Austroads

Austroads' Submission (Supplementary)

House of Representatives Standing Committee on Regional Development, Infrastructure and Transport

Inquiry into the Implications of Severe Weather Events on the National Regional, Rural, and Remote Road Network

Contents

1. Introduction

Austroads is the collective association of Australasian road transport and traffic agencies, representing all levels of government. Austroads members are collectively responsible for the management of over 900,000 kilometres of roads valued at more than $250 billion, representing the single largest community asset in Australia and New Zealand. The organisation assists its members and Australia's local government agencies in the adoption of harmonised and consistent road design, construction, management, and safety practices. It does this through the provision of high-quality advice, information, tools, and services that promote national standardised guidelines for road networks.

As the peak body providing and promoting standardised national practices for road assets, Austroads plays a critical role in road maintenance. Austroads have developed several major guides and reports about road maintenance, such as "*Effectiveness of Maintenance Activities on Pavement Conditions*" (AP-R566-18) and "*Guide to Pavement Technology Part 7: Pavement Maintenance*" (AGPT07), which identity, analyse, and recommend effective road maintenance practices for road and transport agencies.

One of the biggest challenges facing road maintenance activities across Australia is to keep pace with the rapidly expanding network. Notwithstanding that total maintenance expenditure has increased since 2001, the proportion of total road expenditure dedicated to maintenance has not significantly changed, as shown in the table below. This is despite the value of the road network asset increasing by over 40% over the same period. Most jurisdictions have fiscal constraints in the form of targets or strategies that impose spending caps on road maintenance expenditures. These caps can restrict road management budgets, potentially prioritising capital investment over asset management strategies.

Table 1-1: Proportion of total road related expenditure spent on maintenance (%)

	2001/02	2020/21
Maintenance share of road expenditure (%)	13.1%	13.9%

Source: analysis of BITRE data

Austroads' focus on road maintenance has increasingly shifted towards emphasising the importance of maintaining roads subject to growing changes in the climate over the past 20 years. Changing climate patterns are driving an increase in severe weather events across Australia, causing further deterioration to the national, regional, rural and remote road networks that are dangerous, disruptive, and expensive to repair. Austroads recognises the need for future climate risk to be considered in present maintenance activities and has accordingly invested in developing several research and technical reports exploring road infrastructure resilience to the impacts of climate change.

A potential part of the solution to overcoming the challenges in national road maintenance is improving asset management data through standardised and harmonious data. To enable collaboration and the adoption of best-practice approaches to road maintenance nationally, Austroads is developing the Road Asset Data Standard (RADS, AP-R673-22). This project aims to standardise and automate methods of recording and sharing road asset information throughout Australia. It includes creating a common understanding of the meaning of road asset data and ensuring consistency in data definition and format. Standardising the collection of road asset data will reduce data collection costs, improve decision making associated with road investment and expenditure, and facilitate the implementation of national reforms. Ultimately, the RADS will create opportunities for future research into effective maintenance practices by road transport and traffic agencies, reduce operational and data collection costs and support funding for road maintenance.

2. Road maintenance

Road infrastructure is a long-lived investment. Roads typically have design lives of 20 to 40 years. Bridges may have design lives of 100 years. Road infrastructure is a key asset of governments and the community. The effective functioning of the road network is central to economy prosperity and social cohesion.

The importance of the road network, the longevity of infrastructure and the variety of infrastructure types and materials requires complex lifecycle management. Increases in traffic loadings and more severe weather events as the climate changes add additional layers of complexity to this task by further increasing the rate of deterioration of roads.

To support the road network and its challenges, ongoing road maintenance services that are reliable and effective are required to maintain existing and future road infrastructure. This service is essential for ensuring that the value of road infrastructure is realised by its users and governments.

Importance of road maintenance

Road maintenance involves any activity aimed at preventing road assets from prematurely deteriorating. In doing so, road maintenance effectively preserves the level of service and functionality roads provide to users.

Road maintenance has several major social and economic consequences. Well maintained roads result in benefits for the user in the forms of:

- increased road safety, speed, and comfort
- reduced vehicle operating costs (quality roads reduce vehicle maintenance needs, and reduced fuel usage)
- increased propensity of transport operators (such as freight) or organisations to use the road to bring economic and social development opportunities to the nation.

