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SmartRoads: tracing the limits of managing road space at the metropolitan road network scale

Introduction

Depending on country and city, the road space out your window might have cars parked and road markings and signage depicting this and other permitted and non-permitted uses. These uses reflect a set of compromises made over the best use of that road space. They could have been implemented yesterday or been in place for decades. During the 1950/60s, the car started to deeply shape how planners determined the best use of road space (Appleyard, 1981; Hass-Klau, 1990; Jacobs, 1961). Today, the car's ubiquity continues to complicate the challenge of allocating road space, as shifting cars from one road to another road simply displaces problems. Yet, long before the car's arrival, determining the best use of road space was the product of a competing and diverse set of interests and uses (Brown-May, 1998; Ehrenfeucht, 2012; Norton, 2008; Winter, 1993). Recent evidence suggests that although the emphasis may have changed the core issues have not (Hess, 2009; Patton, 2007; Sadik-Khan & Solomonow, 2016).

Adding to the challenge of determining the best use of road space is a lack of agreement as to whether one can meet future travel demand. Some planning scholars suggest you can choose to meet demand, or suppress demand, but one can't do both (Banister, 2008; Brindle, 1995; Vuchic, 2000). Despite this lack of consensus, difficulties of continuing to expand road space to accommodate more travel has pushed the task of (re)allocating existing road space to the fore in traffic management. Central to this task is a tension between mobility and liveability.

Roads provide a route of communication (e.g. motorised and non-motorised travel, a link between multiple place-spaces) and the site of transaction (e.g. non mobile access, commercial interactions, embodied place-spaces) (Roberts, Lloyd-Jones, Erickson, & Nice, 1999). These two features have overtime come to be broadly understood as concerns related to mobility and liveability. Negotiating these two concerns ratchets up in complexity when shifting from managing the road space out your window to managing it in relation to a larger road network. Historically, liveability and mobility have been invoked in binary terms to articulate conflicting road space needs (Robinson, 1916; Unwin, 1971 (1909)). Despite commentary suggesting that roads are not simply the site of mobility (Appleyard, 1981; Jacobs, 1961), and arguments that constructing such terms as binary reflect a moribund technocratic Euclidian worldview of time and space (Friedmann, 1993; Graham & Healey, 1999), prioritising mobility and liveability is central to the task of allocating road space. Further, evidence strongly indicates that such transport-related determinations are inherently political (Davison & Yelland, 2004; Legacy, 2015; Norton, 2008; Sadik-Khan & Solomonow, 2016). Yet, how business, political and social communities perceived issues of mobility and liveability a century ago, differ to how they perceive them today. Consequently, informed by professional experience, techniques and knowledge, allocating road space is best understood as a political and value-based question.

In drawing from original research, this article identifies and traces issues which arise when planners determine the best use of road space. Though technical aspects of frameworks employed when making such determinations are discussed, this article is principally concerned with 'how': how do frameworks help practitioners to evaluate and prioritise conflicting road space needs? Specifically, what is open to negotiation, what is assumed as a given, and what is left off the table? Does applying traffic management at the network scale always require prioritising some roads as less important than other roads? Who makes such decisions, and towards what ends? These questions concern this article.

To address these questions, this article proceeds as follows. How planners have historically understood, evaluated and prioritised different road space demands is summarised. Melbourne, Australia then provides a case study to critically examine the complicated and politically contested nature of managing road space at the metropolitan road network scale. Governance, cyclical visions and debates, poor continuity and disagreement around priorities are found to inform, constrain and shape allocation of road space. The article concludes by considering what these issues might mean for applying network operating planning frameworks and thinking in practice within the context of Melbourne, and more broadly.

Evaluating and prioritising road space demands through different hierarchy typologies

Central to the challenge of identifying, evaluating and prioritising competing and often conflicting road space demands is the hierarchy typology. Application of the hierarchy typology is not predetermined, with different hierarchy typologies developed to understand, study, plan and manage urban space.[i] In transport planning, the hierarchy typology has a prominent and long history, including seminal town planning texts (Robinson, 1916; Unwin, 1971 (1909)) and early professional publications (Bartholomew, 1922). In traffic management, hierarchy typologies often differentiate between delineating governing responsibility over certain roads (Marshall, 2005), and classifying different functional characteristics to different roads, based on achieving a variety of aims (Goodwin, 1995). Yet in practice, the link between responsibility and function breaks down, as all roads to some extent serve multiple functions (Brindle, 1995; Goodwin, 1995; Marshall, 2005). As such, hierarchy typologies developed generally conceive urban (road) space as divorced from time, resulting in inadequate accounts of what are dynamic, contested and complex sites of everyday urban life (Graham & Healey, 1999).

The prevalence of the hierarchy typology in traffic management remains in road classification hierarchies. Alker Tripp's work during the 1940s is often cited as developing the formative conventional road classification hierarchy (Goodwin, 1995; Hass-Klau, 1990; Marshall, 2005). Tripp sought to alleviate safety concerns he attributed to cars intermingling with pedestrians by increasing circulation on certain roads and reducing it on others. Two decades later, Colin Buchanan drew upon Tripp's work to craft what is generally regarded as seminal traffic management thinking (Hass-Klau, 1990; Hebbert, 2005; Hillman, 1983). Buchanan's ideas have been suggested as providing the "definitive synthesis of urban design theory for the motor age" (Hebbert, 2005, pp. 43-44). This synthesis fails to preserve a road's traditional site of both mobility and liveability, diverting traffic from 'urban living rooms' (i.e. rooms) and onto 'main traffic distributors' (i.e. corridors) (Marshall, 2005, p. 49). Problems

associated with the 'rooms and corridors' approach are well acknowledged by the traffic management profession (Brindle, 1995).[ii] As such, whereas Tripp concentrated on risk minimisation, Buchanan looked to liveability. This difference hints at why Buchanan's legacy remains debated (Hass-Klau, 1990; Hillman, 1983). Important here, is that Buchanan underscored managing traffic at the city scale required an overall transport route structure (Hass-Klau, 1990; Marshall, 2005)—fundamental to this structure is the hierarchy typology.

