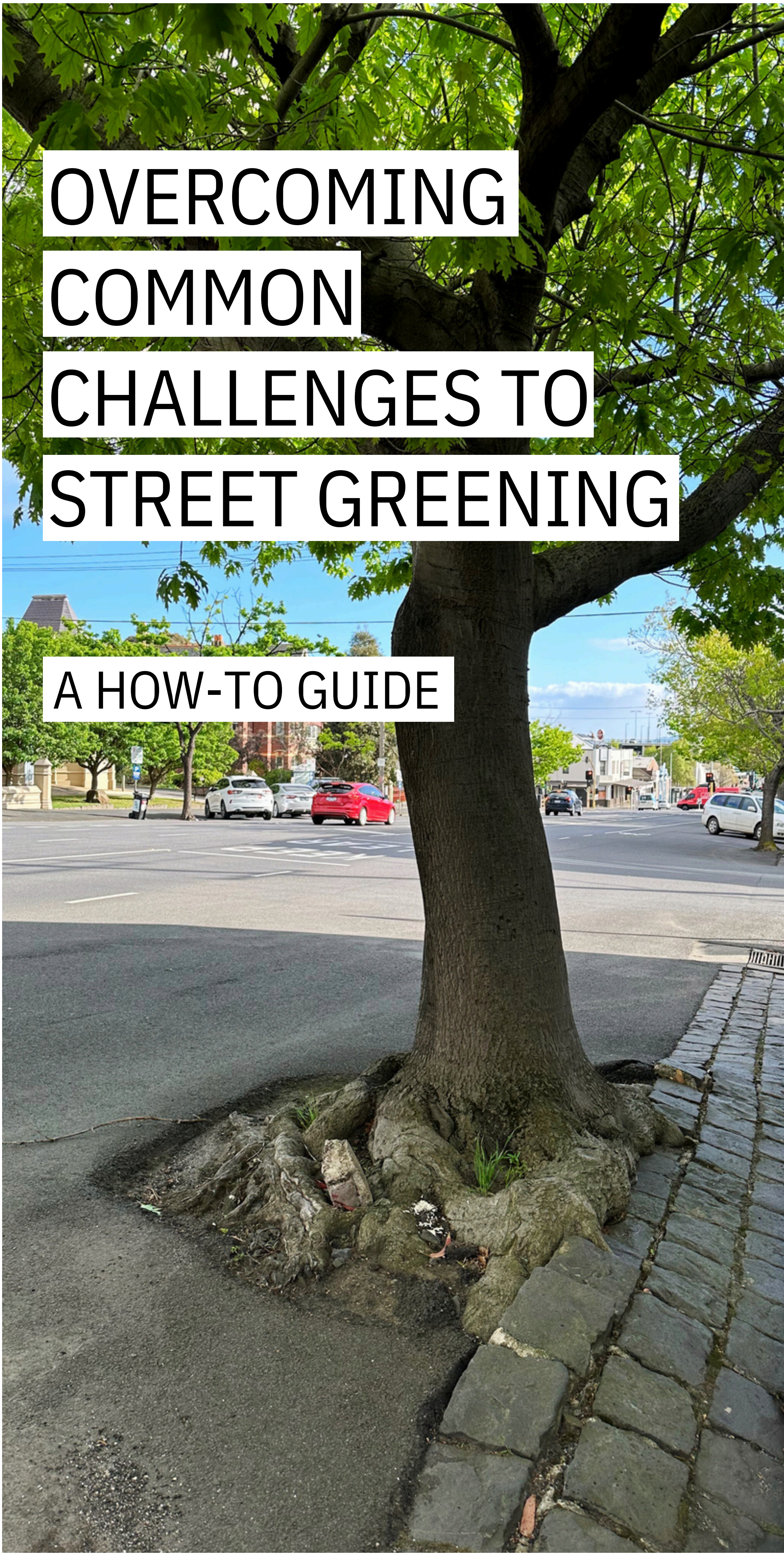
OVERCOMING COMMON CHALLENGES TO STREET GREENING

A HOW-TO GUIDE



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A HOW-TO GUIDE

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The Re-imagining Streets with Green Infrastructure project is an interdisciplinary team spanning urban greening, landscape architecture, engineering and social sciences from the University of Melbourne, in collaboration with partners from Mosaic Insights and RMIT University. The team includes Professor Sarah Bell, Dr. Kylie Soanes, Dr. Marie Dade, Dr. Nano Langenheim, Dr. Kerry Nice, Dr. Dom Blackham, Gavin Chew He Tian, and Dr. Thami Croeser. The project is funded by Hort Innovation and co-investment from the Australian Government, the University of Melbourne and the Victorian Government. The project 'Re-imagining streets with green infrastructure' (GC22011) is a strategic levy investment through the Green Cities Fund, under the Hort Frontiers Strategic Partnerships Initiative. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture. This project has human research ethics approval from The University of Melbourne Project ID #30838.

Cover image: Kylie Soanes

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STREETS CAN MAKE UP AS MUCH AS NINETY PERCENT OF PUBLIC OPEN SPACE AND ARE A CRITICAL TARGET FOR GREEN INFRASTRUCTURE THAT SUPPORTS CLIMATE RESILIENCE, BIODIVERSITY, AND HEALTH URBAN COMMUNITIES.

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INTRODUCTION

Ambitions to retrofit existing streets with green infrastructure, particularly canopy trees, are met with a wide range of technical challenges. However, recent advances in technology, engineering and urban planning provide promising avenues to overcome these challenges and support the creation of green, liveable streets as part of a thriving urban forest.

Drawing on our experience working with communities, local government, and other stakeholders to co-design deep greening retrofits to residential streets, we outline eight commonly presented challenges and concerns, and present guidance on how these can be overcome.

1. Concern about risks to footpaths
2. Lack of irrigation
3. Overhead cables
4. Underground services