Well planned strategic road maintenance has been shown to extend the useful lives of road assets while at the same time lowering whole of life costs. This was observed in the New Zealand Transport Agency's White Paper on State Highway Asset Management which was published in late 2019. It found that New Zealand experienced an extended period of fixed maintenance expenditure from 2009-10 to 2016-17 (i.e., no growth in maintenance expenditure), which resulted in rapid deterioration of road surfaces, an increased number of road crashes and casualties, and ultimately increased the cost of ad-hoc repairs to the road.

In short, a well-maintained road asset will likely have a longer useful life than a poorly maintained asset, allowing for investments in road infrastructure to be of more functional and of higher value to users and governments in the long term.

Types of maintenance

Road maintenance activities relating to the repair of defects associated with the road structure and related facilities to ensure the preservation of the asset. They thus preserve a high level of convenience and safety for road users. Notwithstanding there are different approaches to categorise maintenance activities across various organisations, they can be broadly defined as:

- **Routine Maintenance:** Includes activities that address minor defects and safety issues on and around the carriageway and structures. These works are normally unplanned or planned with short lead time and undertaken with minimal equipment and materials.

- **Preventative periodic maintenance:** Includes activities occurring at timely intervals intended to reduce future deterioration and to ensure skid resistance and general safety do not fall below minimum accepted levels. These works are normally planned with lead time generally greater than a month.
- **Rehabilitation:** Includes works that target roads whose ride quality has deteriorated significantly, or which display inadequate structural capacity for current or future traffic loading. These works are planned with lead time generally greater than a month and often planned as part of an annual, three- or five-year programs.

Maintenance activities could also be categorised by the area of the road such as drainage maintenance, flexible pavement maintenance, concrete pavement maintenance, maintenance of shoulders, and other maintenance activities such as traffic management, incident and emergency management.

Importance of data

Data is collected independently by different road transport and traffic agencies to gain an understanding of road conditions. This data is then used to inform future road management and investment activities, especially relating to the provision of road maintenance. Data collected include metrics that monitor how, where and when road maintenance should occur, accounting for expected traffic volumes, weather events and road deterioration type and extent.

A contemporary use of collected road maintenance data was demonstrated in the Austroads report "*Effectiveness of Maintenance Activities on Pavement Conditions*" (AP-R566-18). Collated data from several jurisdictions was consolidated and analysed to determine the most effective maintenance activities in reducing road deterioration rates. Through the analysis and evaluation, Austroads has been able to empirically reveal the impact of specific maintenance activities on the preservation of national road infrastructure. The use of road data in this way has the potential to shape the development, funding, and provision of road maintenance activities throughout Australia.

Given the aforementioned implications of road data on road maintenance activities, high quality and good accessibility of these data are essential. There is currently an absence of consistently used standards for Australian road maintenance data, resulting in data that is often siloed, of poor quality, held in varied, disparate systems and collected intermittently. As a result, the value of data is not well understood or leveraged to support decisions and forward planning around road maintenance. In response to the need to standardise and harmonise data sets, Austroads are building the RADS to guide member organisations in the exchange and availability of road data. Further information is available in the Austroads report "*Austroads Road Asset Data Standard Version 4.0*" (AP-R673-22).

Appropriate levels of intervention and frequency

Intervention levels are specified condition parameters (usually limiting values) which, if exceeded, trigger a maintenance investigation or maintenance activity. Upon reaching an intervention level, a defect is generally recorded and either rectified or scheduled for rectification within a given response time. Intervention levels may also be known as action levels, maintenance standards or trigger points.

Levels of intervention and frequency contribute to the effectiveness of preventative maintenance activities. Austroads's "*Guide to Pavement Technology*" (AGPT04) outlines that the average target maximum surface age for roads should be 15 years. Specific target ages can vary by road segments, pavement strength, traffic volume, type, and geography/climate conditions.

Given the number of factors that contribute to determining the target conditions of roads, developing criteria for appropriate levels of intervention and frequency is highly complex, likely differing depending on the component composition of the individual road. Various parts of road assets comprise different materials which have different rates of deterioration, useful lives, and sensitivity to external environments. The appropriate intervention levels and frequency of road maintenance activities will likely need to be determined on an individual component basis rather than using general estimation methods.[1]

In addition, expected increases in traffic volumes and weather severity will also increase the ambiguity in estimating the appropriate levels of intervention and frequency, as these factors will accelerate the deterioration of road surfaces over current levels. These increased pressures on road surfaces could also potentially require different interventions and frequency of preventative maintenance activities than used previously.

