

ISSUE 7 • June 2015

# URBAN SOLUTIONS

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SPECIAL FOCUS

*Resilience*

A biannual magazine  
published by

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**LiveableCities**  
SINGAPORE

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# From the Executive Director

“Resilience” is an increasingly common term in recent times. Do we really know what it means?

Judith Rodin, author of *The Resilience Dividend*, defines resilience as “the capacity of any entity – an individual, a community, an organisation, or a natural system – to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience”. But beyond such a definition, what does resilience encompass in real terms? Should city officials prioritise it? How can urban planners mould resiliency into the built environment, and what role does the community play? These are some questions we hope to explore in this issue of **URBAN SOLUTIONS**.

In *Essay*, Dr Rodin explains the five characteristics of resilient systems and how cities can and should reap benefits from investing in their crisis-coping capacity. Christchurch is a stellar example of opportunities that can arise from a crisis, as illustrated in *City Focus*. In *Case Study*, PUB Chairman Tan Gee Paw illustrates the water resilience strategy of Singapore.

We also learn how Surat copes with floods, how Boston prepared itself against terrorist attacks, and how an NGO in Singapore rehabilitates radicalised individuals. We honour the community heroes who have stepped up in times of need in *Illustration*.

In *Interview*, Singapore Minister of National Development Khaw Boon Wan talks about the city state’s public housing and his experience handling the SARS (Severe Acute Respiratory Syndrome) crisis. New York City Mayor Bill de Blasio shares housing and education initiatives that aim to tackle the city’s economic and social inequality and his thoughts on the makeup of a resilient city. In *Young Leader*, former Deputy Mayor of Yokohama Yumiko Noda also lists some examples of the Japanese way of dealing with their various challenges.

Can deliberate design help to shape a resilient urban landscape? In *Opinion*, Professor Eric Klinenberg makes a convincing case for the importance of social

infrastructure when disasters strike. CLC researcher Remy Guo complements this in *Essay*, where he knocks down the paradigm equating fences with defences, and cites examples of fenceless developments in Copenhagen and Singapore that enhance liveability.

What role does science and technology play then? An important one, according to Professor Alexander Zehnder in *Opinion*. Technology doesn’t always come with a hefty price tag though. Juliana Rotich, co-founder and Executive Director of Ushahidi, shows how open source software can be used to make sense of crowdsourced information in *Young Leader*.

This issue of **URBAN SOLUTIONS** cannot give a full picture of resilience, but I sincerely hope it contributes incrementally to our understanding of this important topic.

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**Khoo Teng Chye**  
Executive Director  
*Centre for Liveable Cities*



Minister Khaw at the 61st World Health Organisation Western Pacific Regional Committee Meeting in October 2010.

# Khaw Boon Wan

## DEFINING RESILIENCE

5

interview



Singapore

**A**s Singapore's National Development Minister, **Khaw Boon Wan** oversees policies that guide the country's urban planning and development; as Health Minister previously, he also helped steer the country through one of its greatest crises when SARS hit the region in 2003. Here, he tells Jessica Cheam, from the Centre for Liveable Cities, the lessons learnt, and why he thinks that a society's resilience is ultimately defined by the spirit of its people.

### ● What does 'resilience' mean to you? How do you think Singapore fares in terms of being resilient?

There are a few academic definitions. The Rockefeller Foundation, for example, defines city resilience as "the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kinds of chronic stresses and acute shocks they experience".

Personally, I measure the resilience of a community by how they respond to a disaster when it strikes. The Kobe earthquake in Japan in 1995, for example, was a major catastrophe resulting in the loss of many lives and damages amounting to billions of dollars. But the Japanese demonstrated a high level of resilience – there was no loss of law and order, or futile finger pointing. The people just focused on the immediate tasks of rescue, recovery and rendering mutual help. It was an inspiring response.

In this regard, Singapore also did well when the viral respiratory disease called SARS struck the region in 2003.

There was extensive fear among the population as the nature of the virus was unknown. This was amplified when some hospital staff began to fall ill and died.

The disease struck the economy hard – the roads, Changi Airport and hotels were deserted. But Singaporeans rallied behind the government, looked out for one another, and cooperated fully with medical staff. We overcame the crisis and emerged stronger as one people. This is a mark of resilience.

More recently, the response of Singaporeans to the death of our first Prime Minister, Mr Lee Kuan Yew, was another mark of unity and resilience. The spontaneous outpouring of grief and gratitude for Mr Lee, with more than a million people braving the sun and the rain, waiting patiently for hours to pay their respects, pen their tributes and bid their final farewell, was deeply touching. The nation was united and further bonded as one people during that period. This gives me confidence that Singapore will survive and continue to thrive, come what may.



01 02

● **You mentioned the SARS crisis earlier. Can you share your experience in handling it as chief of the SARS combat unit? What has Singapore learnt from it?**

We can plan and carry out contingency exercises regularly to raise awareness and sharpen acuity, but the response of the people is crucial. A key ingredient is trust – trust in one another, and trust in the government. Without trust, rules will not be followed and the breakdown of law and order will quickly lead to civil strife and further escalation of the crisis.

Indeed, SARS exposed the vulnerabilities of several cities and some did better than others. Fortunately, Singapore did well and had minimal casualties, but we should not be complacent. There will always be future disasters and tests of our resilience. While we should not be paranoid, a realistic sense of our vulnerabilities will help us to be prepared and vigilant. The key is to be mindful that we face these threats together as a community, and we are stronger when united.



*Our public housing policies have always sought to foster strong family ties. Strong family relationships are the foundations of a stable society...which will be critical in times of crisis.*

01 During the SARS outbreak in 2003, schools took precautions by monitoring students' temperatures and health conditions daily.

02 Shared spaces in Singapore's public housing estates facilitates interaction amongst residents, like this rooftop garden in Toa Payoh.

03 Minister Khaw visits Skyville@Dawson, a new generation of public housing in Singapore that aims to build a cohesive and vibrant community, with multi-generational and family-friendly living.



● **The Ministry of National Development (MND) has a vision for Singapore to be an “endearing home and a distinctive global city”. What are some policies which help build social and community resilience?**

Hardware facilitates but it is the software – the *heartware* – which defines resilience. Do we care for one another in times of crisis? Do we put community interests above individual interests?

One example of this is what we call the “*kampung* spirit” here. We had plenty of this in the old days. In the *kampung* (Malay for “village”), we knew and cared for one another. We shared meals, celebrated festivities and grieved together.

With modernisation and urbanisation, we lost some of this spirit. But I believe a modern *kampung* is not an oxymoron. Both elements can co-exist, but they cannot be achieved through a decree or through legislation. It has to be a ground-up effort with local ownership and support. Governments can facilitate this with supportive hardware and sensible policies, but the residents must believe in it themselves.

03

This is why our public housing policies have always sought to foster strong family ties. We have many policies and incentives to help extended families live together or close by for mutual care and support. We believe that strong family relationships are the foundations of a stable society and they will strengthen the social fabric in our towns, which will be critical in times of crisis.

Housing has played a crucial role. The Housing and Development Board (HDB) is a developer but it is no ordinary developer. The HDB does not just build flats, it builds cohesive communities. We measure our success not by how much the values of the HDB flats have increased over the years, but by how many residents are emotionally attached to their HDB towns. We are proud to note that most HDB residents – 60 per cent of them – continue to live in the first homes they bought years ago.

Our policies also extend to the larger community: as a multi-racial and multi-religious society, inter-racial harmony is a key pillar of resilience. This is why we impose an ethnic quota in each residential block to ensure that all races are adequately represented in every town. This way, children grow up with neighbours and classmates of different ethnicities. This ensures racial integration and promotes mutual respect for one another’s cultures, traditions and religious beliefs.

While we offer spaces for individuals to practise their own religions, we are careful to ensure that common spaces are secular so that people from various different backgrounds can live, work and play together.





*A shared appreciation for a quality living environment also builds resilience among our people.*

● **How else does MND's work contribute to building the city's resilience?**

Beyond housing, we plan and provide common amenities to promote neighbourliness and interaction, which will strengthen our social fabric. These shared spaces, such as schools, parks, food centres, sports facilities and neighbourhood shops, are built after much deliberate planning. They are distributed across Singapore and serve residents of both public and private estates.

Some other initiatives include our popular "Community in Bloom" programme, which brings residents together with meaningful community gardening events. They make new

friends, pursue a healthy hobby, and put vegetables on the dining table too.

Our many parks and park connectors make Singapore a "Garden City", and they also enable people from all races, ages and socio-economic statuses to socialise and forge shared experiences in appreciating nature. In this regard, we owe much to Mr Lee Kuan Yew, who had a vision that Singapore can enjoy the benefits of urbanisation without losing our link to nature.

A shared appreciation for a quality living environment also builds resilience among our people. As the nation continues to grow on this small island of limited resources, we will face new challenges. But technology and human ingenuity can overcome these.



In recent years, for example, our architects and landscape experts have been creative in greening our tall buildings and rooftops. We will continue to innovate and protect our natural areas and enhance our biodiversity. As Sir David Attenborough remarked in a recent television documentary, “A Wild City”, Singapore is a city in a jungle. Within half an hour from Orchard Road, you can have close encounters with otters, hornbills, civets, owls, and colugos – not in the Zoo, but in their natural habitats! Very few cities are as rich in biodiversity.

● **How do you think physical planning and infrastructure helps a nation be resilient to disasters, shocks and stresses?**

One way is via tackling climate change, which is also part of MND’s work. Climate change is a global problem that requires a global solution. We are tiny, but we can still make a contribution. For example, together with the United Nations Environmental Programme (UNEP), Singapore’s Building and Construction Authority (BCA) established the BCA Centre for Sustainable Buildings – the first in Asia to help developing countries develop green building policies and actions. Within Singapore, we have set a target of greening 80 per cent of our building stock by 2030. This will play a key role in reducing carbon emissions from the building sector.



*It is the spirit of the people which will determine if a community or a nation can bounce back from a disaster and stand tall again.*

Domestically, we are taking measures to prepare our city for any adverse environmental impacts. For example, we are reclaiming land to a higher level above the sea to cater for potential long-term sea-level rise. It is more costly but as an infrastructure investment over a century, it is a necessary and worthwhile preventive measure.

Hardware helps and there is no shortage of technical experts on urban planning, building codes and emergency response who can guide and offer solutions. But hardware alone is not sufficient. It is the spirit of the people which will determine if a community or a nation can bounce back from a disaster and stand tall again.

01 Minister Khaw at a community youth sport event.





● **Singapore's civil society is maturing and people want to contribute and be involved in shaping the country's future. How can we tap this energy?**

It is a natural and healthy development. Better educated people will want to have a greater say on how their country is run. We should facilitate and promote such participation by encouraging more frequent, broader and deeper public consultations.

For example, we are planning to conserve a historic, unused 24-kilometre long railway track known as the Rail Corridor, which will raise the quality of life of a million residents who live within walking distances from the track. We are spending time to gather the views, suggestions and feedback of the residents. We are confident that the results will be outstanding, but the process is even more important than the outcome. This is the people's rail corridor, and they shall have a say in its creation.

<sup>01</sup> Community walks are organised by civic groups along the Rail Corridor.



*...the process is even more important than the outcome. This is the people's rail corridor, and they shall have a say in its creation.*

● **What happens when such decisions prove divisive? For instance, when citizens strongly disagree with a decision taken by the government? This happens in many countries worldwide.**

It is normal for a society to have disagreements on issues. We encourage everyone to engage in robust debates and share perspectives. We may not always agree with one another, but it is important to come together amicably to understand one another's points of view.

At the end of any debate or public consultation, some decisions have to be made and there will be trade-offs. The chosen solution will not be able to please all, but it must serve the nation's long-term interests. We respect differing views but we must get on with nation building. That is the only way to avoid paralysis and stagnation.

# Bill de Blasio

## TACKLING INEQUALITY



**M**ore than a year into office as Mayor of New York City, **Bill de Blasio** has led the fight on many issues important to the more than eight million people who live in America's largest city. He was elected to office on promises to tackle issues ranging from social inequality to climate change. Here, Mayor de Blasio discusses the progress of some of his game-changing plans for New Yorkers.

● **In your inaugural speech, you pledged to reduce economic and social inequalities. How do you plan to do this?**

Tackling the inequality crisis means getting to the heart of the single greatest burden for millions of New Yorkers: housing. In a city where half of New Yorkers are rent-burdened and families are being priced out of their own neighbourhoods, we need to intervene on a bigger scale than ever before.

“Housing New York” – our plan to build and preserve enough affordable housing for a half-million New Yorkers in the coming decade – is the blueprint for how we'll get this done. We're creating new tools

and reforming existing ones to make sure that neighbourhoods across the boroughs can increase the amount of affordable housing New Yorkers need, while protecting the affordability of existing housing.

“Housing New York” is just one piece of a broad approach to combatting inequality. We're also implementing free, full-day pre-kindergarten for every child, implementing paid sick leave worker protection, raising and expanding our living wage, and creating new career pathways so more New Yorkers can acquire the skills they need to secure quality jobs in a growing 21st century economy.



*Tackling the inequality crisis means getting to the heart of the single greatest burden for millions of New Yorkers: housing.*





● **Tell us more about the “Pre-K for All” initiative, and the US\$150-million plan to improve over 90 public schools.**

Full-day pre-K, or pre-kindergarten, is the cornerstone of our administration’s plan to transform public education in New York City. This is combined with the doubling of after-school enrichment for middle schools and the creation of new community schools. NYC has also reached a new labour agreement with its teachers that will improve the standard of educators. This contract, the first in years, enables greater professional development, innovative school models, and tougher procedures to remove those unfit for the profession.

High-quality pre-K represents change at a scale that will raise achievement and reduce inequality across all communities.

Today, more than 75 per cent of the cohort of 70,000 children is enrolled in free, high-quality, full-day pre-K. Next year, we will serve every child. Early childhood interventions like these make sure that all New York children are on the fast track to success, starting from the youngest ages, where disparities begin.

We’re confronting those disparities in later grades as well. Our “School Renewal Program” will fundamentally change the direction of and accelerate progress in 94 struggling schools. This is in stark contrast to the old approach of simply closing, or phasing schools out. Each “Renewal School” will transform into a “Community School”, knitting together new services that support children’s families, as well as their mental health and physical wellbeing. Each Renewal School will provide an extra hour of extended instruction per day, and could offer additional after-school, weekend and summer learning opportunities, as needed. Each school will also receive additional resources for academic intervention and professional development to create a better learning environment for students.





*For years, the conventional wisdom has been that certain neighbourhoods are doomed to isolation because of their geography... We're going to change that.*



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● **This June, New York will host the World Cities Summit Mayors Forum 2015, with the theme “Innovative Cities of Opportunity”. In your view, what are some innovative solutions to addressing inequality that cities can explore?**

As mayors, we have diverse solutions at our fingertips. If we work together to leverage the power of municipal governments, we can advance local strategies and build a global urban agenda together. We can catalyse real change for the people that we serve.

This year, we launched the most ambitious, dynamic and useful municipal ID card programme in the United States, empowering all New Yorkers regardless of their immigration status. IDNYC is not only a card for all New Yorkers, it is the gateway to the city’s services. It is the key to opening a bank account, or getting a library card, and the ticket to many of our city’s finest cultural institutions. More than that, this card represents who we are: New Yorkers who value equality, opportunity and diversity.

We must also remember that access to affordable transportation is central to fighting inequality and making our cities more resilient. For years, the conventional wisdom has been that certain neighbourhoods are doomed to isolation because of their geography. That’s a phenomenon that’s been true in New York and cities across the globe. Even people who can see Manhattan’s skyline from their home face more than an hour of commuting. We’re going to change that.