A suitable hierarchy typology to manage road space at the metropolitan scale

A suitable hierarchy typology to manage road space at the metropolitan scale remains an elusive, yet persistent chimera in traffic management's maturation. Australia has a history of managing road space at the corridor level, beginning in the 1980s (Armstrong, Black, Lukovich, Sheffield, & Westerman, 1992)—where lessons from projects were compiled into a 'best practice' and 'resource guide' under the title *Cities for tomorrow* (Westerman, 1998)—and more recently under the *Network City* (Curtis, 2006). Similar work in the UK started in 2000 under *Mixed Priority Routes* (DfT, 2008), and in North America around the same time under *Context Sensitive Solutions* (TRB, 2002), and *Complete Streets* (McCann, 2013). *Link & Place* (Jones, Boujenko, & Marshall, 2007) represents one of the more robust attempts to date to develop a comprehensive methodology for managing road space at the metropolitan scale that doesn't lose sight of place making concerns. Similarly, Part 4 of Austroads' 13 separate traffic management guides details network operating planning (Easpada & Green, 2015). Underpinning all these frameworks rests a different formulation of a hierarchy typology, and thus a different proposed approach to traffic management. Central to these different approaches are questions of priority to what modes for what ends.

In Victoria, Australia, VicRoads is the primary state planning authority responsible for road construction and management activities in the state. The need for a better account of how different road users operate on existing road networks in particular urban environments, helped to formulate the *Network Operating* division within VicRoads around 2005 (Vincent, 2006). Tasked with determining how can and/or should a road network operate, a key output of the new division was the creation of Network Operating Plans (NOPs)—since badged *SmartRoads* (VicRoads, 2012).[iii] Elaboration of *SmartRoads*' technical features (Wall, 2011), pilot studies documentation (Bittner, Burdan, & Witono, 2011; Fitts, 2012), and comparison to other frameworks (Weeratunga & Luk, 2010) exist. In summary, *SmartRoads*, is a mode-based hierarchy of road use framework that helps planners manage road space at the road network level. *SmartRoads* can accommodate a range of stakeholders, and NOPs developed can be altered to accommodate change in local or state government policy. At the time of this research, *SmartRoads* exercises had principally included local and state government politicians and planning practitioners.

SmartRoads begins with participants developing a Road Use Hierarchy for a road network segment, generally delineated by a local government council boundary. This helps to establish high-level objectives for determining optimisation of the road network, and priority for different modes by route, place and time. Figure 1 illustrates (circled in red) how road classifications help to generate network operating objectives (from Figure 5-1, VicRoads, 2012, p. 41). Figure 2 illustrates (circled in red) how weightings prioritise mobility or

liveability (from Figure 2-11, VicRoads, 2012, p. 26). For example, recognising temporal variations in road use helps planners to determine current network performance and to isolate gaps in network performance. This in turn facilitates selection of potential road measures which may be applied to address network gaps. Thus, an NOP physically and metaphorically reflects a roadmap to pursue future management of road space—currently road measures identified are selected based on optimising Melbourne's wider road network.

Insert Figures 1 and 2 here

Network operating planning reflects a new stream of thinking in traffic management. Like Buchanan, managing a road network begins first and foremost with a hierarchy typology—the first step in *SmartRoads* for instance is to define a Road Use Hierarchy. Formulation of the hierarchy typology is central to practitioners defining a road's role and level of importance for mobility and liveability. Currently, formulation and application is informed by the jurisdictional responsibility over particular roads (point elaborated below). Consideration of both mobility and liveability represents a significantly more nuanced reinterpretation of Level of Service (LOS) than volume/capacity ratios traditionally applied in traffic management to measure and effectively prioritise speed and unfettered car travel (Table 3.3, VicRoads, 2012, p. 28). A further distinctive feature of network operating planning more generally is that it combines multiple disciplinary concerns. Specifically, it combines traditional traffic management concerns, with urban design and planning concerns related to place making, along with transport planning concerns related to transportation network planning and management. The level of importance given to each differs between network operating planning frameworks (Weeratunga & Luk, 2010).

The case and research design

Melbourne provides a unique case study to examine the complex challenge of managing road space at the metropolitan road network scale. Melbourne is the capital city of the state of Victoria and Australia's second largest with a population roughly 5 million. Government reports have described two distinctive Melbournes: a densely urbanised core supported with an extensive public transport network largely unchanged since the 1940s, and an expanding outer-suburban Melbourne lacking such services and dominated by car-systems of provision (Essential Economics, 2012). Managing Melbourne's road network, therefore, involves planners contending with one of the world's largest tram networks that shares road space with multiple modes (Bittner et al., 2011), as well as 40 years of car-specific infrastructure (Curtis & Low, 2012; Davison & Yelland, 2004).

Evidence presented is drawn from a larger research project examining how planners allocate road space in Victoria, Australia (reference). The project identified and examined rules that govern the task of road space allocation, analysed when, why and how this task has been carried out, and explored professional practices pertinent to carrying out the task. Research data collection occurred over the 2010-2012 time period, and included analysis of archival

materials and government policy and legislative materials, interviews with over 60 practicing and retired planners and participant observation of a *SmartRoads* exercise. Participants interviewed included local government councillors, and professionals employed in advocacy groups, local councils and state road, public transport and land use planning authorities.

