

# **COMPREHENSIVE RESILIENCE IN URBAN DESIGN**

Professor Gordon Holden

*Griffith University, Gold Coast, Australia*

**ABSTRACT:** *This paper engages with resilience in urban design by discussing knowledge that can be derived from case studies as being important contributions to innovation and hope, the core of resilience.*

*The purpose of urban design is to sustainably add cultural, environmental and economic value to human settlements. In order to achieve this urban design must cover a broad scope of concerns, it must be comprehensive. Urban design knowledge cannot stultify but must advance through expansion, continual testing and refinement. Resilience in urban design knowledge springs from constant engagement with and adaptation of national and international ideas and examples disseminated through conferences, visits, study and reflection. In an attempt at comprehensiveness, current urban design examples from small scale to whole cities, all relevant to sustainable cities, are discussed under the five headings of - smart containment, smart growth, re-birth, building performance, and ecological urbanism. If a city expects to evolve sustainably and with resilience, urban design requires a comprehensive approach across the full scale from individual houses to the city as a whole, all of which is locally relevant. This can embrace the adaptation and transfer of ideas and knowledge that is widely available from other places. The challenge is to experiment and innovate and to strike the appropriate balance for application between place uniqueness and globalised culture.*

**Keywords:** *Urban Design Knowledge; Urban Design Examples; Architecture Examples; Urban Design Sustainability and Resilience*

## INTRODUCTION

The urban design discipline, which predominantly encompasses planning, landscape architecture, architecture, social sciences, urban economics and engineering, is the overarching field that can comprehensively and sustainably add cultural, environmental and economic value to human settlements. In order to achieve this urban design knowledge must not stultify, but must continually expand. Maintaining an active awareness of and willingness to adapt visionary trends, ideas and examples across a wide „comprehensive“ spectrum, is a key in achieving this.

In the book „The Art of City Making“ (2006) Charles Landry establishes seven city-making principles which emphasise the need for a creative approach to interpreting sense of place and making the particular place work best for residents. In explaining this he highlights that a city must be aware of what other cities are doing “go with the grain of local cultures and their distinctiveness, yet be open to outside influences. Balance local and global” and further, “learn from what others have done, but don’t copy them thoughtlessly” (p1).

Further reinforcing the necessity of awareness of trends, Newman and Jennings link the need for a city to be connected to the world of experience and ideas in their 2008 book „Cities as Sustainable Ecosystems“ “...visions are placed within a context that is more tangible than the global arena but that provides a basis for global concerns. Moreover the diversity of approaches enhances resilience” (p24)

In their book „Resilient Cities“ (2009) Newman, Beatley and Boyer point to several authors including Peter Hall, Robert Friedel, Lewis Mumford and Tim Gorringer who write in similar ways about cities successfully adapting to change by concluding “whatever it is called, the ability to experiment and innovate is the tissue of hope and the core of resilience” (p5).

This paper sets out to contribute to the process of learning from others by updating and expanding our stock of examples across a wide scope to feed our knowledge bank. It highlights what are considered to be important current trends and examples from which transferable lessons, each contributing to greater sustainability, may be gleaned thereby contributing to city resilience.

Five trends are identified that relate to city sustainability. Each is developed further with case studies, discussed at the level of principles rather than attempting deep explanations. All of these trends are seen to potentially contribute to sustainable resilience. Using the word „potentially“ implies that the examples may be adapted or adopted in a range of locations and to varying degrees. The paper does not provide specific applications, seeing this as the task of others who may gain awareness from the paper and be provoked into searching wider than otherwise for solutions. The final heading „sense of place“ reminds us, as Landry (2006) does, to connect current knowledge about exemplars to the local scene:

- 1. SMART CONTAINMENT
- 2. SMART GROWTH
- 3. RE-BIRTH
- 4. BUILDING PERFORMANC
- 5. ECOLOGICAL URBANISM
- 6. SENSE OF PLACE

The examples fall within Newman et al's (2009) „Ten strategic steps towards a resilient city“ items: 3 – Target public buildings, parking and road structures as green icons; 4 – Build transit-oriented, pedestrian-oriented and green-oriented developments together; and, 8 – Regenerate households and neighbourhoods. The paper is structured to highlight examples and its style is notational, to accompany the power-point conference presentation.

## **1. 1 SMART CONTAINMENT - INFILL**

Many communities have vacant parcels of land within existing neighbourhoods that lend themselves to residential development.

