SUBMISSION TO HOUSE OF REPRESENTATIVES STANDING COMMITTEE

IMPLICATIONS OF SEVERE WEATHER EVENTS ON THE NATIONAL ROAD NETWORK

OVERVIEW REPORT

RURAL WORKS PTY LTD

DOCUMENT CONTROL

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EXECUTIVE SUMMARY

I wish to make a submission as a former Local Government Engineer, and currently a Consultant Civil and Structural Engineer providing road and bridge design and network rehabilitation reports to Local Government in Victoria for the past 47 years. I am prepared to appear in person at the enquiry into the implications of severe weather events on the national road network.

Current weather events, including the wet spring and winter, has highlighted the shortcomings in our road network that have built up since many of our roads were constructed.

Most of the current road network was built and developed from the 1950's through to the 1980's and was originally designed for a 30 to 40 year life. Hence these roads are well beyond their original design life, notwithstanding rehabilitation works undertaken in the intervening period.

Recent drought years prior to the current higher rainfall period have tended to lull road authorities into complacency in relation to long term rehabilitation and routine road and bridge maintenance. Hence the significant impact of the current high rainfall period.

It should be noted that concrete bridges are designed for a nominal life of 100 years and timber bridges for 80 years. There are still many timber bridges on the local road network that are over 80 years old.

The impact on the road and bridge network of the current severe weather event has been greatly exacerbated due to historical and ongoing lack of routine maintenance and rehabilitation works. Upgrading the design standards will help improve the durability of the network at considerable cost, but will not solve the current deterioration issues if the current lack of maintenance and rehabilitation continues.

Report Prepared by John Dunn, with contact and other details provided in submission email. This report has been specifically prepared for submission to the House of Representatives inquiry and has not been published elsewhere. It is not a confidential submission.

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1. INTRODUCTION

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The impact on the road and bridge network of the current severe weather event has been greatly exacerbated due to historical and ongoing lack of routine maintenance and rehabilitation works. Upgrading the design standards will help improve the durability of the network at considerable cost. However the development of higher design standards and practices will not solve the current deterioration issues if the current lack of maintenance and rehabilitation continues.

2. BRIDGE AND ROAD DESIGN STANDARDS

Bridge Design Standards

It must be noted that the earliest bridges were made of stone, some of which date back over 1,000 years in other parts of the world. These bridges were however, only designed for foot traffic and horse drawn vehicles.

Bridge design standards have developed and changed significantly since the early 1850's. Most significant bridges from the 1850's to the early 1900's were designed for rail traffic, with the main structural elements being timber or wrought iron. The loading for the rail bridges were based on the mass of the locomotives generally being between 60 tonne and 120 tonne.

Early road bridges were constructed of timber in rural areas, with the use of wrought iron for major bridges in larger cities. The design load was based on foot, horse and bullock drawn vehicles and a steam roller generally, in the order of up to 15 tonne. The construction of road bridges in Victoria started just prior to 1900 and grew significantly after the First World War with the introduction of reinforced concrete bridges, designed by John Monash and Monier & Anderson. The construction of road bridges, from riveted wrought iron and timber continued in parallel with the introduction of reinforced concrete bridges. The general design load of 15 tonne remained in place until about 1950 when it was increased 20 tonne for the trucks in use at that time. The 20 tonne design was in place until 1976 when T44 (44 tonne articulated trucks) loading was introduced. The Australian standard for bridge design was introduced in 2003 where SM1600 loading was introduced. SM1600 being a 16 tonne axle with other stationary and mobile loads added.

Road Design Standards

There were few formal road design guidelines for rural Victoria until the formation of the Country Roads Board (CRB) in 1913. The predecessor authorities; Board of Lands & Works, and the Public Works Department, predominantly provided guidance on city/town road design. The CRB was replaced by the Road Construction Authority (VicRoads) in 1983. CRB and subsequent VicRoads design standards are still in use, but have now generally been replaced Austroads design guidelines. Austroads is the successor (in 1989) to the National Association of Australian State Road Authorities that was formed in 1959. The general road design principals have generally remained unchanged. However, the latest design standards have been prepared for appropriate lane widths and axle loading catering for current multi-trailer trucks.

3. BRIDGE AND ROAD DESIGN LIFE

Bridge Design life

Bridges and culverts have a nominal design life as follows:

- Culverts - 50 years.
- Timber bridges – 80 years.
- Concrete and steel bridges 100- years.

It should be noted that there are many bridges and culverts on the road network that are well beyond their design life. Some are now showing significant deterioration.

Road Design life

Roads have nominal design life as follows:

- Urban Streets - 30 years.
- Rural Roads - 30 years but can vary depending on the road classification.