01 The lack of affordable housing is one of the most pressing issues in New York.  
02 From left to right: NYC School Chancellor Carmen Fariña, First Lady Chirlane McCray, Mayor Bill de Blasio and Queens Borough President Melinda Katz visit Home Sweet Home Children’s School in Queens during the first-day-of-school five-borough tour.  
03 Mayor de Blasio launches the IDNYC municipal identification programme on 12 January 2015.

This year, we announced that we're launching a new citywide ferry service to be open for business in 2017. New ferry rides will be priced the same as subway fares, so ferries will be as affordable to New Yorkers as our subways and buses. Residents in long-isolated communities like the Rockaways, Red Hook and Soundview will be closer to the opportunities they need. And beyond connecting residents to jobs in the central business district, our new citywide ferry system will spur the development of new commercial corridors throughout the outer boroughs.

We will also expand the Bus Rapid Transit (BRT) serving 400,000 New Yorkers by completing a network of 20 routes over the next four years. BRT will cut transit time on existing routes by 15 to 25 per cent. This means New Yorkers will spend less time in transit and more time living their lives.

● **To what extent do economic and social inequalities affect urban resilience? How would narrowing the rich-poor divide make a city more resilient?**

Since the great recession, New York City has, in many ways, bounced back. We've grown to 8.4 million people with a record 3.5 million private sector jobs and more Fortune 500 companies than anywhere else in the world. But progress has been uneven. While the number of jobs is up, many of these jobs are in lower-paying sectors with fewer opportunities for wage growth and career advancement. Restoring upward mobility to people at every rung of the economic ladder is critical to making cities resilient for the long-term.

We live in a world where cities and regions compete for talent, investment and jobs, and where economic turbulence and crises caused by climate change are becoming more and more common. Forward-thinking cities need to invest in their people to prepare for those uncertainties. A better-educated and trained workforce helps a city compete for good jobs in the global economy. Families with paid sick leave and access to early education for their children are better positioned to handle the ups and downs of life without losing a job or falling into hardship. Cities that can reduce the skyrocketing cost of housing can maintain the kind of economic diversity needed to attract employers and make for sustainable communities.





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*...there is no substitute for person-to-person contact in crises... bringing help to New Yorkers' doorsteps is the most effective way to reach people...*

● This issue of **URBAN SOLUTIONS** has a special focus on resilience. What does resilience mean to you in the urban context? How would you define a resilient city?

Resilient cities don't just weather proverbial storms but are prepared for them and put measures in place to minimise their impact and protect their people. They invest in the economic stability and the upward mobility of families. They invest in 21st century infrastructure, and they prioritise education as the foundation of long-term success.

● What role can the individual and the community play in disaster preparedness, response and recovery?

In 2012, 44 New Yorkers lost their lives and tens of thousands were displaced by Hurricane Sandy. In the face of incredible hardship, New Yorkers, especially our first responders, showed extraordinary courage, generosity and determination. We saw ordinary New Yorkers providing assistance, care, and temporary housing for their neighbours in distress. Community-based organisations played a critical role in the city's first-line of communication with New Yorkers in all five boroughs, and they've since been integrated more deeply into our broader emergency response plans to harness the goodwill of New Yorkers in every neighbourhood.

One thing we learnt during Sandy is that there is no substitute for person-to-person contact in crises. From evacuation to emergency provisioning, to delivering medical aid, bringing help to New Yorkers' doorsteps is the most effective way to reach people – not waiting for them to come to the government.

<sup>01</sup> This past February, Mayor de Blasio announced a new, affordable citywide ferry service which will launch its first phase by 2017.

<sup>02</sup> Select Bus Service, NYC's version of a Bus Rapid Transit system, will be expanded over the next four years.

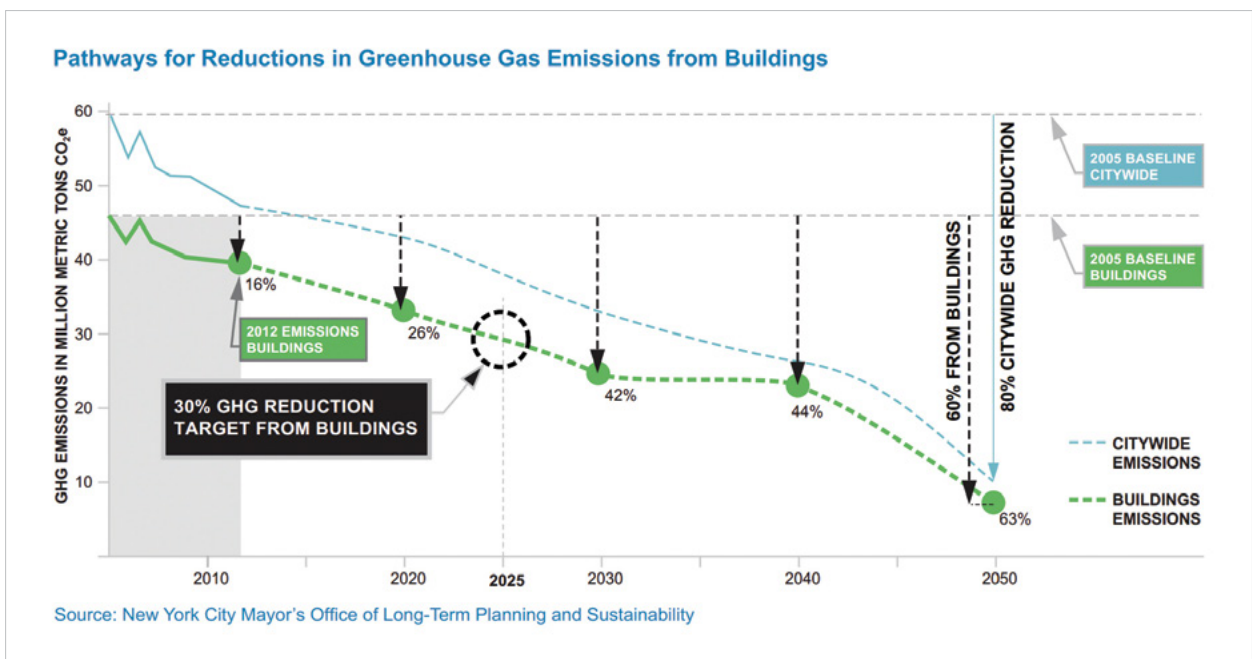
● **A resilient city invests in preparing for future extreme weather events, in addition to its post-disaster recovery. What are the main challenges balancing these two priorities, and how do you overcome them?**

The need to rebuild and the need to invest in resiliency aren't at odds. They go hand-in-hand. We're building back post-Sandy in a way that will better protect us from future disasters. We've kickstarted Sandy recovery and are now delivering relief to residents and businesses around the city. But we're making sure that the work facilitates raising foundations, fortifying homes and protecting vital infrastructure from future storms. This is all part of a massive, comprehensive, and multi-layered resiliency plan being implemented around the city.

Today, we're working to build back the most affected communities and to strengthen them for whatever may come our way. That includes strengthening coastal defences, upgrading buildings, protecting infrastructure and critical services, and making homes, businesses and neighbourhoods safer and more vibrant.

We're also confronting climate change at its source, becoming the largest city in the world to commit to reducing our carbon emissions by 80 per cent by the year 2050. Doing this isn't just smart environmental policy, or even an existential imperative to protect New Yorkers – taking on climate change is good economics too.

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*...reducing our carbon emissions... isn't just smart environmental policy, or even an existential imperative to protect New Yorkers – taking on climate change is good economics too.*

● **URBAN SOLUTIONS** is read by over 30,000 city leaders and allied professionals. What is one message that you would like to convey to our readers?

Cities are wrestling the challenges of our time: rising inequality, climate change, the need for more affordable housing, among many others. We can lead, we can innovate. We cannot wait.

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01 The roadmap for reducing greenhouse gas emission will create an estimated 3,500 construction-related jobs, and generate US\$8.5 billion in total cost savings for New Yorkers over the next 10 years.

02 Mayor de Blasio tours the Staten Island University Hospital (SIUH) power plant and boiler room, which will benefit from the US\$28-million resiliency investment in preparation for any future weather events. SIUH is home to the largest emergency room on Staten Island with about half a million residents.

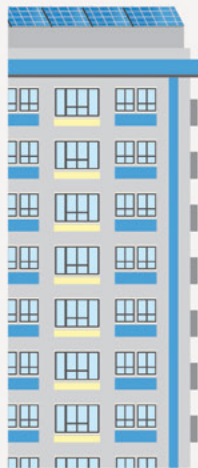
03 The reconstructed Coney Island Boardwalk at Brighton Beach uses recycled plastic lumber which lasts longer, and fares better in hurricanes. It will include a 10-foot-wide concrete carriage lane to better accommodate emergency response services.

# Sustainable Singapore Blueprint 2015

**T**he Sustainable Singapore Blueprint 2015, published by the Ministry of the Environment and Water Resources and the Ministry of National Development, outlines Singapore's national vision and plans for a more liveable and sustainable Singapore, to support the diverse needs and growing aspirations of Singaporeans. This blueprint is a plan for action and provides all residents a unique opportunity to work together to create a better home, a better environment, and a better future that all can be proud of.

## Sustainable Singapore Blueprint – Where We Are Today

### Eco-Friendly Buildings



**Sustainability features** implemented in some of our HDB flats



LED lighting in common areas



energy regenerative lift



centralised chutes for recyclables

**>170** HDB blocks with solar panels



**130** buildings have benefited from the **Green Mark Incentive Scheme for Existing Buildings**

**2,100** with **BCA Green Mark** certification

**>2,600** with **Water Efficient Building** certification

### Green and Blue Spaces



More than **80%** of households within 10-min walk of a park

**24 Active, Beautiful, Clean Waters** projects completed with **26** more underway

The **Singapore Index on Cities' Biodiversity** allows cities to benchmark their biodiversity conservation efforts over time.



1/2 of new residential and 1/3 of new commercial buildings greened under **Landscaping of Urban Spaces and High Rises** scheme since 2009

**110** existing buildings greened through **Skyrise Greenerly Incentive Scheme**

	2009	2013
Amount of skyrise greenery (ha)	10	61
Amount of green space (ha)	3,602	4,040
Length of park connectors (km)	113	216
Amount of waterbodies open for recreational activity (ha)	650	959
Length of waterways open for recreational activity (km)	72	93

### Sustainable Transport



Rail network extended to about **180 km** today

At least **4 in 5 buses** run every **10 minutes** or less during peak hours on weekdays

**>100 km** of cycling paths built since 2009

**Carbon Emissions-Based Vehicle Scheme** for more environmentally friendly vehicles implemented

### Public Cleanliness



**Department of Public Cleanliness** has integrated public cleaning since 2012

**>100 Enhanced Clean Mark** accredited companies since 2012; licensing regime introduced in 2014

**>300 litter-free Bright Spots** created since 2012

## Energy Use



**>200** companies  
are part of the **Energy Efficiency National Partnership**



**\$125m** of annual energy savings identified under **Energy Efficiency Improvement Assistance Scheme** and **\$712m** of projected lifetime energy savings from **Grant for Energy Efficient Technologies**

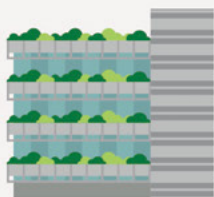


**Mandatory Energy Labelling Scheme** and **Minimum Energy Performance Standards** for household appliances

Energy consumption per \$ GDP, improvement from 2005 (%)



## Water Use



**>370** companies  
have submitted voluntary **Water Efficiency Management Plans** since 2010



**>70** projects funded under **Water Efficiency Fund**



**Mandatory Water Efficiency Labelling Scheme** and **Minimum Water Efficiency Standards** for household appliances and water fittings

Domestic water consumption (litres per capita per day)



## Waste & Recycling



**>140** signatories saved **>20,000 tonnes** of packaging waste under the **Singapore Packaging Agreement**



**20,000 tonnes** of waste to be reduced, reused or recycled with **3R Fund** projects



**1 recycling bin for every HDB block** rolled out since 2011

National recycling rate (%)



## Air Quality



Power stations and refineries are implementing process improvements



Tighter emissions standards for new vehicles implemented



Annual ambient mean ( $\mu\text{g}/\text{m}^3$ )	From 2008 to 2013
PM 2.5	16 to 20
SO <sub>2</sub>	11 to 14

# Targets for 2030





	Indicator	2013 Levels	Targets for 2030
<b>Green and Blue Spaces</b>			
1	Amount of skyrise greenery	61 ha	200 ha
2	Amount of park space and waterbodies open to recreational activity		Park Provision Ratio of 0.8 ha / 1,000 population
	a) Parks	4,040 ha	
	b) Waterbodies	959 ha	1,039 ha
3	Length of park connectors and waterways open to recreational activity		
	a) Park connectors <sup>1</sup>	216 km	400 km
	b) Waterways	93 km	100 km
4	Length of Nature Ways	21 km	180 km
5	Proportion of households within 10-min walk of a park	80%	90%
<b>Mobility</b>			
6	Length of cycling paths	230 km	700 km
7	Modal share of journeys during peak hours made via public transport	64%	75%
8	Length of rail network	180 km	360 km
9	Proportion of households within 10-min walk of a train station	58.5%	80%
<b>Resource Sustainability</b>			
10	Proportion of buildings to achieve BCA Green Mark Certified rating	21.9%	80%
11	Energy intensity improvement (from 2005 levels)	25% <sup>2</sup>	35%
12	Domestic water consumption per capita per day	151 L	140 L
13	National recycling rate	61%	70%
	a) Domestic recycling rate	20%	30%
	b) Non-domestic recycling rate	77%	81%
<b>Air Quality</b>			
14	Air Quality		(Targets for 2020)
	a) PM2.5		
	Annual mean	20 µg/m <sup>3</sup>	12 µg/m <sup>3</sup> (Long term: 10 µg/m <sup>3</sup> )
	24-hour mean (99 <sup>th</sup> percentile)	176 µg/m <sup>3</sup>	37.5 µg/m <sup>3</sup> (Long term: 25 µg/m <sup>3</sup> )
	b) PM10		
	Annual mean	31 µg/m <sup>3</sup>	20 µg/m <sup>3</sup>
	24-hour mean (99 <sup>th</sup> percentile)	215 µg/m <sup>3</sup>	50 µg/m <sup>3</sup>
	c) Sulphur Dioxide (SO <sub>2</sub> ), 24-hour mean (Max)	75 µg/m <sup>3</sup>	50 µg/m <sup>3</sup> (Long term: 20 µg/m <sup>3</sup> )
	d) Ozone, 8-hour mean (Max)	139 µg/m <sup>3</sup>	100 µg/m <sup>3</sup>
	e) Nitrogen Dioxide (NO <sub>2</sub> )		
	Annual mean	25 µg/m <sup>3</sup>	40 µg/m <sup>3</sup>
	1-hour mean (Max)	132 µg/m <sup>3</sup>	200 µg/m <sup>3</sup>
	f) Carbon Monoxide (CO)		
	8-hour mean (Max)	5.5 mg/m <sup>3</sup>	10 mg/m <sup>3</sup>
	1-hour mean (Max)	7.5 mg/m <sup>3</sup>	30 mg/m <sup>3</sup>
<b>Drainage</b>			
15	Flood-prone areas	36 ha	23 ha
<b>Community Stewardship</b>			
16	Number of active green volunteers	>1,000	5,000
17	Number of Community in Bloom Gardens	>700	2,000
18	Number of litter-free Bright Spots	>300	500 (by 2015)

<sup>1</sup> Includes Round Island Route

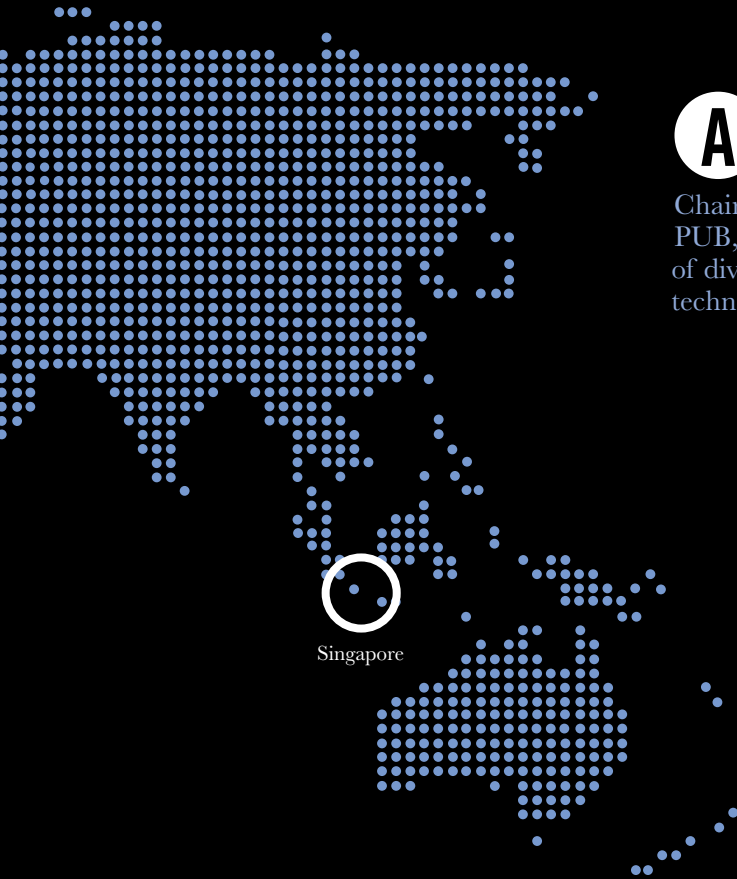
<sup>2</sup> The figure includes estimated consumption data on Liquefied Petroleum Gas (LPG) and petroleum coke.