5. Heritage bluestone cobbles
6. Narrow footpaths and lack of planting space
7. Dangerous drivers and traffic speed
8. Zero-setback buildings

For each challenge, we share multiple potential solutions, drawn from the latest innovations in urban greening. Given the unique challenges presented by each individual street context, there is no 'one size fits all' solution. However, by presenting a menu of options, communities and land managers have access to a baseline set of tools that can be adjusted and tailored to achieve the desired outcomes for a given site.

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These challenges were raised during the co-design of three residential streets across Melbourne as part of the Re-imagining Streets with Green Infrastructure project. Case studies of solutions devised by the community co-design team are presented throughout this document to demonstrate the solutions in action.

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CHALLENGE 1: CONCERN ABOUT RISKS TO FOOTPATHS

MANY RESIDENTS AND LAND MANAGERS ARE HESITANT TO INCLUDE LARGE TREES IN STREETSCAPES DUE TO THE RISK OF FUTURE DAMAGE TO FOOTPATHS CREATED BY TREE ROOTS. RECENT TECHNICAL ADVANCES CAN ALLEVIATE THESE RISKS BY PROVIDING ADEQUATE SOIL AND IRRIGATION TO SUPPORT TREE HEALTH WITHOUT COMPROMISING SAFE PEDESTRIAN INFRASTRUCTURE.

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PERMEABLE PAVING

Permeable paving systems replace conventional concrete or asphalt footpaths with materials that allow water and air to pass through to the root zone below. Options include permeable interlocking concrete pavers, porous asphalt, and resin-bound gravel surfaces. By enabling moisture and oxygen exchange through the surface, permeable paving reduces the hydraulic pressure that causes roots to lift conventional paths – tree roots are less inclined to grow laterally toward the surface when they can access water and air in deeper layers of the soil profile. The slight flexibility of permeable paving materials also allows them to smoothly accommodate expansion and contraction of soil volumes, which is avoids the trip hazards that arise when asphalt cracks, or single cobblestones are raised unevenly.

