Resilient Cities, Resilient Lives

Learning from the 100RC Network

July, 2019

Bangkok, Thailand

Dear colleagues and friends,

As I write this letter, in the lead-up to the 2019 Urban Resilience Summit in Rotterdam, I am proud to be a part of this vibrant and growing global movement to change how the world's cities plan for and act upon the greatest challenges of our time.

In the six years since the creation of 100 Resilient Cities, more than 70 cities in our Network have published Resilience Strategies containing over 3,000 initiatives. Nearly 80% of our member cities have institutionalized the role of Chief Resilience Officer. Our movement's broad reach includes a community of practice nearly 20,000 people strong, and has engaged approximately 3,000 different community groups to ensure residents' voices are heard and that ownership of the resilience agenda is shared. Our combined efforts have helped to mainstream the concept of resilience in both the global and urban lexicon, resulting in thousands of articles published which mention our work in international, national, and local publications in every city where we operate.

But more important than the Strategies we've created and the thought leadership we've fostered is the fact that member cities are taking real action. Partners new and old are deeply engaged in the implementation of thousands of holistic, multi-benefit initiatives that have served to change the way cities address their most acute shocks and chronic stresses. To date, more than US$25 billion has been catalyzed by 100RC member cities toward the resilience agenda, and the world's leading development financial institutions are building resilience criteria into how large-scale infrastructure projects are funded.

This report is meant to inspire, to capture the lessons we've learned from working in this space over the past six years, and to serve as a practical guide for new actors hoping to learn how they too can participate in this global movement to make cities more forward-looking, inclusive, integrated, and risk-aware. Cities are the main audience, especially those who hope to begin or will continue resilience journeys of their own, and who will benefit from the lessons and replicable stories spanning the entire 100RC Network. City partners, thought-leaders, investors, and all urban resilience practitioners, however new to the field, will also find insights and learnings they can bring to their own work.

We know our work is far from over, but after six years, we stand on the precipice of fulfilling the ambitious promise made at the outset of 100RC – to create a global movement of city leaders and urban practitioners, and a platform for action toward our vision of a more resilient world. I hope you welcome these lessons and stories from our work, and hope you too will play a part in planning the next chapter of this movement.

Best,

Michael Berkowitz

Introduction

Mumbai, India

Why Cities?

We are living in the century of cities. As important political centers, major engines of innovation, and magnets for both our world's richest and our most in-need, cities stand at the forefront of the challenges and opportunities of the 21st century.

Today, over 55% of the world's population lives in urban areas, a proportion due to reach nearly 70% by 2050. Cities are not only where a majority of us live, they are also the foci of the world's economy, generating 80% of global GDP. The density and scale of cities amplify urban economic productivity and reduce an individual city resident's environmental impact, while elevating living standards across the board. But cities also face significant challenges. Mass migration, climate change, aging infrastructure, technological change, and widening social and economic inequities all disproportionately impact our urban centers.

These global pressures affect individuals and systems at a local level and on a day-to-day basis. While presidents and prime ministers slowly navigate national and international politics to reach consensus on solutions, the demands, expectations, and urgencies from city residents mean that mayors and city leaders do not have the luxury to wait for others to bestow on them solutions to the daily problems their residents face, and so they are defining their own trajectories and making investments that will provide tangible benefits.

The visions cities have for their futures – their decisions on what to build, how to build it, who to build it for, and what to prioritize politically – will reverberate globally. Cities represent an unparalleled opportunity for leveraging innovation and creative planning to combat global challenges and make meaningful improvements in the lives of billions of people.

Today, over 55% of the world's population lives in urban areas, a proportion due to reach nearly 70% by 2050.

Why Urban Resilience?

The world is more densely populated and more interconnected than ever before. From extreme weather to refugee crises, from disease pandemics to cyberattacks, today's state of play requires new models of governance to mitigate risk and respond to challenges. Business-as-usual models of reactive planning and siloed decision-making will not generate the fundamental strength and flexibility essential for us to thrive in the face of the shocks and stresses of the 21st century.

Acute shocks are sudden, intense events that threaten a community, such as earthquakes, hurricanes, and terrorist attacks. The harm caused by acute shocks is exacerbated by chronic stresses – pressures that weaken the fabric of a community over time, such as recurrent flooding, high unemployment, and overtaxed or inefficient public transportation systems. Of course, it is rarely possible for cities to tackle just one challenge at a time. Instead, they are confronted by interdependent combinations of acute shocks and chronic stresses.

The world is more densely populated and more interconnected than ever before.

Born from the exigencies of three converging trends – climate change, urbanization, and globalization – urban resilience is the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what chronic stresses and acute shocks they experience. An urban resilience agenda understands that by strengthening a city's underlying fabric and deepening its understanding of the risks that threaten its stability, a city can improve its overall trajectory and the well-being of its citizens, allowing it to prosper in the face of challenges both expected and as yet unimagined.

A well-known example of the consequences of weakened resilience is Hurricane Katrina, which hit the south-eastern U.S. in 2005 with devasting impacts. Katrina was only designated a Category 3 storm when it made landfall – so it was not the force of the wind or the rain alone that caused such a crisis in the City of New Orleans. The storm's impact was greatly exacerbated by chronic stresses, including institutional racism, violence, aging

Jaipur, India

infrastructure, poverty, poor macroeconomic conditions, and environmental degradation. When Hurricane Katrina hit, these deep-seated weaknesses were exposed. Unaddressed social, economic, and environmental stresses undermined New Orleans's resilience, amplifying the impact of the shock when it hit and ultimately making it far more difficult for the city to bounce back.

Resilience thinking demands that cities look holistically at their capacities and their risks. This is not easy work. The current approach to urban governance is a siloed one, with one team designing disaster recovery plans, another team exploring sustainability issues, another focused on livelihoods and well-being, and yet another on land-use planning and infrastructure. That may be an efficient way to structure the work of a city, but it is not the most effective one. Cities are systems – not silos. Planning for a resilient future entails tackling challenges and creating solutions in an integrated, inclusive, risk-aware, and forward-looking manner. Solutions developed through resilience thinking will allow cities to enjoy multiple benefits, or resilience dividends – maximizing the value of every dollar spent, reducing and even helping to prevent the impact of shocks and stresses on the city's people, economy, and physical environment, and improving residents' quality of life.

"Cities are the places of innovation, but they also touch the most numbers of lives. If we can get it right in one city, we can share those practices with other cities, and literally lift up millions of people."

–Libby Schaaf,
Mayor of Oakland, U.S.A.

100 Resilient Cities

The Rockefeller Foundation (RF) has been a leader in urban policy since the late 1950s, when it launched an Urban Design Studies program. One of its first grants was to a then-obscure author for the research and writing of her groundbreaking book, *The Death and Life of Great American Cities*. More than fifty years later, Jane Jacobs's book remains one of the most influential works ever written on urban design, having laid the foundations for urban resilience thinking today.

In 2013 RF marked its centennial by making a transformational philanthropic investment that honored its deep roots in urbanism, while also leveraging its burgeoning leadership in what was then the emerging field of resilience. That 2013 investment launched 100 Resilient Cities (100RC), a non-profit organization dedicated to helping cities around the world become more resilient to the physical, social, and economic challenges of the 21st century.

The launch of 100RC acknowledged that the escalating trends of urbanization, globalization, and climate change pose tremendous risks - lives imperiled, economies endangered, and progress jeopardized - but also offer a tremendous opportunity for fulfilling RF's mission to promote the well-being of humanity in general. In 2013 RF entrusted 100RC in turn with the mission of catalyzing a global urban resilience movement, and in the six years since 100RC has grown from an idea and a press release into a dynamic program with a global network of cities who are together tackling their most pressing issues, supported by hundreds of partners and 100RC staff.

Despite their diversity, 100RC's dynamic network of global cities face a common set of shocks and stresses. The most common shocks threatening the 100 cities are rainfall flooding, infrastructure failure, earthquakes, and extreme heat, while the most common stresses are aging infrastructure, lack of affordable housing, inadequate public transportation, and low social cohesion. These problems are compounded by climate change, shifting global economic forces, and rising inequality around the world.

Scope

6 continents

47 countries

20 languages

40K – 21M
Cities with populations ranging from 40K to 21M

100RC's network encompasses:

Urban space equivalent to Belgium and the Netherlands combined

More than **67,000 square kilometers** of urban space
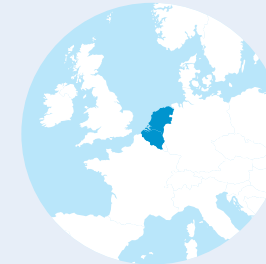
Urban population equivalent to more than Brazil's population

Nearly **220 million people** living in member cities, with another 250 million more residing in the greater metropolitan areas of those cities.

Urban poor population equivalent to Colombia's population

Nearly **50 million people living below their respective national poverty lines**, including an estimated 21 million people living on less than $2/day.

Cities with a combined GDP larger than China's economy

Approximately 20% of the world's GDP – an estimated $15 trillion of economic activity across the greater metropolitan areas of member cities.

This *Resilient Cities, Resilient Lives* report, captures 99 examples of the resilience-building work being done in cities across the global 100RC Network.

VANCOUVER
SEATTLE
CALGARY
MONTREAL
TORONTO
BOSTON
BERKELEY
MINNEAPOLIS
CHICAGO
PITTSBURGH
OAKLAND
ST. LOUIS
NEW YORK CITY
SAN FRANCISCO
BOULDER
WASHINGTON D.C.
NASHVILLE
NORFOLK
LOS ANGELES
TULSA
DALLAS
LOUISVILLE
EL PASO
ATLANTA
JUAREZ
HOUSTON
NEW ORLEANS
GREATER MIAMI & THE BEACHES
HONOLULU
COLIMA
MEXICO CITY
SAN JUAN
SANTIAGO DE LOS CABALLEROS
PANAMA CITY
MEDELLIN
CALI
QUITO
SALVADOR
RIO DE JANEIRO
SANTIAGO DE CHILE
SANTA FE
PORTO ALEGRE
BUENOS AIRES
MONTEVIDEO

GREATER MANCHESTER
GLASGOW
BELFAST
LONDON
VEJLE
THE HAGUE
BRISTOL
ROTTERDAM
PARIS
MILAN
BELGRADE
TBILISI
BARCELONA
ROME
THESSALONIKI
LISBON
ATHENS
BYBLOS
TEL AVIV
AMMAN
RAMALLAH
DAKAR
SURAT
PUNE
MANDALAY
CHENNAI
BANGKOK
DA NANG
CAN THO
ADDIS ABABA
PAYNESVILLE
LAGOS
ACCRA
MELAKA
SINGAPORE
KIGALI
NAIROBI
JAKARTA
SEMARANG
DURBAN
CAPE TOWN
TOYAMA
SEOUL
KYOTO
DEYANG
HUANGSHI
SYDNEY
MELBOURNE
WELLINGTON
CHRISTCHURCH

100RC's Program

100RC's long-term goal has been to change the way the world's cities plan and act, encouraging them to think proactively and collaboratively about their interconnected challenges, thereby improving their overall ability to adapt and thrive, and reducing the vulnerability of millions of urban residents. To achieve this goal, 100RC organized its operations around two key insights. First, that cities consist of complex and siloed systems, which often result in narrow-minded solutions to immense challenges. Second, that existing services or ideas that could help solve urban problems often do not reach cities or scale efficiently between them.

To drive change around these two key insights, 100RC held three competitive challenges to select 100 cities around the globe, which attracted over 1,000 applicants from more than 150 countries. Once accepted into the Network, member cities initially received four core offerings from 100RC:

Chief Resilience Officer (CRO)

1. Financial and logistical guidance for establishing an innovative new position in city government, a Chief Resilience Officer (CRO), to lead the city's resilience efforts

Resilience Strategy

2. Technical support to develop a holistic Resilience Strategy that reflects each city's distinct needs

Platform of Partners

3. Access to an innovative Platform of Partners from the private, public, and non-profit sectors that offer solutions, services, and support for Resilience Strategy development and project implementation

Network of member cities

4. Inclusion in 100RC's global Network of member cities, for mutual exchange of knowledge and best practices

"It takes discipline to be forward-thinking, and that is what resilience planning is all about. It's about thinking about the future: what are the challenges and stressors that we are facing? What can we do to address those issues today?"

–Keisha Lance Bottoms,
Mayor of Atlanta, U.S.A.

Over time, 100RC's partnership and support has enabled cities to strengthen their core resilience-building capacities, integrate resilience thinking into their processes, policies, practices, and budgets, embed resilience goals into the design and delivery of priority projects, and create resilience champions beyond the CRO's office, among city leadership, civil society, and other key stakeholders.

To support member cities through project implementation, 100RC has offered technical assistance and staff expertise for specific projects, while also helping cities to build political will and civic buy-in for resilience, and to keep the long-term resilience agenda on track as other priorities shifted year-to-year. Additionally, 100RC worked to facilitate large-scale investment into urban resilience projects across the Network, to establish a market standard for resilient infrastructure, and to demonstrate the value of the resilience dividend, by highlighting both the value of resilience and the demand for resilience that exists in urban communities.

Finally, catalyzing an urban resilience movement will not only require changes within individual cities, but will also demand the engagement and commitment of global organizations that have the capital, power, or regulatory authority to make dramatic interventions in urban challenges and opportunities. Recognizing this, 100RC has sought to inspire and influence global thought leaders, policy makers, and key institutions to incentivize and support resilience-building efforts in 100RC member cities and around the world.

100RC's Impact

Catalyzing a movement takes time, and 100RC's vision for change is multi-generational. But early findings indicate that the very real institutional changes taking root in member cities as a result of their participation in the 100RC Network are having a direct and positive impact on their capacity to implement resilience initiatives. Cities report that their engagement with 100RC ensures that resilience-building priorities are consensus-led, feasible, and expected to deliver multiple benefits for their residents. In six years of operation, 100RC has already seen the following outcomes:

135
people have held the office of CRO, with 89 CRO positions currently active

10,000+
hours of resilience capacity-building delivered to CROs

17,850+
members of a community of practice working on urban resilience in 100RC cities globally

70
holistic Resilience Strategies, with over 3,500 concrete actions and initiatives

200+
collaborations between partners and cities to address city challenges

$12.5M
of pro bono solutions, tools, and services delivered into cities

$25.4BN+
spent in member cities to implement the resilience agenda

2,866
key media citations of 100RC's work and thought-leadership

Urban resilience offers decision-makers a holistic lens uniquely suited to meet the needs of the modern city and the regions of which cities are critical constituents. Addressing shocks and stresses holistically builds a city's capacity to respond to adverse events, and in general to deliver basic services to all populations, in both good times and bad.

"There was no global urban resilience network before 100RC. Now, Chief Resilience Officers consistently report their 100 Resilient Cities networks of peers as being instrumental in understanding the fundamental shocks and stressors their cities face, in identifying the knowledge resources to promote solutions, and in learning how to navigate the internal politics of city government while attempting to transform city institutions."

-The Urban Institute Midterm Evaluation Report, December 2018

"At the start of The Rockefeller Foundation's second century, we see urban resilience as an idea whose time has come. It is our goal that 100 Resilient Cities will serve as a platform for greater action that will make a more resilient world."

- Dr. Judith Rodin, Former President, The Rockefeller Foundation, May 2013

New York City, U.S.A.

Content of this Report

This report shares 100RC's knowledge about what it takes to catalyze an urban resilience movement. **The first section details what 100RC has learned about building urban resilience within a city**, illustrated by 23 examples from across the global network. 100RC's hypothesis is that there are four key pathways along which cities must direct their efforts if they are to build their resilience:

1. Creating Resilience Champions

- The Role and Key Qualities of a Chief Resilience Officer
- Creating and Embedding the Resilience Office
- Cultivating Diverse Resilience Champions
- Leveraging the Resilience Strategy
- Leveraging City Leadership
- Communicating Resilience

3. Finding Funding and Financing for Resilience

- Enhancing City Creditworthiness
- Building Institutional and Local Capacity
- Financially Prioritizing Resilience in a City
- Developing Financial Products that Deliver Resilience Benefits
- Addressing the Data Gap to Articulate the Value of Resilience

2. Changing the Way Cities Plan and Take Action

- Developing a Resilience Strategy
- Building Resilience into Project Design
- Integrating Resilience into City Policies and Systems
- Measuring and Evaluating Resilience

4. Leveraging Partnerships and Working at Scale

- Creating a Network of CROs and other City Practitioners
- Building Resilience Across Metropolitan Regions
- Components of Successful City-Partner Collaborations
- The Power of Collective Action and the Role of Global Institutions
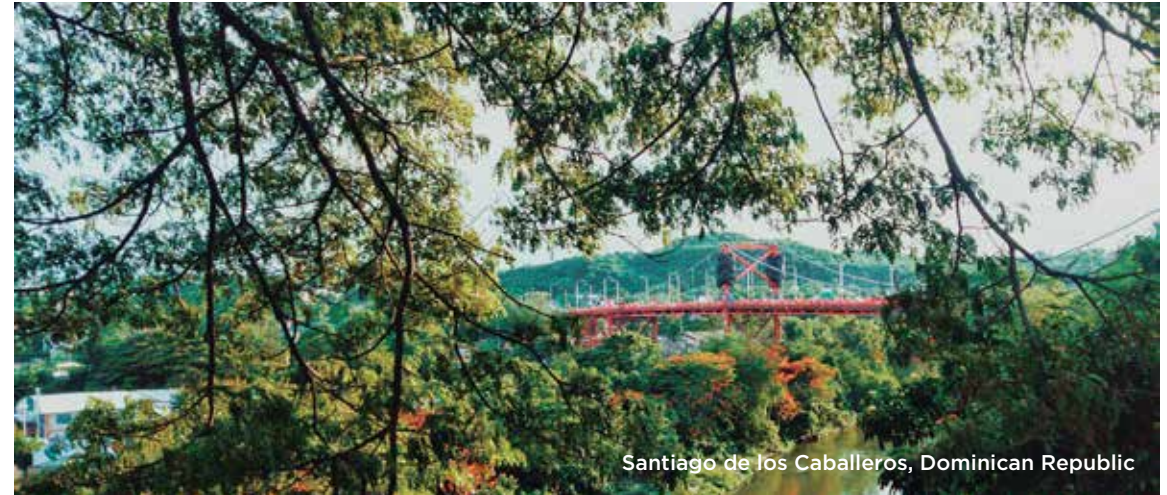
Santiago de los Caballeros, Dominican Republic

The second section explores a wide variety of actions that member cities are taking to build their resilience within specific sectors. Although resilience is a holistic endeavor, 100RC knows that the entry point for many cities will necessarily be through sectoral work. This report looks at 76 different city projects from around the world through the lens of 15 different key urban sectors:

- CLIMATE CHANGE
- DATA AND TECHNOLOGY
- EARTHQUAKE RESILIENCE
- ECONOMIC DEVELOPMENT
- EDUCATION AND SOCIAL INFRASTRUCTURE
- FLOODING
- HERITAGE AND CULTURE
- HOUSING
- NATURAL ASSETS AND NATURE-BASED INFRASTRUCTURE
- POST-DISASTER RESILIENCE
- RESILIENCE DISTRICTS
- RESILIENT RIVERS
- SOCIAL EQUITY
- TRANSPORT AND MOBILITY
- WATER AND SANITATION

While each project in the *Resilient Cities, Resilient Lives* report is presented in the context of just one sector or pathway, the holistic nature of the work means that any given effort touches on a variety of them

Report section: Champions

City	Title
Los Angeles	Institutionalizing Resilience throughout City Hall
European Union	Resilience as a Political Agenda for Europe
Kyoto	Facilitating Resilience Dialogues
Mandalay	Using Problem Framing to Open a Dialogue on Resilience
Puerto Rico	Hurricane Maria and ReImagina Puerto Rico
Singapore	Building Community Resilience through Human-Centric Design

Report section: Actions

City	Title
Cape Town	Water Resilience and Avoiding Day Zero
El Paso	Embedding Resilience in Municipal Operations
Oakland	Civic Design Lab
Ramallah	Using the Resilience Strategy for Change Management
Rotterdam	Delivering Resilience to Projects: A Resilience Scan Tool for Cities

Report section: Funding

City	Title
Atlanta	Proctor Creek Greenway Environmental Impact Bond
Cape Town	Budgeting for Resilience
European Union	Piloting and Scaling Resilience Finance across the EU
Greater Miami and the Beaches	Planning (and Voting) for Regional Resilience
Pittsburgh	A Resilience Strategy as an Investment Prospectus
Porto Alegre	Financing Solar Expansion
The World Bank	Deploying Resources to the 100RC Network

Report section: Partnerships / Scale

City	Title
India	Developing a National Level Engagement on Urban Resilience
Colima	Metropolitan Governance for Resilience
London	Counter-terrorism Preparedness and Societal Resilience
Sydney	Working Beyond Boundaries to Foster Metropolitan Resilience
United States of America	The Natural Disaster Resilience Competition

Report section: Climate Change

City	Title
Paris	OASIS Schoolyards: Battling Heat and Building Resilience
Berkely	Assessing Resilient Energy Systems
Boulder	Reducing Emissions through Systemic Energy Efficiency Approaches
Chicago	Ready for 100: Transitioning Buildings to 100% Clean Energy
Santiago de Chile	Waste to Energy
Tel Aviv/Yafo	Using the Resilience Accelerator to Address Urban Heat

Report section: Data and Technology

City	Title
Da Nang	Adopting a Data-driven Approach to Disaster Preparedness
Ciudad Juarez	The Role of Technology in Reducing Violence
European Union	Using Technology to Help Vulnerable Populations
New York City	NYC Data CoLab: The Role of Data in Mitigating Resilience Challenges
The Hague	Digital Cities and Cyber Resilience

Report section: Earthquakes

City	Title
Mexico City	Seismic Resilience Recovery Plan
Deyang	Leveraging Seismic Expertise in the 100RC Network
Medellin	Informal Communities and Build Change
San Francisco	Retrofitting Seismically Dangerous Buildings

Report section: Economic Development

City	Title
Addis Ababa / Belfast / Tel Aviv	Building Sustainable Economies through Alternative Financing
Dakar	#MadeinDakar
Glasgow	Social Resilience: From Risk Reduction to Inclusive Growth
Kigali	A Center for Urban Excellence in Africa
Quito	ZEDE Quito: Special Economic Zone
Salvador	Diversifying Economic Opportunities

Report section: Education and Social Infrastructure

City	Title
Cali	Mi Comunidad Es Escuela
Chennai	Green Infrastructure Vision for Civic Engagement
San Francisco	Applying a Resilience Lens to Comprehensive Campus Planning
Tbilisi	Prioritizing Early Childhood Development Programs

Report section: Flooding

City	Title
Montevideo	Pantanoso River Basin
Bangkok	Setting a Vision for Water Management of the Chao Phraya
New York City	East Side Coastal Resiliency
Vancouver	Partnering to Understand Flood Impacts
Vejle	Fjordbyen: Living with Water in the 21st Century
Washington DC	Understanding Flood Risks

Report section: Heritage and Culture

City	Title
Athens	Lycabettus Hill and the Future of Athens' Urban Forest
Byblos	Byblos' Coastal Heritage Trail and Beyond
Melaka	The Role of the Past in Melaka's Future
Seoul	Seoullo 7017: Reimagining Aging Urban Infrastructure
Tulsa	Memorializing Black Wall Street

Report section: Housing

City	Title
Norfolk	Sea Change in St. Paul's: Integrating Climate Adaptation and Housing Equity in Norfolk
Durban	Collaborative Action for Informal Settlements
Huangshi	Huangshi's Resilient Slum Transformation
Louisville	Homeless Encampment Task Force
Toronto	Building Vertical Resilience

Report section: Nature-based Infrastructure

City	Title
Melbourne	Melbourne's Urban Forest: Bringing a City Together to Enhance Natural Assets
Calgary	Natural Infrastructure Blueprint
Can Tho	Reconciling Growth with Environmental Protection
Milan	Urban Forest Strategy
Toyama	Tree Planting Projects Take Root

Report section: Post-Disaster Resilience

City	Title
Amman & Athens	From Crisis Response to Urban Resilience
Belfast	Leveraging the Resilience Strategy Process Post-Shock
Houston	Creating a Path to Resilience Following Hurricane Harvey
Paris	Fluctuat Nec Mergitur: Tossed but Never Sunk
Wellington	Resilience Following the Kaik ura earthquake

Report section: Resilience Districts

City	Title
Santa Fe	Belgrano Station: Converting a Heritage Train Station into a Thriving District
Christchurch	Building Resilience in Eastern Christchurch
New Orleans	The Mirabeau Water Garden in the Gentilly Resilience District
Porto Alegre	Transforming the Fourth District
Rotterdam	Resilient BoTu 2028: Toward the Urban Social Index Average in 10 years
Surat	Water Resilience on the Tapi River

Report section: Resilient Rivers

City	Title
Los Angeles	Revitalizing Neighborhoods Surrounding the L.A. River
Panama City	The Juan Diaz River Basin
Pune	The Mula-Mutha River: Re-Evaluating Existing Projects through a Resilience Lens
Santiago de los Caballeros	Vive el Yaque

Report section: Social Equity

City	Title
Boston	The Economic Mobility Lab
Barcelona	Etapas de la Vida
Buenos Aires	Empowered Women, Resilient Cities
Seattle	The Race and Social Justice Initiative
St Louis	Quantifying Inequity After Ferguson

Report section: Transport and mobility

City	Title
Accra	Creating a Resilient Transit System
Dallas	The Intersection of Mobility and Economic Inequality
Honolulu	Planning for Transit-Oriented Development in Kap lama and Iwilei
Semarang	Collaboration and Co-Investment for Resilience Outcomes
Thessaloniki	Egnadia Boulevard: Leveraging Transport Investments to Build Resilience

Report section: Water and Sanitation

City	Title
Wellington	Reinforcing Wellington's Lifeline Infrastructure
Greater Manchester	Building Resilience into Water Infrastructure Upgrades
Jakarta	Studying Decentralized Water Treatment Technologies
Lagos	African Water City
Paynesville	Building Resilient Water and Sanitation Systems in Post-Conflict Cities

Four Key Pathways for Cities

Lessons from 100RC on Building Resilience

Rotterdam, the Netherlands

⚑ Champions

Cities will need to create champions of the resilience agenda in order to build their overall resilience.

To catalyze a resilience movement, local leadership – from both within and outside of government - must serve as resilience champions, galvanizing support among stakeholders and residents. One of the key innovations of 100RC was the creation of a new type of urban resilience champion, an urban Chief Resilience Officer (CRO), and the installation of the world's first CROs in member city governments.

Ideally reporting directly to a city's chief executive, a CRO acts as the city's lead point person for resilience-building. CROs work across municipal departments to help coordinate all their city's resilience efforts and ensure that resilience-building principles are incorporated into the way the city plans and acts, so that resources are leveraged holistically, and so that the co-benefits and dividends of resilience are realized.

Though still newly positioned in their cities, the CROs across the 100RC Network have leveraged both the formal authority imbued by their appointment, as well as their leadership among a broad coalition of actors, to co-create and advance their cities' resilience agendas. They are at the vanguard of urban resilience champions worldwide – crucial ambassadors instrumental in helping cities address their complex challenges, and to the evolution of a long-lasting global community of resilience practice.

But while a CRO is a necessary champion, that single person is in no way sufficient to build the overall resilience of a city. An ecosystem of champions from both within and outside municipal government must be cultivated and leveraged.

The following pages share what 100RC has learned about creating urban resilience champions, both CROs and others, around the globe. The lessons included in this section cover:

✓ The Role and Key Qualities of a Chief Resilience Officer

✓ Leveraging the Resilience Strategy

✓ Creating and Embedding the Resilience Office

✓ Leveraging City Leadership

✓ Cultivating Diverse Resilience Champions

✓ Communicating Resilience

The Chief Resilience Officer

On being accepted into the 100RC Network, member cities collaborated with 100RC to tailor a job description and remit for a new CRO position within their government. Member cities then received grant funding from 100RC for the salary of the person hired into the role for two years.

100RC designed this model to make it possible for cities to take what they might perceive as a risk in creating the new position. Cities have limited resources, with every dollar devoted to the daily priorities of their residents. 100RC's rationale for the two-year funding period was to allow cities to judge for themselves, based on experience, the value of a CRO and how to best integrate and institutionalize resilience, before committing their own resources to the position. This bet paid off, and over the six years of 100RC's operation, 78% of cities continued to fund the CRO role after the two-year grant period concluded. What's more, 100RC member cities have quickly come to value resilience-building enough to have hired an average of five additional staff per Resilience Office.

While individual city contexts are always important, 100RC has identified critical elements of the CRO position that resonate globally. The **main responsibilities of an effective CRO**, as seen in the 100RC network, are:

- **To serve as a senior adviser** to the mayor or city executive, and as a resilience ambassador for their entire city, communicating with residents and other stakeholders about the value of resilience-building.

- **To bring together diverse stakeholders** to think holistically about their city's interdependent shocks and stresses, assets and risks, and aspirations and challenges.

- **To lead the Resilience Strategy development process,** culminating in a resilience vision, clear goals, and a comprehensive suite of existing and new initiatives that together will build their city's overall resilience.

- **To ensure implementation** of those Resilience Strategy initiatives across their diverse owners and partnerships, while ensuring resilience principles are maintained through a project's design and execution.

- **To infuse the resilience agenda across city operations,** changing the way their city plans and acts in order to bring risk and vulnerability to the forefront.

- **To work across government departments,** to help their city improve its internal communications, navigate its own complexities, and focus on long-term resilience. By facilitating dynamic communication across internal divisions, a CRO drives new collaboration, ensures resources are not wasted on duplicative work, and promotes synergies between the projects and plans of various agencies. This work is often called **"silo-busting,"** and is critical to resilience-building.

- **To work at scale,** collaborating beyond their city's boundaries at the regional, national, and international levels to identify and integrate lessons, solutions, and best practices from other cities or partnerships.

Above all, the CRO is a connector and facilitator, bringing together disparate people, processes, and resources in an effective and efficient way. Though the unique contexts of a city may give different weight to these, and certainly no single candidate could ever embody them all, some **key qualities of a successful CRO** as observed within the 100RC network include:

- **Leadership**: A CRO in their professional capacity is a convener, articulating new visions for the future and new ways of thinking. They should be able to inspire, influence, and enlist colleagues and city residents to develop, support, and implement the city's Resilience Strategy in order to achieve the city's resilience goals.

- **Authority**: A CRO should be in a senior-level position endorsed by city leadership with access to key conversations and decision-making processes, and the license to engage key stakeholders and oversee resilience-building.

- **Appropriate political positioning**: A CRO is ideally a senior city official sitting at mayor-minus-one or mayor-minus-two within a city's government. But both the candidate and the position itself should be capable of weathering political transitions and working beyond short-term swings in political will.

- **Ability to engage locally**: A CRO should be able to personally internalize their city's resilience goals, understand and connect with their communities, and establish and maintain strong engagement from city residents and other key stakeholders.

- **Ability to engage globally**: A CRO should be able to represent their city and interact in global forums in order to share information and ideas, glean best practices, and effectively develop innovative solutions for resilience-building.

- **Ability to function across disciplines**: A CRO should be able to identify key opportunities for cross-disciplinary work, and convene and dialogue with multiple key sectors and disciplines including transportation, energy, water, emergency management, economic development, healthcare, housing, education, and community engagement.

- **Focus on execution**: A CRO should be able to manage multiple streams of work and multiple relationships in an effective and efficient manner, including synthesizing the resilience work with other key priorities, milestones, or deadlines for the city.

- **Enterprising spirit**: A CRO should be resourceful and willing to experiment, pursue new ideas, and take risks.

- **Effective communicator**: A CRO should be able to drive the resilience conversation in the city, across the government, through the media, and with communities.

Creating and Embedding the Resilience Office

A cornerstone of the impact evaluation of the 100RC program was tracking the institutionalization of resilience across the cities in the Network.

Institutionalization – that is, "the action of establishing something (in this case, resilience) as a convention or norm in an organization or culture (in this case, a city)" – is a key path for enabling the generational, silo-busting changes across city governments required for true resilience-building.

100RC monitored two primary forms of institutionalization. One of them was institutionalization via the creation of resilience champions, represented by the formalization of the CRO position and/or a Resilience Office as a permanent fixture of city government. (The other – the integration of resilience thinking to change the way cities plan and act – is discussed in the following section of this report, "Actions.")

While institutionalization does occur through the formalization of the CRO position, and although the CRO is certainly critical to overall resilience-building, the experience of cities from across 100RC's Network demonstrated that they were most successful when they invested in a robust resilience team, funding additional staff and capacity-building.

A Resilience Office, headed by the CRO, ensures a diversity of skills for implementing the work. Investing in a team also ensures that even if someone leaves for another agency, they take the resilience perspective and increased capacity with them.

Formalizing and staffing a Resilience Office, with a clear mandate and function, has been shown to:

1. Ensure permanence of the resilience work beyond the current political administration and/or election cycle

2. Provide meaningful progress toward getting the right policies and structures in place to meet resilience objectives

3. Build the capacity of other city staff around resilience and systems thinking

4. Equip the Resilience Office with the needed technical and specialist staff to implement resilience initiatives

100RC observed another pattern across its Network that cities might consider: appointing a Deputy CRO (DCRO) allowed for an important specialization, with the CRO then able to navigate city government, develop partnerships, and secure political capital and funding, while the DRCO took on a project manager role that operationalized the work.

Cultivating Diverse Resilience Champions

As stated above, the CRO and their team cannot be the sole drivers of resilience in a city. To develop and implement a city's Resilience Strategy and the work of its Resilience Office, it is also critically important to establish and maintain inclusive and balanced stakeholder engagement that cultivates buy-in to the resilience agenda from across city government and civil society.

The holistic and inclusive definition of urban resilience is one that touches on many aspects of city residents' lives, and so by nature invites broad stakeholder engagement. To truly build a city's resilience, CROs and city governments must enter into dialogue with and be willing to listen to their residents in new and various ways.

Stakeholders are individuals, groups, and institutions both within and outside of city government with the influence or capacity to contribute to resilience. They represent the diverse ecosystem of the city and the many different interests and needs of the civic, private, and public sectors. Stakeholder engagement should not be limited to experts and specialists – the true constellation of stakeholders consulted in a city's resilience journey must be representative of the city's diversity, and include vulnerable populations and/or communities that have previously recovered from a shock or stress.

The experience of 100RC's member cities has proven that early, thoughtful engagement with stakeholders sets the tone for transparency, rigor, and inclusion, and results in more support and resources, and stronger champions. Moreover, the process of bringing diverse stakeholders together, for an honest conversation about risk and opportunity, is itself a key step in creating champions and building the city's resilience.

Cultivating champions from a suitably representative swath of stakeholders can be difficult. Additional, multi-pronged, conscious efforts are often required to bring marginalized populations into the conversation. These voices are essential, however, to the overall resilience of a city, which is closely tied to the resilience of the city's most vulnerable residents.

It is important to note that the champions critical to supporting the overall citywide resilience agenda, to institutionalizing resilience into the way a city plans and acts, or to developing a holistic and visionary Resilience Strategy, may not be the same stakeholders necessary for the successful implementation of resilience-building initiatives. Resilience champions support the vision overall, while diverse other champions may be critical to specific projects.

Finally, the particular value of leveraging academic research to inform the Resilience Strategy and priorities, and of leveraging a city's academic stakeholders – including students – as champions and contributors, became clear in 100RC member cities across the world. In some contexts, an academic institution will be a more consistent and stable partner for the resilience agenda than a governmental administration, given the election cycles of the latter.

Leveraging the Resilience Strategy

A city's resilience journey broadly entails first creating a Resilience Strategy, and then implementing the Strategy's initiatives. 100RC's program developed methods for cultivating resilience champions among diverse stakeholders at each of these steps.

During the Resilience Strategy development process (detailed in the following "Actions" section of this report), 100RC CROs were encouraged to elicit support from various stakeholder groups to conduct the technical and political work of identifying the root causes of critical challenges to their cities' resilience and prioritizing opportunities and solutions. These groups, leveraged at various moments of the Strategy development process, offer CROs and their Resilience Offices a wide range of the needed skills, insights, and expertise to create a credible and holistic Resilience Strategy.

Engaging various actors from across and outside city government to participate in the Resilience Strategy development process offers a critical, time-bound opportunity to cultivate wider buy-in to the value of resilience citywide, which is required for successful implementation of the strategy. The individuals and representatives involved in identifying new opportunities and assessing existing efforts become well-positioned not only to help design resilience initiatives, but also to identify available resources and secure buy-in for their implementation.

100RC's work has found **three distinct moments of the Strategy development process to be critical points for creating champions**, and in turn for ensuring successful implementation and the embedding of resilience principles and practices throughout city systems. A city may call these entities by different names, but should understand the distinct intended roles of each.

First, a **Resilience Steering Committee (RSC)** consisting of a small group of high-level multisector decision makers responsible for overseeing the governance and support of the Resilience Strategy and its implementation. In 100RC member cities around the world, the RSC has proven to be an invaluable sounding board, critical voice, conduit for new resources, and political ally.

It is essential that the RSC and its members are positioned to navigate city politics in support of resilience. The RSC should have the expertise to challenge and enhance the city's thinking on resilience priorities, the diversity of perspectives to ensure a holistic view, and the capacity to help mobilize the necessary resources and influence to deliver the resilience strategy.

Best practice finds that RSCs should include a mix of internal city staff and stakeholders from outside city government. A key insight from 100RC's work is that CROs need to be strategic in convening an active RSC for long-term engagement. Above all, CROs should have concrete, short-term, tactical "asks" for the leaders they are cultivating for the SC (e.g. "Can you host this event for me?" or "Can you put me in touch with such and such a person?"), as compared to longer-term "Could you be a supporter?" requests.

Second, and separate from the RSC, are **Topical Working Groups** (called "Discovery Areas" in the 100RC process), which consist of a variety of interdisciplinary teams that partner with the Resilience Office to conduct the analysis and diagnostic work needed to advance a city's understanding of its challenges and goals and identify new actions for inclusion in the Resilience Strategy. The exact composition of a Working Group can vary, but ideally it includes city staff and topical experts beyond the Resilience Office, such as representatives from budget, emergency management, planning, or community development departments. These working groups can also include representatives from state, national, regional or international authorities as well as other stakeholder groups such as universities, civic organizations, key funding institutions, multilateral organizations, and/or regulatory bodies.

Finally, a city and its CRO can find champions for their resilience agendas around the world in the form of a **CRO network**. Initially fostered by 100RC to catalyze resilience-building across 100RC member cities, the international peer-to-peer and city-to-city network of CROs established working relationships between diverse CROs and their teams. Any city can now leverage the global scope of the urban resilience movement and the existence of CROs around the world to share knowledge, best practices, and co-create new solutions to resilience challenges. Throughout the Resilience Strategy development and implementation process, CROs have become trusted partners to each other. This network of CROs can create a force for collective action on the regional and global stage.

"Through the development of a citywide Resilience Strategy, Paris has brought government together in new and important ways – fostering collaboration and initiatives that would have otherwise never surfaced. Throughout this process, Paris has embedded a mindset of transforming risk into opportunity, facing challenges head-on to improve the quality of life for residents in the short and long term."

–Anne Hidalgo, Mayor of Paris, France

Leveraging City Leadership

Along with CROs, Resilience Offices, and stake-holders from across the city and beyond, when cultivated as resilience champions, the city's top leadership can provide the regular and informed validation of the work that will be paramount to ensuring the Resilience Strategy is well-resourced and aligned with other city priorities, and to build-ing the city's overall capacity. When cultivated as champions, city leaders can inspire the whole city to tackle its most pressing issues in a strategic, integrated, risk-aware way. They weave resilience into the overall vision for the city, and can make it the city's overarching organizing principle.

Experience across the 100RC Network has shown the need for early identification of who in city leadership has the authority to move the resil-ience work forward, as well as who controls bud-getary decisions. This is often the mayor or chief executive, but not always – city managers, deputy mayors, or other agency heads may in fact be the best targets for cultivating the needed resilience champions in city leadership.

Regular briefings between key city leaders and the CRO are necessary to keep the leadership in-formed and engaged on new learnings, emerging resilience priorities, and the overall progress and direction of the Resilience Strategy and its imple-mentation.

The need for such regular briefings, as well as for city leader sign-off on key milestones including the final Resilience Strategy, should be factored into the resilience decision-making processes, the shaping of the Resilience Steering Commit-tee, and the work plan. This momentum and polit-ical capital needs to be continually renewed – the

Resilience Office cannot stop after publishing the Strategy, but should continually seek endorse-ment and political authority.

In addition to regular briefings, CROs have been able to strategically leverage 100RC events and other global convenings as moments to engage and expose city leaders to the resilience agenda. Bringing mayors, city executives, and other in-fluential city leaders to events such as CityX-Change, 100RC Network Exchanges, COP 22, and UN Habitat has allowed CROs to demonstrate the work in practical terms, elevate the value of the global movement, and let city leaders to step away from their day-to-day and engage in the long-term resilience agenda. Resilience-build-ing is generational work, an effort that requires longer timeframes than the political cycles of almost any city.

Finally, enduring political transitions will be a re-quirement of the resilience effort – something that 100RC member cities have experienced around the world. Key insights from these experi-ences include that successfully navigating transi-tions is highly specific to individual city contexts. In some places, outreach to upcoming candi-dates to cultivate their commitment to the work regardless of election results will best serve the resilience effort. In other cases, generating com-mitment among entrenched bureaucracies that will remain in place despite any transition is the most effective path. In all cases, finding and ele-vating the links between the most important resil-ience issues of a city and the political priorities of a given administration will be critical.

> "We want Santa Fe to be a thriving city, which is encouraged to innovate and transform, to lead regional development and create growth opportunities for all. A city capable of learning from and overcoming its problems, with an active community which values life and coexists with its rivers. We firmly believe that the resilient approach is giving us those tools that Santa Fe people already had but that we are learning to strengthen."
>
> –José Corral, Mayor of Santa Fe, Argentina

Porto Alegre, Brazil

Communicating Resilience

Media and communications play a vital role in cultivating champions and raising awareness of the value of resilience. Intentionally creating a communications and outreach strategy, and being open to media engagements at all moments of a city's resilience journey, sets up the city for long-term success. Through shifting political agendas, residents, city leaders and project owners alike will need to understand and believe in the value of resilience. Resilience Offices will need to build grassroots political buy-in and inspire city residents to get involved in the work in their own communities.

Stakeholders, including funders and key partners, will only support the resilience effort if it has proven its value and its ability to execute and get results – communicating progress is therefore essential. Each resilience project that is completed and promoted will in turn benefit future projects by bolstering the credibility of the Resilience Office.

A strong communications strategy containing clear, thoughtful, and vetted messaging will:

1. Build overall momentum throughout the process

2. Help the resilience work survive political transitions

3. Empower CROs, their teams, and all other resilience champions to explain the value of resilience

4. Guide how and when the CRO and city connects with external audiences, as another form of stakeholder engagement

5. Lay the groundwork for media outreach at key milestones (such as the release of a Resilience Strategy, or successful progress and impact in implementation)

Communications about resilience should be delivered in creative ways, making what can sometimes be difficult or abstract concepts relevant to real people, moments, and results.

But the challenges to communicating the value of resilience globally begin with the word itself. For example, there is no word equivalent to "resilience" in Thai, while in Mandarin there are multiple words, each with a slightly different connotation. Nuances like this are found around the world. Even in English, the word "resilience" is open to interpretation. While 100RC has promoted a very specific definition of urban resilience, this is likely not what most audiences will immediately think of when hearing the term. Moreover, urban resilience is often conflated with other concepts such as climate change adaptation and mitigation, disaster preparedness and risk reduction, sustainability, and smart cities – but these are only part of the story of urban resilience.

Finally, resilience, even under 100RC's definition, is not tied to a single metric, process, or outcome, but rather is a holistic concept about making systemic, ongoing changes to the way cities understand risk and plan for the future. Resilience is complex, at times even for expert practitioners.

In light of these challenges, it is important to be thoughtful of the local context, and to be clear and consistent when determining how to communicate about resilience in a given city.

100RC's experience has uncovered some best practices for cities communicating about resilience:

Highlight the city's resilience challenges and resilience vision statements, using strong problem and impact statements to underscore the need for and value of resilience.

Frame stories using local context and language, and anchor resilience-building efforts in the specific context of the city.

Use concise, clear messaging with supporting talking points to help the process or project be better understood.

Maintain and monitor avenues of communication with stakeholders, keeping them apprised of progress through regular communication, and anticipating where their questions or interests might lie.

Complement consistent communications efforts by taking advantage of key opportunities and milestones to report on progress and engage key audiences.

Experiment with creative, accessible multimedia storytelling techniques to reach broader audiences.

Consider responding to detractors using both direct and indirect tactics, e.g. producing a video or other digital content, or issuing an op-ed or other proactive statement to the press to address the critique directly, vs. privately contacting the detractor or influencing their network.

Los Angeles
Institutionalizing Resilience throughout City Hall

CHAMPIONS

ACTIONS   FUNDING   SCALE   PARTNERS

Los Angeles, home to over four million people, is the second most populous city in the United States. Known as the "creative capital of the world," L.A.'s economy is driven by international trade, entertainment, technology, fashion, and tourism – the metropolitan region has the third highest GDP of anywhere in the world. The city faces a diverse range of shocks, particularly earthquakes, wildfires, droughts, and flooding, and is challenged by stresses including economic inequality, aging infrastructure, and the impacts of climate change.

Building resilience, especially in a city as large and complicated as Los Angeles, will require creating resilience champions throughout municipal government. A single Resilience Office and CRO, no matter how centrally institutionalized, will not achieve sufficient reach or impact. This is especially true given the ambition and scope of L.A.'s Resilience Strategy, which includes nearly 100 actions affiliated with a wide range of municipal offices. With a significant portion of implementation that must be executed by other city departments, it is critical of the Resilience Office to foster broad buy-in and capacity to deliver. Making resilience a core part of the work across city departments will also help institutionalize this work for the long term, through mayoral transitions and other political changes.

Building this needed buy-in to resilience started with the Strategy development process. The Resilience Office engaged holistically across departments, leveraging the CRO's unique convening power to get officials from disparate parts of city government in the same room, and laying the groundwork for them to collaborate on resilience-building. As a result of this consultative approach, the final Strategy resonated with the various departments. Staff could see clearly reflected in the document the priorities they had identified in terms of the city's shocks and stresses, the rationale for why Los Angeles has to address them, and a clear path forward for the involvement of all divisions in implementation.

To further formalize this distributed and collaborative ownership of resilience work, as announced in the Strategy, the Mayor of Los Angeles appointed over 30 Departmental Chief Resilience Officers (DCROs) within the city's government – making Los Angeles the first city in the 100RC Network to establish such positions. This action incorporated resilience across city functions, curated an in-city network of resilience practitioners to advance initiatives, and institutionalized a requirement for every city department to contribute to and be responsible for the city's resilience. This fulfills part

of Action 43 of the Strategy, which aims to make resilience-building a permanent part of the City of Los Angeles's systems and services.

Other key elements of Action 43 include:

• Expanding the Office of Resilience to lead the implementation of the Strategy, foster citywide partnerships for resilience, and engage Angelenos in resilience-building actions
• Incorporating Strategy implementation into agency performance reviews and budget proposals
• Establishing inter-agency working groups to promote collaboration around specific shocks and stresses
• Measuring and tracking citywide resilience metrics and progress toward resilience goals, building on L.A.'s pilot of the City Resilience Index (CRI), a comprehensive tool for measuring resilience in a systematic, globally applicable way

The DCROs are now working together on initiatives focused on critical infrastructure, disaster preparedness and recovery, and extreme heat mitigation. Following the appointment of the DCROs, and just months after the March 2018 release of its Resilience Strategy, the L.A. Resilience Office held a "Resilience Week," which brought together several related resilience-building efforts and served to galvanize momentum, mobilize resources, create champions, and secure buy-in from key city stakeholders for the city's resilience agenda. A meeting of the DCROs during that week was an important moment to deepen coordination between officers in that cohort, and explore how their respective departments could work together to advance holistic resilience initiatives.

Following that meeting, in November of 2018, Resilient Los Angeles partnered with 100RC staff experts to lead in-depth collaboration sessions for the DCROs on project finance and methods for the monitoring and evaluation of resilience projects. This interactive workshop equipped the DCROs with new methods and tools to design and implement projects with resilience benefits, and empowered them to apply these practices directly. The DCROs can, in turn, serve as pollinators in their own spheres, building the wider resilience capacity of departmental staff and key city stakeholders.

Today, Los Angeles's DCROs are working together on applications for state grants to finance resilience initiatives. In collaboration with the CRO, they are also working across departments to implement actions such as ShakeAlert, an earthquake early warning app launched in early 2019 – the successful deployment of which will require close partnership between the Police, Fire, Public Works, General Services and Information Technology departments along with a host of external stakeholders. The DCROs are also leading resilience training for municipal staff and aligning citywide communications on the implementation of the Strategy.

With its wide diversity in expertise and thematic interests, as well as roles and responsibilities within the city, the cohort of DCROs is a critical resource for mainstreaming resilience across Los Angeles. Appointing the DRCOs significantly expanded the number of resilience champions in the city and is paving the way for new kinds of cross-departmental partnership on resilience initiatives. The departmental CROs are now sitting alongside the CRO at the forefront of implementing L.A.'s Resilience Strategy.

European Union
Resilience as a Political Agenda for Europe

CHAMPIONS

ACTIONS   SCALE

Since 100RC launched in 2013, both member and non-member cities around the world have been changing the way they plan and act and institutionalizing the position of the Chief Resilience Officer in order to build their cities' overall resilience to the shocks and stresses of the 21st century.

A core component of resilience-building is to break down government silos, thereby enabling cities to plan more strategically and to deal effectively and efficiently with their most pressing challenges. To facilitate silo-busting, as well as the development and implementation of resilience-building initiatives, a growing number of 100RC member cities in Europe and the Middle East have decided to introduce and formalize the position of Deputy Mayor for Urban Resilience to serve as CROs.

Such institutional appointments are capable of breaking down government silos, enabling cities to conduct strategic planning and empowering them to deal effectively and efficiently with the particular shocks they face, which they would otherwise struggle to address. Breaking silos can help identify synergies for the use of limited government funds, allowing a city to accomplish more with the same amount of resources.

To be successful, the silo-busting work of the Deputy Mayors requires a combination of technical expertise (or the ability to source it) and a high degree of political support – which takes a variety of forms in different city administrations, but which is always necessary to transform the operations and effectiveness of centuries-old cities so that they are able to address 21st century challenges.

The particular model of Deputy Mayor for Urban Resilience that has been spreading across the region was pioneered by the City of Thessaloniki, with the introduction of the position of the Deputy Mayor of Urban Resilience and Development Programs in April of 2016. Other cities have followed Thessaloniki's example, with London appointing a Deputy Mayor of Fire and Resilience, Athens a Deputy Mayor of Green, Urban Resilience, and Adaptation to Climate Change, and Lisbon a Deputy Mayor responsible for resilience and civil protection.

This trend across Europe and the Middle East signals the growing prominence of the urban resilience practice in the EU and among its neighbors. And the trend is expected to continue, with enhanced funding and financing becoming available, given that urban resilience has been deemed a key planning priority for the EU going forward.

Kyoto
Facilitating Resilience Dialogues

CHAMPIONS

ACTIONS   SCALE

An inland city situated in the central part of the Japanese archipelago, Kyoto is home to over 1.5 million people. With over 1,200 years of continuous history, Kyoto is one of the world's most ancient living cities, known for its rich cultural heritage, and with a reputation for tolerance. The city has built its resilience over the centuries in the face of countless shocks and stresses, including natural disasters, epidemics, and civil wars.

In recent years however, interdependent global trends such as climate change, globalization, and population displacement are causing more frequent and severe challenges for Kyoto. Today, Kyoto is grappling with a range of stresses that weaken the fabric of the city and its ability to overcome future shocks, including vulnerability to flooding and earthquakes, a declining local economy, the aging and shrinking of its population, increasing social isolation due to the breakdown of community cohesion – and the deterioration of urban landscapes overall due to a combination of these stresses.

Kyoto's resilience champions agreed, in the face of these risks, that the city needed urgently to depart from its business-as-usual way of working, where each problem was handled separately, and city plans created in silos. The champions advocated for concerted efforts to foster collaboration between Kyoto city council departments and increase interdependencies in the city's approaches for addressing key issues.

To that end, in 2017, Kyoto's CRO led the Resilience Team in initiating a series of "Resilience Dialogues" to facilitate conversation between directors, deputy directors, and team members from various city government departments. These inter-departmental workshops and one-on-one briefings allowed participants to share information and provide feedback on various city priorities, drawing on their respective areas of expertise, which included population and demographic changes, environment, and disaster risk reduction.

This collaborative process helped secure buy-in from crucial department heads and council members for the Resilience Strategy's initiatives. It also ensured that resilience will be part of the larger city vision for Kyoto, by enabling the Resilience Strategy to be incorporated into the city's Master Plan, due for renewal in 2021.

Mandalay
Using Problem Framing to Open a Dialogue on Resilience

🏆 CHAMPIONS

🎯 ACTIONS   🌀 CLIMATE CHANGE   🏛 HERITAGE AND CULTURE   🚲 TRANSPORT AND MOBILITY

Mandalay, a city of over one million people, is a major economic and cultural hub in Myanmar. Suffering from poor mobility systems, prone to recurrent floods, vulnerable to climate change, and permanently at risk from earthquakes, resilience-building is recognized by city leadership as critical to Mandalay's future prosperity.

However, in Mandalay, as in many other cities around the world, the siloed nature of decision-making, compounded by the complex, multifaceted nature of many urban challenges, makes it difficult to adopt systems thinking and plan for the future in a holistic manner. Designing truly resilience-building projects requires a thorough assessment of problems and the barriers to addressing them.

Mandalay's resilience champions worked with 100RC to help the wider constellation of city stakeholders change the way they planned for their major challenges. Notably, a **Problem Framing Workshop** was convened in October of 2017 as part of Mandalay's Resilience Strategy development process. The city chose to focus the workshop on two priority resilience areas: climate change, and traffic and mobility.

During the workshop, Mandalay staff engaged with

key stakeholders in academia, the private sector, and civil society. Participants worked to create a clearly defined vision statement for each priority area, unpacking the root causes for problems rather than merely designing solutions to alleviate their consequences. By diagnosing needs, setting priorities, and generating stakeholder buy-in, the Problem Framing Workshop increased Mandalay's capacity to crowdsource opportunities and collaborate between government departments and officials.

By the end of the workshop Mandalay was considering new visions for an 80% reduction in mobility issues, the development of an efficient public transportation system, and the introduction of effective water management strategies in the face of climate change. Mandalay recognized barriers to realizing these visions, such as a lack of coordination between government agencies and a rapid influx of new migrants to the city, and identified available resources for tackling those underlying challenges. The outputs of the workshop in turn influenced Mandalay's Resilience Strategy. Potential initiatives the city may pursue to address the problems include a risk communication strategy for earthquakes and floods, as well as the formation of a new Mandalay City Road Transportation Authority.

100RC Tool

Problem Framing Workshop
Allows CROs to engage an array of city stakeholders to create a deeper and shared understanding of key city challenges, culminating in the creation of new resilience-building policies and programs.

Puerto Rico
Hurricane Maria and ReImagina Puerto Rico

🚩 CHAMPIONS

🤝 PARTNERS   ↗ SCALE   ⚡ POST-DISASTER RESILIENCE

Hurricane Maria struck the island of Puerto Rico in September of 2017 as the tenth-strongest Atlantic hurricane ever recorded. Thousands of residents lost their lives, and upwards of US$90 billion of damage was suffered. With a history characterized by multiple waves of settlement, colonization, and new populations from around the world, the island's people have long demonstrated resilience. But the damage from Hurricane Maria was transformative, and underlying stresses including aging and inadequate infrastructure, poverty among residents, and the debt crisis of the government, worsened its impacts.

Puerto Rico is taking advantage of the rebuilding process it must go through to *build back better* – to leverage the recovery investments to foster a social and economic transformation across the island that results in a more just, equitable and resilient society. As part of the numerous recovery efforts that emerged, the Resilient Puerto Rico Advisory Commission (the Commission) was created in November 2017 to serve as a unifying force among a diverse group of Puerto Rican voices.

Funded by RF, the Ford Foundation, and the Open Society Foundation, the Commission is led by an executive director and a group of five co-chairs, all of whom have strong connections to the island, and who in turn selected 24 commissioners to lead the work, in partnership with 100 Resilient Cities. The Commission represents a foundational cohort of resilience champions for the island, and they jumped into the work to elevate resilience thinking beyond the 100RC member city of San Juan to span the entire island of Puerto Rico.

After founding, the Commission held island-wide meetings to hear from over 750 residents and key stakeholders to identify risks, discuss concerns and aspirations, engage with the federal, state, and municipal governments, and lay out recommendations to a make Puerto Rico a stronger, more resilient place, for all of its citizens.

This work led to the production of ReImagina Puerto Rico, six cross-cutting sectoral strategies that together represent an actionable and timely set of recommendations for how to maximize the deployment of philanthropic, local government, and federal recovery funds. ReImagina Puerto Rico established the following goals for the six sectors:

- **Housing:** Develop a portfolio of strategies that reduce risk exposure and foster community empowerment, addressing the diversity in socioeconomic conditions, housing types, and tenure in Puerto Rico.

- **Energy:** Address Puerto Rico's energy needs by transforming its electric power infrastructure into an affordable, reliable, and innovative system, while reducing adverse impacts on human health and the environment.

- **Physical Infrastructure:** Develop and maintain infrastructure systems that are accessible, integrated, flexible, and robust enough that they may sustain critical operations for the well-being of Puerto Ricans.

- **Health, Education, & Social Services:** Develop initiatives that ensure the provision of health, educational, and social services to reduce existing and future vulnerabilities and chart a pathway toward improved equity and well-being, with community participation in design and implementation.

