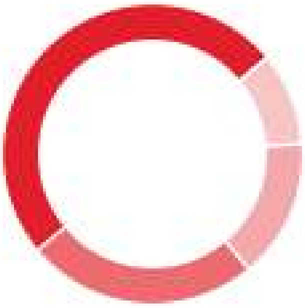


Circular Building Design Toolkit

Future Proof your Project

The Circular Design Framework enables you to future proof your project. The principles of the Circular Economy have been translated into a prioritized set of strategies and actions relevant for real estate projects.

Aligned with International Policies

This framework is based on relevant international best practices and policies such as:

- EU Taxonomy
- EU Level(s)

The strategies are also aligned with Circular Economy recommendations from the World Green Building Council as well as National Green Building Councils

Build nothing

1 Refuse new construction

Build for long term value

2 Increase building utilisation

3 Design for longevity

4 Design for adaptability

Build efficiently

5 Design for disassembly

6 Refuse unnecesary components

7 Increase material efficiency

8 Reduce the use of virgin materials

Build with the right resources

9 Reduce the use of carbon intensive materials

10 Design out hazardous/polluting materials

Circular Buildings Toolkit

A Circular design strategies and actions

C Case studies and solutions library

E Circular design rating

B Circular design workshop

D Tools for circular design assessment

F Circular economy project benchmarking

Framework + Circular Strategies
Interactive card set for design team to understand existing best practices

Circular Design Statement
Report structure to capture circular options

Circular Design Workflows
Design actions filtered by discipline and design stage

Indicator Based Optioneering
Translate design options into consistent and tangible indicators

CE Rating per strategy
Based on defined indicators and metrics (calculated externally)

Visualization & Reporting
Visual benchmarking to assess the circular value

1. Refuse unnecessary new construction

Description

Decisions made in the early stages of a project have the greatest potential impact. A deep and thoughtful interrogation of the project brief against the client's needs is needed to decide whether a new building is the best way to meet those needs.

This strategy aims at avoiding the intensive material use linked to the construction of a new building by first reassessing if a physical building is necessary for the envisioned requirements, and if so, assessing if an existing building can be used to meet them.

Key Performance Indicator

Reuse of existing usable surface:
Share of reused floor area as percentage of total project gross floor area

[%]

Benefits

- Reduce embodied carbon emissions
- Reduce waste resulting from demolition works
- Minimise the extraction of new resources
- Assign value to existing processed materials, creating a new market for otherwise disposable products
- Protection of heritage buildings
- Potential lower cost intensity

Challenges

- Achieving compliance with applicable technical regulations
- Availability and quality of information on the existing asset (materiality and technical performance)
- Architectonical quality of existing assets (outdated aesthetics).
- Strict heritage requirements restricting design opportunities
- Confirming the residual life span of the main structural elements

Impact Level

5/6

Key Design Phase

Strategic Definition

Design Impact

5/5	Client
5/5	Architect
4/5	Structural Engineer
3/5	Facades Engineer
1/5	MEP Engineer
1/5	Interior Designer

1.1 Reuse, renovate or repurpose an existing asset.

Description

Instead of developing new building space to accommodate functions, reusing existing space can be a more effective use of energy and materials.

Beyond the reuse of an exisitng structure, other building layers such as 'skin' and 'services' could also have the potential to be reused. The extent of material savings will depend highly on the state and flexibility of the existing asset. When reusing individual components or complete bulding layers, the residual service life needs to be investigated and assessed thoroughly.

Sub-actions

- Interrogate the project brief against client needs to reflect whether it represents the most efficient solution
- Review available assets in the client's portfolio and assess the potential for efficient and flexible use of available space and resources
- Engage a sustainability consultant during the Strategic Definition stage
- Raise awareness on future European regulation/requirements in regard to embodied carbon and circular economy
- Carry out a feasibility study between renovation/new construction options, adding embodied carbon, virgin material use and LCC as assessment criteria (simplified Life Cycle Assessment)
- Carry out technical assessments to evaluate the quality of the existing structure, facade and systems, as well as their reuse potential. Generate a full building material inventory
- Review the thermal insulation properties of external wall, improve thermal insulation performance by considering low embodied carbon insulation layer to facilitate low heat gain / loss from internal
- Review the existing glazing properties in terms of shading coefficient, visible transmittance and conductivity

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Strategic Definition

Available tools

Project Reference

Quay Quarter Tower
LocHal

1.2 Avoid nature-to-urban land conversion

Description

Foster land use that protects ecosystems by prioritising building on land that has been previously occupied or contaminated. Such development should steer away from untouched natural areas, ensuring minimal disturbance of ecosystems and biodiversity.
Engaging ecological experts and adhering to environmental policies is recommended, as a means to guide the planning process and avoid unintentional negative impact.
This action can be employed locally within the boundaries of a specific site as well as within the broader scope of a stakeholder's portfolio.

Sub-actions

- Avoid building on greenfield land with high biodiversity value, wilderness or habitats of endangered species (including plants) listed on the European Red List, arable or crop land with minimum moderate soil fertility and below ground biodiversity, forest or in a floodplain
- Prioritise selction of sites with a high percentage of previously occupied or brownfield land and avoid building on previously undisturbed land, e.g. areas with lowest ecological value, land which is contaminated, or previously occupied.
- Consult with experts of the local ecology and policies on implementing project restrictions to ensure approriate land protection policies of the site.

Building Layers

Architects

Key Stakeholders

Architect

Key Design Phase

Strategic Definition, Spatial Coordination

Available tools

Project Reference

2. Increase building utilisation

Description

Increasing the space utilisation in a building is fundamental to minimising overall resource consumption. The ability to accommodate various functions in a single space (multi-use of areas) must be designed into the building programme early on.

This strategy aims to reduce upfront resource consumption by maximising the utilization of spaces and avoiding use-free periods in the building programme. Considerably optimised utilisation can be achieved through the exploration of the "Space sharing" and "multi-use" concepts, following the sharing schemes already deeply present and successful in other sectors.

The future utilisation potential is explored under "Design for Adaptability".

Key Performance Indicator

Total building utilisation:
Cumulative hours of occupancy, defined as total hours*person spent in the building on a weekly basis, and normalized per square metre

[hrs/m2]

Benefits

- Reduce embodied carbon emissions
- Reduce waste resulting from demolition works
- Minimise the extraction of new resources
- Potential cost savings for users and landlords due to higher space utilisation

Challenges

- Hesitancy within the building sector to investigate the sharing schemes that have already been successful in other businesses.
- Acceptance of multi-use schemes is not equally present amongst all population groups

Impact Level

Key Design Phase

Preparation and Briefing

Design Impact

Client
Architect
Structural Engineer
Facades Engineer
MEP Engineer
Interior Designer

- Rebound effects resulting from the creation of a space-sharing market that will be added to, and not partly replace, the traditional single-use system
- Increased technical requirements to accommodate multiple uses
- Hesitancy due to safety and confidentiality issues resulting from a space-sharing scheme

2.1 Increase the multi-use potential of building spaces

Description

When designing assets for a single use type, it results in limited utilisation of the space during the day/month/year. Multi-use concepts can be explored and included in the building programme to increase the space utilisation over time and thus increase the utilisation of material resources input in the building.

When using the space for multi-purpose use, the total necessary floor space area for the desired functions can be optimised.

Sub-actions

- Review successful multi-use projects and question whether such projects could also be successful in the current project context, location and community
- Ask if alternating or simultaneous usage models could be suitable for the intended area
- For "Alternating Use", investigate the most suitable supplementary uses. Office buildings, for example, can be supplemented with educational evening courses, exhibits or receptions. (easier for other user types such as schools or cultural centres).
- For "Simultaneous Use", explore the concepts of "co-working" or "co-living" where utilisation of common areas is optimised.
- Review availability of local digital platforms promoting and supporting shared use of space

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Preparation and Briefing

Available tools

DGNB Checklist for Multi-Use of Areas

Project Reference

LocHal

2.2 Create the general physical conditions to enable multi-use implementation

Description

Aim for flexible floor spaces that can (easily) accommodate several functional purposes during its initial intended service life, thus maximizing its current utilisation without the need for retrofit.

Flexibility needs to be evaluated under various technical performance parameters such as structural performance, structural materials, durability, acoustics and thermal comfort.

Enabling flexibility might result in more upfront project-specific material uses. Nevertheless, overall material use would be considerably lower by accounting for the following:
a: total life cycle savings by avoiding future refurbishments
b: avoiding the need for other building projects (within the client's portfolio).

Sub-actions

- Draw a floor plate layout for the building, displaying how it would work for at least one use case other than the main one
- Determine the compatibility of uses and activities in the same space for technical aspects such as structural loads, durability, acoustic adaptation and energy requirements among others.
- Reduce the number of internal load bearing walls to allow for more flexible internal space configurations
- Consider live load assumptions covering flexible use
- Investigate greater ceiling heights to give more flexibility in the routing of services.
- Analyze if larger bays would allow for more internal space configurations
- Consider standardised grid systems of design allowing easy assembled components to be relocated to facilitate multi-function space implementation
- Consider all additional requirements so that spaces can be used for several purposes and at different "business" hours. Some aspects to be considered are:
- Security (access during non-traditional hours, access control, separation of "common areas")
- Access to sanitary facilities
- Additional requirements for room conditioning
- Flexible basic equipment
- Room and building acoustics
- Escape routes

Building Layers

All Disciplines

Key Stakeholders

Structural Eng.

Key Design Phase

Spatial Coordination -
Concept Technical Design

Available tools

DGNB Checklist for Multi-Use of Areas

Project Reference

LocHal

2.3 Design for an increased utilisation of regularly "empty" spaces

Description

Traditional building space programmes include spaces with low utilisation, even during "business" hours. Spaces such as atriums, lobbies and conference rooms, although useful and needed, are materially intensive when accounting for their space occupancy.

Designing these spaces so that they can host more "intensive" uses such as meetings, break outs and commercial uses would increase the overall space and thus material efficiency of the project.

