# Path Material Options

## Calala to CBD Recreational Path

DSJN1429-REP03

Regional Services

Strategy Assets and Design Division

Tamworth Regional Council

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# 1 Introduction

## 1.1 Purpose of the Report

Tamworth Regional Council (TRC) is developing the design of a recreational path between Calala and the CBD. The material used for the construction of the path is sensitive to several of the stakeholder groups due to the proximity of the path to State Heritage listed trees and the location of the path being within a floodplain that is regularly submerged. The aim of this document is to investigate and assess the preferred material for the path. This is achieved by establishing the context where the path is located, the objectives of the path construction material and an assessment of whether the different options meet the objectives.

## 1.2 Site Location

The project commences at Paradise Bridge and continues along King George V Avenue and Campbell Road (both the unformed and formed Road Reserves) and finishes at the recently constructed Roundabout at the intersection of Calala Lane and Campbell Road. The proposed path is approximately 3700 metres long.

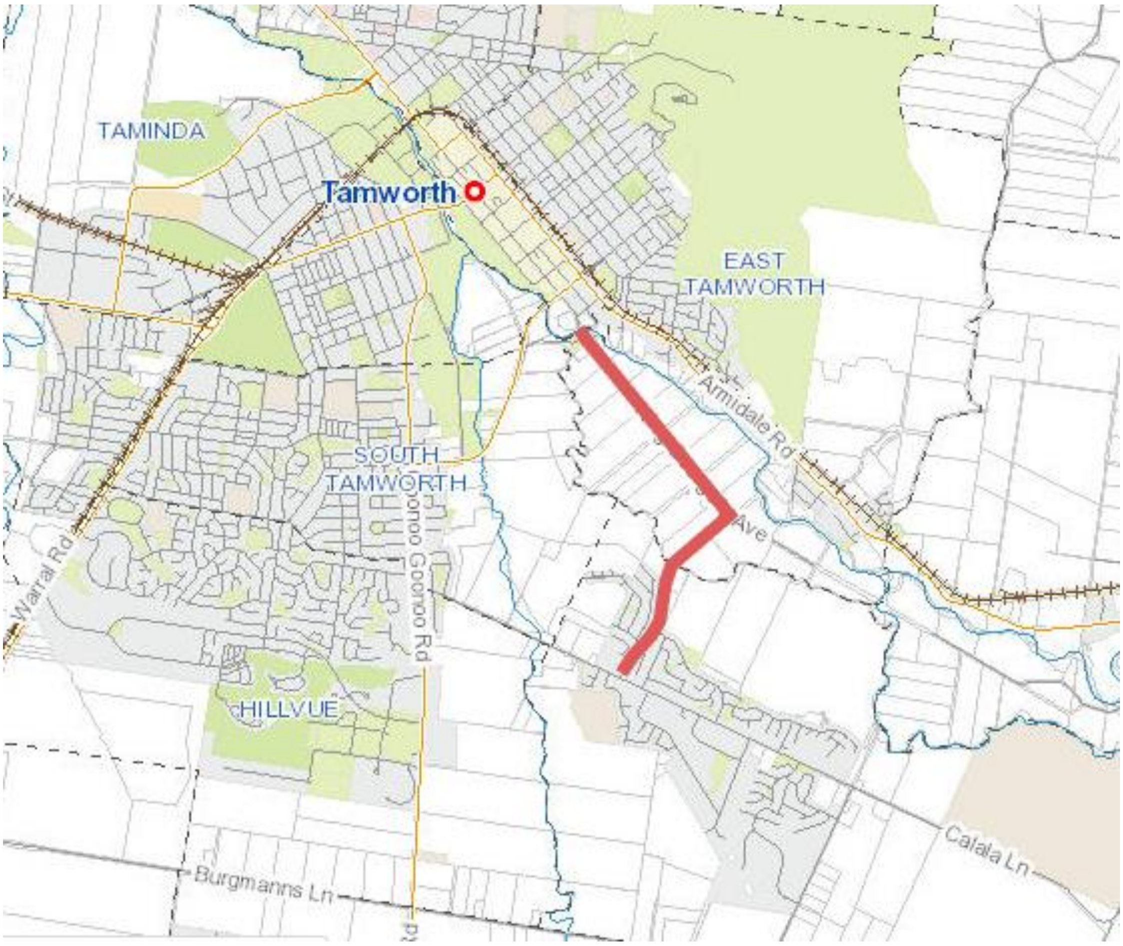


Figure 1 Site plan

## 1.3 Understand the Context

*Understand the context of the area and what is important about the local character including what role the path should play within the area*

The route of the path passes through two distinctly different landscape contexts with a change in path width between the two settings.

