Landscape guideline

Landscape design and maintenance guidelines to improve the quality, safety and cost effectiveness of road corridor planting and seeding
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Acknowledgments

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This document has been prepared to guide the greening of our road corridors. It is published as part of the Beyond the Pavement urban design initiative and sets down the RTA approach to the design and management of planting and revegetation.

Wherever they are situated, whether in town or country, roads and their settings are enhanced by the presence of vegetation. It provides character, colour, texture and interest to our places. It helps filter air and water borne pollutants, provides shade and comfort from the sun and converts carbon dioxide to oxygen.

Vegetation is the perfect foil for the hard elements of roads and buildings. It helps provide structure and form to road alignments, helps integrate roads into built and natural settings, provides a distinctive frontage or entry to towns, and helps create a unique sense of place which assists way-finding. Landscape designs are a relatively inexpensive element of our roads yet improve with age – at maturity providing great character as well as habitat for our native fauna.

Yet this asset can also be a problem if not designed properly. Vegetation can be expensive and hazardous to maintain and, more importantly, a safety issue for road users, cyclists and pedestrians.

This guideline, developed from the lessons learnt from many RTA projects over the years, ensures that the right conditions are provided so that in time a green road corridor is established safely and cost effectively.

I commend these guidelines to the RTA and its contractors.

Les Wielinga
Chief Executive, RTA
2008
Introduction
1.1 Purpose of the guideline

The purpose of this guideline is to set down minimum landscape design standards for all projects undertaken on road corridors so that the landscape is:

- Integrated into the project and built and natural fabric of the area.
- Ecologically sound.
- Appropriately designed for road corridors.
- Functional and provides value for money.
- Safe for road users.
- Safe to build and maintain.
- Low maintenance and cost effective.

This document is intended for landscape designers, landscape contractors, and road designers as well as project managers. It focuses primarily on the design, establishment and maintenance of planting and seeding and as such is not a comprehensive policy on landscape design and all its facets. It should be read in conjunction with Beyond the Pavement: RTA Urban and Regional Design Practice Notes, and the Roadscape Manual and their updates.

It forms part of a series of urban design guidelines, including Bridge Aesthetics, Noise Wall Design Guideline and Shotcrete Design Guidelines, which also contain advice on landscape in relation to their subject matter.

1.1.1 The value of good road landscape

When it is designed well the landscape becomes an important component of the road network.

- It is one of the key elements that contribute to the character of an area – the combination of landscape and built form helps provide a unique sense of place of value to the community.
- It helps integrate or fit the road into its setting.
- It provides structure and a three dimensional scale to the road corridor.
- It helps unify the road corridor environment, providing interest and a milestone to users as well as helping create a simple, strong and intuitive driving experience.
- It can be a valuable ecological asset in an area, especially when adjacent land is over-developed or when existing habitats and ecological corridors need to be augmented and connected.
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- It provides shade for pedestrian areas and buildings and a setting to take a break from driving in rest areas along the road network.
- It is valuable in terms of impact mitigation. It screens undesirable views of roads and traffic, helps filter air and water pollutants, suppresses weed growth, helps reconnect habitat, and can help recover threatened species. It also minimises the carbon ‘footprint’ of road works – for at least the lifetime of the landscape.
- It can contribute to a safer road, for example, by screening headlight glare, slowing errant vehicles and helping create an intuitive, self explaining driving experience.
- It helps stabilise slopes and minimise erosion.

1.1.2 Key issues

When it is designed and managed poorly, landscape can be a problem:

- Overly complicated designs can look inappropriate and be expensive to maintain.
- Permits for traffic lane closures for landscape maintenance are expensive, time consuming and difficult to obtain.
- Poor plant selection can result in unsuccessful, ailing planting designs, increased bushfire risk or can be ecologically damaging by introducing inappropriate or weed species.
- Too much planting can block views and make the journey monotonous for road users.
- Incorrect plant sizes and densities can lead to unsuccessful, high cost maintenance outcomes and a higher risk of weed infestation.
- Poor location of planting can result in damage to the road infrastructure, interference with utilities, obstruction of signage and problems of maintenance.
- Most importantly, vegetation can result in injuries and fatalities. Large trees can create a formidable hazard for vehicles and planting of shrubs and other plants can obscure pedestrians from drivers. In NSW between 2002 to 2005, 335 people were recorded as killed and 5087 people injured in crashes where a vehicle ran off the road and hit a tree.
1.2 Terminology

Considerable confusion can be caused by incorrect or misleading landscape terminology. For the purpose of RTA projects the following definitions shall apply.

**Bonded fibre matrix**

A very heavy application of hydromulch used on unstable or steep gradients.

**Clear zone**

The area that begins at the outer edge of the lane, next to the shoulder and extends for a set distance, which is available for emergency use by errant vehicles. *(Road Design Guide, Glossary of Terms, December 1989)*.

**Climbers**

Prostrate spreading or climbing plants.

**Cover crop**

Fast growing but short-lived exotic pasture grasses used to revegetate exposed batters and to help minimise erosion and weed infestation.

**Dynamic deflection**

The distance the safety barrier deflects on impact by a vehicle.

**Exotic grass**

Grass plants that are not native to Australia.

**Frangible planting**

Planting which breaks under the impact of a motor vehicle (and hence helps to stop a vehicle). Generally trees and shrubs with a mature trunk diameter of less than 100mm at around 500mm above ground level are considered frangible.

**Ground cover**

A low growing woody or herbaceous plant.

**Hydroseeding**

Broadcasting of seed under pressure by spraying a slurry of water, seed and fertiliser. It is predominantly used as the seeding component with straw mulching.

**Hydromulching**

Broadcasting of seed under pressure by spraying a slurry of water, seed and fertiliser in addition to mulch (eg sugar cane mulch), binder and a green dye. Executed in one operation.

**Indigenous species**

Plant species native to the area in which the project is located.
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Local native seed collection is an important operation in revegetation along RTA road projects.

A successful revegetation along the median and verge two years after native seeding.

Lawn
A grass maintained at a low height for functional or aesthetic reasons.

Local provenance species
Species found growing in the locality of a project.

Median
The central reservation which separates carriageways from traffic travelling in the opposite direction.

Mulch
Organic woodchip derived from waste vegetation placed around the plant to suppress weed growth and retain soil moisture.

Native grass
Grass plants that are native to Australia.

Planting
To establish a vegetation cover by planting of trees, shrubs and groundcovers. (Refer to RTA specification R179).

Planting sizes

Viro-tube**
Container size: 50 x 90mm deep
Plant height: 200 - 300mm

Forestry-tube
Container size: 50 x 120mm deep
Plant height: 200 - 300mm

Semi advanced
Container size: 150 x 150mm deep
Plant height: 300 - 400mm

Advanced
Container size: 200 x 200mm deep,
Plant height: 400 - 600mm

Super advanced
Container size: 20 litres
Plant height: 1200 - 1500mm

Viro-cells (smaller than viro-tubes) are not favoured in RTA landscape projects due to a high failure rate during establishment.

** For the purposes of calculating plant numbers the RTA considers one and a half viro-tubes are the equivalent to one forestry-tube.
Revegetation
To revegetate an area by direct seeding with native species using manual or mechanical means such as hydromulching, strawmulching, and tractor seeding. (Refer to RTA specification R176 and 178).

Road reserve
A legally described area of land within which facilities such as roads, footpaths and associated features may be constructed for public travel.

Roadside
The area from the edge of the carriageway to the boundary of the road reserve.

Safe intersection sight distances
Safe intersection sight distance is the minimum sight distance which should be available from vehicles on legs of an intersection. (Road Design Guide, Section 4 May 1999).

Sedge
Rush or grass like plant often growing in wet areas.

Seed provenance
The geographical locality where any stand of trees is now growing and from which seed was or will be collected. Hence using seed of local provenance would require seed to be collected from trees growing in the locality of the project.

Shrub
A woody perennial plant (smaller than a tree), that usually has several stems arising at or near the ground and giving the plant a bushy appearance.

Straw mulching
The broadcasting of chopped straw over previously seeded areas which is then sprayed with bitumen emulsion to form a windproof vegetation mat. It is the second of a two tier operation the first being hydroseeding.

Tractor seeding
The sowing of seed in a dry form using a tractor drawn seed drill, then harrowing it afterwards to cover the seed with a thin layer of soil.

Tree
Large perennial plant with a permanent woody main stem or trunk.

Turf
Grass maintained at a short relatively even length, used as a ground cover or lawn.