Sub-actions

- Identify spaces in the building space programme which would traditionally have a low utilisation rate
- Identify more time "intensive" uses which are either already required or could be added to the project brief, which could be placed in those "low-utilisation" spaces
- Consider technical and space requirements of the more time intensive uses and how they could be met in a larger space

Building Layers

Envelope Design

Key Stakeholders

Facades Eng.

Key Design Phase

Spatial Coordination -
Concept Technical Design

Available tools

DGNB Checklist for Multi-Use of Areas

Project Reference

2.4 Design local building performance units so that they can work at various space configurations and requirements

Description

Design the building performance units with multiple functions in mind, so the spaces can meet the technical performance requirements of more than one use type. One can think of building performances such as ventilation, heating and plumbing.

Implementing this action could likely require more material at the start, but considering the reduced need for additional projects/buildings, it is expected to be more material-efficient over the whole life cycle.

Sub-actions

- From the list of considered multi-uses, identify the one which represents the critical requirements for each system (ventilation rates, lighting levels, etc.)
- Design the buiding systems to gradually provide for those uses with added requirements, instead of designing single large systems with exceeded capacity
- Integrate demand control systems and variable speed equipment to facilitate part-load operations under different functional uses
- Design for simplified and modular distribution systems
- Consider standardised grid systems of design, which allow easy assembled components to be relocated to facilitate multi-function space implementation
- Consider flexible engineering services designs, such as hybrid HVAC system, air diffuser on flexible ducts, movable luminaires and uplighters
- Reduce the use of embedded infrastructure for power, data and HVAC system.

Building Layers

Building Systems - MEP

Key Stakeholders

M&E engineer

Key Design Phase

Technical Design

Available tools

DGNB Checklist for Multi-Use of Areas

Project Reference

LocHal

2.5 Make us of versatile/flexible/movable internal walls for the space layout to support multi-use.

Description

Design the internal walls with multiple functions in mind, thus optimising the building utilisation.
One can think of sliding and rolling room dividers so room configurations can be changed in a matter of minutes.

Implementing this action would likely require more material compared to non-flexible fixed spaces, but considering the reduced need for additional spaces, it is expected to be more material-efficient.

Sub-actions

- Particularly for commercial/educational/office project, minimise the exclusive surfaces which are used for short periods of time a day (meeting rooms, break rooms, auditoriums, etc.)
- Investigate if these type of spaces could follow a pop-up format, rather than a fixed one
- Research the local supply chain for flexible interior fit-out components such as sliding partition walls and compressable storage units
- Implement a modular design approach with standardised connecting details to allow the flexible configuration of larger or smaller spaces as needed at a particular time

Building Layers

Interior Fit-Out

Key Stakeholders

Interior designer

Key Design Phase

Technical Design

Available tools

DGNB Checklist for Multi-Use of Areas

Project Reference

3. Design for Longevity

Description

This strategy aims at maximising the value of the building and its components over time, optimising value retention and value recovery potential.

At the building level, it aims to preserve the timeless architecture that people love and care for by designing and selecting durable products that can stand the test of time. At the component level, the strategy aims to use durable products and materials that guarantee a long life, preferably beyond the necessary service life, so they can be adapted and reused in the future.

Long-lasting components are directly linked to their respective design, as the design sets the baseline for an element’s quality, maintenance need, necessity for repair, adaptability and residual value when removed.

Key Performance Indicator

Value retention and recovery over whole life cycle:
A good indicator to assess value retention is Life Cycle Cost (according to EU Level(s) Indicator 6.1 Life Cycle Costs), accounting for real functional service lives of the building and of each individual component, as well as assessing potential returns due to sell-back schemes and high residual value of components.

[$/m2/yr]

Benefits

- Reduce embodied carbon emissions in the long term
- Reduce material extraction in the long term
- Enable future tenants to adapt the space to their anticipated needs
- Enable future reuse of building components
- Reduce costs over the entire building life cycle

Challenges

Impact Level

Key Design Phase

Technical Design

Design Impact

Client
Architect
Structural Engineer
Facades Engineer
MEP Engineer
Interior Designer

- May result in requiring higher material quantities for the first use, but still beneficial over the total life cycle
- May result in higher environmental impacts for the first use, but still beneficial over the total life cycle

3.1 Design for future climate adaptability/ resilience

Description

Resilience to changing climate conditions should be embedded in the design process in order to ensure adequate future performance of the building and to retain its value - particularly the building layers and systems with a long life span.

Future proofing, however, frequently leads to designs that require more materials to meet more onerous performance requirements. It is thus recommended to follow a staged approach, considering incremental adaptability, rather than designing for the worst case distant future scenario.

Sub-actions

- Do not limit design to current technical standards when defining thresholds/set points (e.g. temperature, precipitation depth, seismic intensity, wind forces, etc.)
- Carry out a climate risk assessment of the project site following frameworks such as those described under the TCFD or the EU Taxonomy and take the results into account when determining design parameters for building services, envelope and structure
- Make use of digital tools to assess projected future climate conditions of your project location
- Develop a staged climate adaptability plan with clear steps for addressing worsening weather per design discipline
- Use appropriate time frames for climate projections, depending on expected service life of the building layer
- Prioritise passive resilience strategies over larger technical infratructure
- Take into consideration future possible reuse scenarios

- Climate-change related hazards that could potentially impact the running performance of the asset are, among others:
a) longer and more extreme heat waves and frost periods
b) more intense short duration rainfall
c) longer dry spells/drought periods
d) heavier rainfall

Other hazards that should be accounted for include:
a) river or rain flooding
b) stronger wind storms
c) soil subsidence
d) seismic events

- Use sustainable drainage system designs to integrate storm water management such as rain gardens and bioswales which collect rainwater from nearby areas, allowing precipitation to slowly infiltrate the ground, thereby reducing flooding and lessen the strain on municipal grey stormwater management systems

Building Layers

All Disciplines

Key Stakeholders

M&E engineer

Key Design Phase

Concept Architectural Design

Available tools

WeatherShift

Project Reference

Gasholders London

3.2 Prioritize standarised, modular elements over bespoke/tailor-made solutions, and avoid complex building geometries

Description

The uniqueness of a project is traditionally related to higher value. However, this can often also translate to reduced flexibility and reusability of the space and the building components. Non-standard/ bespoke elements have reduced chance of being reclaimed and reused. Also, manufacturing processes of standard elements are optimised to reduce waste, which is not necessarily the case for bespoke products.

The market is small for used unique elements, but not for unique projects. Innovation and uniqueness can also be achieved through clever use of standardized and modular elements.

Sub-actions

- Fix the architectural concept/challenge for the project to achieve the desired outcome using standardised/modular components
- Follow standardised floor-to-floor dimensions
- Architectural spatial planning to incorporate standardised grid or layouts (I.e standardising floor-to-floor heights across building typologies and grids i.e 9x9, 4.5x4.5, 3x3, etc.)
- Avoid complex architectural forms where possible
- Carry out a preliminary life cycle cost assessment, comparing a bespoke project using bespoke elements with one using standard modular ones.
- Engage with potential local manufacturers to understand the available and modular systems on which the design can be based
- Include disassembly potential as selection criteria when consulting and engaging with local manufacturers
- Make use of digital parametric tools to obtain optimised geometries and performance through clever placement of standard components rather than unique, yet to be developed ones.

Building Layers

Envelope Design

Key Stakeholders

Architect

Key Design Phase

Technical Design

Available tools

One Click LCA

Project Reference

3.3 Investigate Product-as-a-Service schemes for components expected to have a short or medium service life in the project

Description

Certain elements in a building are often replaced before they have reached the end of their first functional life. For example, facade, services or interior design elements are often replaced due to a change in the space tenant or simply as a design refresh. Product-as-a-service or leasing schemes promote a payment for the actual use of certain elements (either by time, cycles or performance), rather than a full acquisition of the physical product. These schemes greatly foster the value retention of the serviced products, maximising proactive maintenance as well as reuse and recycle potential.

Sub-actions

- Review case studies in which product-as-a-service or leasing schemes have been implemented. Common components being offered under such schemes are building envelope, lifts, large MEP equipment, lighting and interior design elements
- Research and engage with manufacturers that already provide such schemes. Alternatively, engage with known, trusted manufacturers and evaluate together the potential for implementation
- Carry out research on legal best practices which minimise the risk for both client and supply chain

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Concept Architectural Design

Available tools

Project Reference

The Circular Building

3.4 Maximise the durablity of the building structure through careful selection, protection and maintenance of components

Description

To maximise the adaptability and disassembly potential, it is key to increase the durability of building components.
Maintenance is often minimised/forgotten during use, hence durable materials with low maintenance requirements will outperform durable materials that rely on a maintenance regime that is backlogged.

'Designing the building by respecting the nature of the chosen material, protecting the main structure adequately, implementing durable detailing and allowing for ease of replacement if necessary will increase the lifespan

Sub-actions

- Choose materials that offer inate durability to certain environments eg concrete for robustness, timber for high chlorine content

- In environments which are highly aggressive against materials, such as coastal areas, locations with high humidity levels or with extreme temperature variations, make use of a comparison matrix to select the optimal material, weighing higher capital cost against reduced maintenance costs (lower whole life cycle cost)
- Design the building so that "raw" materials (e.g. timber and steel) remain unexposed and/or protected from water and moisture and UV
- Implement details that ensure encapsulation and protecction are assured

Building Layers

Structural Design

Key Stakeholders

Structural Eng.

Key Design Phase

Preparation and Briefing

Available tools

Project Reference

3.5 Ensure the individual service life of envelope systems, components, products and materials align with the minimum service life of the building.

Description

Discrepancies in the service life of a building and individual systems, components, products and materials exist in common design practice and often result in wider scale demolition or replacement than necessary. For example. replacing gaskets in a unitised curtain wall facade system requires the full replacement of the façade system. This can be avoided by specifying materials that meet the building service life or designing for minimally invasive techniques to maintain, test and replace individual components or products that have lower service lives.