Permeable paving also contributes to stormwater management by reducing runoff, which can be a useful co-benefit when justifying additional cost to council, and to tree health, which can translate into strong tree growth outcomes provided waterlogging is avoided. Key considerations in applying permeable paving include higher upfront cost compared to standard concrete, the need for periodic maintenance to prevent clogging of the porous surface, and the importance of specifying adequate sub-base depth for both structural load-bearing and root development. Several Australian councils including City of Melbourne and City of Sydney have deployed permeable paving in streetscape upgrades with positive results.

SOIL VAULTS

Soil vaults (also known as suspended pavement systems or structural cells) create large volumes of uncompacted, high-quality soil beneath the footpath surface by using a load-bearing frame or modular crate system to carry the weight of pavement and pedestrian traffic. By providing ample rooting volume (a good general target is 15–20 cubic metres of soil per tree), soil vaults encourage deep root growth rather than surface-level root spread, dramatically reducing the incidence of footpath heaving. They also improve tree health and growth rates by providing better soil conditions, especially when combined with stormwater infiltration (e.g. from permeable paving or kerb inlets). Installation requires significant excavation, and costs are substantially higher than conventional tree pits – but the long-term savings on footpath repair and tree replacement can offset this, and strongly improve the benefits offered by trees due to greater health and longevity. Soil vaults are particularly effective in constrained urban streetscapes where conventional tree pit expansion is impossible. This approach is also effective in avoiding many of the underground service problems that arise when trees grown in constrained soil volumes grow roots close to the surface (complicating access) or grow alongside underground services due to the less-compacted soils surrounding them (eventually cracking or blocking pipes, or limiting access).

STRUCTURAL SOILS

Structural soils are engineered growing media designed to be compacted to pavement sub-base standards while still providing pore spaces for root penetration, air, and water. The original Cornell University ‘CU-Structural Soil’ uses a matrix of crushed stone (typically 80% by weight) with loam and a hydrogel binder to maintain voids between the aggregate. More recently, ‘Stockholm-style’ structural soils using biochar-enriched topsoil hosed into the voids between the matrix of 30-70mm crushed rock aggregate have gained traction. Structural soils can be installed in wide trenches beneath footpaths, creating connected rooting corridors between trees. They work best in combination with adequate irrigation or passive water harvesting. Key design considerations include specifying the correct aggregate grading to prevent settlement, and ensuring the soil blend meets both structural (CBR) and horticultural requirements.

CHALLENGE 2: LACK OF IRRIGATION

ABSENCE OF ADEQUATE IRRIGATION TO SUPPORT TREE ESTABLISHMENT AND SURVIVAL DURING EXTENDED HEATWAVES LEADS TO POOR OUTCOMES FOR STREET GREENING INITIATIVES. LAND MANAGERS BEAR THE BURDEN AND COST OF REPLACING TREE STOCK AND SUPPLEMENTING IRRIGATION, WHILE COMMUNITY MEMBERS BECOME DISCOURAGED BY UNHEALTHY, NEGLECTED TREES.

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RAINGARDENS

Raingardens are shallow, vegetated depressions designed to capture and filter stormwater runoff before it enters the drainage system. When integrated into tree planting designs, raingardens can direct road and footpath runoff into the tree's root zone, providing passive irrigation with every rainfall event. The design typically involves a depressed planting area slightly below kerb height, a filter media layer (usually a sandy loam blend), and an overflow connection to the stormwater system. In non-arid climates, a well-designed raingarden adjacent to a street tree can supplement water availability by thousands of litres per year depending on catchment area. The key design challenge is ensuring adequate pre-treatment of runoff (leaf litter and sediment can clog filter media) and sizing the raingarden to handle peak flows without flooding the footpath. WSUD guidelines for Australian cities tend to be well-developed, often providing detailed sizing and specification resources. With integrated design, raingardens also provide amenity and biodiversity value through their understorey plantings.