Responding to severe weather events such as floods and droughts

With the increase in severe weather events, there is elevated pressure on road maintenance activities to preserve sealed pavement roads in an effective and efficient manner. Many defects result from the presence of excess moisture in the pavement or subgrade, inferring that the prevention of water reaching or remaining on the pavement is of critical important to maintenance. Almost every area of the road is affected by excess water, with flexible and concrete pavements deteriorated by excess water, while the drainage system and pavement shoulders are involved in the inception and disposal of surface or ground water. In addition, high temperatures resulting from heatwaves and bushfires also have a prevalent impact on road surfaces, primarily causing detriment to bituminous materials used in road sealing.

The maintenance of roads that are exposed to extreme weather events is mainly undertaken through routine maintenance procedures. Recurrent routine maintenance to repair minor defects may obviate major defects with consequent costly repairs and prevent the development of conditions likely to be hazardous or inconvenient to the road user.

Austroads has developed several relevant research and technical reports, including the recent *"Austroads Road Deterioration Model Update*" (AP-T367-23; AP-T368-23; AP-T369-23; and AP-T370-23) technical report series. These reports offer updated guidance on how best to manage road deterioration in the changing climate and the relevant maintenance needs of affected road infrastructure.

[1] More information about deterioration rates of road components is available in Austroads guidelines such as "Effectiveness of Maintenance Activities on Pavement Conditions" (AP-R566).

3. Road network trends and funding process

Over the last decades the road network has been expanded as capital expenditure in road related infrastructure projects has been at historically high levels in many jurisdictions. An expanded network is likely to generate increased maintenance and replacement requirements in the future. This chapter explores trends and developments in the road network at a national level and the funding process for road expenditures.

3.1 Extent and composition

The Bureau of Infrastructure, Transport and Regional Economics (BITRE) publishes estimates on the growth of the Australian road system, including the total length of the road network considering number of lanes measured in lane kilometres and the value of the network estimated using value equivalent lane kilometres.[2] Comparing the network's physical extent and value highlights its growing sophistication and complexity.

Figure 3.1 shows that while the total length has only marginally grown over the presented 55-year period, the paved network has been substantially expanded. The network's value has also grown significantly from approximately $25 billion to more than $220 billion in 2015 (in real terms). The growth is mostly driven by said expansion of the paved network, which has grown by a factor of ten from under $20 billion in 1950 to $212 billion in 2015.

Figure 3.1: Australian road network lane kilometres

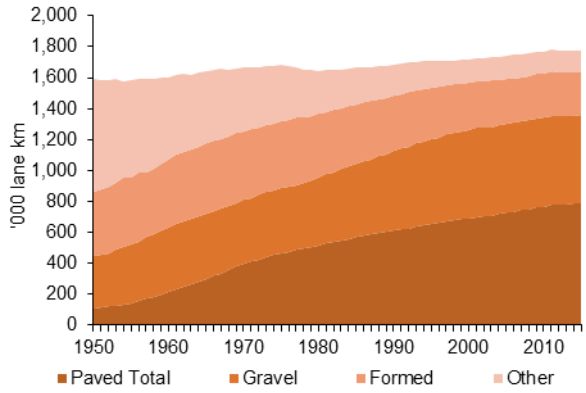
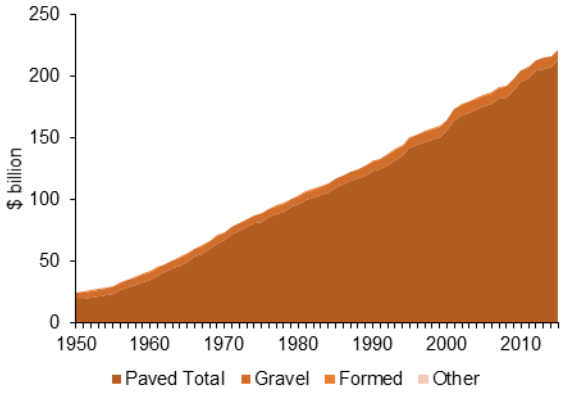


Figure 3.2: Value of the Australian road network ($b)



Source: analysis of BITRE data

Road management is mainly carried out by states and councils. States tend to be responsible for major roads and councils for roads of local significance. BITRE's classification system suggests that divided roads, freeways, and tunnels are usually state-managed, while a large portion of undivided paved roads is council-managed.[3] The decomposition of the paved road network into these categories provides a first indication of maintenance expenditure for each level of government. Figure 3.3 shows undivided paved roads have steadily increased in value, while the other categories have grown from insignificantly low levels in the 1950's to making up nearly half the lane equivalent value of the network today.

