

ARE OUR BUILDINGS FIT FOR THE FUTURE?



STRUCTURAL ENGINEERING FOR THE FUTURE

CAROLINE FIELD, HEAD OF RISK & RESILIENCE, BUROHAPPOLD ENGINEERING

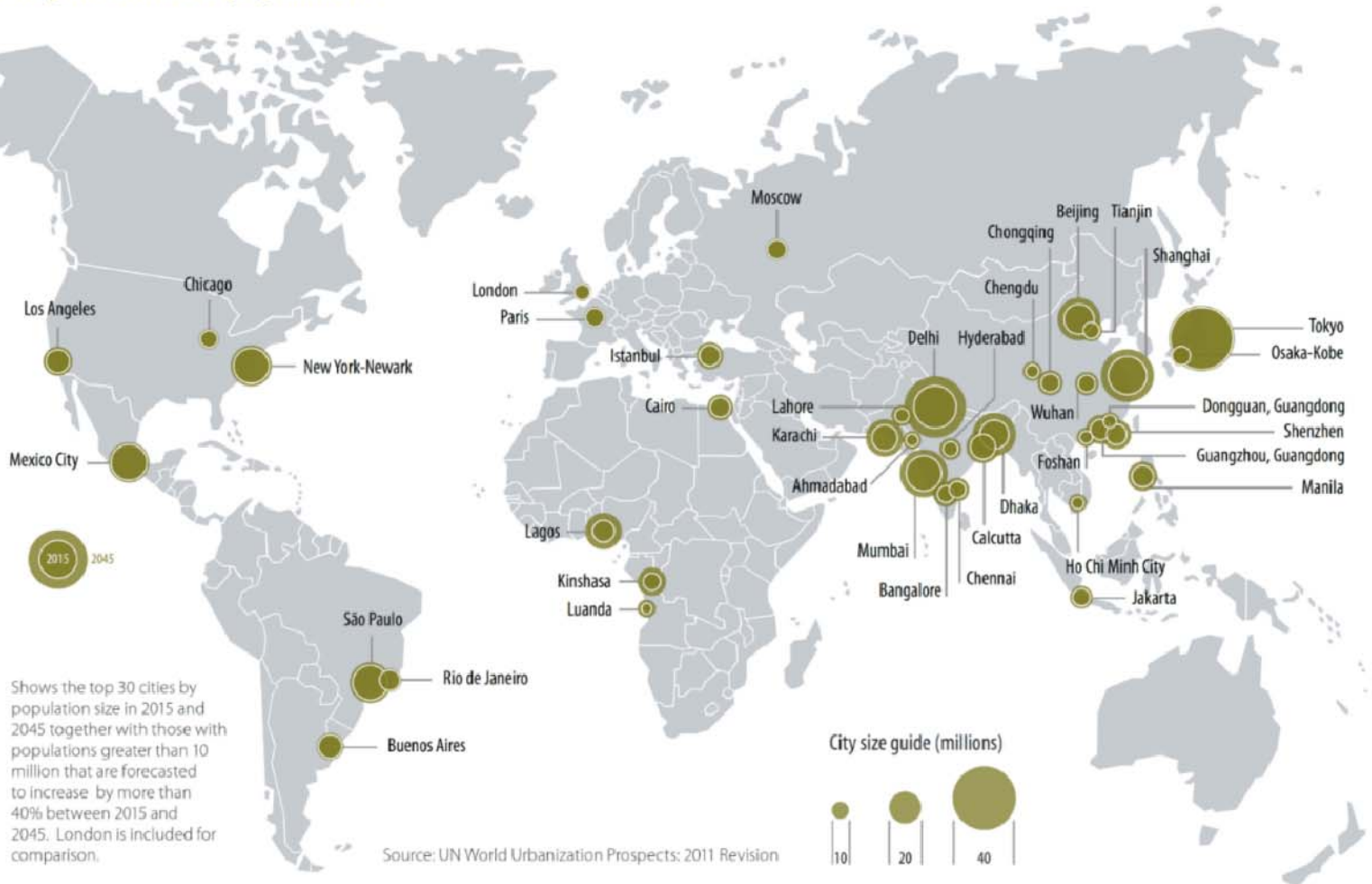
GEOPOLITICS



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ENGINEERING

URBANISATION

Major centres of population



CLIMATE CHANGE

Water Stress



Air Pollution



Environment



Heat Stress



Sea Level Rise

BUROHAPPOLD
ENGINEERING

NATURAL HAZARDS

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ENGINEERING

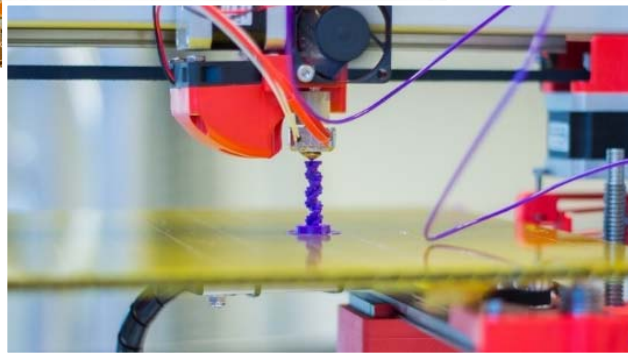
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Thames valley, 2014

