Green Infrastructure for the Future: Design and Retrofit

Neighbourhood Level Green Infrastructure

Green infrastructure is a network of multi-functional green space, both new and existing, both rural and urban, which supports the natural and ecological processes and is integral to the health and quality of life of sustainable communities.

Introduction

Green infrastructure is underpinned by the concept of multi-functionality, the potential to deliver a wide array of simultaneous benefits to different stakeholders. For example, a new public park can increase local biodiversity by providing new habitats for insects and birds; improve food resilience by providing an area for local food growing; and simultaneously promote a healthy, active lifestyle for people living in the local area.

Our submission to the Green Infrastructure Design Challenge addresses the following question:

“What constitutes a healthy, productive and sustainable urban environment from both a building performance perspective and as an improvement of surrounding public spaces?”

Our strategy involves building on this idea of multi-functionality, exploring the ways in which we can maximise the co-benefits of green infrastructure features at a variety of scales.

Central to this concept is the idea that whenever possible these green infrastructure features should be able to be integrated into both new and, perhaps more importantly, existing developments. Across two posters we set out our vision for utilising the principles of green infrastructure to create multi-functional spaces at both neighbourhood and building level.

Our first poster presents multi-functional spaces that can be implemented at neighbourhood level.

Parks and Gardens

Parks are designed to be accessible to all local residents and include a range of habitat types. These open green spaces are linked to other green infrastructure features both within the local area and across the wider region, acting as wildlife corridors.

All new buildings with suitable flat roof areas to include a biodiverse green roof. These systems utilise stored substrate depths, diverse planting and areas of bare ground (in addition to features such as log piles) to create numerous new habitats.

Where extensive biodiverse green roofs are not possible lightweight wildflower blankets or brown roofs can be utilised.

Areas within the park are left wild and varying heights and levels of planting are used to encourage biodiversity. Individual gardens can also play a role in enhancing biodiversity. By educating residents to leave areas of their gardens wild and incorporate key native species these spaces can combine to form mini-wildlife corridors.

Play areas and outdoor gyms promote healthy, active lifestyles among local residents.

Urban Forms and Allotments

Local food growing is encouraged through the use of community gardens and allotments. These areas are defined by new hedgerows, separating them from parks and other areas of amenity space.

Hedgerows provide a vital habitat and promote biodiversity, they can also be used as a source of foraged food and are planted with a variety of edible wild plants.

Community gardens act as education centres for local schools, promoting food growing among children. Small businesses and start-ups are supported by providing space of urban farms.

These utilise vertically stacked, hydroponic, solar powered systems to grow crops in an urban setting.

Aquaponics can be included, whereby fish are farmed alongside salads and herbs. Produce is sold to local businesses. Other small businesses, such as bee keeping or cottage industries, can be set up around urban farming schemes.

Rivers and Waterways

Buried rivers and ponds are reinstated to create wildlife havens. These features also work to create a sense of place and can remediate local drainage problems.

Features such as rain gardens can be easily integrated into existing properties, built around rainwater downpipes.

Innovative materials are utilised in construction of new roads, such as carbon negative concrete, which actively absorbs carbon from the atmosphere.

Roots are designed to encourage cycling. Clearly marked, segregated cycle lanes are provided, in addition to cycling-friendly, routes making cycling the easiest, quickest way to get around the neighbourhood.

Low emission zones are implemented to promote alternative transport methods and improve air quality. Electric vehicles are supported, with charging stations provided in on-street parking bays.

Mature trees are planted alongside roads, to improve air quality. Tree planting plots are linked to the below ground drainage systems, reducing the amount of surface water run off that reaches the sewers. Trees are used as an acoustic screen, minimising the acoustic impacts of car traffic.

Mature trees provide a valuable habitat and can act as a link between different green spaces.

Sustainable drainage features are incorporated into the design of roads and paths. Features such as permeable surfaces and urban trees are used to manage surface water run off in a sustainable manner.

Smaller features such as rain gardens can be easily integrated into existing properties, built around rainwater downpipes.