Urban and rural context
For the purposes of this document, urban refers to built up, urbanised areas. Rural refers to non built up areas that can occur in cities and metropolitan areas.
## Design approach

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2.1 Landscape design objectives

The following design objectives and related key principles should be addressed in the design and management of the landscape.

2.1.1 Landscape should be safe

Landscape must be safe to construct and maintain and safe for road users and pedestrians. It should be designed to help improve road safety and where possible encourage safer driver behaviour.

As a minimum:

- Safe sight distances must be applied according to the design speed.
- The clear zone must be kept clear of all non-frangible vegetation. If it is not possible to provide the required clear zone then barriers must be used to protect road users from non-frangible objects.
- Landscape must not create hidden public spaces with poor surveillance.
- Landscape must not obscure signage.
- Landscape must not be hazardous to build and maintain.

The landscape itself can also contribute to providing a safer road:

- Planting and seeding in the median can be used to screen headlight glare.
- Prostrate ground cover plants can help smother weeds within sight distances.
- Low planting between the footpath or cycleway and the road can help keep pedestrians and cyclists away from traffic.
- Occasional feature planting can help provide milestones and relieve the monotony of long journeys.
- Planting can help create a self-explaining road by providing visual cues to drivers as to the road alignment and the appropriate speed limits.
- Frangible vegetation can help slow or stop errant vehicles, before they hit non-frangible objects.
- Anecdotal evidence has shown that an interesting – not distracting – visual experience can help improve driver behaviour and alertness.

2.1.2 Landscape should be integrated into the project and the built and natural fabric

Due to their linear nature, road corridors have a wide influence on the urban and landscape fabric through which they pass. When designed well they can achieve a good fit.
Where they cut across the grain of that fabric, they can be disruptive.

The landscape design should help minimise that disruption by continuing the grain of the local character across the road corridor as well as knitting the new lines of the road corridor back into the existing landscape and urban fabric.

2.1.3 Landscape should be ecologically sound

With such a large state road network the road corridor has a role to play in protecting and recovering local biodiversity. The landscape should be designed so that it recovers and consolidates local habitat, reinstates wildlife corridors and connections, filters and cleanses stormwater runoff and minimises waste and pollution in its construction and maintenance.

2.1.4 Road landscape should add character and value to the built environment

People spend a significant amount of time travelling. A person’s perception of a place is heavily influenced by the journey to that place as well as the quality of the roads and streets. Consequently, it is important that the road landscape should contribute to the quality of the environment and travelling experience.

2.1.5 Landscape should be cost effective

With an asset as vast as the RTA road network it is important, for both cost and sustainability reasons, to minimise the maintenance requirements placed on the organisation and other agencies.

As natural systems survive without human intervention, the closer the design approach is to a natural landscape – within the constraints of the design objectives – the less the level of ongoing maintenance (after the establishment period) and generally the more ecologically valuable the landscape. In many rural situations the best landscape approach is the simple, minimal solution of continuing the adjacent vegetation cover into the roadside.

The road landscape should be robust enough to withstand various natural and man-made impacts such as drought, weeds and vehicular damage. This leads to cost savings in road asset management.

It should also be simple, and appropriate to the local area and the needs of the road corridor. Complexity and too much detail is not appropriate on large scale road projects.

Natural regeneration of *Pultenaea* on the Pacific Highway creates a memorable impact, is ecologically beneficial and was free.

A simple continuation of the adjacent grass cover alone is appropriate and highly cost effective.

Bangalow palms and *lomandra* provide the dominant species for the Bangalow Bypass, Pacific Highway, northern NSW. They create a simple, self reliant and attractive design outcome.
2.2 Landscape design process

The following broad design process should be followed in designing landscape:

2.2.1 Understand context

Designers must understand the context of the area, appreciate what is important about the local character and what role the landscape should play.

2.2.2 Set objectives

In parallel with the contextual analysis the design objectives should emerge. They should be simple, succinct and in accordance with this document.

2.2.3 Define principles

Once the objectives are set, the design principles which will realise those objectives, should be defined.

2.2.4 Develop design

The concept and detail design should then be developed translating the objectives and principles into physical form. The design must be developed in collaboration with the whole project team.

Each landscape design for RTA funded projects must be accompanied by a landscape design OHS report. It is the responsibility of the landscape designer to develop the OHS report. This report must capture the health and safety hazards and identify measures that will eliminate or reduce the impact of each hazard on constructors and maintainers (refer to Appendix B).

2.2.5 Monitor implementation

The implementation of the design must be monitored by the designers. Changes during construction are inevitable and need to be managed so that they are consistent with the design objectives and principles.

2.2.6 Monitor maintenance

Landscape is not instant and improves with age, however it can fail if neglected in the vital early establishment period. Therefore the landscape needs to be monitored in its early stages so that it can be self-reliant and thrive when established.

2.2.7 Management

Landscape should be managed in the long term in accordance with the landscape objectives. A landscape management plan for the established road landscape should be developed which incorporates the landscape design and management objectives (refer to Appendix C).
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3.1 General landscape design guidelines

The following general planting and revegetation guidelines should be addressed:

3.1.1. Ensure adequate space for landscape

A successful road landscape requires space. Overly steep batters and cuttings and narrow strips of land for the verge and median will generally result in a poor landscape outcome. There are ways of vegetating steep slopes or using appropriate species to fit in narrow spaces but these are far from ideal. When corridors are planned, where possible, adequate room should be allocated to cater for the road, the clear zone and the planting at its maturity.

3.1.2. Use trees in road corridors

Trees are the most memorable aspect of a roadside planting design. They have an appropriate scale for a road corridor, are clearly noticed when travelling and are the best means for ameliorating the hard built elements of the road corridor. Subject to their safe use, they should be the primary element of a landscape design.

Trees should however, be used selectively in a corridor. For example they should not obscure expansive views and they should be located carefully and deliberately, outside clear zones and away from utilities (see Section 3.4).

3.1.3. Minimise species choice in urban areas

Road landscape design should be as simple and straightforward as the context allows. For example in urban areas designs should utilise one or two dominant tree or shrub species where possible. The simple repetition of the same species can have a powerful, memorable effect. Such a landscape is also easier to maintain.

3.1.4. Use turf as grass cover in urban areas

In general, grass in rural areas should be achieved by seeding and in urban areas by turf. Revegetation and grass seeding is generally not appropriate in urban areas because of the higher pedestrian traffic, the presence of more fertile and weed contaminated soils and the difficulties of maintenance under traffic.

3.1.5. Use grasses, groundcovers and sedges in rural areas

Groundcovers, sedges and grasses are generally preferable to short cut grass in rural areas for ecological and aesthetic reasons as well as the cost of maintenance.
3.1.6. Provide good visibility in urban areas

Trees in turf, groundcovers or low shrub planting are generally preferable to trees in shrub planting in urban areas. Trees with a low understorey allow views, sunlight in winter and passive surveillance of footpaths and public spaces. Turf should be used for large areas and where pedestrians are likely. Planting should be used for small areas or where the requirement is for a purely visual effect.

3.1.7. Use indigenous species

To reduce water consumption, preserve local biodiversity and landscape distinctiveness, and increase design life, the use of indigenous species of local provenance are preferred on the road corridor in rural areas and, where practical, in urban areas. This can be achieved either through seed collection and revegetation, purchase of plants from local nurseries or through propagating locally collected seed for the project.

The distinction between indigenous species and Australian native species must be considered. Australian native species may not always be appropriate for the local area. They may require a different climate and water regime and may even be classified a weed eg Acacia saligna.

3.1.8. Consider the value of exotic plants in urban areas

While not being particularly valuable in ecological terms, exotic trees and shrubs should not be forgotten, particularly in urban areas. They can be useful in providing a distinctive marker on the road or street, can be used to help fit roads into cultural landscapes, can be particularly hardy in a roadside environment and, in the case of trees, offer shade in summer and light in winter.

3.1.9. Consider the cost for landscape in terms of its context

As a general guide the cost of landscape (supply and planting, staking, seeding, turfing and establishment, excluding revegetation for erosion control) should be between 1.5% to 2% of the project cost for urban areas and around 1% for rural areas.

3.1.10. Design for a project life of 40 years

For urban areas, plants selected should have a minimum of 40 years life span, to be in line with the long design life of the other elements of the road. For rural and bushland areas the use of short lived shrubs and groundcovers is acceptable provided they can self regenerate. Short lived, highly flammable, fine leaf tussocks should be avoided.
3.2 Detailed landscape design guidelines

All landscape should be designed in accordance with the objectives and guidelines set down in this document, however there are some specific guidelines that should be addressed for different road contexts. These are set down as follows:

3.2.1 Rural road reserves

Design approach

Due to the size of the areas involved, the majority of the vegetated landscape on rural road reserves should be provided by revegetation (native seeding).

