International perspectives on solutions and innovations to greening compact cities

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C.Y. Jim
Education University of Hong Kong

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Evolution of the tree growth form
Fossil record of early tree roots

- Palaeosol, Cairo, NY
- Circa 380 MBP
- Mid-Devonian
- Early evolution of trees
- Tree fern like plant
- Complex & advanced root system
- Radial spread pattern
- Ramified, hierarchical, tapering
- Nature’s survival strategy
Inadequate and hostile aerial and soil growing space

- From survival of the fittest, to expecting the unfit to survive
Compact city development mode
Tight urban fabric:
Meagre planting space

A. Building and related constraints
1. High building density
2. Finely divided building lots
3. Site coverage at 100% at street level
4. Narrow frontage of buildings
5. Redevelopment at higher intensity with more site coverage and floor area
6. Scanty occurrence of incidental and remnant amenity plots
7. GIC ground level space usurped by vehicle parking with hard paving
8. GIC sites threatened by redevelopment and infilling at higher density

B. Road and related constraints
9. Narrow pavements
10. Awning above pavements
11. Narrow roads
12. Narrow lanes
13. High road density
14. Narrow or no central dividers
15. Elevated roads
16. Profusion of underground utilities
17. Heavy vehicular traffic
18. High pedestrian flow
19. No pedestrianization
20. High density of traffic signs
Tree-unfriendly development
Raise green cover in built-up areas
Preserve interstitial greenery

Kuala Lumpur

Nice
Allocate green space in urban renewal

Singapore
Maximise green plot ratio
Assign generous roadside greening space

Singapore
Furnish wide roadside green verge

Grasse

Baltimore
Install multiple rows of roadside trees
Set back buildings or roadside trees
Widen pavements for trees
Accommodate trees in central business districts

San Francisco

Zurich

Dunhuang
Green pedestrianised shopping streets

Barcelona

Frankfurt
Maximise street greening
Plant trees along narrow pavements

Zurich

Dunhuang

Sapporo
Fit trees into narrow roadsides

Vancouver

Venice
Nurture trees in narrow lanes

Venice  
Taipei

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Barcelona
Adopt high hedge and tree pleaching
Generate green tunnel effect

Brussels

Nanjing
Establish exemplary highway greening

Singapore
Green civic space in city centre

New York

Sydney
Establish high-quality urban lawns

Paris

Seoul
Develop greenways or linear parks

Tokyo

Vancouver

Leuven

Kagoshima
Insert greenway between buildings

New York
Build greenway above railway tracks
Build greenway above highway

Munich
Convert old railway viaduct to greenway
Convert old railway viaduct to greenway
Rehabilitate old flyover as greenway
Cover tramways with grasses or herbs

Barcelona

Dublin

Vienna

Zurich
Enhance greenway landscape design

Singapore

Versailles

Sapporo
Reserve green fingers in urban development

Moscow

Xiamen

Hong Kong
Preserve combined blueway & greenway
Revive urban river as blueway-cum-greenway
Create green-cum-blue infrastructure
Optimise greening of promenades
Plant tree clusters to create mini-woodlands

Paris

Osaka

Singapore

Bruges
Preserve or conceive urban forest parks

Dublin: Phoenix Park

London: Holland Park

Paris: Bois de Boulogne

Tokyo: Meiji Shrine
Maximise greenery cover and biomass

San Francisco

Vancouver
Green emergency vehicle access

Singapore
Plant trees at roadside parking spaces

Saint Gallen

Brussels

Zurich
Green areas below flyovers

Singapore
Green bus stops

Tokyo
Green urban space collaterally using florist shop

Prague
Green temporarily vacant building lot

Singapore
Adopt minimum-space vertical greening

Venice

Leuven

Zurich
Establish roadside shrub screen
Plant trees in indoor space

San Francisco
Singapore
Vancouver
Sapporo
Design naturalistic parks

Tokyo
Insert natural pockets into green spaces
Encourage food production in cities

Allotment garden & urban agriculture
Protect heritage and champion trees
Preserve woodland in developed areas
Transplant large trees *en masse*
Promote three-dimensional urban greening
Revive roof greening tradition
Inspire innovative green roof design
Install green roof on railway station
Install green roof on enclosed highway junction
Install green roof on underground carpark
Install green roof on shopping mall
Envelop building with sky woodland and green wall

Hong Kong
Nurture luxuriant green wall

Milan
Bosco Verticale

Milan
Poor soil, poor root growth, poor tree

- Shallow
- Stony
- Sandy
- Compacted
- Layering
- Poor structure
- Low porosity
- Truncated
- Buried

- Construction rubble
- Artifacts
- High pH (alkaline)
- Meagre organic matter
- Nutrient deficient
- Nutrient unavailable
- Soil pollutants
- Low moisture content
- Poor drainage

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Strategies for roadside soil volume extension: Soil connectors

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Enlarge tree pit: Without or with suspended paving
Expand tree pit

Berlin
Install roadside soil corridor
Apply soil-root rehabilitation

Vertical mulching

Radial trenching
Improve urban soil for trees
Refurbish soil in the whole street section
Build common utility tunnel

Common ducts are built to concentrate utilities (electricity, gas, water, etc.) underground, organize them efficiently, and protect and maintain them safely and securely. This reduces the need to dig up the roads repeatedly when servicing utilities, and is also an effective means of disaster prevention in urban areas.
Maximise ecosystem services: Nature-based solutions

Berlin’s Biotope Area Factor (BAF)
Nature-based solutions for sustainable and liveable cities

http://www.stadtentwicklung.berlin.de/umwelt/landschaftsplanung/bff/index_en.shtml
Paris: Baron Hausmann’s town-plan overhaul

1853–1870
Meet new challenges:
Accentuated warming of cities

Paris

Regional Mean Temperature
Change by Heat Waves
Change by Population Dynamics
Exposure under Heat Waves

23.7 °C
3.6 °C
1.9 °C
29.2 °C
UN-FAO (2018): Mantova Challenge

Green cities
Healthy cities
Smart cities
Prosperous cities
Happy cities
Liveable cities
Sustainable cities
Thank You
Let us discuss during networking time