KERB CUTS AND PERMEABLE KERBS

Kerb cuts are simple openings in the roadside kerb that allow stormwater to flow from the road surface into adjacent tree pits or garden beds. They are one of the lowest-cost passive irrigation interventions available, often requiring only a saw-cut in an existing kerb and minor regrading. Permeable kerbs achieve a similar outcome using a kerb unit with built-in openings or porous material that allows water to pass through while still providing the structural and vehicle guidance functions of a conventional kerb. Both approaches work by intercepting sheet flow from the road before it enters stormwater drains, redirecting it to tree root zones. Design considerations include ensuring adequate sediment management (a small rock or gravel filter at the entry point helps), sizing the opening appropriately for the road's drainage catchment, and ensuring the tree pit can handle the volume without creating consistent waterlogging; this is a crucial success factor requiring consideration of surrounding soils, and may require additional works to retrofit underground drainage and/or overflow strategies.

KERB INLETS AND STORMWATER OUTLET DIVERSION

Where kerb cuts alone cannot deliver sufficient water volume, more engineered solutions such as kerb inlets and stormwater outlet diversion can be employed. Kerb inlets are grated or slotted entry points built into the kerb that direct road runoff into a subsurface distribution system connected to tree root zones, often via perforated pipes running through soil vaults or structural soil trenches. Permeable paving materials are beginning to be available for kerb construction, offering the potential for a more diffuse ingress of water that avoids clogging issues that must be carefully managed in existing inlet technologies.

Stormwater outlet diversion involves redirecting flows from existing stormwater side entry pits (SEPs) toward tree planting areas before they enter the underground drainage network. This can be achieved by modifying the pit configuration or adding a diversion pipe. Both approaches require hydraulic design input to ensure flood risk is not increased and that the diverted volumes are appropriate for the trees' water needs. They also require coordination with the drainage authority (typically water authorities and/or local council's drainage engineers). The advantage is that they tap into an existing, reliable water source – urban stormwater, from rooftops or other hardscaped areas – and redirect it to where it can do the most good. Diverting this kind of drainage into a long planting trench with multiple trees, rather than a single pit, can offer the potential for one or two well-considered diversions to water a whole row of trees.

CHALLENGE 3: OVERHEAD CABLES

OVERHEAD CABLES, SUCH AS POWERLINES AND TELECOMMUNICATIONS, OFTEN CONFLICT WITH AMBITIONS TO IMPROVE CANOPY COVER IN RESIDENTIAL STREETS. NEW PLANTINGS UNDER CABLES MAY BE RESTRICTED TO SMALLER SPECIES, OR AVOIDED ENTIRELY, SEVERELY LIMITING OUTCOMES FOR SHADE AND COOLING. RESIDENTS FREQUENTLY EXPRESS OBJECTION TO HEAVILY PRUNED CANOPY TREES.

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AERIAL BUNDLED CABLING (ABC)

Aerial bundled cabling replaces bare overhead conductors with insulated cables bundled together. Because the cables are insulated, clearance requirements are dramatically reduced under legislation for low-voltage lines– trees can grow much closer to (and in some cases in contact with) ABC than bare wires. Advocating for the conversion of overhead lines to ABC in target streets can substantially expand the range of tree species and planting locations available, and reduce expensive pruning obligations. Costs of conversion are often passed onto councils that request ABC treatments, but bundling may also be triggered by asset renewal cycles, safety upgrade programs, or bushfire risk reduction initiatives; working with network operators leveraging these renewals may offer opportunities to reduce costs . Community groups and councils can advocate for priority conversion in streets identified for canopy enhancement. The key constraint is that ABC conversion is a network operator decision and may involve long lead times and widely varying fees.

UNDERGROUNDING

Undergrounding power and communications cables entirely removes the aerial conflict. While it is the most complete solution, it is also by far the most expensive in established urban areas. Undergrounding is occasionally funded through developer contributions (particularly in new subdivisions or major urban renewal areas), council capital works programs, or state government programs. For community-led streetscape projects, undergrounding may be prohibitive unless it can be aligned with other major capital works (road reconstruction, utility renewals) to share excavation costs.

