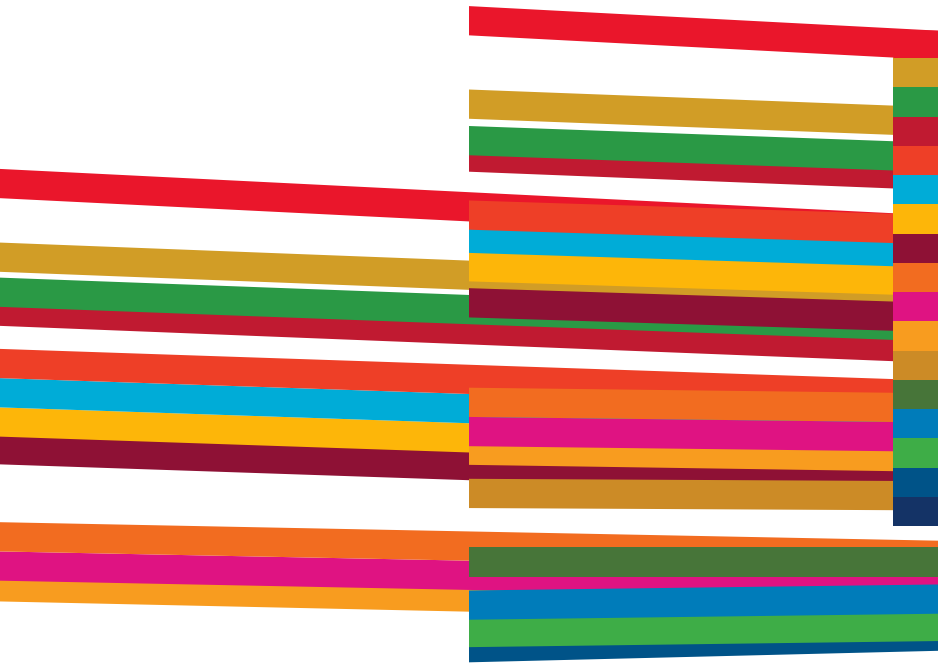
AN ARCHITECTURE GUIDE
to the UN 17 Sustainable Development Goals
Volume 2



THE 17 GOALS

In 2015, world leaders agreed to 17 goals for a better world by 2030. These goals have the power to end poverty, fight inequality and stop climate change. Guided by the goals, it is now up to all of us, governments, businesses, civil society and the general public to work together to build a better future for everyone. **https://www.globalgoals.org/**

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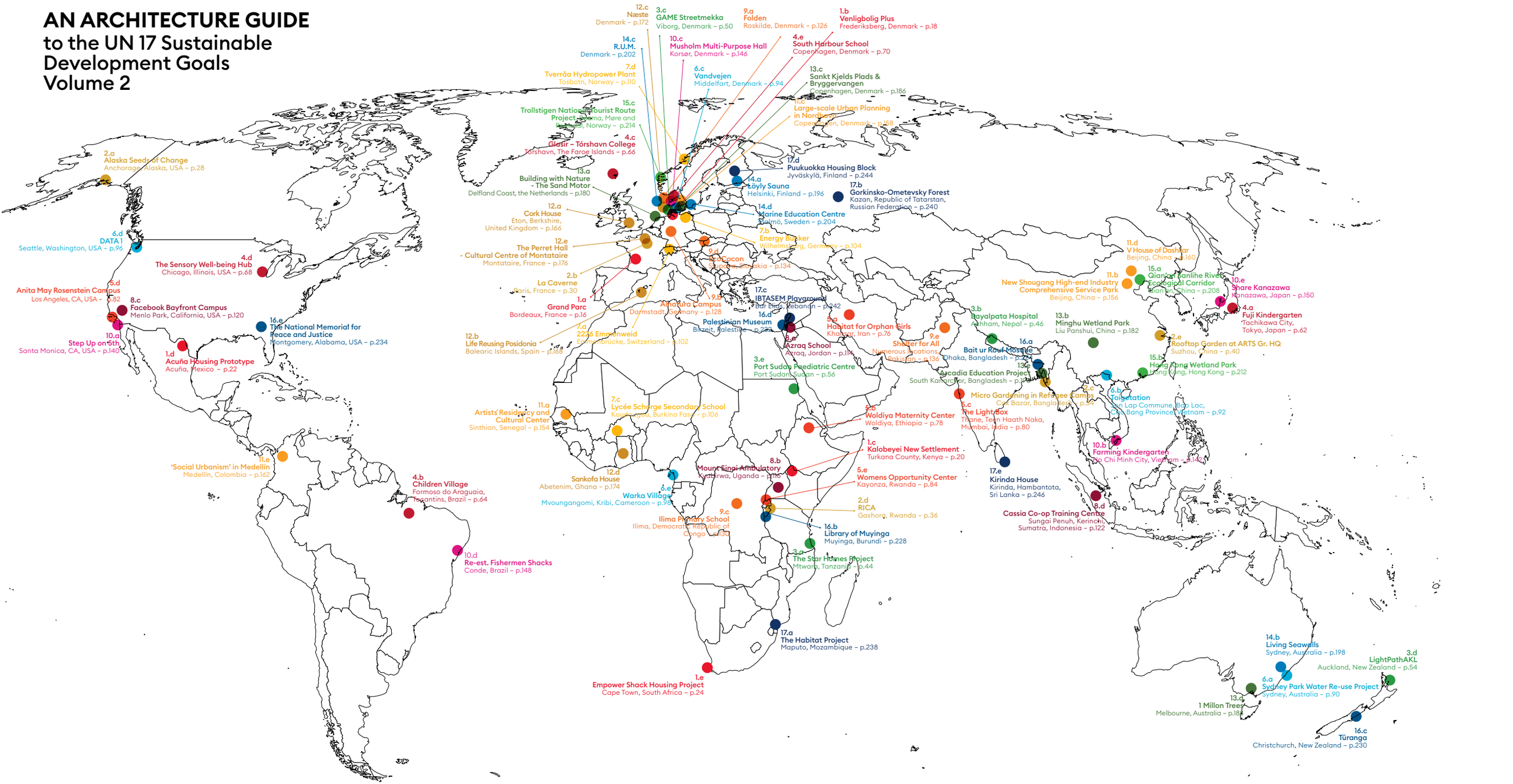

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Architecture
Design
Conservation

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Leave No One Behind

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Artists' Residency and Cultural Center by Toshiko Mori Architect featured on p. 154 / Photo: Iwan Baan

The UN 17 Sustainable Development Goals are a call for urgent action if we want to be able to promote prosperity while protecting the planet. They are a call for international cooperation and partnerships between countries and regions, national and local governments, business and financial institutions, civil society and each of us individually to act to stop climate change and promote sustainable behaviour.

Architects can provide basic ideas and proposals for regulations that make it possible for us to have sustainable cities and communities in the future. Architects can facilitate an open dialogue and work in partnerships to give us good solutions, and they can encourage authorities to make the regulations necessary to move forward. This publication is a very valuable presentation of ideas and projects about just that.

Mogens Lykketoft

Former Danish Minister of Finance and of Foreign Affairs. President of the United Nations General Assembly from September 2015 to September 2016, when the Global Goals were approved and the Paris Climate Agreement was signed.
October, 2020

Architecture's Contribution to the UN 17 Sustainable Development Goals

The UN 17 Sustainable Development Goals represent the aspiration of the people of the United Nations for a more sustainable future.

The Goals define the challenges we need to address in order to achieve a better and more sustainable future for all. They address the global problems we face together, including those related to poverty, inequality, climate, environmental degradation, prosperity, health, peace and justice. The Goals are deeply interconnected, and, to leave no one behind, the world must move significantly towards achieving each Goal by 2030.

The built environment, planning, architecture and design interact with every goal. And most crucially: not just on an aspirational level or as future potential but through realised buildings, settlements and cities all over the world. Architectural solutions are already there, everywhere, contributing to sustainable communities and quality of life. However, the built environment is also a part of the current challenges – a major consumer of energy and natural resources, and a producer of waste. Furthermore, how we build can exacerbate inequalities and affect health.

That is why the Royal Danish Academy – Architecture, Design, Conservation, the UIA Sustainable Development Goals Commission and the UIA World Congress of Architects 2023 have partnered to create a second volume of "An Architecture Guide to the UN 17 Sustainable Development Goals". A first volume was published in 2018, and both volumes can be downloaded for free at the websites

of the Royal Danish Academy and UIA. With the architecture guide, we hope to make it tangible how the built environment interacts with the goals and to inspire architects and stakeholders involved in the built environment to engage with the challenges. It is for each and every one of us to contribute to the realisation of the goals.

The intention of this book is, as with the first volume, to provide an architecture guide to the Goals. The 17 chapters present how each Goal is defined by the UN, outlines how it interacts with the built environment and gives examples of realised projects that illustrate architectural contributions.

Many of the cases address more than one goal; however, the aim here is not to explore sustainable projects in their full complexity but to understand the Goals as they relate to architecture. All cases are realised architectural projects, planning initiatives and structures that illustrate how architects and architecture can contribute to the realisation of the Goals. Our hope is that the cases will form a basis from which to continue a conversation about how the built environment can contribute to each Goal.

In this second volume of the guide, we have 4-5 cases to illustrate each goal, from all over the world. Each case is inspiring and noteworthy, but they are not the final answer to how the built environment can contribute to the realisation of the Goals. There is no one answer to that.

To move towards the realisation of the Goals, we need many new solutions adapted to local climate, culture and challenges, and we need them not as ideas, but on the ground; implemented and in use. It is through realised buildings, settlements and planning that the effect is achieved both environmentally and humanely.

This publication is dedicated to the architecture students who will shape the future of architecture, planning and design; to the politicians who will aid them by understanding the intersections between architecture and the Goals; and to all citizens, professionals and institutions who join in the collective challenge ahead – to address social needs while protecting the planet.

On behalf of the Editorial Committee

Natalie Mossin
Chief Editor

Leave No One Behind

As we embark on this great collective journey, we pledge that no one will be left behind. Recognising that the dignity of the human person is fundamental, we wish to see the goals and targets met for all nations and peoples and for all segments of society. And we will endeavour to reach the furthest behind first.[1]

Within countries, all people, regardless of their backgrounds, have rights and responsibilities to fulfil their potential in life and lead decent, dignified and rewarding lives in a healthy environment. This means that goals and targets need to be met for all segments of society. Their voices must be heard, and their active participation as agents of change needs to be promoted.[2]

To find out more about Leave no one behind, visit:
https://unsdg.un.org/2030-agenda/universal-values/leave-no-one-behind

[1] Extract from the UN publication: "Transforming Our World: The 2030 Agenda for Sustainable Development"

[2] Extract from the UN news article "Leaving no one behind", available at: https://www.un.org/development/desa/en/news/sustainable/leaving-no-one-behind.html

The pledge to "Leave no one behind" is an overarching value of the UN 17 Sustainable Development Goals, and it is deeply relevant to all parts of the built environment. At its core, it means that all architecture, buildings, settlements, public spaces and infrastructure must be designed and constructed to include all people, with a specific focus on those at risk of exclusion.

All architecture must contribute to inclusion, and this will require new approaches to how we design and build. We must strive to reach the furthest behind first; to include people living in poverty and other vulnerable situations, and to include, on equal terms, persons with disabilities, people living with illness, the needs of children, youth and older persons, indigenous peoples, refugees and internally displaced persons and migrants.

This means that the main entry to a school must be designed using Universal Design principles so that persons with physical disabilities can enter on equal terms alongside classmates; that public bathrooms must be designed to be safe and accessible to all genders; that public spaces and parks must be designed as a resource equally to people living in poverty; and that public institutions must be designed to be safe and inviting to all persons, regardless of ethnicity and religion.

Truly sustainable development is not possible without adhering to the core values of the human rights declaration; the right to equal treatment and non-discrimination for all. In the built environment, this means that each time we build, each time we renovate or develop an element of the built environment, we must ask ourselves: who are the furthest behind here? And we must take it upon ourselves to reach those people first, to make sure that what we build is promoting their inclusion, rather than allowing what we build to limit the participation in society of vulnerable persons.

1 NO POVERTY

End poverty in all its forms everywhere

Poverty is more than the lack of income and resources to ensure a sustainable livelihood. Its manifestations include hunger and malnutrition, limited access to education and other basic services, social discrimination and exclusion as well as the lack of participation in decision making.[1]

The decline of global extreme poverty continues but has slowed. The deceleration indicates that the world is not on track to achieve the target of less than 3% of the world's population living in extreme poverty by 2030. Strong social protection systems and government spending on key services often help those left behind get back on their feet and escape poverty, but these services need to be brought to scale.[2]

To find out more about Goal #1, visit:
https://www.un.org/sustainabledevelopment/poverty/

[1] Extract from UN's Global Issues, available from https://www.un.org/en/sections/issues-depth/poverty/

[2] Extract from UN's SDGs Knowledge Platform, available from https://sustainabledevelopment.un.org/sdg1

Architecture cannot lift people out of poverty, but the built environment can affect the impact of poverty on people's lives by providing access to affordable housing, sanitation, educational institutions, health facilities and spaces for recreation.

Through building design and planning, architects can develop buildings and settlements that are low cost, safe and healthy. Examples of this can be found in social housing schemes, co-ops and projects for urban upgrading.

The overarching principle of architecture's contribution to the goal of no poverty is that buildings and public spaces must help provide services that are affordable and accessible for marginalised and poor citizens. This requires new architectural solutions emphasising low-cost construction principles, natural light and ventilation, use of local materials and increased reuse of available materials. Buildings must be designed using products and materials that do not compromise the environment, while maintaining the affordability of the solutions. Furthermore, architecture, landscape design and planning must adapt the built environment to local climatic, geographical and cultural contexts, working with the surrounding environment and not against it, to increase quality of life while helping inhabitants save on electricity and other running costs. As part of this, architects working on development projects must engage local communities and help marginalised and poor citizens gain ownership of the built environment of which they are a part. Finally, the building process itself must take place under conditions that protect the environment as well as workers and other stakeholders.

Grand Parc

Bordeaux, France

Challenge

In many countries, the post-war period saw an unprecedented boom in social housing projects. Today, the large-scale housing projects of the 1960s are struggling both with the quality of housing and with social stigma. Poorly built, expensive to maintain and socially alienating, the social housing projects from this period might offer the basic amenities, but they have been heavily criticised for the lack of architectural qualities. While architecture has a stake in the problem it also has the potential to transform. As inhabitants are subject to stigmatisation and aggressive police are introduced to combat the challenges – real or perceived – there is also an increasing realisation that eviction, demolition and uprooting are not necessarily the best ways to address this heritage and the people it houses.

Contribution

The Grand Parc project consists of the transformation of three social housing blocks built in the 1960s. It is part of the renovation programme of the 'Cité du Grand Parc' in Bordeaux – a district with more than 4,000 dwellings. After considering their demolition, it was decided to renovate three buildings containing a total of 530 dwellings. The general economy of the project was based on the strategy of transforming the existing building without major interventions to the main structure and instead focusing on additions and extensions – including the addition of winter gardens on the south-facing façades and improving the insulation of the north façade. This approach made it possible to concentrate the resources on solutions that significantly improve the architectural quality of the dwellings and the performance of the buildings as a whole. This project demonstrates how the transformation of social housing can be economically feasible and introduce architectural qualities that not only upgrade the individual dwelling but also challenge the stigma connected with the large-scale housing projects of the 1960s.

Origin/team
Aquitanis O.P.H. de la communauté
Urbaine de Bordeaux (CUB)
Anne Lacaton & Jean-Philippe Vassal Architectes,
Fréderic Druot Architecture,
Christophe Hutin Architecture avec Julien Callot,
Marion Cadran,
Vincent Puyoo,
Marion Pautrot

Photos: Philippe Ruault

Venligbolig Plus
Frederiksberg, Denmark

Challenge
The present market conditions, coupled with an increasing demand for housing in urban areas, put pressure on prices. This makes it a challenge to build affordable and decent housing for groups of society with a low income. Moreover, socioeconomic forces lead to urban gentrification and segregation of neighbourhoods, which in turn influences the social equality. In order to obtain a socially inclusive and sustainable city, architects must design affordable, small and smart types of housing while still paying close attention to comfort and functionality.

Contribution
Venligbolig Plus is a concept developed by ONV architects and We Do Democracy, and it has been built in collaboration with the social housing corporations KAB and FFB, and Frederiksberg Municipality. Venligbolig Plus – which roughly translates into 'Friendly Housing Plus' – is a new micro-housing typology designed to accommodate safe and affordable housing for low-income members of society. In 2019, 78 young students and refugees moved into the housing that consists of 41 units built as 3 cubes with 4 floors. Each of the 41 apartments of gross 50 square metres hosts two people where each occupant has their own room and share a kitchen and living room as well as a toilet, bath and a balcony.

An important part of the project is a so-called "buddy scheme" in which the students assist the refugees in their daily life. The private square metres are kept down and optimised with elevated beds and integrated cabinet solutions in order to make bigger common areas where community interaction can happen on several different scales and levels. The budget of the housing units is kept down by using a prefabricated module system with load-bearing wooden structures. The modules form a sustainable building system that reduces construction time and material waste production, and quality management is handled before production is started, which again reduces the risk of errors and deficiencies. Venligbolig Plus is built from a vision; that the successful integration of refugees relies on physical and social integration into a Danish community, and that accommodating citizens across social, cultural and economic boundaries is part of the tool kit needed for integration to succeed.

Origin/team
ONV Architects
We do Democracy
Frederiksberg Municipality
FFB/KAB
Øllgaard Rådgivende Ingeniører
VEGA landscape
Holte Projekt
BM Bygge Industri

Photo: ONV arkitekter

Kalobeyei New Settlement

Turkana County, Kenya

Challenge

The last fifty years have seen a rise in global conflict, resulting in an ever-growing refugee crisis. In Sub-Saharan Africa, the number of refugees grew from 985,145 people in 1970 to 4,472,440 people in 2015. This rise in refugee migration has challenged local development in affected countries and stretched the need for humanitarian assistance. In Kenya, the increase in refugee populations has also increased conflicts between refugees and host communities, creating new potential conflict zones.[1]

Contribution

Answering the need for decongesting Kakuma Camp in Northern Kenya, and to make refugees more self-reliant, an "Integrated Refugee Settlement concept" was introduced in June 2015. The Kalobeyei Settlement, located 30 km from Kakuma Camp, is an integrated settlement for both refugees and local population – an innovative concept promoting the self-reliance of both refugees and the host community. Rather than expanding the Kakuma camp, the new settlement concept represents an urban planning approach that has been designed to accommodate 60,000 refugees and members of the host community, complete with an urban plan, social and physical infrastructure and a diversity of economic opportunities.

Today, Kalobeyei is a formal settlement with individual shelters, vegetable gardens, urban infrastructure, solar-powered street lights, marketplaces, schools, hospitals and hinterland farming possibilities – all available to both refugees and the local communities.[2] The Kalobeyei approach, with its intended integration of both physical development – equal provision of physical and social infrastructure – and economic development – provision of equal or joint income and growth-related opportunities – is already proving to be a well-functioning recipe for promoting prosperity in the larger Kakuma area.[3] According to a UN-Habitat report, the most critical lesson learned from the implementation of the Kalobeyei project is the need to invest more in bridging the humanitarian and developmental agendas at the local level to promote equitable growth among two often disadvantaged groups; refugees and their associated host communities.[4]

Origin/team
Gert Lüdeking, Architect maa,
UN-Habitat Director a.i. (Ret.),
Geneva Humanitarian Affairs Office.
Project Coordinator: Yuka Terada.
National Officer: Jeremiah Ougo.
UN-Habitat Kakuma Office: Naoya Kuboshima, David Kaloki Kitenge, Catherine Witt.
Implementation partner: Peace Winds Japan (PWJ), Association for Aid and Relief, Japan.
UNHCR, the Kenya Ministry of Interior, Coordination of National Government and the Turkana County Government.

Photos: Gert Lüdeking

Acuña Housing Prototype

Acuña, Mexico

Challenge

Mexico, with its population of more than 128 million people, is suffering from a lack of affordable housing. This was also a problem in 2001, where the country set out on an ambitious mission to create new homes for millions of people in the suburbs and new towns. An estimated 20 million people moved into new, affordable homes – but today it is apparent that the quality was poor, the homes were too small and the new towns lacked social strengths and identity[1].

Contribution

To create affordable housing, the construction costs must also be affordable for investors, whether they be public or private. But that does not mean that the quality of materials or design needs to be poor. In the city of Ciudad Acuña, Mexican architect Tatiana Bilbao designed houses for 23 families who were left homeless by a tornado in 2015, and she approached the challenge in a different way.

Bilbao has been committed to the housing shortage agenda, and the housing project in Acuña is based on previous projects, prototypes and research experiments by her architecture studio. The houses are designed of modules so that they can be expanded, and interior walls can be added to create separate bedrooms etc. The materials used are primarily concrete and wood, and the interior structure is made of recycled materials, such as wooden pallets.

While the previous Mexican approach to the housing crisis focused on quantity – erecting as many units as possible at the lowest cost and fastest pace – Bilbao's team approached the task differently. The architects took the time to interview the families and potential future tenants to get a better idea of their needs and wishes for a home. This taught them that it was important to the families not only that the houses looked finished and permanent but that public spaces and outdoor areas were considered critical in creating a sense of community. The architects later revisited the families to interview them and collect more data for future social housing projects.

Origin/team
Tatiana Bilbao Estudio,
Mexico's federal housing
agency INFONAVIT,
The State of Coahuila

Photos: Jaime Navarro

Empower Shack Housing Project

Cape Town, South Africa

Challenge

Urbanisation is a global tendency that creates huge pressure on cities across the globe. A lack of affordable housing for all results in inequality in urban societies and prohibits entire communities from reaching their potential. In Cape Town, this tendency is extreme even though South Africa's post-apartheid Constitution enshrined a 'right of access to adequate housing' for everyone.

Contribution

Cape Town's informal settlement Khayelitsha has many challenges. There is poor sanitation, no fire safety and the area lacks proper social infrastructure. This means severe safety and health risks for the inhabitants. The Empower Shack project is an ambitious partnership project and a prototype on how to tackle all of these challenges in a holistic and sustainable way.

The design is a flexible, multi-storey structure that can be expanded as a family grows. The units have a small ground plan, which means that they easily fit into well-planned communities with room for more units and more public space around the buildings. The design is modular, with readily available local materials for self-construction, and the risk of fire is minimised by the fireproof walls between each unit.

The project also includes an open-source digital planning tool that makes it possible to digitally plan the layout of units in a neighbourhood or block, providing the municipalities and communities with an overview of the possibilities at their specific site. Micro-financing schemes are also built into the planning tools, so residents can take out small, ethical loans when building an Empower Shack or adding another storey. Residents currently pay a net average of 14% of the construction cost through a micro-finance programme, based on the footprint of the shack and household affordability assessments.

Origin/team
Urban Think Tank,
Alfredo Brillembourg,
Ikhayalami,
BT Section Site C Development Committee,
City of Cape Town,
Design Space Africa,
The Swiss Re Foundation,
Vhernier and Individual Donors,
De Villiers & Hulme,
ETHZ,
Transolar,
OKRA Landscape Architects,
Arturo Brillembourg,
Riverside Consulting

Photos: Urban Think Tank LLC

2 ZERO HUNGER

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

It is time to rethink how we grow, share and consume our food in more sustainable ways. If done right, agriculture, forestry and fisheries can provide nutritious food for all and generate decent incomes while supporting people-centred rural development and protecting the environment.

Right now, our soils, freshwater, oceans, forests and biodiversity are being rapidly degraded. Climate change is putting even more pressure on the resources we depend on, increasing risks associated with disasters, such as droughts and floods. Many rural women and men can no longer make ends meet on their land, forcing them to migrate to cities in search of opportunities.[1]

To find out more about Goal #2, visit:
https://www.un.org/sustainabledevelopment/hunger/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/hunger/

The built environment contributes to the securing of food supplies through planning, landscape and building designs that protect existing ecosystems and prioritise the preservation and expansion of areas for food production.

Creating conditions to support sustainable farming must be an integral part of building development, especially where fertile land is scarce due to urban density, harsh climatic conditions or restricted access. Planning, landscape and building design can contribute by developing built environments that favour land use for food production in many scales. Examples of this can be found in urban farming projects, micro-gardening initiatives for refugees, production cooperatives and regenerative landscape design. Furthermore, the built environment can help to maintain and rebuild species diversity in open land as well as in suburban settlements and even in dense urban areas. This requires working with local geography, climatic conditions and locally adapted crops in the design of areas for food production.

The design of areas for food production, on a micro scale as well as on a larger scale, must be robust and geared to cope with climatic changes, such as more extreme weather, drought and floods. Also, a local production ecosystem can co-exist between the production of building materials, like timber or bricks, and food, making it important to consider how the food production interacts with the production of building materials. Finally, building and landscape design must involve end users when designing areas for food production to ensure the relevance and longevity of the production.

Alaska Seeds of Change

Anchorage, Alaska, USA

Challenge

95% of the food that Alaskans purchase is imported, thus making food security a pertinent issue in the state.[1] Over the years, initiatives to develop farmland to ensure commercial-scale food production have failed due to various reasons, such as high production costs and failed land management, while urban development has turned some of the state's best farmlands into suburbs. And while supplementary farming, hunting and fishing accounts for a relatively large portion of the rural population's diet, the urban population is to a large extent relying on imported foods that are not only expensive but also subject to supply insecurity.

Contribution

Development of small-scale farming for local consumers is growing as a response to the food insecurity in Alaska, with direct sales running at 13 times the national average in 2012.[2] Both private and public funds are being infused to develop innovative farming and distribution, education and skill building, as well as a broader scope of empowerment and community building.

Alaska Seeds of Change is a workforce development programme and hydroponic food production facility located in midtown Anchorage, the largest city in Alaska with a population of close to 300,000. The first seeds were planted in 2016, and the facility now features 1,500 "growing towers" – vertical columns containing thousands of plants; leafy greens, vegetables, fresh herbs and more. The facility provides the local community with a variety of fresh produce sold through farmers markets and distributed to restaurants in the urban area. In addition, Alaska Seeds of Change employs and empowers local youth, promoting self-reliance and community involvement, to grow and sell fresh produce. The programme is run by young adults between the ages of 16 and 24 with support provided by senior staff members. The non-profit organisation offers additional training in skills for independent living, including things like how to do taxes, cooking and meal planning, as well as budgeting.

Origin/team
Alaska Seeds of Change is owned and operated by Anchorage Community Mental Health Services.
Ryan Witten,
Greenhouse Manager,
Alaska Seeds of Change,
Anchorage Community Mental Health Services

Photo: Tiago Da Costa Vasconcelos

Photo: Thomas Chevalier Bøjstrup

La Caverne
Paris, France

Challenge
The world population is increasing steadily[1], and our cities are expanding rapidly both in terms of size and number of inhabitants. This puts our planet's resources under severe pressure. The food production systems we have today are not even close to being sufficient to feed the world's population, and the situation therefore poses a very real threat to both the environment and the opportunities of future generations.

Contribution
Western post-industrial cities are filled with infrastructure designed for cars. Highways, parking lots and underground parking facilities take up a lot of the cities' urban space and are perhaps more than anything a heritage from the post-WWII modernistic way of designing cities as efficient ecosystems of economic growth.

Today, European cities are facing an ecological transition in order to decrease their heavy carbon footprint and become cities for people. Several cities are banning cars from the city centres to minimise pollution and to enhance sustainable transportation methods like biking and walking. This transition leaves the cities with abandoned concrete, car-oriented infrastructure.

In Paris, young farmers exploit the abandoned structures to create urban farms supported by the city government. In an abandoned basement carpark in the low-income community of La Chapelle, the Cycloponics project created La Caverne – the Cave – an underground farm where they grow organic mushrooms and vegetables. The farm produce is sold on farmers' markets and at a discount rate to the people living in the social housing above the underground farm. Cycloponics are expanding their concept to other abandoned underground spaces, creating sustainable local food and jobs all at once.

Today, urban farms produce 20% of our food[2], and La Caverne shows how alternative locations can create space for sustainable farming even in dense cities.

Origin/team
Cycloponics, Lita.co, LaNef Société coopérative de finances solidaires, Agricultures & Territories Chambres d'agriculture, ECO Cert

Photos: ICF La Sabliere - Cycloponics

Photos: ICF La Sabliere - Cycloponics

Micro Gardening in Refugee Camps

Cox Bazar, Bangladesh

Challenge

Displacement due to unrest, persecution and climate change-related natural disasters is a growing problem globally. Often poor, cramped or barren plots in neighbouring regions provide shelter for refugees with poor resources. Both the refugees and the host communities risk suffering from malnutrition and poverty due to the pressure of an increased population and a higher demand for the regions' natural resources.

Contribution

The Rohingya Refugee Camps in Bangladesh have expanded from approximately 200,000 to 1.2 million refugees in a few years with local government, the UN and NGOs providing tents, infrastructure and sanitation.

Like many other refugee camps in the world, the overcrowded camps are fenced off from the neighbouring communities with both very little space and little prospect to improve residents' standard of living. In order to tackle malnutrition, NGOs are distributing Micro Gardening Kits together with basic food rations to refugees and neighbouring communities. FAO and IOM, in partnership with the Bangladesh Department of Agriculture Extension, were the initiators of the kits in the early months of 2018 – delivering 25,000 within the camps and 35,000 to the host communities. These distributions were done simultaneously, intentionally to improve balance in the provision of support between communities. The programme also accompanied a large roll out of agricultural support to the host community including mechanisation, training, capacity building of government staff, irrigation, green houses and storage facilities.

The kit consists of various vegetable seeds, such as high-iron spinach and pumpkin seeds, a compost, a spade, a watering can, a watertight, 60-litre food storage drum to prevent decay and rotting during the wet season, and a one hour tutorial on how to manage production on a 12-inch space bordering each tent or shelter. The kit enables a small production of vegetables on the scarce lands between the tents and on the roofs. In addition, plants growing on roofs and between tents have a positive effect on the microclimate, lowering the temperature slightly through evapotranspiration.

Origin/team
Initiators of The Micro Gardening Kits initiative: UN Food and Agriculture Organization (FAO), IOM, Bangladesh Department of Agriculture Extension [1]

Photos: Natalie Mossin

The Rwanda Institute for Conservation Agriculture (RICA)

Gashora, Rwanda

Challenge

Rwanda is densely populated with over 441 people per km², a number predicted to double by 2050. The growth has spurred rapid land development, decreasing the availability of agricultural land. Without radical transformation of the country's agricultural production, Rwanda is challenged to produce enough food to sustain its people.

Contribution

The Rwanda Institute for Conservation Agriculture (RICA) seeks to revolutionise agriculture in Rwanda. The concept was initiated by the Howard G. Buffett Foundation with the mission to train the next generation of leaders in *Conservation Agriculture;* a long-term farming approach uniting sustainability and high productivity. Through this concept, Rwanda has the potential to become not only self-sufficient but also to be world leaders in healthy and sustainable food production.

The RICA campus design includes the landscape, housing, academic space, barn storage and processing space for the institute. Each academic building across the campus is dedicated to one of the six different plant and animal-based agricultural enterprises that students will study and engage with throughout their three years at the institute. Once they graduate, the students will define the future of Rwandan agriculture by establishing farms, continuing their studies, educating others or through further research in conservation agriculture.

