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Moving beyond techno-rationalism: new models of transit priority implementation

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Abstract

There is wide agreement that prioritising on-road public transport services is beneficial, but considerable uncertainty about how best to implement priority measures in practice. As yet it is unclear why some transit priority schemes receive political, institutional and public support while others are blocked, cancelled or compromised, often for non-technical reasons.

This paper explores how public policy analysis concepts can be adapted to describe and potentially improve transit priority implementation. Previous evaluation approaches have focused on the traffic, mobility and economic impacts of transit priority measures. What has been missing is a consideration of how politics, institutional arrangements and other non-rational factors influence priority implementation.

This paper describes the major forms of policy analysis (rationalism, institutionalism, incrementalism, political approaches and the 'garbage can' model) and uses each to develop new conceptual models of priority implementation.

Institutional and top-down models emphasise the government's control over the road and transit system. They suggest that better policies and centralisation of decision-making might improve priority implementation. In contrast, bottom-up implementation theories and what is termed the 'garbage can' model emphasise the influence of street-level actors and project team members. These suggest that understanding the drivers of individuals' opinions, strategies and decision-making is necessary to improve implementation and outcomes. Incrementalism based models, on the other hand, suggest using a series of small changes to gradually increase the level of transit priority over time instead of a large, and potentially controversial, single step.

This paper provides an initial move beyond the prevailing 'techno-rationalist' approaches to transit priority implementation. It concludes with a description of opportunities for future research to test these new models and to explore the political, institutional and other factors influencing transit priority implementation. *(Abstract 280 words, limit 300)*

1. Introduction

On-road public transport can carry passengers more efficiently at volume than travel by private car and therefore can provide better environmental, economic and social outcomes. This is a strong rationale for prioritising buses and trams over other vehicles in urban areas.

A transit priority measure is a road environment feature that preferences on-road public transport services over other road uses (Currie 2016, p. 478; Vuchic 2007, p. 240). The research literature divides transit priority measures into two basic types: priority in space and priority in time (Currie 2016, p. 478; Currie et al. 2013, pp. 5-6).

Space priority measures include transit lanes, longitudinal or grade separation of transit alignments, movement restrictions, and measures related to transit stops. Time priority measures include passive and active signal priority, the provision of priority to transit movements at unsignalised intersections, and yield to bus laws (Currie 2016; Currie et al. 2013; Korve et al. 1996; Litman 2016; Ryus et al. 2016; Vuchic 2007).

Many warrants, models and other assessment tools have been developed to evaluate when and where to provide transit priority. However, on-road public transport tends to receive little priority in most Australasian cities, and attempts to introduce transit priority measures have had mixed results. There are a number of successfully implemented transit priority systems operating in Australia and New Zealand (Currie & Delbosc 2014), but others have been subsequently removed or significantly altered, often for non-technical reasons (Currie 2016). As of yet it is unclear why some have succeeded but others have failed.

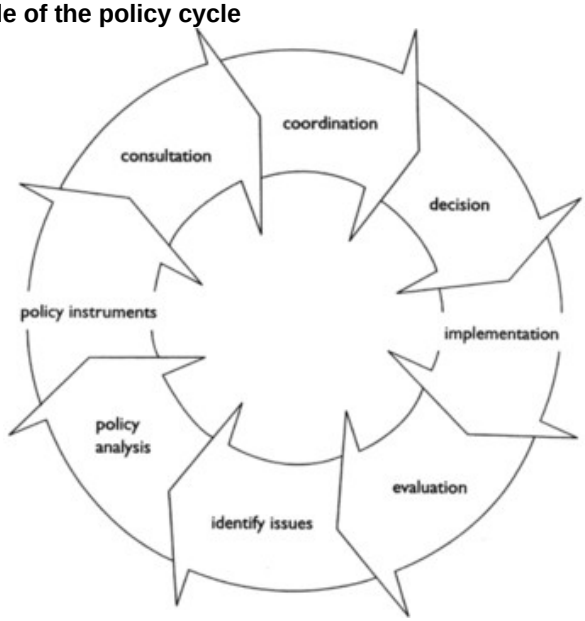
This paper investigates this gap in knowledge by using public policy analysis approaches to develop new conceptual models of transit priority implementation. The structure of the paper is as follows: firstly, there is a description of the prevailing technical and rational ('techno-rational') approach to transit priority implementation. A review of public policy analysis and related research fields then follows. In the main body of the paper each of the dominant non-rational policy analysis approaches (institutionalism, incrementalism, political approaches and the 'garbage can' model) are described and used to conceptualise new transit priority policy implementation models. The paper concludes with a comparison and discussion of the implications of these models, and suggested directions for future research.

2. Rational transit priority implementation

Rationality has a basis in economics and utilitarianism and is focused on improving economic welfare and efficiency (Parsons 1995, p. 33). It assumes that decision-makers are rational and actively searching for the 'best' solution to a problem. Vuchic (2005, pp. 479-81) and Brash (2003, p. 12) provide two of the many examples of transport decision-making approaches based on concepts of rationality.

Policy analysis using rationality typically makes use of the 'policy cycle', an example of which is shown in Figure 1. This concept sees decisions as part of an endless cycle of pre-choice steps (issue identification, analysis, consultation etc.), followed by a decision and then post-choice implementation and review steps.

Figure 1: An example of the policy cycle



Source: Althaus et al. (2013, p. 38)

The analysis and evaluation of the impacts of various potential options forms the basis for a rational decision. How to weigh the impacts, however, will depend on the perspective adopted by the decision maker. Table 1 shows a synthesis of transport system evaluation perspectives described in selected research literature.

Table 1: Perspectives on transport system and transit priority evaluation.

Perspective	Evaluation based on:	Department for Transport (1997)	Litman (2003)	Ryus et al. (2003)	Currie et al. (2007)	Meyrick and Associates (2009)	Grant et al. (2010)	Litman (2016)	Currie (2016)
Traffic	The impacts on speed, delay and level of service for vehicles.	✓	✓	✓	✓	✓	✓	✓	✓
Mobility	The impacts on people (and goods) movement and net travel time	✓	✓	✓	✓	✓	✓	✓	✓
Accessibility	Changes to the accessibility of services and activities.		✓	✓			✓	✓	
Transit operator	Impacts on transit service efficiency, service effectiveness and cost efficiency.	✓		✓	✓		✓		✓
Economic efficiency	The total economic benefits and costs.	✓		✓	✓		✓	✓	✓
Horizontal social equity	The extent to which road space and time is allocated equally amongst road users.					✓		✓	
Vertical social equity	The extent to which to the disadvantaged receive a benefit.			✓		✓		✓	✓
Strategic planning	The extent to which strategic goals and objectives are met.	✓		✓		✓	✓	✓	
Safety	The impacts on road and public safety.	✓	✓	✓		✓	✓	✓	✓
Environmental	The impacts on the environment such as noise and air pollution.	✓		✓	✓	✓	✓	✓	✓
Integration	The extent to which transport facilities / services are integrated and connected.					✓	✓		
Transparency	The extent to which transport operations and decision-making are transparent.					✓	✓		
Reliability	The extent to which travellers can rely on the transport system.	✓		✓	✓	✓	✓	✓	✓

