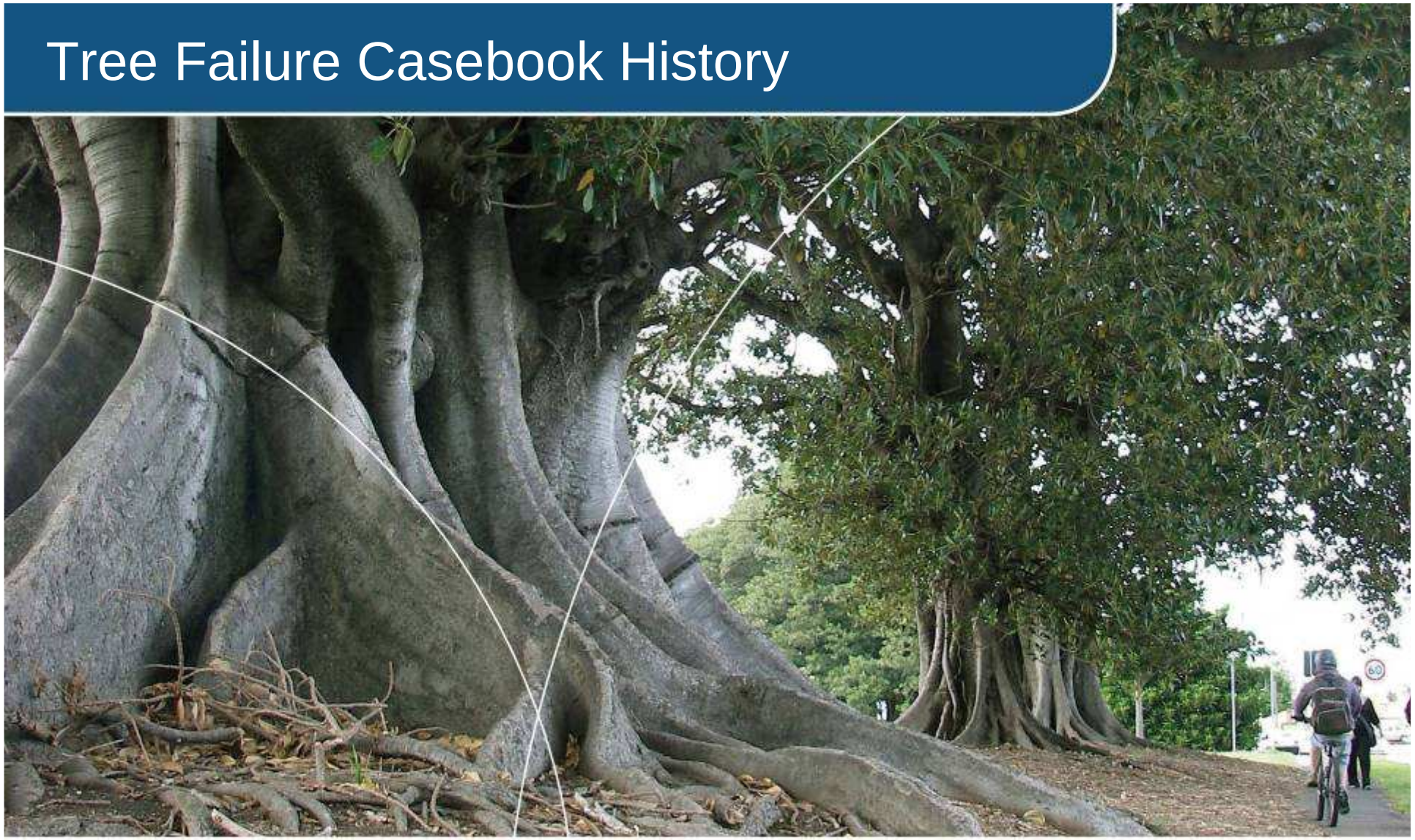
Tree Failure Casebook History



Informing Tree Management in Newcastle

2000 - 2011

The City of Newcastle

Background

Newcastle City Council has collated a 12 year record of tree failures and tree damage to inform risk management decisions on mature trees in the public domain. This casebook history makes particular mention of Hills Weeping Fig because of the large number of mature specimens growing in the inner city streets and Parks.

Hills Weeping Fig (*Ficus microcarpa* var Hillii) was planted throughout greater Newcastle from about 1930 onwards in part to address criticisms that described the city as treeless and unattractive.

It is believed that a majority of the Hills Figs planted in Newcastle during the 1930's were propagated at the Sydney Royal Botanic Gardens from cuttings taken from a single tree in a Brisbane park. Therefore most of Newcastle's mature Hills Figs are likely to be clones i.e. genetically identical to the parent tree. A structural weakness in the parent tree such as an inherent defect in branch attachments in Hills Fig can be expected to be evident in the propagated offspring.

In accordance with the practice of the day, Newcastle's Hills Fig trees were routinely 'lopped' to form a stout short trunk with a multi-stemmed branch habit that could be kept neat and rounded. The 'lopping' ceased in the late 1970's and many of the 'lopped' figs grew rapidly eventually exceeding 20m in height and 30m width despite extreme limitations on available root space due to buildings, road pavement and utilities.

Perhaps the early planters of Hills Figs envisaged the trees would be continuously 'lopped' and so the potential size was not an impediment to planting in Newcastle streets. History has shown otherwise and despite their size and stature, there is an increasing urgency to plan and manage the inevitable replacement of the trees that have not only outgrown their available space but which have degrees of weakened branch systems as a legacy of their early 'lopping' history and inherent parent characteristics.

Lopped street trees in Laman Street in the early 1930's.

Routine lopping was widespread practice that continued until late 1970's.

Lopping created a legacy of poorly structured trees that Newcastle is still addressing today.

PHOTO - the large lopped tree in the foreground is one of four Moreton Bay Figs that preceded the 1930's planting of the lopped Hills Figs in the background.

Background Investigations

Between 2000 and 2010 the City Arborist and an independent arborist systematically assessed and reported on Hills Figs, Moreton Bay Figs, other fig species and other large mature species in city streets and parks.

They applied the Visual Tree Assessment (VTA) methodology described by Mattheck* for the systematic assessment of tree health and mechanical structure. Where they saw evidence of a defect or apparent growth anomaly they applied a stage 2 VTA evaluation to assess the defective parts. The stage 2 assessments variously involved micro-drilling, aerial assessment, pathology testing, and excavations to investigate root crowns and structural roots.

These investigations were necessary in order to address Council's duty of care responsibilities by proactively managing trees that pose a potential risk. The investigations culminated in a casebook history to assist in the ongoing management of risk in the Newcastle public urban forest.

* Mattheck, C, and Breloer, H. (1999) '*The body language of trees a handbook for failure analysis'* HMSO London

Visual Tree Assessment (VTA)

The method proceeds in three stages:

1. Visual inspection for defect symptoms and vitality. If there is no sign of a problem, the investigation is concluded.

2. If a defect is suspected on the basis of symptoms, its presence or absence must be confirmed by a thorough examination. (VTA stage 2)

3. If the defect is confirmed and appears to be a cause for concern, it must be measured and the strength of the remaining part of the tree evaluated

** The tree is a chain of equally strong members. The stem gathers, so to speak, the bending loads borne by the branches and conducts them downwards into the rootstock from which they are redistributed through a ramifying root system that finally transfers them to the ground*

* Mattheck, C, and Breloer, H. (1999) '*The body language of trees a handbook for failure analysis'* HMSO London

The relevance of a casebook history to addressing the Laman St Fig trees

Council's and other investigations have found that Hills Fig trees growing in Newcastle's streets and footpaths develop characteristically eccentric root plate architecture i.e. the roots are confined by kerbs, pavement and foundations and tend toward a linear form aligned with the kerb direction.

This raises the question *"How can we assess the stability of trees that have eccentric root systems confined by dense infrastructure, and does the research provide assistance?"*

Lonsdale (1999) says *"the criteria for root-plate stability are less certain than those that are now widely accepted for assessing the strength of hollow stems and in any case only apply to the lateral roots of trees with symmetrical root systems".*

He adds "*for the present, considerable subjectivity is involved in the assessment of trees with eccentric root systems…and in such cases, casebook experience of the tree species…may be valuable."* (underline added)

Lonsdale, D (1999) 'Principles of Tree Hazard Assessment and Management.' HMSO, London

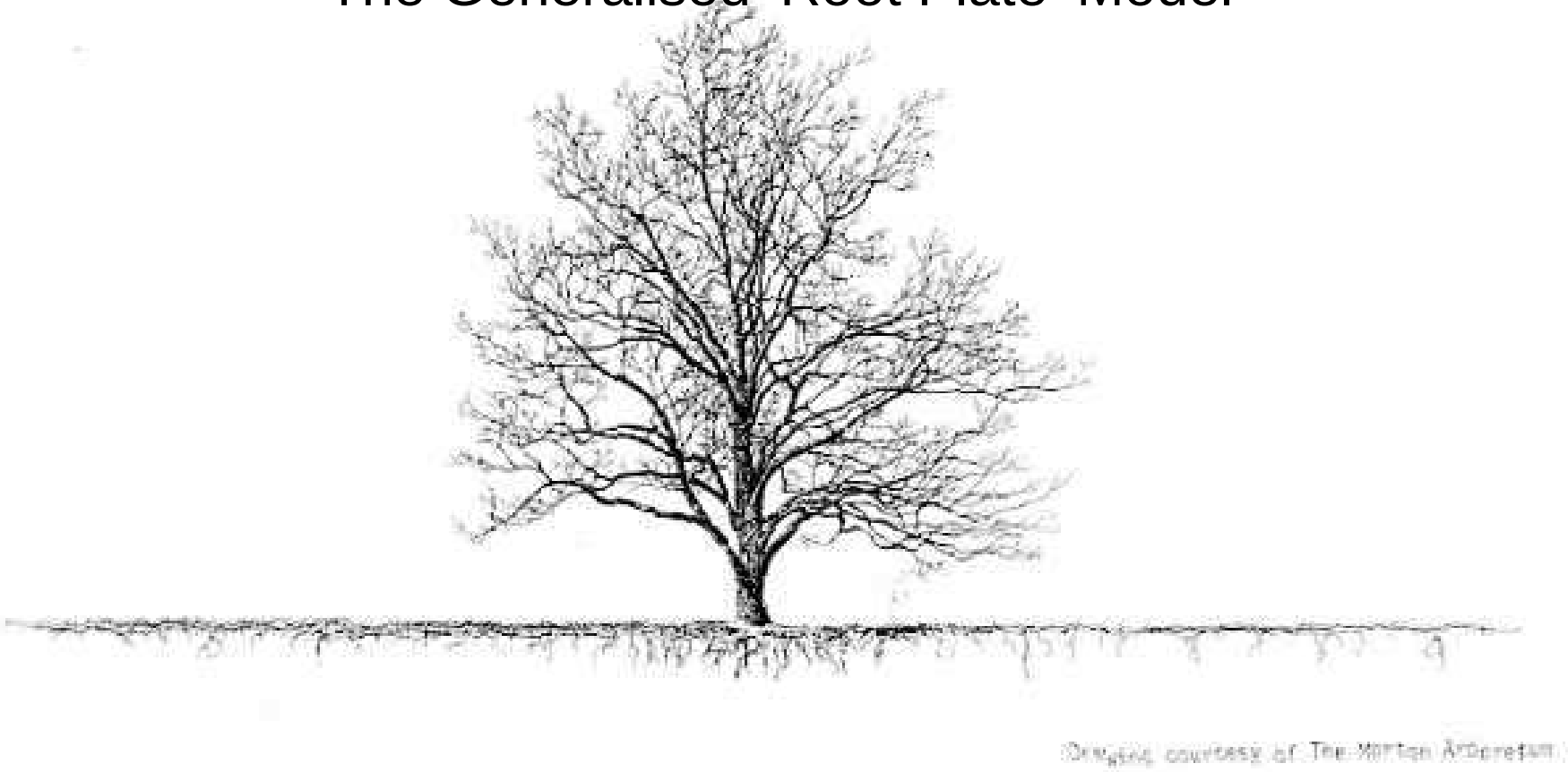
Summary of large tree failures in Newcastle 2000 - 2004

Year	Species	Age	Location	Reason
2004	Hills Fig	Mature	Civic Park	Bark inclusion
	Paperbark	Mature	Hamilton	Bark inclusion
	Kaffir Plum	Mature	Civic Park	Bark inclusion
2003	Hills Fig	Mature	Tyrrell Street	Roots system failure
	Hills Fig	Mature	Tyrrell Street	Roots system failure
	Hills Fig	Mature	Tyrrell Street	Roots system failure
	Moreton Bay Fig	Mature	Richardson Park	Health decline and decay
	Kaffir Plum	Mature	Howe St Playground	Bark Inclusion
2000	Hills Fig	Mature	Tighes Hill TAFE Campus	Root decay
	Hills Fig	Mature	Tighes Hill TAFE Campus	Root decay
	Hills Fig	Mature	BHP Industrial Drive	Bark inclusion
2002	Port Jackson Fig	Mature	Gregson Park	Decayed roots and trunk
2000	Kaffir Plum	Mature	Civic Park	Decayed roots and trunk
	Hills Fig	Mature	Civic Park	Bark inclusion
	Hills Fig	Mature	Civic Park	Bark inclusion

Summary of Fig Removals after VTA stage 2 testing 2000-2003

Year	Species/Age		Location	Reason
2003	Small Leaf Fig	Mature	Church St	Hollow trunk base exceeds published threshold
	Moreton Bay Fig	Mature	Church St	Hollow trunk base exceeds published threshold
	Port Jackson Fig	Mature	Dennison St Hamilton	Hollow trunk exceeds published threshold
	Port Jackson Fig	Mature	Laman St – Cooks Hill	Bark inclusion - decline
	Hills Fig	Mature	Civic Park – Auckland St	Roots & power cables intertwined
	Hills Fig	Mature	Civic Park – Auckland St	Decay in trunk base
	Moreton Bay Fig	Mature	Dan Rees - Wallsend	Decayed trunk
	Moreton Bay Fig	Mature	Islington Park	Hollow trunk exceeds published threshold
	Moreton Bay Fig	Mature	Islington Park	Hollow trunk exceeds published threshold
2000	3 Moreton Bay Fig	Mature	Wallsend	Hollow Trunk & Branches exceeds published threshold

The Generalised ‘Root Plate’ Model



The generalized & unimpeded root system is
broad and shallow (often only 200-300mm deep) with load bearing
(structural) roots extending radially 2-4m with descending (sinker) roots
below the trunk. Non structural fine ‘feeder’ roots are wide-spreading often
beyond the edge of canopy (drip line)

Graphic source - The Morton Arboretum

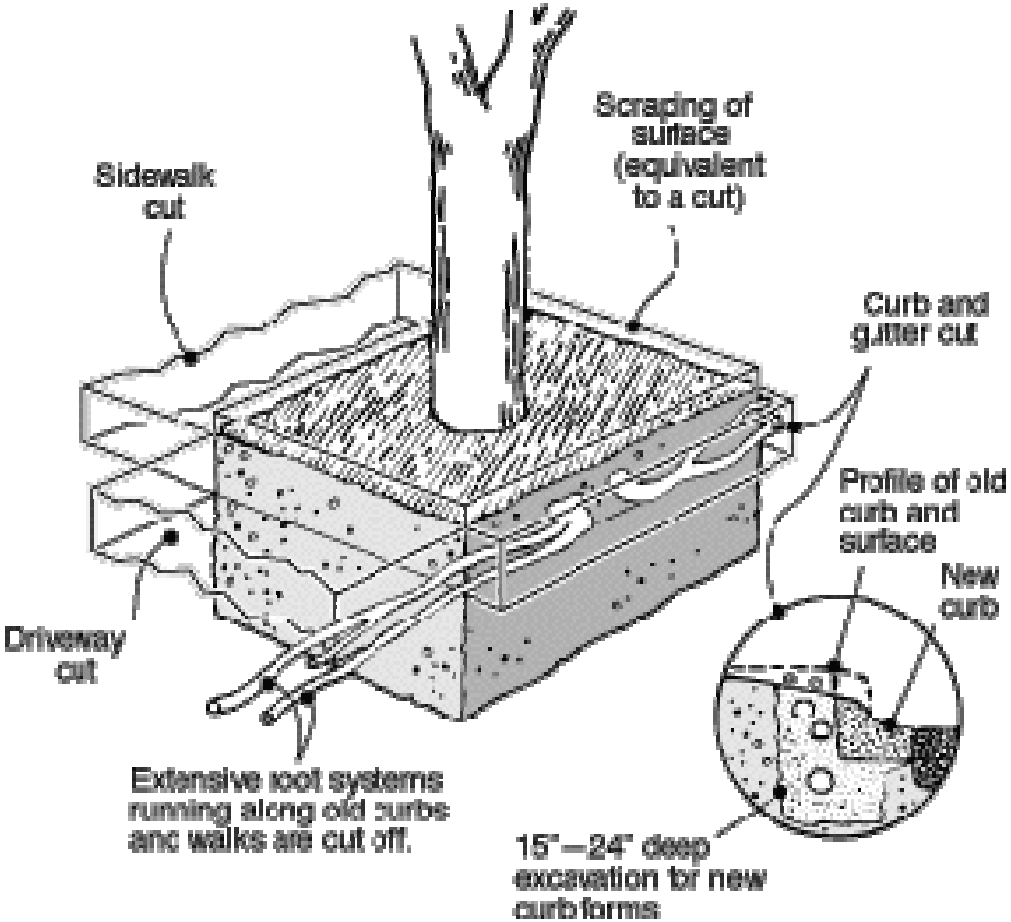
Hills Fig. Typical root crown and buttress development in the absence of urban infrastructure

Hills Fig – characteristic root buttress development in open ground

Utility Installation Civic Park

Non destructive excavation 1m from the trunk of Hills Fig in Civic park (ID14806) reveals structural and non-structural root development typical in sites where infrastructure (kerbing and pavement) does not prevent the radial development of the root system.

The Linear (eccentric) Root System common in streets & footways



The linear root system is caused by physical limitations to the radial spread of roots.

