



# MAKING OUR CITIES MORE RESILIENT

Preparing for the  
challenges of  
the future

#ThisFutureRocks

# MAKING OUR CITIES MORE RESILIENT



## INTRODUCTION

Populations around the world are looking to their city administrators and legislators to improve the resilience of their urban environments. With a host of challenges facing major cities, taking action now can reduce the impact of the chronic stresses and acute shocks of both the present and future. Facing up to the adversities of today will require a holistic approach and systematic transformation of the built environment.

**Urban resilience is a city's ability to bounce back after experiencing hardship.** Many of the world's major cities are leading the fight against climate change, but increasing resilience goes further than just preparing for a natural disaster. It requires policy makers to increase the capacity of individuals, businesses, institutions, communities, and systems to adapt, grow, and survive the variety of adversities they could experience.

Growing populations, pandemics, climate change, and cyber attacks all present very real challenges to modern cities. To make a city more resilient, decision-makers will need to address these challenges, while also making their urban built environments healthier and more comfortable for citizens. By studying the risks faced by the city and understanding the interdependencies of the systems and society, administrators can design robust solutions and implement effective programmes to improve their development trajectories and enhance the wellbeing of their populations.

In some situations, the required changes will result in a new way of living in and around the city. A recent example of that is the COVID-19 pandemic, which put much of the world under pressure, with some cities affected more than others. With people spending more time indoors, it shifted how people work, live, and play in the future, creating a '**new normal**' for many of the world's urban populations.

# WHAT DOES URBAN RESILIENCE MEAN FOR CITIES?

Resilience begins with strong foundations, from the building blocks of the built environment, to investment and society's health and wellbeing. City governments are taking up that challenge by caring for their citizens and trying to solve the local challenges that cities face. Citizens understand that looking to local governments is an effective way to create the necessary resilience required for future prosperity.

## HARDSHIPS THAT CITIES CAN EXPECT TO FACE NOW AND IN THE FUTURE

The rate of urbanisation across the globe will continue to increase exponentially in the future. Currently, some 3.9 billion people live in cities, and by 2050, the United Nations expects that number to grow by another 2.5 billion. With the majority of the world's population living in urban environments, cities have become the beating hearts of their country's economy. Economic prosperity gives cities additional power, but with it comes greater responsibility.

Broadly speaking, officials will need to address two types of challenges that can cause hardship to cities. These include chronic stresses from an increased rate of urbanisation and acute, unexpected shocks from extreme climate conditions and other related events.

### Examples of 'chronic stresses' that can affect major cities include:

- Energy poverty due to insufficient insulation in older buildings
- Noise pollution from transport systems and motorways
- Unhealthy living, working and studying conditions in buildings with poor air quality
- Increased demand for energy leading to higher costs on citizens

### Examples of 'acute shocks' that can affect major cities include:

- Earthquakes or volcanic eruptions
- Attacks from terrorists and cyber criminals (targeting the public or city infrastructure)
- Floods and severe storms
- Outbreaks of disease or viral infections like COVID-19, SARS, or MERS



Depending on the underlying societal issues present in a city, these acute shocks can serve to exacerbate endemic problems in the population. To improve the resilience of cities, a program that addresses both chronic stresses and acute shocks can help people and businesses to bounce back in the face of adversity.

A rising health concern for city administrators is the indoor air quality of structures. City dwellers spend up to 90 percent of their time indoors. Buildings provide shelter to populations, increase their ability to be productive, and when enhanced with the right support systems, improve the health and wellbeing of citizens. By investing in programmes that enhance the built environment, cities can improve their resilience and address the acute shocks and chronic stresses of the future.

# HOW OFFICIALS CAN MAKE CITIES MORE RESILIENT

A resilient city mitigates chronic stresses and is well-prepared for future shocks by absorbing and recovering from these challenges. These cities promote sustainable development by investing in programmes that improve their population's health and wellbeing. The OECD lists four areas for a government to focus their efforts [towards greater resilience](#) in their cities.

