TUS-MOM) is based on the concept of integrated urban strategy, which places the city at the forefront of social, cultural and economic development in the EU.

SLOVAKIA

Stratégia dekarbonizácie SK cementárskeho priemyslu / Cement industry decarbonisation strategy for SK



The strategy entails the fit for 55 program fulfilment until 2030 and targeted carbon neutrality until 2050 using CCUS technology.

Greener Slovakia. Strategy of the Environmental Policy of the Slovak Republic until 2030

Slovakia has implemented a project related to the Organisation for Economic Co-operation and Development (OECD) and EC Roadmap for Circular Economy of the Slovak Republic (1). The Roadmap focusses on the following priority areas: sustainable consumption and production with a focus on economic instruments; CE potential in the construction sector; and achieving circularity in the food and bio-waste value chain. The identified policy measures across these three areas will help to increase the use of secondary raw materials, support eco-design and eco-innovation, stimulate circular consumption patterns as well as improve waste management, reuse and recycling.

Program predchádzania vzniku odpadu Slovenskej republiky na roky 2019 - 2025 - Waste Prevention Program of the Slovak Republic for the years 2019 - 2025

With this obligatory environmental programme, a shift was made from priority of Slovak waste management from waste management to waste prevention. Similar document present conventional Waste Management Plan of the Slovak Republic for the years 2021 - 2025.

Zakon o odpadoch a o zmene a doplneni niektorých zákonov - Slovak Waste Act (79/2015)

Slovak Waste Act (79/2015 Coll) was amended on 15.6.2022 which introduces new legislation on construction and demolition waste as well as new obligations for producers of such waste. The amendment introduced a new concept of selective demolition, preferable on-site recovery of construction and demolition waste to reduce the need for transport and reporting obligations before and after demolition.

The Construction Act

The new legislation entered into force in 2024. The aim of the new legislation was to eliminate the shortcomings of existing legislation and consider the current needs of society. The result should be simplification and acceleration of construction permits, digitization, but also stricter sanctions against unauthorized constructions. One of the important areas of new legislation was also digitisation of the proceedings and digitization of data

The Spatial Planning Act

The Spatial Planning Act was also introduced a new in 2024 in order to strengthen research in the field of spatial planning and transfer research results into the principles of spatial planning, professionalize the state administration and reduce the administrative burden in spatial planning activities.

AUSTRIA

Recyclingbaustoffverordnung - Regulation on recycled building materials

Regulation on the preparation for re-use of building components and quality assurance measures for recycled building materials with the aim to promote circular economy and material efficiency in construction

Deponieverordnung - Regulation on landfilling



Regulation on criteria and processes for the acceptance of waste for landfill including construction waste. The regulation enforces the separation of construction waste on site.

Kreislaufwirtschaftsstrategie - The Austrian Circular Economy Strategy

Strategy on the implementation of circular economy strategies throughout resource intensive sectors in Austria. The construction industry is addressed and goals are defined on the basis of the EU Waste framework Directive 2018/851/EC.

Abfallwirtschaftsgesetz (AWG 2002, BGBl I Nr. 102/2002 idgF) - Waste Management Act (AWG 2002, BGBl I Nr. 102/2002 idgF)

Regulation on general and treatment obligations, licensing rights of waste collectors and stakeholders in treatment, collection and recycling facilities.

CROATIA

Waste Management Plan of the Republic of Croatia for the period 2023-2028

Waste Management Plan of the Republic of Croatia for the period 2023-2028 selected preventing the generation of the construction waste as one of the specific objectives of the Waste prevention programme due to its high recycling potential and environmental impact, and proposes waste prevention measures such as:

- Strengthening the policy framework for the transition to a circular economy in the construction sector
- Promoting the purchase of 'green' products and services
- Raising awareness, conducting education on waste prevention, and sharing best practices
- Promoting ecodesign (systematic integration of environmental aspects into product design with the aim of improving product environmental performance throughout its lifecycle)

To prevent construction waste generation, Croatia also emphasizes measures such as separating reusable materials on-site during reconstruction, maintenance, or demolition, provided they can be reused without processing. It notes that this approach is already embedded in national waste legislation, but acknowledge the need for its better integration with construction regulations in upcoming programming periods. Key strategies include promoting durable building design, minimizing hazardous materials, and encouraging reuse through planning, maintenance, and technological innovation. The public sector, especially through education and procurement, plays a critical role in advancing these goals, particularly by repurposing underused public buildings and embedding circular economy principles into education. Waste Management Plan also mentions the importance of adopting an action plan for Circular Economy in Construction Waste Management and importance of incentives for reusing construction and demolition materials.

Waste Management Act (OG 84/21)

The Act stipulates the measures to protect the environment and human health by preventing or reducing waste generation, reducing the negative effects of waste generation and waste management, reducing the overall effects of the use of raw materials and improving the efficiency of the use of raw materials as well as increasing recycling and the reuse of recycled materials, enabling the extension of the life span of products, which is necessary for the transition to a circular economy

Ordinance on Waste Management (OG 106/22)

This Ordinance sets out detailed rules for waste management in Croatia, including the requirements for registering by-products, reporting from reuse centers, and the use of accompanying waste documents.



It defines the responsibilities of recycling yard operators, such as accepting certain waste types free of charge, and outlines methods for odor testing caused by waste. The Ordinance specifies procedures requiring permits, as well as those exempt from permits, and explains how to confirm the intent to carry out waste management activities. It also details the financial guarantees required for waste shipments subject to notification procedures. Additionally, the Ordinance includes a waste catalog aligned with national legislation, hazardous waste properties, and reporting requirements to the European Commission. Various annexes provide forms and guidelines to support these regulations, ensuring clear standards for effective and compliant waste management practices.

Ordinance on Waste Landfills (OG 4/23)

Generally, waste can be disposed of at a landfill, including underground landfills, if the waste holder who delivers the waste for disposal has ensured the preparation of a basic waste characterization for disposal. The person managing the landfill is obliged, within the implemented information system, to keep the results of the basic waste characterization, compliance testing, and compliance verification until the closure of the landfill, so that they form an integral part of the expert basis for planning the closure of the landfill and measures to prevent harmful environmental impacts after its closure. For hazardous waste, a record is kept of the exact disposal location within the specific landfill.

Ordinance on Construction Waste and Asbestos-Containing Waste (OG 69/16)

The Ordinance prescribes the objectives of the CDW management system, obligations of the construction material manufacturers, conditions for CDW management, obligations to keep records of construction waste and other obligations related to the asbestos-containing waste management system.

Ordinance on End-of-waste Status (OG 55/23)

This Ordinance prescribes the details of specific criteria for the end-of-waste status for a particular substance or object, the manner of implementation of European Union regulations establishing criteria for the end-of-waste status of certain types of waste, the producer's report on the end-of-waste status, and the content of the declaration of conformity by the producer of a substance or object registered in the End-of-Waste Register.

Material derived from waste cannot be placed on the market unless its manufacturer has drawn up a Declaration of Conformity (DOC). In relation to CDW, the EoW status is ruled at Annex 1 - "Specific Criteria for the End-of-Waste Status" - Part 6 "Specific Criteria for the End-of-Waste Status for Recycled Aggregate and Backfilling Material".

Proposed Circular Economy Action Plan (CEAP)

The Government of Croatia has acknowledged the need to move towards a circular economy, minimizing waste generation, separating at source, directing waste streams to various ways of utilization and treating waste as a resource. In this context, the Ministry of Economy and Sustainable Development (MoESD) requested World Bank support and the two began working on the implementation of the Circular Economy Approaches in Solid Waste Management technical assistance, with the aim of improving waste management practices in Croatia and supporting the country in transitioning towards a circular economy. This technical assistance program is financed from the European Union's Cohesion Fund using the Bank's Reimbursable Advisory Services (RAS) instrument. The engagement started in September 2020 resulted in Proposed Circular Economy Action Plan on Construction and Demolition Waste.

It aims to illustrate the sector specific challenges that Croatia is facing in realizing CE in the construction and demolition waste sector and to recommend the potential measures and actions that may help Croatian CDW sector to transition into CE. The CEAP development started with a diagnostic analysis of the CDW sector to understand the status of CDW management in Croatia. Based on the analysis and multiple stakeholder consultation meetings, the diagnostic extracted the six major challenges in the sector and translated them into the corresponding objectives of the CEAP. To propose the best available



measures and actions for CE transition in Croatia, stocktaking of international good practices and policy examples on CE in the CDW sector was conducted to provide guiding principles for the development of the CEAP in Croatia.

Development Program for Circular Management of Space and Buildings for the Period 2021 to 2030

The **Development Program for Circular Management of Space and Buildings for the Period 2021 to 2030** was created with the goal of developing sustainable, inclusive, safe, and resilient cities. It aims to encourage circular measures in the planning of new buildings, defining construction guidelines based on circular economy principles, promoting the reuse of buildings and spaces, extending the lifespan of existing spaces and buildings, encouraging waste reduction in construction, increasing energy efficiency, and the use of renewable energy sources (RES), as well as the reuse of existing construction products and materials.

GERMANY

Digitalstrategie Deutschland (Digital strategy Germany)

Implementation - Smart City Competence Centre and BIM portal. By 2025, BIM should be a standard tool in Germany: a) BIM has to be a standard tool for the planning, construction and operation of building and infrastructure projects - a role model for private construction projects too. b) At least one platform should be established for federal construction projects that enables all participants to exchange information via the cloud. c) The federal government's BIM portal for transport projects and digital twins for infrastructure measures are used. d) Urban development as a whole should benefit from innovative and digital solutions from smart city model projects and a smart city competence centre should support municipalities in the digital transformation.

Kreislaufwirtschaftsgesetz (Circular Economy Act)

The Circular Economy Act came into force on June 1, 2012. The purpose of the Act is to promote the circular economy to conserve natural resources and ensure the protection of people and the environment in the generation and management of waste

Ersatzbaustoffverordnung (EBV) (Substitute Building Materials Ordinance)

The Substitute Building Materials Ordinance (EBV) comes into force on 01.08.2023. The EBV applies directly to all those who produce and/or sell (place on the market) substitute building materials (secondary building materials) for use in technical structures (e.g. recycled building materials or unprocessed/processed soil material) and incorporate these substitute building materials (secondary building materials) into technical structures (e.g. as road and path construction material, for backfilling working areas, for construction roads, for embankment/wall filling, etc.). The EBV regulates a) the requirements for the stationary and mobile production of mineral substitute building materials and for the placing on the market of mineral substitute building materials, b) the requirements for the sampling and testing of unprocessed soil material and unprocessed dredged material that is to be incorporated into a technical structure, c) the requirements for the installation of these mineral substitute building materials in technical structures and the requirements for the harmless use of these mineral substitute building materials in technical structures and d) the requirements for the removal of these mineral substitute building materials from technical structures (separation, reference to GewAbfV).

Selective demolition is not common in the CE region, though there are some regulations, innovation projects - In Austria and Germany there are legal regulations and standards for selective demolition or



utilization-oriented dismantling. These are regulations on waste separation, disposal and recycling of building materials and the environmental compatibility of demolition as: Recycled Building Materials Ordinance) and an accompanying national Standard (ÖNORM B 3151), DAfStb Beton, rezyklierte Gesteinskörnung:2010-09, DAfStb Alkali-Richtlinie 2013-10. Different EN standards are also covering use of recycled materials, e.g. recycled aggregates in construction products such as EN 206:2021 - Concrete - Specification, performance, production and conformity, DIN 1045-2:2014 - Concrete, reinforced and prestressed concrete structures - Part 2: Concrete - Specification, performance, production and conformity - Application rules for DIN EN 206, DIN 1045-2:2023 - Concrete, reinforced and prestressed concrete structures - Part 2: Concrete- DIN 4226-101:2017 - Recycled aggregates for concrete in accordance with DIN EN 12620, Part 101: Types and regulated dangerous substances, DIN 4226-102:2017 - Recycled aggregates for concrete in accordance with DIN EN 12620, Part 102: Type testing and factory production control, DIN EN 12620:2002 - Aggregates for concrete; German version EN 12620:2002+A1:2008. The Ordinance on requirements for the installation of mineral replacement building materials in technical structures (Ersatzbaustoffverordnung) in Germany define the whole process of mineral secondary raw materials in construction from acceptance of waste, production, quality monitoring to installation. Regarding excavated soil and stone as larger quantity of construction and demolition waste group the Bavarian state ministry for the environment and consumer protection has defined Backfilling guidelines in 2023. In Poland, the onsite building waste separation starts from 2025.01.01 following the finalized legislation in 2024. The challenge of introduction is the acquisition of the environmental permissions for this onsite activity. In other countries the regulations, standards regarding selective demolition and construction and demolition waste separation on site are under preparation.

New Buildings Energy Act (Gebäudeenergiegesetz - GEG)

Enacted by: Federal Ministry for Economic Affairs and Climate Action (BMWK)

Description: Unified energy law since November 2020 consolidating EnEG, EnEV and EEWärmeG. Although primarily energy-focused, the GEG integrates life-cycle and resource efficiency requirements indirectly, thereby supporting circular economy through mandates for renewable energy use and energy-efficient, low-impact buildings

Resource Efficiency Programme III (ProgRess III) & National Circular Economy Strategy (NKWS)

Enacted by: Federal Government - BMUV, BMWK

Description: National framework strategies—one adopted in December 2024—setting targets to reduce raw material consumption, improve resource productivity, and promote circular construction practices (e.g. urban mining, recycled content). Includes over 118 measures across the building lifecycle

<https://www.kreislaufwirtschaft-deutschland.de/en/the-national-circular-economy-strategy-nces/action-areas/construction-buildings>

https://publications.europa.eu/resource/cellar/ba48a82f-4153-11f0-b9f2-01aa75ed71a1.0001.03/DOC_1?

https://www.bmuv.de/fileadmin/Daten_BMU/Download_PDF/Abfallwirtschaft/nkws_grundlagen_en_bf.pdf.pdf



Practical guidance / tutorials

- **How to comply**

Environmental legislation increasingly requires proof of recycling, energy efficiency, and reduced emissions in construction. For SMEs, compliance can seem overwhelming, but a structured checklist helps. Such a checklist might include: percentage of recycled content in materials, proof of selective demolition, documentation of waste management, and adherence to energy standards. Following these steps systematically ensures that the company remains compliant throughout design, procurement, and construction. This proactive approach not only avoids fines but also improves reputation in public tenders.

