



TREES ON ROOFTOPS

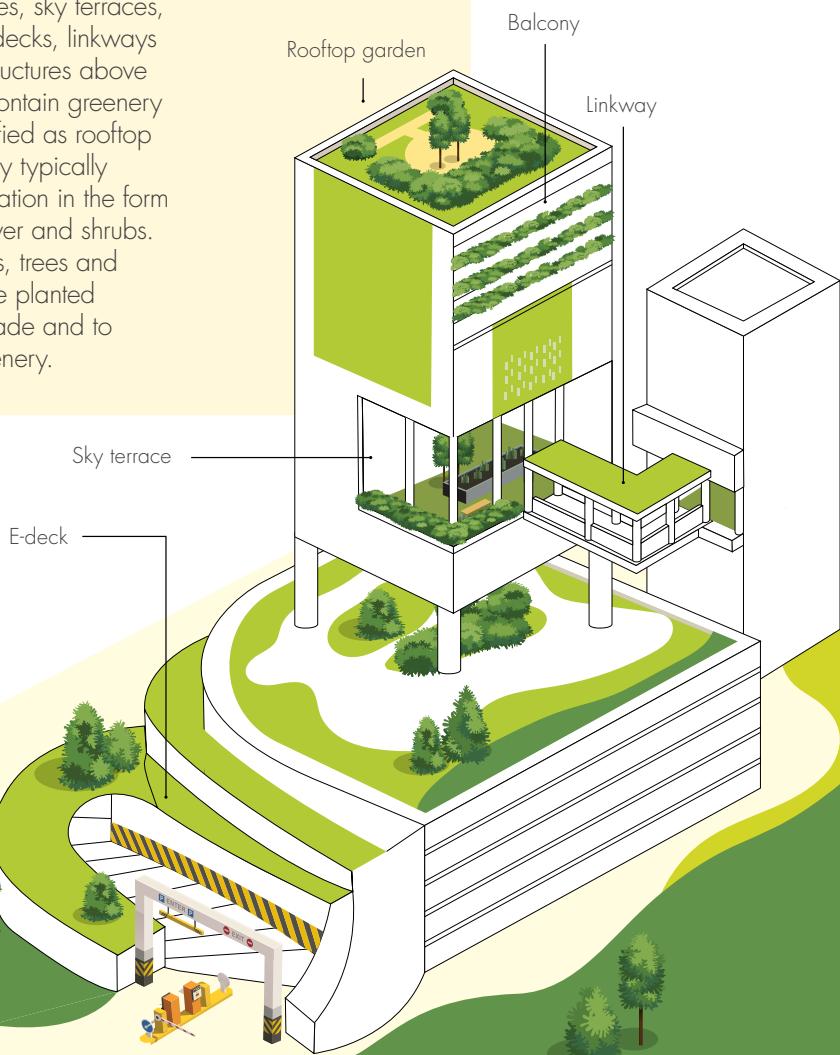
GUIDELINES AND PLANTING CONSIDERATIONS



As the popularity of rooftop gardens grows, so does the need to prioritise the safety aspects involved in building and maintaining them. This is important to ensure the well-being of people and property.

The Different Types Of Rooftop Gardens

Rooftop spaces, sky terraces, balconies, e-decks, linkways and similar structures above ground that contain greenery can be classified as rooftop greenery. They typically contain vegetation in the form of ground cover and shrubs. In some cases, trees and palms may be planted to provide shade and to add lush greenery.



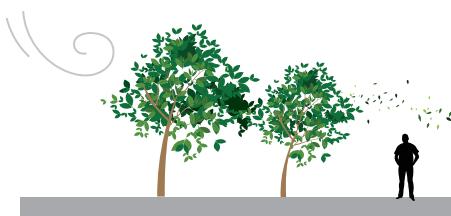
Rooftop Gardens And Their Wind Conditions

Rooftop gardens experience greater exposure to weather elements compared to those at ground level. Careful planning must be taken to ensure that the trees planted on rooftops will not compromise the safety of users within and outside of the space.

Wind conditions are especially relevant as strong winds can pose a danger to public safety, as well as cause damage to property. Wind speeds intensify with increased altitude and are especially evident along roof edges, roof corners, and where there are taller neighbouring buildings that channel the wind.