[2] Value Equivalent Lane Kilometres is a concept where lane kilometres for different road types are weighted by current value estimates. More details refer to *Growth in the Australian Road System, Austroads, 2017*

[3] Commonwealth Grants Commission 2018

Many road network expansions are a reaction to increasing population driving the extent of urban areas and the number of residential subdivisions needing to be connected. Examining this on a per capita basis offers further insight. Figure 3.4 shows that while undivided paved roads' per capita value has remained stable over the past 30 years, that of divided roads, freeways, and tunnels has more than doubled. Meanwhile, state tax revenue for road-related expenses has not grown in proportion and while hard to predict due to year-on-year fluctuations, is unlikely to mirror upward trends in network value. Lower growth in revenue compared to the cost base means assets are being maintained with less per unit funding. This indicates that, due to increasing complexity and maintenance of the network, the states' road management responsibility has already and is likely to further increase. Section 4 further explores these expenditure trends and potential maintenance gaps.

Figure 3.3: Australian road network value ($b) (divided roads, freeways, and tunnels)

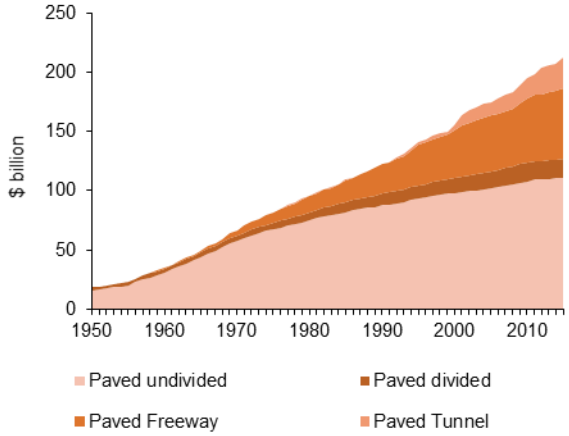
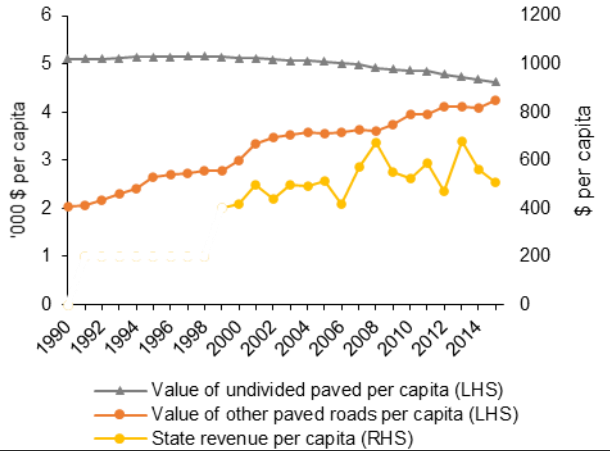


Figure 3.4: Australian paved road network equivalent history – indicators



Source: analysis of BITRE data

3.2 The funding process

When assessed through the business case process, a project is typically described holistically by its initial capital cost, its operating expenditure including any intermediate capital expenditure and the expected benefits for users and society. Nevertheless, typically, approved business cases only provide funding for the initial (construction) capital expenditure. Once construction is completed the asset becomes part of the network and any maintenance schedules prepared for the business case are not further considered. It appears likely that this disconnect can be at least partly explained through the current funding process for road related expenditure.