- **Digital support**

National digital permitting systems make compliance more efficient. In Hungary, the ÉTDR platform supports electronic submissions of permits and allows direct integration with BIM files. In Germany, BIM-based portals are being tested for public works, where digital models can be uploaded and automatically checked for compliance with building codes. Italy's Consip system integrates environmental criteria into public procurement procedures. These digital tools reduce bureaucracy and help embed circularity requirements directly into the permitting process.

- **Tutorials**

SMEs can use published guidelines from the European Construction Sector Observatory or national ministries. These tutorials explain in clear language what each regulation requires and how companies can adapt their workflows. Many include case studies of successful compliance - for example, contractors who introduced material recovery documentation to meet recycling targets. Learning from these best practices saves time and helps SMEs anticipate future legal requirements.



3. LCA/EPD/PEF Level(s)

If a company wants to take steps towards sustainability, a good first step is determining the environmental impact of the products and production process. There are more ways to assess and communicate this impact. Three of them are Life Cycle Assessment (LCA), Environmental Product Declaration (EPD), and Product Environmental Footprint (PEF). All three methods assess and communicate the environmental impact of the product or organisation, and they are interconnected. Each have their own approach and end product, providing different insights and applications.

a. Life Cycle Assessment - LCA

Life Cycle Assessment (LCA), standardised with ISO 14040/44, is a powerful and essential sustainability tool that evaluates the environmental impacts of a product or service across its entire life cycle, from raw material extraction to the end of life.

As the basis of the Product Environmental Footprint (PEF) and Organisation Environmental Footprint (OEF) methods, Life Cycle Assessment (LCA) provides a holistic approach and a framework for decision-making, enabling the comprehensive assessment and management of the environmental impacts of products and organisations. In this way, companies can better understand and reduce their environmental impacts, and use this information to inform consumers about the sustainability of their products or organisations.



The infographic visually represents the Life Cycle Assessment (LCA) as a continuous loop that traces a product's journey. Beginning at the bottom left with **natural resource and raw material extraction**, the loop progresses clockwise through **processing**, **manufacturing**, **packaging and distribution**, **use and maintenance**, and **disposal**. From the disposal stage, one arrow exits the loop, indicating waste that is permanently removed from the cycle. However, the loop continues toward **recycling and recovery**, shown at the bottom right. An arrow from this stage loops back to the start, illustrating that recovered materials

⁵ https://green-forum.ec.europa.eu/environmental-footprint-methods/life-cycle-assessment-ef-methods_en



can be reused in **resource extraction**, thereby restarting the life cycle. This design emphasizes both the linear flow of waste and the potential for circular resource use.

Guidelines and tutorials for LCA

- **Life cycle assessment in the construction sector: A review**

This study provides a comprehensive overview of the current state of LCA in the construction industry, including regulatory developments and practical applications.

<https://globalabc.org/sites/default/files/2022-11/Life%20cycle%20assessment%20in%20the%20construction%20sector%20-%20A%20review.pdf>

- **Building's Life Cycle Assessment (LCA)**

This resource presents the application of LCA in the construction industry, with a focus on the benefits and challenges of prefabricated construction methods.

<https://build-up.ec.europa.eu/en/themes/topic-of-the-month/topic-of-the-month-archive/buildings-life-cycle-assessment-lca>

Hungary

- **ÉMI - LCA Methodologies in Hungarian Construction Practices**

Author: ÉMI Nonprofit Kft. (Építésügyi Minőségellenőrző Innovációs Nonprofit Kft.)

Description: As Hungary's national institute for construction quality and innovation, ÉMI integrates LCA practices into product testing and certification. It provides LCA-related services for construction materials and encourages EPD development in accordance with European standards (EN 15804).

Link (HU): <https://www.emi.hu/hu/kornyezetvedelmi-szolgalatasok>

(No full English version, but technical support for manufacturers is available.)

- **Építőanyag.hu - EPD and LCA Guidelines for Manufacturers**

Author: Magyar Építőanyag és Építési Termék Szövetség (ÉVOSZ / HUNGAROCÉM)

Description: Provides Hungarian manufacturers with guidance on how to prepare Environmental Product Declarations (EPD) and perform LCAs. Offers an introduction to LCA calculation tools and alignment with EU sustainability reporting.

Link (HU): <https://epitoanyag.hu/kornyezeti-termeknyilatkozatok-epd/>

(English summary may be available on request.)

- **Lechner Tudásközpont - Integration of LCA in Building Design Tools**

Author: Lechner Knowledge Center

Description: Supports integration of environmental assessment methodologies (LCA, EPD) into digital tools like BIM and energy simulation in Hungary. Promotes the use of standardized datasets and harmonized EU methods, in line with Level(s) framework.

Link (HU): <https://lechnerkozpont.hu> (Search: "LCA" or "környezeti hatásvizsgálat")

- **Körforgásos Gazdaság Technológiai Platform - Circular Economy Platform Hungary**

Author: Hungarian Circular Economy Platform / BCSDH (Business Council for Sustainable Development in Hungary)

Description: While not exclusively focused on construction, this platform actively promotes LCA and PEF adoption across industries including building materials. Member companies (e.g. Lafarge, Wienerberger) develop environmental declarations and apply life-cycle thinking.



Link (EN): <https://bcsdh.hu/en/our-initiatives/circular-economy-platform/>

- **National Adaptation Geo-Information System (NAGiS) - Environmental Impact and Material Flow Monitoring**

Author: Hungarian Meteorological Service (OMSZ) and Lechner Tudásközpont

Description: Although focused primarily on climate adaptation, NAGiS provides tools and spatial databases that support life-cycle environmental impact analysis related to urban planning and construction projects.

Link (EN): <https://en.nagis.hu>

Czech Republic

- **ČSN EN ISO 14040: Environmental management - Life cycle assessment - Principles and syllabus**

Life Cycle Assessment & the EF methods, European Commission, Prague, ČNI, 2006

https://green-forum.ec.europa.eu/green-business/environmental-footprint-methods/life-cycle-assessment-ef-methods_en

- **ČSN EN ISO 14044: Environmental management - Life cycle assessment - Requirements and guidelines**

Published by: International Organization for Standardization, Prague, ČNI, 2006

<https://www.iso.org/standard/38498.html>

- **ČSN EN ISO 14020: Environmental labels and declarations - General principles**

Published by: International Organization for Standardization, Prague, ČNI, 2006

<https://cdn.standards.iteh.ai/samples/34425/a2dcbda0728a4a1294146dbe5bfddfe8/ISO-14020-2000.pdf>

- **ČSN EN ISO 14025: Environmental labels and declarations - Type III environmental declarations - Principles and procedures**

Published by: International Organization for Standardization, Prague, ČNI, 2006

<https://www.iso.org/standard/38131.html>

- **ČSN EN ISO 14031: Environmental management - Environmental performance assessment - Guidelines**

Published by: International Organization for Standardization, Prague, ČNI, 2000

<https://www.iso.org/standard/81453.html>

- **ČSN EN 15643-1: Sustainability of buildings - Sustainability assessment of buildings - Part 1: General framework**

Published by: NSAI, ÚNMZ, 2011

https://www.intertekinform.com/preview/98703350164.pdf?sku=874849_saig_nsai_nsai_2079814&srltid=AfmBOop4xDjE3Pu6svz06_VEY1AUNqrVnyPqD5QP5ejVpLJIDp4ryfvE

- **ČSN EN 15643-2: Sustainability of buildings - Assessment of sustainability of buildings - Part 2: Framework for assessment of environmental performance**

Published by: SIST, ÚNMZ, 2011

https://standards.iteh.ai/catalog/standards/cen/d363ca6e-8f89-4f30-a4c8-773e8d87e3ca/en-15643-2-2011?srltid=AfmBOorYTQUaUSGyFJK-FH3Nj87kuaVlui_CZh6MrTQwqPGGJ-34_im6



- **SBToolCZ - Sustainability Rating System in the Czech Republic**

Published by: Czech Technical University in Prague

The Czech Republic has developed the Envimat platform: a national database designed to support LCA calculations for building materials and structures. This platform facilitates the assessment of environmental impacts and supports the development of Environmental Product Declarations (EPDs). It is integrated with the SBToolCZ, a national sustainability assessment tool, and aims to provide a unified source of environmental data for the construction sector

SBToolCZ is the Czech national certification and assessment tool for evaluating the quality and sustainability of buildings according to sustainable construction principles. It was adapted by the Czech Technical University in Prague to promote sustainable building design across the whole construction life cycle.

The LCA method in SBToolCZ covers several life cycle stages of buildings, including product stages, use stages, and end-of-life phases

https://www.cesb.cz/cesb13/proceedings/5_tools/CESB13_1311.pdf

- **Project INDICATE**

The INDICATE initiative aims to support climate-neutral construction by addressing the lack of reliable, comprehensive data on building emissions. It brings together governments, industry, and academia to provide Whole Life Carbon (WLC) data—covering emissions from material production to demolition. In the Czech Republic, 56 new LCA case studies and 50 existing ones were analyzed to establish initial national carbon benchmarks. The project also developed guidelines for integrating LCA with BIM, proposed standard procedures aligned with Czech practice, identified calculation risks, and provided policy recommendations to enable effective WLC implementation.

<https://www.indicatedata.com/>

- **Publication: EU Policy Whole Life Carbon Roadmap**

The EU Policy Whole Life Carbon Roadmap, launched by WorldGBC in May 2022 as part of the #BuildingLife project, outlines the key EU policy actions and tools needed to decarbonise the built environment by 2050. It focuses on addressing whole life carbon (WLC) emissions at the building level and serves as a guide for aligning EU policies with climate goals. The roadmap supports EU, national, and local policymakers in harmonising governance, informs the necessary policy trajectory to meet the EU Green Deal and Paris Agreement, and offers a unified reference point to drive greater policy ambition across the construction sector.

https://globalabc.org/sites/default/files/2022-05/EU_Roadmap.pdf

- **Publication: How to establish Whole Life Carbon benchmarks**

This publication supports EU and national policymakers in implementing Whole Life Carbon (WLC) regulations for buildings by analyzing early efforts in Czechia, Ireland, and Spain. It highlights the need for transparent and harmonized data on both operational and embodied carbon to align the construction sector with climate neutrality goals. As required by the revised Energy Performance of Buildings Directive (EPBD), countries must establish WLC benchmarks and limit values by 2027. The report emphasizes the importance of consistent methodologies, presents initial baseline values, and identifies key carbon sources—especially emissions from the product stage. It aims to guide policymakers in setting effective carbon targets and avoid fragmented national approaches.

https://www.bpie.eu/wp-content/uploads/2024/09/How-to-establish-whole-life-carbon-benchmarks_final.pdf



- **Envitrail - LCAs of Construction Materials**

Envitrail specializes in Life Cycle Assessment (LCA) and the development of Environmental Product Declarations (EPDs), with a particular focus on construction materials. The company also organizes training workshops for businesses and the general public to raise awareness and provide education on assessing environmental impacts.

<https://envitrail.com/lca/>

- **Sustainable Materials**

Website, focusing on sustainable materials, includes examples of materials in use in practice, LCA and EPD, circularity and more.

<https://www.setrnmaterialy.cz/cs/navrh-budovy>

Austria

Life Cycle Assessment (LCA): Environmental impacts are assessed using indicators such as the OI3 index (eco-index 3) and the disposal indicator EI10 to ensure the use of environmentally friendly and recyclable building materials.

<https://www.ibo.at/materialoekologie/lebenszyklusanalysen/oekoindex-oi3>

Poland

- **General LCA Methodology Standards and Guides**

- *PN-EN ISO 14040:2009 & PN-EN ISO 14044:2009*

Author: Polish Committee for Standardization (PKN)

Polish adoption of ISO 14040:2006 and ISO 14044:2006, defining the principles, framework, requirements, and procedures for conducting Life Cycle Assessment. These basic standards define how to establish the objectives and scope of an LCA study, conduct a life cycle inventory, assess environmental impacts and interpret the results. (*English versions available as ISO 14040:2006 and ISO 14044:2006.*)

- *ILCD Handbook: General Guide for Life Cycle Assessment (2010)*

Author: European Commission, Joint Research Centre

A comprehensive EU guideline providing detailed technical guidance for LCA studies to ensure consistency and quality. It serves as a “common basis” for robust, quality-assured LCA practice and is aligned with ISO 14040/44 standards. The ILCD Handbook is widely used in Europe (including Poland) as a reference for best practices in LCA methodology. (Document in English.)⁶

- **Construction Sector-Specific Standards and Frameworks**

- *PN-EN 15804:2012+A2:2019*

Author: Polish Committee for Standardization (PKN)

Polish edition of EN 15804, the core standard for Environmental Product Declarations (EPDs) of construction products. EN 15804 provides the common rules (PCR) for assessing and reporting the LCA results of building materials. It defines how EPD data must be collected, calculated (modules A-D), verified, and presented to ensure comparability. This standard is the basis for Poland’s national EPD program and is widely used by industry. (Original text in English; Polish translation available.)

- *PN-EN 15978:2011*

⁶ <https://eplca.jrc.ec.europa.eu/uploads/ILCD-Handbook-General-guide-for-LCA-DETAILED-GUIDANCE-12March2010-ISBN-fin-v1.0-EN.pdf>



Author: Polish Committee for Standardization (PKN)

Polish edition of EN 15978, a standard for evaluating the environmental performance of buildings using a life-cycle approach. It specifies a calculation method (based on LCA and other indicators) to assess a building's environmental impacts over its entire life cycle, covering all stages from production of materials through use and end-of-life. The standard defines system boundaries, required inventory data (often from EPDs), impact indicators, and how results should be reported. PN-EN 15978 is the key reference for whole-building LCA assessments in Poland. (Original in English; Polish version available).