- Context 1: The setting is the built up urban environment within the suburb of Calala. At one end is a recently constructed roundabout at the intersection of Campbell Road and Calala Lane, and the other end is a cul-de-sac just prior to Calala Creek which is currently impassable for pedestrians due to being predominantly wet. The path is located within the verge adjacent to a bitumen sealed road with kerb and gutter. There is substantial hard surfacing within this context such as the roadway, the kerb and gutters, driveway and parking bays. There is regular vehicular traffic using the road. This area is currently used by pedestrians who primarily walk on the grassed verge.

  Context 2: The setting is the Peel River floodplain and the State Heritage listed King George V Avenue. The heritage listed avenue consists of English Oak trees that line both sides of the road to form an interlocking canopy above the roadway for a length of approximately 1500m. At one end is Paradise Bridge which allows vehicular and pedestrian access over the Peel River, and the other end is an unformed section of Campbell Road which meets Calala Creek and is currently impassable for pedestrians due to being predominantly wet. The road is a narrow bitumen sealed surface that provides access to local residents, businesses and farmland. There is low traffic volumes with some anecdotal evidence of high speeds. There are overhead high voltage power lines and worn vehicle tracks within both of the verges. The avenue is subject to regular flooding with flood waters travelling parallel to the road. There is an unformed track, Campbell Road, that crosses the floodplain perpendicular to the flood waters and provides access to a couple of properties thus traffic volumes are very low and speeds are slow. There are numerous mature River Red gum trees within the road reserve and the road reserve is typically grassed. Anecdotally, King George V Avenue is reasonably well utilised by recreational pedestrians who walk along the sealed road.

## 1.4 Set the Objectives

*What are the objectives of the construction material selected for the path*

The objectives of the material adopted for the path are:

- Functionality and Safety - To allow all active transport user groups to safely use the path both in the short term and long term
- Environment – to not cause short term or long term health impact to the heritage listed trees
- Maintenance - To require minimal repairs to the surfacing, particularly avoiding renewal due to flood and root damage
- Cost – To not be cost prohibitive
- Heritage – To complement the character and heritage value of the avenue

## 1.5 Define Design Principles

*What are the design principles that will realise the objectives*

The design principles for the path material shall include:

- Provide a surface that is free of hazards for all bike users and pedestrians, particularly vulnerable user groups such as young children and the elderly
- Provide a surface that is resistant to flood damage, durable for foot and bike traffic and resistant to root damage
- The material used shall minimise impact on tree roots and be assessed to not cause detrimental short or long term impact to the tree health

- Consider whole of life cost of the path over a 100 year design period including maintenance, demolition and renewal as appropriate
- Minimise ongoing maintenance so as to maintain a functional and usable path as often as possible
- Be easily identifiable as a path, rather than another travel lane, and to not detract from the heritage values of the area.

# 2 Path Material Options

As the context of the setting for the path changes, so too could the preferred construction material. In acknowledgement of this, the preferred path material has been considered for each of the two identified contexts