As stated previously, most of the current road network was built and developed from the 1950's through to the 1980's and was originally designed for a 30 to 40 year life. Hence the currant road network is well beyond its original design life notwithstanding rehabilitation works undertaken in the intervening period.

4. ROAD MAINTENANCE

The primary contributor to road pavement failure is water. This can be from

- Rain on the surface.
- Surface runoff entering the pavement from the sides.
- Ground water e.g., springs.
- Floodwater entering the pavement from both above and below.

Pavement failure can also be caused by the breakdown of the pavement material due to traffic volume/loading.

Drainage

Road drainage is critical for the following reasons:

- Table drains ensure that surface water is kept below the base of the pavement, hence keeping the pavement dry.
- Under road culverts and bridges permit the passage of water from one side of the road to the other preventing surface water banking up against the side of the road. Water banked up will ultimately saturate the road pavement.
- Inundation during flood events leads to saturation of the road pavement and pavement failure, if the road is used by traffic before the pavement has dried out.

In order for the table drains and bridges and culverts to function as required the following maintenance work is required:

- Depending on soil types and average annual rainfall and hence vegetation growth, table drains should be cleaned regularly from annually to every 5 years.
- The waterway under culverts and bridges should be checked annually and after all major storm/high flow events. Any debris and silt should be removed as soon as possible and before the next major storm event.

Inspections of roads in rural Victoria show that the required work as listed above is not being undertaken.

Pavement and Surface

As stated above, if the pavement can be kept dry it will be unlikely to fail.

Gravel Roads

These roads require a greater crossfall than sealed roads to ensure that surface water runs off. Traffic use and the resultant dust leads to the loss of fine material in the surface leading larger gravel particles forming windrows on the surface that can be hazardous to vehicles using the road. In addition, often traffic will follow a similar wheel path leading to rutting which will capture surface water and hence leading to pavement failure.

In order to maintain the required profile or shape of the road, and to integrate windrowed material, gravel roads require constant grading and the addition of more pavement material to replace that lost though dust and surface runoff erosion.

Inspections of roads in rural Victoria show that in general the required work as listed above is not being undertaken.

Concrete Roads

Concrete acts as both a pavement and a sealed surface. Concrete roads have high construction costs but require little surface maintenance in their earlier years of life. However, they are still subject failure if water enters the underlying pavement from surface cracks and/or laterally from the adjoining roadside.

Bituminous Spray Sealed Roads

These roads consist of a gravel and/or crushed rock pavement, with a sprayed thin layer of bitumen that includes an embedded layer of single size crushed rock as the wearing surface.

The bitumen seals the surface to prevent water ingress and stops dust and the loss of fines.

However, bitumen is a petroleum product and oxidises over time. This oxidation leads to the bitumen loosing elasticity and becoming brittle and cracking. The cracking then permits the entry of water into the pavement, leading to the development of potholes and pavement rutting.

In order to prevent the effective failure of the bitumen surface the road requires resealing. The frequency of the resealing is dependant of traffic volumes and the general road environment. Generally accepted desirable reseal intervals vary between 7 and 12 years.

During flood events water enters the pavement laterally from the road sides leading to pavement failure. If there are strong currents associated with the flooding the bitumen surface can be removed by the flowing water, leading to major road failure.

Inspections of roads in rural Victoria show that in general the required reseal interval listed above is now being exceeded.

Asphalt Surfaced Roads

The asphalt generally used in Australia is 'Open Graded' and is still porous, and will permit the ingress of surface water into the underlying pavement for shallow layers of up to 50 mm.

Asphalt provides a smooth running surface, but as per sprayed bitumen seals, the bitumen in the asphalt is subject to oxidation. As a result, asphalt surfaces will generally require rehabilitation or surface bitumen spray seals within 30 year of placement.

Road Maintenance Practices

Unfortunately most of the road maintenance undertaken is reactive, as a result of pavement failures. An example being pothole patching, with cold mixed asphalt. However it is apparent that often even this patching work is not undertaken with enough care or knowledge. Examples of this being; a failure to seal the edges of the patch with bitumen, and insufficient compaction of the patch

5. BRIDGE MAINTENANCE

General Maintenance

All bridges require regular maintenance particularly after storm and flood events. This includes:

- Removal of debris from piers and piles. Failure to do this adds significantly to the horizontal load applied by the stream or river to the piers and piles, and can lead to the bridge supports being washed away and the failure of the bridge.
- Removal of sediment from under the structure. Failure to remove sediment reduces the waterway area/volume and flow capacity of the structure. This can lead to the bridge supports being washed away and the failure of the bridge.
- Removal of dirt and debris from the deck. A build-up of dirt and debris on the deck can lead to water ponding on the deck, being a hazard to passing vehicles and potently penetrating the deck leading to more rapid deterioration of the deck material.
- Steel and concrete bridges have bearings at the abutments and piers. The bearings permit movement generated by the structure expanding and contracting due to temperature changes. The bearings need regular maintenance to prevent the bearing seizing. Seized bearings can place very large loads on main structural elements, particularly the deck and girders, leading to significant damage to those elements.