By supplying the asset manager with a diagrammatic manual for how to maintain, test, refurbish and replace individual systems, components, products and materials, he will be more likely to ensure the longevity of the overall building

Sub-actions

- Specific individual systems, components, products and materials that meet the service life of the building
- If individual systems, components, products and materials do not meet the service life of the building, develop a longevity design strategy which outlines maintenance, testing and replacement for individual systems, components, products and materials that are minimally invasive
- Develop a comprehensive Longevity Plan Document which includes clear instructions and diagrams on how to maintain, test, replace and refurbish individual systems, components, products and materials to ensure the service life of the building is met

Building Layers

Envelope Design

Key Stakeholders

Facades Eng.

Key Design Phase

Spatial Coordination -
Concept Technical Design

Available tools

Project Reference

3.6 Make use of Whole Life-Cycle Cost assessment (WLCC) as design assessment tool

Description

The concept of circular economy is to maintain materials at their highest value for the longest possible period and to recover the highest value at end-of-life. This value retention and recovery is maximised when in-use and end-of-life scenarios for the physical building components are taken into account when estimating the real project costs instead of focusing exclusively on capital costs, operational cost and maintenance cost.

Sub-actions

- Involve a Quantity Surveyor at an early design stage
- Involve a Materials Consultant at an early design stage
- Involve a building cost consultant at an early design stage
- Include the residual value of products and material into the WLCC taking into account adaptability, disassembly and recoverability potential (information should ideally come from individual manufacturer)
- Discuss the level of discount rate for future cost and value with you client
- Complete a sensitivity study on the level of the discount rate
- Design following a structured BIM environment. Include WLCC information within BIM plans and protocols.
- Ideally, carry out WLCC and WLCA assessments using one single piece of software

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Spatial Coordination -
Concept Technical Design

Available tools

One Click LCA

Project Reference

3.7 Issue a Building Materials Passport document for the project

Description

Effective recovery and reuse of building components and materials is not possible if detailed information is not gathered and easily accessible for future use.

Making sufficient information available in documentation such as Material Passports helps facilitate reverse logistics and take-back of building products and materials, thus contributing to their value retention over time. Simultaneously, requiring this type of documentation incentivises the supply chain to manufacture healthier and more sustainable materials by prioritising the product/material choices which can disclose and issue the necessary information.

Sub-actions

- Agree within the project team the scope to be included in the building's material passport
- Communicate to the entire design team the type and level of information to be required to relevant suppliers
- Integrate the capacity to provide the required information as selection criteria when selecting product/material suppliers
- Favor suppliers/ manufacturers who can provide more comprehensive information, including Environmental Product Declarations (EPD), Health Product Declarations (HPD), disassembly instructions, and maintenance/repair instructions
- Favor suppliers/ manufacturers who offer take-back schemes for their products/materials
- Use digital tools to collect all relevant information and issue an electronic/digital building material passport
- Integrate Materials Passport requireements in the BIM workflow/plan

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Technical Design

Available tools

Project Reference

The Circular Building

4. Design for Adaptability

Description

This strategy aims at enabling the adaptability potential during the use stage. Buildings have a short functional lifespan and it is of importance that buildings have the ability to adapt to new functions to retain their value. This strategy considers two design principles for adaptability: versatility and convertibility, which are in turn related to the required level of system adaptations. This strategy is most appropriate for sites and typologies where changes of use are likely.

Key Performance Indicator

Adaptability potential:
Adaptability Score, defined as per EU Level(s) Indicator 2.3.
Adaptability, Table 6. (quantitative rating resulting from a qualitative assessment)

Benefits

- Reduce embodied carbon emissions in the long term
- Reduce material extraction in the long term
- Enable future tenants to adapt the space to their anticipated needs
- Retain each asset's value over its service life

Challenges

- May result in requiring higher material quantities for the first use, but still beneficial over total life cycle
- May result in higher environmental impacts for the first use, but still beneficial over total life cycle

Impact Level

Key Design Phase

Concept Architectural Design

Design Impact

Client

Architect

Structural Engineer

Facades Engineer

MEP Engineer

Interior Designer

4.1 Increase convertibility: choose architectural massing, a structural grid and a foundation layout compatible with all likely future uses.

Description

The potential for a building to meet the needs of different typologies (office, residential, education, etc.) is governed to a great degree by some key parameters:
- Floor plate depth
- Floor plate shape
- Floor-to-floor height
- Core locations
- Core and riser sizes, including vertical transportation capacity
- Structural loading allowances
- Foundation loading capacity

Structural column spacing is a important factor but is not a must-have (awkward column locations can typically be worked around with a slight reduction in space efficiency).

At the briefing stage, values for these parameters should be set which are compatible with identified likely future uses for the site in question.

Sub-actions

- Make an assessment on the changing demand of the property market in the area and identify the potential future uses sought after for the real estate assets
- Scenario planning should be used prior to the brief being written to identify the most likely alternative uses - in the absence of this, based on the location of the site, the design team should decide in discussion with the client.
- Understand the range of design values for the identified uses or typologies for each of the listed parameters.
- Determine the single value for each parameter to be included in the brief or design
- Draw at least one additional floor plate layout and key section for the building, to confirm the chosen values for the parameters allow for at least one other use type

Building Layers

Structural Design

Key Stakeholders

Architect
Structural Eng.

Key Design Phase

Spatial Coordination -
Concept Technical Design

Available tools

Level(s)

Project Reference

Taikoo Green Ribbon
The Living Lab

4.2 Increase convertibility: Allow for changes in building use by designing the building envelope to allow for more than one use, or to allow modifications in window size and spacing.

Description

By designing in advance to allow a certain degree of convertibility of the building envelope, the building can be converted to suit different functional needs.

Window size and spacing have a role in determining the suitability of internal spaces for different uses.

Designing the envelope to be compatible with more than one use, or to allow changes to window size and spacing, reduces the costs of future refurbishment, incentivising retention over demolition and thus extending the building's life.

Sub-actions

- Make an assessment on the changing demand of the property market in the area and identify the potential future uses sought after for the real estate assets
- Scenario planning should be used prior to the brief being written to identify the most likely alternative uses; in the absence of this, the design team should decide on the most likely alternative uses based on the location of the site and through discussion with the client
- Draw at least one additional floor plate layout and key elevation for the building, displaying how the facade would work for at least one other use type
- Avoid load bearing facades in order to allow for future changes to be made more easily to both internal layouts and external elements

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Spatial Coordination -
Concept Technical Design

Available tools

Level(s)

Project Reference

4.3 Increase convertibility: Make passive provision accounting for possible changes to MEP systems, provide a plant replacement strategy that avoids waste.

Description

Passive provision is needed to allow the MEP systems to be adapted or replaced to suit alternative uses.

Floor plate depth, floor plate shape, core locations, window sizes and locations, internal partition layouts, plant room sizes, riser sizes and space for horizontal distribution all play a role in determining whether a building can accommodate an adapted or entirely new MEP system.

An adaptability strategy for MEP considers what the values for the parameters above might be and makes passive provision for those which are more onerous than those needed for the first intended use.

MEP systems are composed of components with different service lives. Also, MEP components have a higher likelihood of malfunctioning than that of elements of other building layers. It is also important therefore to have a plant replacement strategy for all MEP installations that avoids waste and minimises disruption.

Sub-actions

- Make an assessment on the changing demand of the property market in the area and identify the potential future uses sought after for the real estate assets
- Scenario planning should be used prior to the brief being written to identify the most likely alternative uses; in the absence of this, the design team should decide on the most likely alternative uses based on the location of the site and through discussion with the client
- Draw at least one additional floor plate layout and key section showing how the MEP strategy will work for one alternative use
- Allow replacement of MEP systems by not embedding them in the building structure or envelope. The exceptions will be renewable energy technologies integrated into building foundations or envelopes.
- Provide sufficient access to plant rooms for future replacement
- Size plant rooms, risers and distribution routes assuming the most onerous case among the identified future uses.
- Ensure pipes, cables, ducts, and local units are accessible for repair, maintenance and replacement of individual components
- Ensure that individual monitoring and servicing for sanitary facilities is possible for sub-divisions of the spaces, this will provide more subletting options.
- Adopt open architectures to avoid lock-in to specific product lines and improve resilience in the case of product discontinuations

Building Layers

Building Systems - MEP

Key Stakeholders

M&E engineer

Key Design Phase

Spatial Coordination - Concept Technical Design

Available tools

Level(s)

Project Reference

4.4 Develop and issue an Adaptability Manual document

Description

A building can be designed to be highly adaptable over time. However, for this to be realised, information on how this can be put in practice must be transfered to the building owner/operators.

Providing asset owners and facility managers with a manual on how to make use of the strategies embedded in the building's design will allow them to exploit the usability and adaptability potential of the building during day to day operations and for potential future use-changes.

Sub-actions

- Develop an Adaptability Manual Document including clear instructions and diagrams on how to adapt the building for different scenarios
- Provide sufficient 3D as-built documentation to the asset management system, also including information about materials and connection types
- When relevant, integrate "adaptability"-related information within the building's Material Passport document

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Technical Design

Available tools

Project Reference

5. Design for Disassembly

Description

This strategy aims at enabling the disassembly potential at end of service life. The useful life of some components in buildings outlast their service life as part of a system. It is important to design upfront for the practical disassembly of components in order to recover residual value at end of their service life. According to ISO 20887, seven design principles for disassembly should be considered: ease of access, independence, avoidance of unnecessary treatments and finishes, supporting re-use business models, simplicity, standardisation and safety of disassembly. Appropriate for all sites and typologies.