Interview participants were initially selected based on their involvement in the clearway controversy. Similar to London's 'red routes' a clearway is a road management strategy that bans parked cars on a specified road. In summary, in early 2008, the state government charged VicRoads with extending and standardising clearways within a 10 kilometre circle around the Melbourne CBD. After almost two years of persistent disagreement between local councils and VicRoads, the two cities of Stonnington and Yarra, both located within the 10 kilometre clearway circle, combined forces to mount a legal case against VicRoads' altering existing clearways. Although the state court found in favour of VicRoads, the controversy occurred during the run-up to a state election in which the legitimacy of clearways to ease congestion had been debated. On December 9, 2010 a newly elected Premier of Victoria Ted Baillieu visited Stonnington to fulfil a pre-election campaign promise—rolling back clearways (Stephen McMahon, December 10 2010). Though VicRoads was and remains, charged with weighing local amenity concerns against metropolitan mobility concerns, in everyday practice, this legislatively mandated remit can't resolve the tension between mobility and liveability, nor how different stakeholders determine the best use of road space. As such, clearways provided an entry point to elicit a participant's knowledge and contextualise their everyday professional activities. The aim was to acquire a detailed informant or insider understanding (Babbie, 2001), of how road space allocation is constituted. Participants were asked to describe their daily professional activities and responsibilities, and any changes to professional routines or planning more broadly. As *SmartRoads* was identified by participants as a notable change in practice, the research study was altered slightly to more systematically pursue network operating planning.

SmartRoads proposes to provide practitioners guidance for traffic management at the road network level. However, application into practice is done so, not with a clean slate, but with decades of professional, social, political and infrastructure history. As described below, recurring features constrain application of frameworks like *SmartRoads* in daily practice, notable being governance, cyclical visions and debates, poor continuity between planning studies and frameworks, and disagreement around priorities. These issues constrain and influence how planners determine the best use of road space, and are identified and discussed in relation to the three questions posed in the introduction: what is open to negotiation, assumed and left off the table? Does traffic management at the network scale require prioritising some roads as less important? Who makes such decisions, and towards what ends?

Governance: what is open to negotiation, assumed and left of the table?

In Melbourne, governance arrangements are crucial to understanding what is open to negotiation, what is assumed and what is left off the table when determining the best use of road space. For instance, governing responsibility for roads, in terms of ownership, funding, maintenance and regulation is principally driven by the 2004 Road Management Act (State of

Victoria, 11 May 2004). Central to formal arrangements are the labels 'declared' and 'non-declared' roads (Figure 3) (VicRoads, 2016a).

Insert Figure 3 here

Whereas declared roads are the responsibility of state planning authorities, ownership, funding and maintenance of non-declared roads fall to local councils. These arrangements reflect formalised government and organisational structures and are established by legislative statutes and constitutional law. In terms of *SmartRoads*, declared and non-declared road classifications become important.

> We've sat down with the councils, we've put a map of the arterial roads, not the local roads, a map of the arterial roads in front of them, we've said, let's colour the roads, which roads should be for traffic primarily, which ones should be for servicing shops, etc. We are going to fund the roads that in a sense serve all Victorians, because our tax base is all Victorians. So we've already made that decision… We've declared a whole stack of roads... Under *SmartRoads*, we have an agreement with Councils, it's on our website, these roads are going to be managed this way (Participant 2).

At the time of data collection (2011-2014), *SmartRoads* had been codified in state policy documents and legislation acts (State of Victoria, 2 March 2010; Victorian Government, 2009), but had yet to be officially adopted by all Victorian local councils. According to VicRoads' website, this appears unchanged (VicRoads, 2016b). Interviews with VicRoads staff tasked with refining and implementing *SmartRoads* indicated that at the time, it had yet to be formalised in practice, or accepted by all VicRoads senior staff.

The importance of funding was also raised during an interview with two planning directors from a local council that had participated in a *SmartRoads* exercise. One director stated emphatically, "is there extra money going to be put in to do certain things? No, I know that for a fact. So my view is what is the point of the exercise?" After a decade with council, the comment reflects agitation in going through different state funding channels. Whereas *SmartRoads* can identify less costly measures like altering traffic signal operations instead of road construction, funding such measures involves VicRoads staff developing a business case based on existing Business Area Plans and Work Plans. Whereas funding for road safety projects and freight exist, available funding for what one VicRoads planner referred to as congestion reduction measures, is more difficult to obtain. As such, innovative policy packages and business plans have yet to match the novelty of *SmartRoads*. Though this novelty might substantiate the claim that VicRoads is engaging traffic management differently, this view was not shared by all planners interviewed. For example, the two council planning directors both remarked that *SmartRoads* had "identified things" and that the "process was good." This echoed its strength, since failure to do so would have signified serious problems. Yet, both felt that they first had to "exhaust all avenues", before going back and saying to state authorities, "we've gone through the processes; you need to give us something else." Consequently, *SmartRoads* opens discussion up to identify less costly and

traditional measures, but appears constrained by legislative remit over road space, traditional traffic management funding approaches and state-sanctioned funding processes.

Cyclical visions and debates: does allocating road space at the network scale require prioritising some roads as less important?