Road pavement, kerbing, guttering and repeated excavation by road authorities and public utilities restrict or sever stabilising roots

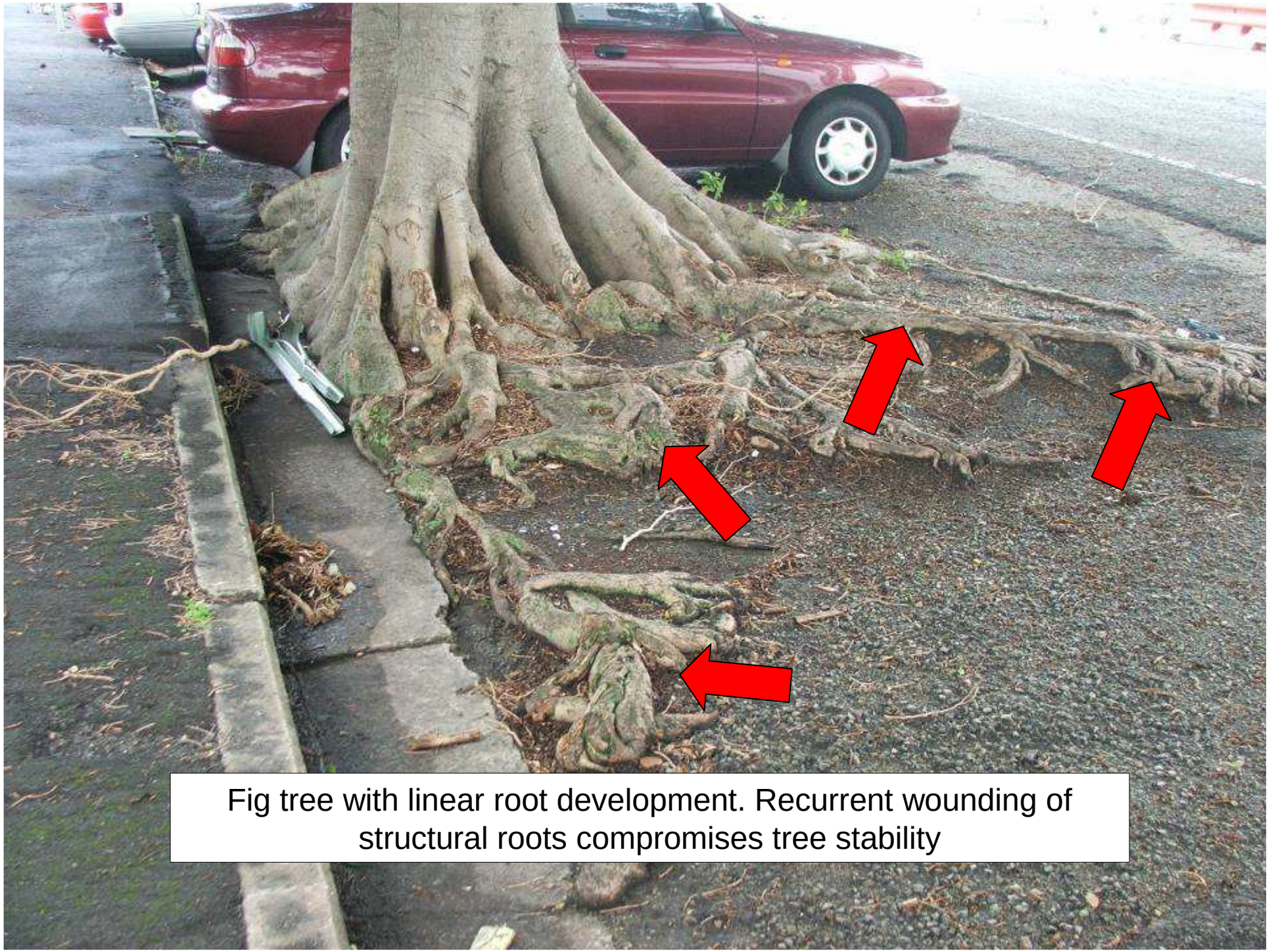


Fig tree with linear root development. Recurrent wounding of structural roots compromises tree stability

Soil Conditions in the Root Zone

Soil conditions under roads, footpaths and in most parks in the older parts of Newcastle have been extensively disturbed and often bear little resemblance to natural soils. Most inner urban trees have been planted into these disturbed soil profiles that were substantially altered by past human activity*

Scalpic	Cut land surfaces in which natural topographic contours are broken and ‘rock structure’ occurs near the surface
Garbic	Organic solid waste and/or a large concentration of methane occurs in the soil atmosphere to within 1 or 2 m of the soil surface, eg sanitary land fill
Urbic	Miscellaneous urban fill with manufactured inorganic artifacts eg bricks, glass and concrete **(typically Civic Park and Laman St)**
Spolic	Locally derived moved earthy material, but without artifacts
Dredgic	Soils containing dredged materials

A classification of soil types commonly found in urban environments, from: Smith, K.D. (1997) *Post Transplanting Responses of Tree Roots to Flooding and Season of Planting,* Masters of applied science Thesis, University of Melbourne

Observations

Tyrrell Street, The Hill

What is the relevance of the Tyrrell St investigations in assessing the Laman Street Hills Figs?

The trees on the southern side of Laman street have few if any compressive roots to provide adequate anchorage against southerly winds. Similarly, they very limited tensile roots.

The trees on the northern side have no apparent tensile roots as the kerb has deflected the potential tensile roots to run parallel to the kerb and perpendicular with the prevailing wind load.

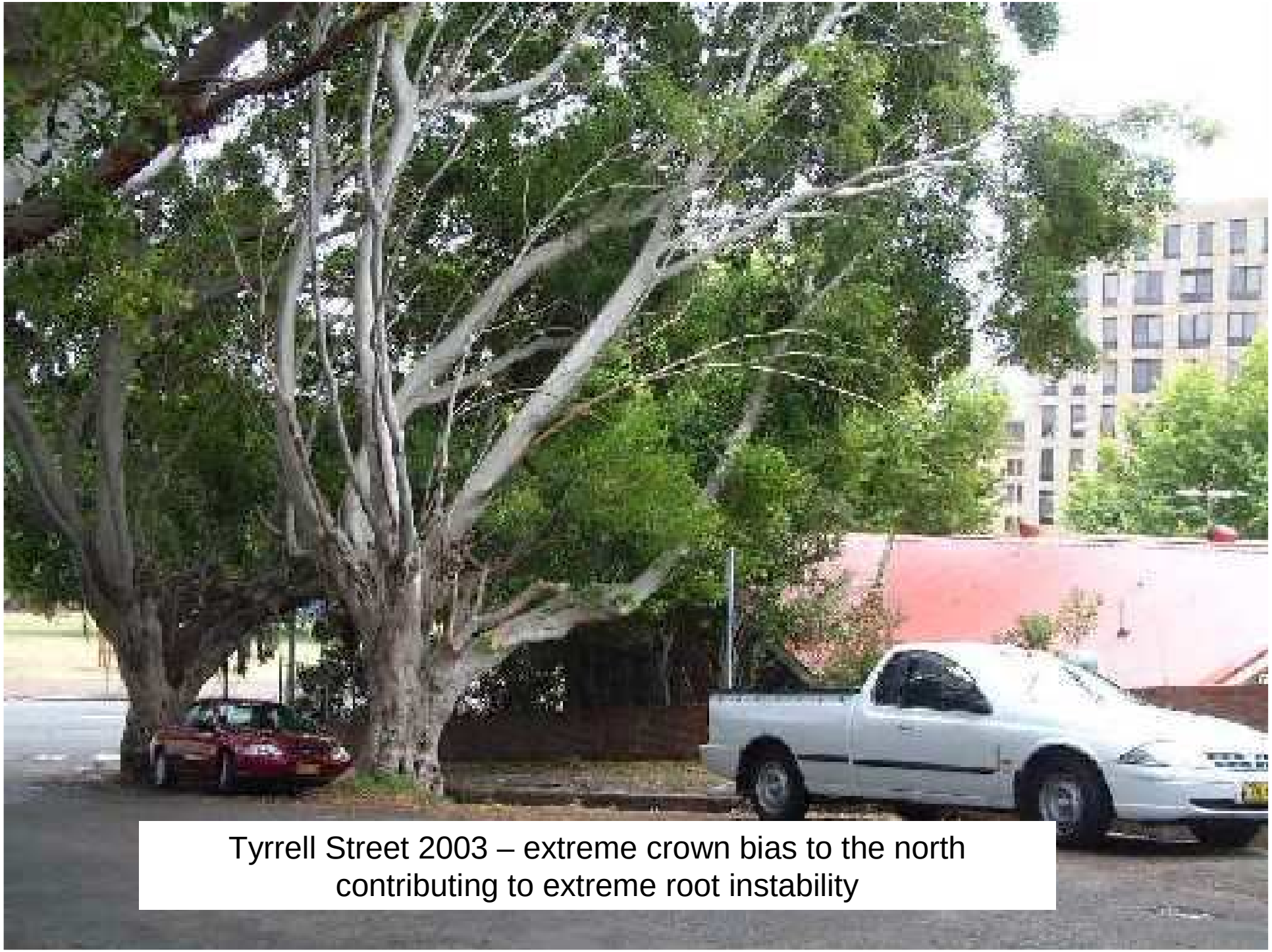
The northern side trees are assumed to have a greater compression root-plate than the southern trees as it appears they may have access to the garden area at the edge of Civic Park.

This leads to the conclusion that the Laman Street trees have characteristically linear (eccentric) root systems as found in Tyrrell Street

Hills Fig - Tyrrell Street - 2001

Tyrrell St 2003

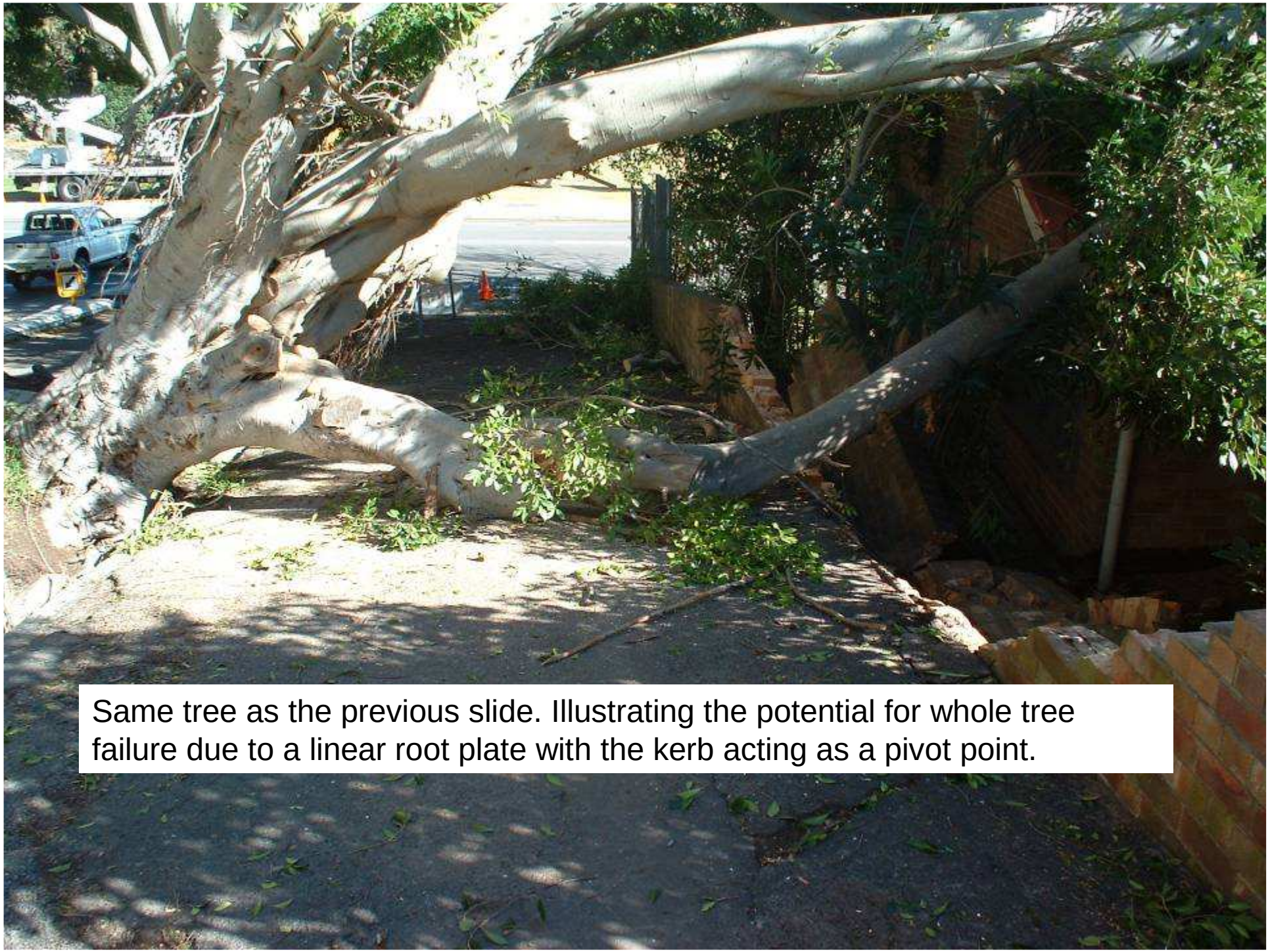
Linear (eccentric) root development with the kerb acting as a potential pivot point increasing the potential for whole tree failure



Tyrrell Street 2003 – extreme crown bias to the north contributing to extreme root instability

Tyrrell Street 2003

Whole tree failed when a 70mm diameter root was cut. The root was found to have been ‘anchored’ under a steel water main. Note the absence of structural roots



Same tree as the previous slide. Illustrating the potential for whole tree failure due to a linear root plate with the kerb acting as a pivot point.

Tyrrell Street 2004 - Storm failure. Typically linear root system.

No mechanically effective support roots

Same tree as previous slide.

Whole-tree failure due to linear (eccentric) root plate and absence of mechanically effective structural roots

Sinker roots directly beneath trunk did not provide the necessary tensile support


Sinker roots contributed to stability under benign conditions but under storm loading they were not a substitute for the lack of tensile support roots

Crown regeneration following emergency crown reduction after the 2004 storm failures. A temporary solution to minimize immediate risk and not an acceptable long term practice.

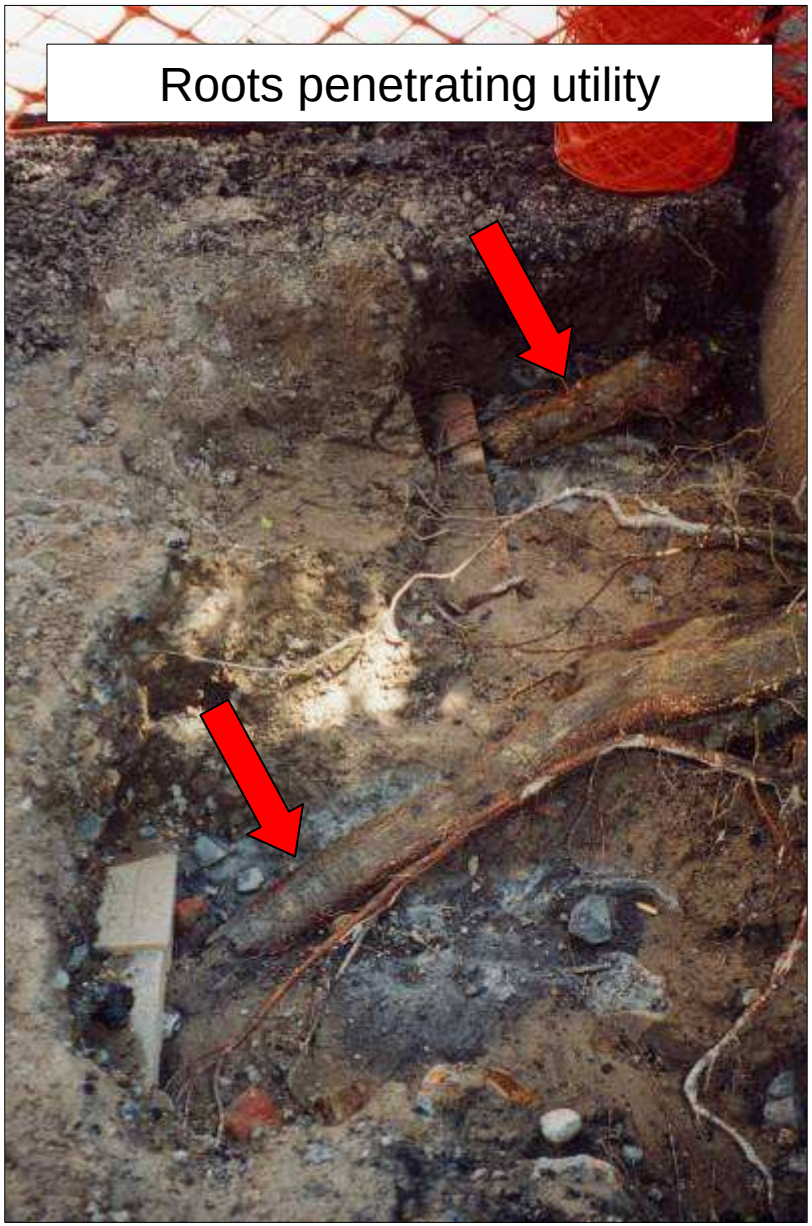
Wind direction (load)

Linear (eccentric) root plate development perpendicular to the prevailing wind direction

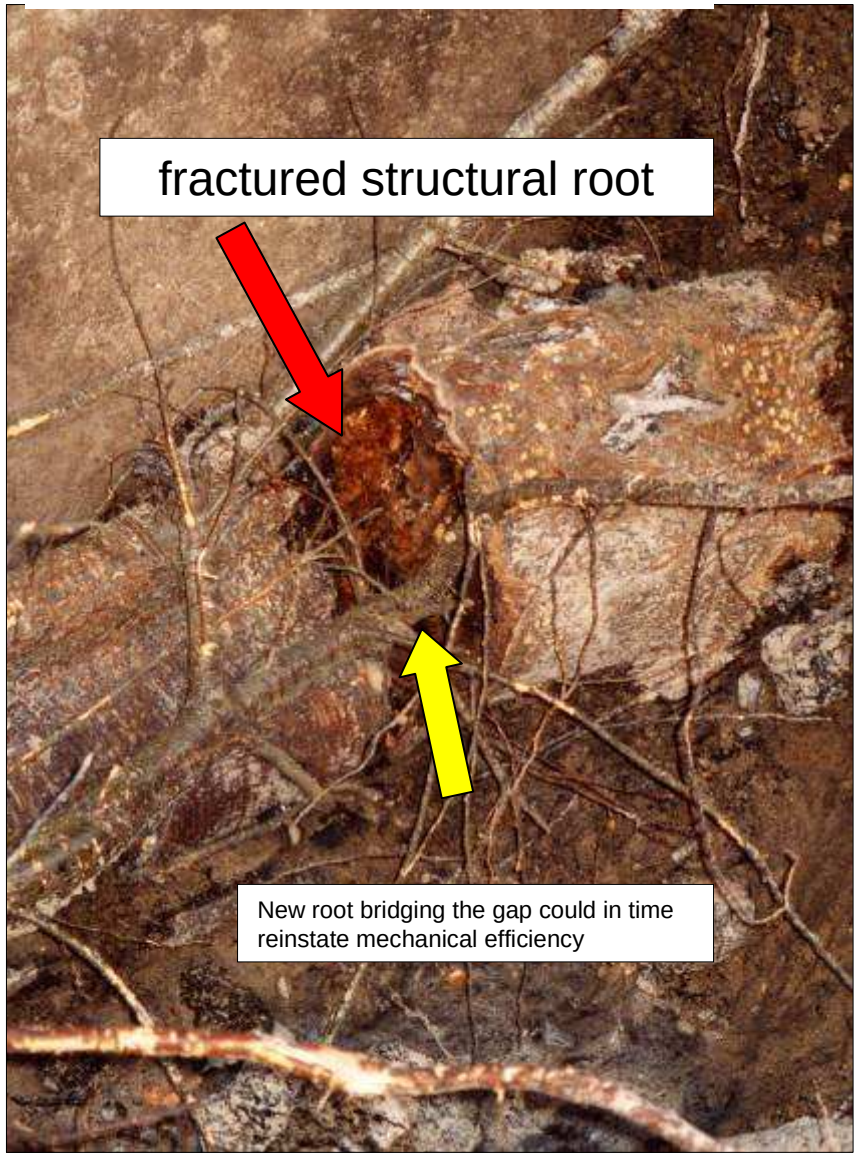
Primary Root direction

Root linearity - structural support roots deflected by kerb


Tyrrell St 2003
proposed cut-out
for root
investigations



Tyrrell St cut-out root investigations 2003



Roots - Stability and Infrastructure

Tree roots may ‘co-opt’ the bulk and strength of surrounding solid infrastructure such as pipes and concrete kerbs, thereby gaining stability for the whole tree.