Planting should be used as an additional measure to ensure that a well vegetated tree corridor is provided and the design objectives, including ecological ones, are achieved.

Detailed guidelines

- All areas should be revegetated with a native seed mix at a minimum application rate of 10kg per hectare of native seed (see Table 11, Section 3.4).

- For planting areas (limited to key locations such as rest areas and intersections) the aim should be a proportion of planted trees to shrubs of 80% to 20%, using 70% Forestry-tubes and 30% advanced 5 litre containers, in a mulched bed. Average spacing of shrubs should be 0.5m² and for trees 0.25m².

- Generally a 2m wide mowing strip along either side of the landscape area adjacent to the carriageway should be allowed for in the design, and maintained.

Simple, ecologically benign, low maintenance road reserve design with a 2m mown verge adjacent to the carriageway. Note that natural regeneration has resulted in vegetation within the clear zone which if non-frangible would need to be removed.

A revegetated reserve helps integrate the road with the landscape and provides a green, attractive corridor.

A 2m wide mown verge along the edge of the motorway or freeway provides a neat litter-free effect, and ensures trees and shrubs do not regenerate adjacent to the road.
3.2.2 Rural road medians

Design approach

The median differs from the reserve in that it is segregated from the landscape by the carriageways. As such it presents a means to visually break up the expanse of hard paving and help continue the characteristics of the landscape across the road corridor.

The median landscape must be frangible within clear zones so that it is safe and helps slow vehicles that have left the road. It should also provide a screen to headlight glare where possible and needed.

Detailed guidelines

- All median landscape areas should be revegetated with a native seed mix using frangible species at a minimum of 10kg per hectare (see Table 11, Section 3.4).
- Again planting should only be used as an additional measure to ensure that a well vegetated corridor is provided and the design objectives are achieved.
- Where planting is needed for medians an average planting density of 1 plant per 2m² should be adopted.
- Where planting is needed for narrow medians native grasses in viro-tubes should be used. Average planting densities are contained in Table 9, Section 3.4. A mowing strip is not necessary in such situations.
- Native grasses in a viro-tube size should be considered for use in the median at interchanges. Average planting densities are contained in Table 9, Section 3.4.
- Where the median is wider than 6m, a 2m mowing strip at the edge of the median should be provided.
- In general, in medians the ratio of shrubs to groundcovers should be in the order of 50% shrubs to 50% groundcovers, depending on local context.
- Ensure that all sight distance requirements are satisfied and maintained at the approaches to intersections.
- Refer to Table 6, Section 3.3 for median vegetation widths and vegetation types for different speed roads. Due to problems of maintenance and plant survival the minimum width for vegetation provision should be 2m for lower speed roads and 4m for higher speed roads. Between 4m and 2m, only grasses and ground covers are appropriate.
3.2.3 Rural road intersections

Design approach

Major rural intersections serve the added function of providing a milestone along the journey and an indication of the character and presence of towns or communities. Consequently (if appropriate), culturally and locally important trees should be used to highlight the intersection and thus way-mark the journey.

There is a temptation to provide more detail and variation to the planting at intersections. This should be avoided. Intersections should be as simple, robust and clear as possible for safety reasons. They should not be confused by complex landscape designs. Therefore the landscape should comprise of simple planting layouts, large trees of one or two species, and low groundcovers and grasses in large simple beds. Avoid the ‘gardensesque’ ie small beds of exotic plants and features.

Detailed guidelines

- All intersection landscape areas should be revegetated with a native seed mix using frangible species at a minimum of 10kg per hectare of native seed (see Table 11, Section 3.4).
- Planting in mulch beds should be used to define the intersection using minimum 5 litre containers.
- The proportion of trees to shrubs to groundcovers should be in the order of 20% trees to 40% shrubs to 40% groundcovers.
- Ensure the landscape design is carried out in accordance with minimum sight distance requirements. Within the intersection, sight clearance should be maintained by a mowed grass area.

Jacaranda and Hoop Pine highlight this rural intersection and add interest and a milestone on the journey.

Complex planting beds are inappropriate on the state road network, expensive to maintain and are rarely successful, this one has been taken over by weeds.

Deciduous trees planted at the edge of the clear zone mark the approach to a town and provide a distinctive milestone. The same approach could also be used at intersections providing access to local towns along freeways and highways.
3.2.4 Rural road rest areas

Design approach

To function properly rest areas must encourage road users to stop and rest. A simple, attractive and shade providing landscape is one of the best ways to achieve this.

In simple terms rest areas must be designed as small parks.

Detailed guidelines

- In the main rest areas, include a signature tall spreading tree species planted at 45 litre size, to shade truck and car bays.
- Wherever possible use a mown grass treatment between the rest area and road to create a distinctive effect and allow views. Screening shrubs should be avoided.
- Allow for an appreciation of the rest area locality with good views where possible.
- Provide open areas for passive recreation and tree areas for shade in summer.
- Consider security and allow good surveillance around and to the rest area.
- Provide a simple, distinctive design that is easy to maintain and recognisable to the motorist.
- Consider the impact of noise on heavy vehicle rest areas and sleeping drivers. Noise mounding may be appropriate, although its use should be balanced with the need for good passive surveillance.

Casuarina trees between bays provide good privacy but insufficient shade.

The design should allow for good passive surveillance within and to the rest area.
3.2.5 Urban road reserves

Design approach

Like rural roads, the urban road landscape must complement and contribute to the adjacent rural and urban fabric. However in urban situations the surroundings are often more formal in character; space is tighter and there are fewer opportunities to develop native woodland.

With higher pedestrian and traffic levels there is the potential for greater conflict. The road landscape should ensure that unsafe environments are not created ie ensuring safe sight distances and open secure environments are provided. The need for shade should be considered along paths and cycleways.

In some circumstances the opportunity exists to create a new landscape that can help lift the character of the area. Such a landscape must be simple and structural perhaps establishing a particular character that can extend on to adjacent streets.

The need for screening of the road also becomes more significant with the rise in the number of potentially affected properties.

Technical requirements

- Where adequate space is available between roads and paths a setback should be provided. A minimum of 750mm is appropriate if a successful and attractive planted or grassed strip is to be achieved. If this is not available it is generally preferable to continue the hard surfacing to the road. Decomposed granite/crushed stone should not be used as it creates a safety and maintenance problem.

- There should be no direct native seeding in urban areas. The landscape should be established using either planting in a fully mulched bed or turfing.

- All tree planting should be a minimum 5 litre container size in a mulched bed. All street and avenue trees should be super advanced size at a minimum.

- Low maintenance turf such as Zoysia, 'Empire' (although it is to be noted that Zoysia is frost susceptible) should be used for grass areas adjacent to the road.

Well vegetated road corridors can significantly contribute to the quality of the urban area and avoid a feeling of bleakness often apparent when planting is sparse.

The opportunity exists to provide something special to enliven the journey. This should not be overdone and the design must address future maintenance issues. Areas of gravel should be carefully considered as the constant removal of weeds is required, generally by chemical means.

Once established, ground cover planting is very effective as a weed suppressant and provides an attractive, neat edge to the road.
Design guidelines

3.2.6 Urban road medians

Design approach

The urban median is a part of the local urban fabric and should be designed to benefit an area. At the very least it should be densely planted, and simple and attractive in appearance. Planting should be neat and structured with lower groundcovers next to the road followed by taller species.

Planting within clear zones must be frangible unless behind a barrier installed as part of the engineering design.

Pedestrian activity is higher in an urban area and median planting must not impede road user sight lines on the approach to intersections or crossing facilities.

Technical requirements

- Landscape treatments for urban medians should consist of hardy and durable groundcovers, or shrubs planted into a mulched bed at a minimum advanced 5 litre size at a density greater than 1 plant per m². If native grasses are used, the densities in Table 8 should be adopted. Planting should be set back 500mm from the road edge to avoid overhang of the carriageway.

- All areas to be grassed should be turfed using low maintenance turf such as Zoysia, ‘Empire’ (although it is to be noted that Zoysia is frost susceptible).

- Infrangible plants should not be located in the median unless outside clear zones or documented justification is provided for their need behind safety barriers (see 3.3.1).

- There should be a 300mm minimum wide concrete margin along the edge of the median to provide a neat, easy to maintain edge.

