WARSAW

Designing Cities Around Trees

A Field Case Study in Urban Tree Engineering, Root Architecture, and Streetscape Design

Field observations — Warsaw, July 2026

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Companion to Volume I — Urban Root Architecture Field Study, São Paulo, Brazil

Volume II of the International Urban Root Architecture Series

Scope and Limitations

This is an observational field study based on systematic photographic documentation across multiple Warsaw districts during a single mid-summer field period (July 2026). Its evidentiary basis is field observation of the public realm, checked against the peer-reviewed urban-forestry literature; it does not include municipal records, subsurface investigation, or instrumented measurement, and its interpretations are confined to what surface observation supports. Conditions that are seasonal in expression may be understated in mid-summer imagery. A small number of species identifications are stated as provisional pending confirmation, and §9 lists detail photographs that would further corroborate individual plates. These are the ordinary limits of a public-realm field study and are stated plainly so that readers can weight the evidence accordingly.

Purpose and use. This document is an observational field case study prepared for professional education and comparative reference. It is provided for informational and educational purposes only. It is not a site-specific tree hazard assessment, engineering opinion, or condition report on any individual tree, and no individual specimen is identified by address. Species identifications made from field photography are provisional unless stated as confirmed.

1. Executive Summary

Urban trees do not succeed by chance. Their long-term health depends on engineering, soil volume, species selection, and maintenance sustained across the decades a tree lives. Field observations throughout Warsaw document how contemporary streetscape design can markedly improve root-zone conditions, while older installations reveal the long-term consequences of restricted rooting space — and how the two outcomes are separated not by city or climate, but by the design generation each belongs to and the care it has since received.

The city's recently redeveloped core demonstrates competent, arboriculturally literate design: generous planting beds, permeable and cellular surfaces, engineered root-zone aeration, and verges dimensioned for large-tree soil volume. This sits alongside a legacy stock of severely constrained pits, degraded older base details, and a body of purely decorative, volume-capped planting that contributes ornament but neither canopy nor root-space. The defensible reading is therefore not "Warsaw does it right," but that Warsaw's current design generation does it well — while its best new work remains young enough that its performance at tree maturity is not yet proven.

The study advances five findings, developed across ten field case studies: that usable rooting volume, not visible pit dimension, is the primary driver of long-term tree performance; that modern engineering improves root-zone conditions, though its durability remains to be tested at maturity; that decorative landscaping should not be confused with urban forestry; that root–pavement conflict is predictable and should be designed for rather than discovered; and that veteran trees are best managed as long-term infrastructure assets. A longitudinal re-inspection of an engineered support system — revisited roughly eighteen months after an initial assessment, and revised on the evidence — anchors the maintenance-over-time theme. The purpose throughout is to identify practical, climate-independent lessons transferable to municipalities worldwide, including the author's Miami Beach practice.

Keywords: urban forestry; root architecture; soil volume; street trees; tree pits; pavement conflict; tree support systems; veteran tree management; Warsaw; comparative urban forestry.

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2. Objectives

Warsaw was selected because it offers, within a single temperate European city, an unusually legible spread of streetscape design generations — constrained legacy pits, decorative volume-capped planting, mature legacy stock, and contemporary engineered installations — alongside one of the best-characterized municipal tree resources in Europe. Against that backdrop, this study set out to:

- Evaluate how root-space and soil volume are allocated across the city's streetscapes.
- Compare legacy and contemporary streetscape and tree-pit designs.
- Document engineering innovations in root-zone provision, aeration, and surface treatment.
- Assess the nature and predictability of long-term root–pavement conflict.
- Identify transferable best-management practices for municipal arborists and streetscape designers.

3. Site and Setting

Warsaw is a temperate continental city of approximately 1.86 million people across roughly 512 km² and 18 districts. It sits in frost-hardiness subzone 6b, with long-term minimum air temperatures in the range of −17.8 °C to −20.5 °C — a zone covering roughly 60% of Poland. This study is the second in an international series; Volume I established the method in a subtropical, verticalized South American city (São Paulo), and Warsaw provides the temperate European comparison.

The city's tree resource is unusually well characterized. The Warsaw Tree Crown Map, a whole-city LiDAR and hyperspectral remote-sensing project, identified approximately 7.1 million tree crowns against a city estimate on the order of 9 million trees, with tree-crown cover at roughly 32% of city area and nearly 50 taxa classified with health status. Scots pine, oak, and linden are among the most common taxa. Notably, linden (Tilia) was flagged as being in the worst condition among common taxa — a finding directly relevant to Plates W-1 and W-5b.

Two features of the Warsaw street-tree population are relevant to this study. First, the street palette leans heavily on a few dominant taxa: Norway maple (Acer platanoides) alone comprised roughly 26% of trees on the main streets of central Warsaw in 1973 and approximately 22% by 2002, and linden (Tilia) is among the most common taxa citywide — a reliance that concentrates risk in the health of a small number of species. Second, Polish arboricultural research has explicitly characterized downtown Warsaw growing conditions as extremely unfavorable — Łukaszkiewicz and Kosmala (2008) excluded downtown trees from a regional growth study on precisely those grounds.

Fabric note. Plates in this study span two distinct urban fabrics: the redeveloped central business district (W-1 to W-4) and a low-rise residential/villa district (W-5). Findings from one should not be generalized to the other without qualification.

4. Methodology

Qualitative field observation and systematic photographic documentation, conducted on foot across multiple districts during July 2026. Each site was recorded with a context view (tree, planting pit or bed, and surrounding built environment), and where accessible, root-flare/collar detail and adjacent pavement or kerb condition. Photographs retain original EXIF metadata establishing date, time, and field presence.