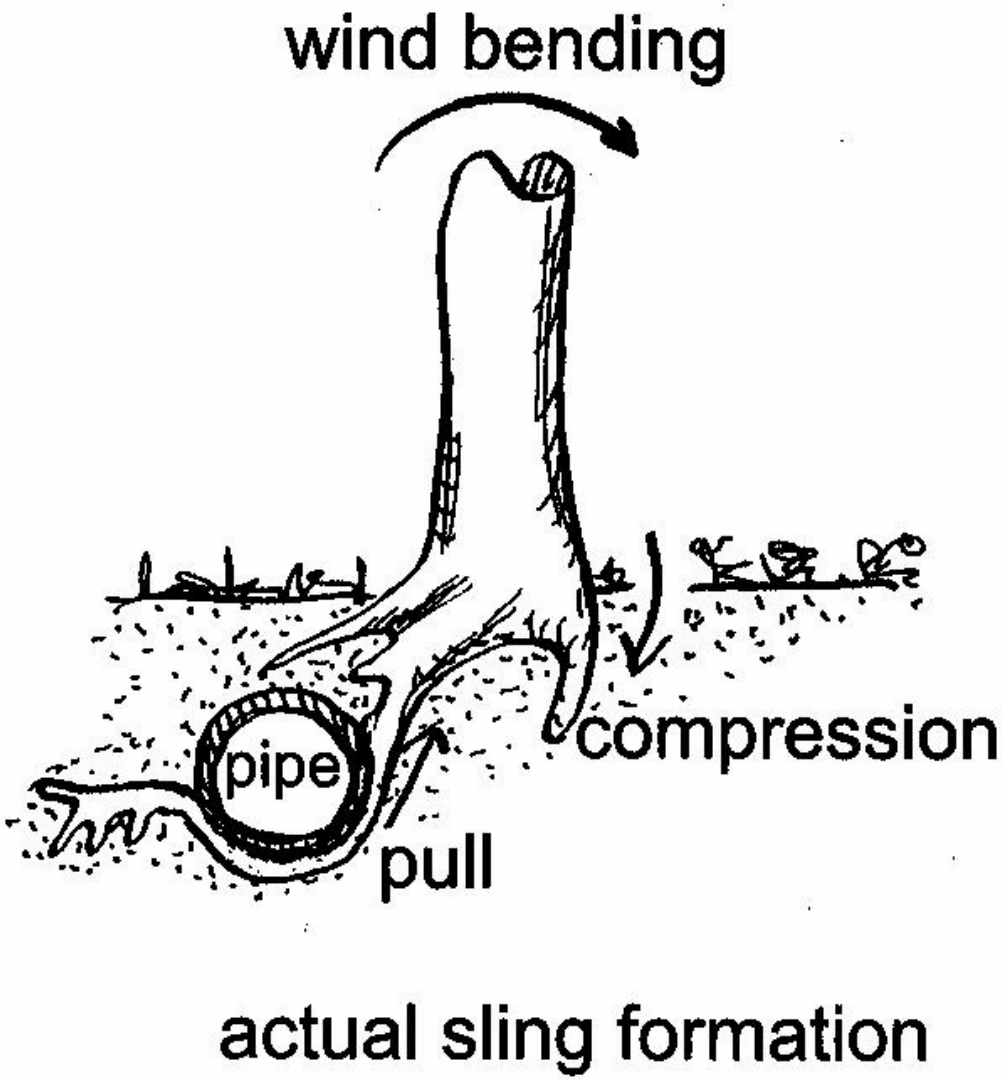
As a tree grows it develops a mechanically effective root system to counter the load experienced by the above ground parts ie gravity and prevailing wind. If roots surround and/or hook under a pipe or kerb, then the continuing stability of the tree requires the continuing presence of the infrastructure. The mechanical effectiveness of the root/infrastructure relationship contributes to tree stability despite the actual lack of mechanically effective roots. In these situations the tree does not develop additional mechanically effective roots but the canopy continues to grow.

If the infrastructure is removed or the root cut, the risk of whole tree failure increases significantly

Root sling gaining additional support from a water main

How roots use pipes (and other infrastructure) as mechanical support

This is the likely scenario for trees on the southern side of Laman Street

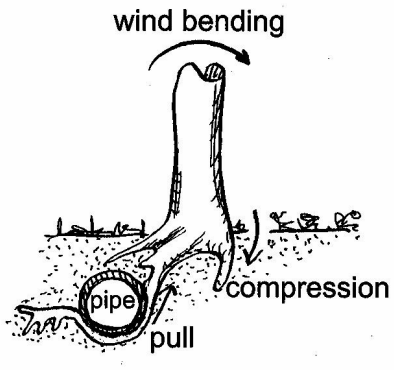


Source: Mattheck, C. & Breloer, H. 1999. *The body language of trees. A handbook for failure analysis. HMSO,* The Stationary Office, London

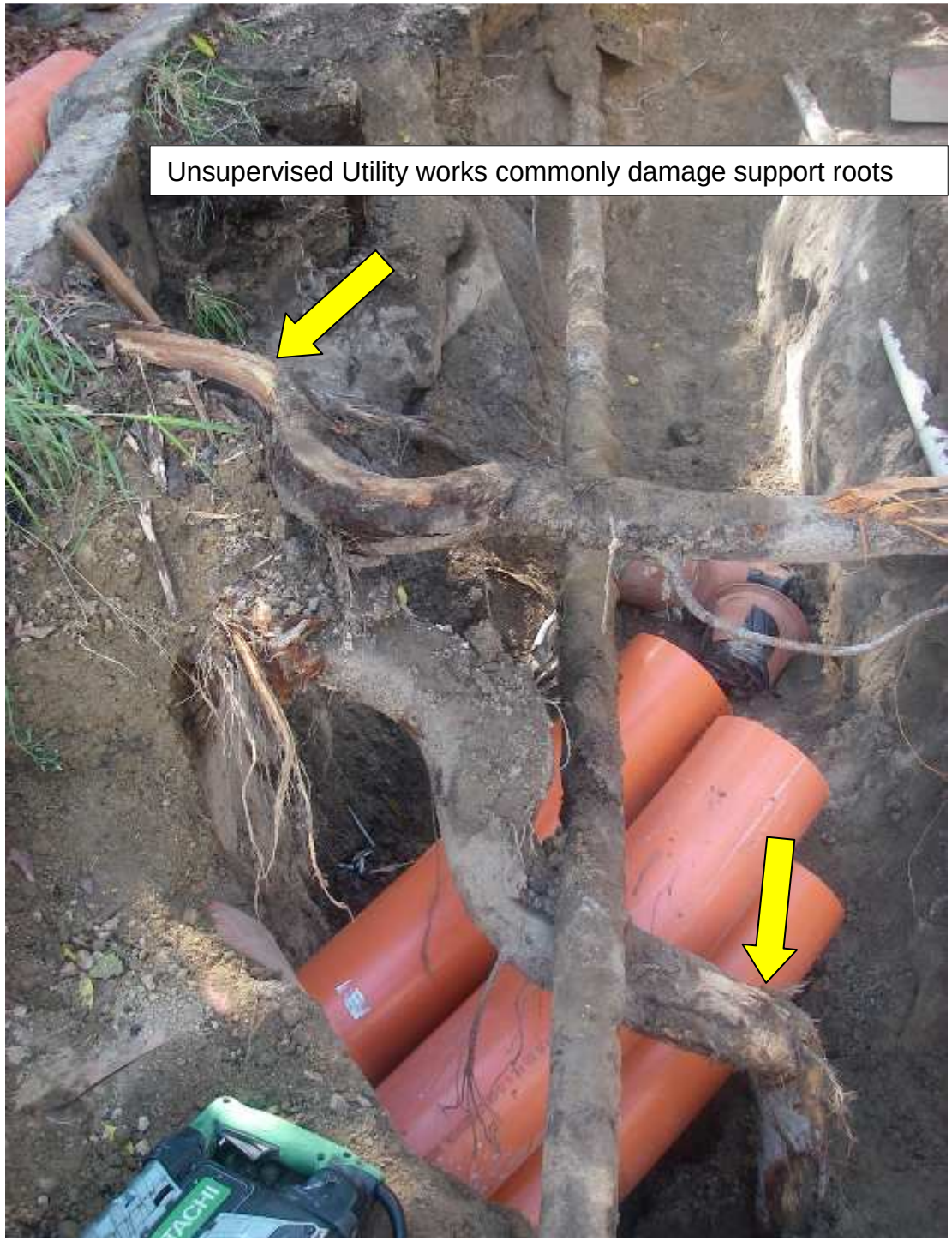
Tyrrell St (southern side)

Pipes & cables providing support to Fig tree.

The tree relies on the pipes for stability thus producing less mechanically functional roots than would occur in the absence of pipes



actual sling formation




Utility excavations in Tyrrell Street 2007 shows a lack of structural roots
Extent of roots located

Observations

Auckland Street & King Street

and Civic Park Newcastle

What is the relevance of investigations into the Auckland Street Hills Fig in assessing the Laman Street Hills Figs?

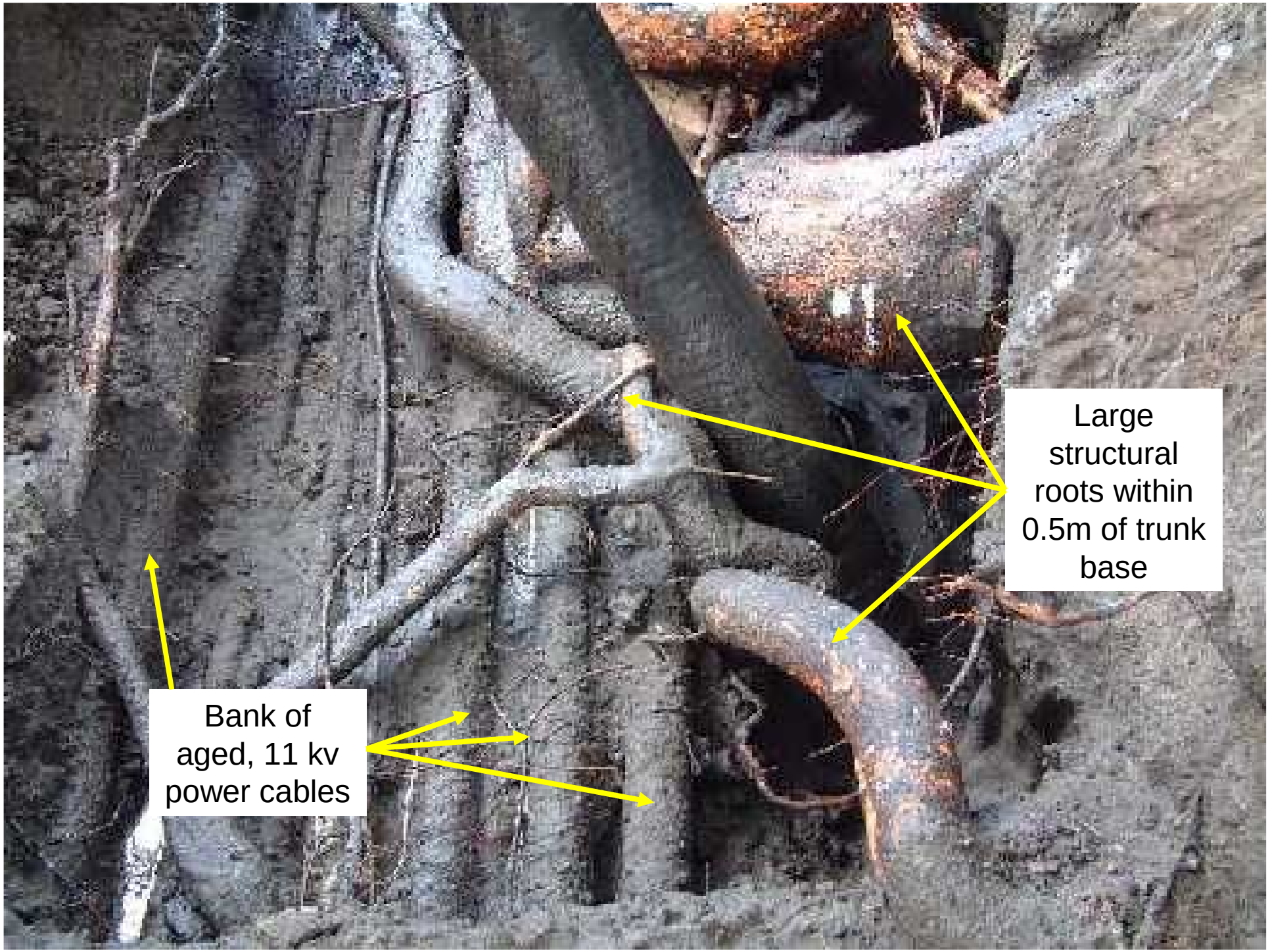
It shows the extent of the structural root system necessary for a large tree such as Hills Fig to adequately support itself. The available evidence shows that a similar structural root system is not present in the Laman Street trees despite the similarity in crown size between Laman St and Auckland St figs.

It also shows the integration of roots and infrastructure where the tree gains a degree of stability and is part reliant on the continuing presence of the infrastructure. The north side Laman Street Figs are located directly above a similar bank of electrical cables.

Underground electrical cables and Hills Fig roots - 2002

11 kv Cables stretched by fig roots

Utility trenches may provide conditions suited to opportunistic root development ie oxygen and water


Large structural roots within 0.5m of trunk base
Bank of aged, 11 kv power cables

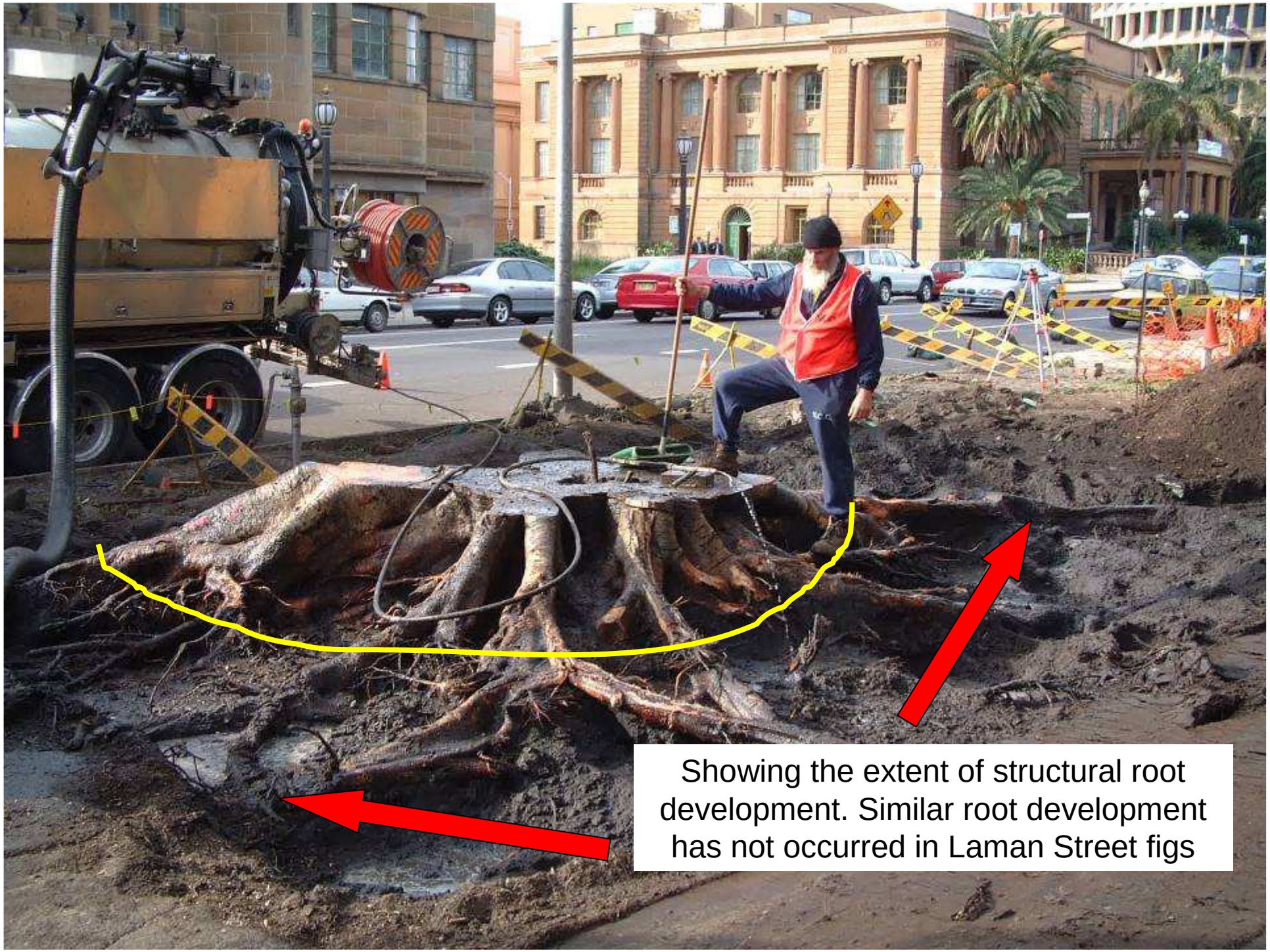
Hills Fig root plate.
Typical root development in the absence of infrastructure constrictions

Hills Fig root system in the absence of kerb and road pavement constrictions

Line indicates the edge of kerb in the Laman St trees

These structural roots are absent in the Laman St trees


Critical root mass absent in Laman Street Fig trees


Showing the extent of structural root development. Similar root development has not occurred in Laman Street figs

Stage 2 Visual Tree Assessment examination for extent of decay and strength loss due to Ganoderma fungus invasion in two Civic Park Hills Figs. Both trees subsequently removed in 2002

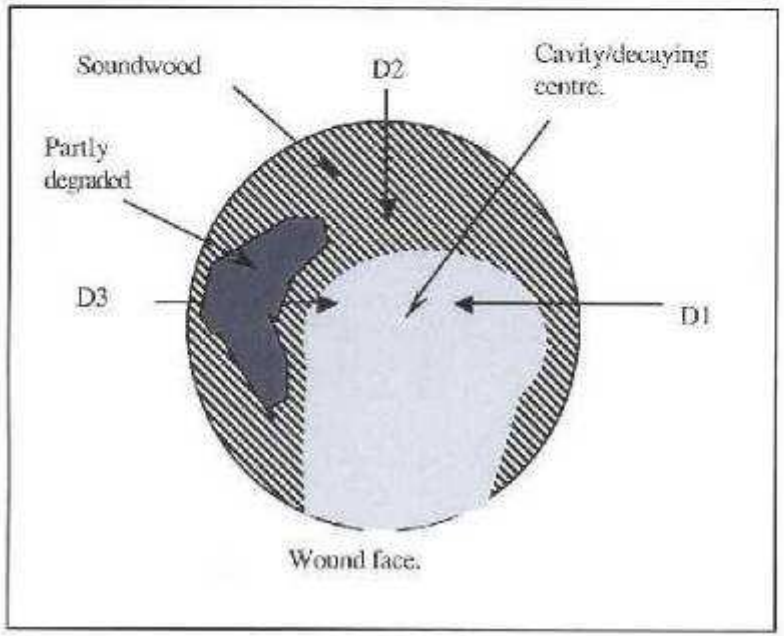


Fig Tree Place, Hamilton.

Severely wounded partially hollow and decaying Port Jackson Fig.

Exploratory use of a resistance drill (Resistograph) to determine and map residual trunk wall thickness.