- *Level(s) Framework (2017)*

Author: European Commission

A voluntary EU framework for sustainable buildings, introducing a set of core sustainability indicators (including Whole Life Carbon measured via LCA) to create a “common language” across Europe's building sector. Level(s) is not a certification scheme but a reporting framework that links building-level LCA results with broader EU resource efficiency goals. It uses a stepped approach (from simplified to more detailed LCA) and aligns with standards like EN 15978. (Documentation in English; applicable in Poland under EU initiatives).

https://green-forum.ec.europa.eu/levels_en

- **Polish National Publications and Initiatives**

- *„Zerowy ślad węglowy budownictwa. Mapa drogowa dekarbonizacji budownictwa do roku 2050” (“Zero Carbon Building - Roadmap to Decarbonise Construction by 2050”) (2021)*

Author: Polish Green Building Council (PLGBC)

A Polish-language report outlining a strategic pathway for achieving climate neutrality in Poland's building sector by 2050. It emphasizes the need for whole-life LCA of buildings (based on PN-EN 15978) and notes the lack of a unified method for calculating building carbon footprints. The roadmap presents an action timeline for all stakeholders (government, developers, investors, designers, material producers, etc.) to reduce both operational and embodied emissions in construction (Available only in Polish).

- *„Szacowanie śladu węglowego budynków” (“Calculating the Carbon Footprint of Buildings”) (2022)*

Author: Polish Green Building Council (PLGBC)

A detailed follow-up guide (in Polish) presenting the assumptions and methodology for assessing a building's carbon footprint across its entire life cycle. This publication introduces a standardized approach with both a simplified method and a full LCA method for buildings. It outlines how to unify calculations of embodied and operational GHG emissions, enabling collection of consistent data on Polish buildings' footprints and comparison across building types. The guide also recommends steps (including developing benchmarks and a national database) to facilitate adoption of LCA in the building industry (Available only in Polish).

- *„Propozycja krajowej metodyki wyznaczania śladu węglowego budynków” (“Proposal of a National Methodology for Determining Building Carbon Footprint”) (2024)*

Author: Narodowa Agencja Poszanowania Energii (NAPE) & partners

A report from an EEA/Norwegian-funded Polish project developing a consistent whole-building LCA methodology. It analyzes case-study buildings and identifies which aspects of a full LCA can be simplified to ease implementation in Poland. The outcome is a set of national guidelines (in Polish) with defined methods, simplifications, and default values for calculating the life-cycle environmental impacts of buildings. The project also includes training for practitioners, aiming to support future regulations on building carbon footprints. (Polish only; no English version available).



- *Guidelines for Carbon Footprint and LCA in Green Public Procurement (2019)*

Author: Institute of Environmental Protection - NRI (IOŚ-PIB).

A Polish-language guidance document funded by the National Fund for Environmental Protection, aimed at public administration. It introduces life cycle thinking in public tenders, providing best practices on using LCA and carbon footprint criteria. One part of the guidelines focuses on comparing vehicles in public procurement (conventional vs. electric cars) by quantifying their full life-cycle environmental impacts. Another part applies LCA to a construction investment, identifying which building components or materials cause significant impacts and suggesting greener alternatives to reduce overall footprint (Available in Polish only).

- *„Opracowanie metodyki LCA dla oceny projektów infrastrukturalnych” (“Development of an LCA Methodology for Evaluating Infrastructure Projects”) (2008)*

Author: Ministry of Regional Development (Poland) & Polish Academy of Sciences (IGSMiE PAN)

An early government-commissioned study (in Polish) that proposed how to integrate LCA into the assessment of infrastructure investments. This report presented the principles of conducting LCA studies and provided examples of LCA application to assess technological solutions used in EU countries. It laid important foundations for subsequent Polish efforts to include environmental life cycle assessment in project planning and assessment (Available in Polish only).

Italy

• Italian regulatory framework

- The Minimum Environmental Criteria (CAM Edilizia), introduced by Ministerial Decree of 23 June 2022, require the use of LCA (and LCC) analyses in public procurement projects as bonus criteria for sustainability

<https://innoecomag.com/life-cycle-assessment>

- These criteria are mandatory in public procurement (Procurement Code Legislative Decree 36/2023 integrated into GPP)

<https://www.icesp.it/news/life-cycle-assessment-edilizia-valutazione-ambientale-alla-scala-delledificio-e-del-prodotto>

• Initiatives and technical groups in Italy

- The Italian LCA Network, through its Construction Working Group, works to promote the adoption of LCA in construction, contributing to the regulatory framework, defining synergies between EPDs and certification protocols, and monitoring initiatives on CAMs and European technical standards

<https://www.reteitalianalca.it/gruppi-di-lavoro/edilizia>

- The book “LCA in edilizia. Ambiti applicativi e orientamenti futuri” (LCA in construction. Areas of application and future directions), published by the Italian LCA Network, is an up-to-date reference on applications, guidelines and national case studies

<https://www.theplan.it/eng/politecnica-university-press/lca-in-edilizia-ambiti-applicativi-e-orientamenti-futuri-della-metodologia-life-cycle-assessment-nel-settore-delle-costruzioni>

• Case study: the ARCADIA project (ENEA)

- Through the ARCADIA project, ENEA is building an Italian LCA Database (BDI LCA) containing national datasets for construction materials (steel, concrete, glass, PVC, cement, construction waste, etc.)

<https://www.arcadia.enea.it/settori-di-intervento/edilizia.html>

- The goal is to make a national database available by 2025 to support LCA assessments on a building and product scale, which will also be useful for public administration and green procurement <https://innoecomag.com/life-cycle-assessment>



Germany

- **DIN EN ISO 14040: Life cycle assessment - Principles and framework**

Author: German Institute for Standardization (DIN) / CEN (Germany-adopted ISO)

Description: Defines basic principles and the structure for conducting an LCA (goal & scope, inventory analysis, impact assessment, interpretation). This is the foundational framework for ISO-compliant LCAs

English version: ISO 14040:2006 (English language through ISO/CEN publications)

- **DIN EN ISO 14044: Life cycle assessment - Requirements and guidelines**

Author: German Institute for Standardization (DIN) / CEN

Description: Specifies detailed requirements and methodological guidance to conduct LCA studies, including reporting and critical review procedures (§ISO 14041 to 14043 consolidated) Intertek InformStandards.ieWikipedia.

English version: ISO 14044:2006 with Amendments A1:2018, A2:2020 (available via ISO / CEN publications)

- **VDI 4431: Life-cycle management in the manufacturing industry**

Author: VDI Association of German Engineers: Society for Energy and Environment

Description: Offers guidance on strategic development of life-cycle management systems, linking product, material, and waste cycles. It supports product design and logistics under a lifecycle perspective VDI VDI.

English version available under the same title: VDI 4431

- **DIN EN 15804: Sustainability of construction works - Environmental Product Declarations - core rules for construction products**

Author: CEN (adopted in Germany via DIN / IBU)

Description: Provides uniform PCR (Product Category Rules) for construction products, specifying LCA indicators and modules following ISO 14040/44. Basis for Environmental Product Declarations in construction

English version: EN 15804:2012 + A2:2019/AC:2021

- **DIN EN 15978: Sustainability of construction works - Assessment of environmental performance of buildings**

Author: CEN / DIN (implemented in Germany)

Description: Defines how to assess whole-building environmental performance, using LCA for operational and embodied impacts across building lifecycle stages

IBU Institut für Bauen und Umwelt e.V. / Institute for Building and Environment e.V.: <https://ibu-epd.com/en/life-cycle-assessment/>

English version: EN 15978 (available via CEN / DIN sources)

- **ÖKOBAUDAT - Building LCA data platform**

Author: BBSR (Federal Institute for Research on Building, Urban Affairs and Spatial Development) for BMWSB

Description: A bilingual (German and English) open database with over 1,400 LCA datasets for construction products. Mandatory data source for the German Federal Sustainable Building Assessment (BNB), used widely for building-level LCA within certification systems DIBt.

<https://www.oekobaudat.de/en.html>



- **Guidelines by UBA & Öko-Institut: ProBas Database for LCA data**

Author: Umweltbundesamt (Federal Environment Agency) in cooperation with Öko-Institut

Description: Offers free access to life cycle inventory data (energy, material, transport, disposal) supporting both corporate and product LCAs. English-language database ProBas aligns with ISO 14040/44 principles.

<https://www.probas.umweltbundesamt.de/>

- **Federal LCA Commons / ILCD-based initiatives supported by UBA**

Author: Umweltbundesamt (Federal Environment Agency, Germany) in coordination with European LCA initiatives (ILCD, GLAD, Life Cycle Initiative)

Description: Involvement in international initiatives (such as ILCDN, GLAD) to enhance consistency and interoperability of LCA methods and data quality in Germany. Provides guidance on best practice use of LCIA methods in alignment with ISO standards.

<https://eplca.jrc.ec.europa.eu/ilcd.html>

Croatia

- **LIFE Level(s) Croatia - Supporting the Development of Quality Data**

As part of the LIFE Level(s) project, Croatia GBC, in collaboration with partner councils across Europe and with the support of experts from Cambridge Architectural Research (UK), has prepared a study on the environmental impacts of a group of commonly used construction materials (Aggregates/Cement/Steel/Aluminum/Glass/Timber/Brick) according to the Life Cycle Assessment (LCA) methodology.

<https://gbccroatia.org/en/cases/life-levels/>

- **Presentation & Toolkit: CarbonGraph Eco Scan LCA Tool (Croatia-based DIH Connect)**

An online LCA-based free tool ("CarbonGraph Eco Scan") offering companies insights into product environmental footprints, including carbon, water, and land use impacts. It includes tutorials and video guidance to support SMEs in product-level LCA.

<https://dihconnect.eu/lca-anketa/?lang=en>

b. Product Environmental Footprint - PEF

The Product Environmental Footprint (PEF) method, based on life cycle assessment (LCA), provides rules to quantify and communicate environmental impacts of products, including goods and services. Building upon global standards (e.g. ISO 14040/44) and other relevant approaches, PEF focuses on reducing impacts throughout the supply chain of products – from raw material extraction to waste management. It provides specific requirements for modelling material flows, emissions, and waste streams, enabling a thorough understanding and management of environmental impacts.



The scope of a PEF includes everything shown on the infographic, including the resources and emissions used or emitted for each of the life cycle stages and each stage's impacts on the environment.

Guidelines and tutorials for PEF

- **Environmental Footprint Methods - European Commission**

EU Life Cycle Assessment (LCA) methodologies, which provide detailed guidance on modeling, calculating and reporting the life cycle environmental impacts of products and organizations.

https://green-forum.ec.europa.eu/environmental-footprint-methods_en

- **Product Environmental Footprint (PEF) Overview - Ecochain**

Overview of the new EU PEF standard, including methodology and database.

<https://ecochain.com/blog/are-you-prepared-for-the-product-environmental-footprint/>

- **Understanding Product Environmental Footprint and Organisation Environmental Footprint methods**

This report provides a simple guide to PEF and OEF, aimed at people who want to know more details about the Environmental Footprint and its main methodological aspects, and people who want to have fast and direct access to the most up-to-date documents, webpages and tools for a more in-depth analysis.

<https://publications.jrc.ec.europa.eu/repository/handle/JRC129907>

Hungary

- **PEF Pilot Project Hungary - Ministry of Agriculture (AM)**

Author: Agrárminisztérium (Hungarian Ministry of Agriculture), with support from the EU Environmental Footprint Pilot phase.

Description: Hungary participated in the EU's PEF pilot initiative through selected sectors (including food and building materials). The Ministry published methodological experiences and recommendations for national implementation of PEF across supply chains.

⁷ https://green-forum.ec.europa.eu/environmental-footprint-methods/pef-method_en



Link (HU): <https://kornyezetugy.hu/> (search: “PEF módszertan”)

(No full English version available, but relevant summaries and EU links are cited.)

- **ÉMI Nonprofit Kft. - Environmental Impact and PEF Consultancy**

Author: ÉMI Építésügyi Minőségellenőrző Innovációs Nonprofit Kft.

Description: ÉMI offers services related to environmental product declarations and life-cycle analysis in alignment with EU PEF recommendations, particularly for construction products and building materials. The organization promotes harmonization with EN 15804 and ISO 14040/44.

Link (HU): <https://www.emi.hu/hu/kornyezeti-szolgaltatasok>

- **BCSDH - Business Council for Sustainable Development Hungary (PEF Promotion)**

Author: BCSDH - Magyarországi Üzleti Tanács a Fenntartható Fejlődésért

Description: Through its Circular Economy Platform and “Race to Zero” initiative, BCSDH promotes the use of environmental footprinting tools such as PEF to Hungarian companies. Offers thematic workshops and publications to guide companies in product sustainability accounting.

Link (EN): <https://bcsdh.hu/en/our-initiatives/circular-economy-platform/>

- **ÖKOINDUSTRIA - Hungarian Green Expo & Knowledge Hub**

Author: Magyar Környezettechnológiai Gyártók és Szolgáltatók Szövetsége (KEXPORT)

Description: The ÖKOINDUSTRIA international green expo and its accompanying workshops highlight PEF case studies, practical tools for product sustainability, and national efforts to implement EU environmental footprint policies across Hungarian industries.

Link (EN): <https://www.okoindustria.hu/en>

- **ÉVOSZ - Construction Industry Sustainability Framework**

Author: Építési Vállalkozók Országos Szakszövetsége (ÉVOSZ)

Description: The Hungarian Construction Employers’ Association publishes guidance for sustainability in the building sector, including references to LCA and PEF methodologies. The organization supports awareness and training for environmental data integration in building product chains.

Link (HU): <https://www.evosz.hu>

Czech Republic

- **ČSN EN ISO 14067 (010967) Greenhouse gases - Product carbon footprint - Requirements and guidelines for quantification/ Greenhouse gases - Product carbon footprint - Requirements and guidelines for quantification and communication**

The standard defines principles, requirements, and guidelines for quantifying and reporting the carbon footprint of a product in line with international life cycle assessment standards (ISO 14040 and ISO 14044). It also covers partial carbon footprint assessments. The focus is solely on one environmental impact category—climate change—making it a tool for evaluating and communicating the climate-related environmental footprint of products.