Considerations For Trees On Rooftops

- In general, the denser and larger the tree canopy spread, the larger the 'sail area' exposed to wind loads. Smaller trees with open canopies allow wind to pass through easily and are more suitable for windy rooftops.
- Suitable trees and palms must be planted adhering to adequate safety measures to prevent the following during strong winds:
 - Falling plant debris from height, which may cause injury and/or damage to property.
 - Possibility of uprooting if rooftop trees and/or palms are not adequately anchored.



Tall trees with dense canopies experience higher wind loads and moment of force.



Porous canopies allow wind to pass through, thus reducing wind loads and impact.

Important Note

The duty of care and liability for trees planted within any premises lies with the occupier of the premises. Occupiers should engage International Society of Arboriculture (ISA) Certified Arborists to carry out regular tree inspections and tree risk assessments to detect and mitigate any potential risks.

Considerations For Future Plantings On Rooftop Gardens

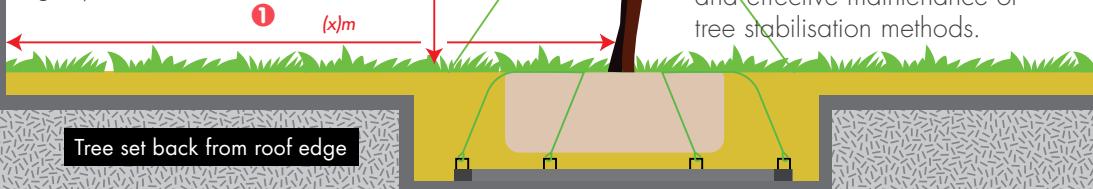
Trees on rooftops should generally be shorter in height and smaller in spread as compared to those planted at the ground level. Proper placement and anchorage of these trees will enhance safety.

② Species selection

The height of small rooftop trees should range from 3 m to 5 m. Trees with dense canopies should be avoided as they have larger 'sail effects'. Periodic pruning is advised to manage the size and form of rooftop trees.

① Ensure proper placement of trees

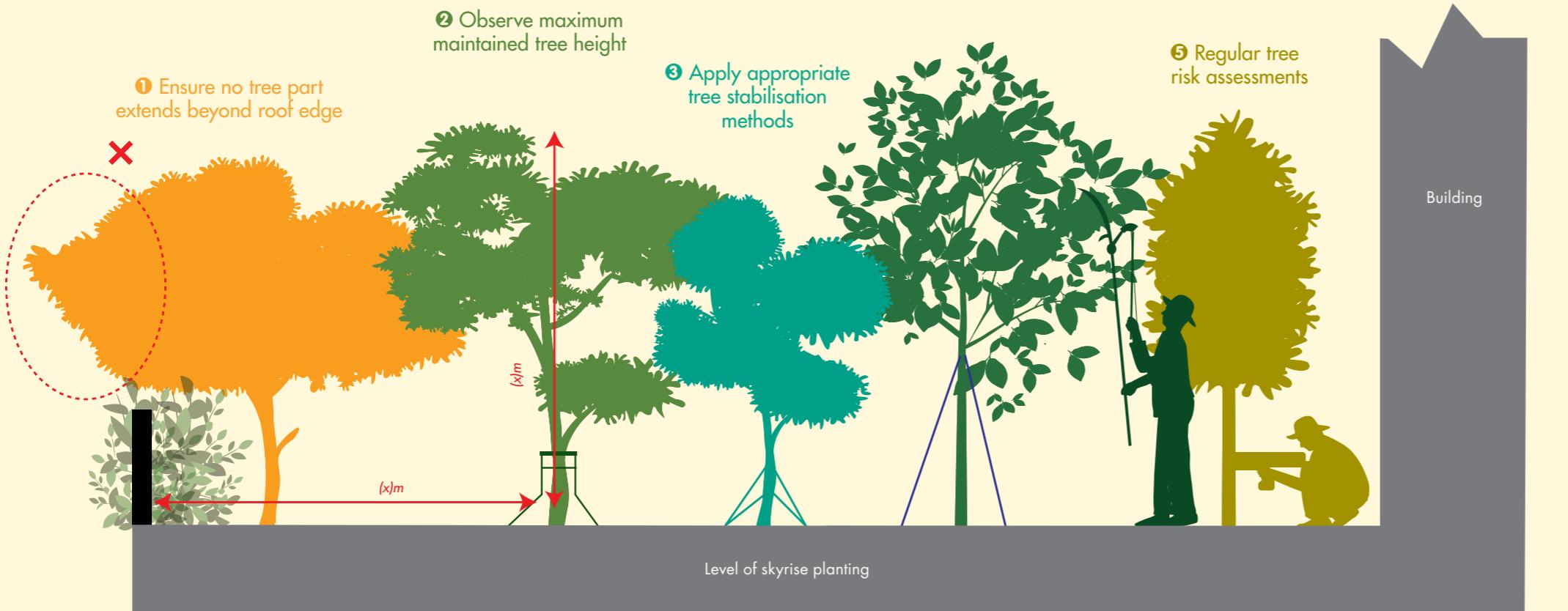
Rooftop trees will be subjected to unexpected periodic wind gusts. Wherever the design allows, trees should be sited at a safe distance (equal to or greater than the expected grown height of the rooftop tree) away from the roof edge. This is to create a buffer zone in the event of the tree becoming uprooted by unexpected gusty winds.



