

COST EFFECTIVE PAVEMENT THICKNESS DESIGN

Key parts of Main Roads' road pavement design system were reviewed to identify opportunities to reduce conservatism and improve outcomes. Issues for investigation, including minimum design thicknesses, material selection and effects of speed and location, were nominated by Main Roads and the WA consulting industry. Selected Main Roads practices were compared to other Australian state road agencies and recommendations made comprising potential changes to design requirements or reinforcement of the value of existing practice.

Pavement design period and project reliability

Main Roads uses a 40-year design period and 95 per cent project reliability level for all flexible pavements, making WA the only Australian state that requires the same design period and reliability level for all classes of road. When it comes to freeways and heavily trafficked highways, Main Roads' approach is similar to most other states. For lesser road classes, all other Australian states reduce both design period and reliability.

Should it change?

Yes and no. For major roads, there is no reason to change current practice. However, Main Roads could consider a lower design period and project reliability for lower class roads.

Minimum thickness for polymer modified asphalts

Polymer modified binders (PMB) are commonly used in upper layers of asphalt pavements in Australia to improve durability. However, asphalt mixes using PMB are more expensive. Main Roads design rules typically result in a minimum thickness of PMB in full-depth asphalt pavements of 140 mm, substantially higher than other state's requirements.

Should it change?

Yes. It is recommended Main Roads reduce the requirements that lead to a minimum of 140 mm of PMB dense-grade asphalt (DGA). Two options considered feasible are: stating the minimum thickness required in the top two DGA layers; or providing greater flexibility in selection of upper intermediate course mix and thickness.

Minimum thickness for structural asphalt

Specifying the minimum required total asphalt and pavement thickness is unique in Australia to Main Roads. No other state specifies minimum required total thickness, instead relying on key design inputs like traffic loading, material properties (modulus, CBR, etc.) and fatigue constants to achieve acceptable pavement thickness and performance outcomes.

Should it change?

Yes. Relaxing specification of the total asphalt or pavement thickness would align Main Roads with other states, who have all reported acceptable design risk outcomes. Such a change should, however, be subject to a review of controls on related key design inputs.

Minimum subbase thickness for full depth asphalt pavements

The use of a granular subbase below full depth asphalt pavements is common practice across Australia. Main Roads' approach is similar to other state agencies.

Should it change?

No. There is no urgent need for Main Roads to consider changing its approach.



Construction tolerances for pavements

Layer construction tolerances are a critical factor in long-term pavement performance. Main Roads' practice is consistent in approach to other state agencies, with its specific tolerance limits less conservative than some.

Should it change?

No. Given the substantial reduction in pavement design life resulting from even small reductions in total pavement thickness, Main Roads' approach is considered justified.

Modulus of granular materials

Main Roads is understood to be interested in how sublayering concepts relate to its use of thin asphalt on granular pavements in heavily trafficked situations. The requirement to mechanistically design these pavements is not common in Australia, but most states do utilise granular pavements, albeit with a spray seal surfacing, in heavily trafficked rural situations.

Should it change?

Yes. Main Roads' minimum requirements for base course design produce outcomes generally similar to other states. However, Main Roads could consider simplifying design rules to provide fewer discrete thickness requirements, as used by other states, rather than being based on current sublayering rules.

Minimum speed at intersections

Heavy vehicle traffic speed influences pavement thickness and cost. All states provide pavement design speed values in their pavement design guidelines. Main Roads' approach is generally consistent with other states. However, additional requirements for steep longitudinal grades are not currently considered.

Should it change?

Yes. It is suggested Main Roads consider including design speeds on steep longitudinal grades.

Traffic multipliers for high stress locations

Main Roads requires multiplication of the design traffic loading by a factor of three at roundabouts and other small radius curves, which are typically high stress locations. It is the only state agency that uses a traffic multiplier; other states consider low design speeds sufficient.

Should it change?

Yes. It is recommended Main Roads reviews the technical basis for the traffic multiplier of three to determine whether a traffic multiplier is necessary in addition to other controls – or if the value could be reduced.

Additional issues

PMB modulus adjustment factors

It is understood Main Roads is interested in a more comprehensive study of typical PMB asphalt modulus from a range of asphalt plants to derive adjustment factors for WA mixes. The related issues are complex. It is suggested Main Roads gains a better understanding of the issue and any subsequent testing be done in a single laboratory to ensure consistent findings.

Empirical design on unbound granular pavements

It is recommended Main Roads reviews the empirical design figure used for design of lightly trafficked unbound granular pavements.

Binder rich bottom asphalt layers

Main Roads does not allow use of binder rich bottom asphalt layers due to concerns regarding trapping moisture and subsequent stripping. It is suggested that once existing issues with asphalt permeability and durability are resolved, use of high binder layers be considered.

There are several areas where Main Roads could improve its practices, to reduce conservatism, drive cost savings and improve efficiencies.