[ČSN EN ISO 14067 | ČSN online](#)

- **ČSN ISO 14053**

Covers material flow cost accounting relevant to life-cycle and environmental cost review of products

[ČSN ISO 14053 | ČSN online](#)



- **ČSN ISO 14021 – Environmental labels and declarations – Self-declared environmental claims / ČSN ISO 14021 Environmentální značky a prohlášení - Vlastní environmentální tvrzení**

The international standard ČSN ISO 14021 specifies requirements for self-declared environmental claims, including statements, labels, and symbols related to products. It defines common terminology, conditions for use, and provides a framework for evaluation and verification methods. Such claims may be made by manufacturers, importers, distributors, or retailers and appear on products, packaging, documentation, advertising, or digital media. The norm emphasizes the importance of reliable verification to prevent negative market effects such as unfair competition or trade barriers caused by unreliable or misleading claims. It aims to harmonize the use of self-declared environmental claims to ensure accuracy, transparency, and scientific soundness, thereby increasing market trust and facilitating informed consumer choices. The standard currently includes specific symbols like the Mobius loop but does not imply that these claims are inherently superior to others. Additional specific labels will be addressed in future updates.

<https://www.technicke-normy-csn.cz/csn-en-iso-14021-010921-158547.html#>

- **National Programme on Environmental Claims - Národní program environmentálního značení (NPEZ) - aktualizace 2017**

The Czech Ministry of Environment's National Program on Environmental Claims (last updated in 2017) provides non-binding guidance on eco-labelling, environmental claims, and environmental product declarations, referencing relevant regulations and ISO standards. Accompanied by Guidelines on the Use of Own Environmental Claims, it outlines best practices for businesses: claims must be accurate, verifiable, relevant, and not misleading, based on robust and reproducible data, and accompanied by transparent methodology. While full life cycle analysis isn't required, all relevant stages should be considered. Though voluntary, the Program sets clear expectations for environmental communication in the Czech market.

https://www.ekoznacka.cz/wp-content/uploads/2022/10/Narodni-program-environmentalniho-znacen-NPEZ_v2017-20180410.pdf

- **Guidelines on the Use of Own Environmental Claims**

The handbook published by the CENIA agency focuses on the proper use of self-declared environmental claims – that is, labels, statements, or symbols that manufacturers and service providers use to present the environmental benefits of their products. In response to the growing interest of Czech consumers in eco-friendly products, the risk of misleading claims, which may be unverifiable or false, is also increasing. Therefore, the handbook provides guidance on how to create accurate, clear, and verifiable claims in accordance with the international standard ČSN ISO 14021, without the need for third-party certification. It also offers the possibility of voluntary registration of claims in the CENIA database and helps companies with their evaluation, use of symbols, and ensuring credibility.

https://cenia.gov.cz/wp-content/uploads/2021/01/VET_prirucka_CENIA_def.pdf

- **ISO 14025:2006 - Environmental labels and declarations - Type III environmental declarations - Principles and procedures (ISO)**

<https://www.iso.org/standard/38131.html>

- **BP X30-323-0:2011 - General principles for the environmental labeling of consumer products (AFNOR, France)**

https://www.betterfly-tourism.com/wp-content/uploads/2024/06/Referentiel-ADEME-BP-X30-323-27_EN.pdf



- **Greenhouse Gas Product Accounting and Reporting Standard (GHG Protocol, 2011)**
<https://www.wri.org/research/greenhouse-gas-protocol-product-life-cycle-accounting-and-reporting-standard>
- **PAS 2050 - Specification for the assessment of the life cycle greenhouse gas emissions of goods and services (BSI, 2011)**
Published by: BSI, Carbon Trust, & The Department for Environment, Food and Rural Affairs (Defra)
http://www.carbonconstruct.com/pdf/pas_2050.pdf
- **ISO 14040:2006 Environmental management – Life cycle assessment –Principles and framework**
<https://www.iso.org/standard/37456.html>
- **ISO 14044:2006 Environmental management – Life cycle assessment –Requirements and guidelines**
<https://www.iso.org/standard/38498.html>
- **ISO 14050:2006 Environmental management – vocabulary**
<https://www.iso.org/standard/31807.html>
- **ISO/TS 14067:2013 Greenhouse gases -- Carbon footprint of products -- Requirements and guidelines for quantification and communication**
<https://www.iso.org/standard/59521.html>
- **ISO 17024:2003 Conformity assessment - General requirements for bodies operating certification of persons.**
<https://www.iso.org/standard/29336.html>
- **ISO/TS 14071:2014 Environmental management – Life cycle assessment – Critical review processes and reviewer competencies: Additional requirements and guidelines to ISO 14044:2006**
<https://www.iso.org/standard/59562.html>
- **ISO 14046:2014 Environmental management -- Water footprint -- Principles, requirements and guidelines**
<https://www.iso.org/standard/43263.html>
- **ENVIFOOD PROTOCOL**
Food SCP RT (2013), ENVIFOOD Protocol, Environmental Assessment of Food and Drink Protocol, European Food Sustainable Consumption and Production Round Table (SCP RT), Working Group 1, Brussels, Belgium.
<https://publications.jrc.ec.europa.eu/repository/handle/JRC69154>

Austria

Austria is not mandatory enforces the provision of a PEF. Verifications are done under the harmonized national technical standard ÖNORM ISO 14067.

This document specifies requirements, principles, and guidelines for the quantification and reporting of the carbon footprint of a product (CFP) in accordance with international standards for life cycle assessment (LCA) (ISO 14040 and ISO 14044). Requirements and guidelines for the quantification of a partial CFP are also specified.



This document defines the scope of CFP studies focused solely on climate change impacts, excluding carbon offsetting, communication of partial results, and any social, economic, or other environmental considerations.

<https://www.austrian-standards.at/de/shop/onorm-en-iso-14067-2019-03-15-p2466166>

Poland

- **Long-Term Building Renovation Strategy (LTRS) - Poland 2020**

Ministry of Development, Labour and Technology prepared strategy that outlines Poland's roadmap to transform its building stock into nearly zero-energy buildings (nZEB) by 2050. It includes renovation scenarios, energy performance targets, and guidelines to support building renovations in Poland.

https://energy.ec.europa.eu/system/files/2022-06/PL_2020_LTRS_EN_version.pdf

- **National Building Renovation Plan (KPRB)**

Ministry of Development and Technology (MRiT) currently works under preparation, the KPRB aims to establish a comprehensive policy for renovating Poland's building stock into highly energy-efficient, zero-emission structures by 2050. It will include minimum efficiency standards and an energy rating system from A to G.

<https://www.ca-epbd.eu/countries/poland>

- **Sustainable Forest Management - Requirements (PEFC PL 1003 ver. 2:2024EN)**

PEFC Poland Council - This document sets the requirements for sustainable forest management in Poland, aligning with PEFC International standards. It includes certification criteria and references to Polish legislation relevant to forest management and construction.

<https://cdn.pefc.org/pefc.org/media/2024-02/03d425f8-caef-4f7f-b5be-36dbf65188bb/04b2b8ac-6ddf-5893-a5fc-86429de4fc68.PDF>

- **Act of November 9, 2018, on Electronic Invoicing in Public Procurement**

Polish Parliament accepted act, that transposes the EU eInvoicing Directive (2014/55/EU) into Polish law, mandating public authorities to receive and process electronic invoices. It led to the establishment of the National eInvoicing Platform (PEF) for B2G transactions.

<https://ec.europa.eu/digital-building-blocks/sites/display/DIGITAL/eInvoicing%2Bin%2BPoland>

- **Construction Permits Process in Poland**

World Bank analyzes Poland's construction permitting process, offering recommendations to improve efficiency, transparency, and compliance with safety and environmental standard.

<https://documents1.worldbank.org/curated/en/559811486555465977/pdf/Construction-permits-process-in-Poland.pdf>

- **National Baseline Assessment on Underperforming Renovations in Poland**

Our CEE evaluates the energy performance of Poland's building stock, highlighting the prevalence of buildings with high primary energy consumption and the need for targeted renovations.

<https://our-cee.eu/wp-content/uploads/2024/07/Baseline-assessment-Poland.pdf>

Italy

- In Italy, the PEF is mainly implemented through the **Made Green in Italy (MGI)** scheme, established pursuant to **Article 21 of Law No. 221/2015** and governed by **Ministerial Decree 56/2018**: it is a voluntary system that uses the PEF methodology and the related European or national PEFCR (Product Environmental Footprint Category Rules).



<https://www.mase.gov.it/portale/home>

- To date, there are **no specific PEFCRs for building products** (such as construction materials) recognised at national or European level.

In the construction sector, the preferred approach is that of the EPD (Environmental Product Declaration), based on standard EN 15804 + A2, which has established itself as a consolidated and widely used standard for building materials in Europe and Italy (e.g. through EPD Italy).

Some experts believe that PEF, being designed primarily for consumer communication, is less suitable for construction products than EPDs, which are considered more consistent with the LCAs required by standards (such as CAM, public procurement, etc.)

<https://www.epditaly.it/2020/11/24/il-percorso-della-sostenibilita>

Germany

- **Product Environmental Footprint - Weiterentwicklung und Anwendung**

Author: Umweltbundesamt (Federal Environment Agency, Germany)

Description: Comprehensive German study (August 2024) on the transition phase following the PEF pilot phase. It includes methodological developments of PEF Category Rules (PEFCRs), a detailed comparison with UBA's 1999 method, and discussion of implementation options in national policy.

<https://www.umweltbundesamt.de/en/publikationen/product-environmental-footprint-weiterentwicklung> (English summary included in pdf)

- **Environmental Footprint: Der Umwelt-Fußabdruck von Produkten und Dienstleistungen**

Author: Umweltbundesamt (Federal Environment Agency, Germany) Finkbeiner, Bach & Lehmann

Description: UBA's 2019 report reflecting on the 2013-2018 PEF pilot phase. Covers the assessment and critique of initial PEFCRs, methodological challenges, and broader implications for policy and voluntary labelling systems.

<https://www.umweltbundesamt.de/publikationen/environmental-footprint-der-umwelt-fussabdruck-von-0>

- **German Position Paper on PEF and Construction Products**

Author: Deutsche Bauchemie e.V. (German Association of Construction Chemicals)

Description: November 2020 position on the applicability of PEF to construction products. Recommends recognition of EN 15804 EPDs (aligned with PEF) instead of introducing new legislation, and stresses harmonisation of sector-specific data for comparability.

<https://deutsche-bauchemie.de/verband/positionspapiere/august-2020-positionspapier-zum-product-environmental-footprint-pef>

- **Oeko-Institut Methodologies for Product Environmental Footprint (PEF)**

Author: Oeko-Institute e.V., in collaboration with public authorities

Description: Guidance on applying PEF and product carbon footprint (PCF) for products and organisations. Includes advice on modelling, system boundaries, and integration with ISO-based LCA practices. Particularly relevant for German companies.

<https://www.oeko.de/en/expertise/methodologies>



c. Environmental Product Declaration - EPD

An Environmental Product Declaration (EPD) is a standardized, third-party verified document that provides transparent and credible information about a product's environmental performance throughout its life cycle.

EPDs are based on several key standards:

- EPD Standards (Construction products): EN 15804+A1 / EN 15804+A2
- Lifecycle assessment (LCA) standards: ISO 14040 and ISO 14044
- External verification standards: ISO 14025 (Type III Environmental Claim) and ISO 21930 (specific to buildings)
- Self-declared internal verification standards: ISO 14021 (Type II Environmental)

to ensure consistency and reliability in environmental reporting. The creation process involves selecting a program operator (such as International EPD® System) and relevant Product Category Rules (PCR), conducting a detailed Life Cycle Assessment (LCA), drafting the EPD document, undergoing third-party verification, and publishing the verified EPD on a recognized portal.

Various types of EPDs exist, including product-specific, forthcoming product, multiple product, and sector-average declarations.

EPDs offer numerous benefits such as enhanced transparency, adherence to international standards, improved supply chain efficiency, regulatory compliance, sustainable product development, support for green procurement, and added brand value.

Verified EPDs are particularly important in meeting European and UK sustainability initiatives, as they provide accurate data aligned with the EU Green Deal, Circular Economy Action Plan, Product Environmental Footprint standards, and other regulations like the Ecodesign for Sustainable Products Regulation (ESPR) and EU Level(s) framework.⁸



⁸ <https://www.tuvsud.com/en-gb/resource-centre/blogs/uk/sustainability-blog/what-is-epd-environmental-product-declaration>

⁹ <https://www.environdec.com/all-about-epds/create-your-epd>



Guidelines and tutorials for EPD

- **Environmental Product Declarations - Construction Products Europe**

Guidance on the use of EPDs for construction products, including minimum requirements for the substantiation and communication of green claims.

<https://www.construction-products.eu/publications/environmental-product-declarations/>

- **Environmental Product Declaration (EPD) - The Complete Guide**

Comprehensive guide to EPDs, including standardization and verification processes.

<https://ecochain.com/blog/environmental-product-declaration-epd-basics/>

Hungary

- **ÉMI Nonprofit Kft. - EPD Development and Verification**

Author: ÉMI Építésügyi Minőségellenőrző Innovációs Nonprofit Kft.

Description: ÉMI provides professional services in life cycle analysis and EPD preparation for construction materials and building products in Hungary. It follows European standards (EN 15804) and ISO 14025, and also supports companies in the third-party verification process required for registering EPDs.

Link (HU): <https://www.emi.hu/hu/kornyezeti-szolgalattasok>

(No full English version, but services are aligned with international EPD system requirements.)

- **Hungarian EPD Case Studies - KÖVET Association for Sustainable Economies**

Author: KÖVET Egyesület a Fenntartható Gazdaságért

Description: KÖVET has conducted LCA and EPD pilot projects for Hungarian companies, focusing on the environmental footprint of various products. These case studies serve as practical examples for small and medium-sized enterprises (SMEs) in Hungary.