- **Economic Development:** Craft a diversified portfolio of economic activities that augment Puerto Rico's resilience by enhancing existing capabilities, improving employment prospects, and reducing inequalities.

- **Natural Infrastructure:** Improve human health and well-being, foster economic development, and reduce exposure to hazards, through the sustainable use of Puerto Rico's natural resources.

The ReImagina Puerto Rico blueprint contains 97 recommendations across these six sectors, 17 of which are immediate priorities in the recovery and reconstruction of Puerto Rico. Together these recommendations comprehensively address unmet needs and ongoing challenges to guide long-term recovery and reconstruction efforts in Puerto Rico and mitigate the impact of future disasters.

All of the recommendations, though envisioned through six key sectors, are holistic in design, and applied a resilience lens to ensure that they improve the capacity of individuals, communities, institutions, businesses, and systems to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience. In addition, the extensive stakeholder engagement involved in their creation ensures that they are truly representative of the community needs.

Overall, ReImagina aspires to rebuild Puerto Rico on a more solid, equitable, and resilient foundation. It looks beyond pre-disaster conditions and seeks to promote innovation, ingenuity, and a learning-by-doing approach in all reconstruction projects. ReImagina aligns recovery efforts and brings greater transparency to the work, implementing tools and multi-stakeholder coalitions to advance reforms and track progress of Puerto Rico's recovery. The recommendations of ReImagina Puerto Rico are now being leveraged to create a detailed post-disaster recovery plan that takes into account both rural and urban needs, protection of the island's ecosystems, and the unique political and economic conditions of Puerto Rico.

Singapore
Building Community Resilience through Human-Centric Design

CHAMPIONS

PARTNERS   CLIMATE CHANGE   FLOODING

As a small island city-state, Singapore is extremely vulnerable to the impacts of climate change, and in recent years has suffered an associated uptick in heavy rainfall, flash floods, and extreme heat.

The city has a long track record of successfully constructing robust physical infrastructure to cope with disasters and the anticipated impacts of climate change. But after embarking on its resilience-building journey, Singapore began to look beyond these hard defenses toward softer and/or non-structural measures.

As part of its Resilience Strategy development process the city conducted stakeholder engagement sessions, which uncovered ways to improve its methods of planning for climate change. The sessions suggested that Singapore develop more effective communication with stakeholders to cultivate better understandings of the risks and challenges facing the city, make more targeted efforts to foster meaningful collaborations with stakeholders that result in impactful projects, and move toward a human-centric approach to solution design.

Through Singapore's membership in the 100RC network, the Singaporean government's Centre for Liveable Cities (CLC) tapped the non-profit Rebuild by Design (RBD) to put these three key insights into action, drawing on RBD's expertise in participatory and collaborative planning and design processes.

RBD is supporting CLC to develop a framework for the city's technical agencies, through which they can engage with the communities most exposed to the impacts of climate change and empower these communities to implement low-cost, low-risk measures for building their adaptive capacity.

CLC is launching a demonstration project in a low-lying neighborhood that will bring together local community and government stakeholders in the co-creation and implementation of innovative climate adaptation projects. RBD will also help CLC document best practices and transferable lessons from this pilot.

Overall, the partnership between RBD and CLC will produce guidelines and a toolkit that will enable the city to deliver better outcomes for any and all neighborhoods at risk of flash flooding, and to increase the capacity of residents to deal with extreme weather events.

Rebuild by Design
In the devastating aftermath of Hurricane Sandy, which hit the U.S. Eastern Seaboard in October of 2012, a partnership between The Rockefeller Foundation and the U.S. Department of Housing and Urban Development (HUD) created a new design competition, Rebuild by Design (RBD), leveraging private philanthropic dollars to bring the talents of the world's greatest designers and thinkers to bear on the affected areas of New York, Connecticut, and New Jersey.

That initial RBD competition concluded in 2014 with HUD awarding US\$1 billion to the winning jurisdictions. In addition, the work of and learnings from RBD was built into 100RC from the program's launch.

RBD has since gone on to partner on resilience building with cities and communities around the world.
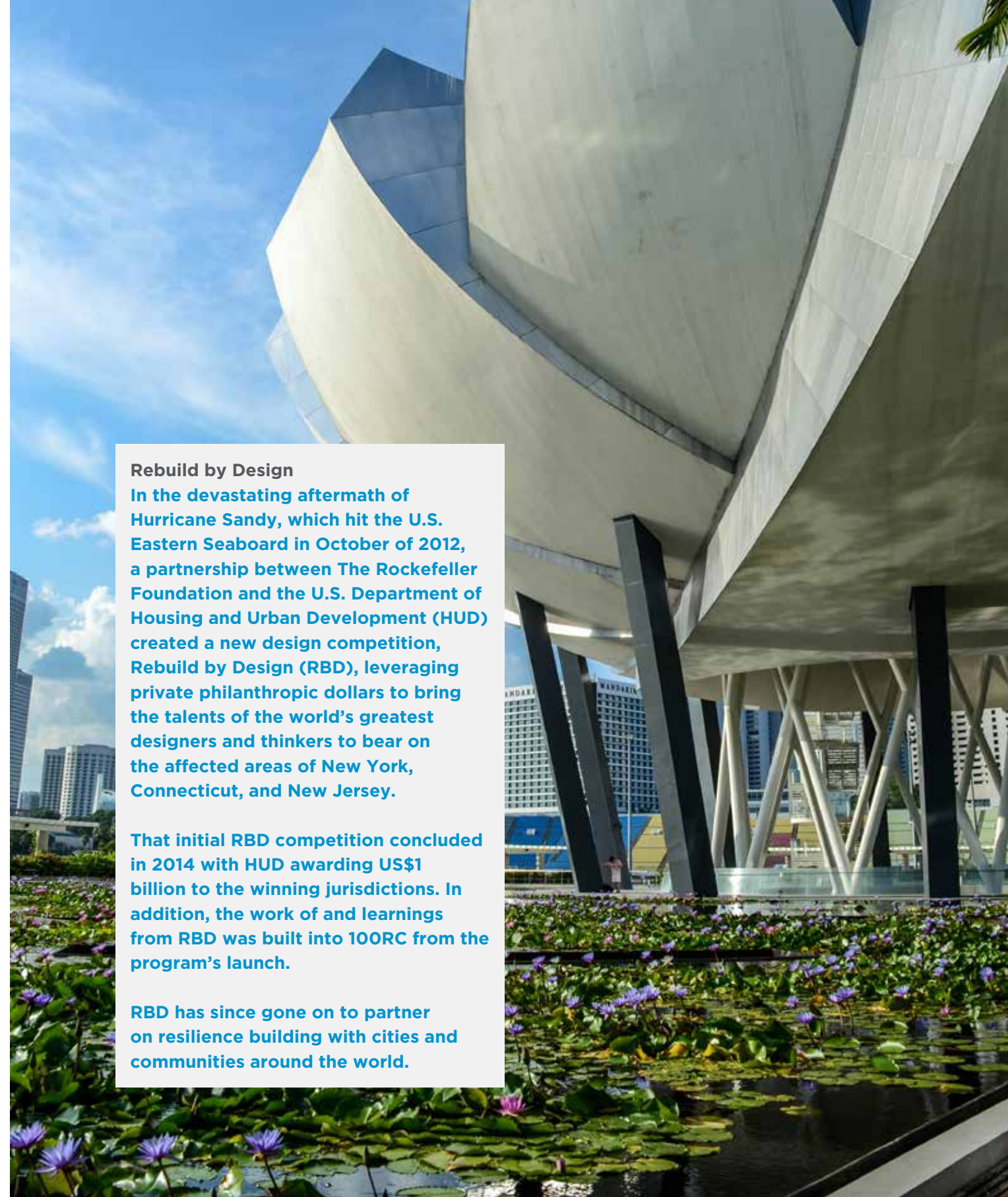
Champions across the 100RC Network - Impact

100RC partnered with cities to create the position of Chief Resilience Officer in their governments, to lead the resilience agenda. These diverse and dynamic leaders represent the vanguard of the resilience practice and are driving change in some of the world's most complex and dynamic cities.

To date, **135 people** have been trained and held the office of CRO across 100RC member cities, with **89 CRO positions** currently active in cities; and this despite **72 mayoral transitions having taken place in 62 of those cities.**

100RC provided seed funding for the CRO position for just two years, with the goal of catalyzing longer-term change. Thus far, that bet has paid off, and **78% of cities have continued to fund the CRO role** after the 100RC grant period, institutionalizing the role and proving it to be an integral part of city government in the 21st century.

This was confirmed by 100RC's external evaluation by the Urban Institute, which reported that CROs are truly embedded in city hierarchies.

In partnership with local stakeholders, 100RC delivered training, shared best practices, and collectively built a global movement for urban resilience. CROs and their teams received over **21,000 hours of resilience capacity-building**.

What's more, 100RC member cities have quickly come to value resilience-building enough to have hired **an average of five additional staff per Resilience Office**.

Beyond the CROs and Resilience Offices, a **community of practice of more than 17,850 practitioners** has engaged in the development of Resilience Strategies in member cities globally, including more than **3,000 community groups**, who ensure the voice of residents in the process and broaden ownership of the resilience agenda.

> **"CROs have given public speeches, been approached by cities outside of 100RC (typically, neighboring cities), and used the 100RC network to connect non-CRO colleagues with their counterparts across member cities to share technical expertise. The clear majority of members in the network have effectively become ambassadors for the resilience movement both within the global market and for neighboring cities and regions in their own countries."**
>
> – The Urban Institute Midterm Evaluation Report, December 2018

Gathering in Bellagio, Italy

⊃ Actions

Cities will need to change the way they plan and act in order to build their overall resilience.

The founding mission of 100RC – to catalyze a global urban resilience movement – is fundamentally about helping cities change their trajectories by rethinking their relationships to both risk and opportunity. A commitment to building urban resilience entails systems-level change across all facets of a city's operations. It requires looking at a city holistically – planning with an understanding of its systems and their interdependencies, as well as the interdependencies of the various risks that the city may face.

Similarly, resilience-building projects should be designed holistically, such that multiple benefits may be obtained from a singular intervention. Doing this work will contribute to delivering a "Resilience Dividend" – that is, the net social, economic, and physical benefits achieved when designing urban initiatives and projects in a forward-thinking, risk-aware, inclusive, and integrated way. The ongoing process of creating and implementing a Resilience Strategy, and designing and delivering resilience-building projects, gives a city the capacity and opportunity for overall resilience-building goals to evolve and be realized.

Evidence and experience from across 100RC's member cities around the world suggests that making fundamental structural changes to embed resilience into how cities plan and act will in turn allow them to:

• Use their limited resources in innovative ways and for greater benefit

• Be better organized and more coordinated, and implement more effective projects that are inclusive and risk-aware in their design

• Be better prepared to deal with future challenges, both foreseen and unexpected

• Be better able to engage with and serve their residents in both good times and bad

Seeking a structured process that would help orient cities around making those changes, 100RC created and refined a new concept in urban planning and management, the Resilience Strategy. A Resilience Strategy serves as a roadmap to building resilience in a city. It articulates a city's long-term challenges, aspirations, and priorities for the future, as well as the specific actions, or initiatives, that represent the path forward. It is designed to trigger action, investment, and support within city government and from outside groups.

As part of their acceptance into the 100RC program and associated grant package, member cities received support from external expert facilitators (called "Strategy Partners" in the 100RC program) to lead them through a specific 100RC Process for Resilience Strategy development – but the concept may be realized by any city with a commitment to resilience-building.

While it is possible to pursue urban resilience without a Resilience Strategy, the analysis, consensus-building, and visioning efforts that are undertaken to develop the Strategy have proven essential in creating the enabling environment for resilience-building across 100RC member cities.

The lessons included in this section cover:

- ☑ Developing a Resilience Strategy
- ☑ Integrating Resilience into City Policies and Systems
- ☑ Building Resilience into Project Design
- ☑ Measuring and Evaluating Resilience

"Social connectedness and levels of cohesion are key determinants of how a city and community will respond and recover from any kind of emergency or disruption. In other words, being connected matters."

–Beck Dawson, Chief Resilience Officer, Sydney, Australia

Developing a Resilience Strategy

The development of an urban Resilience Strategy will help a city, the private sector, civic and government partners, and citizens understand their city's capacities, strengths, weaknesses, and risks in a comprehensive way. It will culminate in the articulation of a city's resilience goals – the future the city is striving to create – as well as the design of a suite of concrete actions in pursuit of those goals, capable of fostering both short-term impacts and long-term change. These actions should be a blend of wholly new ideas stemming from the Strategy development process along with ongoing work in the city that is recognized for its resilience value. The Strategy initiatives should run the gamut from the routine and highly feasible to the very ambitious, from discrete events, campaigns, or research studies, to social programs, city planning frameworks, new fiscal levers, and large-scale infrastructure projects.

But unlike many traditional planning processes, solution development is not the starting point for resilience-building, nor does it constitute the bulk of the Strategy development process. Instead, a city must first deeply understand its own context by conducting a holistic scan of its current state of resilience through a combination of stakeholder workshops, desktop analysis, leadership decisions, and robust community outreach.

The development of a Resilience Strategy entails five key innovations:

1. Understanding Risks and Assets Holistically
Most cities have long had detailed procedures to identify, plan for, and recover from emergencies. Many cities also have programs and objectives for mitigating their chronic challenges. But these two sets of plans and programs are often found in separate silos of city governments, and the interplay between the shocks and stresses may never have been considered.

Meanwhile a resilient city looks at its risks holistically, understanding how its shocks and stresses are related and interdependent, and how they impact its ability to thrive. A resilient city understands its known risks, anticipates its potential risks, and develops plans for an uncertain future.

It is therefore critical to conduct a fresh baseline assessment that capture a city's risk profile from a holistic perspective and enumerates a city's various existing assets that mitigate against current or future risks. By requiring that shocks and stresses be understood together, the Strategy development process encourages different stakeholders to look beyond their areas of expertise to consider how the city's risks and assets might be defined and interrelated.

The overall risks and assets profile should be contextualized by an understanding of how diverse residents in the city experience those strengths and weaknesses, and comparing those perspectives and perceptions against formal city data. Doing so provides a more comprehensive and tangible definition of what contributes to the city's resilience, bridging the gap between qualitative and quantitative data while increasing the chance that critical actors who may typically be excluded from such efforts have an opportunity to shape the city's resilience agenda.

2. Mapping Existing Actions and Perceptions

Even if a city is newly embarking on its resilience journey, no city is starting from scratch – every city will have actions or investments underway that could support its resilience agenda and should be leveraged to that end. An effective Resilience Strategy is also aligned with existing city plans and priorities, ensuring the highest feasibility of implementation and greatest impact.

Therefore, an inventory of existing city efforts should be created before any new resilience solutions are designed. This inventory should ideally include any plan, strategy, program, project, practice, initiative, legislation, or funding that is deliberately designed to contribute to the protection, functioning, or advancement of the city. These may be spatial or non-spatial, in planning, in execution, completed, or on hold, and could be driven by not only the city but also by businesses or civic organizations, or by local, municipal, regional or state government entities. Some of the actions in this inventory may be considered among the assets of a city identified in the previous analysis.

In addition to understanding what actions are underway, the Resilience Strategy development process creates an opportunity, sometimes for the first time in a city, to make sense of all the city's plans and actions together, providing a bigger picture of where there may be duplicative efforts or gaps. For cities with multiple strategies, this is a particularly useful exercise.

As an additional lens, stakeholder and resident perceptions should be sought out and analyzed to begin capturing how people are experiencing the actions documented. These perceptions provide a baseline for deeper discovery, putting into question the effectiveness of existing actions, and uncovering areas for growth and improvement.

3. Investing in Exploratory Work and Filling Knowledge Gaps

A final critical piece of Resilience Strategy development, which should occur before any solutions are identified, is for the city to leverage the two preceding analyses and identify a set of targeted areas where it still needs to better understand its risk, evaluate interdependencies, or otherwise gather new data to fully understand the potential for resilience-building initiatives. The city must be prepared to devote resources to clarifying and filling these knowledge gaps before proceeding with the development of Strategy initiatives.

Cities in the 100RC network tackled this by articulating thematic or topical areas for further exploration, and tasking a committed team of experts from within and outside the city with understanding and articulating the root causes of the challenges and opportunities associated with knowledge gaps in those thematic areas (called Discovery Areas in the 100RC program).

These Topical Working Groups, also covered in the Champions sections of this report, are multi-sectoral, and take a variety of innovative approaches to find new insights, data, information, and perspectives on their respective thematic or topical area, to determine the best course or range of actions both existing and new, and to address the issues raised through their deeper investigatory work.

The Working Groups should review relevant actions underway in the city to assess whether they are effectively addressing the challenges they were created to resolve, and whether they contribute to improving the city's resilience across varying timeframes, scales, and intervention points.

Finally, the findings and recommendations of all the various Working Groups should be looked at holistically to identify complementary opportunities, either based on content, responsible actors or domains, or spatial considerations.

By ensuring that the research and exploratory work conducted during this phase of the Resilience Strategy development process breaks down existing silos to bring new and diverse perspectives to the table, cities build the muscle for partnership and stakeholder engagement needed for successful implementation of the resulting Resilience Strategy. The people leading and engaging with the Working Group process should become the resilience champions that help turn ideas into action.

4. Selecting Resilience Initiatives

Resilience initiatives are the specific, measurable, and tactical projects that the Strategy proposes to implement, and that together will allow the city to progress toward its resilience vision. Identification and design of resilience initiatives is a highly iterative exercise. All of the learnings garnered through the three steps outlined above represent a rich set of ideas for how the city and its partners can take action to build resilience.

To reflect on, prioritize, and ultimately commit to the strongest suite of initiatives for inclusion in the final Resilience Strategy, the city should undertake a dedicated series of conversations and workshops with a wide swath of stakeholders, designed to take stock of all the ideas generated to date, facilitate new ideas for projects, and prioritize the efforts that will have the greatest impact on resilience-building.

"Deyang joined the 100 Resilient Cities network in hopes of turning the tragic history of the 2008 Wenchuan earthquake into a point of strength in our resilience narrative. This [Resilience Strategy] lays out a vision for a safe and livable city for all residents under all circumstances and goes beyond seismic risk reduction. Thanks to the holistic and collaborative process Deyang has undertaken to craft this strategy, our city is now a leader in the urban resilience field in China and is proud to set an example for this work in practice for our neighbors."

–He Li, Mayor of Deyang, China

This opportunities assessment is designed to help identify those initiatives that will yield multiple resilience benefits and advance the Strategy's goals by surfacing discussion around the initiatives' links to resilience qualities, city priorities, impact on various communities, and more. The work of identifying such information for all potential initiatives also helps cities prepare to implement those eventually selected, by beginning to identify potential barriers, owners and partners, resources, legislation, and more.

5. Creating a Compelling Resilience Narrative
The eventual Resilience Strategy presents a hierarchy of the city's challenges, vision, goals, and initiatives. This creates a narrative for the city, helping to explain how the actions in the Strategy will respond to the shocks and stresses identified, how the goals reflect the community engagement and holistic city context work, and how the overall Strategy offers a coherent and credible path for the city that can be adopted and invested in by politicians, bureaucrats, businesses, and communities alike.

Through this narrative, contributors begin to see themselves in the goals and work ahead, building the capacity, understanding, and buy-in needed across the city's ecosystem to take the resilience principles and projects forward into their own agendas, work, and budgets.

In sum, a robust citywide Resilience Strategy not only identifies the city's resilience priorities, acting as a roadmap for future investment, but also teaches the city how to incorporate resilience principles into its core processes. The Resilience Strategy development process creates resilience champions and gives the city a new holistic view of its risks and opportunities. Finally, a Resilience Strategy should be understood not as a fixed plan but rather a dynamic document. A city's resilience-building efforts will need be re-informed as new shocks or stresses are experienced, as preliminary initiatives are implemented, as new data becomes available, and as new resources or opportunities for collaboration are revealed.

The Seven Qualities of a Resilient System

Understanding the systems and current resilience context of a city is a critical to building a resilient future. Understanding resilience itself, and what qualities belong to a system that is truly resilient – truly able to withstand, respond to, and readily adapt to shocks and stresses – is likewise needed for the creation of city's Resilience Strategy vision, goals, and actions. 100RC and other thought leaders and practitioners from the global urban resilience movement identified seven characteristics that will be seen in a resilient project, institution, piece of infrastructure, and the city itself as a whole:

Reflective – use past experience to inform future decisions and be able modify standards and behaviors accordingly.

Resourceful – recognize alternative ways to use resources, particularly in times of crisis, in order to meet needs or achieve goals.

Inclusive – prioritize broad consultation and "many seats at the table" to create a sense of shared ownership in decision-making and/or a joint vision for building city resilience.

Integrated – bring together a range of distinct systems and institutions, allowing for the catalysis of additional benefits, as resources are shared and actors are enabled to work together to achieve greater ends.

Robust – well-conceived, constructed, and managed, and includes making provision to ensure failure is predictable, safe, and not disproportionate to the cause.

Redundant – spare capacity purposefully created to accommodate disruption, with multiple ways to achieve a given need, including during the extreme pressures or surges in demand experienced in a crisis.

Flexible – willingness and ability to adopt alternative strategies in response to changing circumstances or sudden crises. Systems can be made more flexible through introducing new technologies or knowledge, including recognizing traditional practices.

In sum, reflectiveness and resourcefulness are about the ability to learn from the past and act in times of crisis. Inclusivity and integration relate to the processes of good governance and effective leadership that ensure investments and actions are appropriate, address the needs of the most vulnerable and collectively create a resilient city – for everyone. And robustness, redundancy, and flexibility are qualities that help to design systems and assets that can withstand shocks and stresses and are willing to pursue innovative strategies to facilitate rapid recovery.

Building Resilience into Project Design

Every dollar spent by a city is precious, and likely entails a trade-off for a dollar not spent on something else. Decision makers have the opportunity to be explicit about maximizing the co-benefits of their money and should strive to deploy projects that will serve communities in both the good times and the bad. Resilience makes this possible. An investment in resilience-based planning, projects, and practices is intended to return cost-savings, cost-avoidance, and multiple benefits across city systems.

100RC's approach envisions that cities that build resilience into their projects do five key things:

1. Incorporate systems thinking into their decision-making, taking into account shocks and stresses, and maximizing co-benefits.

2. Engage with diverse stakeholder communities in the planning process.

3. Integrate projects within a broader community vision that includes vulnerable populations.

4. Assess and build projects based on the long-term environmental, social, and economic benefits they will bring, as well as their ability to withstand short-term disruptions.

5. Recognize that their infrastructure and other systems will need to adapt to new and unforeseen challenges in the future.

Resilience initiative design requires bringing together the most relevant stakeholders to frame, align around, and detail the initiative, including its intended impacts and the expected value to be gained. A key challenge of implementing resilience projects is that, by their very nature, they cross silos and sectors. This means that their implementation often requires collaboration and buy-in from multiple agencies, which may have had limited incentive in the past for cooperating or limited experience in leveraging each other's resources and investments.

To help overcome these silos, the Resilience Dividend – the multiple cross-cutting benefits of an initiative – should be clearly articulated as the guiding principle around which project design will be oriented. Enumerating the co-benefits of a resilience project, and explicitly calling out how these benefits are different from business as usual for the city, will make a case for why the resilience project is worth it, even if at first glance it seems more expensive or difficult.

Articulating the Resilience Dividend of a single project can play an important role in gaining support not only from the various implementing bodies associated with that project, but also the wider ecosystem of important stakeholders such as elected officials, community members, the local business community, community-based organizations, and potential investors.

This application of the Resilience Dividend should be combined with global best practices for project management: outline the roles of implementing actors early on; develop a roadmap of the overall timeframe for implementation and progress tracking, including the crucial milestones and decision points and their impacts; identify links to existing planning or implementation timelines of donors, partners, or the city; and unpack any sequencing implications or interdependencies within initiatives.

Even in the early stages of design, it is critical to think about long-term funding, stakeholder engagement, and implementation strategies, in order to ensure the original resilience-building aspirations are not engineered out of the project's design.

This is a key tripping point for many cities as they move from solution generation and visioning to design and implementation – when difficult decision points arise throughout implementation, cities naturally revert to their business-as-usual processes for a given project, and much of the intended resilience-building innovation of the project can be lost.

100RC's experience has shown that cities have been able to avoid this by using an outcomes- or results-based approach to project design, where the longer-term Resilience Strategy goals are linked to the activities, outputs, and outcomes of a project. The intended change sought by an initiative should be clearly articulated, to ensure that the investment of time, resources, and expertise will affect measurable results in line with the Strategy's goals.

"The years ahead will prove to be a tipping point for our resilience actions as we confront the challenges of climate change and rising inequality. OneNYC laid out the pathway to building a more resilient New York City and we look forward to continuing to work with our communities as we build a strong and just city."

–Daniel A. Zarrilli, Chief Climate Policy Advisor and OneNYC Director, City of New York, U.S.A.

The application of a "resilience lens" to project design has also proven useful within the 100RC Network in helping cities stay on track as they make decisions and trade-offs about initiative design, evaluate and prioritize options for implementation, and ensure maximum resilience outcomes. Essentially a set of diagnostic questions, the concept of a "resilience lens" can be applied at different stages of decision-making, and there may be value in revisiting it frequently.

Key diagnostic questions for applying a resilience lens to project design include:

- Does this initiative or aspect of its implementation incorporate or embody at least some of the seven qualities of resilience?

- Does this initiative or aspect of its implementation approach risks and vulnerabilities in an integrated (cross-sector) and comprehensive way?

- Does this initiative or aspect of its implementation consider impacts of multiple shocks and stresses identified through a broad risk and hazard assessment?

- Have the short-, medium- and long-term direct and indirect benefits (and negative impacts) expected to result from this initiative or aspect of its implementation been identified?

- Does this initiative or aspect of its implementation aim for broadly equitable outcomes?

- Does this initiative or aspect of its implementation leverage the ability and capacities of a broad group of stakeholders?

- Does this initiative or aspect of its implementation take into consideration cross-jurisdictional implications (i.e. intercity, regional, or national)?

Along with frequently checking to ensure that the resilience value is not being lost as project design progresses, 100RC learned through the experiences of its member cities the importance of identifying in advance any barriers that will likely arise during implementation. As part of the design of resilience-building projects, cities will need to identify and plan for anticipated implementation barriers, e.g. lack of required resources, lack of alignment of community views, etc. Once barriers to the project are identified, project designers should consider questions including:

- Has the city attempted to implement a similar initiative in the past? If so, did the initiative accomplish its goals? Why or why not?

- What efforts currently underway face similar barriers? Is it possible to align efforts?

- Which stakeholders have a vested interest in the outcomes of this initiative, and what level and type of evidence is required to meet their needs?

Finally, 100RC found that the institutional changes, particularly the establishment of a CRO and the undertaking of a Resilience Strategy development process, had a direct and positive impact on cities' capacity to deliver on the promise of their resilience goals and implement projects.

Integrating Resilience into City Policies and Systems

A cornerstone of the impact evaluation of the 100RC program was tracking the institutionalization of resilience across the cities in its Network.

Institutionalization, that is, "the action of establishing something (in this case, resilience) as a convention or norm in an organization or culture (in this case, a city)" is a key path for enabling the silo-busting changes across city government required for effective resilience-building in the short and long term.

100RC monitored two primary forms of institutionalization. One of them was the integration of resilience thinking into specific city plans and policies to change the way cities understand risk, engage their populations, and plan for the future. (The other, the institutionalization of the CRO and Resilience Office, is discussed in the preceding section of this report, "Champions.")

In the six years since 100RC launched, member cities have embedded resilience thinking in a wide variety of ways, from their capital planning processes and budgeting, to their land-use planning and other key operational functions of municipal government. The details of exactly how member cities integrated resilience into their policy landscape vary, but 100RC is able to reflect on the following trends across the global Network:

Budgeting and capital planning: Recognizing that the budgeting and planning process is a key lever of influence toward long-term change and perpetual decision making, many cities are finding ways to integrate resilience into the budgeting and capital planning processes, for example, by mandating that decisions align with Resilience Strategy goals and/or are made with consideration of the qualities of resilience.

Cities may encourage their departments to consider the following questions when submitting budget requests: How does this offer create long-term benefits (25+ years) in addition to achieving the annual performance targets listed? How does this offer pursue outcomes in multiple result areas? How does this offer leverage other departmental offers or existing programs and projects to create collaborative opportunities and cross-departmental efficiencies? How does this offer advance or contribute to the achievement of a goal in the Resilience Strategy?

Project design: Cities are changing the design processes that dictate how programs or initiatives are developed or approved. This is done primarily in two ways: by embedding resilience principles, community risk assessments, and systems thinking into the formal processes and practices associated either with how municipalities design, and/or with how they make decisions about projects that may influence a city's overall resilience.

Land-use planning: Based on their resilience profiles (the shocks and stresses they face, their areas of strength and vulnerability, an understanding of interdependencies, etc.) cites are changing the zoning and regulations that govern the built environment – determining what can be built where and with what requirements, and retrofitting or upgrading existing assets as required.

Incentivizing resilience: Cities are creating incentives or benefits – such as accelerated permitting, matching funds, and tax credits – for private resilience efforts. They are also, crucially, introducing regulations requiring private and public sector compliance. These "carrot and stick" approaches are often created in explicit support of a Resilience Strategy goal or the implementation of an initiative.

Political integration: Cities are influencing and aligning with the priorities of other government bodies whose formal or informal authority will have an impact on the city's resilience agenda. This can include integrating resilience as a pillar into a neighborhood, state, or national planning process, bringing together various political entities to align and affect policy change, influencing aspects of city operations such as inter-agency communication standards or employee performance review processes, or aligning the Resilience Office with mayoral or city leadership priorities and goals.

> **"Looking towards the coming years, we are growing in numbers and focusing on implementation: tangible actions that address our city's most denied resilience challenge, rising temperatures and heat waves. At the same time, we are continuously trying to co-create the framework and root resilience in the city's long-term planning and vision. What is most exciting to me is introducing, designing, and 'embedding' nature-based solutions in the consciousness and the practices of municipal administration and community groups around the city."**
>
> – Eleni Myrivili, Chief Resilience Officer and Vice-Mayor for Urban Nature, Urban Resilience and Climate Change Adaptation, Athens, Greece

Measuring and Evaluating Resilience-Building

Across the 100RC Network, cities have made encouraging progress in a complex and challenging area of implementation: how to monitor progress, measure impact, and report against successes and challenges. Measuring urban resilience is a young and emerging field, and cities have not shied away from the challenge of how to report in a meaningful way on progress toward the ambitious change agenda set out in a Resilience Strategy and the operations and policies needed to create an enabling environment for overall resilience-building.

The purpose of monitoring is to systematically track implementation of resilience-building activities in order to promote learning and course correction as needed. It helps answer the question: *Are we doing what we set out to do?* Evaluation supports this effort but takes it a step further to objectively assess project impact and effectiveness over time. By focusing on project outcomes, evaluation allows a city to answer the question: *Are we having the impact we set out to have?*

Monitoring and evaluation (M&E) is therefore important for assessing the diverse range of initiatives and goals that are driving resilience in a given city, and building a global evidence base of urban resilience. The information generated by M&E can help to build momentum, attract investment and stakeholder buy-in, and ensure maximum impact.

100RC has encouraged CROs and Resilience Offices to look for opportunities to design projects with both **targets** – the specific, anticipated results of the initiative and goals within a particular timeframe – and **metrics** – measurable units

that illustrate outputs, outcomes, and impact of the initiative. Many cities have created comprehensive reporting and monitoring systems, and have built on 100RC's evaluation framework to create their own evaluation methodologies at both the project and Strategy level.

Over 20 cities across the 100RC Network have used the City Resilience Index (CRI) to establish a quantitative and qualitative baseline for resilience at the city scale, with some linking their project-based M&E to the CRI indicators and metrics. Other cities have looked to adapt their existing citywide data collection processes to create proxy measures for resilience improvements.

The City Resilience Index (CRI) is a comprehensive tool that helps cities understand and measure resilience in a systematic, globally applicable way. Designed as a self-assessment, the CRI online tool generates a resilience profile that reveals a city's specific strengths and weaknesses, creating a baseline to plan from and measure future progress against.

The CRI then helps cities observe their resilience over time through localized indicators, showing key actors what is working and what is not. It also helps cities improve transparency by providing more and better information to city managers and the public.

100RC's collaborations with cities and partners identified the following questions to consider when integrating measurement into resilience plans and projects, and their importance to the process:

GUIDING QUESTION	IMPORTANCE
PRIMARY MOTIVATION: What is the most important reason for developing a plan for tracking progress and success?	It is important to align on the primary purpose of your measurement before you get into the details of the plan. For example: demonstration for future replication, learning opportunity, mayoral priority, funding opportunity, etc. This will set the parameters and direction of your measurement work.
KEY CONSTITUENTS: Who cares most about this issue, goal, or project? What will success look like for them?	It is necessary to identify early on whose buy-in is critical for success. This could be political or financial leaders who you hope will sponsor the project or goal; it could be the intended beneficiaries of the work; or perhaps the internal project team. This will inform the metrics you choose to track for your communication and reporting.
LEVEL & TYPE OF EVIDENCE: What level of evidence will be needed to convince or demonstrate to key stakeholders (such as those identified above) that you have made progress on this issue? What type of data is most critical to these stakeholders?	Sometimes funders or political actors need rigorous evidence produced by research institutions – while at other times, what is needed is a good human story. Relatedly, you may find that a key constituent requires the use of very particular data. It will be important to identify this early on and design the project and M&E plan accordingly.
TIMELINE: Is there a political, financial, or other timeline to keep in mind when considering when you hope to demonstrate success? How often will you need to measure progress? Is there mandatory reporting to keep in mind?	You want to ensure that any key metrics you will track are aligned with the expectations from key stakeholders and the broader context. E.g. if the mayor has re-elections in two years, you may want to ensure you have a mix of short and medium-term metrics that can signal early success to correspond with the political timeline.
DATA PARTNERS: What partners should you bring into early conversations to support with decisions around existing/new data or data systems? Who will measure your key metrics, and can you use this as an opportunity to work across silos? When is the best time to involve this person or agency? Who will be responsible for identifying challenges and course-correcting?	Some cities have found it helpful to ensure academic or research institutions or staff from their data agencies are involved in the early stages of project design. This ties into the question above around the level of data rigor needed to convince key stakeholders. When a high level of rigor is needed, there is often more urgency to involve partners.
DATA SOURCE: Where will the data come from? Are there existing data that will speak to this work, or will you need to collect new data? Do you have baseline data on where the city is currently, to inform change over time?	For both data source and system, it's critical to leverage (and not duplicate, unless needed) the existing data infrastructures of your city or program. Be sure to consider existing (and often mandatory) reporting processes that you may need to feed into. This is an opportunity to work across silos, and/or create new cross-department teams to meet your M&E needs.
DATA SYSTEM: Is there an existing data tracking or collecting system that you can leverage for this work, or will you need to develop a new system?	
MULTIPLE BENEFITS: Can you begin to articulate the multiple benefits you want to achieve from this work?	It is often useful to provide as much detail as possible on the multiple benefits you hope to achieve – such as details on who you hope will benefit from the work, by when, etc. Consider SMART criteria (specific, measurable, attainable, relevant, and time-bound). That way, once implementation begins, you have a shared vision of "success" that can guide the cross-agency work, especially as projects or goals are often being led by agencies outside the Resilience Office. These specifics also help to position the work and people involved to ensure resilience is maintained throughout implementation vs. resorting to business-as-usual.
KEY METRICS: What are the qualities of success that you can build into the work early on? For example, can you specify resilience for whom and by when?	
COMMUNICATING SUCCESS: What partners are needed to report and communicate on your success?	Identifying this early on will help to ensure alignment between project or goal data and the intended audience of your communications and reporting plans.
REPORTING SYSTEM & TIMELINE: How will you report progress and success back to your key stakeholders? Are there existing reporting systems to leverage? How often do you need to report back on progress and success? Does this align with your proposed timeline for data collection?	This ensures that you take into consideration any existing or mandatory reporting systems as you build your measurement plan. For example, many funders require a particular type and frequency of reports. It also ensures an alignment between your data collection and your communications plans.

Ramallah, Palestine

Cape Town
Water Resilience and Avoiding Day Zero

The prospect of an imminent "Day Zero" in Cape Town made international headlines throughout 2017 and 2018. Yet the shock to Cape Town's water system can be traced back to a complex confluence of events, as early as 2015, which began the driest three-year period since the 1930s in the region's dam catchment area, the Western Cape Water Supply System (WCWSS). Because the event was particularly rare in terms of severity – the best estimate of the return interval of a similar drought is over 300 years – it truly tested the adaptive capabilities of the city and surrounding region.

Near exclusive reliance on surface water from rainfall makes Cape Town and its surrounds very vulnerable to drought shocks of this severity. The city's predominant lever of response was to increase water restrictions, which were first instituted at the beginning of 2016 and which grew ever stricter over the next two years, until Capetonians were allotted just 50 liters per person per day.

While city government grappled with uncertainty in the system, implementing small-scale augmentation projects to bring in a limited amount of new water, Capetonians, in households and businesses, took remarkable action to contribute to the drought response. Lawns and water-sensitive plants were replaced with alternatives requiring less water. Bathing time was slashed, and the resulting grey water collected for use in toilet flushing. Residents invested in water-saving devices such as low-flow taps, water-efficient shower heads, and smaller toilet cisterns. Capetonians who had the means to do so installed rainwater harvesting tanks, and drilled boreholes and well points. A few corporate entities even went entirely off-grid, turning to groundwater or desalination. New businesses emerged that offered water-saving solutions, demonstrating a noteworthy entrepreneurial spirit. This impressive collective response would eventually drive down water consumption by over 50% compared to predrought levels – effectively reducing the demand for water, alleviating pressure on low dam levels, and providing an overwhelming contribution to avoiding the projected Day Zero of 2018.

Still Day Zero – a scenario in which city government would turn off certain parts of the reticulation system, literally turning off the taps – loomed closer. This necessitated business continuity planning by all spheres of government, businesses, and communities for what would need to happen should the reticulation system be turned off. The city and provincial governments worked tirelessly with businesses to share information, hear concerns, and tweak plans. Business groups developed their own task teams. Neighborhood watches and other community organizations developed responses unique to their own communities. Cape Town was becoming a shock-ready city.

Far from seamless, the process relied on Capetonians across the private sector, communities, and government to operate under some degree of uncertainty. Steps that contributed to the city's growing resilience in the face of the crisis included the public sector becoming better at partnering, and the City Council establishing a "Section 80 Water Resilience Advisory Committee" comprising external experts from all spheres of government, academia, the agriculture sector, non-governmental organizations, and business, which began meeting in late 2017 to support the city's drought response and investment choices.

Additionally, smart process controllers were installed to allow the city to manage water pressure on a zone-by-zone basis, greatly decreasing water consumption. Further success came from the city's public-facing Day Zero Campaign, which heightened in intensity in January of 2018 to provide weekly information updates. These updates allowed Capetonians to understand dam behavior and the relationships between consumption against various rainfall scenarios, and were coupled with a Water Outlook publication to help inform businesses as they made investment decisions of their own. Thanks to all of these efforts, Capetonians were becoming more empowered.

In February of 2018, with the crisis still not averted and adaptive capacities stretched thin, the city undertook a partnership with other large users in the water system, which facilitated a considerable water transfer from a private agricultural association – a timely alliance that revealed the value of collaboration between different stakeholders. This, along with the regular attainment of daily water consumption of close to 500 megaliters, as well as a few early rains, resulted in the prospect of Day Zero being called off for 2018. Soon thereafter, it was removed as a possibility for 2019 as well.

Although the immediate crisis was contained, the entire experience served as a strong wake-up call to the extremity of the drought events that are expected to become more frequent in the southwestern Cape in the years ahead, particularly in light of climate change. Cape Town is still recovering from this drought: ramifications from the drought extended deep into the regional economy, negative international press hurt the city's investment profile, and the number of tourist arrivals fell. The city government's investment grade was demoted by a major international credit rating agency, due to driving down economic consumption and an expected revenue gap for the water utility. But positively, behaviors have also changed permanently: during the whole of 2018, and in the early months of 2019, residents' water-saving and efficiency behaviors endured, even as restrictions were gradually lessened. Water consumption is unlikely to ever return to pre-drought levels.

Using the lessons learned from the drought shock, city authorities are now working hard to ensure that Cape Town is water resilient by 2030. Many of their insights are included in the new Cape Town Water Strategy, which will be approved for implementation in 2019. It will take some time for all spheres of government to win back public trust, making this a key principle of the new Water

Strategy. The Cape Town economy is bouncing back, and there is considerable effort going into marketing the city-region as a destination with strong resilience capabilities.

Overall, the drought experience has highlighted Cape Town as a leading example of a global city being forced to change its relationship with water.

Since joining the 100RC Network in 2016, the City of Cape Town has operated under the clear mandate of prioritizing the long-term resilience not only of its water system but of its entire urban ecosystem. The city's first-ever Resilience Strategy, to be released in the second half of 2019, recognizes water management as a top concern, with water management considered in the wider context of a rapidly growing population, increasingly characterized by informality and grappling with a history of division and inequality. For example, access to sufficient, clean water intersects significantly with chronic stresses such as high unemployment, poverty, food insecurity, and lack of affordable housing.

In Cape Town, as in other cities worldwide, there is an ever greater need to promote long-term planning and investment in water resilience, including the implementation of measures for managing water resources in sustainable ways, increasing the efficiency of water use, and reducing demand for water.

Resilience challenges, while daunting, are also opportunities for transformative growth. The resilience program is by nature a collaborative process, and the city's team has done an outstanding job of engaging over 150 thematic specialists and more than 11,000 residents in developing a holistic vision for the future. Considering that this

work was undertaken in the midst of a citywide water crisis, Cape Town's achievements stand as further evidence of the positive impact that partnering with residents and stakeholders at all levels can have on a city's governance and operations. In today's ever-changing world, the only certainty is that the future is uncertain, with immense impacts on our water systems, our economies, our societies – for Cape Town, this has meant taking crucial steps toward building a more adaptive, inclusive, and ultimately resilient city.

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El Paso
Embedding Resilience in Municipal Operations

ACTIONS

CHAMPIONS   FUNDING

In 2014, just months before hiring a CRO, El Paso had hired a new City Manager who came to the job with the goal of improving city processes and prioritizing tangible, measurable outcomes in municipal operations. El Paso's Resilience Strategy was therefore developed concurrently with making substantial changes to the strategic planning process the city uses to guide its overall operations. These parallel changes have helped the city make significant strides in integrating and institutionalizing resilience into its daily operations, using the key fulcrums of the municipal budget and Strategic Plan.

The 2014 strategic planning process initiated a new push in El Paso to start measuring results and tying the outcomes of the city's actions back into budgetary decision-making. This set the stage for the 2017 planning process, which had two components that helped integrate resilience into city operations. First, the city's budget was reoriented around its Strategic Plan, meaning that the city will now intentionally align its budget with outcomes it wants to achieve in specific areas. Second, the City Council voted unanimously to formally incorporate the priorities identified over two years of developing the El Paso resilience strategy into

the Strategic Plan, and hence into the way the budget is allocated.

This decision to incorporate resilience principles into such wide-reaching aspects of city operations did not happen overnight. Rather, it was the result of several years of work by the Resilience Office to introduce the vocabulary, goals, and concepts of resilience to the wider universe of El Paso stakeholders and decision makers. Today, those principles are core to El Paso operations, and are used and owned by people across the municipal organization. By recognizing that making changes to the way a city government does its job can be just as impactful as changing what the government's job is, El Paso was able to make resilience more than merely an add-on to some projects. Resilience is now a formally- and legally-recognized, integral component of the city's day-to-day operations.

Oakland
Civic Design Lab

⌖ ACTIONS

💧 CHAMPIONS   🏠 HOUSING   ⚖️ SOCIAL EQUITY

For the City of Oakland, its Resilience Strategy was a crucial call to action, designed to tackle its most pressing systemic and interdependent economic, social, and infrastructure challenges.

A community-led, 3-year initiative from the city's Resilience Strategy's created a civic innovation lab within Oakland City Hall, the Civic Design Lab (CDL). Launched through a public-private partnership, the CDL convenes cross-sector teams to incubate new approaches to tackling Oakland's resilience challenges.

Principles of the CDL include systems thinking, human-centered design, and the application of a racial equity lens. Combined, these principles enable the CDL to transcend institutional silos in city government, and create more responsive policy and services for those who need it most. In practice, this means putting community and staff first in the policy development process, and making city government more accessible for residents and employees.

The CDL team has approached some of the city's most entrenched problems in new ways, using design strategies to find solutions that will make city government more effective in advancing its

resilience goals. In turn, the City of Oakland is now approaching its work differently and rethinking how it maximizes limited resources to benefit communities more equitably.

For example, when the city identified upgrading its Rent Adjustment Program Database and Online System as a top priority, the CDL team saw this as an opportunity to facilitate a conversation between renters, property owners, and city staff. Extensive user research, engagement, and testing allowed CDL to launch a responsive website and online application in under 5 months. The newly optimized and more accessible Rent Adjustment Program portal serves to protect Oaklanders' access to affordable housing and improves transparency and community trust in government.

Along with redesigning the city's online Rent Adjustment Program portal to make it more user-friendly for both tenants and property owners, the CDL has also already improved the Healthy Housing inspection process and streamlined partnerships between city programs and social entrepreneurs working toward equitable economic growth.

Ramallah
Using the Resilience Strategy for Change Management

⌖ ACTIONS

💧 CHAMPIONS   🤖 DATA AND TECHNOLOGY

Perched some 880 meters above sea level, Ramallah's 80,000 residents cover just 21km square. Today the administrative center for the Palestine National Authority, Ramallah was originally established in the mid-1500s, and in the following centuries the city's prosperity, continuity, and identity have been tested through cycles of occupation and mass immigration. The complex 21st century political situation of the West Bank, which in many respects remains under Israeli control, complicates the city's governance, economy, and management of basic services.

Ramallah aligned its November 2017 Resilience Strategy with other city strategies for mobility, environmental protection, and citizen participation. The city has since been working to deepen its resilience practice and implement the priorities set forth in the Strategy, which is being used to guide not only the city's administration but also the activities of the many stakeholders from the international community working in the city.

All heads of department in Ramallah have ownership of some Strategy actions – moreover, they have been mandated to include resilience in their remits. The city has also adopted the resilience approach for community engagement and outreach

as part of its Strategic Development and Investment Plan (SDIP).

Within this context the city's general manager, serving in the role of CRO, is leading the internal mainstreaming of community engagement approaches along with the Deputy CRO. The nomination of the general manager as CRO aims to ensure a strong combination of policy development, capacity-building, and power of execution. This enables Ramallah to optimize its many international collaborations, especially in situations where innovative problem solving is crucial for dealing with conflict-related emergencies and other crises, such as radical budget deficits, while empowering the community.

Finally, Ramallah has been influencing existing collaborative efforts to ensure that the implementation of specific Resilience Strategy actions follows a target-driven approach. For example, as part of implementing the initiatives in its Resilience Strategy, Ramallah became the first Palestinian city to implement postal codes for all city residents, has put in place a GPS-based navigation system to enhance emergency responsiveness, and has developed an emergency network of partners to help deal with hazards resulting from severe weather conditions.

Rotterdam
Delivering Resilience to Projects: A Resilience Scan Tool for Cities

As a pragmatic and high-capacity city, Rotterdam is well placed to test new ways to operationalize and embed resilience. A key goal of the Rotterdam Resilience Strategy is to anchor resilience thinking in all of its city projects.

Since the Strategy's release, and thanks to the extensive stakeholder engagement conducted as part of its development, the city's Resilience Team began to receive requests from several of the city's municipal departments asking how they could deliver their work in a more "resilient" way. More specifically, project owners reached out to the Resilience Team asking for assistance assessing and improving the resilience value of a range of planned and ongoing projects.

In response to those requests, Rotterdam's Resilience Team partnered with 100RC to design a tool that would support such efforts. The tool needed to be flexible enough to be applied to any project. It also needed to assist the city in articulating each project in terms of its resilience value.

The resulting MS Excel-based **Project Scan tool** produces rapid assessments to help project owners and the Resilience Team understand projects' resilience value along three axes: the alignment of the project to the Resilience Strategy's goals, the project's relationship to the city's shocks and stresses, and which of the seven resilience qualities the project incorporates. Using the results of the Project Scan tool, the Resilience Team and project owners may then redesign the project to deliver more resilience value for the city as well as for the project itself.

The Project Scan tool is both a technical and a participatory tool, helping develop practical ways to enhance the resilience value of a project, while serving as a way to engage stakeholders and strengthen the resilience movement in the city as a whole.

Rotterdam has since applied Project Scan to a variety of projects, from tenders for a district to improvements of specific buildings. A main challenge has been to unpack the seven resilience qualities and their relevance to different type of projects. To address this, Rotterdam is currently finalizing a set of case studies with examples that outline how each quality applies in various sectors.

Since partnering on the early version of Project Scan, Rotterdam has continued to develop it, moving away from an Excel-based format to a workshop format aimed at being more participatory.

100RC has also tested and delivered the tool in Greater Manchester and San Francisco. Greater Manchester's Resilience Team trained to deliver Project Scan independently, so that they too can continue to apply the tool to other projects in their city's region.

Resilience Innovations: 100RC Tools

100 Resilient Cities learned that cities need support in diagnosing their resilience needs, and maximizing, protecting, and maintaining a resilience value in the development and delivery of strategies and projects.

To support cities in this work, 100RC collaborated with cities and Partners to create, develop, and optimize a customizable set of resources - the 100RC Tools.

100RC Tools, apply a specific methodology or process, that is replicable and scalable, to urban resilience-specific concepts or theories to obtain a defined outcome.

Tools can help define or enhance the resilience value or dividend and ensure that it is not lost through project ideation, design, and delivery processes. They can also be used to convene impacted communities, the private sector, and city decision makers.

100 Resilient Cities used 100RC Tools to provide appropriate methodological support at each stage of a member city's Resilience Strategy development and implementation. Though not all of these tools are publicly available, the descriptions of what functions there were designed to serve can inspire cities globally to think creatively about how to develop and deliver resilience-building strategies and projects.

Actions across the 100RC Network - Impact

100RC has provided funding, capacity-building, and technical assistance to help cities change the way they understand their risks and plan for their futures.

The 100RC grant funded the resource of a Strategy Partner to work in each city on the development of their Resilience Strategy – **13 Partners** in total worked in member cities around the world – a cohort of resilience expertise in its own right. To date, **71 cities and two regional or national government bodies have published a holistic and actionable Resilience Strategy** that sets a tactical road map for taking action towards building a city's resilience.

These Strategies contain more than **3,550 specific projects and initiatives targeted at improving resilience** – from discrete social programs to ambitious infrastructure projects, running on timescales from a few months to multiple generations. Together these initiatives build on a city's existing assets and holistically address its key shocks and stresses: together they will build the overall resilience of a city.

Analysis of published Strategies shows encouraging signs of movement building – **Strategies devised in very different contexts around the world nevertheless share many common goals** and seek replicable methods for tackling similar challenges.

While all member cities have created actions targeting good governance, institutionalizing resilience, improving sustainability, and managing key city services, the 100RC Network also clearly shows the influence of regional conditions and unique city characters, with African cities focused on energy and waste management, the Asia-Pacific region honing in on disaster preparedness, Latin America concerned with social cohesion, Europe innovating around urban design, and North America prioritizing socio-economic

"The [Urban Institute] team found no other program that explicitly targets fundamental change in city institutions, such as de-siloing within cities…"

"100RC is among the first global urban initiatives to employ a consistent set of tools, supports, and resources across so many diverse cities – and certainly the first of its size to have the explicit mission of building city-level resilience."

– The Urban Institute Midterm Evaluation Report, December 2018

equity (relative to the prevalence of all these topics globally). The process of developing and implementing a Resilience Strategy will in turn fundamentally change the way a city plans and acts.

100RC's external evaluation by the Urban Institute singles out 100RC as the only program in the urban resilience space to target long-term, systems change in city processes and operations, with an integrative approach and holistic definition of resilience that stands in contrast to other programs, which tend to be more sector-specific and less flexible. In its evaluation, the Urban Institute also found that 100RC is already having a positive impact to this end:

- 100RC's more holistic definition of resilience – delineating the interactions between shocks and stresses – is taking root in city planning

- Cities' plans are engendering more internal consistency as the resilience planning process advances

- Central resilience offices are being established across member cities

- City, state, and national entities are making specific commitments for resilience-building efforts

- Cities are investing in resilience – by changing their budgetary review processes and/or leveraging additional funds for resilience-building efforts

100RC's internal monitoring shows that **83% of cities have embedded resilience** principles into city plans, policies, and practices, such as incorporating a resilience lens in how they allocate budget or design for the future.

Importantly, the Urban Institute's findings indicate that the very real institutional changes taking root in member cities have a direct and positive impact on cities' capacity to deliver on the promise of their resilience strategies and implement initiatives.

"Transformations in cross-sectoral planning and operational de-siloing as well as having a central resilience coordinating entity like the CRO appear to be effective institutionalization schemes for initiative implementation."

"De-siloing efforts are moving forward and often as a direct consequence of the collaboration required to produce the Resilience Strategy. Further, there's early evidence that de-siloing is linked to higher quality and more efficient project implementation."

– The Urban Institute Midterm Evaluation Report, December 2018

Leveraging Funding and Financing for Resilience

Cities will need to be able to source funding and financing for their resilience projects in order to build systemic resilience.

Leaders in cities of all sizes around the globe have committed to and have begun advancing their urban Resilience Strategies and sustainable development goals, in a testament to growing momentum for moving away from conventional ways of governing cities to more systemic, holistic, and inclusive approaches. For cities to deliver on these goals, however, they will need to create and promote the enabling conditions that support the development and implementation of resilience-building projects, and expand and capitalize on investor interest and existing resources in the market to invest in those projects. They also require the right kinds of education, project preparation, and public and private partnerships, set to the scale of the cities and projects in question.

There is no shortage of capital or investor interest seeking well-structured urban resilience projects. According to McKinsey & Company, total global assets under management grew to an all-time high of US$89 trillion in 2017. A report from The Forum for Sustainable and Responsible Investment found that sustainable, responsible, and impact investing assets claimed US$12 trillion in the U.S. alone – almost one-third of the region's total, and up 38% from US$9 trillion in 2016. 100RC has observed similar trends in its work, noticing an increased focus on sustainability and resilience in its conversations both with investors seeking projects and with financial partners seeking to collaborate on the creation of new financial mechanisms.

Despite this strong demand from investors, cities generally do not have the capacity to access the diverse sources of financing that can make long-term investments happen, and there often is a fundamental mismatch between the availability of capital and the supply of investment-ready projects. 100RC's experience has uncovered three main challenges that hamper urban resilience projects from securing needed finance. First, although many cities are beginning to adopt resilience-based project design, as it is a new and less familiar approach, it requires greater political commitment and investment of already strapped city resources. Second, a quantifiable value proposition associated with urban resilience is still in its infancy. Third, in the absence of this

According to McKinsey & Company, total global assets under management grew to an all-time high of US$89 trillion in 2017.

quantification and significant supporting data, investors have not yet understood or valued resilience in the investment decision-making process.

Investing with resilience goals in mind helps cities and communities address their most intractable challenges and build on any opportunities that should arise, enabling them to procure holistic solutions for their particular place and situation. Resilience projects are diverse, and resilience is a novel concept that requires governments as well as investors to change the way they operate, and to foster collaboration between the public and private sector across various efforts, such as data collection, project development, and financing.

In aiming to address these challenges, enhance market progress, and accelerate the delivery of critical urban resilience projects, 100RC's work has uncovered five finance-related lessons:

- ✔ Enhancing City Creditworthiness
- ✔ Building Institutional and Local Capacity
- ✔ Financially Prioritizing Resilience in a City Developing Financial
- ✔ Products that Deliver Resilience Benefits
- ✔ Addressing the Data Gap to Articulate the Value of Resilience
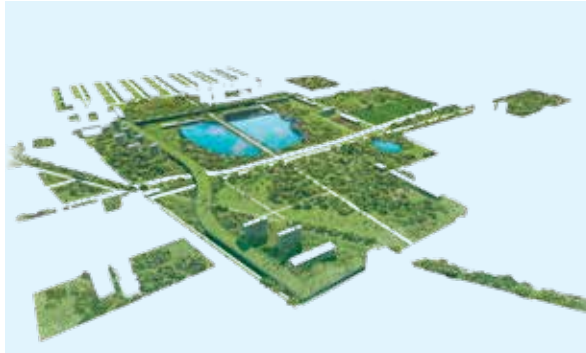
"The goals and concrete objectives of our Resilience Strategy make Santa Fe a serious, transparent municipality with the capacity to mobilize private capital to implement initiatives."

"Because it is in cities and their territories where the world's greatest challenges are concentrated, and where we face increasingly complex dilemmas, we see local governments emerging as leaders in the international arena. We are able to leverage this into local action: our flagship Parque del Norte project is attracting attention from World Bank's Resilient Cities Program and other global entities."

– Andrea Valsagna, Chief Resilience Officer of Santa Fe, Argentina

Enhancing City Creditworthiness

Cities need access to capital in order to deliver resilience-building interventions. But in certain jurisdictions, cities have limited access to capital markets and/or are beholden to national government consent or guarantees, severely constricting their capacity to finance investments.

Recent estimates published by the World Bank show that less than 20% of the largest 500 cities in the developing world are deemed creditworthy. By strengthening underlying financial systems, cities will be able to improve their creditworthiness and enable their financial autonomy, establishing the adequate conditions to unlock the capital necessary to bring resilience-building projects to fruition. Financial autonomy and creditworthiness are leading indications of a city's economic, political, and financial stability, and send a strong signal to the capital markets that a municipality has the resources to honor its financial commitments.