Housing development on these infill lots not only increases the affordable housing supply, but also revitalizes declining neighbourhoods and expands a community's property tax base. Providing financial and regulatory incentives to offset the costs of development can help encourage construction of affordable housing within these parcels.

A benchmark example in Toronto is by architect Lawrence Dodd (see below).

Investigations into barriers to infill development are underway in Australia which show that the following topics need revision: Construction Costs; Tax Reform; Land Supply; Development Approval Timeframes.



Image credit - [www.worldarchitecturenews.com/index.php?fusea...](http://www.worldarchitecturenews.com/index.php?fusea...)

## 1.2 SMART CONTAINMENT - DESIGNED SUBURBAN INTENSIFICATION

Australian architect John Gray at Victoria University Wellington, New Zealand, conducted research into suburban intensification for a case-study area of 2.3ha which houses about 41 people/ha at 2.1 people per dwelling unit resulting in 75 people and 36 dwelling units (Gray and Hoare, 2010).

Under Wellington's existing „containment“ regulations the area could support 48 dwelling units, which at 2.1 people/household equals 101 people, an increase of 35%

If the example was carefully designed to achieve habitable-code standards, accounting for topography, existing building, privacy etc. the capacity of the area could be 78 dwelling units, which at 2.1 people/household equals 164 people, an occupancy increase of approximately 120%.

About 1600m<sup>2</sup> could be given to gardens for food production.

The Wellington example would require planning and building code relaxations, a unique design approach and neighbourhood cooperation.

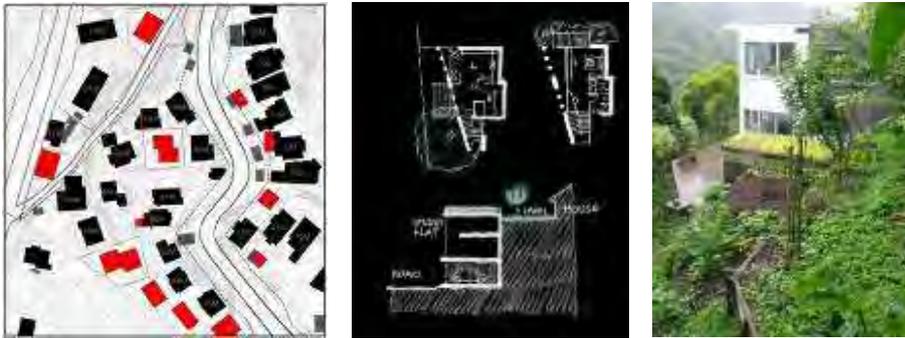


Image credit – John Gray

## 1.3 SMART CONTAINMENT – MELBOURNE'S VISION

The „Melbourne 2030 Strategy: Planning for Sustainable Growth“ shows that the city can accommodate the projected large growth of an additional million people sustainably without extending its boundaries. It can do this through intensifying habitation along transport corridors and by upgrading the suburbs to be more self-sufficient and sustainable.

Approximately 6% of Melbourne is given to urban corridors (3%) and activity centres (3%) [retail/service/cultural including city centre]. The projected growth is targeted in these areas to avoid loss of sense of place of the suburbs.

Illustrated is a corridor as it is currently and it's possible future....showing the potential of corridor-intensification and infill. Five-story mixed use buildings with sub-centres spaced along corridors provide a solution.

Six ingredients are needed: A Mix of Uses; Higher Density; Strong Connectivity-Good transport; High Quality Public Realm; Distinctive Local Character.

Compared with incremental growth on the edge of the city the economic saving of this contained intensification could approach 110 \$Billion over the next 50 years.



Image credit – City of Melbourne, (2009)

## 2.1 SMART GROWTH

Towns and cities are at a crossroad. Down one path is urban sprawl. This leads to endless roads, long commutes and traffic jams, high social and infrastructure costs and loss of farmlands and open space.

Urban sprawl is widely spread-out development outside city centres, usually on previously undeveloped or farm land. It is characterized by having few people per hectare, homes that are separate from retail, commercial and industrial areas.

The spread-out nature of urban sprawl does not support public transportation. Urban sprawl homes are separate from places of work, shops and services, meaning that residents usually drive for all their travel. Continued sprawl threatens the health of our families, our communities, and ecosystems.

In the other direction is „smart growth“ which creates compact, higher-density communities supported by public transit, bike and walking paths, surrounded by productive farmland and green spaces, forests and wetlands.

Smart growth promotes exercise and cardiovascular health. It includes a mix of housing, commercial, and shopping uses. It is development that provides business opportunities and jobs, balances development and environmental protection, and encourages strong neighbourhoods.