## 2.1 Context 1: Urban residential environment within Calala

**Table 1 Context 1 Path material assessment for the urban residential environment**

| | Path Material | Provides Functionality and Safety | Environment | Minimises Maintenance | Not be Cost Prohibitive | Complements Heritage character |
|---|---|---|---|---|---|---|
| Non-porous | Concrete | Yes. Unlikely to create hazards and has a smooth surface that can be utilised safely by multiple user groups including walkers, cyclists, scooters, rollerblades etc. Able to be line marked and stencilled where required. | No critical trees within this context | Very durable material including for vehicle loading at driveway crossings<br>**Debris on path** – able to be removed easily with no damage to path | Larger upfront cost but very minimal additional cost typically results in lower whole of life cost than asphalt | N/A for this context |
| | Dense Graded Asphalt | Yes. Unlikely to create hazards and has a smooth surface that can be utilised safely by multiple user groups including walkers, cyclists, scooters, rollerblades etc. Able to be line marked and stencilled where required. | No critical trees within this context | Very durable material including for vehicle loading at driveway crossings<br>**Debris on path** – able to be removed easily with no damage to path | Moderate upfront cost (cheaper than concrete) but typically requires maintenance after 10-15 years | N/A for this context |
| Porous | Grass Pave or similar | Is functional for walkers joggers and capable bike riders. It is difficult to maintain a flush surface as the pavers or plastic grids displace over time and grass grows and/or dies which can cause trip hazards. Wet grass may be a slip hazard if not mown regularly. Risk of weeds | No critical trees within this context | Grass within the geogrid or between pavers can die off and would need renewing. Geogrid or pavers can become displaced and require re-setting. Risk of weeds growing | Moderate upfront cost and high maintenance cost | N/A for this context |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | growing within geogrid which can reduce useability in some instances.<br>The surface is not suitable for scooters, rollerblades young children with bikes etc. | | within geogrid which can reduce useability in some instances<br>Ongoing maintenance such as mowing required to maintain path functionality. | | |
| | Gravel | No. unbound gravel can prohibit the use of smaller bikes for young children, scooters, prams and skateboards. Unable to be line marked or stencilled. Potential trip hazard for vulnerable pedestrians.<br>The surface is not suitable for commuter cyclists (especially those with road bicycles), Loose Gravel and rutting is a significant risk. | No critical trees within this context | Gravel regularly requires reinstatement particularly after rain events. Prone to encroachment by grass and weeds which can reduce useability in some instances | Low upfront cost and high maintenance cost | N/A for this context |

## 2.2 Context 2: Peel River Floodplain and King George V Avenue

**Table 2 Context 2 Path material assessment for the Peel River floodplain and King George V Avenue**

| Permeability | Path Material | Provides Functionality and Safety | Environment | Minimises Maintenance | Not be Cost Prohibitive | Complements Heritage character |
|---|---|---|---|---|---|---|
| Non-porous | Concrete | Excellent functionality and safety. Has a smooth surface and is suitable for all path user types. Able to be line marked and stencilled where required. Minimal risk of trip hazards | **Root damage during excavation** – Excavation limited to 50-75mm below ground level which is typically above depth of the feeder roots. There may be some cutting of roots required however this can be controlled to reduce impact to tree health<br>**Compaction loads** – compaction loads only slighter higher than a person loading<br>**Reduction in oxygen and water reaching tree roots** – The Level 5 arborist notes that concrete slabs don't prevent root development as evidenced when slabs are typically lifted. Moisture will track through the soil and the underside of slabs can often be damp. Roots are opportunistic and will seek the moisture, wherever it is in the proximity of the tree | **Flood loading** - Very durable material to resist flood damage. May require a downturn beam to prevent undermining, subject to velocities<br>**Root penetration –** very resistant to damage from roots<br>**Vehicle loading** – can resist vehicle loads<br>**Debris on path** – able to be removed easily with no damage to path | Larger upfront cost but very minimal additional cost | Although a concrete path would be a change to the historical landscape, the heritage consultant considers it acceptable in the context of re-invigorating awareness and use of the avenue. Oxides may be used if desired to lessen its visual impact |
| | Dense Graded Asphalt | Excellent functionality and safety. Has a smooth surface and is suitable for all path user types. Able to be line marked and stencilled where required. Minimal risk of trip hazards | **Root damage during excavation** – Excavation limited to 50-75mm below ground level which is typically above depth of the feeder roots. There may be some cutting of roots required however this can be controlled to reduce impact to tree health | **Flood loading** - Very durable material to resist flood damage. May require a downturn beam to prevent undermining, subject to velocities<br>**Root penetration –** reasonable resistance to | Moderate upfront cost (cheaper than concrete) but may require maintenance after 10-15 years if root penetrations affects the surface | The use of black asphalt should be avoided to avoid the path being mistaken for a road. Coloured asphalt would be an acceptable outcome |