RICA strives to be the first climate-positive university campus in the world constructed from the ground up. The campus is entirely off-grid and sustainably solar powered, and it is accompanied by a vast landscape and habitat restoration scheme that more than offsets all carbon emissions created by the project itself. The entire supply chain was considered; the embodied carbon of the building process was calculated, over 95% of the materials were sourced locally, and the materials were also processed locally or on site. This approach to considering the interconnected impacts of humans, animals and the environment is called "One-Health" and supports RICA's mission to attain healthy and sustainable food

independence in Rwanda. Through One Health, RICA harnesses symbiotic ecological and agricultural relationships and regenerative principles to achieve greater crop yields, increased biodiversity, utilised waste streams, healthier soils and cleaner water.

With their curriculum and campus design, both grounded in the One Health approach, RICA hopes to soon become a world leader in experiential education, research and conservation agriculture.

Origin/team
Rwanda Institute for Conservation Agriculture,
The Howard G. Buffett Foundation,
Government of Rwanda,
University of Nebraska Lincoln,
MASS Design Group, Arup,
Remote Group

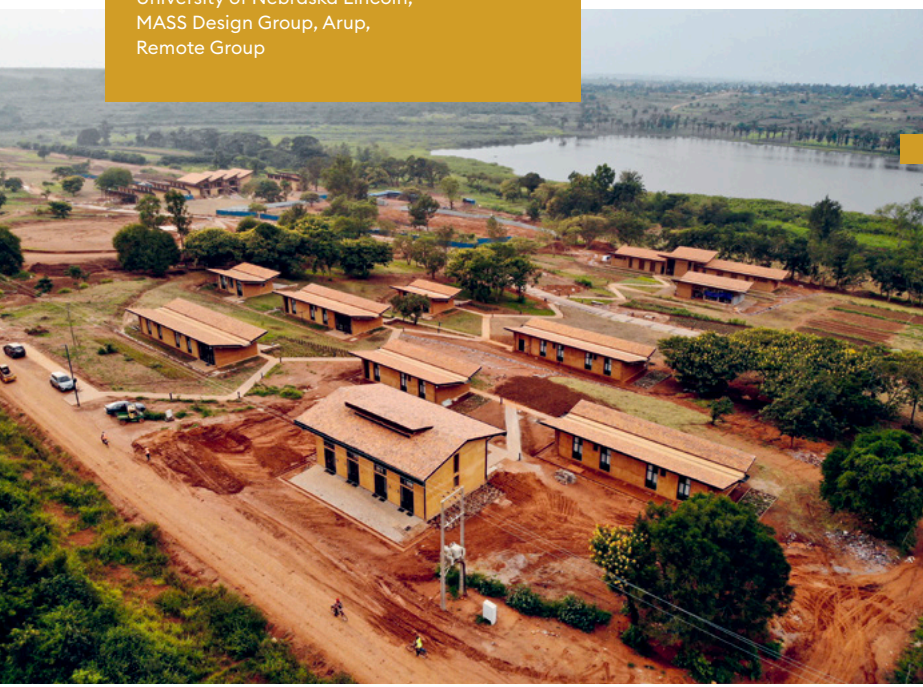


Photo: MASS Design Group

Photos: MASS Design Group

Rooftop Garden at ARTS Group Headquarters

Suzhou, China

Challenge

As half of humanity today live in cities – and more and more will do so in the future[1] – solutions to how we grow, share and consume our food in more sustainable ways must also be found within the urban context. Although small scale, the rooftop farm of an office building in Suzhou illustrates how design solutions can help contribute to local food production in big cities.

Contribution

The ARTS Group is an architect design firm located in Suzhou. The city is known for its traditional Chinese gardens, and today it is an industrial city closely connected to Shanghai. The ARTS Group headquarters office building combines the local, ancient building culture with the modern and softens the transition from outside to inside, from movement to relaxation. In the 20-storey tower building, every three floors share a tall interior planted garden, hereby bridging the vertical connection between each floor. In the six-storey wing, the gardens are accessed by spiral stairs that lead employees and visitors to enjoy an abundant rooftop farm.

The rooftop farm provides employees with sustainably produced vegetables, a solar collector array for hot water, and an open space for leisure to enhance well-being and provide a healthy work environment. By bringing the farming tradition to the office building, the design project connects employees as they voluntarily nurse the plants as well as share the harvests and farming knowledge. The rooftop farm has been established with advice from professional farmers and includes a rainwater harvesting system for irrigation. From time to time, there is enough crop to provide food for the employees in the canteen. In this way, the building's unique, green urban space educates the employees about both the benefits of sustainable food production and solar energy use, while it also provides a green and lush work environment.

Photo: Guida Moseley Brown Architects

Origin/team
ARTS Group Co., Guida Moseley Brown Architects.
Material provided by China Academy of Building Research and Guida Moseley Brown Architects

Photo: China Academy of Building Research

3 GOOD HEALTH AND WELL-BEING

Ensure healthy lives and promote well-being for all at all ages

Ensuring healthy lives and promoting well-being for all at all ages is important to building prosperous societies. Yet, despite great strides in improving people's health and well-being in recent years, inequalities in health care access still persist.[1]

Many more efforts are needed to fully eradicate a wide range of diseases and address many different persistent and emerging health issues. By focusing on providing more efficient funding of health systems, improved sanitation and hygiene, increased access to physicians and more tips on ways to reduce ambient pollution, significant progress can be made in helping to save the lives of millions.[2]

To find out more about Goal #3, visit:
https://www.un.org/sustainabledevelopment/health/

[1] Extract from UN report WHY IT MATTERS – Good Health and well-being – PDF
[2] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/health/

Architecture plays a crucial part in creating a built environment that supports good health and well-being. Access to health systems, sanitation and hygiene plays a major role in a healthy life, and in reducing the spread of diseases, as does spatial planning that allows social distancing in public spaces and at work.

Furthermore, most people spend the majority of their lives indoors, making indoor climate an influential factor of health. Building design must thus enable a healthy indoor climate concerning light, acoustics, air quality and exposure to radiation and degassing. This is important in all buildings, but especially so in buildings with vulnerable users, such as hospitals. Building design must further avoid the use of environmentally hazardous materials and substances.

Transmission of diseases and illnesses often happens within the built environment. Building design and the layout of settlements and urban areas are crucial to curb the spread of diseases and exposure to bacteria and viruses, such as the novel COVID-19.

Furthermore, infrastructure, health institutions and the design of urban areas affect citizens' access to exercise opportunities. Buildings, settlements and urban areas must therefore be planned so that they allow and encourage physical activity. Urban layout also influences the risk of accidents, for example in traffic, and this too can be addressed through design.

How architecture interacts with health varies greatly, and examples of this can be found in housing that reduces the risk of infection with malaria, in patient-community buildings and in the design of public spaces.

The Star Homes Project

Mtwara, Tanzania

Challenge

Sub-Saharan Africa will account for most of the world's population growth over the coming decades with the addition of a predicted 1.05 bn people by 2050.[1] This will necessitate the construction of millions of new homes. New housing in hot, humid regions of sub-Saharan Africa usually consists of single-level, poorly ventilated concrete block structures that predispose families to a number of preventable diseases. Minimal airflow leads to a hot indoor climate which reduces the use of bed nets and increases malaria transmission. Cooking without adequate ventilation results in many women developing respiratory tract infections, and inadequate water supply and sanitation predisposes family members, especially children and the elderly, to enteric infections.

Contribution

A growing body of recent scientific work is starting to demonstrate that well-designed housing could result in broad benefits in several disease categories.[2] The Star Homes Project is a clinical trial that investigates the impact of improved housing on family health in Tanzania. 110 improved houses with separate latrines are being constructed in 60 villages throughout the Mtwara region, and the health of residents will be compared to those living in 440 control homes over a 3-year period.

The design of the houses draws inspiration from the Magoda project[3] and traditional homes in South-East Asia that are often well adapted to the hot-humid climate. The front bench and plan layout draw inspiration from houses local to the Mtwara region. In addition, the design team utilised iterative parametric modelling and environmental simulation techniques, such as Computational Fluid Dynamics (CFD), to improve indoor comfort and the design of individual elements, like the smokeless stove. The design of the houses aims to reduce rates of malaria, respiratory tract infections and enteric diseases. For example, bedrooms are raised with larger, permeable openings to help lower indoor temperature and reduce entry of Anopheles gambiae mosquitoes. The project has been developed by a cross-disciplinary team of architects, physicians, social scientists and entomologists alongside local community leaders and stakeholders.

Origin/team

Jakob Knudsen, Royal Danish Academy – Architecture, Design, Conservation
Lorenz von Seidlein, Mahidol Oxford Research Unit
Hannah Wood and Otis Sloan Brittain, Ingvartsen
Salum Mushamu and Catherine Khabuka, CSK
Steve Lindsay, Durham University & London School of Hygiene and Tropical Medicine
Jacqueline Deen, University of the Philippines – Manila
Arnold Mmbando, Ifakara Health Institute

Photos: Ingvartsen Architects

Bayalpata Hospital
Achham, Nepal

Challenge
Access to healthcare for people living in rural areas can be very limited. In Nepal, long distances, poor and expensive infrastructure, and outdated communication tools cause many deaths. The WHO recommends a doctor-patient ratio of 1:1,000, and while the capital, Kathmandu, has a ratio of 1:850, the ratio is as high as 1:150,000 in rural areas. 81% of the population lives in rural areas, and the need for more healthcare institutions and qualified staff is critical.

Contribution
The new Bayalpata Hospital is initiated by a public-private partnership between the government of Nepal and the NGO Possible Health. It is located in Achham, one of Nepal's poorest and most remote regions, where patients travel on foot for days to reach medical care. The ambition is to demonstrate that accessible and free medical care is possible even in the Achham district which suffers the highest maternal and child mortality and the lowest life span of all Nepalese districts.

The campus is designed like a village; the buildings are in a human scale and surrounded by outdoor public spaces. The design is inspired by traditional Nepalese architecture and building practices to make the patients and their relatives feel more at home. To minimise costs and the project's carbon footprint, the architects introduced rammed earth as a main material using locally sourced soil and aggregate. Rammed earth is cost effective in a country like Nepal where labour costs are low, and it is less carbon intensive than concrete and has thermal mass to reduce the heating/cooling load. The material also makes it possible to reduce transportation costs and to use local labour. The hospital is mainly powered by solar power and is naturally ventilated. This means that the hospital has a small carbon footprint both in terms of construction and maintenance.

The new hospital facilities also include housing for staff and for patients and relatives travelling from afar. Today, the hospital treats over 100,000 patients a year from Achham and the surrounding mountain districts.

Origin/team
Sharon Davis Design,
Office of Structural Design (OSD),
Ethicons-EWES J/V,
Subedi-Associate J/V,
Transsolar Climate Engineering,
SunFarmer,
eDesign Dynamics (EDD),
XS Space,
Possible Health

Photos: Elizabeth Felicella

Photos: Tyler Survant

GAME Streetmekka

Viborg, Denmark

Challenge

A lack of sports facilities, and the high cost of sports club memberships coupled with Danish children's easy access to digital entertainment, puts the health of young people in urban areas at risk. Physical inactivity, especially at a young age, can lead to lifestyle diseases and obesity, and it also has negative social consequences. Such development can be countered by playing sports or doing other physical activities that both increase fitness and create opportunities to meet people, socialise and build communities.

Contribution

GAME is a non-profit organisation that aims to create social change through street culture, movement and activity. The organisation teaches young people to become 'Playmakers' – trainers that act as role models in their own urban communities.

GAME Streetmekka Viborg is established in a vacant industrial building that has been transformed into a culture house for street sports, culture and arts. The original building is a generic factory building from the 1960s similar to thousands of old industrial buildings in European suburbs, typically constructed from prefabricated concrete panels or corrugated steel.

The architect stripped the factory of all secondary walls and installations to create a huge open space with high ceilings perfect for high-flying skateboard tricks. Full-width industrial windows at each end open the building to the surrounding landscape and create a fluent experience of the inner and outer playgrounds and sports fields.

The GAME organisation has opened new Streetmekkas in four Danish cities but is also engaged in Ghana, Jordan, Lebanon and Somaliland where the NGO educates local Playmakers. The Playmaker education is centred around empowerment, life skills, teamwork, gender equality and civil society. GAME Playmakers are role models in marginalised communities and an important part of the social change that GAME works towards.

Origin/team
EFFEKT,
Viborg Municipality,
Realdania,
Lokale- & Anlægsfonden,
TrygFonden,
NordeaFonden,
GAME,
Beaver Concrete,
BOGL,
Thomas Andersen,
Jonathan Linde,
Bjørn Isager,
Lars Pedersen,
Nørlum

Photos: Rasmus Hjortshøj

Photos: Rasmus Hjortshøj


Game

LightPathAKL
Auckland, New Zealand

Challenge
The way we plan our cities has a major influence on health. Two thirds of people with diabetes live in cities, and obesity is the biggest modifiable risk factor for type 2 diabetes.[1] Consequently we must build and plan our cities so they enable a healthy lifestyle, not least by providing public space for exercise. Facilitating an infrastructure for soft transportation, and thereby making biking or walking a part of citizens daily routine, is key to an active lifestyle.

Contribution
In Auckland, 700 metres of redundant highway has been reinvented as a bicycle path that completes Auckland's inner-city cycle loop. The project is part of the Urban Cycleways Programme and was jointly delivered by the NZ Transport Agency, Auckland Council and Auckland Transport as part of a strategy strengthening the soft infrastructure of the city. Through improved and connected cycle ways and the education of future bikers down to primary school level, cycling has become the fastest growing means of transportation in several New Zealand cities[2].

The design intent of the LightPathAKL was to create a hybrid space that supports its intended function as a cycle path and as a piece of urban art. Maori artist Katz Maihi was part of the team, imbuing the project with a sense of narrative, interaction and place. Architecturally, the project had to work simultaneously at both the macro and the micro level – for the city and the individual.

The former highway has been coated with a highly vivid and provocative, pink resin aggregate surfacing in order to make an impact and constitute a bold statement in Auckland's urban realm, illustrating movement, speed and aspiration. Three hundred individual LED light poles, controlled by sensors, are arranged as a spine down the city side of the path creating a living and breathing interactive urban light sculpture that responds to varying patterns and intensities of user movement.

Origin/team
Monk Mackenzie Architects + LandLAB,
GHD, Katz Maihi, iion,
Hawkins Construction,
New Zealand Transport Agency,
Auckland Council and Transport

Photos: Monk Mackenzie Architects

Port Sudan Paediatric Centre

Port Sudan, Sudan

Challenge

Sudan has been enduring the consequences of ongoing conflict since 1983 at enormous costs for the civil population.[1] Today, the country is in an economic crisis, experiencing a heavy shortage of medical personnel and a lack of free healthcare services, which makes medical treatment inaccessible to a large part of the population. The mortality rate of children under five years is 60.5 (per 1,000 live births), placing Sudan 166 out of 192 nations.[2]

Contribution

The Port Sudan Paediatric Centre opened in 2012, and it offers free healthcare for children up to the age of 14 in an area with a population of over 800,000 people. The public hospitals in the region were in poor condition, and the private healthcare facilities were economically inaccessible for the majority of the people living there.[3]

The Paediatric Centre is designed by the design firm TAMassociati as a single storey space containing a ward with 18 beds, a sub-intensive care unit, 3 paediatric clinics, a pharmacy, diagnostic services and a central courtyard. Using local materials and techniques, the centre is cooled by natural ventilation and shade. This makes it very energy efficient and at the same time reduces the construction and maintenance costs.

The children's centre was built by the independent NGO EMERGENCY that was founded in Italy in 1994 with the aim of providing medical support to civilian victims of war and poverty. The centre provides high-quality treatment for children but also serves as a centre for healthcare outreach initiatives. The clinic's professionals, called Health Promoters, visit the area's communities to make house calls and to provide crucial life-saving information on nutrition, first-aid and hygiene. The centre also offers training and education for local staff in collaboration with the Port Sudan Nursing Academy.

The Paediatric Centre admits around 100 children every month, of whom 89% are under the age of 5. Through the centre, children can complete the vaccination programme under international protocols; a service provided in collaboration with the Sudan Ministry of Health.

Origin/team
EMERGENCY NGO, TAMassociati,
EMERGENCY NGO - Building and Technical Division,
Government of Sudan.
Government of Italy.
Private sponsors.
The Paediatric Centre in Port Sudan was built in part thanks to the contribution of Massimo Grimaldi, an Italian artist who donated the cash prize won at the international contest *MAXXI 2per100*.
Climosfera srl (mechanical/services engineering),
INGECO srl (structural engineering),
Roberto Crestan (site engineering).

Photos: Courtesy of Massimo Grimaldi and EMERGENCY NGO

Photo: Courtesy of Massimo Grimaldi and EMERGENCY NGO

4 QUALITY EDUCATION

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Obtaining quality education is the foundation to creating sustainable development. In addition to improving quality of life, access to inclusive education can help equip locals with the tools required to develop innovative solutions to the world's greatest problems.

The reasons for lack of quality education are due to lack of adequately trained teachers, poor conditions of schools and equity issues related to opportunities provided to rural children. For quality education to be provided to the children of impoverished families, investment is needed in educational scholarships, teacher training workshops, school building and improvement of water and electricity access in schools.[1]

To find out more about Goal #4, visit:
https://www.un.org/sustainabledevelopment/education/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/education/

Schools and educational spaces are a crucial part of our investment in the future.

Whether in a refugee camp, in informal settlements or in rural communities, access to schools and education is defining the future of our children. Schools, universities and other educational institutions all require architectural design that enables a productive learning environment. However, architecture also has a key role to play in creating affordable, accessible and inclusive educational solutions for all children, including children who are marginalised or have special needs, and for communities with limited resources to maintain conventional school buildings or limited access to an existing school system. Children from poor or marginalised communities, who are female or have disabilities, must not be left behind, and this requires architectural solutions that are accessible and address the needs of all students.

Examples of this can be found in school facilities for minorities or marginalised groups, in schools that enable children to stay in their local community while studying, and in schools for children with special needs.

Furthermore, the built environment can provide training opportunities regarding the sustainable performance of buildings, settlements and urban areas for both users and craftsmen. In development, as well as in use, buildings and communal facilities can interact with and promote a sustainable culture of usage.

On the level of primary education, an increased focus on knowledge regarding sustainable design and crafts will be key in building the future sustainable development.

Fuji Kindergarten

Tachikawa City, Tokyo, Japan

Challenge

Early childhood education plays a key role in ensuring a society's sustainable development[1]. From a very early age, children are impacted by their physical environment, the people that they interact with and the experiences they have. Our global society urgently requires new kinds of education that can help us support the development of future citizens that are caring, engaged in society, creative and collaborative.

Contribution

Fuji Kindergarten is designed as an ideal environment for pre-school children. Modernist institutions for children were typically designed to accommodate the teachers by making the spaces efficient workspaces for the staff. Fuji Kindergarten is built for the children, and everything is in a scale that fits their size, promotes their free movement and is safe for them to use. The ceiling height is only 2.1 m, and utilities, such as sinks, are placed at the children's level.

The kindergarten is a circular structure with an open indoor/outdoor landscape of experiences all accessible for the 600 children enrolled in the facility. The structure is built around three existing zelkova trees so that the trees penetrate the circular wooden deck roof and create shade and hiding places for the children. The architecture activates the children's senses; they can run around the roof, climb the trees and play with water – all designed with the philosophy that experience cannot be taught. The design wants to stimulate the children's curiosity so that they go on adventures together in a safe environment.

In Fuji Kindergarten, there are no toys or playgrounds – the building and the landscape itself offers many opportunities to play. The interior has no permanent walls, instead the staff can create smaller flexible environments by moving lightweight boxes, sliding panels and cabinets. The free plan design encourages both independence and collaboration, and the children are not forced to sit still, keep the areas clean or be silent.

Origin/team
Tezuka Architects,
Takenaka Corporation

Photo: Katsuhisa Kida/FOTOTECA

Photo: Fuji Kindergarten Staff

Children Village

Formoso do Araguaia, Tocantins, Brazil

Challenge

Throughout the world, villages and rural areas are experiencing the effects of a movement towards urban centres. Among the consequences of depopulation is the closing of public services, such as schools, and parents are therefore forced to send their children far away to ensure educational opportunities. This situation is very severe in the central region of Brazil where the main population struggles to survive and does not have the means to send their children to school.

Contribution

The Children Village is a combination of a day school and boarding school funded and initiated by the Bradesco Foundation. It provides free quality education for 800 children coming from low-income families in different regions of Brazil.

The project is designed as a small village, rather than a large educational institution, with small housing units instead of large dormitories and with close contact to the surrounding nature and the local community.

The ambition of the project was to create a temporary home away from home and a community for the students. Therefore, the architects worked very closely with students, teachers and local representatives in a creative design and construction process focusing on a scale fit for the children, an understanding of the local architectural vernacular and the use of local materials and techniques.

The building structure is made of prefabricated wooden modules, the roof is lightweight metal and the walls are made of locally produced compressed, sun-dried soil bricks. The materials, the interpretation of traditional Brazilian architecture and the close connection to nature makes for a light, transparent and welcoming design.

Origin/team
Estúdio Gustavo Utrabo, Pedro Duschenes, Rosenbaum, Fundação Bradesco, Ita Construtora, Raul Pereira Arquitetos Associados, Lux Projetos Luminotécnicos, Meirelles Carvalho, Ambiental Consultoria, Lutie, Inova TS, Metroll, Rosenbaum e o Fetiche, Fabiana Zanin

Photos: Critobal Palma

Glasir – Tórshavn College

Tórshavn, The Faroe Islands

Challenge

Remote countries or regions can suffer "brain drain" as a consequence of education being centralised in national or regional hubs. In order for young people to receive a quality education they sometimes have to choose between leaving their homes, hometown or even their countries – or compromising on their choice of education based on what level and field of education is offered locally.

Contribution

In the small nation of the Faroe Islands, the government decided to invest in a new multi-disciplinary college in the capital of Tórshavn. The project is the biggest building project in the Faroe Islands' history, and it represents an enormous public investment in the future learning environments of the nation.

The concept of the college is to merge three different types of upper secondary education – the technical college, the business college and the academic Faroe Islands Gymnasium – into one big common campus and learning community. This way, the students of the respective schools each get an upgraded, modern learning environment by pooling the development funds for each school into a shared state-of-the-art facility.

Each school has its own building volume so that its students can build and maintain a strong community around their specific profession, but each building volume is also connected to a central, vertical atrium so big that it functions as a central plaza in a campus where everyone meets. The central plaza is both the physical and conceptual heart of the project, as it is the space where the interaction between the students, the schools and the different disciplines flourishes.

Photos: Rasmus Hjortshøj

Origin/team
BIG - Bjarke Ingels Group, Landsverk, Mentamálaráðið, Fuglark, Lemming Eriksson, Martin E. Leo, Sámal Johannesen, KJ Elrád

The Sensory Well-being Hub

Chicago, Illinois, USA

Challenge

As society experiences centralisation, small schools are often either closed or moved to gather the highest quality education for as many as possible in one location. This tendency has many advantages, such as cost savings and easy access to best practices. When it comes to large public schools, teachers and administrative staff are at risk of not noticing the individual needs of each child, and large learning environments can seem out of scale for children, especially if they have sensory processing challenges. It is a global challenge to provide adequate learning facilities for children with special needs.

Contribution

The Sensory Well-being Hub at Lane Tech College Prep High School is a small space with the purpose of improving the health and long-term prospects of people who live with sensory processing challenges. The pro bono project aims to help students with autism and developmental disabilities recover from sensory stressors and refocus on classroom learning.

Built within an existing classroom, the Hub is a place to reset and find equilibrium. The space is comprised of a demountable framing structure with movable panels housing two parts: a stimulating wall module featuring changeable artefacts and a mobile tent structure – the Sensory Cocoon – that dampens noise, light and other stimuli, creating a calming environment.

Research demonstrates that the space is helping students with special needs re-join the classroom sooner while improving their general mood and demeanour both at home and at school. The Hub serves as a conduit to learning and narrows the education gap for an underserved segment of society.

The team created the Hub as an open-source design constructed with affordable, non-proprietary off-the-shelf materials. The design is available as a free download online to any school or organisation that wants to replicate it in part or whole, depending on their budget.

Origin/team
HKS Architects
ASID Foundation Transform Grant
Lane Tech Alumni Association
Sean Ahlquist (University of Michigan)
OUVA
Mohawk

Photos: HKS Architects

South Harbour School

Copenhagen, Denmark

Challenge

Urbanisation is happening at a rapid speed globally, creating a high demand for new urban areas and suburbs to cities. But city development risks compromising the identity and quality of life in new urban dwellings if speed, efficiency and economy become the main factors defining the planning and development of a new area.

Contribution

Sydhavn, Copenhagen's southern harbour area, is transforming from an old industrial area to a new residential mix-use area. While developers have invested in housing projects for the area, the city of Copenhagen has the responsibility to create public gathering points as well as quality education facilities capable of attracting citizens to the area.

The new school has a science and maritime profile that emphasises the area's connection to the harbour. It is designed with the ground floor as the school's natural meeting place and as a mixture between a large classroom and a city square – accessible to the public outside of school hours. The outdoor areas and playgrounds are also open to the public so that the neighbourhood can use them for play and physical activity. The design offers a wide variety of activities and surfaces to accommodate the diversity in its user groups; from small children to elderly citizens going for a walk. Both the school building and the landscape are designed to be accessible for users with physical disabilities.

Physical activity also plays an important role in the layout of the school itself; the students can access the roofs, play around in special activity areas and they always have easy access to the outdoors and the harbour. That way, the kids are intuitively taught an active, healthy lifestyle and gain a close contact to nature. The harbour becomes an extra classroom where the students can sail canoes, catch fish for cooking or study marine life.

The school and its landscape invite its neighbours in while also reaching out. In this way, it is becoming a vital player in creating a new, diverse and sustainable community in Copenhagen.

Photo: JJW Architects

Origin/team
JJW Arkitekter, NIRAS,
JJW Landscape / PK3 Landskab,
Keinicke & Overgaard Arkitekter,
B. Nygaard Sørensen A/S,
G.V.L. ENTREPRISE A/S, Lindpro,
Jakon A/S, Friis Andersen Arkitekter,
Peter Holst Henckel

Photo: Torben Eskerod

Photo: Torben Eskerod

5 GENDER EQUALITY

Achieve gender equality and empower all women and girls

Gender equality is not only a fundamental human right, but a necessary foundation for a peaceful, prosperous and sustainable world.[1]

Yet, gender inequality persists worldwide, depriving women and girls of their basic rights and opportunities. Achieving gender equality and the empowerment of women and girls will require more vigorous efforts, including legal frameworks, to counter deeply rooted gender-based discrimination that often results from patriarchal attitudes and related social norms.[2]

To find out more about Goal #5, visit:
https://www.un.org/sustainabledevelopment/gender-equality/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/gender-equality/

[2] Extract from UN's SDGs Knowledge Platform, available from https://sustainabledevelopment.un.org/sdg5

To support a movement towards gender equality, the design of buildings, settlements and urban areas must be inclusive to all citizens regardless of gender.

The organisation of public spaces, institutions and services must prioritise the security of girls, women and LGBT+ citizens and help minimise the risk of abuse. The ability to move safely in public spaces, in public institutions and at the workplace is essential to the inclusion of women and girls in civil society and to women being able to hold a job outside of their home, which is key to being self-supporting. Also needed are affordable and secure buildings to provide health services, basic sanitary services and meeting places for women and LGBT+ citizens. Examples of this includes maternity clinics, community centres, safe houses or secure public bathrooms.

Design of playgrounds, public parks and sports facilities must offer girls, women and LGBT+ citizens equal access to leisure and physical activities and create conditions that encourage use by all.

The building industry itself must work towards equal pay, promote diversity and work to oppose sexual harassment. As part of this, the industry must support women's ability to handle heavy construction processes that are otherwise reserved for men, for example by the introduction of lifting technologies. From design through construction, the industry must avoid a narrowly gendered work culture in order to promote diversity and co-ownership so that more women and LGBT+ professionals will be able to join the industry at all levels.

Habitat for Orphan Girls

Khansar, Iran

Challenge

Women in Iran face considerable gender inequality, as documented in the Global Gender Gap Report by The World Economic Forum in 2020, where Iran ranked as number 148 out of 153 countries.[1] Iran is also one of only six nations that has not ratified the UN's Convention on the Elimination of all Forms of Discrimination Against Women, a 1979 treaty that aims to promote the rights of women across the globe.

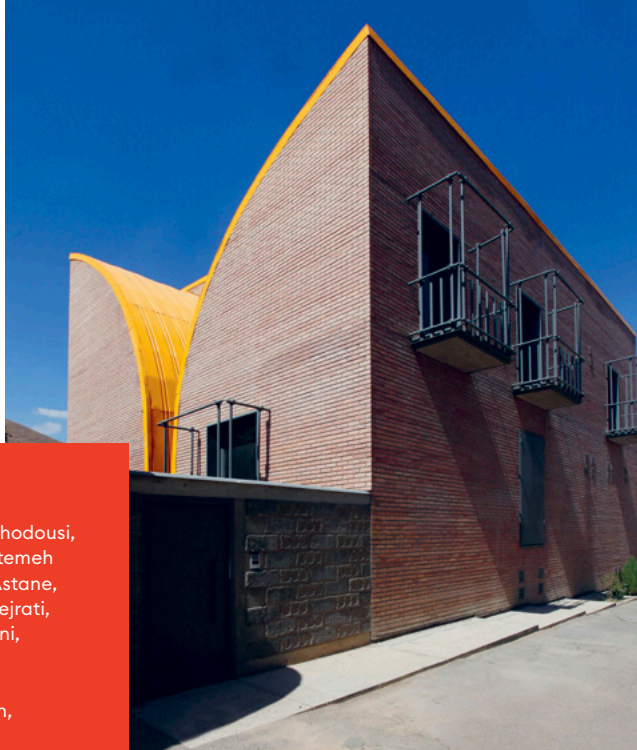
Contribution

While all women in gender-unequal societies suffer inequality socially, economically and culturally, orphan girls are especially vulnerable. With no family or economy to ensure their safety, this group is at high risk of abuse and discrimination. Combined with a society in which the freedom of women is very limited, the Iranian orphan girls have almost no opportunities.

Zav Architects' Habitat for Orphan Girls creates a home that aims to both protect and provide personal freedom to young orphan girls. The late philanthropist Dr Ahmad Maleki initiated the home, which is located in the religiously conservative city of Khansar. While orphanages in Iran by law are restricted to be designed as large dormitories, the architects and the client in this case insisted on creating a home rather than an institution.

The design of the building shields the girls from the surrounding town, both physically and visually, by a large wall and flexible curtains attached to the balconies. This allows the girls to act freely within their home and to enjoy the sun and wind on the balconies and outdoor areas without being covered up. The garden even has a shallow pool so that the children can cool down in the summertime. The home combines smaller rooms for sleeping with larger social areas – all to give the girls a feeling of a home with private life and family.

While the design protects and shields the girls from the neighbourhood, the orphanage is located in the middle of the town to emphasise the fact that the girls are equal citizens and have an important role to play in both current and future Iranian society.