## THESE AREAS INCLUDE:

**ECONOMICAL** – Requires a diverse set of industries with a dynamic economy that generates growth and provides the conditions that allow innovation while giving people access to employment, education, skills training, and support systems.

**SOCIETAL** – Providing a cohesive and inclusive societal structure with community networks, safe neighbourhoods, and healthy built environments for citizens.

**ENVIRONMENTAL** – Investing in sound and diverse ecosystems with infrastructure that meets the population's basic needs, the sustainable management of natural resources, and developing coherent policies for land use.

**GOVERNMENTAL** – Developing an open leadership strategy that includes initiatives promoting their integrated approach to challenges while investing in public sector skills that help achieve their long-term goals.

As residents spend more time indoors, prioritising the city's built environment can help officials to achieve their goals of improving a city's resilience. Renovating the city's buildings to be healthier and more comfortable should remain a focal point for any programme that seeks to promote resilience. Considering the renovation of existing structures and accommodating the latest technologies into new developments can deliver the best return on investment, stimulate economic activity, and reduce the burden on their health infrastructure.



## HOW BUILT ENVIRONMENTS AFFECT WORLD-CLASS ATHLETES

The Denmark SailGP Team races in the heart of some of the world's major cities – and, being so close to shore, the athletes have to constantly adapt their approach, depending on each location's built environment.

Urban landscapes around the world are diverse, but face similar challenges – noise and air pollution, a rapidly expanding population and extremes in weather due to climate change.

According to Denmark SailGP Team helmsman Nicolai Sehested, it's not always just where, but how a city is built, that can affect sailing performance on the water: "You definitely notice a big difference in the conditions out there, depending on the city's landscape," he says.

The first SailGP event of this year, which took place in Sydney, Australia, presented unique challenges to Sehested and his crew.

Sydney experiences an 'urban island heat effect' – that's when a metropolitan area is significantly warmer than the rural areas surrounding it, due to heat generated from people, buildings, and transport. The city is more susceptible to extremes in weather, including heat waves and droughts.

"Sydney is a challenging place to sail. It's located in a coastal basin and surface winds in the harbour are notoriously complex. When you're racing, you can really feel the difference between the warm, humid air of the city, and the cooler, fresh sea breeze," adds Nicolai.

Sydney is also an economic powerhouse, boasting more high-rise buildings than any other city in Australia, and a busy harbour with nearly 15 million ferry trips annually.

"High-rise buildings make it difficult to predict the winds," explains Nicolai. "For example, in a place like New York, it can almost feel impossible to sail. With so many high-rise buildings right by the water, you experience strange puffs – almost like mini tornadoes."

How do you prepare for the constantly changing conditions, when racing at close to 100 km/hr in the supercharged F50?

"Preparation is key – you have to understand and research each city you race in. That local knowledge gives you confidence and allows you to be more flexible, adaptable and ready to react whatever the circumstances."

# 4 CONSIDERATIONS FOR MAKING BUILDINGS SAFER

- AND MORE COMFORTABLE



Increasing resilience in cities begins by reducing the impact of everyday stresses and improving conditions for people and businesses. As sudden shocks can often exacerbate pre-existing issues, reducing these smaller, more persistent impacts means residents are less vulnerable in the case of bigger, more dramatic events. The built environment plays a major role in negating these impacts, as resilient buildings and infrastructure can help citizens weather crises.

## 1. HUMIDITY

Around 80 million people in Europe live in homes that suffer from a [poor indoor climate](#). One of the chief concerns is high humidity and poor ventilation of aging buildings. As temperatures fluctuate outside the building, high humidity will exacerbate the negative effects of these temperature shifts. In addition, [high humidity](#) increases the risk of mould that, in turn, can lead to chronic illnesses like asthma and other respiratory conditions. According to the EU, Europe's residents are 40 percent more likely to develop asthma if they [live in a damp environment](#), a condition that costs the European Union 82 billion EUR each year. Conversely, too low humidity can cause dry skin and rashes.

