CIRCULAR ECONOMY IN LANDSCAPE ARCHITECTURE

D A N S K E LANDSKABSARKITEKTER



Circular Economy in landscape architecture

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Thank you to all contributors and partners

Preface

The Association of Danish Landscape Architects (DL) has a proud tradition of addressing socially relevant issues and influencing the development of our cities and landscapes. Today, the climate crisis is a burning issue, and the search for new solutions and methods for reducing our negative impact on climate is becoming increasingly urgent.

This makes it a particular pleasure for us to present an updated version of this publication – CIRCULAR ECONOMY IN LANDSCAPE ARCHITECTURE – that features more specific guidelines, additional sample projects and an English translation. The purpose remains the same, namely to inspire more landscape architects, colleagues and project partners to incorporate circular economy into their projects. It is clear to everyone that the circular economy is here to stay, and the present publication clearly demonstrates that as landscape architects, we are well prepared to act on this agenda.

We send a warm thanks to all the contributors to the publication and, in particular, to the other members of DL's Commitee for Circular Economy for their hard work and dedication. May the future bring more circular discussions, experiments and finished projects.

Martin Hedevang Andersen,

President of the Association of Danish Landscape Architects.

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Introduction

Landscape architecture is green by definition, but we believe it can become even more environmentally friendly, resource-conscious and circular!

This conviction has served as the mantra for our work with this publication. As landscape architects and representatives of a green profession, we are already making a positive contribution to the green transition and the fight against climate change.

With our current resource consumption, we have already done irreparable damage to the planet we all share, which will affect both our own lives and the lives of future generations. The construction sector is responsible for significant levels of CO² emissions as well as a huge share of the waste generated globally. In the future, we need to do better.

Today, the construction sector operates with a linear economy, where resources are extracted, used and discarded. That leads to an untenable drain on the planet's resources, and we need to transition to a circular economy, where we keep the extracted resources in the cycle of materials. That calls for new methods, new approaches to design and the choice of materials, new, innovative products and, not least, inspiration and knowledge sharing across disciplines and professions.

These issues present a challenge to society as a whole, and the solution has to be found in an interdisciplinary partnership. As landscape architects, we are in a unique position, as we have a tradition for employing a circular mindset – we just need to recover that focus. For many years, for example, we have designed landscapes using 'building blocks' that can be disassembled, and we rarely need to join elements together using glue and other chemicals.

Moreover, our longstanding tradition for choosing materials that stand up to the elements gives us a keen focus on durability. As landscape architects, we are therefore ready to lead the way and demonstrate how we can embrace the perspectives of a circular economy – to inspire ourselves and each other and, just as importantly, society at large.

Enjoy!

The Association of Danish Landscape Architects, Committee for Circular Economy

What is Circular Economy?

Circular Economy is the term used to describe an economic system in balance with nature, an economy which doesn't extract or pollute more than systemically sustainable. Generally, Circular Economy operates with four principles for creating value by extending the lifetime of products or materials. These principles are here translated for use within the context of landscape architecture and construction.



The Inner Circle

The less change you need to apply to a site, to parts of a site - or the less you need to refurbish a structure or a material to reuse it - the higher the potential savings on energy, water and labour are. The keys to The Inner Circle are retaining existing project parts, for instance: plantings, soil, sub- or base layers, or entire paved areas, as they already are on site.

Long Term Circulation



The longer a structure or a material can last, the fewer natural resources are needed in long term perspective. Long Term Circulation is ensured by designing and constructing structures in a way, that allows for easy maintenance, partial replacement, and eventual disassembly and recirculation. Long Term Circulation is any effort intending to prolong the lifetime of structures, and/or to minimize the resources needed for maintenance.



Cascaded use

Through light reprocessing or refurbishment, used materials or construction parts can extend their lifetime and be reused as parts in new projects. This keeps the materials in circulation, even in reshaped or refurbished forms, thereby minimizing the need for extraction of new, virgin material resources and lowering the environmental footprint in general.



Pure Circles

If a construction material retains its purity and quality, it's easier to reuse the material, than if it's been processed or mixed – for instance if it's been coated or joined through casting or gluing. Pure materials often have a higher resale value, even often increasing value over time.