| Permeability | Path Material | Provides Functionality and Safety | Environment | Minimises Maintenance | Not be Cost Prohibitive | Complements Heritage character |
|---|---|---|---|---|---|---|
| | | | **Compaction loads** – compaction of asphalt is required by construction plant<br><br>**Reduction in oxygen and water reaching tree roots** – The Level 5 arborist notes that asphalt slabs don't prevent root development as evidenced when slabs are typically lifted. Moisture will track through the soil and the underside of slabs can often be damp. Roots are opportunistic and will seek the moisture, wherever it is in the proximity of the tree | root penetration. The surface may crack and become displaced over time<br><br>**Vehicle loading** – can resist vehicle loads<br><br>**Debris on path** – able to be removed easily with no damage to path | | |
| | Open Graded Asphalt | Excellent functionality and safety. Has a smooth surface and is suitable for all path user types. Able to be line marked and stencilled where required. Minimal risk of trip hazards | **Root damage during excavation** – Excavation limited to 50-75mm below ground level which is typically above depth of the feeder roots. There may be some cutting of roots required however this can be controlled to reduce impact to tree health<br><br>**Compaction loads** – compaction of asphalt is required by construction plant<br><br>**Reduction in oxygen and water reaching tree roots** – Open graded asphalt contains voids which allows moisture to pass through the slab. The tree roots will see less moisture under the path but not a complete loss of moisture. The permeability of the | **Flood loading** – durable material that can resist flood loading however the voids within the asphalt will become clogged after flooding which is very difficult to rectify which results in the porosity of the asphalt being reduced<br><br>**Root penetration –** reasonable resistance to root penetration. The surface may crack and become displaced over time<br><br>**Vehicle loading** – can resist vehicle loads | Moderate upfront cost (cheaper than concrete) but may require maintenance after 10-15 years if root penetrations affects the surface | The use of black asphalt should be avoided to avoid the path being mistaken for a road. Coloured asphalt would be an acceptable outcome |

| Permeability | Path Material | Provides Functionality and Safety | Environment | Minimises Maintenance | Not be Cost Prohibitive | Complements Heritage character |
|---|---|---|---|---|---|---|
| | | | asphalt will reduce after each flood event as fine particles clog the voids and are unable to be flushed clean. | **Debris on path** – able to be removed easily with no damage to path | | |
| | Stabilised granite | Good functionality and safety initially when there is a smooth surface. Over time the path will lose functionality as the surface breaks up if it isn't repaired. Potential trip hazards for vulnerable pedestrians if not maintained regularly. Unable to be line marked or stencilled | **Root damage during excavation** – the stabilisation process is likely to cut through shallow feeder roots in an uncontrolled manner and should be avoided<br>**Compaction loads** – compaction of granite material will be required by construction plant<br>**Reduction in oxygen and water reaching tree roots** – Yes, the surface will generally shed water unless it has cracked up | **Flood loading** – Initial resistance to flood damage however once the surface is broken or cracked, it will become easily damaged<br>**Root penetration –** root penetration will cause the stabilised material to crack, leading to increased maintenance works<br>**Vehicle loading** – will become damaged due to vehicle loads<br>Once the surface is damaged, it is difficult to repair in isolation of the rest of the path<br>**Debris on path** – difficult to remove without damaging path | Cheap to build but regular maintenance needed | This material would provide a natural look however if the surface is damaged and not accessible for all user groups then this would reduce the effectiveness of the path at reinvigorating the avenue |
| Porous | Elevated boardwalk | Assuming FRP decking is used it will be functional for all path users. The elevated edge of boardwalk is a hazard and prevents path users stepping off the path to avoid oncoming users. | **Root damage during excavation** – Excavation for footings will cut through roots. This will only occur at discrete locations<br>**Compaction loads** – No, loads will be transferred below ground level via the footings | **Flood loading** - Very durable structure however FRP decking may need replacement after floods<br>**Root penetration –** Excellent resistance to root penetration | Expensive upfront cost. Still requires some maintenance after flooding, particularly if decking is washed away | An elevated boardwalk is both a change to the historical landscape and a more visually obtrusive structure than an at ground solution |