Renovating or designing buildings with materials and systems which improve the building's natural ability to breathe and maintain a stable, healthy humidity level could potentially save billions of euros in health costs each year and improve the health and wellbeing of residents.

Poor indoor climate can negatively impact health



Asthma and respiratory conditions



Dry skin or rashes

# 4 CONSIDERATIONS FOR MAKING BUILDINGS SAFER

- AND MORE COMFORTABLE



## 2. TEMPERATURE

Poor thermal performance in buildings leaves citizens more vulnerable to changes in temperature and can have a negative impact on productivity. Estimates suggest that 54 million Europeans struggle to heat their homes adequately due to [poor thermal performance](#). This leaves these citizens especially exposed in the case of loss of supply due to damage to the energy infrastructure, or in the case of rising energy prices, due to economic fluctuations. In contrast, buildings with poor energy and thermal performance leave residents more vulnerable during a heatwave, as keeping the temperature at a comfortable level will require more energy. On a more practical note, the productivity of people working in temperatures outside the comfort zone drops by 6 percent, as it becomes increasingly difficult to concentrate in extreme temperatures. This means that businesses and public institutions could potentially save thousands of euros each year by improving the thermal performance of their offices and buildings.

Improving buildings to deal with changing temperatures will help keep the people living or working inside them safe and comfortable while reducing health costs and improving productivity. Improving the thermal performance of the built environment will significantly reduce overall energy demand and thereby reduce CO<sub>2</sub> emissions.

INSULATING WITH  
STONE WOOL COULD  
REDUCE HEATING AND  
COOLING NEEDS BY

UP TO **70%**

# 4 CONSIDERATIONS FOR MAKING BUILDINGS SAFER

- AND MORE COMFORTABLE

THE WORLD HEALTH ORGANIZATION RECOMMENDS NOISE LEVELS DO NOT EXCEED **40db** DURING SLEEP

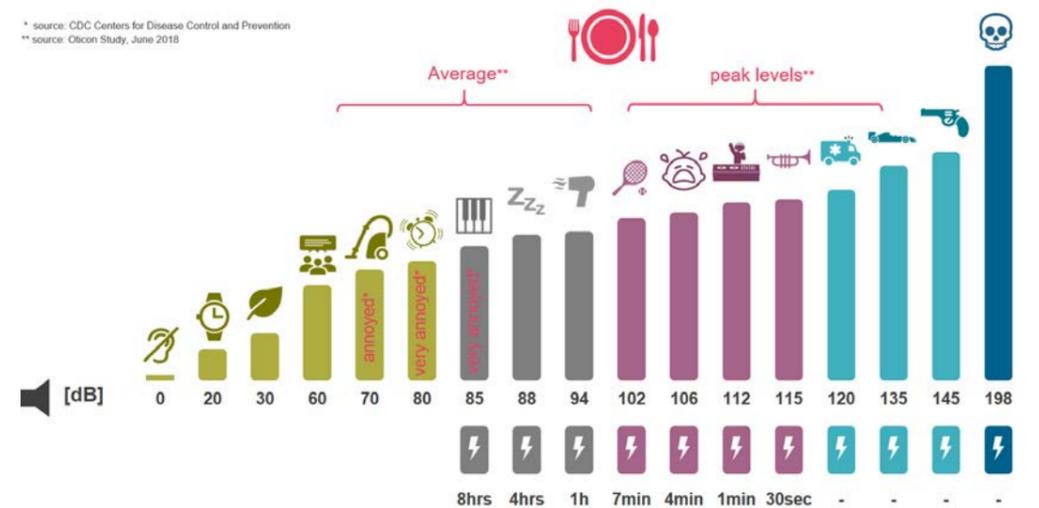


## 3. NOISE

Excessive noise and noise pollution is an emerging health crisis. In urban environments, noise pollution leads to serious health issues like hypertension, increased stress, poor concentration, plus sleep loss and fatigue. Reducing noise pollution in buildings is essential for future resilience and a healthier society, particularly in the world's biggest cities. Although London remains a preferred location for global workers, 41 percent of those who move out of the city cite noise pollution as the reason for leaving. Noise pollution is a major health risk for populations, with the World Health Organization (WHO) estimating about 1 million lives lost per year indirectly from exposure to environmental noise.