Read all about the initiatives under the Sustainable Singapore Blueprint 2015:



# *Four National Taps*

## *SINGAPORE'S WATER RESILIENCE STORY*



**A**s an island-state with few natural water-storage resources, Singapore historically faced challenges in securing its water supply. Chairman of Singapore's national water agency PUB, **Tan Gee Paw**, explains how a strategy of diversification, innovation and investment in technology safeguards this vital resource.

### The Challenge

Singapore is a densely populated city-state with over five million people in just 718 square kilometres. Although it receives an average of 2,400 millimetres of rainfall each year, it has limited land to collect and store rainwater. With neither big rivers nor lakes, Singapore was ranked 170th out of 193 countries for availability of natural water resources in the 2006 United Nations World Water Development Report.

During the early days of Singapore's independence in the 1960s and 1970s, it relied mainly on water imported from neighbouring countries to meet its needs. This meant that if a drought affected Singapore and



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its neighbours concurrently, the city would be extremely vulnerable in times of very little rainfall. Singapore would then also be at the mercy of its neighbours for survival.

In 1960 and 1963-4, severe droughts did hit Singapore and water rationing had to be carried out. At that time, the city faced water shortages due to post-war population growth and under-investment in infrastructure.

Providing an adequate water supply became a top priority then.

Today, the threat of a prolonged drought remains a cause for concern. In the past decade, Singapore experienced two dry spells – in 2010 and 2014. In fact, February 2014 was the driest month recorded in the last 145 years, with only 0.2 millimetres of rainfall recorded compared with the mean February rainfall of 161 millimetres.

01 Water rationing in the 1960s.





## The Solution

Singapore's first significant step towards building a sound water management system for the long term began in 1971 with the formation of the Water Planning Unit under the Prime Minister's Office. The first Water Master Plan in 1972 envisioned a diversified water supply over the next half-century, from what would become known as the Four National Taps: local catchment water, imported water, reclaimed water, and desalinated water.

### ***Maximising Existing Local Supply***

PUB's first strategy was to harvest and store as much rain as possible, which required the creation of unprotected, urbanised water catchments. However, many of the rivers that could be dammed for reservoirs had been polluted by economic and residential activities.

Driven to create a clean, liveable environment and expand water supply, the government undertook a massive clean-up effort for the

Singapore and Kallang rivers, relocating pollutive activities, resettling squatters into proper housing, and legislating to protect catchments.

Today, two-thirds of Singapore's land area collects rainwater which is then channelled into 17 reservoirs. Reservoirs at Punggol, Serangoon and Marina were created by damming rivers. Marina Reservoir, set in the heart of downtown Singapore, collects rainwater from some of the oldest and most densely built-up areas of Singapore. Singapore is the only city in the world where urban stormwater harvesting is carried out on such a large scale. Notwithstanding, the local catchment supply remained vulnerable to drought. Alternative sources of water that are less rainfall-dependent were required.

<sup>01</sup> The Marina Reservoir is fed by five rivers running through the heart of Singapore and can meet about 10% of Singapore's water needs.



### ***Transitioning to Unconventional Water Sources***

Singapore had been exploring water reuse since the 1970s as a means of diversifying its water resources, but had shelved the idea due to high costs and the unproven reliability of membrane technology then. By the 1990s, the performance and cost of membrane technology had improved significantly, and other countries were starting to use it in water treatment and reclamation.

In 1998, a PUB study team tested the latest membrane technology in water reclamation for potable purposes. Two years later, the agency commissioned a full-scale demonstration plant that could produce 10,000 cubic metres of ultra-clean, high-grade reclaimed water a day. In 2003, NEWater was introduced. To ensure that NEWater is of the highest quality, a comprehensive water sampling and analysis programme was implemented, benchmarking the results against World Health Organisation and the United States Environmental Protection Agency's drinking water standards.

Today, NEWater is supplied primarily for non-domestic use in wafer fabrication parks, industrial estates and commercial buildings, and to top up reservoirs during dry months. It allows Singapore to reduce its dependence on rainfall, enabling every drop to be used and reused.

As membrane technology continued to advance, desalination became a natural choice for the island city. In 2005, Singapore opened its first desalination plant which has a capacity to produce 136,000 cubic metres per day. A second plant commissioned in 2013, added another 318,500 cubic metres of capacity per day. To be better prepared against dry spells which may become more prolonged due to climate change, a third desalination plant will be built by 2017.

As rainfall-independent sources, NEWater and desalinated water are key to building up Singapore's drought resilience. By 2060, the two sources will be able to meet up to 80% of Singapore's total water demand.

**Managing Demand**

Aware that Singapore's water-management success may breed complacency, the PUB relies on a multi-pronged approach to promote conservation: by pricing water correctly, mandating standards for efficiency in water usage, and facilitating programmes to encourage water conservation. Demand management is equally essential to ensure a sustainable water supply.

In the long term, non-domestic use is expected to make up 70% of total water demand. Singapore encourages industries to adopt water-efficient systems and processes, and views this as an opportunity to grow the local water industry by spurring the co-creation, test-bedding and adoption of water-efficient technologies.

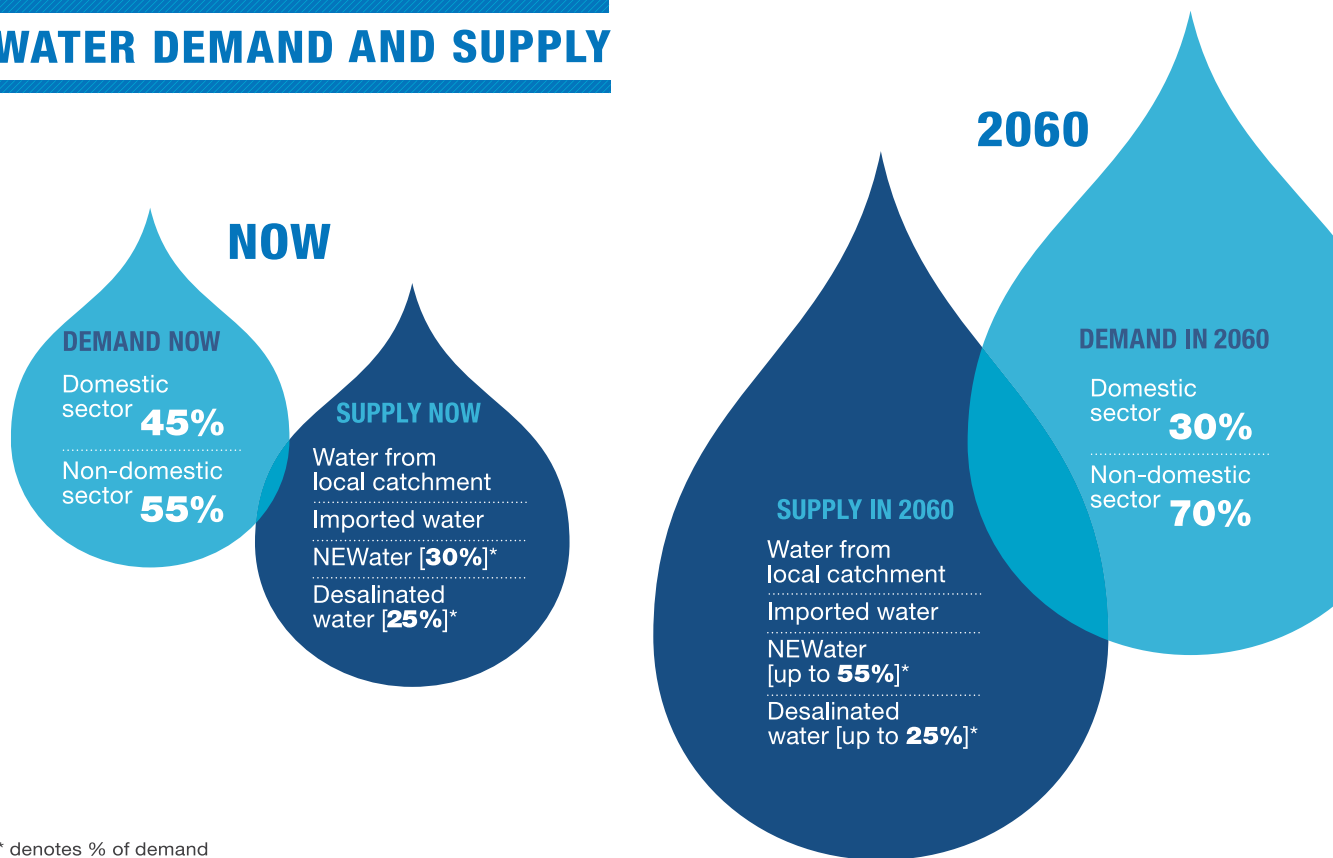
- 01 The NEWater Visitor Centre offers an educational and interactive multimedia experience on Singapore's water story and water reclamation.
- 02 NEWater is produced by further purifying treated used water using advanced membrane technologies.
- 03 Post-treatment facilities at the Tuaspring Desalination Plant. The two desalination plants in Singapore are designed, built, owned and operated by the private sector.
- 04 Children at primary schools learn about water conservation.

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## WATER DEMAND AND SUPPLY





## The Outcome

Singapore has come a long way from its water-rationing days. Today, its people enjoy good, clean drinking water at the turn of a tap. The success of Singapore's water resource management was made possible with clear vision, firm political resolve and the integration of urban planning with water resource management. Singapore has also gained global recognition for its water management achievements. The PUB received the Stockholm Industry Water Award in 2007 and the "Water for Life" United Nations Best Practices Award in 2014.

Singapore has lowered its daily per capita domestic water consumption from 165 litres in

2003 to 150.4 litres in 2014, and aims to further reduce this to 140 litres by 2030. Today, it is a global water hub with 150 water companies and 26 research centres actively pursuing a range of water infrastructural and R&D work.

During the dry spell in 2014, Singapore was able to meet its water needs by running desalination and NEWater plants at nearly full capacities. Fortunately, regular rainfall resumed after three dry months. A prolonged drought would have put a strain on the system. The journey towards water sustainability has not ended, and PUB continues to update its water supply strategies, invest in research and innovation, and promote water-consciousness.



**Tan Gee Paw** was appointed Chairman of PUB, Singapore's national water agency on 1 April 2001. As Chairman, Tan brought about the integration of water, drainage and sewerage services under one agency, enabling Singapore to put in place a robust and sustainable water-supply system. He was also instrumental in overseeing the development of NEWater.

His invaluable contributions over the decades have been recognised through numerous awards which include the Public Administration Medal (Silver) in 1978, a Special Award (Gold Medal) for Clean River Commemoration in 1987, the President's Award for the Environment in 2007 and the Distinguished Service Order in 2010 for his work as Chairman of PUB.

# Boston Strong

## HOW PLANNING AND TRAINING SAVED LIVES IN THE 2013 BOSTON MARATHON

**B**oston's 10-year journey towards greater emergency preparedness, coordination and training enabled a fast and efficient response to the 2013 Boston Marathon terrorist bombing. This saved lives, restored order, and resulted in the swift capture of the remaining suspect. This was followed by an exemplary display of strength and solidarity by the community.



01 Two bombs exploded during the 117th Boston Marathon, killing three people and injuring 261 others.

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## The Challenge

On the morning of 15 April 2013, as runners approached the end of the 117th Boston Marathon, two improvised explosive devices (IEDs) detonated near the finish line. The bombs exploded 12 seconds apart on Boylston Street, claiming the lives of three and injuring another 261 people.

The aftermath of the attacks posed enormous challenges for emergency personnel. Police worked to secure the blast scene amidst the chaos of hundreds of injured victims, and despite poor situational awareness. Their efforts were further

compounded by the many bags that the spectators dropped as they scattered to safety, and investigators had to treat each abandoned bag as a potential bomb.

The City of Boston and the Massachusetts state government were taken by surprise, but their response was highly effective. The rapid coordination among state and municipality officials, hospitals, transportation authorities, private firms, safety experts and volunteers was not an accident. At least 10 years of planning, training and preparation contributed to an extraordinary survival rate among the injured.

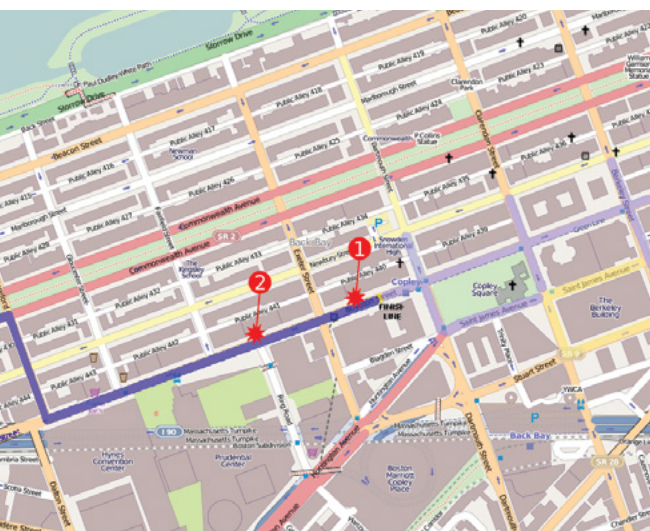
## The Solution

Massachusetts' preparedness was the legacy of the events of 11 September 2001. Drawing lessons from the deadliest terrorist attack in US history, regional government agencies worked with stakeholders to enhance long-term resilience capabilities, and develop specific emergency measures for events like the Boston Marathon.

Large investments were made to improve communications, while plans and procedures were updated to reflect changing circumstances. In 2004, the Massachusetts Emergency Management Agency installed the WebEOC, a tool to enable real-time sharing of information amongst the emergency management community. Three years later, Massachusetts'

Statewide Interoperability Executive Committee, consisting of members from Massachusetts' five security regions, developed the Statewide Communications Interoperability Plan to integrate communication systems more seamlessly across the state. In 2011, Massachusetts added an Improvised Explosive Device (IED) Annex to its regional response plans, which provided for coordinated resource deployment when responding to an IED incident. Finally, using Federal grants, the state conducted Joint Counterterrorism Awareness Workshops to plan and practise responses to IED-related threats. Representatives from law enforcement, fire departments, emergency medical services (EMS), communication centres, private sector communities, and non-governmental organisations took part.

