

Professional Services Specifications (PSS)

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T15 – Pavements

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**Revision History**

|  |  |  |
| --- | --- | --- |
| **Version No.** | **Date** | **Description of changes** |
| 1.1 | 17 August 2020 | Template updated and old references to superseded documents/entities updated |
| 1.0 | 7 July 2014 | ‘Department of State Growth’ replaces ‘DIER’T15.1 Clause rewordedT15.2-T15.5 New Clauses added, previous Clauses T15.2 & T15.3 removedT15.6 Previous Clause removedT15.6 Replaces previous Clause T15.4, Clause rewordedT15.7 Replaces previous Clause T15.5, Clause rewordedT15.8-T15.14 New Clauses addedT15.15 Replaces previous Clause T15.7 and previous Appendix T15.AT15.B & T15.C Previous Appendices removed |

#

## Scope

This specification sets out the minimum requirements for the design of new flexible pavements and the rehabilitation of existing flexible pavements, and applies to both sealed and unsealed pavements. The specification outlines the general principles that are to be followed as well as certain specific requirements.

This specification does not cover the design or rehabilitation of rigid pavements, or the design of bituminous surfacings.

## Objective

Whilst the objective of this Specification is to provide clear directions for the design and rehabilitation of flexible pavements, it is not an exhaustive document, as each project will have individual requirements. However it does contain the minimum requirements and provides direction on where additional information may be sourced.

## References and Standards

The design requirements of pavements shall be compatible with the provisions of all Department of State Growth’s Specifications as well as Austroads Guides and Test Methods and Australian Standards, in particular:

*Austroads*

* AP-C87/10 Glossary of Austroads Terms
* AP-T63/06 Asphalt Characterisation for Pavement Design
* AP-T18/02 Austroads Framework for Specifying Asphalt
* AP-T235/13 Guide to the Selection and Use of Polymer Modified Binders and Multigrade Bitumens

*Austroads Guide to Pavement Technology*

* Part 1 – Introduction to Pavement Technology
* Part 2 – Pavement Structural Design
* Part 3 – Pavement Surfacings
* Part 4 – Pavement Materials
* Part 5 – Pavement Evaluation and Treatment Design
* Part 10 – Subsurface Drainage

This specification takes precedence over the *Austroads Guide to Pavement Technology* series if and where they differ.

## General Considerations

### Design Life

Unless advised otherwise, the design life shall be 20 years for flexible pavements. This applies to both new and rehabilitated pavements.

### Design Traffic

The AADT and heavy vehicle content is available across the Department of State Growth-managed State Road network. For some sites, more detailed traffic data is available. In the absence of more detailed, site-specific information, the design shall assume that:

* All heavy vehicles travel in the outside lane on multi-lane roads;
* Direction Factor of 0.5 (i.e. traffic is divided equally between the PD and CD direction);
* The number of heavy vehicle axle groups per heavy vehicle (NHVAG) shall be 2.8 for rural roads and 2.5 for urban roads;
* The traffic load distribution (TLD) for granular pavements with a thin bituminous surfacing shall be 0.9 ESA’s per HVAG for rural roads and 0.7 ESA’s per HVAG for urban roads;
* Annual traffic growth rate 3%.

*Note: The 3% growth rate is intended to cover both the growth in the number of heavy vehicles over time but also the growth in ESA’s per heavy vehicle.*

Designers shall establish if more detailed traffic data exists for the site or is required to be collected, particularly where a sensitivity analysis highlights a need. In the event that weigh-in-motion information is available, this shall be used to determine the direction factor, the number of heavy vehicle axle groups per heavy vehicle and the traffic load distribution.

For new pavements, the pavement design shall be based on the traffic lane with the highest Design Traffic. This design shall be applied across the full carriageway width including the shoulders. For strengthening of a multi-lane road, different treatments for each lane may be considered, in which case the Design Traffic should be calculated for each lane.

### Design Traffic Calculations for Temporary Pavements

For temporary pavements with a design period of less than five years, the design traffic shall be calculated using a 20 year design period with zero traffic growth rate, using the maximum daily heavy vehicle volume.

## Investigations

Investigations shall be undertaken in accordance with *Specification T6 Geotechnical and Site Investigations and Reporting*.

Prior to undertaking any investigations, the Consultant shall identify what information is required to inform the design. The Consultant shall determine whether any relevant information already exists. For example, in the case of rehabilitation projects, the Department collects condition data including roughness, rutting and cracking on a regular basis, and has deflectograph data for much of the network. In addition, there are construction and seal histories across the network, and historical records (such as previous investigations) that may also be useful.