Key Performance Indicator

Disassembly and recovery potential:
Ease of Recovery + Ease of Reuse and Recycling Scoring, defined as per EU Level(s) Indicator 2.4 Design for Deconstruction
(Assessment methodology based on DGNB TEC1.6 Ease of recovery & recycling)

Benefits

- Reduce embodied carbon emissions in the long term
- Reduce material extraction in the long term
- Enable future reuse of building components
- Retain each asset's value at end of service life

Challenges

- May result in requiring higher material quantities for the first use, but beneficial over total life cycle
- May result in higher environmental impacts for the first use, but beneficial over total life cycle

Impact Level

Key Design Phase

Technical Design

Design Impact

Client
Architect
Structural Engineer
Facades Engineer
MEP Engineer
Interior Designer

5.1 Develop reversible connections between the building super-structure elements

Description

Use reversible connections between components in different layers with different life spans so those with shorter expected service life periods can be easily and independently extracted, adapted, reused, repaired, refurbished or replaced. This will increase the reusability potential of each individual component, as well as the reusability and adaptability potential of the building as a whole.

For the building structure and building envelope, favoring prefabricated components over those constructed on-site will directly increase the disassembly potential.

Sub-actions

Prefabrication:
- Favor structural systems that maximze the use of prefabricated elements
- Favor suppliers/manufacturers who can offer disassembly instructions and take-back schemes

Consideration for connections:
- Favor mechanically-fixed systems over adhesive-fixed
- Favor bolted connections over welded connections
- Rethink composite components for future ease of recycling
- Use connection methods that do not damage the individual elements so that they can be reused directly (assuming they meet performance requirements)
- Minimise the number of connections types in order to facilitate future disassembly
- Connections should be designed to minimise deformations during service life since these can make future disassembly difficult

In order to take advantage of reversible connections, it is important to create sufficient visibility and access to undo and remove for repair, replacement or reuse:
- Avoid unnecessary finishes that block access
- Include safe accessibility to the connections

Considerations for disassembly:
- Make sure there is room to safely secure and remove the components away from the building
- Use universally recognised methods for assembly, disassembly and reassembly of connections

Building Layers

Structural Design

Key Stakeholders

Structural Eng.

Key Design Phase

Technical Design

Available tools

DGNB criteria "Ease of recovery and recycling"
Level(s)
DGBC - Circular Buildings

Project Reference

The Circular Building
Quay Quarter Tower
Peoples Pavilion

5.2 Allow access to reversible connections between the structure and building services.

Description

In order to take advantage of reversible connections, it is important to create sufficient visibility and access to undo and remove components for reuse. This will improve the reusability potential of each component.

Sub-actions

- Avoid unnecessary finishes that block access to buiding services components
- Provide an access panel to ease inspection and maintenance processes
- Include safe accessibility and walkable working platform to access the services at height
- Allow sufficient room around connections to allow for disassembly actions to to be comfortably carried out

Building Layers

Building Systems - MEP

Key Stakeholders

MEP engineer

Key Design Phase

Technical Design

Available tools

DGNB criteria "Ease of recovery and recycling"
Level(s)
DGBC - Circular Buildings

Project Reference

Quay Quarter Tower

5.3 Develop and issue a Disassembly Manual Document for the building

Description

A building can be designed in a way that it can be disassembled into its components. However, if the information on how this process is to effectiviely done is not transferred to the building owner/operators, then the disassembly potential embedded in the design can end up not actually being used.

Providing asset owners and facility managers with a thorough manual on how the disassembly process is effectively carried-out will allow them to exploit this potential and maximise their repair and reuse of individual components, thus maximising their value retention.

Sub-actions

- Develop a Disassembly Manual Document including clear instructions and diagrams on how to disassemble different components and for different scenarios
- Provide sufficient 3D as-built documentation to the asset management system, also including information about materials and connection types
- When relevant, integrate "adaptability"-related information within the building's Material Passport document

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Technical Design

Available tools

Project Reference

The Circular Building

6. Refuse unnecessary components

Description

This strategy aims at meeting the project requirements with minimal material consumption. At all levels, it fosters simple design approaches and thoughtful consideration of the real need of components and materials. It aims at questioning if certain components can be refused without compromising the ability for the project to function at the desired performance level.

Key Performance Indicator

Conceptual material efficiency:
To account for material use reductions not achieved through technical optimisations, but rather conceptual decisions, a material use intensity factor per functional unit over building life cycle is introduced. The functional unit is to be set depending on the building typology, for example, total material use intensity per workstation/hotel bed/resident, etc.

[kg/unit/yr]

Impact Level

Key Design Phase

Concept Architectural Design

Design Impact

Client

Architect

Structural Engineer

Facades Engineer

MEP Engineer

Interior Designer

Benefits

- Reduce embodied carbon emissions
- Minimise the extraction of new resources
- Reduce upfront material costs per sq m
- Reduce energy consumption and operational carbon emissions
- Reduce operational costs

Challenges

- Achieving the desired architectural concept with less products/materials
- Perceived reduced market value in certain locations due to limited availability of certain components, in comparison to traditional assets
- Perceived potential lower comfort control of building occupants

6.1 Refuse redundancy in spaces and overestimated headcounts

Description

A redundancy of space and programme directly translates to unnecessary material use and decreased space utilisation. Adaptability to potential future changes can be achieved via clever design strategies, rather than simply having a redundancy in the space program.

The COVID-19 pandemic drastically accelerated the transformation of work patterns and therefore affected the utilisations of buildings. The transformation expected by digitalisation of several activities should be considered when developing the project brief and space program.

Sub-actions

- Interrogate the project brief for potential redundancy in spaces and headcounts
- Assess impact and opportunities for digital, innovative approaches to functions that could reduce the use of space and release it for other functions
- During feasibility studies, include expected space utilisation as an assessment parameter
- Consider phasing and modular expansion approach as an alternative to redundancy and overestimating spaces
- Identify spaces with low utilisation, and if they cannot be fully taken out of the project programme, assess how they can be merged/designed to host additional usages (See Action 2.3)

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Strategic Definition

Available tools

Project Reference

6.2 Eliminate/reduce the need for on-site parking space

Description

Parking infrastructure for private vehicles adds considerable space requirements to building projects. The allocation of these spaces has particularly large impacts as they are normally located underground or at ground level around the building footprint.

Considering alternative mobility strategies which reduce or, ideally, fully eliminate the need for on-site parking spaces would have a considerable impact on resource consumption, urban cohesion and the immediate social context.

Sub-actions

- Prioritise development on areas which are well served by public transport infrastructure
- Interrogate the project brief against overly strict on-site parking requirements
- If local regulations state mininum parking space requirements, engage with local authorities and investigate potential compensation measures (e.g.. alternative mobility plans, co-financing public transport programme for building users, car pooling + mobility sharing platforms, financing for local sustainable mobility infrastructure)
- If parking on-site is required, avoid locating it underground and design parking levels to be adaptable for potential alternative uses (see Action 4.2)

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Concept Architectural Design

Available tools

Project Reference

6.3 `Prioritise passive and simple servicing strategies over overly complex ones

Description

Technical systems design guidelines often fail to add an initial step, which is to question whether the required service and level of performance can be achieved through passive measures (e.g. architectural shading and mechanical cooling, natural ventilation over mechanical ventilation, more attractive and better stair usage over full reliance on lift equipment, etc.).

Furthermore, traditional design is carried out to meet maximum and minimum required set points and peak loads, which are often overestimated. Integrating passive measures in the space conditioning strategy, aside from achieving lower energy demand, results in reduced equipment sizes and thus reduced space requirements.

Sub-actions

- Interrogate the project brief against overly strict interior comfort set-points (temperature, humidity, etc.)
- Interrogate the project brief against over dimensioned internal process loads (IT equipment, lighting fixtures, other receptable equipment)
- Interrogate the project brief against over-dimensioned ventilation rate requirements, whilst adhering to local air quality standards
- Integrate adaptive comfort design methodologies to decrease (or eliminate) the requirement of installed cooling and heating capacities
- Interview the facility management and building users to understand their actual needs to optimise the system design in avoiding over-design
- Carry out a feasibility study/ simple energy model to assess the potential of natural ventilation and passive cooling/heating strategies
- Carry out a feasibility study/ simple energy model to assess the potential of a mix-mode system
- Dimension required cooling and heating capacities using detailed load modelling, instead of overly conservative rule of thumb assumptions which lead to over dimensioning of building systems
- Consider displacement ventilation, floor AC supply and/or mid-level AC supply to serve the occupied zone only as opposed to the entire room column
- Adopt CFD model to review ventilation and thermal distribution profile to optimise the air diffuser and flowrate design
- Savings in materials used for ductwork can be obtained by carefully considering ducting routes. This can also improve operational efficiency (e.g. minimising the length of insulated ducts can reduce fan power needs)

Building Layers

Building Systems - MEP

Key Stakeholders

M&E engineer

Key Design Phase

Spatial Coordination -
Concept Technical Design

Available tools

Project Reference

6.4 Refuse finishes where possible

Description

The overall material use for interior design components is considerably smaller compared to that for the building structure, however, internal finishes have a much shorter service life and are frequently replaced over the service life of the building. When taking into account the need for frequent replacement, maintenance and upkeep of these "smaller" components, material use over the whole life-cycle becomes quite considerable.

Considering the use of exposed surface of structural elements and exposed MEP systems as part of the interior design concept, instead of concealing these under layers of light but often "unnecessary" materials can add a particular architectural character to the project, whilst saving considerable amount of materials.

Sub-actions

Develop a design look and feel which draws from the very nature of the building components and self finished materials, reavealing rather than hiding what things are made of and how they are put together
- Engage with the client at to communicate the importance of such design approach, including arguments such as whole life-cycle material use, -carbon emissions and -cost as arguments for a minimalistic concept
- Designing structure and building services and architectural components in carefully coordinated way, so that they can be left exposed and unfinsihed, however achieving a pleaseing and coherent look and feel
- Interior finishes often perform a technical function, namely fire resistance, thermal insulation and acoustic characteristics. Engage with other design disciplines since early design stage to ensure finishing elements are being considered where technically required and using as little material possible
- Investigate Biophilic design strategies that could contribute to adequate functional performance with lower material use

Building Layers

Interior Fit-Out

Key Stakeholders

Interior designer

Key Design Phase

Technical Design

Available tools

Project Reference

7. Increase material efficiency

Description

This strategy aims at meeting the project requirements with minimal material consumption. At all levels, it aims for an efficient use of materials at a maximum level of performance. It looks at avoiding inefficient building material volumes (high-rise, transfer, long-span, cantilevers or deep underground structures) and selecting efficient systems and forms. It also looks at the use of high-performance products and materials and advance engineering methodologies.