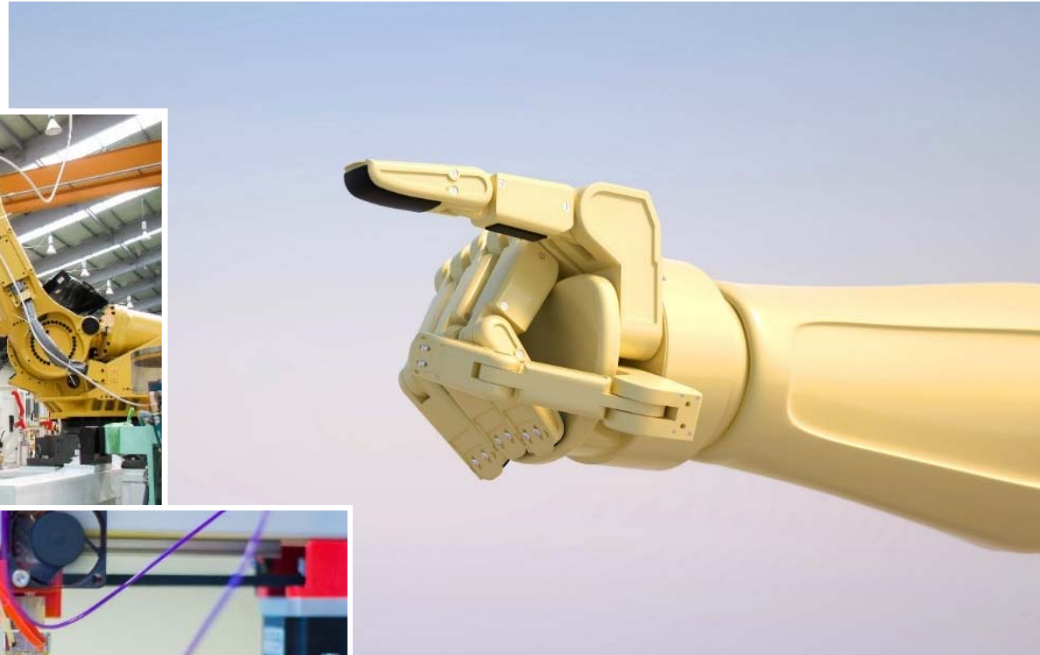
TECHNOLOGY

Artificial Intelligence

Automation

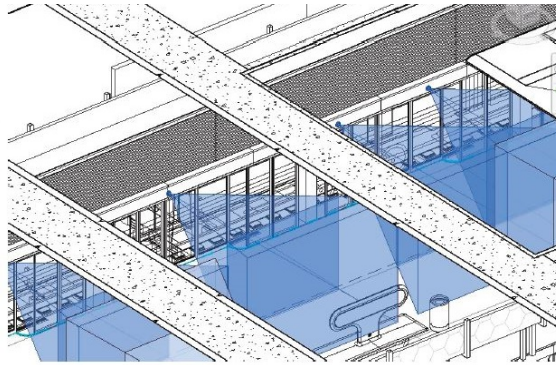
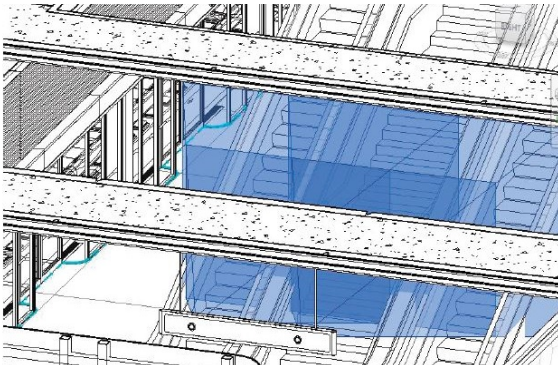
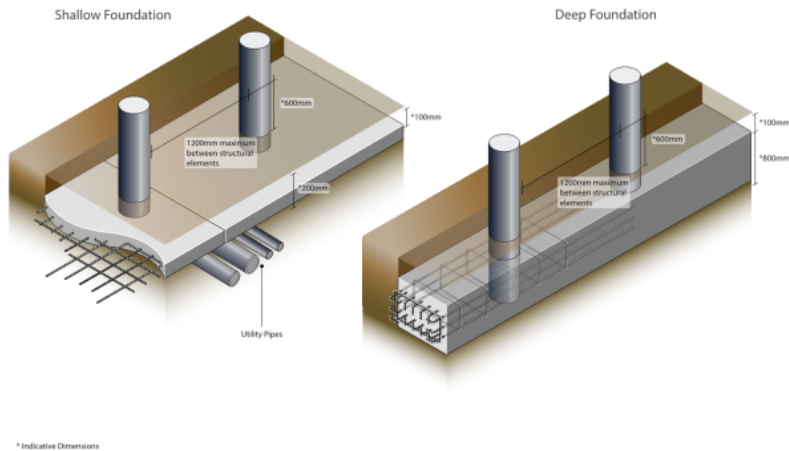