During a House Homeland Security Committee hearing after the bombings, Boston Police Commissioner Edward Davis testified that if these simulations had not taken place, more people would have died in the attacks. According to him, Urban Shield Exercises improved coordination and communication between departments, and "made a difference in our ability to respond to the explosions."



- 01 The two explosions that occurred 12 seconds apart on Boylston Street.
- 02 The efficient dispatch of casualties to the hospitals.
- 03 An emergency medical technician and two members of the public evacuating a casualty.



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At the city level, Boston participated in Urban Shield Exercises since 2011 to validate its investments in emergency response equipment and training, utilising a series of scenarios involving multiple threats to public safety and security. These simulations involved many aspects of emergency response, including intelligence, law enforcement, police, and EMS. In 2012, eight Boston hospitals took part in the exercise, which simulated the management of casualties and the activation of the Medical Intelligence Centre (MIC).

The MIC had been formed in 2009 to communicate and share information during large-scale incidents. It played a crucial role on the day of the bomb attacks. Minutes after the blasts, EMS personnel alerted the MIC, which in turn immediately notified local hospitals about the possible surge in admissions. The MIC also disseminated reports to relevant agencies and hospitals, with information on patients, hospital supply needs, security updates, and services available to the victims.

Beyond long-term capability building, authorities improved their emergency preparedness for the Boston Marathon through a Tabletop Exercise conducted one month before the event. They discussed specific disaster scenarios, and plans to deal with these. One of the scenarios featured an IED explosion. Subsequently, a multi-agency coordination centre was set up for the Marathon, comprising personnel from groups that had participated in the Urban Shield Exercises.



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## The Outcome

Boston's 10-year effort to improve its disaster preparedness enabled an efficient and coordinated response to the terrorist attacks. This saved lives, restored order, and eventually led to the capture of the surviving suspect.

The emergency medical response, in particular, has been given enormous credit. The three people who were killed by the bombs all died before reaching a hospital. The other 261 casualties, including those with severe injuries, survived. Not a single hospital was overwhelmed with patients in the aftermath of the bombings. This outstanding result was due to the efficient communication and coordination across the city, especially through the MIC. The runners' first-aid tent was rapidly converted into a mass-casualty triage unit, and medical personnel dispatched all the injured to eight hospitals in minutes, based on each hospital's capacity and capabilities.

Civil society and the public also played an active role. People shared information through social media, and those present contributed their photographs and videos to investigators to assist in the identification and pursuit of the suspects. Others provided lodging, blankets, food, phone calls, and other assistance to runners who could not complete the race and



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needed to locate friends and family. Over the following days, the whole community came together and paid tribute to the victims at memorials and services.

Researchers from Harvard University later conducted a comprehensive study on Boston's response to the 2013 Marathon bombings. They reiterated that Boston's fast and effective emergency response was the product of years of planning. The

improvements in interoperability and communication among different agencies, as well as the simulation exercises conducted in the preceding years were key.

Many of these lessons from Boston can be applied to other scenarios, such as natural disasters and industrial accidents, and can offer other cities guidance in improving their resilience.



**Carolina Landulfo** is a second-year Master in Public Policy candidate at NUS and spent the first year of the programme at London School of Economics, where she started cultivating a special interest in urban development. Carolina was a Student Fellow with the Centre for Liveable Cities from December 2014 to January 2015. Prior to moving to London, the graduate student was a journalist and public relations officer in Brazil, where she worked for six years in the most important media outlets and public relations agencies in her home city, São Paulo.

- 01 Centrepiece of the makeshift memorial that sprang up steps away from the marathon finishing line.
- 02 Hundreds of running shoes were hung in tribute on the police barricades along Boylston and Berkeley streets.
- 03 Boston Strong: a case of preparedness and community solidarity in the face of an unexpected crisis.

# Religious Rehabilitation Group

*RESTORING RELIGIOUS HARMONY*



**S**ince the 9/11 attacks of 2001, a rise in religious extremism has threatened global security. How can cities deal with such threats to liveability? **Koh Buck Song** from the Centre for Liveable Cities looks at how Singapore is addressing this issue through the work of the Religious Rehabilitation Group.

<sup>01</sup> In 2001-2002, radical activists from Jemaah Islamiah were detained on suspicion of plots to attack diplomatic missions and a train station.



NEW FACES ON WALKABOUT: PAP may field SGH chief, woman labour leader and doctor PAGE 6

# The Straits Times

Monday • October 13, 2003 • 64 Pages in six parts • S\$15.10 (S\$14.2000) • Singapore Press Holdings publication 60

**3 hurt in JB shooting**  
Racing veteran Ringo Chong (left), diamond dealer Frank Chew and brother in hospital after being shot >>> PAGE 4

**COUNTERSTRIKE AGAINST TERRORISM**  
• Bush assures anxious Americans  
• Al-Qaeda warns of more terror >>> PAGE 3

## PM: Pull together to overcome threats

**Singaporeans urged to do their part to overcome challenges; DPM Lee to head panel to change development strategy**

**SINGAPORE** — Prime Minister Lee Hsien-Lock urged Singaporeans to do their part to overcome challenges and to pull together to overcome threats.

Mr Lee said that Singaporeans should not be lulled into a false sense of security by the fact that Singapore has not experienced any major terrorist attacks.

He said that Singaporeans should be alert and ready to face any threats that may arise.

Mr Lee also announced that Deputy Prime Minister Lee Hsien-Lock will head an inter-agency committee to draw up the blueprint to change Singapore's development strategy and restructure the economy.

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### CYBERSPACE CAUTION

There are dangers, apparently Singaporeans, who expressed grave alarm about the attacks on the U.S. At the same time, there are others who linked the terrorism to Islam and Muslims. The potential for such incidents in cyberspace to lead over to the physical world is real. Eugene Scriver to be responsible in expressing their views.

— PM Goh, warning that Internet postings on terrorism and Osama bin Laden have been inflammatory

growth rates a sharp slide, from 11 per cent in 2001 to a pre-war in 2002. Inflation tracked down from 2 per cent in 2001 to 20 per cent in 2002.

Mr Goh said, "We are looking at broader issues that despite the trade and industrial recovery, the economy would be 'flat' in an overall sense of all at the first half of the year."

The PM's attacks, he said, were to prompt the world economy into its second stage since 1973.

Five jobs imposed by the Middle East petroleum cartel in 1973 saw Singapore's growth rates a sharp slide, from 11 per cent in 2001 to a pre-war in 2002. Inflation tracked down from 2 per cent in 2001 to 20 per cent in 2002.

### THREATS FACING SINGAPORE

PM Goh Chak Tong highlighted these issues, and what is being done.

**ECONOMIC GROWTH** — Singapore's economic growth has slowed down since the U.S. has slashed interest rates and taken steps to stimulate the economy. DPM Lee Hsien-Lock to lead high-level panel to draw up new development strategy.

**WE WILL DEAL SERIOUSLY WITH ANYONE WHO TRIES TO EXPLOIT THE CURRENT SITUATION TO INFLAME RELATIONS BETWEEN RACIAL AND RELIGIOUS GROUPS. WE WILL SCOURGE ALL INFORMATION RELATED TO INTER-RACIAL INCIDENTS. WE HAVE TO BE ESPECIALLY CAREFUL OF ANY INSINUATIVE ACTION DURING THIS PERIOD.**

**ECONOMIC RECOVERY** — Singapore's economic growth has slowed down since the U.S. has slashed interest rates and taken steps to stimulate the economy. DPM Lee Hsien-Lock to lead high-level panel to draw up new development strategy.

**WE WILL RECOVER FROM THE ECONOMIC RECESSION — THAT IS CERTAIN.**

**SECURITY** — Singapore will continue to remain vigilant and ready to face any threats that may arise.

**WE HAVE PUT IN PLACE PLANS TO PREVENT TERRORIST ATTACKS, AND TO DEAL WITH THEM SHOULD THEY OCCUR.**



THREATS FACING SINGAPORE

PM Goh Chak Tong highlighted these issues, and what is being done.

## Terrorists tried to recruit S'poreans

**SINGAPORE** — A MIDEAS-B&EFT security group tried to recruit and recruit Singaporean Muslims to join their cause.

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## The Challenge

"Resilience" is often considered in environmental or social equity terms, such as preparing for natural disasters or addressing wealth gaps. In fact, social resilience also encompasses religious harmony. This connects with a major concern today - religious extremism.

Extremism has become more pervasive in the post-9/11 world. In 2001 and 2002, a number of activists of the radical group Jemaah Islamiah were arrested under the Internal Security Act for seeking to create chaos in Singapore. Some of them had trained in terrorist camps in Afghanistan. Dealing with such threats is vital to the security of any country. It is especially crucial for small cities like Singapore, whose livelihood depend on keeping its borders open to trade, tourism, investment and, increasingly, immigration.



## The Solution

After the Jemaah Islamiah arrests, the Singapore government approached community leaders Ustaz Ali Haji Mohamed and Ustaz Mohamad Hasbi Hassan in 2003 to help counsel the detainees, drawing on their previous work with the Singapore Islamic Scholars and Religious Teachers Association (Pergas) and the Islamic Religious Council of Singapore (Muis). The two men enlisted the help of a few Islamic scholars and teachers, and this led to the formation of the Religious Rehabilitation Group (RRG).

This voluntary organisation seeks to address the religious aspect of the rehabilitation of those arrested. The two other components in the rehabilitation process are psychological and social. To address the detainees' social needs such as helping their families cope with life while they are under detention, RRG works with a few partner organisations. These community bodies include Khadijah Mosque, Council for the Development of Singapore Malay/Muslim Community (Mendaki), the Singapore

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Malay Youth Library Association (Taman Bacaan) and the Association of Muslim Professionals (AMP).

Integrating former offenders back into normal life requires the support of the rest of the society. In this way, RRG’s work within the Muslim community has many similarities with another secular national initiative called the Yellow Ribbon Project, which aims to change the mindsets of employers and society to give former offenders a second chance in life, to return to their families and find new jobs.

RRG’s resource counselling centre supports research on subjects such as the Syrian conflict, as well as training, public education and information-sharing. Its community outreach has touched thousands of people, including those in schools, churches, community centres and Chinese clan associations. The centre, which has a multimedia visitor gallery, has become a must-see stop on the Geylang community heritage trail for grassroots groups.

RRG’s 39 counsellors spend time with detainees to identify and correct misinterpreted Muslim concepts that have been used to justify political objectives, for example, wrongly applying Quranic verses about “jihad” to advocate random acts of killing. The counsellors also help the detainees better appreciate living amongst Singapore’s multi-racial and multi-religious harmony in a secular state.



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- 01 The Khadijah Mosque on Geylang Road. The community in this mosque are active supporters of RRG’s work and partner closely with them.
- 02 The resource centre serves as space for public education as well as training and research.
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The detainees are usually suspicious at first. They open up only when they realise that the counsellors are not paid government officers, but volunteers who care about the well-being of society and the good name of the Muslim community, according to Ustaz Mohamed Ali, RRG's volunteer vice-chairman, who is an academic at the International Centre for Political Violence and Terrorism Research. In a recent interview with *The Straits Times*, he said that RRG's "counter-ideological approach" of re-education works because "no one is born a terrorist, a radical or extremist. It's through a process of radicalisation that these people become like that."

RRG's counsellors are certified by a selection board, and they work towards a specialist diploma in counselling and psychology while doing their work. They have to be well-read in geopolitics and engage effectively in discussions on global developments. For instance, since the recent rise of the Islamic State in Iraq and Syria (ISIS), RRG's outreach has included more online platforms such as a Facebook page, Youtube videos of detainees recanting false ideologies, and a mobile app to provide accurate, scholarly interpretation of the Quran.

The work of RRG is built on a foundation of longstanding trust between the community at large and the government, and also among



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religious communities. As Salim Mohamed Nasir, an academic in international relations and volunteer head of RRG's secretariat, says, "Respect and acceptance of diversity are key. It's about helping one community for the greater good." The Singaporean approach to addressing religious issues has always been supported by a broader country-wide grassroots network. For example, all constituencies have Inter Racial and Religious Confidence Circles, inter-faith groups of leaders who come together to share information and maintain harmony in the community. These networks of people form a system that facilitates quick response and easy communication between groups from different faiths and state organisations in times of need. Such conditions, in some ways unique to Singapore's multi-racial society, facilitate RRG's work of fostering a more cohesive, resilient nation.



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## The Outcome

Since 2003, RRG has conducted hundreds of counselling sessions. After months, sometimes years, of counselling, the detainees begin to embrace “wasatiyyah” (moderation) and let go of earlier mistaken beliefs of hate and violence, when the Quran, in fact, condemns suicide and murder. Supervision programmes for former offenders help them break away from violent ideologies and rebuild normal lives.

Singapore has a well-established social network, ready to address extremist threats to society. Since 2002, more than 60 people have been detained for involvement in terrorism-related activities. To date, more than two-thirds have been released. There has been only one case of recidivism so far – and this is a credit to RRG and the Muslim community’s efforts to help nurture the religious harmony that is a vital facet of any liveable city.



**Koh Buck Song** is an adjunct staff of the Centre for Liveable Cities. He is the author and editor of more than 20 books, on subjects including Singapore’s country branding, economic strategy, manpower development, public housing and energy policy.

- 01 Informational and awareness material produced by RRG are used in the community’s educational and outreach efforts.
- 02 RRG regularly hosts student visits at their Resource and Counselling Centre.

# Improving SURAT'S FLOOD RESILIENCE



**S**urat, the eighth largest city in India and second-largest in Gujarat state, is one of India's fastest-growing cities. This rapid rise and its location on the Tapi River, however, make it vulnerable to climate-change associated risks such as devastating floods and their accompanying outbreaks of disease. **Dr Isher Judge Ahluwalia**, Chairperson of the Indian Council for Research on International Economic Relations, and **Kamlesh Yagnik**, immediate past president of the Southern Gujarat Chamber of Commerce and Industry, explain how the city has strengthened itself against floods and climate hazards.





Surat, India



## The Challenge

In August 2006, the city of Surat suffered devastating floods after three consecutive days of rain. Then, an emergency release of water from the upstream Ukai Dam into the Tapi River inundated nearly 80 per cent of the city, leaving 2 million of its residents trapped in their homes without food or drinking water. The episode was the latest in a series that highlights Surat's geographical vulnerabilities. In 1994, a flood had triggered a plague epidemic that caused 56 deaths, while flooding also affected lives of the residents in 1998 and 2004.

Located on the banks of the Tapi River, directly downstream from the Ukai Dam, Surat is particularly susceptible to floods. In the dry season, the dam supplies water to city-dwellers, farmers in the region, and the Hazira industrial district. During the wet season, however, emergency water releases have to be carried out in response

to heavy rainfall, and this can result in downstream flooding. Rapid urban growth has also put pressure on water resources. The Tapi's carrying capacity shrank from 1.2 million cubic feet per second in the 1970s to 0.35 million cubic feet per second in 2015 because of bridges, embankments, encroachments and siltation as Surat expanded to three times its original size. Currently, 75 per cent of Surat's more than five million people are vulnerable to floods. In particular, the 450,000 residents living along riverbanks, tidal creeks and between drainage lines are most at risk.

Today, climate change poses new threats to Surat. Rising winter temperatures and high humidity could lengthen the mosquito-breeding period and create conditions favourable for malaria, dengue and other vector-borne diseases. Higher rainfall in Tapi's upper catchment will also mean larger volumes of water in the river, while rising sea levels will cause saltwater intrusion into aquifers and contaminate groundwater.

01 A flooded Surat.



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01 Drainage works.

02 The water treatment plant at the Vesu area provides 35 million litres of piped water per day.

## The Solution

After the 2006 floods, Surat began to overhaul its stormwater and sewerage infrastructure, put in place urban health initiatives, and implement a comprehensive city resilience strategy.