- Refer to Table 6, Section 3.3 for median vegetation widths and vegetation types for different speed roads. Due to problems of maintenance and plant survival the minimum width for vegetation provision should be 2m for lower speed roads and 4m for higher speed roads. Between 4m and 2m only grasses and ground covers are appropriate.
3.2.7 Arterials through towns

Design approach

A particular road context which needs to be carefully considered is where a major road passes through a city, town or village centre. This occurs on many arterial roads where population centres have built up along the arterial road or at busy nodes or junctions.

In these situations the posted speed of the road is generally lower than in rural areas as there is a high pedestrian usage of the area with crossing points and footpaths alongside the road. Advertising, signage and shopfronts of businesses are located along the road all seeking maximum visual exposure.

Planting in these locations needs to be carefully designed to avoid impacts on visibility, access and movement and road user and pedestrian safety. With the higher pedestrian usage and car parking, planting also needs to be robust and well protected from damage by vehicles and pedestrians.

Tree species should be selected wisely. They should not pose a safety problem in terms of limb drop, or a maintenance problem in terms of fruit, seed or sap damage to vehicles.

Detailed guidelines

The following guidelines should be considered:

- Groundcovers and shrubs should be avoided or only used in carefully selected areas. Space for pedestrians and vehicles should be maximised.
- Trees should be used to ameliorate the impacts of traffic and the expanse of the road and provide an attractive structure to the town or village.
- It is preferable that trees are located to the edge of the road behind the kerb and outside the clear zone applicable. Trees may be provided in the median but if this is their only location they will have a lesser impact visually, and do not offer any shade benefit for pedestrians.
- Subject to context and local community requirements it is desirable that deciduous trees are utilised to allow sunlight to penetrate to street level in winter.
- Tree species should be medium to large in size at maturity have a good history of survival in urban areas and be able to be maintained with a high crown. They should be planted at a large size, a minimum of 45 litres where possible and appropriate.
3.2.8 Local roads

Design approach

Landscape design of local roads should contribute to the public domain and character of the locality.

The best way to achieve this is through tree planting which provides structure and form to the street, colour and texture to balance built elements, a habitat for urban wildlife, shade in summer and if deciduous, adequate light in winter.

Tree species should not pose a safety problem in terms of limb drop, or a maintenance problem in terms of fruit, seed or sap damage to vehicles or damage to utilities.

Detailed guidelines

The following guidelines should be considered:

- In locating trees, clear zones for the appropriate speed zone must be complied with and minimum sight distances must not be compromised.
- In general, but dependent on context and tree species, tree spacings should be in the order of 7m to 10m apart.
- Trees should be planted in grass or within a defined tree pit, grate or planting bed.
- In general, to ensure success, street trees should be greater than 45 litre size at planting.

Local roads generally being of slower posted speed limits, have narrower clear zones and parking lanes. Trees planted at the edges of the clear zone can have a strong visual effect and reinforce an understanding of the lower speed limit.

Distinctive street tree planting is important in creating a memorable and attractive place. In this example the cherry trees reinforce the three dimensional qualities of the street and contribute to the sense of the place.

The visual effect of a strong avenue of native gum trees cannot be underestimated and creates a memorable experience. However, clear zones must be observed and in this case a 3m gap is appropriate for a road with a 60km/h limit.
3.2.9 Roundabouts

Design approach

Like the median the roundabout is separated from the surrounding area by road with no pedestrian access, because of this they are primarily visual elements and offer little in terms of pedestrian connectivity and built form.

It is therefore important to tailor the landscape approach to the context and produce a minimal maintenance solution. For example it might be of value to create a distinctive effect, but distraction and too much complexity must be avoided. Alternatively a simple paved or grass surface might be more appropriate on smaller roundabouts.

Detailed guidelines

■ In general robust ground covers and grasses should be used in roundabouts. A concrete edge should be provided to protect planting.

■ If used, trees must not be planted in a configuration that will impede road user sight lines or be in a location that might obstruct errant vehicles unable to stop at the roundabout. If used trees should be frangible with a high crown. These should be planted at an ‘Advanced’ size.

■ Mass planting of shrubs should be dense low groundcovers and native grasses, planted into weedmat overlaid with mulch.

■ Adequate drainage must be provided in such self contained, small areas.

A simple ground cover, in this case Gazania, is suitable for roundabouts, suppressing weeds, creating a neat effect, keeping sight lines clear and not causing an obstacle for errant vehicles.
3.2.10 Noise walls

Design approach

Whilst some walls are designed as interesting, elegant objects in their own right (and not requiring planting), the majority of noise walls are enhanced by planting on both resident and road user side. This usually assists in graffiti reduction.

Detailed guidelines

- To achieve a good screen or softening of the noise wall, adequate space for planting and seeding must be provided. Two metres is just sufficient, however the wider the better. Planting can be partially successful as low as 1m in width, although it will not be as self reliant.

- Where space is limited, planting can be achieved using creepers such as creeping fig and virginia creeper. Climbers on frames should be avoided where possible to minimise maintenance and vandalism.

- Planting should consist of dense durable shrubs at minimum 5 litre size (advanced), to provide an effective screen to the wall. Planting should be in mulched beds. On the roadside it should have a sufficient setback from the roadway to avoid overhanging vegetation obstructing sight lines and clear of the safety barrier dynamic deflection zone.

- The planting design should allow for access to the wall for maintenance purposes.

(For further guidance, reference should be made to the RTA Noise Wall Design Guidelines.)
3.2.11 Stormwater treatment facilities

Design approach
An integrated ecological and landscape approach is required combining the cleansing effects and biodiversity benefits of native wetland and riparian species, while creating an attractive natural drainage system. A natural, fitting appearance should generally be adopted, maximising the effective wetland and riparian area, and sculpted to fit into the existing landform.

Detailed guidelines
- Facilities should be designed to be as self reliant as possible. The area around the swale or pond should be revegetated with native seed at an application rate of 10kg/ha (see Table 11, Section 3.4).
- Planting in mulched beds should be used on the margins of the pond (eg 1-3m) to stabilise the embankments. Forestry-tubes should be used at 1/m² with virotubes in the wetter areas.
- Ensure plants sit at correct level to suit the inundation/operation of the wetland.
3.2.12 Cuttings

**Design approach**

To achieve a successful vegetation cover on a cutting, adequate space must be allocated in the early stages of the project to lay back the batters no steeper than a 1 in 2 (V:H) gradient (and less where possible).

This approach will generally lead to lower maintenance, better looking road landscape outcomes.

**Detailed guidelines**

- Cuttings should be revegetated with a native seed mix (see Table 11, Section 3.4).
- Revegetate beyond the top of the cutting to help integrate the project into the surrounding landscape. Avoid planting in this area unless necessary as planting is out of sight and is unlikely to be maintained.
- In the case of steep benched cuttings, with the exception of native grasses there should be no planting or revegetation on the benches.
- At the base of such cuttings it is preferable to allow for a vegetated verge to collect debris fall and soften the appearance of the cutting. An area of irrigated soil must be provided to achieve this outcome.

(For further guidance, reference should be made to the RTA Shotcrete Design Guidelines.)
Design guidelines

3.3 Safety guidelines for clear zones and sight distances

The following information is taken from the Road Design Guide. It is provided for ease of reference not as a substitute for the Guide itself.

3.3.1 Clear zone requirements

The clear zone must be kept free of all infrangible objects which includes most trees. The dimensions of the clear zone are dependant on road design speeds, traffic volumes and the grade of the verge. Table 1 provides an indication of the clear zone for different design speeds and Table 3 is the clear zone nomograph from which these values are calculated.

If it is not possible to avoid infrangible objects in the clear zone then a safety barrier must be employed to protect road users.

With the exception of a concrete barrier, it is a part of a safety barriers function to deflect under impact, therefore an infrangible object within the dynamic deflection zone will impair the function of the barrier. Consequently the dynamic deflection guidelines set down in the Road Design Guide must be followed. As a rough guide Table 2 sets down some typical deflection values.

It is important to note that safety barriers can be a hazard in their own right and under extreme circumstances the safety barrier can be breached. If trees are required enough land should be set aside to allow for the road, the clear zone and space for trees.

3.3.2 Public utility clearances

The landscape design should address the requirements of the utility companies and their setbacks and clearances. Detailed guidelines have been developed, for example the Country Energy Vegetation Management Plan.