SEEKING REGULATORY REFORM

In some jurisdictions, clearance distance regulations are much more conservative than necessary, particularly for low-voltage lines and insulated conductors. In these cases the costs and negotiations associated with designing around large offset requirements are more a regulatory problem than an issue of technical problem-solving. Community advocates and councils can engage with energy regulators and distribution businesses to seek more nuanced clearance standards that reflect actual risk rather than convenient blanket distances. Rules vary within Australian states, with South Australia offering strong precedents on reduced pruning obligations that better balance tree and fire risks, especially in urban areas with low fire risks. Building a case for reform typically involves compiling evidence on actual failure rates, benchmarking against comparable jurisdictions, building stakeholder alliances, and engaging regulators and political leaders.

AVOIDANCE THROUGH SPECIES SELECTION

A common response to overhead cables is to plant smaller-statured tree species that will not encroach on the clearance envelope. This is not ideal as tree shade tends to be very limited under this approach. Energy Safe Victoria's regulations specify minimum clearance distances from powerlines (currently 1.5m from low-voltage and greater for high-voltage), and many councils maintain approved species lists for planting beneath powerlines. The limitation is that small trees deliver significantly less shade, cooling benefit, and stormwater interception than large-canopy species. In streets where the urban heat challenge is a concern, avoidance alone may be an insufficient response, and should be carefully avoided unless all alternative options are exhausted. In these cases, heat performance can be augmented by strategies such as understorey planting, raingarden or infiltration investments, and closer planting distances (e.g. gaps of 3-4m).

COMMUNITY CO-DESIGN EXAMPLE: ALFRIEDA STREET

The community of Alfrieda Street, St Albans, recognised the constraints imposed by overhead lines. Given their street contained extensive nature strips, the community felt they could achieve meaningful greening gains by tailoring tree species selection, rather than the accept the cost of undergrounding powerlines. Tall shade-casting eucalypts were placed on the open side of the street, while lower growing callistemon were placed under the powerlines.

CHALLENGE 4: UNDEGROUND SERVICES

ADEQUATE SOIL VOLUME IS REQUIRED TO SUPPORT THE GROWTH AND LONG-TERM SURVIVAL OF HEALTHY CANOPY TREES. HOWEVER, THE GROUND UNDERNEATH STREET SCAPES IS OFTEN CROWDED, HOUSING MULTIPLE PIPES AND CABLES FOR WATER, SEWERAGE, OR TELECOMMUNICATIONS. THE RISK OF TREE ROOTS INTERFERING WITH THESE CRITICAL INFRASTRUCTURES, OR PREVENTING THEIR ROUTINE MAINTENANCE, OFTEN LIMITS THE PLACEMENT OF TREES IN STREETSCAPES.

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ROADWAY RELOCATION OF TREE PLANTING

When the footpath zone is heavily congested with underground services, relocating tree planting positions into the roadway (carriageway) can bypass the most constrained areas entirely. This is typically achieved through tree bulb-outs or build-outs that extend the kerb line into the parking lane or traffic lane, creating a planting area in the road pavement zone where subsurface services are often less dense. Roadway planting requires traffic engineering approval and may involve reallocating parking spaces or planting between spaces, but it can access larger soil volumes and avoid the dense service corridors that typically run parallel to property boundaries within the footpath zone. This approach is increasingly common in inner-urban streetscape projects.

ROOT BARRIERS

Root barriers are physical membranes or panels installed vertically in the soil to deflect tree roots away from sensitive infrastructure. Modern root barriers are typically made from high-density polyethylene (HDPE) or geotextile composites and are installed to depths of 600–1000mm. They can protect specific assets (such as a gas main or sewer) while still allowing root growth in other directions. Root barriers are a proven, relatively low-cost technique, but they must be installed correctly – gaps at joints, cracks, or insufficient depth will allow root bypass. They also constrain the tree's rooting volume on one side, so they should be used in combination with adequate soil provision on the unrestricted side. They are not a substitute for providing sufficient rooting space; rather, they are a tool for directing roots within an available volume.