### ***Infrastructure Renewal***

The Surat Municipal Corporation accessed funds from India's massive city modernisation scheme, the Jawaharlal Nehru National Urban Renewal Mission, to augment its stormwater drainage network and sewerage network and treatment plants. They also installed a modern, SCADA (Supervisory Control and Data Acquisition)-based industrial control system in 2009, which brought about significant savings in sewage-treatment energy consumption. Today, Surat treats over 90 per cent of its wastewater, well above the average of 30 per cent for Indian cities. The Corporation also strengthened river embankments, built new floodgates and a weir. These improvements allow stormwater to drain more easily and prevent the spread of diseases.

### ***Urban Health Initiatives***

Urban health initiatives implemented by the Surat Municipal Corporation between 2006 and 2009 include regular medical camps in low-income locales, and health exhibitions to build awareness on disease-prevention.

### ***Surat Climate Change Trust***

In 2011, the Surat Municipal Corporation developed its City Resilience Strategy to address the challenges of climate change in general, and flood vulnerability,



in particular. This work was done in partnership with the Rockefeller Foundation's Asian Cities Climate Change Resilience Network and local experts such as TARU Leading Edge, an Indian urban development consultancy.

As a result, the Surat Climate Change Trust was set up as a multi-stakeholder body which pulls together city authorities across various sectors, from water management to urban development, as well as the private industry and the community. A major objective of the trust is to safely rehabilitate the poor and most vulnerable populations living in low-lying, flood-prone parts of the city.

The first major accomplishment by the trust was an early warning system that uses satellite data and hydrological models to forecast weather conditions two to three days in advance such that the water authorities can release smaller installments of rainwater over a longer period. Mobile phone messages are sent to citizens 48 hours in advance of the release of water, which gives them time to react and evacuate, if necessary.

Another important development was the setting up of the Urban Health and Climate Resilience Center (UHCRC) in 2013 to monitor the impact of extreme health events. The centre further built on earlier work done on an Internet-based Urban Service Monitoring System, which had enabled city officials to generate data on the disease trends in Surat regularly. Work at UHCRC involves close interaction with the Southern Gujarat Chamber of Commerce and Industry, the Surat Municipal Corporation, and the Health and Family Welfare Department.

These measures do not come cheap, but the city has paid for them through property and commercial taxes – thanks to a prosperous industrial base – and cross-subsidies in a water-tariff structure which charges industrial users four times the residential rate. Industrial units at Hazira also partly financed the building of a weir. Additional revenue is raised through the sale of recycled domestic wastewater to industrial units based in Pandesara – some 35 million litres of tertiary treated wastewater per day.

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## The Outcome

While many of Surat's resilience initiatives are works in progress, their impact has already been felt. The early warning system was critical in preventing large-scale devastation by the flood in 2013.

In 2006, the sudden release of almost 900,000 cubic feet per second had left the entire city flooded. In contrast, 700,000 cubic feet per second released in 2013 did no damage to the city. Information on water inflow and outflow from the dam was published on the Surat Municipal Corporation website and via a mobile application. No evacuation effort was needed in 2013.

In the past few years, Surat has won numerous awards in India, as well as internationally, for governance, inclusion, and conservation. It received the Best Performing City award from the Ministry of Urban Development in 2009 and the Best City Award from India Today, a news weekly, in 2014. Moving forward, the Surat Municipal Corporation is working with Microsoft CityNext to develop Surat as a smart city with advanced urban planning and citizen-empowerment processes.

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- 01 Gaurav Path submerged during the 2006 floods.
- 02 Gaurav Path on a sunny day.
- 03 Majura Gate, one of the few multi-layer flyovers in India.



**Kamlesh Yagnik** has three decades of experience in business and consulting. He is the past president of the Southern Gujarat Chamber of Commerce and Industry and a founder trustee of the Surat Climate Change Trust. He has studied vulnerabilities, impact and adaptation strategies for climate change in Surat, and previously collaborated with the local government to create an end-to-end early-warning system for river floods. An engineer by training, he is director of two companies in the energy and information technology sectors.



**Dr Isher Judge Ahluwalia** is a renowned economist and Chairperson, Board of Governors, the Indian Council for Research on International Economic Relations (ICRIER). She has written several books on India's industrial growth and productivity, including the recently published "Transforming Our Cities: Postcards of Change" (Harper Collins), which is a collection of stories on innovation across the country's urban landscape.

## Young Leader

Juliana Rotich

# The Software OF RESILIENCE



**J**uliana Rotich is the co-founder and Executive Director of Ushahidi, a non-profit technology company that develops free, open-source software for data gathering and application. The organisation started out as a website that helped restore public safety during the 2007–2008 Kenyan crisis after a disputed presidential election. Ushahidi has since benefitted many societies in situations ranging from mapping oil spills to managing earthquake recovery. In this interview with CLC's Hazelina Yeo, she explains how technology can bring cities and their citizens closer together.

### ● Tell us about Ushahidi in 2030.

First, Ushahidi will keep creating and maintaining open-source software for changing information flow – mobile apps, things like Ping, SMSsync – different tools grounded in being able to work not just in Africa, but anywhere.

Second, Ushahidi will be a catalyst playing a very important role in communities, such as promoting open innovation with the iHub in Nairobi, Kenya, and spinning out companies and initiatives like the Crisis Mappers Network and BRCK, the Wi-Fi hotspot router.

Third, Ushahidi will aim to stay influential with expertise, implementation and consulting, with solutions tailored for cities to be more resilient, working with officials in emerging markets to really figure out what it means to have technology as part of the problem-solving kit. We often say technology is 10 per cent of what is needed for impact. The other 90 per cent is typically a lot of partnerships, engagement, commitment, community and expertise around problems such as responding to disasters.

### ● How can cities benefit from Ushahidi?

Cities can use Ushahidi to bring down costs significantly. The tools create information flows in a much more collaborative way of engaging citizens as part of the solution, and also to provide a channel for the city to respond to its citizens. For example, in Dublin, Ireland, the FixMyStreet

software was used to report things broken around the city, like potholes. The city committed to responding within 48 hours.

One of Ushahidi's strengths is that the software is open-source, so people can modify, customise and localise it. One should be able to use it without having to know how to code. Anyone who has used blogging software, like WordPress, can pretty much just work on it. The software is translated to over 40 different languages, which makes it even more impactful.

● **How are technology and innovation altering urban governance?**

Urban governance can be participatory and inclusive when you use tools like Ushahidi, particularly in areas that may otherwise be marginalised. For example, Voice of Kibera is an implementation of Ushahidi in Kibera, one of the largest slums in Africa, giving a collective global voice to the residents while in the process of digitally mapping the area.

● **Please recommend one Ushahidi product that will be useful to a city like Singapore.**

The Ushahidi Data Studio creates a dashboard that serves as a crowd-sourcing platform to engage the people on areas such as air quality. It's an additional tool that can pull in information from Ushahidi and other sources such as Excel spreadsheets, giving municipal decision-makers a clearer picture of the ground.

Urban leaders and planners can create their own dashboard. Ushahidi can work with cities and resilience officers in the 100 Resilient Cities Network to figure out what needs to go into this dashboard. For example, a dashboard of crisis data can be useful for decision-making. A dashboard for Singapore would be quite different from that for other cities.

● **Name some affordable measures that cities can look into to be more resilient.**

Different cities need to be resilient in different ways. In terms of affordable measures, OpenMRS or FrontlineSMS are very useful tools that can be used to manage information in the healthcare space.

More importantly, cities need to look at which communities they can work with to be more resilient, which communities to empower, to provide technology and training for, so that when something happens, those communities that know how to use technology can help respond. Technology is just one part. Strategy, community building and engaging the community are also part of the special "sauce" that makes cities more resilient.

● **Are there urban sustainability problems that Ushahidi plans to solve in future?**

Ushahidi tries to solve problems around information flow, which crosscuts many urban problems around the environment such as air quality, as well as around service, such



*Technology is just one part. Strategy, community building and engaging the community are also part of the special "sauce" that makes cities more resilient.*

as service delivery from the city government. Ushahidi can be an enabler of change, to give people tools to gather and contextualise information, and come up with solutions with the larger community.

● **As a new WORLD CITIES SUMMIT YOUNG LEADER, what do you hope to bring to the table?**

I hope to bring about an appreciation of the opportunities that abound when working with emerging markets and developing countries, and being grounded in the reality of difficult, edge-type environments. These places give different challenges, but also inspire better tools, technology and strategies that can be scalable to other countries.

*Young Leader*

*Yumiko Noda*

# The Japanese PERSPECTIVE



**Y**umiko Noda, a partner of PwC Japan and former Deputy Mayor of Yokohama city, is a pioneer of public-private partnership projects in Japan. In this interview with CLC's Hazelina Yeo, she shares the Japanese perspective and suggests how cities can become more resilient by developing their soft infrastructure, including social and cultural competencies.

● **Why is investing in risk-resilient infrastructure important?**

With climate change and urbanisation, cities are increasingly vulnerable to natural hazards. One extreme weather event can cause significant human and economic losses. Based on our experience in Japan and a range of analyses, we have found that spending on recovery far outweighs spending for resilience.

Devastation from disasters may also undermine the trust of citizens and business communities, leading to the flight of talents and investors. Rebuilding that trust takes time. Investing in resilience will protect your city's "brand" and prosperity.

● **What role can the private sector fill in building a city's resilience?**

The private sector has increasingly begun to own critical infrastructure, such as telecommunications, which plays a crucial role in the aftermath of disaster. The private sector can bring smart technologies, innovative ideas and funding solutions through public-private partnerships, and they can play an integral role in disaster response. The greater the disaster, the less government can do.

● **You have highlighted Sendai as a great example of a resilient city – tell us why.**

First, Sendai has continuously fortified its key infrastructure, including highly elastic pipes and "redundancies" to ensure continuity in water and energy supplies. This enabled a swift recovery from the Tohoku earthquake that occurred on 11 March 2011 (also known as the 3.11 earthquake).

Second, the city actively engages the private sector, carrying out regular joint physical

exercises and fostering a “crisis mentality” for better preparedness.

Third, the city encourages social inclusion. Certificates are given to condominiums that develop measures to protect elderly citizens at risk and maintain stockpiles of food, water and medication.

● **You have interviewed several mayors and authorities for a report on resilience. What is one key lesson distilled from that?**

I would say “human resilience.” Investment in infrastructure is vital to protect cities. But many mayors and officials stressed that investment in “soft infrastructure” – social, cultural, and educational competencies – is vitally important. Akihiro Ohta, Japan’s Minister of Land, Infrastructure, Transport and Tourism, told me that disaster-prevention education and training with simulated drills among diverse stakeholders contributed substantially to the recovery from the 3.11 earthquake.

● **Name one unique way that Japan has adapted its environment for its super-ageing population.**

For our “compact city” initiative, Toyama city leads the way. By investing in light rail and circle trams in the downtown, Toyama strives to create an elderly-friendly, “walkable” city. The effects are significant – environmentally, socially and economically. Greenhouse gas emissions will decrease by reversing an over-reliance on cars. Elderly

citizens go out, enjoy, and spend more. In return, healthier lifestyles bring down social welfare expense.

● **How did Yokohama cut its waste by 30% in just five years?**

Three ways: clear vision, strict policy, and citizen engagement. In 2003, then-mayor, Hiroshi Nakada, initiated a G30 plan to reduce solid waste by 30%. An unpopular policy of segregating waste into 15 categories was implemented. But the city made extensive efforts to communicate with its citizens through more than 10,000 briefings, 600 campaigns and 3,300 early-morning sessions!

What is most effective in reducing waste is changing people’s mindsets and behaviour, particularly transforming the urban lifestyle of mass consumption into that of environmental consciousness.

● **What is one initiative that best helps to increase urban resilience?**

The government could enter into “collaborative agreements” with the private sector to secure immediate assistance during natural disasters. Densely populated urban areas

with high daytime populations will face massive confusion with “commuter refugees” who cannot go home. Tokyo experienced this on 3.11. Many Japanese municipalities sign agreements with companies so that convenience stores, shopping malls, rail stations and gas stations will provide food, water, shelter and fuel in the event of an emergency.

● **What is your greatest takeaway from being in the World Cities Summit Young Leaders network?**

It is such a stimulating platform. The greatest lesson for me is that there are so many common issues and solutions that can be shared among city leaders – regardless of culture and stage of development.

Whilst Japanese cities are advanced today, we suffered serious urbanisation problems in the late 20th century. Such experiences can be shared with rapidly developing cities. At the same time, emerging cities are making “leap-frog” progress, from which we can learn a lot.

**ABOUT THE  
WORLD CITIES SUMMIT  
YOUNG LEADERS**

The WORLD CITIES SUMMIT YOUNG LEADERS is a select group of change-makers from diverse sectors who shape the global urban agenda at the annual WORLD CITIES SUMMIT YOUNG LEADERS SYMPOSIUM.

*CITIES IN THE AGE OF CRISIS*

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# *REALISING THE RESILIENCE DIVIDEND*

**C**ities face multiple and interconnected challenges and stresses in the 21st century. To thrive in the age of crisis, **Judith Rodin**, president of the Rockefeller Foundation, urges cities to seek resilience dividends – the immediate and long-term benefits to individuals, communities and the environment from investments that improve a city’s capacity to recover, learn, adapt and revitalise.

29 August 2015 will mark 10 years since Hurricane Katrina made land-fall in New Orleans, Louisiana. The city was devastated: levees were breached or overtopped in 50 places; floodwalls bent and toppled. Pumps were overwhelmed, leaving half of New Orleans’ homes flooded. Over 850 billion litres of water had to be pumped out of the city, a process that took over two months.

The crisis was not only a failure of the levees, but a reflection of the city’s decades-long slide into social and economic disrepair. Before the hurricane, New Orleans’ school system was failing, its economy was dangerously reliant on oil and gas, and social cohesion was, at best, strained. The floods only exacerbated these realities, turning a disruption into one of the greatest humanitarian disasters in the United States.

In the aftermath, the recovery process took time to find its legs due to a failure of leadership. Communities disagreed with experts – and one another – over which neighbourhoods to rebuild, and how to do so. Federal funding was slow to arrive. But with support from The Rockefeller Foundation and others, the city finally developed a unified neighbourhood revitalisation plan that unlocked funding flows. Flood protection, including both natural and physical infrastructure, was revitalised and strengthened. Homes were rebuilt. As people returned to the city, further investments helped to improve social and economic conditions, rather than allow the city to slip back into its old ways.





*...not every disruption needs to become a disaster... we can prepare cities for a range of threats, and unleash greater opportunities with the same investments.*

Today, New Orleans has been recognised as one of the most entrepreneurial cities in the world, boasting new startups, a growing population of young, optimistic workers, and a rising generation of responsible political and community leaders. The school system has been reformed, the economy diversified, and the city is more protected than ever from future storms.

New Orleans is just one of many cities facing dire challenges worldwide. Every week we see cities dealing with blizzards, flooding, fires, terrorism, or civil unrest. According to data compiled by Swiss Re, nearly 400 million urban dwellers are in peril of coastal and river flooding, and more than 200 million face the threat of earthquakes. Natural disasters are only part of the equation. London has listed cyberattacks as a key threat, and disease outbreaks like Ebola can easily spread to, and between, major cities.

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Then there are the slower-burning stresses that weaken a city over time, such as extreme poverty, crime and violence, changing macroeconomic trends and failing infrastructure. These are slow, insidious forces, rather than high impact but one-off events. These stresses greatly decrease a city's ability to respond to a shock, as we saw in New Orleans.

But not every disruption needs to become a disaster. By building resilient physical infrastructure and social and natural systems, we can prepare cities for a range of threats, and unleash greater opportunities with the same investments.