Species identifications are made from bark, form, foliage, and characteristic litter, supported in one case by mobile identification software; all are stated as provisional unless confirmed.

One site (W-4) was subject to longitudinal re-inspection, having been documented and publicly assessed by the author approximately eighteen months prior. This constitutes the study's only time-series observation.

> *Scope note. Observations were made during a single mid-summer field period. Conditions that are seasonal in expression — for example, foliar stress symptoms most visible earlier in the growing season — may be understated in mid-summer imagery. Interpretations are confined to what the summer field evidence supports.*

5. Selected Case Studies

The ten field case studies below are ordered along a single gradient — from the most constrained street pit to open park ground — and together cover the themes this study set out to examine: continuous and generous planting beds that increase rooting volume (W-2, W-3); engineered plaza and street-pit systems with aeration, drainage, and permeable surfaces (W-6, W-10); veteran-tree preservation and protected root zones (W-9); habitat-tree and over-mature-tree retention (W-4, W-5a); and root conflict with pavement displacement (W-1, W-7, W-8). Each case is presented with what field observation can and cannot establish; species identifications are provisional unless stated as confirmed.

Case W-1 — Typical Streetscape Confinement

Central district; mature Tilia sp. (provisional); pedestrian allée adjacent to a Metro entrance.

Plate W-1. Mature linden in an undersized pit cut into monolithic paving. Note the perforated aeration/irrigation plate set into the pit surface — evidence of designed accommodation — and the constrained, near-flush root flare.

A mature linden occupies a small square pit cut into a continuous monolithic paver plaza. The pit is undersized relative to current stem girth; the trunk now fills most of the opening and the root flare is constrained and near-flush at grade, with limited visible taper. The surrounding rooting area is effectively sealed by impervious paving.

The pit is nonetheless fitted with a perforated metal aeration/irrigation plate and framed with cut granite edging — evidence of designed accommodation for air and water delivery to the root zone.

Analysis. This is the study's first substantive divergence from São Paulo. The São Paulo plates documented reactive repair — brick-and-mortar infill applied after root overflow had already displaced the surface, with no evidence of design-stage accommodation. This Warsaw pit shows the opposite posture: a deliberately engineered installation that is nonetheless spatially inadequate for the mature stem it now contains. The contrast is intentional-but-insufficient versus reactive-only, and it points to a genuine difference in design culture rather than merely a difference in outcome.

The species matters. Linden is the common taxon the city's own remote-sensing survey identified as being in the worst condition. Documenting the confinement pattern on the city's most compromised dominant taxon is not incidental — it is the intersection of the two.

Plate W-2 — Well-Designed Mature Planting

Contemporary redeveloped pedestrian promenade; Platanus × hispanica (London plane), confirmed.

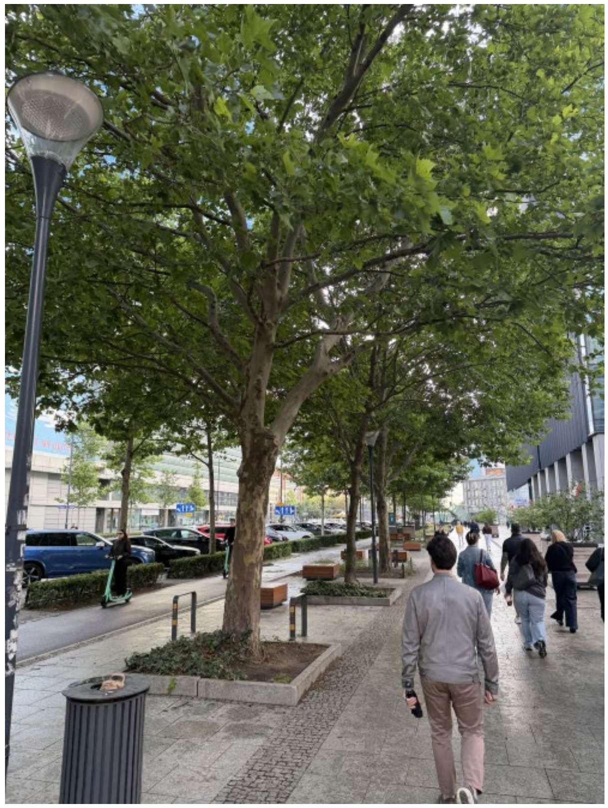

Plate W-2a. Generous granite-kerbed bed with permeable ivy groundcover, bollard protection, and appropriate species selection for a hardscape promenade.

Plate W-2b. Visible, tapered, healthy root flare — the direct contrast with W-1. Note also the ring aeration/irrigation pipe, here sitting exposed on the bed surface, and the bare compacted bed treatment.

A markedly better-executed installation. Species selection is appropriate: plane is the archetypal urban hardscape tree, tolerant of compaction, pollution, root restriction, and heavy pruning. The trees sit in generous granite-kerbed beds with permeable ivy groundcover over the root zone, are fitted with installed ring aeration/irrigation piping, and are protected by bollards. The root flare is visible, tapered, and healthy — not buried or constricted, in direct contrast to W-1. Adjacent granite paving and kerbing are intact within the frame.

Analysis — and a necessary caution. This is genuine good practice and the correct counterpoint to W-1. However, its durability is unproven. These planes are young-to-early-mature. Plane-root pavement conflict is characteristically a full-maturity failure mode, emerging at roughly 25–40+ years as buttress roots enlarge; plane is among the species most notorious for lifting rigid pavement at that stage, precisely because of its vigor and ultimate size. The absence of displacement at this age is the expected baseline, not evidence that the design has defeated the conflict. The flare is already trending toward the granite kerb on one side.