Source: Author's summary and synthesis of selected research

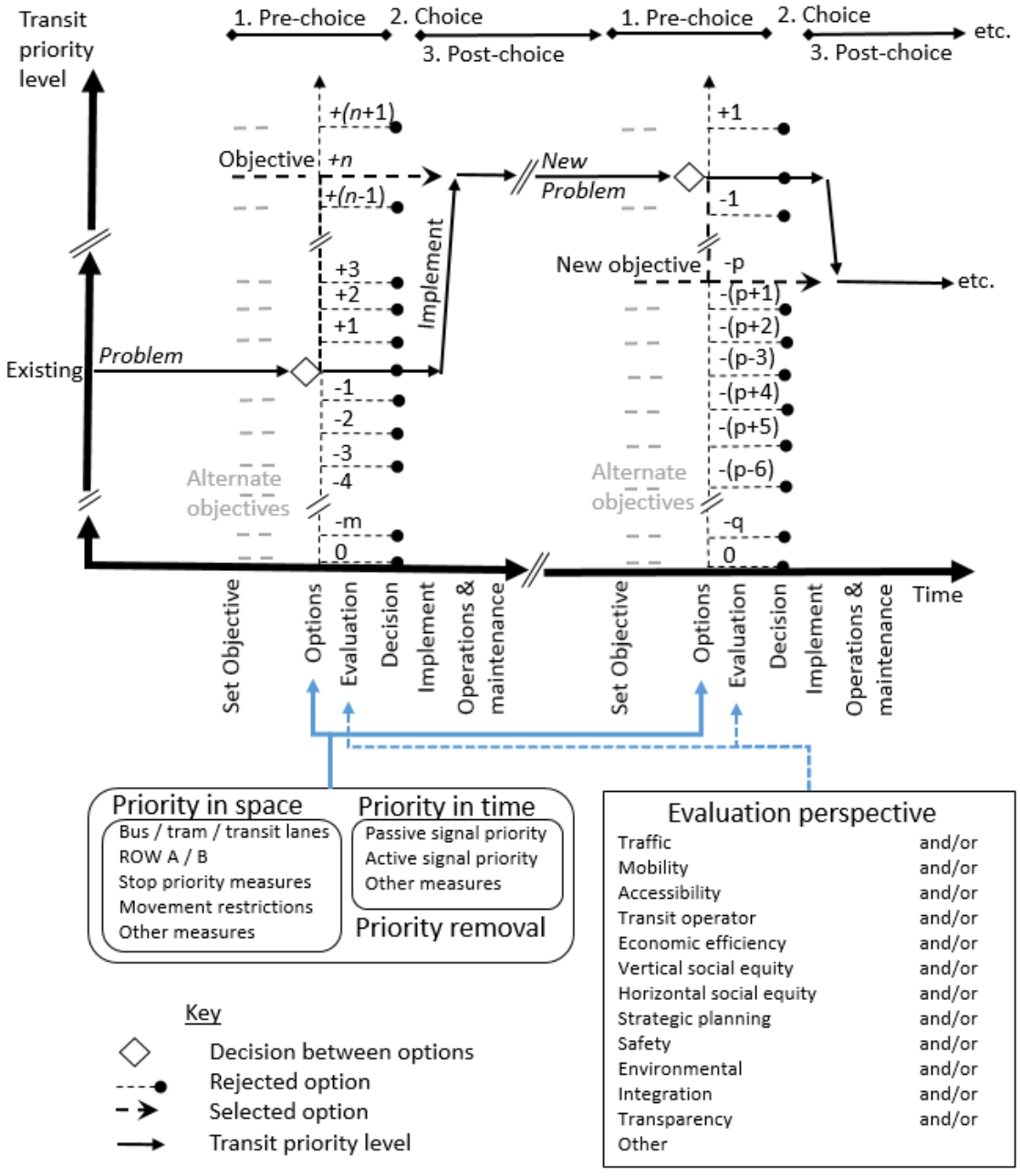
All of the selected literature discusses traffic and mobility perspectives, which focus on the impacts on vehicles or the movement of people (and goods) respectively. However, these perspectives often neglect the wider benefits of transit priority measures due to their narrow focus on road traffic (Currie et al. 2007, pp. 414-6), and can limit priority systems or lead to their removal (Currie 2016, pp. 489-90; Currie & Shalaby 2007, p. 38).

Other perspectives shown in Table 1 are not as widely discussed in the literature and do not appear to be as regularly used to evaluate transit priority measures. In some cases this may be due to measurement difficulties, such as for the accessibility perspective where the many influencing factors (Litman 2003) and the different values that people place on various activities, services and places (Handy 1994, p. 6) complicate measurement. In other cases it may be due to a lack of comprehensive models, such as for the economic perspective where models have been found to be poor at estimating benefits of priority measures (Litman 2016, pp. 3-8), to consider few criteria and to use simplistic traffic and travel behaviour modelling (Currie et al. 2007, pp. 414-7).

Recent research by Goh et al. (2014) and Naznin et al. (2016), and Currie (2016, pp. 492-5) has advanced approaches for evaluating transit priority measures from the safety and strategic perspectives respectively. However, evaluation from equity, integration and transparency perspectives is not yet as widely researched. While, community, environmental and planning goals are included in various transit priority evaluation approaches, for example Department for Transport (1997, p. 38) and Ryus et al. (2003, pp. 7-8), many of these perspectives do not appear to be at the forefront of technical approaches to transit priority evaluation.

Figure 2 conceptualises a model for transit priority implementation. The rational policy cycle forms the basis for this model, which also incorporates the evaluation perspectives in Table 1.

Figure 2: Model 1: Rational model of transit priority implementation.



Source: Author's concept.

In the model, the process starts with the identification of a problem with the existing level of transit priority. The pre-choice steps of setting an objective, searching for options and evaluating impacts are then undertaken. As shown in the box in the bottom left of the model the various options might include measures that prioritise transit in time or space, as well as the removal of existing priority measures.

The box in the bottom right of the model shows the perspectives that may be used to evaluate options against the objective. Notably, the model includes 'other' perspectives in the list in recognition that a choice about transit priority based on other issues, which might not be related to the transit system itself, can still be rational. The choice itself involves the selection of the option that will best meet the objective. The third, post-choice stage includes the implementation of the selected measure followed by operations and maintenance.