Key Performance Indicator

Material use efficiency:
Total material use intensity by area, and over whole building life cycle, accounting for all building materials

[kg/m2/yr]

Benefits

- Reduce embodied carbon emissions
- Minimise the extraction of new resources
- Reduce upfront material costs per sq. m.

Challenges

- Moving away from the concept of extreme high rise buildings as architectural beacons
- Slow adoption of advanced digital design tools
- Risk of lower return on investment with less GFA
- Perceived higher cost of new construction/building technologies
- Hesitancy of adoption of new construction/building technologies due to perceived higher risk

Impact Level

Key Design Phase

Concept Architectural Design

Design Impact

Client

Architect

Structural Engineer

Facades Engineer

MEP Engineer

Interior Designer

7.1 Avoid material intensive deep underground and high rise construction

Description

Increasing the total usable floor space made available per buildable land surface directly affects the value of the site. However, this often occurs at the expense of other parameters.

Underground and high rise construction are particularly not material efficient per square metre. The material volume increases exponentially due to horizontal loads on stability core (wind, earthquakes) and foundation design (water and ground pressures). Furthermore, underground and high-rise construction is highly concrete and steel intensive, drastically increasing the embodied carbon footprint of a project.

Sub-actions

- Prioritise development on areas which are well served by public transport infrastructure
- Site a building to minimize the requirement for earthworks - i.e. unnecessary infill/ excavation
- Make use of the existing ground levels for the development of the architectural massing/layout
- Interrogate the project brief against overly strict on-site parking requirements

Building Layers

Structural Design

Key Stakeholders

Structural Eng.

Key Design Phase

Concept Architectural Design

Available tools

Project Reference

7.2 Reduce the material use intensity in the building structure via material-efficient structural forms and techniques, such as hybrid and/or composite solutions.

Description

Structural behaviour is strongly influenced by the structural form. The form can be optimised to enhance a load path via axial internal forces and will result in a reduction of the material needed. An example of this can be seen in the use of vaulted structures, which work in axial compression. The form can also be optimized to follow the force lines. An example of this is floor beams following the bending moment line instead of a constant cross-section over the length.

Composite solutions allow for a combination of materials to efficiently use the intrinsic resistance to certain loads of each material. Examples of this are steel for tension and timber and concrete for compression.

Sub-actions

- Interact early on with the architect, structural engineer and MEP to define efficient building forms
- Optimise the building form to reduce impact of wind loading and seismic loading (where applicable)
- Restrict long spans to avoid unnecessary large cross sections
- Avoid cantilevers
- Reduce the weight of structural flooring systems (e.g. ribbed slabs, voided slabs, post-tensioned slabs, corrugated aluminium)
- Use truss structures over solid beams
- Optimise the dimension of columns according to their loading and stability performance. This can result in lighter columns towards the top.
- Optimise the column grid to reduce span and hence the material need of beams and floors

Building Layers

Structural Design

Key Stakeholders

Structural Eng.

Key Design Phase

Spatial Coordination -
Concept Technical Design

Available tools

Project Reference

7.3 Reduce dimensions of the building structure components through selection of high strength materials

Description

When component dimensions are governed by their structural capacity, using higher strength materials can reduce the total material need.

Where system dimensions are governed by performance requirements, e.g. deflections or vibrations, using hybrid systems and alternate geometry can help reduce the total material need.

Sub-actions

- Prioritise the use of steel strength S460 or higher for structural elements when strength is governing over deflection and stability
- Prioritise the use of ultra high strength concrete (UHSC) for structural elements when strength is governing over deflection and stability
- Prioritise the use of timber for systems with a low LL to DL ratio, as timber has a better self-weight to strength ratio
- Investigate new lightweight material innovations like FRP
- Investigate hybrid and composite solutions (eg. timber-concrete composite)

Building Layers

Structural Design

Key Stakeholders

Structural Eng.

Key Design Phase

Spatial Coordination -
Concept Technical Design

Available tools

Project Reference

7.4 Use advanced engineering practices to improve material efficiency of structural and envelope components.

Description

Advanced engineering can help optimise material need to a minimum (for example, ductile lateral systems, soil-structure interaction, dynamics, high-rise building design / tensile strutures).

Digital fabrication processes will be needed to fully realise the material benefits without adding significant additional labour costs.

This approach is in tension with Action 3.3 regarding standardisation. Action 3.3 is more appropriate for typologies with a large number of individual units, while this approach may be more appropriate for typologies which are unique or needed in very small numbers. An Industrialised Construction approach can be used to partially reconcile this tension.

Sub-actions

Building Layers

Structural Design

Key Stakeholders

Structural Eng.

Key Design Phase

Technical Design

Available tools

Project Reference

7.5 Reduce material waste at production and construction through off-site prefabrication of the building structure and envelope components.

Description

Manufacturing components off-site and transporting complete modules or components to the construction site leads to various benefits such a:
- Reduced excess waste resulting from 'poor workmanship' with on-site production (working on heights, not optimal equipment).
- Waste is also reduced as off-site prefabrication is not exposed to weather, thus quality is traditionaly higher than on-site construction.
- Material use is optimised, as it is in most chain-manufacturing processes.
- When the prefabrication (component or modules) is also standardised any 'left-over' resources from one project can be used for a next project.

Sub-actions

- Rethink if the building can be fully or partially made from prefabricated building modules:
1) Use prefabricated concrete components, like beams, columns and floor slabs
2) Use prefabricated steel assemblies section, like beams and columns. Avoid unique prefabricated sections.
3) Use timber prefabricated assemblies, both as panels (in 2D or volumes (in 3D))
- Optimise the logistics of necessary materials on-site
- If fabrication is too far away, investigate close-by temporary erection facilities

Building Layers

Structural Design

Key Stakeholders

Structural Eng.

Key Design Phase

Manufacturing and Construction

Available tools

Project Reference

Peoples Pavilion

8. Reduce the use of virgin and non-renewable materials

Description

This strategy aims at the prevention of virgin abiotic material consumption (particularly critical raw materials) and promotion of secondary products and materials. At all levels, it aims to promote the use of reused products and recycled materials, as well as promoting the use of renewable and biobased materials.

Key Performance Indicator

A good overall indicator for material input use and output potential is the Material Circularity Indicator (MCI) from the Ellen MacArthur Foundation.

Benefits

- Reduce embodied carbon emissions
- Minimise the extraction of non renewable resources
- Reduce waste resulting from demolition works
- Assigning value to existing processed materials, creating a new market for otherwise disposable products

Challenges

- Achieving compliance with applicable technical regulations
- Limited information on the existing materials/components (uncertainty of technical performance)
- Complex procurement process
- Availability of market places for reused products in the building sector
- Potential higher capital cost associated with (responsibly sourced) bio-based materials

Impact Level

3/6

Key Design Phase

Technical Design

Design Impact

2/5	Client
5/5	Architect
5/5	Structural Engineer
5/5	Facades Engineer
2/5	MEP Engineer
5/5	Interior Designer

8.1 Maximise the use of reclaimed components for all building layers

Description

When reusing components from existing, soon to be demolished, or already deconstructed structures, the need for manufacturing new components is reduced. The main structure and envelope account for more than 50% of total material use and therefore are areas of focus.

When reusing components in elements of the building exposed to weathering, the residual durability will need to be assessed. When reusing components in elements of the building structure, the residual strength will need to be assured.

Sub-actions

- Refer to exisiting frameworks/guidelines such as the EU Taxonomy, the LETI and pre-existing targets for the project
- If the site is a previously developed site or an existing building, minimise demolition works as much as possible. Make an inventory of the existing components and carry out a feasibility assessment for potential reuse of building components
- When refurbishing existing buildings, refer to existing frameworks and set fixed targets for reuse and recycling of deconstruction/demolition material (i.e. 90% as per EU Taxonomy)
- Where possible source materials from secondary material marketplaces
- Involve urban miners and material banks early in your design
- Reuse steel, concrete or timber frames from deconstructed structures
- Consult envelope manufacturers who have a product-as-a-service scheme in place for used components
- Specify reused materials and components in procurement documentation

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Spatial Coordination -
Concept Technical Design

Available tools

DGNB criteria "Ease of recovery and recycling"
Arup - Evaluation of Re-Use Potential

Project Reference

Gasholders London

8.2 Use concrete with high secondary content

Description

Concrete is the most used construction material and can come with different levels of secondary content. Increasing the secondary content can reduce a waste stream and reduce the embodied carbon emissions associated with concrete.
It is important to assess the potential effects on the durability and quality of such materials compared to the current standards.

Sub-actions

- Use concrete with the highest nationally accepted % secondary content that also meets the performance specification
- Use cement with the highest nationally and reasonable % secondary content that also meets the performance specification

Building Layers

Structural Design

Key Stakeholders

Structural Eng.

Key Design Phase

Manufacturing and Construction

Available tools

Project Reference

8.3 Use engineered timber (or other biobased materials) in building structures

Description

Engineered timber products offer benefits in terms of reduced carbon emissions, faster build times, smaller foundations and a natural feel that in some cases minimises the need for additional finishes.

Sub-actions

- Use CLT for the flooring system
- Use Glulam for the structural columns and beams
- Use CLT for shear walls / stability elements
- Investigate other alternative bio-based materials such as bamboo, rammed earth or hemp for smaller-scale structures
- Select bio-based materials from certified sources, which ensure ethical and sustainable supply chains, e.g., ensuring that the rights, usage of and access to land and resources, fair labor practices, and responsibilities of stakeholders are acknowledged and respected.

Building Layers

Structural Design

Key Stakeholders

Structural Eng.