---

**TABLE 1** Approximate clear zone requirements for a road with a relatively flat verge and traffic volumes in excess of 3000 AADT

<table>
<thead>
<tr>
<th>DESIGN SPEED (85th percentile)</th>
<th>CLEAR ZONE (metres from the edge of the travel lane)</th>
</tr>
</thead>
<tbody>
<tr>
<td>60 or less</td>
<td>3</td>
</tr>
<tr>
<td>80</td>
<td>5</td>
</tr>
<tr>
<td>100</td>
<td>9</td>
</tr>
<tr>
<td>110</td>
<td>11</td>
</tr>
</tbody>
</table>

**TABLE 2** Dynamic deflection for two barrier types

<table>
<thead>
<tr>
<th>BARRIER TYPE</th>
<th>DESIGN SPEED 80km/h</th>
<th>100km/h</th>
<th>110km/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wire rope</td>
<td>1.2m</td>
<td>1.4m</td>
<td>1.5m</td>
</tr>
<tr>
<td>100m between anchors 3/4 wires, 2.4-2.5m post spacing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thrie beam</td>
<td>0.5m</td>
<td>0.9m</td>
<td>1.1m</td>
</tr>
<tr>
<td>Single rail, 2m post spacing, 2.7 base metal thickness</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
On embankment slopes steeper than 4:1, the clearzone is to be measured from the bottom of the batter, at the slope of the natural terrain.

1. These distances (*) are Weighted Average Distance when used on complex batter arrangements.

2. Design speeds shown are the 85th percentile value, measured (or predicted) for the site being considered.

Table 3: Clear zone nomograph (from Road Design Guide)
### TABLE 4  Stopping sight distances for level bituminous or concrete pavement (from Road Design Guide)

<table>
<thead>
<tr>
<th>DESIGN SPEED</th>
<th>STOPPING SIGHT DISTANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>50km/h</td>
<td>45m</td>
</tr>
<tr>
<td>60km/h</td>
<td>60m</td>
</tr>
<tr>
<td>80km/h</td>
<td>100m</td>
</tr>
<tr>
<td>100km/h</td>
<td>150/175m</td>
</tr>
<tr>
<td>110km/h</td>
<td>210m</td>
</tr>
</tbody>
</table>

### TABLE 5  Safe Intersection Sight Distances (SISD) for level pavement measured from driver eye heights (1.15m-1.15m) (from Road Design Guide)

<table>
<thead>
<tr>
<th>DESIGN SPEED</th>
<th>SISD</th>
</tr>
</thead>
<tbody>
<tr>
<td>50km/h</td>
<td>80m</td>
</tr>
<tr>
<td>60km/h</td>
<td>105m</td>
</tr>
<tr>
<td>80km/h</td>
<td>160m</td>
</tr>
<tr>
<td>100km/h</td>
<td>225/255m</td>
</tr>
<tr>
<td>110km/h</td>
<td>295m</td>
</tr>
</tbody>
</table>

### TABLE 6  Vegetation widths in medians for different speed roads

<table>
<thead>
<tr>
<th>DESIGN SPEED</th>
<th>MINIMUM WIDTH OF PLANTING (below which median should be paved)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 70km/h</td>
<td>2m</td>
</tr>
<tr>
<td>&gt; 70km/h</td>
<td>4m</td>
</tr>
</tbody>
</table>

### 3.3.3 Sight distance requirements

There are three main sight distance requirements which should be addressed in the landscape design.

#### Stopping sight distance

The stopping sight distance is the sight distance required for a driver to observe, react and stop a vehicle on level bituminous or concrete pavements. Landscape designs should ensure the preservation of the stopping sight distance in the design and life of planting or revegetation works (see Table 4).

#### Approach Sight Distance (ASD) 1.15m to 0m

At intersections the approach sight distance must be adopted. This is the stopping sight distance measured from 1.15m at the driver to 0m at the pavement, to enable road markings to be observed and allow drivers to observe, react and to stop if necessary.

#### Safe Intersection Sight Distances (SISD) 1.15m to 1.15m

SISD comprises stopping sight distance plus three seconds of travel time (observation time).

This provides sufficient sight distance for a driver on an approach to an intersection to observe a vehicle entering from a side street, decelerate and stop prior to a point of conflict (see Tables 5 and 6).

*Sketch showing measurement of SISD*
### 3.3.4 Vegetation types and safety implications

Landscape design decisions have significant implications in terms of road safety and OHS issues. The following Table 7 provides a guide to designers on the uses and safety and maintenance implications of different vegetation types – whether grass, groundcovers, trees or shrubs.

**TABLE 7 Vegetation type guide**

<table>
<thead>
<tr>
<th>VEGETATION TYPE</th>
<th>USEFUL FOR</th>
<th>ROAD SAFETY IMPLICATIONS</th>
<th>MAINTENANCE IMPLICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass</td>
<td>Semi urban situations, urban situations adjacent to open landscape such as parks, rest areas to allow good visibility and passive recreation space, visually separating footpaths and road, where space is limited, narrow medians in lower speed zones to visually break up expanse or road pavement</td>
<td>Safety barrier is not required, allows clear sight lines, does not discourage pedestrians, does not provide crash cushion effect</td>
<td>Minimum viable width 0.75m, requires mowing and possible lane closures</td>
</tr>
<tr>
<td>Ground Cover (Low exotic vegetation)</td>
<td>Medians in urban or semi urban areas, roundabouts and intersections in semi urban or urban areas</td>
<td>Safety barrier is not required, where prostrate species used allows clear sight lines, discourages pedestrian access, does not provide crash cushion effect</td>
<td>Minimum viable width 1.5m, may require pruning and possible lane closures</td>
</tr>
<tr>
<td>Ground Cover (Low native vegetation)</td>
<td>Bushland areas to help restore landscape and habitat, semi urban and bushland areas, intersections and roundabouts, minimum maintenance planting in narrow medians</td>
<td>Safety barrier is not required, can obstruct safe sight lines, can screen headlight glare, does not provide significant crash cushion effect</td>
<td>Minimum viable width 1.5m, may require trimming/cutting and possible lane closures</td>
</tr>
<tr>
<td>Frangible native vegetation</td>
<td>Bushland areas to help restore landscape and habitat, encourage native fauna corridors where width is adequate, in front of noise walls in clear zones or immediately behind traffic barriers</td>
<td>Safety barrier is not required, obscures passive surveillance, can screen headlight glare, blocks pedestrian access, provides a crash cushion effect</td>
<td>Minimum viable width 2.5m</td>
</tr>
<tr>
<td>Non-frangible native vegetation</td>
<td>Bushland to help restore landscape and habitat, providing structure and character to road corridor, shade in rest areas or along footpaths, providing landmarks and milestones along route</td>
<td>Non-frangible vegetation is hazardous and must only be established outside the clear zone, it should not be used in medians unless they can accommodate the clear zone, when overshadowing the road large trees can extend the presence of frost into the day in colder areas</td>
<td>Pruning and lopping may be required long term</td>
</tr>
<tr>
<td>Non-frangible exotic vegetation</td>
<td>Roads in towns and cities to help fit road into built fabric, providing structure and character to road corridor, shade in rest areas or along footpaths, providing landmarks and milestones along route</td>
<td>Non-frangible vegetation is hazardous and must only be established outside the clear zone, it should not be used in medians unless they can accommodate the clear zone, when overshadowing the road large trees can extend the presence of frost into the day in colder areas</td>
<td>Pruning and lopping may be required long term</td>
</tr>
</tbody>
</table>
3.4 Planting and revegetation guidelines

The following information has been provided as a guide for planting and seeding, implementation and maintenance for road landscape. It has been developed from experience and monitoring of the successes and failures of RTA projects.

3.4.1 Key principles of planting implementation

In general there are five main conditions to get right in the implementation of a planting design. Achieving these conditions will greatly improve the success of the landscape, minimise weed infestation and ensure the landscape is less susceptible to drought.

1. The plants must be healthy, of an appropriate size and suitable for their context. In general using native species will ensure that plants are matched to local conditions and best able to cope with drought.
2. The ground must be ripped, or planting holes well broken up, to ensure good drainage and root penetration.
3. The optimal planting density to achieve rapid ground coverage must be used.
4. The planting bed must be fully mulched and weeding must be regularly carried out around the planting.
5. The plants should be watered regularly after planting in the absence of rain. Planting during the dormant period (autumn/winter) will reduce the reliance on irrigation.

The following guidelines provide information on plant sizes, species and densities for different areas and uses in the road corridor.

3.4.2 Detailed guidelines

Plant material specification

All plants should be grown by a nursery situated in an area of similar climate to where they are to be planted. They should be grown from seed collected from the project area wherever possible.

All plant material should be true to species and sizes. That is to say they should be well grown, of good form, not soft or forced, and with large healthy root systems. They should not be root bound and should be free from disease, weeds and insect pests. Trees should have a single leading shoot. Nursery stock should be hardened for planting prior to movement to the planting location.

*Poa, Danthonia* and *Themeda* species are not favoured because of high failure rates, fire risk and excessive maintenance requirements. They are more appropriate for bushland restoration works.