Where relevant, the geotechnical investigation should include the stability of the road formation and settlement under the pavement. The *Austroads Guide to Pavement Technology* series does not contain provisions for settlement below the pavement. Where required, additional investigations and assessments shall be carried out to determine if settlement may occur, and if so, how this affects the pavement design and/or construction.

## Subgrade Assessment

### Determination of Subgrade CBR

For new pavements, the strength of the subgrade shall be assessed using a 4-day soaked CBR test. For existing pavements, alternative methods to assess the subgrade strength may be utilised.

When determining the design CBR, the variability of the subgrade shall be taken into account.

### Maximum Subgrade CBR

The maximum subgrade CBR shall be as follows:

|  |  |
| --- | --- |
| **Design Traffic** | **Maximum CBR** |
| Design Traffic less than or equal to 5x105 DESA’s | 15% |
| Design Traffic greater than 5x105 DESA’s but less than or equal to 5x106 DESA’s | 10% |
| Design Traffic greater than 5x106 DESA’s | 10% |

The maximum CBR for constructed subgrades is specified in the Department’s Standard Specifications.

### Soft Subgrades

If the subgrade CBR is less than 3%, consideration shall be given to subgrade improvement or measures such as inclusion of a geogrid, to assist in providing a construction platform.

If the subgrade CBR is less than 2%, a stable working platform must be included in the design, to enable subsequent layers to be compacted.

Lime stabilisation of the subgrade can be an effective construction tool. Where minimal or no field and laboratory testing is undertaken, such treatments are not considered in the pavement design calculations: i.e. the original insitu subgrade CBR forms the basis of the pavement design.

Where geogrids are included in the design to facilitate construction, the geogrid shall not be considered in the pavement design calculations: i.e. no reduction in pavement thickness or increased strength is permitted due to the geogrid.

### Rock Subgrades

Rock subgrades can be slow to drain, particularly in cuttings, and preparation of the surface invariably results in some unevenness. To ensure any water ponding on the top of a rock subgrade does not adversely affect the pavement, a minimum 150mm of free draining rock fill shall be placed on top of the rock cutting. The depth of the rock drainage layer should be increased if the fracture characteristics of the rock result in more significant surface irregularities. A geotextile complying with *Standard Section 210 Geotextiles in Earthworks* shall be placed above and below the rock blanket.

The subgrade strength shall be assessed, and shall comply with the requirements of *Clause T15.6.2*.

Sub-soil drains may be required, especially for boxed-in construction. For this to be effective, the rock needs to be sufficiently fractured for water to drain into the sub-soil drain.

## Specific Design Requirements

### Design Considerations

Designers shall give due consideration to the following items during the Design and Specification phases:

* Life cycle costs.
* Suitability of the treatment having regard to the location within the network and adjacent pavement construction.
* The location of add-ons and joints. These shall not be placed in potential wheel paths. The preferred location is at lane boundaries. Alternatively they may be placed between wheelpaths.
* The effect of disturbing existing pavement materials or exposing the subgrade.
* Pavement surface and subsurface drainage issues.
* The location of existing services: underground, surface and above ground.
* The effect of an increase in pavement height on available pavement widths, clearance heights to overhead structures and on drainage and drainage structures.
* Alternative asphalt thicknesses. The *Austroads* design method will often indicate two possible asphalt thicknesses, a thin course of less than 50mm and a thicker course exceeding 100mm. Both should be reported with comment on advantages and disadvantages.
* The required properties of the surfacing with respect to skid resistance, noise generation, robustness, spray generation, visibility and lighting.
* Compatibility of the design with predictable future treatments. This might include level considerations for kerb and gutters and the compatibility of aggregate sizes in seal design.
* Potential for the reuse of existing pavement, surfacing and natural materials and any possible reduction in the transport task and related energy use considerations.
* Different pavement types should not be used in adjacent lanes or with the shoulders due to the possible structural incompatibility, drainage and safety issues.
* The timing of works. The considerations here might include the season (summer, winter) in which the work will be undertaken and staging considerations such as trafficking the pavement prior to placing the final surface, the release of volatiles from cutback bitumen.
* Local industry capacity. In the event that a potentially favourable solution may not be within the capacity of local industry to perform, or involves the importation of a special material, particularly special bituminous products, additives and equipment, not commonly available in Tasmania, discussions should be held with that section of industry. The discussions should cover the process and cost implications, minimum quantities and possible alternative solutions. This requirement is not intended to limit innovation, but is aimed only at clearly establishing the benefit and cost implications of the innovation.
* Designers may offer alternatives and are encouraged to do so, provided that a reasoned case that justifies the deviation is provided. However in this scenario, it is ultimately up to Department of State Growth whether any alternative is adopted. In all cases though, a complying design must be provided as a reference for comparison.