3D Printing



BUILDING INFORMATION MODELING

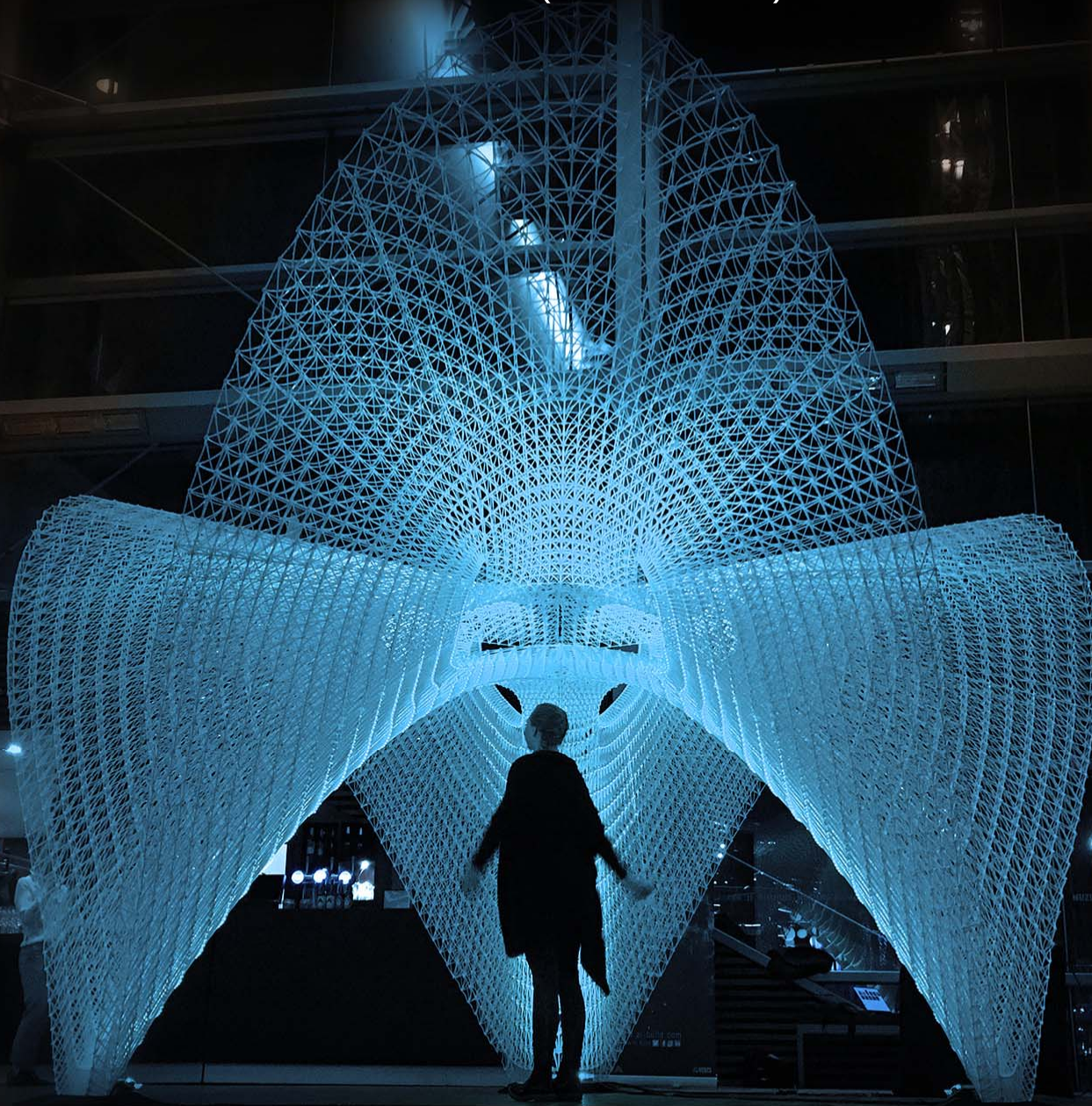
Jeddah Metro - IWA-14 Security Bollards



Properties	
_BHE_SecurityDevices_CameraStatic12 Internal Wall Surface	
Security Devices (1) Edit Type	
Constraints	
Length	5980.000 mm
REV STATUS NO	1
REV STATUS REPORT	Uncontrolled Insertion
Review Approval	<input type="checkbox"/>
Offset	0.000 mm
Work Plane	Level : Level 0
Graphics	
INFRARED	<input type="checkbox"/>
LASER	<input type="checkbox"/>
Electrical - Loads	
Dimensions	
DFOV	0.000 mm
DISTANCE	5980.000 mm
FAR LIMIT	5980.000 mm
FOCUS HEIGHT	2300.000 mm
FOCUS WIDTH	2624.159 mm
HFOV	6303.784 mm
HORIZONTAL ANGLE	55.5849378°
Mounting Horizontal Angle	110.0000000°
Mounting Horizontal Offset	0.000 mm
Mounting Offset	0.000 mm
Mounting Vertical Offset	0.000 mm
NEAR LIMIT	111.100 mm
OFFSET	3000.000 mm
VERTICAL ANGLE	38.3830452°
VFOV	4736.809 mm
Identity Data	
Phasing	
General	
