Darwin Shared Path & Bicycle Lane Technical Notes

16. Shared Path & Bicycle Lane Construction Materials

Objective

The objective of the *Darwin Shared Path & Bicycle Lane Technical Notes* is to provide direction and guidance for the planning and delivery of cycling facilities within the City of Darwin area. These technical notes are also intended to provide information for other stakeholders including the NT Government, cycling groups and the community.

References

Throughout this document, references have been made to the following technical standards and guidelines:

- Australian Bicycle Council *User Guide to Bicycle and Shared Path Selection – Using Whole-of-life Costing* (2006)
- Austroads *Cycling Aspects of Austroads Guides* (2014)
- Austroads *Research Report - Cycling on Higher Speed Roads* (2012)
- Austroads *Guide to Road Design Part 6A: Pedestrian and Cyclist Paths* (2009)
- City of Darwin *Footpath and Pram Crossings (Drawing No. DCC-104)*
- Northern Territory Government *Cycle and Pedestrian Shared Path (Drawing No. CS3006)*
- Road and Traffic Authority *NSW Bicycle Guidelines* (2005)

The technical note should be read in conjunction with these documents.

Introduction

This technical note provides direction and guidance on bicycle path construction materials. The information is compiled from multiple sources, detailing good design practice with reference to the advantages and disadvantage of the different path construction materials.

A number of factors should be taken into consideration when deciding the type of material use in the construction of bicycle paths. These include:

- Design life of the material
- Material and maintenance costs
- Quality of riding surface
- Type of bicycle users expected
- Presence of tree roots along the path alignment
- Thickness of asphalt and concrete paths as well as across driveways

Recommended on-road cycle lane material

Austroads *Cycling on Higher Speed Roads* recommends that shoulders and cycle lanes should be sealed with asphalt (urban road reserves) or spray sealed with aggregate size 7mm or less. This provides a smoother surface, is easier to delineate and has a lower initial construction cost. Asphalt is preferred in urban road reserves.

In rural road reserves, where the transportation of asphalt material is costly or not feasible or where initial costs are a key priority, spray seals are more widely used and preferred. A spray seal at the roadway edge can improve the cycling experience compared to unsealed shoulders.

RTA *NSW Bicycle Guidelines* also suggests that asphaltic concrete is the preferred construction material for on-road bicycle lanes within the road corridor.

Recommended off-road path material

There are mainly four different types of construction materials that may be used; concrete, asphalt, bitumen seal, and unsealed.