### Minimum Pavement Thickness

For flexible pavements comprising unmodified granular materials and a sprayed seal or thin (<50mm) asphalt surfacing, the pavement thickness shall be determined in accordance with the *Austroads Guide to Pavement Technology* series. In addition to the *Austroads* requirements, the minimum pavement thickness shall comply with the following:

|  |  |
| --- | --- |
| **Design Traffic** | **Minimum Pavement Thickness** |
| Design Traffic less than or equal to 5x105 DESA’s | 300 mm |
| Design Traffic greater than 5x105 DESA’s but less than or equal to 5x106 DESA’s | 400 mm |
| Design Traffic greater than 5x106 DESA’s  | 450 mm |

### Minimum Base Course Thickness

For flexible pavements comprising unmodified granular base materials and a sprayed seal or thin (<50mm) asphalt surfacing, the thickness of Base Course shall be determined in accordance with the Austroads Guide to Pavement Technology series. However, if the thickness of Base Course is less than specified in the following table, then the Base Course thickness shall be increased to meet the following requirements:

|  |  |
| --- | --- |
| **Design Traffic** | **Minimum Base Thickness** |
| Design Traffic less than or equal to 5x105 DESA’s | 100 mm |
| Design Traffic greater than 5x105 DESA’s but less than or equal to 5x106 DESA’s | 150 mm |
| Design Traffic greater than 5x106 DESA’s  | 175 mm |

### Material Quality – Sealed Pavements

Base Class A shall be specified for sites where the Design Traffic is greater than 5x106 DESA’s, and for pavements where an asphalt surface is required. For all other sites, Base Class A is the preferred material. However, for lower trafficked roads, Base Class B may be specified if it is justified by a life cycle costing and is not detrimental to the structural capacity of the pavement.

### Material Quality – Unsealed Pavements

The pavement Base Course material for unsealed roads is defined in the Department’s Standard Specifications.

### Non-standard Granular Materials

The use of non-standard local gravel sources or the re-use of existing materials may be nominated by Department of State Growth in the design brief, or identified by the designer based on economic considerations. Non-standard materials shall only be considered for remote locations where standard materials are not readily available, or for low traffic roads.

Although not desirable, it is recognised that for some sites, it is more economical to utilise local gravel sources or re-use existing materials, rather than import Base Class A or B or subbase materials. Prior to the use of non-standard Base materials, the suitability for surfacing shall be established.

Non-standard materials should only be used after consideration of:

* The documented performance history of the proposed material
* Relative cost compared to complying materials
* The predicted traffic loading
* The subgrade conditions, in particular the sensitivity to moisture
* The quality and uniformity of the materials as demonstrated by laboratory testing
* The consequences of poor performance.

The quality of the materials shall be taken into consideration when calculating the base course thickness and total pavement thickness. If necessary, mechanistic design should be undertaken to account for lower quality materials.

The use of non-standard materials is a Hold Point, requiring approval from Department of State Growth Road Asset Management Section, prior to undertaking the pavement design.

### Asphalt Pavements

For pavements comprising an asphalt Base, the pavements shall include a granular layer, comprising of at least 150mm of Base A quality material, placed immediately below the asphalt Base.

For pavements comprising an asphalt Base and asphalt subbase, the pavements shall include a granular subbase, comprising of at least 150mm of subbase 1 quality material, placed immediately below the asphalt subbase.

### Temporary Pavements

The pavement design for temporary pavements including detours shall utilise a Project Reliability Factor of 80%.

### Other Pavement Design Considerations

The thickness of bituminous surfacing, including thin asphalt surfacings (less than 50mm thick) and geotextile seals, is considered non-structural for the purpose of pavement design, and shall not be included in the total pavement thickness.

Geotextiles and geosynthetics that reinforce pavement layers or have load spreading properties are excluded from the mechanistic modelling procedure.

Granular and asphalt thicknesses shall be rounded up to the nearest 5mm.

A construction tolerance of 10mm shall be added to the thickness of the critical layer. The critical layer is defined as the layer that controls the design life of the pavement through its fatigue resistance, or in the case of granular pavements, is the unbound granular base layer.

### Economics of Construction

When determining the configuration of the pavement layers, the designer shall take into account the maximum layer thicknesses defined in the Department’s Standard Specifications. To enable adequate compaction, the layer thickness shall be no less than three times the nominal stone size.