| Permeability | Path Material | Provides Functionality and Safety | Environment | Minimises Maintenance | Not be Cost Prohibitive | Complements Heritage character |
|---|---|---|---|---|---|---|
| | | Would need to transition to a concrete path at driveways without stairs. Potential slip hazard when wet if certain construction materials used. Potential difficulty in line marking or stencilling | **Reduction in oxygen and water reaching tree roots** – No | **Vehicle loading** – Will need to transition to a bon-porous, durable material at driveways<br><br>**Debris on path** – Reasonably difficult to remove debris due to elevation | | |
| | No Fines Concrete | Yes, if screed finished it will be free of hazards however it is expected aggregates will chip off over time unless a suitable permeable wearing surface is provided. Will resist vehicle loads at driveways. Potential difficulty in line marking or stencilling. | **Root damage during excavation** – Excavation limited to 50-75mm below ground level which is typically above depth of the feeder roots. There may be some cutting of roots required however this can be controlled to reduce impact to tree health<br><br>**Compaction loads** – compaction loads only slighter higher than pedestrian loading<br><br>**Reduction in oxygen and water** – Slight reduction but will allow moisture and oxygen to penetrate through. The permeability of the no fines concrete will reduce after each flood event as fine particles clog the voids and are unable to be flushed clean. | **Flood loading** – Resistance to flood loading is unknown. Voids would likely get clogged after flooding which is difficult to rectify and would reduce the effectiveness of the permeability over time<br><br>**Root penetration –** good resistance to root penetration<br><br>**Vehicle loading** – can resist vehicle loading<br><br>It is likely that the surface aggregates will chip off over time which may lead to isolated repairs being necessary unless they are covered by a permeable material such as pebble pave. This wearing surface will also likely need replacing over time | Moderate upfront cost. Ongoing maintenance may be required. The use of polypropylene fibres would improve the resistance of the concrete to damage | Although a concrete path would be a change to the historical landscape, the heritage consultant considers it acceptable in the context of re-invigorating awareness and use of the avenue. Oxides may be used if desired to lessen its visual impact |

| Permeability | Path Material | Provides Functionality and Safety | Environment | Minimises Maintenance | Not be Cost Prohibitive | Complements Heritage character |
|---|---|---|---|---|---|---|
| | | | | **Debris on path** – likely that some damage will occur to path when removing debris | | |
| | Grass pave, truegrid paver, geohex or similar | Partial. Difficult to maintain a flush surface as the individual pavers or plastic grids displace. May present a trip hazard particularly for vulnerable pedestrians. Not functional for all users such as children's bikes, road bikes, scooters, prams and skateboards due to uneven surface. Wet grass may be a slip hazard if not mown regularly. Grassed area may not be distinguishable as a path and vehicles continue to park there. Risk of weeds growing within geogrid which can reduce useability in some instances. Unable to be line marked or stencilled. | **Root damage during excavation** – excavation up to 150mm depth so the path is flush with the ground level which is likely to be within the feeder root zone and will require cutting of some tree roots. This can be controlled to reduce the impact to tree health<br>**Compaction loads** – bedding for the paver is required which will need some compaction<br>**Reduction in oxygen and water reaching tree roots** – Negligible reduction in oxygen and moisture ingress to the root zone<br>Will have a low surface temperature at the surface of the path compared to other materials | **Flood loading** – Resistance to flood loading is unknown. Risk of grids washing away due to them being individual units<br>**Root penetration –** roots can lift sections of the path creating an uneven surface<br>**Vehicle loading** – can resist vehicle loading<br>**Debris on path** – likely that some damage will occur to path when removing debris<br>Prone to weed growth which can reduce useability in some instances<br>Ongoing maintenance such as mowing required to maintain path functionality. | Low upfront cost. Ongoing maintenance is likely, particularly as roots grow or after flooding. | Once established, permeable material such as grass pave would be less visible and result in less impact on the visual amenity. Permeable materials such as gravel have been discounted as they aren't suitable for all user groups. Unless visually distinguishable, the grass surface is likely to see continued use by vehicles which will continue to compact the ground and not achieve the desired outcome of preserving tree health |
| | Gravel | No. unbound gravel can prohibit the use of smaller bikes for young children, | **Root damage during excavation** – excavation likely to be within the feeder root zone (root size > | **Flood loading** – Will require substantial maintenance after a flood | Low upfront cost. Extensive | This has been discounted on the grounds the |