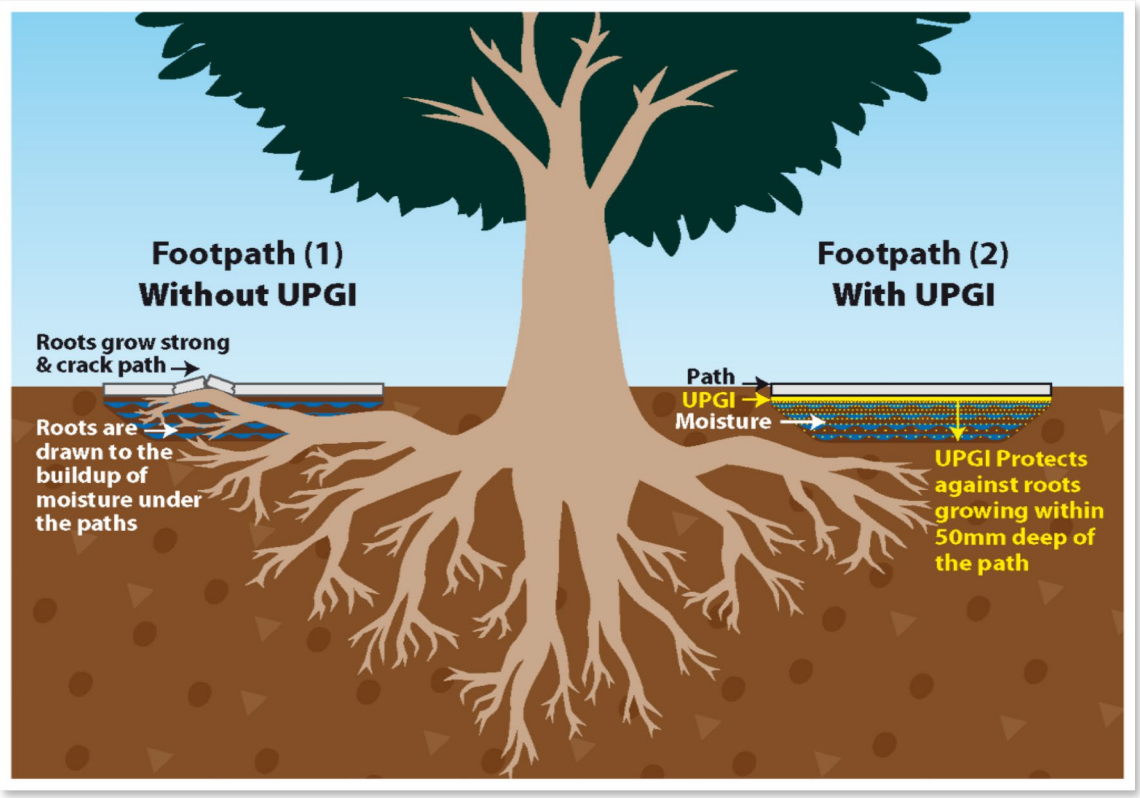
Concrete and asphalt are the preferred material for hot climates as they radiate less heat and thus are the preferred materials for the Northern Territory Climate. Asphalt is generally preferred by path users as it has superior riding qualities. Concrete on the other hand is generally associated with longer design life and a low level of maintenance. For additional information, refer to Austroads *Guide to Road Design: Part 6A Section 6: Commentary 9.*

Concrete

Concrete should be used over asphalt where environmental conditions support this construction. Examples include areas where grass is likely to grow out of pavement cracks, where the path alignment passes close to trees where root intrusion is an issue or where flooding is a common occurrence, such as along riverbanks (as asphalt is more susceptible to water damage).

In general, concrete is easy to maintain, longer lasting and more durable, resulting in lower maintenance costs. Because of this, it is the preferred material choice in low cycling volume applications (less than 10 users per hour).

To protect against deformation/cracking of the path and dislodgement of slabs, root barriers should be used in close proximity to trees and root systems. The most common type of root barrier used for paths is the Under Path Growth Inhibitor (UPGI) – a horizontal layer below the path which protects against trees roots pushing upwards towards the path into the moisture which is trapped below the concrete, as shown in the figure below.



SOURCE: ROOTBARRIER.COM.AU.

A summary of concrete pavement design details as recommended from NTG's standard drawing for shared path is provided below.

Item	Comment
Path thickness	100mm Class N25
Reinforcement	SL72 mesh centrally placed
Base	50mm sand bedding with builders plastic
Subgrade	prepare subgrade to 150mm depth (compact to 95% M.M.D.D)
Expansion Joint	Preformed metal key joints 'Connolly' crack inducer or similar (6m centres)
Tool Joint	2m centres
Root Barrier	Used vertical or horizontally wherever tree roots are at risk of causing damage to the paths as a result of moisture build-up beneath or adjacent to path

SOURCE: ADAPTED FROM NTG CYCLE AND PEDESTRIAN SHARED PATH (DRAWING NO. CS0011)

Asphalt

Asphalt provides a smoother surface than concrete, thereby making the path more attractive for cyclists. It is therefore recommended for paths with high bicycle traffic such as commuter routes (e.g. more than 50 users per hour).

Asphalt is widely used due to its application in a variety of ground conditions. This includes reactive soils (i.e. high clay proportions) that may move due to weather and seasonal change.

While the asphalt surface may crack or deteriorate over time, damage tends to be localised and relatively inexpensive to fix and does not require replacement. This is in contrast to concrete paths, which tend to experience a greater extent of failure when subjected to loads exceeding its capacity, often requiring the whole section of the path to be replaced.

The use of concrete edge restraints are recommended alongside asphalt paths. Alternatively, paths may be constructed with a 0.5m sealed shoulder to minimise deterioration of the path edge.