The historically cyclical nature of visions and debates in Melbourne around prioritising particular roads has important implications for understanding trade-offs involved in managing one piece of road space, with respect to its wider road network. Prioritising some demands over others occurs against a relatively static backdrop of asphalt, compared to more dynamic and continually changing societal demands and expectations around mobility and liveability. As such, disagreement can stem from different approaches to allocating road space. For instance, managing road space at the road network scale, or shifting from segregating different road users to advancing multiple users share the same road space.

Karndacharuk, Wilson and Dunn (2014) succinctly summarise different 'shared street' concepts and programmes implemented which target road corridors, neighbourhoods and activity centres. Table 1 summarises Melbourne-specific planning studies, workshops and programmes which target the arterial and/or road network.

Insert Table 1 here

During the 1970s for instance, the *Hierarchy of Roads* study engaged with many issues identified in network operating planning thinking—underscoring the reoccurring mobility and liveability tension between approaching roads from the perspective of pedestrian needs, motorised single-occupant needs, motorised public transport needs, or some combination. *The Hierarchy* study included a range of state and local authorities, and from 1978 to 1988, generated over 15 documents (Pattinson, 1982). Central to this discussion was the creation of the *Road/Amenity Classification* table and the *Framework for Conflict Resolution* (Loder & Bayly, 1980, p. 11). Classifying different roads involved stakeholders working through a three-step process, based on three criteria:

1. The road hierarchy
2. The degree of conflict (defined by a quantitative matrix measuring traffic flow versus residential amenity, crossing expectations, public transport operation and congestion)
3. Government body responsible for management

Each step was supported with maps illustrating two points: 1. conflicts generated from the new road classifications (Figure 4); and 2. potential implementation strategies (Figure 5) (Figures 4 and 5 from Loder & Bayly, 1981, Figures 4 and 9, respectively). Aside from advances in technology, data collection and manipulation and professional thinking which inform *SmartRoads*, maps generated from the *Hierarchy* study share significant commonalities with NOPs. *Hierarchy* study maps were intended to provide more transparent policy outcomes. They "did not resolve the conflicts" (Loder & Bayly, 1980, p. 11), nor

provide answers, but provided planners a means to normatively weigh up and prioritise local amenity and regional mobility.

Insert Figures 4 and 5 here

Under the Kennett coalition government during the 1990s, traffic management was altered by a powerful infrastructure vision (Curtis & Low, 2012). The vision reconfigured VicRoads' key aims, and in 1993, the *Traffic and Road Use Management* department was formed (Natalizio & Saggers, 1998). The division eventually created and implemented the *Principal Traffic Routes* programme (McConnell & Somers, 2005). Guided by economic objectives, the programme's mobility focus targeted travel time savings on declared roads during weekday business hours. Measures included lane configurations, altered intersection and traffic signalling and expanded clearway times. Within five years, the programme covered almost one-third of Victoria's 3,000 km declared road network (McConnell & Somers, 2005). However, the programme required expensive, time-consuming reports that were cumbersome to VicRoads budgeting frameworks, and the programme was eventually discontinued.

The vision of governing urban space advocated by the Kennett coalition government underscores the influence of politics on expediting change for how one might prioritise road space. As such, choosing to meet demand, or suppress demand is not straight forward. It can quickly be altered by a change in government, or halted more incrementally under the bureaucratic strain in the case of complicated traffic management programmes. Irrespective of how road space is prioritised, such determinations are almost always guided by a set of formalised rules. One planner in the Department of Transport suggested during an interview that compared to other frameworks, *SmartRoads* advances important rules for playing the game of road space allocation:

> People do network optimization across the world, but they don't do *SmartRoads*… The angle [taken by *SmartRoads*] is not just optimise, but minimize conflict. When you have conflict in a road network, everyone loses… *SmartRoads* is… a methodology to help you understand those impacts… [it allows] all the modes to sit at a table and play a card game…. But to play that card game, there's two conditions. One you need to have a network, a clearly defined network. Secondly and most importantly - that network needs to have a set of priorities. So you cannot say cycling should have priority everywhere, that means you're going to lose everywhere, because if you have priority everywhere, you are going to have conflict everywhere. You need to determine where are the higher level of priority for cycling for your network and then a second level or a base case. So that's really important to understand, because if you don't have that, you cannot play the card and you're never going to have a possibility to trade off (Participant 19).

The rules described by the planner allude to a persistent tension between regional mobility and local amenity. The tension shapes the level of importance given to different roads. As another planner remarks, "at the state level, I think there are different imperatives, and I think

there are different priorities which have a higher priority" (Participant 13). In daily practice, the tension in relation to 'optimising' Melbourne's road network, remains fluid and up for debate. For example, over half of participants interviewed tentatively supported extending and standardising clearways, but felt its benefits had been undermined by poor implementation—dismissing important contextual differences of roads which ran through multiple council boundaries. Disagreement stems in part from different remit—place-making with local government, regional mobility with VicRoads. Many participants remarked that the controversy substantiated the claim that VicRoads remains a car-oriented authority. Irrespective of the validity, the actions of VicRoads staff charged with clearways influenced how local government councillors and planning staff later engaged a different VicRoads division charged with *SmartRoads*.

Generally, planners interviewed considered *SmartRoads* a useful tool for establishing priorities for managing all types of road space. Its two key strengths are flexibility and transparency—it can be applied to any road network segment and provides transparent principles that help translate conflicting aims to reach consensus. However, as a planner in VicRoads highlights, these strengths are shaped by professional responsibilities:

> At the end of the day we're accountable for that transport network… It's not about consensus each and every time, it's about consultation but at some point you got to make some decisions, where you don't have agreement… you just move on, and that's part of our role (Participant 17).