The tree was subsequently removed as mapping showed the hollow exceeded the safety threshold

Failure of Kaffir Plum Civic Park 2000

Brown Rot in the stem base and root crown. Failure occurred at night time under calm conditions

Civic Park 2006

Failure due to severe inclusion defect. This trunk and branch inclusion defect is a relatively common characteristic of Hills Fig. The natural growth of Fig trunks makes assessment of such defects problematic

Observations

Bruce Street, Cooks Hill

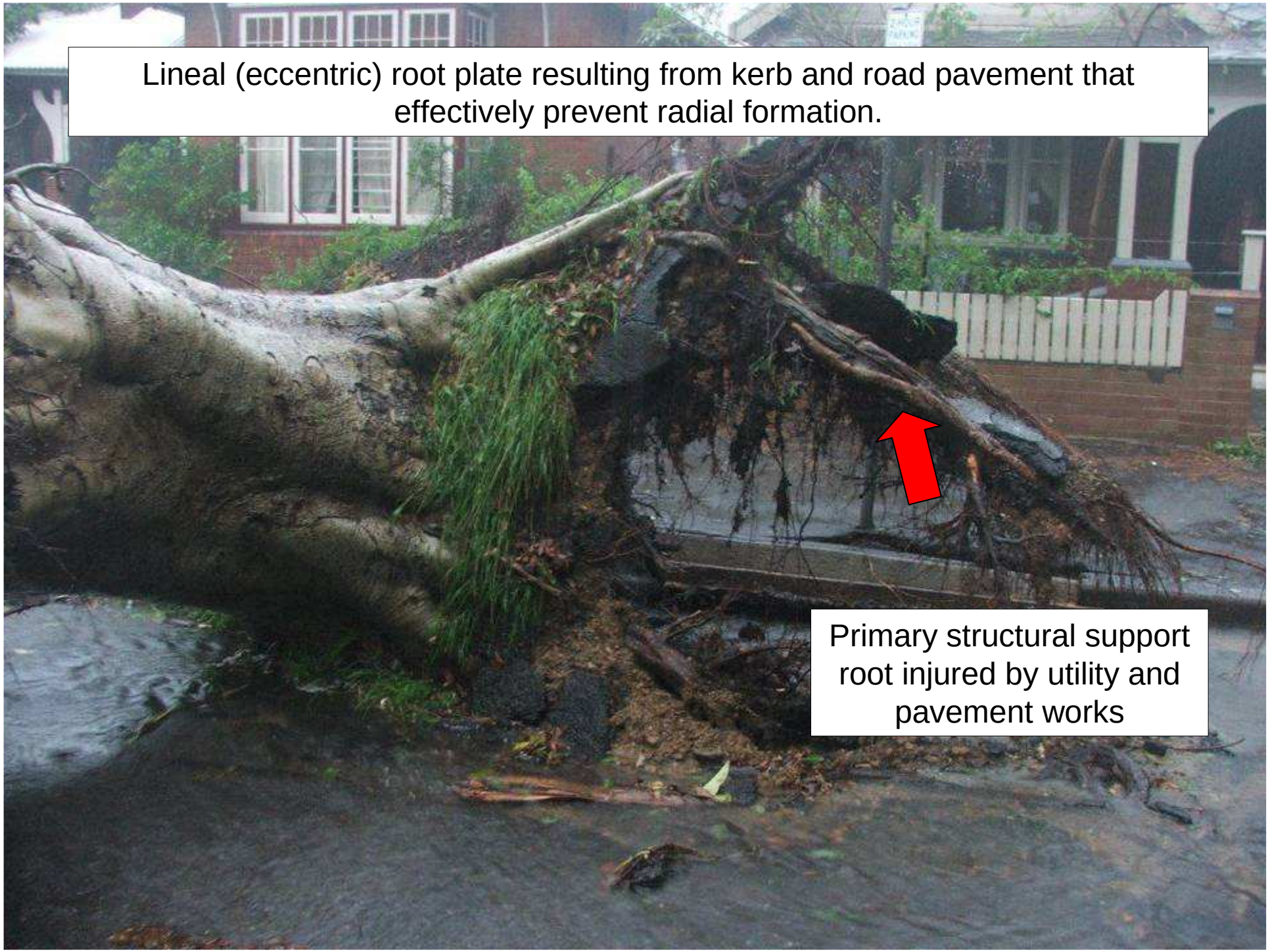
What is the relevance of investigations into the Bruce Street Hills Figs in assessing the Laman Street Hills Figs?

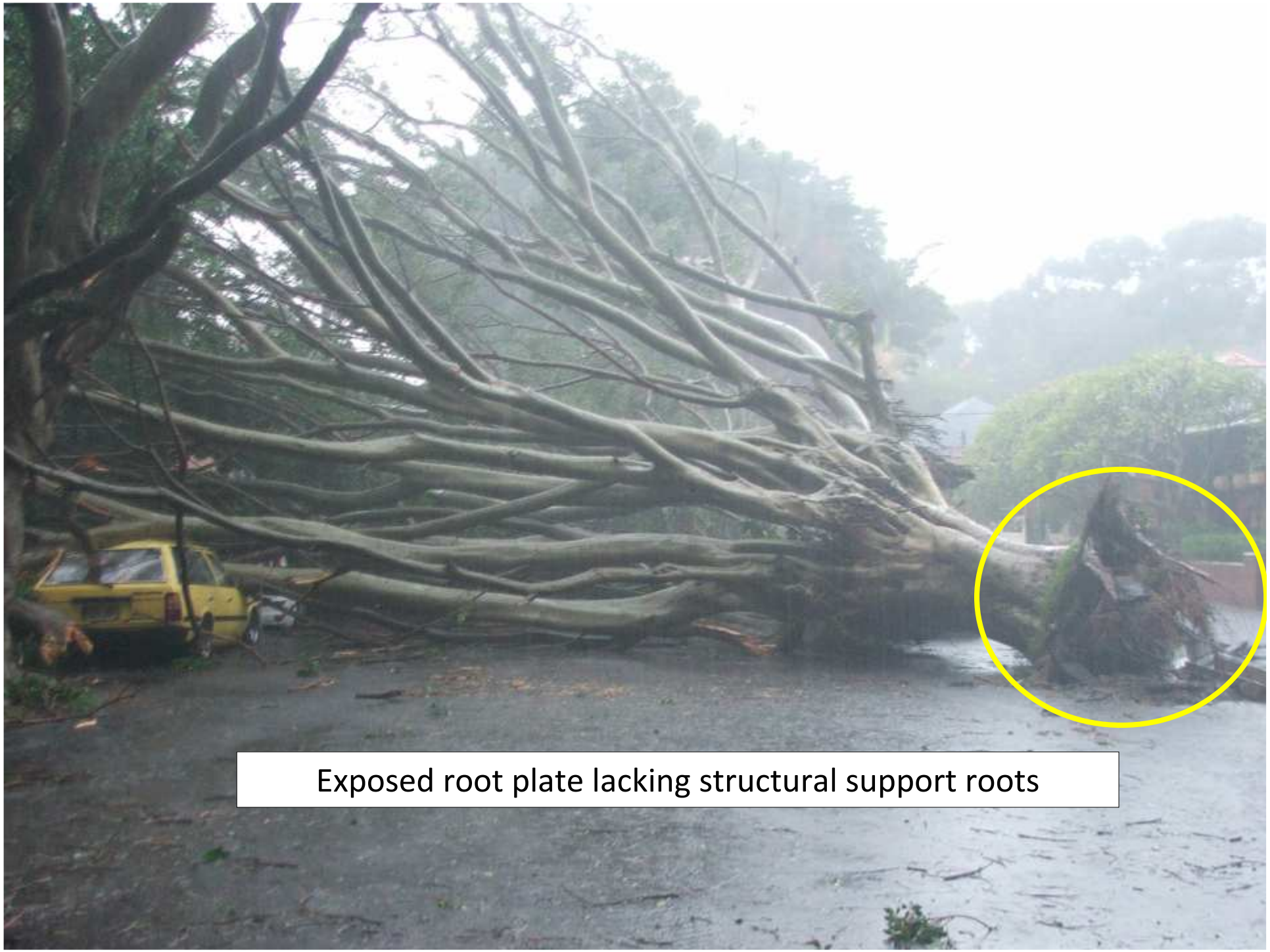
The Fig trees that failed in Bruce Street revealed the absence of an adequate structural root system in the large Hills Fig growing in similar circumstances to the Laman Street trees.

The integration between roots and infrastructure indicates that structural stability is partly reliant on the continuing presence of intact infrastructure.

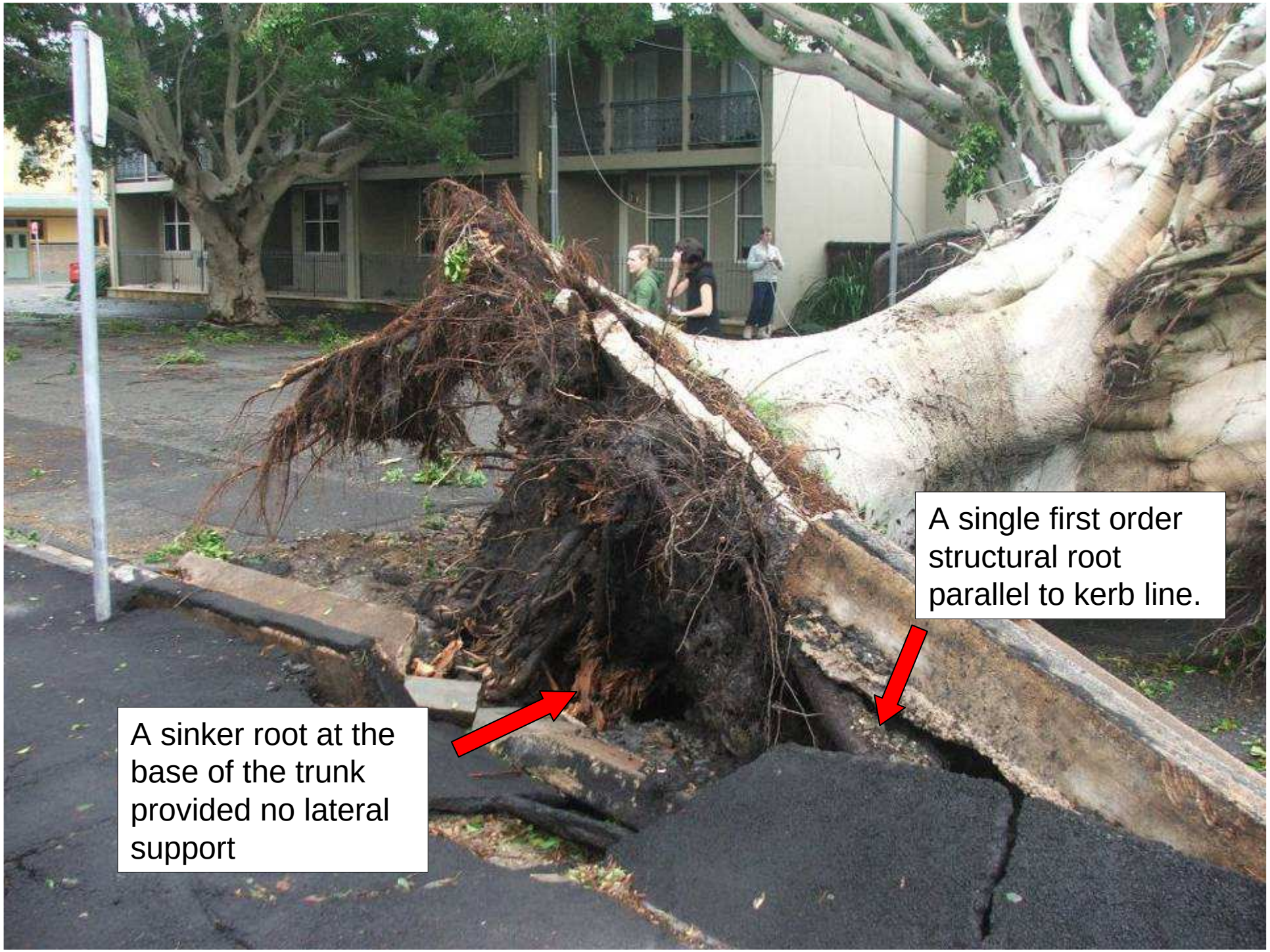
Bruce St – June 2007 - Hills Fig

NB Bruce Street is within 300 meters of Laman Street


Lineal (eccentric) root plate resulting from kerb and road pavement that effectively prevent radial formation.
Primary structural support root injured by utility and pavement works



Exposed root plate lacking structural support roots


A single first order structural root parallel to kerb line.
A sinker root at the base of the trunk provided no lateral support


The extent of radial root development was defined by the kerb line. There was no effective mechanical support on the tension-side (footpath) of the root plate.
Principle direction of roots

Bruce St 2010 – investigations for drainage works. Pot-holing at the centre of the street. Fine sand forms 100% of the substrate.


Potholing pit 2m from existing Fig is 1m inside the theoretical critical root zone. NO STRUCTURAL ROOTS.
Conclusion: linear root plate.

Pot hole excavation 7m from existing tree & 5m from the Fig that failed in the 2007 storm. One non-structural root – no other roots found

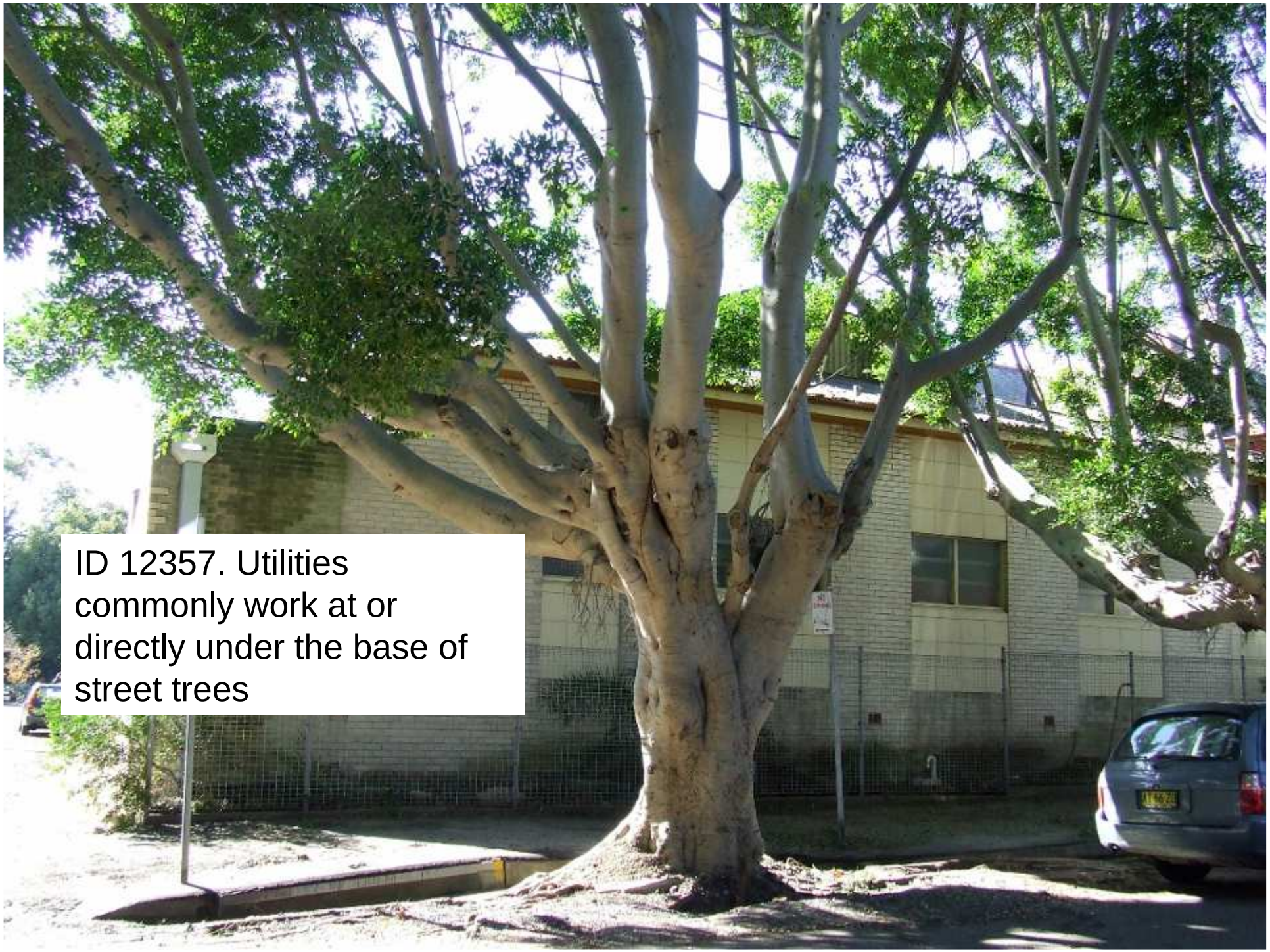
Observations

Council Street, Cooks Hill

What is the relevance of utility works in Council Street to the Laman Street Figs?

Utility works in Council Street reveal the same characteristically linear (eccentric) root system common to mature Hills Figs growing in city streets and footpaths.

Utility, footpath and road repairs are a common source of concealed root injury. A precautionary approach must be adopted when assessing the stability of large mature trees such as Hills Fig in streets and footpaths.


ID 12357. Utilities commonly work at or directly under the base of street trees

ID 12357. Water main repairs involving deep excavations and root damage


ID 12357. Water main repairs

ID 12357.
Utility works have been backfilled and the extent of root loss and injury concealed

Council Street.

Root and trunk abrasion and root zone pollution from recurrent vehicle parking

Observations

Trees in other Newcastle Locations

What is the relevance of investigations into other tree failures in Newcastle in assessing the Laman Street Hills Figs?

They show that where the structural root system of a large tree is compromised through space limitations and/or injury there may be significant risk consequences.

They show the consequences of confining the natural radial development of the root system of large growing trees.

They show the consequences of allowing immature and potentially large growing trees to retain compression forks with a propensity for included bark.

Gregson Park 2002 - Port Jackson Fig. Failure due to root decay and restricted root development

Gordon Avenue 2007

Radiata Pine root failure due to linear root development

Slide 1 of 2

Linear (eccentric) root development in a large kerb-side tree requires further examination

Slide 2 of 2

National Park - Storm failure 2007. Fig root system was confined by footway path and shallow soil overlaying garbic fill (bottles, bricks, concrete)

TAFE Campus - Tighes Hill

Mature Hills Fig multiple failures due to compression forks with bark inclusion

TAFE Campus, Tighes Hill. Failure due to decayed buttress roots

Steel Street Newcastle, Hills Fig Branch Inclusion Failure 2011

Port Jackson Fig – Sudden Limb Failure - Wallsend Park January 2011

Port Jackson Fig – Sudden Limb Failure at Wallsend Park January 2011

Slide 2 of 4

Port Jackson Fig at Wallsend Park.

