



Managing motorways and urban arterials in Australia: Country Report for Australia

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Abstract

Australian States have been investing heavily in managed motorways. It was acknowledged some time ago that motorways that had slow moving congested traffic caused considerable loss of value to the community. The concepts of “Productivity” and “Reliability” were applied to Motorways and have since become key performance indicators used to rate motorway systems. The approach to motorway management has extended overseas practices although different algorithms have been developed in Australia.

Management of motorways cannot be undertaken without consideration of the urban arterial network. It is therefore important to see the network as a whole noting that drivers tend to change their routes so that both the motorways and the arterial must work in unison to provide the level of service to the user. It is therefore important that the performance of the arterial road system be maximised. The paper outlines some of the research that is directed at maximising the arterial road, using detectors on the departure side of signalized intersections to evaluate the potential for operational improvement.

This paper describes recent work in Australia to better manage motorways and arterial roads to be as effective as possible. The paper does not cover all Australian research in this area, but outlines a few cases in more detail.

Keywords: Motorways, arterial roads, control systems, optimisation.

1 Introduction

Traffic management on the road network is becoming increasingly important. For instance, the demand for travel measured in vehicles-kilometres of travel will increase by over 17 per cent in the next decade and the construction of new roads will only increase the road space by about 4 per cent on Melbourne’s roads (Gaffney, Lam, Somers, Johnston, & Boddington, 2015). It is becoming more important to manage the use of roads rather than attempt to build sufficient new roads to satisfy the demand.

This paper describes recent work in Australia to better manage motorways and arterial roads to be as effective as possible. The paper does not hope to cover all Australian research in this area, but outlines a few cases in more detail.

2 Managed Motorways

In 2007 Austroads, an association of state Australian Road Authorities, published the national performance indicators for network operations (Troutbeck, Su, & Luk, 2007). The five performance indicators were established as follows

- “Traveller Efficiency (Travel Speed) – this indicator monitors congestion in terms of speeds. It is derived from spot speeds on freeways measured directly using point sensors such as a pair of loops. On arterial roads, it can be derived from the inverse of travel times estimated from an ATC system. This indicator does not use histograms for its reporting and uses a single number for each performance measurement period (all the other four indicators use histograms for performance reporting).
- Traveller Efficiency (Variation from Posted Speeds) – this indicator monitors the proportions of a road network at various levels of deviations from posted speed limits on freeway or arterial road links.
- Traveller Efficiency (Arterial Intersection Performance) – this indicator monitors the proportion of an arterial road network at various levels of congestion.
- Reliability (Travel Speed) – this indicator measures the variability of speeds by calculating the coefficient of variation. It is displayed as the proportions of a road network at different levels of variability in a measurement time period.
- Productivity (Speed and Flow) – this indicator is based on the product of speed and flow. A high productivity is achieved if both speed and flow are maintained near maximum values, i.e. near free-flow speed and capacity flow. It is displayed as the proportions of a network at various levels of productivity in a measurement period. “

The last performance measure was based on the earlier paper by Werner Brilon at the fourth International Symposium on Highway Capacity (Brilon, 2000). Brilon established the concept of “efficiency” for roads being the product of speed and flow along a road length, Brilon based this term on analogies with mechanics where force was “equivalent” to the number of vehicles passing a point and power, the rate of doing work, was equivalent to “efficiency”.

In the Austroads Report the term “productivity” was used. Essentially the usefulness of the road system to the economy of a city or region was due to the “productivity” of the road or network. The concept was at first hard to appreciate. The question was then asked why multiply these terms together. One reason given is that flow describes how many vehicles can make the trip and speed quantifies the quality of the trip as delay quantifies the quality of a trip under the HCM.

It was also realized that the capacity of a freeway or the flow at which it breaks down is not a constant that is often implied in the textbooks but rather a stochastic variable (Brilon, Geistefeldt, & Regler, 2005; Eleftriadou, Roess, & McShane, 1995). The stochastic nature calls for a more intelligent motorway control system.

2.1 Motorway management -Victoria

At about the same time as the Austroads performance indexes were being developed, the Victorian road authority, VicRoads, was concerned about the loss of “productivity” when the motorway is congested and the traffic flow breaks down causing the average speed to drop and the flow to be decreased. The solution was to manage the use of the motorway through ramp metering to minimize

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