Link (HU): <https://kovet.hu/> (Search: “EPD esettanulmány”)

(Mainly in Hungarian; some materials are translated during international conferences or EU-supported workshops.)

- **HUGBC - Hungarian Green Building Council - EPD and Sustainable Materials**

Author: Hungary Green Building Council (HuGBC)

Description: HuGBC promotes the use of certified construction materials and EPDs through its training programs and circular economy workgroup. It collaborates with ÉMI and international systems like BRE and EPD International.

Link (EN): <https://www.hugbc.hu/en>

(Specific page on EPDs not always available, but materials are often referenced in workshops and publications.)

- **Környezetbarát Termék védjegy (Eco-label Hungary) - Voluntary Environmental Declaration**

Author: Herman Ottó Institute Nonprofit Ltd. (on behalf of Ministry of Agriculture)

Description: While not a formal EPD system, Hungary’s national eco-label system encourages LCA-based environmental transparency. It offers a pathway toward more comprehensive environmental declarations like EPDs, particularly for construction-related products.

Link (EN): <https://kornyeztbarat-termek.hu/> (Basic info in English available)



- **ÉVOSZ - Guidance on EPD in Public Procurement**

Author: Építési Vállalkozók Országos Szakszövetsége (ÉVOSZ)

Description: In line with EU green public procurement requirements, ÉVOSZ provides Hungarian construction companies with policy guidance and tools for including EPDs and LCA data in project documentation, especially for public tenders.

Link (HU): <https://evosz.hu> (Publications and project documents available upon request or during training events.)

Czech Republic

- **EPD database in the Czech Republic**

Published by: Ministry of Environment

Created and managed by the ministry of the environment, the Czech Republic has a EPD database for products regarding the effect that they have on the environment throughout their lifetime.

All entries into the database need to follow a concise and strict structure as highlighted by PCR (Product Category Rules). There are different PCRs for different product categories.

<https://www.ekoznacka.cz/database-epd-v-cr/>

- **National Environmental Labelling Program (NPEZ) - 2017 update**

Document from the Ministry of Environment to implement EPD:

Paper from the ministry of environment putting into place a directive for EPD to be implemented in the Czech Republic. Sets out the framework for the implementation, challenges and barriers for the implementation as well the positives that companies and products may gain from the implementation of EPD.

https://www.ekoznacka.cz/wp-content/uploads/2022/10/Narodni-program-environmentalniho-znaceni-NPEZ_v2017-20180410.pdf (Only in Czech)

Austria

In general, the procedure for creating an EPD and its required contents are regulated in ISO 14025 and in EN 15804. In addition, specific product category rules (PCR) are intended to create a uniform basis for the creation of life cycle assessments in the construction sector and to lead to consistent and thus comparable building material data, which can also be used in building assessment systems.

<https://www.ibo.at/en/building-material-ecology/product-declarations-epd>

The nonprofit and scientific institute Austrian Institute for Healthy & Ecological Building provides several ecological product declarations and nationally recognized quality classes.

Poland

- **PN-EN 15804:2012 + A2:2019 - Sustainability of construction works: Environmental Product Declarations**

Standard containing rules for the product categories of construction products - European Committee for Standardization (CEN); Polish Committee for Standardization (PKN)

This European standard (adopted in Poland as PN-EN 15804) provides the core methodological rules for developing EPDs for construction materials and products. It ensures all EPDs in the construction sector use consistent Life Cycle Assessment (LCA) rules and environmental indicators, enabling comparable and transparent reporting across different products.

<https://www.itb.pl/epd-faq/?lang=en>



- **ITB EPD Program - General Program Requirements - Building Research Institute (ITB), Poland.**

ITB operates the national EPD program for construction products, providing detailed guidelines and procedures for creating and verifying Type III EPDs. The program's requirements document (e.g. ver. 1.7 of 2025) aligns with ISO 14025 and EN 15804+A2 standards, ensuring EPDs contain quantifiable, standardized environmental data for building products. The ITB EPD program is voluntary and open to all construction product manufacturers, covering all products defined under the EU Construction Products Regulation.

<https://www.itb.pl/sustainable-construction/?lang=en>

- **EPD Polska - Opracowanie EPD (Developing an EPD)**

EPD Poland Program (operated by Multicert Sp. z o.o.)

The EPD Poland program (EPD Polska) is a recognized program operator in Poland offering EPD certification. Their online guide "Opracowanie EPD" outlines the step-by-step process for preparing an Environmental Product Declaration for a construction product. It covers defining the goal and scope of the LCA, collecting life-cycle data, preparing the EPD draft, undergoing independent third-party verification, and finally registering and publishing the EPD. This tutorial ensures that EPDs are developed in compliance with EN 15804 and verified for credibility.

<https://www.itb.pl/sustainable-construction/?lang=en>

- **Deklaracje środowiskowe produktu - EPD - Bureau Veritas Polska**

This is an informational resource provided by Bureau Veritas Poland, a certification body, describing what an Environmental Product Declaration is and how to implement it. The guide explains the LCA-based process of creating an EPD ("from cradle to grave"), the requirements of standards like ISO 14025 and EN 15804, and the importance of third-party verification. It also highlights who should consider obtaining an EPD certificate and the competitive advantages of having verified EPDs (e.g. demonstrating compliance and sustainability leadership). Only Polish version is available.

<https://www.bureauveritas.pl/needs/deklaracje-srodowiskowe-epd>

- **"Deklaracja środowiskowa wyrobu (EPD) - istotne narzędzie dla branży budowlanej"**

KPMG Poland (Authors: Justyna Wysocka-Golec; Dr. inż. Konrad Witczak; Marta Głażewska)

This is a 2023 blog post on KPMG's website that serves as a tutorial in Q&A format about EPDs in the construction industry. It explains the growing importance of EPDs as a tool for the green transformation of the building sector and answers practical questions about them. The guide defines what an EPD is - a transparent, third-party-verified document detailing a product's environmental footprint over its life cycle - and notes that EPDs are prepared according to standards like ISO 14040/44, ISO 14025, and PN-EN 15804. It also discusses why more building product manufacturers in Poland are adopting EPDs and how EPDs can meet emerging ESG and regulatory demands. Only Polish version is available.

<https://kpmg.com/pl/pl/blogs/home/posts/2023/07/deklaracja-srodowiskowa-wyrobu-epd-istotne-narzedzie-dla-branzy-budowlanej-esg-blog.html>

- **"Deklaracje środowiskowe wyrobów EPD"**

Inżynier Budownictwa Magazine (Polish Chamber of Civil Engineers), 17 Oct 2022

This professional article (in Polish) introduces the concept of Environmental Product Declarations for building products and situates it within sustainable construction practices. It explains that Type III EPDs, in line with PN-EN ISO 14025, quantify a product's environmental characteristics over its life cycle as defined by the PN-EN 15804 standard. The article discusses the voluntary nature of EPDs in the European market and notes that their use has been largely industry-driven, coordinated by the ECO Platform program of EPD operators. It provides an overview of what information EPDs include and how they support the assessment of buildings' sustainability.



<https://inzynierbudownictwa.pl/deklaracje-srodowiskowe-wyrobow-epd/>

- **“Deklaracje środowiskowe produktu EPD a ESG”**

Materiały Budowlane Journal 1/2025 (Sigma-NOT)

This is a recent Polish-language publication by Dr. inż. Paweł Walczak (an expert from SOLBET and a member of CEN's working group on EN 15804) that links EPDs with corporate ESG reporting in the construction materials industry. The article underscores that EPDs contain extensive information about a product's entire life cycle, which can be challenging for end users to interpret. Walczak clarifies how to read and use EPD data, providing guidance on interpreting key environmental indicators in EPDs. He frames EPDs as a valuable data source for assessing product sustainability and notes their role in forthcoming EU sustainability requirements (e.g. the Corporate Sustainability Reporting Directive). This tutorial-like piece helps construction product manufacturers understand the significance of EPDs in the context of reducing carbon emissions and meeting ESG criteria.

<https://www.materiałybudowlane.info.pl/pl/505-wydanie/mb-01-2025/16165-deklaracje-srodowiskowe-produktu-epd-a-esg.html>

Italy

- **Italian regulatory framework: recognition and obligations**

- The Minimum Environmental Criteria (CAM Edilizia) introduced by Ministerial Decree of 23 June 2022 explicitly require the use of EPDs compliant with UNI EN 15804, ISO 14025 and ISO 21930 as a valid award criterion for participation in public tenders

The decree recognises EPDIItaly® as the official national Programme Operator: it produces and publishes EPDs verified according to the rules of the above-mentioned standards

<https://www.epditaly.it/2018/04/27/epditaly-nel-nuovo-decreto-sui-cam-edilizia>

On 27 March 2025, EPDIItaly Regulation Rev.7 came into force, updating the technical and data quality requirements and aligning the scheme with EN 15941 and ISO 14020, with a transition period until 28 June 2026.

<https://www.epditaly.it/2025/03/27/nuovo-regolamento-epditaly-rev-7>

Practical applications: concrete examples in Italy

MC Prefabbricati S.p.A. (Lombardy) has obtained EPDIItaly® for its line of prefabricated reinforced concrete structural elements, using EPDs to communicate the environmental sustainability of its products and meet CAM requirements.

<https://www.epditaly.it/2025/03/07/chi-ha-scelto-epditaly-si-racconta-mc-prefabbricati-s-p-a>

Olympus S.r.l., operating in the construction sector, has certified several products with EPDs (via EPDIItaly®) in order to participate in public tenders and comply with CAM criteria, highlighting the impact of EPDs on competitive and environmental positioning

<https://www.ingenio-web.it/articoli/olympus-si-certifica-epd-process-per-un-edilizia-piu-sostenibile>

Germany

- **DIN EN ISO 14025: Environmental labels and declarations - Type III environmental declarations - Principles and procedures**

Author / Issuer: DIN (German national adoption of ISO 14025 via CEN)

Description: Specifies principles and requirements for developing Type III environmental declarations (EPDs) and EPD programmes. Defines linkage to ISO 14040/44-based LCA methodology, third-party verification, and product category rules (PCRs). Includes rules for consumer-oriented declarations and EPD programme operation.



<https://www.dinmedia.de/en/standard/din-en-iso-14025/144319534>

<https://www.dinmedia.de/de/norm-entwurf/din-en-iso-14025/390964032>

- **DIN EN 15804: Sustainability of construction works - Environmental Product Declarations - Core rules for construction products**

Author / Issuer: CEN, adopted in Germany via DIN and widely used by Institut Bauen und Umwelt e.V. (IBU) – publicly recognised German programme operator for construction-sector EPDs

Description: Defines the Product Category Rules (PCR) for construction products, including life-cycle modules (A-D), impact indicators, system boundary rules, and verification requirements aligned with Type III declarations.

English version published as EN 15804:2012 + A2:2019 / AC:2021.

<https://www.wecobis.de/en/service/lexikon/umweltproduktdeklaration-lex.html> (only German)

- **Institut Bauen und Umwelt (IBU) - EPD-Programme & PCR frameworks**

Author / Issuer: Institut Bauen und Umwelt e.V. (IBU) – publicly recognised German programme operator for construction-sector EPDs

Description: IBU issues German PCR documents, organises expert Product Group Forums, and ensures independent verification under ISO 14025 and EN 15804. Its programme governs EPD publication and registration and is compatible with the ECO Platform mutual recognition system.

IBU publishes an English FAQ, methodology descriptions and PCR summaries via its website (e.g. “What does ISO 14025 contain?”).

<https://ibu-epd.com/en/faq-items/what-does-iso-14025-contain>

- **ift Rosenheim Guidance: General Guide to the Preparation of Type III Environmental Product Declarations**

Author / Issuer: ift Rosenheim (German institute for window and façade technology, programme holder for specific PCRs)

Description: Practical guidance detailing steps to prepare construction-related EPDs based on DIN EN ISO 14025 and EN 15804. Covers industry-specific PCRs, data collection templates, verification, and certification processes.

ift Rosenheim provides PCRs and guidance documents; language availability varies, but English summaries and some documents available.

<https://www.ift-rosenheim.de/en/ift-model-epds>

- **ISO 21930:2017 (Sustainable buildings – Environmental declaration of building products)**

Author / Issuer: ISO (adopted by CEN / DIN in Germany)

Description: International standard specific to environmental declarations (EPDs) for building products. Provides detailed rules consistent with ISO 14025 and EN 15804. Not a German national standard per se, but central in German construction EPD context via harmonisation with EN 15804 and IBU.

<https://www.iso.org/standard/61694.html>



Practical guidance / tutorials

- **How to start**

Conducting a Life Cycle Assessment (LCA) may sound complex, but companies can begin with very simple steps. Open-source software such as openLCA allows entry-level assessments with limited datasets. Trial versions of OneClickLCA provide easy-to-use interfaces where firms can input basic information like material type, weight, and transport distance. Even a small pilot project gives valuable insights into the environmental impact of design choices and demonstrates the benefits of considering the full life cycle of a building.

- **Tutorials**

To move beyond the basics, structured tutorials are available. The CityLoops Circular Construction Handbook illustrates the full process of implementing LCA in urban projects, while EPD International guidance documents explain how to prepare Environmental Product Declarations (EPDs). These resources demystify the standards (such as ISO 14040 or EN 15804) and show how to apply them in daily practice. Using the EU Level(s) framework as a reference helps ensure consistency across Europe and prepares companies for stricter future requirements.

- **Tips for SMEs**

For smaller firms with limited resources, it is possible to start by collecting simple input-output data: energy consumption from invoices, material use from suppliers, and waste quantities from contractors. Even without advanced modelling, these data can reveal hotspots of inefficiency. Partnering with universities, chambers of commerce, or innovation centres can also provide access to more sophisticated LCA expertise at low cost. Gradually, SMEs can build internal knowledge and integrate LCA into tenders and client communication.