> *The defensible claim is: a well-designed planting demonstrating good practice — species, bed volume, permeable surface, aeration infrastructure — performing without conflict at its current age. Any stronger claim would not survive a hostile reading.*

Two minor deficiencies are noted: the ring aeration pipe sits exposed on the bed surface, suggesting soil settlement or disturbance; and bed treatment is inconsistent across the scheme, with permeable groundcover in some beds and bare compacted sand in others.

Plate W-3 — Generous Soft Verge

Arterial with tram corridor and cycle path; Fraxinus excelsior (provisional) with Betula pendula in the median.

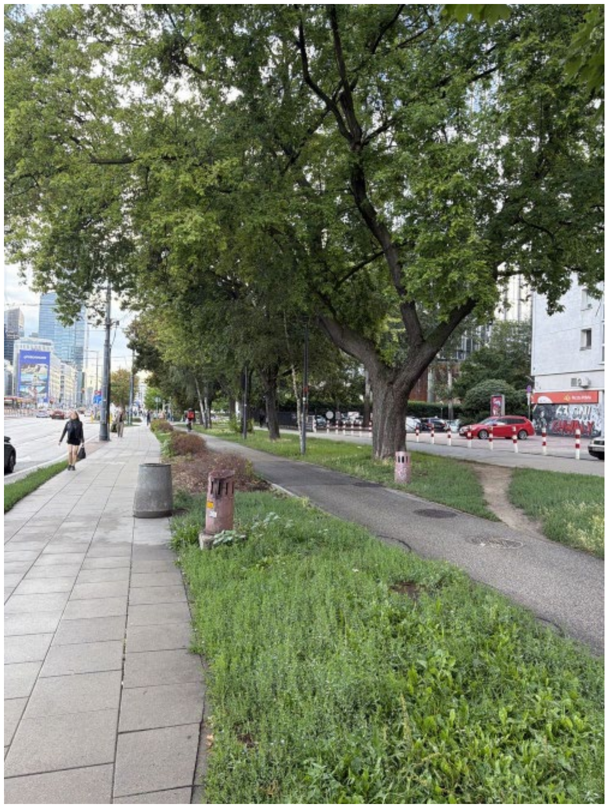

Plate W-3. Continuous unpaved vegetated verge — no cut pit. Effectively unrestricted lateral soil volume and a permeable surface. Note the flexible asphalt path threading past the trees.

Trees growing in a continuous, unpaved, vegetated verge — no cut pit at all. Effectively unrestricted lateral soil volume, permeable grass and herbaceous surface, natural infiltration and gas exchange. Crowns are full and vigorous with good extension growth.

Analysis. This is the low-restriction end of the soil-volume gradient, and the trees respond accordingly. Two qualifications matter. First, this is a street verge, not a park: park-like soil conditions, but with traffic proximity and pedestrian compaction (visible as desire-line wear across the turf). It belongs in the "best street condition" category, not the park category.

Second, and more useful: the path threading through this verge is flexible asphalt, not rigid granite. Where root conflict eventually occurs here, the pavement will deform and heave gently rather than crack into discrete trip-hazard lips, and remediation is a comparatively cheap mill-and-repave. The same root pressure produces a materially lower-consequence, lower-cost failure than it would in the rigid paving of W-1 and W-2. This flexible-versus-rigid distinction is a concrete management lever and transfers to any jurisdiction.

Plate W-4 — Longitudinal Re-Inspection: Engineered Prop System on a Leaning Veteran

Open turf verge adjacent to a busy arterial; Acer negundo (box elder), confirmed. Approximately eighteen-month re-inspection interval.

> *This is the study's flagship plate. Same observer, same tree, same season, an eighteen-month interval, photographically documented — with a published prior conclusion now revised on the evidence.*

Prior assessment (author, approximately eighteen months earlier — published)

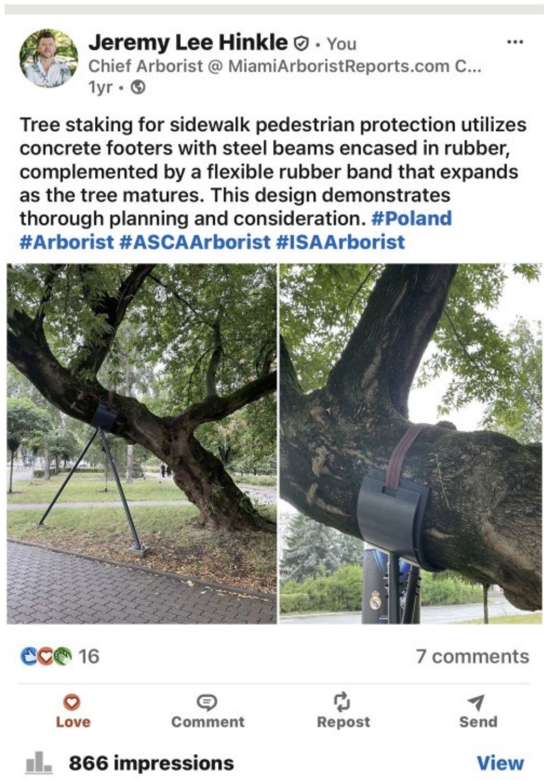

Plate W-4a. The author's prior published assessment. The system was described as employing "a flexible rubber band that expands as the tree matures," and was concluded to demonstrate "thorough planning and consideration."

Current observation

Plate W-4b. The prop system in situ: concrete footers, steel struts, rubber-faced saddle at the upper contact point. The lean is held; footers are stable; the root plate shows no heaving and surrounding turf is intact.