Origin/team
ZAV Architects,
Mohamadreza Ghodousi,
Parsa Ardam, Fatemeh
Rezaie Fakhr-e-Astane,
Seyed Hossein Hejrati,
Mahshid Ghorbani,
Sara Jafari,
Golnaz Bahrami,
Ali Ghasemzadeh,
Nader Shokoufi,
The Late Ahmad Maleki,
Parvin Maleki

Photo: Soroush Majidi

Photo: Tahmine Monzavi

Woldyia Maternity Center

Woldiya, Ethiopia

Challenge

Maternal mortality is a key indicator of the health disparities between poorer and richer nations, and for overall development. Women in Ethiopia suffer from high maternal and infant death rates, and the effects of a high maternal death rate affects both children, remaining families and communities. Children left without a mother are more vulnerable to malnutrition and suffer greater health risks.[1]

Contribution

The purpose of Woldyia City Hospital's new maternity center is to ensure safe conditions for pregnant women, new mothers and infants. The center contains a medical and surgical maternity unit as well as a mothers' waiting area. The design of the waiting area mirrors a small local village, providing future mothers with higher-risk pregnancies a temporary home where they can stay during the final stages of pregnancy.

The waiting village is a space where future mothers coming from rural areas can live in a healthy environment, and where they can feel safe while waiting to give birth. Often, the travel time from a woman's local rural home to a hospital is crucial in ensuring the survival of both mother and child. Being close to medical facility minimises risk, helps women with higher-risk pregnancies feel safe and allows future mothers to interact, share advice and establish a sense of community with each other.

The composition of the waiting area is inspired by the tukuls, the traditional Ethiopian huts, and it is organised in a similar circular pattern. There are private huts for families and a large common room with a kitchen for the temporary community all constructed as a steel structure with bamboo for the façade.

The adjacent medical maternity unit consists of three concrete volumes connected by glass corridors. The unit's electricity comes from photovoltaic panels, making it off-grid and independent and therefore more protected against blackouts.

Origin/team
Vilalta Studio,
IPI Cooperación

Photos: Elizabeth Felicella

The Light Box

Thane, Teen Haath Naka, Mumbai, India

Challenge

India is ranked 112 of 153 countries in World Economic Forum's Global Gender Gap index 2020,[1] and women are at high risk of abuse both within their domestic environments and in the public realm. Even though women's rights organisations, WHO and UN are publicly raising awareness, progress for women's security and rights is still moving very slowly. In order to help Indian women achieve equal rights, the design of public spaces and urban infrastructure must make cities safer for girls and women – thus allowing them to travel safely from their homes to schools, work places or social events.

Contribution

The Light Box – Restroom for Women creates a safe, sanitary social space for women in Thane, Teen Haath Naka, Mumbai. The space combines sanitary toilet functions in private booths with a semi-private social space in which women can sit down, rest and recover. The social space is also a free gallery to display art for amateur artists, a place for lectures and awareness campaigns, celebrating festivals, seasonal activities and events. The restroom is guarded by a security guard and monitored with CCTV to ensure the safety of the female users and to prohibit vandalism.

The restroom is built with low-cost, lightweight materials and a semi-transparent roof allowing natural light into the space during day-time. The design is built around an existing tree so that the leaves and branches create natural shade while also making the restroom fit into the existing urban infrastructure in a subtle way. The walls are slightly perforated to create natural ventilation. The project is an example of how architectural additions to the urban environment can contribute in making cities available for all genders.

Origin/team
RC Architects,
Agasti (Sahej Mantri founder),
Prashant Haval,
Shailendra Vishvakarma

Photos: Rohan Chavan

Anita May Rosenstein Campus

Los Angeles, California, USA

Challenge

Discrimination affecting lesbian, gay, bisexual, transgender, queer and non-binary (LGBTQ+) people is widespread. The shape and form of discrimination varies greatly and spans from bullying and ostracism to the death penalty for homosexuality. Even though the United States, since 2015, are amongst the countries that recognise marriage equality, the LGBTQ+ community continues to face large challenges throughout the states, suffering discrimination and political inconsistency.

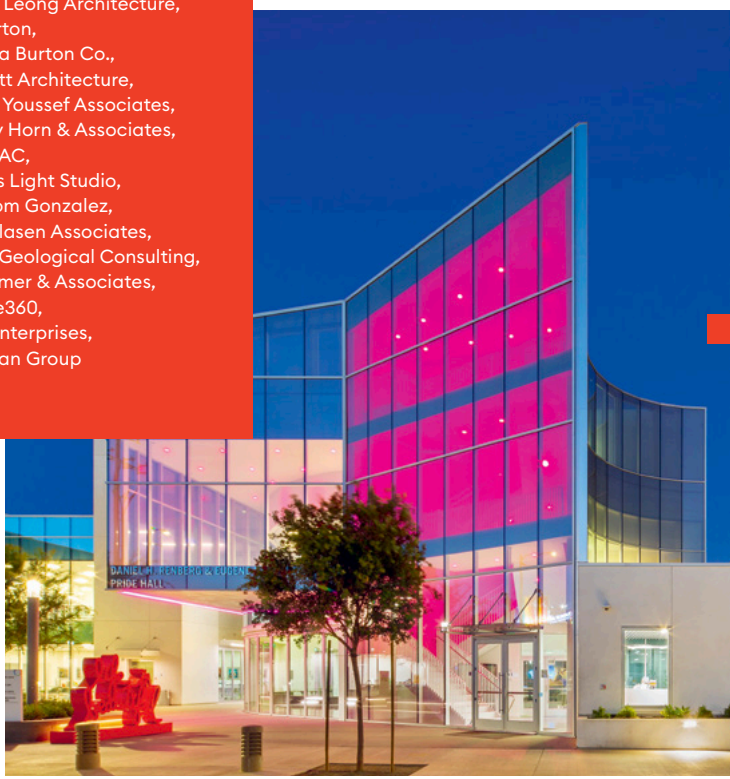
Contribution

Los Angeles, California, USA, is home to a strong LGBTQ+ community, and the non-profit Los Angeles LGBT Center – the world's largest provider of programmes and services to LGBT people – recently celebrated its 50th anniversary with the opening of the revolutionary Anita May Rosenstein Campus. The campus provides the community with a new facility that weaves together housing, education, healthcare, social exchange and legal support. It is the world's first intergenerational facility serving LGBT seniors and youth.

Surveys show that there are 4,000 youth, ages 18 to 24, living on the streets of Los Angeles on any given day, and in Hollywood a staggering 40% of them are LGBTQ+. Research shows that 64% of the young, homeless LGBTQ+ citizens in the US are on the streets due to bigotry and discrimination within their own families, schools and local neighbourhoods.[1] Experiencing homelessness deprives young people of the possibility to get an education, puts their health severely at risk and leaves them unprotected from crime. The Los Angeles LGBT's new campus provides these vulnerable young people with homes and support – and helps them to establish support systems within the LGBTQ+ community.

The two-acre campus is designed as a small village with interior courtyards and a central plaza. From the street, the campus' architectural design is transparent, evoking openness and welcoming the surrounding city into the community.

Origin/team
Los Angeles LGBT Center,
KFA Architecture,
Leong Leong Architecture,
Swinerton,
Pamela Burton Co.,
Wolcott Architecture,
Nabih Youssef Associates,
Kimley Horn & Associates,
GLUMAC,
Oculus Light Studio,
Newsom Gonzalez,
Veneklasen Associates,
Feffer Geological Consulting,
BJ Palmer & Associates,
Exante360,
Clay Enterprises,
Freeman Group



Photos: KFA and Jim Simmons

Women's Opportunity Center

Kayonza, Rwanda

Challenge

Countries and areas that have been exposed to war or disaster face great challenges. Often, infrastructure has been severely damaged and generations of knowhow lost. In Rwanda, the civil war from 1990-1994 left the country devastated and at a loss for resources both physical, economic and educational. Within the civil war was the genocide in 1994, which affected the population in Rwanda profoundly. After 1994, the majority of the population of Rwanda was female, in some areas up to 80%.

Contribution

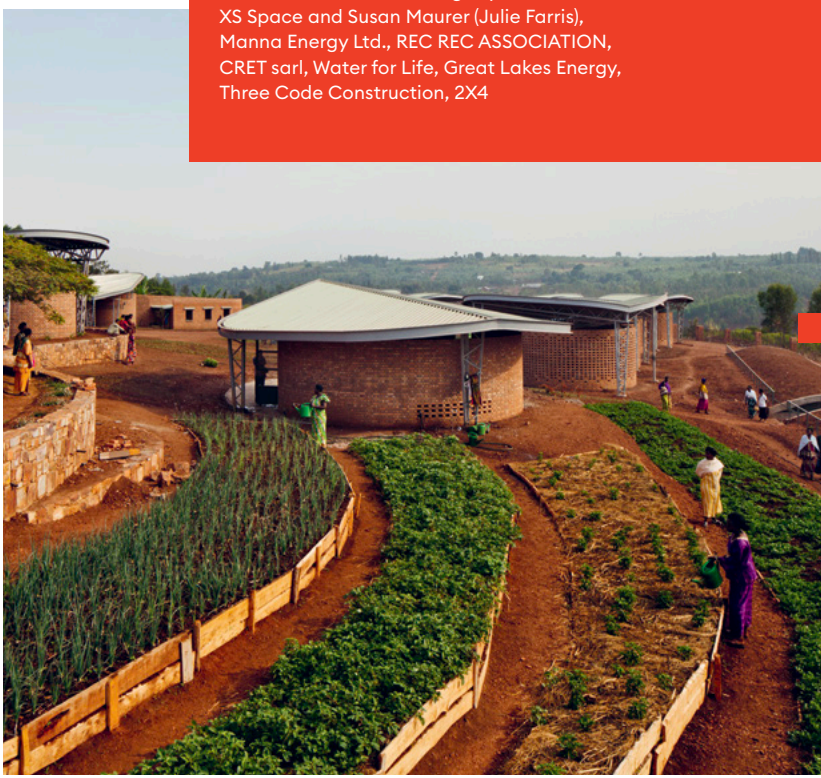
After the civil war, the people left to govern Rwanda were women. The situation caused the Rwandans to establish some of the world's most women-friendly policies – and at record speed. Laws made it possible for women to inherit property, obtain loans and study in previously male-dominated fields.

Since 2003, Rwanda's constitution has required that women hold 30% of elected positions. Today, with 49 women in parliament, that figure is 61%, the highest in the world. Rwanda is ranked near the top as no. 9 of 153 countries in The World Economic Forum's 2020 Global Gender Gap report.[1]

The non-profit organisation 'Women for Women' initiated the new Women's Opportunity Center in the small town Kayonza. The center is built to enhance economic growth by supporting women entrepreneurs, and it is a place where women can study, go to classes, sell their crafts and exchange ideas and experiences with their peers.

The center itself is designed in collaboration with the teachers and students of the center – using local crafts and skills, such as stamped clay bricks produced by the women at the center. The circular shape of the learning spaces is chosen because the teachers at the center believe this shape allows the students to focus on the teacher while experiencing a strong sense of community.

Origin/team
Sharon Davis Design, Women for Women International, OSD ENGINEERING, eDesignDynamics, XS Space and Susan Maurer (Julie Farris), Manna Energy Ltd., REC REC ASSOCIATION, CRET sarl, Water for Life, Great Lakes Energy, Three Code Construction, 2X4



Photos: Elizabeth Felicella

Photo: Elizabeth Felicella

6 CLEAN WATER AND SANITATION

Ensure availability and sustainable management of water and sanitation for all

Access to water, sanitation and hygiene is a human right, yet billions are still faced with daily challenges accessing even the most basic of services.

Clean, accessible water for all is an essential part of the world we want to live in, and there is sufficient fresh water on the planet to achieve this. However, due to bad economics or poor infrastructure, millions of people including children die every year from diseases associated with inadequate water supply, sanitation and hygiene.[1]

To find out more about Goal #6, visit:
https://www.un.org/sustainabledevelopment/water-and-sanitation/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/water-and-sanitation/

Adequate treatment and disposal of sewage, access to clean drinking water and access to handwashing and cleaning are crucial to human health and to stopping the spread of bacteria and viruses, such as Schistosomiasis.

Buildings and public spaces must be designed so that access to handwashing and cleaning is accessible to all citizens. Furthermore, to take advantage of rainfall where clean water is scarce, buildings must be designed so that rainwater can be collected, purified and used as drinking water.

In areas where rainwater does not need to be collected for drinking water, buildings and urban areas must be designed so that rainwater can enter the groundwater without being mixed with wastewater or being polluted in other ways. As for sanitation, the buildings, services, sewage systems and infrastructure must be planned and designed to keep bacteria and contaminated water separate from clean water and out of contact with citizens. A key part of this is to ensure access to toilet facilities that are designed to handle the waste produced. Building materials that do not contribute to groundwater contamination should be chosen, whether during extraction, construction or in use.

Furthermore, urban areas, settlements and buildings must be designed to withstand climate change related to water, such as more extreme precipitation, drought and floods. Landscape architecture and urban planning must protect freshwater resources through conservation projects and the design of recreational areas that protect, collect and handle water.

Examples of this are found in water-handling features at building level, in climate adaptation projects on an urban scale, and in communal toilets and washing facilities.

Sydney Park Water Re-Use Project

Sydney, Australia

Challenge

In many places of the world, climate change results in a two-faced problem with heavy rainfall during storms on one side and long periods of droughts on the other. The intensity of the rainfalls causes erosion and pollution of natural water systems, since run-off water from urban areas carry pollutants, nutrients and litter with it, and because the storm water is usually not treated before being discharged to the recipient.[1]

Contribution

During the Millennium Drought of the late nineties and early 2000s, Sydney had to unwillingly draw upon remote river catchments to maintain its water supply until the drought was declared officially over. This was the catalyst for the City of Sydney to prepare for its future water security through the Sustainable Sydney 2030 report and the Decentralised Water Master Plan (2012-2030). With Sydney and New South Wales now experiencing further record-breaking droughts, the importance of this Master Plan is once again clear.

In order to strengthen the natural water systems and benefit from the massive amount of rainwater that falls during cloudbursts, the Sydney Park Stormwater Re-use Project captures and cleans around 850 million litres of stormwater each year for release downstream and re-use within the park. The water is also re-used for an on-site plant nursery and for washing trucks at the City of Sydney Depot. The 44 hectares park is located in a former industrial area used for the extraction of clay, and later landfilled, and it consists of four wetland areas that are an important part of the park's ecosystems as well as the storm flood management. The park is the result of a partnership between architects and the Australian Government through the National Urban Water and Desalination Plan, and it draws on interdisciplinary knowledge from art, science and ecology. At all times connected to the water narrative of capture, movement and cleansing, the park design educates visitors on the importance of water management and how improving water quality and reducing potable water can be intrinsically linked to our natural surroundings.

Origin/team
Client: City of Sydney
Landscape Architect: Turf Design Studio & Environmental Partnership
Lead Contractor: Design Landscapes
Water and Environment: Civille
Artists: Turpin Crawford
Structural: Partridge Engineering
Ecology: Dragonfly Consulting

Photos: Ethan Rohloff Photography

Toigetation

Son Lap Commune, Bao Lac, Cao Bang Province, Vietnam

Challenge

Access to basic sanitation is recognised as a human right. However, upwards of 2.5 billion people lack access to basic sanitation, and more than one billion people are still defecating outdoors. In Vietnam, it is common that schools cannot offer students and staff basic sanitation in the form of toilets and places to wash. Currently, 88% of schools in the countryside do not have toilets meeting the criteria set by the National Ministry of Health, and 25% have no toilets at all.

Contribution

In Son Lap Commune, Bao Lac, Cao Bang Province more than 70% of the population is living in poverty. Most people live disconnected from the most basic infrastructure; electricity, roads, markets and telecommunication network. Son Lap School has a total of 485 students from kindergarten to secondary levels with more than 10 classes at the main school, 4 branch schools and some staff housing. Before the project, none of the buildings met the minimum standards in terms of sanitary and washing facilities. A space including toilet and washing area was urgently needed. This challenge applies to the Vietnam countryside in general, and therefore the bathroom and washing facility Toigetation has been designed based on three objectives: quick construction, low cost and a design that can be widely applied. The building features a layer of vegetation on its four sides and the surrounding terraced garden. The vegetation layer helps regulate indoor climate, reinforce the load-bearing structure, supply food and at the same time creates a boundary between inside and outside.

Toigetation was created by local human resources and local materials, using simple construction methods and local building techniques that make the structure resilient to natural disasters. The building is naturally ventilated and lit. In addition, it also has solar panels for producing energy and it reuses wastewater and running water. Toigetation was built in three weeks and cost 3,000 USD.

Origin/team
Architects: H&P Architects
Architecture Advisor: Dr. Nguyen Tri Thanh
Client: Son Lap Commune
Contractor: H&P Architects and Volunteers

Photos: Doan Thanh Ha

Vandvejen
Middelfart, Denmark

Challenge
Sealed surfaces, such as tarmac and pavements in urban areas, prevent infiltration of the increasing amounts of rainwater caused by climate change. Rainwater overflows the sewage systems and causes environmental and economic damage. Surface solutions to handle rainwater have potential co-benefits, such as trees and vegetation diminishing temperature rise through evapotranspiration and increased urban biodiversity.

Contribution
In 2012, the city of Middelfart decided that resilience investments should also benefit the urban environment and its residents on an everyday basis. Today, state-of-the-art climate adaptation projects are displayed in neighbourhoods throughout the city in different scales and typologies. This was only possible through a close collaboration between the utility company and the municipality, specialists in water management, road construction and urban planning.

One of the new solutions tested in Middelfart is *Vandvejen* (The Waterway). The overarching ambition of the project is to showcase how it is possible to add value to the public realm as an integral part of a climate adaption project and still remain financially viable compared to traditional approaches. The system introduces a radical reconfiguration of the street profile (from convex to concave) and a system of partly open water channels. The system increases the street's capacity for handling and retaining large amounts of rainwater during times of extreme precipitation, leading water from the roofs and street surfaces away from buildings and into either channels or rainwater beds without compromising street safety or accessibility.

The project provides an upgrade to the public realm with new attractive street elements – such as benches, planters and surface materials in concrete, asphalt and Corten steel – all of which are a part of the Vandvejen system. The project improves the quality of people's experience of the street; delivering the goal of the municipality to create better cities through climate adaptation and green growth.

Photos: Schultze+Grassov

Origin/team
Schulze+Grassov, EnviDan, Colas Danmark,
Malmos anlægsgartnere,
Thisted-Fjerritslev Cementvarefabrik,
Middelfart Municipality,
Middelfart Water Utility Company,
Smith Innovation, Realdania

DATA 1
Seattle, Washington, USA

Challenge

In many cities, untreated stormwater from roads and highways runs into natural bodies of water. Brake dust, motor oil, gasoline, tire particles and heavy metals wash directly into lakes, rivers and streams where aquatic life consequently suffers from the accumulated toxins. Humans also suffer the consequences of polluted regional watersheds, which is the source for drinking water in many urban areas, as well as localised exposure to polluted recreation landscapes, as when swimming or boating.

Contribution

In Seattle, the heavily trafficked Aurora Bridge crosses Lake Union; a large freshwater lake within the city and a key point in the primary spawning route for salmon headed from Puget Sound to the rivers east of Lake Washington. The bridge's stormwater runoff flows directly into these spawning waters, and it is approximately eight times more polluted than average highway runoff. Researchers, developers, architects and engineers have designed a landscape with bioretention cells. The cells' biofiltration using soil, gravel and plants dramatically reduces the level of toxins in this runoff, resulting in healthier waterways and providing the dense city with a welcomed green public space.

The landscape now removes toxic contaminants from more than 750,000 litres of polluted stormwater each year by slowing the flow and acting like a filter before the remaining water ends up in the lake. A host of microbes in the soil break down the pollutants while plants uptake excess nutrients.

Tests show that not only are nearly 70% of contaminants removed from the stormwater, the majority of the water is also absorbed by the soil as it flows through the cells, meaning that much of the runoff does not make it to the lake at all. The bioretention cells thereby benefit in both improving the stormwater's quality and reducing the stormwater volume altogether. The solution is rooted in natural processes and could be replicated in other communities. During the process, an NGO was founded to raise awareness and funds to treat the many other stormwater outfalls and bridges around Lake Union, and it will eventually scale up to treat other waterways.

Origin/team
Troll Ave, LLC, Weber Thompson, Pennon Construction Company, KPFF, DCI Engineers, WSP, Sazan Group, Technical Resources Consultants, Heffron Transportation, Inc., PanGEO, Morrison Hershfield, Foster Pepper, Lerch Bates, Urban Relations

Photos: Built Work Photography

Warka Village

Mvoungangomi, Kribi, Cameroon

Challenge

In Central Africa, pygmy communities are challenged as the resources they need to sustain their communities are increasingly limited. As the tropical rainforest areas that the communities inhabit are being drastically reduced every year, and converted to plantations and agricultural farmland, scarcity and poor quality of food and water threaten the pygmy peoples' existence.[1]

Contribution

Pygmy communities are traditionally hunter-gatherers who make their living in the tropical rainforests. The communities have traditionally been nomadic, moving from one area to another in the search for resources, but are now increasingly dependent on defined settlements.

The Warka Village project is a collaborative development project between the NGO Warka and the pygmy Bagyeli community, located in the middle of the rainforest with no roads or infrastructure linking it to the nearby city of Kribi, 40 km away. The collaboration aims to enhance the living conditions of the community by providing potable water and proper sanitation and hygiene without compromising the peoples' culture of isolated, rural living. The village consists of seven homes/shelters that are inspired by the region's vernacular dwellings, and it features rainwater towers, toilets, a pavilion and a modular edible garden that provides food for the 30+ villagers.

Central to the village are the two towers designed to collect and harvest potable water from the air.[2] The towers distribute between 40 to 80 litres of clean drinking water every day, minimising the health risk of drinking water directly from the rivers or from water saved in unsanitary pots or barrels. The composting toilets that operate without flushing water also enhance hygiene and reduce the risk of disease in the village and establish a simple system for waste management, so that the community can obtain a healthy way of living in the village permanently.

The village is built using local and natural materials, such as bamboo, palm leaves, wood and earth, as well as ancient local construction techniques.

Origin/team
Warka Water,
Arturo Vittori,
The Bagyeli Community

Photos: Arturo Vittori & Warka Water

7 AFFORDABLE AND CLEAN ENERGY

Ensure access to affordable, reliable, sustainable and modern energy for all

Our everyday lives depend on reliable and affordable energy services to function smoothly and to develop equitably. In fact, energy is central to nearly every major challenge and opportunity the world faces today. Be it for jobs, security, climate change, food production or increasing incomes, access to energy for all is essential.

Focusing on universal access to energy, increased energy efficiency and the increased use of renewable energy through new economic and job opportunities is crucial to creating more sustainable and inclusive communities and resilience to environmental issues like climate change.

However, the challenge is far from being solved and there needs to be more access to clean fuel and technology and more progress needs to be made regarding integrating renewable energy into end-use applications in buildings, transport and industry.[1]

To find out more about Goal #7, visit:
https://www.un.org/sustainabledevelopment/energy/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/energy/

The built environment is a major source of energy consumption throughout the life cycle of buildings and structures; from the extraction of raw materials and production of components, over the construction of buildings and structures, to the energy consumed throughout a building or structure's lifetime, to energy used in disassembly and finally disposal or reuse.

Buildings must be designed both to limit energy consumption in use, for example by using materials and layouts that minimise overheating, and to produce and recycle energy, for example by storing excess heat during the day and employing it at night. This means designing and constructing buildings, settlements and urban areas that employ appropriate energy technology under the given geographical, climatic and cultural conditions. Examples of this includes the use of daylight, natural ventilation or a choice of materials that support heating or cooling, such as heavy exterior walls in a hot and dry climate. Solutions that would consume a high level of energy in use in a given context must be avoided, such as exposed all-glass facades in a hot climate. The built environment can also contribute through the development of solutions that employ innovative sources of renewable energy.

Building and planning must be approached with a focus on total energy consumption through the whole life cycle. As part of this, energy-intensive materials and materials produced with non-clean energy, such as coal-fired bricks, must be phased out or find new forms.

2226 Emmenweid

Emmenbrücke, Switzerland

Challenge

Energy efficiency and performance in modern buildings is too often achieved by means of energy and service demanding high-tech solutions. Even though ventilation and heating systems have achieved profound energy efficiency, we are not able to control the disruptive factor of human beings and our changing needs. For example, opening a window is a pleasure that many enjoy, but at the same time the physical connection with the outside world represents a disturbing factor in automatic systems. When we optimise the anatomy of the building to improve its performance and reduce energy consumption, we can save a lot of energy with a few simple and robust design measures.

Contribution

The numbers in the building project's name, '2226 Emmenweid', refer to the interior temperature which ranges from 22 to 26°C at all times, achieved through principles of the building's anatomy and physical framework. Without heating, cooling or mechanical ventilation, the steady temperature is achieved only by the radiant heat from users of the building, equipment and lighting, the thermal mass of the walls, and the sun. Sensor-controlled ventilation panels control the temperature and CO_2 levels and ensure a comfortable environment whatever the season. Double-skinned walls, of almost 80 cm in thickness, and the restrained use of glass keeps the temperature stable. The additional cost of the construction and building materials can be saved on operating expenses.

Origin/team
Client: BRUN Real Estate AG,
Architecture: Baumschlager Eberle Architekten,
Landscape design: USUS Landschaftsarchitektur AG,
Interior design: Baumschlager Eberle Architekten

Photos: Roger Frei

Energy Bunker

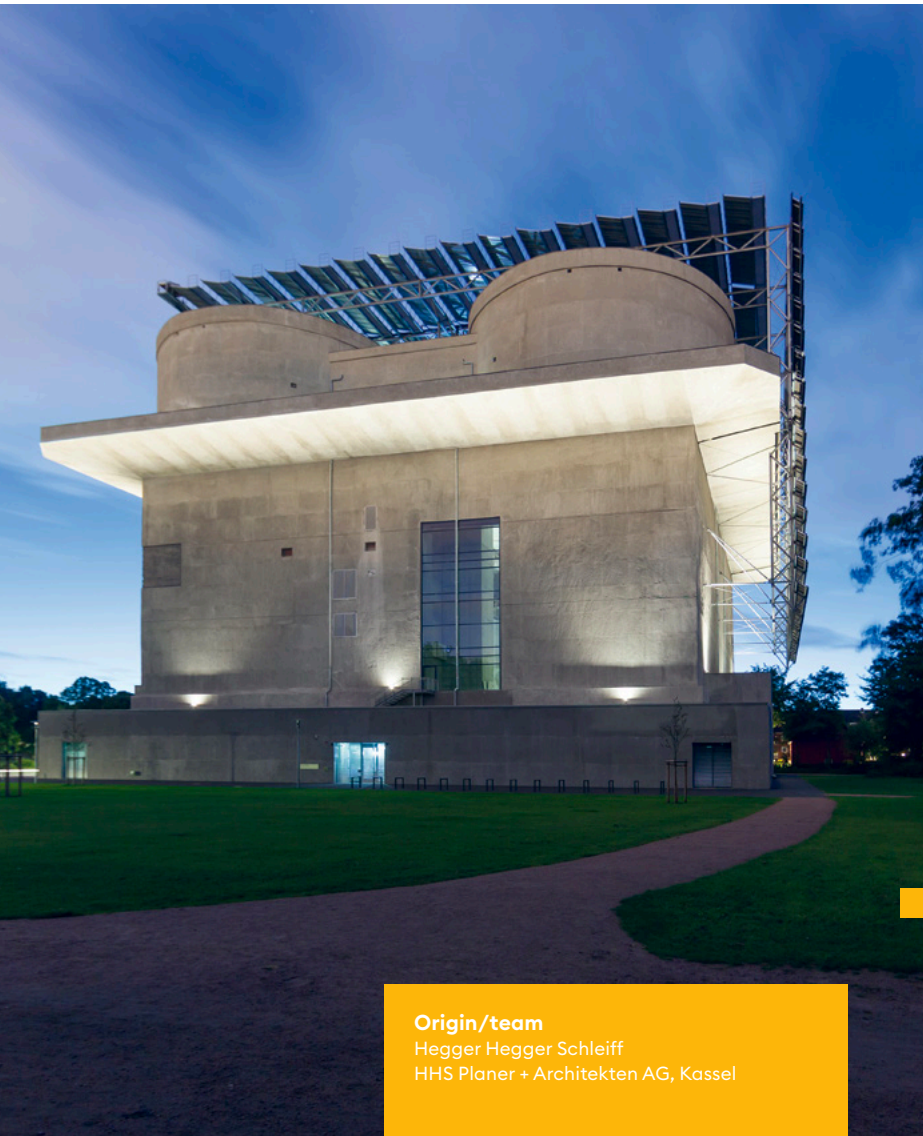
Wilhelmsburg, Germany

Challenge

The deployment of decentralised renewable energy is fuelling a transformation of the energy sector. The rapid growth of decentralised renewable energy technologies helps change the structure of the energy sector towards a multi-actor set-up in which large utilities interact with self-producing consumers and mini-utilities. Accelerating the deployment of decentralised renewable energy can drive energy solutions that are both sustainable and more in line with people's needs, in particular those who prioritise energy services with other development co-benefits. The focus of energy access is therefore not just wiring and poles but quality supply that supports local economic activities and sustainable development.[1]

Contribution

As a local power plant, the Energy Bunker represents a decentralised energy policy that creates local jobs and income.[2] The former anti-aircraft bunker in the urban district of Wilhelmsburg has been transformed into an "energy bunker". Largely destroyed internally and unused for around 60 years, the tower has now seen substantial renovation in preparation for public use and as the technical control centre for a district heating system for the neighbouring residential areas. The design provides for two different uses: public and technical. The upper floors house a museum in which one of the gun emplacements in the turrets is transformed into an exhibition area. A museum café is located beneath the exhibition areas, and the existing cantilevered area is used as an all-round terrace. The lower floors house the technical centre of the energy plant in which a range of novel innovations are combined into what will eventually become an environmentally-friendly electrical supply and district heating system. Among them are a buffer reservoir for hot water, a solar collector façade and a roof-mounted photovoltaic surface. Subtle architectural elements on the anti-aircraft bunker suggest the new, civil uses while preserving the building's original character.



Origin/team
Hegger Hegger Schleiff
HHS Planer + Architekten AG, Kassel

Photo: Frieder Blickle

Lycée Schorge Secondary School
Koudougou, Burkina Faso

Challenge
The building sector continues to grow, especially in African and Asian regions where urbanisation is rapidly increasing. In order to reduce energy consumption in the sector, we need to reduce operational costs, the embedded energy in building materials, transport emissions, construction and maintenance. This can be done by sourcing locally, designing for disassembly, designing with awareness and the use of passive measures, using low impact materials, and sustainable and renewable energy.

Contribution
In Koudougou, the third most populated city in Burkina Faso, Kéré Architecture has built a school, together with local partners, that sets an architectural example by displaying locally sourced building materials while also setting a new standard for educational excellence in the region.

The design for the school consists of 9 modules that accommodate a series of classrooms, administration rooms and a dental clinic for the students. Centred on optimising passive measures, both the built anatomy and the building materials chosen contribute to create a naturally ventilated, comfortable indoor space; the walls are made from locally harvested laterite stone which, together with the unique wind-catching towers and the overhanging roofs, lowers the temperature of the interior spaces exponentially. Other features that help naturally ventilate and illuminate the interiors are a massive undulating ceiling and a system of wooden screens that acts as a shading element for the spaces inside. In order to minimise the amount of materials transported to the site, the school furniture inside the classrooms is made from local hardwoods and leftover elements from the main building construction, such as steel scraps from the roof. The architecture not only functions as a marker in the landscape, it is also a testament to how local materials, in combination with creativity and teamwork, can be transformed into something significant with profound, lasting effects.