City residents are constantly exposed to noise above 85 decibels from sources like traffic, subways, industrial activity, and airports. Sirens ring at a sound-pressure level of 120 decibels – a level that corresponds with the human pain threshold, according to the World Health Organization. However, there are solutions to significantly reduce noise pollution in daily life. Insulation is key to maintaining a comfortable and noise-free home or workplace. Not only does stone wool insulation help reduce the negative health effects of noise pollution but slashing noise in workplaces may improve productivity by up to 3 percent, saving firms up to €1,800 per employee per annum.

\* source: CDC Centers for Disease Control and Prevention  
 \*\* source: Cbcon Study, June 2018



# 4 CONSIDERATIONS FOR MAKING BUILDINGS SAFER

- AND MORE COMFORTABLE



## 4. FIRE

Fire resilience is an important consideration as population density increases. With more buildings in less space, fires can more easily spread. Partially due to the amount of synthetic materials in buildings and homes, fires today develop six times faster than they did 50 years ago. As cities grow, more high-rise structures are required to accommodate new citizens. When talking about fire safety, these type of structures need additional safety consideration during construction to ensure that in case of emergency, solutions are in place to help to slow the spread of a fire and allow occupants to escape safely.

Materials like stone wool that improve the [fire resilience](#) of buildings can help keep inhabitants safe and limit the impact of potentially devastating events.

### Smoke inhalation is more dangerous than fire

When people fear fire, they typically imagine suffering from intense heat and burns. However, the majority of fire-related deaths and injuries can actually be attributed to the inhalation of smoke.

All combustible materials produce toxic smoke when they burn. The volume and toxicity of smoke emitted depends on the material burning, the amount of oxygen available, and the length of time it burns. Using non-combustible materials like stone wool will help minimise the amount of toxic smoke whilst helping contain the fire to where it started.

STONE WOOL WITHSTANDS  
TEMPERATURES OF UP TO

**1,000°C**

# BUILDING A COMPREHENSIVE RESILIENCE PROGRAMME



For city officials, considering these factors when designing a resilience programme will be vital for future prosperity. By 2014, more than 200 cities had decided to implement systems and programmes to protect populations against the effects of climate change and increase their urban resilience. Cities like Denver (USA), Durban (South Africa), London (UK), Madrid (Spain), and Taipei (Taiwan) reported a 12 percent [reduction of CO<sub>2</sub> emissions](#) by 2014, equivalent to 13.1 million tons of carbon.

Reducing existential risks by investing in resilient infrastructure can improve a city's economic competitiveness. With public and private collaboration, cities have an opportunity to limit the effects of climate change and create an environment that fosters economic prosperity. Increased economic activity leads to greater tax revenues, which in turn can help fund new or additional resilience programmes. [Investing €1 billion in renovation](#) could help create 20,000 local jobs in the short-term, while also contributing to a city's green transition and effectively lowering CO<sub>2</sub> emissions with two times the economic payback in the medium-term.

## THE 4 AREAS OF CONSIDERATION



Humidity



Temperature



Noise



Fire resilience

# MINIMISING DAMAGES TO THE BUILT ENVIRONMENT IN CITIES

Resilience depends on more than just absorbing the initial impact of an event. The effects of some events will linger long after, putting individuals and businesses under persistent pressure. Increased pressure on economic activity and individual prosperity affects the city as a whole. Programmes that support building more resilient solutions into the underlying infrastructure of cities are the best way to ensure a population can bounce back and return to normal activity, even if the 'new normal' is different to the living and economic circumstances before they experienced the event. The kind of programmes required should focus on improving the robustness of the built environment, promoting circularity, and addressing the changing climate.