VERTICAL OFFSETS AND SERVICE CONDUITS

Vertical offsets involve adjusting the planting depth or grade level to create vertical separation between tree roots and underground services. Service conduits take a different approach: encasing existing or new services in protective conduits (typically PVC or concrete pipe) that prevent root intrusion and allow future service access without disturbing the tree. Conduits are particularly useful for protecting high-priority services like telecommunications fibre and gas mains. Both approaches require detailed survey information to establish existing service depths before design.

ACCESS AND LIABILITY AGREEMENTS

One of the less-discussed barriers to planting near underground services is not physical but institutional – service authorities often require minimum offset distances from their assets, and these distances may be more conservative than strictly necessary. Negotiating access and liability agreements with service authorities can sometimes reduce these offsets. These agreements typically specify that the tree planting proponent accepts responsibility for any root-related damage to the service, agrees to fund protective measures (root barriers, conduits), and commits to meeting specific maintenance and access requirements. The process requires engagement with individual service authorities (water, gas, electricity, telecommunications) and can be time-consuming, but it may be the only path to planting in heavily serviced streets where physical solutions alone cannot resolve all conflicts. Securing municipality-wide insurance against this category of liability may offer councils an avenue to avoid time-consuming case-by-case liability negotiations.

CHALLENGE 5: HERITAGE BLUESTONE COBBLES

HERITAGE FEATURES, SUCH AS BLUESTONE COBBLES, ARE OFTEN PROTECTED BY REGULATORY OVERLAYS THAT PREVENT OR DISCOURAGE ALTERATION. THIS CAN LIMIT THE CAPACITY FOR INTEGRATED WATER MANAGEMENT AND GREENING, FOR EXAMPLE, WHERE BLUESTONE GUTTERS ARE THE PRIMARY STORMWATER INFRASTRUCTURE.

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USING COBBLED AREAS AS INFILTRATION ZONES FOR SOIL VOLUMES

Bluestone kerb-and-channel drains and cobbled laneways can be designed to be inherently permeable, if the joints between cobbles are bound with a porous substance (e.g. sand, gravel) that allows stormwater to infiltrate into the sub-base. This approach can be enhanced by installing soil vaults or structural soils beneath cobbled areas and using the cobblestone surface as the infiltration entry point. The cobbles are carefully lifted, the soil system is installed, and the cobbles are re-laid on a permeable bedding layer above the vault. This approach preserves the heritage surface while creating valuable soil volume and passive irrigation for nearby trees. In low-traffic locations such as rear lanes, soil volumes may be sufficiently uncompacted to justify simply placing stones over existing soils and ensuring their binding is permeable. This can support attractive vertical growth on walls.

RELOCATION AND SAWING

Where conventional concrete footpaths adjoin heritage bluestone channels or kerbs, replacing the concrete or asphalt of footpaths with the bluestone cobbles after they have received a sawing treatment to flatten their top surfaces can create a visually cohesive streetscape that retains heritage character while also avoiding the creation of ‘no-plant’ zones due to the need to retain cobbles. Sawn bluestone can be laid on a permeable sub-base to provide both heritage-compatible aesthetics and stormwater infiltration benefits. Relocation and sawing of cobbles is the key challenge to be negotiated with heritage advisors, but if approved converts them from a barrier to planting into an attractive footpath surface that frees up kerbside planting space.

CHALLENGE 6: NARROW FOOTPATHS AND LACK OF PLANTING SPACE

WHERE THE STREET ENVELOPE IS NARROW AND CONSTRAINED, PEDESTRIAN EXPERIENCE AND GREENING INFRASTRUCTURE CAN COMPETE FOR SPACE.