Second branch failure incident

January 2012

Slide 3 of 4

Temporary safety fencing restricting public access following a second branch failure incident. The location (in a Heritage Park); the trees very large size and age status means that the tree will be retained and permanent fencing installed

Observations

Swan Street, Cooks Hill

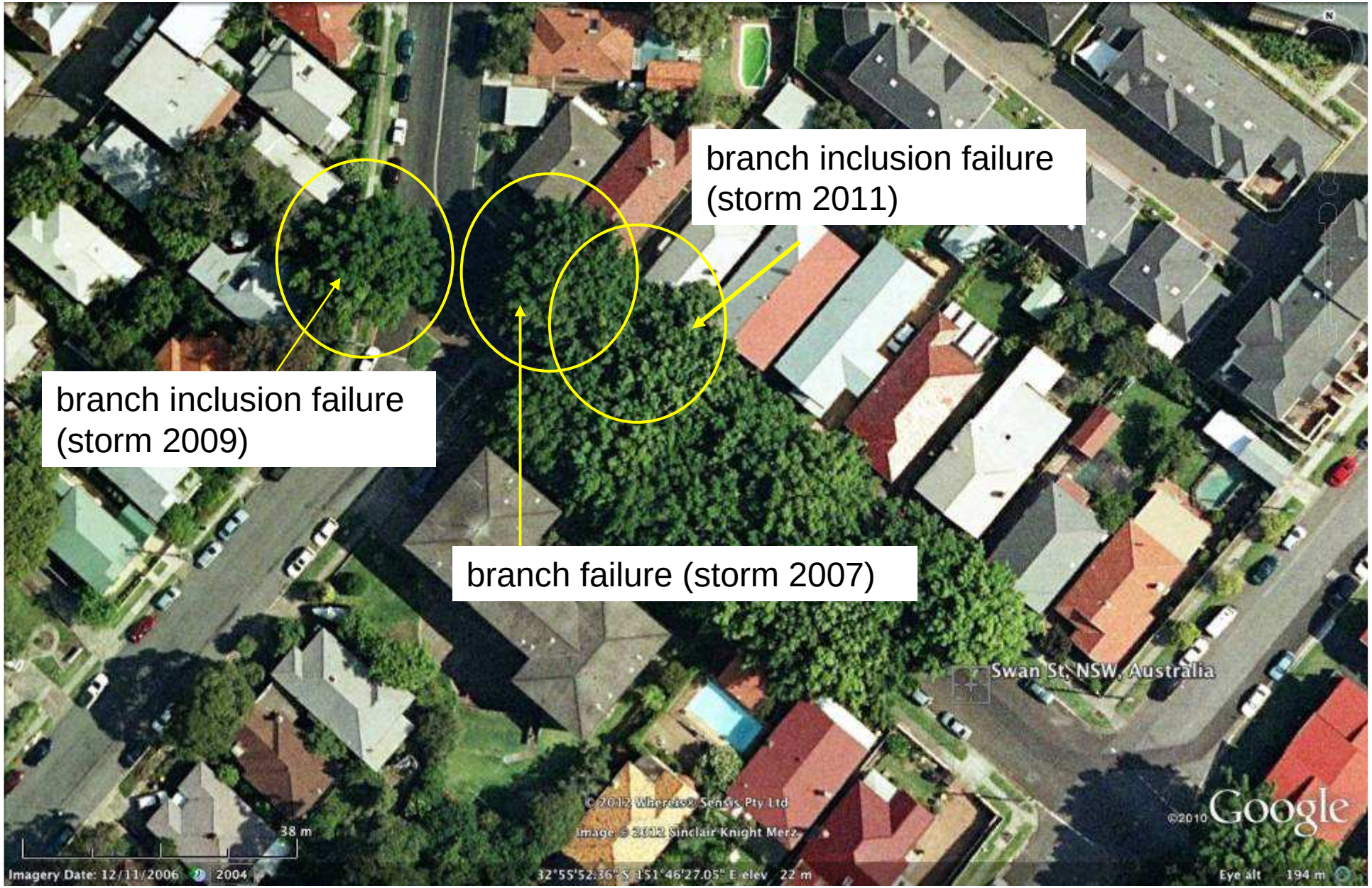
What is the relevance of investigations into the Swan Street Hills Figs in assessing the Laman Street Hills Figs?

Given that the Laman Street trees are similar in age and past treatments to Swan Street Figs, it shows the potential for failure where canopies have been allowed to generate a weak branch and stem system with an increased probability for failure. The risk may be amplified if adjacent trees are removed leading to sudden changes in wind loading.

It also shows the extent of area affected and potential impact of failure resulting from stem and branch inclusion defects in Hills Fig.

Swan St, Cooks Hill
Pictorial review of Hills Fig branch defect and structural failures

Summary of Hills Fig failures in Swan Street 2007-2011



The Notch Defect (branch bark inclusion) parameters for assessment

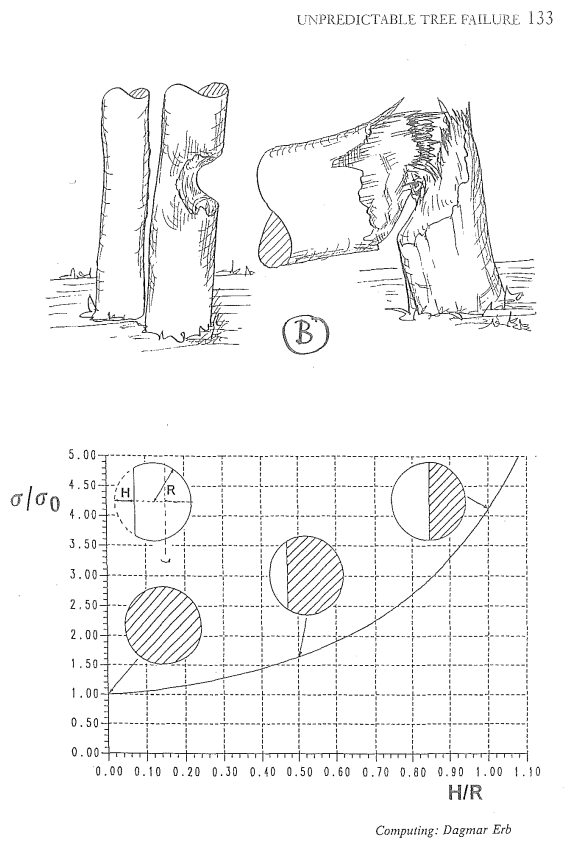


Fig 77. Field experiments for determining the safety factor in resistance to stem-breaking in trees (sawn sections: Jörg Sigmund).

A: Window cut in tree.

B: 'Beaver gnawings and related increase in stress' (Prof. Dr. Kübler kindly showed us these trees).

Parameters for assessing the "notch" defect were adapted in 2004 from Mattheck & Breloer** (1994) and developed by the City Arborist and The Sugar Factory * for application in assessing included bark on Hill's Figs in Newcastle.

When the notch depth exceeds 50% of branch thickness failure is likely. Council adopted a notch depth of 40% as an acceptable limit.

This 'notch defect' parameter is not an industry-wide criterion and is not found in standard texts on tree hazard assessment. The method was developed primarily as a way of identifying particular defects on individual trees in order to set a priority for works, given the commonality of included bark in Hill's Figs.

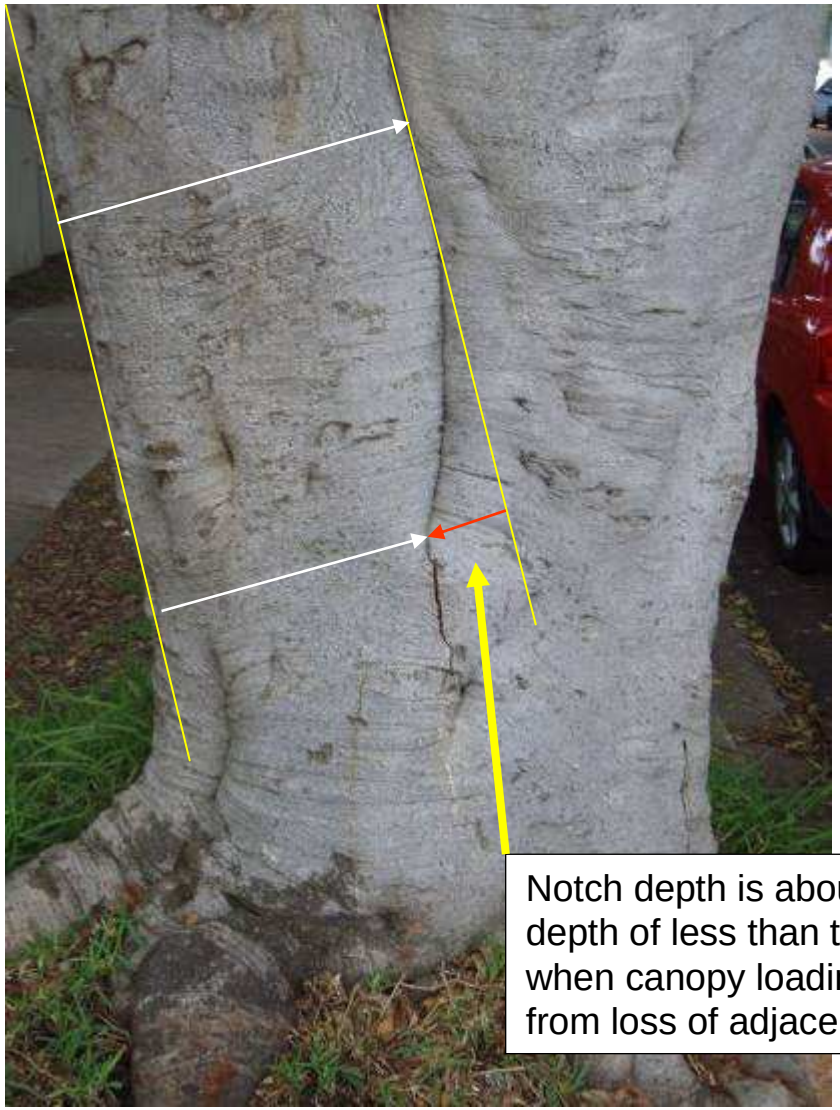
Mattheck and Breloer** write in regard of notches:

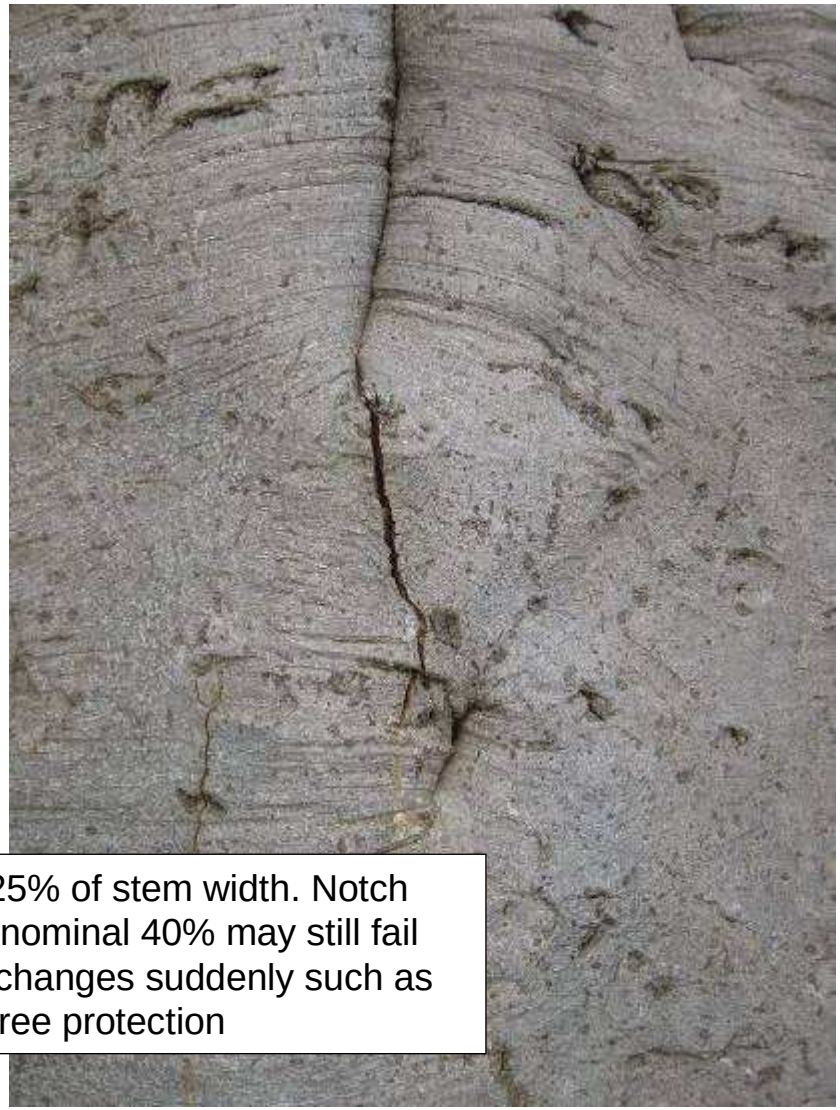
"…a flawed structure is characterized by one or more potential fracture points where locally high stresses develop. Failure is predictable in certain kinds of structure that show such faults. This is most commonly the case at so-called 'notches', which is an engineer's description of any concave configuration within a component which diverts the force flow around it….Notch stresses…occur where the force flow, diverted by a notch, is greatly intensified, i.e. a higher force flow per surface element is conveyed."

* Marsden, D (2004) Notch Stresses and Weak Forks – Research Update for the City of Newcastle

** Mattheck, C and Breloer, H (1994) *'The Body Language of Trees – A Handbook for failure Analysis'* Research for Amenity Trees #4, HMSO, Norwich.

Branch inclusion failure in Swan Street





Notch depth is about 25% of stem width. Notch depth of less than the nominal 40% may still fail when canopy loading changes suddenly such as from loss of adjacent tree protection

Marsden, D (2004) Notch Stresses and Weak Forks – Research Update for City of Newcastle (ECM 2774442)

Mattheck, C and Breloer, H (1994) *'The Body Language of Trees – A Handbook for failure Analysis'* Research for Amenity Trees #4, HMSO, Norwich.

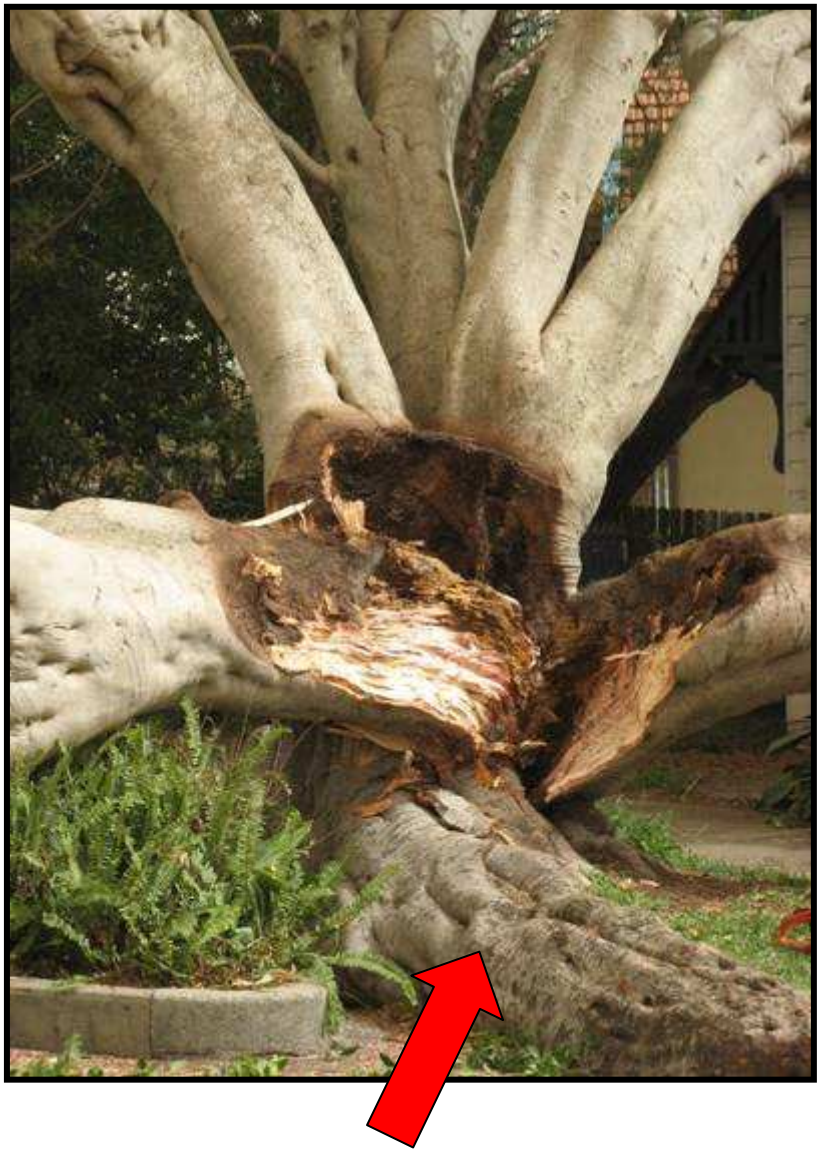
Helliwell, R (2004) *'A Discussion of the Failure of Weak Forks'* Arboriculture Journal (27) pp. 245-249 AB Academic Publishers, GB

Branch failure of Hills Fig in Swan Street 20 June 2007

Branch failure occurred at the weakened re-growth junction resulting from past lopping

The ‘Pasha Bulka’ storm that occurred on 7 June 2007 is likely to have fractured the branch which then totally failed on 20 June 2007. The tree was assessed and found to be at significant risk of further branch failures. Due to the high pedestrian use and built assets the only responsible risk mitigation option was tree removal.

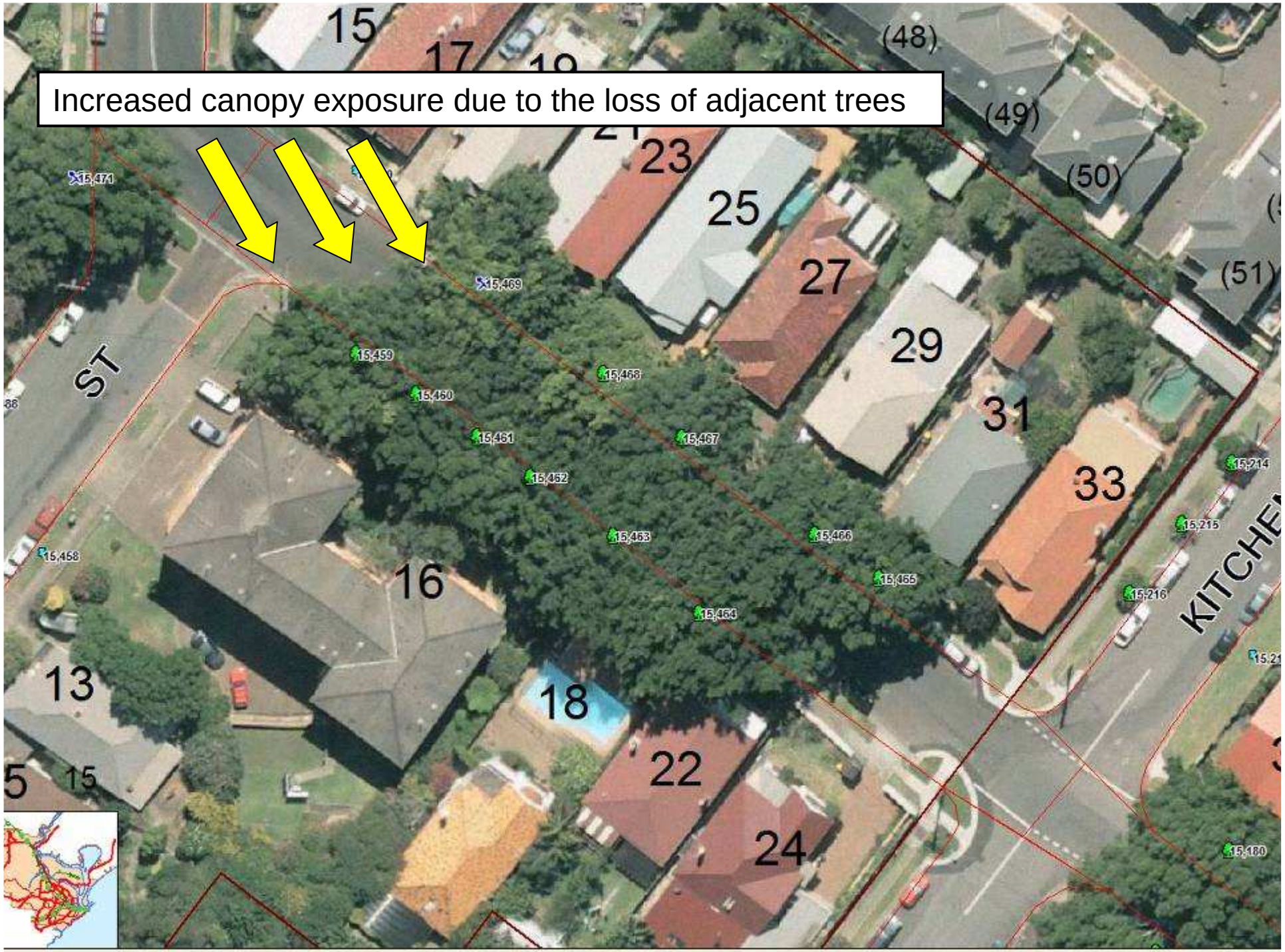

Trunk/branch inclusion failure (2009) at corner of
Brooks Street and Swan Street



Single massive linear root aligned with kerb direction

Corner Brooks and Swan Street 2009

The typical form of multiple compression forks, here creating a ‘cluster wedge’ stem configuration. Each stem exerts pressure on the adjacent stem. As the stems increase in length and weight, wood growth in the compression area at the stem base acts like a wedge, leveraging the stems apart until failure.