IT HUB	
NETWORK SWITCH REFERENCE	
OPERATIONAL REQUIREMENT	
Electrical - Circuiting	
Electrical Data	
Data	
MEGAPIXELS	1.800000
MICROPHONE	<input type="checkbox"/>
PIXELS PER FACE WIDTH	24.366318
PPM	203.053 mm
RESOLUTION	0.922 mm
RESOLUTION HEIGHT	720.000 mm
RESOLUTION WIDTH	1280.000 mm
ROTAKIN	400.000000
ROTAKIN EQUIVALENT	56.403514
WEATHER PROOF	<input type="checkbox"/>
Visibility	
Properties help	
Apply	

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LARGE SCALE 3D PRINTING (AIBUILD)



Copyright: <http://3dp.ai-build.com/>

AUTOMATION & AI



WHAT IS THE FUTURE ROLE OF ENGINEERS?

- SOCIETAL
- PEOPLE FOCUSED
- CONSULTATIVE
- EXPERIENCE
- INNOVATORS

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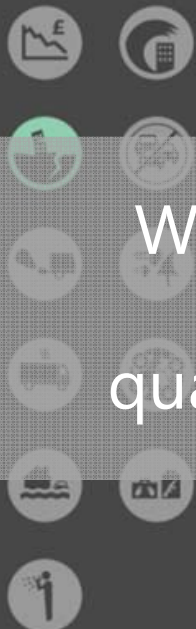


OUR DEFINITION OF RESILIENCE

“The **will** and **ability** to **anticipate**, endure, adapt and thrive within a disruptive and changing environment”