Køge Nord (Køge North)

Landscape architect: Schønherr Location: Køge N (55.505194, 12.163750) Completion from 2020

The purpose of the projects in Køge Nord (Køge North) is to store and purify rainwater from the new urban district that is under construction before the water is led into two natural recipients, the rivers Skensved Å and Snogebækken. The many component facilities in connection with pipe systems form the overall blue-green structure that is to serve both technical and recreational purposes for the coming district, that is expected to accommodate approx. 1600 homes when fully developed.

The design of the facilities aims to ensure soil balance and has thus been guided by analyses of the existing topographic, hydrological and nutritional conditions.

Plantings, which are an integrated part of water purification, have been established based on native species requiring extensive management, in some cases through entirely natural immigration and succession.

All the areas are open to the public and are designed based on site-adapted organic forms rather than rational technical geometries.





As much as possible, all soil is reused on-site. The available soil types are analysed and sorted based on structure and nutrition content, and landscape designs are adapted to the available amounts in order to maximize reuse within the project area. This effort alone has eliminated the need for more than 1,000 truck transports.

Long Term Circulation

Building components are designed for disassembly and ease of maintenance and consist of as few, and as pure, raw materials as possible. The use of edging and cast concrete is minimized, all paving is based on unbound substructures, and basin and bridge components are made in unfinished oak.

The plantings are established using native species and mainly based on seed mixes and bare root plants. Large sections are established based on natural immigration and succession. Management and maintenance of the plantings are extensive and low-frequency and are continuously adapted to match the condition of the facilities, fluctuations in weather or other seasonal variations.

Pure circles

All paving is established on unbound base courses and constructed of the smallest number of different materials possible.

Soil types are sorted and reincorporated into pure layers to prevent mixing and enable endof-life reuse.

Wooden constructions use wood without impregnation/oil finish/paint and are assembled with mechanical joints. This facilitates end-of-life disassembly and enables the reuse of individual materials.





Ålebækken Ruin Park

Landscape architect: Rambøll Location: Lyngby-Taarbæk (55.799384, 12.496390) Completed: 2021

A combination of a defunct sewage treatment plant left to nature, two new underground overflow basins and a desire from the client (Lyngby-Taarbæk Utilities) to open the area up to recreational use inspired the basic approach of viewing everything in the area as a resource.

The strong geometry of the former plant is preserved and transformed into spatial experiences and little gardens. Parts of the area are returned to the original wet terrain level in order to help the natural biotopes along the Mølleåen river re-establish themselves. Once the project is completed, the area will be opened to the public as a recreational element in cultural-historical context of the Mølleådalen river valley.

Throughout, the project was guided by a focus on maximizing the reuse of soil and constructions.





The existing concrete constructions from the sewage treatment plant were originally slated to be dismantled and removed as waste. By envisioning an alternative function to the original one, the project enabled the constructions to live on with a new purpose. Minor repairs and adaptations transform the site from posing a safety risk to visitors to adding an unusual recreational experience to the local area.

Long Term Circulation



In connection with the excavation for the two underground basins and the clean-up of pollution, just under 35,000 m³ of soil will be removed. Aiming to maximize reuse, the project incorporates more than 85% of the excavated soil, in part as landscape solutions, in part as landfill in former basins. The polluted soil is used as deeper layers, while the clean, intact soil is used as top soil. The remaining 15% is removed due to its degree of toxicity.

The planting is selected to create a resilient foundation for a naturally developing vegetation with a wilder, natural expression. Thus, only parts of the area were planted, and the selected species already grew locally in similar biotopes. That reduces the need for management and any need to replace plants.





Tuborg Beach Meadow

Landscape architect: Julie Kierkegaard Location: Tuborg Harbour (55.722656, 12.581978) Completed: 2021

On the former Tuborg brewery site, a nature area of more than 100,000 m^2 is established where the poor soil is used as the basis of a beach meadow-inspired landscape.

The area is part of open land near new residential developments but a also publicly accessible recreational area. It is designed as an undulating grassy landscape dotted with clusters of fir trees, oaks, and wild roses with a cover of herbs.

The rocky, depleted soil, which would normally have been removed and replaced with quality garden soil, has been reused, reducing the need for CO₂-emitting transport and natural resources.

The project has been developed through a longer collaboration between a landscape gardener and landscape architect, who has made it possible to test different soil treatment methods and herbal mixtures, to reach processes that with the least possible effort gave the greatest possible effect.



Reusing existing soil has saved an estimated 4,000 lorry loads of soil that would have needed to be removed or added.