Plate W-4c. THE FINDING. The stem is engulfing the rigid saddle — bark growing around and over the metal contact plate. The early stage of inclusion. The strap and steel saddle do not expand. The stem does.

Plate W-4d. Basal deformity and old wound-callus tissue at the stem base.

Plate W-4e. Author on site at re-inspection, July 2026.

An over-mature box elder with a pronounced lean and heavy lateral limbs is supported by an engineered permanent prop system: concrete footers, steel struts, and a rubber-faced steel saddle secured with a broad strap at the upper contact point.

The prop system is performing its load-bearing function. The lean is held, the footers are stable, the root plate shows no heaving and the surrounding turf is intact. However, the stem is now visibly engulfing the rigid saddle — bark is growing around and over the metal contact plate, the early stage of inclusion. The strap and the steel saddle do not expand. The stem does. The geometry is one-directional.

Analysis. The re-inspection revises the initial assessment. The system is succeeding at load support and failing at long-term stem compatibility. These are two separate verdicts and must be reported as such. The claim that the hardware accommodates growth is not supported by the current evidence.

Three points of professional substance follow

Terminology. This is not staking. Staking is temporary, applied to establish young transplants. This is a permanent prop system supporting a mature leaning veteran — a distinct intervention with a distinct maintenance obligation.

The generalizable lesson. Permanent rigid support hardware installed on a living, expanding stem is a scheduled maintenance liability, not a one-time installation. Absent a defined re-inspection and adjustment interval, the hardware eventually becomes the injury. This applies to any jurisdiction installing props, cables, or bracing — including Miami Beach — and it does not depend on climate.

The retention question. Acer negundo is weak-wooded, short-lived, and treated as a weed or volunteer tree across much of North American municipal practice; a specimen in this condition would be a likely removal candidate. Warsaw has instead committed engineered, concrete-footed infrastructure to retain it. This is examined further in §6.4.

Methodological note. The São Paulo failure data — and most urban tree failure literature — is cross-sectional. This is not.

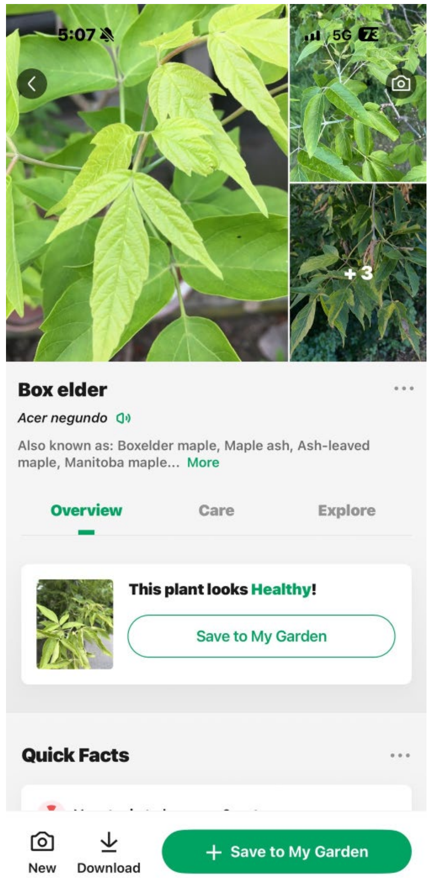

Plate W-4f. Species confirmation: Acer negundo (box elder / ash-leaved maple). Compound pinnate leaves; readily mistaken for Fraxinus.

Plate W-5 — Residential District: Retained Deadwood and Constrained Mature Lindens

Low-rise residential/villa district — a different urban fabric from Plates W-1 to W-4.

5a — Standing monolith

Plate W-5a. A large stem cut to a standing stub with an irregular top and a fresh brush pile behind — but with a decorative iron fence and deliberate groundcover planting installed around its base. A stump awaiting grinding is not fenced and planted.

A large stem cut to a standing stub of roughly three metres with an irregular top, a fresh brush-and-log pile behind it, and — decisively — a decorative iron fence and deliberate groundcover planting installed around its base.

The favored reading is a deliberately retained habitat monolith: standing deadwood conserved for biodiversity value, a documented practice in Central and Northern European urban forestry. Confirmation pending: close inspection of the cut surface and the fence/planting detail.

5b — Constrained mature lindens

Plate W-5b. Mature multi-stemmed Tilia with the trunk at the road edge and a narrow granite-sett apron as the only permeable surface at grade. Legacy stock — and thriving.

Large multi-stemmed mature Tilia with trunks sitting essentially at the road edge, a narrow granite-sett apron providing the only permeable surface at grade, and rooting volume presumably running beneath both carriageway and footway. This is legacy stock, predating the current design generation. And it is thriving — dense foliage, full crowns, heavy flowering and fruiting.

Analysis — an honest complication. These trees are severely constrained at the surface and performing well, which cuts against the clean soil-volume gradient established by W-1 through W-3. The complication is retained rather than suppressed, and it yields a better finding than the simple gradient did.

> *Surface opening size is not the same thing as rooting volume. The granite setts here are permeable, jointed, and sand-bedded, and the street is low-traffic residential; the trees likely enjoy substantially more usable rooting volume and infiltration beneath the surface than the monolithic, sealed paver field of W-1 permits — despite the visible opening looking comparably tight. This is a hypothesis to be explored, not a conclusion to be asserted.*

5c — Park-edge allée

Plate W-5c. Generous leaf-littered open beds with a young staked tree; sits near the W-3 end of the gradient. Not a true park pair.

Plate W-6 — Young Hornbeam in Cellular Permeable Paving

Modern plaza beside a contemporary institutional building; Carpinus betulus (European hornbeam), likely ‘Fastigiata’.