RTA *NSW Bicycle Guidelines* suggests typically asphaltic concrete path comprise of a 125mm thick gravel sub base with a 60mm wearing course asphaltic concrete (6mm aggregate size, machine laid).

A summary of asphalt pavement design details as recommended from NTG's standard drawing for shared path is provided below.

Item	Comment
Coat	Prime Tack Coat & 30mm Asphaltic Surface Sami Seal Coat S25E 14mm Aggregate @1.7L/m^2
Base	150mm Type 2 Gravel (compacted to 98% M.M.D.D.)
Subgrade	prepare subgrade to 150mm depth (compact to 95% M.M.D.D) – Min CBR 10

SOURCE: NTG CYCLE AND PEDESTRIAN SHARED PATH (DRAWING NO. CS0011)

Selecting the appropriate path material

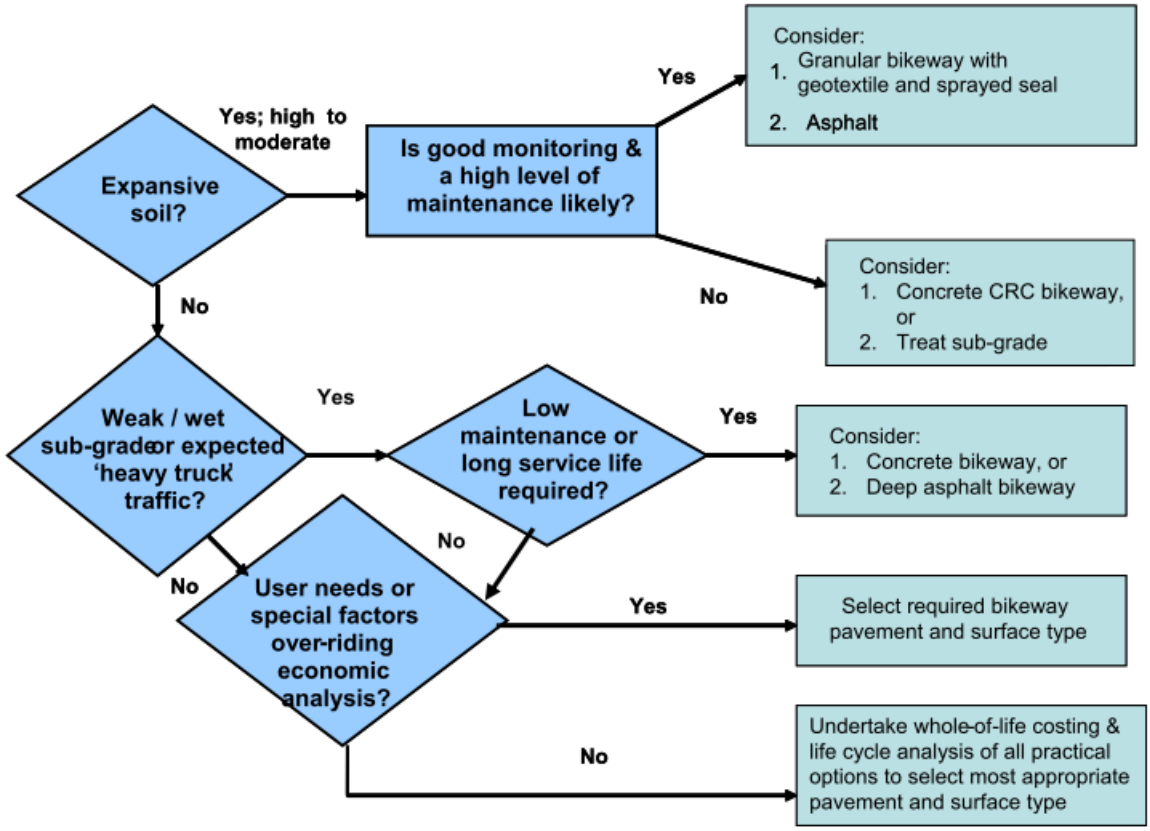
There are numerous factors which go into the selection of appropriate path materials, including the individual site characteristics, route type, expected usage, capital works budget, maintenance budgets or arrangements and whole-of-life costs.