Origin/team
Architect: Kéré Architecture, Diébédo Francis Kéré. Construction management and supervision: Association Dolai, Diébédo Francis Kéré, Marta Migliorini, Nataniel Sawadogo, Wéneyida Kéré

Photos: Andrea Maretto

Photo: Andrea Maretto

Tverråa Hydropower Plant

Tosbotn, Norway

Challenge

Hydropower has a great potential in the transition towards renewable energy because it provides the best CO_2 performance, highest energy efficiency rate and longest life span of all power generation technologies.[1] Having a very low environmental impact on a global scale, the impact of hydropower in a local scale, however, can be damaging to wildlife habitats and, when implemented in a larger scale, it can cause a disturbance of the downstream water balance and water supply.

Contribution

Possessing abundant natural resources and ideal topography for hydropower, Norway gets more than 99% of its total power production from hydropower.[2] Worldwide, hydropower contributes to around one sixth of the total electricity supply. Large areas of Norway are sparsely populated and therefore dependent on this kind of decentral energy supply. Helgelands Kraft AS produces hydraulic power in Northern Norway, and in 2015 they decided to build five new power plants in Tosbotn, a northern peripheral region of Norway. Apart from providing 6,500 homes with clean electricity, their aim with the new hydro power plants is to bring attention to hydropower and its environmental benefits. They do this by turning the hydro power plants into tourist destinations and fitting them respectfully into the spectacular Norwegian landscape. The plants are built with materials that complement the surrounding landscapes' character, and the outdoor spaces have been designed to support the visitors' experience of hydropower and the force of the Norwegian landscape. From the bridge in front of the Tverråa Hydropower Plant, visitors can for example experience the display of strong natural forces as the water flows through the plant, and they can get a close look at the streaming water. The Tverråa plant provides electricity to 820 homes, equivalent to 16 GWh.

Origin/team
Helgeland Kraft AS,
Ncc Norge AS, Istak Ldt,
Sweco Norge AS

Photos: Helgeland Kraft AS

8 DECENT WORK AND ECONOMIC GROWTH

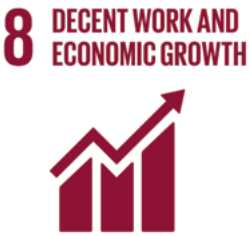
Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

Today, roughly half the world's population still lives on the equivalent of about US$2 a day with global unemployment rates of 5.7%, and having a job doesn't guarantee the ability to escape from poverty in many places. This slow and uneven progress requires us to rethink and retool our economic and social policies aimed at eradicating poverty.[1]

Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs that stimulate the economy while not harming the environment. Job opportunities and decent working conditions are also required for the whole working age population.

To find out more about Goal #8, visit:
https://www.un.org/sustainabledevelopment/economic-growth/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/economic-growth/



The built environment interacts with decent work and economic growth on both a planning level and on a building level.

Safe public spaces and affordable transit routes to the workplace are crucial for finding employment. The ability to move from home to a workplace, and the time spent in transit, determines what jobs are available, making healthy and safe public space and transportation systems key to citizens' access to work. Cities and settlements must also be planned and designed so that poor and marginalised citizens have access to a business outlet, such as a marketplace, where local produce, handicrafts and other services can be bought and sold. Workplaces must be designed so that they support healthy, accessible and productive work environments for all employees, including access to sanitation and a spatial organisation that makes social distancing possible when needed. Investing in good working conditions backs a company's economic growth through higher productivity and fewer sick days.

In the building industry, focus is needed on decent working conditions and safety for workers. This entails the use of materials extracted and produced in safe and clean working environments as well as secure and controlled working conditions on building sites and in demolition processes. Furthermore, by emphasising investment in human resources, the industry can develop towards more sustainable economic growth by using increased skills and knowledge to reduce the amount of raw materials and energy needed, while improving productivity.

Examples of this can be found in planning projects for informal settlements, in state-of-the-art office buildings and in capacity-building initiatives.

Azraq School

Azraq, Jordan

Challenge

Since 2011, the population of Azraq, a small city in Jordan, has increased from 12,000 to over 20,000 with the arrival of Syrian, Iraqi and Yemeni refugees. Among the 8,000+ refugees, about 50% are children between the age of 0-17 years. Lack of resources and skills to build up capacity in the host community and amongst the refugees means that most of the newcomers lack facilities to cover basic needs. As an example, it is estimated that 3 out of 5 children are out of school due to a lack of capacity in the pre-existing eight schools in town. Lack of capacity in the school system is not unique to Azraq, but a global challenge recurring in many areas that receive an influx of refugees.

Contribution

As part of expanding the school capacity in Azraq, and at the same time increasing capacity building for the refugees and for impoverished Jordanians, EAHR combined the building of a new school with education and employment of local, unskilled workers. Provision of the facilities was conducted through a participatory and capacity-building process where locals were active participants in constructing the facility.

The school is built of compressed earth bricks; a building technique that enables locals to work with locally available tools and construct from locally available and abundant materials. Fifty-seven locals learned to build with this construction technique and were hired for the construction process, supporting nearly fifty-five families for a period of four months. The education facility ultimately allows 200 out-of-school children (from age 9 to 18+) a week to attend formal class education, leading to their possible achievement of a Tawjeehe, which is a formal high-school qualification. The buildings include a library, an information and communication technology classroom, three toilets, a kitchen, a resting area providing shade and a football field. The goal was to increase the enrolment and attendance rate of Syrian refugees and underprivileged Jordanians in Azraq, improving curricular educational activities and out-of-school vocational trainings, and especially strengthening community cohesion and self-reliance.

Origin/team
Emergency Architecture & Human Rights (EAHR), Architecture for Refugees Switzerland, Black Stone Engineering, Francesco Stefilongo Engineer, Salvador Gomis, Bóvedas Tabicadas, Dr. Mohammad Abdelqader Engineer.

Photos: Chiara Garbelotto

Mount Sinai Ambulatory Surgical Facility

Kyabirwa, Uganda

Challenge

Access to qualified surgical therapy is essential to the treatment and cure of many illnesses. In developing countries, roughly five billion people lack any form of safe or affordable surgery, which results in millions of deaths each year.[1] One of the main reasons for this situation is that the educational facilities to educate surgeons are not available and that local surgeons in rural areas lack professional peers, training and inspiration in order for them to maintain and develop their skills.

Contribution

A new hospital in Uganda utilises modern technology to create a self-sustaining surgical facility in a resource-poor area. The project includes an integrated, self-sufficient infrastructure for clean water, power, and sewage disposal, minimising the dependence on insecure and frequently unavailable local infrastructure. This includes solar power with battery storage, which can keep the facility running for two days, the use of grey water to flush toilets, natural light and ventilation. The only air conditioning is in operating rooms to provide a sterile environment. An essential aspect of the project's infrastructure is a reliable internet connection. Twenty miles of underground cabling brings fibre-optic service to the site.

The internet connection keeps the surgical facility directly linked to the internationally renowned Mount Sinai Hospital in New York through telemedicine links. These digital links provide the facility with real-time advanced surgical consultation and operating room video conferencing. Patients and the staff benefit from the decades of experience and the internationally acknowledged specialists working at the Mount Sinai facilities in New York.

While the surgical staff in Kyabirwa is supported by colleagues in New York, the exchange goes both ways. Students and staff of the New York facilities can also visit and train in Uganda, which gives them a unique education in surgery in developing countries and resource-scarce areas and allows them to learn from the local specialists working in Kyabirwa. The building itself was designed as a simple construction so that it could

be built and maintained using local materials, building practices and labour. The building's regionally sourced bricks are composed in complex patterns of varying densities, forming screens that let in light and air through exterior walls. The bricks and cladding tiles used in the facility were made from red clay dug directly out of the ground near the building site and fired in a local kiln. Brick was chosen for this project because of its availability, its historical presence in the area, and the potential to support the local economy through its use.

Origin/team
Mount Sinai Health System New York, Kliment Halsband Architects,
George Everest Nile Precision Surveys Jinja,
Silman Structural Engineers,
Keltron Development Services

Photo: Bob Ditty

Photos: Kliment Halsband Architects

Facebook Bayfront Campus

Menlo Park, California, USA

Challenge

The SDGs promote sustained and economic growth, higher levels of productivity and technological innovation through decent physical and psychosocial working conditions.[1] Corporations must comply with human rights and make an effort to offer their employees decent conditions, counting the whole chain of production across borders and disciplines. Improving working conditions promotes productivity, the rate of innovation and reduces sick leave,[2] making decent work a requisite for sustainable growth.

Contribution

With the expansion and refurbishment of Facebook's headquarters in Menlo Park, California, the landscape and buildings are designed to increase community connectivity, provide public access, create plant and wildlife habitats and to reflect the culture of the business. It is designed as a network of civic spaces and landscapes that increase community connectivity, provide public access and create habitats.

The headquarters is located in a post-industrial brownfield area; a former tidal wetland system that has since been divided into salt flats for the production of industrial salts. The salt flats have become the habitat for several endangered species, and with the growth of Silicon Valley, the area is now a complex mosaic of industry, ecology and infrastructure.

The planning of the Bayfront Campus is rooted in ecological principles, creating a layered environment that is biodiverse, social, natural and urban. Focused on restoring the brownfield site to a resilient landscape, the design merges the functional needs of the workplace culture with the habitat created by establishing natural systems. The landscape pulls through the building to activate courtyards and gardens at the office level, climbs up terraces where drought and wind-tolerant plant communities cluster along the edges, and emerges onto the roof. Art, ecology and social spaces are interwoven to create a vital and biodiverse habitat and a synthesis of built and natural systems that help foster connections between employees and their broader environment.

Origin/team
Facebook,
Gehry Partners, CMG
Landscape Architecture,
BKF Engineers,
Kier + Wright,
Level 10 Construction,
Brightview, Jensen,
Forell/Elsesser Engineers,
PAE Consulting Engineers,
L'Observatoire International,
Lightswitch,
Fehr & Peers Associates,
Cornerstone Earth Group,
RMA, SBCA Tree,
Cornerstone Earth Group,
City of Menlo Park Building
Division

Photos: MPK20 - Marion Brenner

Cassia Co-op Training Centre

Sungai Penuh, Kerinchi, Sumatra, Indonesia

Challenge

The Indonesian island of Sumatra supplies 85% of the world's cinnamon consumption. Cinnamon is an inherently sustainable crop; it grows back immediately after harvest, and the forests grow naturally without the aid of agrochemicals and are intercropped with other trees and plants.[1] However, local workers are often without labour rights, underpaid and working long days in unsafe and unsanitary factories.

Contribution

Cassia Co-op Training Centre is a centre for cinnamon production in Kerinchi, Sumatra, built to advance socially sustainable production. The factory is constructed to be sanitary and safe, and farmers and workers receive a living wage, healthcare and access to schools and training. Cassia Co-op is able to offer a higher salary by reducing the number of stakeholders between farmers and customers.[2]

The complex is built as a light wooden construction on a base of heavy brick and concrete. It offers a naturally ventilated climate, beneath a roof surface of 600 square metres, through the use of thermal mass, reduction of sunrays and maximised eaves. Underneath the massive roof surface are five brick buildings, amongst them a small laboratory, classrooms, offices and a kitchen. The project is based on two materials; locally crafted brick and wood from cinnamon trees. The wood is a biproduct from the cinnamon production and is applied in everything from the main construction to the interior of the centre.

Frequent earthquakes present a major challenge to building in the area. The light construction, separates different building components with different material frequency, which makes it earthquake resilient, and the compound has already survived several severe earthquakes.

The centre was constructed in only three months and completed in 2011. Seventy local workers took part, the architects participated and oversaw the construction and eight water buffaloes hauled trees from the forest to an on-site sawmill.

Origin/team
TYIN tegnestue with local workers, Patrick Barthelemy

Photos: Pasi Aalto / pasiaalto.com

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation

Economic growth, social development and climate action are heavily dependent on investments in infrastructure, sustainable industrial development and technological progress. In the face of a rapidly changing global economic landscape and increasing inequalities, sustained growth must therefore include industrialisation that first of all, makes opportunities accessible to all people, and secondly, is supported by innovation and resilient infrastructure.[1]

To find out more about Goal #9, visit:
https://www.un.org/sustainabledevelopment/infrastructure-industrialization/

[1] Extract from UN report WHY IT MATTERS – INDUSTRY, INNOVATION AND INFRASTRUCTURE – PDF.

The building industry is producing massive amounts of waste and consuming large amounts of natural resources and energy. Further to this, the transportation and production of building components globally rather than locally carry environmental as well as humane costs.

Advancing sustainability in the built environment requires a development of industry and industrial infrastructure away from current practice and towards new ways of producing and assembling. We must develop our industry, its services, products and transportation systems to pollute less, tie up less energy, produce less waste and provide solutions that are safer and healthier than current standards.

The building industry is by nature site specific, and we must aim at utilising local industries and advancing the development of sustainable products locally, in all countries. This requires the development of both physical and digital infrastructures to promote more sustainable trade and coexistence, including much more focus on the industry's use of local materials and resources. Where advanced industry is available, the focus is on the development of products that improve existing standards and raise the level of sustainability, for example by moving from a focus on no waste in production to a focus on no waste in a life-cycle perspective. This requires training and the development of new competences at all levels in the building industry as well as research and prototypes for testing the potential of new tools, processes and solutions. The resulting innovations in industry must continuously be measured against a culturally and climatically site-specific impact on sustainability.

Folden
Roskilde, Denmark

Challenge
A rising global population increases the need for adequate and affordable housing all the while carbon emissions caused by the building industry urgently need to be reduced. This calls for a drastic change in the way we build. Industrial production and prefabrication, with its efficient and controlled processes, has a potential to contribute to the reduction of carbon emissions and the ecological footprint of the materials we use.

Contribution
One fifth of all dwellings in Denmark are known as 'almene boliger'. This is a Danish brand of social housing co-owned and governed by residents, which means that residents live under a certain set of regulations where no one profits from the rent and the rent is cost-related.[1] In Roskilde, Denmark, 60 family units – including 6 units for marginalised residents – have been built using prefabricated box modules and a high level of energy optimisation. The box system is not only cheaper than conventional concrete modules, it is also less resource and energy-consuming and thereby more sustainable.

The box housing typology has been planned and developed in a partnership between architects and manufacturers, which means that all principles, details, materials and procedures are optimised for industrial production, thereby lowering the cost and maximising the quality within a strict budget. The box system consists of largescale wood-based modules that are industrially produced and easily assembled on site. This reduces the time consumption during the erection process. Box modules with a slim body and varying depths create an interesting and variable expression and make it possible to optimise the inflow of light and the utilisation of space. An example of the benefits of close collaboration between architect and manufacturer is the introduction of a solid wood staircase. The internal staircase in exposed wood was included in the prefabrication stage because it proved to have a stabilising effect on the box modules during transport, which reduced the cost of repairs on site.

Photo: TM&E

Origin/team
KAB,
Høje Tåstrup Boligselskab,
Vandkunsten Architects,
DEM and Tyréns,
BM Byggeindustri

Photo: Vandkunsten

Alnatura Campus
Darmstadt, Germany

Challenge
Industrialisation processes in the building industry have largely led to building materials being produced and processed away from the place where the construction takes place. This causes carbon emissions through transport. Aiming for a more sustainable practice, we must utilise and build on the knowledge embedded in local building techniques, craftsmanship and the local materials carefully developed through centuries.

Contribution
The new headquarters in Darmstadt for Alnatura, a retailer of organic groceries, has a gross area of 13,500 square metres and a mixed programme of workspaces, a public kindergarten, a vegetarian restaurant and gardens that can be rented for one garden season by anyone, including schools. At the time of its completion in 2019, it was Europe's largest office building with an external façade of rammed earth walls. This is made possible by using prefabricated rammed earth elements developed by Lehm Ton Erde. Here, prefabricated rammed earth wall panels are developed with thermal heating piping integrated directly into the wall system and with a weather-independent production and drying process conducted entirely within a production hall. A middle insulation layer of 12 cm foam-glass granulate is integrated for this type of panel, although the heat storing capacity of the material already has a very high potential. Despite the industrial prefabrication, a high degree of customisation can be achieved through detailing, which allows a flexible and variable execution. Other advantages of rammed earth include the fact that the required mixture of silt, sand and gravel occurs in nature in most parts of the world, that the material is solid – with a density comparable to concrete – and that it is fully recyclable.

Locally extracted earth reflects local colours, varying from white to light beige, yellow to ochre, brown to grey, blue and red, making the prefabricated rammed earth elements an integrated and familiar part of its context and building culture. Building and monitoring the Alnatura Campus was part of developing and upscaling rammed earth as a contemporary building material, and the development demanded the engagement of both researchers, producers, architects, developers and consumers.

Photo: Eduardo Perez

Origin/team
Alnatura Campus:
Campus 360,
haas cook zemmrich Studio2050,
Transsolar Energietechnik,
Flachglas Wernberg,
Lehm Ton Erde Baukunst,
Knippers Helbig, Stuttgart, TU München,
Ramboll Studio Dreiseitl
are amongst the contributors

Photo: Lars Gruber

Ilima Primary School

Ilima, Democratic Republic of Congo

Challenge

As globalisation continues to centralise societies' core institutions in large cities, the smaller and more remote communities risk being left behind. Many villages and communities are isolated and have limited access to education and work. Strengthening these remote communities, which experience a lack of infrastructure and are disconnected from supply chains, is part of an overarching agenda of sustainable development of local industry. To develop local industry and infrastructure we must spend more time on human capacity building, advancing manufacturing techniques and processes in the local context.

Contribution

The Ilima community is one of the most isolated in the world, located deep in the jungle of the Democratic Republic of Congo. For generations, the people have coexisted with wildlife in the surrounding forest, but modern development has caused the fragile ecosystem to suffer. The African Wildlife Foundation recognised Ilima as one of thirty-five locations in need of investment as part of their African Conservation Schools initiative. The mission of this initiative is to protect people and wildlife by focusing specifically on primary education and agricultural training as a paradigm for how wildlife conservation can improve lives through community empowerment. As they designed and constructed the school, the team worked from the assumption that conservation and development are most feasible when communities are given the opportunity to develop in harmony with their surrounding natural environment. With all materials sourced from the country, and 99% being sourced from within ten kilometres of the site, the construction was dependant on the local craftsmen and builders' unique knowledge of the site, the natural resources and the local vernacular construction methods. The construction employed custom hardwood shingles, adobe earth blocks and wooden beams made exclusively from local materials harvested on and around the site. The design and construction of Ilima Primary School demonstrates how challenges relating to remoteness or isolation and extreme climate conditions can be overcome by seizing local opportunities in order to reduce both economic costs and the carbon footprint. The team found that the construction

emitted 307,000 kilograms less carbon than the global average for a similarly sized school project. Additionally, 120 people from the local community were employed in the construction, thereby strengthening not only the physical facilities in the community but also local capacity building by creating jobs and providing training in construction-related crafts. The finished building uses natural light and ventilation and operates independently of the country's energy grid, making it a fully integrated part of the Ilima village ecosystem.

Photo: Thatcher Bean

Origin/team
Ilima, Équateur Province, DRC, African Wildlife Foundation, MASS Design Group, ARUP, Ekongo Modogo, Ziko Lokuli, Camile Abiyo

Photo: Thatcher Bean

EcoCocon
Stupava, Slovakia

Challenge
11% of all carbon emissions in the world come from embodied carbon emissions associated with material production and construction processes throughout a building's lifespan.[1] In order to reduce carbon emissions, the building industry must do things differently. New materials, methods and processes can innovate the way we design and build to make the building industry more sustainable. But can these innovations also compete with the existing materials and processes when it comes to time and economy?

Contribution
Modular building materials and mass production are often associated with post-war construction using concrete and steel, and therefore also with large carbon footprints. However, modularity and mass production can be combined with local, natural, renewable materials and make for sustainable and accessible alternatives to concrete.

The EcoCocon panel is a modular wall element consisting of 98% natural, renewable materials, using mainly straw and wood. The concept is based on an ambition to create affordable buildings made of renewable, healthy, local materials. The panels' straw and wood can be returned safely to nature after use and therefore leave a minimal ecological footprint as natural materials demand little to no processing. Straw and wood, for instance, have a negative material value, meaning that the building material obtains (while in growth) and stores (while in use) CO_2 rather than produces it,[2] contrary to materials like concrete and steel.[3]

In a single-family home in Stupava, Slovakia, constructed using EcoCocon, the straw alone stores 11,500kg CO_2. The house is a certified Passive House which requires little energy for space heating or cooling. This means that it is not only cheap to construct but also to live in. EcoCocon is working through local partners in 21 European countries.

Photo: Bjorn Kierulf CREATERRA

Origin/team
EcoCocon, Architectural studio
CREATERRA

Photo: Bill Steen, CREATERRA

Shelter for All

Numerous locations, Pakistan

Challenge

Pakistan is geographically located on a highly active fault line of continental crusts that makes the country prone to earthquakes. Through history, the seismic activity has killed hundred thousands of people and made millions homeless[1]. Earthquakes destroy buildings and infrastructure and have the capacity to move immense amounts of water, which can cause tsunamis in coastal zones. Furthermore, the country suffers recurring floods due to the melting of glaciers in the north, and architecture in these regions must therefore be resistant to both earthquakes and floods and accommodate all residents, rich as poor.

Contribution

In 2005, a quake measuring 7.6 on the Richter scale struck the Kashmir region in Pakistan and killed at least 73,000 people and made more than 3.3 million homeless[1]. Since this disaster, and the frequently recurring floods, a team led by the Pakistani architect Yasmeen Lari has refined design and construction techniques for disaster relief shelters and have helped develop over 50,000 bamboo, lime and mud shelters in northern Pakistan and the Sindh province.

The structures are designed as low cost, low carbon footprint shelters, using local materials and technologies and utilising student volunteers, local, trained artisans and villagers to support capacity building in local communities. The shelters consist of adobe/mud walls and strong bamboo cross-braced structures *(dhijji)* that have proven to be a seismic resistant structural technique. The shelters vary in size, the biggest ones can accommodate up to 5 persons, and include a veranda, kitchen, toilet and bath. The strategy involves avoiding wood and instead makes use of a fast-growing bamboo in order to avoid illegal logging. Also, the use of local materials, such as clay soil and lime, helps economic regeneration within affected communities. Mud structures, especially with the use of lime renderings, create a well-insulated, comfortable habitat suited for the local climate which can entail both extreme heat, rain and humidity. Using simple, indigenous materials and techniques, the team has succeeded in local capacity building and developing flood and earthquake-resistant houses that are both cost-effective and sustainable.

As part of the capacity building, a women's centre has been built in Moak Sharif in 2011-2015 to provide a place for women to socialise and share training in 'barefoot' enterprises.

Origin/team
Heritage Foundation of Pakistan

Photo: Heritage Foundation of Pakistan

10 REDUCED INEQUALITIES

Reduce inequality within and among countries

Inequalities based on income, sex, age, disability, sexual orientation, race, class, ethnicity, religion and opportunity continue to persist across the world, within and among countries. Inequality threatens long-term social and economic development, harms poverty reduction and destroys people's sense of fulfilment and self-worth. This, in turn, can breed crime, disease and environmental degradation.

Most importantly, we cannot achieve sustainable development and make the planet better for all if people are excluded from opportunities, services and the chance of having a better life. To reduce inequality within and among countries is therefore a key issue.[1]

To find out more about Goal #10, visit:
https://www.un.org/sustainabledevelopment/inequality/

[1] Extract from UN report WHY IT MATTERS – REDUCED INEQUALITIES – PDF

The built environment can act as an amplifier and enforcer of inequalities. To reduce inequalities, planning and building must prioritise design that ensures inclusion and accessibility for all, including citizens that are marginalised, at risk or living with a disability.

Citizens with disabilities risk being restricted to their homes, or unable to hold a job, because stairs, steps, information systems, acoustics and other design features can make streets, transportation systems and institutions inaccessible. Religious and ethnic minorities, LGBT+ citizens and women experience being confined to designated areas or secluded from educational institutions and leisure facilities. Landscape qualities, like a beach or a view, can be closed to the public through design and planning that make them accessible only to owners or customers.

To reduce inequalities, architecture must be designed and executed so that it is socially responsible, inclusive and takes into consideration the needs of all members of society, leaving no one behind. Buildings, settlements and urban areas must be designed with accessibility as a core functionality; from ensuring even surfaces, lifts, ramps and wayfinding features to giving attention to doorways and the height of utilities. It also means that social responsibility and inclusiveness must guide the programming, planning and design of buildings and urban areas so that they support and allow use by all, with respect to local culture and needs. Examples span from state-of-the-art institutions adhering to universal design, over initiatives supporting specific at-need groups, to communities designed to include and prioritise marginalised citizens.

Step Up on 5th

Santa Monica, California, USA

Challenge

In the USA, about 600,000 people are homeless on any given night and 2 million at some time in any given year. About a quarter to a third of the homeless suffer from a serious mental illness.[1] While the connection between homelessness and mental illness is broadly recognised it is also a complex one with multiple parameters potentially amplifying each other. Several studies have shown, however, that individuals with a mental illness often find themselves homeless primarily as the result of poverty and a lack of low-income housing. Programmes that provide long-term (a year or longer) stable housing for people with a mental illness can help to improve mental health outcomes, including reducing the number of visits to inpatient psychiatric hospitals.[2]

Contribution

Step Up on 5th provides a home, support services and rehabilitation for the homeless and mentally disabled population of Santa Monica, California. The new structure provides 46 studio apartments of permanent affordable housing. The facility is developed by Step Up on Second and A Community of Friends, a charitable organisation, with a mission to end homelessness through the provision of high-quality, permanent supportive housing for people with mental illness. The building distinguishes itself from most conventionally developed projects in that it incorporates energy-efficient measures that exceed standard practice, optimise building performance and ensure reduced energy use during all phases of construction and occupancy. The planning and design of Step Up on 5th emerged from close consideration and employment of passive design strategies. These strategies include: locating and orienting the building to control solar cooling loads; shaping and orienting the building for exposure to prevailing winds; shaping the building to induce buoyancy for natural ventilation; designing windows to maximise day lighting, and more. These passive strategies alone make this building 50% more energy efficient than a conventionally designed structure.

Origin/team
Architect: Brooks + Scarpa
Principal-in-Charge:
Angela Brooks, AIA
Design Architect:
Lawrence Scarpa, FAIA

Photos: John Linden Photography

Farming Kindergarten

Ho Chi Minh City, Vietnam

Challenge

Reducing inequality is multifaceted and includes empowering women through education and accessible public service that helps support families and advance gender equality. In many developing countries, women have left the domestic domain to work, yet they still have the primary household and caretaking responsibility. Globally, women do three times as much unpaid care and domestic work as men, including the majority of child-care. Often, services that support working women are either not in place or are not affordable, and many women must rely on networks of relatives and friends to take care of their children or bring the children to their workplace. Therefore, high-quality and affordable childcare services for working parents are a key part of a social protection system, as it allows women to increase their income, thereby boosting gender equality.[1]

Contribution

One of the biggest industrial areas in Vietnam is located in the outskirts of Ho Chi Minh City in a typical tropical monsoon climate. In this area, a shoe factory employs 20,000 workers, including 17,000 women. As a part of the social responsibility of the factory, the owner has erected a kinder-garten for 500 pre-school children, devoted to the workers' children.

The building concept is a "Farming Kindergarten" with a continuous green roof that provides food and agricultural experience for the children and functions as a safe playground. The green roof is a triple-ring shape drawn with a single stroke, creating three courtyards inside that provide safe and comfortable playgrounds for the children. As the roof lowers to the court-yard it provides access to the upper level classrooms and gardens, allowing children to experience and participate in the agricultural gardens as they traverse the roof. The green roof is designed as a vegetable garden with five different vegetables. Red spinach, mustard greens, water spinach, Malabar spinach and sweet potato leaves are planted in the 200 square metres garden for agricultural education. The kindergarten enables women with children to work, which empowers both them and their families.

The building furthermore constitutes a prototype for sustainable education spaces in tropical climates; it teaches children the importance of agriculture and the value of a close relationship with nature.

Origin/team
Client: Pouchen Vietnam
Architect: Vo Trong Nghia Architects

Photo: Hiroyuki Oki

Photo: Quang Dam

Photo: Hiroyuki Oki

Musholm Multi-Purpose Hall

Korsør, Denmark

Challenge

Physical inactivity can reduce a person's life with several years and may lead to various types of illnesses.[1] This is especially true for people with mobility disabilities, 38% of whom are physically inactive. Being unable to exercise is a severe threat to any individual's physical and mental health, but physical inactivity also means high healthcare costs for society. In Denmark, every second person with a mobility disability highlights their physical surroundings as the primary barrier keeping them from living an active life; not their own ability to do so.[2]

Contribution

Musholm is a conference and holiday facility with holiday homes, sports facilities and social functions. The expansion of Musholm with a new multi-purpose hall and 24 new holiday homes has shown how architecture can improve quality of life for people with a disability by creating room for differences. The facility is designed so that all facilities are accessible to people with disabilities and mobility challenges; it is a multifunctional powerhouse that motivates everyone – regardless of their physical abilities – to lead an active life.

The newly added multi-purpose hall includes a 110-metre-long activity ramp that encourages physical activity. With its landings and recreational zones, the ramp brings the visitors onto a plateau where wheelchair users are able to engage in activities, such as wall climbing on a customised wall featuring the world's first cable-lift for wheelchair users. In that way, Musholm becomes a place that gets people moving, no matter their disabilities, and gives them the opportunity to play, have experiences and form new social bonds.

Musholm demonstrates how architecture and landscape design can aspire to remove physical barriers so that buildings and urban spaces increasingly embrace the differences that make us human – not by smoothing out those differences but by being more inclusive.

Photo: Kirstine Mengel

Origin/team
AART architects,
Keinicke & Overgaard Architects, UrbanLab,
MOE and D & N,
Karin Bendixen,
The Danish muscular dystrophy foundation

Photo: Submarine

Re-establishing Fishermen Shacks

Conde, Brazil

Challenge

The travel and tourism sector is one of the fastest growing economic sectors in the world. According to the UN World Tourism Organization, tourism was the third-largest export category in 2019.[1] A growing number of tourists worldwide create large revenues and growth that enriches the lives of many. But tourism also puts pressure on resources and local communities when it is not carried out with respect for cultural heritage, natural habitats and the environment, and when it suppresses the livelihood of local residents.

Contribution

An increasing amount of informal beach shacks used as bars or small shops turned into an environmental problem for many coastal cities in Brazil. In order to resolve hazards relating to the informal settlements, court orders are issued demanding the demolition of shacks along several Brazilian beaches. Among these were shacks built along Praia do Amor, the "Love Beach", in the bay of Conde in the north-eastern part of Brazil.

A complete elimination of shacks at the beach included so-called *caiçaras* built to shelter fishing and sailing tools and other work materials used by the traditional fishermen community of the area. The fishermen community had made a living from fishing for generations, and the demolition of the shacks meant removing vital facilities supporting their livelihood.

In order to solve the severe and unintended effects of the court order, the Secretary of Planning in the Municipality of Paraíba initiated a series of investigative meetings with other authorities and the fishermen community, and together they found a legal solution. A team of professors and students from both a local University and a design studio conducted a 12-day community workshop to rebuild nine caiçaras from scratch.[2]

The joint effort resulted in a low-technology, low-capital, quickly built solution that is now located between the river and the sea, hereby respecting both legal boundaries and the natural water movements over the year.