STONE WOOL LASTS FOR MORE THAN **55 YEARS**



## IMPROVING THE ROBUSTNESS OF THE BUILT ENVIRONMENT

Using materials that can weather the changing elements and stand the test of time without losing performance during a deep renovation or the construction of new dwellings, commercial structures, and public buildings can help improve a city's resilience and better prepare it to deal with stresses and shocks. Modern insulation made from stone wool uses the seven strengths of stone to improve a building's living conditions and perform optimally for 55 years. It provides an effective barrier against fire, noise, and thermal losses keeping residents safe and comfortable from a range of challenges. Using durable materials not only has the benefit of making the built environment more resilient, but it also saves money over the building's lifetime, as less money will be spent on renovating the property in the future.

## SUSTAINING A CIRCULAR ECONOMY

The construction industry is traditionally a big contributor to global waste generation. Construction accounts for the biggest source of waste in the EU, and the level of recyclability of construction and demolition waste across Europe varies greatly from 10 to 90 percent. According to the Ellen MacArthur Foundation, some 54 percent of demolition waste in Europe is landfilled.

Officials can reduce the amount of waste incurred through construction and demolition by opting to utilise more sustainable and circular construction materials in new building and development projects. Not only are these circular materials – like stone wool – highly resilient, energy-efficient and better for the planet, they can also reduce the cost of rebuilding in the case of an acute shock as the damaged materials can be recycled.

# INVESTING IN CLIMATE ADAPTATION SOLUTIONS



Climate change remains a persistent threat to cities around the world. As cities deal with the immediate question of the resilience of their built environment, they should ensure that their solution also addresses the long-term climate goals of the community. While governments may need to stimulate businesses and subsidise specific programmes to keep their economies strong and prosperous, they should also ensure these solutions better prepare their cities to handle the future effects of climate change.

For instance, increased rainfall – a direct consequence of climate change – can put a city's drainage systems at risk, leading to localised flooding. In 2011, Copenhagen suffered an estimated €800 million [in damages from cloudbursts](#) alone. Stone wool products like Rockflow can help city officials to [manage localised flooding](#) from extreme rain events by channelling excess rainwater to underground buffers, helping sewer systems deal with these climate events. Other ways of adapting the built environment to deal with climate change could include improving thermal performance and using durable materials as discussed previously.

**70%** OF CITIES  
are already dealing with the  
effects of climate change

# WHY CITIES NEED TO INVEST IN RESILIENCE NOW



Investing in renovation can help to kick-start the local economy, provide new jobs, and improve city building stocks. Legislating for the deep renovation of public buildings, private residences, and commercial structures can reduce energy demand, limit noise pollution in densely populated areas, and increase the fire resilience of the city's infrastructure.

The [EU will provide major support](#) to governments in their recovery efforts after this pandemic. By allocating these funds to programmes that aid future resilience and deliver more sustainable solutions, city governments can help their populations adapt and prepare for future events, enabling them to recover effectively.

#### Investing in renovation programmes can help officials to:

- Reduce air pollution and support healthy living in safer environments with improved indoor climates.
- Increase their population's energy-efficiency helping to reduce the effects of climate change in the future.
- Transform 250 million households and transition to new ways of using spaces in urban environments.
- Improve the living conditions and reduce energy poverty experienced by 11 percent of the European population.
- Provide for improved quality of life for people spending 90 percent of their time indoors, with 67 percent spent at home.
- Help owners modernise their living environment, as 70 percent of homes are owner-occupied.

# WHY CITIES NEED TO INVEST IN RESILIENCE NOW



Buildings account for  
**30%**  
of total energy demand

Investing in renovation projects has a direct, positive economic impact while also resulting in long-term benefits to the city and its inhabitants. The construction industry is labour intensive, so increasing investment in this industry will support both the direct and indirect economies. Renovation programmes that focus on improved resilience can help city governments achieve their green goals by reducing carbon emissions with improved energy-efficiency.