There are various actions that cities can undertake to increase their financial autonomy and enhance their creditworthiness. 100RC's work has focused on four particular actions:

Enhance existing revenue streams, and identify new revenue streams. Maximize existing sources of revenue, and develop new opportunities for independent revenue collection in partnership with the national government, particularly for cities more dependent on the central government.

Create the enabling conditions that support private sector participation. Promote institutional reform that creates the enabling legal, political, and regulatory conditions for public-private partnerships.

Improve visibility into funding packages from the national government. Work together with the national government to establish and implement measures that allow for greater and longer-term visibility into funding packages, to increase certainty and predictability in funding allocations and tenor/time to maturity.

Promote better fiscal management across sectors. Commit to devolved funding and powers to help cities develop integrated strategies for transport, housing, economic development, and other sectors.

Building Institutional and Local Capacity

While some cities have limited access to finance due to their lack of creditworthiness, others struggle to attract private investment due to the limited supply of robust and investment-ready projects. One of the key bottlenecks causing this shortage is the project development gap – in other words, cities do not have the wherewithal or capacity to prepare projects for investment.

The 100RC Resilience Finance team engaged with financial institutions to galvanize interest among investors in mobilizing early-stage capital, leveraging their resources to supplement gaps in local capabilities and expertise, and enhancing their understanding of cities' critical urban challenges to structure and deliver the appropriate financial products.

Based on 100RC's experience working with cities in pivoting from Resilience Strategy development to project implementation, this project development gap is caused and exacerbated by a number of challenges:

• The need to navigate complex regulatory, political, and legal environments

• Lack of local capacity, resources, and expertise to prioritize, plan, and deliver projects

• Limited engagement from private actors due to the perceived risk and resource intensity associated with early-stage projects

To help address the project development gap, governments and development banks are investing in and creating a host of resources, including project preparation facilities. The current landscape is in fact a crowded market. But so far, all of the resources dedicated to delivering and improving the quality of projects have made only a modest impact on addressing the challenges in project development and implementation.

100RC identified four main challenges and limitations that underpin the slow or stalled progress in cities' ability to deliver investment-ready projects:

Resource deployment can be slow due to lengthy, political, and bureaucratic decision-making processes.

Existing resources do not tackle the challenges head on. Existing project preparation resources are largely hosted by development finance institutions. Projects therefore are strongly influenced by institutions' policies and competencies, and may not necessarily align with or cater to the priority needs of cities.

Project development support is widely disjointed. Few resources provide end-to-end support, as what is available typically focuses on certain segments of the project development process. Either holistic support must be provided, or existing resources must be stitched together so that cities can advance projects from concept to financial close in a streamlined and cohesive manner.

Existing resources typically target middle to later stages of project preparation. Although the middle and later stages of project preparation tend to be more resource-intensive and costly, the current landscape is crowded with project preparation facilities that support these activities. As a result, the earlier stages of project preparation, as well as implementation and monitoring, receive the least attention. Many of the initiatives and actions coming out of cities' Resilience Strategies are in the incipient stages of project development, and 100RC has seen that cities often struggle to advance beyond even the idea generation and project definition phases.

100RC's work developed four recommendations to address these challenges and limitations, and effectively bring projects across the finish line:

Cities should engage investors from the beginning to mobilize capital toward project development. Engaging financial institutions from the start, and throughout the project lifecycle, will help cities better understand what investors are looking for in a project. Likewise, engaging investors from the start will mobilize resources and capital toward project preparation, allowing effective conversion of cities' resilience priorities and actions into viable and investment-ready projects. Having a continuum in the investor cycle spurs interest and ensures that the private sector has "skin in the game" – that it is motivated and incentivized to move projects aligned with cities' priorities and interests to financial close. However, responsibility for engaging investors lies not only with cities. Historically, investors have targeted and preferred to engage with projects that are nearer to financial close – they must become prepared to be brought in early in the project cycle.

Cities should establish shared financial and political commitment from city and national actors. Projects may be owned and operated by various entities at the national and subnational levels, therefore requiring support and coordination across different levels of government. Aligning political agendas and investment priorities, and strengthening coordination across the various entities, can benefit projects' co-funding and financing arrangements, increase projects' accountability, and reduce conflicts among different strategies and plans.

Cities should create and nurture an enabling environment that supports project development and implementation. An enabling environment is crucial to carrying out project development adequately, and to eventually scaling up projects. An enabling environment includes:

• Robust legal and policy frameworks and regulatory regimes that support project development and private sector participation

• Key stakeholders – both city agencies and impacted communities – aligned on investment priorities

• Local governments and project developers equipped with the capabilities and capacities to prioritize, plan, and deliver projects

• Good governance practices and established processes that promote coordination across departments, agencies, and ministries at the city and national levels

Cities and partners should create a series of trusted partnerships to advance project development in a more streamlined and cohesive manner. Rarely does a city have the capacity to drive projects forward through the project cycle. Partners must work with cities on their core competencies, and do so in a manner that allows the next partner to keep the project development process moving forward.

"Personally, the opportunity to meet with my fellow mayors during 100RC's City Leaders' Summit in 2017 was an unforgettable experience. Along with the new global friendships I made with other mayors, it was a truly eye-opening experience to discuss mutual concerns and also learn about municipal issues which are different from those in my city, bringing a new perspective to my daily work as a mayor."

– Masashi Mori, Mayor of Toyama, Japan

Financially Prioritizing Resilience in a City

As part of changing the way they plan and act, many of 100RC's member cities have found it necessary to amend their budgeting process to accommodate the multi-departmental, integrated nature of resilience. But changing municipal budgeting practices and reprioritizing spending to address resilience needs has not been an easy task, especially as some cities intentionally limit their investments in critical projects as a strategy to bolster reserves, with the goal of achieving Aaa/AAA credit ratings.

In order to effectively convert resilience priorities into investment-ready projects, cities need to expand beyond the traditional process for municipal budgeting, and beyond business-as-usual funding models – instead adopting decision-making criteria that consider the holistic impact of investments.

100RC has noted three ways that member cities have embedded resilience into their municipal budgeting processes, allowing them to leverage existing resources and tools to support urban resilience-building.

First, member cities have embedded resilience into their municipal budgeting processes **by leveraging existing resources and tools, and promoting cross-departmental collaboration**. Municipal budgets should represent community priorities and values. Given limited resources, city officials must choose to allocate funding across competing priorities at scales that range from day-to-day service provision to multi-decade investments in infrastructure. In traditional budgeting processes, agencies are assigned a funding target from the outset, and decision-making is often siloed, with

limited coordination between and across agencies. This leads to competition between departments to maintain the "status quo" of the operating budget, and limits the reprioritization or submission of capital projects. But the complex nature of interdependent shocks and stresses and their impacts on various city systems means that building resilience necessitates strong collaboration between different city agencies and entities. Traditional government silos must be overcome if cities are to leverage existing resources and tools in a more resourceful, coordinated, and streamlined manner to deliver resilience projects.

Second, member cities have embeddzed resilience into their municipal budgeting processes **by using procurement as a tool.** Existing procurement processes are typically set up for government agencies to buy more of what they already have from vendors and contractors that they have already worked with, making it difficult for a city to depart from a well-trodden path and cater to its evolving priorities.

New Orleans is a shining example of a city that reimagined its procurement process. The city began exploring ways to improve workforce participation and to connect underrepresented and vulnerable communities to economic, social, and cultural opportunities through technology. Through 100RC, New Orleans secured help from the firm Citymart to develop and launch a Digital Equity Challenge in early 2017. The competition was structured in the form of a Request for Information (RFI) soliciting creative ideas to address the digital divide, and New Orleans was lauded for its open and user-friendly challenge process that focused on deeper problems and desired

outcomes. In addition, all challenge participants were asked to complete a Corporate Endeavor Agreement along with their submissions, which will allow non-traditional vendors to be more easily cleared for doing business with the city going forward. The success of this effort has led the city to integrate RFIs as a standard component of its procurement processes, making it possible for New Orleans to draw from a much wider new world of resilience expertise and inform future innovation challenges.

And third, member cities have embedded resilience into their municipal budgeting processes **by integrating resilience outcomes into the municipal budgeting process**. Budget decisionmakers are not subject matter experts on the specific operating programs and capital projects being evaluated. As a result, cities tend to default to incremental budgeting and adopt blanket approaches using historical and often outdated information to determine funding levels, rather than clearly identifying and budgeting around the priority outcomes that the city wants to achieve. Budgets should be allocated to outcomes, in order to guarantee greater focus on performance and results, rather than inputs and processes. 100RC has helped its member cities develop foundational knowledge in funding and financing, and has captured and disseminated best practices and lessons learned through in-person training and a shared online platform, to encourage cities to adopt more innovative approaches to municipal budgeting, and to give them the tools to help them make better decisions more effectively. The online platform allowed member cities and partners, including investors and insurance companies, to share best practices and expertise through curated topics around funding and financing, ranging from para-

metric risk solutions to impact bonds from industry experts. Participants focused on exchanging ideas and approaches to embedding resilience outcomes in the municipal budgeting process, and on exploring the challenges associated with developing and executing on funding and financing strategies for resilience projects.

"By utilizing our Resilience Strategy and convening working groups, we are identifying the costs associated with the transformational projects that will lead the city to thrive by 2030. By creating an Investment Prospectus to raise the capital needed to ameliorate the chronic stresses that currently impact resident well-being, we see a real ability to move the needle toward these long-term goals, while improving the lives of Pittsburghers day-in and day-out... Fundamentally, our ability to achieve this vision of resilience is about our ability to make these necessary investments."

– William Peduto, Mayor of Pittsburgh, U.S.A.

Developing Financial Products that Deliver Resilience Benefits

Developing a project using a resilience-based approach is often viewed as a novel and expensive proposition, and investors have yet to understand its value. Financial institutions need a better understanding of global urban challenges and the large unmet needs of cities – both at the macro level and at the community level – to design the appropriate financing structures and vehicles that can support cities with their resilience projects as well as demonstrate the resilience dividend.

One of the primary objectives of the global Resilience Finance team launched by 100RC is to educate financial institutions on the merits of resilience, and to support their ability to adapt their products and their decision-making to better address cities' critical resilience challenges as well as create the solutions and mechanisms that support the mobilization of capital toward urban resilience at scale.

Therefore the 100RC team aimed to develop scalable financial mechanisms that demonstrate the value of resilience and help investors better understand it. This requires new ideas, and a new approach to investment and partnership. 100RC's team partnered with The Rockefeller Foundation's Innovative Finance team to guide the structuring of innovative financial products in a way that helps cities overcome their resilience challenges and achieve additional impact and capital efficiency compared to existing market initiatives. 100RC, RF, and a global asset manager have also collaborating to establish a new and scalable financing approach toward addressing the world's critical infrastructure funding gap that utilizes a "resilience screen" and demonstrates the value of the resilience dividend.

Together, they aim to support the investability of resilience infrastructure projects by addressing two market gaps: **the lack of early-stage development, financial, and human capital** and **the lack of appropriate financing structures**.

This collaboration is turning the tide by establishing a new norm in urban infrastructure investment, with resilience at its core.

Additionally, innovations in the insurance industry can help cities tackle and address their sustainability and resilience challenges. With its financial partners, including Swiss Re, the Resilience Finance team was beginning to explore new insurance solutions that can help cities understand, prevent, and reduce risk. Partnerships between governments and insurance companies can create and encourage a proactive rather than reactive approach. These new mechanisms can help governments avoid damages and reduce losses to a significant degree, as rebuilding after the fact tends to be much more costly than effectively preparing cities for natural disasters.

Addressing the Data Gap to Articulate the Value of Resilience

Investors are attracted to projects that generate clear and stable cashflows – to take two examples from the infrastructure sector, a highway bridge with toll revenues or a water system that charges user fees. Projects designed with a resilience lens not only deliver these clear revenue streams, but also are able to deliver multiple benefits that support a community's resilience goals, such as better health outcomes, reduced greenhouse emissions, increased economic activity, and improved energy efficiency. 100RC believes that these intrinsic values will ultimately consolidate in improved reliability and performance, resulting in a more valuable asset or higher issuer credit rating. At the moment, these values are purely intrinsic to a project, and exogenous to its valuation. However, as more and more cities transition toward using resilience methodologies in project development, it is critical that practitioners begin to quantify these intrinsic values to enhance investor understanding and participation. As the adage goes, "If you can measure it, you can finance it."

There are a number of frameworks, rating systems, and standards that seek to quantify the resilience dividend for the benefit of investors. However, the lack of data and limited project comparables remain challenges. 100RC believes that overcoming this data gap and developing a process that quantitatively demonstrates the marginal impact of adopting a resilience approach versus a business-as-usual approach – such as a higher exit value – will change the way that both cities and investors perceive resilience and in turn accelerate action.

As more and more cities transition toward using resilience methodologies in project development, it is critical that practitioners begin to quantify these intrinsic values to enhance investor understanding and participation.

To support and evaluate innovative urban infrastructure projects, the 100RC Resilience Finance team, in partnership with a consortium of consultants, worked to develop a Resilience Screen capable of identifying and calculating the resilience value of infrastructure projects. The Screen is designed to guide the development of infrastructure projects and evaluate their resilience-generating attributes. The Screen derives from 100RC's Resilience Principles for urban infrastructure, which define a resilience-building infrastructure project as one that is:

- Conceived and developed through a resilience-based process

- Able to withstand and recover quickly from dynamic shocks and stresses, exhibiting reliable performance and intended outcomes in both routine and extraordinary situations

- Able to maintain resilience over the lifespan of the project – for instance, a power grid's ability to perform in the face of 60mph winds, plus its ability to operate in the face of municipal budget crises

- Provides additional "dividends" to cities and their basic functions, such as creating positive social, economic, and environmental co-benefits

- Minimizes short- and long-term negative impacts by recognizing the systemic interdependencies that exist in cities – for instance, a transit line extension that links a historically disconnected community with jobs and a commercial corridor, as well as offering back-up transportation options should a system fail

Through the development of the Resilience Screen, 100RC sought to contribute to the design and delivery of resilience-building infrastructure projects consistent with the seven qualities of resilience, to establish a market standard for resilience infrastructure and demonstrate the value of the resilience dividend, and to mobilize private sector funding to support cities' efforts in achieving resilience.

The Screen is being reviewed by various industry leaders for their input on its potential to achieve the aforementioned goals and applicability across various industry and project sectors, and to encourage market uptake, and ensure that resilience is integrated across their business practices.

In 2018, 100RC leveraged the Resilience Screen to launch the Resilient Community Development Finance (ResCDF) Campaign, with the aim of connecting mission-related investors such as CDFIs, impact investors, and others with member cities that need help financing the projects emerging from their Resilience Strategies.

The concept of resilience goes hand-in-hand with the ethos of the community development sector, as it concerns engaging communities of all sizes to understand their underlying systems and interdependencies, and the risks they may face as they look to the future. 100RC believes there is a great opportunity to be had in "resiliencize-ing" community development and aligning common goals. The domestic community development and private-sector investors will be able to use the Resilience Screen, together with 100RC's "community impact" resilience principles, to identify and evaluate the resilience value of community- and city-led projects. The Screen will also help identify ways to improve the resilience dividend of potential investments, leading further education and systems change, and hopefully establishing an industry standard for resilience projects.

Resulting projects could include combining a seismic upgrade to community facilities with social infrastructure, such as youth and elder functions or multi-purpose gardens, or combining a communications backup installation with the provision of free wireless hubs. The buildings are thus made more resilient, and the surrounding community and systems are also made more resilient, equitable, and safe.

Atlanta
Proctor Creek Greenway
Environmental Impact Bond

($) FUNDING

ACTIONS   SOCIAL EQUITY   TRANSPORT AND MOBILITY

As one of the most populous metropolitan areas in the United States, Atlanta is a major hub for transportation and industry. Home to the headquarters of such corporations as Coca-Cola, Delta Airlines, and UPS, it also has a prominent entertainment scene, producing popular hip-hop music, film, and television. A cradle of the American civil rights movement, with an historically enfranchised African-American population who today make up over 50% of the city's population, Atlanta is nevertheless geographically segregated along racial lines, and has the highest income inequality of any city in the United States. These two stresses overlap, as poverty in Atlanta is suffered most severely by the city's residents of color. These communities are also more likely to face environmental justice issues in their neighborhoods. Despite an abundance of trees that has earned it the nickname "city in a forest," in 2017 only 41% of Atlanta's residents could safely walk to a green space, such as a park, with low-income and/or minority communities having lower rates of access than the city overall.

Wholly contained within the city's borders, Proctor Creek, a tributary of the Chattahoochee River, originates in downtown Atlanta and is piped through tunnels until emerging in the economically depressed Westside neighborhoods five miles from the city center, where more than 90% of the 50,000 residents are minorities. For decades, the 16 square miles of the Proctor Creek watershed have been plagued by environmental degradation including erosion, street run-off, pollution from illegal dumping, and stormwater floods contaminated with sewer overflows.

A priority initiative of Atlanta's Resilience Strategy was therefore to construct the first segment of a new Proctor Creek Greenway trail, as part of the Strategy's wider goal of creating 500 new acres of publicly-accessible green space across the city by 2022. The trail was funded through a US$160,000 investment from the Department of Water Management (DWN) and a US$3.6 million investment from a transportation-oriented special-purpose sales tax (TSPLOST) endorsed by voters in 2016.

On May 7, 2018, the first three-mile segment of the Greenway officially opened to the public. Boasting biking and pedestrian trails, the Greenway offers multiple co-benefits from a single intervention, as it will facilitate exercise and healthy living, enhance Atlanta's natural assets, and foster economic development in an area of the city that faces considerable environmental and economic challenges.

When complete, the Greenway will be seven miles long, with 50 acres of linear park and 400 acres of green space, connecting multiple isolated neighborhoods in West and Northwest Atlanta to transit, schools, and restaurants. Eventually, when Cobb County and Fulton County build their respective riverwalks to traverse the Chattahoochee, the Proctor Creek Greenway will link downtown Atlanta to the Silver Comet Trail that runs all the way out to Alabama.

Building on this initial success the DWM, by way of 100RC, participated in a nationwide competitive process for a Rockefeller Foundation grant, and was selected to develop green infrastructure (GI) for resilience projects using innovative Environmental Impact Bond (EIB) financing.

The Rockefeller grant funded the services of impact investment firm Quantified Ventures to help Atlanta coordinate and structure the deal, as well as municipal finance specialists Neighborly Corporation, to underwrite and market the bonds. This financing opportunity provided DWM with access to a new source of private investment capital, by tapping into a unique sector of community-oriented investors focused on environmental and social impact.

In February of 2019, the DWM issued the nation's first publicly-offered EIB for US$13.5 million, to help finance six green infrastructure projects in underserved neighborhoods within the Proctor Creek watershed. Atlanta is now using that EIB funding to invest in neighborhoods of the city's Westside that have been disproportionately impacted by flooding, combined sewer overflows, environmental degradation, and unemployment. DWM's EIB-funded green infrastructure projects aim to install ten blocks of street-side vegetated stormwater planters, restore an eroded section of the creek to reduce stagnant water where mosquitoes gather, designate bioretention areas in area parks, restore native habitats, establishing new wetland areas, and create new green spaces for community use.

While the different projects will generate different types of environmental, social, economic, and health benefits, all the projects have been cumulatively designed to provide 6.4 million gallons of stormwater capture capacity, reducing run-off by 56 million gallons annually. This directly mitigates flooding and improves water quality by reducing the impacts of run-off on combined sewer systems and waterways.

Additionally, the DWM will ensure that the EIB funding stimulates equitable economic development that directly benefits the local community, by supporting workforce development initiatives in Proctor Creek watershed that will hire local community members to carry out the work.

The issuance of Environmental Impact Bonds allowed Atlanta to undertake infrastructure projects that previously had been sidelined, due to other priorities and due to uncertainty over performance, despite their high potential for both environmental and community impact. By reframing the financing around outcomes, the EIBs enabled the city to access new funds and showcase its appetite for innovation. The process of structuring the bond and the evaluation of ultimate outcomes have helped to optimize and secure funding for future project planning, as well as enabling Atlanta's DWM to better understand how green infrastructure projects impact the hydrology and social equity of environmentally and economically distressed neighborhoods.

Cape Town
Budgeting for Resilience

$ FUNDING

◎« ACTIONS

Cape Town, located at the southern tip of Africa and home to two UNESCO world heritage sites, is world-renowned for its stunning beauty and biodiversity, and one of the most popular tourist destinations in the world. Yet Cape Town is a city with complex underlying challenges that play out in the form of continuous stresses in society such as high levels of inequality, unemployment, substance abuse, and crime. From 2015 to 2018, Cape Town experienced the worst drought in its recorded history and narrowly avoided having to turn off parts of its reticulation system, a scenario that came to be known as Day Zero.

The drought shone a light on how vulnerable Cape Town can be during shock events in regard to funding emergency and tactical responses quickly. However, the drought also offered an excellent starting point for city officials to consider what it means to manage a system under stress with an uncertain picture of the future (in this case, the amount of rainfall). Thus, the city embarked on an ambitious program to break down its siloes and mainstream resilience thinking into budgetary decisions and planning.

Around the world, municipal processes – budgeting processes in particular – are traditionally siloed,

with limited coordination between and across various governmental departments and agencies. To build their overall resilience, cities will need to break down these silos and adopt more integrated and collaborative approaches.

To that end, Cape Town has developed a comprehensive Corporate Project Portfolio Management system, which enables the alignment of projects (mostly capital projects) with organizational strategy. This alignment allows the city to allocate its limited resources to its various priority projects more effectively. It also provides the city's senior management with a more holistic picture of the composition of projects in Cape Town's entire portfolio, uncovering any conflicting priorities, and improving the city's ability to map progress against new and existing plans.

Cape Town's Resilience Strategy presents an opportunity to consider resilience-building benefits across a whole portfolio of projects rather than for individual projects. This means for example that the city can de-silo its resilience efforts, building a pipeline of projects across sectors intended to address particular shocks and stresses, or combinations thereof. A multi-year pipeline of projects streamlines the city government's response,

allowing for decision-makers to make quicker choices within the context of constrained municipal budgets and to pursue new strategic directions as new information or risks emerge.

Investment in infrastructure is a core part of the city's business. In the past, infrastructure programs have focused on largely traditional plans of isolated utility maintenance, upgrades, and expansion. Coordination requires understanding the future urban requirements of the city, especially adaptations that will be needed to manage the impacts of major shocks such as floods and fires, and stresses such as rapid urbanization.

Through an initiative in the Cape Town Resilience Strategy, the City will utilize a resilience lens to inform program and design principles for long-term infrastructure plans: conducting analysis across portfolios of projects to search for commonalities, gaps, and potential dividends in infrastructure plans that seek to address prioritized shocks and stresses; ensure that each budget submission to the Council is based on a 15-year detailed projection of infrastructure needs focused on each sector, managed by a central strategy analysis team and with vetting by related infrastructure sectors.

Another initiative in Cape Town's ambitious strategy will incorporate resilience planning in the conceptualization stage of every project in order to maximize the resilience dividend. To achieve this goal, Cape Town will conduct a careful mapping of the benefits that need to be realized during the course of a project and after its completion. The city will seek to maximize the resilience value of projects by searching for project co-dependencies, mechanisms for community collaboration, and inter-departmental or inter-organizational project

collaboration. In assessing the resilience benefits of a project, the city will identify key knowledge outcomes of what worked and what didn't work, and feed these back iteratively into successive benefit network concepts.

European Union
Piloting and scaling resilience finance across the EU

$ FUNDING

◎ ACTIONS

The cities of the European Union (EU) are highly diverse, exemplifying the combination of challenges that must be met and transformations that must be achieved in order to build urban resilience in the 21st century.

The EU itself is a global leader on urban development, climate change, and social equity policies, and it has long been setting mutually agreed national targets for change in these areas and making funding and financing tools for the development and implementation of urban programs available. Its Urban Agenda – an ambitious policy aiming to strengthen the democratic role and delivery capacity of EU cities – was formally adopted in 2016.

The Resilience Strategy development process has been identified by EU cities and EU partners as a key mechanism for conceptualizing the programs and projects needed to deliver on EU targets, and for appropriately leveraging available funding instruments for implementation. EU member cities that belong to the 100RC network have led the way across the region, efficiently deploying available funds to maximize co-benefits and resilience-building, leading in certain cases to EU-wide pilots and best practices.

100RC also formed a partnership with the European Investment Bank (EIB), the largest multilateral lender, to help the EIB innovate around city needs and allow many 10)RC member cities to take advantage of the resources disbursed through the bank's project preparation facilities, to bolster and advance their resilience projects. Selected examples include:

The Natural Capital Financing Facility (NCFF), a financial instrument developed by a partnership between European Investment Bank (EIB) and the European Commission, backed by an EU guarantee, to support biodiversity and climate adaptation through tailored loans, technical assistance, and investments.

100RC member city Athens was the first city in southern Europe to benefit from the NCFF, and is the first NCFF-backed effort to deploy nature-based infrastructure. The €5 million loan is an extension of the EIB's original €50 million loan to the city, to drive the implementation of the Athens Resilience Strategy for 2030 and build its capacity to face major risks. The NCFF money will fund green and blue-green infrastructure projects around the city, including on Lycabettus Hill, a flagship resilience project.

The NCFF loan is supported by a €500,000 technical assistance package from EIB, with which Athens will to develop resilience principles for each funded project that will allow those projects to be replicated in cities across Europe. Particular attention is being given to the development of climate change adaptation design principles, linking the NCFF perspective to the other projects funded by the broader EIB loan that impact the built environment.

The entire process has functioned as a pilot for the EIB on the potential for funding Resilience Strategy implementation and scalability, and for the NCFF to fund nature-based infrastructure.

The Urban Innovative Actions (UIA) is an EU instrument that aims to encourage innovation and the scaling of solutions among EU cities, in order to develop novel approaches and solve problems.

Paris's Oasis Schools program was successfully piloted with city funds in three schools. To scale that effort to every school in the city, the Paris Resilience Office, with the support of 100RC, requested funding from the UIA. Nearly 5 million was awarded to expand the program across Paris and into additional EU cities.

100RC member city Barcelona has now also received UIA funding and is partnering with Paris to develop a similar program to adapt its schools to climate change. Both programs are expected to be complete by 2021, and have already become widely referenced examples of urban transformation.

Other 100RC member cities in the EU have been identifying and sourcing EU funding for the goals and interventions outlined in their Resilience Strat-

egies, effectively using those strategies to secure needed finance. For example,

The URBACT Resilient Europe Action-Planning Network awarded cities additional funding to continue evolving and implementing selected resilience priorities. The Network is led by Rotterdam, and involves the 100RC cities Bristol, Glasgow, Thessaloniki, and Vejle, as well as other cities from the EU region.

The Horizon 2020 Smart Mature Resilience program was a multi-disciplinary research project that ran from 2016-2018. The consortium of cities and partners included the four 100RC cities of Bristol, Glasgow, Rome, and Vejle, as well as San Sebastian and Kristiansad. The work generated Resilience Management Guidelines that support city decision-makers in developing and implementing resilience measures.

Greater Miami and the Beaches
Planning (and Voting) for Regional Resilience

$ FUNDING

↗ SCALE   ⬆ FLOODING   🌐 CLIMATE CHANGE

The City of Miami, the City of Miami Beach, and Miami-Dade County have been working across jurisdictions and geographic footprints, in a unique partnership with 100 Resilient Cities. Recognizing that shocks and stresses have no human borders, the three mayors, CROs, and respective government leaders banded together to take an innovative approach to resilient urban planning and management, and recently released their unique combined Resilience Strategy. Though specific resilience goals are being tailored to the different jurisdictions, as a whole the low-lying region is highly vulnerable to rising sea levels and has one of the highest levels of economic inequality in the United States. Implementing the collaborative and integrated Resilience Strategy will require sustained, long-term financing and community buy-in.

In November of 2017, voters in the City of Miami approved a US$400 million general obligation bond. This "Miami Forever Bond" will fund infrastructure projects that will "keep property values high and streets dry." The city has earmarked US$192 million of the bond for storm drain upgrades, flood pumps, and sea walls to curb worsening flooding. Other major areas of planned spending include affordable housing, economic development, parks and cultural facilities, road improvements, and public safety. The inclusion of these diverse objectives opens the door to funding and partnership with a range of corporate and community financial institutions, local nonprofits, foundations, and development organizations who are eager to engage in deeper resilience finance. The City of Miami is also developing an overarching Stormwater Master Plan, which will lay the foundations for an estimated US$1 billion in projects needed to brace the city against rising seas.

A year later, in November of 2018, voters in neighboring Miami Beach approved a US$439 million general obligation bond to fund upgrades to the city's public spaces, recreational facilities, pedestrian causeways, neighborhood infrastructure, and public safety.

Miami-Dade County has also sought to embed a resilience focus within the budget process, organizing its Annual Budget and associated programmatic spending around the four dimensions of the City Resilience Framework: "Health & Wellbeing," "Economy & Society," "Infrastructure & Environment," and "Leadership & Strategy." In the County's Fiscal Year 2018-19 budget, more than US$600 million in operating budget and US$21 billion in multi-year capital plan investment is committed to resilience efforts.

In all three cases, the ensuing projects (and those coming out of the combined resilience strategy) are being developed with resilience-building principles in order to receive funding – and, for the first time, the bonds include equity and community engagement as guiding tenets for their disbursement. For example, flood mitigation efforts will be structured to ensure low-income tenants are not displaced, while the input of minority voices will actively be sought in project design. This aspect also encourages a broader range of partners, in service provision and implementation as well as various forms of financing.

Finally, the bonds take into account the overall economic resilience of the municipalities at a critical time, as they will not increase tax rates relative to capital projects debt, but rather will allow the cities to take on new debt only as old debt comes off the books. Along with protecting the city from disaster and improving equity in infrastructure, housing, and public spaces, these investments will in turn unleash new opportunities for investments in jobs, improved properties, business development, and tourism.

Pittsburgh
A Resilience Strategy as an Investment Prospectus

$ FUNDING

⊚ ACTIONS   💧 CHAMPIONS   ⚖ SOCIAL EQUITY

OnePGH, Pittsburgh's Resilience Strategy, establishes a bold vision that builds on a wealth of community assets and the new growth and successes of recent decades, while directly confronting a range of ongoing, complex challenges. The city's vision for resilience is predicated on the entire community sharing the same opportunities for prosperity, where "progress" means that all residents are well cared for and prepared to face potential risks and adversities. The Resilience Strategy is intended to shape city plans and initiatives such that they are able to achieve maximum community impact, by addressing the root causes of systemic challenges through a holistic approach to urban systems management that fosters relationships between sectors.

Learning from efforts to develop 100RC regional and global project portfolios for investors starting in 2016, OnePGH also serves as a "project pipeline" or aggregator for the city's own "investment prospectus" – the first and only one of its kind across the network. OnePGH has demonstrated where gaps exist and where new investment could yield the greatest benefits and dividends for all city residents, showcasing investment opportunities that will develop the resilient "people, place, and planet" that Pittsburghers envision by 2030.

By 2030, the city aims to show measurable impact in tackling environmental stresses, maintaining cultural and natural assets, and eradicating hunger and homelessness. For example, OnePGH's vision for safe streets goes beyond physical mobility, aspiring for true social mobility and access to opportunities in each of the city's unique neighborhoods. Additionally, OnePGH prioritizes making housing affordable, making the Pre-K program available for all children, transforming stormwater into an asset, and having a world-class water system in place.

Three years of city-led resilience analysis and planning culminated in the development of a project-specific implementation plan that complements the Resilience Strategy. Interested partners and investors will be able to take this document and contribute to an equitable Pittsburgh by helping to finance critical initiatives and/or develop appropriate public-private partnerships. The selected investments will not only serve as a social safety net for vulnerable Pittsburghers, but will also create the stability needed to properly maintain and leverage the natural, built, and cultural assets that distinguish Pittsburgh. Overall, these investments will foster a healthy, safe, enriching, and resilient environment for the city's residents.

Porto Alegre
Financing Solar Expansion

$ FUNDING

🤝 PARTNERS   👥 EDUCATION AND SOCIAL INFRASTRUCTURE   🌐 CLIMATE CHANGE

The southernmost state capital of Brazil and home to over 1.5 million people, Porto Alegre has a long tradition of progressivism, from hosting the World Social Forum, to being the first city in the world to implement participatory budgeting, and one of the first in Brazil to mainstream comprehensive best practices for recycling and waste management. More recently, as part of its overall resilience-building agenda, Porto Alegre has been pursuing various initiatives that will promote sustainable energy generation and improve the efficiency of energy use across the city.

In 2016, through its participation in 100RC, Porto Alegre collaborated with ICLEI, a global network of local governments committed to sustainability, to deliver a pilot installation of solar panels on the roof of a public school in the city. Once the data made clear that the pilot intervention had substantially reduced the school's energy bills, the Resilience Office began work to expand the initiative, now called the Energy Efficiency and Solar Energy at Schools project (or "Luz do Saber"), to every school in the city, and to incorporate efficiency retrofits in the renewable generation technologies.

The expanded project was selected, thanks to its proven resilience-building value, to receive technical assistance from the Financing Energy for Low-Carbon Investment (FELICTY), an initiative led by *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) and the European Investment Bank (EIB). FELICITY funds the development and implementation of green energy projects, projects that boost energy efficiency, or projects that integrate renewables into an overall generation portfolio. FELICITY provided pre-feasibility support to the scaling effort, sharing expertise between fund consultants and local employees, and building capacity among the city staff to pursue energy efficiency improvements in other public buildings in the future. Porto Alegre's Resilience Strategy has set a goal for the city of protecting the local environment and instilling a sense of environmental responsibility in the next generation, in light of the 21st century challenges of climate change and resource constraints.

Using the social infrastructure of public schools as a demonstration point for solar and efficiency technologies reduces the risk of power outages in schools, reduces the city's energy bills and greenhouse gas emissions, gives students direct exposure to these sustainable opportunities, and helps meet the city's wider resilience goals.

The World Bank
Deploying Resources to the 100RC Network

The World Bank, with support from RF and 100RC, established two innovative new programs for helping cities build their overall resilience, the **City Creditworthiness Initiative**, and the **City Resilience Program**.

The City Creditworthiness Initiative aims to help cities improve their financial performance and achieve higher creditworthiness so that they can secure the capital they need to finance their resilience infrastructure projects and services. The initiative has two components: the City Creditworthiness Academies and the City Creditworthiness Implementation Programs

Many member cities in the 100RC network have benefited from these programs to date. The municipalities of Medellin, Porto Alegre, and Cali participated in the City Creditworthiness Academies, which provided hands-on learning programs focused on enhancing local authorities' knowledge and understanding of the fundamentals of creditworthiness and municipal finance. Through the program, the cities applied a self-assessment and planning tool, as well as a questionnaire, to identify the challenges and develop a customized action plan to help enhance their creditworthiness.

Other member cities have benefited from deeper engagements through the City Creditworthiness Implementation Programs, which engaged external consultancies and subject matter experts to provide in-depth technical assistance, ranging from improving the national legal and regulatory frameworks to reforming the capital budget plan.

This initiative has enabled or has created the conditions for resilience projects to be delivered in many cities belonging to the 100RC network, including Addis Ababa. One of the fastest growing countries in the world, Ethiopia's institutional systems and infrastructure have failed to keep pace with its rapid urbanization. Meanwhile, its municipal finance and governance are still in their infancy, with authority and certain responsibilities, such as control over public spending, having only recently shifted from the central to local government.

Given this context, Addis Ababa was selected to participate in The World Bank Creditworthiness Initiative, with the program specifically designed to help the city assess its legal and regulatory framework for subnational public-private partnerships, enhance its Own-Source Revenue collection and support climate-smart capital

investment planning at the local government level. In addition to developing the local capacity, incentives, and financial resources to allow Addis Ababa to deliver infrastructure and services to its residents, the lessons learned from this experience will be rolled out to other cities in Ethiopia.

The other program established by the World Bank with support from RF and 100RC is the City Resilience Program, set up to help cities enhance their resilience and strengthen urban planning. The program provides capacity development and technical assistance, and connects cities to various investors to assess different financing options and opportunities.

Through the City Resilience Program, the World Bank hired external consultancies to conduct pre-feasibility studies over a six-month period for select 100RC member cities and their projects, including drainage infrastructure upgrades in Accra; investments in flood control, upgrades in drainage and wastewater systems, and resettlement of slums in Can Tho; community redevelopment on the hillsides in Medellin; waterfront improvement in Panama City; improvement of the Fourth District in Porto Alegre; and the redevelopment of Estación Belgrano and its surroundings in Santa Fe.

As a result of the City Resilience Program's technical assistance, these member cities were able to build local capacity by directly engaging with the external consultancies, and to advance their projects further along project development and to securing finance.

Funding across the 100RC Network – Impact

Across the 100RC Network, Resilience Strategies are serving as visionary documents and plans for cities' futures – they are also driving budget decisions, major grant awards, and capital flow.

To date, 100RC member cities have catalyzed **over US$25.4 billion** to implement resilience projects, fund their resilience offices, and support their resilience agendas. These funds are coming directly from city governments, as well as from central and regional governments, private sector donations, international aid and philanthropy, intergovernmental organizations, and private sector investments.

100RC set out to capture this figure as **a proxy for the "size of the market for urban resilience."** It is most definitely an undercount, both as a result of the money flowing through member cities that was not reported to 100RC, and given that there are many more cities in the world outside the 100RC Network than within it. The market for urban resilience is therefore nascent but growing rapidly, given that all of those funds were committed in the last decade.

The diversity of the investments made to date maps onto **the diversity of projects in a Resilience Strategy.** Across the Network a large number of governance and civic programs have attracted investments of under US$1 million, while a smaller number of much bigger investments have gone to resilience-building infrastructure projects. A wide diversity of investors is also seen around the world. There is a substantial opportunity to orient additional investments around the Resilience Strategies – only about **one third of Resilience Strategy initiatives were fully resourced** at the time the Strategy was published.

"Since entering 100RC, six cities [of 22 surveyed] have been able to **attract significant additional funding sources for resilience activities** due largely to their 100RC participation, and there is some potential funding coming to a handful of others."

– The Urban Institute Midterm Evaluation Report, December 2018

"[However] access to funding is a common challenge across the board, and cities of all kinds have had to creatively use existing national or multilateral resources such as special revenue or debt schemes."

– The Urban Institute Midterm Evaluation Report, December 2018

"Spending on resilience increased in the recent past both in depth and breadth of donors. Broadly, the range of funding sources includes multi-donor trust funds, cities paying for technical assistance from their own sources, membership dues, and bilateral donor programs."

– The Urban Institute Midterm Evaluation Report, December 2018

Greater Miami and the Beaches, U.S.A.

Panama City, Panama

🤝 Partnerships + ↗ Scale

Cities need strong partnerships across sectors and scales to advance their resilience-building.

No city is an island, even cities located on islands – cities exist within metro areas, regions, markets, countries, and more. Resilience challenges can be local, impacting certain communities in relation to a shared geography; cross-jurisdictional, affecting lives irrespective of legal boundaries; and even global, crossing geographical and jurisdictional boundaries in unprecedented ways. Truly building a city's resilience requires taking all of these scales into consideration. Moreover, no city can do this work alone: the expertise and services of other cities and non-city partners will be required.

To catalyze an urban resilience movement, diverse leaders and resilience champions must recognize what they share and what they can learn from each other, as well as the fact that the world is now more connected than ever before and demands new ways of working together. By establishing partnerships outside of business-as-usual models, and at new scales, cities and non-city actors can invent and advance new solutions to longstanding challenges.

As part of their acceptance into the 100RC program and associated grant package, member cities were enrolled in the 100RC Network. This Network had two facets – one, comprising all member cities and their CROs, allowed the cities to cross-pollinate best practices, scale new ideas, and foster collective action around shared challenges and innovations. The other, comprising the Platform of Partners, provided member cities with access to pro bono services and expertise

from a diverse cohort of leading actors in the private sector, academia, non-profits, national governments, and others. This ecosystem worked at many scales to form a global community of urban resilience practice.

By having 100 disparate cities around the world adopt a common CRO role and Resilience Strategy development process, 100RC created a shared language and cohesive experience base, enabling different cities and partners to inform each other's work and solve problems collectively. The 100RC Network of member cities – in partnership with non-city actors – worked across and beyond city borders while also reimagining the roles of larger global actors and institutions.

The following pages share what 100RC has learned about fostering partnerships across the Network and beyond to support the complicated work of resilience-building at various scales. The lessons in this section cover:

✓ Creating a Network of CROs and Other City Practitioners

✓ Components of Successful City-Partner Collaborations

✓ Building Resilience across Metropolitan Regions

✓ The Power of Collective Action and the Role of Global Institutions

Creating a Network of CROs and Other City Practitioners

A core component of the 100RC effort was the member city Network, which comprised all global CROs and their teams, working toward a cohesive global practice of resilience. This city-to-city peer-learning Network enabled cities and CROs to better understand the intersections between the shocks and stresses their cities face, to source new ideas and solutions for city challenges, and to more effectively navigate the often difficult politics associated with transforming city institutions.

The 100RC Network, at its core, was a group of individuals – which is why it was so important that they were at the table, as **co-creators of the Network** itself, to ensure its functions were grounded in the CROs' priorities, needs, and hopes. Their shared vision for the Network, articulated in their own words, was for the Network to be:

- A strong and trusted peer group
- A hub of knowledge to share and leverage across member cities
- A force for collective action that catalyzes change
- A "United Cities" that rivals the United Nations
- A global movement, inspiring more cities to hire more CROs
- A catalyst for more investment in resilience-building initiatives and efforts

To support this vision, 100RC entered into partnership with CROs to develop the suite of Network programs and services grounded in these aspirations and goals, and endeavored to create the space for the global community of CROs and their peers to advance this bold agenda.

In order to have honest conversations about cities' pressing challenges and the barriers to implementing a resilience agenda in their cities, Network members needed to know and trust each other, and so the Network had to be a **strong peer group rooted in interpersonal connections**. 100RC placed an emphasis on in-person convenings, training, and workshops to help foster those relationships, maximizing opportunities for practitioners not only to work together but also to spend time connecting informally. Hence, shared meals and joint outings were as important as formal workshops and presentations during any 100RC convening.

These **in-person collaborations** – where CROs and teams came together to share, learn, and build a collective practice – were consistently the most valued aspects of the 100RC Network as reported by member cities. However, with CROs and their teams working across the globe, technology became a critical tool for continuing collaborative work beyond face-to-face meetings. To make this possible, 100RC established an **Online Community (OC) platform to support and enhance Network programming**. One key lesson from the creation of the OC and other virtual programming was that while tech platforms may provide a place for a network to persist, they cannot create a network, and they should not be created without the input of the network. 100RC's Online Community was co-created with members, and very importantly, led by a dedicated Community Manager who oversaw and facilitated member city connections and learning.

Another of the reasons the Network was successful was because its primary members, the CROs, had both a **shared identity** in terms of title, job function, and mission, and a **shared experience** of building resilience in their local contexts, however diverse, in partnership with 100RC.

Especially in the Network's early years, this collective experience shared among a core group of senior municipal officials – all of whom were at the vanguard of the urban resilience practice – was a strong, cohesive force. There was true and lasting power in this shared identity and shared experience that remained even as the Network expanded to include members beyond the CROs themselves, bringing in additional members of city Resilience Teams and other local partners.

At launch, the Network was limited to CROs, in order to build trust and cement relationships. **Expanding the Network beyond CROs** to include CROs' key city partners and collaborators became critical as cities moved from planning to implementation.

CROs were encouraged to think strategically about who in their city should join the global conversation, and how they could leverage the Network to promote wider buy-in and a deeper understanding of resilience. The expansion exposed new stakeholders to the power of a global network while elevating the work of CROs and Resilience Teams, **creating city champions** who were energized and inspired to support the resilience work within their own remits. This diversity of voices and experiences in the Network brought deeper technical know-how to the

projects and increased the Network's value for member cities.

While many collaborations between member cities happened organically, others were carefully curated by 100RC, for example through a 100RC Network Exchange or Co-Lab, where cities had the opportunity to **work collectively to formulate solutions** for a shared challenge. These exchanges were a powerful means to strengthen connections, amplify learnings, and create a sense of shared ownership and momentum for action.

From these curated convenings, 100RC learned that *"if you want action, you need to have the actors in the room."* Business-as-usual conferences and events will bring together elected officials and other experts, who are certainly important for lending credibility and perspective to any conversation. However, 100RC found that some of the most successful collaborations were those that instead brought together peer practitioners – for example, the Head of Public Works or Water Utilities, Budget Directors, and CROs and their teams. CROs were responsible for involving the right people, using their convening power to connect technical experts across cities to tackle shared challenges.

This mix of practitioner-actors allowed the conversation to focus not just on what should be done, but instead on what is possible and doable, given the specific context of a city. It provided a fresh space for practitioners, even those in the same city, to break down silos and collaborate together in new ways – a common experience that they could draw on when they went back to

their daily work in their own departments. This was particularly powerful when collaborations brought together practitioners with similar roles from different cities, as it generated momentum, confidence, and motivation for the ongoing work needed, while drawing on transferable expertise from across the globe.

100RC also saw clearly that "*If you want action, ensure the actors co-design the process for collaboration.*" It was critical that practitioners determined their objectives for any convening or collaboration ahead of time, including the specific issues and actions they wanted the group to focus on. This ensured that participants came into the room with a clear and shared purpose, ready to roll up their sleeves and work together on a solution – rather than being passive listeners. Similarly, practitioners had to jointly determine what collective work would be required after a convening. If it was a call-to-action report, for example, the practitioners should agree upon the scope, the contribution they would each make, and the timing of the deliverable – allowing an actor like 100RC to serve as the facilitator and project manager, rather than the leader of the conversation.

100RC's experience has found that city-to-city collaborations are most effective and successful when cities are explicit about what they want from their peers and what they believe they can share with each other; when they communicate strategically and with specificity about the support they need from their peers, including when, why, and how; and critically, when they acknowledge the responsibility of being a member of a network, and carefully consider and follow through on commitments. This "give and get" approach to collaboration fosters deep connection, practical exchange, and follow-through.

Finally, CROs must be open and honest about the challenges their cities face. They should not talk only about the successes, but instead invite their peers into honest conversations about where they have struggled and mistakes they have made, promoting actionable and constructive feedback.

> **"Becoming a 100 Resilient Cities Platform Partner was a strategic imperative for Wood – a deliberate move toward working with cities pioneering the resilience movement and market."**
>
> – Peter Hall, Global Program Manager for Climate, Resilience and Sustainability at Wood

> **"Our work with The Nature Conservancy, a 100RC Platform Partner, to deliver the first metropolitan-wide urban forest strategy in Melbourne will set in place a city that is ready for the future, while also locking in livability benefits, including helping us adapt and thrive under the increasing pressures we face due to stresses such as climate change."**
>
> – Toby Kent, Chief Resilience Officer of Melbourne, Australia

Building Resilience across Metropolitan Regions

In an increasingly urbanized world, little of what impacts a city is contained neatly within its political boundaries. Some of the most pressing challenges cities face – from economic development to housing, from water management to mobility, from data collection to disaster risk management – transcend municipal jurisdictions, and are best addressed at the metropolitian level or through regional collaborations. However, well-tested tactics or playbooks for coordinating, delivering, and resourcing urban solutions at this scale – the *how* – are hard to come by.

Many 100RC member cities around the world came up against this question of how to take action on a resilience agenda across a metropolitan region, particularly when those neighboring municipalities had not hired a CRO or committed to resilience-building in the same way.

First and foremost, the 100RC experience showed the need to **build demand and political will for metropolitan coordination,** by bringing all stakeholders to the table and generating buy-in around the mutual problems that can only be solved by working together. Taking the time to determine who those key stakeholders are – who has the expertise and who has the authority – is key to this effort. It also requires **breaking down the siloed implementation of 'integrated plans'** – for example, land-use planning must be integrated with transportation, housing, or environmental plans in order to create more equitable, human-centered cities and metropolitan regions.

Member cities found that they were more successful in generating this needed buy-in when they **considered voluntary collaborations and agreements alongside more formal governance reforms**, which

can be a long, circuitous, and uncertain road. Investing resources in setting up and managing more informal collaborations was necessary to build new coordination functions and establish needed champions for metropolitan approaches.

Governance is not the only consideration for municipal work – in the 21st century, all challenges will need good data and information to tackle them. Cities must build **the trust and coordinating muscle necessary to unlock the power of data integration at the metropolitan level**. Cities should also be mindful that data sharing is not solely a technical task: it is critical to develop strategies for collaboration across various data owners, including how to build consensus on approaches to data sharing, aggregating, and reporting.

And of course, nothing gets done without money. The finance of metropolitan resilience projects will vary widely depending on the powers bestowed on municipalities by their states or regions (e.g. ability to float municipal bonds, collect local taxes). Regardless of local context, however, cities need to **consider the full range of available funding options**, from longer-term approaches such as tax reform measures and devolution strategies, to sources available now, be they impact fees, concessions revenues, or cost-sharing strategies through collective purchasing.

Finally, governments, particularly national governments need to **abandon the notion that "one size fits all."** A single governance model of assembled powers, levers, or resources may not work across all metropolitan areas in a country because of differences in population share, local economic drivers, and other key factors.

Components of Successful City-Partner Collaborations

Cities cannot build their overall resilience solely on the basis of the resources and expertise they have within their governments. But the needed services and tools from external partners have often been inaccessible, whether because a city has limited knowledge of existing market offerings, lacks understanding of how to leverage an offering for a particular need, or simply cannot afford it.

A key component of the 100RC program was to provide member cities with access to "Platform Partners," a curated roster of diverse partners from the private, public, academic, and non-profit sectors. These partners offered an extensive catalog of pro bono resilience-building tools, services, and expertise, and formed an additional Network of the global urban resilience movement.

By facilitating engagements between member cities and Platform Partners, 100RC created a learning community where cities could explore and leverage proven tools and services to address their particular challenges. This enabled city governments to signal their most pressing needs to solution providers and specify their demands for outside partnership. And at the same time, the collaborations provided a space for the solution providers to receive feedback on their value propositions to cities, in order to build new tools or improve the effectiveness of their existing services for the global urban marketplace.

Over the course of 100RC's operation, external partners provided a wealth of expertise to member cities, from the aggregation, evaluation, and integration of big data for decision-making to the assessment of risk exposure to hazards, from the facilitation of lively stakeholder engagement to the design of resilient urban infrastructure and environments.

While the specific catalog of pro bono offerings from 100RC Platform Partners is not available to cities outside the 100RC program, the lessons learned in the course of those city-partner collaborations are widely applicable.

The biggest take-away is that **collaboration is worth the pain** - though it can be painful. 100RC found that the most successful progress and impact required the collaboration of multiple actors across different sectors, as this was the best way to truly address the underlying and systemic nature of shock exposures or chronic stress conditions. In turn, a portfolio approach helped cities apply their many levers for change, such as policies, budgets, economic incentives, licensing, land ownership, and development control.

Collaboration is more difficult or inefficient not only because of the multiple actors involved, but also because **city governments and partners often have very different perspectives, informed by their different social roles and constituencies**. These differences arise from the sets of stakeholders they serve and the ways they pursue their respective missions. For successful partnership, each side needs to better understand and appreciate these different dynamics and pressures. Companies often consider the bottom line and are more open to taking risks, but their timeframes are limited and strict. Cities focus on societal benefits, are traditionally risk-adverse, and are comfortable with timeframes that change and/or span multiple years. There are good reasons

for this – for one thing, voters can be very unforgiving of missteps. Beyond considerations of public opinion, governmental failures can result in serious impacts on the lives and livelihoods of citizens. Meanwhile, providing incentives or adjusting rules to accommodate start-ups or innovative partnerships may expose city leaders to accusations of cronyism or corruption.

Innovation is critical to building resilience, so cities should be willing to use the bully pulpit to enable it, particularly to overcome barriers or speedbumps found at the national level. Cities are the closest point of contact between residents and government, and residents often feel visceral relationships with their city leaders in a way that they do not with national government officials. The public goes to city leaders with their problems, and expects solutions, even when those solutions might traditionally lie outside the city's purview. But even where cities lack formal authority, mayors can use their offices to influence the conversation and break out of traditional bureaucratic inertia. By advocating for their residents, city leaders can create tremendous change, going well beyond their statutory authority. Appointing a dedicated point of contact for external partnerships can further demonstrate mayoral commitment to innovation.

Cities themselves are also likely to be innovators in the space and can ease the path to turning custom solutions into products. Many large cities have developed powerful custom solutions for urban resilience needs – but those solutions are rarely shared widely, even when made available as open source. Instead of letting solutions languish, cities and government-focused devel-

opers should find new structures to enable the wider distribution of custom-built tools. This could mean open-sourcing more solutions once they have been developed, or giving partners the right to sell solutions to other cities, perhaps in exchange for licensing fees. Building markets around previously bespoke solutions would also give non-city partners an incentive to continue refining tools.

Once a city and non-city partner have begun scoping a potential collaboration, they should **focus their conversations on the problem that needs to be solved, rather than solely on procurement needs**. It is an accepted fact among both cities and partners that procurement and partnership policies can stand in the way of successful partnerships. And for good reason: city procurement policies are designed to prevent contracting scandals, not to encourage innovation. Procurements tend to happen through requests for proposal (RFPs), which are confusing for first-time bidders and rarely written to solicit innovative solutions. Many RFPs even include requirements that bidders or solutions have a minimum number of years in the market, excluding certain offerings before they even have a chance to bid. These procurements can also take years to materialize, further discouraging partners that move more quickly in product, profit, or funding cycles.

Furthermore, these legally constrained interactions often leave little room for the helpful back-and-forth that could elicit a more appropriate, creative, or effective solution from the market. 100RC intentionally created a space for cities and Platform Partners to **connect upstream from a procurement** while the city is defining and

articulating its problem, as an alternative to a buying-selling relationship. These engagements sparked real creativity, learning, and collaboration. Partners gained a greater understanding of a city's real needs and had better ideas about other actors who could join the conversation to support innovation or service delivery.

Throughout its operation, 100RC facilitated city-partner collaborations on incredibly diverse thematic areas and across a full range of urban sectors and concerns, and found that the most successful city-partner engagements:

Ensured clear scope of work and defined expectations. The city was able to define and articulate their challenge and objective, and, just as importantly, had a clear understanding of the partner's expertise and how their offering could be leveraged.

Leveraged local knowledge. The city secured partners with familiarity and experience in their local context, as well as fluency in the local language. This was particularly important as partners most often needed to work with other city practitioners, outside of the CRO, who are less connected to the 100RC program.

Promoted cross-departmental collaboration. CROs were successful in identifying and involving key colleagues from other city departments who could benefit from or help facilitate the work. Often, rather than "owning" the project themselves, CROs delegated the leadership on the partner interaction to the right technical lead and worked tirelessly to provide support and cover.

Addressed shocks. Cities were faster to pursue partnerships when they were addressing shocks; however, if the shock was too severe, engagements often came to a halt.

Were strategically timed. The city was intentional about deploying the service or tool at key moments that aligned with major timelines, made use of available capacity to execute, and leveraged political windows of opportunity. Securing the necessary buy-in involved aligning with the political priorities of senior leadership. However, even the best-laid plans required partners who were flexible and patient with city timelines.

Cities and partners need to prepare and plan ahead for **leadership transitions**, which are key moments in any city-partner conversation. Change at the top can unsettle almost any organization, but the election cycle ensures that cities face regular turnover. Newly elected city leaders may choose to cancel some of their predecessors' projects, particularly if they are viewed as the priorities of a previous administration or party. To mitigate this issue, contracts should bridge administrations, with plenty of time for incoming city leaders to understand a city-partner effort before it comes up for renewal. Projects need to be both well-supported in the bureaucracy and well-understood by incoming political appointees. Having relationships throughout a city's structure will insulate the project at the end of a term.

Finally, cities should be aware that many potential **partners are already prioritizing resilience, and/or have reoriented themselves more directly toward cities as clients.** From the experience of 100RC, some Platform Partners developed new strategies for prioritizing resilience-related work, including adopting more holistic approaches to resilience efforts, changing their missions, and assessing their business lines through a resilience lens. Some of them were already doing this before they joined the 100RC effort. However, the experience also highlighted that some of the bigger changes seen in partners did not consist in their reorientation around resilience, but rather in relation to urban challenges and how city governments operate – both shifts represent opportunities for cities.

> **"Our work with 100RC and its member cities has helped our firm impact our own environments and neighborhoods, working with them to make them stronger and tackling persistent 21st-century challenges – from fostering economic development to addressing climate change and improving infrastructure."**
>
> – Bill Banks,
> Global Leader Infrastructure Advisory, EY

Rotterdam, the Netherlands

The Power of Collective Action and the Role of Global Institutions

A critical goal of 100RC was to ensure that global institutions – insurance companies, international financial institutions, big banks, regulators, national governments, and others – understood the benefit of resilience and adopted it both in their business models and in how they interact with cities, as a way to incentivize and support cities to engage in resilience-building.

The hope was that global institutions, like credit rating agencies, would reward cities that were building resilience and provide guidance for other cities that wanted to engage in resilience-building. Financial institutions and other funders would give preferential treatment and better rates to re-silience-building projects, viewing resilience as a pathway to maximize their resources. Targeted national governments and international bodies would adopt resilience principles and promote local governance structures conducive to urban resilience-building.

100RC undertook some of this advocacy on its own, as a global non-profit. Cities also have a critical and fundamental role to play in changing global institutions – but, whether as a market actor or as an influencer of regional, national, and institutional priorities, a single city may not have the power or demand-pull. This is why the **collective action of cities at scale** offers a powerful opportunity to build the global urban resilience movement.