Origin/team
Municipality of Conde,
Mayor of Conde, Secretary of Planning,
Coordinator of Territorial Planning,
School of Architecture and Design - Escuela de Arquitectura y Diseño - Pontificia Universidad Católica de Valparaíso 'Oficina Espacial' Design Studio

Photos: Oficina Espacial, 2018

Share Kanazawa

Kanazawa, Japan

Challenge

The world's population is getting older. People are living longer, which means that 22% of people will be over 60 years old in 2050.[1] Japan has the oldest population in the world,[2] and this demographic – combined with a negative population growth[3] – poses a challenge for the nation. The workforce will simply not be big enough to care and provide for the elderly in the future if society does not adapt to the demographic development.[4]

Contribution

Share Kanazawa is developed by a social welfare group as an affordable prototype for a 'Continuing Care Retirement Community' (CCRC). In this small-scale village in the outskirts of Kanazawa city, old and young, able and disabled live together in one community. Seniors can live here and work part-time in the village shop, in the café or care for the children with special needs, and in this way, they are invited to stay active in society longer.

The concept also provides young students with an attractive, cheaper housing option compared to the central city. The idea of mixing children, students and seniors creates a diverse community rather than a retirement home for the seniors or a caretaking institution for the children. The elderly residents and the children with special needs also share a necessity for accessibility in both housing, streets, public spaces and community facilities.

CCRCs are often placed in or outside suburbs; where land and buildings are available, where rent can be kept at an affordable level and where accessibility is easier to obtain than in the extremely dense Japanese cities. The demographically diverse communities are attractive to regional governments at risk of depopulation – attracting CCRCs means they can maintain and possibly even grow local employment opportunities, especially in thehealth care sector.[5]

Origin/team
GOI Architects,
Creation & Technology
Social Welfare Coorperation Bussien Group
http://www.bussien.com/#/

Photos: Goi Architectural Institute

11 SUSTAINABLE CITIES AND COMMUNITIES

Make cities and human settlements inclusive, safe, resilient and sustainable

Cities are hubs for ideas, commerce, culture, science, productivity, social development and much more. At their best, cities have enabled people to advance socially and economically. With the number of people living within cities projected to rise to 5 billion people – 60% of the world's population – by 2030, it is important that efficient urban planning and management practices are in place to deal with the challenges brought by urbanisation.[1]

Many challenges exist to maintaining cities in a way that continues to create jobs and prosperity without straining land and resources. Common urban challenges include congestion, lack of funds to provide basic services, a shortage of adequate housing, declining infrastructure and rising air pollution within cities.

To find out more about Goal #11, visit:
https://www.un.org/sustainabledevelopment/cities/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/cities/

The built environment is crucial to the development of sustainable cities and communities.

Architecture, design and planning contribute in multiple ways to make cities and settlements inclusive, safe, healthy, resilient and environmentally sustainable. Among key contributions are design and planning that secure affordable, accessible and healthy housing, access to sanitation, as well as buildings, public spaces and infrastructure which help to reduce the spread of diseases through design. Furthermore, public infrastructure can enhance mobility and accessibility, both between parts of a city and its surroundings, and can contribute to the reduction of pollution from transportation by enabling walking and biking.

Urban design can contribute to including all citizens by spatial organisation and designs that reduce risks of intimidation and crimes, such as assault. Consideration of the needs of marginalised and disenfranchised citizens should be included from the early stages of planning, and all levels of stakeholders should be involved in the process. Urban design should also help reduce and counteract the environmental impacts of overuse, traffic, waste, noise and light pollution in urban areas. Individual buildings, as well as building complexes and settlements, must be developed to increase resilience and robustness in the face of climate change and include vegetation and green areas to help counteract the loss of vegetation and biodiversity caused by urban growth.

Examples of this span broadly and can be found in urban renewal projects, in climate adaptation plans, in the transformation and reuse of outdated buildings and structures, and in initiatives aimed at the inclusion and support of marginalised citizens.

Artists' Residency and Cultural Center

Sinthian, Senegal

Challenge

Common space for formal or informal gatherings across cultural or social differences supports a sense of unity and community building in cities and communities. Architecture can support this sense of cohesion visually by using traditional craftsmanship that creates a sense of belonging, familiarity and ownership.

Contribution

The cultural center designed by Toshiko Mori Architect in Sinthian, Senegal, offers a diverse array of community programmes, including a performance center, a studio and workshop for visiting artists, as well as a gathering space for markets and meetings. Complementing existing facilities on the site, these locations of social and cultural exchange provide a sense of common ground for a community consisting of approximately twelve different tribes.

The structure itself is in direct conversation with the vernacular architecture of the region, taking inspiration from the traditional pitched roof, and through a process of inversion it simultaneously creates interior courtyards and shaded studio areas around the perimeter, ideal for passive ventilation. Additionally, the form of the roof allows for the collection and storage of rainwater in cisterns, fulfilling substantial domestic and agricultural water needs for the community. The climatic comfort is reinforced through multiple overhangs and spaced-brick walls that absorb heat and allow for airflow through the building interior.

Relying exclusively on local materials and construction techniques, as well as project management by local villagers, the project is designed to establish ownership, empowerment and belonging.

Origin/team
Josef and Anni Albers Foundation, Le Korsa, Toshiko Mori Architect

Photos: Iwan Baan

New Shougang High-end Industry Comprehensive Service Park

Beijing, China

Challenge

All over the world, manufacturing facilities are being relocated from urban locations to suburban or rural districts, and massive post-industrial areas are left behind and redeveloped as residential areas. In this process, we must consider the value of the post-industrial building heritage both in terms of the culture it represents and the value of the natural resources and energy that are embedded in the existing buildings and building materials used. There lies a challenge in making use of these potential values in a sustainable way.

Contribution

The major industrial area of Shougang Steel Mill, which was built in 1919 in the suburbs of Beijing, was one of the earliest modern iron and steel enterprises in China. The facility is a unique and well-preserved example of a complete industrial structure in an urban context. Due to a relocation of production in 2010, the area is now undergoing a transformation from industrial area to office district with parks and 150,000 workplaces.

Instead of demolishing all the industrial buildings, the Beijing Municipal Commission of Planning and Natural Resources approved it as a pilot project of post-industrial transformation and urban reintegration. Thanks to a renovation and transformation process, the steel mill facilities are now home to several prestigious institutions, including the Beijing 2022 Winter Olympics Organizing Committee. A pilot site of 2.9 square kilometres is planned for the north zone, which will be home to 5,000 residents and 25,000 workplaces, and includes a so-called 'woven city innovation factory' with a concentration of renovated and transformed industrial buildings.

The Shougang Park has been accepted into C40's Climate Positive Development Program – which recognises the world's most ambitious low-carbon projects – because of its "climate positive" emissions target of net-negative operational greenhouse gas emissions associated with energy, waste and transportation.[1]

Origin/team
Beijing Shougang Construction Investment Co.,
material provided by China Academy of Building Research

Photos: China Academy og Building Research

Large-scale Urban Planning in Nordhavn

Copenhagen, Denmark

Challenge

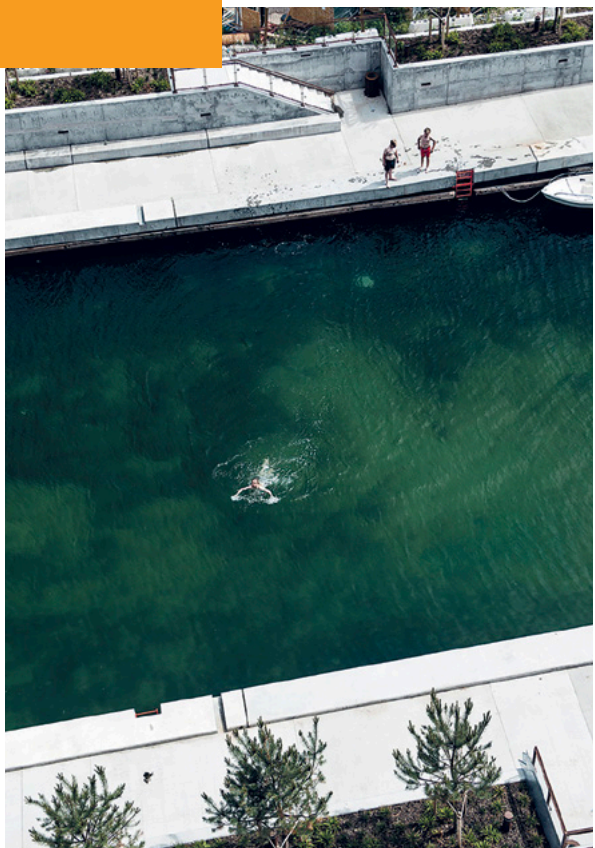
Today, 55% of the world's population lives in urban areas, a proportion that is expected to increase to 68% by 2050 due to urbanisation and overall growth of the world's population.[1] The cities expand and densify in order to meet the growing demand, and the development encroaches on adjacent, undeveloped suburban land and natural resorts.

Contribution

The planning and regulation of urban development can contribute to solve challenges relating to climate change, inequality, mobility, energy consumption and sea-level rise, and it can promote social inclusiveness and economic robustness. In the northern part of Copenhagen, a once busy industrial port is now undergoing both a transformation and land expansion into a mixed-use neighbourhood. The development was kickstarted in 2008, when Copenhagen City & Port Development made an open international call for an open and adaptive plan relying on "eco-friendly" principles including renewable energy, sustainable mobility, socially mixed neighbourhoods, optimal use of resources and recycling.[2] The winning proposal presented a robust, yet flexible, structure plan that was developed to include a design of public spaces, streetscapes and promenades, landscaping, bicycle infrastructure and metro stations and a vision of turning Nordhavn into the first DGNB platinum pre-certified urban area in Denmark. Additionally, the plan relied on the transformation of industrial heritage buildings, a prioritisation of soft mobility, public transport and 25% affordable housing.

The development plan of Nordhavn attempts to present a model for future urbanisation that measures sustainability not only environmentally but also socially and economically. The first phase of the Nordhavn project has been successfully completed. Implementing a sustainable vision on both a strategic and a legal 'district plan level' improves the chance of achieving it; however, the long timeline of urban development projects makes them vulnerable to changes in governance, economy and stakeholder priorities.

Origin/team
CPH City & Port Development,
COBE,
Sleth,
Polyform,
Rambøll



Photos: Rasmus Hjortshøj – COAST

V House of Dashilar

Beijing, China

Challenge

Like many cities around the world, Beijing is in the middle of an extensive transformation. As the Chinese economy grows and the population of the capital steadily increases, the face of the city is changing at a rapid pace. Urban development is sweeping away the old and bringing in the new; buildings, neighbourhoods, even entire districts. The urban fabric is changing, and the traditional *hutongs* are making way for new structures. One estimate states that only one third of Beijing's hutongs are still intact.[1] The cost is not only a loss of building heritage but also building stock and the disruption of the social fabric.

Contribution

It is increasingly recognised that renovating buildings holds great potential in creating sustainable cities. Improving the quality of buildings will improve the quality of cities, which will not only lead to better quality of life for the citizens, but also create local jobs and opportunities for residents to engage more actively in their communities.[2]

The V house is located on a hutong courtyard plot in the Dashilar area of Beijing. The project is part of an alternative redevelopment strategy for the area, which was launched in 2011. The existing house, with its four side-halls surrounding a courtyard, represents a typical layout in Dashilar. This typology of houses traditionally belonged to one family, but part of the project was to share ownership between several families. This distribution of ownership is central to the strategy of transforming the functions of the house from being strictly private and introverted, to becoming public and extroverted; the aim is a building that communicates with its surroundings and reflects the general development of the area towards a more mixed-use, open and welcoming community. An important goal for the renovation was also to expose the traces of the spatial elements that have been superimposed over time. In this process, the architects reused the traditional grey bricks to build a wall that forms two enclosed courtyards, based on the footprint of the original buildings.

Origin/team
hyperSity

Photos: hyperSity

‘Social Urbanism’ in Medellín

Medellín, Colombia

Challenge

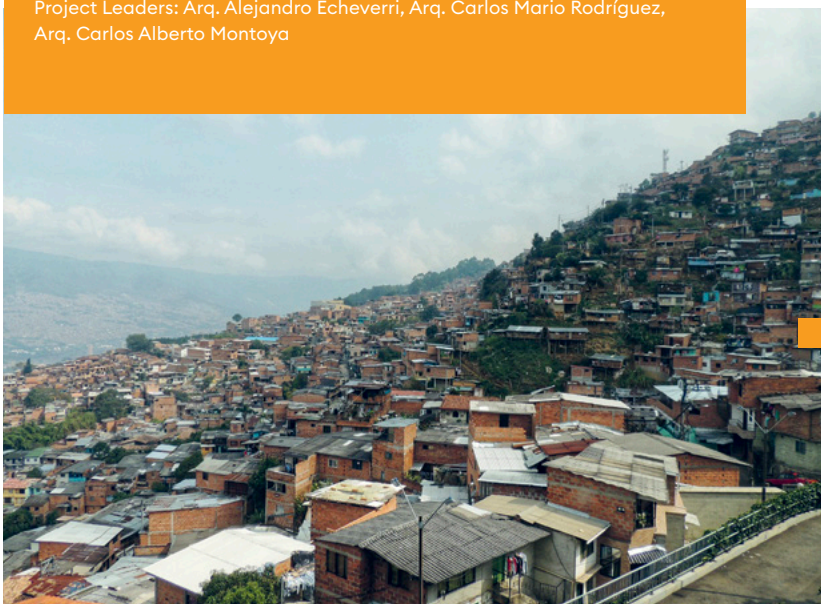
Our cities continue to grow at a rapid pace and so does the number of people living in slums or informal settlements. In 2018, an estimated 23,5% of the world’s urban population lived in slums or informal settlements[1] where many residents lack even basic services and housing conditions are often inadequate or unsafe. Often residents lack legal rights to occupy their home, and in many cities, dense informal settlements are built on terrain that is unsuited or hazardous to live on.

Contribution

In a 1988 article, Time Magazine dubbed Medellín ‘the most dangerous city in the world’.[2] This period marked a low point for the city that had been caught in a downward spiral of violence and urban degradation for years. A renewed political focus on urban development, and its importance in reducing crime and raising living standards, empowered local governments to put public space, infrastructure and inclusion in the frontline of a transformation.

In 2012, Medellín was celebrated as ‘Innovative City of the Year’[3] due to a ‘Social Urbanism’ reform model (2004–12) that had succeeded in improving public service delivery, quality of life and renewed government legitimacy.[4] ‘Social Urbanism’ – a term used by director of urban projects Alejandro Echeverri – describes strategies that integrate socio-economic and physical development[5] and which use urban design and architecture as tools to attain its goals. A successful method to reorganise the social fabric of Medellin and mobilise citizens was to have a community representative on site. This representative was the mediator between the government and the community in which interventions were proposed, and local residents and once warring factions were invited to reimagine the physical and social framework for community building, which established a will to change.[6] Social Urbanism also includes linking the safety of the informal communities to the city’s overall ability to thrive; using a general upgrading of the building stock and training local builders to work together with authorities in rolling out retrofitting schemes. Not only is the housing stock upgraded, but the local economies are as well.

Origin/team
Empresa de Desarrollo Urbano (EDU): Coordinates the design, management, and execution of projects.
Alcaldía de Medellín: Supplies resources for the completion of projects as part of the official development plan.
Empresa de Transporte Masivo del Valle de Aburrá Limitada: Operates the mass-transit service that connects projects with the rest of the city, manages public spaces adjacent to the stations, and provided partial resources for the construction of the Metrocable.
City Mayor, 2004–2007: Sergio Fajardo
Project Leaders: Arq. Alejandro Echeverri, Arq. Carlos Mario Rodríguez, Arq. Carlos Alberto Montoya



Photos: Ivan Erre Jota

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Ensure sustainable consumption and production patterns

Sustainable consumption and production is about promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services, green and decent jobs and a better quality of life for all. Its implementation helps to achieve overall development plans, reduce future economic, environmental and social costs, strengthen economic competitiveness and reduce poverty.

Worldwide material consumption has expanded rapidly, as has material footprint per capita, seriously jeopardising the achievement of Sustainable Development Goal 12 and the Goals more broadly. Urgent action is needed to ensure that current material needs do not lead to the overextraction of resources or to the degradation of environmental resources, and should include policies that improve resource efficiency, reduce waste and mainstream sustainability practices across all sectors of the economy.[1]

To find out more about Goal #12, visit:
https://www.un.org/sustainabledevelopment/sustainable-consumption-production

[1] Extract from UN's Sustainability Goals, available from https://sustainabledevelopment.un.org/sdg12

The building industry is a major consumer of natural resources and contributor to waste.

When buildings are demolished, most of the value of existing materials and components are lost. The same applies to renovations, which transform vast amounts of already extracted and treated materials into waste. Even the process of constructing new buildings is producing waste; from cut-off bits of gypsum board over discarded formwork and the wrapping that components are delivered in, to materials damaged by weather or mistreatment.

Designing for long lifetime, steady maintenance and keeping what we already have, by careful adaptation of existing buildings, are keys to sustainable consumption in the built environment. Design considerations for durability and life cycles can reduce the value loss and waste production in the building industry and in individual components, buildings and structures. Ideally, the design of buildings allows them to transform into different uses over time so that the materials and other resources invested in the structure retain their value even when a given use changes or becomes obsolete. Additionally, individual components and materials should be designed and employed so that they can be recycled and upcycled.

Design and construction of new buildings must give priority to reducing the amount of material resources employed and waste produced. New architectural solutions and components must be developed that significantly reduce the use of resources overall, significantly limit the use of non-renewable natural resources and emphasise the use and reuse of local materials.

Cork House

Eton, Berkshire, United Kingdom

Challenge

Buildings and construction account for almost 40% of energy-related carbon emissions. Close to a third of those are embodied in building materials. If we are to reach the targets set for 2030, we need to address the question of embodied carbon and view buildings in a whole-life perspective.[1] We need comprehensive methods to calculate the total impact of buildings, but we also need innovation and experimentation with the materials we use and the way we use them.

Contribution

Cork House is the first of its kind, with monolithic walls and corbelled roof pyramids made almost entirely from solid load-bearing cork. Its distinctive structural form and atmospheric spaces are the result of a whole-life approach to environmental sustainability. Conceived as a kit-of-parts and designed for disassembly, components are prefabricated off-site and assembled by hand on-site without mortar or glue. With a focus on the solid, simple and sustainable, the project is an inventive response to the complexities and conventions of modern house construction. Instead of the typically complex, layered building envelope that incorporates an array of building materials, products and specialist sub-systems, the Cork House is an attempt to make solid walls and roofs from a single bio-renewable material. This highly innovative form of plant-based construction has resulted in a building that is carbon negative at completion with extremely low whole-life carbon of 619kgCO_2e/m^2 (as per British Standard BS EN 15978).

Expanded cork is a pure plant-based material made with by-product from cork forestry. The bark of the cork oak is harvested by hand every nine years without harming the tree. This gentle form of agroforestry is widely recognised to contribute to a rich, biodiverse ecosystem. In the architect's words, Cork House is a case study of a holistic attempt to reconcile human habitation with natural resource systems.

Origin/team
Matthew Barnett Howland with Dido Milne (CSK Architects) and Oliver Wilton (UCL)

Photos: Barnett Howland

Life Reusing Posidonia

Balearic Islands, Spain

Challenge

Since the 1950s, mass production has generally been regarded as the most cost-efficient production method. New transportation technologies and the industrialisation of concrete and steel modules helped answer the heavy population influx of the European cities after World War 2 and proved efficient to solve the housing and health crisis in the city centres. Working class families moved into new mass-produced concrete housing in the suburbs, which was affordable and provided better sanitation and higher comfort. Today, we know that the building industry is one of the major contributors to waste, and we need to build differently – without compromising on providing affordable housing for everyone.

Contribution

Life Reusing Posidonia is a climate change adaptation project, on the Balearic island of Formentera, with the main objective to improve habitability in dwellings and provide regulators and public institutions with the data to decrease resource consumption without compromising comfort. The concept is to study and recover local resources; both locally found natural materials and local building practices and methods adapted to a specific community and building site. Instead of investing in standardised building elements that have been mass produced in a large production facility in a different community, the project investigates how this investment can be put into the local community and create better housing, job opportunities and economic growth. At the same time, investing and producing locally reduces transport costs and CO_2 emissions. The project's 14 housing units are insulated with a local seaweed, Posidonia, using traditional skills to harvest and apply the insulation material. All indoor woodwork is made of upcycled material; reusing doors and wood from old buildings. The houses are cooled and heated by natural ventilation, allowing the sea breezes to flow through the homes in the summer.

Life Reusing Posidonia is an open source project with all data and knowledge available for free at http://reusingposidonia.com/

Origin/team
Carles Oliver Barceló, Antonio Martín Procopio,
Joaquín Moyá Costa, Alfonso Reina Ferragut,
Maria Antònia Garcías Roig.
Architects at the Balearic Social Housing Institute (IBAVI)
Alberto Rubido, Xim Torrebella, José Luís Velilla Lon,
EEI enigneers, Miguel R. Nevado,
Societat Otgànica +10SCCL

Photos: José Hevia

Photo: José Hevia

Næste
Copenhagen, Denmark

Challenge

By 2025, the annual volume of solid waste generated globally is expected to reach a staggering 2.2 billion tonnes. Half of this waste comes from the building industry and more than half of that are building materials, such as wood, shingles, asphalt, concrete and gypsum board.[1] With the rapid increase in construction, this trend is not looking to slow down, and there is an urgent need to develop policies and business models that are based on circular economy and promote recycling and upcycling.

Contribution

Næste is a high-quality shed building system for household, municipal and office buildings, providing unheated storage space that can store bins for waste sorting, bicycles, etc. and is itself built from recycled building materials. These materials have an estimated future lifetime of 50-200 years, but in Denmark and many other developed countries they are frequently downcycled and crushed into landfill or burned to generate energy for heating.

The demand for unheated storage and shelter is increasing, as is the demand for integrated services optimising its use; electrical charging as well as data on: use, space, maintenance etc. By introducing their circular shed typology to the market, Næste wants to provide real-estate owners, stakeholders and users with the opportunity of an easy first step into a green transition. Therefore, Næste will also offer services supporting the users' "life around the shed", hereby creating a strong platform for other resource-efficient strategies in a shared economy for all users to benefit from. For the creators of Næste, the ambition is that everybody should see and feel that the transition to a sustainable society can be feasible, durable as well as architecturally and socially appealing. According to its creators, Næste creates a demand for the reuse of materials and, with a new product as a service, introduces a circular business model that potentially could revolutionise the building industry.

Origin/team
Circular Chain Operator: Næste
Strategic partners: Enemærke & Petersen, Tscherning, Lejerbo, TRUST, Fremtidens Fundament, Fischer Lighting, Art-Tek structural engineers, Danish Technological Institute

Photos: Jonathan Weimar

Sankofa House

Abetenim, Ghana

Challenge

In cities and villages across the world, cement of an often poor quality has become a dominant homebuilding material in spite of the fact that the increasingly high cost of the material makes homeownership for low-income families almost impossible. In Ghana, as in many countries in West Africa, prejudice persists against earth construction, since it symbolises, for many, an image of the poor farmer's house. The ancient local architecture was abandoned in the twentieth century in favour of more "modern" constructions made of cement blocks and other industrial materials. These materials are not only expensive and thermally unsuited to the region's tropical climate, they are also imported from abroad, adding transportation to the environmental impact.

Contribution

The Sankofa House aims to rediscover the qualities of Ghanaian vernacular architectures. Here, contemporary design is largely inspired by the Ashanti people's traditional constructions. Not only culturally resonant, the architecture is also well adapted to the Ghanaian tropical climate. The shape of the Sankofa House, inspired by the Ashanti's built heritage with its successions of sloping roofs, draws a beautiful "skyline" and generates thermal comfort by allowing the hot air to rise, which is not possible in cement and brickwork structures with flat roofs. The building is a single volume, oriented north-south. Large covered outdoor areas are managed around a central courtyard that draws on the layout of traditional housing as well. A light structure of terraces creates ventilated spaces to help cool the interior. The idea is to produce a replicable building; easy to copy by other homeowners and adaptable to the needs of the inhabitants, and thus the bioclimatic solutions are kept simple. The high volume of the walls stores the coolness and humidity of tropical nights, the large internal volume and ventilated roof keep a low indoor temperature while a rainwater recovery system is set at the junction of two roofs. Laterite, or red earth, is available everywhere in Ghana and many other African countries. Present on the project site, it is directly recovered from the excavations. This sandy-clay earth possesses sufficient cohesion to build walls.

Origin/team
A learning by doing workshop organised by M.A.M.O.T.H.

Photos: MAMOTH

The Perret Hall – Cultural Centre of Montataire

Montataire, France

Challenge

Sustainable development in the building sector requires that we urgently reduce our ecological footprint, and an important part of this is changing the way we handle existing built structures and building materials. For centuries, buildings have been reused and transformed concurrently with the replacement of convictions, regimes, aesthetics and needs. This practice has, however, changed in the course of industrialisation, and the degradation and demolition of buildings has taken over, resulting in a major loss of natural resources. In order to obtain a more responsible management of our shared natural resources, we have to recognise that the life span of buildings and building materials exceeds the programme and use of it, making recycling and retrofitting a crucial choice to reach the goal of responsible consumption and production.

Contribution

The life span and robustness of concrete makes it an ideal building material for long-lasting structures, such as bridges and harbour reinforcement. When concrete is used for buildings, the material might well outlive the original use, which makes it an important subject for transformation from a sustainable point of view. A successful example of such a transformation is the former market hall in Montataire, France, which – initiated by the City government – has been retrofitted to contain a multiple programme culture centre. The 2,276 square metres cultural centre now contains a music school, a dance school, a broadcast room and a recording studio. The spatial qualities of the 1949 building, its generous volume and vaults and the reinforced concrete is aesthetically and functionally transformed by exposing the original concrete, structure. The programme of the cultural centre benefits from the height and openness of the building, and the interior, with its many activities, is flooded in light. The building was shortlisted for the Mies van der Rohe Award for contemporary architecture, as one of 40 buildings in 2019, and with the Perret Hall, the team has proven that industrial or commercial built heritage can be beautifully transformed into new public domain.

Origin/team
Client: City of Montataire
Architects: Atelier d'architecture
Pierre Hebbelinck / Représentative
Hart Berteloot Atelier
Architecture Territoire / Associate

Photos: François Brix

13 CLIMATE ACTION

Take urgent action to combat climate change and its impacts

Climate change is now affecting every country on every continent. It is disrupting national economies and affecting lives, costing people, communities and countries dearly today and even more tomorrow. Weather patterns are changing, sea levels are rising, weather events are becoming more extreme and greenhouse gas emissions are now at their highest levels in history. Without action, the world's average surface temperature is likely to surpass a 3 degrees centigrade increase this century. The poorest and most vulnerable people are being affected the most.

Affordable, scalable solutions are now available to enable countries to leapfrog to cleaner, more resilient economies. Climate change, however, is a global challenge that does not respect national borders. It is an issue that requires solutions that need to be coordinated at the international level to help developing countries move toward a low-carbon economy.[1]

To find out more about Goal #13, visit:
https://www.un.org/sustainabledevelopment/climate-change/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/climate-change/

The CO_2 footprint of the built environment must be reduced, and buildings and settlements must be adapted to the changing climate.

The CO_2 impact of buildings, settlements and cities must be reduced imminently. We can achieve reductions through energy renovations, by integrating renewable energy production in buildings, by expanding sustainable transportation infrastructures, by reducing transport of building materials, and by emphasising the use of local and renewable materials. Furthermore, the design of new buildings can optimise climatic comfort with a minimum of energy consumption for heating, cooling and lighting. This requires consideration of the local climate and design that incorporates natural light, natural ventilation and the thermal properties of building structures.

At the same time, climate change is already happening, and existing buildings and settlements must be adapted to the changing conditions, including more extreme rainfalls, floods, hurricanes, drought and heat-waves. This requires new design solutions that are resilient to the changing conditions and sensitive to local culture as well as local topographic and climatic conditions. The amount of adaptations and new infrastructure needed is huge and costly and will affect settlements and cities significantly over the coming years. Architecture, planning and design have a special responsibility in developing climate adaptation solutions with co-benefits, such as overflow basins for extreme rainfall doubling as a recreational area between rainfalls.

Building with Nature – The Sand Motor

Delfland Coast, the Netherlands

Challenge

In the 2019 Special Report on the Ocean and Cryosphere in a Changing Climate by the Intergovernmental Panel on Climate Change, it is stated that sea level rise will increase the frequency of extreme sea level events that occur for example during high tides and intense storms.[1] Sea-level rise and storms will threaten coastal and island communities, as well as vital infrastructure, through erosion and flooding. This is something many countries and communities are already experiencing and trying to prevent with dikes and coastal protection.

Contribution

The Netherlands has years of experience with coastal protection as more than half of the country is located less than one metre above sea level, which makes it prone to flooding. During the last 10 years, a collaborative effort involving public authorities, private companies and research institutes have worked with the power of wind, waves and currents to help protect parts of the Dutch coast. Through a 'Building with Nature' approach to hydraulic engineering, nature's forces are used to benefit environment, economy and society.

Instead of steadily nourishing the coastlines with sand and thereby disrupting coastal ecosystems, the Sand Motor Delfland Coast project is a mega-nourishment operation that involved depositing 21.5 million m^3 of sand in a single location, with the height of the deposit rising to 5 metres above the mean sea level. Using the forces of wind and currents, the sand is gradually redistributed along the shoreface, beach and dunes. By using natural processes to spread the sand, the project aims to limit the disturbance of local ecosystems while also providing new areas for nature and leisure to unfurl. The project is closely monitored with an extensive research programme to find out if the strategy of concentrating nourishment operations is indeed a climate-robust and environment-friendly way of countering coastal erosion. In addition, the temporary presence of surplus sand also creates new areas for nature and leisure. The method protects wildlife and natural ecosystems to a larger degree than the standard five-year cycle of sand nourishment, and the lower frequency

of disturbance boosts development of new ecosystems. The Sand Motor project was initiated by Rijkswaterstaat and Provincie Zuid Holland. It is also part of the 'Building with Nature' innovation programme, run by the interdisciplinary network and foundation EcoShape. Within EcoShape contractors, engineering companies, research institutions, governments and NGOs work together to develop and spread knowledge about the concept of 'Building with Nature'. This is a new philosophy in hydraulic engineering that takes its starting point in building with natural materials and the use of forces and interactions within the natural system.[2]

Origin/team
Rijkswaterstaat and the Provincie Zuid Holland, EcoShape

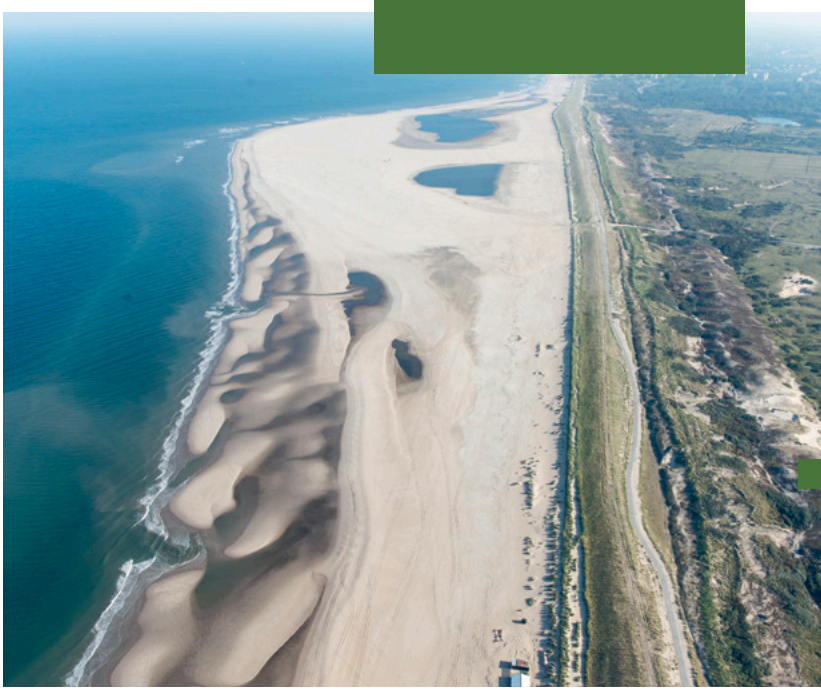


Photo: Joop Van Houdt Rijkwaterstaat

Minghu Wetland Park

Liu Panshui, China

Challenge

In the past ten years, disastrous floods and rainstorms have hit several cities in China, which has acted as a catalyst for the so-called 'Sponge City' planning movement. The movement reintroduces ancient Chinese flood management, turning paved impermeable surfaces of cities into green and wet, resilient urban areas. 30 cities have now been designated as 'Sponge Cities', and by 2030, the government wants 80%[1] of its cities to have 'sponge abilities', which means being able to either capture, reuse or infiltrate at least 70% of storm water runoff, and in this way prevent future flooding caused by climate change.