Key Design Phase

Concept Architectural Design

Available tools

Project Reference

HAUT
White Collar Factory
The Living Lab

8.4 Use bio-based rapidly renewable materials for the interior design concept

Description

Even though they are often less resource-intensive than the building structure and envelope, interior fit-out components are still resource-intensive given they often need to be frequently replaced.

Particularly for commercial projects (office, retail, hotels, etc.), interior finishes are replaced considerably before the end of their technical service lives. When considering the whole life cycle of a building, rather than just the initial construction, the impact of interior fit-out elements becomes more significant.

Sub-actions

- Incorporate the characteristics of natural, bio-based materials in the interior design concept
- Research for direct bio-alternatives of traditional fit-out products (e.g. Linoleum as an alternative to vinyl flooring products)
- Consider rapidly renewable or fast-growing wood types such as cork and bamboo for elements such as cladding and flooring elements
- Avoid using hardwood timber for products with low structural requirements. Prioritise the use of faster-growing softwoods
- Research the market for availability of innovative bio-based materials such as mycelium and natural fibres (hemp, seagrass, etc.) to help minimize use of materials such as timber and wood
- Research the supply chain and favor suppliers who can certify a regenerative and ethical production. Not all timber and bio-materials providers are the same

Building Layers

Interior Fit-Out

Key Stakeholders

Interior designer

Key Design Phase

Technical Design

Available tools

Project Reference

HAUT
The Circular Building
Taikoo Green Ribbon

8.5 Reduce the use of critical raw materials

Description

The European union has developed a list of critical raw materials for the economy of Europe. Normal construction materials like iron ore and cement are not on the list, but bauxite for aluminium is on the list. Furthermore, coking coal used for the production of steel is on the list as well as several materials used in finishes and building services.

Sub-actions

- Use recycled aluminium to refuse the use of bauxite
- Use beryllium free copper alloys instead of traditional copper alloys
- Refuse the use of boron-treated glass fibre for insulating and structural fiberglass
- Refuse the use of coking coal by using recycled (or reused) steel
- Refuse the use of Gallium, Silicon Metal and Indium by reusing photovoltaic cells
- Refuse the use of lithium-ion batteries to decrease the use of lithium
- Don't design new magnesium oxide boards for walls, ceilings or magnesium soffits
- Refuse the use of natural rubber, such as rubber blocks (used beneath tiles)
- Design for Tungsten-free light bulbs
- Refuse the use of materials sourced from unethical supply chains and unfair labour practies

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Technical Design

Available tools

Circularity Builder
Level(s)
Cradle to Cradle Certified

Project Reference

The Circular Building

9. Reduce the use of carbon-intensive materials

Description

In the building industry, embodied carbon can be responsible for more than half of the total life cycle carbon emissions of a new construction project. Embodied carbon immediately cuts into our remaining carbon budget to stay below the agreed 2°C temperature rise by 2050.
Other strategies mainly look at reducing material demand, now and in the future. This strategy aims at reducing the use of carbon intense materials. It prioritizes suppliers which use reused products, recycled materials, renewable and bio-based materials or products and that use clean energy in their manufacturing processes.

Key Performance Indicator

Whole life cycle GHG emissions:
Carbon emissions intensity measured over the whole building life-cycle, as defined under Level(s) Indicator 1.2 Life-cycle Global Warming Potential

[kgCO2eq/m2/year]

Benefits

- Reduce overall embodied carbon emissions
- Products with low embodied carbon footprints tend to integrate recycled or bio-based materials, reducing the overall consumption of virgin materials
- Contributes towards sustainability benchmarking schemes
- Contributes to improved health and well-being for building users through material ingredient transparency and optimisation

Challenges

- Potential higher capital cost associated with some low carbon materials
- Reduced product choices require consideration of low embodied carbon goals in the early design stages
- Quality and availability of information in the supply chain

Impact Level

4 of 6

Key Design Phase

Technical Design

Design Impact

Role	Impact (of 5)
Client	4
Architect	5
Structural Engineer	5
Facades Engineer	5
MEP Engineer	3
Interior Designer	5

9.1 Track the embodied carbon footprint during design and set an ambitious overall embodied carbon target for the project

Description

During recent decades, sustainable building design has focused moreso on operational carbon and much less on capital carbon related to the production and manufacturing of construction products. For a commercial building in Europe, embodied emissions can account for 50% of whole life-cycle emissions. It is fundamental that the project sets out to achieve an ambitious embodied carbon goal in accordance to ensure compliance with national and regional benchmarks.

Life Cycle Analyses need to be carried out in order to set individual targets and keep track of the project performance throughout the design phase.

Sub-actions

- Talk to your client about adopting a carbon management process on the project aligned with PAS2080: Carbon Management in Infrastructure
- Consult international frameworks and benchmarks for low embodied carbon design such as WBCSD, LETI, DGNB, RIBA Challenge or SCORS
- Identify any specific organisational, government or other decarbonisation policies, goals or targets
- Fix an embodied carbon target for the overall project that agrees with the client ambitions and the regional context
- Design on a 3D environment (Revit) allowing to carry out LCAs at various levels
- Ensure the 3D model to be set-up according to best practice EC/LCA standards
- Develop a project digital twin to track performance during operation

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Technical Design

Available tools

Arup Carbon Digital Tool
IES Virtual Environment (IESVE)
DGNB Certification system
Level(s)
Cradle to Cradle Certified

Project Reference

9.2 Track the embodied carbon footprint of building structure and set a target which is below the regionally recommended thresholds

Description

The building structure contributes to around 1/3 of all whole life cycle emissions (assuming a 50-year lifespan) and more than half of the embodied carbon emissions of a traditional new building project.

Setting specific embodied carbon footprint targets for the building structure is of the utmost importance as any improvements for this building layer will have, by far, the largest impact on the overall carbon footprint of the project.

Traditional structural systems make use of extremely large amounts of two very high carbon intensive materials: steel and cement. Evaluating the potential use of less carbon intensive materials or engaging with the supply chain to procure low-carbon products needs to become common design practice.

Sub-actions

- Consult international frameworks and benchmarks such as WBCSD, LETI, DGNB, RIBA Challenge or SCORS and check specific benchmarks for the building structure (Links to benchmarks)
- Fix an embodied carbon target for the building structure based on external benchmarks or derived from the overall project's embodied carbon target
- Define specific life-spans for all main components
- Carry out early LCAs comparing potential structural systems and their technical implications
- Conduct framing/bay studies for the horizontal and vertical grid at concept stage for different materials to determine the impact on the total embodied carbon for varying solutions
- Include embodied carbon performance into the design criteria for selecting the structural system
- Request EPDs from product manufacturers during the final design stage
- Prioritise low embodied carbon materials like timber to high carbon materials like steel and concrete
- Engage with the industry to investigate the potential of recycled concrete, cement aggregates and steel with high recycled content

Building Layers

Structural Design

Key Stakeholders

Structural Eng.

Key Design Phase

Technical Design

Available tools

Arup Carbon Digital Tool
One Click LCA

Project Reference

9.3 Track the embodied carbon footprint of building envelope and set a target which is below the regionally recommended thresholds

Description

The building envelope contributes to around 1/5 of all embodied carbon emissions of a traditional new building project and is, after the building structure, the layer contributes the most to the embodied carbon footprint of a building project.

Setting specific embodied carbon footprint targets for the building envelope is of utmost importance as any improvements for this building layer will have a large impact on the overall carbon footprint of the project.

Traditional envelope systems make use of large amounts of carbon-intensive materials such as steel, aluminium and concrete. Evaluating the potential use of less carbon intensive materials or engaging with the supply chain to procure low-carbon products needs to become common design practice.

Sub-actions

- Consult international frameworks and benchmarks such as WBCSD, LETI, DGNB, RIBA Challenge (Links to benchmarks)
- Consult if the client has defined specific decarbonisation policies, goals or targets
- Fix an embodied carbon target for the project and for the building envelope based on consulted and applicable benchmarks
- Carry out early parametric analyses to assess the impact of potential envelope systems on both embodied and operational carbon (Grasshopper plug-ins such as HoneyBee, Bombyx, etc.)
- Investigate how additional materials such as secondary metal framing can be avoided
- Limit the use of metals and ensure materials can be recycled at the end of life
- Request EPDs from product manufacturers during the pre-selection process
- Set embodied carbon as a decision making parameter when comparing performance of considered products

Building Layers

Envelope Design

Key Stakeholders

Facades Eng.

Key Design Phase

Technical Design

Available tools

Arup Carbon Digital Tool
One Click LCA

Project Reference

9.4 Track the embodied carbon footprint of building systems and set a target which is below the regionally recommended thresholds

Description

The embodied carbon footprint of the building systems is often overlooked, as priority is given to energy performance and operational carbon emissions. Despite this, building systems contribute to around 1/5 of all embodied carbon emissions of a traditional new building project (in locations with clear winter and summer seasons).

Building systems make use of high carbon intensive materials such as metals and plastics. Researching the market for products with high levels of recycled content and high reusability/recyclability can considerably reduce the embodied carbon footprint of this building layer.

Sub-actions

- Consult international frameworks and benchmarks such as WBCSD, LETI, DGNB, RIBA Challenge (Links to benchmarks)
- Consult if the client has defined specific decarbonisation policies, goals or targets
- Fix an embodied carbon target for the project and for the building systems based on consulted and applicable benchmarks
- Set embodied carbon as a decision making parameter when selecting products in comparing the embodied carbon performance of considered products
- Consider the use of decentralized systems, which reduce the need for large and carbon intensive supply infrastructure
- Carefully select refrigerants with low Global Warming Potential and consider refrigerant leakage in the whole life carbon analysis
- Request EPDs from product manufacturers during the pre-selection process

Building Layers

Building Systems - MEP

Key Stakeholders

M&E engineer

Key Design Phase

Technical Design

Available tools

Arup Carbon Digital Tool
One Click LCA

Project Reference

9.5 Track the embodied carbon footprint of building fit out components and set a target which is below the regionally recommended thresholds

Description

The embodied carbon footprint of the building fit-out greatly varies from one project to other. Several Life Cycle Assessment frameworks exclude these elements from the analysis scope, due to a perceived lower impact and lack of appropriate benchmarks. Nevertheless, depending on the project, the building fit-out can contribute to up to 1/4 of all embodied carbon emissions of new building projects (particularly for hotel or high-end commercial projects with regular changes of the fit-out).