## 2.2 SMART GROWTH - TRANSPORT ORIENTED NEW DEVELOPMENT

*Varsity Lakes* on the Gold Coast is a 343-hectare green-field site in Gold Coast City. The project's mixed-use precinct is synergistically situated next to Bond University.

A modified-grid system of residential streets creates walkable linked neighbourhoods that share institutional recreation spaces and which are train-station accessible.

The layout encourages optimum solar orientation of houses and passive surveillance of public areas.



Image credits - [www.airviewonline.com.au/aerial/3649/lakes-Ae](http://www.airviewonline.com.au/aerial/3649/lakes-Ae)  
[www.southernbeaches.realway.com.au/index-tess...](http://www.southernbeaches.realway.com.au/index-tess...)

### 2.3 SMART GROWTH - MIXED-USE URBAN INTENSIFICATION

„South-Bank“ Brisbane supports a rich mix of uses (culture, park-lands, recreation, restaurants, entertainment, exhibitions, retail, residential, education.....but is missing household food shopping.

There are clear visual links with the park and river. There are also strong physical links into adjoining neighbourhoods and across the river.

The rehabilitated Grey Street adds to overall coherence.

South-Bank has excellent accessibility across all modes including train, bus, ferry, pedestrians, bicycles, vehicles.



Image credits – John Byrne

### 3.1 RE-BIRTH - THROUGH RETRO-FIT and UPGRADING

It is significant that 95% of Australia’s existing buildings were constructed without sustainability considerations.

Keeping our existing buildings for as long as possible adds markedly to their life-cycle efficiency. But where possible, upgrading should be undertaken through retro-fitting that achieve sustainability goals.

Office buildings are already being re-fitted to comparatively higher performance standards, but more innovative solutions are possible including the „Evolvo“ competition entry which clips

prefabricated modules onto the exterior of existing buildings, adding a layer of green space for gardening, wind turbines or social uses.



Image credit – [www.modool.net/?module=articles](http://www.modool.net/?module=articles)

### 3.2 RE-BIRTH THROUGH REDEVELOPMENT

The mixed-use Mizner Park, Florida, town centre demonstrates how suburban communities can create vital downtowns by redeveloping low functioning shopping centres. Mizner Park was a „dead“ internalised shopping centre surrounded by parked cars until its re-birth as a „Town Centre“ with regular streets and a wider range of mixed uses including apartments.



Image credits – [andrewlainton.wordpress.com/.../](http://andrewlainton.wordpress.com/.../)

### 3.3 RE-BIRTH - THROUGH INFRASTRUCTURE TRANSFORMATION

Obsolete railway viaducts in Paris and New Your have been re-borne to enhance liveability of those cities.

Paris has transformed the 1.5k, 70 arch „*Viaduct des Arts*“ to house arts and crafts workshops, galleries, showrooms, restaurants and café.

On top is the „*Promenade Plantee*“ which extends beyond the viaduct for 4.5k, sometimes through buildings, providing a green pathway connecting districts.

The 2.3k „High-Line Park“ in New York is a disused freight train line in the lower West side. Walkway, seating and native planting provide an urban outdoor experience that has contributed greatly to a renaissance of the neighbourhood.



Image credits - [www.quora.com/Lazaro-Fuentes](http://www.quora.com/Lazaro-Fuentes)

[www.ny1.com/.../](http://www.ny1.com/.../)

### 3.4 RE-BIRTH THROUGH ECO-CITY GREENING

In an eco-city, people and organisations adapt to a changing climate and act to build a sustainable future.

Such a city is compact, with high density of housing, business and cultural uses that sustain an effective public transport system, and walking and cycling above car use.

With excellent air quality and generous public open space and landscaping, biodiversity is supported and people enjoy the benefits of health and happiness.

City infrastructure and buildings generate and use renewable energy and feed into the metropolitan electricity grid.

Food is grown locally and creatively, using horizontal and vertical spaces on buildings and in private and public gardens.



Image credits - [www.getartisan.com.au/news/view/641](http://www.getartisan.com.au/news/view/641)

[en.paperblog.com/.../](http://en.paperblog.com/.../)

### 3.5 RE-BIRTH THROUGH BUILDING ON TOP

By comparison with building anew, constructing on top of existing buildings contributes significantly to sustainability by providing:

- \* low energy costs in demolition & disposal;
- \* low building material waste;
- \* materials savings - no need for footings - what can be built is limited by height & carrying capacity of the existing building;

- \* Light-weight construction (steel frame with plantation timber frame) OVERALL 35% building cost saving.
- \* increased number of city residents = fewer vehicle trips & less pollution for work trips;
- \* increased pedestrian journeys gives greater community health at less public cost;
- \* by limiting urban sprawl, overall journeys are shorter and the existing urban fabric is used more effectively – counter to decreasing household occupancy rate. OVERALL 33% increased city residency.