A simple summary of appropriate situations to use either concrete, asphalt, or unsealed surface is provided below.

Material	Appropriate Situation
Concrete	• Low cycling volumes (less than 10 users per hour) • Areas where grass is likely to grow out of pavement cracks • Path alignment located close to trees which have root intrusion issues • Flooding is common occurrence (e.g. paths located close to watercourses) • Poor subgrade conditions
Asphalt	• Higher cycling volumes (more than 50 users per hour); OR • On a primary cycle route to assist passive wayfinding • Reactive soils

Unsealed	• Low cycling volumes (less than 10 users per hour); AND • Minimal commuter cycling demand – i.e. majority of cycling users will have mountain bikes rather than thin-tyred urban/road bicycles • Where necessary to reduce construction costs • Path unlikely to flood to the extent of high repair costs • Flat gradients (less than 3%) • Where environmental amenity will be reduced by adopting a sealed path

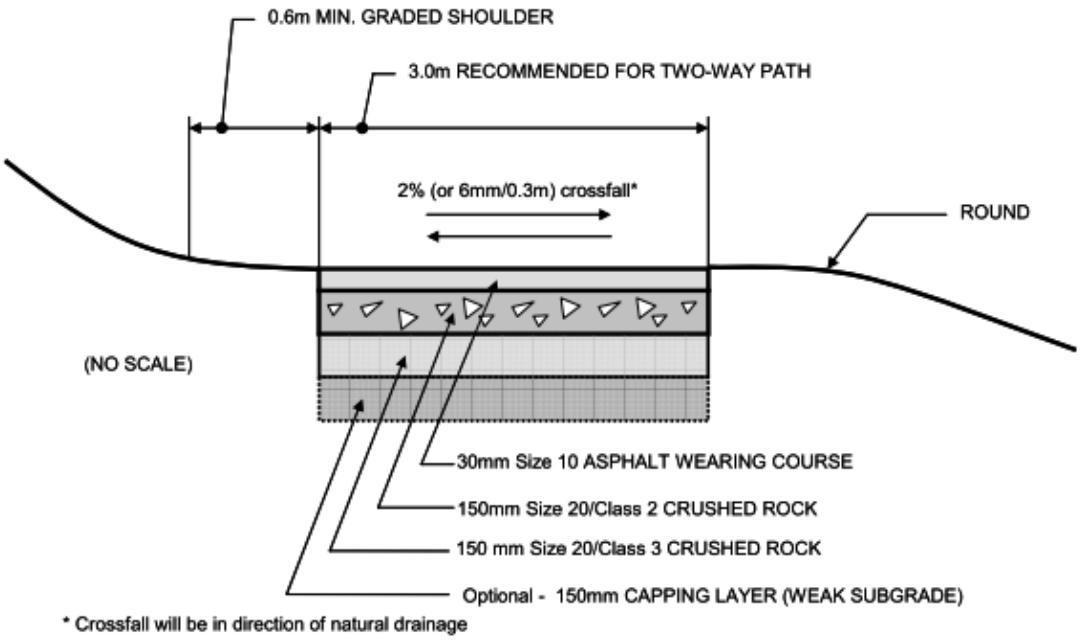
For higher-use shared paths or bikeways, a more nuanced approach to selecting the appropriate path material, considering the whole-of-life costs is presented in the following flowchart, taken from Australian Bicycle Council (2006).



SOURCE: AUSTRALIAN BICYCLE COUNCIL (2006), FIGURE 14 – ADAPTED FROM TRANSPORT SOUTH AUSTRALIA 'BIKEWAY PAVEMENT DESIGN CONSTRUCTION AND MAINTENANCE GUIDE FOR SOUTH AUSTRALIA' (2001).

Pavement Design to cater for Maintenance Trucks

Shared paths may need to be designed to cater for the movements of maintenance trucks in a range of locations – e.g. at driveway crossovers or along sections with no nearby road access. Pavement designs will need to be tailored to the individual path and site conditions. An example of the pavement design being used for Principal Shared Paths in Western Australia is shown in the figure below.



SOURCE: AUSTRALIAN BICYCLE COUNCIL (2006), FIGURE 3