Contribution

A number of climate adaptive landscapes in urban areas has been established under the Sponge City movement. One of these landscape projects is located in Liupanshui, an industrial city built in the 1960s in a valley surrounded by limestone hills and home to coal, steel and cement industries. Over decades, these industries, together with chemical fertilizer runoffs from the farmland on the hills, have caused an immense water pollution of the local river, Shuichenghe. In order to reduce the risk of flooding, clean the runoff water and restore the ecological balance of the river, the city government executed a water-based infrastructure masterplan through a series of water-retention ponds and purification wetlands with different capacities.

The Minghu Wetland Park is part of this system and consists of terraced retention ponds with aerating cascades, which add oxygen that fosters bioremediation of the nutrient-rich water and reduce peak water flow. Native vegetation, customised to the various water and soil conditions, slows the flow of water and speeds up nutrient removal from the water, as microorganisms and plant species use excess nutrients as resources for rapid growth. Also, the natural riverbank has been restored, and pathways, bicycle lanes, resting platforms and viewing towers reintroduce public access to the riverfront. The park regulates stormwater, cleans contaminated water, restores native habitats for biodiversity and attracts residents and tourists in one of China's rapidly growing cities.

Origin/team
Kongjian Yu,
Turenscape & Peking University College of Architecture and Landscape

Photos: Kongjian Yu, Turenscape

Photo: Kongjian Yu, Turenscape

Sankt Kjelds Plads & Bryggervangen
Copenhagen, Denmark

Challenge
Globally, climate change results in extreme weather events, such as droughts and cloudbursts. Insufficient sewage systems and a lack of vegetation and permeable surfaces lead to flooding and human and economical disasters. Droughts and high temperatures are exacerbated by built thermal mass, which absorbs and retains heat, and the density of the city prevents wind and replacement of air. Nature-based climate adaptation solutions have the capacity to reduce the impact of cloudbursts while reducing heat and adding many other surplus values to urban environments.

Contribution
The combined climate adaptation and urban space project 'Sankt Kjelds Plads & Bryggervangen' is part of a designated 'Climate Resilient Neighbourhood' in Copenhagen. This project adapts a residential neighbourhood to climate change, showcasing how protection against cloudbursts can combine recreational urban spaces with biodiversity.

The project transforms a sealed-surface roundabout and infrastructure into a blue-green climate-adapted habitat using nature-based design to handle runoff water from cloudbursts. 586 new trees are central to the rainwater management, and they have been planted to form a network of green rain gardens that enable the project to handle even the largest cloudburst events. When the cloudbursts hit, the rainwater is directed to the tree and rain gardens where it irrigates the vegetation, evaporates, is slowly infiltrated or is redirected to separate sewage systems and cloudburst pipelines. In addition to remedying cloudbursts, the project also provides local residents with a wide range of green qualities for new meeting places and social activities. Sidewalks and paths lead through an 'urban forest' where you can experience 48 different local species and plants. The project's squares and urban spaces are fitted with benches for relaxation, and large overturned trees make up habitats for fungus, insects and small wildlife. The project demonstrates that cloudburst management can also contribute to new nature and improved biodiversity in the city, reduce the noise from traffic, increase quality of life for local residents and reduce the urban heat island effect through evapotranspiration.

Origin/team
The City of Copenhagen, HOFOR, SLA, Alectia, Via Trafik, Jens Rørbech and Ebbe Dalsgaard A/S

Photos: Mikkel Eye

1 Million Trees

Melbourne, Australia

Challenge

Urban heat island effect is a phenomenon that is observed across the globe. The effect is created by the absorption and trapping of solar radiation by the built environment[1],and the result is that temperatures are increased with several degrees compared with surrounding natural landscapes.[2] In urban environments, which already have high mean temperatures, this effect can have considerable impact on both ecosystems and the health and well-being of people, and it results in derived effects on energy consumption and CO_2 emissions as well.[3]

Contribution

In Melbourne, temperatures often exceed 40 degrees Celsius in the summer and, like the rest of Australia, the city has experienced increased temperatures in recent years.[4,5] The city is also one of the fastest growing urban areas in the country, with many new residents settling in its western suburbs. A partnership was established in the western suburbs[6] that set out on an ambitious plan to lower temperatures in West Melbourne, known to locals as "the West", to the benefit of local residents – but also the urban environment as a whole. In the 2009 bushfire, 374 people died in the heatwave leading to the bushfire with many of these deaths in northern and western suburbs. In 2013, the initiative Greening the West was launched with a key strategic target to increase canopy cover across the West by 2040 to mitigate the impacts of heatwaves. For the local communities, the initiative aims to deliver positive health and social outcomes through urban greening as well as actively supporting projects and activities that increase vegetation and improve the quality and usability of green spaces for residents. One of the projects under the initiative being the 1 Million Trees Project, which received $5 million from the federal government to plant a million trees across the western suburbs of Melbourne between 2016-2018. Envisioned as a project that engages the local communities in the effort to green existing public space, hundreds of places have been greened.

Origin/team
Adrian Gray, Co-Chair GTW and Manager Urban Design, Brimbank City Council, Emma Pryse, Co-Chair and Coordinator Greening the Pipeline, Wyndham City Council, Darren Coughlan, Greening Champion and IWM & Liveability Project Officer, City West Water

Photos: Adrian Gray

Arcadia Education Project

South Kanarchor, Bangladesh

Challenge

Climate change, temperature rise and the consequential sea water rise pose immediate threats for low-lying countries such as Bangladesh. A permanent sea water rise of 1 metre alone would erase 20% of the country, and the flooding has increased severely the past 20 years. Bangladesh is defined by the two large rivers Brahmaputra and Ganges, and towns and villages were developed by the riverbanks because they provided fertile lands and infrastructure. Today, the increased flooding makes the riverbanks almost inhabitable.

Contribution

Razia Alam set out to establish a school for underprivileged children through her foundation, Maleka Welfare Trust. But finding a dry building site proved impossible with the available budget, and she decided on a riverside plot which was submerged in up to 3 metres of monsoon water for a third of the year. Constructing a building's base high enough to shield the educational facilities from the unsanitary river water and strong enough to protect the structure from damage would be unobtainable within the limited budget. Instead, a local architect, Saif Ul Haque Sthapati, came up with an alternative solution that allows the school to follow the water level and be placed on the ground during the dry season and float on the water, anchored to the site, during the wet season.

The amphibious structure uses tyres for cushioning, bamboo for both anchoring and as the main building material, and steel drums for floating. Bamboo is light and cheap and could be bought in the local village nearby to minimise transport cost while also supporting the local community. After construction, the bamboo was treated with liquid from boiled gaab fruit for maintenance purpose, a traditional local method to make material waterproof. Most of the joints use rope rather than steel to prevent corrosion, and almost all construction was made using hand tools. The design makes for a light, flexible structure that adapts to its climate and its surroundings rather than trying to withstand the existing ecosystem. The final school building is resilient to flooding, low cost, locally sourced and easy to manually maintain.

Photos: Aga Kahn Trust for Culture / Sandro di Carlo Darsa

Origin/team
Maleka Welfare Trust,
Saif Ul Haque Sthapati

Photo: Aga Kahn Trust for Culture / Sandro di Carlo Darsa

14 LIFE BELOW WATER

Conserve and sustainably use the oceans, seas and marine resources for sustainable development

The world's oceans – their temperature, chemistry, currents and life – drive global systems that make the Earth habitable for humankind. Our rainwater, drinking water, weather, climate, coastlines, much of our food, and even the oxygen in the air we breathe, are all ultimately provided and regulated by the sea. Throughout history, oceans and seas have been vital conduits for trade and transportation.

Careful management of this essential global resource is a key feature of a sustainable future. However, at the current time, there is a continuous deterioration of coastal waters owing to pollution, and ocean acidification is having an adversarial effect on the functioning of ecosystems and biodiversity. This is also negatively impacting small-scale fisheries.[1]

To find out more about Goal #14, visit:
https://www.un.org/sustainabledevelopment/oceans/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/oceans/

Most of the built environment is situated on land, but buildings, settlements and infrastructure, as well as the production and construction of built structures, nevertheless affect the oceans.

The building industry affects the oceans through transport of building materials at sea while existing buildings, settlements and cities discharge wastewater and other waste into the oceans. To help preserve life under water, we must reduce transport of building materials and components over long distances by sea through the development of local industries and production facilities. Furthermore, we must abolish one-use plastic wrapping of materials and components to reduce the sources of non-degradable waste that ends up in the oceans.

Landscape design and urban planning must ensure that pollutants like pesticides, nitrogen and human waste are handled on site and do not reach the groundwater or the oceans. This means that sewer systems, overflow basins and wastewater treatment facilities are central parts of the built environment's relationship with the oceans. Through architecture, planning and design, we can develop solutions that reduce cost and add co-benefits to water-managing infrastructure. Furthermore, landscape design can ensure regenerative processes on polluted land close to the sea or where life below water is depleted.

Caution must be exercised when buildings or settlements are placed on the coast or in fragile coastal ecosystems; on the other hand, architecturally significant and carefully placed research and learning facilities in fragile coastal ecosystems can generate new knowledge and help increase public protection and awareness.

Löyly Sauna
Helsinki, Finland

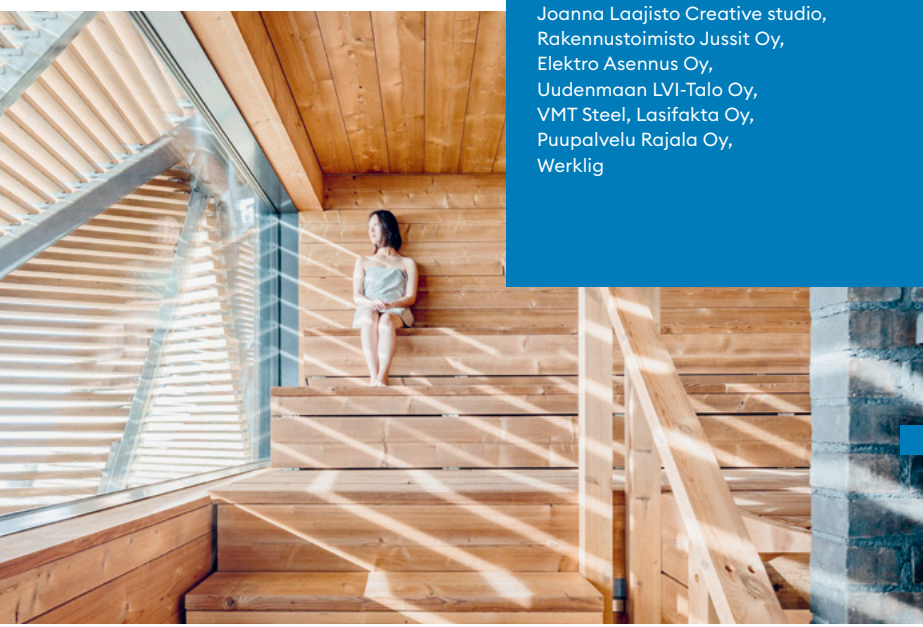
Challenge
Apart from being a vital and limited natural resource, the sea has always fostered cities by providing the foundation for food and transport. However, oceans have also been the recipient of harmful emissions, sewage wastewater and litter, which has contaminated the environment and life below the water.

Contribution
The archipelago of Helsinki consists of several shallow bays characterised by inefficient water exchange. Like in many other coastal cities, the water of Helsinki Bay was polluted until authorities started to put in measures to improve the water quality. The City of Helsinki started to remove phosphorous in 1979 and is now conducting recipient control and management of wastewater treatment outlets, ensuring the water quality of the bay is clean enough for swimming.[1]

The public sauna and restaurant Löyly is situated in Hernesaari, close to the city centre of Helsinki, where it supports the long and widespread tradition of public saunas and winter swimming in Finland. The slim building consists of sauna and restaurant spaces and is located in a former industrial area on the seashore. The building is clad with wooden lamellas that provide access to both the sea and the roof. The indoor spaces of the building are covered with a free-form “cloak” of wooden lamellas that have turned grey over time and make the building blend in with its surroundings like a rock on the shoreline. The lamellas provide visual privacy for the users, sheltered transition zones between the sauna and bathing area, and they also help protect the building from the harsh coastal climate. Löyly is an example of an architectural space the utilisation of which requires recipient control and management of wastewater for the benefit of humans as well as life below the sea, and which in its nature fosters appreciation and awareness of the sea and its wildlife.

Photos: kuvio.com

Origin/team
avanto architects ltd,
Kidvekkeli Oy, Qtio Oy,
Royal Restaurants,
Ramboll Finland Oy,
SS-Teracon Oy, Optiplan Oy,
Kanta Kaivu Oy, Ramboll,
Joanna Laajisto Creative studio,
Rakennustoimisto Jussit Oy,
Elektro Asennus Oy,
Uudenmaan LVI-Talo Oy,
VMT Steel, Lasifakta Oy,
Puupalvelu Rajala Oy,
Werklig



Living Seawalls
Sydney, Australia

Challenge
The transition zone between land and sea in urban or industrialised areas is often abrupt, made up by plain quaysides unsuited for marine habitats. Seawalls can be completely flat and devoid of crevices, thereby minimising the potential for colonising organisms. Due to general acidification, pollution and destruction of natural habitats in our oceans, these urban seawalls make up a potential adjacent area for an effort to support and foster new coastal marine habitats. Having a rich biodiversity of filter-feeding organisms that can absorb and filter out pollutants means that supporting marine habitats is not only a matter of strengthening biodiversity but also a part of the solution towards a cleaner sea.

Contribution
The Living Seawalls project builds on years of marine green engineering research that shows that retrofitting existing seawalls with habitat-enhancing units can improve the ecological performance of artificial structures. The project is realised in a partnership between Sidney Institute of Marine Science and the design studio Reef Design Lab, and it is made possible by both government, philanthropic and corporate sponsors.

The project investigates how 3D printed geometric figures can be used to create a habitat for marine species that live on seawalls. The habitat is created by tiles that can be retrofitted to existing seawalls. They are designed to mimic natural habitat features of Sydney's rocky shores and to withstand local wave climates, with the expectation of remaining on the seawalls for at least 20 years. Each tile is 55 cm in diameter and has a unique hexagonal shape that allows tiles of different designs to be attached in a mosaic pattern that suits site conditions or aesthetic requirements. Through comprehensive monitoring of pilot projects, the goal is to find designs that encourage native species to colonise and thereby foster biodiversity, in order to develop methodologies to incorporate these designs into marine infrastructure on a larger scale. One of these pilot projects is installed on seawalls in the northern part of Sydney, and it is the largest retrofit of a Living Seawall in Australia. Along the harbour stretch, 108 new habitat tiles have been added, comprising

five designs developed by the Reef Design Lab. The company Volvo also installed 50 of their own 'mangrove tiles' that have been slightly modified to mimic the root of mangrove trees. In the future, the team anticipates developing additional cost-effective habitat-enhancing structures, such as seawall blocks, that can be produced and installed during seawall construction or renovation. The team also plans to expand the project to other artificial marine infrastructures, such as pilings and breakwaters.

Origin/team
Sidney Institute of Marine Science,
Reef Design Lab,
GHD, North Sydney Council,
New South Wales government
(NSW Environmental Trust Grant),
the Harding Miller Foundation,
James N. Kirby Foundation,
The Ian Potter Foundation,
Lim Sutton Initiative,
SIMS Foundation,
Volvo Australia.

Photos: Alex Goad

Photo: Alex Goad

R.U.M.
Denmark

Challenge
20% of all plastic produced is used in the building industry as insulation, piping, window frames and interior design etc., but also as wrapping and packaging, which further contributes to the vast amount of waste from the sector. According to the UN Environment Programme, UNEP, an estimated eight million tonnes of plastic end up in the ocean each year, equivalent to a full garbage truck dumped into the sea every minute.[1] To reduce marine litter and plastic debris, we must engage in recycling and waste reduction in all stages of the building process.

Contribution
R.U.M. stands for ReUsed Materials and is a sustainable chair with a plastic shell made of recycled post-use plastic waste from the maritime industry, such as fishing nets, trawls, and ropes. The design of the stacking chair is rooted in circular principles, with its seat, back and pipe shoe all fashioned from granulated recycled material mounted on a steel frame. The design can be repaired, reused and recycled.

The plastic raw materials used for R.U.M. are based on post-use and obsolete input streams collected from a number of marine ports, net makers and plastics collectors globally. PLASTIX, the producer of this ocean-based plastic raw material, called OceanIX, uses scientific methods and advanced data analysis to continually advance their knowledge of their input stream. Furthermore, they collaborate with educational institutions and other partners in order to develop innovative approaches and to ensure quality with the best practice available. Despite being labour intensive, PLASTIX sorts and fractionates the input streams into different types of plastics and colours and then shreds, washes, separates and dries the material before it is compounded and extruded into new “Green Plastic” pellets. All output products are analysed, quality assured and their properties matched with a specific data sheet in a database as a prerequisite for guaranteeing high-quality products.

Photo: Plastix A/S

Origin/team
Wehlers.com,
C.F. Møller Architects,
Plastix,
Letbæk

Photo: Mette Johnsen / Wehlers

Marine Education Centre

Malmö, Sweden

Challenge

Climate change is affecting the oceans, and marine life is at risk due to loss of habitat, temperature stress and exposure to severe weather. When we include oceans and marine life in a discussion about climate change, we often exclusively focus on rising oceans, flooding risks and storms. But oceans make up more than 70% of the planet, and they are crucial to our planet's ecosystem; generating oxygen, storing CO_2 and providing food. In order to solve the climate crisis, we also need to understand the profound impact marine life and oceans have on our lives.

Contribution

In the city of Malmö, on the west coast of Sweden, the Marine Education Centre has been designed to facilitate education in oceans, marine biology and climate. The centre welcomes school children, the public and private groups throughout the year, communicating knowledge about the oceans through first-hand experiences. The centre is based on a very large international network collaborating on research, communication and skills, and it is funded and supported both by private and public partners, such as the city of Malmö. The aim is to contribute to sustainable development in the oceans through education and to inspire and attract attention through aesthetic and tactile experiences.

The centre itself merges landscape and building, and it is placed on the edge of land and the sea. The indoor and outdoor spaces merge under a large roof, encouraging visitors to dive into a multitude of educational activities focusing on easy access to life under water, which is normally inaccessible. The activities are based on first-hand experiences, allowing the guests to touch and try during their visit. Flexible learning spaces encourage visitors to engage in experiments and science-based knowledge that focuses on marine life. The architecture is rooted in an idea of a holistic learning landscape, where technical installations like water handling and circulation, solar energy production and consumption, and ventilation also contributes to the total learning experience on resources and sustainability. The vision of the Marine Education Centre is to improve the conditions for a viable sea by promoting knowledge, awareness and responsibility of citizens, businesses and decision makers.

Photos: Adam Mørk

Origin/team
Malmö Municipality,
NORD Architects,
Sweco Malmö

15 LIFE ON LAND

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

Forests cover 30.7% of the Earth's surface and, in addition to providing food security and shelter, they are key to combating climate change, protecting biodiversity and the homes of the indigenous population. By protecting forests, we will also be able to strengthen natural resource management and increase land productivity. At the current time, thirteen million hectares of forests are being lost every year while the persistent degradation of drylands has led to the desertification of 3.6 billion hectares. Even though up to 15% of land is currently under protection, biodiversity is still at risk.[1]

To find out more about Goal #15, visit:
https://www.un.org/sustainabledevelopment/biodiversity/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/biodiversity/

The amount of built structures, buildings, settlements and cities taking up land, is rapidly growing.

Ecosystems and biodiversity are under intense pressure due to growing cities and settlements, farming, mining and the changing climate. To protect, restore and support ecosystems and biodiversity, buildings and settlements must include habitats for plants, insects and animals. This means that green-field developments should be kept to a minimum and that planning and development of all new settlements must ensure sustainable conditions for local ecosystems, flora and fauna. Nature networks that allow plant life should be developed in existing settlements and urban areas so that insects and other animals can co-exist with the built environment. Examples are found at all scales; from pocket parks and insect hotels to large-scale planning projects establishing or re-establishing nature networks and biodiversity in both big cities, suburbia and farmland.

Furthermore, the building industry can help promote sustainable forestry and combat deforestation by using wood only from sustainable sources and by generally using materials that are renewable and sustainably produced and which do not compromise biodiversity and natural habitats. Local flora and fauna must form the basis of landscape design in buildings and settlements, including lawns and interior greenery, so that the plants will interact with and support local ecosystems.

When done carefully, buildings placed in vulnerable ecosystems or in wildlife-parks can add to their preservation through sustainable tourism and raised public awareness.

Qian'an Sanlihe River Ecological Corridor

Qian'an, China

Challenge

The degradation of ecosystems and extinction of species caused by human activities and climate change is happening at an alarming rate, and we are facing an extinction crisis if we do not act.[1] Industrialisation and urbanisation have put pressure on land and freshwater habitats, but landscape design can contribute to restore degraded ecosystems, protect habitats and create sustainable urban development with recreational values.

Contribution

Qian'an is known for its papermaking industry that started in the Yongle period (1403-1424) of the Ming Dynasty, and the first mechanical paper-making factory in northern China was founded here. The city is located at the foot of the Yanshan Mountain and at the bank of Luan River that has provided the region with a clean freshwater supply that has nourished a rich natural wildlife, the farmers and the local paper industry through centuries. However, the river has been badly polluted by sewage and waste since the 1970s, and because of depletion of the regional freshwater supply it almost dried up, which resulted in the local government taking action in 2006.

The Qian'an Sanlihe River Ecological Corridor is a strategic regeneration project developed in micro and macro scale, and it includes a comprehensive cleaning of the site, landscape design and new sewage and solid waste control. The greenway is 16 km in length, varies from 100 to 300 m in width across the city and covers 800 hectares. The design includes removing the existing concrete channel of the river and creating a multiple wetland and retention pond system that regulates floods and collects urban storm water runoff. When the river's water level drops to its lowest point, pools of water remain in the emerald hollows which creates a "green river" and ecological purification buffer for urban storm water runoff. These meandering natural waterways with various water surface levels become diverse habitats for wildlife. The park area, 'The Red Folding Paper', is a part of the revitalised greenway that combines installation art, outdoor furniture, pathways and bike lanes. It protects wildlife while providing green areas for recreation and reconnecting with the waterways in an

area of rapid urban development. Inspired by the local folk art ‘paperfolding’ and the city’s industrial history, folded paper shapes made of fiberglass accompany the visitor as a continuous art installation of benches, shelters and windbreaks. Parts of the original dried-up channel have been transformed into a flower ribbon in the forest where many native wild chrysanthemums grace the lush greenery.

Origin/team
Kongjian Yu,
Turenscape & Peking University College of Architecture and Landscape

Photo: Kongjian Yu, Turenscape

Photo: Kongjian Yu, Turenscape

Hong Kong Wetland Park

Mai Po, Hong Kong

Challenge

In the transition zones between the built and natural environments, the effects of the building processes meet terrestrial ecosystems and often cause damage to biodiversity and degradation of habitats. However, these transition zones also hold a great potential to provide awareness, appreciation and knowledge of natural wildlife while offering recreation and calmness. Landscape architecture can reduce the damaging effects of urban dwelling, such as handling polluted runoff water from the city.

Contribution

The built density of Hong Kong City, with its approximately 6,500 people per square kilometre, contrasts its luxuriant green areas, which cover almost 87% of the territory of Hong Kong. In fact, 40% of the total land area consists of national parks and special areas subject to statutory protection.[1] As population density grows, transition zones become crucial in order to provide public access to recreational areas while also fostering knowledge and understanding of the inherent values of wildlife, so as to marshal public support and action for wetland conservation.

Hong Kong Wetland Park, which opened in 2006, covers 61 hectares that display the diversity of Hong Kong's wetland ecosystem. The park provides public awareness with a wide range of facilities balancing functions of conservation, tourism, education and recreation. Through ecological monitoring, researchers and staff continuously collect information about diversity, distribution and behaviour of the wildlife inhabited within the park and disseminate it to the public through a school programme. As part of a transition zone between the densely populated Tin Shui Wai New Town development and the protected wetlands, Hong Kong Wetland Park also includes a reedbed filtering system of 1 hectare that treats storm water runoff from Tin Shui Wai before it enters the freshwater wetland system of the park.

Origin/team
Architectural Services Department, HKSARG

Photo: Tomoaki INABA

Photo: Architectural Services Department, HKSARG

Trollstigen National Tourist Route Project

Rauma, Møre and Romsdal, Norway

Challenge

Untouched areas of nature are home to a great biodiversity and indispensable natural resources – both important keys to our planet's sustainable development. But human interaction with vulnerable natural areas can impact ecosystems in negative ways. The dilemma is evident; we are much better at protecting things we know and feel connected to, and therefore providing access to nature can be a way of promoting conservation while at the same time protecting it from human interference.

Contribution

People travel to Norway to experience the powerful nature; the mountains, waterfalls and wildlife. However, tourists have to drive, fly or sail for quite a long time in order to experience the vast territory. In the 1990s, the Norwegian Public Roads Administration, 10 county administrations, about 60 municipalities and some local businesses decided to rethink the way tourists experience Norway. The Norwegian Scenic Routes consist of 18 routes throughout Norway that combine some of the country's main attractions. The routes invite the drivers to stop for a picnic, visit a sight or experience art at spots selected for their ability to frame and create a stunning – but also curated – experience of nature.

Trollstigen (the Troll's Road) with its visitor centre and plateau is located at the top of the winding road, and it presents the visitors with the most dramatic view of the Norwegian landscape and the three surrounding mountains: Kongen, Dronninga and Bispen. The visitor centre is built with cast-in-place concrete and corten steel that oxidises and gains its own patina over time. These materials were chosen to endure the harsh climate at the site – which is prone to extreme snowfall in the winter – and to meet the high safety requirements for the visiting tourists. The installation is designed to enhance the experience of nature without itself competing with the dramatic scenery.

The Trollstigen architecture takes on two challenges at the same time: It creates access to a unique experience that used to be inaccessible to the public, and it prohibits the guests from too many ventures out into nature on their own, with their own safety and nature's at risk.

Origin/team
The Norwegian Public Roads Administration,
Reiulf Ramstad Architects (RRA),
Dr Techn. Kristoffer Apeland AS

Photos: Reiulf Ramstad Architects, Oslo Norway, Diephotodesigner.de

Photo: Reiulf Ramstad Architects, Oslo Norway, Diephotodesigner.de

Renaturation of the River Aire

Geneva, Switzerland

Challenge

As part of an industrialisation of farming, a comprehensive channelisation of rivers was performed all across Europe. In order to effectively drain the fields, rivers were straightened and vegetation and stones, which slowed the water flow, were removed. Among many other unintended consequences, the channelisation quickly resulted in a massive decline in biodiversity in the rivers. Therefore, a process of river revitalisation has been conducted since the 1980s, with an aim of returning the rivers to their original shape and state. In highly populated and cultivated areas, the idea of 'renaturation' and of 'nature' being in opposition to 'culture' induce a paradox, because culture and nature are deeply entwined.

Contribution

The River Aire flows through an area in Geneva originally devoted to farming, and in 2001 the state of Genova held a restricted competition to return the channelised river to its original shape. In opposition to the idea of returning the river to a pure and original state, the team of the winning proposal combined the existing canal with the creation of a new dynamic and fluctuating river, giving the visitor an understanding of 'the before and after' and allowing ecological improvements to emerge as a cultural change. In the design, the footprint of the linear channel is kept and transformed into a series of flower beds along the new river, and the linear shape encapsulates both the 'wild' and organised aspects of the design. This echoes the characteristics of a cultivated garden, which also consists of organised sequences of diverse places. Within the 5 km stretch, a new river is shaped by the interplay between dynamic forces of nature and prepared terrain. Conscious of the paradox of designing a new river, which naturally designs itself, the multidisciplinary team conducted the design in two phases. First, a diamond-shaped pattern was excavated by removing the humus layer and maintaining a precise control of the longitude of the new river. Then the terrain was left for natural forces of the running water and erosion to finalise the shape of the river, which now flows freely across the significantly modified geometrical matrix.

Origin/team
Republique et Canton de Genève (State of Geneva),
Group Superpositions,
Georges Descombes and Atelier Descombes & Rampini SA,
B+C Hydraulic engineers,
ZS structural engineers,
Biotec SA applied biology

Photo: Fabio Chironi

Văcărești Natural Park

Bucharest, Romania

Challenge

According to a 2012 UN report on cities and biodiversity, an estimated 6.3 billion people will inhabit the world's towns and cities by 2050. Urban growth will have a significant impact on biodiversity, natural habitats and many ecosystem services that society relies on. In response to this development, the report concludes that it will not be enough to simply protect existing ecosystems but instead, "...preserving biodiversity on [sic] this new urban world requires going well beyond the traditional conservation approaches of protecting and restoring what we think of as 'natural ecosystems,' and trying to infuse or mimic such elements in the design of urban spaces." [1]

Contribution

The Văcărești Natural Park is a wetland formed on the site of an unfinished hydrotechnical project commenced by the communist regime in 1988. The area is located in Bucharest, 6 km away from the city centre, and it spreads over a surface of 183 hectares. From a natural point of view, the area is accessible especially to birds – with over 170 bird species observed so far. Apart from natural species and habitats, the area also offers a magnificent landscape and an interesting contrast between the urban, anthropised area and the natural wetland with expanses of reeds, swamps and wetland-specific trees and vegetation. In 2017, the first of several thematic trails in the park opened to the public: the "Urban biodiversity trail" which is marked by seven signposts with information and photographs of the main species of plants and animals in the park, along with a wildlife observatory and an otter's den. In the future, the landscape architecture plans will be expanded to improve the possibilities for conducting educational activities and visiting. This will be done by installing wildlife observatories in other areas of the park, organising tours that experiment with and interpret nature in new ways, and initiating programmes for training children to become protectors and defenders of nature. Văcărești Natural Park Association (VNPA) was established in 2014 by a group of enthusiasts, nature lovers, and specialists in nature protection and the management of protected areas, who developed the project of establishing the park.