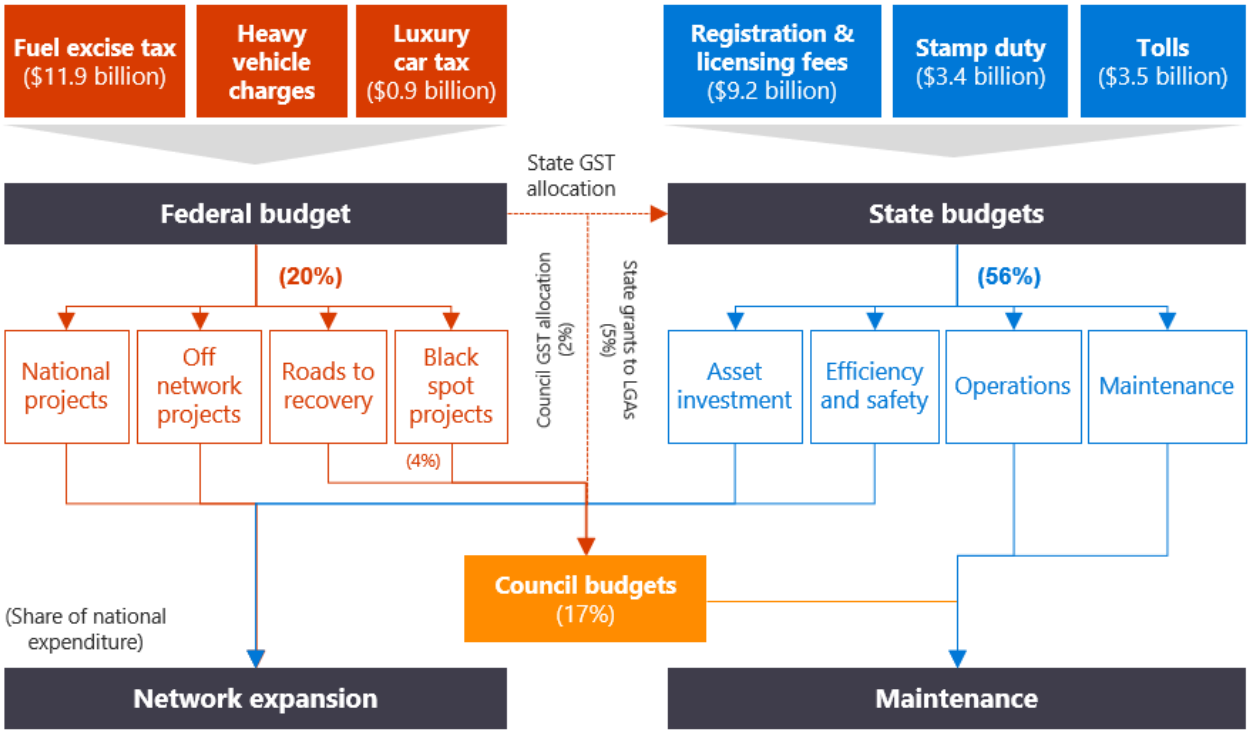
Most road use charges and tax incomes funnel into consolidated revenues and are subject to standard government budgeting processes, leading to limited visibility and a lack of confidence in charging and investment decisions.[4] Maintenance responsibilities also vary among states, as noted by the CGC:

> *All three levels of government fund the roads network, and State and local governments manage the network. The main roads are usually managed by the State governments. Roads of lesser significance in both urban and rural areas are typically the responsibility of local governments. The allocation of road management responsibilities between State and local governments is not based on an agreed standard but is generally due to historical policy decisions. As a result, the allocation varies from State to State.*
> *(Commonwealth Grants Commission 2018)*

[4] Heavy Vehicle Road Reform Consultation Paper, Department of Infrastructure, Transport, Regional Development and Communications (DITRD&C), 2020

The complexity of the process becomes evident when tracing the flow of funds from revenue raising to expenditure. Figure 3.5 shows motorist-related taxes and fees are collected at federal and state levels, which become part of their respective general budgets. The federal government distributes funds to states through consolidated revenue and (purpose specific) GST allocations and to LGAs as road specific grants and (untied) support grants, while also directly funding national network expansion projects. States in turn allocate budgets to asset investment, safety, efficiency, network operations, and maintenance and pass on funds received from the federal level to councils. While details vary between jurisdictions, this broad structure is generally applicable to all.

Figure 3.2: Road revenue to expenditure illustrated



Source: illustration based on BITRE 2022 and 2020-2021 budget papers

The illustration shows that network expansion and maintenance activity tend to be funded through specific channels typically separately administered by different branches within road agencies or transport departments, with some capital projects sitting outside these departments. This structure of collection, funding, distributing and refunnelling can be perceived as creating uncertainty about future funding levels, particularly for recurring (capitalised) maintenance.

4. Maintaining the road network

The task of maintaining the road network becomes increasingly complex as roads:

- are more costly to construct (e.g., tunnels, freeways)
- are more costly to maintain as they have greater surfaces and more complex componentry (e.g., sensors)
- carry more traffic and require more frequent maintenance that occurs at times of lower traffic volumes (such as at night) which is more costly to perform.