The model incorporates the never-ending policy cycle concept by showing a new problem being identified following a period of operations. This new problem might result from a review shortly after the implementation, or from some other source following a longer period of operations. The new problem launches a new series of pre-choice, choice and post-choice stages, thereby continuing the never-ending implementation cycle.

The objective set during the pre-choice stage of each implementation stage drives the level of transit priority. Setting a different objective would result in a different outcome. The many possible objectives are shown in the model in grey, and reflect the potential alternative transit priority levels that could result from each implementation cycle.

While setting a very high transit priority object might seem desirable, road management is about more than just transit priority. Competing objectives, such as to reduce impacts on parking, traffic or other road uses may constrain the transit priority that can be provided. The model illustrates this in the example shown in the second policy cycle in which the new objective is set lower than the priority level that resulted from the first implementation cycle.

Various researchers have identified problems with the policy cycle approach including that:

- it is artificial and in reality policy and decision making is more complex;
- it does not explain how policy moves from one stage to the next;
- it cannot be empirically tested (Parsons 1995);
- it assumes decision makers are unbiased and have perfect information;
- it gives the illusion policy making can be fully managed (Das & Bing-Sheng 1999); and
- it does not necessarily help decision makers make better decisions (Klein 1999).

These problems apply just as much to Model 1 as to rationality in general. While this model may provide an illustration of an ideal transit priority implementation process, it assumes that the objective is the sole determinant of outcomes, and the choice is based on a perfect evaluation that locates the option that perfectly meets the objective. Under this model, the way to improve transit priority is to set objectives that favour transit, and the way to improve implementation processes is to continue to refine evaluation methods and develop more priority measures so as to have a wider variety of options.

But will more complex and comprehensive technical evaluation methods make transit priority implementation more successful? The next section discusses why this might not be the case.

3. Beyond 'techno-rationalism'

It is already known that limited road space and intersection time can be most efficiently used by transit (Currie 2016, p. 478; Litman 2016, p. 2) and that treating all vehicles equally "is an illogical and inequitable anachronism that often results in increased cost and travel time to all participants" (Vuchic 2007, p. 240). Despite this, transit priority is underused in many cities due to a focus on traffic amongst political and road authority decision makers (ibid. p. 243).

More technical impact evaluation models are unlikely to alter entrenched attitudes amongst decision makers, nor lead to more successful priority implementation. Instead, to improve transit priority implementation it is necessary to develop a greater understanding of the politics, decision-making and competition surrounding the allocation of road space and intersection time.

Previous research has identified that a focus on technical aspects to the exclusion of other factors is a problem with current approaches to transport policy research. Marsden and Reardon (2017) reviewed 100 papers in two leading transportation policy journals and found that few "engage with real policies or policy makers" (p.248) and most instead focus on quantitative analysis models.

The many warrants, models and evaluation methods used to assess transit priority measures (Currie et al. 2007, p. 415; Litman 2016) suggest that transit priority implementation also has a disproportionate emphasis on techno-rationalism. However, as transit priority measures often have immediate negative impacts on motorists, who tend to be politically influential (Litman 2016, pp. 3-7), this lack of consideration of political and other non-technical influences in current approaches to transportation policy research is a particular problem for transit priority implementation.

The concluding statement from Marsden and Reardon (2017, p. 249) is that "if we are **to understand and advance the state of the art of transportation policy study** then there is a need to engage with substantive questions of governance which **pay greater attention to context, politics, power, resources and legitimacy**" (emphasis added).

This is just as relevant to advancing transit priority implementation. There is a similar need to move beyond warrants and multi-criteria evaluation models to a wider understanding of how political, institutional and other factors influence the allocation of limited road space and intersection time. For this, a focus on public policy analysis will be useful.

4. Public policy analysis

Public policy analysis developed in the early twentieth century around the idea that governments can use policy to 'solve' problems, as well as a need to better understand institutional decision-making (Parsons 1995, p. 17). There are now a "wild and ever-escalating cacophony of decision-making theories, models, processes, tools, techniques, and approaches" (Fitzgerald 2002, p. 2). Various researchers have developed systems to classify public policy analysis approaches and Table 2 presents a synthesis of these systems, together with broader listings of the approaches discussed in selected public policy analysis texts.

Rationality, institutionalism, incrementalism, political and 'garbage can' approaches are all widely discussed in the literature. This is a close match to the list of public policy approaches provided by Lyles and Thomas (1988), and it is the list preferred by Das and Bing-Sheng (1999, p. 759) as it covers most of the important types of public policy analysis and goes from the most (rationality) to the least structured (**'**garbage can**'**) process.

The next sections describe institutional, incremental, political and 'garbage can' approaches, and develop new transit priority implementation models based on each of these concepts.

4.1 Institutionalism

Institutionalism considers organisational structures and their influence on decision-making (Huber 1981, p. 4; Turpin & Marais 2004, p. 145). It was the focus of public policy analysis until the 'behavioural revolution' in the 1930s moved the field towards a greater emphasis on how individuals influence decisions (Caramani 2011, pp. 5-6; Peters 2011, p. 41).

Figure 3 shows a conceptual institutional model that describes priority implementation as the result of the mechanisms and relationships that link governing bodies, agencies and people.