Origin/team
Văcărești Natural Park Association (VNPA)

Photos: VNPA

16 PEACE, JUSTICE AND STRONG INSTITUTIONS

Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

Peaceful, just and inclusive societies are necessary to achieve the Sustainable Development Goals (SDGs). People everywhere need to be free of fear of all forms of violence and feel safe as they go about their lives whatever their ethnicity, faith or sexual orientation. In order to advance the SDGs, we need effective and inclusive public institutions that can deliver quality education and healthcare, fair economic policies and inclusive environmental protection.[1]

To find out more about Goal #16, visit:
https://www.un.org/sustainabledevelopment/peace-justice/

[1] Extract from UN report WHY IT MATTERS – PEACE; JUSTICE AND STRONG INSTITUTIONS – PDF

Parliaments, courthouses, as well as civic institutions like public libraries, are cornerstones in a just and peaceful society while local community centres, places of worship and memorials can represent citizens' commitment to social change and to an inclusive and compassionate society.

Architecture does not make an institution just, but the effort and values put into a building can represent society's commitment to justice, democracy and inclusiveness. Examples of this span from prestigious public buildings to NGO-funded memorials and community centres. The built environment evolves continuously as new buildings, monuments and structures are added and older ones are developed or replaced. In this process, representation of equal justice for all citizens must find an architectural expression shaped through the inclusion of, and in dialogue with, all stakeholders.

To support society's expression of its values through buildings and public space, architecture and planning must ensure that public spaces and institutions are inclusive, welcoming, secure and non-discriminatory. As part of this, public health measures and terror protection should be developed that are inclusive and inviting to all citizens and users. The design of libraries, community centres, memorials and places of worship must ensure safety, inclusiveness and affordability.

The building industry itself must pay close attention to procurement and construction processes in order to discourage theft, corruption, bribery and all other forms of organised crime. The building industry must also ensure that the extraction, production and handling of building materials do not rely on abuse, exploitation, human trafficking or child labour.

Bait ur Rouf Mosque

Dhaka, Bangladesh

Challenge

All cities and communities need institutions that support community building and democratic dialogue embodied in inclusive spaces for gathering, worshipping and simply being together across social backgrounds and age. When a government lacks attention, plan or policy towards unmanageable urban growth and fails to respond to the basic need of urban dwellers, people must unite their will and resources toward a positive living environment that contributes to a healthy urban life. Small-scale participatory projects are unique ways of contributing to urban dwelling in contemporary cities.

Contribution

Bait ur Rouf Mosque is located in the northern expansion of Dhaka, a fast-growing community of lower middle-income families. The building is composed of three volumes; each one inserted within the other to create a sequence of spaces. The outer volume and main façade of the mosque is a square figure situated parallel to the road, a cylindrical volume is inserted into it, which facilitates the orientation of the prayer hall. All ancillary functions, such as the entrance courts, ablution and toilet facilities, imam's office and stairs, are located within the space created by the outer square and cylindrical volume. This part of the design is conceived as a load-bearing brick construction, whereas the prayer hall is in concrete. Bait ur Rouf Mosque celebrates the local tradition of brick craftsmanship and constructing using brick. The building breathes naturally through the porous brick façade that wraps the prayer hall, essentially a pavilion on eight columns. Ample skylight allows the space to remain lit throughout the day, introducing a sense of spirituality.

Funded by the local community, the mosque is a small yet effective example of people's will towards a better living environment in one of the fastest growing cities in the world. Amplified in its architecture, Bait ur Rouf Mosque is an example of a strong, inclusive institution and a much-needed community space that powers unity and solidarity in a densely populated neighbourhood.

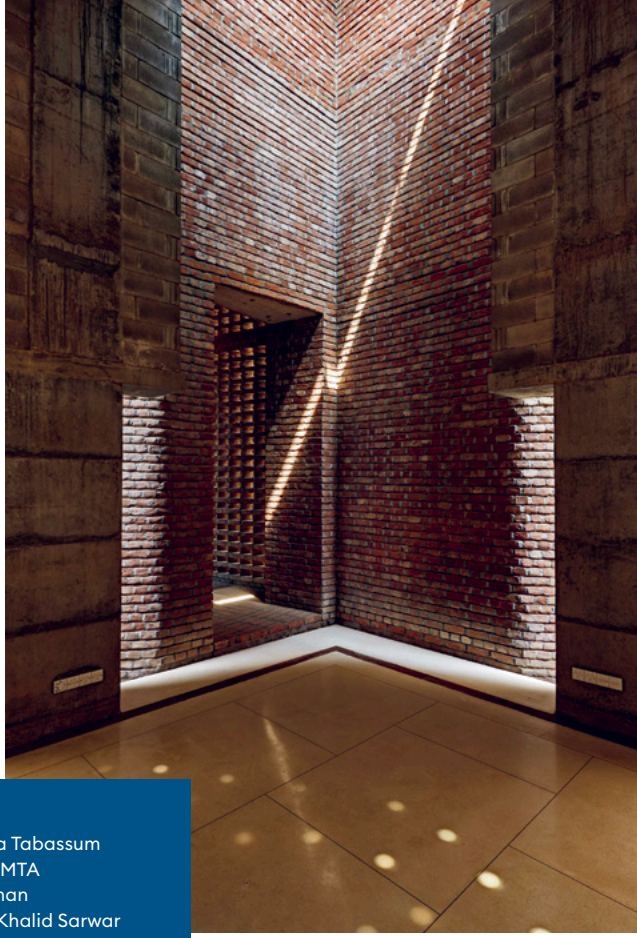


Photo: Rajesh Vora

Origin/team
Architect: Marina Tabassum
Consulting Firm: MTA
Site: Bazlur Rahman
Structure: Daud Khalid Sarwar
MEP: Rafiqul Islam

Photo: Hassan Saifuddin Chandan

Photo: Sandro di Carlo Darsa

Library of Muyinga
Muyinga, Burundi

Challenge
Across Africa, persons with disabilities encounter considerable obstacles in terms of equal access to participation in society, equal rights and equal justice. In the informal and oral Burundian culture, children with hearing impairments are excluded from stories, information and education. This means that they are isolated or even expelled from participation in society. Persons with disabilities who have received an education are better equipped to understand their rights and make use of the justice system than those who have been deprived of the right to an education.[1]

Contribution
The library of Muyinga is linked to an inclusive boarding school for children with hearing impearments. As the first of its kind in Muyinga, the public infrastructure creates the possibility of belonging to a group and to the wider community of Muyinga.

The library was built in locally sourced compressed earth blocks – with a participatory approach. A thorough study of vernacular architectural practices in Burundi was used as the basis of the building's design. Two months of fieldwork in the region and surrounding provinces gave the architects insight into the local materials, techniques and building typologies. These findings were then applied, updated, reinterpreted and framed within the local know-how and traditions of Muyinga. The general form of the library is the result of a structural logic derived from the material choice; compressed earth blocks masonry and baked clay roof tiles. A very important element in Burundian and, generally, African architecture is the very present demarcation of property lines. It is a tradition that goes back to tribal practices of compounding family settlements. For the library of Muyinga, the compound wall was developed in a co-design process with the community and the client – a local NGO.

In a later stage, the school will further integrate students with hearing impearments into broader society via a school-based wood workshop and a future multi-purpose hall, both serving the wider community of Muyinga.

Origin/team
Architect: BC architects
Local material consultancy: BC studies
Community participation and organisation:
BC studies and ODEDIM Muyinga
Cooperation: ODEDIM Muyinga NGO, Satimo vzw,
Sint-Lucas Architecture University, Sarolta Hüttl,
Sebastiaan De Beir, Hanne Eckelmans

Photos: BC architects and studies

Tūranga
Christchurch, New Zealand

Challenge
Cities and societies form and build their significant identities through their history; through decades or centuries of investments, cultural developments and personal characteristics. When disasters devastate entire societies – whether the disasters are natural or manmade – these societies are also at risk of losing the identity they have established.

Contribution
Over the course of 15 months in 2010 and 2011, Christchurch, the largest city of New Zealand's South Island, was devastated by four major earthquakes that toppled the city known for its arts, culture and surrounding natural beauty. The earthquakes cost 185 citizens' lives and left the city's infrastructure and buildings severely damaged with an estimated 400,000 citizens directly affected by the natural disaster. Rebuilding Christchurch, rehousing the people who were left homeless by the earthquake and quickly restoring the city's infrastructure was a challenge. But the city also needed to rebuild its identity and emphasise its cultural strengths in order for the community to regain trust and confidence. The new central library is one of nine anchor projects identified as vital to the redevelopment of the city centre. It is designed to be a symbol of hope, unity and rebirth, and it is a unifying meeting place for the people of Christchurch.

The design of the library in Christchurch's historic Cathedral Square supports the city's desire for a public space that strengthens the community, advances literacy and lifetime learning, celebrates diversity of culture and heritage, draws people back to the city centre and fosters innovation. Early in the design process, the architects collaborated with the local Ngāi Tūāhuriri people on aspects such as building materials and physical orientation so that a rich tapestry of ancestry, traditional knowledge and culture was woven throughout the library. The structure is built to withstand future potential earthquakes of the magnitude that destroyed so many of Christchurch's buildings in 2011.

Origin/team
Client: Christchurch City Council
Lead Design Architect: Schmidt Hammer Lassen Architects
Principal Collaborating Architect: Architectus

Photos: Adam Mørk

Palestinian Museum

Birzeit, Palestine

Challenge

The situation in the Middle East is one of global society's longest and most complex conflicts, with the Israel/Palestine war as a tragic example of decades of ongoing conflict at great cost for the region's population. Though international diplomatic and political interference has resulted in temporary truces and dialogue processes, the conflict is yet to be resolved.

Contribution

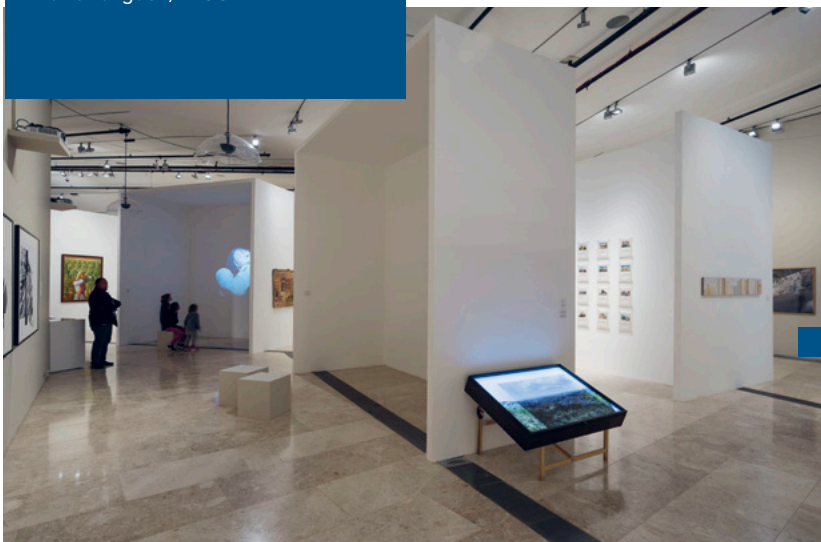
The Palestinian Museum in Birzeit was initiated by the largest NGO in Palestine, the 'Taawon Welfare Association'. The cultural institution was built with a mission to celebrate Palestinian heritage and a hope to foster a culture of dialogue.

The city of Birzeit is located on the West Bank, and the museum was built under difficult conditions with severe restrictions on both the materials and craftsmen allowed into the West Bank. The museum is located close to the University of Birzeit that also contributed to the development and realisation of the project with their research and knowledge of Palestinian culture and heritage. The building design is inspired by traditional Palestinian architecture, the vernacular landscape and local building practices. The zig-zagging shape of both the building and the surrounding landscape refers to the local agricultural terraces, and the museum gardens produce local crops for the museum café. The façade and the paving are built using Palestinian limestone quarried locally outside Bethlehem.

The initiative to build a national museum in a time of seemingly endless conflict is seen as an act of hope in the local community. The history of Palestine and the Palestinian people is so closely linked to the conflict that the broader culture and heritage of the people often is forgotten. With the new museum, the Palestinian people have a centre for their culture and history, and a positive, forward-looking landmark for dialogue, tolerance and hope for current and future generations.

Photos: Reiulf Ramstad Architects

Origin/team
Taawon Welfare Association,
heneghan peng architects,
Lara Zureikat, Arabtech Jardaneh,
Consolidated Contractors Company,
Tubaila Target United, ARUP,
Bartenbach GmbH,
T/E/S/S atelier d'ingénierie,
Projacs International,
Cultural Innovations,
Davis Langdon/AECOM



The National Memorial for Peace and Justice

Montgomery, Alabama, USA

Challenge

Man-made disaster, organised war crimes and systematic terror actions create deep wounds and trauma in societies for decades or even centuries. In the United States, the history of slavery still causes societal damage, conflicts and hurt. The past centuries saw prolonged periods of racial terror, lynching and segregation, especially in the southern states. This fuelled a mass immigration to the north and created a fearful environment where racial subordination and segregation was enforced for decades, still haunting society today.

Contribution

In order for societies to move forward from trauma and terror, it is important to recognise and acknowledge what has happened, and both sides of history need to process what has occurred.

The United States' history of slavery, lynching and racial terror is brought into the light by The National Memorial for Peace and Justice, to encourage the much-needed, but extremely difficult, conversations that have to take place to enable a healing process to commence. More than 4,000 racial lynchings have been documented, and the National Memorial is based on this objective documentation.

The memorial is the first national memorial to victims of lynching in the US. The structure suspends eight hundred Corten steel monuments to represent the counties in the United States where racial terror lynchings took place, each engraved with the names of its victims. On the memorial grounds are sculptures depicting critical moments in the nation's history; from slavery and the civil rights era, to contemporary issues of police violence and mass incarceration. Duplicates of each of the monuments lie in the monument park outside of the primary structure. The corresponding counties are invited to claim their monument and place it as a marker in their own community as an act of acknowledgement. As counties claim their monuments, the memorial's landscape transforms and serves as a report on which parts of the country that have confronted the truth of this terror.

Origin/team
The Equal Justice Initiative, MASS Design Group, NOUS Engineering, Mazzetti, Lam Partners Engineering, Howe Engineers, Delta Fountains, Robert Schwartz and Associates, Steiner Studio, Small Stuff, Kwame Akoto-Bamfo, Dana King, Hank Willis Thomas

Photos: MASS Design Group

17 PARTNERSHIPS FOR THE GOALS

Strengthen the means of implementation and revitalise the global partnership for sustainable development

A successful sustainable development agenda requires partnerships between governments, the private sector and civil society. These inclusive partnerships built upon principles and values, a shared vision, and shared goals that place people and the planet at the centre, are needed at the global, regional, national and local level.

Urgent action is needed to mobilise, redirect and unlock the transformative power of trillions of dollars of private resources to deliver on sustainable development objectives. Long-term investments, including foreign direct investment, are needed in critical sectors, especially in developing countries.[1]

To find out more about Goal #17, visit:
https://www.un.org/sustainabledevelopment/globalpartnerships/

[1] Extract from UN's Sustainability Goals, available from https://www.un.org/sustainabledevelopment/globalpartnerships/

Every home, building and settlement is built by many hands, and the development of a sustainable future similarly requires that we work together, in partnership. No single stakeholder can reach the UN 17 sustainable development goals alone.

The challenge of achieving the goals requires the involvement of all; from governments and institutional actors to researchers, businesses and citizens. Architects, designers and planners can contribute by sharing knowledge, promoting sustainable solutions and engaging in collaborations with research and institutional partners to develop and implement sustainable solutions. Examples span from non-profit partnerships providing homes for the displaced, to commercial partnerships developing new sustainable products and services to the building industry. Key to the partnerships is a willingness to include new knowledge, test new practices, engage with local climate, culture and resources and work with end users to ensure commitment and ownership in a life-cycle perspective.

Partnerships for the goals also include associations and networks of professionals who have committed to working with the goals. From the International Union of Architects (UIA), which brings together architectural associations from all over the world and represent 3.2 million architects, to local study groups sharing know-how of green roofing systems.

The challenges addressed by the goals are global; to achieve them we must work together across professional fields and national borders. Architecture interacts with each of the goals, and for each goal we must partner with other professionals, authorities, citizens and researchers to move towards more sustainable solutions everywhere.

The Habitat Project
Maputo, Mozambique

Challenge
Informal settlements, defined by UN Habitat as residential areas where a group of housing units has been constructed on land to which the occupants have no legal claim or which they occupy illegally, are spreading. Living in these settlements poses significant health risks due to a lack of sanitation and sewage facilities, food storage and poor water supply.[1] Non-compliance with planning and building regulations results in unsafe housing conditions, and often fire-fighting vehicles and ambulances are unable to pass through the narrow street networks.

Contribution
According to the Spanish NGO Arquitectura Sin Fronteras, 48% of the residents in Maputo's informal settlements are vulnerable and exposed to health risks. They lack clean water and sanitation in the overcrowded and non-durable dwellings, and they are not able to get access to state-granted land rights (DUAT).[2] The Habitat Project's main goal is to ensure residents their land rights. In a partnership with public authorities, the NGO Water & Sanitation for the Urban Poor, and local partners, Arquitectura Sin Fronteras has worked to ensure residents their right to habitation as well as helping the settlements develop so that they can function as accessible neighbourhoods. This is done through a method called "6 steps to DUAT", that seeks access to land through involvement processes and negotiation between public authorities (who own the land legally) and residents. As part of the process, residents renounce parts of their informal plots in order to obtain legal rights to a portion of the land. Consequently, a tool to establish legal borders and a legal framework is put in place, which makes it possible to establish streets with adequate widths and functional public spaces. Through this method, several neighbourhoods in Chamanculo, a part of Maputo, have obtained DUAT and seen a revival of the streetscape as a social space.

Architecture Sans Frontières International is a network of independent non-profit organisations that enables vulnerable communities to access architectural services, research and educational resources. Collaboration involves organisational, political and practical levels, and includes a wide range of professional fields.

Origin/team
Conselho Municipal de Maputo (CMM),
Arquitectura Sin Fronteras (demarcación de Catalunya),
Ordem dos Advogados de Moçambique (OAM)
Water & Sanitation for the Urban Poor (WSUP),
City Council of Barcelona – Global Justice Program-,
SELAVIP Foundation,
Radio Comunitaria Maxaquene
Instituto Politecnico de Ciencias de Terra e Ambiente (IFCTA)

Photos: Celia Márquez Coello
& Sara Márquez Martín

Gorkinsko-Ometevsky Forest

Kazan, Republic of Tatarstan, Russian Federation

Challenge

Political regimes influence culture and identity in many ways, including the architecture and infrastructure of the societies they rule. During the Soviet period in Tatarstan, hierarchical centralised planning was implemented with diverse urban locations being made to look alike. Religious and historical monuments and buildings were destroyed in the process, leaving many public spaces without their original function and identity.

Contribution

In 2015, the republic of Tatarstan initiated a programme to revive its regions' public spaces and to recreate the communities' sense of identity through the extensive *Public Spaces Development Programme*. From its inception in 2015 until the end of 2019, the programme transformed about 400 spaces across each of the Republic's 45 municipal districts, covering villages, towns and major cities – each one in partnership with local authorities, citizens and businesses.

One of the projects in the programme is the revival of the Gorkinsko-Ometevsky forest in what used to be the outskirts of the city Kazan. The forest had been reduced radically due to the construction of residential areas and the construction of a highway that divides it into several parts. Today, the Gorkinsko-Ometevsky forest is a protected natural area with three functional zones: Ometevsky Forest – an ecology zone, Gorkinsky Forest – a recreation and sports zone, and the central part of the park – a family leisure zone. The Ometevsky Forest is a unique natural area with a large number of rare trees, plants and animals. In order to give the public access while protecting the flora and fauna, visitors experience the nature from designated paths for walking and biking while information stands help create an understanding of nature.

The Gorkinsky Forest and family zone includes facilities such as a ski base, rental of sports equipment, a café and a playground. An eco-centre with a viewing platform offers education on the nature of the forest. There are also facilities for showing films, giving lectures and organising festivals, which makes the forest a public gathering point in Kazan for citizens of all ages.

Origin/team
Institute for Urban Development of the Republic of Tatarstan.
Ministry of Construction, Housing and Utilities of the Russian Federation.
Cabinet of Ministers of the Republic of Tatarstan,
Ministry of Construction, Architecture, Housing and Utilities of the Republic of Tatarstan, SBI (State Budget Institution).
"Main Investment and Construction Administration of the Republic of Tatarstan". "Project Group 8".
LLC. Directorate of Parks and Squares., Executive Committee of Kazan.
Architectural Bureau "*Architecturny Desant*".
The citizens of Kazan

Photos: Institute of urban development of the Republic of Tatarstan

IBTASEM Playground

Bar Elias, Lebanon

Challenge

The Syrian crisis is the world's largest refugee crisis, and it has been going on for almost a quarter of a century under UNCHR's mandate.[1] It has devastated lives; uprooting families from their homes and forcing them to leave the country to find safety elsewhere. Out of the more than 5 million refugees that have fled Syria as a result of the conflict, Lebanon have accepted 1.2 million – half of which are children. Temporary refugee camps provide shelter and safety for families but often fail to create a healthy community for children to grow up in.

Contribution

Refugee settlements typically, and rightly, focus on creating safe and sanitary living conditions for people in need of temporary shelter. However, temporality is a relative term, and families often stay in refugee camps for years or even decades, and it is common for children to be born and grow up in camps.[2]

In August 2015, the construction of the pilot project 'Ibtasem' was completed in Bar Elias, Lebanon. It is a collaboration between architects, a university and local NGOs, resulting in a playground design that reflects the necessity of a playground in situations of emergency response. Far too often, playgrounds and public spaces dedicated to children are not prioritised, as they are not deemed necessary in urgent conditions.

The children themselves, along with volunteers and locals, attended workshops where the Ibtasem playground was designed and built using wood and locally available reused materials, such as vegetable crates, tyres and ropes.

The project recognises children as experts in play, and the participatory approach gives the children both a unique playground and a strong sense of ownership. The playground creates a feeling of belonging for the children in Bar Elias while at the same time creating awareness about children's rights to safety, education and play no matter where they live.

Origin/team
CatalyticAction, American University of Beirut (AUB) Center for Civic Engagement and Community Service (CCECS), Kayany Foundation, ARUP, Vimala Foundation

Photos: Lorenzo Conti, Ronan Glynn, Odysseas Mourtzouchos, Joana Dabaj

Puukuokka Housing Block
Jyväskylä, Finland

Challenge
Access to affordable housing is key to social sustainability, while the materials and construction methods utilised in building affordable housing are key to environmental sustainability. Mass production and cost-efficient new materials, like concrete and steel, helped industrialised nations provide huge, affordable housing units for the working classes in the post-WWII building boom. However, the big residential suburbs turned out to carry a high cost both environmentally and socially.

Contribution
In the Puukuokka Housing Block, the architects took on the challenge to design modular, affordable housing, not in steel and concrete, but in locally prefabricated wood. CLT – cross-laminated timber – is strong enough to be the building material for Puukuokka's three eight-storey buildings; the first building in the Puukuokka trio was the tallest wooden building in Finland at the time of its completion in 2015.

Wood is a naturally renewable resource locally available in Finland; it stores CO_2 throughout its lifetime and does not require the burning of fossil fuels during its production. Wood is also recyclable and can return to the earth, as opposed to excavated materials such as stone, sand and metals.[1] Building with a natural material also has proven health benefits and can contribute to an improved indoor climate because of its moisture-absorbing properties.[2]

In Finland, the government and the affordable housing associations are joining forces to invest in the construction of high-quality affordable housing while at the same time prototyping new sustainable materials, methods and economic models for renting or buying.

Origin/team
Lakea Oy, OOPEAA Office for Peripheral Architecture, Engineering Pertti Ruuskanen Oy, SWECO rakennetekniikka Oy, A-Insinöörit Oy, Engineering Koski-Konsultit Oy, VSU Landscape architects, KK-palokonsultti Oy, Firecon Group Oy, Vahanen Oy, Jwood Ky

Photos: Mikko Auerniitty

Kirinda House

Kirinda, Hambantota, Sri Lanka

Challenge

Natural disasters, such as tsunamis, earthquakes and floods, pose great challenges to communities. When disaster hits, entire villages and neighbourhoods can be wiped away, leaving people without accommodation or livelihood for years to come. If they are lucky, the affected people are offered temporary shelter, but this can mean getting by without sanitation, privacy, community and an everyday life for an indefinite amount of time.

Contribution

In 2004, the Muslim fishing village Kirinda on the southeast coast of Sri Lanka was hit by a tsunami that left the small fishing community devastated. The fishermen and their families were forced to live in temporary shelters. Japanese architect, Shigeru Ban, was invited to lead the development of a prototype family house based on the needs described by the families, built and equipped using local labour and materials.

Since this was a rehabilitation project, it was important to reduce both the overall cost and the construction period. The main building material was CEB blocks – a compressed mixture of earth, clay and cement – that were available locally at a very low cost. To make the transition into the newly-built community easier for the families, the shelters come fully furnished with furniture designed by the architects and made from rubber trees. Rubber trees are a locally sourced, natural material also available at a low cost from plantations nationwide because of Sri Lanka's tire industry.

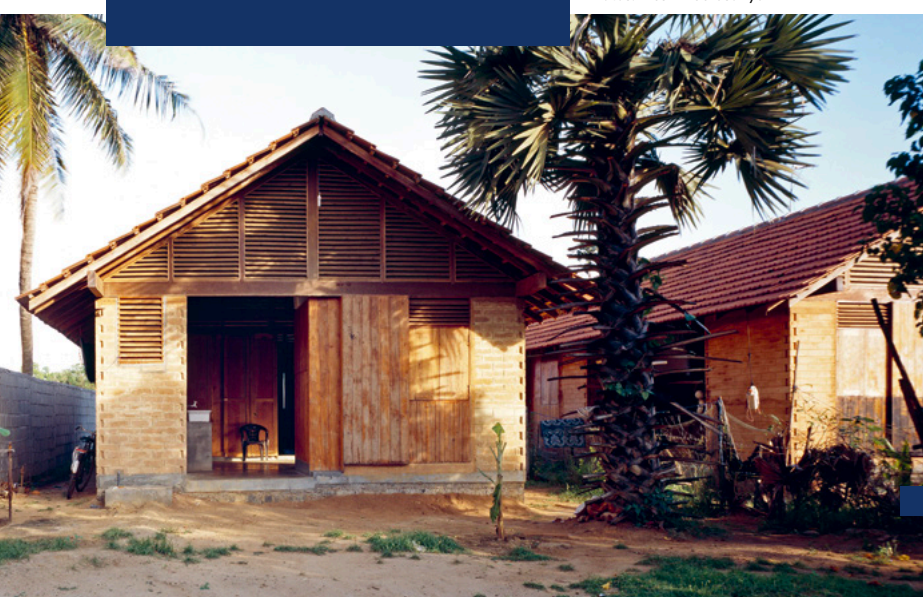
Each home has two bedrooms, a hall and a semi-open roofed courtyard space where the family can interact with their neighbours. The roofed courtyard provides protection from the sun and is naturally ventilated. It makes for an extra living room or a space where the fishermen can repair and prepare their fishing nets and equipment.

Shigeru Ban established the Volunteer Architect Network (VAN) after the Great Hanshin-Awaji Earthquake in 1995 in Japan to support disaster-affected areas and communities. The network gathered talented architects and students internationally and grew to become a catalyst for strategic

partnerships between the UN, local NGOs, governments, communities and architects. Besides Kirinda House, VAN has contributed with designs for disaster relief in nations such as Japan, Nepal, Haiti and New Zealand. The approach is signified by the combination of creative, innovative design and local know-how, skills, materials and engagement.

Origin/team
Philip Bay, Shigeru Ban Architects Europe, PWA Architects, Jeyasuthan Poornampillai, Shitanee Ivonne Balasunya, University of Moratuwa, Keio University

Photos: Eresh Weerasuriya



Photos: Eresh Weerasuriya

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Thank you to all the wonderful people actively involved in making this volume of the Architecture Guide come true, including those involved in the first volume, in particular Vibeke Grupe Larsen and Maja Lotz whose work lives on in this new volume.

Our gratitude goes to the members of the UIA Sustainable Development Goals Commission, without whom this book would not have been possible, specifically: Joel Chan, Yves Monnot, Cid Blanco Jr., Z Smith, Peter Oborn, Alice Leong Pek Lian, Mona Rady, Ramatu Aliyu, Wang Qingqin, Sudeep Sharma Paudyal, Kazuo Iwamura, Yaroslav Usov, Bruno Marques, Stefano Meneghini, Elie E. Khoury, Richard Anthony Losalajome and Allan Rodger. Special thanks to Gustavo Ribeiro, Carlos Alejandro Echeverri Restrepo and the Aga Khan Foundation for their contribution to research.

And most of all, a heartfelt thank you to the architects all over the world whose work is presented in this book, and to those who submitted their work for consideration. We could not include all the many wonderful projects in this volume and had to select among a great number of high-quality projects to reflect different challenges within each goal, different approaches to the contribution and different conditions around the world. Thank you for your commitment and efforts towards providing solutions to sustainable development challenges, your work gives us hope and inspiration. Finally, we extend our gratitude to Royal Danish Academy – Architecture, Design, Conservation and the Dreyer Foundation for supporting the publication of this book.

Royal Danish Academy – Architecture, Design, Conservation, is an architecture school in Copenhagen founded in 1754. In 2015, the Academy committed to working with the UN's 17 Sustainable Development Goals, making it mandatory for all graduates to engage with the goals in their thesis.

For more information visit www.royaldanishacademy.com

The UIA Sustainable Development Goals Commission, was established by the International Union of Architects (UIA) in 2017. The UIA itself was founded in Switzerland in 1948 to unite the architects of the world through a federation of architects' national organisations. The UIA encompasses key professional organisations and architects in 115 countries and territories worldwide. The UIA Commission on the UN 17 Sustainable Development Goals is one of four UIA commissions and brings together architects from all over the world with the purpose of collecting, analysing and disseminating knowledge of architecture's contribution to the Goals.

For more information visit www.uia-architectes.org and www.uia-architectes.org/webApi/en/working-bodies/sdg

The associations of architects in Scandinavia form the Nordic Section in the UIA and will host the **UIA World Congress in Copenhagen in 2023.** The congress will be held under the theme ***"Sustainable Futures - Leave No One Behind"*** and will focus on how architecture can contribute to the achievement of the UN Sustainable Development Goals.

For more information visit www.uia2023cph.org

REFERENCES

1 NO POVERTY

Grand Parc
https://www.lacatonvassal.com/index.php?idp=80
https://www.christophehutin.com/portfolio/transformation-de-530-logements-batiments-gh-et-i-du-grand-parc/

Venligbolig Plus
https://onv.dk/projekt/venligbolig-plus/

Kalobeyei New Settlement
https://www.unhcr.org/ke/kalobeyei-settlement

1,3,4. Terada,Yuka. Jerimah Ougo et al. "KALOBEYEI NEW SETTLEMENT." United Nations Human Settlement Programme Urban Planning and Design Branch (2020): 1, 3, 9.