### TABLE 8 Guide to container size and plant height

<table>
<thead>
<tr>
<th>PLANT SIZE</th>
<th>CONTAINER SIZE</th>
<th>APPROVED PLANT HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viro-tube</td>
<td>50mm dia x 90mm deep</td>
<td>200mm-300mm</td>
</tr>
<tr>
<td>Forestry-tube</td>
<td>50mm dia x 120mm deep</td>
<td>200mm-300mm</td>
</tr>
<tr>
<td>Semi Advanced</td>
<td>150mm dia x 150mm deep</td>
<td>300mm-400mm</td>
</tr>
<tr>
<td>Advanced</td>
<td>200mm dia x 200mm deep</td>
<td>300mm-500mm</td>
</tr>
<tr>
<td>Super Advanced</td>
<td>20L container size</td>
<td>1200mm-1500mm</td>
</tr>
</tbody>
</table>

### TABLE 9 Guide to container size and plant spacing for native grasses in urban areas and rural areas (shown in brackets)

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>VIRO-TUBE</th>
<th>SEMI-ADVANCED</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pennisetum alopecuroides</em></td>
<td>6 (4)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>‘Nafray’</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lomandra longifolia</em></td>
<td>6 (4)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>‘Cassica’</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lomandra longifolia</em></td>
<td>6 (4)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>‘Katrinus’</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lomandra longifolia</em></td>
<td>9 (6)</td>
<td>6 (4)</td>
</tr>
<tr>
<td>‘Tanika’</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Dianella caerulea</em></td>
<td>9 (6)</td>
<td>6 (4)</td>
</tr>
<tr>
<td>‘Little Jess’</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Dianella caerulea</em></td>
<td>9 (6)</td>
<td>6 (4)</td>
</tr>
<tr>
<td>‘Breeze’</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Liriope spp.</em></td>
<td>9 (6)</td>
<td>6 (4)</td>
</tr>
<tr>
<td><em>Themeda australis</em></td>
<td>9 (6)</td>
<td>6 (4)</td>
</tr>
<tr>
<td><em>Gahnia sieberiana</em></td>
<td>9 (6)</td>
<td>6 (4)</td>
</tr>
<tr>
<td><em>Carex appressa</em></td>
<td>9 (6)</td>
<td>6 (4)</td>
</tr>
<tr>
<td><em>Juncus usitatus</em></td>
<td>9 (6)</td>
<td>6 (4)</td>
</tr>
</tbody>
</table>
Design guidelines

Container size and plant height

All plants should be supplied in containers and to have grown to the approved heights as specified in Table 8.

Virocells or similar are not to be used in RTA projects due to initial high maintenance requirements and past failures.

Container size and plant spacing for urban areas

It is important to achieve a dense planting coverage in urban areas to ensure a successful well vegetated project and avoid weed infestation more prevalent in urban than rural areas. Table 9 provides information on plant spacings for urban areas.

Planting size and direct seeding requirements for urban and rural locations

Table 10 provides guidance on the sizes which should be used of trees shrubs, groundcovers and native grass in urban and rural areas. Information on mulching and direct seeding is also provided.

### TABLE 10: Planting size and direct seeding requirements for urban and rural locations

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>TREE, SHRUB AND GROUND COVER</th>
<th>NATIVE GRASS</th>
<th>MULCHING (HARDWOOD CHIP MULCH)</th>
<th>DIRECT NATIVE SEEDING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban areas</td>
<td>Minimum 5L containers</td>
<td>Viro-tubes</td>
<td>Fully mulched</td>
<td>No</td>
</tr>
<tr>
<td>Rural areas</td>
<td>70% Forestry-tubes and 30% Advanced</td>
<td>Viro-tubes</td>
<td>Fully mulched</td>
<td>Yes</td>
</tr>
<tr>
<td>Intersections, interchanges and roundabouts</td>
<td>Minimum 5L containers</td>
<td>Viro-tubes</td>
<td>Fully mulched</td>
<td>No</td>
</tr>
<tr>
<td>Noise walls and retaining walls</td>
<td>Minimum 5L containers</td>
<td>Viro-tubes</td>
<td>Fully mulched</td>
<td>No</td>
</tr>
</tbody>
</table>
Design guidelines

### TABLE II  Cover crop and native seed application rates
(Recommended sowing seasons shown in brackets)

<table>
<thead>
<tr>
<th>NORTH COAST, CENTRAL COAST AND SOUTH COAST</th>
<th>@ 35kgs/ha</th>
<th>@ 35kgs/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese Millet (Sep-Mar) or Rye Corn (Apr-Aug)</td>
<td>Eclipse Rye</td>
<td>Couch</td>
</tr>
<tr>
<td>Rye Corn (Apr-Aug)</td>
<td>Rye Corn (Apr-Aug)</td>
<td>Rye Corn (Apr-Aug)</td>
</tr>
<tr>
<td>Red Clover</td>
<td>Red Clover</td>
<td>Red Clover</td>
</tr>
<tr>
<td>Austrodanthonia richardsonii var Hume</td>
<td>Austrodanthonia richardsonii var Hume</td>
<td>Austrodanthonia richardsonii var Hume</td>
</tr>
<tr>
<td>Microlaena stipoides var Griffin</td>
<td>Microlaena stipoides var Griffin</td>
<td>Microlaena stipoides var Griffin</td>
</tr>
<tr>
<td>Themeda triandra var Tangara</td>
<td>Themeda triandra var Tangara</td>
<td>Themeda triandra var Tangara</td>
</tr>
<tr>
<td>Native Seeds**</td>
<td>Native Seeds**</td>
<td>Native Seeds**</td>
</tr>
<tr>
<td>Organic Fertiliser</td>
<td>Organic Fertiliser</td>
<td>Organic Fertiliser</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TABLELANDS</th>
<th>@ 35kgs/ha</th>
<th>@ 20kgs/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese Millet (Sept-Mar) or Coolibah Oats (Apr-Aug)</td>
<td>Eclipse Rye</td>
<td>Couch</td>
</tr>
<tr>
<td>Coolibah Oats (Apr-Aug)</td>
<td>Coolibah Oats (Apr-Aug)</td>
<td>Coolibah Oats (Apr-Aug)</td>
</tr>
<tr>
<td>Red Clover</td>
<td>Red Clover</td>
<td>Red Clover</td>
</tr>
<tr>
<td>Austrodanthonia richardsonii var Hume</td>
<td>Austrodanthonia richardsonii var Hume</td>
<td>Austrodanthonia richardsonii var Hume</td>
</tr>
<tr>
<td>Microlaena stipoides var Griffin</td>
<td>Microlaena stipoides var Griffin</td>
<td>Microlaena stipoides var Griffin</td>
</tr>
<tr>
<td>Themeda triandra var Tangara</td>
<td>Themeda triandra var Tangara</td>
<td>Themeda triandra var Tangara</td>
</tr>
<tr>
<td>Native Seeds**</td>
<td>Native Seeds**</td>
<td>Native Seeds**</td>
</tr>
<tr>
<td>Organic Fertiliser</td>
<td>Organic Fertiliser</td>
<td>Organic Fertiliser</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CENTRAL SLOPES</th>
<th>@ 25kgs/ha</th>
<th>@ 20kgs/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese Millet (Sep-Mar) or Coolibah Oats (Apr-Aug)</td>
<td>Eclipse Rye</td>
<td>Couch</td>
</tr>
<tr>
<td>Coolibah Oats (Apr-Aug)</td>
<td>Coolibah Oats (Apr-Aug)</td>
<td>Coolibah Oats (Apr-Aug)</td>
</tr>
<tr>
<td>Red Clover</td>
<td>Red Clover</td>
<td>Red Clover</td>
</tr>
<tr>
<td>Austrodanthonia richardsonii var Hume</td>
<td>Austrodanthonia richardsonii var Hume</td>
<td>Austrodanthonia richardsonii var Hume</td>
</tr>
<tr>
<td>Microlaena stipoides var Griffin</td>
<td>Microlaena stipoides var Griffin</td>
<td>Microlaena stipoides var Griffin</td>
</tr>
<tr>
<td>Themeda triandra var Tangara</td>
<td>Themeda triandra var Tangara</td>
<td>Themeda triandra var Tangara</td>
</tr>
<tr>
<td>Native Seeds**</td>
<td>Native Seeds**</td>
<td>Native Seeds**</td>
</tr>
<tr>
<td>Organic Fertiliser</td>
<td>Organic Fertiliser</td>
<td>Organic Fertiliser</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WESTERN PLAINS</th>
<th>@ 20kgs/ha</th>
<th>@ 10kgs/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japanese Millet (Sep-Mar) or Coolibah Oats (Apr-Aug)</td>
<td>Eclipse Rye</td>
<td>Couch</td>
</tr>
<tr>
<td>Coolibah Oats (Apr-Aug)</td>
<td>Coolibah Oats (Apr-Aug)</td>
<td>Coolibah Oats (Apr-Aug)</td>
</tr>
<tr>
<td>Red Clover</td>
<td>Red Clover</td>
<td>Red Clover</td>
</tr>
<tr>
<td>Native Seeds**</td>
<td>Native Seeds**</td>
<td>Native Seeds**</td>
</tr>
<tr>
<td>Organic Fertiliser</td>
<td>Organic Fertiliser</td>
<td>Organic Fertiliser</td>
</tr>
</tbody>
</table>

**Native seed mix shall comprise selected local acacia species 25%, hardwood shrubs 45% and ground covers 30% by weight of the above application rates.