Image credits – [www.e-architect.co.uk/architecture\\_competitio...](http://www.e-architect.co.uk/architecture_competitio...) – Graham Meltzer

#### 4.1 BUILDING PERFORMANCE - ENERGY AUTONOMY

*First Light* is the name given by four Architecture Students at Victoria University in Wellington, New Zealand, for their finalist entry to US Dpt. Energy Sponsored „Solar Decathlon“ (Farrow, et al, 2009).

Solar Decathlon is a competition that short-lists twenty house designs by university teams internationally every two years. The designs are built and exhibited on „The Mall“ in Washington DC, educating a new generation of professionals & the public.

The designs must be liveable, completely solar-powered but must also blend aesthetics and modern conveniences with maximum energy production and optimal efficiency.

*First Light* includes electronic management of smart-systems including re-cycling, water collection, security, air-conditioning, ventilation, thermal performance and communications. It generates power for its own operation; it can re-charge an electric car and export power.



Image credit – [firstlighthouse.ac.nz/featured/the-house/](http://firstlighthouse.ac.nz/featured/the-house/)

#### 4.2 BUILDING PERFORMANCE - GREEN OFFICES

Nearing completion is the 310m high *„Pearl River Tower“* in Guangzhou, China, by SOM. The sculptural façade directs wind to the pair of funnel-like openings at its mechanical floors at one-third and two-thirds the height.

Wind power in even mild conditions from different directions drive turbines to generate electricity for heating and ventilation.

The tower has a double-skin curtain wall for insulation as well as trapping heat for hot water.

Integrated solar collectors generate AC current for lighting & other needs. Daylight is „harvested“ for lighting.



Image credit – [www.skyscrapercity.com/showthread.php?t=410543](http://www.skyscrapercity.com/showthread.php?t=410543)

#### 4.3 BUILDING PERFORMANCE - SUPER GREEN OFFICE

In 2006 Australia’s first 6-star rated building „*Council-House 2*“ in Melbourne successfully set out to establish new performance standards for office buildings.

It gave reductions of: CO2 emissions by 82%; Electricity use by 82%; Gas usage by 87%; and Water use by 72%.

Productivity improved 10% compared with the previously occupied council administration building.

Four years later was Australia’s 250th 6-star or better building. The world’s first carbon-neutral better than a „perfect-score“ office building „*Pixel*“ in Melbourne.



Image credit - [construction.com/CE/articles/0801edit-1.asp](http://construction.com/CE/articles/0801edit-1.asp)

#### 4.4 BUILDING PERFORMANCE - PIXEL

Pixel by architects studio 505 and Grocon is self-sufficient for water and will generate surplus energy to neutralise its embodied energy.

Innovations include carbon neutrality, a vacuum toilet system, the anaerobic digestion system and reduced car parking. The water initiatives in the project mean the building could be self sufficient for water – in this context, the project is water balanced as well as carbon neutral.

The building features a new type of concrete which halves the carbon in the mix. Melbourne University designed the „living roof“ which re-introduces Victorian grassland species to the Melbourne area, and includes tracking photovoltaic roof panels. The multi-coloured sun shade system on the exterior of the building will provide the maximum amount of daylight into the office space, protecting it from glare and heat in the summer. While smart window technology ensures windows will open automatically on cool nights to enable air flow into the building. Electricity is generated by roof-mounted wind turbines.



Image credit – [www.australiandesignreview.com/news/17810-Pix...](http://www.australiandesignreview.com/news/17810-Pix...)

#### **4.5 BUILDING PERFORMANCE - DELTA**

Another project by studio 5050 under design development, is the proposal for DELTA a 50-unit residential tower designed to stand 10-12 stories atop a heritage bluestone building in Melbourne. The tower will be composed of prefabricated laminated timbers that will be locally sourced.

The project's carbon neutral design goes well beyond the materials used as it is seeking Passive House certification, it the most efficient building in the country.

The super-efficient shell is highly insulated, meticulously airtight, and features super high-efficiency windows. This sharply reduces the size of the equipment needed to heat and cool the building.

The prefabricated componentized system will make the building simpler to assemble on-site.