③ Tree stabilisation

At the design stage, provisions should be made for the installation and effective maintenance of tree stabilisation methods.

Enhancing Safety In An Existing Rooftop Garden



① Ensure no tree part extends beyond roof edge

Trees along edges should be pruned regularly to ensure that there are no overhanging branches beyond the roof edge.

② Observe maximum maintained tree height

Trees should be maintained at a maximum height equivalent to the horizontal distance from the edge.

③ Apply appropriate tree stabilisation methods

Due to higher wind velocity on elevated roof gardens, staking needs to be more structurally sound than that for general landscaping at the ground level (Fig 1). Besides pole staking, anchors or cabling should also be used to anchor the rootball or tree itself to solid concrete structures (Fig 2). Such anchors should be endorsed by professional engineers to be weight-bearing and should cater for the tree mass at maturity. Due to their weight bearing nature, these anchors can remain with the tree beyond the establishment period.

Fig 1

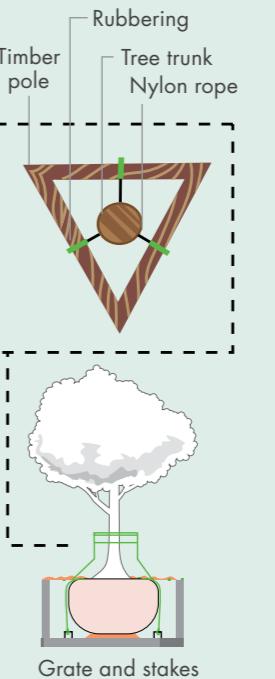
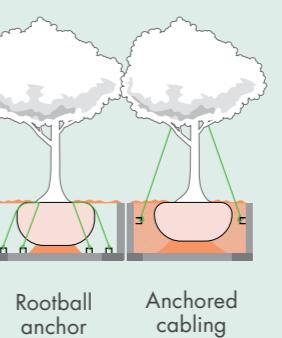


Fig 2



④ Regular maintenance

Periodic canopy thinning through selective removal of branches improves air movement through the tree canopy. This can help mitigate excessive wind load on rooftop trees and palms. As a general rule, rooftop trees and palms should be pruned once every three to six months, depending on the species and the rate of growth.

Pruning strategies to reduce wind loads include crown reduction to reduce plant height, crown thinning to reduce drag, and structure pruning to improve crown form. During periods of drought, strong winds or heavy rain, checks and maintenance should be stepped up.

⑤ Regular tree risk assessments

Trees are living things and their condition alters over time. Regular tree inspections should therefore be carried out by Certified Arborists who are qualified to detect any arising structural defects or potential causes for concern, assess the risks involved, and mitigate them. Such risk assessments should also cover investigations into the soil conditions of the tree and evaluations of the wind conditions that the tree is exposed to. As trees at height can possibly pose high risks, inspections should be carried out once every six to 12 months at minimum. Where risks are higher, greater maintenance frequency should be kept. Ultimately, your own risk management team should determine the frequency of tree inspections and risk assessments.



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For more information on rooftop gardens, visit our website at
www.nparks.gov.sg/skyrisegreenery.

For more information on rooftop gardens and the necessary mitigation measures to take, please refer to CUGE guidelines CS E09:2012 "**Guidelines on Planting of Trees, Palms and Tall Shrubs on Rooftop**", which is available on www.nparks.gov.sg/CUGE.