Ahead of the final choice of method for soil treatment and the specific herbal mixture, a test area was established in which the existing soil was used as a growth medium respectively with and without the largest of the stones and mixed with sand in varying degrees. The sand was leftovers from constructions of housings close to the sea in so-called 'cofferdams'. Different herbal mixtures were tested. When choosing the final solution, the focus was on the relationship between the least possible preparation and the greatest possible effect.



Long Term Circulation

Sowing herbs in the poor soil is expected to require less management than if the soil had been richer.





The Courtyard of the Future

Landscape architect: BOGL Location: Copenhagen S (55.648981, 12.530357) Completed: 2020

The courtyard garden turns the challenge of rainwater into a valuable resource for the residents by creating effective and visible rainwater solutions that form beautiful garden spaces for community, play and sensory experiences.

The courtyard garden turns materials that are normally regarded as waste into a new beautiful courtyard design to the benefit of the residents of the housing blocks. The courtyard garden is built of reused construction materials and thus helps the city avoid waste, reduce the consumption of shared resources and reduce CO² emissions. The courtyard garden was developed in a co-creative innovation process with the residents and the City's courtyard team.

The process made the residents co-creators of the solutions and generated strong support and a sense of shared ownership for the courtyard design.





The courtyard design is based on a soil balance where the existing soil is sufficient for the vegetation, which eliminates the need to add new soil.



Long Term Circulation

Recycled wood is used for terraces, facade cladding, sheds and benches. The wood for terraces and stairs is preserved using thermal modification instead of traditional treatments. This means the wood is free of toxic chemicals and easier to reuse.



Cascaded use

The courtyard's climate border, which collects rainwater and leads it into the small courtyard lake, is made of recycled concrete, a mix of crushed used concrete and new concrete. Wood reused as cladding on sheds has been charred with fire, which protects the planks from rot and drying. The aesthetic and natural footpaths paving uses recycled setts, cobblestones and slate.



Pure Circles

As much as possible, the courtyard design uses pure materials that can be taken apart and reused, including with unbound joints and base courses.





Nordre Fælled (North Common)

Landscape architect: ORCA/Out of Office Architecture Location: Ørestad, Copenhagen (55.626034, 12.571710) Completed: 2020

At Nordre Fælled (North Common), three vacant plots have transformed into a temporary nature project.

The project includes the establishment of a sunset spot towards the common, an observation post next to it and an expansive, hilly landscape with sheltered spots.

New embankments towards Hannemanns Allé dampen traffic noise and block the light from passing cars. The embankments are planted with willow saplings, and wildflowers are sown in the hollows in between the hills.

Benches made of former quay stones with larch planks as seats offer a place to pause and rest. Finally, an urban garden has been established where local residents can grow vegetables among large reused concrete slabs.





From the outset, the project aimed to use the materials that are available on site, and thus the terrain was landscaped using existing gravel materials. The plants are mainly planted in gravel; only where it was absolutely necessary has garden soil been added, for example in the urban gardens. To create a softer boundary, the planting is based on the natural vegetation in the abutting Amager Common Nature Reserve.

Long Term Circulation



The planting is based on nature's own processes and aims to maximize environmental economic savings by sowing seeds and using saplings rather than purchasing plants. Large areas have been sown with a diverse meadow mix, with resilient grasses used in more exposed areas with particularly poor soil. Furthermore, willow saplings have been planted to ensure quick growth.

The planting was also selected with a view to minimizing management. It requires no particular care and is allowed to develop at its own pace.

Cascaded use



All the design components, including benches, paving stones and rocks, come from the stores of CPH City and Port Development, minimizing the need for virgin materials. The unique benches were designed specially for the park, drawing on a large store of quay stones from the Copenhagen Port. The result is a robust bench with a unique Copenhagen history.

All the elements are placed or installed in a way that makes it easy to remove them from the area and reuse them in other contexts and settings.





Christiansborg Palace Square

Landscape architect: LYTT Architecture Location: Copenhagen K (55.676126, 12.581620) Completed: 2019

The design of the security measures at Christiansborg Palace, which is the seat of the Danish Parliament, the Prime Minister's office and the Supreme Court, was guided by a conviction that sustainability must be site-specific. This design philosophy promotes recycling and the deliberate choice of robust quality materials with a long lifespan as well as a focus on a timeless design and a painstaking construction process.

The geometry of the square is defined by an arc with 85 granite spheres. The spheres are carved out of the same light-coloured Nordic granite that is used in Christiansborg's facade. The slope of the square gives the place a more supple character, and the calm surface with its new paving has given it a more coherent appearance.