## Stabilised Materials

### Key Considerations

Where stabilisation is considered, the following factors must be taken into account:

* The uniformity of the existing materials, both longitudinally and transversely
* Suitability of the material for stabilisation
* Impact of any variability in thickness of the existing materials
* Strength and variability of the subgrade, and the ability to withstand compaction
* The presences and extent of any asphalt patches
* The presence and depth of any underground services
* Implications for future maintenance and rehabilitation.

When proposing a stabilised design, the designer shall ensure there is sufficient testing to demonstrate it is a viable option and is likely to deliver the intended design life.

### Minimum Cover over Stabilised Materials

Stabilised materials must be covered by either a granular or asphalt Base Course. The thickness of the Base Course, irrespective of whether it is granular or asphalt, shall comply with the requirements of *Clause T15.7.3*.

No minimum cover is required for temporary pavements.

### Pavement Layer Thickness

The minimum thickness of a stabilised layer is 150mm.

The maximum thickness of a stabilised layer is 250mm, to ensure full compaction.

Multiple bound layers should be avoided. If multiple layers are necessary, particular attention needs to be directed towards the bonding of the layers. The sensitivity of the pavement life to the nature of the bond between layers should be assessed.

### Cracking

Shrinkage cracking in cementitious materials is inevitable. Cracks that reflect through to the pavement surface allow the ingress of water, which can compromise the structural integrity and performance of the pavement. The design process must include measures to minimise cracking.

## Shoulders

Shoulders and verges shall be constructed in accordance with the pavement design for the adjacent traffic lane.

## Pavement Drainage

### Sub-surface Drainage

Particular attention is to be directed towards an understanding of groundwater regimes and solutions defined during design. Designers should pay close attention to potentially high ground water levels in cuts and at cut-fill boundaries and provide remedies.

Water shall not be allowed to accumulate in the pavement.

Full width construction is preferred. Boxed-in construction (where the shoulder material is less permeable than pavement) should be avoided.

Permeability reversals (a sharp decrease in permeability) between the base and subbase should be avoided.

Where it is intended to place a granular overlay over an existing bituminous surfacing, the existing surfacing should be broken up or removed.

### Surface Drainage

The surface drainage must be such that water will shed quickly from pavements without the development of water flow depths that would lead to a significant reduction in skid resistance. Flow paths shall be assessed for urban asphalt sites and other high-risk locations.

Where a one way cross-fall occurs, consideration should be given to the sealing of the higher shoulder and/or the use of subsurface drains.

Consideration must be given to the permeability characteristics of medians and islands, with the aim of limiting water ingress into the pavement.

The invert of a table drain must be lower than the underside of the lowest pavement layer.

## Bituminous Surfacing Selection

The bituminous surfacing type shall take into account the likely road users (e.g. motor vehicles, pedestrians, cyclists) and environmental factors (e.g. noise, snow clearing).

The selection of bituminous surfacing shall be undertaken in accordance with the latest version of the *Austroads Guide to Pavement Technology Part 3: Pavement Surfacings*.

The selection of bituminous surfacings shall be consistent with the provisions of the Tasmanian State Road Traffic Noise Management Guidelines (2011).

A waterproofing seal shall be provided underneath all asphalt wearing courses, except for dense graded asphalt greater than 100mm thick. The preferred waterproofing seal is a 10mm primerseal with bitumen emulsion.

Where an asphalt surfacing is proposed, asphalt fatigue shall be assessed in accordance with the *Austroads Guide to Pavement Technology* series.

Open Graded Asphalt (OGA) shall only be used to address specific issues. OGA shall not be used in locations where there are significant stopping and turning movements such as at intersections with traffic lights, approaches to roundabouts etc. Their use is limited to where:

* The substrate is free of depressions that will cause water to pond
* Water is free to drain from the edge of the OGA
* The OGA is placed on an effectively impermeable surface.

Class 170 bitumen shall be used in sprayed seals and in most conventional asphalt applications. Class 320 bitumen may be used for specific applications such as deep lift asphalt pavements or to provide increased rut resistance. For sites with significant heavy vehicles generating additional stress for the surfacing, the designer shall consult with Department of State Growth Road Asset Management Section.

If a polymer modified binder treatment is specified, consideration must be given to the availability in Tasmania of the various binders.

Traffic shall not be allowed to travel on sprayed seals with aggregates larger than 14mm nominal size.

Traffic shall not be allowed to travel on primes or tack coats.

Primerseals are a short term treatment. Specification of the primer seal shall take into account the design requirements of the final seal. The typical stone size allowable for primersealing is 10mm. Approval is required from Department of State Growth’s Road Asset Management Section if specifying an alternate stone size for a primerseal.

For pavements constructed clear of traffic with delayed opening time, particularly attention to the surfacing design is required. The key factors are the time of initial seal, and time lapse until the road is open to traffic.