Timber Bridges

Timber bridges are quite flexible. This leads to movement of the components and loosening of the connecting bolts. Hence there is a constant need for connecting bolts to be tightened.

As above, the build-up of debris on any of the components leads to greatly increased rot and deterioration of the timber components.

Concrete Bridges

Concrete bridges do not require a lot of maintenance in their early years, other than that given above. However, as they age the concrete matrix breaks down and this can lead to the eventual rusting of the reinforcement, leading to spalling of the surface and loss of surface concrete. There are treatments that can identify and rectify this condition.

Also, concrete elements within the active waterway suffer from loss of the fines in the concrete matrix. This again can lead to the rusting of the reinforcement and spalling of the surface. There are treatments that can identify and rectify this condition.

Steel Bridges

All steel components will evenly need surface retreatment to prevent rust. Painted components need this more frequently than galvanized components. A failure to keep the surface treated will lead to rusting and loss of steel section. This lessens the strength of the member and can lead to bridge failure.

Vehicle Loads on Bridges

As stated above, the loads applied to bridges have increased significantly over the past 100 years. Whilst older bridges may not immediately fail under the higher loads, they will deteriorate faster. This is often seen through the cracking of components, and requires more frequent maintenance repairs.

6. BRIDGE AND ROAD REHABILITATION

Bridge Rehabilitation

Older bridges can remain on the road network by undertaking repairs, rehabilitation and upgrades as the elements deteriorate or become overloaded. Examples of these treatments are:

- Deck overlays
- Carbon fibre strengthening.
- Addition of more components
- The addition of specialist coatings

Road Rehabilitation

Older roads can remain on the road network by undertaking repairs, rehabilitation and upgrades as the road deteriorate or become overloaded. Examples of these treatments are:

- Asphalt overlays
- Crushed rock overlays
- Major table drain restoration.
- The addition of specialist seal coatings

7. BRIDGE AND ROAD DESIGN STANDARDS REVIEW

Road engineering and construction standards required to enhance the resiliency of future road construction

As stated above, appropriate Standardises are already in place. However, the resilience of the road and bridge network is currently severely impacted by:

- A lack of routine maintenance
- A lack of timely rehabilitation
- A failure to use known best practice standards
- The addition of specialist coatings

All the above can be directly related to a lack of funding.

Identification of climate resilient corridors suitable for future road construction projects

Future climate resilient corridors for road construction could be identified. However, it will not the corridor that will be the issue, it will be the cost of the associated construction. An example of this is the railway network in rural Victoria, that was built about 170 years ago. Generally, the rails tracks are much higher and the bridges spans greater than the adjoining road network., making them less subject to the impact of flooding. The cost of building the roads to this standard would be massive, and has the potential lead to even less road maintenance being undertaken, due to overall funding constraints.

Opportunities to enhance road resilience through the use of waterproof products in road construction

Waterproof membranes are already used on roads, being bitumen or concrete surfaces. The issue is that the membrane is not being maintained. In addition, waterproof surfacing products do not prevent the entry of water into a for a pavement from the sides or from underneath. It is not financially viable to waterproof the entire pavement.

The Commonwealth's role in road resilience planning

It is not so much a matter of resilience planning, but the provision of adequate funding to ensure that the network is:

- Built to the required standards.
- Is regularly maintained to the requires standards.
- Is regularly rehabilitated in a timely manner.

8. SUMMARY AND RECOMMENDATIONS

Most of the current road network was built and developed from the 1950's through to the 1980's and was originally designed for a 30 to 40 year life. Hence it is well beyond its original design life notwithstanding rehabilitation works undertaken in the intervening period.

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The impact on the road and bridge network of the current severe weather events has been greatly exacerbated due to historical and ongoing lack of routine maintenance and rehabilitation works. Upgrading the design standards may help improve the durability of the network at considerable cost, but will not solve the current deterioration issues if the current lack of maintenance and rehabilitation continues. A scenario that demonstrates the issue is; if you buy a $500 car and do not change the oil the motor will eventually seize. If you by a $500,000 car and do not change the oil the motor will still seize.