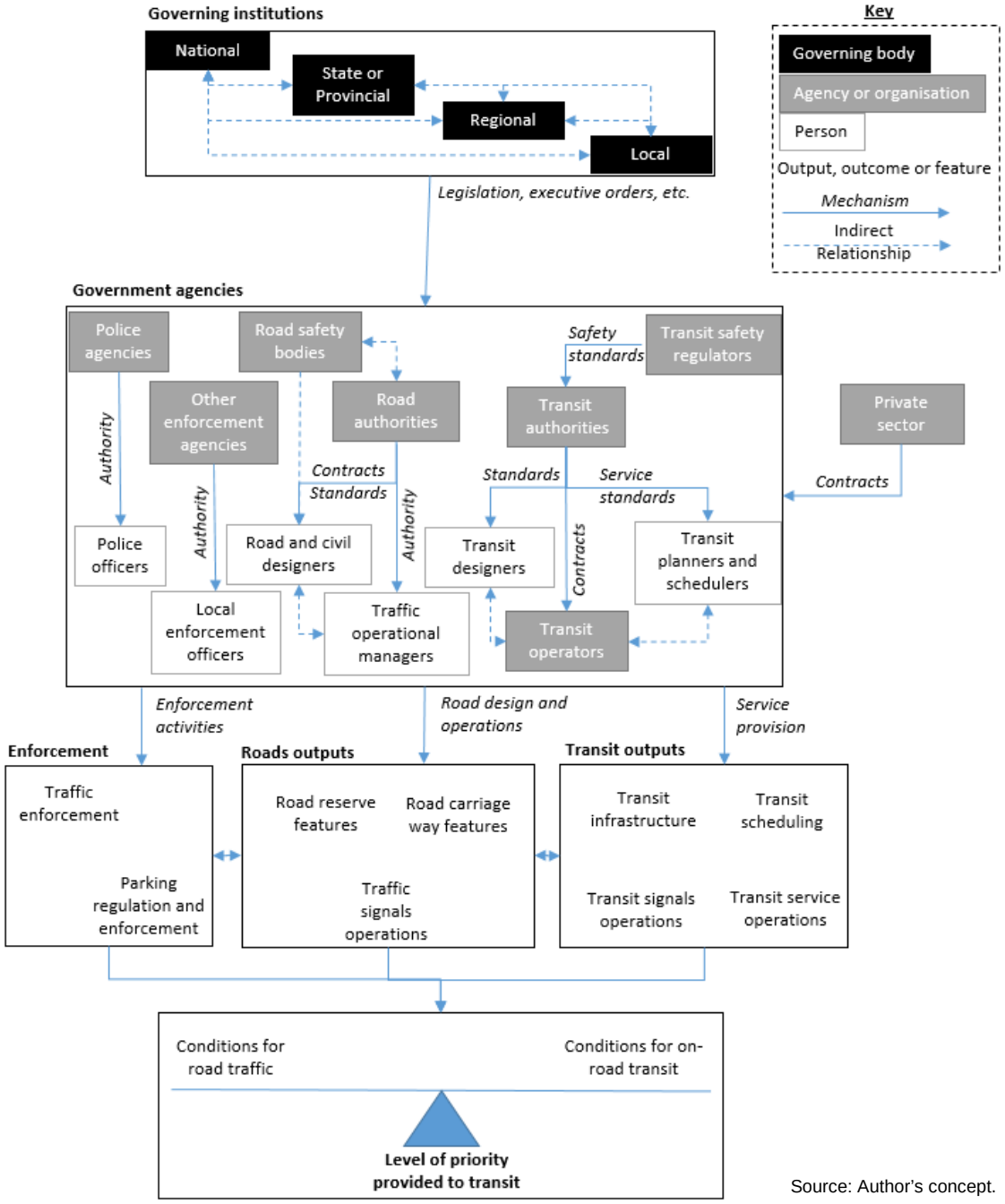
Table 2: Categories of public policy analysis approaches and decision-making systems.

Category	Janis and Mann (1977)	Lindblom (1979)	Huber (1981)	Shrivastava and Grant (1985)[1]	Bobrow and Dryzek (1987)[1]	Hickson (1987)[1]	Eisenhardt and Zbaracki (1992)[2]	Parsons (1995)	Lyles and Thomas (1998)[1]	Turpin and Marais (2004)	Caramani (2011)	Peters (2011)	Andersen (2011)
Rational / optimizing	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	
Institutionalism			✓	✓				✓	✓	✓	✓	✓	
Incrementalism	✓	✓				✓		✓	✓	✓			
Political			✓	✓			✓	✓	✓	✓	✓		
Garbage can			✓			✓	✓	✓	✓	✓			
Bounded rationality/satisficing	✓							✓		✓			
Systematic/structural functionalism								✓			✓	✓	
Autocracy				✓					✓				
Comparative politics								✓					✓
Corporatism								✓				✓	
Disjointed incrementalism		✓						✓					
Governance								✓				✓	
Information processing					✓			✓					
Mixed scanning	✓							✓					
Multiple perspectives								✓		✓			
Naturalistic decision-making								✓		✓			
Network theory								✓				✓	
New institutionalism								✓			✓		
Policy learning, social learning								✓					✓
Political philosophy					✓			✓					
Public choice					✓			✓					
Social structure					✓			✓					
Strategic analysis		✓						✓					
Systems theory								✓				✓	
Welfare economics					✓			✓					
Adaptive				✓									
Case-oriented analysis											✓		
Conflict model	✓												
Consocialism												✓	
Elimination by aspects	✓												
Grounded theory											✓		
Individual differences										✓			
Management								✓					
Marxism												✓	
Path dependence													✓
Policy convergence													✓
Policy diffusion													✓
Policy feedback													✓
Policy transfer													✓
Political process								✓					
Quasi-satisficing	✓												

Source: Author's synthesis of selected research.

[1] As reported in Parsons (1995, p. 33)
[2] As reported in Das and Bing-Sheng (1999)

Figure 3: Model 2: 'Institutional' model of transit priority implementation.



Source: Author's concept.

This model states that governing institutions at the national, state, regional or local levels use legislation, executive orders and other formal powers to direct government agencies. These agencies use a mix of standards, contracts and the delegation of authority to direct police and enforcement officers, designers, managers, operators, and planners to undertake enforcement, road design and operations, and service provision. All of these influence the level of transit priority provided on the road network. The private sector can also have influence as a transit operator, contractor or in some other capacity.

Future research might use this model to investigate the extent to which, and how, different institutional structures influence the outcomes of transit priority implementation.