4. Circular Business Creation

Moving a business towards a circular economy is compelling and necessary. It offers a way to improve resource and economic efficiency while reducing impacts on the natural environment, biodiversity and climate. While technology, policy and regulation have a critical role to play, the transition to circularity will be driven by businesses of all sizes finding new, circular ways to create, deliver and capture value. The collected guides help companies explore and design their circular business models. They provide practical steps and templates for this transition.

Guidelines and tutorials for circular business creation

- **Circular Construction in Europe - Handbook for Local and Regional Authorities**

Handbook for the implementation of circular building practices at local and regional level.

https://cityloops.eu/fileadmin/user_upload/Resources/City-Loops-Circular-Construction-handbook.pdf

- **Sustainable and Circular Construction - Interreg Europe**

Policy proposals and best practices to promote sustainable and circular construction.

<https://www.interregeurope.eu/find-policy-solutions/policy-briefs/sustainable-circular-construction>

Hungary

- **Circular Economy Platform of Hungary - Strategic Framework**

Author: Hungarian Business Leaders Forum (HBLF), IFUA, BCSDH - Business Council for Sustainable Development in Hungary

Description: The Hungarian Circular Economy Platform provides a national framework for supporting circular business transitions. It offers tools, research, pilot case studies, and practical guidance for Hungarian companies on integrating circularity in their business models. It encourages industrial symbiosis, resource efficiency, and design for reuse in the construction sector.

Link (EN): <https://www.circular-economy.hu/en>

(Includes downloadable materials and reports in English and Hungarian.)

- **IFKA - Circular Economy Business Model Toolkit (CEBMT)**

Author: IFKA Public Benefit Nonprofit Ltd. for the Development of the Industry

Description: This toolkit supports Hungarian SMEs in developing circular business models, with a focus on reuse, remanufacturing, product-as-a-service, and material flow optimization. The toolkit is aligned with EU and national policy directions.

Link (HU): <https://ifka.hu/circular-economy>

(Some components available in English upon request or through related EU-funded projects.)

- **HuGBC - Circular Construction Working Group**

Author: Hungary Green Building Council (HuGBC)

Description: HuGBC's Circular Economy Working Group provides guidance and case studies focused on circularity in the built environment. They publish presentations, host events, and offer practical recommendations for implementing circular design, material reuse, and lifecycle thinking in construction.

Link (EN): <https://www.hugbc.hu/en/circular-economy/2515>



(Includes event archives and publications focused on Hungarian construction sector practices.)

- **EIT Climate-KIC Hungary - Circular Economy Incubation Program**

Author: EIT Climate-KIC, PANNON Pro Innovations

Description: The Hungarian arm of EIT Climate-KIC offers targeted incubation and acceleration programs for circular startups and SMEs. These include mentoring, toolkits, and funding advice to help Hungarian companies transition to circular business models.

Link (EN): <https://www.ppi.hu/en/projects/climate-kic/>

(Resources available in English for international participants.)

- **MoHU - Circular Waste Management and Business Model Innovation**

Author: MOHU (MOL Hulladékgazdálkodási Zrt.)

Description: As Hungary's new centralized waste management company (since 2023), MOHU promotes circular business practices by supporting recycling, extended producer responsibility (EPR), and material return systems. The company collaborates with stakeholders to explore circular service models and value chain redesign.

Link (HU): <https://www.mohu.hu>

(Key circular economy reports and model frameworks are expected to be released in English as the system matures.)

Czech Republic

- **DoubleDecker - Rebooting the National qualification platforms and Roadmaps towards implementation of nearly Zero Energy Buildings and support for Renovation Wave**

The DoubleDecker project, part of the Build Up Skills initiative, aimed to create a strategic framework for transforming the construction sector in the Czech Republic and Slovakia. The project unfolded in two phases: first, a Status-quo analysis was prepared, followed by the development of National Development Roadmaps, with all strategic documents completed by March 2024.

https://database.crafted.eu/storage/app/media/DoubleDecker/cs/d64/DD_FINAL_REPORT_04_09_2024_EN%20V2.pdf

- **Circular economy country profile - Czechia -**

Published by: European Environmental Agency

In 2021, the Czech Republic adopted a national plan called Circular Czechia 2040 to transition toward a circular economy. The approach focused on reducing waste, reusing materials, and using resources more efficiently. The vision is that by 2040, the circular economy will bring major environmental, economic, and social benefits, such as protecting the environment, boosting competitiveness, creating jobs, increasing resource security, and helping people gain new skills. The main goal is "less waste and more value for the Czech Republic."

The plan sets out ten goals, some include:

- education and awareness
- economic tools (like taxes or incentives)
- greener cities and better infrastructure
- promoting natural resource management, etc.

And they will achieve these goals by focusing on:

- products and their lifecycle
- raw materials, construction, industry, and energy
- waste management, etc.



https://www.eionet.europa.eu/etcs/etc-ce/products/etc-ce-products/etc-ce-report-5-2022-country-profiles-on-circular-economy/czechia-ce-country-profile-2022_for-publication.pdf

- **Institute of Circular Economy, INCIEN**

Circular Czechia (Církulární Česko), led by the Institute for Circular Economy (INCIEN), a Czech NGO founded in 2015, supports the transition of businesses, municipalities, and organizations toward a circular economy. The platform serves as a national hub by providing stakeholders with the tools, expertise, and networks needed for sustainable change.

The platform provides practical tools, knowledge, and opportunities for collaboration. Its core services include offering step-by-step guides and real-world case studies to help companies adopt circular practices like waste reduction and sustainable supply chains. It also runs workshops, training sessions, and working groups to support circular strategy development, along with expert consultancy for implementation.

Circular Czechia hosts the Czech Circular Hotspot, the country's largest circular economy network with around 70 members across sectors.

Additional activities include:

- policy monitoring
- promoting successful projects
- raising awareness through education
- collaboration with international partners

<https://busgocircular.eu/about/incien/>

Poland

- **Polish Guidelines and Standards**

- *Circular Economy Country Profile - Poland*

European Environment Agency (EEA) report provides an overview of Poland's circular economy policies, focusing on initiatives that go beyond EU mandates, with insights into the construction sector's role.

https://www.eionet.europa.eu/etcs/etc-ce/products/etc-ce-products/etc-ce-report-5-2022-country-profiles-on-circular-economy/poland-ce-country-profile-2022_for-publication.pdf

- *Condition of Circular Economy in Poland*

Article published by Paweł Falaciński analyzes the state of circular economy implementation in Poland, highlighting challenges and opportunities within the construction industry.

https://www.researchgate.net/publication/385683426_Condition_of_Circular_Economy_in_Poland/fullTextFileContent

- *Safe Use of Circular Construction Products*

European Climate Initiative (EUKI) offers guidance on the requirements for secondary materials in construction, focusing on technical properties and environmental impacts.

<https://www.euki.de/en/euki-publications/safe-use-of-circular-construction-products/>

- *Circular Economy in Poland: Good Practices and Recommendations*

Article published by K.Czerwionka et.al. presents good practices and recommendations for implementing circular economy principles in Poland, with a focus on green public procurement in construction.

<https://www.jeeng.net/pdf-199698-120700>



- **European and International Guidelines**

- *Sustainable Construction Guidelines for Public Authorities - A Circular Economy Perspective*

Association of Cities and Regions for Sustainable Resource Management (ACR+) aims to assist public authorities in promoting sustainable construction through circular economy principles, emphasizing material resource efficiency.

<https://circulareconomy.europa.eu/platform/en/toolkits-guidelines/sustainable-construction-guidelines-public-authorities-circular-economy-perspective>

- *prEN 18177 - Circular Economy in the Construction Sector*

European Committee for Standardization (CEN) defines key terminology and establishes principles for implementing circular economy practices in construction works and products.

- *Circular Technologies in Construction: Putting Science Into Standards*

Technical University of Denmark (DTU) provides recommendations for standardizing circular technologies in construction, covering frameworks, data, and design for circularity.

https://backend.orbit.dtu.dk/ws/portalfiles/portal/378235718/Circular_technologies_in_construction-putting_science_into_standards.pdf

- *Circularity Gap Report - Poland*

Circle Economy Foundation assesses Poland's circularity performance, identifying opportunities for improvement, particularly in the construction sector.

https://backend.orbit.dtu.dk/ws/portalfiles/portal/378235718/Circular_technologies_in_construction-putting_science_into_standards.pdf

- *Sustainable and Circular Construction - Policy Brief*

Interreg Europe portal in policy brief section discusses the potential of circular construction to deliver environmental and economic benefits, offering policy recommendations.

<https://www.interregeurope.eu/find-policy-solutions/policy-briefs/sustainable-circular-construction>

Italy

- **Policy & Legal Framework**

- *National Strategy for Circular Economy (SNEC)*

Italy's National Strategy for the Circular Economy, updated in 2022, explicitly targets construction as a priority sector. It sets measurable objectives through 2035 to promote reuse, recovery of building materials, eco-design, and industrial symbiosis practices.

<https://en.ecomondo.com/blog/20205404/update-circular-economy-europe-italy>

- *Green Public Procurement (GPP) & CAM*

The National Green Public Procurement Action Plan (2023) and mandatory Criteri Ambientali Minimi (CAM) for construction procurements promote circular practices: mandatory waste prevention, use of secondary materials, modular design, and design for deconstruction.

<https://www.mdpi.com/2624-6511/8/2/48>

Germany

- **National Circular Economy Strategy (Nationale Kreislaufwirtschaftsstrategie - NKWS)**

Author: Federal Ministry for the Environment (BMUV)



Description: Outlines Germany's roadmap to a circular economy, emphasizing resource-efficient production, product durability, reuse, and new business models. Defines eight action fields (e.g., circular production, public procurement, ICT, construction).

English version: „Fundamentals for the process of transforming to a circular economy” available as PDF:

https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Abfallwirtschaft/nkws_grundlagen_en_bf.pdf.pdf

- **Circular Economy Model Germany (CEMG)**

Author: WWF Germany with Oeko-Institute, Fraunhofer ISI, FU Berlin

Description: Provides a sectoral roadmap and concrete measures to implement circular economy in Germany, including strategies for businesses to adopt circular models and resource-efficient design. Offers policy and commercial guidance.

<https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/Unternehmen/WWF-model-germany-circular-economy.pdf>

- **German Standardization Roadmap Circular Economy**

Author: German Institute for Standardization (DIN)

Description: Identifies standardization needs and gaps across product lifecycles to support circular business models—covering product design, service models, and material cycles. Must-read for aligning innovation with norms.

<https://www.din.de/resource/blob/906910/0d691bed63405ae85f281336ed71162c/standardization-roadmap-circular-economy-data.pdf>

- **Circular Business Models — Circular Economy Initiative Deutschland (CEID)**

Author: acatech & CEID working group

Description: A scientifically based roadmap offering methods to develop, evaluate, and scale circular business models. Focuses on enabling frameworks like digitalisation, new value networks (e.g., batteries, packaging), and innovation drivers.

<https://en.acatech.de/publication/circular-business-models-overcoming-barriers-unleashing-potentials>

- **“Make it Circular!” Strategy Game**

Author: Circular Economy Initiative Deutschland

Description: A playful, interactive tool for SMEs to understand and develop circular business models. Includes workshop templates and practical exercises to embed circular strategies in organisations.

<https://www.circular-economy-initiative.de/about-the-initiative>

- **Chemie³: Guide to Circular Economy in the Chemical Industry**

Author: Chemie³ (Initiative of German chemical sector & trade unions)

Description: Offers a six-step management and operational framework tailored to chemical SMEs for achieving circularity—from raw materials and product design to take-back, recycling, and novel business models. Includes checklists and case studies.

https://www.chemiehoch3.de/fileadmin/user_upload/Chemie3_Guide_to_Circular_Economy.pdf

- **OECD - “The Circular Economy in Berlin, Germany”**

Author: Organisation for Economic Co-operation and Development (OECD)



Description: City-level analysis with lessons and policy benchmarks for businesses. Discusses public procurement, EPR, and circular city-business collaboration models—useful for organisations partnering with municipalities.

https://www.oecd.org/content/dam/oecd/en/publications/reports/2024/11/the-circular-economy-in-berlin-germany_43b54b2b/459defe7-en.pdf

Croatia

• Sustainable Renovation Blueprint for Croatia - CROSS Guidelines

The guidelines underscore the significance of sustainable construction methods, promoting the use of renewable energy and eco-friendly materials. They encourage the adoption of innovative funding, procurement, and financing approaches to effectively support renovation initiatives. Furthermore, the document highlights the critical role of stakeholder involvement and a focus on long-term sustainability to ensure project success.

It details technical requirements related to key renovation elements, including energy efficiency, thermal insulation, and structural stability. Emphasis is placed on designing buildings that are flexible for future use and resilient to climate change. The guidelines also advocate the application of modern technologies—particularly Building Information Modelling (BIM)—to improve planning and implementation throughout the renovation process.

build-up.ec.europa.eu/en/resources-and-tools/publications/sustainable-renovation-blueprint-croatia?utm_source=chatgpt.com

• Regional Guidebook on Circular Procurement - Croatia 2020

As part of the Interreg-supported Smart Circular Procurement (CircPro) project, Croatian IGRA Development Agency developed a practitioner-oriented guide focusing on circular public procurement in Croatia. Offers step-by-step tutorials for embedding circularity also in public-sector building projects, by guiding through the following steps:

- Pre-award stage: needs analysis, zero waste design, risk assesment
- Functional/technical specifications and labels
- Market analysis: methodology for involving economic operators in the circular procurement process
- Preparatory stage - defining the requirements and procurers needs, subject matter
- Exclusion grounds and selection criteria
- Award procedures
- Award criteria
- Contract performance terms and conditions

https://projects2014-2020.interregeurope.eu/fileadmin/user_upload/tx_tevprojects/library/file_1639643386.pdf

• Roadmap for decarbonization of buildings in Republic of Croatia

To encourage a shift toward more sustainable construction, the Croatian Green Building Council developed this document as a guideline for synchronizing stakeholders in the construction sector to regulate, organize, plan, design, and build structures with reduced environmental impact, higher economic value, and improved health and comfort for users.