Increased canopy exposure due to the loss of adjacent trees
15
17
(48)
(49)
(50)
(51)
23
25
27
29
31
33
16
18
22
24
13
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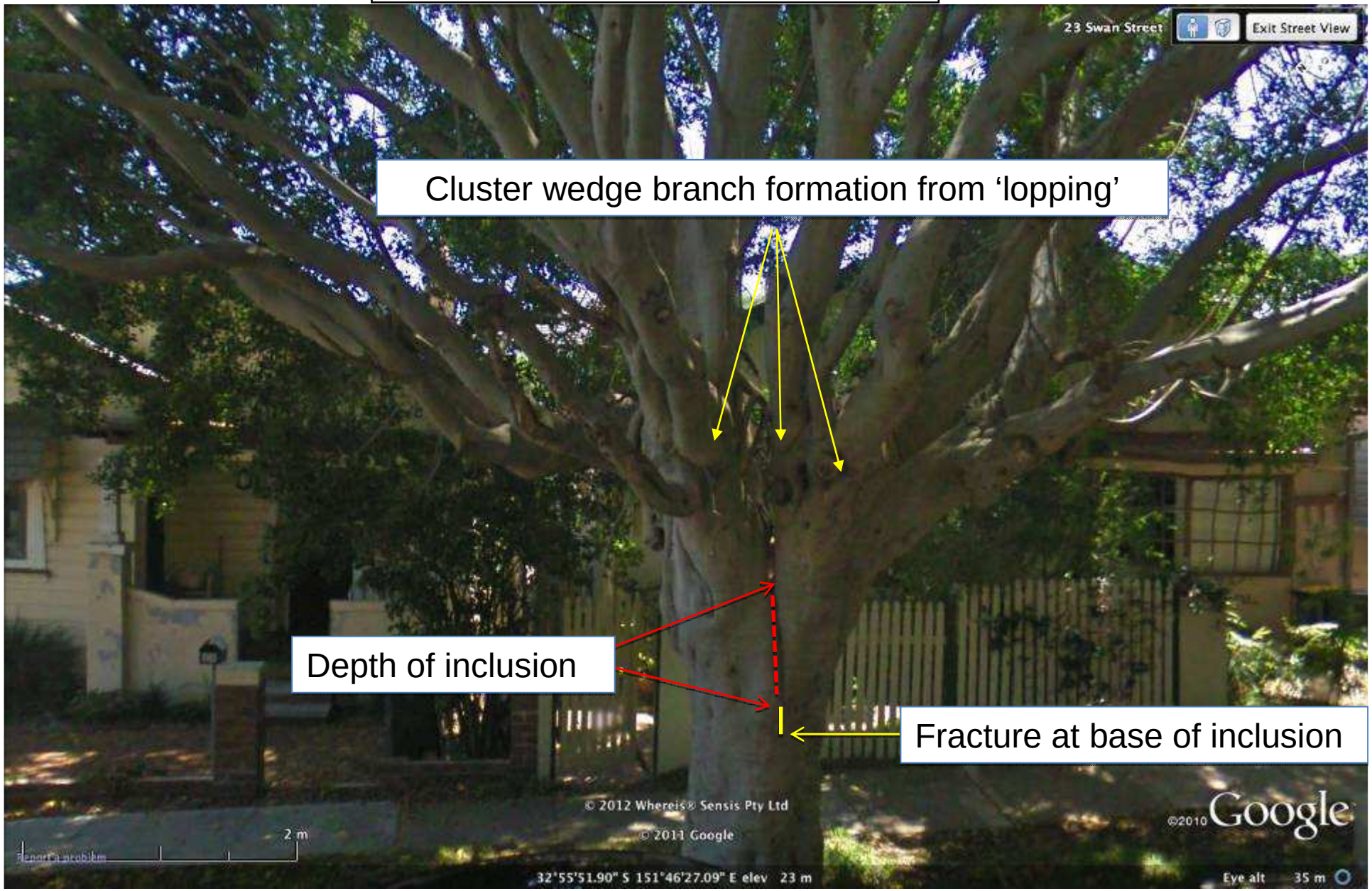
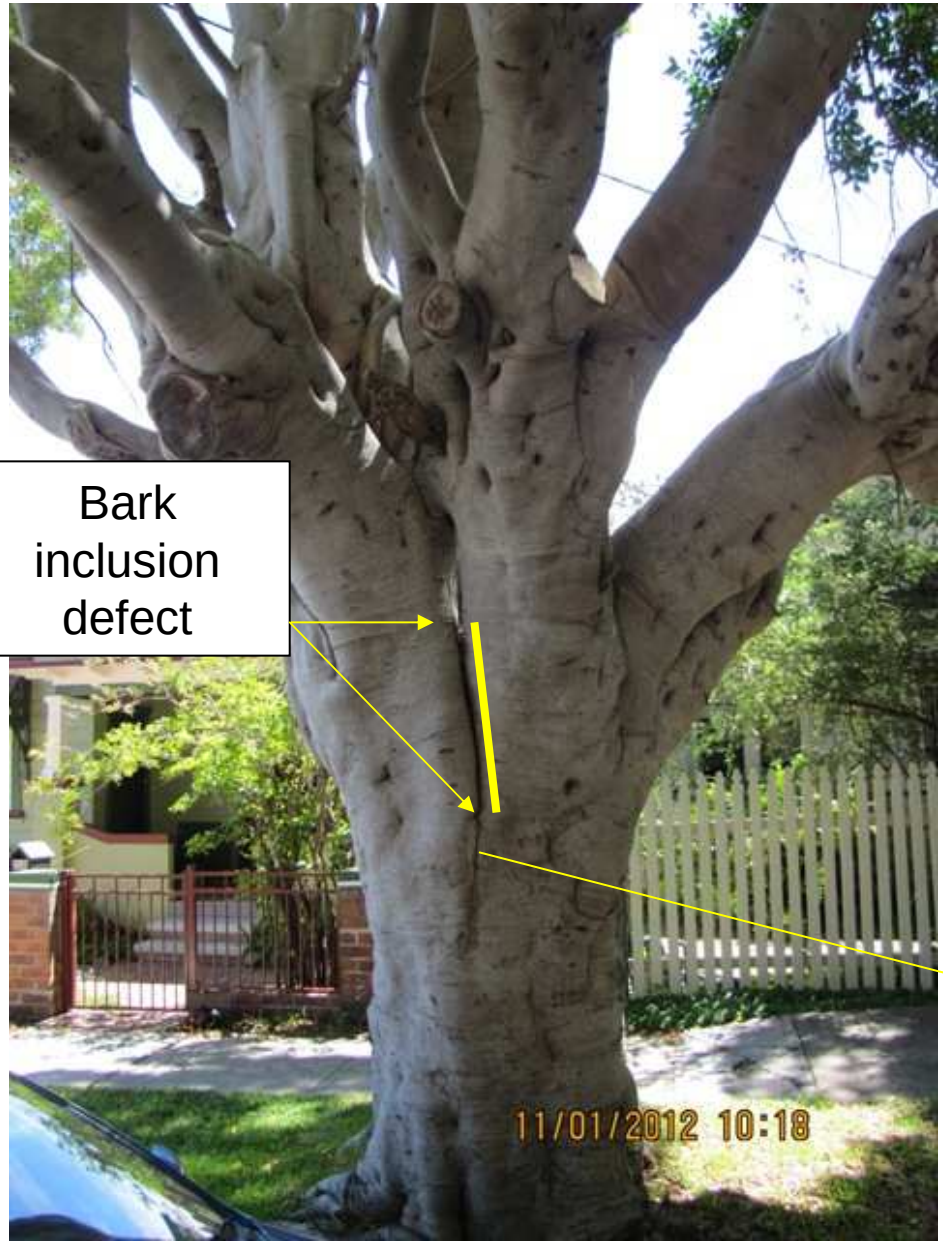
Increased wind loading after the removal of the adjacent tree contributed to the failure at the branch inclusion defect.

Tree ID 15469 (21 Swan St)



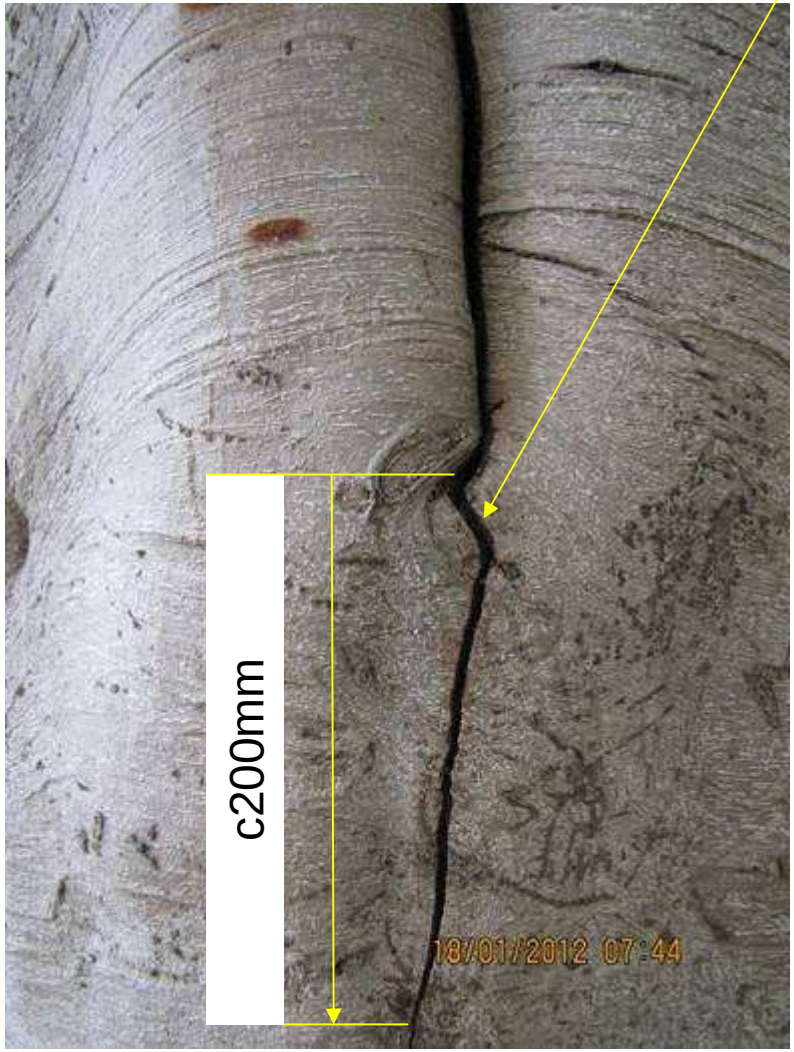
Stem separation as a consequence of bark inclusion

Bark inclusion defect

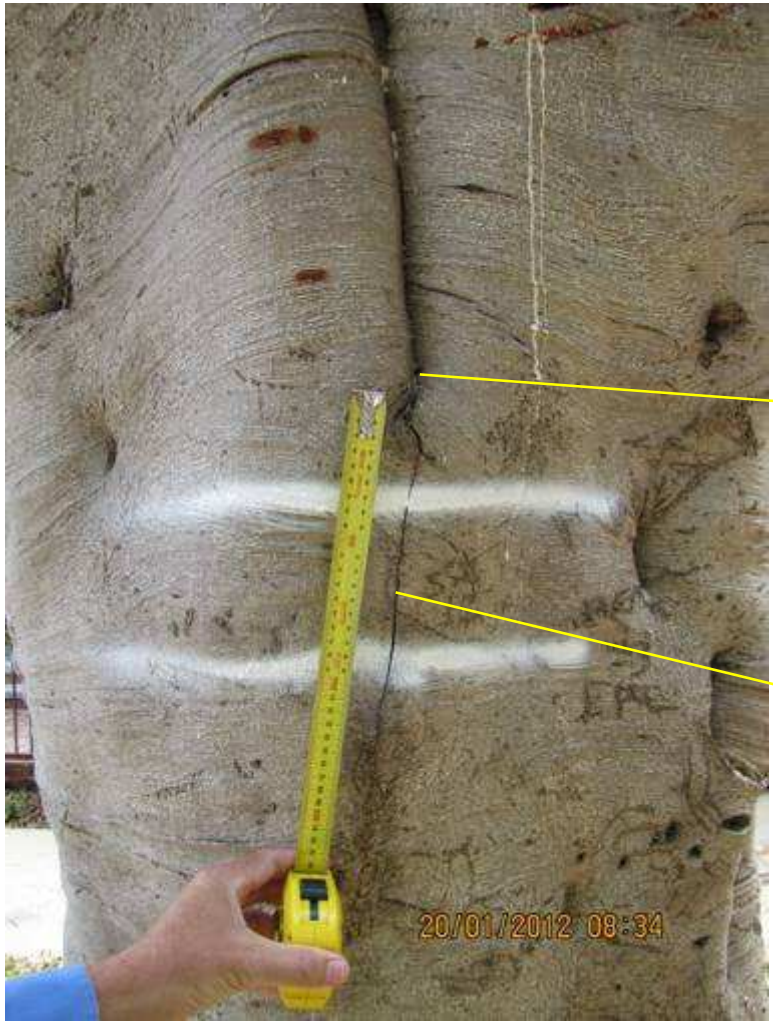


Tensile fracture at the base of the branch inclusion

Road side crack & stem closure after the tensile load was reduced during felling



Road side compression fork with branch inclusion as an internal structural defect



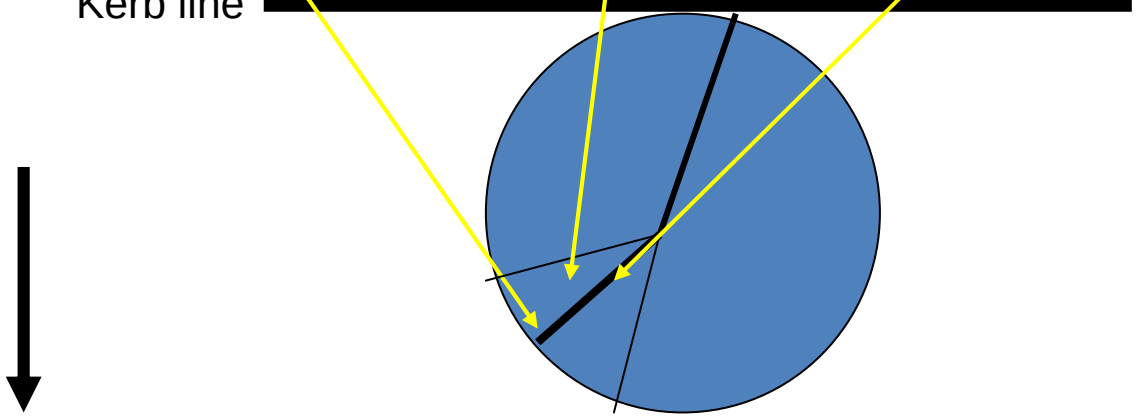
Footway Stem inclusion defect – a compression fork

Exterior view

Interior view

Kerb line

Internal seam



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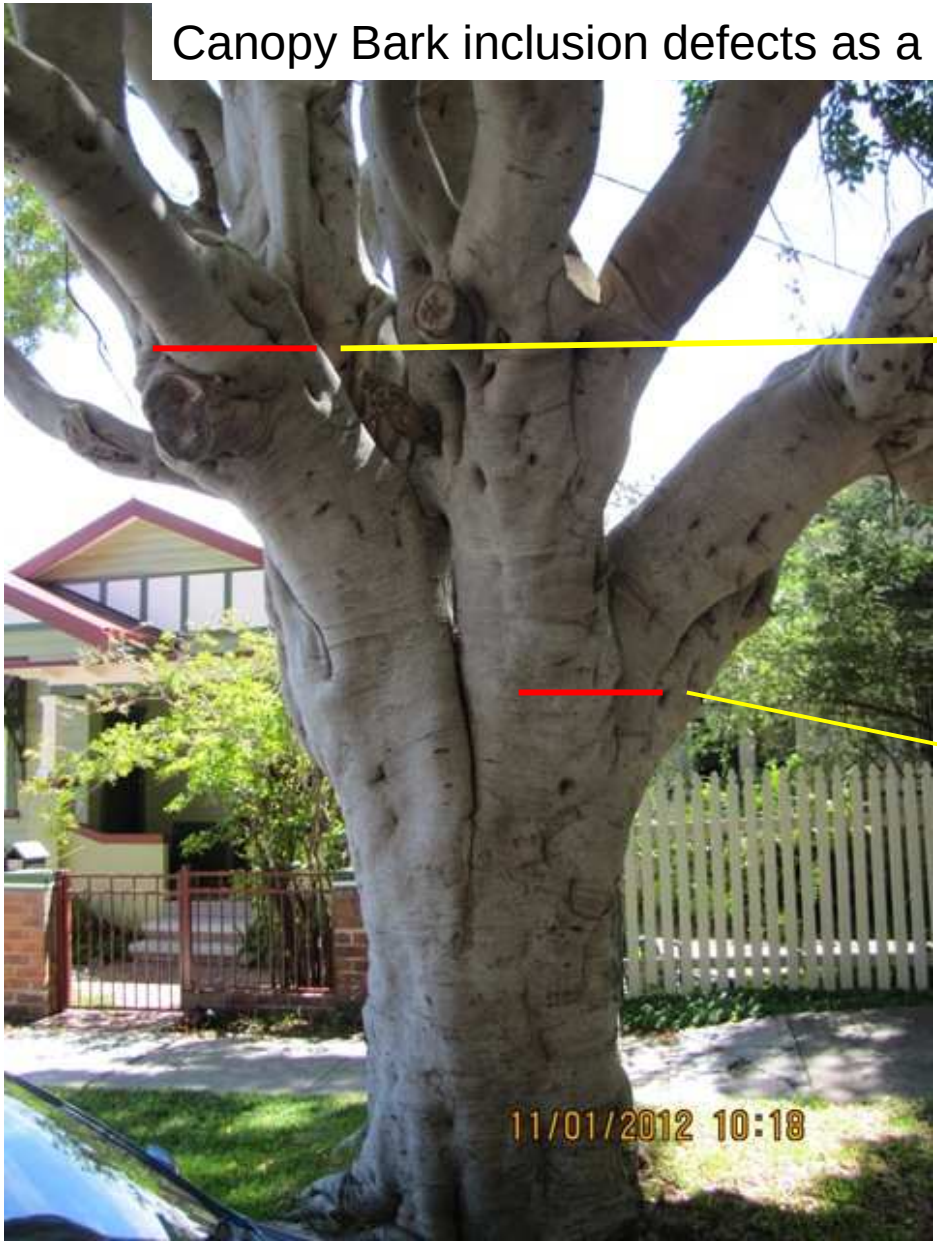
Footway