FILTER SHOCKS

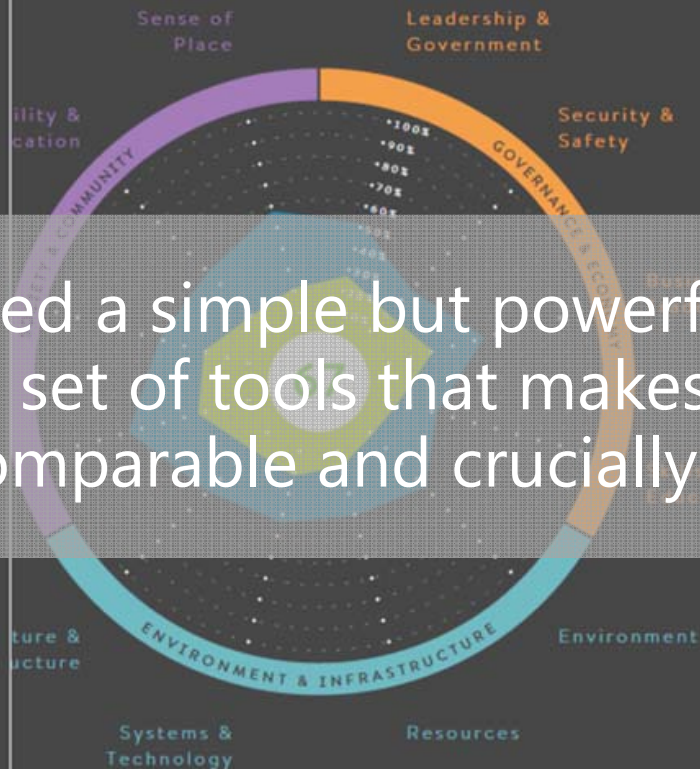
Select the shocks/stresses that will be used in this report. Active shocks/stresses are shown in colour. The others are in grey.




LAND MOVEMENT, EARTHQUAKE,
LANDSLIP & SUBSIDENCE

RESILIENCE REPORT

HEEL



PROJECT LIST 

- SELECT 
- DEMAND 
- DIAGNOSE 
- CAPACITY 
- REPORT 
- LOGOUT 

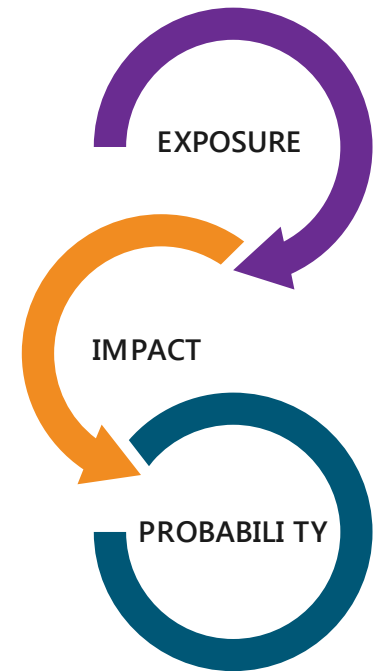
We have created a simple but powerful approach, backed by a set of tools that makes resilience quantifiable, comparable and crucially manageable.