100RC found that cohorts of cities that are geo-graphically proximate, or belong to the same or similar regional or national governance contexts, could strategically lean on each other for advice, support, and mentorship, whether through self-organized monthly meetings or sponta-neously in moments of need. The power of this collective action .was demonstrated, for example, during Resilience Strategy releases, when CROs from across a country or region came to support and celebrate a fellow member, and by doing so were able collectively to draw the attention of national actors. Neighboring cities in a region could approach potential vendors together, with the hope that those external partners could offer solutions at scale in a way that would confer cost savings across multiple cities.

Across the 100RC member cities Network, **a credible evidence base of resilience projects at the city level**, grounded in technical rigor and community assessment, was found to be one of the most effective ways to influence national pri-orities. In other words, cities should take the out-comes from the Resilience Strategy development process – the thorough assessment of risks and assets, the community engagement, the goals, and the projects – to national conversations as key inputs into national policies and programs.

This becomes even more powerful when the ev-idence comes from a variety of peer cities in a nation that together represent equally credible yet diverse perspectives. Instead of speaking as lone voices, cities can draw on each of their proven resilience successes to influence the funding and policy priorities of national governments and others. Urban residents are often the majority of a nation's population, and so their combined voices can have credence. For example, 100RC member cities have been shifting national emergency

CityXChange Summit, Bellagio, Italy

management conversation, policies, and regula-tions away from concerns about insurance and risk transfer, to a focus on resilience planning and proactive measures that increase safety for their community members. Cities have been partnering with their regional neighbors to demonstrate to their national governments an alternative, more resilient approach to recovery and rebuilding – one of bottom-up planning rooted in community.

Looking beyond national governments, **CROs have proven to possess a unique coordinating role when working with other key global institu-tions**, and resilience priorities have proven to be a critical organizing principle for such collabora-tions. CROs represent local government and are often directly accountable to their cities' chief ex-ecutives; they are not external advisors that report to a donor or another external third party. This coordinating and organizing role across various institutions is particularly valuable in cities that are juggling a crowded pool of external actors, such as donors, and their various priorities. These actors have found it effective to have a single point of contact, the CRO, with a clear point of view, the Resilience Strategy, on their city's most pressing needs.

Given that it represents a city's perspective on its priorities, with specific projects grounded in technical rigor and holistic assessments, **the Resilience Strategy can be leveraged as a comprehensive project pipeline for institutional partnerships and funding opportunities**. Many global institutions find this to be an efficient and effective entry point to conversation with cities, rather than sourcing new projects from scratch. This is even more critical when there is a history of poor partnerships, or lack of trust between cities and funders. As Resilience Strategies are developed via rigorous and inclusive processes, many institutions will be reassured that the voices of previously excluded populations have been taken into account. Such conversations still require a deep understanding of the priorities of a given global institution, and an ability to repackage city resilience projects in ways that will resonate with target audiences.

Conversations with institutional actors can also be strengthened by collective action from a cohort of cities. Instead of developing an application or proposal alone, **cities across the Network have come together to support each other on joint research and funding proposals**. Cities have also included cases studies or best practices from across the Network as examples they plan to replicate if awarded the funds they seek. Others have

referenced the Network as an effective distribution mechanism for sharing learnings during and after a project.

Finally, the 100RC experience found that **while the market is ready to innovate, many cities are still reluctant to sufficiently invest in resilience**. While 100RC cities have made important strides toward rethinking how they use their money to build resilience, there remains a huge opportunity for member cities, and others around the world, to continue prioritizing resilience. The market for resilience service offerings is still in its early days – and until more cities demand the work, non-city actors, whether profit- or mission-driven, will not be fully incentivized to iterate on, improve, and deliver resilience solutions. For example, many cities make bold statements about being energy efficient or carbon neutral, but have yet to begun investing in those resilience-building transformations.

Despite having room to grow, the success of the 100RC Network is indicated by the remarkable extent to which city leaders, Resilience Teams, and Platform Partners coalesced around their common challenges to share experiences, jointly build a global knowledge base on urban resilience, and unite to enact change at various scales.

India
Developing a National Level Engagement on Urban Resilience

⤝ PARTNERS   ↗ SCALE

◎ ACTIONS   ⚖ SOCIAL EQUITY

India's 2011 census found that its cities are home to over 377 million people, a population expected to surpass 590 million by 2030. While these cities contribute over 70% of the nation's GDP, they face tremendous pressures on their civic infrastructure systems. The current trend of unplanned, unregulated, and unsustainable urban growth is greatly aggravating existing shocks and stresses such as flooding, environmental degradation, air pollution, and increasingly frequent climate-induced disasters.

In recent decades the Indian government has been prioritizing and investing in urban development, including new flagship programs such as the Smart Cities Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Swachh Bharat Mission (Clean India Mission) and the Pradhan Mantri Awas Yojana (Housing for All) scheme. Overseen by the Ministry of Housing and Urban Affairs (MoHUA) of the Government of India, these programs have resulted in an overall investment of Rs. 685,758 crores (US$98 billion) in 4,041 urban local bodies across India. Together they provide an opportunity to leverage funding, achieve scale, and influence the future trajectory of urban development by mainstreaming resilience in urban programs.

Three Indian cities – Surat, Chennai, and Pune – were accepted into the 100RC Network, and have been progressing through their resilience-building journey and Resilience Strategy development process. It became obvious early in their processes that the larger initiatives needed to drive resilience in each of these cities could only be achieved with the policy and financial support of the national government.

The progress of these three 100RC cities created demand from around India for the three CROs to share the value proposition of urban resilience and applicable lessons with a wider network of Indian cities. 100 Resilient Cities therefore sought a partnership with the National Institute of Urban Affairs (NIUA), an autonomous body under MoHUA, to set up an Indian Urban Resilience Unit (URU) in July of 2018. The URU is now working at the national level to mainstream urban resilience across India by focusing on six key pathways.

First, the URU is supporting the MoHUA directly in its efforts to mainstream urban resilience-building into existing and new national urban missions. NIUA is a premier institute for research, capacity-building, and knowledge dissemination for the urban sector in India. Their involvement in national

programs and projects places them in a unique position to identify synergies among various initiatives and opportunities for mainstreaming resilience within them. For example, the URU has been developing resilience parameters and collaborating with the Cities Investment to Innovate Integrate and Sustain team (CITIIS, a program funded by the French Development Agency) at NIUA to integrate resilience with the CITIIS project. URU has also contributed to integrating resilience parameters into the Ease of Living Index 2.0 and into MoHUA's Climate-Smart Cities initiative for measuring cities' performance in improving quality of life and climate action.

Through its research, engagement, and knowledge initiatives, URU is building a national discourse and narrative about urban resilience. To this end, URU recently supported MoHUA in organizing a high-level consultation to deliberate on recommendations for scaling up actions and mainstreaming urban flood resilience through the national programs, namely the Smart Cities Mission and AMRUT. URU is also part of the Technical Steering Committee of the National Disaster Management Authority and the Ministry of Home Affairs for "Disaster Resilient Infrastructure." This Committee is responsible for identifying collaborative actions for the global Coalition on Disaster Resilient Infrastructure (CDRI), comprised of 33 countries from the Asia-Pacific region, for which India is currently the Secretariat.

NIUA's capacity to institutionalize resilience-building practices in national projects and guidelines will not only help ensure that India's three 100RC member cities continue their resilience journey, it will also open up a new pool of investments for resilience-building in Indian cities and communities outside the 100RC network.

An Urban Data Observatory is a platform serving as a repository for accurate and frequently updated city-specific spatial and non-spatial data that can be used as a decision-support system. The platform includes both visualization and analytical tools.

Second, the URU is developing technical tools to inform and support the incorporation of resilience into new urban development projects. URU is creating a comprehensive risk and resilience tool, customized for Indian cities, to help city project managers identify key shocks and stresses, and options for addressing them in a systematic manner.

The URU's third pathway to building resilience is creating a national framework for establishing urban data observatories. These observatories will equip city managers with the data needed to make informed decisions and tackle the managerial and policy challenges of rapid urbanization in India. The national framework will also help forge connections between observatories, linking the national-level Indian Urban Data Observatory of the MoHUA with the city-level observatories, and with the Integrated Command and Control Centers being implemented under the 100 Smart Cities program.

The URU's fourth pathway is engaging with donor organizations and other stakeholders to explore the possibility of working with likeminded partners to pilot resilience projects. This will build on the work 100RC has been doing with CROs and municipal governments in Surat, Pune, and Chennai. For example, the URU is currently working with the CRO of Chennai and representatives from the Indian Institute of Technology-Madras and the Madras Chamber of Commerce to advance the pilot of an urban data observatory in Chennai.

Fifth, the URU is engaging with educational institutes to incorporate resilience frameworks into the curricula of urban planning, development, and management, by working with faculties from academic institutions, providing them with the necessary frameworks and tools for incorporating resilience into their existing studios, course modules, and research. By mainstreaming resilience into education, more urban planners and managers will be equipped to support cities in more effectively planning and responding to shocks and stresses. This effort will also support a Network Platform that would bridge the gap between Urban Local Bodies and domain-expert academicians/researchers and build synergies between cities and academia for addressing real urban challenges. The Network Platform has been conceptualized as a knowledge dissemination platform for the universities and will be embedded within SMARTNET.

The URU's sixth pathway is engaging with mayors, commissioners, city engineers, planners, businesses, and NGOs, and developing customized briefs that communicate the value of resilience investments and inform those key stakeholders of opportunities across various urban thematic areas.

The URU has committed to contributing their own resilience expertise and knowledge of the national political landscape to the 100RC Network through 2020. This partnership will champion urban resilience at a national and regional scale, building capacity across key decision makers and in academia. Deepened engagement in the three 100RC member cities will uncover best practices that can further inform MoHUA in adopting the practice of resilience in other cities across India.

SMARTNET, developed and maintained by NIUA, is an initiative of the Ministry of Housing and Urban Affairs to support the development of cities across India, and to create a resource-rich ecosystem of learning, sharing, and disseminating for city managers and primary stakeholders in the urban transformation of India.

Colima
Metropolitan Governance for Resilience

🤝 PARTNERS   ↗ SCALE

✋ CHAMPIONS   ◎ ACTIONS

Often, a city's most intransigent shocks and stresses transcend municipal boundaries. As cities design and implement their Resilience Strategies, they increasingly understand the need to redefine previously established social, political, functional, and geographic borders. This is especially true in light of an increasing trend of metropolization – as urbanization continues apace, the functional definition of "city" is expanding and becoming more nuanced, to encompass neighboring municipalities and rural peripheries.

While home to only 150,000 people, the City of Colima is a state capital and an important economic center, and is ranked tenth for quality of life out of all cities in Latin America. Functionally however, the city is in fact a metropolitan area of five municipalities, home to 360,000 people, which represents half the population of the State of Colima. Though the five municipalities share environmental, socio-economic, and administrative challenges, to date most of the area's issues have been addressed with little coordination between the different governments. Attempted initiatives to promote collaboration, such as the creation of an Inter-municipal Metropolitan Association and a Metropolitan Observatory, have ultimately failed to influence decision-making, due to a lack of supporting legislation. With the aim of improving the

coordination of planning processes and unifying the development visions of the five municipalities that form its metropolitan area, the City of Colima is creating a new public inter-municipal management body, the Metropolitan Resilience and Planning Institute (MRPI). Managed by a general director, the Institute will consist of a multi-disciplinary technical team of professionals. Oversight will come from an integrated and gender-diverse Citizen Council, comprising both municipal presidents and distinguished citizens. The Colima Resilience Office will seek support from the local congress for the MRPI's legal establishment.

One of the main challenges to Colima's resilience is a history of uncontrolled expansion of the urban footprint, exacerbated by lack of cooperation between the five municipalities. MRPI therefore aims to develop and promote metropolitan policies and regulations, as well as projects, studies, programs, and guidelines, for sustainable and resilient development. There is particular interest regarding land use and zoning decisions. The MRPI will also conduct capacity-building for key stakeholders, such as municipal and state governmental bodies, on best practices for effective management to build the overall resilience of Colima's metropolitan region as a whole.

London
Counter-Terrorism Preparedness and Societal Resilience

🤝 PARTNERS   ↗ SCALE

✋ CHAMPIONS   ◎ ACTIONS   ⚡ POST-DISASTER RESILIENCE

London is a global pioneer of urban resilience. Founded as a key trading port on the River Thames, the city has been an important regional power for nearly 2,000 years. It has since grown into an international cultural capital and financial center, boasting a host of successful industries, and is a destination for people from all over the world. Its desirability has driven the cost of living there beyond the reach of many, and inequality is exacerbating other social stresses.

London faces diverse threats including terror attacks, floods and drought, economic inequality, a lack of affordable housing, and even Brexit. Shortly after joining 100RC in 2017, London suffered the Grenfell Tower fire, and Lord Harris's report on London's terror preparedness was launched – both of these events informed the city's resilience-building priorities.

The city's emergency services have long worked to understand and protect against a wide range of threats. Over the last decade, this work has evolved into a wider program of holistic urban resilience, with the mayor appointing the city's first Deputy Mayor for Fire and Resilience in 2018. This new fire and resilience team, endowed with a wider remit, began the city's 100RC journey in earnest.

Then in 2019, the appointment and orientation of a CRO for the City of London (a small administrative district in the center of the metropolitan area) enabled London to begin collaborating with a number of other European cities on common resilience challenges, particularly social stresses. Reducing the threat of terrorism is high on the agenda of several major European cities. Applying a resilience lens to otherwise traditional security structures has enhanced existing anti-radicalization agendas by increasing their focus on identifying and reducing the causes of radicalization toward violence.

Through the 100RC Network, London launched a collaboration with the cities of Barcelona, Manchester, Paris, Rotterdam, and Stockholm, with the possibility of expanding to include other cities. This cohort, Counter-Terrorism Preparedness and Societal Resilience, is collaborating with each other as well as with key social and security stakeholders to support the development of city-level policies to counter terrorism and build societal resilience holistically. The group is currently exploring workstreams concerned with anti-radicalization, strategic coordination, psychological interventions, humanitarian assistance and recovery, major events and crowded places, and community preparedness.

Sydney
Working Beyond Boundaries to Foster Metropolitan Resilience

🤝 PARTNERS   ↗ SCALE

🔥 CHAMPIONS   ◎ ACTIONS $ FUNDING

When staff at the City of Sydney first applied to the 100 Resilient Cities network, city leadership was challenged by 100RC to "work beyond boundaries." While the City of Sydney, a local government area in the center of the Sydney metropolitan region, is just 25 square kilometers and houses just over 200,000 residents, truly building resilience for Sydney requires working across the integrated metropolitan region, an area of 12,000 square kilometers, home to over 5 million people, and divided across 33 local government areas (councils) with no metropolitan governance structure in place. The challenge is daunting.

Lacking the authority to compel participation, the CEO of the City of Sydney personally reached out to the leaders of all the councils with a proposal: to join the 100RC network as one metropolitan region, and to leverage the 100RC program to work differently. By employing a methodology that put community risk and vulnerability at the center of planning, all the governments of Sydney would be able to make a stronger case for action and investment where it was needed most.

As a result, in 2015 for the first time ever, leaders and representatives of all 33 councils, along with many state, business, and civil society groups, attended an inception workshop for the development of a metropolitan Resilience Strategy. Participants concluded that building Sydney's resilience would indeed require "working beyond boundaries."

Once the CRO for metropolitan Sydney was in place, a Resilience Steering Committee was formed that represented the diversity of communities, geography and needs across the metropolis. The Sydney Resilience Office designed the stakeholder engagement element of the Resilience Strategy development process to include a community research program, with a representative sample of residents from across all parts of the city. Results of that process established a clear public mandate for all city leaders to respond to what communities need and value, regardless of political priorities or ideological position.

The community research program unearthed the key local and metropolitan-scale challenges faced by different geographies, age cohorts, and ethnic groups across the hyper-diverse city. Identifying a common set of resilience challenges has enabled resilience champions to make the case for change in the way planning and investment occurs at the local, state, and federal levels of government, as well as with businesses. Moreover, this community-

based ground truthing enabled the Resilience Steering Committee to build the legitimacy of the resilience work among their peers across metropolitan Sydney, and identify links to local and regional strategic planning efforts that all 33 local governments were undertaking.

June of 2018 brought another first for Sydney, with all 33 council mayors, and the state and national governments, coming together to endorse and release a local-government-led, metropolitan-scale document – The Resilient Sydney Strategy. The Strategy includes five directions (goals) and 35 actions to address resilience challenges. The goal, "One City," responds directly to the challenge of disjointed governance at scale, with programs to support better understanding of interdependencies and risks, opportunities for risk mitigation, and a commitment to including those most impacted in the decision-making process. The Strategy is just the beginning of building the capacity and interest to "work beyond boundaries" in Sydney, in order to manage the community and system risks of a complex metropolitan city.

> **By employing a methodology that puts community risk and vulnerability at the center of planning, all the governments of Sydney will be able to make a stronger case for action and investment where it is needed most.**

The United States of America
The Natural Disaster Resilience Competition

PARTNERS   SCALE

CLIMATE CHANGE   FLOODING   POST-DISASTER RESILIENCE

The National Disaster Resilience Competition (NDRC), announced by President Barack Obama in 2014, was developed in response to requests from state, local, and tribal leaders seeking to build resilience and better prepare their communities for the impacts of climate change. The competition leveraged insights from the RBD post-Sandy model to bring resilience-building policy and practice to states and communities affected by disaster nationwide.

Designed to transform the paradigm of business-as-usual disaster response and recovery to one of planning, preparation, and returns, the NDRC promotes risk assessment, stakeholder engagement, and resilience planning in communities where the risks of disaster are projected to increase substantially due to climate change.

Eligible jurisdictions competed for more than US$1 billion in new HUD recovery block grants, with funding coming from Community Development Block Grant-Disaster Recovery appropriations provided by the Disaster Relief Appropriations Act of 2013.

When NRDC winners were announced in January of 2016, the three largest awards went to 100RC member cities: New York City, Norfolk, and New Orleans. All three had already begun to implement their 100RC-supported Resilience Strategies at the time. Each city's CRO played a major role in the competition's application process, and the projects funded were essential elements of the cities' Resilience Strategies.

The success of Norfolk, New York, and New Orleans served as early evidence that communities are seeing major dividends as a result of integrating resilience-building into their planning and operations, be it recognition from national governments or from the private sector. Each of those three cities reoriented their planning and governance to incorporate a holistic evaluation of the threats facing their communities, then took concrete action to build resilience to their unique environmental, social, and economic challenges. Most importantly, the three winning cities worked at scale to learn from each other in this effort, and to share lessons learned with to the central government and municipalities nationwide.

Partnerships across the 100RC Network – Impact

100RC launched with an ambitious goal of addressing a major challenge in the urban space: that existing solutions were not scaling or being shared, and so cities often found themselves "reinventing the wheel," despite having in fact many similar needs and concerns around the world. In response, 100RC curated a suite of pro bono resilience-building tools and services for member cities, supplied by a carefully selected Platform of Partners from the private, public, academic, and non-profit sectors, with the goal of creating a learning community and facilitating city-partner engagements to address this challenge.

100RC's external evaluation by the Urban Institute validated the uniqueness of this goal:

"...no other programs robustly focus on creating a city-level marketplace for resilience services, supplied by specialized private and not-for-profit organizations with cities as the main clients."

– The Urban Institute Baseline Evaluation Report, March 2017

100RC cultivated nearly **130 Platform Partners who pledged over US$200 million in tools and services** to 100RC member cities. The most common solutions aimed to support cities with buildings, emergency and disaster management, and information and technology. 100RC helped to facilitate over **200 collaborations** between these partners and member cities, totaling nearly **US$12.5 million in solutions and services delivered to 100RC cities.**

But helping individual cities to leverage resources beyond RF's US$164 million commitment was not the only goal of 100RC's work. By introducing Platform Partners to cities, 100RC aimed to catalyze a private sector marketplace for resilience tools. Giving Platform Partners a deeper understanding of cities' needs made them better equipped to build new tools and improve old ones – tools that would be available to all cities. Already, Partners have developed nearly **20 new solutions** as a result of their collaborations with cities.

Looking beyond the Platform of Partners, 100RC member cities are also partnering with diverse stakeholders to implement the initiatives from their Resilience Strategies. Local NGOs and community groups are participating in the delivery of one-third of Strategy initiatives around the world, while the private sector is collaborating on 29% of them. Regional governments are involved in 24%, while academic institutions play an important role in over 20%. Together with their partners, the cities whose Strategies were published at least one year ago have already **completed over 300 of their initiatives,** ranging from infrastructure projects to media campaigns, with an additional 1,079 initiatives currently underway.

⬈ Scale across the 100RC Network – Impact

The cities in 100RC's network span **47 countries and 21 languages** and yet face a common set of challenges. The most common shocks confronting member cities include rainfall flooding, infrastructure failure, and extreme heat, while economic inequality, a lack of affordable housing and climate change are the most common stresses. The 100RC Network of CROs and their teams was comprised of nearly **600 resilience practitioners across the globe.** It was created to provide opportunities for exchanging lessons learned, collaborating with resilience experts to build skills, and sharing ideas and inspiration to advance resilience projects.

"There was no global urban resilience network prior to 100RC... Now, CROs consistently report their 100RC network of peers and, in turn, their peers' networks, as being instrumental in understanding the fundamental shocks and stressors their cities face, in identifying the knowledge resources to promote solutions, and in learning how to navigate the internal politics of city government while attempting to transform city institutions."

– The Urban Institute Midterm Evaluation Report, December 2018

In the **first 64 Resilience Strategies published, there were over 1,400 examples of member cities collaborating with, guiding, and inspiring each other** in the creation of their initiatives. What's more, the Urban Institute found evidence that "the CROs are advancing the field with substantial engagement with non-member cities," ensuring that the resilience movement continues to gain momentum and spread.

100RC inspired and influenced global thought leaders, policy makers, and financial institutions to incentivize and support resilience-building, in member cities and around the world, by proving the value of resilience and amplifying work being done on the ground. Since 2014, there have been over **2,850 articles published across 58 different countries** that feature 100RC as a thought leader. 100RC has **over 230,000 followers across its digital and social media channels.** In the first five months of 2019 alone, 100RC received over **520,000 visits to its website, from every single country in the world.**

"As the largest and most consistently applied contemporary urban resilience intervention in scope and scale, 100RC has not only influenced the field of urban resilience — it has defined it in many ways."

– The Urban Institute Midterm Evaluation Report, December 2018

"100RC's global scale covering all continents and both the industrialized and developing world through institution-altering interventions is unique among resilience programs, creating both opportunities and challenges. Working across all continents helps produce unique collaborative learning but also requires flexibility to customize offerings to every context..."

– The Urban Institute Midterm Evaluation Report, December, 2018

Accra, Ghana

Cities Taking Action

Stories from across the 100RC Network

Cities Taking Action

The following pages share 76 more stories of work underway across the 100RC Network world-wide, that member cities are undertaking to build their resilience along the four key pathways for resilience-building. These holistic actions are presented through the lens of 15 different sectors.

All of these efforts are in or near implementation, and they will continue to evolve as member cities and their partners learn and iterate on the work, and as initial goals are met and new work grows from that preliminary impact.

Though tailored to the shocks and stresses of their respective cities, these projects have many similarities in the resilience thinking that undergirds them and the triple-bottom-line benefits that they will achieve:

1. All of them will continually integrate extensive and meaningful engagement with impacted local residents into their planning and scoping, with a particular focus on equity and the needs and concerns of poor and vulnerable segments of society.

2. They are all concerned with balancing economic growth and new construction against environmental sustainability and the maintenance of healthy natural assets.

3. All of them are key priorities of the leadership of their cities, with substantial political will and commitment behind them.

4. They all evolved out of their cities' Resilience Strategy development processes, and so seek resilient co-benefits far beyond the business-as-usual for such projects.

Toyama, Japan

Climate Change

Climate change will transform the world's cities. An unprecedented source of risk and uncertainty, climate change offers a clear entry point for conversations with communities and cities about systematic transformation.

Climate change demands that cities proactively identify transformative tipping points, reorganize, and move forward while retaining their own sense of place. Around the world, cities are undertaking visionary projects both for mitigation (reducing greenhouse gas emissions to lessen the degree of climate change suffered globally) and for adaptation (preparing physical or social forms to adapt to the impacts of climate change, many of which are already occurring).

However, by and large these projects have stopped short of what is truly needed to alter our cities before they are negatively transformed by climate change. Projects may pilot a new solar power system, green a neighborhood, or demonstrate a new method of rainwater storage – but scaling these kinds of efforts, in ways that reorganize the fundamental structures of our cities and how they operate at various scales, requires a different approach and a new kind of work.

Cities consume over two thirds of the world's energy and are the end-user demand points for over 70% of the world's CO_2 emissions. Recent documents, such as the 1.5°C IPCC special report, give a startling estimate of just how much mitigation work is required to hold the world within a less-than-catastrophic degree of climate disruption. According to that IPCC report, to prevent average warming of more than 1.5°C the world must take drastic measures that include phasing out fossil fuel passenger vehicle sales by 2035; reducing building emissions to at least 80% of current levels by 2050; requiring all new construction as of 2020 to be fossil-free and near zero-energy; refurbishing all existing building stock in OECD countries to net zero standards at a rate of 5% per annum starting in 2020; and achieving net zero CO_2 emissions by 2050, hitting 50% by 2030. These are not gradual evolutions, but revolutionary changes to every facet of society.

In terms of adaptation, with over 90% of all urban areas worldwide located along bodies of water, increased flooding and sea level rise threaten global assets. Heat waves, drought, severe storms, and other shocks will all impact global population centers. Stresses such as fluctuating commodity costs, given that agricultural supply chains are impacted by climate change, will also require cities to respond. The opportunity being realized within the 100RC Network is to bring the richness of resilience thinking into conversations about climate mitigation and adaptation, and to develop analytical and diagnostic tools and a scalable process to co-develop plans and governance systems with communities.

Paris
OASIS Schoolyards: Battling Heat and Building Resilience

CLIMATE CHANGE

SCALE   CHAMPIONS   EDUCATION AND SOCIAL INFRASTRUCTURE   NATURAL ASSETS AND NATURE-BASED INFRASTRUCTURE

Paris has long been a global icon and center for economic and cultural activity. Its centuries of history have also made it a heavily institutionalized city. As Paris began its resilience-building journey it committed to changing the way it plans and acts, and to developing and adopting novel solutions to meet the unprecedented challenges of today.

In 2003, Paris suffered a heatwave that killed over 700 residents – climate change will only make such heatwaves more frequent. The densest capital in Europe, Paris has only 14.5m^2 of green space per inhabitant, compared to London's 45m^2 or Rome's 321m^2. This preponderance of asphalted and impervious surfaces increases both the urban heat island effect and the risk of storm water flooding. With space at a premium, the city had to consider existing assets it could leverage to tackle its resilience challenges of heatwaves, flooding, declining social cohesion, and limited green space.

In the course of developing its Resilience Strategy, Paris determined that its schoolyards and college campus represent over 70 hectares of paved and impervious open-air surfaces within the city. Moreover, these locations are easily recognizable and familiar to the public, and very few Parisians live more than 200 meters away from one, making schoolyards a major piece of social infrastructure – but one which to date has been off-limits to the general public even outside of school hours.

The Paris Resilience Strategy, adopted in September of 2017, therefore envisions the renovation of the city's network of 761 schools into green islands, or "oases," of cooler temperatures and community solidarity, including the most vulnerable neighborhood residents. Project OASIS (Openness, Adaptation, Sensitisation, Innovation, and Social Ties) aims at addressing the following identified challenges pertinent both to the schools as social and built infrastructure and to the city of Paris as a whole:

- Increase the health and well-being of pupils and Parisian citizens
- Reduce the city's exposure to the urban heat island effect by making more green and cool spaces available to vulnerable populations
- Protect the city of Paris from flash floods and improve stormwater management
- Improve the decision-making and management capacity of political and permanent municipal staff
- Increase social interaction and community sense of ownership

- Design a novel project by adapting traditional management structures, solving the problem of cost and efficiency

The city launched OASIS with the 2018 renovation of three pilot schoolyards, costing approximately €1 million in total from the city's existing budget for school renovations. The three schools selected were the École maternelle, 70 avenue Daumesnil, in the 12th arrondissement; the École maternelle, 2 rue Charles Hermite, in the 18th arrondissement; and the École maternelle et élémentaire, 14-16 rue Riblette, in the 20th arrondissement. In the case of 14-16 rue Riblette, renovations were co-designed with the education community, including teachers, children, and parents.

The renovation work entailed:

- replacing asphalt with porous material
- increasing green spaces
- modernizing water management for flood control
- installing cooling fountains, water sprayers, and other facilities
- improving stormwater drainage
- creating natural and artificial shade structures

Criteria used in selecting the three pilot schools included:

- direct street access
- low proximity of other green spaces
- interest of relevant education community in participating
- low levels of soil pollution
- meets minimum surface area requirements for measure of climate impacts
- pre-existing funding allocated for renovation

This last point is key – as the pilot schools were already part of an existing renovation program, which included a participatory engagement process at Rue Riblette elementary, OASIS led to a redirection of existing, established processes for schoolyard renovation, and thus functioned as a public sector change-management pilot project.

The pilot of the OASIS approach is gaining recognition at the European level, with the project winning the 2019 Urban Innovation Actions (UIA) award, out of 22 other projects from across the continent. Paris has received €5 million of EU co-funding, which will be used for:

- developing a standardized methodology of co-designing the OASIS schoolyards with the involvement of children, parents, and teachers who are already using them, and moreover to engage citizens in the neighborhood, young and old, in improving their living environment and communities;
- identifying effective solutions for overcoming current bottlenecks to opening the school facilities to the wider public;
- renovating ten of the 33 schoolyards slated for 2019; and
- conducting a robust and comprehension evaluation of OASIS's approach, process, outcomes and impacts.

Through this second stage of implementation, Paris will be looking to other European cities – such as Athens, which pioneered an open-schools initiative – to identify optimal ways of treating the schoolyard as a public social infrastructure that may be available to the neighborhood outside of school hours. This allows schoolyards to act as social cohesion enablers, elevating community well-being and increasing

École primaire Charles Hermite, Paris.

social integration opportunities at the neighborhood level.

What makes the OASIS schoolyards program innovative is its governance, which brought together twelve different city departments (including the departments for schools, health, roads, green spaces, and water) to design and deliver the project in an integrated manner, using a common process, budget, and schedule. Within this unique governance system, Paris's CRO and Resilience Team played a leading role as resilience champions, coordinating efforts and ensuring the maximization of the project's resilience dividend.

Through deep and meaningful engagement with the pupils, parents, and education community as well as with both city and national governments, the Resilience Team was able to co-design the schoolyards with end users and effectively transform their vision into reality. This also helped the Team secure buy-in from all stakeholders to open these spaces (which traditionally are completely closed off) to vulnerable populations such as the elderly during heatwaves.

By 2050, Paris aims to scale this concept to the approximately 700 schools across the city as part of a wider program to make the city more resilient to heatwaves. In 2019, the city will focus on renovating over 30 schoolyards, with the goal of accelerating the process of co-design with users. Some key lessons that emerged from the 2018 pilots include the need for city planners and urban resilience practitioners to develop a robust methodology for co-designing and co-building OASIS schoolyards with the wider education community. While the three pilots were each transformed separately by the architecture units in their respective arrondissements, Paris aims to standardize the

frameworks and specifications used for transforming the schoolyards. The city is working to define different categories, with minimum criteria that must be met for a schoolyard renovation to qualify as a cooling "oasis," and some higher qualifications defined for a handful of flagship locations.

In the process of transforming the next tranche of schoolyards, Paris will test and evaluate innovative methods for cooling outdoor spaces as well as the adjacent school buildings. The city will explore cutting-edge and highly sustainable materials and engineering solutions – their insights will have relevance and replicability for cities around the world as the impacts of climate change grow. However, the procurement of these new solutions will increase the cost of implementation. The city is therefore seeking new methods to finance both a portion of capital costs and resources for operations and maintenance.

A final question that Paris aims to solve is how to open the schoolyards to the general public outside of school hours while addressing all concerns about safety and upkeep. The schoolyards are envisioned as sites for community interaction and conviviality, accessible to all.

Compared to the current design of the schoolyards, the renovated "oases" are expected to generate a 10% decrease in average surface temperatures, a decrease in daytime air temperatures from 1 to 3°C, and an increase in water absorption capacity from 4 to 16 mm. These new breathing spaces at the heart of neighborhoods, designed with users, will improve the living environment, cope with the climate emergency, and reinforce social cohesion. The built "oasis," a fertile island able to accommodate the plant and the human within an arid expanse, becomes

a refuge in the middle of the pressures of the urban environment.

The OASIS project was explicitly designed in terms of the qualities of urban resilience. OASIS is **robust** because it meets all minimum building code requirements and puts safety first in its design. OASIS is **integrated**, as it was designed to leverage synergies with other city plans and budgets, with a key first step for the pilots being an integrated governance system with stakeholders from various city departments, who together could unpack the complexity of the project and organize and facilitate well-informed decision-making. OASIS is **reflective**, as measurement and evaluation have been built in as key components of the project, and changes in important metrics such as temperature and water infiltration will be monitored and the data analyzed. Any insights gained from initial results will be incorporated into the design of future renovations. OASIS is **resourceful** because it leverages existing city resources, with the pilot schools selected partly by virtue of their already having a budget allocated for renovation. Finally, OASIS is **inclusive** because the schoolyards will be open to vulnerable groups during heatwaves, and eventually to the wider public outside of school hours year-round. Moreover, co-design with the school's community and its wider neighborhood will be integral to the program moving forward.

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Berkeley
Assessing Resilient Energy Systems

CLIMATE CHANGE

SCALE   FUNDING   EARTHQUAKE RESILIENCE

Berkeley, a city on the Pacific coast of California with just over 120,000 residents, has a long tradition of environmental progressivism. Today, it is committed to mitigating its contribution to climate change and the impact of its energy consumption on the environment.

Having set Resilience Strategy goals to improve community members' ability to prepare for, respond to, and recover from natural disasters, and to accelerate access to reliable clean energy, Berkeley has focused on the potential of distributed energy to simultaneously reduce emissions and bolster emergency preparedness.

In 2016 the city was awarded a US$1.5 million planning grant from the California Energy Commission to conduct a regulatory, financial, and technical feasibility study of microgrids and related technologies. In assessing its options for low-carbon energy provision, the city determined that a combined solar and storage system would be the best solution for its concerns. Under normal conditions, the city's grid would be able to utilize the solar generation capacity for better load management and overall cleaner energy. The system would build resilience for the city more broadly, as Berkeley suffers from substantial earthquake risk,

which can cause the failure of basic infrastructure systems. During a power outage, the combined solar-plus-storage system could be islanded from the main utility and provide power for critical buildings.

While Berkeley ultimately determined that the costs associated with such a microgrid system were prohibitively high, it is continuing to explore financial and ownership models for solar-plus-storage systems that could be installed at key facilities. It has also shared the results of its research as a case study to other cities, including policy recommendations for advancing distributed power adoption.

The price barrier that Berkeley encountered is not merely a function of the cost of the technologies, but in fact a combination of regulatory factors that govern the generation, transmission, and distribution of energy, some of which are beyond the control or jurisdiction of most cities. Many cities around the world, with similar motivations to Berkeley, are interested in incorporating renewables into their energy matrices. As climate change continues to necessitate a global energy transition, cities may need to find new partners and work at scales beyond their borders to build resilient energy systems.

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Boulder
Reducing Emissions through Systemic Energy Efficiency Approaches

🌍 CLIMATE CHANGE

💲 FUNDING   🏠 HOUSING   ⚖️ SOCIAL EQUITY

The City of Boulder, in the U.S. state of Colorado, is home to around 100,000 people. Overall, residents enjoy a high quality of life, with a major university anchoring the economy, and access to outdoor activities in the surrounding mountains. However, Boulder is challenged by the shock impacts of climate change, including forest fires and droughts, as well as a lack of affordable housing.

The city has one of the most aggressive climate action programs in the United States, anchored by the first voter-approved carbon tax in the country, originally passed in 2006 and extended in 2015. Levied on residents and businesses on the basis of their electricity consumption, the tax generates approximately US$1.8 million per year for local energy efficiency and renewable energy projects. The tax funds a network of 48 city-operated electric vehicle charging stations, in addition to the EnergySmart, SmartRegs, and Boulder Energy Challenge programs.

EnergySmart provides energy efficiency advisory services and rebates for residents. The program has stimulated nearly US$17 million in private investments and reduced CO_2 emissions by over 16,000 tons. Boulder's EnergySmart model has now been copied by cities around the U.S.

SmartRegs places energy efficiency requirements on rental properties. Through this program Boulder has catalyzed nearly US$7 million in new investments and reduced CO_2 emissions by over 14,000 tons.

Finally, the Boulder Energy Challenge has made grants of nearly US$500,000 to foster the development of innovative community solutions for reducing CO_2 emissions, including an online portal for individuals and organizations working on climate action, and the of pilot of an inclusive renewable energy and energy efficiency workforce development program.

Through these and other climate action efforts, Boulder has reduced its emissions by 16% since 2005 – meaningful progress towards its goal of 80% by 2050. These programs also address Boulder's key resilience concerns of affordability and equity, since they offer the co-benefits of lowering energy costs for residents and encouraging community collaboration around climate action.

Chicago
Ready for 100: Transitioning Buildings to 100% Clean Energy

🌍 CLIMATE CHANGE

↗️ SCALE   🤝 PARTNERS   ⚖️ SOCIAL EQUITY

Chicago is the third largest city in the U.S. and a hub of culture and commerce renowned for its skyscrapers and museums. Through the Resilience Strategy development process, the city identified poverty and socioeconomic inequality, and racism and racial inequality, as two of its most critical resilience priorities. Chicago's Strategy therefore grounds its goal of reducing city-wide greenhouse gas emissions in the potential equity impacts of its climate action efforts.

In tandem with the release of its Resilience Strategy in February of 2019, Chicago announced that it was joining the Sierra Club's Ready for 100 campaign, a national movement of communities committing to a just transition to 100% clean energy. Chicago's Ready for 100 commitment formally establishes goals of transitioning to 100% renewable energy in buildings across the city by 2035, and of transitioning to an all-electric city bus fleet by 2040.

The City Council resolution committing Chicago to these goals is grounded in its resilience-building commitment not only to lower the city's environmental impact, but also to further social and economic justice. Accordingly, the resolution calls on the city to weigh cost effectiveness, equity, displacement, and economic development in seeking to ensure that the multiple benefits of an energy transition accrue to all residents. The resolution directs city purchasing towards clean energy companies committed to hiring historically disadvantaged workers and displaced fossil fuel industry workers under fair working conditions. It also holds that Chicago should engage communities in order to determine the principles of a just transition, use metrics to measure equity in that process, and develop a meaningful feedback process. Finally, Chicago must ensure that environmental and public health policies center the disproportionate impacts likely to be experienced by low-income communities and communities of color.

This bold commitment captures Chicago's intention to make immediate progress on its Resilience Strategy's suite of initiatives aimed at lowering emissions while also increasing equity – to be accomplished in close collaboration with key stakeholders, various institutions, community organizations, and local residents.

Santiago de Chile
Waste to Energy

CLIMATE CHANGE

DATA AND TECHNOLOGY   ECONOMIC DEVELOPMENT   SOCIAL EQUITY

The Metropolitan Region of Santiago is by far the most densely populated area of Chile. Expected to exceed 7.5 million people by 2020, it claims over 40% of the country's total population. Solid waste management is a chronic stress for this growing city. While waste management and other environmental regulations do exist, challenges persist due to lack of centralized coordination amongst municipalities, a lack of long-term management plans, and poor public awareness of or participation in recycling programs. Every year the region generates three million tons of solid waste from residential sources, of which 98% is sent to any one of only three land-fill sites, two of which will soon reach their recommended operating capacities. The stress of social segregation in Santiago is exacerbated by the fact that the three landfills are located in low-income areas, as are other hazardous industries. The city also has a number of illegal landfills and dumps, also concentrated in vulnerable neighborhoods.

Above all, Santiago has a waste storage problem. But landfills the world over, particularly ones that are illegal and ill-managed, are also significant sources of the greenhouse gas methane – which is a far more potent warming gas than CO2. Cities seeking to reduce their climate impact must include solid waste management in that effort.

Thus, to build its overall resilience, Santiago is scoping the introduction of modern waste-to-energy technologies – a single solution that could bring the multiple benefits of alleviating its waste storage problem, reducing the burden of waste storage that disproportionately falls on poor neighborhoods, mitigating its climate footprint, and even improving the resilience of its energy systems. The initiative could also help reduce costs in transportation and disposal compared for the municipality.

The Waste-to-Energy initiative consists of the planning, design, and operation of a plant that will turn waste into usable electricity, heat, and steam, which can be used by the plant itself or sold to other users. The city has completed a pre-feasibility report; follow-up activities required to approve the project include conducting a full feasibility study, with environmental and economic analyses, and a regulatory framework analysis. The technology could be scaled from producing 7-8 megawatts of energy from 150,000 tons of solid waste per year, up to 60-65 megawatts from one million tons. The investment in the plant will be coupled with efforts to better coordinate waste management between municipalities, and to promote recycling among residents, potentially leveraging the city's 1,500 green areas as public drop-off points and education nexuses.

Tel Aviv / Yafo
Using the Resilience Accelerator to Address Urban Heat

CLIMATE CHANGE

SCALE   PARTNERS   SOCIAL EQUITY

Home to nearly half a million people, Tel Aviv-Yafo is a lively and innovative city located on Israel's Mediterranean coast. It is the second most populous city in the country after Jerusalem, and the economic and technological center of the country.

In 1925 Tel Aviv-Yafo commissioned a Scottish biologist, sociologist, and town planner by the name of Patrick Geddes to design and implement a master plan for the city. A key feature of Geddes's plan was to address the city's innate risk of high heat by circulating traffic along "mainways" connected by smaller roads that together served to funnel cool offshore breezes into the center of the city.

But Tel Aviv-Yafo has grown and sprawled substantially in the years since, such that the original Geddes plan now makes up less than 10% of its urban area. Thanks to the build-up of business parks and dense residential areas, combined with the effects of climate change, Tel Aviv-Yafo today is at significant risk from decreasing rainfall and increasing urban heat island effect, resulting in many days per year of extreme heat. Moreover, there is observable inequality in residents' access to green and open spaces, with the city's most vulnerable populations disproportion-

ally affected. Through the Resilience Accelerator program, the City of Tel Aviv-Yafo entered into a partnership with 100RC, Tel Aviv University, and the Center for Resilient Cities and Landscapes and the Center for Climate Systems Research at Columbia University. The partnership pioneered a new method of identifying and studying the areas of the city most exposed to heat impacts, and then designing pilot projects that would not only mitigate those impacts but also simultaneously build a network of community planners and leaders who can share knowledge and help scale best practices to achieve a more resilient Tel Aviv-Yafo.

Working with a number of climatologists and technical experts, the Resilience Accelerator team's initial findings will include creating climate projections for the city through the 2080s, mapping land surface temperature and the social vulnerability citywide, and articulating the next steps necessary to apply an understanding of localized impacts to future adaptation strategies.

This effort is producing accurate projections and original data looking to 2080 for the first time ever in the city. The projections will be used to inform multi-disciplinary interventions, and the

valuable data produced and the programs developed will be the basis for the city's overall Climate Change Adaptation plan.

With the new ability to accurately map the city's hot spots and analyze them against social vulnerability indicators, Tel Aviv-Yafo will explore possible solutions in prototypic sites and refine the concept for a scaled urban heat island mitigation program. The overall aim of the work is to increase social equity in the southern part of the city and improve quality of life for those who live in and/or frequently visit its hotter, lower-income, and more vulnerable neighborhoods. The pilot is considering a community center, a children's school yard, a mixed-use main street used by commuters, and other key public spaces that will connect the climatic heat issue with the various social and economic related challenges facing Tel Aviv-Yafo and ameliorate them both through cohesive interventions.

The city's resilience effort is a successful example of silo-breaking, introducing a multi-layered new way of collaborating within the city administration. This model is already on course to drive changes in budget allocation methods, and is considered replicable and scalable nationwide, particularly given Tel Aviv-Yafo's position as Israel's technological capital.

100RC Tool

Resilience Accelerator
Connects cities with design talent at Columbia University and a global network of resilience practitioners and researchers to expand the resilience value of projects, deepen relationships between project teams across sectors, and accelerate implementation strategies.

Universities and scientific institutions have enormous capacity to support cities to become more resilient but lack the structures to do this. The Resilience Accelerator provides the framework to do this.

Having the best available scientific understanding and high-quality design at the front end of resilience project development leads to better outcomes for cities and the communities they serve.
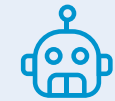
Data and Technology

When it comes to data and technology, cities engaged in resilience-building are presented with two distinct work streams. The first harnesses the capabilities of data and new technologies to build the resilience of the city as a whole. The second is often called "cyber-resilience" – building the resilience of critical data and IT systems themselves.

The ability of technology to play a meaningful role in better assessing and mitigating urban shocks and stresses is steadily increasing, as new products and services are brought to market and mature. Recent technological innovations – including cloud computing, data analytics, mobile communications, and social applications – are coming together to define the digital transformation of city operations and service delivery, and play a critical role in supporting urban resilience. Cities can leverage these new technologies to enhance decision-making, improve service delivery, crowdsource solutions, and engage with citizens more directly.

In addition, as cities, like the rest of society, transition more and more of their critical functions to digital technologies, the risks of any interruption to those systems grow. While traditional cybersecurity seeks to prevent cyber-attacks from disrupting IT systems, cyber-resilience looks one step further, incorporating resilience principles of redundancy, flexibility, and adaptivity to ensure that IT systems continue to deliver their intended outcomes in all conditions, from a successful cyber-attack to a power outage or natural disaster.

However, cities face challenges in taking full advantage of these new opportunities and integrating them into key municipal functions. Lack of executive support, inadequate governance models and policies, low levels of community engagement, insufficient business models for procurement and maintenance, uncertainties and emerging issues around architecture and privacy, and risks around security and digital rights – these shortfalls in particular limit the benefits cities can realize from the opportunities offered by data and technology today.
The two most important steps for cities seeking to leverage the full capabilities of technology to support urban resilience are to develop foundational infrastructure, and to foster internal and external cultures open to adopting new technologies, not to mention the cultural changes that these technologies will drive.

Da Nang
Adopting a Data-driven Approach to Disaster Preparedness

CLIMATE CHANGE   FLOODING   HOUSING

The port city of Da Nang sits on a long strip of low-lying coastline at the mouth of the Han River. Now the biggest metropolis in central Vietnam, the city is a rapidly growing hub for transportation, services, and tourism. But Da Nang's location also means that its weather is influenced by monsoon circulation, making it subject to frequent cyclones and tropical depressions, shocks that either trigger or aggravate chronic stresses such as flood-damaged housing, water shortages, unemployment, poor public health, and business continuity challenges.

Over the past few years, Da Nang has made major investments in urban expansion, hard infrastructure, and mobility, putting an increasing number of assets at risk of potential flood events. Compounded by the projected impact of climate change on Vietnam's South Central coast – where precipitation is expected to increase 1.5% by 2020, and 4.0% by 2050 (relative to the 1990s) – flooding has all too quickly become a substantial threat to the city's continued prosperity. Between 1998 and 2015, Da Nang suffered 33 major storms and an additional 46 floods, resulting in the destruction of nearly 150,000 homes and over US$400 million in losses. Still fresh in the memory of Da Nang's

residents is Typhoon Nari, which devastated almost 8,000 homes in 2013.

Motivated to mitigate such disasters, the city applied a resilience lens to its planning and preparedness models. This uncovered a need for better data collection on the impacts – especially the projected costs – of cyclones and the accompanying high winds, rainfall, and storm surges to which Da Nang is prone.

In 2016, the city released its Resilience Strategy, which outlines several key objectives within a vision for the city through to 2030. In particular, Da Nang aims to build infrastructure systems that can quickly bounce back from disasters, and thereby reduce fears about disaster safety in places where residents live, work, and play. The city also recognizes the importance of communication and data sharing to the creation of a thriving economy despite the threat of disasters. The Resilience Strategy proposes dialogue between the government, residents, and businesses that will enable everyone to manage risks more effectively.

To address all of these objectives concurrently, 100RC brokered a partner engagement between Da Nang and the Commonwealth Scientific and In-

dustrial Research Organization (CSIRO) of Australia, creators of the Visual Climate Adaptation Platform (VCAP) – a GIS-based platform that enables users like Da Nang to assess the impacts, costs, and benefits of various adaptation options that could reduce the vulnerability of housing and infrastructure to natural hazards. The VCAP is based on CSIRO's MetroEngines, a web-based decision-support tool that applies various scenarios of wind intensity and precipitation to spatial information such as topography, terrain, and shielding from the built environment, to highlight the areas of a city most susceptible to damage in a future cyclone event.

A four-month pilot of the CSIRO VCAP was undertaken in collaboration with the Da Nang Climate Change Coordination Office in order to assess the potential impact of cyclones on residential housing in two wards, Tho Quang and Hoa Hai. The study produced a highly granular visual map showing where exposure to climate risk was highest within Tho Quang and Hoa Hai, and how that exposure was likely to change over time. Potential decision points illuminated by the data included relocating residents away from low-lying areas, building stronger roof-to-wall connections, installing resilient building envelopes, raising building standards, building sea walls, and increasing floodwater retention and absorption capacities. The results also reflected cost-benefit analyses of these various options.

The collaboration between CSIRO Australia and Da Nang's Climate Change Coordination Office was one of the first times Da Nang has been able to translate its own data on disasters into usable planning information. This empowers the city to target its investments in housing retrofits and other risk-reduction measures much more efficiently, prioritizing damage hotspots and ensuring the highest avoided losses.

The VCAP data is also now supporting the development of new insurance models for Da Nang. Through 100RC, CSIRO Australia initiated discussions with ISET and Swiss Re to brainstorm how cyclone risk could be better understood, and how that information could be applied to a city like Da Nang to better prepare vulnerable populations.

Designers hope to transform the initial platform into a science-based decision-support tool for relevant stakeholders, which may include Da Nang's Department of Agricultural and Rural Development, Disaster Management Center, Water Resource Bureau, and Committee for Flood and Storm Control. Other technical departments – including the Department of Construction and the Department of Planning and Investment – should eventually be able to use the platform to inform the city's future development plans. By creating a single "master" map and dataset, the CSIRO VCAP will encourage city agencies to depart from their traditional models of siloed governance and management, and move toward a more collaborative working environment. It also facilitates citywide preparedness, as it enables a range of stakeholders to understand the anticipated extent of damage before calamity hits. The preventative measures taken as a result of the VCAP findings will equip residents and their businesses to function at full capacity despite adverse weather events.

Da Nang is now seeking funding to scale up the CSIRO VCAP pilot study. It proposes to investigate the vulnerability of its existing housing stock to flooding in all 56 wards in the city, to collect data on the attributes of individual homes and the historical storm damage inflicted on them, and to enhance the simulation's capability to model the impacts of storms on future housing stock under climate change scenarios through 2050.

Ciudad Juárez
The Role of Technology in Reducing Violence

ACTIONS   CHAMPIONS   SCALE

Ciudad Juárez is a city of 1.4 million people located on the U.S.-Mexican border adjacent to the city of El Paso. This urban metropolis is known as the Borderplex, a geographic location that makes Juárez a center of commerce for a host of products, including narcotics, between the U.S. and Mexico. As a result, Juárez suffers from endemic violence, which is frequently intensified by cartel instability or leadership changes. Recognizing this as one of the key challenges to creating a resilient Juárez, the city's Resilience Office has been looking closely at how to address the issue.

In light of the international implications of the crime and violence, the city's municipal police force is supported by multiple Mexican and U.S. agencies. To improve coordination between these various authorities and integrate resilience thinking into the management of the current crime operation center, the city convened local and international NGOs, city authorities, global firms, and 100RC member cities Colima and St. Louis for a two-day workshop. Participants assembled a comprehensive understanding of the wider systems related to the violence, including causes, challenges, and both previous and existing efforts for violence reduction. The workshop uncovered specific opportunities to leverage new technologies to improve public safety

infrastructure and supporting technical capabilities, which were then captured in a "Juárez Roadmap to Reduce and Prevent Violence."

To better take advantage of global best practices in crime-reduction technologies and data-driven decision-making, the city has been working closely with the Citizens' Observatory for Prevention, Security, and Justice. Funded by a public-private trust, this new institution uses state-of-the-art systems to collect and analyze data, producing reports of crime incidence and geographical distribution that contribute to improving inter-agency efficiency as well as data-driven decision-making.

Finally, another of Juárez's resilience goals is to improve overall social cohesion and make life safer for two of its more vulnerable populations – women and young people. To that end, the city created "safety corridors" for female pedestrians, leveraging newer technologies to install kiosks with video cameras and alarm buttons in crime hot spots. Juárez also launched a new phone app, No Estoy Sola ("I am not alone"), with which women can send emergency text messages to trusted contacts by just shaking their phones or touching a button.

European Union
Using Technology to Help Vulnerable Populations

PARTNERS   CLIMATE CHANGE   SOCIAL EQUITY

Extreme weather phenomena such as heat waves tend to disproportionally impact a city's more vulnerable populations, whether those vulnerabilities are due to age, social circumstances, or inequitable access to resources. With the modern problem of climate change exacerbating these risks, cities are turning to the modern solution of new technologies to ensure the safety and resilience of their most vulnerable residents.

100RC partnered with the National Observatory of Athens, Greece (NOA) to pilot, improve, and scale the EXTREMA Europe phone application. The "EXTReme tEMperature Alerts for Europe" service uses real-time satellite data paired with other model- and city-specific data to estimate the temperature, humidity, and discomfort index for every square kilometer in a city. Temperature estimates are updated every 5 minutes – a greater spatial and temporal resolution of data than any other existing tool. The app allows users to monitor the locations of the hottest areas in the city, and to see when and for how long the temperatures peak.

EXTREMA aims to improve the resilience of any individual to extreme temperatures by providing them, through their phones, with information about their personal risk levels, recommendations

for protection and relief, and directions instructions to the nearest cooling centers. It also aims to provide city authorities with tools to prepare for and manage heatwaves.

EXTREMA leverages the widespread use of smartphones to create a new digital infrastructure that raises risk awareness among the general public to help build resilient communities. The key innovation of EXTREMA is making existing scientific knowledge accessible and personalized to residents. Along with the mobile app for residents, EXTREMA provides a dashboard for city authorities to assess temperatures across the city and manage their cooling centers. After deploying the app for residents and the dashboard for city authorities as it was originally designed, cities such as Athens, Paris, Rotterdam, Lisbon, and Milan have begun innovating and expanding on the EXTREMA services to respond to their specific challenges. For example, 100RC member city Paris has enhanced the EXTREMA app with a function that allows residents to plot the "coolest" route from any point A to point B in the city, taking into consideration real-time temperatures and cooling centers along the route. A benefit of smartphone apps is that these innovative features can be quickly scaled up for use in other cities around the world.

New York City
NYC Data CoLab: The Role of Data in Mitigating Resilience Challenges

ACTIONS   CHAMPIONS   PARTNERS

NYC is not alone in recognizing the foundational role of data in helping to mitigate resilience challenges. Data, and the creation or enhancement of citywide data management systems, has emerged as a major cluster in the Resilience Strategies published worldwide by cities in the 100RC Network.

Located in the heart of Downtown Brooklyn, the New York City (NYC) Department of Information Technology and Telecommunications (DoITT) works daily to ensure effective data sharing across the complex "city that never sleeps," with its over 120 city agencies and over 8.6 million residents. The agency has taken up the mandate of OneNYC, the city's comprehensive Resilience Strategy, to expand its internal data integration capacity and build an integrated data platform for citywide use, in support of far-reaching goals ranging from expediting service delivery to reducing crime, from improving air quality to developing the city's workforce.

To advance its goals by leveraging the scale of the 100RC Network, NYC convened a 100RC "CoLab" in October of 2018. The global group that assembled for the three-day workshop included a cross-agency contingency from NYC, data and tech leads from Greater Manchester, Cape Town,

and San Francisco, and a host of experts from prominent local universities, civic tech firms, international thought leaders, and more.

A core component of a CoLab is the recognition that cities often begin designing solutions to a perceived need, but fail to unpack the root causes, barriers, or challenges that created the need in the first place. Limited understandings of problems can prevent urban solutions from achieving their anticipated impact. The NYC CoLab group therefore took an extensive look at the challenges of urban data use, and only then began developing potential solutions grounded in real, data-driven use cases from NYC's Office of Resiliency.

A number of actionable proposals emerged from the NYC CoLab's design and innovation sprint. One Account NYC envisioned a one-stop data portal offering an integrated experience for all residents, with accounts for every household. A Unified Data Response for stresses called for regular "stress charrettes" to take a deep dive on the chronic challenges identified by OneNYC and drive relevant data sharing between agencies, similar to the organized, citywide responses prepared for and activated in the event of a shock. And the Data Catalogue idea would address the fact that, under

current constraints, it is difficult for city employees to find the data they need and verify its quality; to reduce this "time to knowledge," the city would build a comprehensive catalogue of existing data sets from participating city agencies and make it available to all city employees.

Ongoing advances in cloud computing, mobility, big data, and software applications have significantly improved the value and technical feasibility of a city building and maintaining a centralized data platform. Overall, the CoLab group supported the hypothesis that such a platform is potentially a powerful tool for catalyzing urban resilience.

The Hague
Digital Cities and Cyber Resilience

DATA AND TECHNOLOGY

CHAMPIONS   ACTIONS   SCALE

In the 21st century it is incumbent upon cities to adapt their operations to the digital world. Digitization brings unparalleled opportunities to deliver services more quickly, more easily, and better tailored to residents and other stakeholders. But digitization also comes with risks – technical glitches, mismanagement, and cyber-attacks, as well as the risk of excluding citizens, entrepreneurs, and other smaller institutions who cannot keep pace with rapid developments in technology and data use. The adoption of new technologies and the digitization of city systems therefore needs to be conducted in a holistic and integrated way. While most cities are pursuing some degree of cybersecurity, given the fact that cities are responsible for delivering basic services to thousands or millions of residents daily, the principles of cyber-resilience are in fact a much better fit for cities' needs and goals.