Canopy Bark inclusion defects as a result of lopping

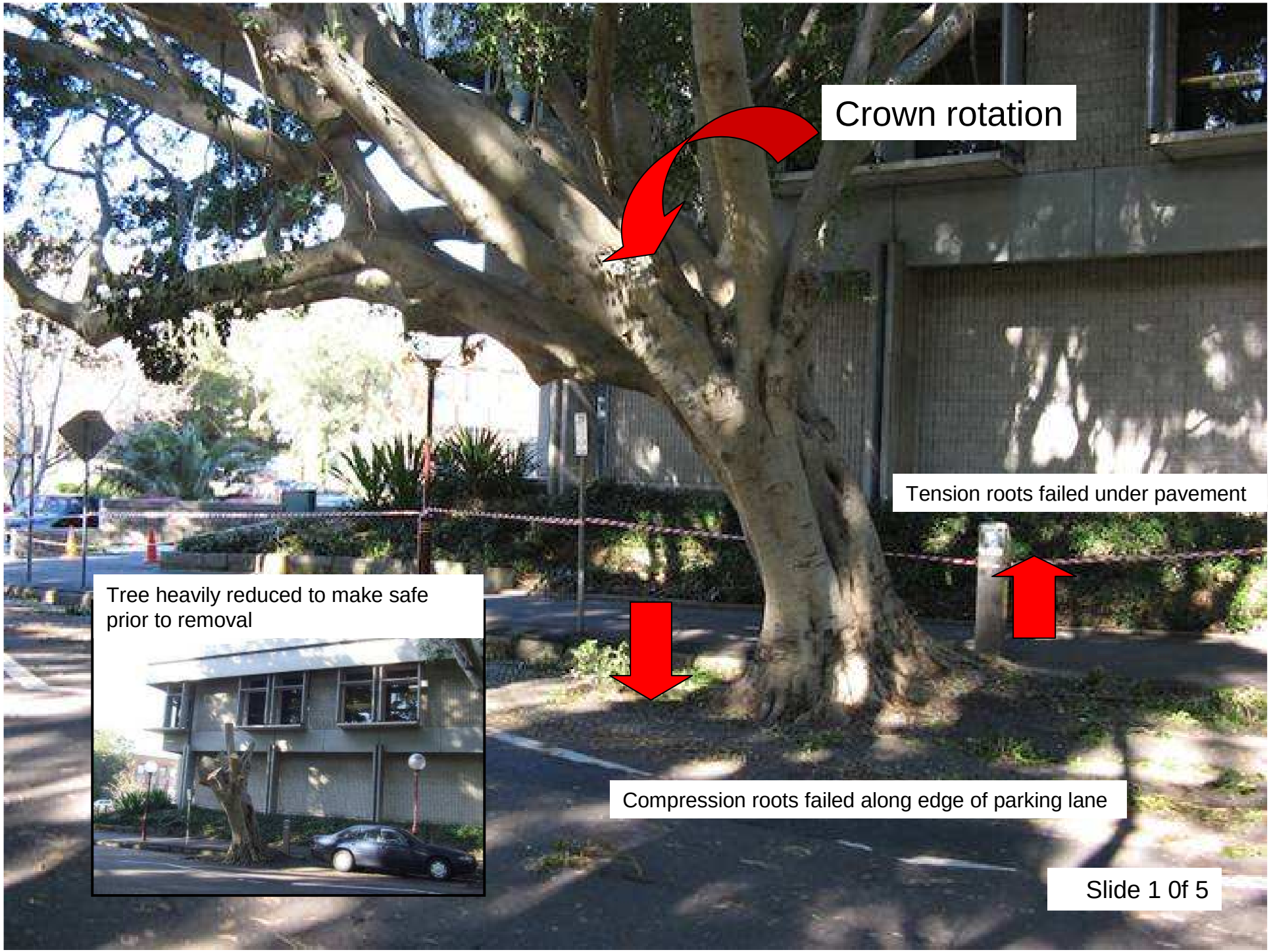


Observations

Laman Street, Cooks Hill

Laman Street Fig canopy before June 2007

Laman Street Fig canopy after June 2007 - three trees removed due to root plate failure

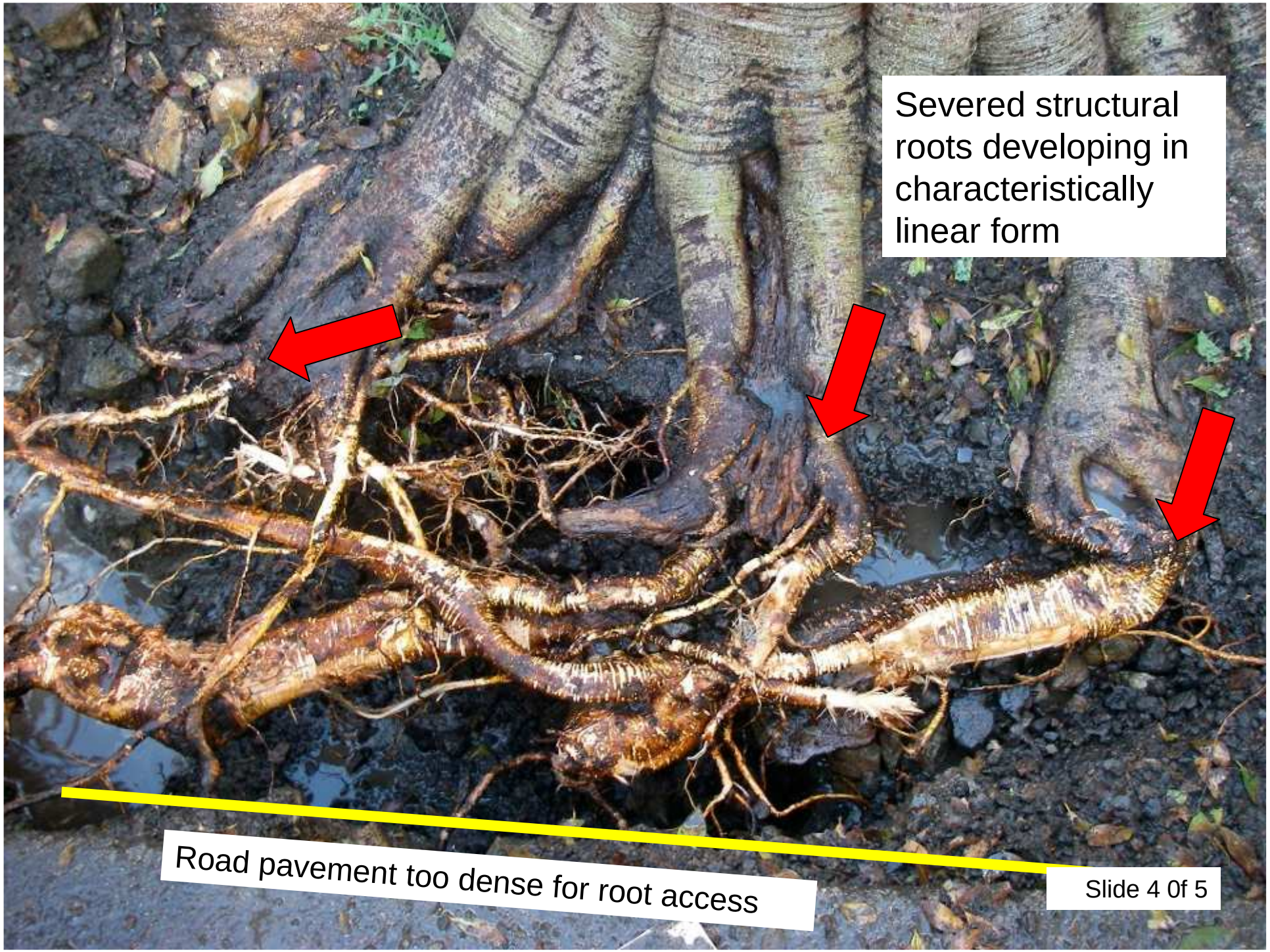

Crown rotation
Tension roots failed under pavement
Tree heavily reduced to make safe prior to removal
Compression roots failed along edge of parking lane
Slide 1 0f 5


Investigation of root heaved tree in Laman Street (south side)
Absence of structural support roots at 300mm depth
Northern side of tree sunk 50mm into the road during 2007 storm
NCC
NCC

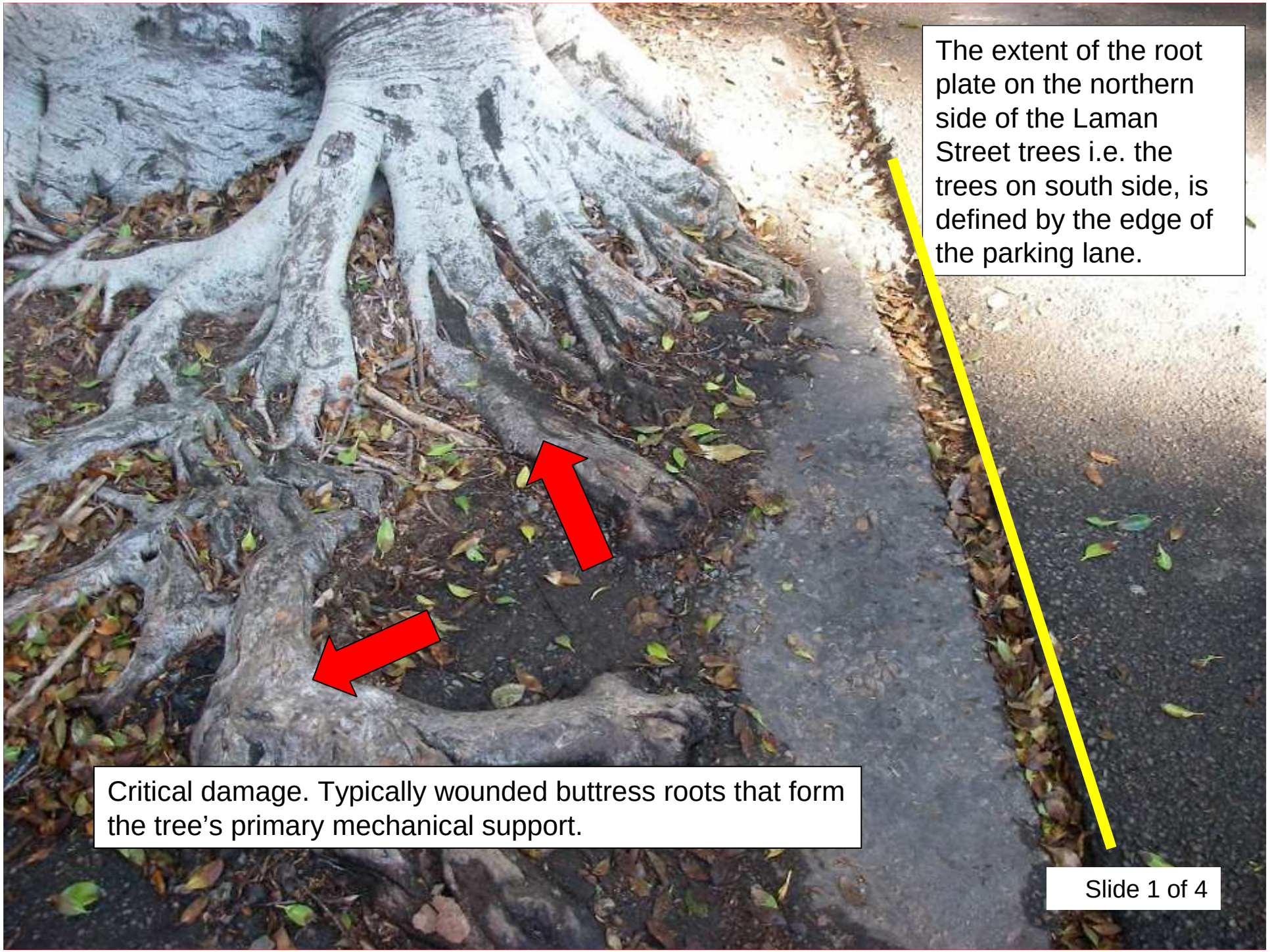
structural roots cut for road repairs have regenerated. Roots unable to penetrate the road due to density of pavement. Roots follow line of least resistance developing a typically linear form.

These new roots provide no mechanical support on the compression side of the root plate.

The tree's tension side root plate thus carries the full load under prevailing wind.


Severed structural roots developing in characteristically linear form
Road pavement too dense for root access

Laman Street root excavations investigation found no roots below the immediate surface layer, consistent with investigations in Bruce Street and Tyrrell Street

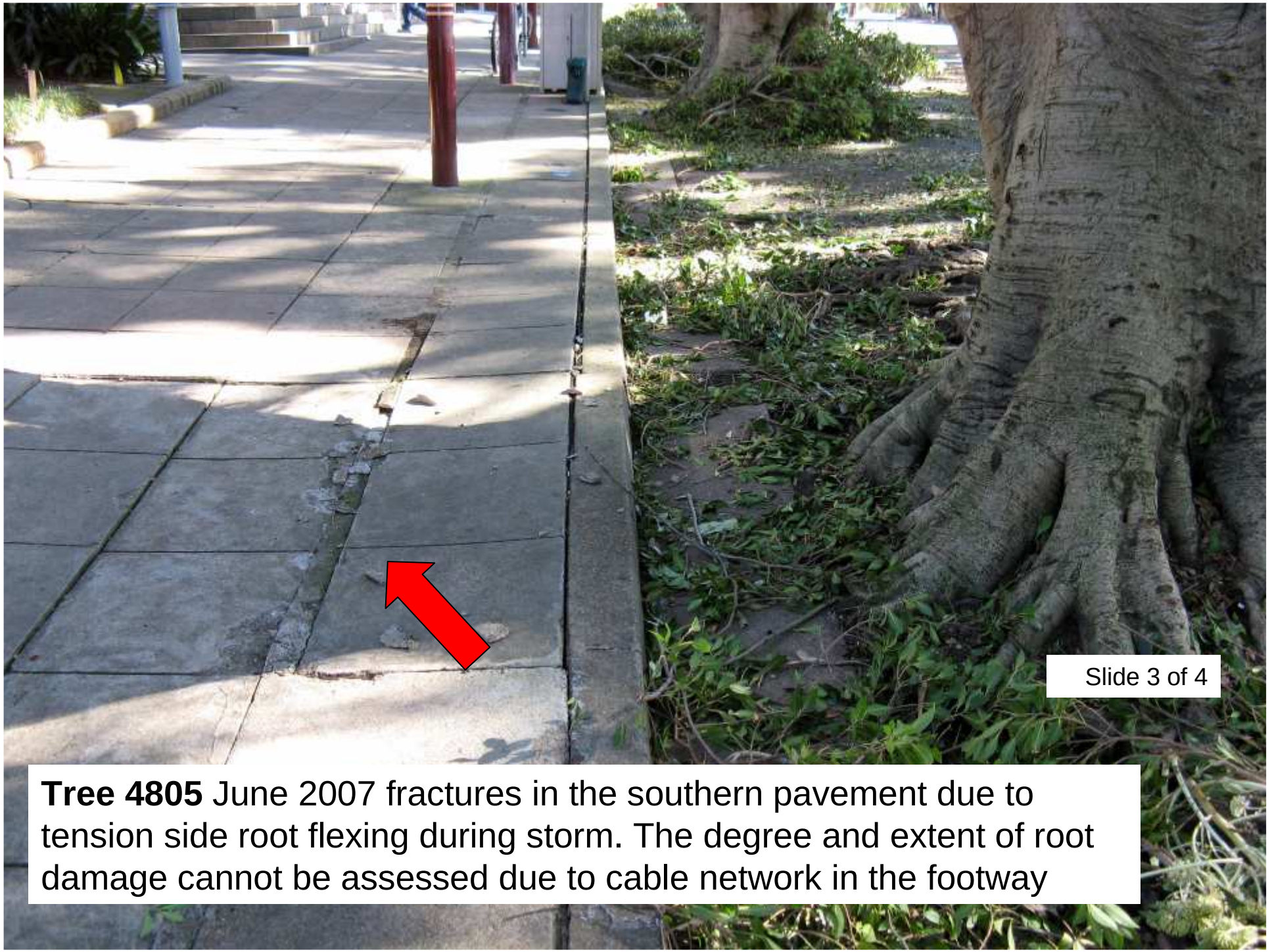

The extent of the root plate on the northern side of the Laman Street trees i.e. the trees on south side, is defined by the edge of the parking lane.
Critical damage. Typically wounded buttress roots that form the tree's primary mechanical support.

Fractured kerb and channel caused by flexing of tensile loaded roots

Tree 4805

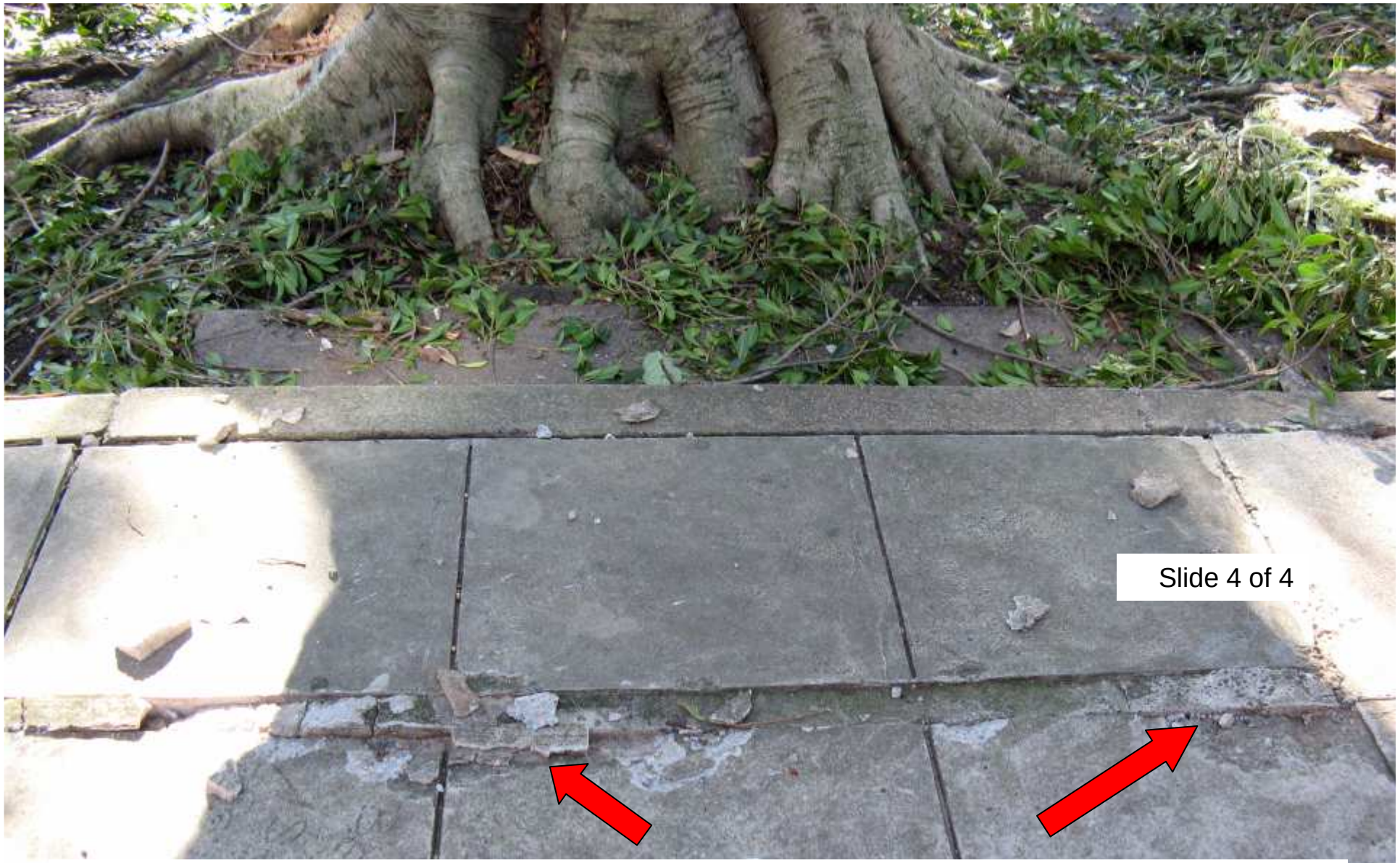
Laman Street southern side 2007

A 25m high tree with wounded and weakened structural roots is a mechanically compromised structure