Sub-actions

- Consult international frameworks and benchmarks such as WBCSD, LETI, DGNB, RIBA Challenge, and World Carbon Forum (Links to benchmarks)
- Consult if the client has defined specific decarbonisation policies, goals or targets
- Fix an embodied carbon target for the project and for the main fit-out components such as partition walls, insulation, flooring and ceiling systems
- Set embodied carbon as a KPI during the procurement process
- Be aware of the replacement cycle and specify for longevity
- Consider lightweight materials for transportation purposes
- Request EPDs from product manufacturers during the pre-selection process

Building Layers

Interior Fit-Out

Key Stakeholders

Architect

Key Design Phase

Technical Design

Available tools

Arup Carbon Digital Tool
One Click LCA

Project Reference

9.6 Design for digital information management and provide sufficient information for LCA

Description

Performing LCAs is crucial to evaluating the carbon performance of a project and making it possible to identify carbon intensive materials. Making available a detailed level of information ensures the quality of data and calculations.

Sub-actions

- Design in a 3D environment
- Ensure the 3D model to be set-up according to best practice EC/LCA standards
- Consider the generation of digital material passports
- Develop a project digital twin to track performance during operation
- Make use of Life Cycle Costing Analyses, accounting for future recoverable value

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

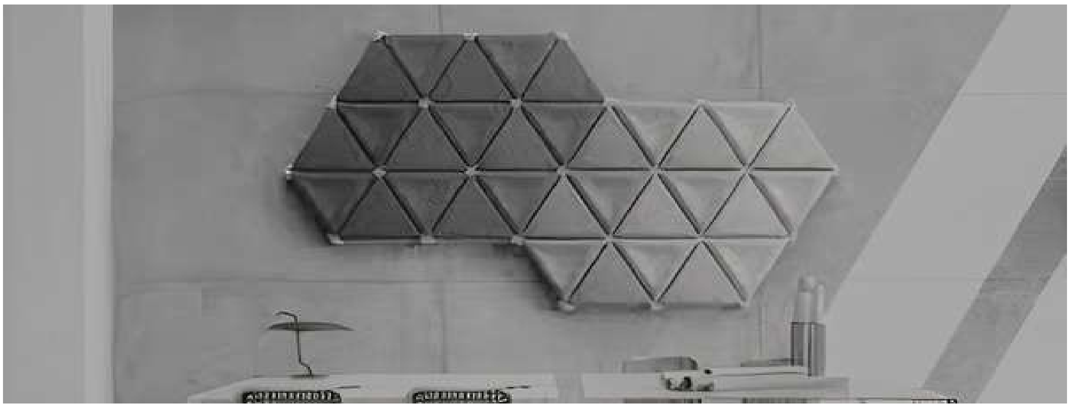
Concept Architectural Design

Available tools

Project Reference

HAUT

10. Design out hazardous/pollutant materials



Description

This strategy aims at preventing the use of materials that have a negative impact on the other planetary boundaries than the Global Warming Potential that is covered by strategy 09. It focuses on the environmental impact categories covered in international LCA guidelines.

Additionally, this strategy aims at preventing the use of materials that have a negative impact on the health and wellbeing of building users. Materials which pose a potential risk to human health are likely to prevent the reusability of building structures and components in the future, thus impeding on the value retention potential.

Key Performance Indicator

Environmental cost:
Whole life cycle environmental impact cost per floor area, and over the whole life cycle period as defined, as defined by the Dutch MPG methodology

[€/m2/year]

Benefits

- Contributes to improved health and wellbeing for the planet
- Contributes to improved health and wellbeing in the material production industry
- Contributes to the future reusability potential of materials
- Contributes to improved health and wellbeing for building users

Challenges

- Potential higher capital cost associated with clean materials
- Reduced material choices
- Requires consideration of clean material goals in the early design stages
- Quality and availability of information in the supply chain

Impact Level

Key Design Phase

Technical Design

Design Impact

Client

Architect

Structural Engineer

Facades Engineer

MEP Engineer

Interior Designer

10.1 Track all environmental impacts during design through detailed LCA, not just carbon, and set an ambitious target for the overall project (all layers, including realistic functional and service lives of components)

Description

Life Cycle Analyses need to be carried out in order to set individual environmental targets and keep track of the project performance throughout design. A LCA will measure beyond the environmental impact category of Global Warming Potential (GWP). It also measures environmental impact categories such as,ozone depletion, acidification, eutrophication, depletion of abiotic resources and toxicities.

Sub-actions

- Develop Bill of Quantity (BoQ) (based on actual material types and quantities)
- Set a baseline with a reduction target for each stage, or set an intensity target
- Complete a life cycle assessment compliant with EN15978:2011
- Look for available Environmental Product Declarations (EPD) compatible with EN15804:2012 from suppliers (for Technical design stage, earlier stages can use material market average values)

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Technical Design

Available tools

Circularity Builder
Level(s)
Cradle to Cradle Certified
One Click LCA

Project Reference

10.2 Ensure that building materials and products are not on the 'Living Building Challenge (LBC) Red List'

Description

The Living Building Challenge (LBC) Red List represents the “worst in class” materials, chemicals and elements known to pose serious risks to human health and the greater ecosystem that are prevalent in the building products industry.
https://living-future.org/declare/declare-about/red-list/

Sub-actions

- Review the red list, created by Living Future
- Create a project-specific red list which includes all materials, chemicals and elements to be avoided on the project. Where possible, identify material/component-specific requirements for substance avoidance as opposed to using a blanket project avoidance list
- Include the project-specific red list in the procurement reports/specifications to ensure other stakeholders (such as the general contractor) implement the list into their design and procurement of products

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Technical Design

Available tools

Project Reference

10.3 Use on-site electric equipment to reduce the use of fossil fuel driven machines on site, to in turn reduce the impact of nitrogen, smog and particulate matter emissions in the area.

Description

Especially in already sensitive or high-pollution areas, the added emissions of nitrogen, smog and particulate matter due to construction (and transport to site) needs to be limited. This is already regulated through planning and building permissions in some locations.

Sub-actions

- Use electric machines (for example, electric excavators, electric wheel loaders, electric-powered rammers and electric dozers)
- Aim for a 100% electric construction site

Building Layers

All Disciplines

Key Stakeholders

Architect

Key Design Phase

Manufacturing and Construction

Available tools

Project Reference

10.4 Avoid the use of hazardous/pollutant materials in the services inside the building.

Description

Hazardous/pollutant materials shouldn't be used for building services when it is possible to avoid them because they can have a negative impact on human health and climate. Project teams, contractors and manufacturers should avoid identified toxic substances to minimise potential impact.

Sub-actions

- Refuse the use of PCBs (polychlorinated biphenyls) in coolants, lubricants and insulators for electrical equipment of all types.
- Avoid the use of PVC in pipes

Plant and equipment contains many different materials but as they are often procured as complex multi-component systems, it is typically difficult to influence the materials they contain. However, pipes, insulation, wires, lighting and ducts can be influenced more directly:

* Drinking water systems and plumbing products should be lead-free
* Specify polyolefin-based piping and not chlorinated polymers
* Avoid lead in brass cooler drains, pumps, motors and valves
* Avoid halogenated flame retardants in piping and electrical cables, conduits and junction boxes, duct and pipe insulation.
* Avoid phthalates in plumbing pipes and fire alarms, meters, sensors, thermostats and load break switches.
* Mercury and lead (in illuminated exit signs, thermostats, switches, fire alarms, meters, sensors, electrical relays and fluorescent/sodium lighting) must not be present or where present should meet RoHS restrictions
* Avoid heavy metals (lead, cadmium, mercury, hexavalent chromium) in newly installed electrical components: fire alarms, meters, sensors, thermostats and load break switches
* Use halogen-free wires and cables
* Limit lead in ducts & conduits
* Avoid neoprene for isolation bearings unless required for durability
* Avoid spray foam and rigid foam insulation

Building Layers

Building Systems - MEP

Key Stakeholders

MEP engineer

Key Design Phase

Technical Design

Available tools

Circularity Builder

Project Reference

10.5 Avoid the use of hazardous/pollutant materials in the space

Description

Hazardous/pollutant materials shouldn't be used in the layers space, skin and structures where possible as they can have a negative impact on human health and the wider environment. Project documentation and specifications should signal to project teams, contractors and manufacturers where certain materials and chemicals should be avoided.

Sub-actions

- Anti-microbial treatments (for example to paints, finishes, flooring) must not be used where the active ingredients are classified as Persistent Bio-accumulative Toxins (PBTs)
- Refuse the use of California-banned solvents (VOCs that create smog) in architectural adhesives, sealants, paints and coatings and install furniture and furnishings, flooring and thermal and acoustic insulation that have been independently tested and meet low VOC emission thresholds
- Refuse the use of PVC in cables, window profiles, flooring and roofing
- Avoid the use of halogenated Fire Retardants (HFRs) (unless required by fire safety regulations)
- Refuse the use of perfluoroalkyl and Polyfluoroalkyl Substances, also commonly referred to as PFAS substances with many uses in building and consumer products. Building product applications of PFAS include roofing materials, paints and coatings, sealants, caulks, adhesives, carpets.
- Avoid lead in doors and door hardware, mirrors/ glass, vinyl blinds and wall coverings
- Limit heavy metals (mercury, cadmium, antimony, hexavalent chromium) in newly installed furnishings and furniture
- Avoid thermal insulation and timber board products that contain formaldehyde-based resins
- Limit phthalates in flooring, including resilient and hard surface flooring and carpet, wall coverings, window blinds and shades, shower curtains, furniture and upholstery
- Install newly applied coatings applied inside the building that have been independently tested and meet low VOC emission thresholds
- Avoid carpets and fabric furnishings that contain fluorinated stain repellent treatments
- Avoid carpets with PVC backing or fly ash as filler
- Avoid flexible finishes that contain oestrogen mimicking compounds or biocides
- Prefer products with a Health Product Declaration (HPD) compliant with the HPD Open Standard
- Prefer products with a high C2C score
- Prefer products with an Environmental Product Declaration (EPD)
- Do not use products where active ingredients are classed as Persistent, Bio-accumulative Toxins (PBT), e.g. triclosan
- Do not used formaldehyde-based adhesives (PF, PRF, MF, MUF, UF) and products containing chlorinated or aromatic solvents

Building Layers

Interior Fit-Out, Site

Key Stakeholders

Architect

Key Design Phase

Technical Design

Available tools

Circularity Builder

Project Reference

- Refuse the use of petrochemical fertilizers or pesticides during preperation, operation and maintenance of the on-site landscape

10.6 Manage hazards of legacy materials in existing buildings

Description

There are many legacy hazardous materials in existing buildings and they need to be treated (contained or removed and disposed of) according to local code in order to ensure they do not pose a health hazard to future building users or cause damage to the environment.