The influence that professional responsibilities have in traffic management is not new. For example, a retired planner, who had moved between Melbourne Metropolitan Board of Works, Country Roads Board (CRB) and Road Safety & Traffic Authority (RoSTA), recalled during the interview that the work developed under the *Hierarchy* study was innovative for its time (Participant 61). The planner continues to occasionally consult with VicRoads, which has demonstrated many similarities between the *Hierarchy* study and *SmartRoads*. Yet, an important distinction relates to process and particularly, *"in the way the work was implemented and how it was implemented"* (emphasis stressed by Participant 61). Whereas previously, CRB or RoSTA staff often entered a meeting "knowing the answer", VicRoads staff—from the retired planner's perspective—engage in a more open, transparent and rigorous discussion (Participant 61). Without overstating the claim, organisational conventions constituting different authorities obstructed planners from familiarising themselves with more detailed specifics of the *Hierarchy* study—resulting in failing to build upon the work completed in the *Hierarchy* study (Participant 58). The work therefore became lost when RTA was absorbed into VicRoads in early 1990 (Participant 50). After this point, under the Kennett coalition government, the aims and objectives of VicRoads shifted to optimising Melbourne's declared road network and constructing big road projects. This ensured arterial roads were given greater priority over non-arterial roads.

Lack of continuity: who makes decisions and towards what ends?

Lack of continuity between planning studies and frameworks is a recurring feature in Melbourne's traffic management history. This has important implications for understanding who determines road space priority, and towards what ends. For example, from 1990 to

1992, VicRoads staff embarked on a set of '*Search Conferences*' (VicRoads, 1991). Intended to gather opinions and advice from professional and non-professional stakeholders, the *Search Conferences* were to assist the state in developing an arterial road strategy for the next two decades. Yet, the *Search Conferences* failed to build on the *Hierarchy* study. *Hierarchy* study planners did lead many of the *Search Conferences*, but an explicit link between each was not made: i.e. public consultation via the *Search Conferences* will build on and advance learnings and frameworks developed in the *Hierarchy* study. Lack of continuity is succinctly illustrated in a report's title summarising a *Search Conference: Whose Roads?: Allocation of Arterial Road Space in Melbourne* (Andrew O'Brien & Associates, 1990). At the time of this research, VicRoads staff had only recently became aware of the *Hierarchy* study. This occurred after staff presented their work to a group of professionals, and an audience member suggested revisiting the study (later identified as a retired RoSTA employee). Similarly, VicRoads staff discovered *Search Conferences* during the development of *SmartRoads* (McConnell & Somers, 2005). During an interview, a senior planner in VicRoads described *SmartRoads* as "effectively creating… a whole new manual for how you manage" road space (Participant 21). This description was quickly followed with the statement that not everyone in VicRoads is up to this challenge (evidence clearly indicates that the description applies more broadly).

Central to developing a manual for how to manage Melbourne's road network is understanding how liveability and mobility are operationalised in daily practice. Many planners interviewed, for instance, were aware the work done in the UK under the term *Link & Place* (Jones et al., 2007), remarking *SmartRoads* shared many similarities. Yet, in Melbourne, mobility and liveability have a particularly heightened role in relation to highly profitable shopping corridors that constitute many tram routes. As one planner remarks, whereas no one is going to sit and have a coffee on the side of the Eastern Freeway, when it comes to Melbourne's shopping corridors, one must decide, "is it a link or is it a place, or is it a link at some times of the day and a place other times of day" (Participant 3). Many planners remarked that whereas *Link & Place* approached constrained road space from a planner's perspective, *SmartRoads* approached it from a traffic engineering or transport perspective. Despite similarities, many planners noted concerns that *SmartRoads* was being led by VicRoads. Compared to transport and land use authorities which might intrinsically arrive at understanding a road's various place attributes, planners indicated that this learning is relatively new to VicRoads:

> I think DOT are ahead in terms of understanding place, and what that means for transport. So VicRoads is now got its head around places as activity centres, but it doesn't have its head around road as places, managing roads as places. And effectively you think about a road it is the journey, which is a place (Participant 16).

As the state public transport authority at the time, DOT was tasked with making the case for getting people out of their cars and onto public transport. Yet, for local council planners, this focus is insufficient for place-making concerns related to creating a positive reinforcing circle of living, working and playing in localised areas. "I don't think *SmartRoads* sufficiently acknowledges that in my mind… *SmartRoads* tends to think in one mode priority, for roads… So it is not a case of saying look, this is a pedestrian street, this is a trams street,

because a tram street is a pedestrian street" (Participant 7). Collectively, comments from local and state planners presented here speak to the incremental nature of altering mobility trends. Planners perceived that this challenge clearly involves managing "the network now with the view to the future, and aggressively move towards that" (Participant 26)—but that this can't happen overnight (Participants 21, 26, 46, 49). Thus, remarks from a planner underscore the challenge of agreeing upon priorities for managing road space:

> In my mind, it's a no-brainer: you manage the signals so that 80% of the time is given to trams so they don't get delayed at all. But in reality it doesn't work like that…. no one's prescribing those rules with respect to how we manage the network, because it's just too hard (Participant 46).

The state government at the time had signalled that whenever possible, traffic signals should facilitate passenger throughput, not vehicle throughput. However, as the planner notes, justifying whether a car travelling through an intersection is more or less valuable than a tram, is where "the hard decisions will have to be made, and no one's talking about that" (Participant 46). Many VicRoads staff interviewed noted that *SmartRoads* was designed to facilitate this task, as it was developed to remove politics, as much as possible, out of the consensus development process. Getting agreement around road network objectives could in turn help assess proposals against objectives for different modes. This removes the "politics out of the decision, because it is very much what the network needs to do" (Participant 26).