FILTER SHOCKS

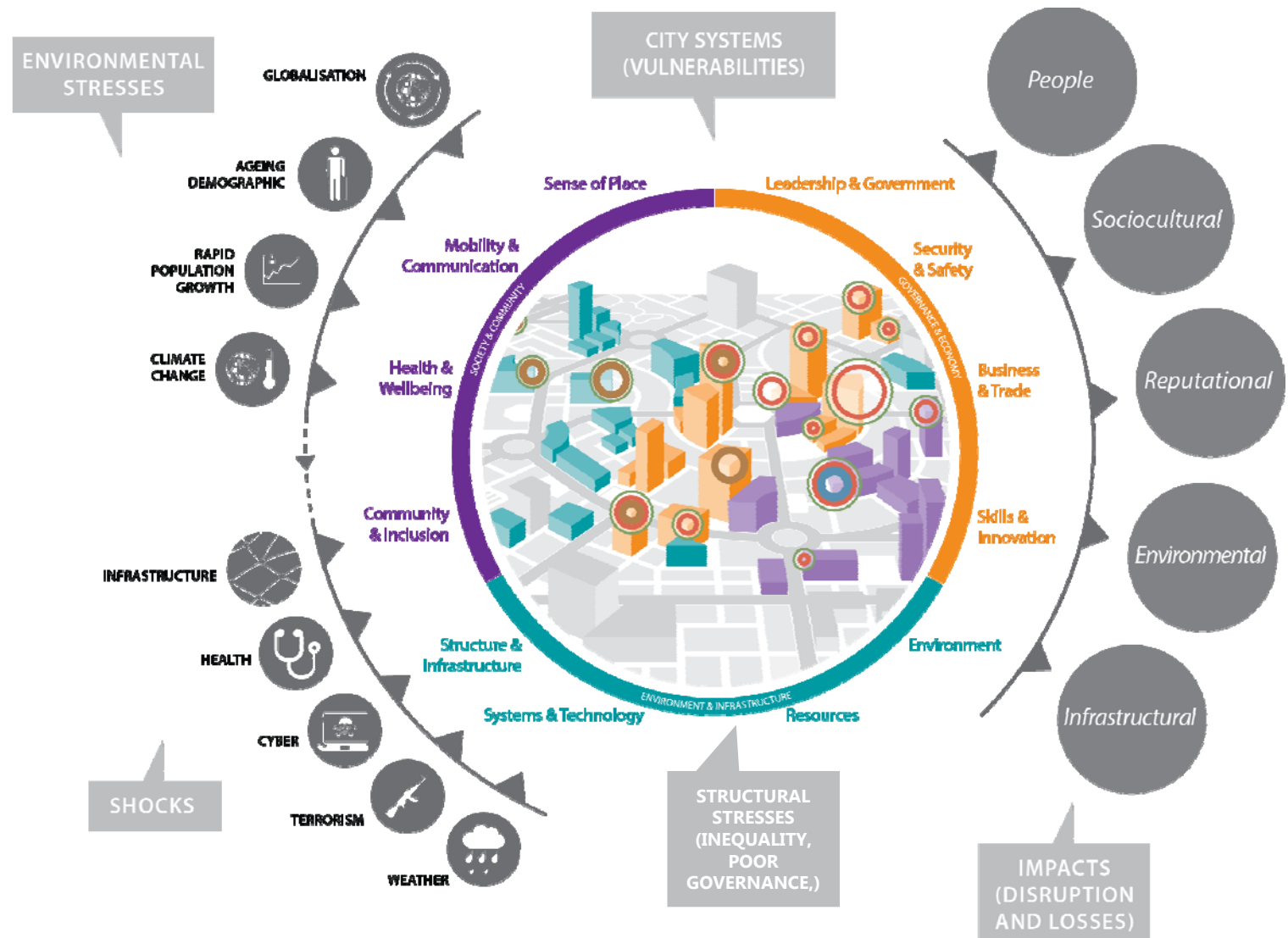
PRINT

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UNDERSTANDING THE RISKS, UNCERTAINTIES & TRENDS

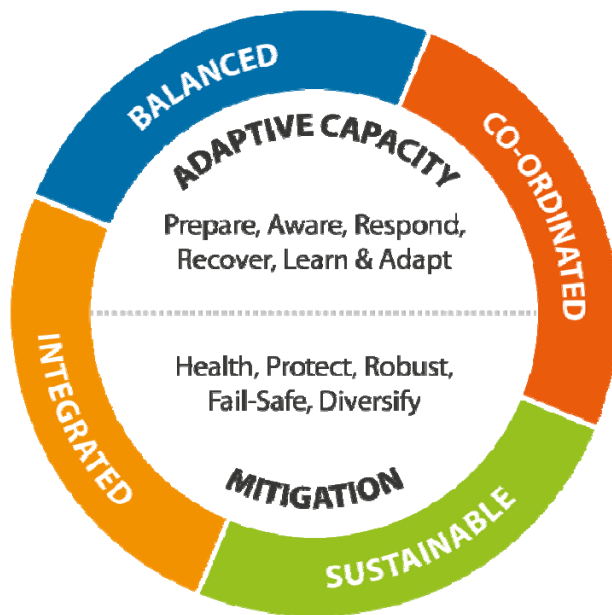


RESILIENCE DEMAND



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RESILIENCE CAPACITY