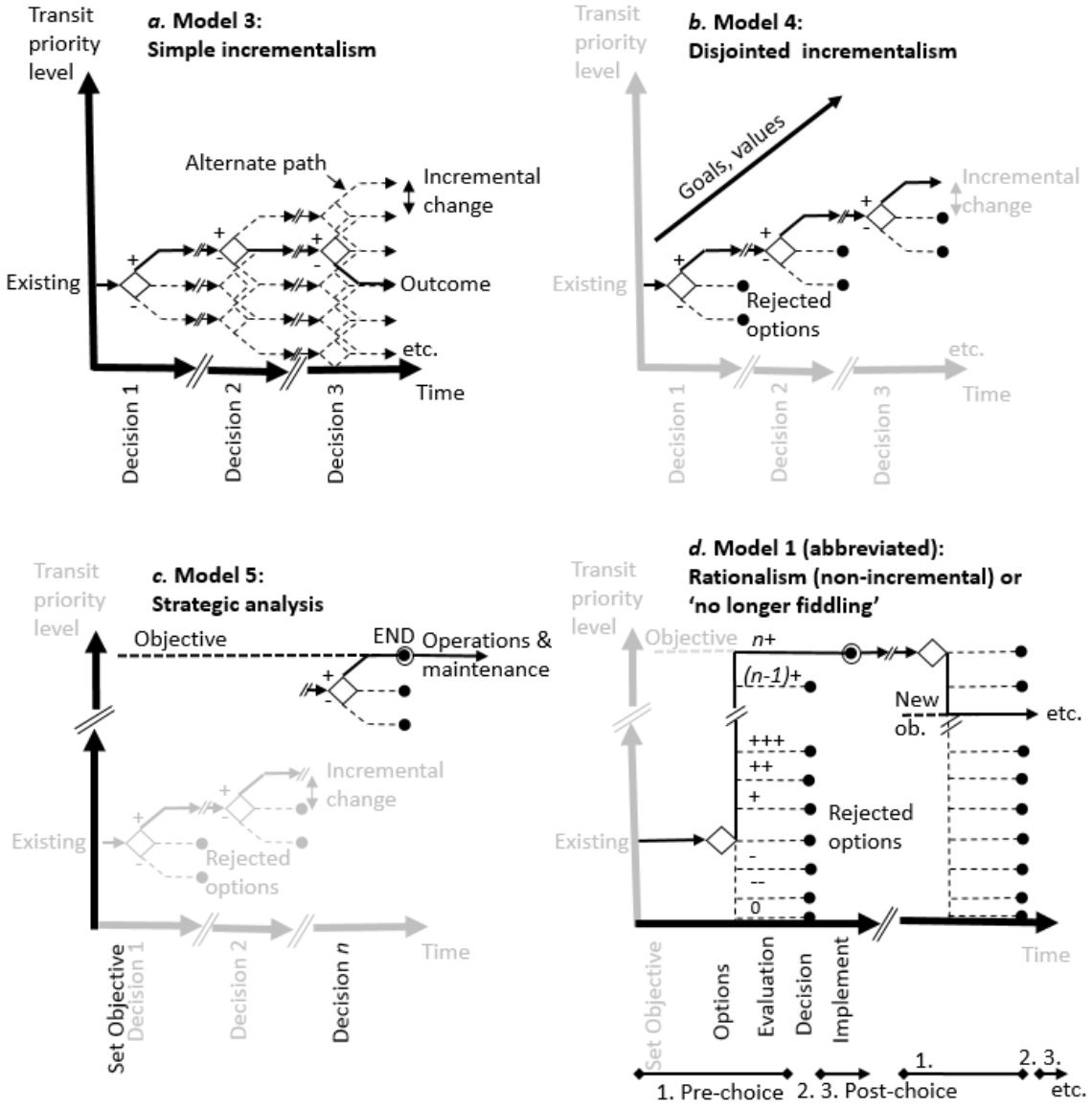
4.2 Incrementalism

Incrementalism was introduced by Lindblom (1959) in the landmark paper 'The science of "muddling through"' and further developed in 'Still muddling, not yet through' (Lindblom 1979). Lindblom (1979) sees policy development as either:

- simple incrementalism – incremental changes, but without a long term goal;
- disjointed incrementalism ('muddling through') – incremental changes directed towards long term goals or values;
- strategic analysis – incremental changes to achieve long term objectives; and
- 'no longer fiddling' – rational approaches where change is no longer incremental.

Figure 4 presents models of transit priority implementation based on these three types of incrementalism, together with an abbreviated version of Model 1 representing 'no longer fiddling'. Changes between each successive model in Figure 4 are shown in black, while components shown in grey remain the same.

Figure 4: (*a, b,* c) 'Incremental' transit priority implementation models and (*d*) 'no longer fiddling



Source: Author's concept based on Lindblom (1979)

Model 3 (Figure 4a) is based on simple incrementalism. It shows an initial decision (Decision 1) between marginally increasing, marginally decreasing or maintaining the existing level of transit priority. Sometime later, another similar decision (Decision 2) is made, and then another (Decision 3) sometime later again, and so on. Notably the chance of successive and continued improvement of the level of transit priority under this model is probably low.

Model 4 (Figure 4b) is a disjointed incremental transit priority implementation model. Like in Model 3, the level of transit priority changes through a series of small steps. However, in Model 4 each decision is guided by a longer-term goal of increasing the level of transit priority. Hence, at each decision the options to reduce or maintain the priority level are rejected and the level of priority increases incrementally over time.

Model 5 (Figure 4c) is a model of incremental transit priority implementation using strategic analysis. It is generally similar to Model 4 (Figure 4b) except that an overall objective for the ultimate level of transit priority is set prior to the first decision. Each decision is one small step towards this ultimate objective and once the desired level of transit priority is achieved (Decision *n*) the process ends. This contrasts with Model 4 (disjointed incremental) where changes to the road environment are made towards a loosely defined goal of increasing transit priority levels, rather than a defined objective.

Lindblom (1979) refers to rationality as ‘no longer fiddling’. Model 1, which was previously developed based on rationality in Section 2, is shown in an abbreviated form for comparison in Figure 4d. Model 1 is similar to Model 5 (strategic incrementalism) in that an objective is set at the beginning of the process. However, Model 1 uses a single step to attain the objective rather than a series of incremental steps. This single step is likely to involve significant change to the road environment, and so stakeholders might be more likely to oppose changes if a ‘no longer fiddling’ approach is used rather than an incremental process. Additionally, Model 1 includes subsequent iterations of the implementation cycle in which new objectives are set, new decisions are taken and further changes are made to the priority level. In contrast, Model 5 assumes that reaching the original objective ends the process.

To illustrate the differences between these four models (the three incremental models and ‘no longer fiddling’) consider the hypothetical example of a bus operating in mixed traffic along an arterial corridor. A simple incrementalism approach (Model 3) might involve adding a queue jump lane at one intersection, then later changing traffic signal timing at another intersection to favour side street traffic (to the detriment of the bus), and then another change some time later, and so on. Under simple incrementalism the level of bus priority would change by small amounts over time, but might not always increase. In contrast, a disjointed incrementalism approach (Model 4) would be guided by an overall vision of increasing the bus priority level. Therefore signal time adjustments that favour side street traffic and make conditions for the bus worse would be rejected, and only incremental changes that increase the level of bus priority, or at least do not decrease it, would be implemented.

The strategic analysis incremental approach (Model 5) takes this one step further and defines a long-term objective, for example that the bus will ultimately operate in an exclusive bus lane along the corridor. The incremental changes to the road environment would then be directed towards this objective. The installation of a queue jump lane might be followed by another queue jump lane at another intersection, and then another and so on. Over time, a bus lane lane would emerge along the entire corridor as isolated queue jump and other bus lanes were gradually joined together to fulfil the overall objective. This is in sharp contrast to the ‘no longer fiddling’ approach were a bus lane would be implemented along the entire corridor in one go, or at least in a series of stages that were large enough to no longer be ‘incremental’.