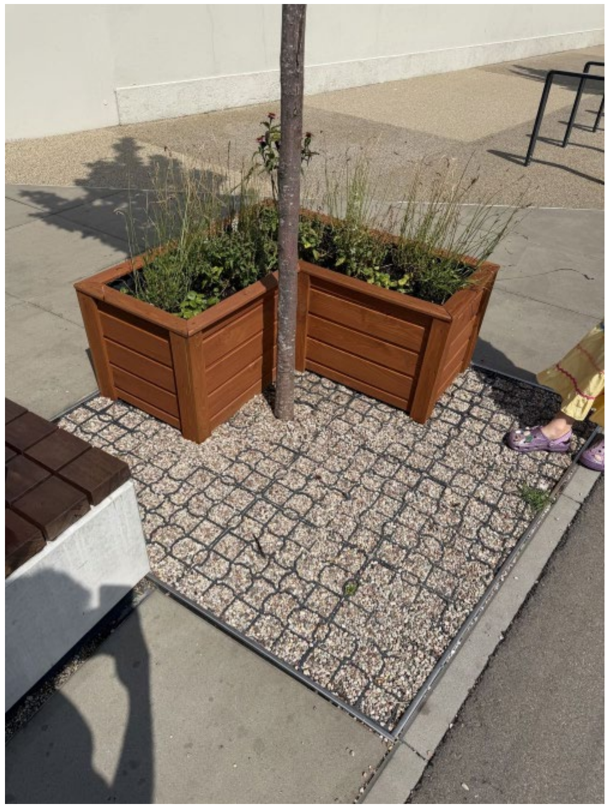

Plate W-6a. The best root-zone detail documented in this study. The tree stands in an open gravel bed retained within a cellular (geocellular) paving grid — a trafficable porous surface that spreads load while keeping the soil beneath uncompacted and open to air and water.

Plate W-6b. Tight fastigiate columnar form — the standard European urban hornbeam selection — in context against the building.

The tree is set in an open gravel bed retained within a cellular geocellular paving grid — a honeycomb load-spreading structure that provides a trafficable porous surface while keeping the underlying soil uncompacted and open to air and water infiltration. It is flanked by timber planters with perennial and grass underplanting.

Analysis. This is the engineered answer to the exact failure mode documented in W-1: sealed, compacted, undersized. It is the strongest permeable-surface detail in the study, and — because it solves the harder problem of an open root zone within a trafficked hardscape — arguably a more impressive demonstration than the open verge of W-3.

The same caution applies as at W-2. The detail is excellent as installed, but its performance-determining variables are maintenance-stage and cannot be assessed at the tree's current age: whether the cell fill stays loose or silts up and seals, and whether it is periodically topped up. The defensible claim is a best-practice permeable-surface detail, excellent as installed, unproven over time. Plate W-7, a short distance away, shows what an aging base detail becomes.

Plate W-7 — Mature Maple by the Museum: Degraded Legacy Base Detail

Park/promenade edge beside a major museum; Acer sp., consistent with mature Norway maple.

Plate W-7a. The counter-evidence, and this time the conflict is visible: the circular brick retaining ring is fractured and displaced, the soil inside is bare, compacted and eroding away from the root plate, and roots are surfacing.

Plate W-7b. The mature maple in context at the museum edge.

A mature maple stands in a raised circular brick retaining ring at its base. The ring is fractured and displaced, the masonry worked loose; the soil inside is bare, compacted, and eroding away from the root plate, with roots surfacing.

Analysis — mechanism matters. This reads less like classic root-heave lifting intact masonry and more like a raised planting ring degrading while the internal grade dropped: soil loss and compaction inside the ring, with slow root movement and weathering working the brick loose over decades. The observation of a damaged brick barrier is correct; the cause is most likely combined soil-loss, compaction, and weathering rather than root pressure alone. The finding that matters here is temporal: a base detail that was presumably sound when installed has degraded across the tree's life for want of maintenance.

> *The matched pair. W-6 (young hornbeam, pristine cellular permeable paving) and W-7 (old maple, degraded brick ring) stand a short distance apart. Best-practice new install versus degraded legacy install, in one city, a short walk apart. This is §6.2 — design generation and maintenance over time are the real variables — made visible in a single pair, and it is the strongest illustration of that finding in the study. It also substantiates the W-6 caution directly: a base detail presumably sound when installed has degraded over decades.*

Plate W-8 — Open-Grown Park Trees: The Comparison Case

Large municipal park, central Warsaw; mature broadleaf specimens including Quercus (oak) and Tilia (linden).

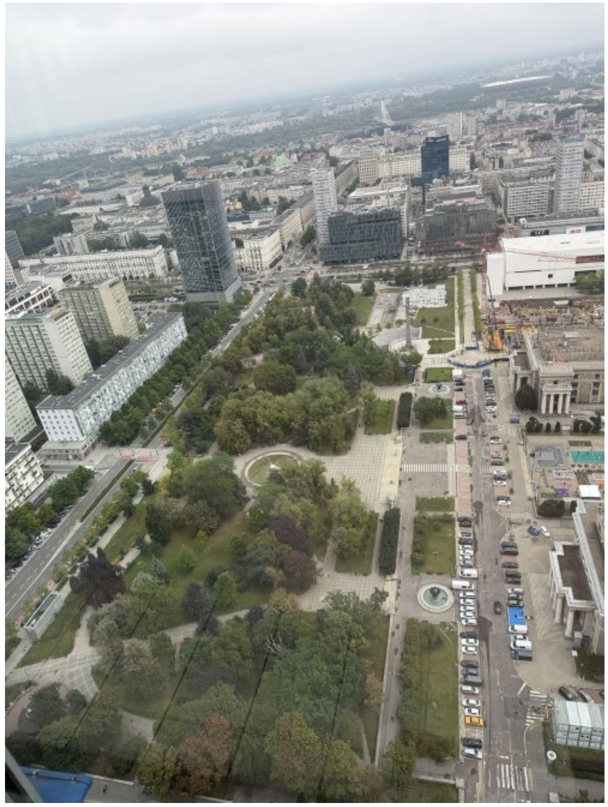

Plate W-8a. Warsaw retains substantial contiguous parkland in the central districts — the open-soil condition against which the constrained street plates are read.