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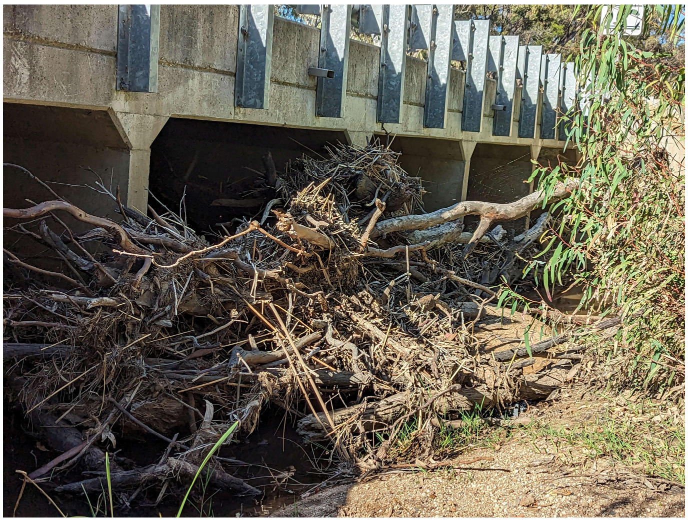
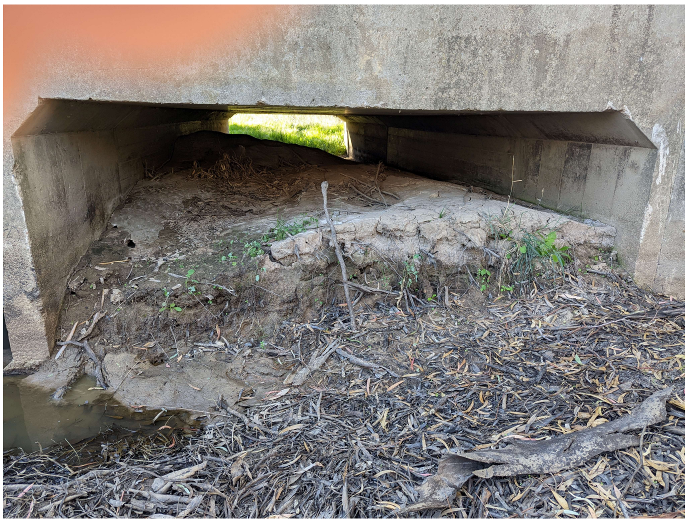
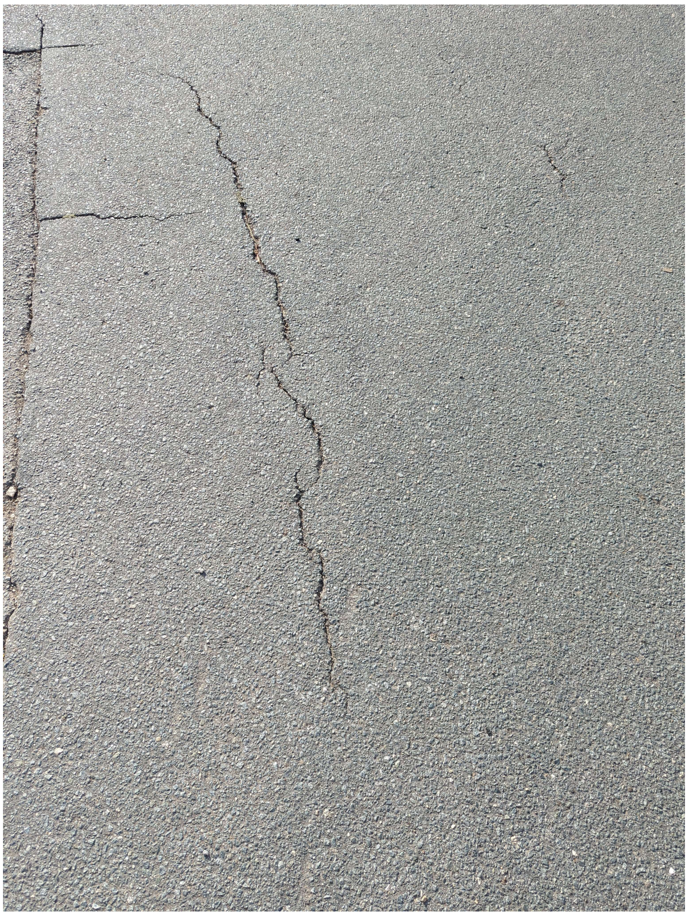
APPENDIX A

Examples of Maintenance failures

Description	Photo
Culvert blocked with debris.	
Culverts severely silted up.	

Description	Photo
Cracked asphalt paving.	
Cracks in asphalt overlay due to a failure to treat underlying pavement cracks.	

Description	Photo
Table drains with large trees that prevent table drain cleaning, and are a hazard to passing vehicles.