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REALLOCATING ROAD SPACE: PARKING REMOVAL AND ONE-WAY CONVERSION

In many narrow inner-urban streets, the roadway carriageway occupies a disproportionate share of the total street width relative to pedestrian and cyclist use. Reallocating road space – by removing one or both sides of on-street parking, converting a two-way street to one-way traffic, or narrowing traffic lanes – can create new planting zones in the carriageway. Parking removal is politically sensitive but increasingly supported by evidence that street trees improve property values and commercial activity, often more than the parking spaces they replace. One-way conversion can free up an entire lane width (typically 3–3.5m) for greening, cycling, or pedestrian use. Both approaches require traffic engineering analysis and community consultation, but they represent the single biggest opportunity to create planting space in constrained streets, and can be scaled up or down to deliver a design that balances evidence-based needs for access, parking and greening. Careful use of co-design and trialling can help reduce risk perception of these treatments, which can often seem politically unviable in initial discussions with communities.

SOIL VAULTS BENEATH FOOTPATHS

Even where the footpath itself is narrow, soil vaults can be installed beneath the paved surface to provide adequate rooting volume without widening the footpath or removing road space. The vault structure carries the footpath loads while the soil within supports tree growth. This is particularly effective where the footpath width is sufficient for pedestrian passage (minimum 1.5m clear) but too narrow for conventional tree pits. The tree itself may be located in a small opening in the footpath, with roots extending through the vault system well beyond the visible tree pit. This hidden infrastructure approach allows canopy outcomes that would seem impossible given the visible surface constraints.

TREE BULBS

Tree bulbs (also referred to as kerb extensions or build-outs) are localised extensions of the kerb line into the road carriageway, typically occupying as little as half a parking space of road length, to create a planting pocket. They are one of the most versatile tools for adding trees to constrained streets and offer the additional benefit of narrowing the perceived road width at the bulb location, which can calm traffic speeds. Tree bulbs can incorporate soil vaults, stormwater capture, seating, and bicycle parking. Design considerations include maintaining adequate traffic lane width, managing sight lines at intersections, providing adequate drainage, and ensuring the bulb does not impede access or unduly block turning circles for waste collection and emergency vehicles.

CHALLENGE 7: DANGEROUS DRIVERS AND TRAFFIC SPEED

THE PRIORITISATION OF STREETS FOR CARS AND TRAFFIC CAN CREATE BARRIERS TO STREET GREENING. RESIDENTS MAY BE CONCERNED ABOUT THE IMAPCTS OF GREENING ON LINE-OF-SIGHT AND FEELINGS OF SAFETY, WHILE REGULATIONS TO MAINTAIN SAFE DRIVING AT SPEED SEVERELY LIMIT THE AVAILABLE PLANTING SPACE.

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ROADWAY REDESIGN FOR A NARROWER FEEL

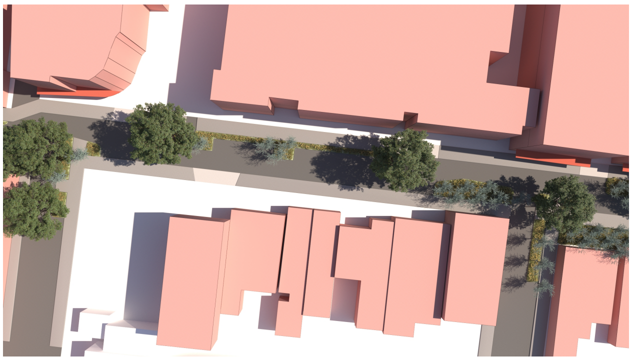
Drivers often drive to the road conditions they see, rather than posted speed limits, in suburban streets. This means they adjust their speed based on the perceived width and enclosure of the road environment. Streets that feel wide and open encourage higher speeds, while streets that feel narrow and enclosed encourage slower, more cautious driving. Streetscape design can exploit this by narrowing the visual field: tree bulbs, larger kerb extensions, greened-up medians can visually reduce lane widths to contribute to a 'narrower feel' without necessarily changing the physical lane dimensions.