**Note:**
1. Triticale species must not be used in revegetation mix in Tablelands, Central Slopes and Western Plains in order to avoid the spread of wheat rust in wheat growing areas.
2. White, strawberry and subterranean clovers should not be used in revegetation mix as these aggressive spreading clovers would prevent germination of native seeds.
Site preparation, establishment and weed control

The RTA has developed consistent and practical methods for site preparation establishment and weed control. The guidelines in Table 12 should be adopted for all RTA projects.

**TABLE 12** Site preparation, establishment and weed control for virotubes and semi advanced sizes

<table>
<thead>
<tr>
<th>PROCEDURE</th>
<th>Viro tube 50mm sq x 90mm deep</th>
<th>Forestry tube 45mm sq x 120mm deep</th>
<th>Semi advanced 150mm sq x 150mm deep</th>
<th>Advanced 200mm sq x 200mm deep</th>
<th>25L 300mm sq x 300mm deep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ripping (300mm centres)</td>
<td>200mm</td>
<td>200mm</td>
<td>200mm</td>
<td>400mm</td>
<td>400mm</td>
</tr>
<tr>
<td>Cultivation depth</td>
<td>200mm</td>
<td>200mm</td>
<td>200mm</td>
<td>200mm</td>
<td>Nil</td>
</tr>
<tr>
<td>Mulch depth</td>
<td>50mm</td>
<td>75mm</td>
<td>75mm</td>
<td>75mm</td>
<td>75mm</td>
</tr>
<tr>
<td>Planting hole size</td>
<td>50mm dia x 100mm deep</td>
<td>200mm sq x 200mm deep</td>
<td>300mm sq x 300mm deep</td>
<td>400mm sq x 400mm deep</td>
<td>600mm sq x 600mm deep</td>
</tr>
<tr>
<td>Watering after establishment</td>
<td>12 weeks</td>
<td>12 weeks</td>
<td>12 weeks</td>
<td>12 weeks</td>
<td>12 weeks</td>
</tr>
<tr>
<td>Weed Control (every four weeks)</td>
<td>Hand weeding Spot weeding with Glyphosate</td>
<td>Hand weeding Spot weeding with Glyphosate</td>
<td>Hand weeding Spot weeding with Glyphosate</td>
<td>Spot weeding with Glyphosate</td>
<td>Spot weeding with Glyphosate</td>
</tr>
</tbody>
</table>

**TABLE 13** Site maintenance and management for native grasses

<table>
<thead>
<tr>
<th>Month in which plant should be cut back</th>
<th>April</th>
</tr>
</thead>
<tbody>
<tr>
<td>How far to cut back above ground</td>
<td>300mm</td>
</tr>
<tr>
<td>Frequency of cutting back</td>
<td>Every 4 years</td>
</tr>
<tr>
<td>Fertilise once per year</td>
<td>August</td>
</tr>
<tr>
<td>N.P.K and type of fertiliser</td>
<td>18 + 3 + 10 – Slow release</td>
</tr>
<tr>
<td>Rate (spread evenly into hole)</td>
<td>10 grams per plant</td>
</tr>
</tbody>
</table>

**Mulch**

Mulch used in RTA road landscape planting must, where possible, be derived from trees and shrubs obtained during the clearing and grubbing works on the site. Site trees must be chipped and not ground. If the mulch produced in this way is insufficient the shortfall must be made up by using imported woodchip (refer to RTA Specification R179 for further information).

**Site maintenance and management**

The guidelines in Table 13 should be adopted for site maintenance and management. This information should be used in preparation of the landscape management plan for RTA projects.
4.1 Requirements for drawings

Landscape drawings are reviewed by a number of people including sponsors, verifiers, designers, stakeholders, the community and contractors. They must be easy to read, enable the design to be easily visualised and most importantly be easily understood for implementation purposes.

The following principles should be adopted:

1. Consider the purpose and viewer of the drawings and tailor their content and presentation accordingly. For example:
   - For public exhibition and development consent, photomontages and colour graphics are attractive and easily understood. Photomontages should be carefully selected to show different key parts of the project. For honesty the image should be realistic and show the likely signage and other road furniture elements.
   - If public exhibition is not required then it is likely that such high quality and costly presentation material is not needed. Simple, clear sketches and drawings are generally sufficient for internal review. Photographs of precedents are highly convincing and descriptive.
   - If the purpose of the drawing is to inform and guide the engineering team then a complex drawing is unnecessary and probably too late to do its job – a quick mark up might be the best and most cost effective solution.
   - If a construction drawing is required then simplicity is the key and each drawing should stand alone. Plant locations and arrangements should be legible and unequivocal, hatching and shading variation should be highly distinctive, full names of species, their sizes and planting details should be included. The drawings should work in black and white and abbreviations and cross referencing should be avoided.

2. The adjacent land uses, property boundaries, vegetation, context of the project should be shown in some form on the drawings. This can vary from simple sketched line drawings to photographic bases depending on the purpose of the drawing.
3. All planting or seeding not on RTA land must be labelled ‘off site planting subject to landowner approval’ until such time as approval is granted. Not withstanding approval such landscape work must not be essential to the project as it cannot be guaranteed for the life of the project. Where landscape work is essential, land must be secured to implement it.

4. Plant abbreviations should not be used. They can be misinterpreted and make it hard to visualise the outcome. All botanical plant names should be written in full.

5. The number of plants of each species should be stated for each planting bed and written down adjacent to the bed on the drawing.

6. Plant schedules should be provided on each drawing stating numbers of each species, total number of plants, sizes, and staking/special requirements.

7. Application rates for seeding should be defined for each seeded area.

8. All drawings, whatever their purpose must include a scale, north point and labelled key places/landmarks.

9. Sections, sketches and photomontages should be realistic in their illustration of vegetation growth. 5-10 years growth is sufficient. Drawings showing the intended effect after 20-30 years can look unrealistic.

(For detailed CADD drawing requirements refer to the RTA CADD drawing standards for landscape design.)
Appendix A: Basic road corridor plant palette for urban areas

There are a number of plants that serve the RTA well as avenue and street trees, features trees, structure planting, screening, rest area planting shade and mass ground cover planting. These plants are self reliant, robust, yet attractive species that are known to thrive in a roadside environment. The following list sets down some of these species with suggestions as to their usage, generally in urban and semi urban areas. There are 63 plants provided as a starting point for designers. It is not exhaustive and further context specific species should be researched and used.

Trees

*Angophora costata* (Smooth barked apple)
Avenues / structure / landmark

*Archontophoenix cunninghamiana* (Bangalow palm)
Medians / roundabouts / intersections

*Araucaria cunninghamii* (Hoop pine)
Landmark

*Araucaria heterophylla* (Norfolk island pine)
Landmark

*Brachychiton acerifolium* (Illawarra flame tree)
Landmark / avenue

*Casuarina cunninghamiana* and *glauca* (She oak)
Screening / narrow spaces

*Corymbia citriodora* (Lemon scented gum)
Avenues / landmark / rest areas

*Corymbia maculata* (Spotted gum)
Avenue / landmark

*Eucalyptus crebra* (Narrow leaf ironbark)
Structure

*Eucalyptus haemastoma* (Scribbly gum)
Structure / landmark / avenue

*Eucalyptus microcorys* (Tallow wood)
Structure / rest areas

*Eucalyptus moluccana* (Grey box)
Structure
Appendix A: Basic road corridor plant palette

Landscape guideline

*Eucalyptus paniculata* (Grey or White ironbark)
Structure

*Eucalyptus pilularis* (Blackbutt)
Structure

*Eucalyptus punctata* (Grey gum)
Structure

*Eucalyptus saligna* (Sydney blue gum)
Structure / avenue / landmark / rest areas

*Eucalyptus sideroxylon* (Mugga ironbark)
Structure / avenue

*Eucalyptus tereticornis* (Forest red gum)
Structure / landmark

*Ficus hillii* (Hills fig)
Street tree / landmark / rest areas

*Ficus macrophylla* (Moreton bay fig)
Shade / landmark / rest areas

*Ficus rubignosa* (Port jackson fig)
Shade / landmark / rest areas

*Fraxinus excelsior* (Ash)
Avenues / streets

*Jacaranda mimosifolia* (Jacaranda)
Street tree / landmark / rest areas

*Liquidambar styraciflua* (Liquidambar)
Avenues and streets

*Lagerstroemia indica* (Crepe myrtle)
Streets.