01 More than 80 per cent of the people in New Orleans evacuated after Hurricane Katrina.

## Crisis as the New Normal

Disruption has always been a part of urban life. But the dramatic collision of three 21st century trends has made crisis the new normal.

The first is the rapid acceleration of urbanisation. The world's population is urbanising more rapidly than ever before. By 2050, three out of every four people will live in cities. Growing populations make cities vulnerable to disruptions in new ways, place new stresses on infrastructure and services, and strain social cohesion.

The second trend is globalisation, which has hastened the pace of change and added unprecedented complexity to increasingly interdependent systems. Vulnerabilities in one place can quickly spread. For example, the 2011 floods in Bangkok didn't just paralyse the local economy: they shut down a sizeable part of the global supply chain.

The third trend is climate change. As last year's Intergovernmental Panel on Climate Change reports showed, climate change is not a distant threat, but a current reality. Cities face growing climate-driven risks, including sea level rise, changing temperatures and flooding. But the same report shows some powerful

opportunities: urban planning and investment in the highest-risk cities might be the key to significantly cutting greenhouse gas emissions, while promoting climate adaptation on a global scale.

This concept of turning crisis into opportunity is not new. As Winston Churchill famously said, "A crisis is a terrible thing to waste." But because of globalisation, urbanisation, and climate change, the challenges are much bigger, and therefore the opportunities much greater, than before. This requires reframing our mindsets and our tool kits – to build resilience, and build resiliently.

The question facing every city today is whether it will take a crisis, be it in the form of a shock or a slower-burning stress, to galvanise people into preparing for the new realities of the 21st century.



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*...cities don't have to choose between doing well in the short run and doing what's best over the long term...*

**The Resilience Dividend**

The Rockefeller Foundation has spent over half a billion dollars helping cities and communities of all kinds build resilience and the capacity to plan and prepare more effectively; and if a disruption does occur, to bounce back, learn from it, and revitalise because of it. Building resilience is more than just disaster mitigation. These upfront investments pay off in the long run, and not just during crises, but also in times of calm. We call these “resilience dividends” – and they include economic development, job creation, improved social services, more vibrant ecosystems, and greater community cohesion.

In Lima, Peru, engineers have found a creative approach to solving the city’s water shortages using an abundant resource: humid air. By attaching humidity collectors and water purifiers to a billboard, they can produce nearly 100 litres of clean drinking water daily. Beyond increasing the water supply, the project hopes to inspire young people to become engineers at the leading edge of innovative and resilient urban infrastructure.

Pune, India, invested in more resilient transportation systems and utilities, and better integration between government and citizen groups. As a result, Deutsche Bank selected Pune as the location for a large operations centre. In turn, these investments can fuel more inclusive economies.

These are just two examples of the resilience dividend. Both demonstrate a broader truth: cities don’t have to choose between doing well in the short run and doing what’s best over the long term, for our communities, our planet, and our shared future.

01 A special billboard in Lima, Peru, harvests water vapour and uses reverse osmosis to purify the condensed water collected in the storage tank at the base of the billboard.

## **The Five Characteristics of Resilience**

How can cities create systems that yield benefits in the short term and help them withstand future crises? We have identified the five characteristics of resilient systems.

First, they are aware of their vulnerabilities and their assets. They are willing and able to assess, learn from, and adjust to that information using robust monitoring and feedback loops. New data aggregation and analytical tools are especially useful here.

Second, they can access a variety of alternative and fallback options, so that if one part of the system is challenged, it can rely on another. Incorporating sufficient diversity and redundancy in the planning phase is critical.

Third, they share information in an integrated way, ensuring coordinated action. The left hand knows what the right hand is doing, and they're working towards the same goals. This means integration across systems, sectors, and institutions, and between various branches of government.

Fourth, they are self-regulating. If one part of the system fails, the entity can contain the problem and keep it from spreading. This is the difference between safe failure, and failing catastrophically.

Finally, resilient entities are adaptive. They can adjust in real time to changing circumstances by developing new plans, taking new actions, or modifying past behaviour. The entity is flexible – it bends without breaking.

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## **Resilience Characteristics in Practice**

Cities can apply these concepts to build resilience across physical, natural and social infrastructure.

21st century infrastructure must serve multiple functions, ranging from roadways built or repaired with materials that absorb water or release it slowly during heavy rainfall, to bridges constructed with 3D-printed pilings that flex rather than buckle in high waves. For example, the city of Rotterdam in Netherlands addresses flooding using carparks engineered to function as large water storage facilities, with the capacity to hold 10 million litres. This reflects an awareness of threats and adaptation to current realities, and embodies the characteristics of spare capacity and integrated planning, and getting more benefits from a single investment.

These concepts can also be applied to natural infrastructure. New York's shorelines were once protected by natural buffers, such as oyster beds and tidal wetlands. However, most of these are gone due to industrial and urban development over the last 100 years. As a result, many populated areas were vulnerable to the storm surges from Superstorm Sandy in 2012.

In the aftermath, landscape architects and engineers worked with conservation scientists and local community organisations to restore natural wave barriers by creating layered habitats including oyster reefs and protective ecosystems, nurturing richer biodiversity that will serve as natural buffers against erosion and rising sea levels. This programme has been integrated with educational

initiatives that encourage community members to become stewards for this newly-created natural infrastructure. By coupling these programmes, the city is realising the resilience dividend by increasing its ability to adapt to new climate patterns, and the diversity of the buffers that could protect them from storms, while fostering greater cohesion between community members and improving their relationship with their environment.

This is especially important. While physical and natural infrastructure are the first lines of defence against disaster, friends and neighbours are often the first responders if something goes wrong. Many cities now recognise that investing in social infrastructure is a big part of preparing for and withstanding 21st century challenges.

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01 The Museumpark carpark in Rotterdam not only accommodates cars, but also houses one of the largest underground water reservoirs in the Netherlands.

02 A rendering of the proposed Living Breakwaters, which brings together educational programmes with oyster reef restoration.



*Physical, natural and social infrastructure individually improve resilience, but at their best, these investments reinforce each other.*

Athens is experiencing this acutely. Homelessness was not a major challenge for the city before the economic crisis, but it increased 25 per cent between 2009 and 2011. Its 60 per cent youth unemployment rate has contributed to riots and continued unrest. Athens will now address these stresses as part of the 100 Resilient Cities Network, pioneered by The Rockefeller Foundation, through the opportunity to exchange best practices with cities facing similar challenges, such as Glasgow and St. Louis.

Physical, natural and social infrastructure individually improve resilience, but at their best, these investments reinforce each other. This was certainly the case in New Orleans. Merely fixing the levees would not have spurred the revitalising growth that the city has experienced in the last decade.



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01 Homelessness is one challenge that several cities are trying to resolve.



Another example of this interdependence can be seen in Medellín, Colombia, where a chronic stress, rather than a single shock, galvanised action. Following decades of rampant drug trafficking and gang violence, the city engineered an innovative transit system using metros, gondolas, and escalators built into steep, mountainous terrain, which then connected the hillside slums to the economic centers in the valley below. But the physical infrastructure was just the beginning. Planners also integrated social services such as health care clinics and daycare providers at station stops. Combined, these physical and social interventions reduced crime rates by nearly 90 per cent and restored social cohesion.

### **Better Than Normal**

In all these examples, cities resisted the basic human tendency to rebuild back to “normal.” In Medellín, high crime had been accepted as the norm for far too long, with tragic consequences. In New Orleans, flooding was a part of city life. Both demonstrate that cities must not be lulled into returning to the status quo, which may have created the vulnerabilities in the first place. Rather, when disrupted, cities must adapt, grow, and revitalise.



*...cities can stop the lurch from crisis to crisis, and march confidently – and resiliently – into the future.*

Building resilience requires continuous action. Ten years after the storm, New Orleans is still working to build resilience to address lingering challenges, including sea level rise, wetland deterioration, and crime. In doing so, it has recognised what all other cities must recognise: resilience is not an end-state that is achieved and set aside. Cities that will reap the dividends are forever striving to become more resilient, whether or not they ever put their worst-case emergency response plans into action. With the right governance and planning, cities can stop the lurch from crisis to crisis, and march confidently – and resiliently – into the future.



**Judith Rodin** is president of The Rockefeller Foundation, one of the world’s leading philanthropic organisations. She was previously president of the University of Pennsylvania, and provost of Yale University. Dr Rodin is the author of more than 200 academic articles and has written or co-written 15 books, including her most recent, *The Resilience Dividend*.

*BUILDING*

# *FENCELESS COMMUNITIES*

**A**s urbanisation gets even denser on scarce land, can building developments without fences be a new solution? **Remy Guo** from the Centre for Liveable Cities uses examples from Copenhagen and Singapore to suggest how.

In land-scarce Singapore, a growing population over the last decade has created significant land-use pressure. As agencies are actively exploring land-optimising solutions, one key initiative is co-locating amenities.

Most people would relate this with mega-developments like Tampines Town Hub, where public functions such as a library, community club and public sports facilities are housed within one building. Co-location also refers to siting facilities such as childcare centres within park spaces. Another development approach increasingly common in recent years is opening up pockets of greenery within existing neighbourhoods for development.

What does a childcare centre in a park have in common with an eldercare centre within an existing estate? While the decision for locating such amenities may have been spurred on by “picking low-hanging fruits” in terms of available space, this also means a reduction in areas available to the public. While planners generally do due diligence to ensure that new developments are compatible with the existing context, such approaches can still trigger “NIMBY” (not in my backyard) reactions from the community due to perceived disamenities.

Must such developments be a zero-sum game? What if they can retain public spaces, letting us have our cake and eating it too?

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*The inviting, inclusive quality of the public space helped reinforce community ownership.*

### **How Copenhagen Removed Fences**

Recent urban rejuvenation projects in Copenhagen, Denmark, by the Danish firm Nord Architects provide food for thought on how new developments and public spaces can be integrated through a fenceless approach.

The Guldberg School Yard is a case in point. Nørrebro was among Copenhagen's toughest neighbourhoods. The culturally diverse neighbourhood was a most unlikely place for a fenceless development. The place was the epicentre of the most serious riots in recent Danish history in 2007, when the clearing of squatters sparked four days of violent confrontation between those evicted and the police.

The high-density district also suffered from a shortage of outdoor public spaces and a myriad of socio-spatial issues. The city government's urban rejuvenation programme "New Urban Life around Guldberg Skole" brought

a series of architectural interventions focused on improving integration between developments and public spaces.

Guldberg School Yard was initiated in 2009 as one key project. To address the lack of quality outdoor public spaces within the neighbourhood, the school yard was conceptualised as a multi-functional space, serving as town square, public playground and schoolyard all at once. This helped create a precious multi-functional sliver of urban space. The key lies in the bold, thoughtful treatment of site boundaries. In place of a five-metre high fence enclosing the former school playground, a strip of public benches was built, inviting people to sit and watch children play. The benches also double as bike parking. While there were security concerns due to the schoolyard's openness, the inviting, inclusive quality of the public space helped reinforce community ownership by proving to be an asset for the neighbourhood and, in turn, encouraging public surveillance.

<sup>01</sup> A mix of public and private housing in HDB estates.

<sup>02</sup> Pockets of green in HDB estates can be well-used by residents for recreational activities.

<sup>03</sup> Guldberg School Yard: town square, public playground and school yard in Nørrebro, Copenhagen.

A key enabler was the participatory design process. The community and the school were invited to contribute ideas to shape the public space they wanted, with the architect as facilitator. The co-created design produced a sense of ownership even before the project was implemented, helping to ensure that the spaces would be well-used. Ideas from the community included seemingly whimsical ones like a track that does not touch the ground. This was translated creatively by the architects into tracks that run horizontally and vertically, allowing children to run, bike, skate and climb.

Dialogue between user groups helped shape the implicit rules that allow the space to function. For example, residents understand that they can use the space only after school hours. Such rules are based on mutual understanding and trust, which even extends to how discipline is instilled in students. Children are taught and trusted not to wander beyond the schoolyard, while peer support among the children helps prevent stragglers from wandering beyond the group.



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*The community and the school were invited to contribute ideas to shape the public space they wanted, with the architect as facilitator.*

01 Interactive boundaries at Amager Fælled Skole blur the edges between private and public.



### Creating Grey Boundaries

Fenceless developments do not always need to be so radical. Neither does a boundary wall necessarily mean segregating entire developments from the public. Spatial integration is often far more nuanced and involves creative reinterpretation of the relationship between private and public space.

The design for Amager Faelled School Yard exemplifies this approach in redefining boundaries. Situated between forested areas and the city,

the school is at the city edge. Rather than creating a self-contained institution that would cut the community off from the greenery, the school boundary was designed as a series of active spaces where people can sit, play and interact. Different architectural treatments are applied to the low wall around the edge, while niches and terraces allow the entire boundary wall to be used as a parkour course. Play areas are integrated into the edge, inviting the public to enjoy and share the new facilities. The boundary between public and private is effectively blurred.

The school yard was also designed as a lush green sanctuary, in response to students' desire for a "forest school". This gave neighbouring residents a green space accessible to the public after school hours.

The Amager Faelled School Yard, as it is today, is the result of rigorous engagement between the community and the school. Dialogue and interaction began during the design process, before any brick was laid. This enabled different groups to be recognised as "co-owners" of the shared space and helped establish their sustained involvement and interest in the amenities.



## The Copenhagen approach: focus on urban life before designing spaces and buildings

### **It's Not Just About Removing Fences; It's About Contributing to Public Life Through Design**

The success of Guldberg and Amager Faelled schoolyards show that removing fences is not means to an end, but it can also help create quality public spaces that are inviting. These are outcomes of the overall Danish architectural policy, which recognises the potential of good design in supporting “opportunities for communities and urban life”.

In an interview with CLC, Tina Saaby, City Architect for Copenhagen, emphasised the importance of outdoor urban life in contributing to Copenhagen being one of the world's most liveable cities. This is how Copenhagen approaches the relationship between urban life and architecture:

*We want to focus on city life before designing urban space, and we want to focus on urban space before designing the buildings...It's a little different from how you normally plan the city because you often start with putting buildings on a big model, and then maybe you realise that there is an urban space and you start to plan for that. But often, you do not talk about the urban life, and therefore, you will often discuss it in the end instead of in the beginning.*

Copenhagen's approach prioritises the role of buildings in supporting urban life. Developers are expected by city authorities to propose how their developments can contribute to urban life before finalising space and building designs.

This presents a new development paradigm that aligns with decades of well-established discourse on public life and space. Jan Gehl, the prominent Danish urban designer who deeply influenced Copenhagen's current approach to urban planning and design, emphasised the importance of supporting urban life by integrating buildings with their surroundings rather than segregating them, inviting rather than repelling people, opening up to the public realm rather than closing in.

Similarly, American urbanist Jane Jacobs famously advocated the importance of “eyes on the streets” for urban environments, which can only be achieved by allowing opportunities for visual and physical connections between people.



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### **The Social Dividends of ‘De-Fencing’**

The social benefits of fenceless developments are evident, serving as platforms for everyday social interaction. According to Gehl, such casual exchanges, as simple as experiencing other people through visual connections, “represents a particularly colourful and attractive opportunity for stimulation” and is the basis for enriching urban life. Fenceless designs and shared space solutions also contribute towards creating a more inclusive society.

With Singapore society becoming increasingly diverse in recent years due to a widening income gap and influx of foreigners, gated developments – particularly those serving certain target groups such as international schools and luxury condominiums – can only exacerbate perceptions of social divide and exclusion. On the other hand, shared public spaces provide opportunities for different groups to experience each other’s presence in an everyday, casual setting. This offers an undemanding way of facilitating a sense of community.

**01** Tina Saaby, City Architect for Copenhagen, shares with CLC the key factors leading to the city’s urban planning successes.