Conclusion and implications

In drawing from original research, this article used Melbourne, Australia as a case study to identify and trace recurring issues when determining the best use of road space. Prior studies have noted that making substantive change in traffic management requires actively questioning the historical bias towards methods and procedures that prioritise mobility (Hebbert, 2005), and paying particular attention to different stakeholders involved in traffic management, their interests, and the rules for making decisions (Hess, 2009). In Melbourne, examples like the redesign of Swanston Street suggest that heeding such advice can engage the mobility and liveability tension where a diversity of users benefit.

At the time of this research, in the heart of Melbourne, multiple city blocks of Swanston Street were undergoing extensive material alterations aimed at largely prohibiting motorised travel and introducing new tram stop designs which afforded greater intermingling between pedestrians and cyclists. The modifications physically and metaphorically echo a particular perspective towards appropriate use and allocation of road space. When asked if other corridors in Melbourne might make similar transitions, most planners interviewed here hesitated, replying some eventually might. Responses were always contextualised against current planning conditions. If Melbourne's planning past is a barometer to go by, Swanston Street's transformation appears an allegory many in Melbourne are not ready for.

The creation and application of *SmartRoads* indicates a willingness by planners to wrestle with the challenge of network operating planning. Yet, a mismatch remains between *SmartRoads* identifying less costly and traditional measures with a lack of innovative policy packages and business plans to implement such measures. Further, similar frameworks in Melbourne's history accord with the politics of the day. Frameworks developed in the 1980s

were dropped under the Kennett government's infrastructure vision during the 1990s, only to resurface under Labor government's sustainable vision during the 2000s. Poor continuity between subsequent studies and frameworks results in knowledge to be lost, only to be rediscovered. Since councils are pressured to participate in continually changing state sanctioned frameworks to receive funding, frameworks are often perceived as simply another bureaucratic hurdle being pushed by state authorities. Thus, negative planning experiences can obstruct application of frameworks later on. Though issues related to governance, cyclical visions and debates, lack of continuity and disagreement around priorities play out in a particular manner in Melbourne, revisiting the questions posed in the introduction helps draw out lessons for a wider audience concerned with determining the best use of road space.

What is open to negotiation, what is assumed as a given, and what is left off the table? Ownership, funding, maintenance and regulation of road space, which constitute formalised government and organisational processes, set the stage for determining the best use of road space, but not necessarily the outcome. As such, allocating road space will always be inherently political, fraught with competing and conflicting interests. This underscores the difficulty and undesirability in separating politics from urban planning matters (Legacy, 2015). Explicit instances of political influence include frameworks quickly becoming subverted by and subjected to, political processes such as elections. Yet, more nuanced instances include establishing road space priorities and determining a road's level of importance over another—examples that are inherently both political and value-based questions. As such, there is good reason to question understanding the problem of allocating road space, as one of simply weighing up conflicting mobility needs over increasingly constrained space (Mesbah, Sarvi, Ouveysi, & Currie, 2011). For instance, public transport obviously carries significantly more people than a car. Re-allocating road space to favour public transport therefore has clear environmental, mobility and social benefits. Yet, singularly applying this criteria to evaluate and prioritise road space needs, formulates a hierarchy typology in a way which prioritises mobility over liveability. Network operating planning does not provide a simple resolution to the mobility and liveability tension, but it does give mobility and liveability equal attention. Prioritisation given to each is where the main challenges remain.

Does applying traffic management at the metropolitan scale always require prioritising some roads as less important than other roads? Aside from minimising complexity, network operating planning frameworks often seek to remove politics, as much as possible, out of the consensus development process. However, networks don't have needs. Further, whereas metropolitan mobility needs often fall under the remit of regional, state or national authorities, place-making concerns remain with local authorities. Meeting and suppressing demand is therefore often delineated by different roads within a network—motorways and arterials target metropolitan needs, local roads target local needs. This outcome neglects issues found on roads connecting local roads to arterial roads. Network operating planning can help with such 'connector roads' which have historically been a source of consternation in traffic management (Brindle, 1995; Westerman, 1998). Application in practice can be enhanced by actively questioning traditional traffic management legacies of thinking which for the most part, continue to underpin network operating planning. Such legacies

unintentionally reproduce a 'rooms and corridors' outcome—albeit with a significantly more nuanced appreciation and account of temporal variations and rhythms of everyday urban life. Given a car's inherently mobile flexibility, evidence and theory generally concur that traffic calming one road must occur in relation to managing the larger road network. This involves developing and agreeing upon a vision for how a road network should operate in the future, and ensuring that the vision is consistently carried out over a period not tied to political election cycles.

Who makes such decisions, and towards what ends? Deciding road space priorities occurs against the backdrop of legislative statute and constitutional law. In practice however, priority setting is fluid and dynamic—affording opportunities to tweak network operating planning. For example, applying network-planning principles to existing public transport systems has been suggested as providing a productive short-term tactic to achieving better utilisation of existing services (Stone et al., 2012). Thus, road network optimisation could be defined as greater utilisation of a public transport system. As such, network operating planning suggests a shift in expectations around how society and planners portray and prioritise different road space needs. Application in practice reflect an intermingling of a disciplinary delineation over road space (see Karndacharuk et al., 2014 for illustration of tradditional road space remit), which support equally entrenched professional rationalities (Patton, 2007), but which are actively being questioned by a greater appreciation for the contested nature of mobility and liveability (Sadik-Khan & Solomonow, 2016). This speaks directly to the 'how' in this article's introduction. At the end of the day, a decision has to be made concerning what roads will carry what type and level of traffic. Network operating planning reflects a pragmatic technique to engage what is ultimately a complex, contested and value-based answer(s). Holding in view both the local and network view helps avoid overlooking the potential for local changes to impact networks and vice versa. This reminds planners that small changes have network level implications, but in a way that doesn't lose sight of finer-grained road space use details.