Models 4 and 5 (Figures 4b and 4c) may provide guidance for practitioners as to how to increase the level of transit priority in line with long-term goals or a formal objective. These approaches may offer advantages by eliminating the sudden large impacts on on-street parking and road conditions that might lead to community backlash and/or implementation

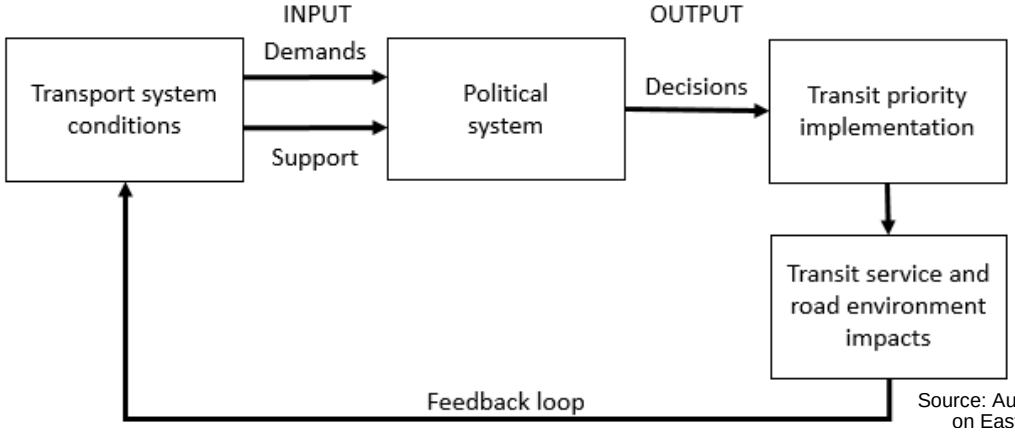
failure. Future research might seek to identify transit priority measures that are incremental versus those that might be better implemented through multiple steps using disjointed or strategic incremental approaches.

4.3 Political approaches

Political approaches consider how the strategies and tactics of participants influence a never-ending series of conflicts between self-interested parties, where outcomes generally favor the most powerful (Das & Bing-Sheng 1999, p. 758; Huber 1981, p. 3; Turpin & Marais 2004, pp. 145-6). Political influence on transit priority implementation appears to be frequent in practice, but not well described in the literature. This may be due to the sensitive nature of political decisions, and that "(a)uthorities are also keener to publish success stories than to share learnings resulting from system failures" (Currie 2016, p. 490).

The Easton (1965) model conceptualises the political system as a black box that takes input in the form of demands and support, and outputs decisions. Figure 5 shows a model of transit priority implementation based on the Easton (1965) model, in which the transport system conditions generate demands and support for change. Political decisions lead to transit priority implementation that affects the transit service and road environment, and potentially generate new demands and support for change.

Figure 5: Model 6: Political system model of transit priority implementation.



Source: Author based on Easton (1965).

While this model provides some hints as to how competition between the demands of different stakeholders might influence transit priority decision-making, the political system itself remains a black box. Further research might seek to identify what demands and support levels lead to decisions in favour of transit priority, but for a greater understanding of transit priority implementation in political systems it is necessary to turn towards implementation theory.

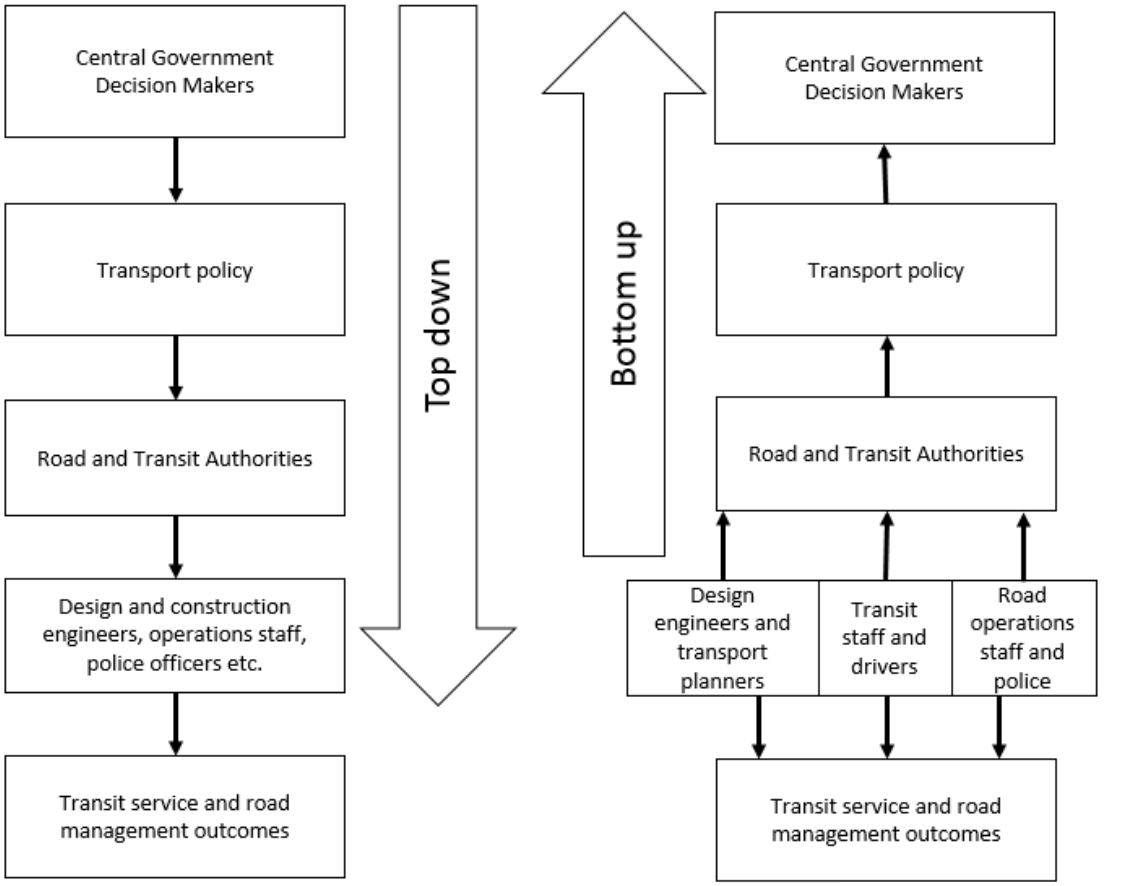
Top-down models of implementation focus on the influence of central government decision makers on policy, while bottom-up models focus on the control of local bureaucrats (Knill & Tosun 2011, pp. 379-80) over design, operations and enforcement. Figure 6 conceptualizes transit priority implementation through both the top-down and bottom-up paradigms.

Model 7 (Figure 6a) is based on the top-down approach. It shows central government decision makers setting transport policies that guide road and transport authorities, that have design, construction, operations, enforcement and other staff who deliver transit service and road management outcomes. According to this model, priority implementation occurs because of central decision makers adopting pro-transit policies, and so this model is similar to Model 2 (institutional).