PREPARATION



AWARENESS



RESPONSE



RECOVERY



LEARNING & ADAPTATION



HEALTH



PROTECTION



ROBUSTNESS



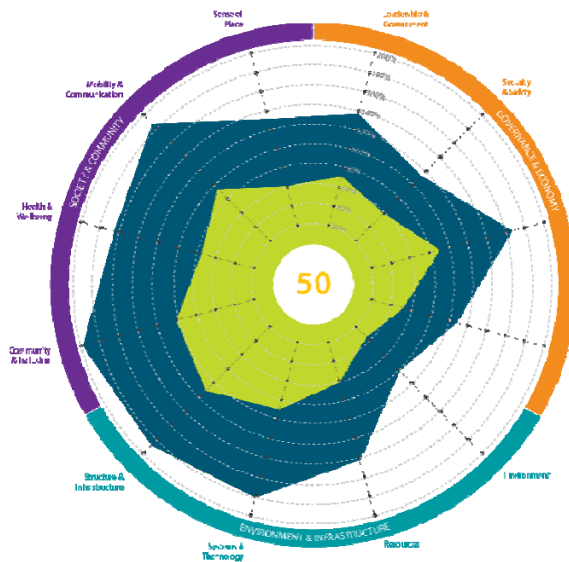
DIVERSIFY



FAIL SAFES

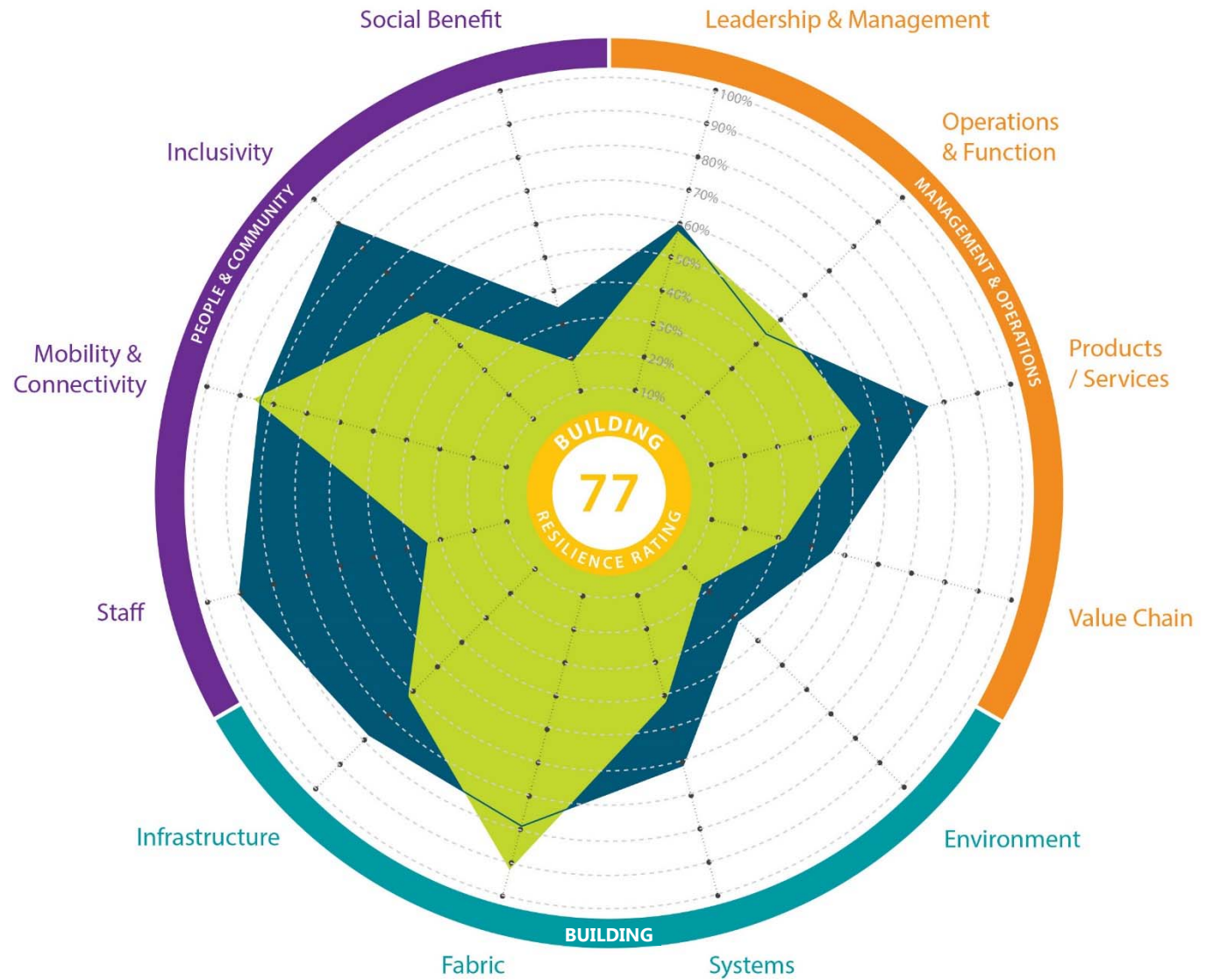
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CITY RESILIENCE