Image credit – [inhabitat.com/.../](http://inhabitat.com/.../)

#### **4.6 BUILDING PERFORMANCE - QUEENSLAND GOVERNMENT**

Queensland Government Architects office „Project Services“ have recently completed the State's first 6+ green star rated building „Dandiiri Contact Centre“ at Zillmere.

Innovations in this building include significant passive design aspects – orientation, shading, mass and insulation, natural lighting and ventilation (selected areas), high ceilings as well as sealing against leakage. Other achievements derive from solar energy collection, recycled

timbers, avoidance of noxious gases from materials, and water collection for internal use and recycling.

Construction materials were carefully selected to reduce CO2 impacts (eg: 40% of cement was replaced with blast furnace slag).

External works include native plants and water management.



Image credit - [www.gbca.org.au/newsletter\\_preview.asp?id=794...](http://www.gbca.org.au/newsletter_preview.asp?id=794...)

## 5.1 ECOLOGICAL URBANISM – FIRST SUSTAINABLE CITY

*Masdar* (Arabic „the Source“) in Abu Dhabi, a new city of 50,000 residents under construction will run entirely on renewable energy when completed in 2015.

Designed by Lord Foster in 2007 the compact, high-density low-rise city of 6 sq k will be completely free of conventional cars and their emissions. A fully automated electric Personal Rapid Transit System will provide a flexible alternative to private cars. Light rail links the city to nearby developments.

Compared to conventional cities there will be 75% less fossil fuel consumed, 300% less water, 400% less waste.

No resident will be more than 200m from essential facilities including shops selling locally grown produce.

The Masdar Institute of Science and Technology (in partnership with MIT) will use the city for research in advanced energy and sustainability.

Passive systems are incorporated: orientation to capture cooling sea breezes; perimeter walls to protect from desert winds. Courtyards and wind towers draw cooling breezes into narrow streets shaded from harsh sunlight...conjuring images of ancient bazaars.



Image credit - [www.bustler.net/.../](http://www.bustler.net/.../)



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[www.renewableenergyworld.com/rea/news/article...](http://www.renewableenergyworld.com/rea/news/article...)

## 5.2 ECOLOGICAL URBANISM – MANY MORE CITIES TO COME

Dongtan Eco City, China (top image) will increase bio-diversity and will create a city that runs entirely on renewable energy for its buildings, its infrastructure and its transport needs. The city will recover, recycle and reuse 90% of all waste in the city, with the eventual aim of becoming a zero waste city.

Dockside Green, Victoria BC Canada. Plans to become North America's first carbon neutral community, achieved through a combination of green solutions for buildings, transportation, energy and waste treatment.

The Eco-City Longrono Montecorvo in Spain (bottom image) foresees the construction of 3,000 social homes and complementary services program. The new neighbourhood achieves a CO2 neutral footprint by producing renewable energy on site.



Image credits - [sustainablecities.dk/en/city-projects/cases/d...](http://sustainablecities.dk/en/city-projects/cases/d...) [naturopoil.com/eco-city-development](http://naturopoil.com/eco-city-development)

## 6. SENSE OF PLACE

What can we learn from these examples? Many things but unless we transfer knowledge gained from case studies in ways that are relevant to our own place then we potentially contribute to deterioration of our sense of place....even by contributing to placelessness (after Relph, 1976) as discussed further with regard to the Gold Coast by Holden (Holden, 2011).

The importance for a city's resilience of developing place specific solutions was identified in reference to Landry (2006) and Newman and Jennings (2008). We know from examples such as the art museum and subway stations of Bilbao in Spain that innovatively designed buildings and services have resulted in strengthening sense of place and resilience notwithstanding the international origin of ideas and forms (Gospondi, 2004).

From this we may conclude that by seeking high quality design for small and large scale private and public elements then the city can potentially gain greater resilience through improved sustainability from selective transfer of ideas from elsewhere.

## CONCLUSION

It is argued that if a city expects to evolve sustainably and with resilience, urban design requires a comprehensive approach, which is locally relevant. This can embrace the adaptation and transfer of ideas and knowledge that is widely available as demonstrated across the case studies shown. The challenge is to strike the appropriate balance for application between place uniqueness and globalised culture and technologies.

The paper selectively engages with physical, technological and visionary-policy driven examples of architecture and urban design across a wide range of scales from an individual autonomous house to entire cities. These are organised under sub-headings that are relevant to city sustainability. Many more examples are available and many of the ideas discussed may be adapted or transferred to other cities provided there is willingness, as Newman et al say (2009), to experiment and innovate, which is at the core of resilience.

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