| Permeability | Path Material | Provides Functionality and Safety | Environment | Minimises Maintenance | Not be Cost Prohibitive | Complements Heritage character |
|---|---|---|---|---|---|---|
| | | scooters, prams and skateboards. Potential trip hazards for vulnerable pedestrians if not maintained regularly. Unable to be line marked or stencilled<br><br>The surface is not suitable for commuter cyclists (especially those with road bicycles), Loose Gravel and Rutting is a significant risk. | Ø5mm) so the path is flush with the ground level<br><br>**Compaction loads** – compaction of gravel material will be required by small construction plant<br><br>**Reduction in oxygen and water reaching tree roots** – No. Gravel is permeable. | **Root penetration –** roots can grow through to the surface easily<br><br>**Vehicle loading** – can resist vehicle loading but turning movements will create loose gravel<br><br>**Debris on path** – difficult to remove without damaging path | maintenance required | surface is not suitable for all users groups |

# 3 Discussion of the assessment

For Context 1 which is the urban residential environment within Calala, a concrete or asphalt path both meet most or all of the objectives of the path. Past experience indicates that a concrete path typically has lower whole of life cost than an asphalt path. Flood and heritage impact were not relevant for this location due to being located outside of these areas.

For Context 2 which is the Peel River floodplain and King George V Avenue, this context is broken up into two sub-contexts for this assessment; namely the unformed Campbell Road within the Peel River floodplain, and King George V Avenue. The reason for splitting up this context is because:

a) the orientation of the path to the direction of floodwater is different with an increased risk of damage to the path when the flow of water is perpendicular to it; and

b) The State Heritage listed Avenue of English Oak trees are only located with King George V Avenue.

The section of path within the unformed Campbell Road is perpendicular to the flow of floodwater and passes close by to several mature River Red Gums. This path orientation results in a bigger risk of erosion and undermining compared to a path orientated parallel to the floodwater due to flood water turbulence on the upstream and downstream edge of the path. Resistance to flood damage is the key objective for the selection of the path material at this location. The velocity of the floodwater up to a 100 year event within Campbell Road are up to 1.8m/s. For comparison, the 100 year velocities at nearby existing concrete paths that are also perpendicular to the floodwater such as the shared path on Calala Lane and the shared path on Scott Road are 2.4m/s and 1.3m/s respectively. There is minimal evidence of erosion, undermining or other flood related damage to these existing paths and the velocity of floodwater across Campbell Road is similar in magnitude to the existing paths. It is also worth noting that neither the existing Calala Lane shared path or the Scott Road shared path have downturn beams which can be considered as an additional safeguard option in the areas perpendicular to floodwater This demonstrates that concrete would be a suitable material for this location.

Table 2.6 of Austroads Guide to Road Design Part 5B provides the permissible flood velocities for vegetated ground based on the percentage of ground cover and the grade. For a relatively flat grade of 0.5%, 70% grass coverage (which is recommended for poorly maintained Rhodes grass or couch) and erosion resistant soils, the maximum permissible flood velocity is 2.4m/s. Erosion resistant soils are deemed suitable at this location given the lack of erosion related water holes and headcuts. The 100 year velocities are less than the permissible velocities, therefore if established grass is present adjacent to the path, it is expected to be able to resist flood damage.

The section of path within King George V Avenue is aligned parallel to the primary flow of floodwater and is in close proximity to the English Oak trees. Resistance to flood damage, minimising negative impact to tree health and functionality are the key objectives for the selection of the path material at this location.