*Singapore's public housing estates...present excellent opportunities to create truly inclusive, fenceless communities.*

### **Bringing Down Fences in Singapore**

Fenceless building designs and shared space concepts are already being considered to various degrees in Singapore. Initiatives such as the Dual Use Scheme, introduced in 2007 to avail sports facilities in schools for community use, and fenceless private residential estates in Marina South and Kallang Basin are some examples.

The greatest potential, however, is in Singapore's public housing estates which are mostly fenceless environments. Singapore's public housing programme is well-established as a social leveller, providing quality homes for over 80 per cent of the population. In all respects – physical, social and economic – these towns present excellent opportunities to create truly inclusive, fenceless communities.

Nevertheless, pockets of gated developments still exist within public housing towns, mostly public schools and private condominiums, for security concerns. The Copenhagen examples show that operational and security issues in fenceless developments can be addressed through creative architectural solutions. For example, by positioning more private areas like classrooms above ground level, the functionality of such spaces can be maintained while freeing up the ground floor for public use.

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### **Making it Work: From Zero-Sum to Win-Win**

Integrating shared public spaces as part of developments requires everyone's active involvement, including the private and people sectors, to ensure that all buildings play a role in contributing to urban life. Public sector initiative, in particular, is crucial in getting all stakeholders on board to realise fenceless designs. This can be achieved through public projects that demonstrate the benefits of fencelessness, incentives for private developers to create shared spaces, and urban design guidelines to create a coherent network of public spaces. Khoo Teck Puat Hospital is a good example of a fenceless development with shared community space, with the Yishun Pond as a "green-blue" asset benefiting both hospital users and residents.

It is perhaps timely to look beyond packing urbanisation neatly into big-box developments to overcome land scarcity. Co-location of amenities within a single development needs creative architectural solutions to facilitate synergy and minimise negative impact between multiple functions. Similarly, new developments within public open spaces and existing communities require design interventions by the public sector to enhance the socio-spatial relationships between buildings. By integrating buildings with the neighbourhood through quality fenceless designs and shared spaces, new developments can present fresh opportunities to inject new life into existing communities, and help create an even more liveable city.



**Remy** is Senior Assistant Director at the Centre for Liveable Cities, where he is involved in planning and development related research. Prior to joining CLC in 2013, Remy was a practising urban designer and architect in the private sector, and completed various local and overseas projects ranging from district level master plans, urban design proposals, to architectural construction projects.

**01** The Guldberg schoolyard has a public ground floor, while the private areas are above.

**02** The Yishun Pond is a waterfront park created as a result of multi-agency collaboration for the enjoyment of both patients and residents.

# Spontaneous Volunteers

AROUND THE WORLD

**W**hen a disaster – natural or man-made – strikes a community, specific emergency-management and non-governmental organisations automatically respond according to pre-established plans. Each of these designated organisations has a specific role to play in delivering responses to effectively mitigate the disaster’s devastation. However, spontaneous and unaffiliated volunteers – neighbours and ordinary citizens – can also be decisive and provide significant contribution to the recovery process. **Carolina Landulfo**, Student Fellow from the Centre for Liveable Cities, shows some examples of such community heroes in this photo essay.







### Free Bike-powered Phone Chargers



Thousands of New Yorkers left without power after the first full day of partial blackout, caused by Hurricane Sandy in 2012, received an unusual form of help from grassroots environmental group, Time's Up! Relying on very basic resources – bicycles and eager volunteers – the group set up a bicycle-powered energy station. Volunteers pedalled all day to generate electricity to charge battery-operated devices. This free service was made available until power was restored to all of Lower Manhattan. Bicycles were also used to pump water out of the Museum of Reclaimed Urban Space's basement, power lighting for a downtown bike-repair class, and provide juice to residents of the East Village.



## SG Haze Rescue



Amidst the serious haze that affected Singapore in 2013, the result of forest fires in Indonesia, a community of Singaporeans – mainly students – created the Facebook page “SG Haze Rescue” calling for people to donate N95 masks (rated as being able to filter out 95% of airborne particles) to those who were unable to procure any due to shortages, or lack of mobility or funds. The group received donations from all over the world and distributed thousands of masks and other resources to the areas of Singapore that needed most help, such as neighbourhoods with ageing populations. The group also appealed for do-gooders to open up their houses and provide relief for those who did not have air-conditioning at home.





### Brisbane Sandbaggers



In the beginning of January 2011, flood emergencies erupted in the Australian states of New South Wales, Victoria and Queensland, where thousands of people were forced to flee their homes after torrential rains. In order to prepare for potential flooding in the following weeks, hundreds of residents volunteered, helping to fill and distribute sandbags throughout their communities. Sandbags were used to divert stormwater away from entering homes. Members of the community also helped with cleaning debris, filling up potholes caused by the wild weather, and manning the government's call centre.



Colouring a  
Grey City



Seeking to improve Egyptians' social responsibility and awareness towards the cleanliness of their own neighbourhoods, a group of five graduates from the Faculty of Fine Arts in Helwan University launched a campaign in 2014 to inject bright colours across the streets of Cairo. They painted many areas, such as the steps of 15 May Bridge, Ghamra's footbridges, and the walls in front of North Giza Court in the neighbourhood of Kit Kat. The project, which started through Facebook, has already gained hundreds of supporters, as well as requests from residents for volunteers to rejuvenate their districts. The group's next project focuses on colouring slum areas in Cairo and Giza.

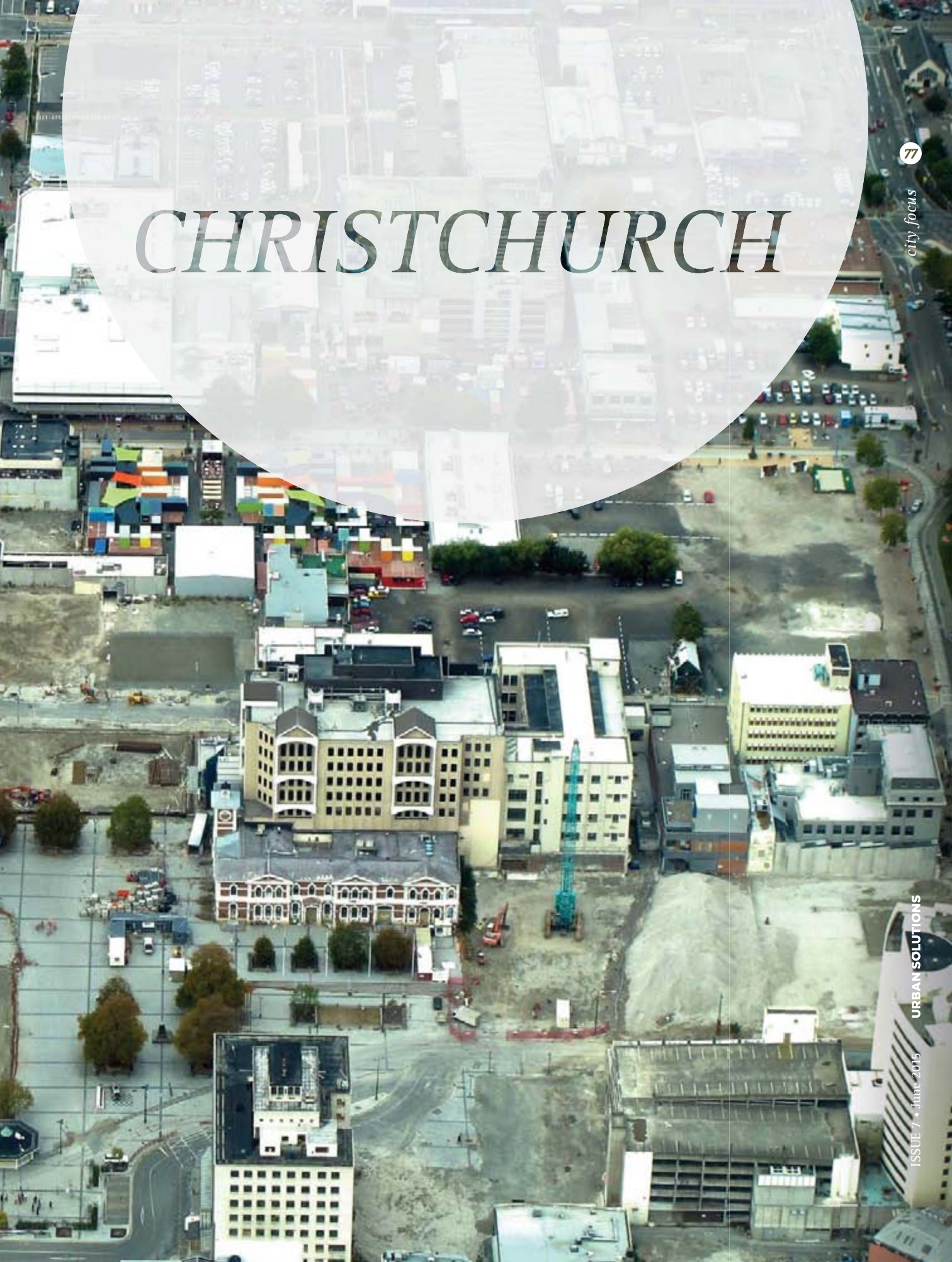
A devastating earthquake of magnitude 8.8 struck the coast of south-central Chile killing more than 700 people and destroying around 1.5 million houses on 27 February 2010. The seismic activity triggered a tsunami that reverberated through the entire Pacific Ocean, exacerbating damage to the coastal regions. In order to aid the coastal towns in dire need of help, the Curicó community collected clothes and plastic bottles to be filled with drinking water for delivery.



**Water and  
Clothes for  
Coastal Towns**







# CHRISTCHURCH



Christchurch,  
New Zealand

**I**n Christchurch, progressive partnerships have been formed to tackle the massive task of rebuilding the city after an earthquake struck in 2011. Some involved community volunteers, who not only helped to clean the streets and feed its residents but also instilled a sense of hope. New partnerships between the government and private sector were also forged in order to cut through red tape and expedite rebuilding efforts. Four years on, while Christchurch is still very much a city under construction, many lessons can be learnt from them. Not just in the way cities can become more resilient, but also how cities may look and function in the future.







On 22 February 2011, an earthquake measuring 6.3 on the Richter scale hit Christchurch, New Zealand's third most populous city of around 340,000 people. The Central Business District (CBD) was just 10 kilometres from the epicentre of the earthquake and as a result, about 80 per cent of the buildings were reduced to rubble. 185 people lost their lives and a further 11,000 were injured that day. An estimated 10,000 suburban homes were either destroyed or irreparably damaged. Another 10,000 residential homes needed extensive structural work, and 150,000 needed repairs. The overall cost of rebuilding Christchurch was estimated at NZ\$40 billion – approximately 10 per cent of New Zealand's GDP.

In the face of such devastation, the residents of Christchurch would have been forgiven for giving into despair. Instead, led by intrepid community leaders, many residents rallied to reclaim their city. Student volunteers were seen shovelling silt from streets and driveways while local farmers organised themselves to truck water supplies to affected households.

*01* The Christchurch gondola.



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Christchurch Mayor Lianne Dalziel believes these people, and many other volunteer groups, have become an integral part of the city's rebuilding efforts. "They have a real values-based approach which is inclusive and participative," she says. "Fundamental to developing our resilience strategy is ensuring that this is done with a community, not for or to a community – as is often the case. No one sector, organisation or group has all the answers."

The Canterbury Earthquake Recovery Authority (CERA) is a central-government agency that was set up to deal with the disaster. But even before it was able to launch Christchurch's new urban blueprint plan in July 2012, community organisations and volunteers stepped up to the fore. One organisation, Gap Filler, had a bit of a head start. Formed after an earlier earthquake hit Christchurch in 2010, Gap Filler recognised that there had to be temporary responses while the city is being rebuilt. This led to various temporary projects on sites that had been cleared and left vacant. For example, to raise the spirits of local residents, Dance-O-Mat was created on one such site, where a dance floor was set up with a coin-operated music player that was built within the shell of an old washing machine. There is even Gap Golf, built by volunteers and community groups who were invited to design and install mini-golf holes on vacant sites around what was once the CBD.

01 The Re:START container mall is Christchurch's out-of-the-box idea to revitalise the central city.

02 Gap Filler's Dance-O-Mat at the corner of Gloucester and Colombo streets. *Photo courtesy of Gap Filler.*

03 Gap Golf at Peterborough Street.

04 Christchurch's annual FESTA revives the city centre with luminous, large-scale installations, a plethora of activities, and live performances.

05 Temple for Christchurch is a temporary structure built from reclaimed materials, forming a space for people to reflect on one's losses. *Photo courtesy of LIVS.*

Gap Filler also played the important role of convincing the Christchurch City Council (CCC) that it had to do more. Coralie Winn, the co-founder and creative director of Gap Filler recalls: “We basically went to [the council] and said transitional activity has massive potential for Christchurch and it needs an entity that can broker access between sites, vacant buildings and projects.” The outcome was the council-funded agency called Life in Vacant Spaces Charitable Trust (LiVS), which has since gone on to broker access to 112 projects on 40 different sites and vacant buildings. Some of these projects include those by community organisations such as Greening the Rubble and the Agropolis Urban Farm, as well as large events like the annual Festival of Transitional Architecture (FESTA) that explores and celebrates creative urban renewal – the first and only festival of its kind in the world. “Things come about by virtue of people having ideas that they want to test out, and us undertaking to make them happen,” says Jane Gregg, Director, LiVS.

Meanwhile, planning for permanent projects like a new public library and sports stadium are underway. However, before anything can be constructed, the task of rebuilding the city’s underground infrastructure has to be completed. This job has been given to the Stronger Christchurch Infrastructure Rebuild Team (SCIRT), which comprises three “owner” government agencies – CERA, the CCC, and the New Zealand Transport Agency – and five engineering companies.

SCIRT oversees a budget of about NZ\$3 billion for more than 650 infrastructure projects including underground pipes carrying drinking water, stormwater and wastewater, utilities such as gas and electricity, and fiber-optics and communications cables. All this is targeted for completion by December 2016, an impressive feat not least because public works often get tied down by bureaucracy.

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To meet its targets, SCIRT adopted a framework which drives both competition between the parent-company organisations, and also collaboration – generating an ongoing cycle of continuous improvement in terms of both ‘cost’ and ‘non-cost’ outcomes. “SCIRT uses the benefits of competition to drive ‘best for community’ outcomes, and designer and constructor inter-team collaboration ensures lessons learnt are shared amongst all the teams,” adds Duncan Gibb, SCIRT’s former and founding general manager.

Overall, SCIRT says it has tracked within a couple of percentage points of its programme budget as at March 2015, even though the final scope of work is still to be confirmed.

01 The Cardboard Cathedral,  
01 Christchurch’s transitional  
03 cathedral.

02 SCIRT at work installing  
vacuum wastewater pipes and  
chambers. © Neil Macbeth,  
licensed to SCIRT.



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What can be confirmed, however, is that Christchurch is a city that has a lot to teach the world, not only in terms of disaster response and resilience but also in how cities of the future might take shape.

One of the first structures to be completed in Christchurch since the February 2011 earthquake is a NZ\$5 million building made of cardboard tubes. Built as a replacement structure to house the congregation of the damaged Christchurch Cathedral, the cardboard structure was designed by Shiguru Ban, the acclaimed Japanese architect who has made it his life's work to design disaster relief architecture. The building is sublime by any measure. It has also been built to last 50 years, by which time, a new Christchurch will have risen from the rubble.



**Arthur Sim** is a freelance writer and journalist with 15 years of experience in the fields of real estate, design and architecture. Trained as an architect, he also has a special interest in urban planning and socio-economics. He is currently an adjunct with the Centre for Liveable Cities, where he writes for and edits its publications.