The Hague leveraged its Resilience Strategy to advance its ongoing work on cyber-resilience and digitization spanning local, municipal, and international domains. Recognizing that the sharing of information and development of universal protocols between all stakeholders is critical to building cyber-resilience, The Hague's Resilience Team is playing a key role in the coordination and implementation of the work.

In The Hague's City Hall, cyber-resilience is being pursued at operational, strategic, and tactical levels. In terms of operations, five of the primary departments have internal information security officers who report to the Chief Information Security Officer (CISO). The CISO has an advisory role at the strategic level, both in procurement and in the municipal cyber strategy. As part of its long-term strategy, the city has developed a mentoring network in collaboration with nearby municipalities, to train talented graduates as public servants and give them experience in policy making on cyber-resilience and digitization issues. Also, at public "Hackathon" events, "ethical hackers" are invited to find vulnerabilities in city systems. And tactically, The Hague is scaling its awareness-raising efforts among citizens and municipal staff. The city works closely with schools and healthcare providers to ensure that both young people and senior citizens have the digital skills they need.

Finally, to learn at scale from cities around the world, The Hague initiated a cyber-resilience peer learning group with fellow 100RC member cities Atlanta and Greater Manchester, sharing best practices for preventing, responding to, and recovering from cyberattacks.

Earthquake Resilience

Earthquakes were responsible for an estimated 1.87 million deaths worldwide over the course of the 20th century. An earthquake is one of the most devastating shocks a city can experience, exposing in seconds the hidden vulnerabilities in a city's infrastructure and social fabric. Earthquakes occur every day, with up to 14,000 around the globe each year; most are either so small, or occurring so far from human activity, that they go unnoticed. But as the global urban population has multiplied dramatically, and with population growth occurring along major active fault lines, each year sees an increase in the number of people and the value of property and economic activity at risk from seismic events.

The seismic risk faced by a city is a combined function of three factors. Geology – both tectonic plates and local soil and substrate conditions – determines the likelihood and degree of seismic hazard for a given location. Density determines the number of people and the value of property exposed to a given seismic hazard. And vulnerability refers to the degree to which that people and property is able to withstand a given seismic hazard.

In cities, the collapse of damaged buildings and other major structures is the overriding cause of loss of life and economic value resulting from an earthquake. A relatively large earthquake can thus be felt by a large number of people yet lead to relatively little damage, if the structures impacted are able to withstand the seismic activity. The most vulnerable cities are those with the least resilient infrastructure, whether due to high quantities of older buildings, informal structures, or otherwise poorly built newer buildings.

Cities that pursue seismic resilience will not only increase their ability to withstand and recover more rapidly from seismic shocks. Building seismic resilience will also address chronic stresses – such as water scarcity, urban sprawl, and inequity – that can exacerbate seismic disasters when they occur.

Any city that faces high seismic risk must take steps both to prepare for and mitigate the impacts of earthquakes. Fortunately, many principles and best practices of seismic-resilient engineering and community preparation to minimize loss of life are highly transferable, so cities around the world can learn from each other and work at scale to build resilience. The application of resilience principles will ensure that resources spent on necessary seismic mitigation, preparedness, response, and recovery efforts generate co-benefits that will bolster the city's ability to thrive as a matter of course, as well as in moments of crisis.

Mexico City
Seismic Resilience Recovery Plan

CHAMPIONS   ACTIONS   POST-DISASTER RESILIENCE

Mexico City is a vibrant metropolis – the oldest capital city in the Americas, one of the largest urban areas in the world, and the largest Spanish-speaking urban center. Its land was originally settled by indigenous peoples over 700 years ago on an island in the middle of a large series of lakes. As the city grew through the colonial era and into modern times to reach 21 million inhabitants, it developed and expanded directly atop those lakes in a zone of high seismic activity – a geographic legacy that creates unique, compound challenges for the city's massive infrastructure and its residents.

On September 19th, 2017, Mexico City was struck by a magnitude 7.1 earthquake that caused the death of 228 people and damaged over 73,000 buildings, including 5,765 homes and 973 schools. The economic impact of that event is estimated at between 0.1% and 0.3% of Mexico's 2018 GDP, while the funds needed for reconstruction are likely to cost in excess of US$3.4 billion.

Though the damage in 2017 was significant, thanks to the city's investments in improved preventive protocols, early alarm systems, and emergency response capabilities, it was considerably less than that suffered in the magnitude 8.0 earthquake of 1985, when tens of thousands of lives were lost. However, the 2017 quake still revealed shortcomings in nearly every city system: transportation, governance, energy, communications, water, sanitation, and health infrastructure all failed to some degree.

As the threat of earthquakes is ever-present for Mexico City, city leadership is leveraging its resilience-building work and Resilience Strategy, released in September of 2016, to make further preparations for future seismic events. Recognizing the value that resilience-building had brought to the city already, city leadership tasked the Resilience Office with conducting a comprehensive review of the lessons learned during the 2017 event, examining how the different city systems and key assets had responded, and making specific preparedness recommendations for better protecting fragile infrastructure and saving lives.

Mexico City's Resilience Office is therefore preparing a Seismic Resilience Recovery Plan that will deliver a comprehensive blueprint for how the city can address its earthquake risk in a resilient manner. The Plan will not only assess emergency response capabilities for the immediate aftermath of a disaster but will also look ahead to what new plans and protocols the city could adopt for continued governance and the functionality of critical city systems. Already, this wide-reaching planning activity has proposed a number of projects and investment opportunities:

Resilient communities: The Plan recommends an effort to build response and recovery capacity in vulnerable areas of the city, by holding training and workshops for risk awareness, and encouraging communities to prepare their own tailored response plans. Mexico City will also leverage the scale of the 100RC Network to share community-focused emergency management best practices with cities such as San Francisco and Los Angeles.

Safe and resilient public space: As public parks and plazas were emergency gathering points and key sites for community organization during and after the 2017 earthquake, the Plan recommends an effort to map and characterize a list of sites that could serve as such in future emergencies and recovery periods, to formally designate and raise public awareness about them, and allow for better coordinated responses. The initiative requires participation from the private sector, city authorities, and organized neighborhoods.

Protocols for a resilient mobility system: With the support of 100RC and the World Resources Institute (WRI), Mexico City performed a diagnostic on the supply and demand of transportation services post-earthquake, and is developing a set of recommendations for implementing a comprehensive strategy for meeting post-emergency transportation needs that defines the roles of different key actors and strengthens coordination between relevant city authorities and the public. The resulting transportation plan will be integrated into a larger emergency response plan, which outlines a range of disaster scenarios for which the city is seeking technological solutions that would facilitate communication among both city actors and the public, and could help organize reconstruction efforts.

Resilience Plan for the Xochimilco Conservation Area: The Xochimilco Conservation Area is one of the last major green spaces in Mexico City, an area of unique cultural heritage, and an important water recharge area and climate regulator for the city as a whole. It is also home to one of the most vulnerable communities in the city, with high rates of poverty, flood risk, subsidence, and pollution. The Seismic Resilience Recovery Plan calls for the development of three major workstreams for Xochimilco: a map of vulnerabilities, a water resilience plan, and a private sector partnership for economic growth. Activities include modelling scenarios to evaluate seismic and geological risks and assess mitigation costs, creating a portfolio of projects to address different challenges including the protection of current water infrastructure assets, constructing new infrastructure to augment water supply and wastewater treatment capabilities, and creating a business incubator to boost local business and promote economic growth. All of these efforts combined will reduce the vulnerability of the area's population to natural disasters while protecting the natural environment. The initiative is being carried out with substantial public outreach, community engagement, and participatory design.

Preventive programs to reduce building vulnerability: A key workstream recommended by the Plan is reducing the seismic vulnerability of buildings across Mexico City. To date the workstream has been collating and assessing best practices for seismic retrofit efforts, reinforcement mechanisms, and financing strategies from around the

world. Mexico City took advantage of the 100RC Network to collaborate with city representatives from nine other member cities (Cali, Christchurch, Colima, Kyoto, Los Angeles, Quito, San Francisco, Vancouver, and Wellington), as well as 100RC partners from the non-profit, academic, and public sectors (Arup, Bain & Co., Build Change, CEMEX, Swiss Re, the World Bank, and WRI, among others). The city is currently working on a reconstruction program, the next steps of which include retrofitting an initial portfolio of buildings, and refining building and construction codes.

The next steps for Mexico City in completing and launching its Seismic Resilience Recovery Plan will be to support the assessment and development of planning recommendations while strengthening the multi-actor coordination capacity of the city's Resilience Office. Already, the city has made progress toward setting a legal framework for resilience-building, institutionalizing the Resilience

Office in 2018 and making the Resilience Strategy a legal document that city authorities are responsible for implementing. In addition, a chapter on resilience was included in the Risk Management and Civil Protection Law, which also allowed for the creation of a Resilience Council, led by the Resilience Office and formed with the objectives of strengthening inter-sector planning and coordination, and developing and implementing projects with multiple resilience dividends. All of these efforts to institutionalize resilience and change the way the city plans and acts in response to its major risks have facilitated the creation and scope of the Seismic Resilience Recovery Plan. In turn, that Plan will engender projects to build and upgrade infrastructure across the city, particularly infrastructure relating to water and mobility, as well as changes to building codes and new mechanisms for covering retrofit expenses and associated insurance burdens.

Deyang
Leveraging Seismic Expertise in the 100RC Network

〜〜 EARTHQUAKE RESILIENCE

⬈ SCALE   ◎ ACTIONS   ⚡ POST-DISASTER RESILIENCE

On May 12th, 2008 a magnitude 7.9 earthquake shook the Chinese province of Sichuan. Deyang, an industrial city of 3.6 million citizens located 50km from the epicenter, suffered severely, with widespread destruction of infrastructure and a death toll of 90,000 people.

The recovery and rebuilding of Deyang's infrastructure progressed efficiently, leveraging a Chinese system for intra-city funding to build 10 intra-city roads, additional greenways and public spaces, and a helicopter airport that increased the city's capacity for post-disaster transportation. Aspects of that recovery were supported by the China Centre for Urban Development (CCUD), a collaboration that resulted in Deyang pioneering urbanism and resilience in China, and eventually joining the 100RC Network.

Historically, Deyang's reconstruction efforts had always focused on the strength and efficiency of physical infrastructure. But in 2018, CCUD and 100RC co-hosted a resilience roundtable, during which Deyang reflected on its earthquake recovery experience with other 100RC member cities, including Christchurch. This was followed by a 100RC-facilitated Exchange program between the two cities to further share their knowledge

on seismic preparedness. Christchurch's own rebuilding strategy included extensive involvement of the community and the private sector, with heavy reliance on private insurance to recover assets. Christchurch also carried out a stakeholder engagement campaign, "Share an Idea," that incorporated a wide range of local voices into the city's long-term disaster preparedness plans.

Through these discussions with Christchurch, Deyang developed a more holistic and resilient model of planning for recovery, with an understanding of how community engagement, public-private partnerships, and decentralization can be effective tools for cost-sharing in rebuilding projects while also strengthening the city's social cohesion. This new focus on inclusiveness adds co-benefits and builds the city's resilience in general, not only in relation to seismic disasters.

Deyang's Resilience Strategy has carried this commitment to inclusiveness through to its current seismic preparedness efforts, which include creating a comprehensive database of buildings, retrofitting old houses to meet updated earthquake-resistant building standards, and establishing an advanced earthquake monitoring and early warning communication system.

Medellín
Informal Communities and Build Change

PARTNERS HOUSING SOCIAL EQUITY

Often known for its violent past, Medellín has risen over the last three decades to become a global example of urban and social transformation. Today, thanks to the collective work of its citizens, leaders, and public and private institutions, Medellín is a city where innovation and dreams flourish.

Between 1951 and 1973, the city's population tripled to over one million people. But along with population growth came chronic stresses such as poverty, poor planning, and insufficient infrastructure. These factors drove the city's most vulnerable residents to build unregulated houses on the precarious hillsides around the city center, prone to landslides and catastrophic impacts in the event of an earthquake.

As part of its resilience work, Medellín acknowledged that the safety of these informal communities is inextricably linked with the city's overall ability to thrive. Consequently, the city turned away from past policies that focused only on slum clearance, moving toward more humane and ultimately more practical investments in upgrading and formally incorporating the communities.

In 2016 the city began making seismic retrofits to slum homes while also strengthening residents' capacity and investment in their communities.

As part of 100RC's assistance to the city, Medellín's Resilience Office partnered with the nonprofit Build Change to create a manual that establishes the technical procedures and guidelines for retrofitting houses for earthquake resilience throughout Colombia. The National Association of Seismic Engineering approved the proposed guidelines, which Build Change then adapted to the specific context of Medellín, where financing was granted to pilot the retrofits on 50 homes.

Build Change also trained local builders in the communities alongside the city's engineers and contractors in the techniques and methods necessary to evaluate and retrofit the houses. The program thus bolsters the local economy, improves community risk management and awareness, and fosters a greater sense of community ownership among homeowners and local builders.

Along with the multiple benefits that accrue to families in safer retrofitted homes, a critical mass of retrofits will lower the risk to the city as a whole of

facing significant economic losses and causalities as the result of a major seismic event or landslide. Plans to retrofit a further 150 homes have already been developed, and are being overseen by the Social Institute of Housing and Habitat of Medellin.

Building on these successful efforts, the city anticipates seeking funding from the World Bank to expand the program to thousands of hillside households. The program is also connecting

homeowners to federal government subsidies for seismic retrofits. These efforts have been recognized nationwide as a replicable example of urban resilience-building. The Medellín Resilience Office is now providing input to the National Development Plan, through the national Ministry of Housing, to integrate resilience principles into national housing improvement guidelines.

San Francisco
Retrofitting Seismically
Dangerous Buildings

∿ EARTHQUAKE RESILIENCE

$ FUNDING   🏠 HOUSING   🌡 CLIMATE CHANGE

In 1906, an earthquake destroyed over 80% of the City of San Francisco, claiming the lives of over 3,000 residents. The city proved highly resilient, with reconstruction taking barely a decade, and the city taking advantage of the disaster to implement tougher building codes, rethink some of its streets and public transport for the 20th century, and foster entirely new neighborhoods in the city.

San Francisco's earthquake risk is ever-present, and the options for mitigating that risk today are much more advanced than they were over a century ago. As part of its resilience-building agenda, the city is therefore pursuing numerous avenues to reduce its seismic risk for the 21st century and beyond.

The Mandatory Soft Story Retrofit Program, created in 2013, is compelling owners of certain wood-frame residential buildings – among the most earthquake-vulnerable housing stock – to implement seismic safety upgrades. As over 115,000 San Franciscans live in such structures, the program began with a significant community outreach effort: all affected property owners were notified and required to return a screening form about building conditions to the city, which achieved a 99% response rate. Since then,

different types of buildings have been required to complete retrofitting work under a staggered compliance timeline, with all retrofits scheduled for completion by September of 2020.

San Francisco is also offering both public and private financing options to help affected property owners afford the retrofits, thanks to a partnership between city government, private banks, credit unions, and non-profit lenders. Named the PACE (Property Assessed Clean Energy) program, this funding mechanism was designed to allow the city to take advantage of these changes to its building stock to simultaneously make progress on its climate mitigation goals. PACE provides property owners with full financing, from an investor of their choice, for seismic upgrades as well as energy- and water-saving improvements. The program allows the property owner to repay the cost over time through a special line item on their property tax bill. This helps property owners enhance their property's value while making a contribution to the overall resilience of the city across a range of environmental and risk-related dimensions.

📊 **Economic Development**

The economic opportunities available in cities are arguably the single biggest driver of the rapid rural-to-urban migration that is ongoing around the world today. Urban areas account for a disproportionate share of global economic activity relative to their populations – 70-80% of Gross Domestic Product in most countries. A strong urban economy can create broadly shared prosperity for its residents, increasing equity, productivity, and innovation. An urban economic slowdown, on the other hand, can drive human capital flight and even bankrupt a municipality. An economy that fails to keep pace with population growth and provide dignified living and work conditions to residents will strain the city's infrastructure and create pockets of extreme poverty.

No city can ever fully control its economic destiny. National policies, international market trends, technological change, and geographic location all play significant roles. But given the ease with which people and businesses can migrate between cities, good governance and economic resilience become matters of competitive necessity.

Urban economic resilience is the ability of a city and its metropolitan economy to adapt and grow in ways that address the city's chronic stresses and exposure to shocks. Resilience involves not only stabilizing local economies and advancing economic growth, but also ensuring that the benefits of growth serve to build the resilience of the city's households, communities, businesses, and institutions. A resilient urban economy allows a city to thrive – and, in a positive feedback loop, increases the city's overall economic potential.

Integrating resilience into local economic development strategies and initiatives requires measures to reduce, mitigate, manage and/or transfer the risks associated with acute, exogenous shocks to the economy – such as natural hazards, market cycles and volatility, currency risk exposure, and political risk – while simultaneously addressing the chronic burdens that stress a city's productivity and economic potential. Examples of such efforts include enhancing transport infrastructure in ways that both harden it against terrorist attacks and boost access and efficiency, providing new insurance mechanisms and instruments for both big businesses and individual households, integrating the economic activities in the city's formal and informal sectors, investing in education, public health, and workforce development, strengthening interinstitutional collaboration, and improving policy transparency and stability.

Addis Ababa, Belfast, & Tel Aviv-Yafo
Building Sustainable Economies through Alternative Financing

PARTNERS   SCALE   DATA AND TECHNOLOGY

Cities across 100RC's global Network have articulated a demand for innovative methods of facilitating local economic and social interactions in ways that elevate vulnerable social groups and build social cohesion. But the marketplace of such tools has been limited to date, so 100RC prioritized the exploration of financial technologies for inclusive local development as one of the challenges it put to the 2018 CityXChange Summit. CityXChange Summits bring together city leaders and technology innovators from around the globe to collaborate on solving tough challenges to urban resilience. The Israel- and UK-based startup Colu Technologies Ltd. responded to this challenge with its digital service of local currency.

Local currency – place-based monetary tools for building sustainable local economies – has been on urbanists' radar for many decades. New technologies can now supply alternative currencies in digital form, making the adoption and use of local currency much easier for cities. Such technologies can bridge the gaps between city administration, social giving, and economic development, while building economic resilience in the form of redundancy at the local scale.

Colu's model specifically incentivizes behaviors that strengthen the economic and social well-being of a city by offering a digital local currency system deployed via a smartphone app, which conducts standard transactions and directs giving to selected causes. This digital currency, which can be spent at local businesses, is added to a resident's Colu Wallet app as payment for any of a set of defined actions that help meet community resilience priorities.

Following the 2018 CityXChange Summit, CROs and other senior policy makers from five 100RC member cities (Addis Ababa, Belfast, Cape Town, Milan, and Porto Alegre) were hosted by the Resilience Office of Tel Aviv-Yafo to take part in a workshop examining how a city-wide digital currency could help their cities become more resilient on the basis of their existing analysis of shocks and stresses.

The cities of Addis Ababa, Belfast, and Tel Aviv-Yafo all embarked on collaborations with Colu that are set to address a combination of economic and social vulnerabilities identified by their Resilience Offices.

Addis Ababa, in Ethiopia, seeks to become a middle-income city by 2025 by addressing chronic stresses including high unemployment, poor mobility, and environmental issues, and by fostering a competitive economy that further cements the city's role as Africa's diplomatic capital.

In alignment with the federal government, the city is seeking to leverage innovative technologies to realize this ambitious goal, and it has already had some success in doing so. For instance, it launched Lehulu Payment Service Centers through a Public-Private Partnership. This one-stop center lets residents pay all of their utility bills in one place, rather than traveling to three different places to settle them. Addis Ababa is also working to develop a city-wide knowledge management platform and online customer complaint and suggestion management system, the first to increase data sharing and coordination among cities' agencies, the second to improve residents' ability to communicate with the government and improve service delivery.

The city is also currently considering a pilot of Colu's city currency in the Arada district. Through this pilot, the city hopes to encourage the following behavioral changes:

Incentivize VAT compliance and improve tax collection: city residents will be encouraged to collect VAT receipts for business transactions and report them to the city tax authority using the Colu app. In exchange, residents will accrue a percentage of their shared invoices in the form of the new city currency, which they can then use to pay for and access municipal services – utilities, but also cultural services owned by the city such as theatres, cinemas, sports facilities, etc. The benefits for the city are higher tax collec-

tion and better VAT compliance from local businesses. The city is also looking into the possibility of using the Colu app to reward local businesses that pay their taxes on time.

Incentivizing recycling: residents will receive a public transport ticket in exchange for every three plastic bottles collected, thus contributing to a cleaner and greener city and incentivizing the use of public transport.

Incentivizing volunteerism: residents volunteering their time to work with local associations, mainly elderly care centers, will be rewarded with city currency.

For Belfast in Northern Ireland, building urban resilience will require supporting inclusive economic growth and strengthening the connections of residents to their city.

Belfast City Council and Colu are launching the Belfast Coin, which will operate as a rewards platform encouraging impactful behaviors that boost the city's economy and help meet environmental goals. Residents will accumulate Belfast Coins in return for activities such as shopping at local businesses, and engaging in practices of healthy living, recycling, volunteering, and other activities that contribute to the resilience of the individual and their community. The Belfast Coin is the UK's first city-wide digital currency designed specifically to encourage positive everyday activities.

Finally, for Tel Aviv-Yafo in Israel, increased urban resilience requires reducing the cost of living, strengthening the local economy, and increasing social responsibility and civic identity.

Tel Aviv-Yafo is collaborating with Colu on two month-long pilot projects, the first of their kind in Israel, to examine the feasibility of using a "digital city currency" as a reward system for people who frequent Tel Aviv businesses. In so doing, they are investing in a goal of the city's Resilience Strategy, and helping to bridge the gap between private enterprise and public policy.

All three cities hope that the adoption of an alternative local currency model – via new technologies that are relatively easy to set up, use, and administer – will represent a practical tool for residents and visitors alike, reducing social disparities, providing redundancy and flexibility in everyday transactions, and building social cohesion with a place-based sense of community.

Local currency – place-based monetary tools for building sustainable local economies – has been on urbanists' radar for many decades. New technologies can now supply alternative currencies in digital form, making the adoption and use of local currency much easier for cities.

The digital currency model is being explored in these three disparate cities as a potential mechanism for economic revival and equitable development, one that will demonstrate the potential of economic incentivization and alternative finance mechanisms to realize long-term resilience goals.

Dakar
#MadeinDakar

ECONOMIC DEVELOPMENT

CHAMPIONS   SOCIAL EQUITY

Dakar, on the Atlantic coast of Senegal, is a vibrant, artistic, and culturally rich city. Young people under the age of 35 are 72% of the city's population, which is expected to reach 1.6 million by 2025. These young residents are one of the city's greatest assets, but also pose a significant challenge to ensuring strong employment. At present, the city's demographic boom has outpaced economic opportunities for its youth, spurring urban poverty, and making efforts to address youth employment imperative to building the city's overall resilience and unleashing its full economic potential.

The informal sector contributes 42% to Senegal's GDP and employs nearly 50% of the working population. Through its Resilience Strategy development process, Dakar realized that achieving inclusive and equitable economic growth, particularly for young people, will require leveraging both the formal and informal economies.

Another insight from its Strategy development process was that 400,000 residents remain disconnected from the solid waste collection network.

Meanwhile, even those households with access to formal waste management have few opportunities to recycle. Of the waste generated in the city, about 21% is recyclable plastic and paper material. But city's ability to scale recycling or create a circular economy is stifled by limited access to markets for recycled products, compounded by negative social perceptions of recycled products, and limited support for companies to promote locally manufactured recycled products. Moreover, local products often face competition (in terms of price and quality) from imported ones, so Dakar's citizens consume fewer local products and tend to prefer imported products.

Applying a resilience lens to two seemingly unrelated challenges – unemployment and inadequate solid waste management – led Dakar to a new solution that would seek to address both at once, by boosting the manufacture and consumption of locally produced goods, particularly recycled or recyclable ones.

The city's #MadeinDakar initiative therefore creates markets for and fosters consumption of these products, with the double objective of reducing pollution and creating inclusive, equitable economic opportunity for the city's young, informal, and often forgotten economic actors. The initiative builds on an existing municipality-led incubator for informal economy actors, and seeks to grant market access to the city's entrepreneurs, artisans, and designers who currently struggle to find markets for their products and services.

The solid waste recycling sector is a focus for the #MadeinDakar initiative, given the opportunity to optimize sanitation management and expand the value chain for locally developed products, as current demand for locally manufactured recycled consumer goods is quite low. A key activity of the #MadeinDakar program therefore entails educating consumers to overcome their biases in favor of imported products, instead prioritizing local products when shopping. By engaging with both local formal businesses and informal entrepreneurs, this initiative will ensure the supply and availability of diverse high-quality products that provide a living wage for producers.

Circular Economy
"Traditional linear economies follow an extractive "take-make-waste" model of production. In comparison, a circular economy attempts to reduce or even eliminate waste and redefine growth, by decoupling value from the consumption of finite resources.

Circular economies are regenerative by design, and can be achieved through combinations of long-lasting design, maintenance, repair, reuse, refurbishing, and recycling."

Glasgow
Social Resilience: From Risk Reduction to Inclusive Growth

ECONOMIC DEVELOPMENT

CHAMPIONS   EDUCATION AND SOCIAL   SCALE
                   INFRASTRUCTURE

The City of Glasgow is a city in transformation. While its legacy as a post-industrial city presents unique challenges, the city has made considerable strides and is now an exemplar of sustainability in Europe. It is also a city of many firsts for the practice of urban resilience. Glasgow was the first city in the U.K. to appoint a Chief Resilience Officer and to release a Resilience Strategy, and an early pioneer of understanding and utilizing urban resilience as a method to deal with risk while addressing long-standing social vulnerabilities.

Glasgow is advancing the field of **social resilience** – the practice of holistic urban development through the lens of societal needs rather than infrastructure – both by incorporating social equity and health principles into city management and planning processes, and by coordinating with cities around the world on including such considerations of transformative city-management in the context of post-industrial city evolution.

Within Glasgow itself, efforts to build social resilience are well underway. The city is introducing social growth targets under the Glasgow City Deal, allocating £1.15 billion to develop an exemplar for Inclusive Economic Growth and Social Resilience. It is revisiting the purpose of infrastructure investments in the context of the Glasgow City Deal by introducing Inclusive Growth criteria. The inclusive growth diagnostic has revealed the following priorities:

- Costs and benefits of fair work practices (e.g. Living Wage)
- Basic digital skills and digital literacy
- Entry-level skills and work readiness
- Access to flexible, affordable, and good-quality childcare (0-16 years)
- Transport of people to workplaces
- Health and well-being, including mental health
- Advanced digital skills in the local population

Finally, with actions such as Improved Transport to Address Social Isolation, Glasgow is integrating its resilience practice and Strategy into the Glasgow Community Plan, as well as into the Resilient Communities Pillar Priority for the City of Glasgow Action Plan 2018-2020.

From the finalization of Glasgow's Resilience Strategy in March of 2016, to the Strategy's official release in September of 2016, and on into 2019, the City of Glasgow has led the way in Scotland toward shaping the national strategy for resilience, and keeping social resilience at the forefront.

Kigali
A Center for Urban Excellence in Africa

ECONOMIC DEVELOPMENT

SOCIAL EQUITY   ACTIONS

Located in the heart of Rwanda, Kigali is the country's largest city, political capital, and most prominent business and administrative center. Kigali has grown rapidly since the Rwandan genocide, enjoying significant economic and industrial expansion. The city's ability to bounce back after such a tragedy is an inspiring story of how visionary leadership and effective public sector management can contribute to fostering resilient nations and cities. Today, the city faces a complex set of new challenges. Current projections estimate Kigali's population of 1.6 million to more than double by 2050.

This unprecedented growth has compounded underlying stresses of unplanned settlement, lack of affordable housing, urban encroachment on sensitive agricultural land, inadequate service provision, and unemployment.

A key stress the city faces, highlighted in its Master Plan, is a lack of gainful employment, particularly for young people. Every year hundreds of college graduates enter Kigali's largely saturated job market, and many of them find that they are unable to match their new skills to the few available jobs. The city's administration is committed to making Kigali a center of urban excellence in Africa, and is taking a new approach to integrated economic

planning, coupled with tactical efforts. Various resilience-building measures are already underway, with more in the pipeline. For example, the city is investing in transport infrastructure such as new roads and dedicated bus lanes. It is providing free exhibition space for "Made in Rwanda" products produced by young entrepreneurs and vulnerable women. Since 2012, the Kigali Employment Service Centre has worked with thousands of job seekers annually to build their skills according to market demands. And an "own a business" program encourages the creation of cooperatives and provides loans for small and medium business enterprises. Targeting vulnerable street vendors and people with physical disabilities, the program has contributed significantly to countering delinquency.

Together, these interventions increase access to jobs, create more productive jobs, connect workers with markets and employment, and provide tailored workforce development services for residents, especially the most vulnerable. Finally, since joining 100RC and embarking on the Resilience Strategy development process, Kigali has begun to mainstream resilience into its other city strategies, ensuring that integrated and holistic planning will permeate its economic development efforts.

Quito
ZEDE Quito: Special Economic Zone

ECONOMIC DEVELOPMENT

FUNDING   TRANSPORT AND MOBILITY

A priority of Quito's resilience agenda is to make its already strong economy more diversified, sustainable and innovative. The city's social capital is characterized by a long tradition of ingenuity, solidarity, collaboration, and participation in decision-making processes for the benefit of its diverse communities. But with one in two Quiteños under the age of 29, and an economy highly dependent on external factors such as oil prices and commodity export markets, Quito urgently needs to overcome its lack of job opportunities and a persistent mismatch between job training programs and the demands of the job market.

To build its overall economic resilience, the city aims to attract investment, generate demand for skilled employees, and incentivize value-added production. City leadership is committed to incentivizing the production of higher value goods and leveraging the productivity of their young population.

Quito has set the goal of establishing a Special Economic Zone (ZEDE Quito) on 207 hectares of land near the new Quito International Airport – connectivity to be complemented by investments in high quality road infrastructure

leading throughout the country. The development of ZEDE Quito will coincide not only with the opening of the new airport but also with the construction of the city's first metro line. The integration of this new transport infrastructure with existing mobility systems represents a historic opportunity to rethink urban development and its dynamics.

As part of the establishment of ZEDE Quito, the city will create new taxes, tariffs, and customs incentives to attract investments and increase the competitiveness of targeted economic sectors. ZEDE Quito will in turn create new supply chains and increase exports and employment in the city by centralizing logistical services and other benefits such as cost reduction, international competitiveness, and tax benefits to a single location. ZEDE Quito will be a concerted hub of innovation and the leading edge of city-wide efforts for economic resilience.

Salvador
Diversifying Economic
Opportunities

ECONOMIC DEVELOPMENT

SOCIAL EQUITY   ACTIONS

A city of nearly three million people on Brazil's northeast coast, and capital of the state of Bahia, Salvador is a prominent international port of commerce, renowned for its culture, climate, and colonial architecture.

But the city's strong overall economy masks significant socioeconomic inequalities, including a large informal sector and high unemployment rate. Salvador is also highly reliant on the two industries of trade and tourism, leaving them vulnerable to economic shifts or crises in these sectors. As a result, in 2018 the Resilience Office of Salvador formed a partnership with the Avina Foundation, a Latin America-focused philanthropic effort, to launch the Latin American Resilient Cities Initiative on Resilient Economies.

Through this initiative, Salvador held a series of workshops in which a range of stakeholders collaborated to identify Salvador's existing economic assets, key risks to its economic resilience, and pathways along which the city could make its businesses more resilient to external shocks and underlying stresses. This effort arrived at two key insights: that to build its economic resilience, Salvador will need to diversify its economy beyond commerce and tourism, and that to build

its overall resilience it will need to foster innovative businesses that improve environmental sustainability while also reducing the socioeconomic vulnerability of marginalized groups.

Salvador's Resilience Strategy thus contained a vision for "Creating Value for the Private Sector." In pursuit of this vision, the city held a workshop to understand the private sector's perception of resilience, and to raise awareness among private sector actors of how resilient thinking could be integrated into their own strategic plans.

Salvador then mapped the companies and existing corporate initiatives that would contribute to building the overall resilience of the city, such as recycling and waste reduction efforts along a production chain, programs that integrate people of color and of lower social classes into the formal economy, and technical courses and other workforce training opportunities for youth and young adults in vulnerable communities. The city is now considering ways to strengthen those initiatives.

Finally, the city is holding two open calls for start-ups to enter incubators, one on circular economies and one on women's entrepreneurship. The

incubator on circular economies aims to develop technologies, methodologies, and solutions for economic activities in the food supply chain, waste management, and water and sewage treatment sectors. Both incubators will be housed at Colabore, Brazil's first public co-working space for micro-enterprises, micro-entrepreneurs, start-ups, and others who have social impact solutions for the city that will contribute to the achievement of the 17 Sustainable Development Goals of the United Nations.

These two incubators make explicit links between Salvador's economic development goals and its environmental and equity goals, and demonstrate how a single intervention can be capable of delivering multiple co-benefits and contributing to the overall resilience of the city.

Salvador will need to diversify its economy beyond commerce and tourism, and to build its overall resilience it will need to foster innovative businesses that improve environmental sustainability while also reducing the socioeconomic vulnerability of marginalized groups.

Education and Social Infrastructure

Social infrastructure – schools, universities, hospitals, community housing, libraries, playgrounds, and even prisons – provides residents with critical municipal social services such as education and healthcare, improving overall quality of life, creating social cohesion, and contributing to reductions in inequality across diverse communities. Given its centrality in resident's lives, cities should apply a resilience lens to the way they design and manage their social infrastructure.

In the case of schools, education is recognized as a fundamental human right that empowers individuals and allows them to fully self-actualize within the economy and society; resilient cities will ensure access to education for all residents of any age. As social infrastructure, schools are often considered only in terms of a primary, limited set of users – the students. But given the fact that most residents of any city live within walking distance of at least one school or education center, these sites can look beyond education to play diverse roles in the lives of every resident, and thus can be leveraged to meet a city's broader resilience goals.

A public school infrastructure system that is planned, designed, and implemented through a resilience-based process will not only provide high quality education to students, but will also experience limited service disruption in an emergency, and will be programmed to serve the broader community beyond its students. School infrastructure achieves this by linking together long-term planning and disaster risk management, education policy and pedagogy, infrastructure design, facilities operations and management, and community engagement. This process requires new forms of collaboration across different scales (country, city, community, school, family) and across traditionally siloed government functions.

Co-designing these spaces together with various local stakeholders generates a deeper mutual understanding of needs and opportunities, and greater buy-in for the chosen solutions. Schools are well-defined spaces where parents, teachers, service providers, and their neighbors can all work together to design for the future of their children and wider community. This type of solidarity and collective action among residents creates a shared sense of belonging and contributes to integration among different groups. Building community and social cohesion among an educated population is a critical factor in cities ensuring that their communities are prepared to weather the known and unknown challenges of the future. Thoughtfully designed social infrastructure, paired with effective delivery of critical social services, allows cities to harness the value of their own assets to build resilience in their communities.

Cali
Mi Comunidad Es Escuela

EDUCATION AND SOCIAL INFRASTRUCTURE

EARTHQUAKE RESILIENCE   ECONOMIC DEVELOPMENT   FLOODING

Santiago de Cali, in the Pacific region of southwest Colombia, is the third largest city in the country, with a population of about 2.4 million. Founded in 1536, it is among the oldest cities in the Americas.

Between 1970 and 1990, Cali endured one of the most difficult periods in its history due to the armed conflict throughout Colombia as a whole, as well as the prominence of drug trafficking in the city. Many people displaced by this nationwide social upheaval moved to Cali during that period, and the city as a result suffered violence, corruption, and unregulated, unplanned growth – the effects of which are still reverberating today.

But the situation across Colombia has stabilized significantly over the last two decades, allowing Cali to finally pursue strategic visions for the future, rather than having its energy consumed by daily stresses. One such initiative is the Territories of Inclusion and Opportunities (TIO) program, which directs private and public investment to the most vulnerable neighborhoods of the city.

Convinced that education and strong social infrastructure is key to reducing violence and building the city's overall resilience, Cali developed a very ambitious plan to invest US$156 million in improvements to school buildings and overall education through its groundbreaking *Mi Comunidad es Escuela* ("My Community My School") program, which is overseen by the TIO. Initially envisioned as merely a seismic retrofit to school buildings, the application of the resilience lens to the work has expanded it significantly, and *Mi Comunidad es Escuela* now aims to make Cali's public schools into engines of positive social change by improving both infrastructure and curricula.

The work is motivated by the fact that Cali's public-school system has significant gaps in its educational performance. In domestic standardized tests, 50% of public grade schools were rated deficient, compared to only 34% of private institutions. Additionally, Cali sits on 48 fault lines and is the most vulnerable of Colombia's major cities to earthquakes. Yet almost all of Cali's public educational infrastructure was constructed over 35 years ago, before Colombia had developed building codes with design provisions for seismic risk, and thus Cali's

schools are not adequately built to withstand such a shock.

Launched in 2017, *Mi Comunidad es Escuela* has pursued improvements along five fundamental vectors of school quality: school management, curriculum development, teaching practices, facilities, and each school's relationship with its community. The program has also been offering culture, arts, sports, and technology training and enrichment programs via the public schools, and for the first time these offerings are available not only to students, but also to the teachers, directors, administrators, families, and surrounding community members who make up the environment of the school as a whole. Each individual school has also launched its own efforts, designed in collaboration with surrounding communities, to improve student experience.

The impacts of *Mi Comunidad es Escuela* are already being seen in just two years, with absence and drop-out rates decreasing, more families taking part in school activities, and data indicating improvements in school climate and relationships between teachers and school directors.

To build on this initial success, Cali, in collaboration with 100RC, organized a series of capacity-building and stakeholder engagement activities with experts sourced from 100RC's Partner Network, in order to support the city in identifying ways that investments in school infrastructure, including the development of school design and operational recommendations, could be leveraged to further build urban resilience.

In early 2018 the World Bank, having participated in one of those 100RC workshops, committed to providing free technical assistance to Cali to implement the Bank's *Roadmap for Safer Schools*, a technical program that results in a long-term investment plan for school infrastructure. Through this program, Cali worked with the World Bank's technical team to survey each public school in the city, in order to understand its structural vulnerabilities and functional deficiencies. The partnership also conducted research on the regulatory environment and construction and building codes in the city. This information allowed the partnership to study and prioritize various possible interventions, both for retrofits and new construction.

As a result of that research, Cali is prioritizing investments into safety improvements and the modernization of schools, including expanding public-school facilities to comply with national capacity standards, at an estimated cost of COP$2.72 trillion. The investment plan calls for replacing 69% of existing school buildings and will be paid for primarily with city funding.

Given the significant new construction envisioned in the investment plan, leaders of *Mi Comunidad es Escuela* decided to develop a 'Catalog' for new, permanent school infrastructure, which will translate national educational infrastructure requirements to local conditions, and will ensure quality and efficiency through the creation of replicable processes and design and construction standards. The Catalog will include planning, design, construction, and programmatic guidance for early childhood education centers, primary schools, and secondary schools.

The Catalog will apply to the diverse terrain and varying rural and urban contexts within the municipality, setting standardized practices when possible and making key distinctions when needed. In addition to serving as a guidance document for school design public tenders in Cali, the Catalog is expected to complement the municipality's Master Plan for Educational Facilities, which is currently under development and will serve as a complement to the city's current land-use plan. Resilience is a key focus of the Catalog, not only in terms of promoting hazard-resistant construction techniques, but also in identifying processes and design standards that provide multiple benefits – including long-term social, environmental, and economic value – to the users of the schools as well as the wider communities in which the schools are located.

In May of 2019, 100RC convened a team of international and Colombia-based partners to support Santiago de Cali over a two-month period in co-developing a conceptual framework for the Catalog that aligns with the city's wider resilience objectives. The team consisted of experts from AECOM, Build Change, Perkins + Will, Save the Children, and WSP, all of whom offered their services on a pro bono basis.

Due to the diverse location, social, and programmatic conditions across the portfolio of public schools in Cali, the team concluded that it would be challenging to design a limited set of "model" schools or replicable typologies for the Catalog. Instead, they determined that the Catalog should document a planning and design process that could apply across a diverse range of conditions and provide guidance and decision-making support for the design of a variety of school conditions. The team also decided to quickly pilot a conceptual design for one existing school in the city as a "case study," and to work side-by-side with the city to document that process for the Catalog. The Cristobal Colon School, located in the 16th district of Cali, and serving a diverse student body population in Grades 5-11, was selected for the case study because it embodies a number of conditions and constraints present in many schools in the city, which the team collectively decided were important to study and address. These include a limited site size, inadequate recreational spaces, poor drainage, high maintenance costs, a lack of redundancy in building services, and challenges related to natural light, ventilation, acoustics, and rain intrusion into buildings. The case study also offered opportunities to enhance the relationship between the school and its neighborhood.

In July of 2019, the 100RC expert team issued a report documenting both the design process as well as specific site and building drawings, details, and renderings for the conceptual design of the Cristobal Colon School. This report will support the city's efforts to develop a replicable process for the design and construction of new public-school infrastructure that builds urban resilience over the next decade in Cali.

Cali's work is unique in Colombia, and the Minister of Education has designated it a pioneering model for the entire country. *Mi Comunidad es Escuela* sits within the overarching vision for education in Cali's Resilience Strategy, which aspires to see graduates of public education institutions equipped with the socio-emotional, academic, and work skills needed to lead a successful life, contribute to society, transform their environment, foster coexistence, and strive for dignity, fairness, and social equality.

Chennai
Green Infrastructure Vision for Civic Engagement

EDUCATION AND SOCIAL
INFRASTRUCTURE

CHAMPIONS   NATURAL ASSETS AND
NATURE-BASED INFRASTRUCTURE   WATER AND SANITATION

In recent decades, population growth and demographic changes have burdened the City of Chennai with the stresses of environmental degradation, poor waste management, insecure water supplies, and declining civic participation. To address these challenges holistically, the city launched an Urban Horticulture initiative that will create rooftop vegetable gardens, particularly in schools, to engage citizens meaningfully with their natural environments.

The initiative calls for investments in green infrastructure paired with awareness programs encouraging citizens to take responsibility for environmental issues in their city. Three workstreams will spur civic engagement among various groups of residents. Urban Horticulture will establish scale-up rooftop farming through a citywide strategy involving stakeholders such as Residential Welfare Associations. Students of 299 city corporation schools will be encouraged to take up rooftop farming, promoting nature-based learning and supplementing the state government's Nutritious Meal Program. The initiative will also conduct training and outreach programs in Chennai's parks, to educate neighborhood residents about rooftop gardening and composting. Together, these

actions will engage residents with the city's environmental challenges, promote water conservation and better waste management, and demonstrate how actions such as rooftop gardens can contribute to resilience building.

To implement this project, the CRO's office is working with multiple agencies and departments of the city and state governments, as well as local non-profits, associations, and private actors. Through the 100RC Network, Chennai also entered a partnership with students from the Global Network for Advanced Management of the University of British Columbia, in order to leverage their expertise in designing the intervention, ensuring that civic participation and engagement were at the heart of the work.

In 2018, the Urban Horticulture initiative featured as one component of the Chennai Smart City Ltd.'s "Model & SMART Corporation Schools in Chennai," the city's entry into a nationwide Smart Cities competition. Chennai won that competition, receiving US$10.9 million of grant funding from the French Development Agency (AFD), a portion of which will support implementation of the rooftop gardens in select schools.

San Francisco
Applying a Resilience Lens to Comprehensive Campus Planning

EDUCATION AND SOCIAL
INFRASTRUCTURE

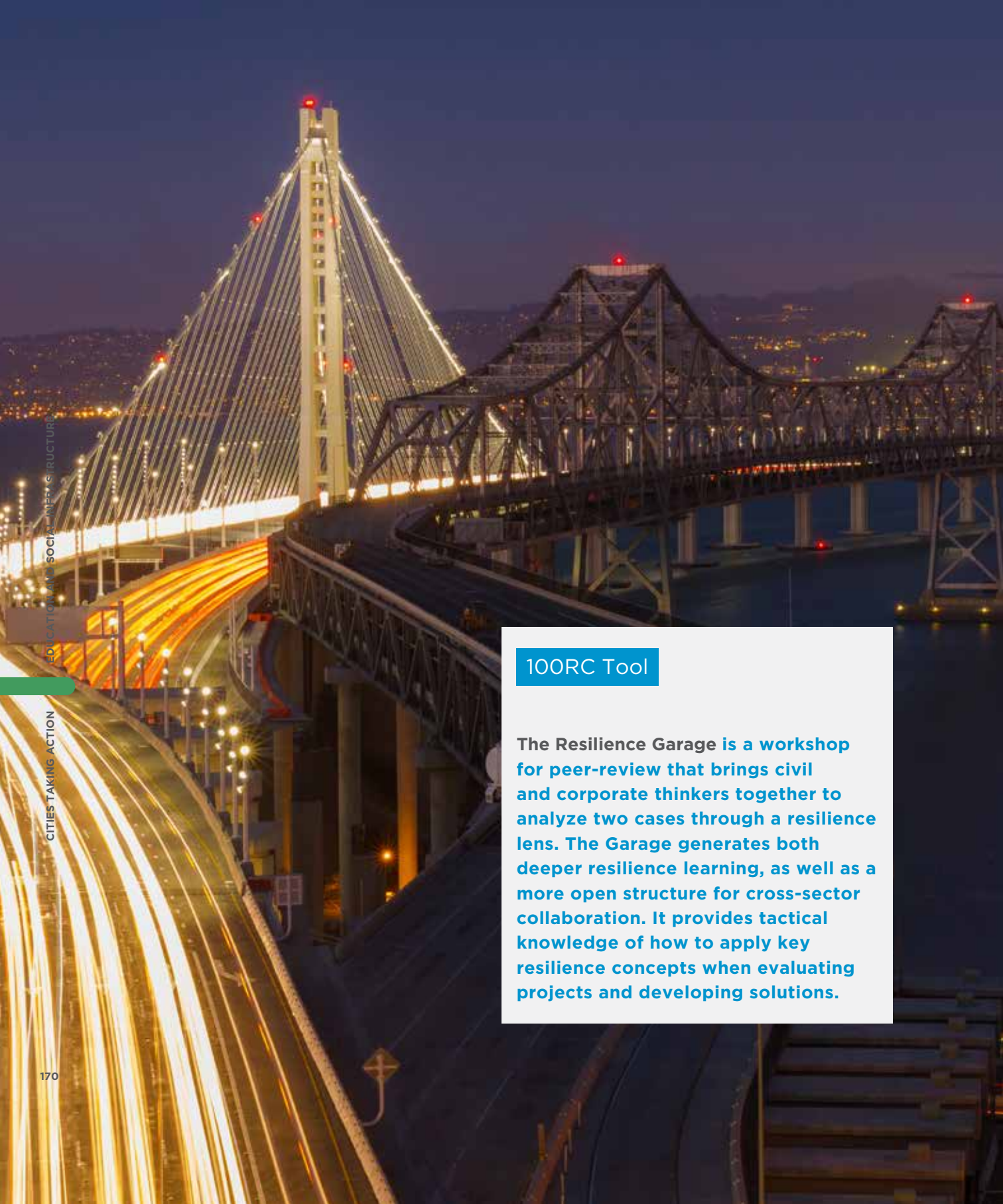CHAMPIONS   PARTNERS   SCALE   RESILIENCE DISTRICTS

The University of California, San Francisco (UCSF) is one of ten campuses in the University of California system and the only one devoted exclusively to health sciences. With a total campus size of 225 acres, UCSF is the second largest employer in San Francisco and operates the largest network of health services in the city.

In early 2018, 100RC and Perkins + Will, an American architecture and design firm, partnered with UCSF to test the application of urban resilience tools in a sub-city context. The team agreed to apply two tools – the Resilience Garage and the Resilience Scan – to UCSF's Long-Range Development Plan update, and specifically to the Comprehensive Plan of the Parnassus Heights campus.

UCSF's goal was to apply a resilience lens to their comprehensive planning process, to identify both shocks and stresses it might not typically consider, and gaps or opportunities in its current system. Additionally, the university hoped to improve its relationship with the City and County of San Francisco, and to explore how UCSF's long-range planning could contribute to the overall resilience of the city.

To implement this project, 100RC first organized a full-day workshop – the Resilience Garage – to familiarize UCSF staff with the concepts of resilience, enhance the relationship between city and university staff, and create a better understanding of the challenges and opportunities at the Parnassus Heights campus. The successful implementation of this workshop created several influential resilience champions among UCSF staff. It was also a starting point for the greater campus planning process, as the report from the workshop was used as a primary input into the initial stages of the comprehensive planning process and served as the basis for including resilience concepts in the draft plan.

The second phase of this project was to assess the resilience value of the draft plan; in early 2019, 100RC ran a second workshop – the Resilience Scan, detailed elsewhere in this report – to do this. That workshop resulted in four high-level considerations that the planning team will use to improve the resilience value of the plan. Throughout this two-year process, UCSF expanded their understanding and valuation of resilience-building concepts, and as a result now plans to extend the resilience lens to other campus planning activities.

Tbilisi
Prioritizing Early Childhood Development Programs

EDUCATION AND SOCIAL INFRASTRUCTURE

ACTIONS **SCALE** **ECONOMIC DEVELOPMENT**

Tbilisi today is a vibrant, diverse capital city of 1.5 million residents, with a growing tourism sector and increasingly attractive as a business destination. However, it is confronted with a unique resilience challenge. The country of Georgia lacks comprehensive building codes, as a result of the deregulation that, following the collapse of the Soviet Union, aimed to boost investment and to remove all "obstacles" to fast and cheap construction. This has led to significant vulnerabilities in Tbilisi's built environment.

Tbilisi's CRO undertook an extremely robust, data-driven, and inclusive Resilience Strategy development process, which unearthed a specific risk within this challenge for the city – the structural unsoundness of municipal kindergartens. Moreover, the current capacity of kindergartens is insufficient to meet existing demand. In coming years new national legislation will enforce the retrofitting of all kindergartens in terms of size and service provision. Alarmingly, data gathered in the Resilience Strategy development process showed that a significant percentage of Tbilisi's 180 public kindergarten buildings are at risk of unprompted isolated collapse. The importance of early childhood education, including kindergarten, to outcomes through adulthood, is well-documented globally. Even with the best of teachers, an unsafe and under-resourced school building will negatively impact students, dragging down education and employment outcomes for the entire city in the long term.

With the support of 100RC, and inspired by fellow member cities Cali and Paris, the CRO of Tbilisi partnered with relevant city departments to develop a holistic and visionary program to address the issue, elevating municipal kindergartens to the status of a top priority for the city. The program will create facilities using designs produced by experts but with input from the children themselves, increasing student engagement and reducing the likelihood of absence and disenrollment. The program will also take advantage of any opportunities to enhance new and retrofitted school gardens with additional green benefits and natural assets. By seeking out multiple perspectives and insights from cities around the world, and leveraging resources and expertise from multiple city stakeholders, Tbilisi's CRO gained the technical and political consensus needed to make investment in municipal kindergartens a top political priority that will have a profound impact on future generations of Tbilisi's citizens – a flagship resilience project.

100RC Tool

The Resilience Garage is a workshop for peer-review that brings civil and corporate thinkers together to analyze two cases through a resilience lens. The Garage generates both deeper resilience learning, as well as a more open structure for cross-sector collaboration. It provides tactical knowledge of how to apply key resilience concepts when evaluating projects and developing solutions.

⬆ Flooding

Floods affect more people globally than any other type of natural hazard. Over 734 million people have been affected by floods in the last ten years alone, with negative impacts on individual livelihoods and the ability of cities and countries to reach their development objectives.

Rising sea levels due to global warming, along with population and economic growth, are increasing the severity of flooding and the value of the assets at risk in cities worldwide, driving demand for flood risk forecasting and management. Urban areas with critical infrastructure such as utility networks, roads, and railways are particularly vulnerable to flooding, given the risk of cascading effects from a flood event to wide regions and markets. Over 80% of 100RC member cities have identified either rainfall flooding or coastal flooding as a critical challenge to their overall resilience.

Despite the prevalence of urban flood risk, cities vary widely in their actual risk profiles. Cities need a solid understanding of their unique flood risks and vulnerabilities, as well as knowledge of existing and potential mitigation measures. Having access to accurate and pragmatic information is crucial to proactive planning, community and stakeholder involvement, the selection of appropriate strategic interventions, and building flood resilience.

A number of solutions for flood mitigation, both long-standing approaches and new ideas, are available to cities around the world today, such as the optimal maintenance of dikes and other protective infrastructure, adherence to flood-aware building codes and land-use planning, and investment in blue-green and nature-based infrastructure. For example, rain is typically treated as waste, making it one of the world's most squandered natural resources; innovative approaches to rain management can prevent flooding and retain stormwater efficiently in water-scarce environments, reducing the need to pipe water from rivers, lakes or rapidly-depleting aquifers.

Many cities have significantly under resourced their flood management and are not accessing available solutions or scaling best practices. Failing to invest in risk reduction can turn hazards into disasters with devastating consequences. Cities must take bold, transformative action, both structural and non-structural, such as the promotion of community resilience in flood-prone areas, in order to reduce flood risk and build flood resilience. With increasing numbers of people and ever more resources exposed to growing flood risk in cities around the world, sound flood risk assessment supported by innovative flood risk management projects are fundamental to building urban resilience globally.

Montevideo
Pantanoso River Basin

⬆ FLOODING

🏠 HOUSING   🌿 NATURAL ASSETS AND NATURE-BASED INFRASTRUCTURE   〰 RESILIENT RIVERS   ⚖ SOCIAL EQUITY

The southernmost capital city in the Americas, Montevideo is situated on the north-eastern bank of the Río de la Plata. Representing over 40% of the total population of Uruguay, the city's more than 1.3 million residents enjoy what has been rated the highest quality of life in South America, with nearly double Uruguay's GDP per capita. Approximately 60% of the city's territory is rural, and while tourism has more recently become a major economic driver, the most important sources of income in Montevideo are domestic trade, logistics, and real estate.

Uruguay overall has seen tremendous improvements in recent years, reducing poverty from 26% of the population in 2006 to 8.3% in 2016 – but the Pantanoso region of Montevideo has not benefited at the same pace, leaving its communities poorer, with less access to opportunity, and living in an environment degraded by pollution, waste, and poor ecosystem management.

The Pantanoso River Basin covers approximately 77 square kilometers in the center-west of Montevideo before emptying into the bay. The stream crosses diverse zones, from agriculturally productive rural areas to more consolidated residential zones and a number of irregular settlements.

Home to around 195,000 people, 15% of the city's total population, the Pantanoso River Basin faces interrelated socio-economic and environmental challenges. Nearly a third of Pantanoso households fall below the poverty line, making certain neighborhoods in the Basin among the neediest in the city, with 33% of the population under 20 years old. The zone is characterized by a shortage of employment opportunities, poor education, low housing standards, and low social and community capital, as well as a lack of investment, and inadequate public infrastructure, connectivity, and green space.

Pantanoso's environmental problems include poor water quality, inadequate solid waste management, degraded wetlands, and high flood risk. These challenges are interrelated, as the informal settlements of the area contribute to the water pollution, while much-needed new investment is discouraged by the flood risk and the widespread perception of the area as generally degraded.

Historically, the Pantanoso area has been subject to numerous interventions implemented by the three different levels of government relevant to the zone (national, district, and local), but without the inter-institutional coordination necessary to

ensure that efforts do not duplicate or contradict each other.

The City of Montevideo has been working for over ten years with communities in the Pantanoso Basin to reduce the impacts of flooding on neighborhoods, and to broadly improve the watershed's social and ecological vitality and resilience. In 2007, the municipality of Montevideo launched preliminary studies and made investments to improve living standards.

The city's Resilience Strategy envisions the Basin becoming an attractive place for new investment with enhanced social cohesion in the existing community. The planning process, in pursuit of resilience-building, includes substantive consultations with relevant stakeholders, especially the poor and vulnerable, and adapts global best practices for the resettlement of irregular settlements as required due to flood risk.

To achieve this, the Resilience Office worked with the city's Planning Department to create a detailed intervention plan that takes into consideration existing policies and investments in the area, and defines roles for the three relevant levels of government in a coherent and coordinated strategy that will ultimately guarantee the transformation of the area.

In 2017 the Department of Planning and Resilience produced a strategic planning document, the Integral Plan for Pantanoso, which coordinates and unites the multiple ongoing actors and projects in the Basin under a strategic vision. Currently undergoing public consultation and pending approval from City Council, the Integral Plan will be an evolving document that seeks to build social resilience, manage flood risk, expand economic opportunity, increase the supply of safe and affordable housing, improve the quality of the natural environment, support biodiversity, and create new incentives for investment in the Pantanoso region.

These efforts will transform the city's relationship to the Pantanoso's streams and tributaries, build a unifying vision for various projects, and better establish the Pantanoso region within Montevideo, enhancing its connection to the city as a whole.

To address all of the region's various challenges holistically, the Plan articulates five symbiotic pathways for action in the Basin:

1. **Environment** – Montevideo will pursue improved water quality, landscape restoration, biodiversity protection, maintenance of wetland environmental services, and flood risk reduction. Specific infrastructure needs include channel management, tie conditioning of bridges and culverts, reversion of critical fillings, and expansions of the sanitation and drainage system.