The velocity of the floodwater up to a 100 year event within King George V Avenue is up to 1.5m/s. Concrete and asphalt have good resistance to damage from flood water exceeding that velocity particularly if established grass is along the edge of the path. Contacted suppliers of permeable materials such as true grid paving have noted they aren't aware of any locations where that material has been used in a floodplain, thus they couldn't provide advice on the resistance to flood damage. These permeable systems typically rely on small sized cells to make the path (eg 600mm x 600mm units split up into a number of smaller sized internal cells) which are more susceptible to flood damage or lifting from tree roots than an homogeneous material like a concrete or asphalt path.

The Level 5 qualified arborist engaged to provide advice for this project has addressed several questions relating to the use of concrete as a material adjacent to the trees and the impact it will have on the tree health (refer to DSJN1429-REP02 for the questions and responses). A few of the specific issues that have been repeatedly raised by the King George V Avenue working group include the risk of Fungus Armillaria attacking the tree due to excavation adjacent to the tree, the roots being starved of oxygen and moisture and compaction of the root zone under the path.

Regarding the risk of Fungus Armillaria, the arborists research indicates that fungal infection typically occurs when infected roots come in contact with uninfected roots, which spreads the infection and that it is unlikely the fungus spreads through the soil by its own devices. Another common means of fungus spread is through the importation of infected material such as plants, roots or mulches. Drought and flood is often associated with severe symptoms of infection, with the stress of the environmental conditions predisposing the tree to severe infection. Both porous and non-porous path materials will require a similar depth of excavation to bed the path below ground level. The excavation is located within the extent of the tree root zone, so transportation of roots from other species is not likely to occur. The arborist has noted that maximising the distance from the path to the tree stump and minimising the depth of excavation are keys ways to reduce the risk of attack from the fungus. Furthermore, reducing the stress on the tree can be achieved by the mitigation measured outlined in the arborists report, such as effective pruning and removal of dead wood prior to the commencement of the excavation.

Another concern was the 3.5m width of path would starve the roots of oxygen and moisture. The arborists notes that a concrete slab does not stop root development, as the root system of a plant is opportunistic. The interface between the underside of slab and clay subgrade can often be a moist environment with a mass of feeder like roots often evident at or near this interface when slabs are manually lifted. Furthermore, the path does not remove moisture from the catchment of the tree, with any rainfall shedding from the slab to the ground adjacent which is still within the extent of the root zone.

Compacted soil around the trees already exists as identified in the Conservation Management Plan (2016), due to the vehicles (both light vehicles and tree pruning vehicles) that currently drive on the verge area. The construction of a concrete path does not require compaction by construction plant and once hardened will spread foot traffic pressures out of a larger distance than a less rigid material (including existing conditions), thus reducing the pressure from a pedestrian walking on a slab compared to walking on the bare ground or even on a permeable path material. The increased weight of concrete compared to the soil it replaces is a minimal increase in pressure. A permeable path incorporates a granular base layer underneath the plastic grids, which requires compaction from construction plant and the flexible material does not spread pedestrian or vehicle load as effectively as concrete. Thus, a concrete path is expected to have less initial and ongoing compaction of the soil than pedestrians using an asphalt or permeable path.

The provision of the path will reduce the number of vehicles driving within the area, with concentrated vehicles loads resulting in much greater compaction than pedestrian loads spread out by a rigid slab, thus the compaction of the soil is not expected to increase following the construction of the path and may even result in reduced compaction over time.

The functionality of a concrete path allows all user groups to safely use the path, thus maximising the opportunity for community use. The use of a porous material such as true grid or grass pave involves grass growing through plastic cells to create a permeable surface that can resist the loads from pedestrian traffic. The use of grass as the surface material, which is not flat or smooth, would be an impediment to some of the path user groups such as skateboarders, young children who ride balance bikes, parents with prams or similar. The grass can be slippery when wet or can be a trip hazard if it grows unevenly or as the individual plastic cells displace due to root growth or flood damage. The grass would need regular mowing to encourage usage and in times of drought or following floods, the grass will die off or become muddy. These numerous functionality issues relating to a permeable path are not an issue for a concrete path.