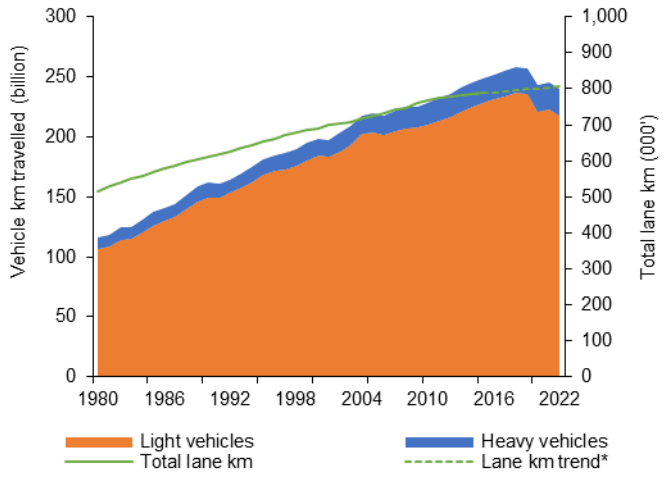
This chapter discusses the key challenges faced by agencies in conducting road maintenance.

4.1 Deferred maintenance

As mentioned in Chapter 2, road maintenance intervention levels are determined by multiple factors. Of which the age of the road surface and vehicle volume provide a first general indication of the asset condition.

It can be expected that increasing volumes will accelerate deterioration and thus – eventually – result in increased maintenance expenditure. Figure 4.1 shows that traffic volumes have grown rapidly over the past 40 years; almost tripling. Moreover, freight volumes which tend to further accelerate surface deterioration have grown at a higher rate than traffic in general. Notwithstanding that there is a decrease from 2020 to 2022 due to the impact of COVID-19, as heavier vehicles put a disproportionate strain on roads, maintenance costs are likely to also grow faster than ever. Further, traffic and freight volumes have also grown at a per lane kilometre basis indicating that every unit of road has to accommodate more traffic. The risk of rapid deterioration, therefore, appears high if the network is not managed well.

Figure 4.1: Australian traffic volumes



Source: analysis of BITRE data

Road condition deteriorates when surfaces age as they tend to be more prone to cracking and forming potholes. A 2018 snapshot of the road asset age by state is shown in Figure 4.2 based on Transport and Infrastructure Council (TIC) asset register.[5] The figure shows that, relatively uniformly across jurisdictions, the age of the road surface is between three and 15 years. However, there are instances in which the surface age is as high as over 33 years.

Measured in lane kilometre, the data is dominated by New South Wales and Queensland as these two States have the longest networks. Expressed as a share of the network as in Figure 4.3, road surface age can be better compared between jurisdictions. The diagram shows that the larger, less densely populated jurisdictions of Western Australia, South Australia and the Northern Territory are characterised by older than average surfaces while the three more densely populated States in the sample show below average age. As traffic volumes (per lane kilometre) in the former tend to be lower this could be an indication of longer assets lives due to lower wear and tear. However, it could also be a result of maintenance outcomes as stakeholders stated that much of their budget is used up by urgent repairs preventing them from conducting their desired levels of resurfacing.

Figure 4.2: Age of road surface by jurisdiction in lane kilometres

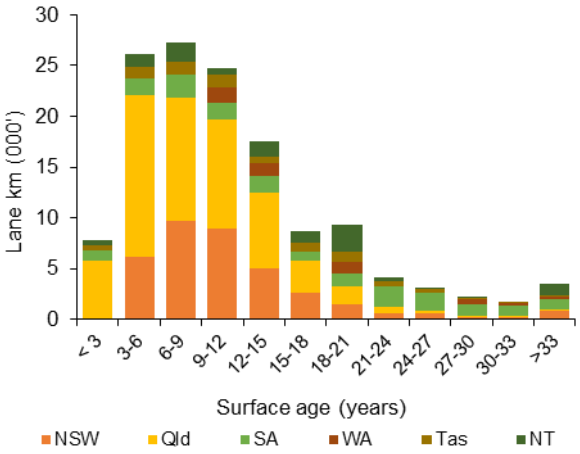
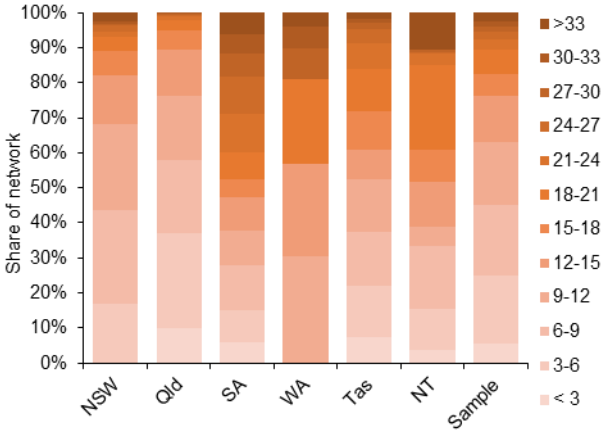