2. **Economic competitiveness** – The city hopes to attract investment in private industry, education, and tourism. The principles of a circular economy offer a particular opportunity for achieving sustainable economic growth in the region, and the city seeks partners and funding to pursue relevant technologies and business models.

3. **Social equity** – Pantanoso has significant needs for investment in new housing, improvements to existing housing stock, and the construction of new public recreational spaces – and for partnerships that will strengthen community and foster a local identity.

4. **Connectivity** – Montevideo has an extensive bus network that serves the Basin, and so is seeking mobility investments including the creation of new pedestrian and cycling infrastructure, as well as new bridges over the watercourses in Pantanoso. The plan aims not only to establish physical connections but also to build an identity connecting Pantanoso with the rest of the city.

5. **Governance, communication, and engagement** – The city seeks support in designing and implementing the process of consultation and citizen participation for the creation of the Pantanoso Plan, and in preparing a communication plan for the process that aligns with the agendas of the mayor and other key stakeholders and institutions.

To advance design concepts for this transformation, Montevideo partnered with the Resilience Accelerator, a joint program from 100RC and the Center for Resilient Cities and Landscapes at Columbia University. In April of 2019 the Resilience Accelerator convened a range of staff from the City of Montevideo and local governments in Pantanoso along with university faculty, potential funders, and subject matter experts, including Deltares. Together, participants identified specific actions for inclusion in the Plan: restoring lost wetlands, managing illegal dumping, strategically relocating informal housing impacted by repeat flooding, creating a remediation process for contaminated sites, enforcing zoning, and avoiding wetlands loss. Participants also jointly established overarching design and implementation principles that will allow the Plan's projects to meet the needs of existing neighborhoods and the broader natural ecosystem of the area. The Resilience Accelerator looked closely at design considerations for two sections of the Plan and three specific neighborhoods, Maracanã, La Cantera del Zorro and La Cachimba del Piojo.

The transformation of the Pantanoso Basin is gaining political momentum in the country. Uruguay will hold a presidential election in October of 2019, and some candidates have noted the project's transformative scope and importance. Both Pantanoso residents and other citizens of Montevideo have expressed support for the Plan.

With a project cost estimated at US$400 million, the national government of Uruguay is exploring external financial sources beyond the budgetary reassignment of resources. The work has already attracted interest from funders, namely, the World Bank and the Interamerican Development Bank. Thus far, Montevideo's Department of Planning and Resilience has received technical assistance for project preparation from these two institutions, including a detailed design of priority projects, an investment plan and financing strategy, a cost-benefit analysis with a resilience lens, and a communication plan. Comprehensively ameliorating the interdependent stresses of the Pantanoso Basin will require resilience thinking and coordinated efforts from multiple stakeholders, managed by the Department of Planning and Resilience. Successful intervention in Pantanoso will have direct impacts on the lives of area residents, and will improve the natural environment, water quality, and economy of the entire city of Montevideo.

FLOODING

CITIES TAKING ACTION

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FLOODING

CITIES TAKING ACTION

175

Draft designs interventions for wetlands restoration

Strategy for wetlands restoration and illegal dumping prevention

Bangkok
Setting a Vision for Water Management of the Chao Phraya

FLOODING

ACTIONS   FUNDING   PARTNERS

Situated on the banks of the mighty Chao Phraya River, Bangkok is highly vulnerable to flooding in the event of heavy rainfall. To fulfil its resilience vision of a "safe, livable and sustainable city for all," the city is developing a roadmap that accounts for future uncertainties, by exploring flood protection and adaptation measures that are green, data-informed, collaborative, and socially inclusive.
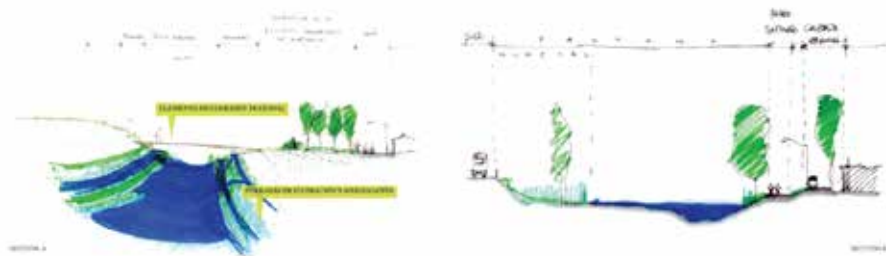
To support the Bangkok Metropolitan Authority (BMA) in this endeavor, 100RC connected BMA with Dutch research institute Deltares, to co-host a workshop on flood resilience in 2017. Representatives from the BMA were joined by representatives from the national government and other Thai provinces, as well as experts from the Government of the Netherlands.

Workshop participants enumerated several critical requirements for the roadmap to build resilience effectively, including improved data collection, cross-sectoral and regional collaboration among planning and implementation agencies, structural measures complemented by nonstructural measures such as increasing knowledge and raising awareness among city officials and citizens, and the adoption of principles of adaptive

management, so that short-term decisions can be implemented in a way that takes the long-term challenges of flood risk into account.

Workshop participants also identified a need for Bangkok to create a single command office to oversee the development of a coherent master plan and associated policies for water management. Moreover, they stressed that resilience efforts in Bangkok will need to consult with local stakeholders from civil society, and make information and data available to the public.

Following the workshop, the city recognized the importance of setting a vision to align the various efforts of water management in the Lower Chao Phraya basin, while searching for the funds required to develop their data-driven adaptive plan.

New York City
East Side Coastal Resiliency

FLOODING

$ FUNDING   CLIMATE CHANGE   POST-DISASTER RESILIENCE

The metropolitan area surrounding New York City is home to over 23 million people, and responsible for a full 8% of the economic output of the U.S. Yet with a shoreline of over 700 miles, and much of its land sitting at sea level, the city is consistently rated one of the most vulnerable to storm surge and rising sea levels in light of climate change – as evidenced by Hurricane Sandy in 2012. When Hurricane Sandy collided with the Eastern Seaboard, including New York City, it caused 160 deaths and US$71 billion of damage. While Sandy was only an average storm in terms of its wind force, the unusual course of its path, and its timing in relation to tidal cycles, brought it into contact with large numbers of people and major global assets. These combined factors triggered breakdowns in critical infrastructure that resulted in massive destruction.

Sandy's storm surge overran the bulkheads surrounding Lower Manhattan, sending floodwaters racing inland. Particularly on the island's east side, neighborhoods were flooded to depths of at least two feet. The majority of the building damage was to business inventory, personal property, and – most costly – critical building systems often located below ground, making conditions for those in the still unflooded floors above challenging or untenable.

Given that climate change will make such storms more frequent and more severe, to fortify itself against future destruction the city unveiled the East Side Coastal Resiliency (ESCR) Project. This integrated coastal protection system will strengthen 2.4 miles of urban coastline against floods and rising sea levels, while improving public spaces, enhancing natural areas, and offering other social and environmental assets that will benefit the community both in good times and at times of crisis.

Years of planning and cooperation among city, state, and federal agencies culminated in the city securing a federal grant of US$335 million to fund the ESCR's design and aspects of its construction. The project's main components include developing a plan to extend the Manhattan shoreline into the East River with new public space in order to protect the low-lying Seaport and Financial District areas. The city is pursuing another US$500 million of capital projects to reinforce Lower Manhattan's coastal areas. Construction on these natural floodplain "pinch points" will incorporate lessons learned from the dynamic community engagement and design process initiated during the Rebuild by Design competition that was launched after Hurricane Sandy.

Vancouver
Partnering to Understand Flood Impacts

FLOODING

ACTIONS   CHAMPIONS   PARTNERS

One of the densest cities in North America, Vancouver – with its large natural harbor – is also the busiest port in Canada. This coastal city therefore has an array of valuable infrastructure vulnerable to sea level rise and coastal storms.

When shocks cause interruptions in the services of critical infrastructure systems such as electricity, telecommunications, drinking water, and transport, it can have especially devastating and long-lasting impacts on a city's systems, including fatalities and economic losses. These effects are compounded by interdependencies between different critical systems, which multiply the impacts of a failure in even one system and potentially reach far beyond the areas directly impacted by the initial shock. The interrelation of these systems also makes it impossible for individual organizations, infrastructure operators, or municipal jurisdictions to prepare for disasters and mitigate risks entirely on their own. Therefore, through 100RC, Vancouver partnered with the Dutch firm Deltares, an independent institute for applied research in the field of water and subsurface, to deploy Deltares's CIrcle (Critical Infrastructures: Relations and Consequences for Life and Environment) tool.

A CIrcle workshop addresses the challenge of siloes by convening key stakeholders to illuminate the complex and interdependent relationships between critical infrastructure systems.

As part of its Resilience Strategy development process, the City of Vancouver used the CIrcle Tool to understand the potential impacts of a flood in the downtown Waterfront Road area. One of the areas most vulnerable to sea level rise and storm surge, the neighborhood has significant infrastructure and assets at risk, including a metro and commuter rail line, a commuter ferry station, a freight rail yard, and water and sewer infrastructure. The proliferation of public and private landowners adds to the complexity of planning in the area.

The CIrcle Tool will help Vancouver understand what the cascading impacts of a flood would be on critical infrastructure, and what social and economic costs are at stake. This analysis will help the city work with partners to prioritize resilient flood protection options, facilitate coordination among the various landholders and other stakeholders, and improve local planning for emergency response and recovery.

Vejle
Fjordbyen: Living with Water in the 21st Century

🌀 CLIMATE CHANGE   🌿 NATURAL ASSETS AND NATURE-BASED INFRASTRUCTURE   📍 RESILIENCE DISTRICTS

Like many other waterfront cities in Denmark and around the world, it is imperative for the City of Vejle to provide effective and long-lasting solutions to flooding and rising sea levels. The city has already been experiencing regular floods, compounded by other shocks and stresses from environmental degradation.

Vejle already had a Flood Risk Management Plan in place when it began to develop its Resilience Strategy. Recognizing the importance of the issue to the city's overall resilience, Vejle used resilience to build on their existing flood plan, introducing new methods of problem-solving and collaboration, and developing a set of "lighthouse" projects. In mapping its assets, part of capturing the city's holistic resilience context for its Strategy development process, Vejle noted that the Fjord – the long and narrow natural port of the city – was a recreational resource with strong growth potential. One of its Resilience Strategy lighthouse projects is therefore the Fjordbyen Program, which has attracted significant attention and investment.

100RC created a partnership between Dutch engineering firm Arcadis, local and international stakeholders, and a cross-section of Vejle city staff proposed three possible intervention options to guide decision-making in the city, all oriented around innovativeness, longevity, and potential for securing finance. For Vejle, the key to defining Fjordbyen as a Resilience Lighthouses program was identifying innovative and long-term problem-solving actions that depart from traditional flood prevention mechanisms in a participatory way.

The first option, the "Blue-Green Necklace," would increase Vejle's resilience using nature-based infrastructure to create a unique project that would bring global attention to the city. The project would develop a series of islands to protect against floods and storm surges, while also increasing water circulation for improved health of the harbor ecosystem. A landmark would also be built at the entrance of the harbor.

Whereas the "Blue-Green Necklace" would have to be financed up front, the second option, the "Inside Out" project, proposes developing the harbor area gradually using a "pay as you go" approach. It focuses on developing a walkway linking the northern harbor with the eastern city quarter, the fjord, and the historical city center. The southern and northern harbors would addi-

tionally be connected by a sluice and a bridge. Finally, new bike lanes would provide the nearby train station with better connectivity to the city as a whole.

Finally, the third option, the "Super Dike" or "Vejle Fjord Park" project, would build a super levee to protect the city against storm surges and floods, without having to build a dam in the fjord. The super levee would be multifunctional, with a parking area constructed underneath that would be directly accessible from the city center and would serve the entire city.

Only together we create the resilient Vejle of the future
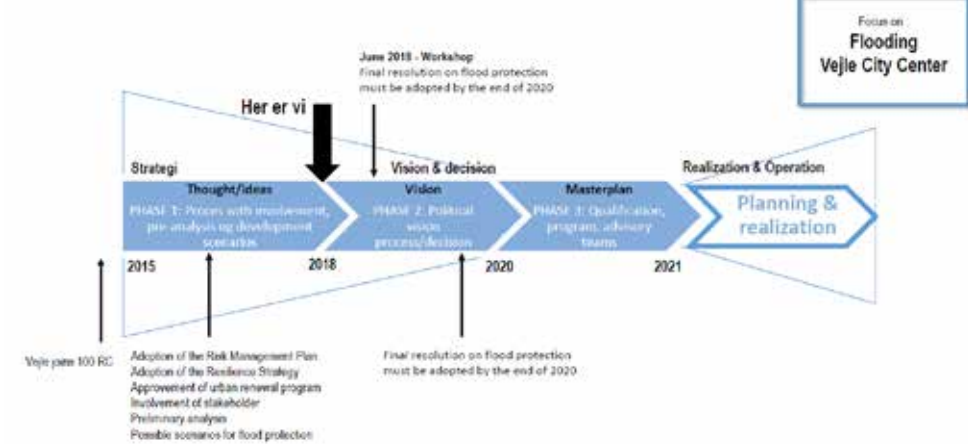
Washington D.C.
Understanding Flood Risks

⌃ FLOODING

🤝 PARTNERS   🏠 HOUSING   ⚖ SOCIAL EQUITY

The District of Columbia has made internationally recognized progress in environmental restoration and riverfront regeneration, leading to the development of several new waterfront neighborhoods. Acknowledging this trend, Washington D.C.'s Resilience Strategy foresees a continuing increase in the number of people living, working, and playing along the Potomac and Anacostia Rivers.

Yet Washington D.C. is also forthright about the challenges on its shoreline. Many communities, already confronting significant inequities, are put under further pressure by new investments, and redevelopment can lead to displacement. At the same time, with over 40 inches of sea level rise predicted by 2080, and an expected increase in the severity and frequency of tropical storms, waterfront neighborhoods are facing a growing risk of serious flooding. Some of the city's poorest and most historically disinvested neighborhoods lie along the Anacostia, making them especially vulnerable to this combination of environmental and economic challenges.

Climate change is increasing flood risks for inland neighborhoods as well. D.C. experienced a 200-year storm event in 2006 and saw record-breaking annual rainfall in 2018: rainfall flooding also needs to be addressed across the District.

Therefore, as part of the development of the District's Resilience Strategy, through 100RC Washington D.C. partnered with the Dutch firm Deltares, an independent institute for applied research in the field of water and subsurface, to better understand the city's current and future flood risk. As part of the Strategy's focus on institutionalizing and bolstering bold climate action, D.C. and Deltares developed an approach that will enable the city to create an integrated urban flood model encompassing all the forms of flood risk faced by the District, including riverine, coastal, and interior flooding. This model will give the District greater insight into its vulnerabilities and guide effective flood management and climate adaptation investments.

In addition, the District is creating a publicly accessible geospatial tool, which will incorporate not only flood risks but also other climate impacts such as extreme heat. This tool will help residents and local institutions understand the risks they face, mobilize their efforts to respond, and prioritize adaptation investments.

🏛 Heritage and Culture

Humans began building cities over 6,000 years ago, and evidence of humans creating cultural artifacts extends back over 44,000 years. Some anthropologists have posited that the many facets of human culture – including language, art, beliefs, and practices – are what most distinguish humanity from the other species on the planet with whom we share a large proportion of our DNA.

Culture, in all its many forms, offers both monetary and intrinsic value to the overall resilience of any city today. A city is a home, and every city has a history. Sense of place builds social cohesion, creates identity, and attracts visitors and new residents. Promoting culture and protecting heritage can also empower marginalized individuals and communities to participate in public or political life, catalyze environmental reclamation processes, and promote stronger economies via entrepreneurship, innovation, new technologies, and tourism.

Cities in the 100RC Network have leveraged the Resilience Strategy development process to engage communities in a participatory way around their culture and heritage. Those efforts are taking into account the fragile assets that constitute unique and non-renewable capital for a city, including local knowledge systems and the contributions of minority groups.

This has resulted in Resilience Strategy initiatives that protect both built and natural heritage, promote sustainable cultural tourism, encourage equitable access to the arts and participation of diverse and marginalized communities, foster cultural and creative industries, support cultural institutions, arts organizations, and other networks, and create resilient cultural hubs. By engaging with community leaders, Network cities have explored and invested in efforts to build shared identities, and to use shared problems as entry points for empowering residents to play a more critical role in overall decision-making.

Athens
Lycabettus Hill and the Future of Athens' Urban Forest

🏛 HERITAGE AND CULTURE

🤝 PARTNERS   🏠 HOUSING   ⚖ SOCIAL EQUITY

With its creation credited to the Greek mythological goddess of Athena, Lycabettus Hill, rising over 270 meters above sea level, is the highest point in the center of the City of Athens. Popular among locals and tourists alike, the hill boasts a 19th century chapel, open-air amphitheater and restaurants, and splendid views across the 3,400-year-old capital city to historic sites like the Acropolis. But Lycabettus Hill, particularly the pine forest that rings its slopes, is suffering from some of the same stresses faced by Athens as a whole – environmental degradation, extreme heat, poor water management, and declining biodiversity. The City of Athens recognized in their Resilience Strategy that building the city's overall resilience will require creating new as well as revitalizing existing green public spaces, particularly in light of increasing density and the risk of rising temperatures due to climate change. Identifying Lycabettus Hill as a key green space with significant heritage value, Athens launched a flagship resilience project to redevelop the urban forest, augment tourism, and build capacity within the city's administration. The project will serve as a model of exemplar environmental, cultural, social participation, and financial management practices. The Lycabettus Hill Program began with the creation of a holistic, streamlined, and integrated plan that leveraged an innovative

participatory design process to prioritize needs and opportunities related to the hill's ownership, management, funding, and risk reduction. By addressing present and future shocks and stresses, the Program aims to enhance the resilience of the hill itself while embedding resilience principles into the management of other large green spaces across the city. Athens has been working intensively on a dynamic Framework Study meant to guide the future of this emblematic area of the city for over two years now. In depth studies of the natural environment and ecology produced by the Agricultural University of Athens (AUA) and of the built environment produced by the National Technical University Architecture Department (NTUA) have been integrated technical expertise with feedback from a robust stakeholder engagement initiative.

The Office of Resilience and Sustainability conducted that stakeholder engagement with the support of 100RC, who brought into the process the expertise of Rebuild by Design (RBD), the New Jersey Institute of Technology, and Interboro Partners. Led by RBD, the process sourced almost 1,500 individual resident opinions. As a result of this research and analysis, Athens has determined that the Lycabettus Hill Program will: protect bio-

diversity, reduce the city's urban heat island effect, protect the built environment from flash floods, overcome the problem of a lack of data, protect the hill as a cultural landmark, improve the decision-making and management capacity of political and permanent municipal staff, and identify funding and financing resources for introducing innovative planning and implementation methods. An international consortium of Greek, American, and European partners has now been working to advance this comprehensive revitalization of the hill. The work will demonstrate, in tangible terms, how building resilience into program development can deliver multiple benefits and allow a city to manage its cultural assets in a risk-aware way.

The process has been both unique and successful in its multidisciplinary approach. There is little precedent in Athens for collaboration with local universities on a project at this scale, that also brings together Greek and international partners. The strong emphasis on widespread community and stakeholder engagement was also a shift from traditional Greek planning processes, and it resulted in more refined proposals with stronger support and input from residents than business-as-usual city efforts. The next steps are the implementation of four priority technical projects, the adoption of the formal strategy for the management of large green spaces in the city, the maturing of the Lycabettus Hill mobility investment plan, and the development of the first Athenian Green Corridor. The four priority technical projects entail the repairment of pedestrian pathways to improve accessibility, water management interventions to address issues of erosion, bioclimatic improvements to the main road, and a deep cleaning of vegetation. Athens is also taking steps to improve the basic maintenance of the ecosystem and infrastructure on the hill, such that the revitalization

of this once-lively public green space will endure for years to come. Future proposed interventions include developing green corridors that connect Lycabettus to other hills in the city and investing in a funicular railway to improve access to the hill while also protecting environmentally vulnerable areas. The revitalization Program also is considering how to improve the water management of a culturally valuable Roman Aquatec, located at the bottom of the hill, which to this day has capacity to meet all municipal public water needs.

Lastly, the redevelopment of Lycabettus will align with other efforts in the city to renovate the hill's 3,000-seat amphitheater designed by renowned Greek architect Takis Zenetos and constructed in the mid 1960's. The theater hosted international groups and performances until its closing in 2011 and it will re-open in the forthcoming period. The Lycabettus Hill Program has received funding as a result of the City of Athens being the first city in southern Europe to benefit from the Natural Capital Financing Facility (NCFF). The NCFF is a financial instrument developed by a partnership between European Investment Bank (EIB) and the European Commission to support biodiversity and climate adaptation through tailored loans and investments, backed by an EU guarantee.

Athens now has a wide range of proposed solutions that will increase the resilience of Lycabettus Hill, ranging from protecting endangered species to promoting sustainable mobility, and from footpath signage to emphasizing the importance of the Lycabettus in city branding and tourism campaigns. Success in protecting and reviving this Athenian landmark, the twin Hill of Acropolis, will allow for the continued endurance and re-definition of a place of nature, engineering, and culture already standing for over 2000 years.

Byblos
Byblos' Coastal Heritage Trail and Beyond

↗ SCALE   🚲 TRANSPORT AND MOBILITY   ⚖ SOCIAL EQUITY

Byblos, with over 5,000 years of history, is one of the oldest continuously inhabited cities in the world. As a port city located on Lebanon's coast along the Mediterranean, the history of the city is intimately linked with the sea. Byblos's waterfront is a central aspect of residents' culture, heritage, and sense of place in their city.

The Municipality of Byblos and the Office of Resilience are currently working on implementing a variety of actions from the city's Resilience Strategy, published in April 2016, many of which concern the protection and celebration of Byblos's history and heritage. One such action is the construction of a new coastal boardwalk along the city's waterfront. The boardwalk supports multiple goals of the city's resilience agenda. As the first of three new green corridors that will connect the city along its north-south axis, the project will improve linkages between central Byblos and the waterfront. It will also address fragmentation between the city's different coastal areas (the marine archaeological grounds, the old port, and the north and south beaches), privatization of beach access, and environmental threats, such as the erosion of the archaeological site by the cliff edge that overlooks the waterfront.

Developed in collaboration with US-based Lebanese architect Hashim Sarkis Studios, and financed by the French Development Agency (AFD), the boardwalk project will combine biking and walking paths with amenities such as bike rental stands, showers for summer bathers, kiosks run by local residents, and other services for tourists.

In a country of growing economic inequality, where access to public spaces such as the beaches and the waterfront has become a privilege rather than a right, Byblos's coastal boardwalk project will set a precedent for protecting the city's shorelines and coastal heritage from privatization and natural threats. By doing so, it will contribute to shaping a more inclusive society that enjoys accessible public spaces – a topic of importance for cities around the world seeking to build their overall resilience.

Melaka
The Role of the Past in Melaka's Future

↗ SCALE   🚲 TRANSPORT AND MOBILITY   ◎ ACTIONS

The over 600-year-old city of Melaka, designated a UNESCO World Heritage Site in 2008, is today a thriving international seaport and tourist destination home to nearly 900,000 people. However, under-investment in transport and drainage infrastructure is causing significant traffic congestion, poor air quality, increased rainfall flooding, and an elevated risk of disease outbreaks. Climate change and anticipated high rates of population growth mean that these risks posed by inadequate infrastructure will only grow – and if not addressed, they will seriously undermine the city's resilience. While Melaka's City Council has a deep understanding of city planning and how to formulate ten-year plans, the recently constituted Resilience Unit (RU) has proactively identified and pursued opportunities to increase the Council's capacity for resilience-driven project management, as well as its ability to engage with the city's various communities on the resilience agenda.

Inspired by the work of other cities in the 100RC Network, Melaka's RU became interested in the potential of Tactical Urban Resilience to ameliorate some of the city's key stresses resulting from inadequate infrastructure. The RU also recognized the importance of elevating the things that make Melaka unique during the resilience-build-

> **Tactical Urbanism** entails a city-led, organization-led, or citizen-led intervention in a neighborhood's built environment, which is short-term, low-cost, and scalable, while also designed to catalyze long-term change.

ing process, to preserve the historic charm of the city. The Melaka Resilience Strategy development process identified the city's built heritage as a key asset, and its traffic congestion as a key risk. Spearheaded by the RU, working across departments in the Melaka City Council, and supported by the mayor, the process decided that Tactical Urban Resilience, along with some related tools developed by 100RC, would be used to pedestrianize the entire World Heritage Site. Anticipating likely pushback from local residents (and potentially the state government), the team is pursuing close and ongoing interactions with people on the ground to better understand the concerns of affected stakeholders and their overall vision for Melaka. Eventually, the successful pedestrianization of Melaka's World Heritage Site will reduce air pollution, greenhouse gas emissions, and traffic injuries, contributing to a vibrant and accessible Melaka. This intervention will also promote both tourism and community engagement, and protect heritage, bringing tangible benefits to residents.

Seoul
Seoullo 7017: Reimagining Aging Urban Infrastructure

⬛ HERITAGE AND CULTURE

📊 ECONOMIC DEVELOPMENT   🚲 TRANSPORT AND MOBILITY   👥 EDUCATION AND SOCIAL INFRASTRUCTURE

Founded over 2,000 years ago, the city of Seoul boomed in the 20th century, growing from one million to over ten million people between 1950 and 1990. This growth drove a massive expansion in infrastructure, much of it planned and constructed as rapidly as possible. One such project was the Seoul Station Overpass, a highway built through the center of the city in 1970. Despite its functional and symbolic significance to Seoul, the overpass faced serious safety concerns after only a few decades of operation. While considering demolishing it, city leaders saw instead an opportunity to repurpose the overpass into a new urban green space that highlighted Seoul's natural heritage.

Through a collaboration between city authorities, experts, partner organizations, and a citizens' committee, the nearly 1km-long park was envisioned as a vibrant cultural hub and symbolic gateway to the city. Named "Seoullo 7017," it was designed by Dutch firm MVRDV, and features 17 different new entry points that connect pedestrians to the Central Station of the city, as well as to surrounding blocks that were previously cut off. Seoullo 7017's strategic location bridges important city sites, including historical landmarks such as Sungnemun and major commercial districts

such as Myeong-dong, and also stimulates commercial activity, dining options, and tourism in what were previously neglected areas under and along the highway. While the project faced some criticism over concerns about gentrification and rising rents, as well as increased traffic congestion on surrounding streets, since opening in 2017 the park has amassed over 17 million visitors as a unique public space. Also known as the Seoul Skygarden, its walkway has been planted with over 280 species of trees, shrubs, and flowers – an abundance of local vegetation arranged in Korean alphabetical order to raise awareness of native biodiversity among visitors to the city. The park also hosts an array of art performances and exhibits, a library, children's activities, and horticulture workshops. Seoullo 7017 demonstrates how aging urban infrastructure can be reimagined as dynamic public space that nurtures a city's identity, heritage, and culture. Such reimagining of the functions of urban infrastructure is particularly important for cities with large quantities of aging infrastructure. Seoul was able to extend the life of the overpass by giving it another purpose – to serve as a linear park and green space that improves pedestrian connectivity in a highly dense and vibrant part of the city.

Tulsa
Memorializing Black Wall Street

⬛ HERITAGE AND CULTURE

🏆 CHAMPIONS   ⚡ POST-DISASTER RESILIENCE   ⚖ SOCIAL EQUITY

The Greenwood area of Tulsa, also known as Black Wall Street, was a thriving neighborhood of African American wealth, home to 11,000 residents, prosperous businesses, stores, schools, a theater, and a hospital. The area's success came to a shocking halt on May 31, 1921 – when white Tulsans stormed the neighborhood in a two-day riot and massacre incited by racial hatred, which ended with over 35 blocks of the district destroyed and hundreds of Tulsans killed. Soon after the massacre, policies enacted by the city's commissioners, including an ordinance prohibiting fire service, hindered rebuilding and left the zone depressed and without a strong sense of community for decades. Over the last decade, local businesses and entrepreneurs have worked to draw new economic opportunity into the Greenwood area, supported by changing city policies and partners such as the Greater Tulsa Area African American Affairs Commission.

With the 100th commemoration of the Tulsa Race Massacre approaching, Tulsa is actively examining the systemic racial inequalities that persist. Recognizing this as a threat to Tulsa's overall resilience, the city's Resilience Strategy explicitly aims to reconcile with its history of racial tension and violence, in order to forge a future that eliminates systemic discrimination, supports diversity,

and celebrates cultural heritage. At the center of achieving these goals is the need to acknowledge and honor the contribution of Black Tulsans to the city's development, both historically and today.

A key initiative of Tulsa's Resilience Strategy will therefore memorialize Black Wall Street, using city budget capital funds to install signs, monuments, and other physical markers across the Greenwood area that foster placemaking and community pride. Lighted signage and other physical tributes will also be used to highlight Black Wall Street visibly from the nearby 244 highway, Oklahoma State University's Tulsa campus, and surrounding areas of town. These efforts will amplify the work of the Race Massacre Centennial Commission, the businesses currently in the area, and elements of the Oklahoma public schools' curriculum that discuss the massacre and its aftermath.

These actions will foster healing for Black and non-Black Tulsans alike, since the city as a whole suffered as a result of the massacre. The initiative seeks to strengthen overall social cohesion and the city's overall resilience, complementing the City of Tulsa's work of driving investment into Greenwood and the community of North Tulsa.

Housing

Apartment or flat, townhome or condo – every one of the four billion residents of the world's cities needs a home. Without safe, secure, functional, and affordable housing options, people are unable to meet their basic needs, are exposed to risk and recurring financial and physical losses, and generally are less able to focus on their livelihoods, well-being, and prosperity. When a city is unable to provide its residents with ample safe and affordable housing options, this lack can quickly become a critical stress to resilience.

While housing is a challenge for every city in the 100RC Network, regardless of geographic region or economic profile, the root problems vary between cities. In some cities, rapid urban growth and limited local capacity to enforce regulations have led to the proliferation of informal housing, and large numbers of slum dwellers exposed to serious natural hazards and lacking access to basic services. In other cities, changes to the economy and government policies have drastically increased the cost of housing and overall inequity, leaving vulnerable residents at risk of extreme poverty and homelessness.

Housing outcomes are likewise subject to a complicated range of factors. Developers, landlords, renters, owners, and even visitors all have rights and interests that must be accounted for. Market forces of supply and demand function at both global and local levels, and interact in cities with building codes, land-use and zoning regulations, environmental considerations, and an overall infrastructure portfolio.

It is essential that policy, program, and infrastructure solutions to these housing challenges tackle the most pressing issues of safety, security, and affordability. Furthermore, by recognizing the interconnections of housing with other social, environmental, and physical urban systems, cities can design housing solutions that offer resilience-building dividends and co-benefits – including improving the health and well-being of citizens, bolstering social cohesion, reducing inequity, responding to shifting macro-economic trends, and shrinking the city's overall environmental footprint.

Norfolk
Sea change in St. Paul's: Integrating Climate Adaptation and Housing Equity in Norfolk

HOUSING

ACTIONS   CLIMATE CHANGE   FLOODING   NATURAL ASSETS AND NATURE-BASED INFRASTRUCTURE   SOCIAL EQUITY

Since its establishment in 1682, Norfolk, the second largest city in the U.S. state of Virginia, has been defined by water. Bordered by the Elizabeth River and the Chesapeake Bay, with an excellent natural harbor, the city serves as a major hub for trade and hosts the largest naval complex in the world. Yet with these strategic assets come grave threats. Norfolk's proximity to the coast leaves it extremely vulnerable to sea level rise, flooding, and subsidence. It has been estimated that the city will require US$1.9 billion in coastal and stormwater defenses to protect it from flooding. As Norfolk reimagines its relationship to the coast, it is seeking to confront its other critical resilience challenges in tandem, including areas of concentrated poverty, significant racial inequities, and a need for greater economic diversification.

These shocks and stress converge in the St. Paul's quadrant of the city. Physically adjacent to downtown, the neighborhood is effectively far removed from that economic hub. The community includes three public housing communities that suffer among the highest rates of poverty in the city, on top of living in poor-quality housing stock. These social vulnerabilities are compounded by the area's significant flood risk.

Rather than understanding the need for quality affordable housing and the need for flood control as competing budget priorities, Norfolk sees them as mutually reinforcing opportunities.

Rather than understanding the need for quality affordable housing and the need for flood control as competing budget priorities, Norfolk sees them as mutually reinforcing opportunities. The city wants to design needed investments in flood risk reduction in ways that will also provide a better quality of life for public housing residents, deconcentrating poverty and creating economic opportunity.

Since 2005, the residents and local businesses of St. Paul's have been working with the city to develop plans to transform the area into a mixed-income, mixed-use neighborhood with pedestrian

friendly development. The plans evolved further following Norfolk's participation in Virginia's successful application for funding from the U.S. National Disaster Resilience Competition (NDRC). A component of that application called for the demolition of the St. Paul's Tidewater Gardens and Calvert Square public housing complexes due to their location in highly flood-prone areas. Those properties would be reimagined with the introduction of innovative stormwater techniques, laying the groundwork for new mixed-income development and a more integrated community.

In January of 2018, a City Council resolution authorized the city and the Norfolk Redevelopment Housing Authority (NRHA) to begin planning with residents and community stakeholders for transforming Tidewater Gardens, Young Terrace, and Calvert Square public housing communities, and surrounding areas – totaling approximately 200 acres.

In pursuit of overall resilience, the St. Paul's initiative will combine the physical transformation of these demolitions with a comprehensive approach to human services. The city worked with Purpose Built Communities, a U.S. non-profit, to develop a "People First" model that links housing needs to education, workforce development, transportation, and healthcare. The model is people-centered, neighborhood-based, and includes intensive, individual case management. The City Council resolution reinforced this commitment to People First by ensuring that "family priorities are paramount in service delivery." The City of Norfolk additionally allocated city budget for the deployment of an innovative case management system for family self-sufficiency.

Case managers will assist current St. Paul's residents in deciding between several different options through the transformation of their community, including:

- Moving to another public housing community; or
- Moving to new housing outside of St. Paul's using a housing choice voucher. In this instance, residents will receive help with finding, applying for, and securing housing, and with communicating with their new landlord and property manager, as well as with developing an early-alert system to prevent and respond to crises should they occur; or
- Staying and becoming part of the renewed St. Paul's area, including support through the transition.

In all cases, families who desire to become homeowners will be eligible for support through the Norfolk Redevelopment Housing Authority's Family Self-Sufficiency program, which provides employment and financial support, and other services.

As for infrastructure, in addition to transforming and revitalizing the community's housing stock, the St. Paul's Area Revitalization Plan calls for the innovative use of green infrastructure for managing stormwater. The crown jewel of this new neighborhood within St. Paul's will be the transformation of some of the lowest-lying land, where flood risk is too high to locate housing, into a "water eco-center" comprised of high-quality green spaces.

Norfolk will no longer be on the water, but rather will be of the water. This flood-resilient, mixed-income community is expected attract pioneering research and technology firms to

provide employment opportunities for Norfolk residents of all income levels.

The Norfolk Redevelopment Housing Authority was recently awarded a Choice Neighborhoods Implementation Grant by the U.S. Department of Housing and Urban Development (HUD). The city and its partners will receive US$30 million to implement their bold vision for St. Paul's, with a specific focus on the Tidewater Gardens community – home to 1,587 residents in 618 apartment units. By offering housing vouchers for each unit, as well as significant funding for supportive services from People First, neighborhood amenities, and housing redevelopment, the grant will allow Tidewater Gardens to move through the first phase of the project at a much faster rate than would otherwise have been possible.

City officials have highlighted that the grant funding will help break the cycle of intergenerational poverty by investing in residents, providing them supportive services around housing, employment, education, and health and wellness programs. It also builds on the current mayor's campaign promises to deconcentrate poverty and expand opportunity for all residents of Norfolk. In addition to the US$30 million Norfolk will receive from HUD, the city and its partners have made investments and commitments of more than US$158.5 million in the St. Paul's area.

Looking beyond the St. Paul's resilience-building initiative, the City of Norfolk plans to leverage lessons they have learned to institutionalize this new planning approach and apply the resilience lens to citywide investments and project prioritization, using levers such as problem-based procurement.

Durban
Collaborative Action for Informal Settlements

🏠 HOUSING

◎ ACTIONS   💧 WATER AND SANITATION   ⚖️ SOCIAL EQUITY

Informal development, both in physical settlements and within the economy, is increasingly the dominant mode of metropolitan urbanization seen in the urban Global South. Planning processes and capacity in many of these cities have been unable to keep pace with the speed and intensity of rapid urbanization. As a result, roughly one billion people live in urban informal settlements, where they are more likely to be adversely affected by man-made or natural disasters due to inadequate infrastructure and lack of critical services. This vulnerability weakens the overall resilience of a city.

Segregated spatial planning during South Africa's apartheid era relegated affordable housing in Durban to the urban periphery, often in informal settlements far from job opportunities and transportation corridors. In the years since, rapid urbanization, population growth, poverty, and high transport costs have all caused informal settlements to proliferate. Today, a serious housing shortage in the city means that just over 800,000 people, approximately 22.4% of the city's population, live in informal settlements. These communities contribute to, and are impacted by, a range of stresses usually related to their location in environmentally vulnerable areas and the impacts of wastewater and pollution run-off into adjacent rivers.

Durban's challenge is characterized by the complex mix of issues facing most African cities – from high levels of economic informality that is increasingly part of the fabric of these cities, to the complexities of politics, policies, and governance that hamper the ability to plan effectively for the future. This complexity prompted Durban's Resilience Team to question the traditional model of African urbanism, which was largely based on western ideals and practices, and drive toward building transformative new partnerships that shift the paradigm on informality in the African city.

Informal settlements are often perceived as a threat to which many municipal governments respond with forced evictions and mass demolitions. But these actions only trap impacted residents in poverty and undermine their ability to contribute to the city's overall resilience. Durban's Resilience Strategy instead adopted a progressive approach, with the overarching objective of creating equity, sustainability, and a good quality of life for all city residents through collaborative action on informal settlements.

Durban recognized that informal settlements, which are often located close to employment opportunities and exist as a result of well-established social networks that help reduce vulnerabilities, offer opportunities for the urban poor to claim their "right to the city." In addition, those settlements create social, economic, and political opportunities for the urban poor where formal systems have failed to deliver. Informal settlements, therefore, demonstrate resourcefulness and flexibility, and in some ways enhance the resilience of their residents.

Building on existing efforts of other city Departments and Units, NGOs, CBOs, and research institutions, Durban's Resilience Strategy articulates eight goals: collaboration among a committed team of champions and relevant coordinating institutional structures; data jointly collected by the community and municipality; partnerships that support collaborative climate-smart and sustainable upgrading; necessary human and financial resources; enabling and integrated administrative systems and regulatory procedures; collaborative monitoring and evaluation; proactive land management; and improved social, economic, and environmental well-being in informal settlements.

Durban's efforts triggered an evolution of 100RC's overall approach to informality and fostered a deepened understanding of the challenges and opportunities that informality affords. Its Strategy inspired member cities across the Network to better integrate informal communities into their planning efforts. For example, Accra and Cape Town have since worked with the NGO Slum Dwellers International to incorporate data and knowledge from informal communities into their Resilience Strategy development process.

Durban's strategic decision to focus on informal settlements as one of two entry points for building resilience in the city (along with improving the planning interface between municipal and traditional governance systems) allowed it to drill deep into core barriers that, if overcome, would help strengthen resilience for all residents. Its approach has advanced the 100RC Network's understanding of the value in focusing resilience-building efforts on inequity and injustice, as a catalyst for broader systemic transformation.

> **Complexity prompted Durban's Resilience Team to question the traditional model of African urbanism, which was largely based on western ideals and practices, and drive toward building transformative new partnerships that shift the paradigm on informality in the African city.**

Huangshi
Huangshi's Resilient Slum Transformation

HOUSING

ACTIONS   FUNDING   SOCIAL EQUITY

Since the turn of the millennium, the Chinese city of Huangshi has been undergoing a period of rapid urbanization and economic restructuring that has left many residents unemployed and without stable housing.

In 2009, in response to a proliferation of informal slum dwellings in disused factory sheds, the city launched a comprehensive program to provide more affordable housing and thereby improve the living conditions, safety, and socio-economic mobility of vulnerable residents. The program tackles the three main challenges of slum housing transformation in any city – funding, expropriation, and resettlement – in a way that is integrated, flexible, and inclusive – three key qualities of resilient urban systems.

First, the city assessed all potential funding channels for the program, including a public housing investment company and a slum reform financing platform, and consolidated them in an integrated financial system to promote consistency in investment decisions. Second, affected residents were given flexible options for resettlement, choosing between monetary compensation or being re-housed at subsidized rates according to their households' needs. Third, the city con-

ducted extensive public consultation around the sensitive issue of housing expropriation to ensure inclusive decision-making. A new inclusivity principle requires that 90% of a building's residents endorse any renovations before it can proceed.

After joining the 100RC Network in 2014, Huangshi's Resilience Strategy development process reaffirmed housing as a priority for overall resilience building. Through stakeholder engagement and technical research, Huangshi's resilience team devised a Diversified Quality Housing Action Plan that enhances livability in the city by advocating for diverse housing types, mixed and inclusive residential layouts, and a dynamic and shared residential environment.

By 2015, Huangshi had far exceeded its housing goals, completing 21,400 housing units and starting a further 54 shed renovation projects that will reach an additional 38,470 households. Huangshi's work has been highly commended by the Chinese central government, in recognition of the city's innovative socio-economic investments that have created high-quality, affordable housing for its low-income population.

Louisville
Homeless Encampment Task Force

HOUSING

ACTIONS   CHAMPIONS   SOCIAL EQUITY

In Louisville, compassion and trust have been identified as fundamental qualities underpinning the city's resilience work. A rich culture of compassion can have tangible benefits for building urban resilience, when paired with a series of concrete, actionable initiatives. The city hopes to see greater transparency among municipal entities, more effective communication with stakeholders and communities, and a new wave of inclusion and social cohesion.

Citing public health and safety concerns, in late 2017 Louisville removed a homeless encampment located in the downtown area. But a critical reaction from local residents and the media prompted the mayor to create a Homeless Encampment Task Force (HETF), to review Louisville's policies and procedures in managing homeless encampments going forward, in a way that will allow the city to meet its resilience goals of building trust with residents and creating a culture of compassion. Led by the city's CRO, the HETF is a collaborative effort of more than 20 partner organizations and 60 participants from government, businesses, non-profits, religious institutions, and concerned citizens. The HETF and its three subcommittees can claim significant successes. They have identified and engaged a number of chronically home-

less individuals, connecting them to more stable housing and services, while developing a deeper understanding of the root causes of homelessness. The HETF has also implemented a new Metro Ordinance that requires 21 days of notice before the clearing of an occupied homeless encampment. A key role of the HETF is to provide a platform for dialogue between service providers, homeless individuals, outreach workers, and the broader community. The platform enables key stakeholders to cooperate in gaining a shared understanding of the challenges, identifying common goals, and developing plans for improved services. These improved channels of communication across government actors allow for better coordination of actions, both internally and externally. Moving forward, city government has committed to requesting and respecting recommendations from the public. Most recently, the HETF has received funding from Louisville Metro Government's Fiscal Year 2019 budget to hire a consultant to explore low-barrier shelter options and make recommendations for the best long-term solutions. Actions in the city's 2019 Resilience Strategy commit to addressing the chronic issues facing homeless individuals and tackling the underlying mental health issues that can lead to addiction, crime, and homelessness.

Toronto
Building Vertical Resilience

🏠 HOUSING

◎ ACTIONS $ FUNDING   ⚖ SOCIAL EQUITY

The Toronto Community Housing Corporation (TCHC) is the largest social housing provider in Canada and the second largest in North America. Its 2,100 buildings and over 15 million square meters of residential space, which represent a CAD$9 billion public asset, are home to 110,000 residents in neighborhoods across the city, nearly 60,000 of whom are past of low- and moderate-income households. TCHC's portfolio includes 170 apartment towers (apartment buildings characterized by 8 or more stories) that have largely fallen into disrepair, with hundreds of unoccupied units classified as unlivable.

An influx of investment from the federal, state, and city levels has boosted TCHC's 2019 budget and enabled Toronto to initiate a deep retrofit of 21 of those towers. Construction began in late fall 2018 and will continue into 2020. Overall building infrastructure will be fortified by adding overcladding to the exterior of 12 of the 21 buildings, creating better insulation for a more comfortable interior environment. Retrofits to apartments will include more efficient lighting and plumbing, upgrades to heating and ventilation systems, replacing single pane windows, installing suite temperature controls, and exchanging window air conditioning units for more efficient in-unit air

conditioning. Efforts are also being made to significantly reduce the towers' gas consumption by installing Combined Heat and Power generators at 40 sites, and upgrading emergency generators that allow tenants to generate electricity onsite, reduce their dependence on TCHC's most costly utility, and shelter in place during any losses of external power.

TCHC's ongoing work on its towers is part of Toronto's larger goal of "vertical resilience" for its many aging high-rise rental apartment buildings, whose vulnerability combines with the city's climate risks to make them Toronto's single most pressing resilience priority. Such towers represent 45% of rental housing stock in Toronto, and face critical challenges related to their infrastructure and basic services. By starting to make necessary changes in the real estate it controls, Toronto is demonstrating the possibilities for other landlords. A multi-pronged initiative of deep retrofits will not only ensure the resilience of aging rental and social housing stock – it will also create a generational opportunity for social, economic, and environmental improvements to tower neighborhoods and lower-income communities.

🌱 Natural Assets and Nature-based Infrastructure

Natural assets are the environmental resources that create benefits for human society, such as water and air quality, natural flood protections, biodiversity, and even soil and minerals. In 2011, the value of our planet's total natural assets was estimated at US$135-157 trillion per year – more than double that of the nominal Gross World Product in 2016. But economists and policymakers alike have long struggled to accurately assess and incorporate the value of natural assets into infrastructure design and decision-making.

Decades of development have eroded the natural assets of cities, paving over the critical conditions and ecosystems that made a city's location ideal for human settlement in the first place. This has forced cities' greater reliance on costly man-made interventions to protect against resulting risks – for example, building expensive sea walls to protect a community from storm surges that were once managed by a natural system of mangroves. Failure to protect or enhance natural assets and nature-based infrastructure is a missed opportunity, ultimately costing cities money and making it more difficult for them to adapt to climate change.

Today, cities around the world are reclaiming the potential of their environments as a building block of urban resilience, critical to reducing their vulnerability to a broad range of shocks and stresses. The terms "natural assets" and "nature-based infrastructure" together describe both healthy, natural systems at scale – such as watersheds, forests, and natural shorelines – as well as distributed, engineered infrastructure such as green roofs, stormwater capture basins, and urban forests.

To date, 100RC member cities have created over 250 Resilience Strategy initiatives related to protecting their ecosystems, valuing their natural assets, and developing nature-based infrastructure.

Sustainable land-use planning can play a critical role in the decades ahead, combating climate change through protecting and rehabilitating natural assets, while also safeguarding lives and critical urban infrastructure. Natural asset management will also prove critical as rising global demand for water begins to outstrip supply. Natural asset management can harness the water-related services provided by forests, wetlands, floodplains, etc., and can also include innovative nature-based infrastructure solutions such as soil moisture retention, riparian buffer strips, and green roofs to enhance water availability, improve water quality, and reduce the risks associated with water-related disasters and climate change.

Melbourne
Melbourne's Urban Forest: Bringing a City Together to Enhance Natural Assets

🌿 NATURAL ASSETS AND
NATURE-BASED INFRASTRUCTURE

🤝 PARTNERS ↗ SCALE 💧 CLIMATE CHANGE ⚡ POST-DISASTER RESILIENCE

Melbourne is a vibrant and proudly multicultural city of 4.5 million residents stretching along the shores of Port Phillip Bay to the Great Dividing Range. It is also a "city of cities" – Melbourne is made up of 32 local government authorities (councils) spread over 10,000 square kilometers. The city has hundreds of diverse neighborhoods, each of which boasts its own character and cultural mix.

With a rapidly growing population anticipated to reach eight million by 2051, metropolitan Melbourne's urban footprint is both expanding outward and becoming denser. These trends are significantly shrinking the city's green space, with parts of metropolitan Melbourne now having some of the lowest urban tree canopy cover in Australia. The infrastructure built to keep pace with population growth has supplanted the vegetation that provided shade, dampened the sun's heat, and absorbed excess rainfall. Now the many new black roofs and roads are intensifying the urban heat island effect and contributing to flooding and runoff during storms.

Historically, the infrastructure required by cities to meet the needs of their citizens has existed in conflict with nature around the world, but there is an increasing realization that the success and long-term viability of cities depends on being able to nurture, protect, and live alongside natural systems.

Melbourne is particularly vulnerable to extreme heat, fire, and flooding – as evidenced in 2009, when the city suffered a heatwave that killed 374 people and caused a wildfire that caused an additional 173 deaths and destroyed thousands of homes.

While the effects of such shocks and stresses are widespread, they disproportionately affect residents who are already vulnerable, including seniors, people with disabilities and chronic illnesses, and those who are financially disadvantaged, as they often live further from assistance facilities or otherwise lack the financial capacity to access help. As climate change increases the frequency and severity of heatwave events, Melbourne has recognized that it must connect, extend, and improve existing greening efforts to preserve and strengthen its natural assets.

Melbourne's Resilience Strategy highlighted the fact that fragmented governance and ownership patterns mean that no single organization or authority is responsible for promoting nature and natural infrastructure across metropolitan Melbourne. To address this coordination challenge, the CRO for Melbourne and the team at the Resilient Melbourne Delivery Office (RMDO) entered a partnership through 100RC with The Nature Conservancy (TNC) to develop a comprehensive urban forestry strategy: Living Melbourne: Our Metropolitan Urban Forest. Seeking to ameliorate the shocks and stresses associated with extreme heat, fire, and flooding while improving quality of life in the city, Living Melbourne formed partnerships with local government authorities, state government agencies, non-governmental and community organizations, and residents.

The first step in developing and implementing Living Melbourne was to cultivate buy-in for the value of natural assets from a diverse range of stakeholders, by making a compelling case for increasing biodiversity and urban forest cover in the city and indicating key zones for intervention. To do this, the RMDO collaborated with TNC to carry out a baseline assessment of metropolitan Melbourne's vegetation and biodiversity. Two other private sector partners, Digital Globe and Trimble, were also leveraged through 100RC to complete this baseline mapping, with Digital Globe providing metropolitan scale satellite imagery, and Trimble providing licenses and training for their "E-cognition" AI software, which processed the satellite imagery to identify vegetation quality and size. This multifaceted collaboration, which ground-truthed findings based on existing council data, produced accurate maps of Melbourne's existing canopy cover at the metropolitan scale for the first time.

While the citywide average canopy cover stands at 15.6%, diverse ecology types and development conditions across Melbourne mean that canopy cover varies greatly, currently ranging from 4.2% to 25.2%. The Living Melbourne strategy sets a goal of increasing all sub-regional canopy cover levels to 20-30% by 2050, contingent on local land use, development density, and the climate of each zone. Goals in hand, the RMDO coordinated a joint effort by Melbourne's 32 councils to develop a cohesive roadmap for improving biodiversity and urban forest cover that accounted for each council's specific circumstances. In February 2017, recognizing the enhanced value of biodiverse green spaces, the RMDO hosted an Urban Biodiversity and City Resilience Exchange, which brought together the CROs of Melbourne, Boulder, Durban, New Orleans, and Semarang to share solutions and work at scale. As a result of this collaboration, Melbourne began to explore how investing in biodiverse natural assets and a connected metropolitan urban forest could further develop its resilience to extreme weather events, strengthening the overall resilience of the city and offering lessons for other cities around the world.

The overall process has been difficult, with technical challenges arising during the initial mapping effort and continuous coordination required to overcome the fragmented governance structure. At the outset, there was limited appetite for a metropolitan-scale approach, but RMDO was able to leverage its power as a convener, which it had already honed through the Resilience Strategy development process, to engage with the wide range of relevant parties. RMDO also created a senior reference group to help build high-level political support and to align Living Melbourne with local and state priorities. Fortunately, the long planning horizons integral

to a commitment to resilience enabled the city to press on with the work, and Living Melbourne was released in June 2019.

The RMDO ambitiously sought formal endorsement of the Living Melbourne strategy, resulting in the support of 41 organizations – including 30 local councils, the State Government of Victoria, water utilities, and key statutory authorities – and thereby sending a strong message of commitment from the various organizations with the ability to influence policy on urban forestry across metropolitan Melbourne. The extent of the endorsement obtained for the strategy was an Australian first. The Living Melbourne strategy document outlines six different actions that together will allow Melbourne to meet its urban forestry goal. The city aims to protect and restore species' habitats and improve connectivity, fund the protection and enhancement of the urban forest, scale up greening on private lands, build a toolkit of resources to underpin implementation, collaborate across sectors and regions, and set targets and track progress.

To enhance the credentials of the project, 100RC provided financial advisory support to the RMDO by scoping what a pitch to funders and financiers would need to include, and determining what data would be required to inform that pitch and give it credibility. 100RC then developed a financial model to generate the needed data that was peer-reviewed by partners TNC and Earth Economics. 100RC also investigated potential financing mechanisms, leveraging staff expertise and conversations with financial institutions and partners experienced in green infrastructure finance, including TNC. The implementation of the metropolitan urban forest strategy, estimated to cost AUS$570 million, is expected to bring

economic benefits currently valued at AUS$4.95 billion per year, a figure anticipated to rise as the canopy cover increases.

Finally, Melbourne sought to scale the lessons learned from its successes to cities around the world. At the first World Forum on Urban Forests, held in Milan in late 2018, CROs from cities across the 100RC Network led a panel on "Designing New Urban Scenarios for Resilient Cities." In addition to sharing the Living Melbourne strategy, the Melbourne CRO used the event to introduce "Building Resilience with Nature: A Practitioner's Guide to Action," a document developed by 100RC and the RMDO in conjunction with Earth Economics, with the objective of incentivizing the use of nature-based solutions in urban Resilience Strategies around the world. Nature is an immensely valuable asset for driving urban resilience – urban forest and the biodiversity that it supports can provide ecosystem services that take pressure off a city's strained built infrastructure. Exposure to nature can also reduce stress and the incidence of mental illness in urban populations. Urban nature also strengthens community bonds by providing spaces where people can congregate and enjoy physical activity, thus also addressing issues of public health and social inequality. Today, sapling trees in the City of Melbourne are tagged and given an email address so that residents can interact with their favorite trees. Tomorrow, Melbourne's full-grown urban forest will reduce the damage caused by acute shocks and chronic stresses, while cleaning the air and water, cooling the city, and providing a valuable habitat for flora and fauna.

Calgary
Natural Infrastructure Blueprint

NATURAL ASSETS AND
NATURE-BASED INFRASTRUCTURE

FUNDING   PARTNERS   CLIMATE CHANGE

Canada's third largest city, Calgary has been the fastest growing metropolis in the country for much of the last decade, boasting a surrounding natural beauty that contributes to its residents' high quality of life. But the city is also highly disaster-prone – half of Canada's ten costliest disasters have happened in Calgary.

The city's Resilience Strategy development process clarified the need to develop holistic solutions that will jointly address the city's risks from the impacts of climate change – including extreme heat, intense storms and flooding, and drought – as well as its high rate of population growth.

Nature-based infrastructure was identified as a promising option for pursuing these twin goals and building overall resilience. However, like most cities, Calgary confronts a status quo in which grey infrastructure is the default option, with natural infrastructure and its vital role in service provision largely ignored.

To address these obstacles, Calgary leveraged the 100RC Platform to connect with the non-profit Earth Economics, which produced a *Natural Infrastructure Blueprint* (NIB) to guide the city on leveraging nature for resilience-building. The

blueprint defines pathways for educating infrastructure stakeholders, collecting data, setting targets for natural infrastructure and the services it provides, funding and implementing projects, and measuring progress. The partnership between the city and Earth Economics resulted in three key recommendations: to foster deeper collaboration between the different municipal business units involved in the decision-making related to any natural infrastructure project, to create standardized, citywide measuring, monitoring, and evaluation systems for the value of natural assets, and to incentivize the preservation and development of natural assets by businesses and residents.

Calgary will use NIB to better understand and internally raise awareness on key concepts related to natural capital and nature-based solutions, their associated economic and non-monetary values, and opportunities for accounting for those values in the city's decisions. NIB will be used to help initiate discussions with the City Council around the general topic of natural capital, as well as to support specific natural capital initiatives. In the mid- and long-term, NIB may be able to foster a general vision for natural capital's role in Calgary, and to help drive natural asset-based strategy and investment decisions for the city.

Can Tho
Reconciling Growth with Environmental Protection

🌱 NATURAL ASSETS AND
NATURE-BASED INFRASTRUCTURE

🤝 PARTNERS 🌍 CLIMATE CHANGE ≈ FLOODING

Future plans for the City of Can Tho – the beating heart of Vietnam's Mekong Delta – outline ambitious objectives for the growth of industry, commerce, and services, while identifying the city's gravest risks as flooding and water pollution. The city expects that the risks of flooding and pollution will be exacerbated by the impacts of climate change, subsidence, development on low-lying agricultural land, the construction of hydropower dams, and the concretization of drainage channels.

To date, Can Tho has focused on combating flooding with hard infrastructure measures, such as sluice gates and physical embankments along rivers and canals. But this conventional approach fails to sufficiently account for Can Tho's unique and dynamic climate risk, financial constraints, and natural heritage. As the city undertakes a review of its master urban development plan through 2020 (with a vision to 2030), its new commitment to resilience-building offers an opportunity to reconcile growth imperatives with the protection of its fragile riverine ecosystem.

As part of its resilience-building process, Can Tho has partnered with the Resilience Accelerator to explore nature-based infrastructure as a method of realizing multiple benefits, including environmental conservation, urban growth management, and flood and stormwater management. The Resilience Accelerator is a joint effort of 100RC and the Center for Resilient Cities and Landscapes at Columbia University, working with Columbia University's Urban Design Studio, Can Tho University and the Can Tho Resilience Office to unite urban expertise with local knowledge and advance the pre-design of priority projects.