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[i] For instance, conceptualisation of urban space, embedded assumptions and primary objectives found in road classification hierarchies (Goodwin, 1995; Marshall, 2005) differ greatly from hierarchy typologies developed by Alexander (1966) and public transport network planning (Stone, Mees, & Imran, 2012).

[ii] A letter by the Institute of Transportation Engineers to the US Department of Transport underscores this awareness. The letter emphasised that mobility as the singular assessment criteria for performance will continue to draw valuable time, funding and resources to mobility outcomes to the detriment of other concerns (Schmitt, August 26, 2016).

[iii] In *SmartRoads*, public transport priority is currently defined by the Principal Public Transport Network (PPTN). This is established prior to developing an NOP and thus inserted as a base assumption. Evidence suggests that the PPTN was crucial to *SmartRoads'* development (Participants 26, 49). The aim of the PPTN was to reflect a network of public transport routes that DOT staff believed consisted of a reasonable standard or could eventuate to a reasonable standard. After viewing the PPTN, planners charged with freight and cycling felt that their mode needed an equivalent plan. As each mode operates on the same road network many in VicRoads remarked that different attempts to prioritise different users requires formalisation to ensure VicRoads staff have clarity around what's expected of them.

Abstract

The task of (re)allocating existing road space has been pushed the fore in traffic management. In Melbourne, Australia, the rise of 'network operating planning' indicates renewed vigour for planners to wrestle with the challenge of managing road space at the network level—highlighted by the creation of *SmartRoads*. Tracing this and prior frameworks in Melbourne's history reveals recurrent issues related to governance, cyclical debates, poor continuity and competing priorities. The issues collectively speak to a tension common in the road space allocation task: accounting for finer-grained road space use details and acknowledging small changes have network level implications. Although playing out differently depending on city, engaging the tension is central to making better informed road space allocation decisions.

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Key words

Network operating planning, road space allocation, traffic management, urban planning policy

Figures and Tables List

Time period	Title	References
1978 to 1988	*Hierarchy* study	(Loder & Bayly, 1980; Pattinson, 1982)
1989-1992	*Search Conferences*	(Andrew O'Brien & Associates, 1990; VicRoads, 1991b)
1995-1999	*Principal Traffic Routes*	(McConnell & Somers, 2005; Natalizio & Saggers, 1998)
2005-today	*SmartRoads*	(VicRoads, 2012; Weeratunga & Luk, 2010)

Table 1: Melbourne arterial/road network studies, workshops and state programmes
Table 1 summaries Melbourne-sp
195x62mm (96 x 96 DPI)

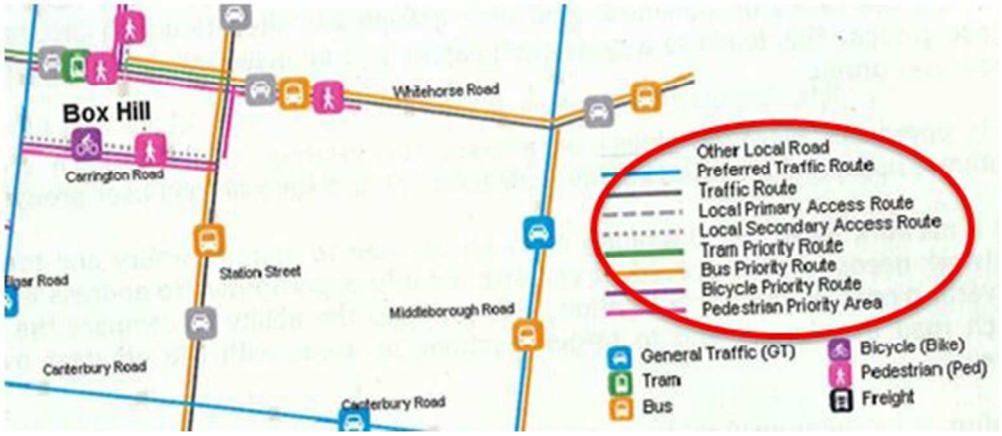

Figure 1: Example of road classifications
Figure 1 illustrates how road
159x69mm (96 x 96 DPI)