'GREEN TRAFFIC CALMING' - TRAFFIC DIVERTERS, CHICANES, AND MEDIANS

Physical traffic calming devices can be combined with tree planting to achieve both speed reduction and canopy goals simultaneously. Planted medians running along the centre of a street narrow the road and provide a planting opportunity. Chicanes – alternating kerb build-outs that force a winding path – create multiple planting pockets while slowing vehicles. Full or partial traffic diverters at intersections can reduce through-traffic volumes (and therefore speed and danger) while creating substantial planting areas at the diverter location; Melbourne streets such as Canning Street, Carlton and Napier Street, Fitzroy employ this approach. These devices are well-established in traffic engineering practice and are typically implemented through council's traffic management programs. The key is to advocate for planted rather than paved versions of these devices, noting the visual role that trees can play in traffic calming as discussed above.

COMMUNITY CO-DESIGN EXAMPLE: BREESE STREET

The community of Breese Street, Brunswick, were strongly motivated to improve the pedestrian experience of their street. Through the co-design process, participants elected to redesign the roadway, reducing its width and reallocating parking spaces to create a 'green meanders'. This served the dual purpose of increasing the area available for greening while also calming traffic. The roadway design was carefully considered based on community needs and known use of the space.



CHALLENGE 8: ZERO-SETBACK BUILDINGS

MANY HIGH-DENSITY RESIDENTIAL AREAS ARE CHARACTERISED BY LOW-TO-NO SETBACK BUILDINGS, WHERE THE BUILDING FOOTPRINT DIRECTLY ABUTS THE FOOTPATH BOUNDARY. THIS NOT ONLY LIMITS THE AVAILABLE PHYSICAL GREENING, BUT CAN ALSO AFFECT THE AVAILABLE SUNLIGHT TO SUPPORT HEALTHY TREE GROWTH. RESIDENTS OF OUR CO-DESIGN WORKSHOPS OFTEN NOTED THAT THE ENCLOSED 'CANYON' OF CONCRETE ADDED TO FEELINGS OF GREYNESS AND 'GLOOM'.

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USING THE PARKING OR TRAFFIC LANE

When buildings directly abut narrow footpaths, the short distance between buildings and potential tree plots can be a barrier to substantial tree planting. In these instances, planting in-ground between car parking spaces, using approaches such as 'Tree Bulbs' or longer kerb outstands (discussed in section 6) may offer a solution. In dense locations where hospitality businesses operate, these kinds of approaches can integrate space for outdoor dining or public seating. This can add to the public appeal of these treatments, easing the process of navigating the trade-off between parking space and green cover.

VERTICAL GREENING SYSTEMS

Vertical greening – including climbing plants on cable or mesh systems, modular living wall panels, and espaliered trees – can deliver canopy cover and cooling benefits on building facades where ground-level planting space is unavailable. Green facades using climbing species such as Virginia Creeper or Boston Ivy (Parthenocissus spp.) or Creeping Fig (Ficus Pumila) are relatively low-cost and can be established from small ground-level planting pits on the building line. More engineered living wall systems using modular panels with integrated irrigation provide greater species diversity and visual impact but at significantly higher cost and maintenance requirements; where budget is available in high-traffic locations, this can offer strong visual impact from the day of installation, and avoid vandalism by placing planter systems above the reach of pedestrian corridors. Vertical greening is not a substitute for tree canopy in terms of shade provision and cooling at street level, but it can substantially reduce building surface temperatures, improve air quality in street canyons, and enhance the visual amenity of hard-edged streetscapes.

CONTAINER PLANTING AND STREETSCAPE FURNITURE

Large container plantings – using robust, well-designed planter boxes or pots – can introduce greenery to streets where in-ground planting is impossible due to building setbacks, underground services, or heritage constraints. As with planting small trees in-ground, this should be seen as a last resort rather than a preferred option; many trees require 20 or more cubic metres of soil to reach healthy sizes. Container-grown trees will not achieve the size or longevity of in-ground specimens, but advances in container design (self-watering reservoirs, root-management systems) can improve outcomes slightly in options with limited alternatives. Containers can be integrated with seating, bicycle parking, or bollard functions to maximise the use of limited footpath space. Window-boxes on building facades offer another lightweight intervention, particularly for retail and hospitality frontages.

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