In contrast, Model 8 (Figure 6b) shows implementation driven by the designers, engineers, transport planners, transit staff, roads operations staff and police who directly control transit service and road management outcomes. These 'street-level bureaucrats' may use a range

of strategies to deliver their desired outcomes such as ignoring higher level policy, subverting it to suit their own ends, or developing networks to influence central policy makers (Sabatier 1986, pp. 30-6).

Figure 6 (a) Model 7 top-down and (b) Model 8 bottom-up transit priority implementation.



a. *b.*

Source: Author's concept.

The top-down model has some similarities with the institutional model developed earlier in the paper (Figure 3). However, it shows a more direct link between central decision makers and outcomes, in contrast to the various mechanisms and indirect relationships that link government bodies, agencies and actors in the institutional model. The top-down model also emphasises the control that central decision makers have over transport policy and therefore over authorities and outcomes. This is in contrast to the institutional model in which the various mechanisms and in-direct relationships acting between agencies may impact outcomes more directly than the legislation and executive orders coming from central governing bodies. In this respect the institutional model has some similarities with the bottom-up model in which transport policy and outcomes can be influenced by various actors.

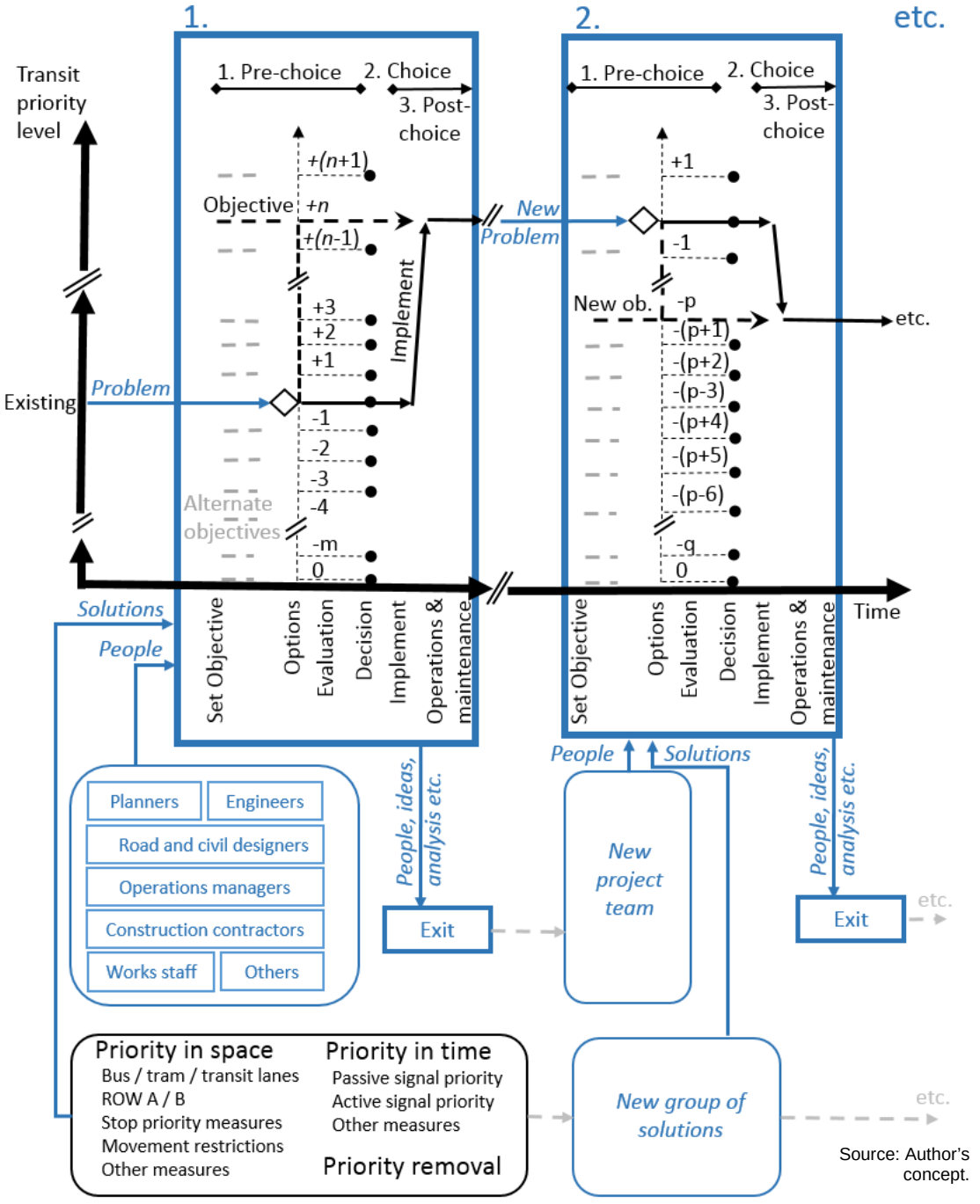
The top-down and bottom-up models may provide new perspectives on transit priority implementation that are simpler and more direct than the institutional approach. Other approaches, such as the hybrid implementation models that combine both top-down and bottom-up approaches (Knill & Tosun 2011, p. 380), may also be valuable avenues for further research into transit priority implementation.

4.4. The 'Garbage Can' model

The 'garbage can' model describes policy making as a process where 'problems looking for solutions', decision makers, and 'solutions looking for problems' combine, output a decision and then disband. Following the decision, the reasoning, analysis and any other leftovers in

the ‘garbage can’ are discarded (Das & Bing-Sheng 1999, pp. 771-2; Huber 1981; Turpin & Marais 2004, p. 146). Unfortunately, the ‘garbage can’ model’s name is rather value laden. It might not be immediately clear that the term ‘garbage’ refers to how the project team, analysis and reasoning are lost, rather than to the quality of the decision itself. Hence, this paper adopts the name ‘everything old is new again’ for the new model of priority implementation shown in Figure 7, as it is synonymous with how a succession of independent transit priority projects might be at risk of reinventing the wheel.

Figure 7: Model 9: The ‘everything old is new again’ model of transit priority implementation.



Source: Author’s concept.

The model shows a distinct transit priority project (box 1) forming out of a problem with the existing level of transit priority. A project team of engineers, planners and others forms to

tackle the problem (*People* input to box 1). This team uses a rational process to set objectives, evaluate options, make a decision and implement a change to the road environment. The options include measures that prioritise transit in space and time, or the option to remove existing priority measures (*Solutions* input to box 1). Following implementation, the project ends and the implemented transit priority measures enter an operations and maintenance phase. The project team disbands and the people, ideas and analysis that supported the decision exit the process. Sometime later, a new problem arises and a new project (box 2) forms with a new project team and a new group of solutions. Some people, analysis approaches and potential solutions from the first project might be included in the second project, as indicated by the grey dashed arrows in Figure 7, but this is not guaranteed. Hence, the level of transit priority changes through a succession of 'new' projects, which might potentially include some 'old' people, ideas and approaches.

