

# The tricky business of managing trees in our built environment

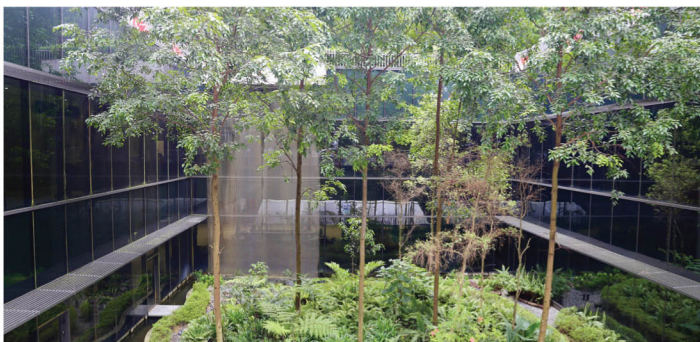
By Michael Casey

Urban greening is becoming an important tool in helping to address climate change by adding greenery into our built environment. The one design inclusion that green infrastructure experts are starting to use more and more is the installation of trees into, and onto, buildings.

With rapid urbanisation and climate change cities are faced with a number of challenges. Urban forests are going to play a role in how we manage the health of our urban environments. Most cities around the world are adopting new urban forest strategies, and according to the City of Melbourne's urban plan, they hope to increase their forest canopy from 22% to 40% by 2040. This strategy aims to adapt the city to climate change, mitigate heat, create healthier ecosystems and become a water-sensitive city. The City of Melbourne naturally plan to add more trees, however, they need to address their condensed streets, footpaths, and a lack of open space as part of the solution. Designers as a result are adopting more innovative ways to integrate trees into the existing and challenging built environments.

Around the world there are plenty of examples of integrating tree plantings into buildings, such as Bosco Verticale in Milan designed by Stefano Boeri, Acros Fukuoka in Japan designed by Emilio Ambasz, the Urban Farming Office in Vietnam designed by Vo Trong Nghia Architects, and in Singapore, the Kampung Admiralty apartments designed by WOHA Architects. Each of the abovementioned buildings have pushed the boundaries on integrating greenery into the built environment and have successfully used trees on both roof spaces and façade planters.

While these are all excellent examples across the world, from a more practical standpoint looking forward, are there standards and best practices that exist that professionals can pick up and run with when specifying and integrating trees correctly? The answer is, not really. There is literature/information on 'how to' successfully implement and manage trees on buildings, but it's limited. Heading down the wrong design and implementation path can present a whole world of pain, much like planting at a ground level, except the stakes are higher due to the complexities of access in, and on, roofs and buildings.



**Urban forest will play a role in managing the environment (Image: Michael Casey)**

A research paper titled '*Trees on Buildings: A Tree Selection Framework Based on Industry Best Practice*' highlights what designers and planners need to consider prior to installation and through to the construction phase's, along with the management of these trees when installed into our built environments'. It's just as the title suggests; a recently released paper (compiled by Majed Abuseif, Karine Dupre and Ruby Michael from the School of Engineering and Built Environment (Griffiths University) and Green Infrastructure Research Labs (Griffiths University)) that provides industry context, highlights the advantages of trees on our buildings and addresses the management of these important assets.

This paper can be viewed in its entirety at <https://www.mdpi.com/>. It highlights five sections that present the literature review, research method, results, discussion, and provides a thorough insight into what should be considered when designing trees into building spaces. The authors' extensive literature review allows for a clear and concise set of considerations that should be followed when selecting tree species.

These considerations include available light, location and aspect, possible structures either above or below that may impede root and canopy growth, and the issues of higher light levels reflecting from built surfaces which are all contributing factors when considering spaces for tree growth.

Planter and substrate requirements are also addressed. Questions such as what is a suitable and appropriate planter size, as trees all differ and have different growing requirements, what happens if the planter size influences tree growth indexes such as growth, height, leaf length, leaf width, root length, and the number of lateral roots, and will an undersized planter and unsuitable substrate affect overall growth and longevity of the tree species. These factors will heavily influence the life expectancy of trees which impact overall management and cost, such as the replacement of trees, or producing a specimen that may never reach its full potential and therefore not satisfy the design intent of the building.