The Resilience Accelerator team developed a decision-making framework for future nature-based infrastructure investments in Can Tho, and analyzed systemic risks and opportunities for improving housing, agriculture, energy production, tourism, and water management. The team drew the key principles in its concept designs from Can Tho's existing infrastructure, neighborhood planning efforts, and its historic identity as a water city and regional center. Emphasis was placed on the preservation of rural landscapes, livelihoods, and community networks. The team shared its work with the public to communicate the complex risks facing communities in Can Tho. The results of the Resilience Accelerator work will enable city decision-makers to realize their twin goals of growth and longterm resilience.

Milan
Urban Forest Strategy

🌱 NATURAL ASSETS AND
NATURE-BASED INFRASTRUCTURE

↗ SCALE 🌍 CLIMATE CHANGE ≈ FLOODING

Milan has successfully transitioned from a post-industrial city into a globally attractive and socially progressive one. Today Milan faces new challenges, no less complex than previous ones, including environmental degradation, declining access to natural resources, and air pollution.

The City of Milan has set a goal of planting three million trees by 2030, aiming to significantly improve the city's air quality, respond to extreme heat waves, and mitigate rainfall flooding. To achieve this goal, Milan's Urban Planning Department tasked the city's Resilience Office and the Polytechnic University of Milan to develop an Urban Forest Strategy by analyzing international best practices, establishing a network of subject-matter experts to provide technical and/or sponsorship support, developing benchmarks, and identifying flagship projects.

One such example of best practice in the 100RC Network came from the urban forestry efforts led by the Resilience Office in Melbourne. Seeing how Melbourne's efforts had been amplified by a convening of diverse stakeholders, Milan hosted the Urban Forestry and Natural Infrastructure Network Exchange in November 2018.

This two-day workshop, facilitated by 100RC, discussed urban forestry, biodiversity, and nature-based solutions as possible drivers of city resilience. CROs from Athens, Buenos Aires, Greater Manchester, Lisbon, Melbourne, Paris, Quito, Tel Aviv-Yafo, and Toronto came together with partners and other local stakeholders.

Participants sought to understand how cities can generate buy-in and secure finance for projects on urban forestry, nature-based solutions, and biodiversity protection. In particular, they looked closely at how to manage relationships between the different agencies and stakeholders involved in such necessarily multi-sectoral and likely multi-jurisdictional efforts.

Inspired by Melbourne's comprehensive strategy for building and strengthening its urban forest, released in June of 2019, Milan is now developing its own Urban Forest Strategy as one of the flagship projects of the Milan Resilience Office.

Toyama
Tree Planting Projects
Take Root

🌿 NATURAL ASSETS AND
NATURE-BASED INFRASTRUCTURE

↗ SCALE   👥 EDUCATION AND SOCIAL
INFRASTRUCTURE   🏛 HERITAGE AND CULTURE

The Japanese coastal city of Toyama, with 400,000 residents, is at significant risk from the stress of an aging and shrinking population. Their Resilience Strategy therefore includes a variety of initiatives that will position the city as an attractive place for both older and younger generations seeking a high quality of life, including programs promoting the health, well-being, and inclusion of individuals and communities. One of these initiatives, "Implement Intergenerational Programs for Local Conservation," began as a tree planting effort in public schools aiming to create an understanding of and appreciation for the natural environment among elementary school students. The program expanded to community gardens in downtown parks, and now allows all residents of all ages to plant and cultivate together. The expanded program has the triple benefit of environmental education, greening the city, and promoting intergenerational interaction, which strengthens social cohesion and addresses Toyama's key resilience stresses.

The initiative was launched in October of 2017 and is due to run for five years. In that period, 4,000 elementary school students will plant 1,000 trees in Yamada Fureai Park, expanding its forest canopy by 1.09 hectares, and eventually reducing the city's carbon emissions by four tons per year. The students will also be taught about the role of trees and healthy forests in combating global warming, such that the program – in addition to cleaning the air, cooling the streets, and providing shade – allows the city's younger residents to develop pride in their community and in their personal contributions toward solving a global problem.

Toyama's tree planting program was inspired by a similar initiative from fellow 100RC member city Bristol, in the United Kingdom. Bristol launched its "One Tree Per Child" project in 2015, as part of its resilience-building agenda. By April of 2016 Bristol had exceeded its goal of planting 36,000 trees by an additional 3,000 trees. The initiative has ensured that local children play an active role in doubling the city's tree cover; local organizations, volunteers, and community groups have also been involved.

Toyama was named a National Environmental Model City by the Government of Japan in both 2008 and 2011. The tree planting initiative – presented to the 2016 G7 Environment Ministers' meeting – is just one of the many ways in which Toyama is demonstrating its leadership in building a resilient and environmentally-friendly city.

⚡ **Post-disaster Resilience**

Disasters and acute shocks can reveal the underlying tensions and structures of a society that are otherwise concealed by the normalcy of everyday life. Longstanding or emerging patterns of racism, corruption, disinvestment, and environmental degradation are made more visible when these disruptive events occur.

At the same time, disasters leave communities longing for restoration: they want to return to their "normal," even if that previous state of being was insufficient for the community to be resilient or truly flourish. This sentiment, coupled with the influx of public and private resources that frequently follows disasters and other shocks, leads to a retrenchment of settlement patterns, a return to business as usual, and the reinforcement of often unjust and inequitable systems.

100RC has observed around the globe how, following a shock or systemic collapse, there is in fact a unique window of opportunity opened for creative transformation to occur. By crafting thoughtful processes that engage communities and local leaders, resilience champions can harness the desire for recovery to "*build back better*" – to rebuild more resilient cities.

A resilient recovery process will always:

- Carve out time and space to reflect, rethink the underlying order of things, and deeply understand existing social and physical conditions;
- Apply creativity and design thinking in a way that allows stakeholders from every vantage point to imagine a new collective vision for their community;
- Leverage the resources, energy, and spirit of the recovery moment to realize strategic actions that achieve this new vision and do so in a way that sets the community on a more positive and risk-aware trajectory for the future.

There is every reason to believe that disasters will be more frequent, more intense, and put more people at risk in the coming decades, as the trends of urbanization, climate change, and population growth continue to collide. Cities have a responsibility to curent residents and future generations to consciously leverage the disaster recovery process to actively build resilience, making the city less vulnerable for that next shock when it arrives.

Amman and Athens
From Crisis Response to Urban Resilience

ACTIONS   PARTNERS   SCALE   ECONOMIC DEVELOPMENT   SOCIAL EQUITY

In 2015, Europe and the Middle East faced a major humanitarian crisis: a growing stream of refugees from the war-stricken country of Syria, who joined the already steady flow of refugees and migrants from other countries in Asia and Africa. Several 100RC member cities found themselves at the center of this challenge.

While 100RC's key purpose is to help member cities become more effective at reducing their vulnerability to risk in the mid- and long-term, it has also often functioned in times of crisis as a mechanism to facilitate quick response and advisory support to cities through its network of experts and partners. In 2015, 100RC began a partnership with the International Rescue Committee (IRC) and Mercy Corps to provide immediate assistance and longer-term strategic planning support to the cities of Amman and Athens.

100RC convened a member city Network Exchange in Athens in September of 2016, where Athens joined the Greater Amman Municipality (GAM) as well as Paris, Ramallah, and Thessaloniki along with key partners like the IRC, to share insights and best practice on dealing with the migration and refugee crisis. This discussion resulted in multiple initiatives and longer-term thematic pro-

grams developed in the majority of these member cities. Following the 100RC Exchange in Athens, the IRC continued its work with both Athens and the GAM, co-sponsoring a crisis plan for the management of potential refugee flows into Athens, analyzing population integration levels in the GAM, and aligning relevant stakeholders through a thematic workshop.

The political, cultural, and economic capital of Jordan, Amman has a rich history of human settlement stretching back over 9,000 years. In the past several decades, it has been shaped by the presence of large refugee communities, Palestinians and Iraqis prominent among them. In more recent years, the city has been one of the top destinations for people fleeing the conflict in Syria: an estimated 28% of all Syrian refugees have settled in the Amman metropolitan area. The sudden influx of new people stretched Amman's service delivery capacity beyond any limits it had planned for, casting significant uncertainty over the future urban development of the city relative to its foreseen services planning.

The resulting 87% increase in Jordan's overall population over the last decade has increased youth unemployment by 30% nationwide. Currently,

more than 70% of Amman's population is under 25 years old. This age group has the highest rate of unemployment in the city, is underrepresented in decision-making, and is largely disenfranchised from the social, economic, political, and cultural conversations of their communities – making young people targets for recruitment by extreme radical groups. In the GAM, the IRC found that displaced and marginalized populations were not accessing existing services due to a lack of awareness and/or unwillingness to access them, meaning existing service providers needed to conduct greater community engagement and awareness activities within refugee communities. The IRC also found considerable coordination shortfalls among the variety of actors working on the issue in Amman. To improve collaboration, the IRC hosted a stakeholder workshop that brought aid agencies, the UN, local organizations, and members of the national government together to discuss the refugee crisis and align on different ways those stakeholders could work together to integrate refugee and displaced populations into the city.

The IRC then provided a set of recommendations to the GAM on the utilization of public-private partnerships to increase humanitarian agency coordination and the identification of financing opportunities through foreign investment funding streams. In addition, the IRC provided recommendations on how the city could incorporate considerations regarding displaced populations into other relevant areas of its Resilience Strategy, resulting in a more inclusive and socially cohesive strategy document.

Finally, via 100RC, the IRC offered Amman an advisory service through which it completed a qualitative assessment of the refugee crisis in the city, delivered an additional stakeholder workshop in

2017 to bring together relevant organizations in the city, and provided the city with recommendations on how it could best address the needs of refugee and vulnerable populations. The workshop also increased coordination among the city, national government, aid agencies, and local actors working with refugee and displaced populations.

The IRC recommended that Amman avoid addressing the needs of displaced populations in an isolated manner, instead including displaced populations in the city's social and cultural fabric; that the city utilize public-private partnerships to increase humanitarian agency coordination; and that the city identify financing opportunities through foreign investment funding streams.

The IRC's expertise influenced Amman to develop a Resilience Strategy that was more inclusive of refugee and marginalized populations than previous city planning efforts had been – of the Strategy's 54 initiatives, 16 were adapted as a result of the engagement. Key initiatives include creating spaces for younger generations to fully participate in the development of their city; promoting the values of inclusion, solidarity, and tolerance; expanding youth employment programs to include migrants and young refugees; organizing an annual job fair to bridge gaps between the education and employment sectors; and incentivizing the creation of start-ups and incubators to capitalize on the drive and energy of young people, and turn Amman into an innovation hub for its region.

As a result of this work, the IRC secured nearly US$5 million in funding to implement some of the initiatives of the Amman Resilience Strategy pertinent to the management and integration of migrant and refugee populations. The total

funding package for Amman was secured from a variety of sources including the EU's Regional Development and Protection Programme, Citibank's Europe, the Middle East and Africa (EMEA) group, the Start Network's Disasters and Emergencies Preparedness Programme (DEPP) Innovation Labs, and ASFARI. The GAM and the IRC have since launched a joint livelihoods program to promote both Jordanian and refugee-owned businesses in Amman's marginalized neighborhoods. The GAM reports that other INGOs have also approached them about direct collaboration following the 2017 workshop.

But the influence that the IRC had on the city was not unidirectional. The engagement with Amman demonstrated to the IRC the value of partnering with municipalities to integrate refugee support into long-term city planning, and how this adds to the sustainability of efforts to protect and support refugee populations long after an initial crisis response. Later in 2017, the IRC replicated its efforts with Amman in the City of Kampala, Uganda. In 2018, the IRC published a report drawing on both experiences, "From Response to Resilience," advocating for "an improved humanitarian response to urban displacement crises by working directly with municipal authorities and through a resilience lens."

Meanwhile the City of Athens, already strained internally by the effects of the prolonged Greek financial crisis, became the EU's entry point for the waves of Syrian refugees. It is estimated that Athens received 1,000 people per day in the summer of 2015. And while the total flow of about one million refugees into the EU was not unmanageable, in Athens – in the absence of existing systems for response or any long-term coordination agenda – the local strain was at times overwhelming. To respond to the crisis, the city pioneered the Athens Coordination Centre for Migrant and Refugee issues (ACCMR), a horizontal coordination mechanism facilitated by the municipality of Athens and the Deputy Mayor for Migration and Refugees, and involving all active CSOs in the city and the Athens Resilience Office. This ACCMR network is a unique forum for priority alignment, budget appropriation, and coordinated implementation, focusing not only on management, but also ultimately on problem-solving across all matters relevant to arriving migrant and refugee populations. The City of Athens is now a leader in the field of global urban migration management, has acquired a complete population-management system, and has led several mayoral and country-level initiatives.

In 2017, in another aspect of its partnership with cities, and recognizing the range of benefits offered by boosting employment opportunities for marginalized youth, the IRC launched a new partnership with Citi Foundation. "Rescuing Futures" is part of Citi Foundation's larger Pathways to Progress Initiative, through which they have pledged more than US$100 million to supply 500,000 young people around the world with job training by 2020. Rescuing Futures will support nearly 1,000 young people aged between 16 and 24 with business training and start-up grants. Rescuing Futures is jointly granting US$2 million to 100RC member cities Amman and Athens, along with the city of Yola, Nigeria, for a two-year pilot program to help vulnerable migrant youth launch their own businesses. Through all of this work, Amman and Athens have continued to collaborate and share insights and best practices as they confront their mutual challenge of incorporating refugees and migrants into their cities, and building resilience for all.

Belfast
Leveraging the Resilience Strategy Process Post-Shock

⚡ POST-DISASTER RESILIENCE

♟ CHAMPIONS   ◎ ACTIONS   🚲 TRANSPORT AND MOBILITY

On August 28, 2018 the City of Belfast, capital of Northern Ireland, was called to respond to an unprecedented event. A devastating fire had broken out in the heart of the city center, in the historic Bank Buildings owned by a major high street retailer. As the five-story building burned for three days, emergency services coordinated their response to ensure public safety, and succeeded in preventing the fire from spreading to other buildings. But even thus contained, with the Bank Buildings at risk of collapse, the fire had an extensive impact on the city center – local shops were unable to trade, main roads were closed, and all traffic had to be redirected.

At the time, Belfast's first CRO had just assumed their post, and was tasked with being the senior responsible officer for the recovery work. As such, the CRO coordinated the response with several city departments, emergency services, city administration, and other stakeholders.

In the short term, the city had to continuously reassess evolving risks, maintain the cordon around the zone, and liaise with the building's owner, other affected retailers, and the general public. Measures such as a wayfinding campaign, temporary public spaces, and targeted marketing efforts were rapidly implemented to ensure that the city center maintained its vibrancy and that there was minimal impact on surrounding businesses during the busiest time of year for retailers, the Christmas holidays.

These response efforts had to be balanced against issues of longer-term recovery. For example, the city had to ensure that the temporary alternative routes initially established were sustainable, as it took over three months to reopen the area around the building to pedestrians due to safety concerns. This required working closely with the public transport provider, business representative bodies, and the national government to deliver alternative travel schemes. The city also ran a marketing campaign – all to ensure that city residents and visitors could easily access and move around the city core during the recovery period.

The fire and its aftermath provided valuable insights into how unexpected events can change a city for better or worse. In Belfast, the temporary public spaces created to drive footfall to the affected area uncovered the importance of reimagining the city's retail core, designing urban spaces for children and families to make sure the city center is vibrant and inclusive. The fact that

the main public transport corridor was cut off by the fire highlighted the need to diversify accessibility into the urban center. Such lessons have been taken on board by the city's Resilience Strategy development process and will influence how Belfast makes decisions about the future of the city center.

The Bank Buildings fire also elevated the significance of a CRO and Resilience Department as institutional coordination support available to an administration, due to their unique ability to offer a holistic approach to risk reduction and adaptability. By coordinating a diverse group of stakeholders, it was possible obtain broad buy-in for decisions and to expedite them. While negative consequences from the fire are still felt today, the CRO's role in responding to the incident made a strong case for urban resilience, demonstrating how an integrated approach to city planning will benefit a city in the long term.

The Bank Buildings fire also elevated the significance of a CRO and Resilience Department as institutional coordination support available to an administration, due to their unique ability to offer a holistic approach to risk reduction and adaptability.

Houston
Creating a Path to Resilience Following Hurricane Harvey

⚡ POST-DISASTER RESILIENCE

◎ ACTIONS   🌐 CLIMATE CHANGE   ⇡ FLOODING

Hurricane Harvey hit Houston in late August of 2017, dropping as much as 50 inches of rain in some areas, claiming 68 lives, and causing US$125 billion in damages to the region. Houstonians' response to the storm's unprecedented assault on the city was remarkable, characterized by heroic rescues, strangers helping strangers, tireless public leadership, and overnight mobilization of critical resources.

One year later, the City of Houston joined the 100 Resilient Cities Network with a goal no less remarkable: to invest its financial, intellectual, and political capital not in "building back" but rather in "building forward" – strengthening the city's overall long-term resilience through an integrated, forward-looking, and coordinated approach that builds on its assets while addressing its persistent challenges.

Through its Resilience Strategy development process, Houston is creating a roadmap that builds upon and connects ongoing Harvey recovery and other major planning efforts, while preparing for current and future shocks and stresses – which include flooding, hurricanes, infrastructure failure, hazardous materials accidents, a lack of affordable housing, poverty, a poor-quality transporta-

tion network, and poor-quality education. As the "101st Resilient City," Houston's membership in the 100RC Network is unique – the first city to be sponsored into the program through local funding and support from the Shell Corporation. With Houston home to its headquarters and a large employee base, Shell is committed to supporting Houston's long-term resilience and enabling Houstonians to thrive and the city to remain a global hub for energy and innovation for decades to come.

Approaching the second anniversary of Hurricane Harvey, Houston is well on its way to completing its Resilience Strategy. Through intensive stakeholder engagement and interdisciplinary coordination, the city will develop a strategic vision and implementable actions informed by the findings uncovered by five Topical Working Groups, who were tasked with the findings uncovered by five Topical Working Groups, who considered questions around achieving equity and inclusion, building back better post-disaster, improving health and safety, integrating housing and mobility, and living both with and without water. In the aftermath of Hurricane Harvey's devastation, Houston is building forward, to be a more resilient city in the face of the shocks and stresses it faces now and in the future.

Paris
Fluctuat Nec Mergitur: Tossed but Never Sunk

🏆 CHAMPIONS   ↗ SCALE   🌍 CLIMATE CHANGE

When Paris applied to join the 100RC Network in 2014, its application focused on vulnerabilities to flooding and heat waves. Given the risk posed by the Seine River overrunning its banks, as well as the deaths of 700 people in the heat waves of 2003, these priorities were appropriate for Paris at the time, and remain important risks faced by the city today.

But then the world watched in horror as the *Charlie Hebdo* shooting and November 2015 attacks unfolded amid this confluence of stresses. During and after the attacks, the people of Paris demonstrated their resilience. Parisians rallied behind their 140-year-old city motto *Fluctuat nec mergitur*, "Tossed but Never Sunk," which perfectly captures the city's long history of resilience, as it has endured and survived invasions, sieges, plagues, and violent political upheavals. These terrorist attacks, which together claimed over 130 lives, made Paris realize it had to reorient its concerns toward more holistic strategies for strengthening the city, which would build more inclusive communities and offer a resilient vision of what it means to be French, Parisian, and European. The Paris Resilience Strategy therefore focuses on strengthening social ties and building hyper-local solidarity, and prioritizes children and early civic education, recognizing that well-being, mental health, and individual resilience must together be the drivers of collective urban resilience.

Paris has not abandoned its original commitment to addressing its heat and flood risks, which are being exacerbated by climate change. Paris secured its place at the vanguard of global climate politics in hosting the COP 21, where the historic Paris Climate Agreement was reached in 2015. It also recognizes that climate change is itself a force behind migration, inequality, lowered social cohesion, and the resulting threat of political extremism and terror attacks. Today Paris is a world-class exporter of best practices for tackling climate-related threats while achieving social integration for its most poor and vulnerable citizens. Paris has since continued to work with many cities in the 100RC Network on a number of challenges, including flood management, migration, and social cohesion. It is also working with a wide local network of public and private stakeholders to implement its Resilience Strategy, which looks at climate change and social cohesion holistically, and which will keep the city's motto – *Fluctuat nec mergitur* – alive and relevant for centuries to come.

Wellington
Resilience Following the Kaikōura Earthquake

⊕ ACTIONS   🏆 CHAMPIONS   〰 EARTHQUAKE RESILIENCE

In November of 2016, a magnitude 7.8 earthquake struck the town of Kaikōura, 60km south of New Zealand's capital Wellington. While no one was killed or seriously injured in the Wellington region, hundreds were forced out of their homes and thousands of workers displaced as buildings were evacuated. Over 80 buildings were affected, and 20 were ultimately demolished, with the insurance claims totaling over NZD$1 billion.

The mayor of Wellington City, only weeks into their first term, was quick to praise the efforts of the community while recognizing the need to act for the future, saying, "Wellington has come through well, but let's not get complacent. We dodged a bullet, but we're not bulletproof."

In the aftermath, the mayor established a new Office of Resilience and Recovery, tasking the CRO to lead the development of a plan to respond to the vulnerabilities exposed by the Kaikōura event. At that point, the CRO and their team were in the final stages of a year-long process with 100RC to prepare the city's Resilience Strategy.

The 2016 earthquake was not the first earthquake to shake the city – far from it. As recently as 2013 a magnitude 6.5 event had damaged 35 buildings. After the Kaikōura earthquake however, the combination of a new mayor, an embedded CRO, and a community-endorsed draft Resilience Strategy enabled Wellington to move swiftly to take advantage of the political and community support for resilience-building that had grown as a result of the disaster.

> **After the Kaikōura earthquake however, the combination of a new mayor, an embedded CRO, and a community-endorsed draft Resilience Strategy enabled Wellington to move swiftly to take advantage of the political and community support for resilience-building that had grown as a result of the disaster.**

Wellington embarked on a program of addressing community priorities across the city in advance of another major shock, and of pushing forward implementation of existing Resilience Strategy initiatives – including developing an emergency water supply – as well as identifying additional initiatives, such as taking action on unreinforced masonry buildings, which caused 40 deaths in the neighboring Christchurch earthquake of 2011.

Within 18 months, the city had completed a program to secure unreinforced masonry parapets and facades on 113 buildings, and is now focused on structurally strengthening over 200 other buildings along routes for emergency management and high-traffic roads.

Wellington has also sought to increase the speed at which it can make decisions about evacuations and building safety following earthquakes. It placed accelerometers (devices that measure acceleration forces from seismic events) in 400 buildings around the city, and established a partnership with the Universities of Auckland and Tokyo, whose assistance with data analysis and structural assessments has reduced the time it takes Wellington to understand the extent of shaking following a seismic event from six weeks to 30 minutes.

Now over two years since the release of Wellington's Resilience Strategy, and just two and half years since the Kaikōura earthquake, the city may not be bulletproof, but it is certainly a less vulnerable place for its community, thanks to its success in leveraging a disaster to greatly accelerate its resilience-building.

Resilience Districts

The spatial division of cities into distinct neighborhoods is one of the few universals of urban life, from the earliest known cities to the present day. Whether the borders between them exist in the collective consciousness or as official administrative boundaries, neighborhoods serve unique purposes and functions, for distinct cultural communities or unique business or recreational activities. Neighborhoods and districts are the basic units by which cities are developed and grow, and from which city residents derive their sense of place and community.

While the resilience of a city must be built at many scales, ranging from its regional economy to individual households, districts have proven to be a critical scale for problem-solving, re-investment, and innovation in cities. Districts may vary in their exposure to flooding, fires, and other natural hazards. They are also the scale at which most development occurs, often requiring special area plans.

The ability of development planning and investments in districts to deliver promised outcomes and benefits is fundamental to a city's ability to shape its future. For these reasons, the implementation of citywide Resilience Strategies will necessarily involve tailoring planning, projects, and investments to the specificities of each district.

Building resilience at district level involves two dimensions of work. Risks and vulnerabilities must be addressed with specific reference to each area's different resident and user groups, the functions and benefits residents and users seek from the district, and the distinct functions that the district serves and aspires to serve through further development. At the same time, since district-scale resilience-building is often triggered by regeneration programs and investments, a district or neighborhood resilience plan also needs to address the risks and vulnerabilities associated with the regeneration project itself and the changes it implies, including project risks and displacement of existing groups and activities.

Santa Fe
Belgrano Station: Converting a Heritage Train Station into a Thriving District

ECONOMIC DEVELOPMENT   HERITAGE AND CULTURE   HOUSING   NATURAL ASSETS AND NATURE-BASED INFRASTRUCTURE

The provincial capital of a key industrial, economic, and agricultural area, the Santa Fe metropolitan region is home to over 650,000 residents. As a strategically located port city, Santa Fe links modern trade across the Pacific and Atlantic oceans, and boasts growing agro-industry and bio-economy sectors, while its nearly 450-year history and role as the birthplace of the Argentinian National Constitution underpin its significant cultural heritage. With three universities and another 14 scientific and technical institutes, Santa Fe is a center of politics, innovation, and entrepreneurism in Argentina today.

The city's resilience vision is to create an integrated and thriving city with a metropolitan approach to development, a safer community with a strong spirit of solidarity, and a sustainable economy with opportunities for young people. In particular, Santa Fe aims to position itself as a hub for business travel, leveraging its architecture, infrastructure, and human capital to attract major events. The city has identified the downtown district surrounding the Belgrano Railway Station as a key intervention point for achieving its resilience goals. In 2008, the city began the renovation of its iconic Belgrano Railway Station through private and public

investment. After 15 years of being left derelict by the national government, the station building was successfully transformed into an important site for exhibitions, fairs, and conventions. More recently, the Argentinian government made a commitment to recovering derelict public lands nationwide. With 24 hectares of underutilized public land surrounding the now thriving station building, the city is seizing the opportunity to enhance the value of the wider Belgrano area. Santa Fe's Resilience Strategy, released in June of 2017, included an initiative for creating a Master Plan for the property surrounding the historic Belgrano Station by mid-2019. The eventual revitalization project will integrate this zone into the wider urban grid by developing housing, green space, bicycle lanes, and new commercial activities. The city will identify sources of financing to carry out the different projects, in particular the expansion of the station building's current Convention Center to a world-class complex.

The Belgrano Station Master Plan project is part of a series of initiatives within the city's Resilience Strategy aimed at exploring urban management models for facilitating the sustainable use of the environmental and social assets of a city. The Resilience Strategy's plan for major socio-

productive works focuses on a series of projects that have broad consensus across relevant stakeholders, including resilient investments in airports, bridges and road connections, and industrial and logistic parks. The Belgrano Station project will take place within this wider context of urban revitalization in Santa Fe, amplifying its potential impact.

The Belgrano Station and the surrounding area belong to the National Government, administered by the State Property Administration Agency (AABE). The Master Plan accounts for the interests and needs, both formal and informal, of the multiple actors who currently make use of the land.

The city and AABE formed a task force to codevelop the Master Plan, which will be reviewed by an ad-hoc board with members from the private sector, NGOs, academia, neighbor associations, and others.

The central location of the iconic Belgrano Station, combined with the high buildability of the site allowed by current regulations, give this project its great potential. The site is envisioned for mixed-use development, including the integration of current residents of informal settlements nearby. Development plans will increase publicly accessible green space and ensure a sustainable environmental footprint for the site as a whole.

Moreover, Santa Fe has made a commitment that any new development must not detract from the cultural and patrimonial value of the Belgrano Station building itself, and that the Master Plan must be developed in a participatory manner with the families currently living in the site and surrounding neighborhoods, including the informal settlements. The Master Plan apportions

the site into 30% developable parcels, 35% public and green spaces, and 35% affordable housing, streets, and other reserved uses. The high percentage of land reserved for public and green spaces reflects the city's goal of the site serving as a significant new natural asset – a "green lung" for the metropolitan region.

The development will attract not only locals but also visitors to the city, including for frequent conferences hosted at the Convention Center. The opportunity for new hotels and hospitality services is particularly high, as the city suffers from a shortage of modern hotel rooms and is currently enlarging the capacity of the Convention Center itself. The intervention will be carried out on lands owned by the National Government, as well as a sector of the property that is leased to the Municipality. Although the intervention is limited to a specific site, its privileged location will make its social and economic impacts felt across the city and beyond.

Given the complexity of interests in the site and the potential impact of the project on Santa Fe, the definition of a management model will be fundamental to the project's success. The management model will have to offer a collaborative and optimized environment that allows for interaction between agencies, the elimination of overlap, and the coordination of interventions, to ensure confidence generation in the real estate market of Belgrano.

At the end of 2018, the Municipality of Santa Fe signed an agreement with the AABE to advance the development process, which provides for the social, environmental, and urban recovery of the entire site, and allows the city to carry out works the residents have long requested, such

as opening new streets in the area. 100RC has supported the city in creating a project brief for the Belgrano Station zone, gathering into one document the various opportunities offered by the concept, and applying a resilience lens to the planning process. 100RC has also joined the city in negotiations with the present owners of the land, to determine the most beneficial ways to structure eventual land deals.

The Belgrano project will address some of the key stresses faced by Santa Fe, such as rainfall flooding, vacant lots, lack of investment and economic diversification, and high unemployment among the city's young people. Not only will existing business be concentrated there, but a new technological district is also planned. Local entrepreneurs with links to the software industry have proposed projects for the neighborhood and the site itself.

Along with the 28,628 residents in surrounding neighborhoods, direct beneficiaries of the Belgrano redevelopment will include young people gaining formal employment, local industries of construction and tourism, the approximately 2,500 families from around the city that will obtain housing in the new development, and the approximately 60 families currently in informal settlements on the site, who will improve their living conditions.

The assets planned for the Belgrano zone will allow Santa Fe to position itself as a reference city for business tourism, leveraging its architectural heritage and associated quality services to attract regional, national, and international events. The Belgrano Station project offers high resilience value for the city, as it is developing an area in the city through a lens that considers multiple

uses and the visions and needs of the different actors involved. As a new "piece of the city," the Belgrano area will not only offer new housing of various types and costs but will also contribute to many other aspects of life in Santa Fe.

The Belgrano area will contribute to the city's health and well-being through the development of mixed uses, including housing, with a generous provision of public spaces. This will offer citizens more options for an active daily life, better provision of equipment, and more employment opportunities. By integrating a diverse group of residents, including the poor and vulnerable, into the district, the Belgrano Station project will help Santa Fe create more cohesive communities with a greater sense of identity and belonging. The implementation of the Belgrano Station project will mean increased investment in Santa Fe, which will in turn boost the city's economy and generate confidence among potential investors.

The process of developing an entire zone of the city offers the opportunity to rethink infrastructure solutions, incorporating new concepts and new technologies to optimize infrastructure operation. The "opening" of the site to the city's residents also offers the opportunity to reconnect areas of the city that are currently isolated and fragmented.

Finally, the Belgrano Station project will contribute to Santa Fe's leadership and strategy. It offers a new opportunity to develop and test urban development processes that integrate local actors (communities, the municipality) and provincial and national organizations (provincial government, AABE) that have historically worked in an unconnected way.

Christchurch
Building Resilience in Eastern Christchurch

RESILIENCE DISTRICTS

PARTNERS   EARTHQUAKE RESILIENCE   SOCIAL EQUITY

Christchurch experienced a series of devastating earthquakes in 2010 and 2011, with the 2011 earthquake hitting Eastern Christchurch particularly hard. Ground shaking caused widespread liquefaction and subsidence, which led the government to buy nearly 7,300 damaged homes in an area known as the Red Zone.

More recent modeling indicated that land subsidence and future sea level rise could leave 25,000 coastal and lower river properties in Eastern Christchurch at risk of sea inundation over the next 50 to 100 years. A further 1,000 properties could disappear due to land erosion.

South New Brighton and Southshore are coastal suburbs in Eastern Christchurch where a community of 2,000 households faces a range of stresses, from pre-existing socio-economic vulnerabilities to the continued impacts of earthquakes and the risk of future inundation. The Resilient Greater Christchurch Plan identified securing a more resilient future for Eastern Christchurch as a key opportunity for building the overall resilience of the city, and as a result engaged in developing a regeneration strategy for the area that included short-, medium- and long-term options for adapting to the identified risks.

The regeneration strategy project has been led by a "How Team" of nine community members and staff members of three city agencies (Regenerate Christchurch, Christchurch City Council, and Environment Canterbury), who co-designed an engagement plan that determined the best ways to engage with South New Brighton and Southshore residents. The team's goal is to build a shared understanding of the values, opportunities, and risks for South New Brighton and Southshore, along with the ability and capacity to work together to address them.

The overall effort will focus on generating multi-party collaborations, first by conducting baseline needs assessments and risk analyses of the area, and then by developing solutions capable of truly addressing these intertwined challenges and regenerating the district.

In a demonstration of what cities can gain by leveraging external partnerships, the idea for Christchurch's "How Team" originated in the community, with a community development agency that had for a number of years been pushing for a co-creation model where communities are embedded in the decision-making process. Thus the team embodied its own core tenet of "nothing about us, without us."

The overall effort will focus on generating multi-party collaborations, first by conducting baseline needs assessments and risk analyses of the area, and then by developing solutions capable of truly addressing these intertwined challenges and regenerating the district.

The Christchurch City Council has been leading the work as it moves into solutions development, which will include the identification of specific actions and opportunities to mitigate inundation and erosion while addressing earthquake legacy, and more detailed planning on the adaptation process for the district of Eastern Christchurch to respond to climate change.

New Orleans
The Mirabeau Water Garden in the Gentilly Resilience District

RESILIENCE DISTRICTS

HOUSING   FLOODING   POST-DISASTER RESILIENCE

Sitting on the delta where the Mississippi River meets the Gulf of Mexico, New Orleans's geography, when combined with inadequate infrastructure, allowed Hurricane Katrina to devastate the city in 2005, flooding 80% of its area, displacing nearly half of the population, and claiming nearly 2,000 lives. The lessons of the storm directly informed the city's Resilience Strategy, released on the ten-year anniversary of Katrina's impact.

The Gentilly Resilience District project exemplifies New Orleans's approach to resilience-building. Launched in 2015 with a US$141 million grant from the U.S. national government, the district planning effort will introduce new water management systems across the residential neighborhood. The city contracted the consulting firm Stantec as a project partner to handle planning, design, engineering, and community engagement for the Gentilly project. The Mirabeau Water Garden, a microcosm of the larger Gentilly District, is a public works project that will transform an empty 25-acre site into a recreational and educational amenity, combining grey and green infrastructure in the creation of underground water storage as well as a rain garden. The project takes a multi-tiered approach that uses public space and vacant land for water management and flood risk

reduction, while also seeking solutions for to issues concerning health, economic development, social cohesion, urban heat, and the educational needs of the surrounding community. New Orleans is particularly interested in using Mirabeau to explore how public art and placemaking can generate community awareness of and support for green infrastructure interventions in the public realm.

Construction of the Mirabeau Water Garden is underway, with an estimated completion in the summer of 2019. Crucially, New Orleans is not measuring the success of the project according to the single metric of flood resistance, but to a wider scope of community benefits – including reduced risk of soil subsidence in the area, increased property values, and improved recreational amenities and community gathering spaces. Over 70% of residents surveyed agreed or strongly agreed that the water management project maximized benefits to the community as a whole.

The Mirabeau Water Garden and the Gentilly District exemplify how New Orleans, in its quest to build its overall resilience, is designing solutions that will enable the city to coexist with water as a permanent, integral feature of its urban landscape.

Porto Alegre
Transforming the Fourth District

RESILIENCE DISTRICTS

ECONOMIC DEVELOPMENT   HERITAGE AND CULTURE   HOUSING   NATURAL ASSETS AND
NATURE-BASED INFRASTRUCTURE

Porto Alegre's booming industrial sector first emerged in the 19th century, with new migrants flocking to the harborside zone of the city's 892-hectare Fourth District, located along the Jacuí river and between the airport and the central business district. But by the middle of the 20th century economic activity had shifted to new locations, and by the 21st century, the historic buildings and warehouses constructed during the district's heyday had fallen largely into disrepair. Though the district boasts a strong cultural identity and valuable location, residents suffer from urban blight, frequent flooding, crime, poverty, and limited opportunities in the formal economy.

But while these shocks and stresses are felt acutely in the Fourth District, they are not unique to it. The city has therefore identified the revitalization of the area as a top resilience priority, and as a pilot project for future resilience-building across Porto Alegre as a whole. The city envisions transforming the Fourth District into an innovative ecosystem of private companies, educational institutions, public entities, and the local community, grounded in advanced ICT capacities.

Porto Alegre is placing particular emphasis on ensuring that any economic development is inclusive of the district's current residents, and that gentrification stresses are monitored and proactively addressed. The city is also committed to leveraging the new economic development to the benefit of the city's poor and vulnerable, particularly its disenfranchised youth, incorporating them into both the formal economy and the overall fabric of the community.

Porto Alegre's comprehensive urban redevelopment project will offer opportunities for investments in housing, mobility, commercial facilities, and parks and public spaces.

The city will measure the success of this project according to the number and diversity of new enterprises operating in the district, demographic density, total tax collection rates – and whether other degraded areas of the city are successful in adopting the methods applied in the Fourth District. Finally, as the drainage needs of the Fourth District are a key consideration, given its high flood risk and currently inadequate sewage infrastructure, the city is committed to implementing blue-green infrastructure and other sustainable techniques for coexisting with water in urban environments.

Porto Alegre's comprehensive urban redevelopment project will offer opportunities for investments in housing, mobility, commercial facilities, and parks and public spaces. The city will be revising building and zoning codes, and scoping other incentives or regulations needed to create an enabling environment for growth and revitalization. They are currently identifying a pilot project site with evident land value capture potential.

The Fourth District project will benefit the entire city, attracting new investment streams and developing new industries, diversifying the city's economy and expanding its global connectivity, and creating new centers of coexistence for different groups.

Rotterdam
Resilient BoTu 2028:
Toward the Urban Social
Index Average in 10 years

📍 RESILIENCE DISTRICTS

📊 ECONOMIC DEVELOPMENT   ⚖️ SOCIAL EQUITY

The Rotterdam districts of Bospolder and Tussendijken, together known as BoTu, are two of the city's lesser-known gems. Densely populated and highly diverse, residents have deep personal resilience and a strong sense of place and community in their neighborhoods. Nevertheless, BoTu lags behind other districts in the city on a range of socio-economic markers. BoTu is home to over 14,000 people, approximately 80% of whom are "new Dutch" immigrants from around the world. This population is relatively young, and almost 75% of BoTu households are in the "low income" bracket. In 2018 the Urban Social Index – a self-assessment of citizens' capacities, living environment, participation, connectedness, and general quality of life – determined the average score among all Rotterdam's districts as 105, while Bospolder scored 94 and Tussendijken only 84.

Launched in 2018, the program Resilient BoTu 2028 sets out to address these challenges holistically, with a goal of raising the social index of the district to the average of the city in 10 years and testing the potential of creating resilience districts across the city. The program will help residents build their capacity to handle challenges and changes in their lives through a set of cross-cutting interventions in BoTu's built, social, and green environment. As well as addressing current concerns, the program will plan for challenges to come, including changing demographics, increasing social isolation, evolving labor markets, and energy transition. Resilient BoTu 2028 is a testing ground for renewal and improvement, with a critical coalition of partners committed to the district's success. The coalition's champions include school directors, health care professionals, police officers, parents, local police, entrepreneurs, the housing cooperation, and the municipality. This new alliance has already launched the first of three main workstreams – the Social Impact by Design process. This is an intensive collaborative process to surface creative, integrated, and implementable solutions to the district's most persistent problems. Social Impact by Design focuses on collaboration with the private sector, from innovative entrepreneurs and startups to larger more established firms.

The other two workstreams of Resilient BoTu 2028 are aligned with goals articulated in the city's overall Resilience Strategy: a focus on asset-based community building, tied to the principles of the Neighborhood Oriented Governance program, and an initiative to design a water park with input from the community, that will create a vibrant public space in Park 1943.

〜 Resilient Rivers

Throughout human history, cities have sprung up near and alongside rivers thanks to their provision of freshwater, transportation, irrigation, biodiversity, and livelihoods. Rivers filter out pollutants, mitigate floods and droughts, recharge groundwater supplies, sustain fisheries, and serve as important byways for travel. The lifelines of the planet, rivers provide many critical services for free. But factors such as urbanization and uncontrolled growth, pollution from industry and agriculture, and mismanaged water consumption, have all accelerated in the 21st century, threatening urban riverscapes the world over. Poor water quality poses a severe threat to human health, with waterborne diseases a leading cause of preventable deaths. Conflicts over water supplies have resulted in violence and political instability in shared river basins. Even well-intentioned efforts to prevent flooding through channelization, building levees and dams, or dredging tributaries, can have damaging effects on the natural environment and dangerous repercussions for residents. Crucial to rivers are watersheds, areas of land that catch precipitation and direct it to streams, rivers, and lakes. Watersheds sustain a rich variety of plants and animals, and are impacted by a variety of human activities, including washing clothes, growing food, mining, commercial farming, and permanent structures such as buildings or roads. Conversely, rivers and their watersheds can be determinant in how many people, flora, and fauna can be sustainably supported in a given area. Finally, rivers and their watersheds traverse political, national, economic, and cultural boundaries – every city exists downstream from somewhere, and upstream from somewhere else.

Cities in the 100RC Network are pursuing innovative efforts to transform their relationships with their rivers and create a collective understanding of them not merely as features of the landscape to be controlled or overcome, but valuable assets to be nurtured, intimately connected to the overall resilience of the city. Resilient river design, planning, and implementation involve a number of elements. A city can implement a phased initiative to improve its water quality, by reducing pollution and refuse in localized efforts that nevertheless consider the ecological and social system on a large scale. Resilient river water management allows a river to expand during heavy rainfall, thereby reducing flooding, while "linked landscapes" create habitat corridors for both people and wildlife. A resilient river system can embrace a cultural approach to integrated water resource management, with urban neighbors feeling connected to the riverfront and its history and landscape. Finally, engaging and educating through science-based approaches can nurture citizen and corporate social responsibility, and help create the next generation of river stewards. A localized, resilience-building approach to urban rivers will create multiple co-benefits – reducing flood risks, improving public health, promoting social cohesion, creating jobs, restoring local ecosystems, and ensuring sufficient water supplies for the future.

Surat
Water Resilience on the Tapi River

PARTNERS   SCALE   WATER AND SANITATION

The City of Surat experienced unprecedented growth in the last four decades, as its population expanded tenfold – one of the highest growth rates in the Asia-Pacific. Unfortunately, this rapid development has resulted in the pollution and overconsumption of the Tapi River, the heart of the city and the sole source of fresh drinking water available to the city's now 6.8 million residents.

Today managed by the Surat Municipal Corporation (SMC), the city has been piping water from the Tapi River for over 100 years. Thanks to the upstream Ukai dam, SMC also uses the Tapi for irrigation and power generation.

However, the water supply is highly intermittent, with a daily average of only three hours of piped water throughout the city. The quality of the water has also been seriously degraded by anthropogenic activities such as wastewater discharge, slum encroachments, and unregulated industrial activities, as well as the increasing salinity of groundwater tables due to rising sea levels and tidal flooding.

With climate change causing unpredictable rainfall patterns, from monsoon flooding to summer droughts, Surat cannot build its overall resilience without addressing these challenges to its water security – the impacts of which will affect the city's most vulnerable residents most acutely.

Water management is therefore central to Surat's Resilience Strategy, which devotes several of its initiatives to remediating environmental damage, managing flooding, and regulating water usage, in order to ensure sufficient clean water for its population in the long term and strengthen links between citizens and their river.

To implement these initiatives, Surat's Resilience team worked through the 100RC Network to identify two critical partnerships, one with fellow 100RC member city Rotterdam to work on sustainable water management, and another with the firm Veolia to support wastewater management along the Tapi River.

Rotterdam-Surat Partnership

Connected through their mutual membership in the 100RC Network, and supported by funding from the European Union's International Urban Cooperation (IUC) program, the SMC entered into a formal partnership with the City of Rotterdam to aid Surat in developing more technical and infrastructure-oriented water management

strategies. The partnership was sparked during the 100RC Network Exchange on Water hosted by Rotterdam in 2015, followed by official dialogues between the cities' CROs during the 100RC Global Urban Resilience Summit in 2017.

As a delta city situated primarily below sea level, Rotterdam has designed many innovative solutions to reduce flooding in the city and connect water to economic opportunity, recreation, and beautification. To learn more about these solutions, the City of Surat sent a delegation to Rotterdam in July of 2018. They visited a variety of Rotterdam sites, including water plazas, multifunctional roofs, and an underground water storage facility, and interacted with water management companies Evides, Deltares, Arcadis, and Veolia. The visit inspired a long list of potential water resilience actions for SMC.

In March of 2019, a Rotterdam delegation in turn visited Surat, and the cities agreed to prioritize projects along the Tapi River related to improving the quality of drinking water, mitigating water pollution, protecting against flooding, and harvesting rainwater – with the experiences of Rotterdam adapted to the local context of Surat. Surat has since piloted two projects inspired by Rotterdam.

First, Surat introduced a new "Blue Roofscape" policy. This policy drives the installation of rooftop rainwater harvesting units onto existing government and institutional buildings and mandates them in newly built high-rises, demonstrating such systems as best practice to both commercial and residential building owners. To date, over 1,350 rainwater harvesting systems have been installed. The collected rainwater replenishes groundwater, offers an alternative source of drinking water,

and encourages awareness of water conservation among residents.

Second, SMC identified a location to pilot a water plaza. In Surat, this multifunctional public plaza will not only provide a space for community recreational opportunities and ceremonial activities during the Ganesha festival, it will also be constructed with water catchment technologies capable of storing stormwater during the monsoon season or other heavy rainfall events, mitigating floods and preventing pollution-laden runoff from reaching the Tapi River.

Wastewater Management with Veolia

Through 100RC, Surat also leveraged a partnership with the multinational firm Veolia, which provides multiple utility-like services. Together they are working to transform wastewater management for the Tapi River, exploring options for improving sewage infrastructure, setting up a comprehensive water quality monitoring system, and installing wastewater treatment plants.

The city has prepared a detailed project report for this effort, outlining plans for the construction of 37 new wastewater treatment plants across the city and its surrounding metropolitan area, an estimated investment of US$140 million.

To date, SMC has been working with Veolia to create a workshop on wastewater management, with the goal of devising a technical solution for wastewater management in the city that incorporates principles of the circular economy, potentially including guidelines for closed loop water reuse. The partnership is also scoping out a pilot site, Valak, for a new wastewater management plant.

Resilience Dividends

Surat's resilience-building work with 100RC helped build the capacity of city staff while providing a common platform for discussions with city leadership and technical experts.

With the various pilot projects for rainwater catchments, water plazas, and improved wastewater management all well underway, the city must now develop a series of detailed, resilience-informed, ready-to-use project reports with which to access funds and leverage resources from various programs when opportunities arise. To consolidate all such efforts, the city must set up a regional water authority (Tapi River Regional Authority) to oversee all matters relating to water security in the metropolitan area of Surat.

The city also now needs to align its many various plans with these resilience initiatives, based on importance and implementation timeframes, while connecting with more partners, advisors, funds and resources from local, state, and central governments. Through extensive infrastructural investments, Surat is reinforcing its overall water resilience by meeting basic water consumption needs, reducing untreated sewage water, and creating new greenscapes and bluescapes. These interventions will all ensure the continuity of critical water services for the city.

The quality and quantity of water in the Tapi River was a central concern for Surat when it began crafting its Resilience Strategy. But as that work progressed, the city's water resilience vision expanded, and Surat is now taking a more holistic approach to water, targeting additional issues such as chronic wastewater mismanagement and monsoon flooding shocks.

> **The quality and quantity of water in the Tapi River was a central concern for Surat when it began crafting its Resilience Strategy. But as that work progressed, the city's water resilience vision expanded, and Surat is now taking a more holistic approach to water, targeting additional issues such as chronic wastewater mismanagement and monsoon flooding shocks.**

Los Angeles
Revitalizing Neighborhoods Surrounding the LA River

〜 RESILIENT RIVERS

◉ RESILIENCE DISTRICTS   ⇧ FLOODING   🌿 NATURAL ASSETS AND NATURE-BASED INFRASTRUCTURE

The Los Angeles River is familiar to many as a concrete-covered channel that features in many iconic movie scenes. Designed nearly a century ago for flood control, the LA River has long been a neglected asset. In its channelized state, the river has had a corrosive effect on the communal and ecological systems that surround it, causing the fragmentation of habitat, erosion of biodiversity, and diminished access to open space and natural resources for the people and wildlife living along its corridor.

Los Angeles is now working to revitalize the neighborhoods surrounding the LA River with a Resilience Strategy that comprises a range of interdependent initiatives, advancing resilience goals such as environmental restoration, affordable housing, social cohesion, and equity. The city is interested in cultivating tools, policies, and unique forms of financing to create physical spaces along the LA River that secure affordable housing, catalyze economic development, increase access to open space, and reduce flood risk.

With respect to ecological systems, LA River revitalization focuses on reestablishing the river's freshwater marsh and aquatic habitats – further protecting and improving the river's ecosystem and biodiversity by expanding open space along the river corridor. The revitalized river will serve as a model for urban ecological revitalization.

To strengthen social cohesion, equity, and neighborhood preparedness, the city is partnering with local non-profit organizations to build on existing educational programs focused on connecting Angelenos with the LA River. Communities will be engaged in new programs related to biodiversity, health and recreation,

> **Los Angeles is now working to revitalize the neighborhoods surrounding the LA River with a Resilience Strategy that comprises a range of interdependent initiatives, advancing resilience goals such as environmental restoration, affordable housing, social cohesion, and equity.**

and LA River stewardship. Actions will include a wayfinding program to enhance visitor connections to the river, a flood risk education program for river-adjacent neighborhoods, and the expansion of the River Rangers and River Ambassadors programs, which provide critical in-person public education opportunities to river-adjacent communities. Other programs will provide people experiencing homelessness near the river with better access to services and housing, and will find ways to leverage the LARiverWay – a bike path and greenway currently under development – for emergency access and evacuation routes. The city will also identify opportunities to incorporate art along the waterway, enhancing it as a public space for the community.

In January of 2019, 100RC supported a Resilience Accelerator workshop to advance the implementation of LA River revitalization. This workshop convened stakeholders across a variety of backgrounds to explore innovative ways of leveraging investments around the LA river to increase resilience benefits. Together, these efforts will transform the LA River into a living laboratory for resilience in a unique urbanized setting.

Panama City
The Juan Díaz River Basin

RESILIENT RIVERS

ACTIONS   FLOODING   NATURAL ASSETS AND NATURE-BASED INFRASTRUCTURE

The Juan Díaz river basin is located about 15km east of the Panama Canal and is part of the Panama City Metropolitan Area. Covering 34,896 hectares, it is home to over 600,000 residents. Decades of poorly managed development have left the river and its surrounding environment polluted and degraded, and Panama City had committed to restoring the natural assets of the area. By applying a resilience lens to this goal, the city identified additional benefits that could be achieved through the work, including flood mitigation, social equity, and climate adaptation.

With funding of US$100 million from the IDB, the city is developing a comprehensive project from its Resilience Strategy, "Resilient Urban River Juan Díaz." One of the main objectives of the project is to tackle flooding and build green and blue infrastructure, enabling the landscape to be a key infrastructural aid to flood mitigation. Panama City is assessing options for the strategic drainage works needed along the river, including low-impact micro-retention measures for run-off and reduced flow, green infrastructure to absorb or retain excess water, and the recovery of coastal and mangrove meanders to minimize flooding.

To ensure that it does not simply invest in the infrastructure needed today, but also builds resilience in the basin for the long term, Panama City is also improving the governance of the Juan Díaz. New land-use and zoning policies, which better account for flood risks in light of climate change, will promote mixed-use and medium-density developments that are appropriate for the flood management capacities of their surrounding natural assets such as the wetlands. The wetlands, meanwhile, will be designed to function also as a network of easily accessible public green and recreational spaces.

Throughout the entire design and planning process for this intervention, Panama City is maintaining a communications campaign for affected residents about the progress and expected benefits of the work. When complete, the upgrade to the Juan Díaz river basin will reduce water pollution in the river, while improving solid waste management in surrounding communities, decreasing the number of households at risk from flooding, improving land use, and promoting the conservation and valuation of environmental services and ecosystems for their flood mitigation and climate adaptation potential.

Pune
The Mula-Mutha River: Re-Evaluating Existing Projects through a Resilience Lens

RESILIENT RIVERS

PARTNERS   NATURAL ASSETS AND   WATER AND SANITATION
                  NATURE-BASED INFRASTRUCTURE

Pune City is located at the confluence of the Mula and Mutha rivers, at the foothills of one of the most biodiverse regions in India. Over the past few decades, however, Pune has been experiencing sprawling urbanization in the form of exurban office parcels on the city's fringe and informal settlements along the banks of the Mula-Mutha, which have created immense pressures on its water resources and civic infrastructure.

The first proposal for the Mula-Mutha River Conservation and Riverfront Project – led by the Pune Municipal Corporation (PMC) and designed by HCP Design Planning and Management – has been criticized by community and environmental groups for its suggestions of excavating and concretizing the riverbanks, and removing native rock forms and wildlife habitat features. The proposal has also encountered significant implementation barriers, owing to complex jurisdictional ownership and management structures. Finally, the proposal assumed the construction of sewage treatment plants by the Japan International Cooperation Agency – the completion of which remains uncertain – rather than addressing the broader efforts necessary to reduce solid waste.

In light of Pune's resilience risks of pollution, growing water consumption, rapid development of upstream areas, and rural versus urban water needs, the city recognized the need for a larger, more systemic vision and stronger coordination systems in order to implement a truly resilient transformation of the river at the relevant scale.

The Resilience Accelerator team looked at different spatial configurations of the river project that would advance the PMC's core purpose – to maximize the value of the Mula-Mutha River and build the overall resilience of Pune.

To find alternatives, Pune partnered with the Resilience Accelerator – a joint effort between 100RC and the Center for Resilient Cities and Landscapes at Columbia University – to reevaluate the proposed project. Together with diverse local institutions and stakeholders, the Resilience Accelerator team scoped nature-based infrastructure, facilitated opportunities for the re-alignment of decision-makers, and explored regional governance regimes as a means of integrating alternative designs.

During an urban design studio workshop conducted with the Institute of Environment Education and Research and the Pune College of Engineering in January of 2019, the Resilience Accelerator team looked at different spatial configurations of the river project that would advance the PMC's core purpose – to maximize the value of the Mula-Mutha River and build the overall resilience of Pune.
Led by faculty and students, the workshop team presented a longer-term socio-ecological revitalization project in lieu of the currently proposed mega-project that beautifies but does not consider the systemic consequences and various relevant scales of operation for equitable water resource management. The alternative vision has been tested by students at various sites along the riverbanks in the river project urban design studio, and is under evaluation by the city.

Santiago de los Caballeros
Vive el Yaque

FLOODING   HOUSING   SOCIAL EQUITY

Founded as a fort by Christopher Columbus in 1495, today the metropolitan region of the City of Santiago de los Caballeros is home to over 850,000 people, making it the second largest city in the Dominican Republic. Well connected to a major port and with fertile surrounding agricultural lands, the growing city is a key location for the nation's largest export industries and the processing of key commodities.

The 308km Yaque River provides the main source of water for the city and the surrounding Cibao Valley agricultural region, as well as an important hydro-dam complex. Crossing the length of Santiago de los Caballeros, the river serves as its most emblematic natural asset. However, watershed management has been poor for some time, and the river and its banks have become polluted.

In recognition of the Yaque's potential to be a strategic ecological corridor for Santiago, the city's Resilience Strategy is prioritizing a series of transformative actions known as *Vive el Yaque*, to recover the river and its banks and improve residents' quality of life. The projects envisioned include stormwater drainage and flood management infrastructure such as levees,

reforestation, and recovery of environmental assets, and the revitalization of the infrastructure and urban habitat of the river basin, including at a core market on the river and elsewhere throughout the city's historic downtown center.

The city government and local stakeholders, in partnership with 100RC and the IDB, have worked to build resilience into this project from the outset, with explicit resilience-related requirements added to all bids and RFPs. The IDB has funded elements of project design and impact assessment.

> **The Resilience Accelerator proved to be a critical moment for key stakeholders to work through barriers and create more resilient projects, with a clearer sense of scope and cost, as well as a community of people committed to their implementation.**

Santiago also partnered with 100RC and Columbia University's Center for Resilient Cities and Landscapes to hold a Resilience Accelerator in November of 2018, which brought diverse global research and design expertise to the work underway by local practitioners. Over the course of three months, the Accelerator team met with community leaders, collected global case studies, and prepared a design charette that included site visits and meetings with community leaders in addition to a two-day workshop. Participants refined the proposed *Vive el Yaque* projects by weighing options against the immediate needs and possible futures of affected neighborhoods. The Resilience Accelerator proved to be a critical moment for key stakeholders to work through barriers and create more resilient projects, with a clearer sense of scope and cost, as well as a community of people committed to their implementation.

The overall revitalization of the Yaque River has an estimated cost of US$80 million, and includes action plans for three distinct areas along the river. The work will directly impact the 25,000 residents along the riverbank, particularly the eleven communities (7,000 people) living in high-risk flood zones, some of which will need to be resettled. The city's vision for the upgraded corridor will benefit all residents, offering reduced flooding, cleaner water, new green parks and leisure areas, a rehabilitated downtown, improved social cohesion, and increased economic opportunity. It will mark a new path of development in the creation of a more resilient, safe, and inclusive city.