Open graded asphalt or no fines concrete both provided good functionality, allow moisture to pass through and have a durable surface. The issue with these materials is that whilst they are initially permeable, each flood event will deposit silts and fine-grained material on the path which will clog the voids and reduce the long term permeability of the material. It is not possible to effectively flush the voids so this benefit will be lost in the long term. The use of open graded asphalt would be preferred over no fines concrete due to its better strength and robustness against flood and root damage. The no fines concrete would also need a special permeable wearing surface to reduce general damage to the surface of the path which may be difficult to replace whilst matching materials. The initial permeability benefits of the open graded asphalt may offset some of the initial stresses on the tree immediately after the path construction and the reduced permeability in time may not be consequential as the tree will have adapted to its new conditions. An asphalt path does however require compaction from construction plant (expected to require a 4T roller) so the benefits of permeability will be reduced by the higher levels of compaction. The heritage consultant is of the opinion that black asphalt would detract from the heritage character of the avenue and thus if this material is adopted, the asphalt should be coloured to better complement the natural colours of the avenue.

In summary, the depth of excavation for all of the considered path materials will be similar and the risk of fungal infection is not associated with the excavation per se but is due to the importation of fungus infected roots to the area and from environmental stressors such as floods and droughts. A concrete path has the best functionality, very good resistance to flood and root damage, the least maintenance requirements, the least amount of ground compaction during construction and in the opinion of the arborist, does not pose an unacceptable risk to the health of the English Oak trees. The use of coloured oxides in the path may, but not must, be adopted to better complement the character of the avenue. An open graded asphalt path would allow some moisture to pass through the voids in the asphalt reducing any immediate loss of moisture related stress on the trees however asphalt will require construction plant to compact the material which will cause increased ground compaction compared to a concrete path. Black asphalt is not considered acceptable due to the similarity to a road surface and if asphalt is adopted as the preferred material, it must be coloured.

In acknowledgement that the path construction from any material will create *some* stress for the trees, a number of tree health mitigation measures are proposed to reduce the stress and to encourage good tree health. Refer to the arborists report for these measures. If oxides or coloured asphalt are proposed, test panels should be constructed to determine the most suitable colour.

# 4 Recommendations and Actions

For Context 1 which is the urban residential environment within Calala, a concrete path is recommended. This material met all the objectives of the path including minimal ongoing maintenance. This material selection is consistent with the preferred material for the majority of the foot path and shared paths within Tamworth.

For Context 2 where the path is located within the unformed Campbell Road across the Peel River floodplain, a concrete path is recommended. This path is aligned perpendicular to the flow of floodwater and this material provides the best resistance to flood damage. The velocities across the path are not considered excessive for this material, as evidenced by the condition of the existing paths on Calala Lane and Scott Road. The provision of a downturn beam on the downstream side of the path or a central key could be considered as low cost inclusions that further reduce the risk of flood damage for this section of the path.

For Context 2 where the path is located along King George V Avenue, there was no material that conclusively met all three of the key objectives, namely resistance to flood damage, minimising negative impact to tree health and functionality. The two materials that best met the objectives are concrete and open graded asphalt, with the arborist determining that the reduced moisture ingress under a concrete path will not result in unacceptable tree health impacts. Whilst a permeable path material has the benefit of not reducing moisture ingress under the path and reducing the surface temperature of the path, it has several functionality and maintenance issues that would preclude the use of the path by numerous user groups. Either a concrete path or open graded asphalt path would be recommended based on both of these materials best achieving the project objectives, which is based on input from Council, suppliers and the specialist consultants. If a concrete path is preferred, a coloured oxide *may* be used to better complement the character of the avenue. If an open graded asphalt path is preferred, the asphalt must be coloured to better complement the character of the avenue. The tree health mitigation measures specified within the arborist report shall be adopted regardless of which material is selected for use.

**END OF REPORT**

**Report Name:** Calala to CBD Recreational Path - Path Material Options

**Report Number:** DSJN1429-REP03

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Tamworth REGIONAL COUNCIL