Plate W-8b. A mature park specimen in open ground: full root plate, unrestricted lateral volume, vigorous crown. This is the low-restriction end of the entire study.

Plate W-8c. The honest twist. Even here, where a rigid paved path abuts the trunk, the slabs are heaved and displaced by the root plate — the same conflict documented on the street, occurring wherever a hard edge meets a root system.

Warsaw retains large, contiguous, mature parkland close to its centre. Specimens here grow in effectively unrestricted open soil, with full root plates and vigorous crowns — the low-restriction benchmark the constrained street plates (W-1, W-5b) are measured against. On rooting volume alone, this is as good as the urban environment offers.

Analysis — and the finding that makes this more than a postcard. The park does not abolish root–pavement conflict; it relocates it. Wherever a rigid paved path abuts a mature trunk (Plate W-8c), the same slab heave documented on the street reappears — root plates lift and displace rigid units regardless of whether the setting is "park" or "street." The operative variable is not the land-use label but the meeting of an expanding root system with an unyielding edge. Open soil volume produces the vigour; hard edges produce the conflict; and the two coexist in the same park tree.

This tempers the intuitive "open ground is always better" expectation in the same spirit as the Volume I nuance: parkland delivers the rooting volume that street pits withhold, but it does not exempt a tree from conflict where design places rigid pavement against it. The lesson transfers directly to any setting — the fix is the edge detail (flexible surfacing, offset, or structural spanning), not the postcode.

One further park observation bears on the retention and design themes: young park plantings here are individually labelled and dated — a signage-confirmed Liquidambar styraciflua recorded a 2022 planting date, sponsored by a local institution — indicating a deliberate, documented replanting programme rather than incidental growth.

Plate W-9 — Veteran-Tree Protection in the Historic Core

Castle Square / Old Town approach; mature Quercus robur (English oak), author field identification.

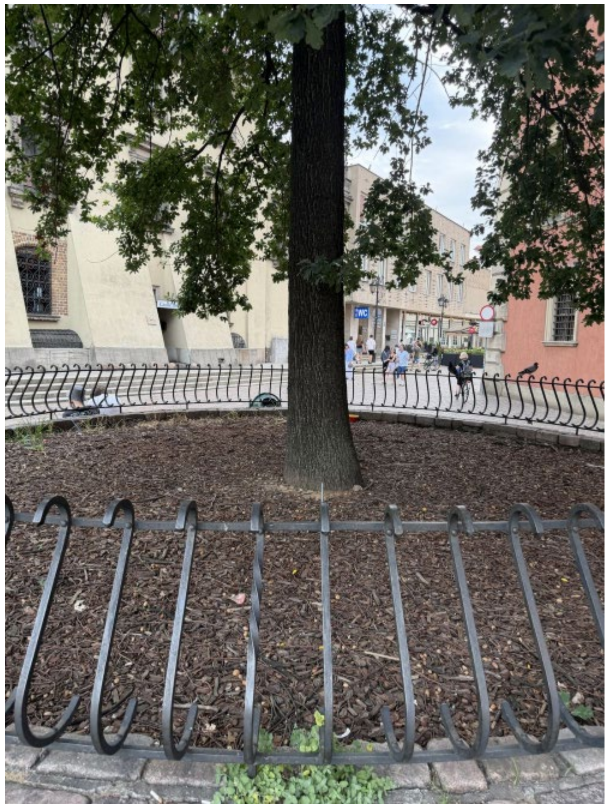

Plate W-9a. A mature English oak retained in the historic core within a raised, bark-mulched bed and an ornate wrought-iron railing that keeps all pedestrian traffic off the root plate.

Plate W-9b. The same tree in context: a high-footfall tourist plaza, with the protective enclosure holding the crowd back from the critical root zone.

A mature English oak stands in one of the busiest pedestrian approaches in Warsaw, retained within a raised brick bed, surfaced with bark mulch, and encircled by an ornate wrought-iron railing. The railing is not merely decorative: in a plaza of this footfall it keeps the entire pedestrian load off the root plate, preventing the soil compaction that is the slow killer of veteran trees in public space.

Analysis. This is the protection counterpart to the retention ethic documented at W-4 and W-5a. Where W-4 showed Warsaw investing engineered hardware to retain an over-mature, low-value tree, this shows the city investing bespoke protective infrastructure to keep a genuinely valuable veteran alive in the hardest possible setting — a compaction-generating tourist crush. The raised bed maintains grade and rooting volume; the mulch surface preserves infiltration and gas exchange; the railing excludes the load. It is, in the plainest terms, how you keep a large old tree in a place that would otherwise kill it. It is also a direct, transferable model for high-footfall civic spaces elsewhere, Miami Beach included.

Plate W-10 — Contemporary Engineered Pits: Current Best Practice

Redeveloped historic high street and adjacent plaza; young street trees in engineered surface systems.