# *Infrastructure, Technology AND RESILIENCE*

*by Alexander Zehnder*

**C**ities face growing challenges from both natural and man-made sources. **Alexander Zehnder** argues that a commitment to developing and funding innovation, technical systems, environmental science, and infrastructure engineering can help localities improve their resilience. Professor Zehnder is the Scientific Director of Water Resources of Alberta Innovates – Energy and Environment Solutions in Edmonton, Canada, and Chair of the Sustainable Earth Office, Nanyang Technological University, Singapore.

Cities face a multitude of challenges. To gain access to water, cities were usually built near to streams, rivers and lakes, and often at the mouths of rivers. Many cities are thus threatened by recurring events such as floods, which destroy infrastructure, reduce the availability of clean water, and disrupt food and energy imports. As cities tend to be compact, densely populated and highly interconnected, the risks of many threats are concentrated in many cities. Fires that spread quickly destroy

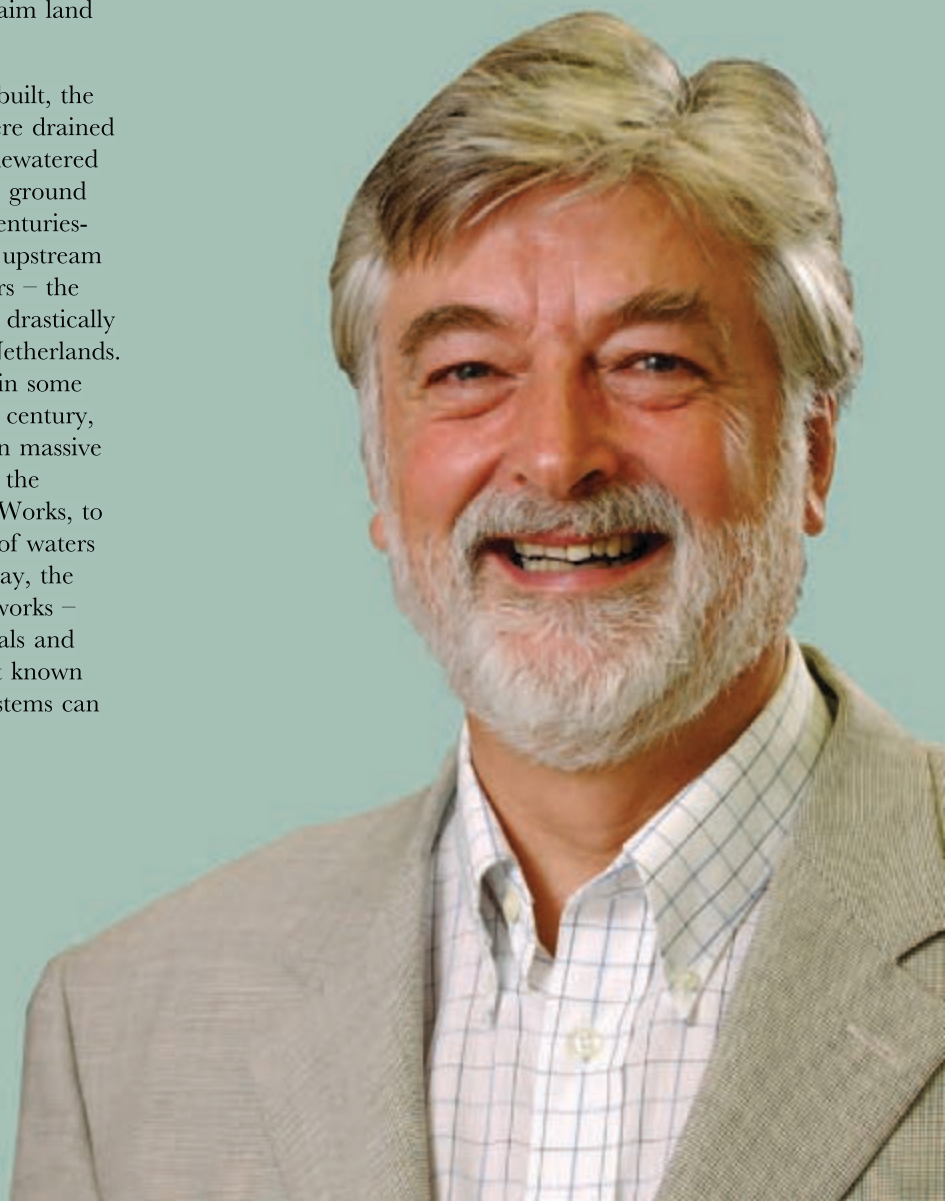
more wealth, while civil unrest, terrorism and earthquakes threaten lives as well as goods. Improvements in food and water hygiene and healthcare infrastructure have helped control the spread of infectious diseases in cities, but the latent threat remains, as seen from the recent outbreak of measles in Berlin, and the earlier SARS epidemic. Rapidly changing urban landscapes bring about new challenges to local leaders and the resilience of cities.

For centuries, technical systems and infrastructure have been central to the fight for resilience. In the Netherlands, which is essentially an alluvial plain, dams and dykes keep water from flooding settlements and agricultural land. Dyke building started around 1000 AD, and by 1250, the dykes had been connected to form a continuous line of defence against the sea. Further dykes were then built to reclaim land from the sea.

While the dykes were being built, the surrounding peat swamps were drained for agriculture, causing the dewatered peat to settle and sinking the ground level. This, combined with centuries-long efforts to straighten the upstream courses of several major rivers – the Rhine, Meuse and Scheldt – drastically increased flood risks in the Netherlands. Flooding was common, and in some cases, disastrous. In the 20th century, the Netherlands embarked on massive engineering projects, such as the Zuiderzee Works and Delta Works, to defend against the intrusion of waters from the sea and rivers. Today, the Netherlands' complex waterworks – comprising dams, dykes, canals and pumps – is probably the best known example of how technical systems can improve resilience.



*...the Netherlands' complex waterworks...is probably the best known example of how technical systems can improve resilience.*



Infrastructure is not simply a physical issue, but involves planning and financial considerations. The Netherlands is increasing the height of its dykes, in response to climate change and the induced sea-level rise of up to 130 centimetres this century. These enhancements are part of the renewal of the dykes every 25 years, at an additional cost of over 1 billion Euros per year. As flood levels are anticipated to rise, the “Room for the River” project allows indefensible land to flood periodically. In such areas, residents have been relocated to higher ground. The sheer scale of these efforts makes it a national task – no city alone could have done the job.

In other places such as Switzerland, environmental engineering helps to stabilise the surrounding environment to enhance resilience where settlements and pastures are threatened by avalanches, falling rocks and mudslides. Resilience building efforts begin at the community (or valley) level, with the management of mountain forests. Natural forest regeneration is helped by regular cuts and plantings, to encourage a heterogeneous stand structure. Above the tree line, avalanche barriers protect settlements, railway lines, major roads and hydroelectric power infrastructure.

Recently, entire mountain tops in Switzerland have been destabilised due to global warming and the thawing of permafrost. One area under threat is

the Engadin in the Swiss Alps. Famous resorts in the area such as St. Moritz and Pontresina are threatened by rapidly-thinning permafrost that can result in rockslides and debris flows. Pontresina is the first community worldwide to invest in resilience measures against the loss of permafrost, by building ground anchors, dams and catch basins. They have the support of eminent scientists, engineers and a strong political lobby. This type of support is critical for such efforts.

Cities and countries can learn from each other. The Dutch have spent centuries fighting floods, land subsidence and rising sea levels. Their organisational and technical responses are becoming a blueprint for many other cities, such as Bangkok, Jakarta, New York and Venice. Singapore decided to raise the minimum height of newly reclaimed land by one metre, and enhance coastal protection. In a similar vein, communities in mountainous areas such as the Andes, the Rockies and the Himalayas are learning from the experience of those in the Alps.



*The battle against natural hazards has taught us two things: disasters are much more severe, and often come earlier, than anticipated.*



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*...focused planning on preparedness is needed, as are community- and stakeholder-outreach programmes.*

The battle against natural hazards has taught us two things: disasters are much more severe, and often come earlier, than anticipated. To successfully strengthen resilience, countries need an absolute, no-nonsense commitment to innovation and action. Inactivity or a “Yes, but...” attitude is not an option.

Climate change is drastically aggravating the challenges to building resilience. According to UN figures, the global cost of adaptation for cities to achieve resilience against the effects of climate change could range from US\$49 billion to US\$171 billion annually. Of this amount, most will go to safeguarding infrastructure, water supplies and agriculture, coastal zones and public health. Without adaptive action, the cost of the damage will be orders of magnitude higher.

Scientific research and technology can help cities improve their resilience. Scientists are developing scenarios and predictions of how climate change may impact specific city regions. Globally, innovations are being made in the areas

of engineering and architecture to improve infrastructure planning, design and construction. These will benefit many local governments, private businesses and utilities, which do not have the capacity to analyse climate issues or to design resilient solutions. While national governments may be able to provide financing, it will increasingly be up to mayors, private landowners and entrepreneurs to find specific and creative solutions.

Although environmental science can play an important role, there is currently little structured support from the scientific community for effective adaptation efforts, promoting collaboration, or getting the knowledge to where the needs are. To address this deficiency, focused planning on preparedness is needed, as are community- and stakeholder-outreach programmes. Putting together a dedicated committee or creating a new job function in the local government is one way of bringing about this focus in addressing the challenges to resilience.

# *Social Infrastructure*

## *THE SURPRISING, MISSING INGREDIENT IN URBAN RESILIENCE*

by Eric Klinenberg

**E**ric Klinenberg makes a convincing case for social infrastructure – the invisible glue of relationships, networks and cooperation that bonds and sustains communities – as a potent factor in enhancing the resilience of cities when disasters strike. Professor Klinenberg is Professor of Sociology and Director of the Institute for Public Knowledge at the New York University. A new edition of his classic book, *Heat Wave: A Social Autopsy of Disaster in Chicago*, will be published in Spring 2015.

Chicago experienced an unusually severe summer in 1995. For nearly a week, thermostats registered tropical highs of 41°C. Infrastructure was not spared. Roads buckled, bridges locked and train rails melted in the heat. The power grid failed, and water pressure fell after residents in poor neighbourhoods opened fire hydrants to cool down. Half the city's hospitals closed their emergency rooms to new patients due to insufficient capacity. In typical years, heat waves kill more

Americans than all other natural disasters combined, but Chicago was unprepared for this calamity. The result was one of the most devastating – but least remembered – urban disasters in U.S. history.

From 14 July to 20 July, 739 Chicago residents in excess of the norm died, and thousands more suffered debilitating heat-related illnesses. The heat wave damaged relatively little property

and killed mainly poor, old, and isolated residents. As a consequence, it received far less public attention compared to more recent and visually spectacular catastrophes, such as Hurricane Katrina and Super-storm Sandy. But with global warming, urban areas across the planet will experience longer, more frequent and more intense heat waves. There is an urgent need to learn how and why cities break down during heat crises, and why some people and places prove surprisingly resilient.

Climate scientists and epidemiologists have developed excellent models for predicting how many people will die during extreme hot weather events. In this case, however, their models dramatically underestimated the death toll. The researchers acknowledged that weather could not fully explain what had happened. I initiated a “social autopsy” to see if I could.

I mapped the heat mortality by neighbourhood and looked for patterns of vulnerability. The initial results seemed predictable: The high mortality areas were predominantly poor and overwhelmingly African American, the places that suffer disproportionately from all kinds of urban problems, from violence to joblessness, asthma to infant mortality. As a matter of social justice, the pattern was infuriating. But as a matter of social science, it was little more than a confirmation of most people’s expectations.



*[The heat wave] received far less public attention compared to more recent and visually spectacular catastrophes...*



Except that, upon closer inspection, it wasn't. When I looked closely at the places that proved most resilient, something completely surprising emerged. On paper, three of the ten neighbourhoods with the lowest heat mortality rates looked like they should have wound up in the high mortality group. They were extremely poor, completely segregated African-American areas. Some were next to the areas that had suffered most. Yet they all had mortality rates that were lower than many of Chicago's most affluent and stable neighbourhoods. This posed an urgent scientific question: what made these neighbourhoods so much more resilient than expected?

No quantitative data could answer this question, so I began a period of ethnographic observation in places with similar demographic profiles but dramatically divergent mortality outcomes during the heat wave. I discovered that the crucial difference had nothing to do with race, ethnicity, culture, poverty rates or household composition, nor was it related to the performance of "hard" infrastructure such as electricity, water and transportation. What mattered was the social infrastructure: the sidewalks, streets, stores, parks, public facilities and community organisations that, when robust, promote contact and enhance social support among friends and neighbours, or, when decrepit, leave residents isolated and estranged.

Consider Englewood and Auburn Gresham, two adjacent Chicago neighbourhoods. Both are very poor and nearly 100 per cent African-American, but the similarities end there.

For most of the past 50 years, Englewood has been stuck in a downward spiral of abandonment and decay. Its major employers are gone, and today the population is less than half compared to 1960. The housing stock, much of it burned from arson during the tumultuous 1960s and 1970s, has been depleted. The banks, grocery stores, restaurants, and local shops that once drew residents – particularly older and more vulnerable people – out of their homes and into neighbourhood life, have also dwindled. The sidewalks and curbs are crumbling. Empty lots are ubiquitous. Local conditions encourage people to hunker down in their houses even, perhaps especially, when disasters hit and social support can make the difference between life and death.

Auburn Gresham has a strikingly different social infrastructure. It similarly experienced a sharp drop in local employers over the past 50 years, but residents have remained in the neighbourhood, the housing stock is still intact, and it has had almost no population loss. Instead, Auburn Gresham has a rich supply of apartment buildings and single-family houses, connected by well-maintained sidewalks and streets. Instead of shuttered stores, it has diners, groceries, and shops. Local churches and community organisations do extensive outreach on a regular basis, and step up their efforts when a heat wave strikes.




*What mattered was the social infrastructure... public facilities and community organisations that, when robust, promote contact and enhance social support among friends and neighbours, or, when decrepit, leave residents isolated and estranged.*

During the 1995 heat wave, residents and community groups in Auburn Gresham knew who was likely to be home, alone, and imperiled, and who was available to help. They also benefited from the neighbourhood's social infrastructure, which – in striking contrast to Englewood – encouraged even the most vulnerable to seek companionship outside.

How much did these differences matter? During the heat wave, the death rate in Englewood was 11 times higher than the death rate in Auburn Gresham. But the value of social infrastructure shows up in another statistic, one that matters in all seasons: life expectancy in Auburn Gresham is five years longer than in Englewood.

Since publishing my research, I've participated in countless policy debates about how to protect cities from dangerous weather. I always insist that investing in the social infrastructure of vulnerable urban areas is essential for promoting resilience, both daily and during disasters. Nearly everyone agrees with this, but almost all the public resources we spend on climate security go to large engineering projects for hard infrastructure instead.

I see the value in these projects, but I also know that there's no such thing as an invulnerable infrastructure system. No matter how much we invest in technology, when a catastrophe strikes, there is a chance that power grids and communications systems will fail, transit networks will be crippled, fuel supplies will be exhausted, food won't get delivered and water taps will run dry. When that happens, social infrastructure becomes our main lifeline. We ignore it at our peril.



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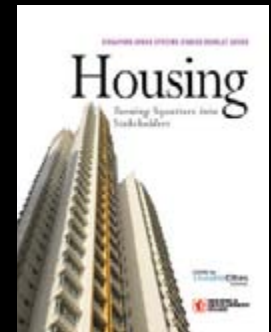
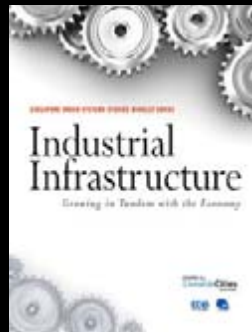
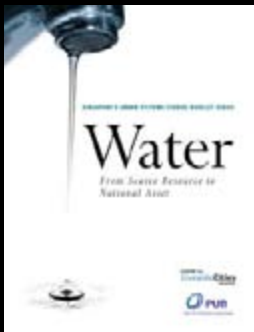
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