A complicated task with relevance for Danish society has been addressed with landscape solutions that combine artistic and pragmatic qualities with the goal of maximizing the added value.





The use of existing resources requires close attention from the initial project stages and remained a key focus throughout the process: the square is paved, in part, with cobblestones that were reused from the previous pavement. Existing granite steps along Christiansborg's main facade were similarly re-incorporated into the design. Furthermore, the base course was reused after simply being re-established and adapted to the new slope.



Long Term Circulation

The new square is paved with 200,000 cobblestones. To have enough cobblestones for the project, the existing granite materials were supplemented with recycled stones from the stores of the City of Copenhagen.



Cascaded use

Before the square was cleared, the granite tiles, flagstones and other paving materials were registered with a view to subsequent sorting. Any stones and slabs that were not used in the project were warehoused by the City of Copenhagen. Thus, all granite materials were either reused locally or stored for later use. The cobblestones were largely reused 1:1. Some of the granite paving stones along the facade were individually adapted to the new paving project and thus achieved an extended lifespan.



Pure Circles

The paving is set mainly in gravel and pointed with unbound gravel materials, which makes it easy to take up and reuse the materials in other contexts. When granite materials, such as cobblestones and granite slabs, are set in gravel, they can, in principle, be reused endlessly, and they only get more beautiful with time.





Hempel Student Residence

Landscape architect: JJW Location: 55.785138,12.512522, Lyngby Completed: 2017

In connection with the construction of a new student residence facility at the Technical University of Denmark (DTU), a multi-level planting strategy was implemented that works on several levels: preservation of as many existing trees as possible; interwoven structure of buildings and vegetation; new planting as well as the reuse of wood from the trees that – despite the original intentions – could not be preserved.

The student residence, whose facades are made of reused bricks, currently houses about 200 students.

The landscape design features new planting that, in combination with preserved trees, creates green surroundings close to buildings with courtyards that open towards the greenery, which simultaneously is supported by the path and the rainwater ditch.



Many of the approximately 50-year-old oak trees were preserved through a persistent focus throughout the process, from the architectural competition to the realization.



The developed tree strategy preserves: Trees along the southern edge of the plot to ensure that the residence is framed by trees; Trees placed by the openings of the buildings to make the forest character enter the buildings; Trees inside the buildings which can help to ensure DTU's identity, coherence with the surroundings and anchoring.

The trunks of oaks with a total length of approximately 450 running meters were dried during the construction process and later cut up to be reused in the landscape project in the form of oak paving discs, posts and stumps for sitting on and as a terrain wall.



Long Term Circulation

Most of the green areas near buildings are covered in extensively managed grass and herbs, which reduces the environmental impact of the ongoing management.





Andreas Steenbergs Plads

Landscape architect: SLA Location: Horsens (55.862871, 9.837810) Completed: 2017

The transformation of a former bus terminal has created a new, dynamic urban space in the centre of Horsens with cosy and pleasant places to hang out, varied planting and paving made of recycled materials that links the street level to the roof a car park.

The new lighting, planting and paving combine to form a pleasant microclimate, a green environment and sensory stimulation in the area. Part of the green oasis is established on the roof of the new-built underground car park.

A sloping design connects the private rooftop garden with the public square and evens out the difference in levels between the roof and the street in an undulating terrain that creates a natural transition to the rooftop, encourages play and provides a range of design options for the expression of the paving.





Reusing the existing paving and base course materials has been a key idea throughout the project. Cobblestones, setts, mosaic stones, flagstones, kerbstones and granite blocks from the former bus terminal were reused in the new urban space but in new combinations that give rise to a brand new expression.



Long Term Circulation

The use of granite materials creates a robust and durable urban space. In connection with roadworks, the paving can be easily repaired with good results.



Cascaded use

Reused local materials include stones from the quay on the inner harbour in Horsens and granite paving stones from the now defunct Ceres brewery. In addition to contributing to reuse, the materials also tell a story unique to Horsens. Left-over stones from projects in the nearby Kongensgade street and Vitus Berings Plads square have also been incorporated into the new urban space.



Pure Circles

All paving has been made using unbound joints and unbound base courses, except just around the water feature.



New contribution

Contact the secretariat of Danish Landscape Architects on DL@landskabsarkitekter.dk for more information.

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