Notably, this model is very similar to Model 1, with the only additions being:

- the 'project' boxes surrounding each iteration of the implementation cycle,
- the concept of problems, solutions and people being key inputs to each project, and
- the 'exit' of people, ideas and analysis at the end of each iteration.

Inclusion of 'people' in Model 5 acts as an expansion of the 'evaluation perspectives' concept in Model 1, in that it is the different people, and their biases towards/against different priority measures, that bring different perspectives to each project.

Future research might seek to understand whether this model is truly reflective of transit priority implementation over time. There may also be opportunities to research ways to help to transfer knowledge, skilled staff, analysis techniques and other key components from one transit priority project to the next and prevent further reinvention of the wheel.

5. Discussion and Conclusions

This paper has developed nine new conceptual models of transit priority implementation based on five public policy approaches: rationalism, institutionalism, incrementalism, political approaches and the 'garbage can' model. It has thus expanded transit priority implementation theory beyond the prevailing 'techno-rational' approaches that dominate transport research.

Table 3 compares the explanatory power and types of each of the models. Normative models are those that describe how a process *should* ideally occur, while explanatory models seek to explain how a process occurs in practice (Parsons 1995, pp. 58-9). As shown in Table 3, Models 1 (rational), 4 (disjointed), 5 (strategic) and 7 (top-down) are all normative, while Models 2 (institutional), 3 (simple), 6 (Easton's), 8 (bottom-up) and 9 (everything old / 'garbage') provide descriptions of how transit priority is implemented.

Model 1 (rational) is a purely techno-rational model and so does not consider political and other factors. It has all the problems of techno-rationality discussed in Section 3, but this model does have value in terms of uniting formal theories of rational decision-making with transport evaluation perspectives. Model 6 (Easton's political model) is the only model to explicitly describe the influence of politics on transit priority implementation, as while Models 2, 8 and 9 each provide insights in how political, institutional and other non-rational factors influence priority implementation, they lack detail. Further research might seek to expand and refine these models to address politics more explicitly.

The level of complexity varies between the models. Models 1 (rational), 6 (political), 7 (top-down) and 8 (bottom-up) provide very simple step-by-step processes, although Model 6 is complicated by a feed-back loop. The remaining models are more complicated due to larger numbers of components and links.

While these models are conceptual, they may give insights into how to improve practice. Table 4 shows an appraisal of how each model suggests priority implementation might be improved.

Table 3: Explanatory power and type of each transit priority implementation model.

Model	Type	Explanatory power
1. **Rational**	Normative	Techno-rational model that does not clearly explain the influence of political and other non-technical factors.
2. **Institutional**	Explanatory	Model explains the links between institutions involved in implementation, but lacks details of how politics influences processes and outcomes.
3. **Simple incremental**	Explanatory	This model may explain implementation in cities that do not follow a long-term plan or goal for transit priority and where changes are small.
4. **Disjointed incremental**	Normative	This model suggests how to implement transit priority using a series of small steps towards a vision.
5. **Strategic incremental**	Normative	This model suggests using a series of small changes over time to reach a transit priority objective.
6. **Political system**	Explanatory	The 'black box' nature of the political system is a useful concept, but the model does not provide detail of what demands and levels of support result in different transit priority outcomes.
7. **Top-down**	Normative	This model suggests that transit priority should be driven by central government, but may not clearly explain how to address political factors.
8. **Bottom-up**	Explanatory	This model explains how designers, engineers etc. control transit priority implementation, but does not clearly explain how stakeholders influence decisions.
9. **'Everything old is new again'** (garbage can model)	Explanatory	This model provides insight into how transit priority programs and projects occur in succession over time. However, it lacks detail of how political factors, community and other stakeholders influence decisions.

Source: Author's assessment.

Table 4: Approaches to improve transit priority implementation processes and outcomes.

Model	Transit priority implementation might be improved by:
1. **Rational**	Better transit priority measures and more comprehensive evaluation methods.
2. **Institutional**	Simpler institutional structures and centralisation of decision-making.
3. **Simple incremental**	Identifying transit priority measures that make only small changes to the status quo, yet are resistant to subsequent reversal.
4. **Disjointed incremental**	Identifying transit priority measures that make only small changes to the status quo, and 'goals' and 'values' that support implementation.
5. **Strategic incremental**	Identifying the long-term objectives and intermediate steps that can be used to reach higher levels of transit priority.
6. **Political system**	A better understanding of what demands and types/levels of support are required for decisions favourable towards transit priority.
7. **Top-down**	Increased central government support for transit priority and development of better policies to guide agencies and practitioners.
8. **Bottom-up**	An emphasis on training design engineers, transport planners, transit and road authority staff, and police on the importance of priority for transit. Developing tools to assist street-level practitioners deliver greater priority to transit.
9. **'Everything old is new again'**	Developing pathways for 'old' staff, ideas and analysis techniques to be included in 'new' transit priority projects, rather than be lost to the process.

Source: Author's concept.

Unsurprisingly, Model 1 (rational) suggests that developing better transit priority measures and rational evaluation methods is the key to better outcomes. However, as discussed in Section 3, further techno-rationalism is unlikely to significantly alter the entrenched attitudes that lead to traffic focused road management, nor assist in navigating the political, institutional and other non-rational factors that might limit transit priority implementation.

Model 2 (institutional), 5 (strategic), 6 (Easton's) and 7 (top-down) suggest that central government support may be needed to increase transit priority levels. In contrast, Models 3 (simple), 4 (disjointed), 8 (bottom-up) and 9 (everything old / 'garbage') suggest that it is individual and lower level decision makers that can drive transit priority implementation. Further research might seek to investigate how different levels of central government versus lower level support influences transit priority implementation in practice.

Of particular interest might be the incremental and the 'everything new is old again' models. These suggest new ways of thinking about how transit priority in a city might change through time, through a succession of individual decisions/projects that are relatively unrelated. Models 4 and 5 suggest that gradual, small changes to the road environment might be a more successful approach to transit priority implementation than major alternations to the status quo.

Further research might seek to expand and test these models of transit priority implementation as well as develop models based on other public policy analysis approaches. Case studies might be used to identify which of the explanatory models describe transit priority implementation and outcomes in practice. Top-down and bottom-up implementation models, as well as hybrid models that combining both approaches, might be of particular interest for framing future research or case studies.

There is a significant body of existing research literature, evaluation models and practical experience in transit priority implementation, but most has been techno-rational in nature. This paper has provided the first step beyond techno-rationalism. Much work remains to explore the political, institutional and other factors that influence priority implementation and to adapt public policy analysis concepts to transit priority.

(Words 6,171 including abstract and excluding references, guideline limit 5,000) (Pages 16, guideline 10-15).

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