Figure 4.3: Age of road surface by jurisdiction as a share of network



Source: analysis of Transport and Infrastructure Council data

As mentioned above, there is a broad agreement among road agencies that the ideal cyclical interval for road resurfacing would be around every ten to 15 years from an asset management point of view. Figure 4.2 and Figure 4.3 show that a considerable portion of the network road surfaces had exceeded 15 years, especially for Western Australia, South Australia and the Northern Territory. This does not necessarily suggest that these roads are in poor condition, however, it is an indication that there is likely a certain degree of deferred maintenance in each of the sample networks.

[5] Victorian data is yet to be published and the ACT did not report surface age.

The Bureau of Infrastructure, Transport and Regional Economics (BITRE) published the total road expenditure by level of government and State maintenance expenditure on arterial road and bridge which are presented in Figure 4.4 and Figure 4.5.[6] The expenditure development, mirroring trends in the network extent and indicating that while Federal and local government area (LGA) expenditure remains stable, State total road spending has nearly doubled from nearly $10 billion in 2001 to $18 billion in 2021. This likely stems from capital expenditure. While there is no visibility on the Federal and LGA maintenance expenditure, the State arterial road and bridge maintenance expenditure provides a good indication of the maintenance effort as the majority of the major roads are state managed. The states' aggregated road maintenance expenditure has grown from less than $2 billion in 2001 to more than $3 billion in recent years with a spike of nearly $4 billion in 2022. The maintenance expenditure accounts for around 13% of the total road expenditure across the years. Notwithstanding the maintenance expenditure has grown steadily in the past two decades in line with the overall expenditure, the growth rate is merely matching the new road expansion rate and falling behind the total accumulative road network expansion.

Figure 4.4: Australian road related expenditure by level of government

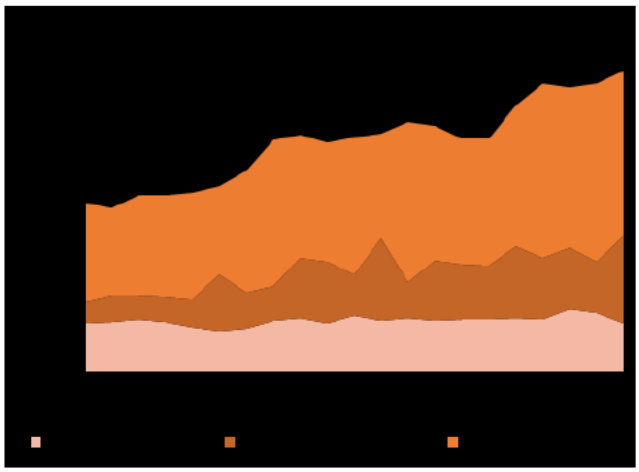
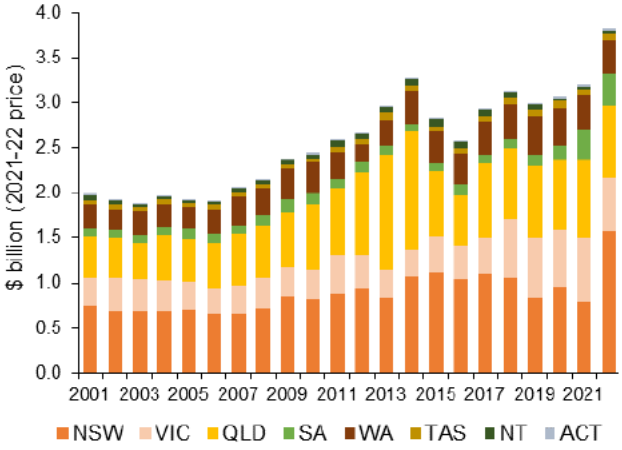


Figure 4.5: State arterial road and bridge maintenance expenditure



Source: analysis of BITRE data

In comparison with the road asset age snapshot in 2018 (Figure 4.2 and Figure 4.3), the expenditure trend has not seen any out of pattern increase in recent years. This indicates it is likely that a large portion of the aged road surfaces (>15 years old) from 2018 still remain in the network which would require to be resurfaced according to the ideal road management cyclical interval.