2. Lüdeking, Gert. "Session 4.2: An integrated Settlement for Refugees and Local Population." (2019): 3.

Acuña Housing Prototype
https://tatianabilbao.com/projects/housing

1. Marosi, Richard. "A Failed Vision." latimes.com.
https://www.latimes.com/projects/la-me-mexico-housing/ (Accessed August 2020).

2. Malkin, Elisabeth. "Matching Architecture to People's Needs, by Listening to Them First." nytimes.com.
https://www.nytimes.com/2018/03/07/arts/design/tatiana-bilbao-architect.html (Accessed August 2020).

Empower Shack Housing Project
http://u-tt.com/project/empower-shack/

2 ZERO HUNGER

Alaska Seeds of Change
https://alaskabehavioralhealth.org/what-we-do/vocational-services/alaska-seeds-of-change/?fbclid=IwAR24e_-BSQSRw5Jcr1guQk9jdyDTmz18TBB2TPAPyyAKw_Vwb54_IR2Z1YU

1,2. Stevenson, K.T., L. Alessa, A.D. Kliskey, H.B. Rader, A. Pantoja, M. Clark. "Sustainable Agriculture for Alaska and the Circumpolar North: Part 1. Development and Status of Northern Agriculture and Food Security." Arctic Institute of North America. 67(3) (2014): 271-295.

La Caverne
http://cycloponics.co/

1. The World Bank. "Total Population" data.worldbank.org.
https://data.worldbank.org/indicator/SP.POP.TOTL (Accessed August 2020).

2. Royte, Elizabeth. "Urban farms now produce 1/5 of the world's food." greenbiz.com.
https://www.greenbiz.com/article/urban-farms-now-produce-15-worlds-food (Accessed August 2020).

3. Food and agriculture Organization of the United Nations. "Urban Food Agenda." fao.org.
http://www.fao.org/urban-agriculture/en/ (Accessed August 2020).

Micro Gardening in Refugee Camps
https://www.iom.int/news/micro-gardening-scheme-help-feed-rohingya-refugees-bangladeshi-local-communities#:~:text=The%20micro%20gardening%20initiative%2C%20which,scale%20production%20among%20local%20farmers.
http://www.fao.org/home/en/

1. FAO turned its attention to supporting these agencies with technical advice to ensure quality and equitable coverage. This work was conducted through the Livelihoods Working Group (LHSWG), co-chaired by FAO and WFP. There are still many agencies distributing various home gardening kits throughout the camps which continue to be mapped and overseen by the LHSW

The Rwanda Institute for Conservation Agriculture (RICA)
https://massdesigngroup.org/work/design/rwanda-institute-conservation-agriculture

Rooftop Garden at ARTS Group Headquarters
http://www.gmbarchitects.com/projects/arts-group-headquarters/

Department of Economic and Social Affairs of United Nations "68% of the world population projected to live in urban areas by 2050, says UN." un.org https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html (Accessed Auhust 2020)

3 GOOD HEALTH AND WELL BEING

The Star Homes Project
http://ingvartsen.dk/star-homes

1. United Nations, Department of Economic and Social Affairs, Population Division. "World Population Prospects 2019: Highlights." ST/ESA/SER.A/423. (2019): 6.

2. Lucy S. Tusting, Peter W. Gething, Harry S. Gibson, Brian Greenwood, Jakob Knudsen, Steve W. Lindsay, Samir Bhatt. "Housing and child health in Sub-Saharan Africa: A cross-sectional analysis." PLOS (March 23, 2020).

3. Featured in volume 1 of An Architecture Guide to the UN17 Sustainable Development Goals.

Bayalpata Hospital
https://sharondavisdesign.com/project/bayalpata-community-hospital-nepal/

1. Bhattarai, Sewa. "How to upgrade Nepals rural health." nepalitimes.com. https://www.nepalitimes.com/banner/this-is-how-to-upgrade-nepals-rural-health/ (Accessed August 2020).

2. Rural Health Information Hub. "Healthcare Access in Rural Communities." ruralhealthinfo.org. https://www.ruralhealthinfo.org/topics/healthcare-access (Accessed August 2020).

GAME Streetmekka
http://effekt.dk/game2
http://gamedenmark.org/game-zoner/game-viborg/

LightPathAKL
http://www.monkmackenzie.com/#/nelson-st-cycleway-1/

1. Cities Changing Diabetes. “Urban diabetes.” citieschangingdiabetes.com. http://www.citieschangingdiabetes.com (Accessed September 2020).

2. New Zealand Transport Agency. “More people than ever cycling to the city from the west.” nzta.govt.nz. https://www.nzta.govt.nz/media-releases/more-people-than-ever-cycling-to-the-city-from-the-west/ (Accessed August 2020).

Port Sudan Paediatric Centre
https://en.emergency.it/projects/port-sudan-paediatric-centre/
https://www.tamassociati.org/portfolio/healing-garden/

1. Human Rights Watch. “Sudan Events of 2019.” hrw-org.
https://www.hrw.org/world-report/2020/country-chapters/sudan (Accessed August 2020).

2. The World Bank. “Mortality rate, under-5 (per 1,000 live births) – Sudan.” data.worldbank.org.
https://data.worldbank.org/indicator/SH.DYN.MORT?locations=SD (Accessed August 2020).

3. DABANGA. “Health services deteriorating in Port Sudan.” dabangasudan.org.
https://www.dabangasudan.org/en/all-news/article/health-services-deteriorating-in-port-sudan (Accessed August 2020).

4 QUALITY EDUCATION

Fuji Kindergarten
http://www.tezuka-arch.com/english/works/education/fujiyochien/

1. Samuelsson, Ingrid Pramling. Yoshie Kaga. “The Contribution of early childhood education to a sustainable society.” Conference: The Role of Early Childhood Education for a Sustainable Society, Göteborg, Sweden, 2007. (https://unesdoc.unesco.org/ark:/48223/pf0000159355

Children Village
https://gustavoutrabo.com/Children-Village-Canuana-RIBA-International-Prize-Winner-2018

Glasir – Tórshavn College
https://big.dk/#projects-faer

The Sensory Well-being Hub
https://www.hksinc.com/our-news/articles/the-sensory-wellbeing-hub-at-chicagos-lane-tech-college-prep-high-school/

South Harbour School
https://www.jjw.dk/?projekt=sydhavnsskolen

5 GENDER EQUALITY

Habitat for Orphan Girls
http://www.zavarchitect.com/?work=habitat-orphan-girls

1. World Economic Forum. “Mind the 100 Year Gap.”, weforum.org.
https://www.weforum.org/reports/gender-gap-2020-report-100-years-pay-equality (Accessed August 2020).

Fariba, Parsa. “The Role of women in building Iran’s future.” Mei.edu.
https://www.mei.edu/publications/role-women-building-irans-future (Accessed August 2020).

Woldyia Maternity Center
https://vilalta.studio/en/portfolio-item/woldyia-maternity/

1. The Guardian "Ethiopia: too many deaths in childbirth as women opt out of healthcare." theguardian.com.

https://www.theguardian.com/global-development/2012/may/05/ethiopia-deaths-childbirth-women-healthcare (Accessed August 2020).

2. World Health Organization Ethiopia Country Profile in "WHO Director-General Roundtable with Women Leaders on Millennium Development Goal 5." 2008, who.int.

https://www.who.int/maternal_child_adolescent/events/2008/mdg5/countries/final_cp_ethiopia_18_09_08.pdf?ua=1 (Accessed August 2020).

The Light Box
https://rcarchitects.in/project/the-light-box-restroom-for-women/

1. UN Women. "UN Women India." unwomen.org.
https://asiapacific.unwomen.org/en/countries/india (Accessed August 2020).

2. Sehgal, Shreya. "India refuses to spend money on women's safety" asiatimes.com
https://www.asiatimes.com/2019/08/article/india-refuses-to-spend-money-on-womens-safety/ (Accessed August 2020).

3. Bhowmick, Nilanjana. "How women in India demanded–and are getting–safer streets." National Geographic, Women: A Century of Change (November 2019) nationalgeographic.com.
https://www.nationalgeographic.com/culture/2019/10/how-women-in-india-demanded-and-are-getting-safer-streets-feature/ (Accessed August 2020).

4. World Economic Forum. "Mind the 100 Year Gap.", weforum.org.
https://www.weforum.org/reports/gender-gap-2020-report-100-years-pay-equality (Accessed August 2020).

Naryan, Deepa."India is the most dangerous country for women. It must face reality." theguardian.com.
https://www.theguardian.com/commentisfree/2018/jul/02/india-most-dangerous-country-women-survey (Accessed August 2020).

Anita May Rosenstein Campus
http://kfalosangeles.com/projectpost/lgbt-center-2/
https://lalgbtcenter.org/

1. University of Chicago. "LGBTQ young adults experience homelessness at more than twice the rate of their peers." news.uchicago.edu.
https://news.uchicago.edu/story/lgbtq-young-adults-experience-homelessness-more-twice-rate-their-peers (Accessed August 2020).

Women's Opportunity Center
http://sharondavisdesign.com/project/womens-opportunity-center/

1. Abouzeid, Rania. "How women are stepping up to remake Rwanda." National Geographic, Women: A Century of Change (November 2019). nationalgeographic.com.
https://www.nationalgeographic.com/culture/2019/10/how-women-are-remaking-rwanda-feature/ (Accessed ? 2020).

2. World Economic Forum. "Mind the 100 Year Gap." weforum.org
https://www.weforum.org/reports/gender-gap-2020-report-100-years-pay-equality (Accessed August 2020).

6 CLEAN WATER AND SANITATION

Sydney Park Water Re-Use Project
https://turfdesign.com/sydney-park-water-re-use-project/

1. City of Sidney. “Sidney Park Wetlands.” cityofsydney.nsw.gov.au. https://www.cityofsydney.nsw.gov.au/vision/better-infrastructure/parks-and-playgrounds/completed-projects/sydney-park-wetlands (Accessed August 2020).

WaterWorld. “Sydney Park: A Flagship for Stormwater Success.” waterworld.com. https://www.waterworld.com/international/wastewater/article/16201129/sydney-park-a-flagship-for-stormwater-success (Accessed August 2020).

Toigetation
http://www.hpa.vn/toigetation_pr129.aspx

Vandvejen
https://www.vandvejen.org/
https://klimaspring.dk/prejekter-og-projekter/vandvej

DATA 1
http://www.weberthompson.com/projects/1118

Warka Village
https://www.warkawater.org/warka-village/

1. Gaworecki, Mike. “First estimate of Congo Basin’s pygmy population comes with warning about increasing threat of deforestation” news.mongabay.com https://news.mongabay.com/2016/01/first-estimate-of-congo-basins-pygmy-population-comeswith-warnings-about-increasing-threat-of-deforestation/ (Accessed September 2020)

2. See description of Warka Tower featured in volume 1 of An Architecture Guide to the UN17 Sustainable Development Goals.

7 AFFORDABLE AND CLEAN ENERGY

2226 Emmenweid
https://www.baumschlager-eberle.com/en/work/projects/projekte-details/2226-emmenweid/

Energy Bunker
https://www.hhs.ag/projects.html?projekt=energy-bunker&typologie=

1. Federal Ministry for Economic Cooperation and Development, Germany, Ministry of Foreign Affairs of the Netherlands, International Renewable Energy Agency and World Bank. “POLICY BRIEF 24: ENERGY SECTOR TRANSFORMATION: DECENTRALIZED RENEWABLE ENERGY FOR UNIVERSAL ENERGY ACCESS.” (2018): 2.

2. IBA_Hamburg. “Energy Bunker.” IBA_Hamburg. https://www.internationale-bauausstellung-hamburg.de/en/projects/energiebunker/projekt/energy-bunker.html (Accessed February 20, 2020).

Lycée Schorge Secondary School
http://www.kere-architecture.com/projects/lycee-schorge-secondary-school/

UN Environment and International Energy Agency (2017): “Towards a zero-emission, efficient, and resilient buildings and construction sector. Global Status Report 2017.”

Tverråa Hydropower Plant
https://www.helgelandkraft.no/Vannkraft/om-oss/vare-anlegg/tverraa-kraftverk/

1. Statkraft. “Hydropower” Factsheet, September 2009. https://www.statkraft.com/globalassets/old-contains-the-old-folder-structure/documents/hydropower-09-eng_tcm9-4572.pdf (Accessed September 2020).

2. International Hydropower Association. “Norway.” Hydropower.org. https://www.hydropower.org/country-profiles/norway (Accessed September 2020).

United Nations Department of Economic and Social Affairs Statistics Division. “Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all.” unstats.un.org. https://unstats.un.org/sdgs/report/2016/goal-07/ (Accessed August 2020).

8 DECENT WORK AND ECONOMIC GROWTH

Azraq School
https://ea-hr.com/all-projects/

Mount Sinai Ambulatory Surgical Facility
https://kliment-halsband.com/work/mount-sinai-kyabirwa-village-surgical-facility-healthcare/

1. World Health Organization. “Meeting the need for surgery.” Bulletin of the World Health Organization, Volume 94: Number 3 (2016), p. 157-232.

2. Mazumdar, Tulip. “Five billion people have no access to safe surgery.” bbc.com. https://www.bbc.com/news/health-32452249 (Accessed September 2020).

Facebook Bayfront Campus
https://www.cmgsite.com/project/facebook-campus/facebook-bayfront-campus/

1. United Nations Development Programme. ”Goal 8: Decent work and economic growth.“ undp.org. https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-8-decent-work-and-economic-growth.html (Accessed August 2020).

2. Stranden. Anne Lise. ”Det er lønnsomt å sette inn tiltak for bedre arbeidsforhold.” forskning.no https://forskning.no/okonomi-arbeid-forebyggende-helse/det-er-lonnsomt-a-sette-inn-tiltak-for-bedre-arbeidsforhold/377937 (Accessed August 2020).

Cassia Co-op Training Centre
http://www.tyinarchitects.com/works/cassia-coop-training-centre/

1. Rainforest Alliance. “Introducing the World’s First Rainforest Alliance Certified Cinnamon Farms.” rainforest-alliance.org.

https://www.rainforest-alliance.org/pictures/cinnamon-slideshow (Accessed August 2020).

2. Boths ENDS. “Cassia Co-op: a bridge between cinnamon farmers in Indonesia and consumers.” bothsends.org.

https://www.bothends.org/en/Whats-new/News/Cassia-Co-op-a-bridge-between-cinnamon-farmers-in-Indonesia-and-consumers-/ (Accessed August 2020).

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

Folden
https://vandkunsten.com/en

1. AAB. “What is social housing?” aab.dk.
https://www.aab.dk/da/TopMenu/In-English/About-social-housing (Accessed August 2020).

Alnatura Campus
https://www.alnatura.de/de-de/ueber-uns/alnatura-campus/
https://www.lehmtonerde.at/en/projects/project.php?pID=97

Ilima Primary School
https://massdesigngroup.org/work/design/ilima-primary-school

EcoCocon
https://ecococon.eu/gb/

1. World Green Building Council. "New report: The building and construction sector can reach net zero carbon emissions by 2050." worldgbc.org. https://www.worldgbc.org/news-media/WorldGBC-embodied-carbon-report-published#_ftn1 (Accessed August 2020).

2. Cinark. "Circular Construction: Materials Architecture Tectonics." Copenhagen: KADK, 2019. P. 30-31. https://issuu.com/cinark/docs/circular_construction_080919_low (Accessed August 2020).

3. Editorial note: Straw stores 1,34kg/kg and Wood stores 1,59kg/kg (kg CO_2/kg of mass). These numbers are from the EPD (Environmetal Product Declaration) of EcoCocon: http://naturalbuilding.fi/wordpress2018/wp-content/uploads/2018/09/EPD-EcoCocon-Straw-Panel_final.pdf (Accessed August 2020).

Shelter for All
https://www.heritagefoundationpak.org/Hf

1. The Pakistan Weather Portal. "History of earthquakes in Pakistan in detail." pakistanweatherportal.com. https://pakistanweatherportal.com/2011/07/30/history-of-earthquakes-in-pakistan-in-detail/ (Accessed August 2020).

2. Jamal, Sana. "Pakistani woman architect Yasmeen Lari wins prestigious Jane Drew Prize." gulfnews.com. https://gulfnews.com/world/asia/pakistan/pakistani-woman-architect-yasmeen-lari-wins-prestigious-jane-drew-prize-1.69329499. (Accessed August 2020).

3. Aljazeera Special series. "Yasmeen Lari: 'On the road to self-reliance.'" aljazeera.com. https://www.aljazeera.com/programmes/rebelarchitecture/2014/08/yasmeen-lari-road-self-reliance-20148511850548381.html (Accessed August 2020).

10 REDUCED INEQUALITIES

Step up on 5th
https://brooksscarpa.com/step-up-on-5th

1. Harvard Medical School. "The homeless mentally ill." Harvard Health Publishing, March 2014. https://www.health.harvard.edu/newsletter_article/The_homeless_mentally_ill (Accessed February 16, 2020).

2. Tarr, Peter. "Homelessness and Mental Illness: A Challenge to Our Society." Brain & Behavior Magazine (September 2018): 40-41.

Farming Kindergarten
https://www.vtnarchitects.net/?pgid=kcq39hz4-f6337ae4-f305-4330-b544-3cb2d6c6b5b9

1. UN Women. "Progress of the world's women – Families in a changing world." unwomen.org. https://www.unwomen.org/en/digital-library/progress-of-the-worlds-women (Accessed August 2020).

Musholm Multi-purpose Hall
https://aart.dk/en/projects/musholm

1. World Health Organization. "Physical inactivity a leading cause of disease and disability, warns WHO." who.int.
https://www.who.int/mediacentre/news/releases/release23/en/ (Accessed August 2020).

2. AART. "Improving the quality of life." aart.dk. https://aart.dk/en/impact/musholm (Accessed August 2020).

Re-establishing Fishermen Shacks
https://www.facebook.com/oficinaespacialI/
https://www.ead.pucv.cl/

1,2. UNWTO World Tourism Organization." TOURISM'S GROWTH ACROSS ALL REGIONS STRENGTHENS SECTOR'S POTENTIAL TO CONTRIBUTE TO SUSTAINABLE DEVELOPMENT AGENDA." WORLD TOURISM BAROMETER, VOLUME 17, NOVEMBER 2019. https://www.unwto.org/news/tourisms-growth-across-all-regions-strengthens-sectors-potential-to-contribute-to-sustainable-development-agenda (Accessed September 2020).

Share Kanazawa
https://www.goi.co.jp/

1. World Health Organization. "Ageing and Health." who.int. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health (Accessed August 2020).

2. World Economic Forum. "Elderly people make up a third of Japan's population – and it's reshaping the country." weforum.org. https://www.weforum.org/agenda/2019/09/elderly-oldest-population-world-japan/ (Accessed August 2020).

3. WorldoMeter. "Japan Population." worldometers.info. https://www.worldometers.info/world-population/japan-population/ (Accessed May 2020)
4. Nippon.com. "Japan's Cities Should Prepare for Growing Elderly Population." nippon.com. https://www.nippon.com/en/japan-data/h00585/japan%E2%80%99s-cities-should-prepare-for-growing-elderly-population.html (Accessed August 2020).

5. JOHNSTON, ERIC. "Kanazawa retirement community a relocation-from-Tokyo success story" japantimes.co.jp
https://www.japantimes.co.jp/news/2016/02/15/national/kanazawa-retirement-community-relocation-tokyo-success-story/#.XsOdWRMzZ0s (Accessed August 2020).

11 SUSTAINABLE CITIES AND COMMUNITIES

Artists' Residency and Cultural Center
https://tmarch.com/thread

New Shougang High-end Industry Comprehensive Service Park
https://www.shougang.com.cn/en/ehtml/ShougangPark/

1. C40 Blog. "New Beijing project first in China to be accepted into C40's Climate Positive Development Programme." c40.org. https://www.c40.org/blog_posts/new-beijing-project-first-in-china-to-be-accepted-into-c40-s-climate-positive-development-programme (Accessed August 2020).

Large-scale Urban Planning in Nordhavn
https://www.cobe.dk/place/nordhavn

1. United Nations, Department of Economic and Social Affairs, Population Division (2019). "World Urbanization Prospects: The 2018 Revision" (ST/ESA/SER.A/420). New York: United Nations.
2. CPH City and Port development." Nordhavnen Urban Strategy." issuu.com. https://issuu.com/nordhavnen/docs/nordhavnen_strategy_271009_low__2_(Accessed August 2020).

V House of Dashilar
http://www.hypersity.cn/projects

1. Xinhua News Agency." 70% of Beijing Hutongs Destroyed."December 20, 2006. http://http://www.china.org.cn/english/MATERIAL/193219.htm (accessed March 4, 2020).

2. ROCKWOOL Group / Copenhagen Economics. "Putting renovation on the agenda: Global perspectives on the value of renovation." (2018): 5.

‘Social Urbanism’ in Medellín

1. United Nations, Department of Economic and Social Affairs, Statistics Division. “Rapid urbanization and population growth are outpacing the construction of adequate and affordable housing.” unstats.un.org. https://unstats.un.org/sdgs/report/2019/goal-11/ (accessed September, 2020).

2. Borrell, John. “Colombia the Most Dangerous City: Welcome to Medellin, coke capital of the world.” March 21 1988. Content.time.com. http://content.time.com/time/subscriber/article/0,33009,967029-4,00.html (accessed September, 2020).

3. Citi, Wall Street Journal and Urban Land Institute. “City of the year.” (2012). wsj.com. https://www.wsj.com/ad/cityoftheyear (accessed April 2, 2020).

4. Martin, A. Gerard Martin. “Proximity, Crime, Politics and Design: Medellin’s Popular neighbourhoods and the Experience of Belonging” in Housing and Belonging in Latin America. Klaufus, C. & Ouweneel, A. (eds.). Cedla Latin America Studies ed. New York / Oxford: Berghahn, Vol. 105. p. 43-79.

5. Restrepo, Alejandro Echeverri. Francesco M. Orsini. “INFORMALITY AND SOCIAL URBANISM IN MEDELLÍN” Medellin: environment, urbanism and society (URBAM 2012): p.132-156.

6. Warnock-Smith, Alex.” Story of cities #42: Medellín escapes grip of drug lord to embrace radical urbanism.” May 13 2016.www.theguardian.com. https://www.theguardian.com/cities/2016/may/13/story-cities-pablo-escobar-inclusive-urbanism-medellin-colombia (accessed December, 2019).

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Cork House
https://www.matthewbarnetthowland.com/cork-house

1. UN Environment and International Energy Agency. “Towards a zero-emission, efficient, and resilient buildings and construction sector.” Global Status Report 2017. (2017): 6.

Life Reusing Posidonia
http://eng.reusingposidonia.com/life-reusing-posidonia/

Næste
https://www.naeste.dk/

1. Slowey, Kim “Report: Global construction waste will almost double by 2025.” in Construction Dive Brief. (March 13, 2018).

Sankofa House
http://www.mamoth.fr/portfolio/sankofa-house/

The Perret Hall
http://www.pierrehebbelinck.net/en/projets/352-en

13 CLIMATE ACTION

Building with Nature – The Sand Motor
https://www.ecoshape.org/en/projects/naturecoast/
https://www.ecoshape.org/en/about-ecoshape/

1. IPCC Press Release. “Choices made now are critical for the future of our ocean and cryosphere.” ipcc.ch. https://www.ipcc.ch/site/assets/uploads/sites/3/2019/09/SROCC_PressRelease_EN.pdf (Accessed August 2020).

2. Climate ADAPT. “Sand Motor – building with nature solution to improve coastal protection along Delfland coast (the Netherlands) (2019).” climate-adapt.eea.europa.eu. https://climate-adapt.eea.europa.eu/metadata/case-studies/sand-motor-2013-building-with-nature-solution-to-improve-coastal-protection-along-delfland-coast-the-netherlands (Accessed August 2020).

Minghu Wetland Park
https://www.turenscape.com/en/project/detail/4556.html

1. Xuan, Liu and Pan Mengqi. "Capital absorbs 'sponge city' ideas." chinadaily.com.cn. https://www.chinadaily.com.cn/china/2017-11/30/content_35131286.htm (Accessed August 2020).

Sankt Kjelds Plads & Bryggervangen
https://www.sla.dk/dk/projects/bryggervangen-sankt-kjelds-plads/

1 Million Trees
https://greeningthewest.org.au/

1. Zhou, B., Rybski, D. & Kropp, J.P. "The role of city size and urban form in the surface urban heat island." Sci Rep 7, 4791 (2017).

2. Leal Filho W, Echevarria Icaza L, Emanche VO, Quasem Al-Amin A. "An Evidence-Based Review of Impacts, Strategies and Tools to Mitigate Urban Heat Islands." Int J Environ Res Public Health. 2017 Dec 19;14(12):1600.

3. M. Santamouris, "Recent progress on urban overheating and heat island research. Integrated assessment of the energy, environmental, vulnerability and health impact. Synergies with the global climate change." Energy and Buildings, Volume 207, 2020.

4. Hope, Zach. "Temperature records tumble across Victoria, as Melbourne peaks at 43.5 degrees." The Age. December 20, 2019. https://www.theage.com.au/national/victoria/temperature-records-tumble-across-victoria-as-melbourne-peaks-at-43-5-degrees-20191220-p53lyr.html#:-:text=Melbourne%20peaked%20at%20a%20scorching,December%20record%20by%20mid%20afternoon. (Accessed September 2020).

5. Steffen, Will. (Climate Commission). "The Angry Summer." Commonwealth of Australia (Department of Climate Change and Energy Efficiency) 2013.

6. Department of Infrastructure and Regional Development. "State of Australian Cities 2014-2015: Progress in Australian
Regions." Australian Government, Commonwealth of Australia, 2015.

Arcadia Education Project
https://bengal.institute/team/saif-ul-haque/
https://www.akdn.org/architecture/project/arcadia-education-project

14 LIFE BELOW WATER

Löyly Sauna
https://avan.to/works/loyly/

1. University of Helsinki. "ENVIRONMENT.", helsinki.fi. http://www.helsinki.fi/envirohist/seaandcities/cities/hel/hel_envi.htm (Accessed August 2020).

Living Seawalls
https://www.sims.org.au/page/130/living-seawalls-landing
https://www.reefdesignlab.com/living-seawalls

North Sidney Council. "Living Seawalls Project." northsydney.nsw.gov.au. https://www.northsydney.nsw.gov.au/Waste_Environment/Sustainability/What_is_Council_Doing/Living_Seawalls_Project (Accessed August 2020).

R.U.M.
https://plastixglobal.com/
https://www.cfmoller.com/p/-da/R-U-M--i3521.html
http://wehlers.com/

Marine Education Centre
https://www.nordarchitects.dk/malmo

15 LIFE ON LAND

Qian'an Sanlihe River Ecological Corridor
https://www.turenscape.com/en/project/detail/4554.html

1. International Union for Conservation of Nature (IUCN). "Biodiversity status and trends." iucn.org. https://www.iucn.org/regions/mediterranean/our-work/mediterranean-species-programme/biodiversity-status-and-trends (Accessed August 2020).

Hong Kong Wetland Park
https://www.wetlandpark.gov.hk/en/

1. Legislative Council of Hong Kong Special Administrative Region of the Peoples Republic of China, Research Office, Legislative Council Secretariat. "Land utilization in Hong Kong." Statistical Highlights is ISSH04/16-17. October 24, 2016.

https://www.flickr.com/photos/ist4u

Trollstigen National Tourist Route Project
http://www.reiulframstadarchitects.com/trollstigen-visitor-centre

1. Nasjonale turistveger/Norwegian Scenic Routes. "Geiranger – Trollstigen." nasjonaleturistveger.no/en. https://www.nasjonaleturistveger.no/en/routes/geiranger-trollstigen (Accessed August 2020).

2. Pearson, Stephanie. "Norway's Bold Plan to Tackle Overtourism And climate change at the same time." outsideonline.com.
https://www.outsideonline.com/2401446/norway-adventure-travel-overtourism (Accessed August 2020).

Renaturation of the River Aire
http://www.adr-architectes.ch/

Văcărești Natural Park
https://parcnaturalvacaresti.ro/en/the-park

1. Secretariat of the Convention on Biological Diversity. "Cities and Biodiversity Outlook. Montreal." (2012): 19.

16 PEACE JUSTICE AND STRONG INSTITUTIONS

Bait ur Rouf Mosque
https://mtarchitekts.com/home.php?o=noflash

Library of Muyinga
http://architects.bc-as.org/Library-of-Muyinga

1. Division for Social Policy Development, Department of Economic and Social Affairs. "ACCESS TO JUSTICE FOR PERSONS WITH DISABILITIES: Toolkit on disability for AFRICA." United Nations (no year): 3.

Tūranga
https://www.shl.dk/dk/christchurch-central-library/

Palestinian Museum
https://www.hparc.com/work/palestinian-museum1
http://www.palmuseum.org/language/english
https://www.akdn.org/architecture/project/palestinian-museum

The National Memorial for Peace and Justice
https://massdesigngroup.org/work/design/national-memorial-peace-and-justice
https://museumandmemorial.eji.org/

17 PARTNERSHIPS FOR THE GOALS

The Habitat Project
http://asfes.org/

Gorkinsko-Ometevsky forest
https://www.akdn.org/architecture/project/public-spaces-development-programme
https://visit-tatarstan.com/en/places/attractions/gorkinsko-ometjevskij_les/

1. Fishman, Natalia. "Transforming Tatarstan's Parks." The Institute of Environment and Recreation Management, ierm.org.za. https://www.ierm.org.za/Transforming_Tatarstans-s_Parks_-_Natalia_Fishman.pdf (Accessed August 2020).

IBTASEM Playground
http://www.catalyticaction.org/all-project-list/playground-syrian-refugees/

1. UNHCR, The UN refugee Agency "UNHCR: Total number of Syrian refugees exceeds four million for first time." unhcr.org.
https://www.unhcr.org/news/press/2015/7/559d67d46/unhcr-total-number-syrian-refugees-exceeds-four-million-first-time.html (Accessed August 2020).

2. USA for UNHCR. "Refugee Camps." unrefugees.org.
https://www.unrefugees.org/refugee-facts/camps (Accessed August 2020).

Puukuokka Housing Block
http://oopeaa.com/project/puukuokka-housing-block/
http://www.housingeurope.eu/resource-1059/finnish-housing-system-in-the-spotlight

1. Harvey, Fiona. "Ply in the sky: the new materials take us beyond concrete." theguardian.com.
https://www.theguardian.com/world/2019/feb/27/ply-sky-new-materials-take-us-beyond-concrete-carbon-dioxide (Accessed August 2020).

2. Jensen, Anders Vestergaard. Nic Craig. "WOOD IN CONSTRUCTION 25 CASES OFNORDIC GOOD PRACTICE." Nordic Wood in Construction Secretariat. Copenhagen: Nordic Council of Ministers, 2019.
http://norden.diva-portal.org/smash/get/diva2:1297443/FULLTEXT03.pdf (Accessed August 2020).

Kirinda House
http://www.shigerubanarchitects.com/works/2005_kirinda-house/index.html


1.a
Grand Parc
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ARCHITECTS' CALL FOR ACTION

The UN 17 Sustainable Development Goals represent the commitment of the people of the United Nations for a more sustainable future. Architecture and the built environment are part of the current problems but also vital to the solutions we need in order to accomplish the Goals. This book is the second volume of an architecture guide to the Goals. The 17 chapters present the Goals as defined by the UN, outline how each goal interacts with the built environment and give examples of real projects that illustrate how architecture can contribute.