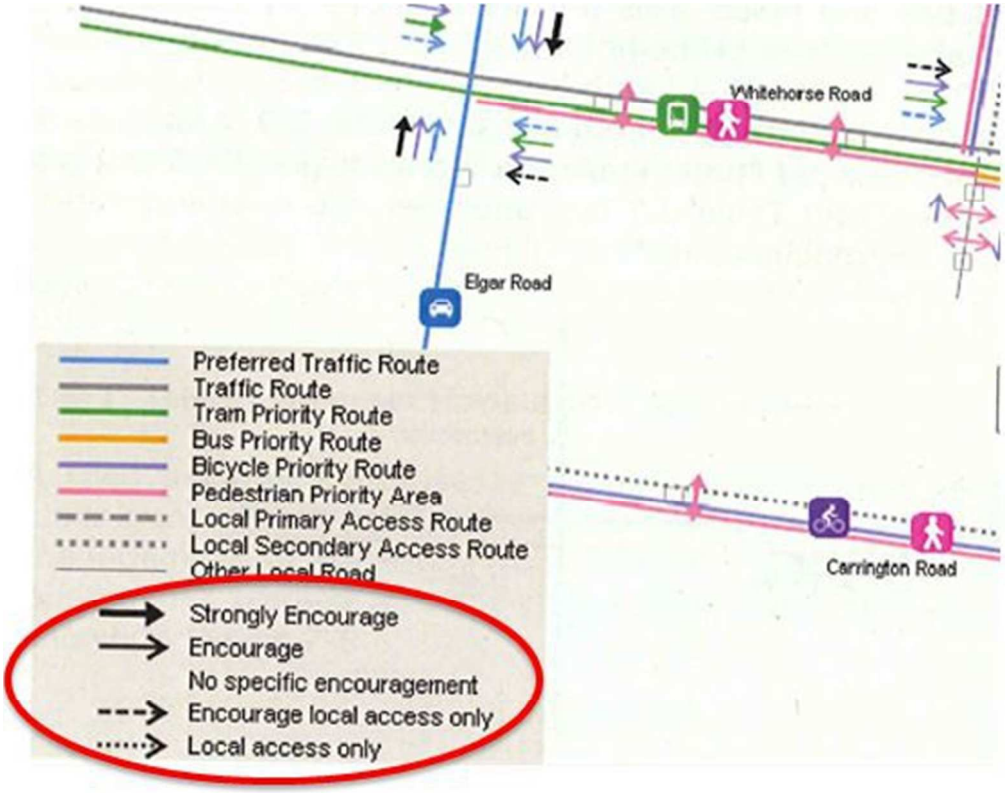

Figure 2: Example of priority
Figure 1 illustrates how road
145x115mm (96 x 96 DPI)

Figure 3: Declared roads within Metropolitan Melbourne
Central to formal arrangements
211x91mm (96 x 96 DPI)

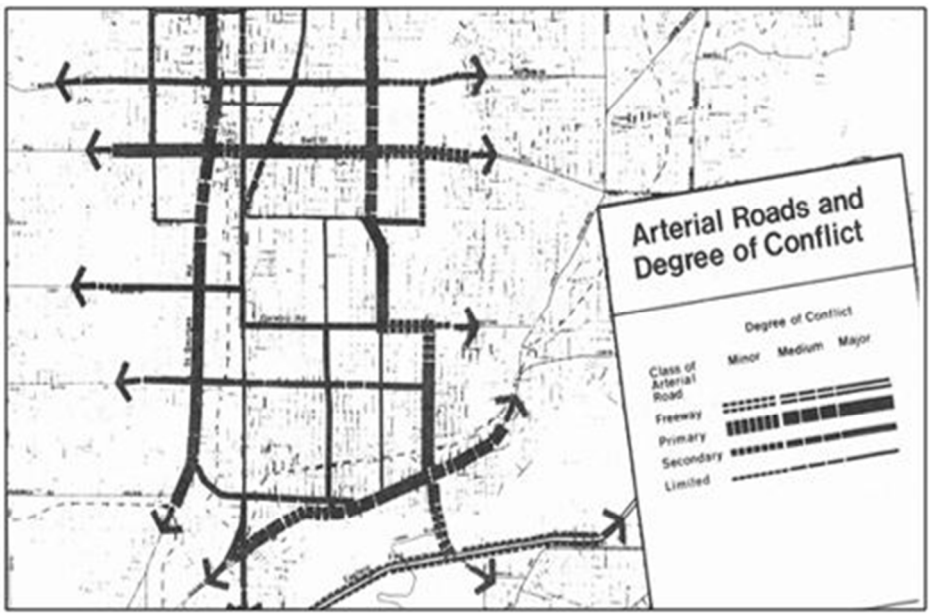

Figure 4: Example of degree of conflict map
Each step was supported with m
123x81mm (96 x 96 DPI)

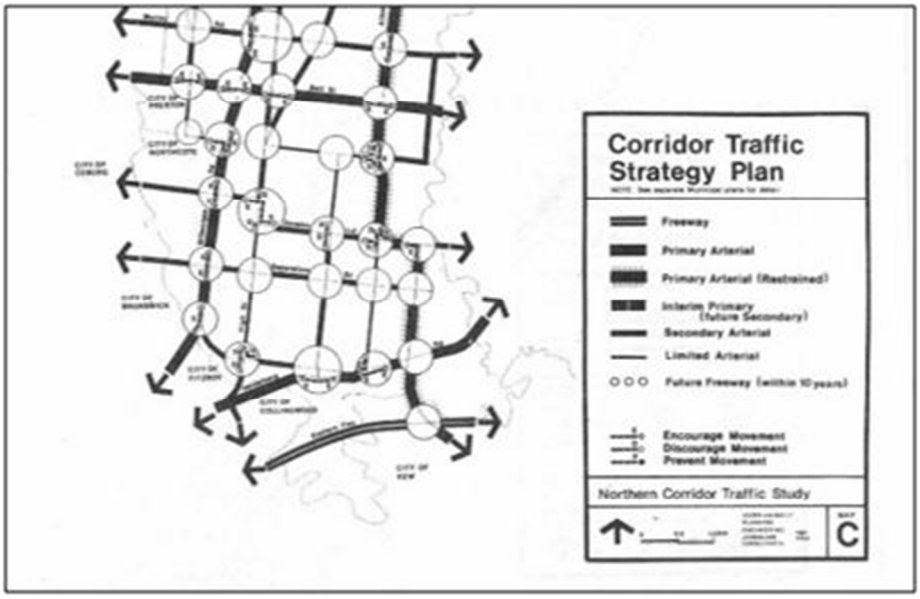

Figure 5: Example of implementation plan
Each step was supported with m
122x78mm (96 x 96 DPI)