⚖ Social Equity

Cities are more than their physical infrastructure; their essence is not merely streets, buildings, and landmarks but communities, residents, and cultures. Social inequities among these communities is a key resilience challenge that threatens the fabric of society in cities across the world. It will be impossible to build more resilient cities without understanding and addressing the various deep vulnerabilities that uniquely affect certain segments of a city's population. The term equity is often used interchangeably with the term equality; however, they differ in important ways that city decision-makers and resilience practitioners must keep in mind. Equality involves treating everyone the same way – ensuring identical inputs, access, opportunities, and resources. But policies and programs grounded in equality assume all recipients begin from equal positions, when in fact, social inequities stemming from the intersections of race, class, ethnicity, religion, language, age, gender, sexuality, and more exist in cities around the world. These arise from years of systemic structures of privilege and oppression and result in deep-rooted disparities. Applying an equity lens to resilience building efforts therefore seeks equal and equitable outcomes; achieving this may in fact require the unequal distribution of resources.

The intrinsic and widespread impacts of social inequity across a city are not merely the accumulated result of individual prejudices but constitute a systemic stress that threatens the resilience of the city as a whole. In times of crisis, the shocks that befall a city are made far worse by social inequities, ultimately making it more costly for the city as a whole to recover.

Moreover, the effects of inequities intersect and intensify over time, depriving marginalized communities of equal access to resources and opportunities, and equal representation in political systems, while exposing them to extreme stresses such as poverty, poor health outcomes, housing insecurity, and a lack of economic mobility. The progress made by communities and individuals in their efforts to escape poverty, for example, is often temporary, with economic shocks, food insecurity, political instability, and climate change constantly threatening the gains made by vulnerable citizens. Over time such interdependent stresses can widen the resource gaps suffered by marginalized communities, deepening social, economic, and political fissures and threatening to destabilize a city. Cities must commit to understanding the extent of the social inequities across their populations and to holding themselves accountable to working with impacted communities to design and prioritize interventions. Resilient responses to social inequities will consider how the interdependent systems within a city affect the well-being of oppressed and marginalized populations, and will address both the root causes of this marginalization as well as the resulting weaknesses.

Boston
The Economic Mobility Lab

⚖ SOCIAL EQUITY

🤝 PARTNERS   ⚚ CHAMPIONS   ₁₁₁ ECONOMIC DEVELOPMENT

One of America's oldest cities, Boston is known today for its higher education institutions and its booming financial services industry, which helps make it the sixth largest metropolitan economy in the U.S. However, Boston also leads all large American cities in income inequality, which cuts starkly along racial lines. Analysis from 2015 revealed that the median net worth of African American households in the Greater Boston region was only US$8, while for white households it was US$80,000. Structural disadvantages such as a lack of emergency or retirement savings, lower rates of homeownership, and higher rates of debt contribute to the long-term economic challenges facing Bostonians of color. Besides causing severe day-to day-trauma, these underlying stresses mean that shocks have a greater negative impact on these communities when they occur.

In applying to join the 100 Resilient Cities Network, the City of Boston recognized that achieving citywide resilience requires addressing racial inequity. The city articulated this guiding principle in its Resilience Strategy, released in 2017, saying: "only when every resident is able to reach their full potential, regardless of their background, will Boston be a truly resilient city."

Central to Boston's Resilience Strategy, therefore, is a mandate to develop robust systems and policies that ensure that all residents progress together and that no one is left behind. The Strategy's vision for "Equitable Economic Opportunity" focuses on creating and strengthening economic and social pathways that support closing the wealth gap – to ensure that a Bostonian's quality of life is not determined by their race or ethnicity.

The City of Boston recognized that achieving citywide resilience requires addressing racial inequity.

To achieve this aspiration, Boston partnered with 100RC and RF to create an Economic Mobility Lab (EML), a flagship initiative for the city launched as part its Resilience Strategy.

The EML sits in the Mayor's Office and is charged with advancing the upward economic mobility of all Bostonians. The Lab crosses silos, working across agencies and government entities at all levels to help coordinate and improve delivery of anti-poverty programs. It also prioritizes data and analysis so that the most effective programs can be tested and scaled. The EML understands that its work does not happen in a vacuum: it is taking a people-centered, holistic approach to deep-rooted challenges by incorporating strategies including human-centered design.

The EML team prioritizes talking to Bostonians about the obstacles they face in trying to move up the economic ladder, in order to understand their lived experiences. In partnership with the design research firm IDEO, the EML has cross-referenced those personal stories with analysis of the latest data and research to extract overall trends. Thus far, the documented experiences of interviewees have reaffirmed the deep connections between economic and personal histories, primarily the determinative importance of both positive and negative "key moments" in a person's life that influence their ability to move up the economic ladder. For instance, many respondents had experienced personal crises that caused long-term economic instability (e.g. eviction and foreclosure, addiction, or chronic illness). Others accessed opportunities at their first job that positioned them for success over their lifetimes. Many women identified childcare as a key barrier to moving up the ladder.

Insights such as these are guiding the EML's pilot projects. Pilots are designed and tested for scalability and aim to address gaps or leverage opportunities in the city's economic mobility ecosystem and to coordinate action across departments or initiatives.

In practice, the EML is working across city departments and agencies both to eliminate long-standing barriers to wealth-building for Boston's communities of color, and to make intergenerational wealth-building opportunities accessible to every Bostonian. By organizing pilots around key moments in people's lives such as early childhood and childcare, the transition to college and career, a first job, and preparing for unexpected expenses, the EML is helping Boston launch and scale innovative efforts to make economic opportunity a reality for all Bostonians regardless of the shocks or stresses they might experience.

Work does not happen in a vacuum: it is taking a people-centered, holistic approach to deep-rooted challenges by incorporating strategies including human-centered design.

To that end, the EML's preliminary areas of focus include projects and programs around childcare, income growth, and the development of tools to help families. For example, working with the Mayor's Office of Women's Advancement, the EML recently developed a childcare-related survey for the city's anonymous 2019 census – making Boston the first city in the country to document local childcare needs and preferences through a census. The optional survey aims to understand better how individuals and households manage childcare, and to discover from residents themselves the best ways for the city to support parents and young children.

Another initial effort of the EML is to coordinate a pipeline of programs that will set up students and their families for income growth. Partnering with Boston Saves, a city-sponsored children's savings account program, the Lab aims to help families build their financial capabilities and save for their children's post-secondary education and training. Moreover, the Lab has partnered with the Mayor's Office of Financial Empowerment to develop and expand tools that help families, such as an incentivized emergency savings account

program. They are also conducting research for and developing new programs with Boston Builds Credit, an initiative that aims to raise the credit scores of city residents.

Partnerships with local academic institutions and Boston's Analytics Team are tracking the long-term impact of this work. Ultimately, the EML builds on the city's Resilience Strategy and its Economic Equity and Inclusion Agendas – setting the stage for new partnerships and sources of investment for innovative projects related to economic development, asset building, workforce development, education, and entrepreneurship. This comprehensive approach with a resilience lens will play a critical role in supporting the economic advancement of Bostonians of color and therefore in building the resilience of the city as a whole.

Finally, thanks to 100RC's facilitation of an exchange of best practices between cities in the Network, Washington DC is planning to pilot initiatives based on the EML's work in Boston, while Boston, in turn, has been sourcing insights and best practices from New York City.

Barcelona
Etapas de la Vida

◎ ACTIONS   📊 ECONOMIC DEVELOPMENT   🏠 HOUSING

The vibrant Spanish port of Barcelona is the largest metropolis on the Mediterranean Sea. The city is a center for tourism, entertainment, sports, and other industries. However, high unemployment has increased the number of people unable to find homes, make mortgage payments, or afford utilities such as water, electricity, and gas. This problem has also impacted social structures, putting stress on traditional family cohesion and impacting residents at their different stages of life.

In recognition of this, Barcelona explicitly used a "Stages of Life" lens in developing its Resilience Strategy, to explore the different needs of Barcelonans throughout the full cycle of their lives and qualitatively analyze the city's responses to their various needs. Stages of Life (Etapas de la Vida) considers the distinct needs of children, young people, and the elderly in designing programs that will create a safe, accessible, and equitable city and guarantee the well-being of residents throughout all life stages.

The Resilience Team used the Etapas de la Vida concept as an entry point for understanding other priority resilience-building areas such as housing, public space, social and economic prosperity, and migration. For example, instead

of generally assessing migrants' interactions with the city and vice versa, by applying the Etapas de la Vida lens to the theme of migration, the Resilience Team was able to look specifically at the needs of unaccompanied minors, assessing the city's response to their particular needs to date, and finding areas for improvement or other new efforts. When looking at housing, the city explored the intersections of affordable housing, the needs of senior citizens, and things younger adults can do today to prepare for their futures. This same lens has been applied to other areas, including public space and social and economic prosperity.

The Etapas de la Vida lens recognizes that there is meaningful diversity within Barcelona's vulnerable populations, and that designing for the needs of specific groups of residents will ensure that the Resilience Strategy contains a robust, specific, and effective set of actions that respond to the specific shocks and stresses faced by the city.

Buenos Aires
Empowered Women, Resilient Cities

🤖 DATA AND TECHNOLOGY   📊 ECONOMIC DEVELOPMENT   ◎ ACTIONS

The largest city in Argentina and a top tourist destination worldwide, with a high quality of life and significant diversity, Buenos Aires nevertheless is stressed by inequities along social and economic lines, which threaten the overall resilience of the city. As a part of its Resilience Strategy development process, Buenos Aires identified achieving gender equality and empowering all women and girls as fundamental to building its resilience.

Buenos Aires therefore drew on international best practices to create a Comprehensive Gender Equality Strategy, with goals of ensuring that women can safely enjoy and circulate in public spaces (physical autonomy), actively participate in decision-making processes and assume leadership positions (autonomy in decision-making), and become key actors in economic development (economic autonomy).

In seeking to implement this strategy, the city identified a major gender gap in its socio-demographic, economic, and political data, and so in 2018 launched a Gender Indicators System to better assess and understand the specific needs of women and girls in the city. The new data revealed that, in comparison with men,

Achieving gender equity is essential to building resilient societies. Enhanced equity will make women less vulnerable in situations of domestic violence, and generally will empower women to fulfill their goals and develop their full personal and economic potential.

women in Buenos Aires spend significantly more time taking care of children and seniors, have lower participation rates in the labor market, and are disproportionately represented in low-productivity sectors. Women in Buenos Aires also face a gender wage gap of 21.8%.

To begin to address these disparities, the city codified a model of shared parental leave for city government employees, granting 45 days of leave to fathers and other non-gestating parents. This enhances the reintegration of women into

the labor market post-partum by allowing a more equitable distribution of parental responsibilities during the early life of a child. To further support women's ability to participate in the labor market as their children grow, Buenos Aires reinforced its public childcare system, building 30 new kindergartens for children as young as three.

Buenos Aires also launched a dialogue between the government, firms, and business groups, on how to include more women in the labor market on fairer terms. That led to the city signing a public agreement with several leading private companies to create a Public-Private Action Plan for Gender Equality in the Labor Market, that will contain specific actions and public commitments to reduce gaps in labor participation, pay, access to leading positions, and entrepreneurship. Finally, Buenos Aires signed a public agreement with the most important corporate consortium in the country (IDEA), under which member companies will implement the UN Global Compact's Women's Empowerment Principles and share staff and salary data to measure progress.

Achieving gender equity is essential to building resilient societies. Enhanced equity will make women less vulnerable in situations of domestic violence, and generally will empower women to fulfill their goals and develop their full personal and economic potential.

Seattle
The Race and Social Justice Initiative

⚖ SOCIAL EQUITY

CHAMPIONS $ FUNDING ⊕ ACTIONS

In 2005, Seattle implemented a Race and Social Justice Initiative (RSJI) to unpack and address the underlying systems within city government that perpetuate racial and social inequities. It was the first U.S. city to launch an effort explicitly focused on addressing institutional racism in city government. Led by the Seattle Office for Civil Rights and an interdepartmental team of city staff, the RSJI examines city policies, projects, initiatives, and budget decisions to ensure that their impact on marginalized and vulnerable groups in Seattle is not discriminatory or otherwise inequitable. Working across the areas of arts and culture, criminal justice, education, environment, equitable development, health, housing, jobs, and social services, the RSJI focuses on strengthening public engagement and outreach, changing existing services to achieve equitable outcomes, and leading a collaborative community effort to eliminate racial inequity across key sectors.

In 2014, an Executive Order by the Mayor's Office required city staff to use RSJI tools and trainings, and to assess the progress that departmental outcomes and internal practices were making in achieving racial equity. As part of this ongoing work, all city departments must conduct a racial equity analysis of their budget requests to determine the impacts of their decision-making on underrepresented communities.

Most departments additionally utilize the RSJI's Racial Equity Toolkit (RET), which lays out a step-by-step process for developing equitable initiatives, policies, and programs. The RET has helped city departments understand and address the equity impacts of city actions, including the expansion of Section 8 voucher protections, the development of a youth participatory budgeting process, a campaign encouraging classroom attendance, and modifications to the Parks Department budget.

All departments publish their Race and Social Justice Initiative workplans to a public website to increase transparency and remain accountable to the community, and all are mandated to report annually to the mayor and City Council on their use of RSJI tools. The work of the RSJI has also led to the creation of additional resilience-building equity efforts across city government, including initiatives related to equitable community outreach and engagement, equitable development, equity and environment, equity in education, digital equity, labor equity, and workforce equity.

St. Louis
Quantifying Inequity After Ferguson

◎ ACTIONS   🏆 CHAMPIONS   🤝 PARTNERS

Sitting near the confluence of the Mississippi and Missouri Rivers, St. Louis was founded as an important trading post in the mid-18th-century and boomed as a crucial midpoint in the westward expansion of the United States. But alongside its heritage of immigration and independence, St. Louis has a history of deep racial inequities. Restrictive covenants and exclusionary zoning policies perpetuated housing segregation for decades, and the city was also one of the last in the U.S. to desegregate its schools. This legacy is still visible today in racial disparities of health, education, employment, and other measures of well-being.

Convened in response to recent police shootings of civilians, the Ferguson Commission's report made a series of calls to action, including the need for a racial equity benchmarking process. As a direct result of this, the city of St. Louis launched a new measurement effort, Equity Indicators.

Equity Indicators is a robust tool that uses localized indicators across specific sectors, such as economic opportunity and public health, to measure and track progress toward greater equality or equity in a specific city or community. The Equity Indicators tool measures 72 indicators

across three themes that reflect the priorities of the Ferguson report: "Youth at the Center," "Opportunity to Thrive," and "Justice for All." Updated annually, these metrics can help leaders and decision-makers craft more effective policies for resilience-building.

For the first time ever, St. Louis is quantifying the state of racial equity in the city and measuring progress over time. This offers powerful new opportunities for all sectors in the city to understand equity challenges, and for the public to hold leaders and institutions accountable. The Equity Indicators tool was developed through a partnership between the CUNY Institute for State and Local Governance (ISLG), The Rockefeller Foundation, and 100RC, working closely with community partners and with input from a wide range of stakeholders. It was pioneered in St. Louis, as well as in the 100RC member cities of Dallas, New York, Oakland, Pittsburgh, and Tulsa. Through its Resilience Strategy development process, St. Louis is exploring how best to implement additional recommendations of the Ferguson report. Overall, St. Louis's Resilience Strategy will focus on equitable development, economic inclusion, and improving quality of life in historically disinvested neighborhoods.

🚲 **Transport and Mobility**

In 2014, 64% of all human travel took place within urban environments – at which point the total number of urban kilometers travelled was projected to triple by 2050. Also in 2014, 157 cities around the world had a metro system in operation, with 53 of those systems constructed in the years since the turn of the millennium. Five of the busiest metro systems in the world are found in 100RC member cities: the combined annual ridership of London, New York, Seoul, Mexico City, and Paris exceeds 10 billion trips. Meanwhile, in African cities walking still accounts for up to 70% of all trips taken, placing even greater importance on the distances between the services residents need.

No matter the modes of transport concerned, urban mobility sits at the confluence of a number of major trends: population growth and shifting population densities, increasing concerns for health and air quality, the need to manage greenhouse gas emissions and energy prices, and the increasing social and economic stratification of neighborhoods.

Urban transport infrastructure is the physical backbone of a city's social, economic, and political activity. The lanes that provide passage for cars, taxis, bicycles, and buses, the streets and sidewalks that lead to homes, markets, and schools, and the railways and air routes that move people and goods en masse – a robust and diverse range of mobility options enables people to access gainful employment, education, and childcare. Well-functioning and widely accessible mobility systems contribute to economic growth as a whole and allow communities to flourish, but insufficient transport options, both public and private, have reverberating impacts on a city's economy, environmental health, and social cohesion.

Incorporating resilience into transportation planning and project implementation at various scales has significant potential to change a broad range of city systems. Chief among these is using resilient mobility as a means to promote healthy environments and strong urban integration processes: drastically reducing the commute times of low-income neighborhoods, connecting isolated communities to resources, and ensuring safer and affordable modes of travel.

By applying a resilience lens to transport, cities can encourage sustainable mobility through planning for complete streets and prioritizing public transport, while recognizing the dependencies between transport infrastructure and other critical city systems, such as water, energy, waste, the economy, and society.

Accra
Creating a Resilient Transit System

🚲 TRANSPORT AND MOBILITY

💲 FUNDING   📊 ECONOMIC DEVELOPMENT   ⚖️ SOCIAL EQUITY

The capital of Ghana and one of the safest cities in Africa, Accra is home to over 1.6 million people. A major regional trading and transportation hub, the city's rate of growth has effectively outpaced urban planning, presenting the city and its administration with a range of complex challenges.

Accra's Resilience Strategy, released in March of 2019, has a vision to transform the city's ongoing stresses into opportunities: by embracing informality as an engine of growth, designing infrastructure to improve its natural and built environments, and optimizing resources and systems for greater efficiency, accountability, and transparency.

One major challenge of Accra's rapid urbanization is the attendant traffic congestion, which has resulted in an inability to meet the population's transportation needs and stymied economic growth. Along with long travel times, many users of Accra's mobility systems face safety and accessibility issues. To date, transportation policies both national and local have largely focused on the realization of a Bus Rapid Transit (BRT) system.

The Government of Ghana launched a new BRT system, the Aayalolo Service, in 2016. New large buses operating in dedicated bus lanes with better emission standards were expected to increase mobility, provide access to more job opportunities, reduce the use of private cars, and contribute to a reduction in CO_2 emissions.

Yet despite an estimated US$46 million invested by the Government of Ghana and donor partners in BRT services such as Aayalolo, the system remains partially developed and underutilized, and has unfortunately struggled to operate successfully. One reason for this is that in Accra over 47% of trips to work and 72% of trips to school are completed by walking. For residents using motorized transport, *trotros* — an informal and loosely regulated transportation network of owner-operated mini-buses — are their primary means of commuting to work and for leisure.

Trotros are immensely popular in Accra. Passengers find them to be readily available, accessible, convenient, and affordable. But they also have poor operational and safety standards and records. Often ignoring traffic regulations, their drivers contribute heavily to traffic congestion and road accidents in the city. Trotros are also heavy polluters as by and large the vehicles are old and inefficient. Residents with greater financial means tend to avoid using trotros whenever possible, preferring private vehicles, the number of which has been rising, further worsening congestion and air quality.

To address this bundle of challenges, a key initiative in Accra's Resilience Strategy aims to integrate the vast network of trotros into the city's still-evolving BRT system and upgrade the mini-bus vehicles to reduce their greenhouse gas emissions. Elements of this comprehensive upgrading program will include:

- The creation and enforcement of regulations aimed at improving urban passenger transport regulations, including those governing registration, licensing, roadworthiness, environmental impact, and other quality standards;
- The establishment of a vehicle-based data system, which will be used in part to track the maintenance of upgraded trotros through bi-annual roadworthy checks;
- Training on safe driving, professionalism, and waste management aboard trotros;
- The facilitation of partnerships between trotro owner associations and financial institutions that result in support for owners and/or drivers to secure tailor-made investment packages for the acquisition of safer and more environmentally friendly vehicles;
- Engagement with owners of existing trotros to understand the economics of trotro holding and their operational models, in order to enable value conversion to upgraded operational regimes, including support for a BRT feeder system; and
- Integration of fare collection systems across all public transport services.

Better integration between the BRT and trotro systems will create a healthy balance between terminal-based mobility operations and routebased operations, using passenger and land-use accessibility parameters as determinants for achieving connectivity efficiencies throughout the network, ultimately creating a more robust transport system that can support Accra's growing population.

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Successful implementation of this program, including better enforcement of urban passenger transport regulations, will have multiple benefits, not least that it will help to strengthen the image of Accra for all who live there or visit the city. It will have a meaningful impact on the lives of poorer residents, who are most likely to depend on trotros or be employed in the trotro sector. And it will improve the quality of mobility for anyone, since encouraging citizens to patronize the BRT

system rather than using private vehicles will ease congestion overall.

These changes will positively impact Accra's economic and social resilience, increasing productivity and disposable incomes, stabilizing revenues for road-based commercial services, and decreasing the risk of accidents and personal harm and the stress levels of individuals. Biannual roadworthy checks that prevent unsuitable vehicles from operating will reduce CO_2 and other emissions and improve air quality while mitigating climate change – a key co-benefit built into the program's design.

The trotro effort is part of a larger goal of Accra to take an integrated approach to infrastructure planning and service provision that accounts for changing climate patterns, economic trends, and population growth. Currently, investment in infrastructure development lags behind Accra's rapidly growing population, which requires an efficient, readily accessible, safe, and affordable multi-modal mobility system.

With dedicated support from the Government of Accra and global partners, this program has the potential to reimagine mass transit in the city. Implementation for a first phase of the project will be shared between the Accra Metropolitan Assembly at the city level, and the Greater Accra Passenger Transport Executive at the regional level. The trotro initiative joins a number of others in Accra's Resilience Strategy in embracing new methods of creating more robust city systems, which will serve all segments of society and contribute to boosting the economy of the region.

A robust system that is capable of withstanding sudden shocks will positively impact economic development in Accra, both in crises and in times of stability. It will help improve businesses' ability to provide goods and services, as well as people's ability to access services, education, and employment. A particular focus on integration and inclusiveness in the systems' design will ensure a shared sense of ownership among the many relevant stakeholders and an ability to coordinate efforts across multiple institutions in order to catalyze multiple benefits.

Dallas
The Intersection of Mobility and Economic Inequality

TRANSPORT AND MOBILITY

ACTIONS   ECONOMIC DEVELOPMENT   SOCIAL EQUITY

The core of the largest metropolitan area in the Southern United States, Dallas is a major hub for business, transportation, and culture. Plagued by some of the worst traffic congestion in the country, the sprawling city has invested significantly in public transit – notably, the region's DART Light Rail, which at nearly 100 miles is the longest light rail system in the U.S.

While the city's growing transportation network has been a point of pride, it is not working effectively for all Dallas residents. During the Strategy development process, the Resilience Office zeroed in on the intersection of mobility with another of the city's key challenges: economic inequality. This led to a partnership with the University of Texas at Arlington, including the commissioning of a study on transportation equity within the city. The study found that despite the transit system's size, it was not efficiently connecting low-income residents to job centers, education, healthcare, and other key services.

This work substantially influenced the Dallas Resilience Strategy, which contains a goal of ensuring the local and regional transit system provides transit-dependent residents with reasonable, reliable, and equitable access. The Strategy development process in turn prompted the city to focus more deeply and act more proactively on transportation equity.

This year US$500,000 was earmarked in Dallas's budget for these efforts, and the North Texas Council of Governments contributed a further US$1 million. The shift in focus has catalyzed other sources of outside funding as well; DART was recently awarded US$2.9 million in federal funding to address inequities in the public transit system.

The city has rethought its relationship to DART, the regional authority that operates the bus and light rail systems, putting greater emphasis on the need for fair distribution of transportation investments and services regionwide. Dallas has, for the first time, established its own Department of Transportation, separate from DART. The Dallas DOT is currently developing the city's first Strategic Mobility plan, which aims to integrate transportation decision-making with economic, equity, and environmental concerns.

The priority of this work has been bolstered by a new focus in the city on Opportunity Zones (a program of the U.S. national government) and

on ensuring the integration of transportation systems with economic development, housing, and bond/maintenance programs. For the first time, maps of areas more vulnerable to crime, as well as racially and ethnically concentrated areas of poverty, are being superimposed on maps of Opportunity Zones, in order to plan more inclusively and comprehensively for infrastructure, safety, economic development, and housing.

Dallas is taking a hard look at its transportation investments through a resilience lens and thinking holistically to address significant social and economic challenges that might have gone ignored in a business-as-usual mobility planning processes.

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Honolulu
Planning for Transit-Oriented Development in Kapālama and Iwilei

TRANSPORT AND MOBILITY

ACTIONS   ECONOMIC DEVELOPMENT   SOCIAL EQUITY

One of the densest cities in the United States, Honolulu also suffers from some of the worst traffic congestion and the country's highest gasoline and diesel prices. An elevated rail line, slated to open in two stages in 2020 and 2025, has the potential to reshape mobility and development patterns in the city. In tandem with the creation of the rail line, Honolulu is pursuing an overarching Transit Oriented Development (TOD) strategy for the neighborhoods of Kapālama and Iwilei, which it has formally designated as areas of major population growth.

These two mixed-use communities in Honolulu's industrial core have long been challenged by poor street connectivity, lack of sidewalks and bike lanes, localized flooding, and susceptibility to sea level rise. They are also adjacent to the major employment and population centers of Downtown Honolulu and Chinatown. The city is therefore making significant investments in water, wastewater, and stormwater infrastructure, and pedestrian and recreational amenities, while incentivizing the development of thousands of new housing units. By combining TOD with an expansion of electric vehicle charging infrastructure and sustainable micro-transit options like bike share and electric scooters,

Honolulu aims to develop a Carbon-Free Corridor along the entire 20-mile, 21-station rail transit system, incorporating additional resilience benefits into the city's development strategy.

This visionary work is not easy, as implementation of the city's long-term vision is constrained by existing design, development, and environmental challenges, which are in turn exacerbated by climate change and sea level rise. The planning process for Kapālama and Iwilei, including substantial engagement with local stakeholders and community members, will therefore produce localized infrastructure plans, phasing strategies, and high-level cost estimates, with a focus on hydrological reports and modeling, and will identify the combination of infrastructure necessary for flood-mitigated transit development.

The TOD plans for Kapālama and Iwilei take a long-term, holistic view of blue, gray, and green infrastructure needs, to address both current and future disaster risk and deliver resilient development around two rail stations and the rail transit corridor. Coupled with the city's forthcoming Climate Adaptation Strategy, these plans will help embed resilience into Honolulu's long-term planning and development.

Semarang
Collaboration and Co-Investment for Resilience Outcomes

TRANSPORT AND MOBILITY

PARTNERS   FUNDING   CLIMATE CHANGE

As a growing metropolis of 1.7 million people, Semarang faces stresses of increasing air pollution, traffic, and urban sprawl. Semarang's 2016 Resilience Strategy commits to investing in environmentally friendly public transit – but with resources scarce, the city has had to develop innovative funding pathways for meeting its goal.

Drawing on the 100RC Network, Semarang formed a partnership with the Japan-based Institute for Global Environmental Strategies (IGES), Diponegoro University, and other local organizations, to conduct a transport sector co-benefit study. This coalition of partners aligned international expertise with local knowledge to make several recommendations for Semarang, including the introduction of retrofitted low-emission vehicles. As a follow-up, the Ministry of Environment of Japan (MOEJ) supported a feasibility study on the introduction of low-emission busses under the auspices of the Joint Crediting Mechanism Program (JCM) of city-to-city cooperation between Semarang and 100RC member city Toyama.

Based on the compelling findings of these studies, in January of 2019 Semarang unveiled 72 city buses with hybrid diesel/compressed natural gas engines, made possible by a US$710,000 co-investment between the city and MOEJ. The resulting fuel savings will reduce CO_2 emissions by approximately 819 tons per year while ameliorating other forms of air pollution.

In parallel, the Semarang city government also facilitated a further collaboration between IGES, Diponegoro University, and the Institute for Transportation Development Policy on guidelines for reforming the city's Bus Rapid Transit system. Through PT Sarana Multi Infrastruktur, a state-owned finance company, the city then secured funding from the Green Climate Fund (GCF) to conduct a feasibility study for dedicated lanes and other integrated BRT infrastructure.

Cities across Indonesia will benefit from being able to replicate and learn from the new financing mechanisms Semarang has pioneered.

The direct city-to-city co-investment through the JCM and the securing of GCF funding are both quite novel models for Indonesia – made possible by the partnerships between the Semarang city government and the national-level Ministry of Home Affairs and Coordinating Ministry for Economic Affairs. Thanks to such creative partnerships, Semarang is now on the way to creating a sustainable mobility system, thereby building the overall resilience of the city to key shocks and stresses. Eventually Semarang's more reliable, cleaner, and better integrated public transport will not only reduce GHG emissions, but will also shortern commutes, increase safety, and create jobs – socio-economic benefits that will accrue to all residents, but particularly to women as well as poor and vulnerable communities. In addition, cities across Indonesia will benefit from being able to replicate and learn from the new financing mechanisms Semarang has pioneered.

Thessaloniki
Egnadia Boulevard: Leveraging Transport Investments to Build Resilience

TRANSPORT AND MOBILITY

PARTNERS   FUNDING   CLIMATE CHANGE

Thessaloniki is a midsize city situated in northern Greece on Ther maikos Bay, part of the Aegean Sea. It is a major port and Greece's second largest city, and has been an urban center continuously since its founding in 315 BC. The Egnadia Boulevard is a Roman road that remains operational today as a major thoroughfare that connects Thessaloniki with other regional towns.

A historical and cultural symbol for the city, the Egnadia Boulevard exemplifies how unexpected crises and chronic pressures can intersect with and reinforce one another. In this case, the 20-year construction process of the Thessaloniki Metro, part of which will run under the boulevard, uncovered the road's vulnerability to flooding as well as a general lack of forward-looking planning in the road's design and maintenance.

Thessaloniki recognized this project as a key resilience-building opportunity, and worked with 100RC to conceptualize, design, and implement a multi-partner and multimodal resilient infrastructure project to modernize Egnadia. In so doing, the project will address key shocks and stresses faced by the city as a whole, including stormwater management, urban heat islands, air quality, and social integration, while retaining and capitalizing on the boulevard's two millennia of cultural heritage. The Office of Urban Resilience of Thessaloniki coordinated with six key municipal departments over the course of a year to make the case for participatory planning in large investment projects. The city then held a series of workshops bringing together all major relevant city stakeholders, other Greek partners, and international private and social entities to conceptualize a proposal for the holistic redevelopment of Egnadia as a resilience project.

With over 400 expert hours dedicated, this represented the first time major institutional actors in the city had collaborated to create a holistic masterplan involving multiple levels of authority.

A program maturity proposal for technical plans of about €1 million was developed by the six departments and submitted for approval to city leadership. Additional works were commissioned by participating entities such as the Thessaloniki Water Company and the State Directorates for management of ancient and modern archaeological landmarks and listed buildings.

Since no single authority was responsible for the redevelopment, the Resilience Office served as a champion and drove agreement on a horizontal vision with specific responsibilities acknowledged by each relevant implementing entity. The mutual framework for intervention has five key areas: land usage, citizens and city business, holistic sustainable transport, economic development through culture, and infrastructure and crisis management. With over 400 expert hours dedicated, this represented the first time major institutional actors in the city had collaborated to create a holistic masterplan involving multiple levels of authority. Following the success of this work, Thessaloniki commissioned the development of an overarching Sustainable Urban Mobility plan for the city, which will work along the same five intervention axes agreed on for the Egnadia Boulevard resilience redevelopment.

Water and Sanitation

Flowing through every part of the economy, water is a fundamental issue for cities and their residents. Throughout the 100RC Network, cities grapple daily with issues related not only to the management of water systems, but also to the risks posed by water, including flooding. Access to safely managed water and sanitation, along with the sound management of freshwater and even ocean ecosystems, are essential to cities' economic prosperity, health and development outcomes, and environmental sustainability. Yet significant challenges stand in the way of cities trying to ensure these outcomes, including inadequate or fragmented governance, inadequate and unequal access, poorly understood or managed risks, and increasing competition for water resources. All of these challenges are further compounded by climate change and rapid urbanization. Today, 700 million urbanites live with inadequate sanitation, while 156 million lack access to a secure and adequate water supply. Urban water resilience is the capacity of the urban water system – inclusive of its human, social, political, economic, physical, and natural assets – to anticipate, respond to, and learn from shocks and stresses, thereby minimizing economic disruption, and protecting public health, well-being, and the natural environment.

Water systems interact with the full range of other city systems and services, and there is significant potential for shocks and stresses to cause cascading and compounding impacts within and between systems. Applying a resilience lens to urban water and wastewater management will help cities around the world understand the interdependencies between different urban systems. At the core of water resilience is a city's capacity to make the most of available water supplies through fit-for-purpose approaches that consider the needs of each type of water use. Building urban water resilience requires cities to build diversified and dynamic water resource portfolios. It also requires the incorporation of analytics on strengths and uncertainties into planning and investment decisions, as well as good governance and strong partnerships – especially given that the water systems cities depend on often extend beyond their jurisdictional boundaries. Finally, cities will need to shift from linear urban water practices, which focus on achieving service standards in a financially sustainable way, to integrated water management approaches that secure reliable and sustainable water supplies that are affordable, financially viable, and protective of precious ecosystems. A robust, effective approach to water and wastewater resilience does not mean that nothing ever goes wrong, or that services never fail. Resilience means that risks are well managed, in ways informed by clearly defined priorities for the present moment and the city's future. Resilience means that initiatives and investments are designed to enhance the performance of service provision, minimize unintended consequences, and create co-benefits through systems thinking. Resilience is therefore not an add-on – it is central to effective water management.

Wellington
Reinforcing Wellington's Lifeline Infrastructure

◌ WATER AND SANITATION

〰 EARTHQUAKE RESILIENCE   ⚡ POST-DISASTER RESILIENCE   ⚖ SOCIAL EQUITY

The capital of New Zealand, the City of Wellington has a diverse population of over 400,000 residents. They draw on a long history of resilience, having created strong communities over the past thousand years in a harbor at the southern tip of the country's North Island. Potentially destructive earthquakes, rising seas, and the city's famous winds have kept Wellingtonians acutely aware of their vulnerability.

Threatened by multiple active fault lines, Wellington has historically responded to seismic events with post-disaster response and recovery efforts. After a magnitude 7.8 earthquake in November 2016 caused extensive damage (though no fatalities), Wellington City's mayor stated that "We've dodged a bullet, but we're not bulletproof." The city saw the recovery process as an opportunity, aiming to "never let a crisis go to waste." Today, Wellington is a city ready to innovate for earthquake resilience and preparedness in order to create tangible benefits for its communities.

Certain areas of Wellington lack a local water supply, and – with the city's critical pipelines located along a major fault line – residents in those areas could be without access to clean drinking water for over 100 days following a major earthquake. In 2017 the City Council therefore allotted funding to upgrade Wellington's water infrastructure through a series of projects aligned with its Resilience Strategy. Three major actions were developed: securing the water supply of the hospital with a new reservoir, building a new cross-harbor pipeline, and creating community water stations for emergency use. Together these three actions will add redundancy and flexibility to Wellington's critical water systems.

The Reservoir
A study of existing infrastructure and current consumption levels found that, should Wellington's water mains fail, the city would have less than 24 hours of water available to the central area and main hospital. The city therefore required a new reservoir that would provide backup emergency supply to this district, and identified Prince of Wales Park, overlooking the hospital and central business district, as the ideal location. The Om roro reservoir will double the district's capacity to 48 hours at current consumption levels. To stretch this resource further, the City Council is also investigating measures to reduce water usage across the city, especially in light of a growing population and the threat of rising sea

levels to fresh water supplies. Ultimately costing NZD$33 million, the reservoir is expected to be completed by 2023.

The Pipeline
Modeling of possible post-earthquake scenarios found it likely that, after a major event, Wellington would effectively become a series of seven "disaster islands," with pockets of residents isolated by landslides, fallen trees, and damaged roads, and it could take over three months to restore basic services to some of these zones. Reliance on a single bulk water supply system also means that any upgrades or repairs to the piped supply system need to be undertaken within the limits of the city's reservoir system in order to prevent shutting off the water.

In search of a second piped water supply the Wellington City Council initially approved drilling bore holes in the harbor but these failed to yield a sufficient water supply. The Council then gave the greenlight to design an NZD$116 million cross-harbor pipeline that will run from the Lower Hutt Valley into Wellington's downtown core, thereby adding redundancy to the city's piped water system.

Community Water Supply
In July of 2017 Wellington launched the Community Infrastructure Resilience Program (CIR), an NZD$8.25 million suite of actions that will increase the city's water security and ensure resilience in the face of the next seismic disaster.

The core of this program was the creation of a decentralized emergency water supply network, consisting of at least 22 strategically placed community water stations across Wellington, which will be redundant to the city's main water infrastructure and ensure water supplies for islanded communities following a disaster.

These community water stations are both pump and water treatment systems, housed in shipping containers, which can tap into either a groundwater or stream-based water supply when needed. Each station will be capable of extracting and treating enough water to supply all residents within 1000m of the station with up to 20 liters of water per person per day, for up to 100 days.

Dormant during normal times, and requiring only quarterly maintenance, in the event of an earthquake the community water stations will be activated and operated by local community
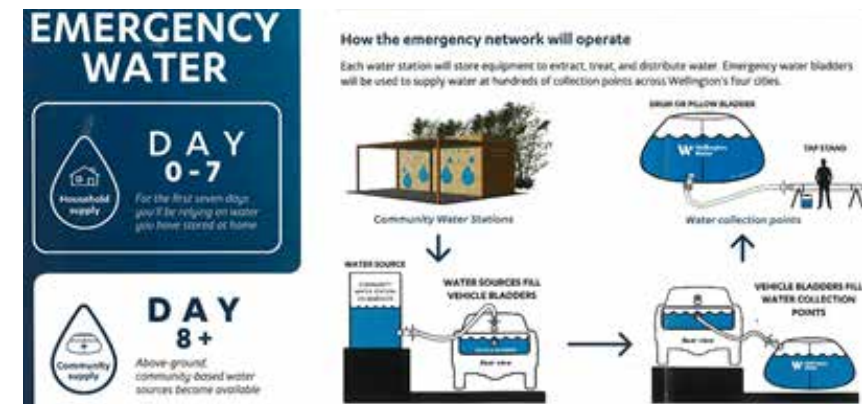
volunteers working with emergency responders. They will also deploy a "bladder network" using trucks to distribute water to collection points for citizens.

The city recognized that the water stations could not effectively serve communities if residents did not know how to access them or how to store water at home. The city therefore undertook a robust community engagement process to develop the plans for the community water stations, including their design and location, and paired that with a comprehensive communications strategy. Residents were informed on how to prepare for an earthquake, the importance of storing seven days' water supply at home, how to support their neighbors through the initial recovery period, and how to access water after the first seven days via the bladder networks. In recognition of Wellington's increasingly diverse population, the CIR project designed communications materials that made use of simple graphics and were easily understood by non-English speakers.
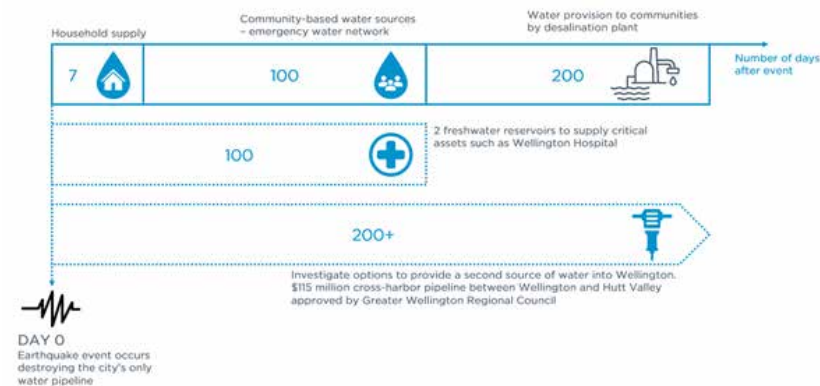
Thanks to the community engagement process, the city was able to strategically co-locate the community water stations with existing social infrastructure, where water resources allowed. Ideal locations included playgrounds and parks that community members already frequently

visited for leisure, and which are memorable and easily accessible. Wellington is also committed to leveraging the water stations for other essential community services in the event of a crisis, such as information, health, and social welfare outreach.

Resilience Dividends

The overall process of reinforcing Wellington's lifeline infrastructure through these three actions – reservoir, pipeline, water stations – demonstrated the need to decentralize critical utilities, which in turn sparked new thinking about how the city procures and deploys critical services. Consequently, Wellington Water Ltd. developed an innovative procurement model, an alliance that builds the capacity of multiple vendors to support lifeline infrastructure at critical times. This restructuring improved the capacity of more actors in the city to manage the water supply network.

By recognizing the lack of robustness of the city's below-ground water supply network, and by taking a decentralized approach to water resilience that builds redundancy via new infrastructure and a new above-ground water supply network, Wellington has created an inclusive and community-centered system for disaster response and recovery.

Household supply | Community-based water sources – emergency water network | Water provision to communities by desalination plant | Number of days after event

7 | 100 | 200

2 freshwater reservoirs to supply critical assets such as Wellington Hospital
100

200+
Investigate options to provide a second source of water into Wellington. $115 million cross-harbor pipeline between Wellington and Hutt Valley approved by Greater Wellington Regional Council

DAY 0
Earthquake event occurs destroying the city's only water pipeline

Greater Manchester
Building resilience into water infrastructure upgrades

WATER AND SANITATION

PARTNERS   SCALE   SOCIAL EQUITY

The metropolitan region of Greater Manchester in the United Kingdom faces the challenge of meeting the water demand of its rapidly growing urban population, particularly in light of its aging water supply infrastructure. Since 2016, Greater Manchester's water utility provider United Utilities (UU) has been exploring options for making needed upgrades to key components of its aqueduct system, which transports potable water 134km from the Lake District to serve the 1.5 million people within the city region. The renewal and/or replacement of this critical infrastructure must ensure the safe and reliable provision of water in the long term, without disrupting the continuity of water provision in the short term. Options under consideration by UU included targeted repairs, the replacement of large parts of the infrastructure, and the construction of new treatment plants. Each option varied in its cost, ability to address shocks and stresses, and level of service disruption. UU and the Greater Manchester Resilience Unit (GMRU) recognized the implications of the water infrastructure work for the city's overall resilience, and saw an opportunity to ensure the project was structured so as to deliver resilience value and co-benefits. To build that thinking into the project scoping, the GMRU partnered with UU to use the Project Scan tool. Developed by 100RC and the

City of Rotterdam, the tool assesses the resilience value of the various options being considered for a project, in this case the aqueduct upgrade. Whatever the project, the tool explores both the resilience of the infrastructure itself and the contribution each option might have on the city's overall resilience.

The Project Scan tool was applied to Greater Manchester's water project in a workshop for key stakeholders. After first unpacking the impact of each option being considered on the shocks and stresses affecting the region, stakeholders then discussed how the various options could be leveraged to embed resilience qualities into the upgraded aqueduct system. UU used the outcomes from the workshop to build resilience thinking into major project design and planning as part of the evidence pack supporting their business plan, which is reviewed by the industry regulator. Whichever option is ultimately selected, the approach taken by the GMRU and UU allowed stakeholders to surface key resilience insights for the aqueduct system as a whole – including the need to engage a wide range of stakeholders and affected communities in the design process, and the need to view water as fundamental to the city region's overall resilience.

WATER AND SANITATION

CITIES TAKING ACTION

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WATER AND SANITATION

CITIES TAKING ACTION

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Jakarta
Studying Decentralized Water Treatment Technologies

◇ WATER AND SANITATION

◎ ACTIONS   ◉ CLIMATE CHANGE   ⚖ SOCIAL EQUITY

As one of Southeast Asia's largest cities, Jakarta faces the significant challenge of providing effective wastewater management for its 10 million citizens. The city relies heavily on septic tanks which often leak into groundwater – the primary water source for 40% of the population. This exposes millions to high levels of contamination and waterborne diseases. The toll is especially high among the city's most vulnerable, as many in low-income areas face logistical and financial barriers to alternative water sources, such as piped water, water resellers, and bulk tankers, and have no choice but to rely on groundwater boreholes shared among several households.

In 2012, the Jakarta government developed a Master Plan for a large-scale centralized sewerage system in the hopes of covering 80% of the city by 2050. However, recognizing the plan's long timeframe to completion and likely interim gaps in coverage, the city identified an alternative consisting of a decentralized system and on-site sanitation facilities, which would offer a more appropriate level of service for the urban poor who suffer disproportionately from low sanitation.

In light of this, the Jakarta government collaborated with 100 Resilient Cities to investigate the potential of decentralized wastewater treatment technologies (DEWATS). Over the course of a year, 100RC and partners GIZ and AECOM completed a scoping study for these technologies, as well as a pilot study on 250 households in the Cambela Child Friendly Park of North Jakarta.

The two studies uncovered even more challenges for the next steps of this initiative, especially from the community perspective. For example, functioning DEWATS only make sense if sufficient wastewater is collected for there to be enough water to be treated – and so it is crucial to provide potable and affordable drinking water along with sanitation services. Furthermore, while improved wastewater services were desirable, improving access to a safe and affordable drinking water supply was found to be a higher priority for the communities.

The two studies also identified other considerations for future implementation, for example changing the procurement for new technologies or new mechanisms to connect pipes to households.

The studies' findings further confirm that while DEWATS is often suggested as a potential solution for urban sanitation needs, it is itself not without challenges, some general and some specific to Jakarta. The findings emerging from this series of technical assessments will help to identify and recommend resilience-centered approaches to addressing Jakarta's urgent lack of access to safe and affordable drinking water and adequate sanitation, that will be aligned with the Resilience Strategy's goals concerning public health.

Lagos
African Water City

○ WATER AND SANITATION

🤝 PARTNERS   〰 FLOODING   ⚖ SOCIAL EQUITY

Water is one of the prevailing stresses in Africa. Cities across the continent grapple with the confluence of climate change, rapid urbanization, and resource limitations, including housing insufficiency in coastal African cities – specifically in the communities that live on or near water. Lagos State and other cities across the 100RC Network are increasingly recognizing the complexity of these challenges and embracing the concept of the "African Water City" as a powerful new way to think about building and living with water.

Lagos State, in Nigeria, is Africa's most populous city, with a rapidly urbanizing population that currently stands at 26 million. Water poses the greatest opportunity and challenge to building the resilience of Lagos, including its coastal slums, its environment, and its natural infrastructure of mangroves and wetlands. The state is caught between having too much water and suffering a flood, and having too little for proper sanitation. It has not been able to manage its water optimally, either in terms of improved water supply or in terms of drainage systems.

Lagos State is therefore representative of the "African Water City," as its geography is

The term "African Water City" evolved from research conducted by Nigerian architect and urban researcher, Kunle Adeyemi, whose work aims to re-envision the way cities approach development and planning around water. The "African Water City" concept hopes to offer new and innovative ways for cities to think about building on and living with water, as well as provide alternative approaches to sustainable infrastructure development.

connected to and characterized by water: a coastal city, it sits on swampy mangroves and largely water-logged soils, and its drainage system is a maze of lagoons and waterways constituting approximately 22%, or 787 square kilometers, of its landmass. These attributes have negative impacts on infrastructure and must be considered for future planning.

The water sector in Lagos State faces huge challenges regarding the accessibility and availability of water, water-related issues of sanitation and hygiene, and flooding and the related adverse effects of climate change. Furthermore, Lagos State overall faces multiple

socio-economic and demographic pressures that worsen its water infrastructure and sanitation challenges. The city needs to address its chronic challenges around resource insufficiency, inadequate housing stock, and a burgeoning youth population with limited employment and economic opportunities. Although Lagos State is the economic capital of Nigeria and accounts for 10% of the nation's GDP, it grapples with widening wealth and income disparities that invariably exacerbate its water challenges.

Inhabitants of the waterfront and coastal areas are often economically disadvantaged, living in overcrowded informal settlements that lack or have limited access to basic services such as potable water, sanitation, and energy. With a growing middle class in Nigeria, these coastal areas are becoming the most desirable and valuable real estate – and their development often results in the involuntary displacement of current inhabitants. As Lagos attempts to balance advancing waterfront development with addressing socio-economic and environmental challenges, it is imperative that the actions taken ensure equitable, inclusive, humane, and environmentally responsible development. This will require Lagos State to embrace a holistic, resilient approach to planning and infrastructure investment, which must engage a broad and diverse array of partners in addition to embracing new and innovative partnership models.

The state has already embarked on cultivating these strategic partnerships. Recognizing the plethora of water challenges and opportunities, the Lagos Resilience Team partnered with the Heinrich Böll Foundation and WaterAid to host "Resilience Lagos Week" in April of 2019. This convention brought together a broad set of

partners to align around the common agenda of the African Water City.

Prior to Resilience Lagos Week, both the Heinrich Böll Foundation and WaterAid were involved in addressing disparate components of Lagos State's water challenge, to increase water access and strengthen the resilience of the water system. The Resilient Lagos team enabled both organizations to share project proposals across stakeholders, gather feedback, and obtain buy-in for the work ahead. As Lagos State's resilience strategy development continues, both organizations will remain critical partners.

Paynesville
Building Resilient Water and Sanitation Systems in Post-Conflict Cities

◇ WATER AND SANITATION

◎ ACTIONS $ FUNDING   ⚡ POST-DISASTER RESILIENCE

As the African continent urbanizes, much of the growth is happening not in major cities, but in towns and secondary cities that are emerging in close proximity to areas traditionally defined as rural. As these secondary cities form the link between rural areas and larger cities, building resilience there is important for achieving country-level development objectives.

Paynesville is a city of over 400,000 inhabitants in Liberia. Despite being a suburb of the capital city of Monrovia, it is geographically larger and hosts one of the largest commercial hubs in the country, the Red Light Market District. The 2003 end of Liberia's 14-year civil war ushered Paynesville into a period of rapid urbanization, and the city was underprepared to provide basic services such as water and sanitation to its new residents. Today, the informal settlements that comprise about 80% of the city are not connected to the national piped water supply system.

The city's lack of capacity to manage basic services magnifies risks from environmental hazards, especially those from climate change, which are projected to increase in intensity and frequency. Critical gaps in the waste management disposal system means that waste is often dumped, buried, or burned indiscriminately. Dumping often happens along natural drainage channels, blocking the flow of water and leading to flooding during the rainy season. The large patches of still water that can remain are also a refuge for mosquitos, and frequently lead to outbreaks of malaria. In addition, poor sanitation and hygiene are key drivers of Paynesville's vulnerability to communicable diseases such as cholera. Unfortunately, many of these shocks have subsequently evolved into chronic stresses on Paynesville's inhabitants.

The development and implementation of a Resilience Strategy for Paynesville is an opportunity to address the root causes of these shocks and stresses, and to lay out a forward-looking vision for a growing city. However, this is no small feat given the plethora of challenges around interjurisdictional coordination (Paynesville is one of 16 zones considered to be a part of Greater Monrovia, the capital city), the lack of sufficient or actionable data to drive decision-making and planning, and the significant fiscal and human resource constraints that hinder the Paynesville City Corporation (PCC) from providing basic services.

Despite these challenges, the early interventions and baseline assessments completed through the Strategy development process have helped to uncover opportunities and strengthen partnerships – two co-benefits of resilience-building in general. For example, building on convenings held during Strategy development, the PCC has partnered with WaterAid and local consultant Petra Resources to understand and document climate change vulnerability in its seven communities most liable to the impacts of changing climate patterns. The findings of this community-specific survey are in turn informing emerging initiatives to be included in the Resilience Strategy, concerning waste management, improving economic opportunity, and increasing access to clean water.

Tblisi, Georgia

100RC: Reflections and the Road Ahead

From a 2013 Rockefeller Foundation press release, to a vibrant network of 100 member cities, over 130 partners, and nearly 100 expert staff across four continents – in the last six years 100 Resilient Cities and our partners have spurred a global urban resilience movement that is now well positioned to thrive and grow in the years ahead.

In this moment of reflection, we are thankful for the inspiring, dynamic community of resilience practitioners worldwide who have helped to grow this movement:

• The hundreds of city actors who have invested, innovated, trusted, and put their hard work into the resilience-building agendas of their own cities and cities around the world

• The hundreds of colleagues from across 100RC, RF, and Strategy Partner organizations who have committed their resources, including their determination and imagination

• The hundreds of Platform Partner companies and subject matter experts who have volunteered their insights, knowledge, and advice

• The many other financing and strategic partners who have demonstrated their support by contributing their resources, thereby catalyzing even more funding into the resilience movement

Sprinkled throughout this report are impressive figures that speak to the impact of the 100RC effort. Behind those numbers are equally im-

pressive individuals and teams, who through their dedication and experimentation have helped cities and the urban resilience community of practice all learn together, by doing. At a time when divisions and tensions are increasing around the world, we must celebrate the power of this network: an evolving and growing ecosystem committed to promoting and improving the well-being of humanity.

Together, we have recognized the challenges facing cities as well as the challenges to building urban resilience. Through consensus, collaboration, and learning from one another, we have brought to life what was essentially only a theory – the value of urban resilience. We have shown through our work that there is a true demand for building resilience in cities worldwide, and that resilience-building has true impact.

By joining the 100RC Network, cities committed to looking holistically at their vulnerabilities and thinking actively about long-term visions for prosperity in light of those risks. They had to reach across local and global boundaries to participate in conversations about shared challenges and replicable solutions. Together, the 100 member cities took a concrete and truly unified step toward building their resilience for the future, in a way that addressed local issues while fostering a global community.

To fulfill its mission of creating a global urban resilience movement, 100RC deployed a unique suite of interdependent services to help solve two major problems cities face:

- Cities are complex systems made of an array of smaller, distinct actors including government agencies, local businesses, and offices of international organizations. Often they do not communicate or interact with one another as much as they should.

- The solutions cities develop are often not treated as scalable knowledge. Cities regularly solve problems that have already been addressed elsewhere, when instead they could be modifying solutions and lessons learned in other cities, tailoring them to be more effective and cost-efficient.

The innovation of 100RC was in the combination of the 100RC member city Network, the new role of Chief Resilience Officer, and the process of developing Resilience Strategies through a common language and shared experience that simultaneously built capacity and elevated the resilience agenda – all supported by a wider Network of committed and innovative Strategy and Platform Partners.

The dynamic process of developing a Resilience Strategy provided cities with an impetus that empowered CROs and Resilience Offices to undertake transformational silo-busting activities and build capacities to more effectively address their risks. This process, with its various milestones and deliverables, created momentum and an enabling environment for resilience-building to continue. Disseminating this concept globally through a thoughtful and codified 100RC Resilience Strategy Development Process and a curated Network further improved cities' ability to learn from each other and their comparable work.

100RC cares deeply about long-term systems change – or as we call it, institutionalizing resilience – because we believe that cities that make fundamental structural changes to embed resilience into how they plan and operate will have the greatest opportunity for long-term change and real impact.

An external evaluation of our program validated the need for such an approach, observing that:

"Building resilience requires profound structural changes in how city institutions plan and function, and in the way that cities provide services that reduce chronic internal stressors and mitigate external shocks, particularly among its most vulnerable populations."

-The Urban Institute Baseline Evaluation Report, March 2017

"Most comparable programs have focused directly on projects or services, while 100RC's theory of change focuses on the long-term transformation of institutions and systems in cities as a precursor to project implementation."

– The Urban Institute Midterm Evaluation Report, December 2018

100RC's ecosystem has played a pivotal role in defining the practice of urban resilience globally. It is the only effort of this scale to have targeted generational systems change in city processes and operations – an ambitious mission, made possible by a uniquely diverse network.

Through the 100RC Network we have experimented with new partnerships amongst ourselves, both within and between cities and partners, modelling and benefitting from listening to each other more intently, and breaking down the barriers that may have previously hindered us from spotting synergies, working more efficiently, and achieving mutual benefits.

It is this desire and ability to share critical lessons, often learned from difficult experiences, that strengthens all of us, equipping us to make this movement even more impactful.

Perhaps the greatest insight of all has been that we are unable to affect change alone – whether as one city, one region, one CRO, one leader, one expert, or one company. Our experience has reiterated time and again the degree to which we all need each other. We are connected and sustained through new ways of thinking and doing, empowered by courage to tackle seemingly insurmountable challenges.

At the time of writing this report, cities around the world continue to face the immense risks and opportunities that come with the escalating consequences of urbanization, globalization, and climate change. This really is the beginning of the work. And it is with gratitude, confidence, and excitement for the future that we conclude this chapter of our journey together thus far.

Thank you for being part of the 100 Resilient Cities journey

Accra GHA Addis Ababa ETH Amman JOR Athens GRC Atlanta USA Bangkok THA Barcelona ESP Belfas...
Belgrade SRB Berkeley USA Boston USA Boulder USA Bristol GBR Buenos Aires ARG Byblos LB...
Calgary CAN Cali COL Can Tho VNM Cape Town ZAF Chennai IND Chicago USA Christchurch NZL Colim...
Da Nang VNM Dakar SEN Dallas USA Deyang CHN Durban ZAF El Paso USA Glasgow GBR Greate...
Manchester GBR Greater Miami and the Beaches USA Guadalajara Metropolitan Area MEX Honolulu US...
Houston USA Huangshi CHN Jaipur IND Jakarta IDN Juárez MEX Kigali RWA Kyoto JPN Lagos NGA Lisbo...
London GBR Los Angeles USA Louisville USA Luxor EGY Mandalay MMR Medellín COL Melaka MY...
elbourne AUS Mexico City MEX Milan ITA Minneapolis USA Montevideo URY Montréal CAN Nairobi KE...