Buildings account for 30 percent of total energy demand, while cities and their buildings remain responsible for 70 percent of CO<sub>2</sub> emissions. Investing in deep renovation of 2.5 percent of EU buildings creates a net benefit to society. Using stone wool insulation can improve the living conditions of millions of Europeans, considering that 40 percent of young people living in cold homes were less healthy than those who grew up in houses with adequate heat.

ROCKWOOL continues to work with city officials, research institutions, and private sector organisations to improve the resilience of the world's urban centres. With economies looking to grow around the world, making the best use of available funding will require innovative strategies that benefit the biggest portion of a city's population. [Putting future resilience](#) on top of the agenda and using renovation to achieve their short-, medium-, and long-term goals is a viable strategy for any city government. Prioritising energy renovation using ROCKWOOL products can help limit the problems cities will have to overcome in the future.

## WANT TO LEARN MORE?



### RENOVATION ON THE AGENDA

Renovating buildings is a necessary step to improve the resilience of cities and achieve our climate goals.

[DOWNLOAD REPORT](#)



### UPSCALE URBAN REGENERATION

Rundown or challenged neighbourhoods are especially exposed, but we can reverse this trend through renovation.

[DOWNLOAD REPORT](#)



### POWERING THE RECOVERY

Green renovation initiatives that improve energy-efficiency can help speed up economic recovery.

[READ MORE](#)

# CASE STUDIES



## IMPROVING BUILDINGS WILMCOTE HOUSE – PORTSMOUTH, UK

**CHALLENGE:** When this 100-house development on England’s south coast was built in 1968, energy performance was much less of a priority than today. Constructed from prefabricated concrete panels featuring just 25mm of insulation, and with costly electric heating systems installed, data showed that many residents were unable to afford to heat their homes adequately. This is called ‘fuel poverty’ and is a problem affecting over 10 percent Europe’s population. It can have serious health implications – plus can lead to the spread of dangerous mould, damp and condensation.

**SOLUTION:** In what is the largest residential energy renovation project delivered with residents in-situ in the world, the City Council undertook a ‘deep retrofit’ across the whole of the Wilmcote House development. With a target to reduce heating demand by 90 percent, ROCKWOOL products were installed to ‘super-insulate’ the development – external wall insulation resulting in excellent thermal performance and air tightness, reduced draughts, condensation and mould growth. Rockpanel® was used to upgrade the façade cladding and improve fire safety, creating a much-improved living environment and quality of life for residents and the local community.

[READ THE FULL CASE STUDY](#)



## CLIMATE ADAPTATION LANGELADS PLADS, FREDERIKSBERG – COPENHAGEN, DENMARK

**CHALLENGE:** Today’s climate is more unpredictable than ever – and extreme rainfall is a growing problem around the planet. Not only is more rain falling due to climate change, but rain showers are often more intense. Known as ‘cloudbursts’, these violent and concentrated rainfalls are becoming increasingly common – and with many of our major cities unprepared to handle such a large amount of water, flooding is a major risk. In 2011, Copenhagen experienced such a storm, so rare that it is referred to as a ‘1,000 year event’ – that is, it only has a 1 in 1,000 chance of happening every year. With over 150 millimetres of rainfall dumped on Denmark’s capital in just two hours, the cloudburst left many areas of the city under over one metre of water, flooding basements, train stations and key roads – and causing an estimated €800 million of damage and insurance claims.

**SOLUTION:** To counter these types of rainstorms, Rockflow – a sustainable and innovative water management system formed from stone wool – was installed beneath the streets and squares of Langelads Plads. Rockflow can absorb up to 95 percent of its own volume in water, slowly releasing the water back into the ground to reduce stress on the city’s sewer system and keeping the city intact and vibrant, even in the most extreme rainfall. As the solution is installed underground, there is no loss of urban space.

[READ THE FULL CASE STUDY](#)