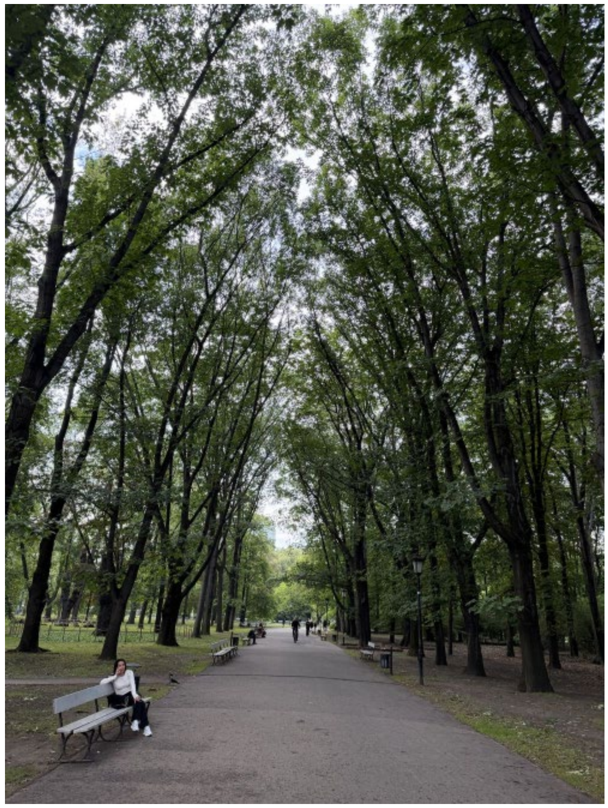

Plate W-10a. A modern tree pit combining a circular stem guard with a radial cast grate over an open, pebble-dressed root aperture — a load-bearing, trafficable, permeable surface with a protected collar.

Plate W-10b. A plaza treatment distributing many small pebble-filled aeration/infiltration inlets across the paved surface around each tree, extending the effective porous area far beyond the pit opening.

Two of the most sophisticated root-zone details in the study, both from recent redevelopments. The first (W-10a) pairs a circular stem guard with a radial cast grate over an open, pebble-dressed aperture: the collar is protected from mechanical damage, and the surface remains trafficable while admitting air and water. The second (W-10b) distributes a field of small pebble-filled inlets across the plaza paving, extending infiltration and gas exchange well beyond the immediate pit — an attempt to give a trafficked hardscape something approaching the porous rooting area of open ground.

Analysis. These are the engineered answer to the W-1 failure mode, and the most advanced surface details Warsaw showed. They belong with W-2, W-3, and W-6 at the competent end of the design-generation gradient. The same caution applies as throughout: excellent as installed, and unproven until the trees mature and the systems have been maintained (or not) across decades — the point W-7 makes concrete. Documented here as current best practice, not as proven durability.

6. Major Findings

6.1 Soil volume is the limiting variable — but rooting volume, not surface aperture

The gradient from W-1 (sealed, minimal) through W-2 (engineered, adequate) to W-3 (open, near-unlimited) tracks tree vigor as the established literature on restricted soil volume would predict. Plate W-5b sharpens this: the operative variable is the volume and permeability of the rooting environment, which the size of the visible surface opening only imperfectly indicates. A narrow, permeable, sand-bedded sett apron over a low-traffic street may deliver more to a tree than a comparably sized aperture cut into a sealed monolithic slab.

6.2 Design generation, not the city, is the real variable

Competent root-space provision in Warsaw is concentrated in new and rebuilt areas. The mature canopy that makes the city feel green is legacy planting — it succeeded under older conditions, or in verges that happened to be generous, not because of the current design philosophy. These are two separate stories, and the young, well-designed plantings must not be permitted to borrow credibility from the old, large trees.

Plates W-6 and W-7 make this visible in a single matched pair. A short walk apart stand a young hornbeam in a pristine cellular permeable-paving detail (W-6) and a mature maple in a fractured, degraded brick base ring (W-7). The variable that separates them is not species, climate, or district — it is the design generation each belongs to, and the decades of weathering the older detail has undergone. The pairing also carries a warning for the newer work: W-7 is a plausible future state of W-6 if the permeable detail is not maintained.

6.3 Support hardware as a scheduled liability

Rigid hardware on an expanding stem has a one-directional geometry. Without a defined re-inspection and adjustment interval, the intervention becomes the injury. This is a transferable management finding independent of climate zone. (From W-4.)

6.4 A distinct retention ethic

Two independent observations — engineered propwork retaining an over-mature, low-value Acer negundo (W-4), and apparent deliberate retention of standing deadwood as habitat structure (W-5a) — point to a value that diverges from the North American removal-and-replace default. Two independent observations of one underlying value constitute a pattern, not an anecdote. This is a genuine cross-cultural finding and it bears directly on §8.

6.5 Decorative planting is not canopy investment

Raised granite planters in the central district: dwarf conifers and prostrate junipers in volume-capped beds. Ornamental hardscape — not urban-forest root-space provision. Note also the visible structural failure in the planter walls.

Raised granite planters containing dwarf conifers, observed in the central district, are volume-capped by design and can never support a large tree. They are ornamental hardscape, not urban-forest root-space provision. The distinction matters when a city's greening effort is evaluated on outcomes rather than appearances — these installations read as "green" in a photograph and deliver no canopy, no shade, and no meaningful ecosystem service.

6.6 Retention and time

A theme running through the plates is temporal: the same intervention can be a success or a liability depending on when it is assessed. The W-4 prop system holds a load while slowly being engulfed; the W-6 permeable detail is excellent as installed and unproven over decades; the W-7 brick ring was presumably adequate once and has since failed. Read together, these argue that urban tree installations are not one-time works but standing commitments, and that the decisive question for any detail is not how it looks on the day of planting but how it behaves across the tree's life. This reframes "good design" as inseparable from maintenance obligation — the through-line of §6.3 and §6.4.