 Paths and Roads

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Green infrastructure works best as a big picture. Our masterplan poster showed green infrastructure delivers benefit at a range of scales and as part of a network. Consequently, green infrastructure is most commonly thought of at the city or neighbourhood scale. However, there are opportunities to bring the themes of green infrastructure to bear within the design of individual buildings, provided these are considered within the building’s wider context.

This question is, how do we incorporate natural elements within buildings and their immediate surroundings in order to maximise these potential benefits? In answering this question, we have identified four potential ‘multi-function’ spaces that could be incorporated into existing or new developments to deliver multiple, simultaneous benefits to building users.

**Building Level Green Infrastructure**

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**Internal shared spaces**

Internal shared spaces, such as communal kitchens and cafés allow residents and building users to make use of fruit and vegetables grown on site. Waste food can be composted in communal facilities and used to fertilise new crops. Internal green infrastructure features, such as green roofs, are encouraged by utilising smaller windows, which provides visual and non-visual connections with nature and provide interior comfort through biophilic design.

Roof terraces

At roof level, the building utilises a biodiverse green roof system to maximise the benefit to local biodiversity, species are selected to complement planting and species within the wider green infrastructure features (in collaboration with local Biodiversity Action Areas).

Areas of the roof are deliberately left bare to replicate brownfield sites (brown roof). A varied substrate depth has been used in combination with other ecological features (such as log piles) to maximise the number of habitats provided. Beehives are installed within biodiversity roofs, allowing building users to experience beekeeping and produce their own local honey.

An area of roof terrace has been set aside for food growing, in the form of a aquaponic water-powered system such as the GrowUp box. This system combines hydroponic salad growing with fish farming. Nutrient-rich water from the aquaponics is used to fertilise the growing beds, which in turn filter the water for use in the fish tanks. This system can produce over 430kg of salads and herbs, and 50kg of fish per year, which can either be used by residents of the building or sold to local businesses.

By providing space for such ‘urban farms’ at roof level, small businesses are supported and local residents have access to locally grown, fresh food.

**External amenity**

External spaces are designed to maximise the services they provide to all building users (office workers and residents) as well as local biodiversity and wider neighbourhood.

Nicely planted areas of urban woodland create valuable habitats for a wide range of species, as well as  a place to relax during summer months. Infilled spaces such as hanging chains, hammocks and temporary shelters, provide building users with a physical connection to nature, which has been shown to boost productivity and improve health and well-being.

Wooded areas also provide a localised cooling function, reducing the urban heat island effect. Building air intakes are located close to or within these wooded areas, ensuring the building utilises cool, fresh air that has been naturally cleansed of harmful VOCs by the surrounding vegetation.

Swales, drainage ditches and infiltration ponds link with the wider neighbourhood drainage plan, ensuring the building reduces local surface water runoff. Reed beds are used to clean and naturally process building greywater.

External landscaping to provide ‘non-rhythmic stimuli’ such as swaying grasses, folding water and the bustle of insects. Non-rhythmic stimuli have been shown to replenish individuals’ capacity for focused tasks and reduce fatigue and stress.

Building windows are located so that they look out on these features, providing building users with a visual connection to nature.

Space is provided within the landscape for exercise, such as an outdoor gym, meditation or yoga. Communal facilities are included to allow building users to eat outdoors.

**Building Facade**

The building utilises a living façade system. Plants within this living wall have been selected to increase biodiversity and also based on their location and orientation to minimise the risk of die off and the need for replacements. Irrigation is primarily from harvested rainwater (helping to slow the amount of water reaching the ground and reduce problematic surface water runoff) and water consumption is minimised through the use of smart irrigation controls.

Bird and bat boxes are integrated into the façade to provide a valuable ecological habitat. Plants within the building’s façade clean the air by capturing VOCs in their foliage, where they are subsequently weathered away by rainwater. Where the façade is comprised of bricks, bee bricks can be used to provide a much needed habitat for solitary bees and wasps.

The living wall façade treatment also provides a localised cooling effect, promoting, by reducing the building’s albedo, this helps to reduce the building’s energy consumption. Larger planters can be incorporated around windows to provide building users with on area for growing plants such as tillers.

This façade system also allows people in surrounding buildings to benefit from improved views and a visual connection with nature.

**References**

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