The document highlights the need for a terminology glossary, especially since many decarbonisation terms are better known in English than in Croatian among professionals. It outlines the EU's legislative and strategic framework in which decarbonisation is a central principle for climate resilience and crisis mitigation.



Beyond environmental protection, the guideline presents decarbonisation as an opportunity for economic progress. It identifies regulatory and transitional barriers within related sectors – from public administration to construction and academia. It also discusses funding mechanisms and tools to support this transition.

The final part offers actionable steps that different stakeholders should take to steer Croatia's building sector toward full decarbonisation. The publication is part of the #BuildingLife project, which aims to institutionalize the concept of "whole life carbon" in national and EU legislation to accelerate the decarbonisation of the built environment. The document positions decarbonised buildings as key to reducing carbon emissions and combating climate change effectively.

<https://gbccroatia.org/wp-content/uploads/2023/06/Putokaz-za-dekarbonizaciju-zgrada-u-RH-Final.pdf>

Practical guidance / tutorials

- **Application**

Circular business models in construction go beyond recycling. They include leasing or sharing construction equipment, creating material banks, or offering renovation services that recover and resell materials. For example, a company can establish a service to rent modular building elements, which are later returned, refurbished, and reused. These models create recurring revenue streams and reduce the environmental footprint of projects. Early adopters in several European countries show that even SMEs can successfully transform their business by focusing on reuse and long-term value.

- **Training**

Awareness and mindset change are essential for circular businesses. Interactive tools such as the Make it Circular! serious game or design sprints help entrepreneurs experiment with different scenarios. These methods make abstract ideas tangible and foster creativity. In training workshops, employees and decision-makers can simulate how their company would adapt to resource shortages, client demands for green solutions, or new regulations. The insights often lead to concrete business opportunities.

- **Tools**

Several toolkits exist to help SMEs design circular strategies. The Circular Business Model Toolkit provides structured templates to map value chains, revenue models, and stakeholder engagement. IFKA in Hungary and HuGBC offer training and mentoring tailored to local needs, supporting SMEs in testing new services. By using these tools, companies reduce risks, identify partners, and build stronger business cases for circular construction projects.



5. Eco-design, new materials and technologies

There is worldwide demand for more efficient and sustainable products to reduce energy and resource consumption. The EU's sustainable product policy, eco-design legislation and energy labelling are effective tools for improving the energy efficiency and sustainability of products. They help eliminate the least performing products from the market and support industrial competitiveness and innovation by promoting the better environmental performance of products throughout the internal market.¹⁰

The Ecodesign for Sustainable Products Regulation (ESPR), which came into force on 18 July 2024, is a key element of the European Commission's strategy to make sustainable products the standard across the EU. It plays a central role in achieving the objectives of the 2020 Circular Economy Action Plan by promoting environmentally friendly, circular, and resource-efficient product design. The ESPR is intended to significantly reduce the environmental impact of consumption within the EU, thereby contributing to climate goals and reducing pollution.

One of the main goals of the ESPR is to improve the sustainability and circularity of products placed on the EU market. This includes enhancing the durability, energy performance, recyclability, and reparability of products. In doing so, the regulation supports more sustainable business models, protects natural resources, and strengthens the EU's overall economic resilience and competitiveness. It also aims to harmonize regulations across Member States, helping to avoid inconsistent national laws and stimulate innovation, especially in sectors such as maintenance, recycling, and remanufacturing.

The ESPR replaces the previous Ecodesign Directive (2009/125/EC) (a transition regime in place) and expands its scope. While the old directive focused only on energy-related products, the ESPR now applies to nearly all physical goods, excluding only a few categories such as food, feed, and pharmaceuticals. It also broadens the types of requirements that can be set—beyond energy efficiency—to include rules on material efficiency, lifespan, recycled content, and minimizing carbon and environmental footprints.

A key innovation introduced by the ESPR is the Digital Product Passport (DPP). This digital tool will serve as a central source of product-specific information, such as material composition, origin, energy use, repair and recycling options, and environmental impacts. Accessible electronically, the DPP will support transparency and better decision-making for consumers, businesses, and authorities. It will also improve regulatory enforcement, including customs checks on imported goods.

Another important component is the regulation's support for Green Public Procurement (GPP). Public authorities in the EU collectively spend around €1.8 trillion annually. The ESPR will allow for mandatory green purchasing rules for certain products, requiring authorities to select goods that meet high sustainability standards. This measure is expected to stimulate demand for greener products and encourage companies to invest in sustainable innovation.

The ESPR is a framework law, meaning that detailed requirements will follow through secondary legislation. The implementation process began with a prioritisation exercise and the adoption of the first Ecodesign and Energy Labelling Working Plan in April 2025, which outlines the initial product categories to be regulated. Future rules are still to be developed.

Guidelines and tutorials for eco-design, new materials and technologies

- **Ecodesign for Sustainable Products Regulation**

New EU legislation to improve the sustainability of products in terms of circularity, energy efficiency, recyclability and durability.

<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024R1781&qid=1719580391746>

¹⁰ https://single-market-economy.ec.europa.eu/industry/sustainability/sustainable-product-policy-ecodesign_en



https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/ecodesign-sustainable-products-regulation_en

- **Circular Construction and Materials for a Sustainable Building Sector**

Articles on circular building practices and the use of new materials in sustainable construction

<https://build-up.ec.europa.eu/en/resources-and-tools/articles/circular-construction-and-materials-sustainable-building-sector>

Hungary

- **Act C of 2023 on Hungarian Architecture - Sustainability Provisions**

Author: Hungarian Parliament

Description: This recently adopted architecture law (effective January 1, 2025) introduces robust sustainability standards for new buildings in Hungary—such as mandatory green space thresholds, protected green belts, restrictions on developing agricultural land, and aesthetic placement of solar panels. It also introduces new building “green certificates” reflecting energy performance and eco-design elements.

Link: [Lexology summary] [OECD OECD Lexology](#)

- **National Waste Management Plan 2021-2027**

Author: Hungarian Government

Description: This plan emphasizes waste prevention through eco-design: encouraging durable, repairable, reusable, recyclable, and upgradeable products—including construction materials. It proposes eco-labeling schemes and supports sustainable consumption models.

Link (HU): via Environmental Agency resources [SGSCorp+5OECD+5OECD+5eea.europa.eu](#)

- **OECD - National Circular Economy Strategy Recommendations for Hungary**

Author: Organisation for Economic Co-operation and Development (OECD)

Description: This strategic report highlights the urgent need to develop quality standards and labeling for secondary materials (like recycled construction aggregates), promote eco-design for recyclability, and enhance digital tools to support reuse and recycling.

Link (EN): [OECD](#)

- **Baker McKenzie - Incentives for Green Retrofit (Hungary)**

Author: Baker McKenzie / Global Sustainable Buildings Guide

Description: Reviews Hungarian incentive schemes—including those for eco-design and energy-efficient retrofits—encouraged by Government Decree 210/2014. Particularly relevant for integrating new materials and technologies into sustainable upgrades.

Link (EN): [resourcehub.bakermckenzie.com+1OECD+1](#)

- **Hungary Green Building Council (HuGBC) - Eco-design and Materials Program**

Author: HuGBC

Description: The Council actively promotes eco-design and innovative construction materials via training, conferences, and advocacy for sustainability rating systems (LEED, BREEAM, DGNB). Their “Environmental Awareness from A to Z” training engages professionals in eco-strategies.

Link (EN): [hugbc.hu](#)



Czech Republic

- **Title of publication: Ecodesign requirements for energy related products**

Published by: Ministry of Industry and Trade

In the Czech Republic, Directive 2009/125/EC on energy-related products was transposed primarily through Law No. 406/2000 Coll., on energy management, which provides the legal basis for implementing ecodesign requirements for energy-related products. This law sets out the principles and obligations regarding energy efficiency and environmental performance for products placed on the Czech market.

In addition to this law, Decree No. 337/2011 Coll. was introduced to detail the rules on energy labelling and ecodesign requirements. This decree specifies how products must be labeled to inform consumers about their energy consumption and environmental impact, ensuring compliance with eco-design standards.

Additionally, specific ecodesign requirements for various categories of energy-related products are established through EU Commission regulations, which are enforced in the Czech market. This legislative framework supports the Czech Republic's commitment to reducing energy consumption, lowering emissions, and promoting sustainable product design in line with EU environmental goals

<https://mpo.gov.cz/en/energy/energy-efficiency/ecodesign-and-energy-labelling-of-products/ecodesign-requirements-for-energy-related-products--235953/>

- **ECODESIGN FOR SUSTAINABLE PRODUCTS REGULATION: IMPACTS ON CZECH BUSINESSES**

The Ecodesign for Sustainable Products Regulation, effective since July 2024, sets rules to make products more durable, energy-efficient, repairable, and recyclable. For the construction sector in the Czech Republic, this means materials like iron, steel, and aluminium, key building components, will face new sustainability standards.

Businesses need to adapt to these rules, including providing detailed product information through a digital product passport (like a QR code). This passport contains key data about the product's composition, repair instructions, recyclability, and environmental impact, enhancing transparency and traceability throughout the product lifecycle.

This framework aims to push construction materials toward greater sustainability, encouraging longer-lasting and more recyclable building products.

The Czech Ministry of Industry and Trade actively supports companies in adapting to these new requirements by offering:

- detailed guidance documents explaining the regulation's provisions,
- workshops and training sessions to help understand compliance obligations,
- advisory services to assist in implementing digital product passports and sustainability measures.

https://cebre.cz/en/czech-business-today/volume-xxii-5-2024/ecodesign-for-sustainable-products-regulation-impacts-on-czech-businesses?utm_source=chatgpt.com

- **Project: Ready4Eco-Design - Ecodesign and digital product passports - the path to a circular economy**

The project develops and shares practical guidelines and awareness materials to help manufacturers and distributors navigate new EU ecodesign legislation, adapt their activities, and apply circular principles for maximum recycling and reuse. Funded by the Technology Agency and Ministry of the Environment, the project runs until the end of 2026.

<https://incien.org/projekty/ready-4-ecodesign/>



Austria

- **WKO's Ökodesign-Leitfaden**

It outlines required ecodesign criteria (repairability, recyclability, digital product passports) and presents a practical four-step method to develop circular products.

<https://www.wko.at/ooe/industrie/wkoo--o-kodesign-leitfaden-241111-web.pdf>

- **The Ökodesign-Verordnung (ESPR)**

Effective July 18, 2024 across the EU, sets 16 criteria including durability, recycled content, CO₂ footprint, and mandates Digital Product Passports; Austrian resources explain how to comply

<https://www.ove.at/ove-news/details/oekodesign-verordnung-in-kraft-normung-unterstuetzt-nachhaltige-wirtschaft>

- **FFG (Österreichische Forschungsförderungsgesellschaft - Austrian Research Promotion Agency)**

One of the main drivers of eco-design driven innovations and technologies is the so called FFG. The FFG is Austria's national funding agency for applied research and innovation, supporting industry-driven R&D to foster sustainable, competitive, and circular economy solutions. Rather than eco design is forced by FFG, it is more supportive into access financial support to projects that implement sustainable principles.

The FFG supports innovation in eco-design and material science through targeted funding programs that promote sustainable, circular, and climate-friendly technologies. Recent calls include Öko-Scheck, aimed at small-scale ecological improvements, and M-ERA.NET, which funds collaborative projects in circular economy and advanced production technologies. The Ressourcenwende program focuses on transformative materials research, including additive manufacturing and recycling, while the Green Frontrunner initiative backs SMEs and mid-sized companies developing green innovations. Together, these programs foster collaboration between industry and research, accelerating Austria's transition to a sustainable economy.

<https://www.ffg.at/en/thema/production-and-materials>

Poland

- **Ordinance on Technical Conditions for Buildings (WT 2021)**

Polish Ministry of Infrastructure in building code includes an ordinance on technical conditions for buildings and their location, which sets minimum requirements for energy saving and thermal insulation in new constructions. Updated to meet EU standards for nearly zero-energy buildings by 2021, these regulations (often called "WT 2021") mandate lower permissible energy demand and improved building envelope insulation to enhance energy efficiency. This legal standard ensures that eco-design principles (such as reduced heat loss and lower non-renewable energy use) are integrated into all new building projects (no official English text available).

<https://resourcehub.bakermckenzie.com/en/resources/global-sustainable-buildings/europe-middle-east-and-africa/poland/topics/green-certification>

<https://isap.sejm.gov.pl/isap.nsf/download.xsp/WDU20220001225/O/D20221225.pdf>

- **Long-Term Building Renovation Strategy (Poland 2022)**

Polish Ministry of Development and Technology published a national strategy adopted in 2022 outlining a roadmap to upgrade Poland's building stock for sustainability. It identifies actions needed to achieve a highly energy-efficient and low-emission building stock by 2050 and provides guidelines to support cost-effective renovations toward nearly zero-energy buildings. The strategy diagnoses current barriers (technical, financial, organizational) and recommends policies, milestones (2030/2040/2050), and



indicators for deep energy retrofits in both public and private buildings. This government plan aligns with EU directives, aiming to cut energy use and emissions through building upgrades while improving indoor comfort and safety.

https://energy.ec.europa.eu/system/files/2022-06/PL%202020%20LTRS%20_%20EN%20version.pdf

- **“How to Decarbonise the Built Environment by 2050: Whole Life Carbon Roadmap for Poland”**

Polish Green Building Council (PLGBC) and European Bank for Reconstruction and Development (EBRD) shared a comprehensive report (2021) presenting a pathway for Poland’s construction and real estate sector to reach climate neutrality by 2050. It quantifies the building sector’s impact (responsible for ~38% of Poland’s carbon emissions) and outlines strategies to address both operational and embodied carbon emissions. The roadmap recommends concrete actions across the building lifecycle and for various stakeholders - government, investors, designers, material producers, contractors, etc. - to collaboratively reduce emissions. This guide serves as a reference for policy and industry, emphasizing whole-life carbon assessment and calling for urgent measures to decarbonize buildings.