7. Street Versus Open-Space Comparison

With the park plates (W-8) in hand, the comparison the series has been building toward can be stated directly. Holding species roughly constant across the study's oaks, lindens, and maples, the difference between a constrained street position and open park ground is stark in one respect and surprisingly modest in another.

Where the settings differ: vigour and rooting volume. Open-grown park specimens (W-8b) carry full root plates and dense, well-extended crowns; the constrained street trees (W-1, W-5b) survive on a fraction of the usable soil volume, and the most severely confined of them (the sealed pit of W-1, on the city's worst-condition taxon) show it. On rooting volume, open ground wins decisively, and it is the single largest lever available to an urban forester.

Where the settings do not differ: edge conflict. The park does not exempt a tree from root–pavement conflict. Plate W-8c shows rigid path slabs heaved and displaced by a park oak's root plate — the identical failure mode seen against street paving. Conflict is a function of the hard edge, not the land use. A park tree with a rigid path laid against it will lift that path exactly as a street tree does.

The synthesis is therefore not "parks good, streets bad." It is that rooting volume and edge treatment are two independent variables. Parkland supplies volume by default but still generates conflict wherever a rigid edge is placed against a trunk; a well-engineered street pit (W-2, W-6, W-10) can supply usable volume and a forgiving edge in the hardest setting. The design levers — volume, surface permeability, and a flexible or offset edge — are the same in both, which is precisely why the findings transfer across settings and cities.

This preserves rather than discards the nuance raised in Volume I: open ground is not automatically superior in every respect. It is superior in rooting volume, neutral on edge conflict, and dependent, like everything else in this study, on the specific detail where root meets built surface.

8. Lessons for Municipal Arborists

The lessons that transfer are climate-independent. Because this study's findings turn on design, rooting volume, and maintenance over time rather than on any regional weather mechanism, they carry directly to other cities — including the author's Miami Beach practice — without translation.

What does transfer:

Rooting volume over surface aperture (§6.1). The most actionable finding. Specification should be written around usable rooting volume and surface permeability, not planting-pit dimensions.

Flexible versus rigid pavement economics (W-3). Where root conflict is foreseeable, flexible pavement converts a rigid-pavement trip-hazard-and-replacement problem into a deformation-and-repave problem. This is a specification lever available immediately.

Support hardware as a maintenance obligation (§6.3). Any cabling, bracing, or propping installed on a living stem requires a defined re-inspection interval written into the works order. Warsaw's example demonstrates the failure mode at eighteen months' remove.

The design-generation caution (§6.2). New, well-designed plantings should not be evaluated as proven until they reach the maturity at which the relevant failure mode actually occurs.

The retention question (§6.4). Whether Central European retention of over-mature and dead structure is a value Miami Beach should adopt, adapt, or decline is a policy question — but it should be an examined one rather than a default.

9. Further Work

Items identified to further strengthen the study:

- A mature plane in active pavement conflict, demonstrating what the young W-2 planting becomes at 30+ years absent management.
- W-4 macro: a tight detail of the bark-to-metal contact at the lower saddle, to make the stem-engulfment finding unarguable.
- W-5a confirmation: the cut surface and fence/planting detail, to settle deliberate deadwood retention versus an abandoned removal.
- W-6 detail: the cellular-grid fill condition (loose versus silted) — the maintenance variable on which that plate's long-term performance depends.
- Species confirmations: W-2 plane (second specimen), W-3 ash, W-6 hornbeam cultivar.
- Desk task: a Warsaw or Polish street-tree failure or condition study to anchor the discussion quantitatively; likely Polish-language.

10. Conclusion

Warsaw shows, within a single city, that the success of a tree in the urban environment is decided less by species or setting than by three design-side variables: the usable rooting volume it is given, the design generation its installation belongs to, and whether that installation is maintained across the decades the tree lives.

The confinement gradient (W-1 through W-3, extended by W-6) demonstrates the first: vigor tracks rooting volume, and — as the constrained-but-thriving lindens of W-5b show — it is usable volume beneath the surface, not the visible aperture, that matters. The matched pair of W-6 and W-7 demonstrates the second and third: a pristine contemporary permeable detail and a degraded legacy one, a short walk apart, separated not by location but by the design era each belongs to and the maintenance each has or has not received. And the W-4 longitudinal re-inspection supplies what a single visit cannot — direct evidence that a well-engineered intervention can be simultaneously succeeding and self-defeating, its rigid hardware slowly engulfed by the living stem it supports.

The practical conclusion is that urban tree installations are standing commitments rather than one-time works. Specification should be written around usable rooting volume and surface permeability; support and edge details should carry defined re-inspection intervals; and new, well-designed plantings should not be judged proven until they reach the age at which the relevant failure modes actually appear. These lessons are independent of climate and transfer directly to other municipalities, including Miami Beach.

The street-versus-open-space comparison (§7) sharpens the same point: open parkland supplies rooting volume by default, but it does not exempt a tree from conflict where a rigid edge is placed against it. Rooting volume and edge treatment are independent design variables in every setting — which is exactly why a well-engineered street pit can outperform an ill-detailed park edge, and why the levers identified here apply wherever a root system meets a built surface.

11. References

Field observations in this study are interpreted against the following sources. Bibliographic details have been verified against the primary records; where a municipal dataset rather than a journal article is cited, it is identified as such.

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12. Appendices

Appendix A. Field presence documentation (EXIF-timestamped).

Appendix B. Professional dissemination — LinkedIn. Note: the W-4 re-inspection lends itself to a follow-up post revising the author’s own prior public assessment. Self-revision on evidence is a credibility asset, and it timestamps the longitudinal work in the public record.