A suitable substrate requires a balance between particle sizes to ensure movement of gases, mainly oxygen and carbon dioxide, along with providing sufficient plant nutrients, and good water retention which will improve root health and reduces the need to produce a larger and less efficient root system. Organic matter must be balanced in the mixture to ensure that minimum amounts are used which reduces decomposition and slumping of growing media over time.

An important rule of thumb, highlighted in the paper around tree selection and understanding tree species, was the need to prioritise stress tolerance over aesthetic appeal and functional

aspects. This rule of stress tolerance over aesthetic appeal may be difficult for some designers who are determined to highlight their building or landscape through the use of more favoured tree species. If they adopt the following criteria we can have a high level of confidence that it will lead to more successful plantings with limited failure rates.

The following criteria, as highlighted by Sjöman and Nielsen, *Selecting trees for urban paved sites in Scandinavia*, can be easily adapted to tree selections on building spaces. Understanding what is the context of planting, the adaptability of the selected trees to the conditions in urban paved (or in this case built) sites, and the availability of the trees locally, will be a solid base to start from in identifying possible species. Further research such as identifying and testing of trees in similar environments, consulting local planting specialists and specifying site types and conditions will expand, yet refine, the list of possible species, and ultimately extend the selection to the full range of tree species suitable to the climatic region.

The final aspect that needs to be factored in is wind loads which are extremely important in ensuring the stability of the trees on the building. To withstand wind loads in nature, a tree will naturally grow roots to evenly distribute its load. In a planter, or shallow environment, the tree will not have the room to adapt its roots to the limited space and will therefore require the use of a mechanical aid such as a tree anchor. Anchoring trees, which involves strapping and bracing a tree while securing to either the wall or ground floor of the planter, will assist the tree in opposing wind load, and assists the soil to resist fracture and handle the compression from the tree weight, and the collected wind load from its canopy.

The paper concludes by summarising the key considerations for any professional seeking to include trees into the built environment:

1. What is the purpose of installing trees in to the built space (environmental considerations, building design considerations and thermal considerations must be identified)
2. Existing and predicted conditions of the tree context (microclimate, planter design, and location and planting strategy)
3. Risk evaluation (risk of failure, risk of root damage)
4. Characteristics of candidate trees (size and form, growth, and maintenance considerations)

The paper is a robust and practical blueprint for tree planting on roofs but there is more of this type of information that needs to flow through the industry. It'll take collaborative groups like Abuseif, Dupre, the School of Engineering and Built Environment (Griffiths University) and Green Infrastructure Research Labs (Griffiths University) to continue to document and share their insights – it's only onwards and upwards from here on in!

Further information can be obtained from the new industry body The Australasian Green Infrastructure Network. Referring to Melbourne Green Factor Tool, or the Guide to Green Roofs, Walls and Facades in Melbourne and Victoria, will assist with understanding more about installing trees into the built environment.

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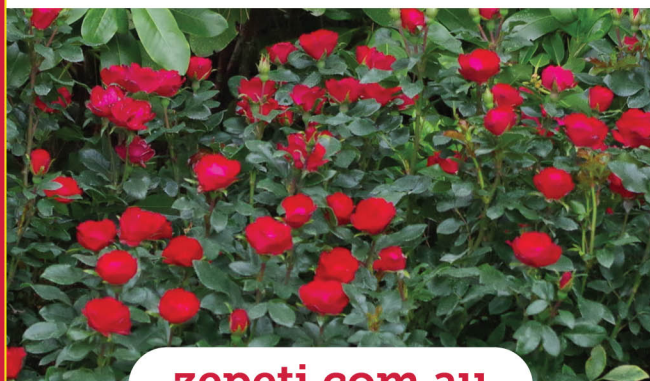
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