All bituminous surfacing selections shall be approved by Department of State Growth Road Asset Management section.

## Construction and Maintenance

Construction and maintenance issues shall be taken into consideration, including:

* The type and frequency of pavement maintenance
* The pavement should be designed to avoid failure in the lower layers, so that future maintenance is confined to the upper layers
* Impact from vibration due to compaction on nearby structures
* Underground services
* Availability and adequacy of construction equipment, materials and expertise
* For narrow pavement widening, ability to compact and/or stabilise the pavement adequately
* The ability to maintain the drainage system to ensure the pavement is protected from water ingress throughout its serviceable life
* Future treatment where there are height or level constraints.

The *Work Health and Safety Act 2012* requires the designer to take into consideration safe work practices for the construction, operation, maintenance and removal of infrastructure assets.

Detailed temperature and rainfall information is available from the Bureau of Meteorology website ([www.bom.gov.au](http://www.bom.gov.au)). Climate and weather should be considered, especially with respect to construction. For example whether it is warm enough to place asphalt overnight, or the risk of exposing the subgrade.

The design shall consider potential safety issues and nuisance that might occur during and after construction, including the safety of construction personnel, road users during and after construction; traffic delays; vibration, siltation and scour, fumes and dust during construction and noise. This list is not exhaustive. The designer must consider the implications of the design on construction personnel, road users and residents and seek to find a balanced solution.

## Specification

Specific design details shall be provided in project specification, including:

* The area of dig out patching and its cost implications compared to an increase in thickness of overlay.
* Proposed substrate treatments where asphalt is to be applied.
* Contingencies if the subgrade conditions do not meet the design CBR.
* The required roughness levels when the proposed works do not comply with the definition of “new work”. In the event that setting appropriate limits is impractical, the project specification should define a method of control for evenness of surface.
* Special testing requirements for asphalt including the need or otherwise of a “Production and Construction Trial” and Level 2 and 3 testing in accordance with APRG Report No 18 “ Selection and design of Asphalt Mixes”.

## Reporting

A pavement design report shall be provided with the planning or preliminary design.

All available information should be referenced in the report if not included. Where not included, the reasons should be stated. Opinion need not be avoided, although it must always have a basis in fact and should be described as opinion.

In preparing the report it should be recognised that the report has uses beyond the design and specification functions. It may be used by Department of State Growth to assess priorities and risks, by the Contractor to determine methods and costs and by the Construction Superintendent to make decisions throughout construction. As a result, in addition to providing full disclosure, the report should:

* Define locations in terms of Department of State Growth’s link numbers and chainage, observing the prescribed and counter direction
* Describe the site and/or existing condition of the pavement including groundwater and moisture conditions
* Provide an understanding of the basis of the design and the determining factors
* Collate data so that is easily accessed by the range of users described above
* Where applicable, include statistical summaries of deflection data as well as overlay thickness estimates based on the *Austroads* overlay design procedures
* Provide comment on compliance of materials with *Department of State Growth’s Standard Specifications* but including a statement about the reliability of the data, scatter of results, statistical significance, etc.
* Discuss alternatives, including benefits, cost and risks. It is important that all parties are made fully aware of likely risks, particularly those arising from a limited data set.
* Include reasons for deviations from the specified standards or those standards outlined above, such as the use of other than a Class 170 or 320 bitumen or where multigrade bitumen or polymer modified binders are recommended.

The pavement design shall be clearly documented, including the methodology and calculations, supported by:

* The subgrade conditions
* The design traffic calculations
* Where relevant, the CIRCLY Job Summary File, critical strains and CIRCLY.clo output files, including the performance relationships used (or an alternative software program complying with the *Austroads Guide to Pavement Technology*)
* Adjustment of the critical layer thickness, in accordance with *Clause T15.7.8*.

## Hold Points

Hold Points for this Specification are listed in *Table T15.15.1 – Hold Points.*

### Schedule of Hold Points

|  |  |  |
| --- | --- | --- |
| **Description of Hold Point** | **Nominated Work Not to Proceed** | **Evidence of Compliance** |
| Use of non-standard materials | Pavement design | Approval from Department of State Growth Road Asset Management Section |
| Pavement Design | Detailed design and preparation of tender documentation | Approval from Department of State Growth Road Asset Management Section |
| Surfacing Selection | Detailed design and preparation of tender documentation | Approval from Department of State Growth Road Asset Management Section |

*Note: Earlier involvement (i.e. prior to reaching the above Hold Points) of Department of State Growth Road Asset Management Section is desirable, and can minimise the risk of re-work if the pavement design is significantly changed as a consequence of the Hold Point.*

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