4.2 Challenges

The funding process illustrated in Section 3.2 shows that road maintenance tasks often compete not only with road expansion projects but also with other (capital) infrastructure initiatives. In combination with the fluid delineation between maintenance and capital investments in the road context, this leads to several challenges when attempting to implement a whole of life funding and costing approach.

[6] Adjusted for inflation reflecting 2021-22 dollar terms

The planning horizon for roads is long, funding commitments only cover short periods of time

Road managers usually attempt to adopt a whole of life per perspective when developing their asset management approach and tend to have longer-term asset maintenance planning. Notwithstanding the level of sophistication of the asset maintenance strategy varies across jurisdictions, planning horizons usually range from 10 years to 30 years. Funding horizons in contrast align with the three or four-year election cycles and the annual budget cycles. This means road managers rarely have more than one year of confirmed and three years of committed funding. This is often perceived as creating uncertainty. The response to this challenge varies from jurisdiction to jurisdiction. Some account for the funding uncertainty by developing a set of asset maintenance scenarios which are deployed based on the actual funding levels while others frequently update maintenance plans or defer lower-priority maintenance activities. This of course can have consequences for asset condition, performance level and asset life span.

Governments and road agencies must deal with competing priorities

While road maintenance can broadly be classified as routine maintenance, periodic/preventative, and rehabilitation most jurisdictions have only two expenditure streams: capital investment and operations. As capitalised maintenance expenditure is usually funded through the capital investment budget it tends to compete with network expansion and sometimes even investment in other essential services. The latter two tend to be prioritised. This in turn can lead to lower than desirable levels of capitalised maintenance activity.

Maintaining the road network is becoming more uncertain than ever before

In addition to the short funding horizon and tight maintenance budget, most jurisdictions face increasing uncertainties regarding maintenance pressure in the near future. This is due to a large amount of capital expenditure in the past decade as well as increasing complexity of the road assets as additional components such as ITS devices and other sophisticated safety measures are installed.

Asset management systems are not often centralised and consistent

Quality monitoring and other activities often overlap between branches (e.g., operations and maintenance) without sharing common data or scheduling systems and maintenance practices are managed in a disaggregated manner. Additionally, monitoring and maintaining tasks are often outsourced to contractors whose performance measures tend to focus on reaction and repair times. In combination these factors lead to a reactive maintenance framework in which the worst segments are repaired first.

There are growing expectations from customers to keep the network at a high standard

The focus of performance measurement is shifting from pure physical road condition to customer satisfaction and place making considerations. This challenge could partly be mitigated by better aligning terminology in communications. This could for example be achieved by highlighting the safety aspect of new surfaces rather than abstract terminology such as improved skid resistance.

5. Conclusion

As the peak body providing and promoting standardised national practices for road assets, Austroads plays an active role supporting road agencies tackle the road maintenance challenge. Austroads' research projects, initiatives and guidelines contribute to the development of best practice in Australia and New Zealand for road maintenance.

Our current "*Road Asset Data Standard*" (RADS) project is aimed at enabling collaboration and the adoption of best-practice approaches to road maintenance through standardised and harmonised data collection, management and sharing. Standardising the collection of road asset data will reduce data collection costs, improve decision making associated with road investment and expenditure, and facilitate the implementation of national reforms.

Further, the adoption of a common asset management system allows an easy exchange of data between the relevant agencies. This could become the basis of common and aligned data and monitoring standards. These in turn could lead to the basis of an integrated whole of life management and funding approach. The RADS project is well-positioned for Commonwealth funding as a national effort involving agencies and road managers at all three levels of government.

There has also been a growing appreciation of the importance of road resilience due to its ability to withstand, adapt and recover positively from shocks and stresses such as severe weather conditions. Australian road agencies need guidance on road resilience to inform the best practices. Starting to meet this need, Austroads has developed a series of sophisticated guidance manuals for design, construction, maintenance, and operation of the road network. The efficiency in road management including maintenance activities could be increased by providing more dynamic and easier user access through digitisation. Commonwealth funding is critical to the execution of this project.