Slide 3 of 4

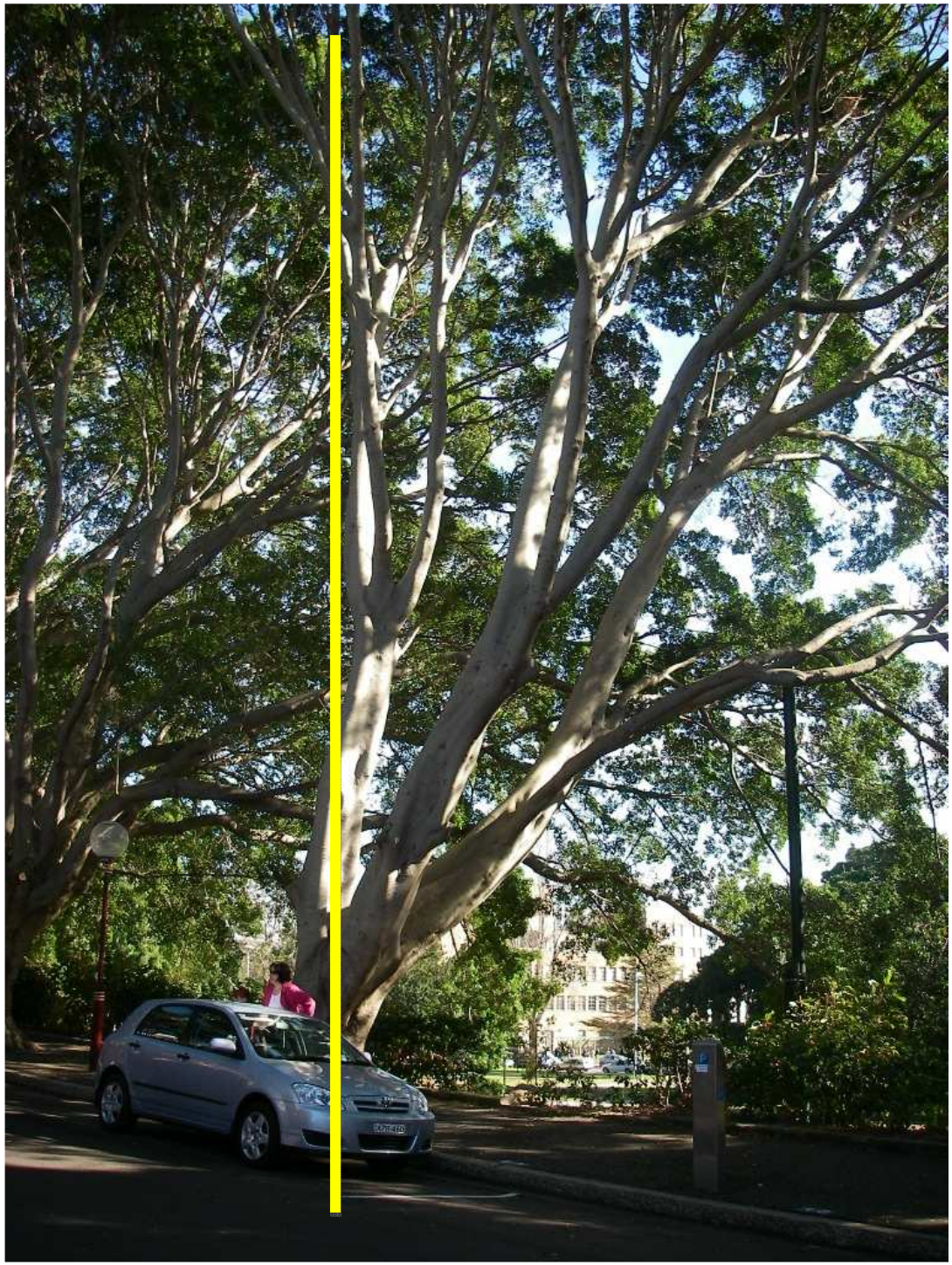
Tree 4805 June 2007 fractures in the southern pavement due to tension side root flexing during storm. The degree and extent of root damage cannot be assessed due to cable network in the footway



Laman St - June 2007 Tree 4805

pavement fractured due to tension side root flexing during the storm. The extent of root damage was not assessable due to presence of utilities. The mechanical effectiveness of longitudinal roots under tensile load is compromised. For this and other trees on the southern side of Laman Street, the tensile roots carry the majority of load due to absence of co-functional compressive roots on the road side of tree


Laman St 2007 Tree # 4797 removed due to instability caused by root plate failure
Slide 1 of 4



Tree 4797

Severe crown asymmetry in 2006

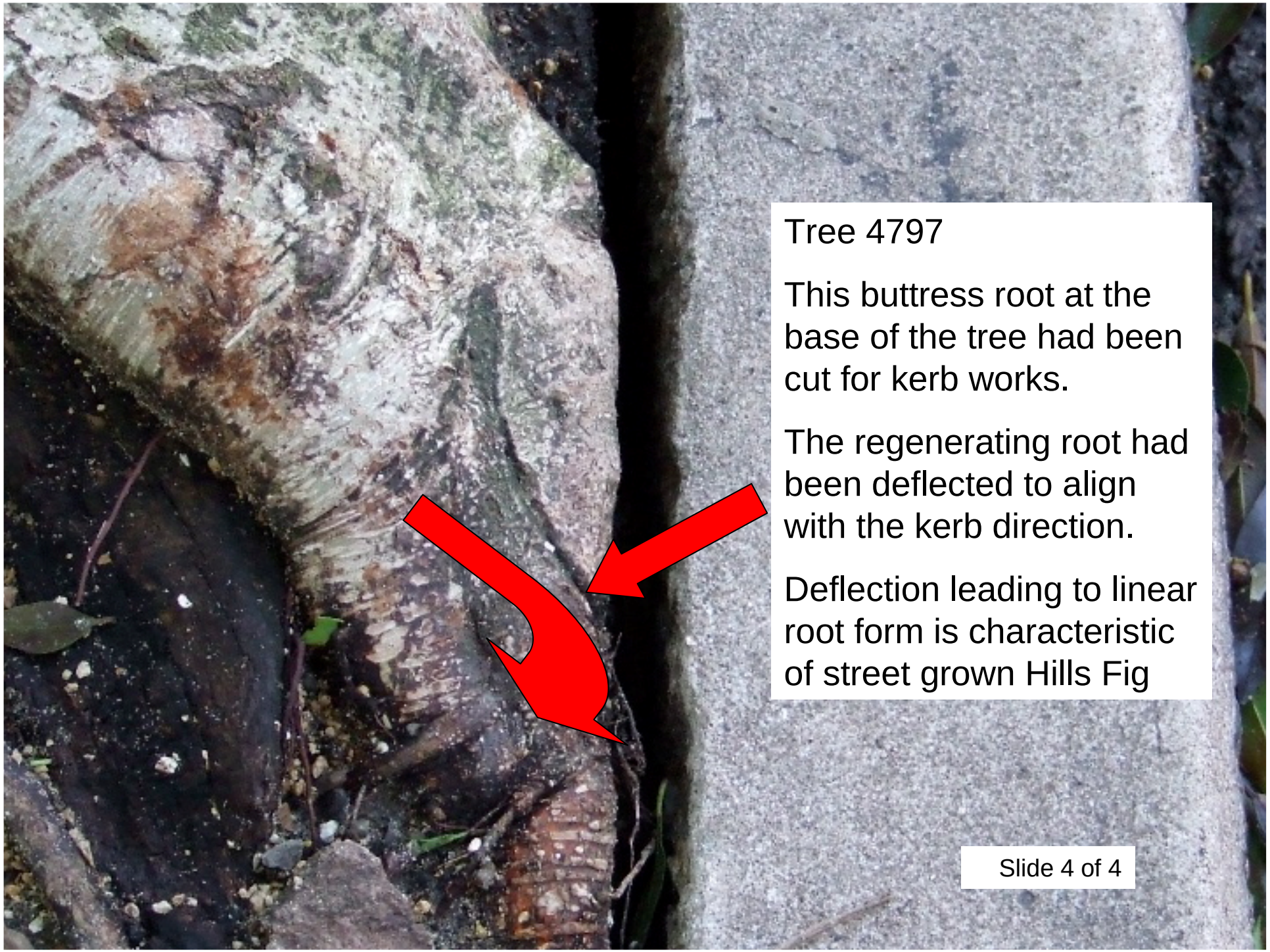
15.5m north,

6.3m south,

9.3m east,

5.6m west


Tree 4797. Structural root movement away from the kerb during the 2007 storm. The illustration below shows the full extent of root development on the southern side of this tree.
Slide 3 of 4



Tree 4797

This buttress root at the base of the tree had been cut for kerb works.

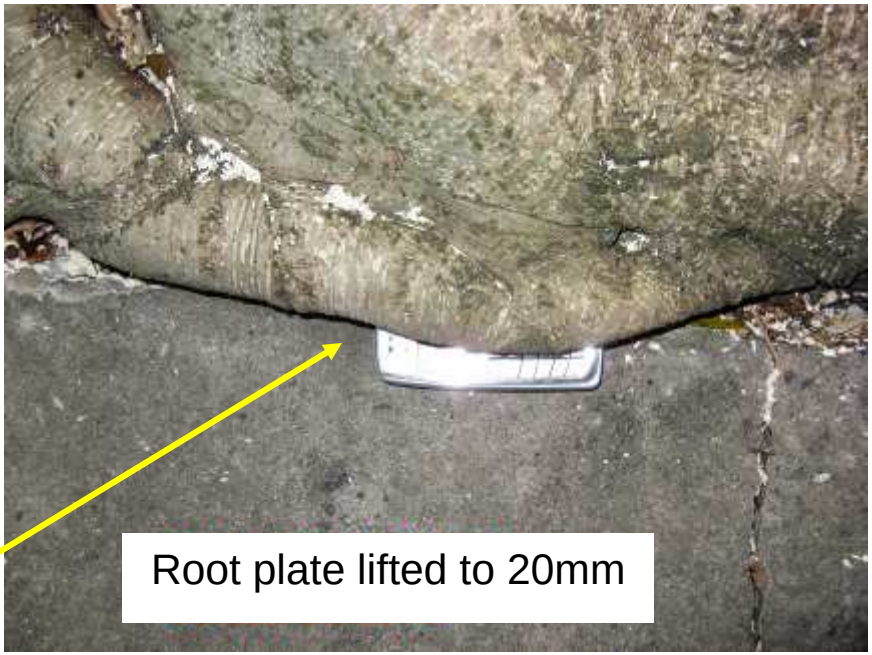
The regenerating root had been deflected to align with the kerb direction.

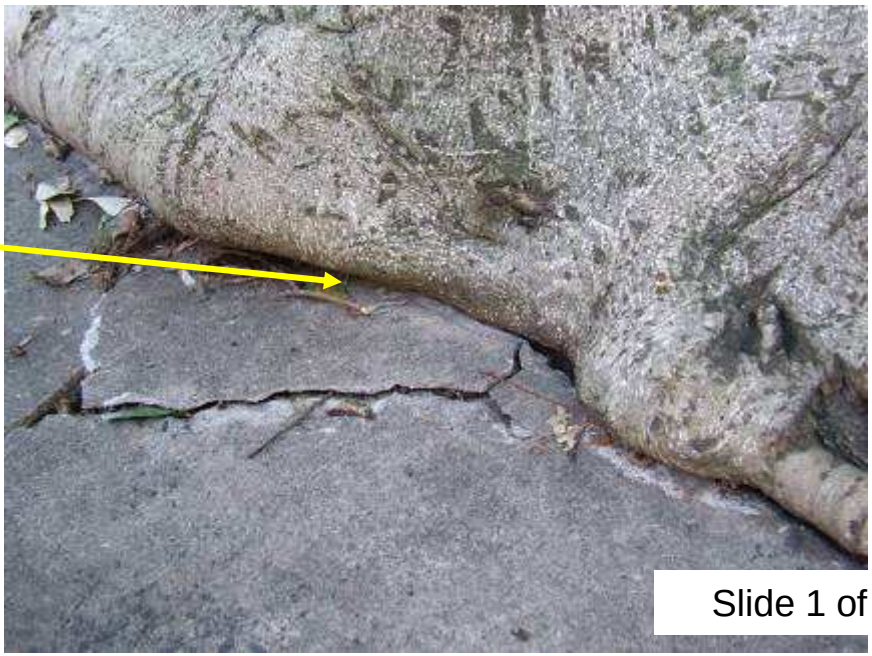
Deflection leading to linear root form is characteristic of street grown Hills Fig

Tree 12018 on the northern footpath at the eastern end of Laman Street was wind rocked in the June 2007 storm.

The tree was assessed and a determination made to retain the tree as it had a more symmetrical form than adjacent trees and no evidence of root movement or root/crown fractures in on the compression side.

Hills Fig tree removed at 41 Laman Street due to tensile root failure in June 2007 storm. Resident advised that foliage previously above vehicle was now touching roof of parked car.





41 Laman St root plate failure

Compression stress cracks on road pavement side

Laman Street northern footpath

Excavations commence for high voltage power cable failure in 2009

Slide 2 of 6

Laman St northern footpath – cable repair in 2005

Laman Street northern side

Two structural roots growing toward Civic Park batter.

Considerably less roots than the Auckland St/Civic Park Hills Fig.

High voltage
electricity cables

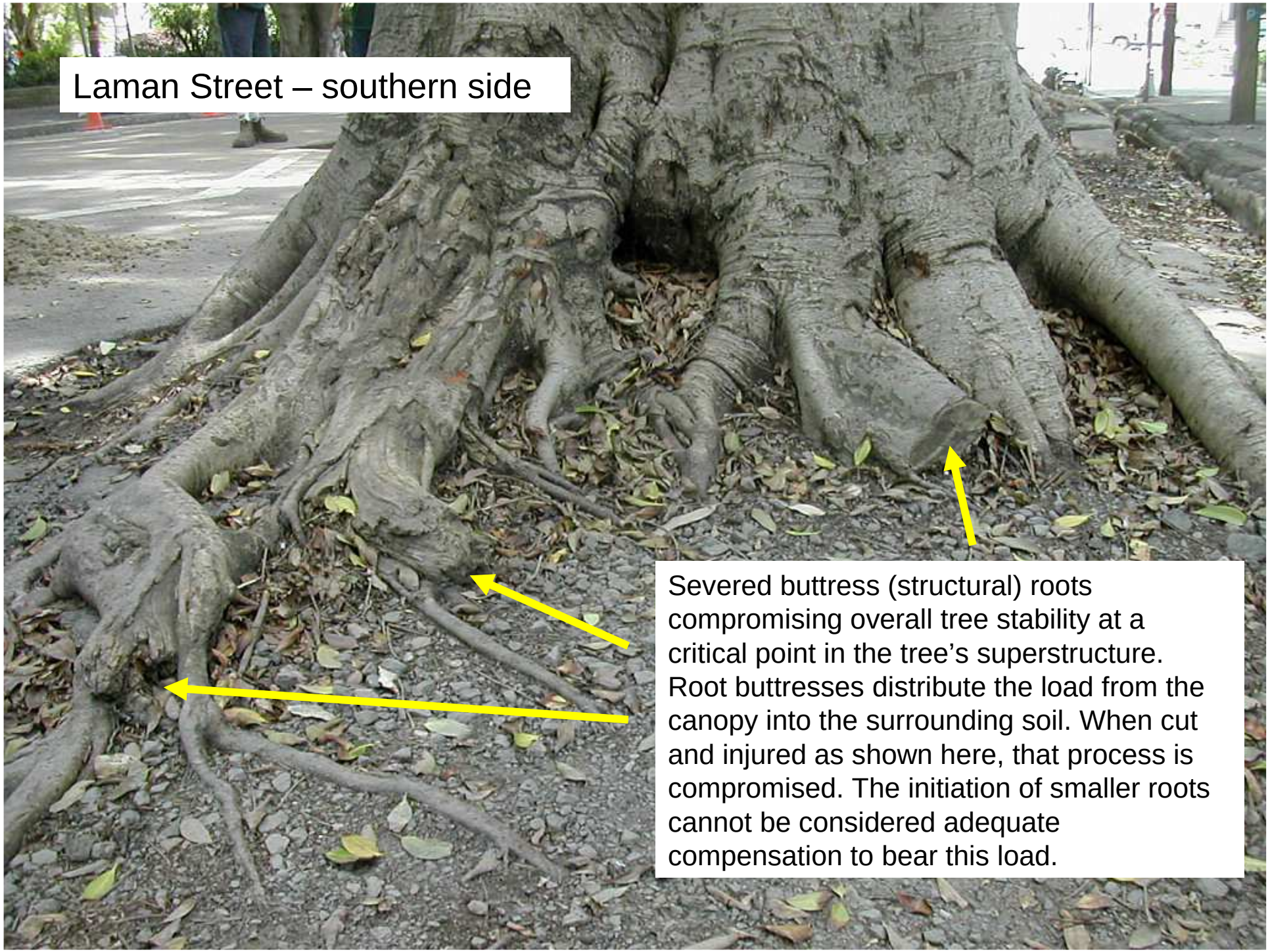
Third footpath
Opening since 2005

Cable realignment passed around the tree and under the exposed roots.

Laman Street
southern side
August 2010

Hunter Water excavation severs structural root that ran along and under gutter line.

This was the only root found on this side of the tree


Laman Street – southern side
Severed buttress (structural) roots compromising overall tree stability at a critical point in the tree's superstructure. Root buttresses distribute the load from the canopy into the surrounding soil. When cut and injured as shown here, that process is compromised. The initiation of smaller roots cannot be considered adequate compensation to bear this load.

The Casebook History 2000 to 2011 Conclusion

The tree failure history illustrated in this presentation concerns Hills Fig trees and other similar large trees growing in streets where infrastructure restricts the development of a mechanically effective root system, and where recurrent road and utility works have damaged critical stabilising roots.

As tree height and spread increase, the leverage on constrained root systems leads to an increase in the risk and incidence of root plate failure. The assessment of the likelihood of such failure is complicated because of numerous unrecorded utility works near the base of the trees. A precautionary approach is necessary in these circumstances.

The history of recurrent and extensive ‘lopping’ of large growing trees, mainly in streets, has resulted in a legacy of large potentially defective trees. Lopping has led to decay in stabilizing root systems, cavities in trunks and structural branches, weak branch unions and other defects.

The historical record cannot be ignored. The legacy of trees subjected to past severe pruning and wounding needs to be systematically assessed. Succession planning is essential in order to ensure continuing public safety and a sustained yield of urban forest benefits.

Postscript

The Laman Street Hills Fig trees were removed in February 2012 in accordance with the resolution of elected Council.

The reconstruction of Laman Street commenced in September 2012 in accordance with the officially adopted design and will be completed by September 2013.