<https://worldgbc.org/article/plgbc-presents-a-whole-life-carbon-roadmap-for-poland/>

- **A Guide to Circularity in Construction (CIRCON Compendium)**

Polish Green Building Council (PLGBC) shared in 2023 publication that serves as a practical compendium on applying circular economy principles in the building sector. Developed under the CIRCON - Circular Economy in Construction project, it contains key guidelines for designing circular buildings - emphasizing longevity, adaptability, reuse of materials, and design for deconstruction. The guide provides educational resources (including an online knowledge base) on circular design, material loops, and case studies, aiming to help architects, engineers, developers and policymakers implement circular solutions in construction. It was introduced at the “Talking Circular” conference in October 2023 and is available in both Polish and English.

<https://circon.plgbc.org.pl>

- **Buildings Modernisation Strategy: Roadmap 2050 (Poland)**

Buildings Performance Institute Europe (BPiE) in collaboration with Polish stakeholders provided a strategic report (2015) that charts a long-term plan for deep renovation of Poland’s buildings by 2050. Supported by BPiE and Polish experts, it characterizes the state of Poland’s building stock and identifies challenges to increasing the rate of energy-efficient renovations. The roadmap analyzes economic impacts and financing mechanisms for large-scale retrofitting, and it proposes solutions to overcome barriers (e.g. funding, regulatory hurdles, awareness) to accelerate renovation activities. By laying out scenarios and benefits (such as energy savings, job creation, emissions reduction), this document guides policymakers and industry on transforming the existing building stock in line with climate goals.

<https://www.bpie.eu/publication/buildings-renovation-strategy-a-plan-towards-2050-for-poland/>

- **Green Building Certification Schemes (LEED, BREEAM, DGNB, HQE)**

Various international organizations applied in Poland by Polish Green Building Council and accredited professionals analyses Poland’s construction sector and widely adopts several well-known green building rating systems that set standards for sustainable design and construction. Four major international certification schemes are active in Poland - BREEAM, LEED, DGNB, and HQE - covering aspects like energy efficiency, water conservation, materials, indoor environment, and innovative eco-technologies. By 2017, over 10 million m² of Polish real estate had been certified “green” under these programs. These voluntary standards, while not government-mandated, have high uptake especially in commercial developments (offices, retail, warehouses), driving market demand for environmentally friendly buildings. Each scheme provides guidelines and checklists for eco-design, helping project teams integrate sustainability from planning through construction and operation.



<https://edgebuildings.com/wp-content/uploads/2022/04/Poland-Green-Building-Market-Intelligence-EXPORT.pdf>

- **Passive House Standard (Budownictwo Pasywne) in Poland**

Passive House Institute (Germany); promoted by the Polish Passive Building Institute and others the Passive House standard is a rigorous energy-efficiency building standard adopted in some Polish projects to drastically reduce heating and cooling needs. It sets a maximum heating demand of 15 kWh/m²/year, achieved through features like super-insulation, airtight construction, heat recovery ventilation, and passive solar design. While not an official Polish regulation, this standard is referenced in Poland's sustainable construction community as an ultimate goal for low-energy buildings. Various Polish publications and tutorials (e.g. from Budowlane ABC and industry blogs) explain passive house principles. The Passive House guidelines serve as a tutorial for designers aiming for ultra-efficient, climate-resilient homes in Poland's climate (Polish only).

<https://budowlaneabc.gov.pl/charakterystyka-energetyczna-budynkow/informacje-poradnik-okreslenie-oplaczalnych-sposobow-poprawy-efektywnosci-energetycznej-wlasciwych-dla-typow-budynkow/budynki-pasywne/>

Italy

- **Legal & Regulatory Framework**

In Italy, the original Directive 2009/125/CE was implemented via D.Lgs. 201/2007, applying to products with energy use, but it sets principles that influence eco-design in building systems too.

<https://www.insic.it/tutela-ambientale/eco-design-definizione-caratteristiche-materiali>

- **Standards & Guidelines**

Environmental Certification Protocols (LEED, BREEAM, WELL)

Widely used in Italy (e.g. by Green Building Council Italia), these rating schemes encourage use of innovative, low-impact, healthy construction materials, transparency in sourcing, and material ingredient disclosure—including recycled content and sustainability performance.

<https://greenwichsrl.it/prodotti-certificati-green-per-edifici-sostenibili-la-nuova-frontiera-delle-costruzioni>

Germany

- **How to do Ecodesign - Practical Guide for Ecodesign (incl. Toolbox)**

Author / Issuer: Umweltbundesamt (UBA) - German Federal Environment Agency (Tischner, Moser)

Description: Comprehensive handbook (585 pp) offering strategies, methods and tools for Ecodesign and Design for Sustainability (DfS). It guides users through incorporating life-cycle thinking into product and process design, and implementing ecodesign in companies.

<https://www.umweltbundesamt.de/en/publikationen/how-to-do-ecodesign>

- **Reducing Pollution through Product Design**

Author / Issuer Umweltbundesamt (UBA) - German Federal Environment Agency

Description: Explains how product decisions impact pollution and resource use. Offers ecodesign principles and integration of environmental criteria into product development, referencing award-based check-lists and LCA-based tools.

<https://www.umweltbundesamt.de/en/reducing-pollution-through-product-design>

- **EU Ecolabel - Germany User Manual**



Author / Issuer: European Commission (German implementation) Environment

Description: Official user manual to implement the EU Ecolabel framework in Germany. Covers criteria for product groups, labelling rules, ecodesign alignment and enforcement mechanisms.

https://environment.ec.europa.eu/publications/eu-ecolabel-germany-user-manual_en

- **VDI-Guideline 2343 - Recycling of Electrical and Electronic Devices**

Author / Issuer: VDI (Association of German Engineers), Guideline Committee VDI 2343

Description: Provides practical recommendations for design, dismantling, logistics and recycling of electronic products to support reuse and circular material flows. Addresses design-for-recycling and compliance with legal obligations.

<https://www.vdi.de/en/home/vdi-standards/details/vdi-2343-blatt-1-recycling-of-electrical-and-electronic-equipment-fundamentals-terms-and-definitions>

- **BMWK Lightweighting Strategy (Federal Government Lightweighting Strategy)**

Author / Issuer: Federal Ministry for Economic Affairs & Climate Action (BMWK)

Description: German national strategy to promote lightweight materials and technologies across sectors. Focuses on reducing resource use, enabling sustainable innovation, and supporting ecodesign of products in construction, mobility, and industry.

<https://www.bundeswirtschaftsministerium.de/Redaktion/EN/Dossier/lightweighting.html>

- **Oeko-Institute - Products and Technologies Guidance**

Author / Issuer: Oeko-Institute e.V.

Description: Offers research-based guidance on sustainable product criteria, new material adoption, resource-efficiency, durability and reparability. Advises on regulatory compliance, ecodesign, and prevention of greenwashing.

<https://www.oeko.de/en/topics/sustainable-production-and-consumption/products-and-technologies>

Practical guidance / tutorials

- **Design for disassembly**

Eco-design begins at the drawing board. Design for disassembly ensures that building elements can be separated without damage and reused or recycled at the end of life. The CIRCON Handbook (funded by EEA Grants) offers detailed principles, checklists, and examples for modular and flexible design. This approach turns buildings into material banks, where components retain value even after decades of use. It requires careful planning but pays off in both environmental and financial terms.

- **Digital material libraries**

Tools like CinderOSS and Madaster act as digital inventories of construction materials. They assign “material passports” that specify composition, lifespan, and recyclability. In practice, this means that when a building is renovated or demolished, its components can be easily identified, recovered, and redirected into new projects. These platforms also allow comparison between different design options and help companies meet reporting obligations on circularity.

- **Tips for SMEs**

Even smaller firms can benefit from eco-design without large investments. By following open-source protocols for selective demolition, SMEs can recover valuable resources while reducing waste disposal fees. Partnering with local recyclers or municipal waste companies ensures that recovered materials are properly processed and re-enter the market. Over time, SMEs can develop a reputation as sustainable contractors, which is increasingly a competitive advantage in public procurement and private tenders.



6. Summary and conclusions

The **ReBuilt project** has been implemented against the backdrop of two major transitions in Europe's construction sector: the urgent need for **climate neutrality and circularity**, and the equally pressing need for **digital transformation**. These shifts are not isolated: they reinforce one another and, when properly integrated, can substantially reduce environmental pressures while creating new opportunities for growth, innovation, and social well-being.

This document—the collection of **Guidelines and Tutorials**—synthesises the knowledge produced in the project and provides a consolidated overview of findings, lessons, and recommendations. It addresses both the *strategic dimension* (policy frameworks, transnational cooperation, regulatory alignment) and the *practical dimension* (methods, tools, business models, training practices).

Key Findings

- **Digitalisation as a cross-cutting enabler**

The project confirmed that digital solutions, ranging from Building Information Modelling (BIM) to blockchain-based material passports, are indispensable to operationalise circularity. Digital twins and IoT sensors make it possible to monitor building performance in real time; blockchain provides transparency for secondary material markets; while BIM integrates data across the design, construction, and demolition phases.

Without these tools, many circular solutions remain theoretical. With them, however, the construction sector can unlock new models of resource efficiency, maintenance, and reuse.

- **Policy frameworks: strengths and gaps**

European strategies such as the Green Deal, the Circular Economy Action Plan, and the Renovation Wave, as well as instruments like the Taxonomy Regulation, already provide a strong political mandate. National regulations also advance circularity; however, fragmentation and uneven enforcement slow down transition.

- **Strengths:** Growing emphasis on green public procurement, emerging end-of-waste criteria, and EU-level standardisation of LCA approaches.

- **Gaps:** Inconsistent interpretation of waste vs. product status, lack of harmonised databases for secondary materials, and divergent approaches to permitting innovative materials.

- **Life-cycle assessment and related methodologies**

Project workshops and training activities underlined the importance of life-cycle based assessment (LCA, EPD, PEF, Level(s)). These approaches allow for a full understanding of environmental burdens, going beyond energy efficiency towards material footprints, CO₂ emissions, and embodied carbon.

However, SMEs and local stakeholders often lack the expertise or resources to apply these methods in daily practice. Tutorials therefore emphasised step-by-step instructions, simplified templates, and practical examples to make methodologies usable even for small actors.

- **Eco-design and new business models**

Eco-design strategies—such as modularity, design for disassembly, design for adaptability—emerged as crucial innovations. Circular business models (product-as-a-service, take-back schemes, material banks) can only succeed if eco-design principles are mainstreamed from the very beginning of the value chain.

Pilot demonstrations proved that alternative materials (e.g. bio-concretes, geopolymers, timber-based hybrids) and new design strategies reduce environmental impact, while also creating competitive niches



for SMEs. Nonetheless, barriers remain: higher upfront costs, limited awareness among investors, and risk-aversion among developers.

- **Capacity building, education, and awareness**

The ReBuilt project devoted considerable effort to training and awareness raising. The Fit for Circular and Digital Construction training and the MOOC represent durable resources that remain accessible after project closure.

Evaluations highlighted three insights:

1. Blended learning (online + face-to-face) is the most effective format.
2. Training must address diverse groups—architects, public authorities, SMEs, students—with tailored content.
3. Educators themselves need continuous training (“train-the-trainers”) to stay updated with rapidly evolving methods.

- **Hubs and institutionalisation**

The creation of Regional Circular and Digital Construction Hubs, connected to a Central Hub, represents one of the project’s most significant legacies. These hubs are not only dissemination platforms but permanent institutions where knowledge is brokered, where pilots are showcased, and where businesses can find partners. By connecting regional innovation ecosystems, the hubs create a transnational critical mass for circular and digital construction in Central Europe.

Strategic Conclusions

The findings lead to several strategic insights:

1. **Circularity is a system challenge**

It requires aligning technology, regulation, finance, and human capacities simultaneously. Partial solutions will not deliver transformative impact.

2. **Digitalisation is a prerequisite, not an add-on**

Circularity depends on reliable data, traceability, and systemic management. Without digitalisation, circular solutions remain fragmented and inefficient.

3. **Policy coherence must be strengthened**

Transnational projects demonstrate that Member States move at different speeds. Harmonisation of criteria, databases, and market incentives is needed to avoid competitive distortions and to accelerate uptake.

4. **SMEs and local actors are pivotal**

The construction sector in Central Europe is dominated by SMEs. Their empowerment through training, access to finance, and innovation support determines the success of the transition.

5. **Long-term institutional support is key**

The Hubs provide an answer to the common weakness of project-based initiatives: lack of durability. By embedding knowledge and practices into regional ecosystems, the Hubs ensure continuity.



Practical Conclusions

At the operational level, the project demonstrated that:

- **Simple tutorials and step-by-step guides** are the most effective tools for transferring complex methods like LCA into practice.
- **Pilot cases** are essential: stakeholders learn best when they see tangible examples of circular design and reuse.
- **Business support services** (e.g. matchmaking, investment advisory) are as important as technical guidelines. Without them, SMEs may not take the risk of innovation.
- **Cross-sector collaboration** (construction firms, municipalities, universities, NGOs) generates new solutions that would not emerge in isolated silos.

Long-term Impact

The combination of guidelines, tutorials, training, pilots, and hubs creates a **multi-layered legacy**:

- Knowledge is codified in tutorials and guidelines.
- Skills are strengthened through training and MOOC.
- Innovation is demonstrated via pilots.
- Institutional continuity is ensured by the hubs.

Together, these outcomes support the ReBuilt mission: to accelerate the transition towards a **circular, digital, and climate-resilient construction sector**. By embedding practices into local, regional, and transnational frameworks, the project contributes directly to the **European Green Deal**, the **Renovation Wave**, and the **EU Climate Law**.

Final Reflection

The ReBuilt project shows that Central Europe can be a **frontrunner region** for sustainable construction. By combining innovation with tradition, and by leveraging both digital tools and circular strategies, the region can transform challenges into opportunities: reducing environmental pressures, creating green jobs, and delivering healthier built environments.

This document is not only a deliverable, but a **starting point for continued cooperation**. It provides the blueprint for actors across Europe who wish to replicate and scale up the ReBuilt approach.