*Livistona australis* (Cabbage tree palm)
Landmark / avenue

*Lophostemon confertus / Tristania conferta* (Brushbox)
Streets / shade

*Melaleuca stypheloides* (Prickly leaf tea tree)
Shade / shelter

*Platanus Spp.* (Plane tree)
Avenues / streets

*Brochichiton acerifolium.*

*Casuarina cunninghamiana.*
Appendix A: Basic road corridor plant palette for urban areas

- **Pyrus calleryana** (Chinese wild pear)
  - Avenues / streets

- **Syncarpia glomulifera** (Turpentine tree)
  - Structure / avenue

- **Syzygium australe** (Lilly pilly)
  - Streets / rest areas

- **Syzygium paniculata** (Brush cherry)
  - Streets / rest areas

- **Tristania laurina** (Water gum)
  - Streets / rest areas

- **Ulmus parviflora** (Chinese elm)
  - Avenues / streets

- **Washingtonia filifera** (Washington fan palm)
  - Landmark / avenue
Appendix A: Basic road corridor plant palette

Landscape guideline

Corymbia maculata.

Ficus rubiginosa.

Liquidamber styraciflua.

Pyrus calleryana.

Corymbia maculata.

Livistona australis.
Appendix A: Basic road corridor plant palette for urban areas

Shrubs

*Banksia spinulosa* (Hairpin banksia)
Medians / reserves

*Banksia ericifolia* (Heath banksia)
Medians / reserves

*Callistemon viminalis* ‘Endeavour’
Medians / reserves

*Callistemon citrinus* ‘Captain Cook’
Medians / reserves

*Callistemon viminalis* ‘Hannah Ray’
Medians / reserves

*Doryanthes excelsa* (Gymea lily)
Medians / reserve

Grevillea ‘Superb’
Medians / reserves

Grevillea ‘Robyn Gordon’
Medians / reserves

*Kunzea ambiguа* (Tick bush)
Medians / reserves

*Leptospermum* ‘Copper Glow’ (Tea tree)
Medians / reserves

*Melaleuca linariifolia* (Snow in summer)
Medians / reserves

*Murraya paniculata* (Orange jessamine)
Medians / reserves

*Raphiolepis indica* (Indian hawthorn)
Medians / reserves
Appendix A: Basic road corridor plant palette

Landscape guideline

Grevillea ‘Royal Mantle’.

Gazania.

Callistemon viminalis Lomandra longifolia and Doryanthes excelsior.

Dianella caerulea.
Appendix A: Basic road corridor plant palette for urban areas

**Groundcovers and creepers**

*Dianella caerulea*
Medians / roundabouts / reserves

*Dianella ‘Breeze’*
Medians / roundabouts / reserves

*Dianella ‘Little Jess’*
Medians / roundabouts / reserves

*Dietes virgata*
Medians / reserves

*Dietes grandiflora* (Wild iris)
Medians / reserves

*Ficus pumila* (Creeping fig)
Noise walls and retaining walls

*Gazania tomentosa*
Median / roundabout / reserve

*Grevillea ‘Royal Mantle’*
Medians

*Hardenbergia violacea* (Lilac vine)
Medians / reserves

*Lomandra longifolia*
Medians / reserves

*Lomandra longifolia ‘Tanika’* (fine leaf dwarf lomandra)
Medians / roundabouts / reserves

*Lomandra confertifolia*
Medians / roundabouts / reserves

*Parthenocissus tricuspidata* (Boston ivy)
Noise walls and retaining walls

*Trachelospermum jasminoides* (Star jasmine)
Medians / noise walls / roundabouts / reserves
The landscape design can have a significant effect on the health and safety of persons constructing or maintaining the end product. Careful consideration by designers regarding the impact on health and safety is necessary.

Some issues include:
- Planting on overly steep slopes.
- High maintenance planting that requires work under traffic at regular intervals.
- Landscape that requires regular weed control and use of pesticides.
- Planting around wire rope fences that makes maintenance difficult.

The OHS legislation (OHS Act S10) requires the RTA to implement sound health and safety design principles to risk manage the OHS hazards associated with construction, maintenance and demolition of the end product. To comply with this and the legislated consultation requirement, the RTA process of OHS in design engages key stakeholders including the designers, constructor, project managers, OHS professionals and maintenance service providers, in a “whole of life” risk management process. The requirements for OHS design applies to projects whether the design is developed “in house” or using external OHS registered consultants.

Each landscape design for RTA projects must be accompanied by a landscape design OHS report. It is the responsibility of the landscape designer to develop the OHS report. It must capture the health and safety hazards and identify measures that will eliminate or reduce the impact of each hazard on constructors, maintainers and persons involved in demolishing the end product.

The details of the landscape design OHS Report will be included into the project OHS development plan which is available on the RTA intranet at rta.nsw.gov.au/doingbusinesswithus/downloads/contractor-ohs/model_documents_dl1.html

The intention of the landscape design OHS report and OHS development plan process is to:
- Demonstrate the orderly management of health and safety throughout the life of the project, and thus provide evidence that designers and the RTA project staff have met their legal health and safety responsibilities.
- Provide a process where key project stakeholders consult on project hazards at development stage.
- Identify hazards at an early stage of the project and establish systems to eliminate/control these hazards.
- Provide a record of how health and safety issues have been identified and responded to over the life of the project including the maintenance period.
- Provide a resource document for those who will carry out maintenance work on the project in the operation phase.

The OHS development plan is reviewed and modified through each of the project stages and hold points to ensure appropriate parties involvement and input. A generic hazard list is also available on the RTA intranet (mentioned above) to assist in the identification of project specific hazards.

Hazards that have not been eliminated at the completion of the design phase are included in the OHS contract specification for the attention of the constructor in their project OHS management plan. Contractors’ procedures/processes for managing these identified hazards are then assessed for completeness during the tender assessment process.
Appendix C: Landscape management plan

Purpose of the plan

The landscape management plan is prepared to promote the cost effective and consistent management of new roadside landscape works. It sets down a standard approach to the maintenance of landscape plantings, both in technique and frequency.

The primary objective is to encourage the establishment of local native plant species and focus on the more dominant and important species within a project. The plan should not be used to provide individual attention and care to all plants in all areas, rather it needs to be looked at in the context of the maintenance of whole areas of planting maintenance and the subsequent suppression of weed species.

In general maintenance activities need to be concentrated along the margins of roadsides, in median planting areas, along footways and cycleways, in front of noise walls and at intersections, where visual and safety issues for both vehicle and pedestrian movements need to be constantly addressed.

Contents of the plan

The landscape management plan should contain the following information. An example of the plan is available from the RTA Urban Design Section.

I. BACKGROUND
1.1 Purpose of this plan
1.2 Site boundaries
1.3 Landscape types

2. SUMMARY TABLE OF MAINTENANCE AND INSPECTION REQUIREMENTS

3. MAINTENANCE ACTIVITIES
3.1 Activities relevant to all areas
   a. Pruning of vegetation for safety
   b. Management of non frangible vegetation
   c. Noxious weed control
   d. Rubbish removal
   e. Fungal and insect attack
   f. Auditing and reporting

3.2 Activities relevant to specific landscape types
   – Grassed areas
     a. Mowing and edging
     b. Replacement of damaged turf
     c. Tree and shrub plantings in turf
     d. Weed control in turf

3.3 Activities relevant to specific landscape types
   – Landscape bed plantings etc
     a. Weeding
     b. Mulching
     c. Removal of dead / dying plant material
     d. Replacement plantings
     e. Tree guards and stakes
     f. Fertilising and pruning

APPENDICES TO THE LMP
Appendix 1 Noxious weed species
Appendix 2 Monthly maintenance audit proforma
Appendix 3 Yearly maintenance audit proforma
Appendix 4 Landscape plans