Sub-actions

The materials in existing buildings that need to be treated, contained or removed and disposed of include:
* Asbestos (insulation, finishes, plant etc)
* Ozone depleting substances (refrigerants, insulation blowing agents and 'halon' fire suppressant systems)
* Lead based paints
* PCBs in electrical systems & materials
* Mercury in switches & lighting
* CCA treated timber

Building Layers

Key Stakeholders

Key Design Phase

Available tools

Project Reference

11. Design for Nature

Strategy image

Description

This strategy aims introduce nature-positive and regenerative actions into the building design process. By increasing our focus and understanding on the ecological value of the building site, steps can be taken to maximise the restoration and regeneration of biodiversity in the built environment. The actions within this strategy help to prioritise the documentation of existing habitats, emphasise interventions that enhance ecology, promote circular use of water resources and enable circular municipal waste management. This strategy also focuses on the use biomimetic principles in the design of buildings, prompting designers to consider how nature-inspired solutions can influence decisions as diverse as material selection, lighting design and ventilation strategies.

Key Performance Indicator

Biodiversity Net Gain (BNG): Percentage increase in site biodiversity post-construction compared to baseline pre-construction levels. Measured either through e-DNA baselining and monitoring or rather more simply by assessing habitat types, species richness, rarity and diversity, and ecological connectivity (green blue corridors). This KPI focuses on the restoration and enhancement of habitats and biodiversity.

Percentage of site area restoration (LEED): Conserve existing natural areas and restore damaged areas to promote natural habitats and biodiversity. Using native or adapted vegetation, restore portions of the site identified as previously disturbed.

Benefits

- Enhanced ecosystem quality for air, water and soil health
- Minimised carbon footprint and resource depletion
- Increased resilience and adaptability to climate change and ecological cycles
- Greater community stewardship and ownership that enhances the well-being of inhabitants

Challenges

Impact Level

Key Design Phase

Technical Design

Design Impact

Client

Architect

Structural Engineer

Facades Engineer

MEP Engineer

Interior Designer

- Upfront costs and complexity from implementing nature-based solutions due to the need for specialised expertise
- Regulatory and market barriers due to lack of supportive policies and market readiness for innovative materials and designs
- Maintenance and management may be more intensive compared to traditional approaches
- Quantifying benefits can be challenging, and thus the associated investments difficult to justify via a conventional cost-benefit analysis

11.1 Document site habitat & ecosystem

Description

Document the ecological site conditions prior to design and construction. Establish a clear understanding using documentation of the ecosystem functions and challenges, and plan site interventions accordingly. As all habitats are interconnected, it is important to consider all ecosystem service elements.

Sub-actions

- Identify a healthy reference ecosystem and habitat for use in documenting the ecological site conditions prior to development
- In collaboration with local ecology experts, carry out an ecosystem services assessment of the site, including mapping of key biodiversity species, Net Primary Production, and key habitats
- Map and document the areas and elements of the ecosystem where the ecological performance gap is greatest, or where nature-positive interventions are most needed and will have the greatest impact. Integrate the findings into the planning of building design and construction processes
- In collaboration with local ecology experts, set specific and relevant targets and objectives for improving the ecological value of the site. For example, the percentage of ecosystem area restored or regenererated, return of a keystone species, or biodiversity net gain
- Ensure that the documentation, targets, and objectives are at minimum aligned with national and local documentation requirements, e.g. with respect to Natura 2000 sites
- Involve experts in local ecology, biodiversity, GIS, climate, and environmental engineering in the pre-planning phase, to ensure appropriate and high quality documentation and targets

Building Layers

Site

Key Stakeholders

Architect

Key Design Phase

Preparation and Briefing

Available tools

Project Reference

11.2 Design to enhance the ecological value of site

Description

Apply nature positive interventions though all life cycle stages of the building to rebuild and enhance the ecological value of the site. The action encompasses a holistic approach to revitalize local ecological systems through developing informed regeneration, restoration, and protection plans, based on prior ecological surveys and consolidation with ecological experts.
This action solely focus on the regeneration and restoration of the site layer. Interventions related to the building envelop (skin), space, and services are listed in the action "Design for nature-based solutions".
The nature-positive interventions to the site are not limited to the planning and construction phase; post-construction, a dedicated plan for continuous monitoring and management of the habitats and ecosystems ensures their sustained health and growth.
This action represents a commitment to not just minimising harm to the natural environment, but to actively improving it.

Sub-actions

- In collaboration with ecological experts, use the previously completed ecological survey to meet the relevant targets by developing a nature-positive action plan of the relevant natural landscape of the site. This should aim to protect, restore and regenerate (enhancing local ecosystems to a state of higher ecological value than prior), including the (re)introduction of native flora and fauna
- Develop a site landscape and habitat management plan which includes impacts of the building on the natural site, both during construction and in operation, and implement active interventions for regeneration, restoration and protection of appropriate land areas. The management plan should be shared with building owner or occupants
- Perform brownfield remediation of site (clean-up of contaminated soil) prior to construction, if assessed to be necessary and prioritise nature-based solutions, e.g., bioremediation where native plants and microorganisms are introduced to degrade the target pollutants and ensure a healthy soil microbiome that allows plants and soil to sequester and store more carbon the soil and the vegetation and soil to improve water storage capacity
- Implement nature corridors in the design to support and connect species with natural areas and habitats
- Involve experts in local ecology, biodiversity, GIS, climate, and environmental engineering in the pre-planning phase, to ensure appropriate nature-positive interventions

Building Layers

Site

Key Stakeholders

Architect, Envelope Design

Key Design Phase

Preparation and Briefing
, Concept Technical Design"

Available tools

Project Reference

11.3 Promote an efficient and circular use of water

Description

Adopt and target a net-zero water approach and prioritise water efficient solutions at all stages of the building lifecycle. Support this approach by integrating design solutions for harvesting and recycling waste water.

Sub-actions

- Perform a whole-life assessment of water supply
- Design for rainwater, greywater harvesting and utilisation and infiltration on site e.g., recovery and recycling of waste water from household sinks, showers and washing machines
- Design nature-based wastewaster treatment, e.g., through integration of bioremediation, native plants, oxygenation, and microbial digestion
- Use smart and efficient water fixtures and fittings, e.g., low flush toilets and smart taps

Building Layers

Interior Fit-Out, Building systems - MEP

Key Stakeholders

Architect
, MEP Engineer

Key Design Phase

Technical Design

Available tools

Project Reference

11.4 Design for circular municipal waste management

Description

Promoting recycling, circulation, and composting in building design involves implementing interventions that facilitate efficient and accessible waste separation and collection. The building design should support circular use and enable reuse and recycling, promote sustainable waste management practices, and encourage occupants to actively participate in recycling and composting initiatives.

Sub-actions

-Integrate design of efficient infrastructure for the collection and transportation of recyclables and compostable food scraps, e.g., above ground collection areas accessible for waste trucks, or below ground automated collection systems
- Ensure easy accessibility for the building occupants to compost and waste sorting stations, to enable recycling of waste and diversion from landfill, e.g., by integrating accessbile waste bin systems that separate compartments for recyclables, compostables, and non-recyclables
- Explore methods and design that enable integration of operational waste into new cycles, e.g., in industrial or natural nutrient loops (e.g., on-site use of compost in dedicated land areas)
- Consolidate with local waste management services to align on waste collection procedures and ensure that the building waste plan complements the broader municipal waste management system

Building Layers

Interior Fit-Out, Building systems - MEP

Key Stakeholders

Architect,
MEP Engineer

Key Design Phase

Technical Design

Available tools

Project Reference

11.5 Design with nature-inspired solutions

Description

This action aims to use biomimetic design principles to create buildings and urban spaces that are not only environmentally sustainable but also integrated with nature. This comprehensive approach yields multiple benefits: ecological enrichment, enhanced aesthetic appeal, and improved mental and physical health for occupants.
According to the EU Taxonomy definition, nature-based solutions are defined as "solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience." Such solutions bring more diverse nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions.

Sub-actions

- Design for green building skin by implementing nature-based and -inspired solutions such as living roofs and green walls that mimic natural processes and support biodiversity
- Allow connectivity to nature by integrating biophilic design principles and elements that emulate natural processes and create a direct connection between nature and the building's occupants, such as natural lighting, ventilation, and the use of organic forms and materials. Such design interventions can enhance the well-being of the building occupants and contributes to urban greening initiatives
- Implement nature corridors in the design to support and connect species with natural areas and habitats. In building new structures, the focus is on creating and preserving ecological networks, ensuring that development enhances, rather than disrupts, local biodiversity corridors

Building Layers

Interior Fit-Out, Building systems - MEP

Key Stakeholders

Envelope Design, Structural Design, Building Systems - MEP

Key Design Phase

Technical Design

Available tools

Project Reference