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BUILDING RESILIENCE



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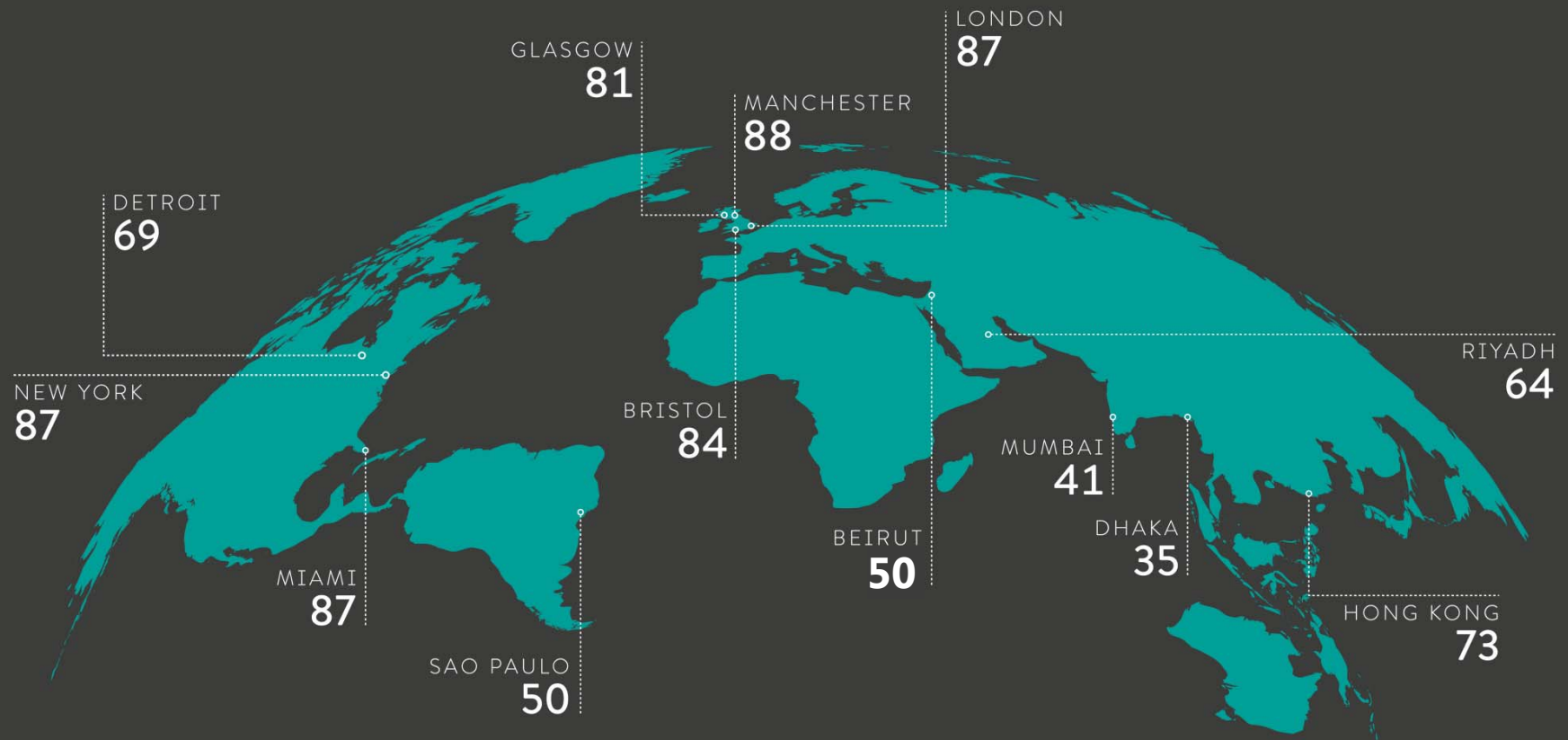
HOW DO WE NEED TO ADAPT?

- EMBRACE TECHNOLOGY
- EDUCATION
- STRESS TESTING
 - WHAT IF SCENARIOS
 - RISK BASED
 - UNDERSTANDING UNCERTAINTY
 - CONSIDER SHOCKS, STRESSES AND FUTURE TRENDS
 - PERFORMANCE BASED
 - FAIL-SAFE DESIGN
 - CONSIDER WIDER SOCIETAL & ECONOMIC EFFECTS OF FAILURE

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Thank You!

risk&resilience@burohappold.com